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## Contents

### **1.1 bzip2 1.0.5**

1.1.1 Available under license

### **1.2 libxml2 2.6.30**

1.2.1 Available under license

### **1.3 libpcap 0.9.8**

1.3.1 Available under license

### **1.4 xinetd 2.3.14**

1.4.1 Available under license

### **1.5 grub 0.97**

1.5.1 Available under license

### **1.6 diffutils 2.8.1**

1.6.1 Available under license

### **1.7 apache-log4j 1.2.15**

1.7.1 Available under license

### **1.8 openssl 0.9.8l**

1.8.1 Notifications

1.8.2 Available under license

### **1.9 pcre 7.8**

1.9.1 Available under license

### **1.10 python 2.6.2**

1.10.1 Available under license

### **1.11 ncurses 5.7**

1.11.1 Available under license

### **1.12 dhcp 4.1.1**

1.12.1 Available under license

### **1.13 e2fsprogs 1.41.9**

- 1.13.1 Available under license
- 1.14 xalan 2.7.1**
  - 1.14.1 Available under license
- 1.15 findutils 4.2.31**
  - 1.15.1 Available under license
- 1.16 tar 1.17**
  - 1.16.1 Available under license
- 1.17 gzip 1.3.12**
  - 1.17.1 Available under license
- 1.18 qemu 1.5.3**
  - 1.18.1 Available under license
- 1.19 valgrind 3.10.1**
  - 1.19.1 Available under license
- 1.20 pixman 0.30.2**
  - 1.20.1 Available under license
- 1.21 readline 5.2**
  - 1.21.1 Available under license
- 1.22 coreutils 6.9**
  - 1.22.1 Available under license
- 1.23 zeromq 4.0.5**
  - 1.23.1 Available under license
- 1.24 commons-io 1.4**
  - 1.24.1 Available under license
- 1.25 python 3.5.1**
  - 1.25.1 Available under license
- 1.26 lighttpd 1.4.39**
  - 1.26.1 Available under license
- 1.27 inetutils 1.9.4**
  - 1.27.1 Available under license
- 1.28 zlib 1.2.3**
  - 1.28.1 Available under license
- 1.29 zlib 1.2.8**
  - 1.29.1 Available under license
- 1.30 slang 2.2.4**
  - 1.30.1 Available under license
- 1.31 dmidecode 3.5**
  - 1.31.1 Available under license
- 1.32 ethtool 3.14**
  - 1.32.1 Available under license

### **1.33 zlib 1.2.5**

1.33.1 Available under license

### **1.34 bash 3.2.39**

1.34.1 Available under license

### **1.35 binutils 2.23.52**

1.35.1 Available under license

### **1.36 sed 4.1.5**

1.36.1 Available under license

### **1.37 iperf 2.0.5**

1.37.1 Available under license

### **1.38 libevent 2.0.10**

1.38.1 Available under license

### **1.39 libuv 1.7.4**

1.39.1 Available under license

### **1.40 tcl 8.3.2**

1.40.1 Available under license

### **1.41 glib 2.26.0**

1.41.1 Available under license

### **1.42 wget 1.15**

1.42.1 Available under license

### **1.43 glibc 2.12**

1.43.1 Available under license

### **1.44 net-tools 1.60**

1.44.1 Available under license

### **1.45 lighttpd 1.4.35**

1.45.1 Available under license

### **1.46 binutils 2.19.51**

1.46.1 Available under license

### **1.47 libunwind 1.1**

1.47.1 Available under license

### **1.48 cryptsetup 1.6.6**

1.48.1 Available under license

### **1.49 ntp 4.2.8p6**

1.49.1 Available under license

### **1.50 pam 1.1.6**

1.50.1 Available under license

### **1.51 netbsd-resolv 2.20**

1.51.1 Available under license

### **1.52 libvirt 1.1.2**

- 1.52.1 Available under license
- 1.53 tcpdump 4.1.1**
  - 1.53.1 Available under license
- 1.54 erlang-otp 7.3**
  - 1.54.1 Available under license
- 1.55 strace 4.5**
  - 1.55.1 Available under license
- 1.56 bridgeutils 1.2**
  - 1.56.1 Available under license
- 1.57 perl 5.20.0**
  - 1.57.1 Available under license
- 1.58 log-rotate 3.7.8**
  - 1.58.1 Available under license
- 1.59 libgpg-error 1.2**
  - 1.59.1 Available under license
- 1.60 libxml2 2.7.6**
  - 1.60.1 Available under license
- 1.61 iptables 1.4.7**
- 1.62 libcap 2.16**
  - 1.62.1 Available under license
- 1.63 libcap-ng 0.7.3**
  - 1.63.1 Available under license
- 1.64 iputils 20101006**
  - 1.64.1 Available under license
- 1.65 oniguruma 5.9.5**
  - 1.65.1 Available under license
- 1.66 commons-lang3 2.4**
  - 1.66.1 Available under license
- 1.67 openssl 1.0.2n**
  - 1.67.1 Available under license
- 1.68 socat 1.7.2.2**
  - 1.68.1 Available under license
- 1.69 gdb 7.0.8**
  - 1.69.1 Available under license
- 1.70 rpm 4.8.0**
  - 1.70.1 Available under license
- 1.71 beecrypt 7.0.0**
  - 1.71.1 Available under license
- 1.72 libssh2 1.2.8**

- 1.72.1 Available under license
- 1.73 linux-kernel 3.10.19**
- 1.73.1 Available under license
- 1.74 sysklogd 1.5.0**
- 1.74.1 Available under license
- 1.75 jdom b9**
- 1.75.1 Available under license
- 1.76 nfs-utils 0.24**
- 1.76.1 Available under license
- 1.77 hd-parm 9.39**
- 1.77.1 Available under license
- 1.78 futures 3.2.0**
- 1.78.1 Available under license
- 1.79 xerces-j 2.9.1**
- 1.79.1 Available under license
- 1.80 sshpass 1.04**
- 1.80.1 Available under license
- 1.81 expat 2.1.0**
- 1.81.1 Available under license
- 1.82 curl 7.30.0**
- 1.82.1 Available under license
- 1.83 fuse 2.8.7**
- 1.83.1 Available under license
- 1.84 expat 2.0.0**
- 1.84.1 Available under license
- 1.85 expat 2.0.1**
- 1.85.1 Available under license
- 1.86 netty 4.0.21.Final**
- 1.86.1 Available under license
- 1.87 openssh 5.4p1**
- 1.87.1 Available under license
- 1.88 tftp-hpa 5.2**
- 1.88.1 Available under license
- 1.89 psmisc 22.6**
- 1.89.1 Available under license
- 1.90 ganymed-ssh2 262**
- 1.90.1 Available under license
- 1.91 berkeley-db 4.7.25**
- 1.91.1 Available under license

## **1.92 dmalloc 5.5.2**

1.92.1 Available under license

## **1.93 libsodium 1.0.1**

1.93.1 Available under license

## **1.94 berkeley-db 4.8.26**

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1.95.1 Available under license

## **1.96 d-bus 1.2.16**

1.96.1 Available under license

## **1.97 crash 7.0.8**

1.97.1 Available under license

## **1.98 upstart 0.6.3**

1.98.1 Available under license

## **1.99 pyyaml 3.12**

1.99.1 Available under license

## **1.100 audit 3.10.19**

1.100.1 Available under license

## **1.101 open-ldap 1.2.5**

1.101.1 Available under license

## **1.102 procps 3.2.8**

1.102.1 Available under license

## **1.103 grpc-go 1.4.0**

1.103.1 Available under license

## **1.104 minicom 2.3**

1.104.1 Available under license

## **1.105 libtasn 1.2**

1.105.1 Available under license

## **1.106 tdb 1.41.9**

1.106.1 Available under license

## **1.107 gawk 3.1.5**

1.107.1 Available under license

## **1.108 libedit 3.1+20181209**

1.108.1 Available under license

## **1.109 yajl 2.0.1**

1.109.1 Available under license

## **1.110 vim 6.1**

1.110.1 Available under license

## **1.111 cpio 2.8**

- 1.111.1 Available under license
- 1.112 cronie 1.4.4**
  - 1.112.1 Available under license
- 1.113 dosfs-tools 3.0.9**
  - 1.113.1 Available under license
- 1.114 elfutils 0.149**
  - 1.114.1 Available under license
- 1.115 file 5.03**
  - 1.115.1 Available under license
- 1.116 gnutls 2.10.5**
  - 1.116.1 Available under license
- 1.117 grub2 2**
  - 1.117.1 Available under license
- 1.118 iproute 2.6.32**
  - 1.118.1 Available under license
- 1.119 jemalloc 4.0.4**
  - 1.119.1 Available under license
- 1.120 kexec-tools 2.0.1**
  - 1.120.1 Available under license
- 1.121 less 1**
  - 1.121.1 Available under license
- 1.122 libaio 0.3.106**
  - 1.122.1 Available under license
- 1.123 libconfig 1.4.6**
  - 1.123.1 Available under license
- 1.124 libgcrypt 1.4.0**
  - 1.124.1 Available under license
- 1.125 libnl3 3.2.22**
  - 1.125.1 Available under license
- 1.126 libpciaccess 0.12.0**
  - 1.126.1 Available under license
- 1.127 libtirpc 0.2.1**
  - 1.127.1 Available under license
- 1.128 netkit-tftp 5**
  - 1.128.1 Available under license
- 1.129 nspr 4.8.2**
  - 1.129.1 Available under license
- 1.130 nss 3.12.4**
  - 1.130.1 Available under license



### **1.131 parted 1.8.6**

1.131.1 Available under license

### **1.132 pciutils 3.1.4**

1.132.1 Available under license

### **1.133 popt 1.15**

1.133.1 Available under license

### **1.134 usbutils 0.86**

1.134.1 Available under license

### **1.135 util-linux 2.17.2**

1.135.1 Available under license

### **1.136 numactl 2.0.3**

1.136.1 Available under license

### **1.137 autogen 1.2**

1.137.1 Available under license

### **1.138 sqlite 3.3.17**

1.138.1 Available under license

### **1.139 libnsl 2.24**

1.139.1 Available under license

### **1.140 smartmontools 5.39**

1.140.1 Available under license

### **1.141 vim 7.3**

1.141.1 Available under license

### **1.142 lsof 4.83**

1.142.1 Available under license

### **1.143 sqlite 3.6.7**

1.143.1 Available under license

### **1.144 lvm2 2.02.64**

1.144.1 Available under license

### **1.145 libdevmapper 1.02.47**

1.145.1 Available under license

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1.146.1 Available under license

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Julian Seward, [jseward@bzip.org](mailto:jseward@bzip.org)  
bzip2/libbzip2 version 1.0.5 of 10 December 2007

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THE BASIC LIBRARY FUNCTIONS

-----

Written by: Philip Hazel

Email local part: ph10

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## 1.10 python 2.6.2

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Python was created in the early 1990s by Guido van Rossum at Stichting Mathematisch Centrum (CWI, see <http://www.cwi.nl>) in the Netherlands as a successor of a language called ABC. Guido remains Python's principal author, although it includes many contributions from others.

In 1995, Guido continued his work on Python at the Corporation for National Research Initiatives (CNRI, see <http://www.cnri.reston.va.us>) in Reston, Virginia where he released several versions of the software.

In May 2000, Guido and the Python core development team moved to BeOpen.com to form the BeOpen PythonLabs team. In October of the same year, the PythonLabs team moved to Digital Creations (now Zope Corporation, see <http://www.zope.com>). In 2001, the Python Software Foundation (PSF, see <http://www.python.org/psf/>) was formed, a non-profit organization created specifically to own Python-related Intellectual Property.

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All Python releases are Open Source (see <http://www.opensource.org> for the Open Source Definition). Historically, most, but not all, Python releases have also been GPL-compatible; the table below summarizes the various releases.

Release	Derived from	Year	Owner	GPL-compatible? (1)
0.9.0 thru 1.2		1991-1995	CWI	yes
1.3 thru 1.5.2	1.2	1995-1999	CNRI	yes

1.6	1.5.2	2000	CNRI	no
2.0	1.6	2000	BeOpen.com	no
1.6.1	1.6	2001	CNRI	yes (2)
2.1	2.0+1.6.1	2001	PSF	no
2.0.1	2.0+1.6.1	2001	PSF	yes
2.1.1	2.1+2.0.1	2001	PSF	yes
2.2	2.1.1	2001	PSF	yes
2.1.2	2.1.1	2002	PSF	yes
2.1.3	2.1.2	2002	PSF	yes
2.2.1	2.2	2002	PSF	yes
2.2.2	2.2.1	2002	PSF	yes
2.2.3	2.2.2	2003	PSF	yes
2.3	2.2.2	2002-2003	PSF	yes
2.3.1	2.3	2002-2003	PSF	yes
2.3.2	2.3.1	2002-2003	PSF	yes
2.3.3	2.3.2	2002-2003	PSF	yes
2.3.4	2.3.3	2004	PSF	yes
2.3.5	2.3.4	2005	PSF	yes
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2.4.3	2.4.2	2006	PSF	yes
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2.5				
	2.4	2006	PSF	yes
2.5.1	2.5	2007	PSF	yes
2.5.2	2.5.1	2008	PSF	yes
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```
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```

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Theodore Ts'o  
23-June-2007

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```

```
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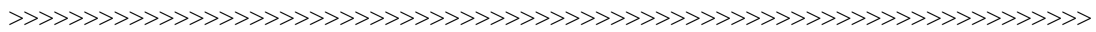
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David Megginson, david@megginson.com  
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## 1.18 qemu 1.5.3

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## 1.19 valgrind 3.10.1

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```
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#
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# a copyright notice. Assumes they're all in the same format:
#
# "Copyright (C) 20xy-2012"
#
# where x can be 0 or 1 and y can be anything.
# To use:
# - change the years in the 'perl' command below appropriately.
# - Run it from the base directory of a Valgrind workspace.
# - And check the results look ok by diffing against the repository.
#
# Note that it will spit out some warnings when it runs; ignore these.
#

# The find command deliberately skips .svn/ subdirs -- we don't want to
# change them.
for i in `find . -name '*.chS]' -o -name '*.in' -type f -not -path '*.svn/*'` ; do
  echo $i
  if [ -L $i ]; then continue; fi # skip symbolic links
  perl -p -e 's/Copyright \(C\) 20([0-1])([0-9])-2013/Copyright (C) 20$1$2-2014/' < $i > tmp.$$
  mv tmp.$$ $i
done

# Copyright IBM Corp. 2010-2011
```

```
perl -p -e 's/Copyright IBM Corp. 20([0-1])([0-9])-2013/Copyright IBM Corp. 20$1$2-2014/'
< $i > tmp.$$
mv tmp.$$ $i
done
```

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```
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<signature of Ty Coon>, 1 April 1989
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## 1.23 zeromq 4.0.5

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OpenPGM, an implementation of the PGM protocol.

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Python was created in the early 1990s by Guido van Rossum at Stichting  
Mathematisch Centrum (CWI, see <http://www.cwi.nl>) in the Netherlands  
as a successor of a language called ABC. Guido remains Python's  
principal author, although it includes many contributions from others.

In 1995, Guido continued his work on Python at the Corporation for  
National Research Initiatives (CNRI, see <http://www.cnri.reston.va.us>)  
in Reston, Virginia where he released several versions of the  
software.

In May 2000, Guido and the Python core development team moved to



BeOpen.com to form the BeOpen PythonLabs team. In October of the same year, the PythonLabs team moved to Digital Creations (now Zope Corporation, see <http://www.zope.com>). In 2001, the Python Software Foundation (PSF, see <http://www.python.org/psf/>) was formed, a non-profit organization created specifically to own Python-related Intellectual Property. Zope Corporation is a sponsoring member of the PSF.

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1.3 thru 1.5.2	1.2	1995-1999	CNRI	yes
1.6	1.5.2	2000	CNRI	no
2.0	1.6	2000	BeOpen.com	no
1.6.1	1.6	2001	CNRI	yes (2)
2.1	2.0+1.6.1	2001	PSF	no
2.0.1	2.0+1.6.1	2001	PSF	yes
2.1.1	2.1+2.0.1	2001	PSF	yes
2.1.2	2.1.1	2002	PSF	yes
2.1.3	2.1.2	2002	PSF	yes
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```

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## 1.32 ethtool 3.14

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```
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version 1.2.11, January 15th, 2017
```

```
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```

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\*/

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## 1.35 binutils 2.23.52

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The hypothetical commands

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```
Yoyodyne, Inc., hereby disclaims all copyright interest in the program
`Gnomovision' (which makes passes at compilers) written by James Hacker.
```

```
<signature of Ty Coon>, 1 April 1989
Ty Coon, President of Vice
```

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(This file is under construction.) -\*- text -\*-

If you've contributed to gas and your name isn't listed here, it is not meant as a slight. I just don't know about it. Email me, nickc@redhat.com and I'll correct the situation.

This file will eventually be deleted: The general info will go into the documentation, and info on specific files will go into an AUTHORS file, as requested by the FSF.

+++++

Dean Elsner wrote the original gas for vax. [more details?]

Jay Fenlason maintained gas for a while, adding support for

gdb-specific debug information and the 68k series machines, most of the preprocessing pass, and extensive changes in messages.c, input-file.c, write.c.

K. Richard Pixley maintained gas for a while, adding various enhancements and many bug fixes, including merging support for several processors, breaking gas up to handle multiple object file format backends (including heavy rewrite, testing, an integration of the coff and b.out backends), adding configuration including heavy testing and verification of cross assemblers and file splits and renaming, converted gas to strictly ansi C including full prototypes, added support for m680[34]0 & cpu32, considerable work on i960 including a coff port (including considerable amounts of reverse engineering), a sparc opcode file rewrite, decstation, rs6000, and hp300hpux host ports, updated "know" assertions and made them work, much other reorganization, cleanup, and lint.

Ken Raeburn wrote the high-level BFD interface code to replace most of the code in format-specific I/O modules.

The original Vax-VMS support was contributed by David L. Kashtan. Eric Youngdale and Pat Rankin have done much work with it since.

The Intel 80386 machine description was written by Eliot Dresselhaus.

Minh Tran-Le at IntelliCorp contributed some AIX 386 support.

The Motorola 88k machine description was contributed by Devon Bowen of Buffalo University and Torbjorn Granlund of the Swedish Institute of Computer Science.

Keith

Knowles at the Open Software Foundation wrote the original MIPS back end (tc-mips.c, tc-mips.h), and contributed Rose format support that hasn't been merged in yet. Ralph Campbell worked with the MIPS code to support a.out format.

Support for the Zilog Z8k and Hitachi H8/300, H8/500 and SH processors (tc-z8k, tc-h8300, tc-h8500, tc-sh), and IEEE 695 object file format (obj-ieee), was written by Steve Chamberlain of Cygnus Solutions. Steve also modified the COFF back end (obj-coffbfd) to use BFD for some low-level operations, for use with the Hitachi, 29k and Zilog targets.

John Gilmore built the AMD 29000 support, added .include support, and simplified the configuration of which versions accept which pseudo-ops. He updated the 68k machine description so that Motorola's

opcodes always produced fixed-size instructions (e.g. jsr), while synthetic instructions remained shrinkable (jbsr). John fixed many bugs, including true tested cross-compilation support, and one bug in relaxation that took a week and required the proverbial one-bit fix.

Ian Lance Taylor of Cygnus Solutions merged the Motorola and MIT syntaxes for the 68k, completed support for some COFF targets (68k, i386 SVR3, and SCO Unix), wrote the ECOFF support based on Michael Meissner's mips-tfile program, wrote the PowerPC and RS/6000 support, and made a few other minor patches. He handled the binutils releases for versions 2.7 through 2.9.

David Edelsohn contributed fixes for the PowerPC and AIX support.

Steve Chamberlain made gas able to generate listings.

Support for the HP9000/300 was contributed by Glenn Engel of HP.

Support for ELF format files has been worked on by Mark Eichin of Cygnus Solutions (original, incomplete implementation), Pete Hoogenboom at the University of Utah (HPPA mainly), Michael Meissner of the Open Software Foundation (i386 mainly), and Ken Raeburn of Cygnus Solutions (sparc, initial 64-bit support).

Several engineers at Cygnus Solutions have also provided many small bug fixes and configuration enhancements.

The initial Alpha support was contributed by Carnegie-Mellon University. Additional work was done by Ken Raeburn of Cygnus Solutions. Richard Henderson then rewrote much of the Alpha support.

Ian Dall updated the support code for the National Semiconductor 32000 series, and added support for Mach 3 and NetBSD running on the PC532.

Klaus Kaempf ported the assembler and the binutils to openVMS/Alpha.

Steve Haworth contributed the support for the Texas Instruction c30 (tms320c30).

H.J. Lu has contributed many patches and much testing.

Alan Modra reworked much of the i386 backend, improving the error checking, updating the code, and improving the 16 bit support, using patches from the work of Martynas Kunigelis and H.J. Lu.

Many others have contributed large or small bugfixes and enhancements. If

you've contributed significant work and are not mentioned on this list, and want to be, let us know. Some of the history has been lost; we aren't intentionally leaving anyone out.

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- d) If a facility in the modified

Library refers to a function or a table of data to be supplied by an application program that uses the facility, other than as an argument passed when the facility is invoked, then you must make a good faith effort to ensure that, in the event an application does not supply such function or table, the facility still operates, and performs whatever part of its purpose remains meaningful.

(For example, a function in a library to compute square roots has a purpose that is entirely well-defined independent of the application. Therefore, Subsection 2d requires that any application-supplied function or table used by this function must be optional: if the application does not supply it, the square root function must still compute square roots.)

These requirements apply to the modified work as a whole. If identifiable sections of that work are not derived from the Library, and can be reasonably considered independent and separate works in themselves,

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Thus, it is not the intent of this section to claim rights or contest your rights to work written entirely by you; rather, the intent is to exercise the right to control the distribution of derivative or collective works based on the Library.

In addition, mere aggregation of another work not based on the Library with the Library (or with a work based on the Library) on a volume of a storage or distribution medium does not bring the other work under the scope of this License.

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This option is useful when you wish to copy part of the code of the Library into a program that is not a library.

4. You may copy and distribute the Library (or a portion or derivative of it, under Section 2) in object code or executable form under the terms of Sections 1 and 2 above provided that you accompany it with the complete corresponding machine-readable source code, which must be distributed under the terms of Sections 1 and 2 above on a medium customarily used for software interchange.

If distribution of object code is made by offering access to copy from a designated place, then offering equivalent access to copy the source code from the same place satisfies the requirement to distribute the source code, even though third parties are not compelled to copy the source along with the object code.

5. A program that contains no derivative of any portion of the Library, but is designed to work with the Library by being compiled or linked with it, is called a "work that uses the Library". Such a work, in isolation, is not a derivative work of the Library, and therefore falls outside the scope of this License.

However, linking a "work that uses the Library" with the Library creates an executable that is a derivative of the Library (because it contains portions of the Library), rather than a "work that uses the library". The executable is therefore covered by this License.

Section 6 states terms for distribution of such executables.

When a "work that uses the Library" uses material from a header file that is part of the Library, the object code for the work may be a derivative work of the Library even though the source code is not. Whether this is true is especially significant if the work can be linked without the Library, or if the work is itself a library. The threshold for this to be true is not precisely defined by law.

If such an object file uses only numerical parameters, data structure layouts and accessors, and small macros and small inline functions (ten lines or less in length), then the use of the object file is unrestricted, regardless of whether it is legally a derivative work. (Executables containing this object code plus portions of the Library will still fall under Section 6.)

Otherwise, if the work is a derivative of the Library, you may

distribute the object code for the work under the terms of Section 6.

Any

executables containing that work also fall under Section 6, whether or not they are linked directly with the Library itself.

6. As an exception to the Sections above, you may also combine or link a "work that uses the Library" with the Library to produce a work containing portions of the Library, and distribute that work under terms of your choice, provided that the terms permit modification of the work for the customer's own use and reverse engineering for debugging such modifications.

You must give prominent notice with each copy of the work that the Library is used in it and that the Library and its use are covered by this License. You must supply a copy of this License. If the work during execution displays copyright notices, you must include the copyright notice for the Library among them, as well as a reference directing the user to the copy of this License. Also, you must do one of these things:

a) Accompany the work with the complete corresponding machine-readable source code for the Library including whatever changes were used in the work (which must be distributed under Sections 1 and 2 above); and, if the work is an executable linked with the Library, with the complete machine-readable "work that uses the Library", as object code and/or source code, so that the user can modify the Library and then relink to produce a modified executable containing the modified Library. (It is understood that the user who changes the contents of definitions files in the Library will not necessarily be able to recompile the application to use the modified definitions.)

b) Use a suitable shared library mechanism for linking with the Library. A suitable mechanism is one that (1) uses at run time a copy of the library already present on the user's computer system, rather than copying library functions into the executable, and (2) will operate properly with a modified version of the library, if the user installs one, as long as the modified version is interface-compatible with the version that the work was made with.

c) Accompany the work with a written offer, valid for at least three years, to give the same user the materials specified in Subsection 6a, above, for a charge no more than the cost of performing this distribution.

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e) Verify that the user has already received a copy of these materials or that you have already sent this user a copy.

For an executable, the required form of the "work that uses the Library" must include any data and utility programs needed for reproducing the executable from it. However, as a special exception, the materials to be distributed need not include anything that is normally distributed (in either source or binary form) with the major components (compiler, kernel, and so on) of the operating system on which the executable runs, unless that component itself accompanies the executable.

It may happen that this requirement contradicts the license restrictions of other proprietary libraries that do not normally accompany the operating system. Such a contradiction means you cannot use both them and the Library together in an executable that you distribute.

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Version 2, June 1991

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Most GNU software, including some libraries, is covered by the ordinary GNU General Public License, which was designed for utility programs. This license, the GNU Library General Public License, applies to certain designated libraries. This license is quite different from the ordinary one; be sure to read it in full, and don't assume that anything in it is the same as in the ordinary license.

The reason we have a separate public license for some libraries is that they blur the distinction we usually make between modifying or adding to a program and simply using it. Linking a program with a library, without changing the library, is in some sense simply using the library, and is analogous to running a utility program or application program. However, in a textual and legal sense, the linked executable is a combined work, a derivative of the original library, and the ordinary General Public License treats it as such.

Because of this blurred distinction, using the ordinary General Public License for libraries did not effectively promote software sharing, because most developers did not use the libraries. We concluded that weaker conditions might promote sharing better.

However, unrestricted linking of non-free programs would deprive the

users of those programs of all benefit from the free status of the libraries themselves. This Library General Public License is intended to permit developers of non-free programs to use free libraries, while preserving your freedom as a user of such programs to change the free libraries that are incorporated in them. (We have not seen how to achieve this as regards changes in header files, but we have achieved it as regards changes in the actual functions of the Library.) The hope is that this will lead to faster development of free libraries.

The precise terms and conditions for copying, distribution and modification follow. Pay close attention to the difference between a "work based on the library" and a "work that uses the library". The former contains code derived from the library, while the latter only works together with the library.

Note that it is possible for a library to be covered by the ordinary General Public License rather than by this special one.

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A "library" means a collection of software functions and/or data prepared so as to be conveniently linked with application programs (which use some of those functions and data) to form executables.

The "Library", below, refers to any such software library or work which has been distributed under these terms. A "work based on the Library" means either the Library or any derivative work under copyright law: that is to say, a work containing the Library or a portion of it, either verbatim or with modifications and/or translated straightforwardly into another language. (Hereinafter, translation is included without limitation in the term "modification".)

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2. You may modify your copy or copies of the Library or any portion of it, thus forming a work based on the Library, and copy and distribute such modifications or work under the terms of Section 1 above, provided that you also meet all of these conditions:

a) The modified work must itself be a software library.

b) You must cause the files modified to carry prominent notices stating that you changed the files and the date of any change.

c) You must cause the whole of the work to be licensed at no charge to all third parties under the terms of this License.

d) If a facility in the modified Library refers to a function or a table of data to be supplied by an application program that uses the facility, other than as an argument passed when the facility is invoked, then you must make a good faith effort to ensure that, in the event an application does not supply such function or table, the facility still operates, and performs whatever part of its purpose remains meaningful.

(For example, a function in a library to compute square roots has a purpose that is entirely well-defined independent of the application. Therefore, Subsection 2d requires that any application-supplied function or table used by this function must

be optional: if the application does not supply it, the square

root function must still compute square roots.)

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In addition,

mere aggregation of another work not based on the Library with the Library (or with a work based on the Library) on a volume of a storage or distribution medium does not bring the other work under the scope of this License.

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4. You may copy and distribute the Library (or a portion or derivative of it, under Section 2) in object code or executable form under the terms of Sections 1 and 2 above provided that you accompany it with the complete corresponding machine-readable source code, which must be distributed under the terms of Sections 1 and 2 above on a medium customarily used for software interchange.

If distribution of object code is made by offering access to copy from a designated place, then offering equivalent access to copy the source code from the same place satisfies the requirement to distribute the source code, even though third parties are not compelled to copy the source along with the object code.

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If such an object file uses only numerical parameters, data structure layouts and accessors, and small macros and small inline functions (ten lines or less in length), then the use of the object file is unrestricted, regardless of whether it is legally a derivative work. (Executables containing this object code plus portions of the Library will still fall under Section 6.)

Otherwise, if the work is a derivative of the Library, you may distribute the object code for the work under the terms of Section 6. Any executables containing that work also fall under Section 6, whether or not they are linked directly with the Library itself.

6. As an exception to the Sections above, you may also compile or link a "work that uses the Library" with the Library to produce a work containing portions of the Library, and distribute that work under terms of your choice, provided that the terms permit modification of the work for the customer's own use and reverse engineering for debugging such modifications.

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b) Accompany the work with a written offer, valid for at least three years, to give the same user the materials specified in Subsection 6a, above, for a charge no more than the cost of performing this distribution.

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It may happen that this requirement contradicts the license restrictions of other proprietary libraries that do not normally accompany the operating system. Such a contradiction means you cannot use both them and the Library together in an executable that you distribute.

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Mark Gates

Ajay Tirumala

Jim Ferguson

Jon Dugan

Feng Qin

Kevin Gibbs

John Estabrook

National Laboratory for Applied Network Research

National Center for Supercomputing Applications

University of Illinois at Urbana-Champaign

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## 1.39 libuv 1.7.4

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\*/

```

#ifndef UV_BSD_H
#define UV_BSD_H

#define UV_PLATFORM_FS_EVENT_FIELDS \
uv__io_t event_watcher; \

#define UV_IO_PRIVATE_PLATFORM_FIELDS \
int rcount; \
int wcount; \

#define UV_HAVE_KQUEUE 1

#endif /* UV_BSD_H */
Files: *
=====

```

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```

Files: getopt.c
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AUTHOR: Michael J. McLennan  
Bell Labs Innovations for Lucent Technologies  
mmclennan@lucent.com  
<http://www.tcltk.com/itcl>

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## 1.41 glib 2.26.0

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## 1.42 wget 1.15

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Because of this blurred distinction, using the ordinary General Public License for libraries did not effectively promote software sharing, because most developers did not use the libraries. We concluded that weaker conditions might promote sharing better.

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## 1.44 net-tools 1.60

### 1.44.1 Available under license :

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```

```
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## 1.46 binutils 2.19.51



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+++++

Dean Elsner wrote the original gas for vax. [more details?]

Jay Fenlason maintained gas for a while, adding support for gdb-specific debug information and the 68k series machines, most of the preprocessing pass, and extensive changes in messages.c, input-file.c, write.c.

K. Richard Pixley maintained gas for a while, adding various enhancements and many bug fixes, including merging support for several processors, breaking gas up to handle multiple object file format backends (including heavy rewrite, testing, an integration of the coff and b.out backends), adding configuration including heavy testing and verification of cross assemblers and file splits and renaming,



converted gas to strictly ansi C including full prototypes, added support for m680[34]0 & cpu32, considerable work on i960 including a coff port (including considerable amounts of reverse engineering), a sparc opcode file rewrite, decstation, rs6000, and hp300hpux host ports, updated "know" assertions and made them work, much other reorganization, cleanup, and lint.

Ken Raeburn wrote the high-level BFD interface code to replace most of the code in format-specific I/O modules.

The original Vax-VMS support was contributed by David L. Kashtan. Eric Youngdale and Pat Rankin have done much work with it since.

The Intel 80386 machine description was written by Eliot Dresselhaus.

Minh Tran-Le at IntelliCorp contributed some AIX 386 support.

The Motorola 88k machine description was contributed by Devon Bowen of Buffalo University and Torbjorn Granlund of the Swedish Institute of Computer Science.

Keith

Knowles at the Open Software Foundation wrote the original MIPS back end (tc-mips.c, tc-mips.h), and contributed Rose format support that hasn't been merged in yet. Ralph Campbell worked with the MIPS code to support a.out format.

Support for the Zilog Z8k and Hitachi H8/300, H8/500 and SH processors (tc-z8k, tc-h8300, tc-h8500, tc-sh), and IEEE 695 object file format (obj-ieee), was written by Steve Chamberlain of Cygnus Solutions. Steve also modified the COFF back end (obj-coffbfd) to use BFD for some low-level operations, for use with the Hitachi, 29k and Zilog targets.

John Gilmore built the AMD 29000 support, added .include support, and simplified the configuration of which versions accept which pseudo-ops. He updated the 68k machine description so that Motorola's opcodes always produced fixed-size instructions (e.g. jsr), while synthetic instructions remained shrinkable (jbsr). John fixed many bugs, including true tested cross-compilation support, and one bug in relaxation that took a week and required the proverbial one-bit fix.

Ian Lance Taylor of Cygnus Solutions merged the Motorola and MIT syntaxes for the 68k, completed support for some COFF targets (68k, i386 SVR3, and SCO Unix), wrote the ECOFF support based on Michael Meissner's mips-tfile program, wrote the PowerPC and RS/6000 support, and made a few other minor patches. He handled the binutils releases

for versions 2.7 through 2.9.

David Edelsohn contributed fixes for the PowerPC and AIX support.

Steve Chamberlain made gas able to generate listings.

Support for the HP9000/300 was contributed by Glenn Engel of HP.

Support for ELF format files has been worked on by Mark Eichin of Cygnus Solutions (original, incomplete implementation), Pete Hoogenboom at the University of Utah (HPPA mainly), Michael Meissner of the Open Software Foundation (i386 mainly), and Ken Raeburn of Cygnus Solutions (sparc, initial 64-bit support).

Several engineers at Cygnus Solutions have also provided many small bug fixes and configuration enhancements.

The initial Alpha support was contributed by Carnegie-Mellon University. Additional work was done by Ken Raeburn of Cygnus Solutions. Richard Henderson then rewrote much of the Alpha support.

Ian Dall updated the support code for the National Semiconductor 32000 series, and added support for Mach 3 and NetBSD running on the PC532.

Klaus Kaempf ported the assembler and the binutils to openVMS/Alpha.

Steve Haworth contributed the support for the Texas Instruction c30 (tms320c30).

H.J. Lu has contributed many patches and much testing.

Alan Modra reworked much of the i386 backend, improving the error checking, updating the code, and improving the 16 bit support, using patches from the work of Martynas Kunigelis and H.J. Lu.

Many others have contributed large or small bugfixes and enhancements. If you've contributed significant work and are not mentioned on this list, and want to be, let us know. Some of the history has been lost; we aren't intentionally leaving anyone out.

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The

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## 1.47 libunwind 1.1

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## 1.48 cryptsetup 1.6.6

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## 1.49 ntp 4.2.8p6

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Version 3, 29 June 2007

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/\*-\*- Mode: Text -\*-\*/

```
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  date = "1992-2017";  
  owner = "The University of Delaware and Network Time Foundation";
```



```

eaddr = "http://bugs.ntp.org, bugs@ntp.org";
type = ntp;
};

long-opts;
config-header = config.h;
environrc;
no-misuse-usage;
version-proc = ntpOptionPrintVersion;

version = `
eval VERSION=`sed -e 's/.*,\\[/ -e 's\\[.*/' < ../sntp/m4/version.m4`
[ -z "${VERSION}" ] && echo "Cannot determine VERSION" && kill -TERM $AG_pid
echo $VERSION`;

version-value = "; /* Don't use -v as a shortcut for --version */

/*
* HMS: man pages already have this, and texi pages can use the
* values in sntp/include/version.texi .
*/
// doc-sub = {
//   sub-name = version;
//   sub-text = 's/#VERSION#/<<version>>/g';
// };
<!DOCTYPE HTML PUBLIC "-//W3C//DTD HTML 4.01 Transitional//EN">
<html>
<head>
<meta http-equiv="content-type" content="text/html; charset=iso-8859-1">
<title>Copyright Notice</title>
<!-- Changed by: Harlan Stenn, 10-Mar-2014 -->
<link href="scripts/style.css" type="text/css" rel="stylesheet">
</head>
<body>
<h3>Copyright Notice</h3>
 "Clone me," says Dolly sheepishly.
<p>Last update:
<!-- #BeginDate format:En2m -->2-Jan-2017 11:58<!-- #EndDate -->
  UTC</p>
<br clear="left">
</p>
<hr>
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<p>The following individuals contributed in part to the Network Time Protocol Distribution Version 4 and are acknowledged as authors of this work.</p>

<ol>

<li><a href="mailto:%20takao\_abe@xurb.jp">Takao Abe &lt;takao\_abe@xurb.jp&gt;</a> Clock driver for JJY receivers</li>

<li><a href="mailto:%20mark\_andrews@isc.org">Mark Andrews &lt;mark\_andrews@isc.org&gt;</a> Leitch atomic clock controller</li>

<li><a href="mailto:%20altmeier@atsoft.de">Bernd Altmeier &lt;altmeier@atsoft.de&gt;</a> hopf Elektronik serial line and PCI-bus devices</li>

<li><a href="mailto:%20vbais@mailman1.intel.co">Viraj Bais &lt;vbais@mailman1.intel.com&gt;</a> and <a href="mailto:%20kirkwood@striderfm.intel.com">Clayton Kirkwood &lt;kirkwood@striderfm.intel.com&gt;</a> port to WindowsNT 3.5</li>

<li><a href="mailto:%20michael.barone@lmco.com">Michael Barone &lt;michael,barone@lmco.com&gt;</a> GPSVME fixes</li>

<li><a href="mailto:%20karl@owl.HQ.ileaf.com">Karl Berry &lt;karl@owl.HQ.ileaf.com&gt;</a> syslog to file option</li>

<li><a href="mailto:%20greg.brackley@bigfoot.com">Greg Brackley &lt;greg.brackley@bigfoot.com&gt;</a> Major rework of WINNT port. Clean up recvbuf and iosignal code into separate modules.</li>

<li><a href="mailto:%20Marc.Brett@westgeo.com">Marc Brett &lt;Marc.Brett@westgeo.com&gt;</a> Magnavox GPS clock driver</li>

<li><a href="mailto:%20Piete.Brooks@cl.cam.ac.uk">Piete Brooks &lt;Piete.Brooks@cl.cam.ac.uk&gt;</a> MSF clock driver, Trimble PARSE support</li>

<li><a href="mailto:%20nelson@bolyard.me">Nelson B Bolyard &lt;nelson@bolyard.me&gt;</a> update and complete broadcast and crypto features in snpt</li>

<li><a href="mailto:%20Jean-Francois.Boudreault@viagenie.qc.ca">Jean-Francois Boudreault &lt;Jean-Francois.Boudreault@viagenie.qc.ca&gt;</a>

IPv6 support</li>

<li><a href="mailto:%20reg@dwf.com">Reg Clemens &lt;reg@dwf.com&gt;</a> Oncore driver (Current maintainer)</li>

<li><a href="mailto:%20clift@ml.csiro.au">Steve Clift &lt;clift@ml.csiro.au&gt;</a> OMEGA clock driver</li>

<li><a href="mailto:%20casey@csc.co.za">Casey Crellin &lt;casey@csc.co.za&gt;</a> vxWorks (Tornado) port and help with target configuration</li>

<li><a href="mailto:%20Sven\_Dietrich@trimble.COM">Sven Dietrich &lt;sven\_dietrich@trimble.com&gt;</a> Palisade reference clock driver, NT adj. residuals, integrated Greg's Winnt port.</li>

<li><a href="mailto:%20dundas@salt.jpl.nasa.gov">John A. Dundas III &lt;dundas@salt.jpl.nasa.gov&gt;</a> Apple A/UX port</li>

<li><a href="mailto:%20duwe@immd4.informatik.uni-erlangen.de">Torsten Duwe &lt;duwe@immd4.informatik.uni-erlangen.de&gt;</a> Linux port</li>

<li><a href="mailto:%20dennis@mrbill.canet.ca">Dennis Ferguson &lt;dennis@mrbill.canet.ca&gt;</a> foundation

code for NTP Version 2 as specified in RFC-1119</li>

<li><a href="mailto:%20jhay@icomtek.csir.co.za">John Hay &lt;jhay@icomtek.csir.co.za&gt;</a> IPv6 support and testing</li>

- <li><a href="mailto:%20davehart@davehart.com">Dave Hart &lt;davehart@davehart.com&gt;</a> General maintenance, Windows port interpolation rewrite</li>
- <li><a href="mailto:%20neoclock4x@linum.com">Claas Hilbrecht &lt;neoclock4x@linum.com&gt;</a> NeoClock4X clock driver</li>
- <li><a href="mailto:%20glenn@herald.usask.ca">Glenn Hollinger &lt;glenn@herald.usask.ca&gt;</a> GOES clock driver</li>
- <li><a href="mailto:%20iglesias@uci.edu">Mike Iglesias &lt;iglesias@uci.edu&gt;</a> DEC Alpha port</li>
- <li><a href="mailto:%20jagubox.gsfc.nasa.gov">Jim Jagielski &lt;jim@jagubox.gsfc.nasa.gov&gt;</a> A/UX port</li>
- <li><a href="mailto:%20jbj@chatham.usdesign.com">Jeff Johnson &lt;jbj@chatham.usdesign.com&gt;</a> massive prototyping overhaul</li>
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- <li><a href="mailto:%20phk@FreeBSD.ORG">Poul-Henning Kamp &lt;phk@FreeBSD.ORG&gt;</a> Oncore driver (Original author)</li>
- <li><a href="http://www4.informatik.uni-erlangen.de/%7ekardel">Frank Kardel</a> <a href="mailto:%20kardel%20%28at%29%20ntp%20%28dot%29%20org">&lt;kardel (at) ntp (dot) org&gt;</a> PARSE &lt;GENERIC&gt; (driver 14 reference clocks), STREAMS modules for PARSE, support scripts, syslog cleanup, dynamic interface handling</li>
- <li><a href="mailto:kuehn@ntp.org">Johannes Maximilian Kuehn &lt;kuehn@ntp.org&gt;</a> Rewrote <tt>snpt</tt> to comply with NTPv4 specification, <tt>ntpq saveconfig</tt></li>
- <li><a href="mailto:%20jones@hermes.chpc.utexas.edu">William L. Jones &lt;jones@hermes.chpc.utexas.edu&gt;</a> RS/6000 AIX modifications, HPUX modifications</li>
- <li><a href="mailto:%20dkatz@cisco.com">Dave Katz &lt;dkatz@cisco.com&gt;</a> RS/6000 AIX port</li>
- <li><a href="mailto:%20leres@ee.lbl.gov">Craig Leres &lt;leres@ee.lbl.gov&gt;</a> 4.4BSD port, ppsclock, Magnavox GPS clock driver</li>
- <li><a href="mailto:%20lindholm@ucs.ubc.ca">George Lindholm &lt;lindholm@ucs.ubc.ca&gt;</a> SunOS 5.1 port</li>
- <li><a href="mailto:%20louie@ni.umd.edu">Louis A. Mamakos &lt;louie@ni.umd.edu&gt;</a> MD5-based authentication</li>
- <li><a href="mailto:%20thorinn@diku.dk">Lars H. Mathiesen &lt;thorinn@diku.dk&gt;</a> adaptation of foundation code for Version 3 as specified in RFC-1305</li>
- <li><a href="mailto:%20mayer@ntp.org">Danny Mayer &lt;mayer@ntp.org&gt;</a> Network I/O, Windows Port, Code Maintenance</li>
- <li><a href="mailto:%20mills@udel.edu">David L. Mills &lt;mills@udel.edu&gt;</a> Version 4 foundation, precision kernel; clock drivers: 1, 3, 4, 6, 7, 11, 13, 18, 19, 22, 36</li>
- <li><a href="mailto:%20moeller@gwdgv1.dnet.gwdg.de">Wolfgang Moeller &lt;moeller@gwdgv1.dnet.gwdg.de&gt;</a> VMS port</li>
- <li><a href="mailto:%20mogul@pa.dec.com">Jeffrey Mogul &lt;mogul@pa.dec.com&gt;</a> ntpttrace utility</li>
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- <li><a href="mailto:%20derek@toybox.demon.co.uk">Derek Mulcahy &lt;derek@toybox.demon.co.uk&gt;</a> and <a href="mailto:%20d@hd.org">Damon Hart-Davis &lt;d@hd.org&gt;</a> ARCRON MSF clock driver</li>

<li><a href="mailto:%20neal@ntp.org">Rob Neal &lt;neal@ntp.org&gt;</a> Bancomm refclock and config/parse code maintenance</li>

<li><a href="mailto:%20Rainer.Pruy@informatik.uni-erlangen.de">Rainer Pruy &lt;Rainer.Pruy@informatik.uni-erlangen.de&gt;</a> monitoring/trap scripts, statistics file handling</li>

<li><a href="mailto:%20dirce@zk3.dec.com">Dirce Richards &lt;dirce@zk3.dec.com&gt;</a> Digital UNIX V4.0 port</li>

<li><a href="mailto:%20wsanchez@apple.com">Wilfredo S&acutene;chez &lt;wsanchez@apple.com&gt;</a> added support for NetInfo</li>

<li><a href="mailto:%20mrapple@quack.kfu.com">Nick Sayer &lt;mrapple@quack.kfu.com&gt;</a> SunOS streams modules</li>

<li><a href="mailto:%20jack@innovativeinternet.com">Jack Sasportas &lt;jack@innovativeinternet.com&gt;</a> Saved a Lot of space on the stuff in the html/pic/ subdirectory</li>

<li><a href="mailto:%20schnitz@unipress.com">Ray Schnitzler &lt;schnitz@unipress.com&gt;</a> Unixware1 port</li>

<li><a href="mailto:%20shields@tembel.org">Michael Shields &lt;shields@tembel.org&gt;</a> USNO clock driver</li>

<li><a href="mailto:%20pebbles.jpl.nasa.gov">Jeff Steinman &lt;jss@pebbles.jpl.nasa.gov&gt;</a> Datum PTS clock driver</li>

<li><a href="mailto:%20harlan@pfcs.com">Harlan Stenn &lt;harlan@pfcs.com&gt;</a> GNU automake/autoconfigure makeover, various other bits (see the ChangeLog)</li>

<li><a href="mailto:%20ken@sdd.hp.com">Kenneth Stone &lt;ken@sdd.hp.com&gt;</a> HP-UX port</li>

<li><a href="mailto:%20ajit@ee.udel.edu">Ajit Thyagarajan &lt;ajit@ee.udel.edu&gt;</a> IP multicast/anycast support</li>

<li><a href="mailto:%20tsuruoka@nc.fukuoka-u.ac.jp">Tomoaki TSURUOKA &lt;tsuruoka@nc.fukuoka-u.ac.jp&gt;</a> TRAK clock driver</li>

<li><a href="mailto:%20brian.utterback@oracle.com">Brian Utterback &lt;brian.utterback@oracle.com&gt;</a> General codebase, Solaris issues</li>

<li><a href="mailto:%20loganaden@gmail.com">Loganaden Velvindron &lt;loganaden@gmail.com&gt;</a> Sandboxing (libseccomp) support</li>

<li><a href="mailto:%20vixie@vix.com">Paul A Vixie &lt;vixie@vix.com&gt;</a> TrueTime GPS driver, generic TrueTime clock driver</li>

<li><a href="mailto:%20Ulrich.Windl@rz.uni-regensburg.de">Ulrich Windl &lt;Ulrich.Windl@rz.uni-regensburg.de&gt;</a> corrected and validated HTML documents according to the HTML DTD</li>

</ol>

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*****

```

The following individuals contributed in part to the Network Time Protocol Distribution

Version 4 and are acknowledged as authors of this work.

1. [1]Takao Abe <takao\_abe@xurb.jp> Clock driver for JY receivers
2. [2]Mark Andrews <mark\_andrews@isc.org> Leitch atomic clock controller
3. [3]Bernd Altmeier <altmeier@atsoft.de> hopf Elektronik serial line and PCI-bus devices
4. [4]Viraj Bais <vbais@mailman1.intel.com> and [5]Clayton Kirkwood <kirkwood@striderfm.intel.com> port to WindowsNT 3.5
5. [6]Michael Barone <michael,barone@lmco.com> GPSVME fixes
6. [7]Karl Berry <karl@owl.HQ.ileaf.com> syslog to file option
7. [8]Greg Brackley <greg.brackley@bigfoot.com> Major rework of WINNT port. Clean up recvbuf and iosignal code into separate modules.
8. [9]Marc Brett <Marc.Brett@westgeo.com> Magnavox GPS clock driver
9. [10]Piete Brooks <Piete.Brooks@cl.cam.ac.uk> MSF clock driver, Trimble PARSE support
10. [11]Nelson B Bolyard <nelson@bolyard.me> update and complete broadcast and crypto features

in sntp

11. [12]Jean-Francois Boudreault  
<Jean-Francois.Boudreault@viagenie.qc.ca> IPv6 support
12. [13]Reg Clemens <reg@dwf.com> Oncore driver (Current maintainer)
13. [14]Steve Clift <clift@ml.csiro.au> OMEGA clock driver
14. [15]Casey Crellin <casey@csc.co.za> vxWorks (Tornado) port and help  
with target configuration
15. [16]Sven Dietrich <sven\_dietrich@trimble.com> Palisade reference  
clock driver, NT adj. residuals, integrated Greg's Winnt port.
16. [17]John A. Dundas III <dundas@salt.jpl.nasa.gov> Apple A/UX port
17. [18]Torsten Duwe <duwe@immd4.informatik.uni-erlangen.de> Linux port
18. [19]Dennis Ferguson <dennis@mrbill.canet.ca> foundation code for  
NTP Version 2 as specified in RFC-1119
19. [20]John Hay <jhay@icomtek.csir.co.za> IPv6 support and testing
20. [21]Dave Hart <davehart@davehart.com> General maintenance, Windows  
port interpolation rewrite
21. [22]Claas Hilbrecht <neoclock4x@linum.com> NeoClock4X  
clock driver
22. [23]Glenn Hollinger <glenn@herald.usask.ca> GOES clock driver
23. [24]Mike Iglesias <iglesias@uci.edu> DEC Alpha port
24. [25]Jim Jagielski <jim@jagubox.gsfc.nasa.gov> A/UX port
25. [26]Jeff Johnson <jbj@chatham.usdesign.com> massive prototyping  
overhaul
26. [27]Hans Lambermont <Hans.Lambermont@nl.origin-it.com> or  
[28]<H.Lambermont@chello.nl> ntpswEEP
27. [29]Poul-Henning Kamp <phk@FreeBSD.ORG> Oncore driver (Original  
author)
28. [30]Frank Kardel [31]<kardel (at) ntp (dot) org> PARSE <GENERIC>  
(driver 14 reference clocks), STREAMS modules for PARSE, support  
scripts, syslog cleanup, dynamic interface handling
29. [32]Johannes Maximilian Kuehn <kuehn@ntp.org> Rewrote sntp to  
comply with NTPv4 specification, ntpq saveconfig
30. [33]William L. Jones <jones@hermes.chpc.utexas.edu> RS/6000 AIX  
modifications, HPUX modifications
31. [34]Dave Katz <dkatz@cisco.com> RS/6000 AIX port
32. [35]Craig  
Leres <leres@ee.lbl.gov> 4.BSD port, ppsclock, Magnavox  
GPS clock driver
33. [36]George Lindholm <lindholm@ucs.ubc.ca> SunOS 5.1 port
34. [37]Louis A. Mamakos <louie@ni.umd.edu> MD5-based authentication
35. [38]Lars H. Mathiesen <thorinn@diku.dk> adaptation of foundation  
code for Version 3 as specified in RFC-1305
36. [39]Danny Mayer <mayer@ntp.org>Network I/O, Windows Port, Code  
Maintenance
37. [40]David L. Mills <mills@udel.edu> Version 4 foundation, precision  
kernel; clock drivers: 1, 3, 4, 6, 7, 11, 13, 18, 19, 22, 36
38. [41]Wolfgang Moeller <moeller@gwdgv1.dnet.gwdg.de> VMS port
39. [42]Jeffrey Mogul <mogul@pa.dec.com> ntptrace utility



40. [43]Tom Moore <tmoore@fieval.daytonoh.ncr.com> i386 svr4 port
  41. [44]Kamal A Mostafa <kamal@whence.com> SCO OpenServer port
  42. [45]Derek Mulcahy <derek@toybox.demon.co.uk> and [46]Damon Hart-Davis <d@hd.org> ARCRON MSF clock driver
  43. [47]Rob Neal <neal@ntp.org> Bancomm refclock and config/parse code maintenance
  44. [48]Rainer Pruy <Rainer.Pruy@informatik.uni-erlangen.de> monitoring/trap scripts, statistics file handling
  45. [49]Dirce Richards <dirce@zk3.dec.com> Digital UNIX V4.0 port
  46. [50]Wilfredo Snchez <wsanchez@apple.com> added support for NetInfo
  47. [51]Nick Sayer <mrapple@quack.kfu.com> SunOS streams modules
  48. [52]Jack Sasportas <jack@innovativeinternet.com> Saved a Lot of space on the stuff in the html/pic/ subdirectory
  49. [53]Ray Schnitzler <schnitz@unipress.com> Unixware1 port
  50. [54]Michael Shields <shields@tembel.org> USNO clock driver
  51. [55]Jeff Steinman <jss@pebbles.jpl.nasa.gov> Datum PTS clock driver
  52. [56]Harlan Stenn <harlan@pfcs.com> GNU automake/autoconfigure makeover, various other bits (see the ChangeLog)
  53. [57]Kenneth Stone <ken@sdd.hp.com> HP-UX port
  54. [58]Ajit Thyagarajan <ajit@ee.udel.edu>IP multicast/anycast support
  55. [59]Tomoaki TSURUOKA <tsuruoka@nc.fukuoka-u.ac.jp>TRAK clock driver
  56. [60]Brian Utterback <brian.utterback@oracle.com> General codebase, Solaris issues
  57. [61]Loganaden Velvindron <loganaden@gmail.com> Sandboxing (libseccomp) support
  58. [62]Paul A Vixie <vixie@vix.com> TrueTime GPS driver, generic TrueTime clock driver
  59. [63]Ulrich Windl <Ulrich.Windl@rz.uni-regensburg.de> corrected and validated HTML documents according to the HTML DTD
- 

## References

1. mailto:%20takao\_abe@xurb.jp
2. mailto:%20mark\_andrews@isc.org
3. mailto:%20altmeier@atsoft.de
4. mailto:%20vbais@mailman1.intel.co
5. mailto:%20kirkwood@striderfm.intel.com
6. mailto:%20michael.barone@lmco.com
7. mailto:%20karl@owl.HQ.ileaf.com
8. mailto:%20greg.brackley@bigfoot.com
9. mailto:%20Marc.Brett@westgeo.com
10. mailto:%20Piete.Brooks@cl.cam.ac.uk
11. mailto:%20nelson@bolyard.me
12. mailto:%20Jean-Francois.Boudreault@viagenie.qc.ca

13. <mailto:%20reg@dwf.com>
14. <mailto:%20clift@ml.csiro.au>
15. <mailto:%20casey@csc.co.za>
16. [mailto:%20Sven\\_Dietrich@trimble.COM](mailto:%20Sven_Dietrich@trimble.COM)
17. <mailto:%20dundas@salt.jpl.nasa.gov>
18. <mailto:%20duwe@immd4.informatik.uni-erlangen.de>
19. <mailto:%20dennis@mrbill.canet.ca>
20. <mailto:%20jhay@icomtek.csir.co.za>
21. <mailto:%20davehart@davehart.com>
22. <mailto:%20neoclock4x@linum.com>
23. <mailto:%20glenn@herald.usask.ca>
24. <mailto:%20iglesias@uci.edu>
25. <mailto:%20jagubox.gsfc.nasa.gov>
26. <mailto:%20jbj@chatham.usdesign.com>
27. <mailto:%20Hans.Lambermont@nl.origin-it.com>
28. <mailto:H.Lambermont@chello.nl>
29. <mailto:%20phk@FreeBSD.ORG>
30. <http://www4.informatik.uni-erlangen.de/%7ekardel>
31. <mailto:%20kardel%20%28at%29%20ntp%20%28dot%29%20org>
32. <mailto:kuehn@ntp.org>
33. <mailto:%20jones@hermes.chpc.utexas.edu>
34. <mailto:%20dkatz@cisco.com>
35. <mailto:%20leres@ee.lbl.gov>
36. <mailto:%20lindholm@ucs.ubc.ca>
37. <mailto:%20louie@ni.umd.edu>
38. <mailto:%20thorinn@diku.dk>
39. <mailto:%20mayer@ntp.org>
40. <mailto:%20mills@udel.edu>
41. <mailto:%20moeller@gwdgv1.dnet.gwdg.de>
42. <mailto:%20mogul@pa.dec.com>
43. <mailto:%20tmoore@fivel.daytonoh.ncr.com>
44. <mailto:%20kamal@whence.com>
45. <mailto:%20derek@toybox.demon.co.uk>
46. <mailto:%20d@hd.org>
47. <mailto:%20neal@ntp.org>
48. <mailto:%20Rainer.Pruy@informatik.uni-erlangen.de>
49. <mailto:%20dirce@zk3.dec.com>
50. <mailto:%20wsanchez@apple.com>
51. <mailto:%20mrapple@quack.kfu.com>
52. <mailto:%20jack@innovativeinternet.com>
53. <mailto:%20schnittz@unipress.com>
54. <mailto:%20shields@tembel.org>
55. <mailto:%20pebbles.jpl.nasa.gov>
56. <mailto:%20harlan@pfcs.com>
57. <mailto:%20ken@sdd.hp.com>
58. <mailto:%20ajit@ee.udel.edu>
59. <mailto:%20tsuruoka@nc.fukuoka-u.ac.jp>

- 60. [mailto:%20brian.utterback@oracle.com](mailto:brian.utterback@oracle.com)
- 61. [mailto:%20loganaden@gmail.com](mailto:loganaden@gmail.com)
- 62. [mailto:%20vixie@vix.com](mailto:vixie@vix.com)
- 63. [mailto:%20Ulrich.Windl@rz.uni-regensburg.de](mailto:Ulrich.Windl@rz.uni-regensburg.de)

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## 1.51 netbsd-resolv 2.20

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## 1.52 libvirt 1.1.2

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abstract: 'Build and install Perl modules'

author:

- 'Ken Williams <kwilliams@cpan.org>'

- "Development questions, bug reports, and patches should be sent to the\nModule-Build mailing list at <module-build@perl.org>."

build\_requires:

File::Temp: 0.15

Test::Harness: 3.16

Test::More: 0.49

generated\_by: 'Module::Build version 0.3608'

license: gpl

meta-spec:

url: <http://module-build.sourceforge.net/META-spec-v1.4.html>

version: 1.4

name: Module-Build

resources:

MailingList: <mailto:module-build@perl.org>

license: <http://dev.perl.org/licenses/>

repository: <http://github.com/dagolden/module-build/>

version: 3

-----  
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Julian Seward, [jseward@bzip.org](mailto:jseward@bzip.org)  
bzip2/libbzip2 version 1.0.6 of 6 September 2010

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```
#!/perl
```

```
=head1 NAME
```

```
copyright.t
```

```
=head1 DESCRIPTION
```

Tests that the latest copyright years in the top-level README file and the C<perl -v> output match each other.

If the test fails, update at least one of README and perl.c so that they match reality.

Optionally you can pass the C<--now> option to check they are at the current year. This isn't checked by default, so that it doesn't fail for people working on older releases. It should be run before making a new release.

```
=cut
```

```
use strict;
```

```
use Config;
```

```
BEGIN { require './test.pl' }
```

```
if ( $Config{usecrosscompile} ) {
```

```
    skip_all( "Not all files are available during cross-compilation" );
```

```
}
```

```
my ($opt) = @ARGV;
```

```

my $readme_year = readme_year();
my $v_year = v_year();

# Check that both copyright dates are up-to-date, but only if requested, so
# that tests still pass for people intentionally working on older versions:
if ($opt eq '--now')
{
my $current_year = (gmtime)[5] + 1900;
is $v_year, $current_year, 'perl -v copyright includes current
year';
is $readme_year, $current_year, 'README copyright includes current year';
}

# Otherwise simply check that the two copyright dates match each other:
else
{
is $readme_year, $v_year, 'README and perl -v copyright dates match';
}

done_testing;

sub readme_year
# returns the latest copyright year from the top-level README file
{

open my $readme, '<', './README' or die "Opening README failed: $!";

# The copyright message is the first paragraph:
local $/ = "";
my $copyright_msg = <$readme>;

my ($year) = $copyright_msg =~ /\b(\d{4,})/s
    or die "Year not found in README copyright message '$copyright_msg'";

$year;
}

sub v_year
# returns the latest copyright year shown in perl -v
{

my $output = runperl switches => ['-v'];
my ($year) = $output =~ /copyright 1987.\b(\d{4,})/i
    or die "Copyright statement not found in perl -v output '$output'";
}

```

```
$year;  
}
```

# 1.58 log-rotate 3.7.8

## 1.58.1 Available under license :

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## 1.68 socat 1.7.2.2

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When a "work that uses the Library" uses material from a header file that is part of the Library, the object code for the work may be a derivative work of the Library even though the source code is not.

Whether this is true is especially significant if the work can be linked without the Library, or if the work is itself a library. The threshold for this to be true is not precisely defined by law.

If such an object file uses only numerical parameters, data structure layouts and accessors, and small macros and small inline functions (ten lines or less in length), then the use of the object file is unrestricted, regardless of whether it is legally a derivative work. (Executables containing this object code plus portions of the Library will still fall under Section 6.)

Otherwise, if the work is a derivative of the Library, you may distribute the object code for the work under the terms of Section 6.

Any

executables containing that work also fall under Section 6, whether or not they are linked directly with the Library itself.

6. As an exception to the Sections above, you may also combine or link a "work that uses the Library" with the Library to produce a work containing portions of the Library, and distribute that work under terms of your choice, provided that the terms permit modification of the work for the customer's own use and reverse engineering for debugging such modifications.

You must give prominent notice with each copy of the work that the Library is used in it and that the Library and its use are covered by this License. You must supply a copy of this License. If the work during execution displays copyright notices, you must include the copyright notice for the Library among them, as well as a reference directing the user to the copy of this License. Also, you must do one of these things:

a) Accompany the work with the complete corresponding machine-readable source code for the Library including whatever changes were used in the work (which must be distributed under Sections 1 and 2 above); and, if the work is an executable linked with the Library, with the complete machine-readable "work that uses the Library", as object code and/or source code, so that the user can modify the Library and then relink to produce a modified executable containing the modified Library. (It is understood that the user who changes the contents of definitions files in the Library will not necessarily be able to recompile the application to use the modified definitions.)

b) Use a suitable shared library mechanism for linking with the Library. A suitable mechanism is one that (1) uses at run time a copy of the library already present on the user's computer system,

rather than copying library functions into the executable, and (2) will operate properly with a modified version of the library, if the user installs one, as long as the modified version is interface-compatible with the version that the work was made with.

c) Accompany the work with a written offer, valid for at least three years, to give the same user the materials specified in Subsection 6a, above, for a charge no more than the cost of performing this distribution.

d) If distribution of the work is made by offering access to copy from a designated place, offer equivalent access to copy the above specified materials from the same place.

e) Verify that the user has already received a copy of these materials or that you have already sent this user a copy.

For an executable, the required form of the "work that uses the Library" must include any data and utility programs needed for reproducing the executable from it. However, as a special exception, the materials to be distributed need not include anything that is normally distributed (in either source or binary form) with the major components (compiler, kernel, and so on) of the operating system on which the executable runs, unless that component itself accompanies the executable.

It may happen that this requirement contradicts the license restrictions of other proprietary libraries that do not normally accompany the operating system. Such a contradiction means you cannot use both them and the Library together in an executable that you distribute.

7. You may place library facilities that are a work based on the Library side-by-side in a single library together with other library facilities not covered by this License, and distribute such a combined library, provided that the separate distribution of the work based on the Library and of the other library facilities is otherwise permitted, and provided that you do these two things:

a) Accompany the combined library with a copy of the same work based on the Library, uncombined with any other library facilities. This must be distributed under the terms of the Sections above.

b) Give prominent notice with the combined library of the fact

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Also add information on how to contact you by electronic and paper mail.

You should also get your employer (if you work as a programmer) or your school, if any, to sign a "copyright disclaimer" for the library, if necessary. Here is a sample; alter the names:

Yoyodyne, Inc., hereby disclaims all copyright interest in the library `Frob' (a library for tweaking knobs) written by James Random Hacker.

<signature of Ty Coon>, 1 April 1990  
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[This is the first released version of the library GPL. It is numbered 2 because it goes with version 2 of the ordinary GPL.]

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The reason we have a separate public license for some libraries is that they blur the distinction we usually make between modifying or adding to a program and simply using it. Linking a program with a library, without changing the library, is in some sense simply using the library, and is

analogous to running a utility program or application program. However, in a textual and legal sense, the linked executable is a combined work, a derivative of the original library, and the ordinary General Public License treats it as such.

Because of this blurred distinction, using the ordinary General Public License for libraries did not effectively promote software sharing, because most developers did not use the libraries. We concluded that weaker conditions might promote sharing better.

However, unrestricted linking of non-free programs would deprive the users of those programs of all benefit from the free status of the libraries themselves. This Library General Public License is intended to permit developers of non-free programs to use free libraries, while preserving your freedom as a user of such programs to change the free libraries that are incorporated in them. (We have not seen how to achieve this as regards changes in header files, but we have achieved it as regards changes in the actual functions of the Library.) The hope is that this will lead to faster development of free libraries.

The precise terms and conditions for copying, distribution and modification follow. Pay close attention to the difference between a "work based on the library" and a "work that uses the library". The former contains code derived from the library, while the latter only works together with the library.

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A "library" means a collection of software functions and/or data prepared so as to be conveniently linked with application programs (which use some of those functions and data) to form executables.

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"Source code" for a work means the preferred form of the work for making modifications to it. For a library, complete source code means all the source code for all modules it contains, plus any associated interface definition files, plus the scripts used to control compilation and installation of the library.

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b) You must cause the files modified to carry prominent notices stating that you changed the files and the date of any change.

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d) If a facility in the modified Library refers to a function or a table of data to be supplied by an application program that uses

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(For example, a function in a library to compute square roots has a purpose that is entirely well-defined independent of the application. Therefore, Subsection 2d requires that any application-supplied function or table used by this function must be optional: if the application does not supply it, the square root function must still compute square roots.)

These requirements apply to the modified work as a whole. If identifiable sections of that work are not derived from the Library, and can be reasonably considered independent and separate works in themselves, then this License, and its terms, do not apply to those sections when you distribute them as separate works. But when you distribute the same sections as part of a whole which is a work based on the Library, the distribution of the whole must be on the terms of this License, whose permissions for other licensees extend to the entire whole, and thus to each and every part regardless of who wrote it.

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This option is useful when you wish to copy part of the code of the Library into a program that is not a library.

4. You may copy and distribute the Library (or a portion or derivative of it, under Section 2) in object code or executable form under the terms of Sections 1 and 2 above provided that you accompany it with the complete corresponding machine-readable source code, which must be distributed under the terms of Sections 1 and 2 above on a medium customarily used for software interchange.

If distribution of object code is made by offering access to copy from a designated place, then offering equivalent access to copy the source code from the same place satisfies the requirement to distribute the source code, even though third parties are not compelled to copy the source along with the object code.

5. A program that contains no derivative of any portion of the Library, but is designed to work with the Library by being compiled or linked with it, is called a "work that uses the Library". Such a work, in isolation, is not a derivative work of the Library, and therefore falls outside the scope of this License.

However, linking a "work that uses the Library" with the Library creates an executable that is a derivative of the Library (because it contains portions of the Library), rather than a "work that uses the library". The executable is therefore covered by this License. Section 6 states terms for distribution of such executables.

When a "work that uses the Library" uses material from a header file that is part of the Library, the object code for the work may be a derivative work of the Library even though the source code is not. Whether this is true is especially significant if the work can be linked without the Library, or if the work is itself a library. The threshold for this to be true is not precisely defined by law.

If such an object file uses only numerical parameters, data structure layouts and accessors, and small macros and small inline functions (ten lines or less in length), then the use of the object file is unrestricted, regardless of whether it is legally a derivative work. (Executables containing this object code plus portions of the Library will still fall under Section 6.)

Otherwise, if the work is a derivative of the Library, you may distribute the object code for the work under the terms of Section 6.

Any executables containing that work also fall under Section 6, whether or not they are linked directly with the Library itself.

6. As an exception to the Sections above, you may also compile or link a "work that uses the Library" with the Library to produce a work containing portions of the Library, and distribute that work under terms of your choice, provided that the terms permit modification of the work for the customer's own use and reverse engineering for debugging such modifications.

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<one line to give the library's name and a brief idea of what it does.>

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```

The hypothetical commands `@samp{show w}` and `@samp{show c}` should show the appropriate parts of the General Public License. Of course, your program's commands might be different; for a GUI interface, you would use an ```about box```.

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@c man end

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## 1.70 rpm 4.8.0

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```
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- Seth Arnold, for contributing to the documentation.
- Daniel Black, (former) maintainer of the Gentoo GNU/Linux BeeCrypt package.
- Jan-Rudolph Bhrmann, for helping me get started on the 64-bit multi-precision integer library.
- Luca Filipozzi, (former) maintainer/packager of BeeCrypt for Debian GNU/Linux.
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- Jon Sturgeon, bug hunter extraordinaire.

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- ARM Ltd, for donating a copy of "ARM Architecture Reference Manual".
- HP/Compaq, for their testdrive program, which gave me the opportunity to test and BeeCrypt on many new platforms.
- FSF France, for providing me with access to the GCC Compile Farm.
- SourceForge, for their excellent open source development platform.

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reported bugs, provided feedback, or works on including BeeCrypt in any

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If I've missed anyone, it's due to oversight. Drop me a line and I'll rectify the situation as quickly as possible.

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Contributors to bttv:

Michael Chu <mmchu@pobox.com>  
AverMedia fix and more flexible card recognition

Alan Cox <alan@lxorguk.ukuu.org.uk>  
Video4Linux interface and 2.1.x kernel adaptation

Chris Kleitsch  
Hardware I2C

Gerd Knorr <kraxel@cs.tu-berlin.de>  
Radio card (ITT sound processor)

bigfoot <bigfoot@net-way.net>  
Ragnar Hojland Espinosa <ragnar@macula.net>  
ConferenceTV card

+ many more (please mail me if you are missing in this list and would like to be mentioned)

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x095840@ti.com.

Please keep the following list in alphabetical order.

Suman Anna  
Sripal Bagadia  
Felipe Balbi  
Ohad Ben-Cohen  
Phil Carmody  
Deepak Chitriki  
Felipe Contreras  
Hiroshi Doyu  
Seth Forshee  
Ivan Gomez Castellanos  
Mark Grosen  
Ramesh Gupta G  
Fernando Guzman Lugo  
Axel Haslam  
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Tony Lindgren  
Antonio Luna  
Hari Nagalla  
Nishanth Menon  
Ameya Palande  
Vijay Pasam  
Gilbert Pitney  
Omar Ramirez Luna  
Ernesto Ramos  
Chris Ring  
Larry Schiefer  
Rebecca Schultz Zavin  
Bhavin Shah  
Andy Shevchenko  
Jeff Taylor  
Roman Tereshonkov  
Armando Uribe de Leon  
Nischal Varide  
Wenbiao Wang

/\* nicstar.c v0.22 Jawaid Bazyar (bazyar@hypermall.com)

\* nicstar.c, M. Welsh (matt.welsh@cl.cam.ac.uk)

\*

\* Hacked October, 1997 by Jawaid Bazyar, Interlink Advertising Services Inc.

\* <http://www.hypermall.com/>

\* 10/1/97 - commented out CFG\_PHYIE bit - we don't care when the PHY

\* interrupts us (except possibly for removal/insertion of the cable?)

\* 10/4/97 - began heavy inline documentation of the code. Corrected typos

- \* and spelling mistakes.
- \* 10/5/97 - added code to handle PHY interrupts, disable PHY on
- \* loss of link, and correctly re-enable PHY when link is
- \* re-established. (put back CFG\_PHYIE)
- \*
- \* Modified to work with the IDT7721 nicstar -- AAL5 (tested) only.
- \*
- \* R. D. Rechenmacher <ron@fnal.gov>, Aug. 6, 1997
- \*
- \* Linux driver for the IDT77201 NICStAR PCI ATM controller.
- \* PHY component is expected to be 155 Mbps S/UNI-Lite or IDT 77155;
- \* see init\_nicstar() for PHY initialization to change this. This driver
- \* expects the Linux ATM stack to support scatter-gather
- lists
- \* (skb->atm.iovcnt != 0) for Rx skb's passed to vcc->push.
- \*
- \* Implementing minimal-copy of received data:
- \* IDT always receives data into a small buffer, then large buffers
- \* as needed. This means that data must always be copied to create
- \* the linear buffer needed by most non-ATM protocol stacks (e.g. IP)
- \* Fix is simple: make large buffers large enough to hold entire
- \* SDU, and leave <small\_buffer\_data> bytes empty at the start. Then
- \* copy small buffer contents to head of large buffer.
- \* Trick is to avoid fragmenting Linux, due to need for a lot of large
- \* buffers. This is done by 2 things:
- \* 1) skb->destructor / skb->atm.recycle\_buffer
- \* combined, allow nicstar\_free\_rx\_skb to be called to
- \* recycle large data buffers
- \* 2) skb\_clone of received buffers
- \* See nicstar\_free\_rx\_skb and linearize\_buffer for implementation
- \* details.
- \*
- \*
- \*
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\*  
\* M. Welsh, 6 July 1996  
\*  
\*  
\*/

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for his contributions to the dvb-net driver



Diego Picciani <d.picciani@novacom.it>  
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(in case you are wondering where CyberLogin is, EON changed its login  
procedure and CyberLogin is no longer used.)

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<obi@linuxtv.org>

Dennis Noermann <dennis.noermann@noernet.de>

Felix Domke <tmbinc@elitedvb.net>

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for the nxt2004 frontend driver

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for the or51211 and or51132 frontend drivers, and  
for merging the nxt2002 and nxt2004 modules into a  
single nxt200x frontend driver.

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```

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## 1.75 jdom b9

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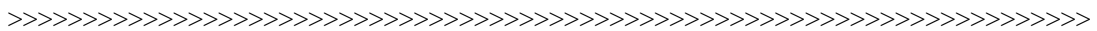
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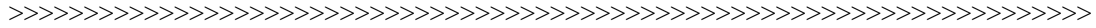
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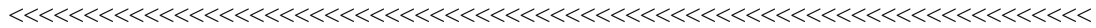


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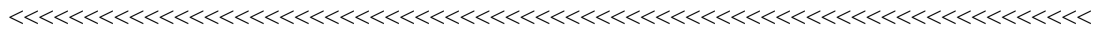
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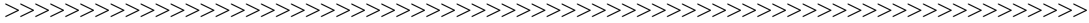
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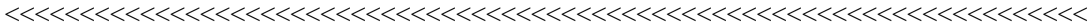


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Authors: J. Bruce Fields, Andy Adamson, Marius Eriksen

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Thus, it is not the intent of this section to claim rights or contest your rights to work written entirely by you; rather, the intent is to exercise the right to control the distribution of derivative or collective works based on the Program.

In addition, mere aggregation of another work not based on the Program with the Program (or with a work based on the Program) on a volume of a storage or distribution medium does not bring the other work under the scope of this License.

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- c) Accompany it with the information you received as to the offer to distribute corresponding source code. (This alternative is allowed only for noncommercial distribution and only if you received the program in object code or executable form with such offer, in accord with Subsection b above.)

The source code for a work means the preferred form of the work for making modifications to it. For an executable work, complete source code means all the source code for all modules it contains, plus any associated interface definition files, plus the scripts used to control compilation and installation of the executable. However, as a special exception, the source code distributed need not include anything that is normally distributed (in either source or binary form) with the major components (compiler, kernel, and so on) of the operating system on which the executable runs, unless that component itself accompanies the executable.

If distribution of executable or object code is made by offering access to copy from a designated place, then offering equivalent access to copy the source code from the same place counts as distribution of the source code, even though third parties are not compelled to copy the source along with the object code.

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Also add information on how to contact you by electronic and paper mail.

If the program is interactive, make it output a short notice like this when it starts in an interactive mode:

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Gnomovision comes with ABSOLUTELY NO WARRANTY; for details type `show w'.  
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under certain conditions; type `show c' for details.

The hypothetical commands `show w' and  
`show c' should show the appropriate  
parts of the General Public License. Of course, the commands you use may  
be called something other than `show w' and `show c'; they could even be  
mouse-clicks or menu items--whatever suits your program.

You should also get your employer (if you work as a programmer) or your  
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necessary. Here is a sample; alter the names:

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<signature of Ty Coon>, 1 April 1989  
Ty Coon, President of Vice

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## 1.81 expat 2.1.0

### 1.81.1 Available under license :

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## 1.82 curl 7.30.0

### 1.82.1 Available under license :

License Mixing with apps, libcurl and Third Party Libraries

=====

libcurl can be built to use a fair amount of various third party libraries, libraries that are written and provided by other parties that are distributed using their own licenses. Even libcurl itself contains code that may cause problems to some. This document attempts to describe what licenses libcurl and the other libraries use and what possible dilemmas linking and mixing them all can lead to for end users.

I am not a lawyer and this is not legal advice!

One common dilemma is that GPL[1]-licensed code is not allowed to be linked with code licensed under the Original BSD license (with the announcement clause). You may still build your own copies that use them all, but distributing them as binaries would be to violate the GPL license - unless you accompany your license with an exception[2]. This particular problem was addressed when the Modified BSD license was created, which does not have the announcement clause that collides with GPL.

libcurl <http://curl.haxx.se/docs/copyright.html>

Uses an MIT (or Modified BSD)-style license that is as liberal as possible. Some of the source files that deal with KRB4 have Original BSD-style announce-clause licenses. You may not distribute binaries with krb4-enabled libcurl that also link with GPL-licensed code!

OpenSSL <http://www.openssl.org/source/license.html>

(May be used for SSL/TLS support) Uses an Original BSD-style license with an announcement clause that makes it "incompatible" with GPL. You are not allowed to ship binaries that link with OpenSSL that includes GPL code (unless that specific GPL code includes an exception for OpenSSL - a habit that is growing more and more common). If OpenSSL's licensing is a problem for you, consider using GnuTLS or yassl instead.

GnuTLS <http://www.gnutls.org/>

(May be used for SSL/TLS support) Uses the LGPL[3] license. If this is a problem for you, consider using OpenSSL instead. Also note that GnuTLS itself depends on and uses other libs (libcrypt and libpgp-error) and they too are LGPL- or GPL-licensed.

yassl <http://www.yassl.com/>

(May be used for SSL/TLS support) Uses the GPL[1] license. If this is a problem for you, consider using OpenSSL or GnuTLS instead.

NSS <http://www.mozilla.org/projects/security/pki/nss/>

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axTLS <http://axtls.sourceforge.net/>

(May be used for SSL/TLS support) Uses a Modified BSD-style license.

c-ares <http://daniel.haxx.se/projects/c-ares/license.html>

(Used for asynchronous name resolves) Uses an MIT license that is very liberal and imposes no restrictions on any other library or part you may link with.

zlib [http://www.gzip.org/zlib/zlib\\_license.html](http://www.gzip.org/zlib/zlib_license.html)

(Used for compressed Transfer-Encoding support) Uses an MIT-style license that shouldn't collide with any other library.

krb4

While nothing in particular says that a Kerberos4 library must use any particular license, the one I've tried and used successfully so far (kth-krb4) is partly Original BSD-licensed with the announcement clause. Some of the code in libcurl that is written to deal with Kerberos4 is Modified BSD-licensed.

MIT Kerberos <http://web.mit.edu/kerberos/www/dist/>

(May be used for GSS support) MIT licensed, that shouldn't collide with any other parts.

Heimdal <http://www.pdc.kth.se/heimdal/>

(May be used for GSS support) Heimdal is Original BSD licensed with the announcement clause.

GNU GSS <http://www.gnu.org/software/gss/>

(May be used for GSS support) GNU GSS is GPL licensed. Note that you may not distribute binary curl packages that uses this if you build curl to also link and use any Original BSD licensed libraries!

fbopenssl

(Used for SPNEGO support) Unclear license. Based on its name, I assume that it uses the OpenSSL license and thus shares the same issues as described for OpenSSL above.

libidn <http://josefsson.org/libidn/>

(Used for IDNA support) Uses the GNU Lesser General Public License [3]. LGPL is a variation of GPL with slightly less aggressive "copyleft". This license requires more requirements to be met when distributing binaries, see the license for details. Also note that if you distribute a binary that includes this library, you must also include the

full LGPL license text. Please properly point out what parts of the distributed package that the license addresses.

OpenLDAP <http://www.openldap.org/software/release/license.html>

(Used for LDAP support) Uses a Modified BSD-style license. Since libcurl uses OpenLDAP as a shared library only, I have not heard of anyone that ships OpenLDAP linked with libcurl in an app.

libssh2 <http://www.libssh2.org/>

(Used for scp and sftp support) libssh2 uses a Modified BSD-style license.

[1] = GPL - GNU General Public License: <http://www.gnu.org/licenses/gpl.html>

[2] = <http://www.fsf.org/licenses/gpl-faq.html#GPLIncompatibleLibs> details on how to write such an exception to the GPL

[3] = LGPL - GNU Lesser General Public License:  
<http://www.gnu.org/licenses/lgpl.html>

[4] = MPL - Mozilla Public License:  
<http://www.mozilla.org/MPL/>



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# 1.83 fuse 2.8.7

## 1.83.1 Available under license :

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Version 2, June 1991

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[This is the first released version of the library GPL. It is  
numbered 2 because it goes with version 2 of the ordinary GPL.]

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Also, for each distributor's protection, we want to make certain that everyone understands that there is no warranty for this free library. If the library is modified by someone else and passed on, we want its recipients to know that what they have is not the original version, so that any problems introduced by others will not reflect on the original authors' reputations.

Finally, any free program is threatened constantly by software patents. We wish to avoid the danger that companies distributing free software will individually obtain patent licenses, thus in effect transforming the program into proprietary software. To prevent this, we have made it clear that any patent must be licensed for everyone's free use or not licensed at all.

Most GNU software, including some libraries, is covered by the ordinary GNU General Public License, which was designed for utility programs. This license, the GNU Library General Public License, applies to certain designated libraries. This license is quite different from the ordinary one; be sure to read it in full, and don't assume that anything in it is

the same as in the ordinary license.

The reason we have a separate public license for some libraries is that they blur the distinction we usually make between modifying or adding to a program and simply using it. Linking a program with a library, without changing the library, is in some sense simply using the library, and is analogous to running a utility program or application program. However, in a textual and legal sense, the linked executable is a combined work, a derivative of the original library, and the ordinary General Public License treats it as such.

Because of this blurred distinction, using the ordinary General Public License for libraries did not effectively promote software sharing, because most developers did not use the libraries. We concluded that weaker conditions might promote sharing better.

However, unrestricted linking of non-free programs would deprive the users of those programs of all benefit from the free status of the libraries themselves. This Library General Public License is intended to permit developers of non-free programs to use free libraries, while preserving your freedom as a user of such programs to change the free libraries that are incorporated in them. (We have not seen how to achieve this as regards changes in header files, but we have achieved it as regards changes in the actual functions of the Library.) The hope is that this will lead to faster development of free libraries.

The precise terms and conditions for copying, distribution and modification follow. Pay close attention to the difference between a "work based on the library" and a "work that uses the library". The former contains code derived from the library, while the latter only works together with the library.

Note that it is possible for a library to be covered by the ordinary General Public License rather than by this special one.

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"Source code" for a work means the preferred form of the work for making modifications to it. For a library, complete source code means all the source code for all modules it contains, plus any associated interface definition files, plus the scripts used to control compilation and installation of the library.

Activities other than copying, distribution and modification are not covered by this License; they are outside its scope. The act of running a program using the Library is not restricted, and output from such a program is covered only if its contents constitute a work based on the Library (independent of the use of the Library in a tool for writing it). Whether that is true depends on what the Library does and what the program that uses the Library does.

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b) You must cause the files modified to carry prominent notices stating that you changed the files and the date of any change.

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d) If a facility in the modified Library refers to a function or a table of data to be supplied by an application program that uses the facility, other than as an argument passed when the facility is invoked, then you must make a good faith effort to ensure that, in the event an application does not supply such function or table, the facility still operates, and performs whatever part of its purpose remains meaningful.

(For example, a function in a library to compute square roots has a purpose that is entirely well-defined independent of the application. Therefore, Subsection 2d requires that any application-supplied function or table used by this function must be optional: if the application does not supply it, the square root function must still compute square roots.)

These requirements apply to the modified work as a whole. If identifiable sections of that work are not derived from the Library, and can be reasonably considered independent and separate works in themselves, then this License, and its terms, do not apply to those sections when you distribute them as separate works. But when you distribute the same sections as part of a whole which is a work based on the Library, the distribution of the whole must be on the terms of this License, whose permissions for other licensees extend to the entire whole, and thus to each and every part regardless of who wrote it.

Thus, it is not the intent of this section to claim rights or contest your rights to work written entirely by you; rather, the intent is to exercise the right to control the distribution of derivative or collective works based on the Library.

In addition, mere aggregation of another work not based on the Library with the Library (or with a work based on the Library) on a volume of a storage or distribution medium does not bring the other work under the scope of this License.

3. You may opt to apply the terms of the ordinary GNU General Public License instead of this License to a given copy of the Library. To do this, you must alter all the notices that refer to this License, so that they refer to the ordinary GNU General Public License, version 2, instead of to this License. (If a newer version than version 2 of the ordinary GNU General Public License has appeared, then you can specify

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Once this change is made in a given copy, it is irreversible for that copy, so the ordinary GNU General Public License applies to all subsequent copies and derivative works made from that copy.

This option is useful when you wish to copy part of the code of the Library into a program that is not a library.

4. You may copy and distribute the Library (or a portion or derivative of it, under Section 2) in object code or executable form under the terms of Sections 1 and 2 above provided that you accompany it with the complete corresponding machine-readable source code, which must be distributed under the terms of Sections 1 and 2 above on a medium customarily used for software interchange.

If distribution of object code is made by offering access to copy from a designated place, then offering equivalent access to copy the source code from the same place satisfies the requirement to distribute the source code, even though third parties are not compelled to copy the source along with the object code.

5. A program that contains no derivative of any portion of the Library, but is designed to work with the Library by being compiled or linked with it, is called a "work that uses the Library". Such a work, in isolation, is not a derivative work of the Library, and therefore falls outside the scope of this License.

However, linking a "work that uses the Library" with the Library creates an executable that is a derivative of the Library (because it contains portions of the Library), rather than a "work that uses the library". The executable is therefore covered by this License. Section 6 states terms for distribution of such executables.

When a "work that uses the Library" uses material from a header file that is part of the Library, the object code for the work may be a derivative work of the Library even though the source code is not. Whether this is true is especially significant if the work can be linked without the Library, or if the work is itself a library. The threshold for this to be true is not precisely defined by law.

If such an object file uses only numerical parameters, data structure layouts and accessors, and small macros and small inline functions (ten lines or less in length), then the use of the

object

file is unrestricted, regardless of whether it is legally a derivative work. (Executables containing this object code plus portions of the Library will still fall under Section 6.)

Otherwise, if the work is a derivative of the Library, you may distribute the object code for the work under the terms of Section 6. Any executables containing that work also fall under Section 6, whether or not they are linked directly with the Library itself.

6. As an exception to the Sections above, you may also compile or link a "work that uses the Library" with the Library to produce a work containing portions of the Library, and distribute that work under terms of your choice, provided that the terms permit modification of the work for the customer's own use and reverse engineering for debugging such modifications.

You must give prominent notice with each copy of the work that the Library is used in it and that the Library and its use are covered by this License. You must supply a copy of this License. If the work during execution displays copyright notices, you must include the copyright notice for the Library among them, as well as a reference directing the user to the copy of this License. Also, you must do one of these things:

a) Accompany the work with the complete corresponding machine-readable source code for the Library including whatever changes were used in the work (which must be distributed under Sections 1 and 2 above); and, if the work is an executable linked with the Library, with the complete machine-readable "work that uses the Library", as object code and/or source code, so that the user can modify the Library and then relink to produce a modified executable containing the modified Library. (It is understood that the user who changes the contents of definitions files in the Library will not necessarily be able to recompile the application to use the modified definitions.)

b) Accompany the work with a written offer, valid for at least three years, to give the same user the materials specified in Subsection 6a, above, for a charge no more than the cost of performing this distribution.

c) If distribution of the work is made by offering access to copy from a designated place, offer equivalent access to copy the above specified materials from the same place.

d) Verify that the user has already received a copy of these materials or that you have already sent this user a copy.

For an executable, the required form of the "work that uses the Library" must include any data and utility programs needed for reproducing the executable from it. However, as a special exception, the source code distributed need not include anything that is normally distributed (in either source or binary form) with the major components (compiler, kernel, and so on) of the operating system on which the executable runs, unless that component itself accompanies the executable.

It may happen that this requirement contradicts the license restrictions of other proprietary libraries that do not normally accompany the operating system. Such a contradiction means you cannot use both them and the Library together in an executable that you distribute.

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# 1.86 netty 4.0.21.Final

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.\" LIABILITY, OR TORT (INCLUDING NEGLIGENCE OR OTHERWISE) ARISING IN ANY WAY
.\" OUT OF THE USE OF THIS SOFTWARE, EVEN IF ADVISED OF THE POSSIBILITY OF
.\" SUCH DAMAGE.
.\"
.\"----- */

```

Found in path(s):

```
* /opt/cola/permits/1127995194_1611893805.73/0/tftp-hpa-5-2-tar-bz2/tftp-hpa-5.2/tftpd/tftpd.8.in
```

No license file was found, but licenses were detected in source scan.

Summary: The client for the Trivial File Transfer Protocol (TFTP).

Name: tftp

Version: 5.2

Release: 1

License: BSD

Group: Applications/Internet

Source0: <http://www.kernel.org/pub/software/network/tftp/tftp-hpa-%{version}.tar.gz>

BuildRequires: tcp\_wrappers-devel

BuildRoot: %{\_tmppath}/%{name}-root

%description

The Trivial File Transfer Protocol (TFTP) is normally used only for booting diskless workstations. The tftp package provides the user interface for TFTP, which allows users to transfer files to and from a remote machine. This program and TFTP provide very little security, and should not be enabled unless it is expressly needed.

%package server

Group: System Environment/Daemons

Summary: The server for the Trivial File Transfer Protocol (TFTP).



Requires: xinetd

%description server

The Trivial File Transfer Protocol (TFTP) is normally used only for booting diskless workstations. The tftp-server package provides the server for TFTP, which allows users to transfer files to and from a remote machine. TFTP provides very little security, and should not be enabled unless it is expressly needed. The TFTP server is run from /etc/xinetd.d/tftp, and is disabled by default on Red Hat Linux systems.

%prep

%setup -q -n tftp-hpa-%{version}

%build

%configure

make %{?\_smp\_mflags}

%install

rm -rf \${RPM\_BUILD\_ROOT}

mkdir -p \${RPM\_BUILD\_ROOT}%{\_bindir}

mkdir -p \${RPM\_BUILD\_ROOT}%{\_mandir}/man{1,8}

mkdir -p \${RPM\_BUILD\_ROOT}%{\_sbindir}

make INSTALLROOT=\${RPM\_BUILD\_ROOT} \

SBINDIR=\${\_sbindir} MANDIR=\${\_mandir} \

install

install -m755 -d \${RPM\_BUILD\_ROOT}%{\_sysconfdir}/xinetd.d/ \${RPM\_BUILD\_ROOT}/tftpboot

install -m644 tftp-xinetd \${RPM\_BUILD\_ROOT}%{\_sysconfdir}/xinetd.d/tftp

%post server

/sbin/service xinetd reload > /dev/null 2>&1 || :

%postun server

if [ \$1 = 0 ]; then

/sbin/service xinetd reload > /dev/null 2>&1 || :

fi

%clean

rm -rf \${RPM\_BUILD\_ROOT}

%files

%defattr(-,root,root)

%{\_bindir}/tftp

%{\_mandir}/man1/\*

%files

```
server
%defattr(-,root,root)
%config(noreplace) % {_sysconfdir}/xinetd.d/tftp
%dir /tftpboot
% {_sbindir}/in.tftpd
% {_mandir}/man8/*

%changelog
* Tue Sep 14 2004 H. Peter Anvin <hpa@zytor.com>
- removed completely broken "Malta" patch.
- integrated into build machinery so rpm -ta works.

* Fri Feb 13 2004 Elliot Lee <sopwith@redhat.com>
- rebuilt

* Wed Jun 04 2003 Elliot Lee <sopwith@redhat.com>
- rebuilt

* Fri Apr 11 2003 Elliot Lee <sopwith@redhat.com>
- 0.33
- Add /tftpboot directory (#88204)

* Mon Feb 24 2003 Elliot Lee <sopwith@redhat.com>
- rebuilt

* Sun Feb 23 2003 Tim Powers <timp@redhat.com>
- add BuildPreReq on tcp_wrappers

* Wed Jan 22 2003 Tim Powers <timp@redhat.com>
- rebuilt

* Mon Nov 11 2002 Elliot Lee <sopwith@redhat.com> 0.32-1
- Update to 0.32

* Wed Oct 23 2002 Elliot Lee <sopwith@redhat.com> 0.30-1
- Fix #55789
- Update to 0.30

* Thu Jun 27 2002 Elliot Lee <sopwith@redhat.com>
- Try applying HJ's patch from #65476

* Fri Jun
21 2002 Tim Powers <timp@redhat.com>
- automated rebuild

* Mon Jun 17 2002 Elliot Lee <sopwith@redhat.com>
- Update to 0.29
```

- \* Thu May 23 2002 Tim Powers <timp@redhat.com>
  - automated rebuild
  
- \* Wed Jan 09 2002 Tim Powers <timp@redhat.com>
  - automated rebuild
  
- \* Tue Dec 18 2001 Elliot Lee <sopwith@redhat.com> 0.17-15
  - Add patch4: netkit-tftp-0.17-defaultport.patch for bug #57562
  - Update to tftp-hpa-0.28 (bug #56131)
  - Remove include/arpa/tftp.h to fix #57259
  - Add resource limits in tftp-xinetd (#56722)
  
- \* Sun Jun 24 2001 Elliot Lee <sopwith@redhat.com>
  - Bump release + rebuild.
  
- \* Tue Jun 12 2001 Helge Deller <hdeller@redhat.de> (0.17-13)
  - updated tftp-hpa source to tftp-hpa-0.17
  - tweaked specfile with different defines for tftp-netkit and tftp-hpa version
  - use hpa's tftpd.8 man page instead of the netkits one
  
- \* Mon May 07 2001 Helge Deller <hdeller@redhat.de>
  - rebuilt in 7.1.x
  
- \* Wed Apr 18 2001 Helge Deller <hdeller@redhat.de>
  - fix tftp client's put problems (#29529)
  - update
  - to tftp-hpa-0.16
  
- \* Wed Apr 4 2001 Jakub Jelinek <jakub@redhat.com>
  - don't let configure to guess compiler, it can pick up eggs
  
- \* Thu Feb 08 2001 Helge Deller <hdeller@redhat.de>
  - changed "wait" in xinetd file to "yes" (hpa-tftpd forks and exits) (#26467)
  - fixed hpa-tftpd to handle files greater than 32MB (#23725)
  - added "-l" flag to hpa-tftpd for file-logging (#26467)
  - added description for "-l" to the man-page
  
- \* Thu Feb 08 2001 Helge Deller <hdeller@redhat.de>
  - updated tftp client to 0.17 stable (#19640),
  - drop dependency on xinetd for tftp client (#25051),
  
- \* Wed Jan 17 2001 Jeff Johnson <jbj@redhat.com>
  - xinetd shouldn't wait on tftp (which forks) (#23923).
  
- \* Sat Jan 6 2001 Jeff Johnson <jbj@redhat.com>
  - fix to permit tftp put's (#18128).
  - startup as root with chroot to /tftpboot with early reversion to nobody is preferable to starting as nobody w/o ability to chroot.

- %%post is needed by server, not client. Add %%postun for erasure as well.

\* Wed Aug 23 2000

Nalin Dahyabhai <nalin@redhat.com>

- default to being disabled

\* Thu Aug 17 2000 Jeff Johnson <jbj@redhat.com>

- correct group.

\* Tue Jul 25 2000 Nalin Dahyabhai <nalin@redhat.com>

- change user from root to nobody

\* Sat Jul 22 2000 Jeff Johnson <jbj@redhat.com>

- update to tftp-hpa-0.14 (#14003).

- add server\_args (#14003).

- remove -D\_BSD\_SOURCE (#14003).

\* Fri Jul 21 2000 Nalin Dahyabhai <nalin@redhat.com>

- cook up an xinetd config file for tftpd

\* Wed Jul 12 2000 Prospector <bugzilla@redhat.com>

- automatic rebuild

\* Sun Jun 18 2000 Jeff Johnson <jbj@redhat.com>

- FHS packaging.

- update to 0.17.

\* Fri May 5 2000 Matt Wilson <msw@redhat.com>

- use \_BSD\_SOURCE for hpa's tftpd so we get BSD signal semantics.

\* Fri Feb 11 2000 Bill Nottingham <notting@redhat.com>

- fix description

\* Wed Feb 9 2000 Jeff Johnson <jbj@redhat.com>

- compress man pages (again).

\* Wed Feb 02 2000 Cristian Gafton <gafton@redhat.com>

- man pages are compressed

- fix description and summary

\* Tue

Jan 4 2000 Bill Nottingham <notting@redhat.com>

- split client and server

\* Tue Dec 21 1999 Jeff Johnson <jbj@redhat.com>

- update to 0.16.

\* Sat Aug 28 1999 Jeff Johnson <jbj@redhat.com>

- update to 0.15.

\* Wed Apr 7 1999 Jeff Johnson <jbj@redhat.com>  
- tftpd should truncate file when overwriting (#412)

\* Sun Mar 21 1999 Cristian Gafton <gafton@redhat.com>  
- auto rebuild in the new build environment (release 22)

\* Mon Mar 15 1999 Jeff Johnson <jbj@redhat.com>  
- compile for 6.0.

\* Fri Aug 7 1998 Jeff Johnson <jbj@redhat.com>  
- build root

\* Mon Apr 27 1998 Prospector System <bugs@redhat.com>  
- translations modified for de, fr, tr

\* Mon Sep 22 1997 Erik Troan <ewt@redhat.com>  
- added check for getpwnam() failure

\* Tue Jul 15 1997 Erik Troan <ewt@redhat.com>  
- initial build

Found in path(s):

\* /opt/cola/permits/1127995194\_1611893805.73/0/tftp-hpa-5-2-tar-bz2/tftp-hpa-5.2/tftp.spec

No license file was found, but licenses were detected in source scan.

```
/* *_c_*_----- *  
*  
* Copyright 2001-2006 H. Peter Anvin - All Rights Reserved  
*  
* This program is free software available under the same license  
* as the "OpenBSD" operating system, distributed at  
* http://www.openbsd.org/.  
*  
* ----- */
```

Found in path(s):

\* /opt/cola/permits/1127995194\_1611893805.73/0/tftp-hpa-5-2-tar-bz2/tftp-hpa-5.2/config.h

No license file was found, but licenses were detected in source scan.

```
/*  
* Copyright (c) 1993  
* The Regents of the University of California. All rights reserved.  
*  
* Redistribution and use in source and binary forms, with or without  
* modification, are permitted provided that the following conditions  
* are met:
```

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- \*/

Found in path(s):

- \* /opt/cola/permits/1127995194\_1611893805.73/0/tftp-hpa-5-2-tar-bz2/tftp-hpa-5.2/tftp/extern.h
- \*
  - \*/opt/cola/permits/1127995194\_1611893805.73/0/tftp-hpa-5-2-tar-bz2/tftp-hpa-5.2/common/tftpsubs.h

No license file was found, but licenses were detected in source scan.

Summary: The client for the Trivial File Transfer Protocol (TFTP).

Name: tftp

Version: @@VERSION@@

Release: 1

License: BSD

Group: Applications/Internet

Source0: <http://www.kernel.org/pub/software/network/tftp/tftp-hpa-%{version}.tar.gz>

BuildRequires: tcp\_wrappers-devel

BuildRoot: %{\_tmppath}/%{name}-root

%description

The Trivial File Transfer Protocol (TFTP) is normally used only for booting diskless workstations. The tftp package provides the user interface for TFTP, which allows users to transfer files to and from a remote machine. This program and TFTP provide very little security,

and should not be enabled unless it is expressly needed.

%package server

Group: System Environment/Daemons

Summary: The server for the Trivial File Transfer Protocol (TFTP).

Requires: xinetd

%description server

The Trivial File Transfer Protocol (TFTP) is normally used only for booting diskless workstations. The tftp-server package provides the server for TFTP, which allows users to transfer files to and from a remote machine. TFTP provides very little security, and should not be enabled unless it is expressly needed. The TFTP server is run from /etc/xinetd.d/tftp, and is disabled by default on Red Hat Linux systems.

%prep

%setup -q -n tftp-hpa-% { version }

%build

%configure

make %{?\_smp\_mflags}

%install

rm -rf \${RPM\_BUILD\_ROOT}

mkdir -p \${RPM\_BUILD\_ROOT}%{\_bindir}

mkdir -p \${RPM\_BUILD\_ROOT}%{\_mandir}/man{1,8}

mkdir -p \${RPM\_BUILD\_ROOT}%{\_sbindir}

make INSTALLROOT=\${RPM\_BUILD\_ROOT} \

SBINDIR=%{\_sbindir} MANDIR=%{\_mandir} \

install

install -m755 -d \${RPM\_BUILD\_ROOT}%{\_sysconfdir}/xinetd.d/ \${RPM\_BUILD\_ROOT}/tftpboot

install -m644 tftp-xinetd \${RPM\_BUILD\_ROOT}%{\_sysconfdir}/xinetd.d/tftp

%post server

/sbin/service xinetd reload > /dev/null 2>&1 || :

%postun server

if [ \$1 = 0 ]; then

/sbin/service xinetd reload > /dev/null 2>&1 || :

fi

%clean

rm -rf \${RPM\_BUILD\_ROOT}

%files

```

%defattr(-,root,root)
%{_bindir}/tftp
%{_mandir}/man1/*

%files
server
%defattr(-,root,root)
%config(noreplace) % {_sysconfdir}/xinetd.d/tftp
%dir /tftpboot
%{_sbindir}/in.tftpd
%{_mandir}/man8/*

%changelog
* Tue Sep 14 2004 H. Peter Anvin <hpa@zytor.com>
- removed completely broken "Malta" patch.
- integrated into build machinery so rpm -ta works.

* Fri Feb 13 2004 Elliot Lee <sopwith@redhat.com>
- rebuilt

* Wed Jun 04 2003 Elliot Lee <sopwith@redhat.com>
- rebuilt

* Fri Apr 11 2003 Elliot Lee <sopwith@redhat.com>
- 0.33
- Add /tftpboot directory (#88204)

* Mon Feb 24 2003 Elliot Lee <sopwith@redhat.com>
- rebuilt

* Sun Feb 23 2003 Tim Powers <timp@redhat.com>
- add BuildPreReq on tcp_wrappers

* Wed Jan 22 2003 Tim Powers <timp@redhat.com>
- rebuilt

* Mon Nov 11 2002 Elliot Lee <sopwith@redhat.com> 0.32-1
- Update to 0.32

* Wed Oct 23 2002 Elliot Lee <sopwith@redhat.com> 0.30-1
- Fix #55789
- Update to 0.30

* Thu Jun 27 2002 Elliot Lee <sopwith@redhat.com>
- Try applying HJ's patch from #65476

*

```



- Fri Jun 21 2002 Tim Powers <timp@redhat.com>  
- automated rebuild
- \* Mon Jun 17 2002 Elliot Lee <sopwith@redhat.com>  
- Update to 0.29
- \* Thu May 23 2002 Tim Powers <timp@redhat.com>  
- automated rebuild
- \* Wed Jan 09 2002 Tim Powers <timp@redhat.com>  
- automated rebuild
- \* Tue Dec 18 2001 Elliot Lee <sopwith@redhat.com> 0.17-15  
- Add patch4: netkit-tftp-0.17-defaultport.patch for bug #57562  
- Update to tftp-hpa-0.28 (bug #56131)  
- Remove include/arpa/tftp.h to fix #57259  
- Add resource limits in tftp-xinetd (#56722)
- \* Sun Jun 24 2001 Elliot Lee <sopwith@redhat.com>  
- Bump release + rebuild.
- \* Tue Jun 12 2001 Helge Deller <hdeller@redhat.de> (0.17-13)  
- updated tftp-hpa source to tftp-hpa-0.17  
- tweaked specfile with different defines for tftp-netkit and tftp-hpa version  
- use hpa's tftpd.8 man page instead of the netkits one
- \* Mon May 07 2001 Helge Deller <hdeller@redhat.de>  
- rebuilt in 7.1.x
- \* Wed Apr 18 2001 Helge Deller <hdeller@redhat.de>  
- fix tftp client's put problems (#29529)  
-  
update to tftp-hpa-0.16
- \* Wed Apr 4 2001 Jakub Jelinek <jakub@redhat.com>  
- don't let configure to guess compiler, it can pick up egcs
- \* Thu Feb 08 2001 Helge Deller <hdeller@redhat.de>  
- changed "wait" in xinetd file to "yes" (hpa-tftpd forks and exits) (#26467)  
- fixed hpa-tftpd to handle files greater than 32MB (#23725)  
- added "-l" flag to hpa-tftpd for file-logging (#26467)  
- added description for "-l" to the man-page
- \* Thu Feb 08 2001 Helge Deller <hdeller@redhat.de>  
- updated tftp client to 0.17 stable (#19640),  
- drop dependency on xinetd for tftp client (#25051),
- \* Wed Jan 17 2001 Jeff Johnson <jbj@redhat.com>

- xinetd shouldn't wait on tftp (which forks) (#23923).
  
- \* Sat Jan 6 2001 Jeff Johnson <jbj@redhat.com>
  - fix to permit tftp put's (#18128).
  - startup as root with chroot to /tftpboot with early reversion to nobody is preferable to starting as nobody w/o ability to chroot.
  - %%post is needed by server, not client. Add %%postun for erasure as well.
  
- \* Wed Aug 23 2000 Nalin Dahyabhai <nalin@redhat.com>
  - default to being disabled
  
- \* Thu Aug 17 2000 Jeff Johnson <jbj@redhat.com>
  - correct group.
  
- \* Tue Jul 25 2000 Nalin Dahyabhai <nalin@redhat.com>
  - change user from root to nobody
  
- \* Sat Jul 22 2000 Jeff Johnson <jbj@redhat.com>
  - update to tftp-hpa-0.14 (#14003).
  - add server\_args (#14003).
  - remove -D\_BSD\_SOURCE (#14003).
  
- \* Fri Jul 21 2000 Nalin Dahyabhai <nalin@redhat.com>
  - cook up an xinetd config file for tftpd
  
- \* Wed Jul 12 2000 Prospector <bugzilla@redhat.com>
  - automatic rebuild
  
- \* Sun Jun 18 2000 Jeff Johnson <jbj@redhat.com>
  - FHS packaging.
  - update to 0.17.
  
- \* Fri May 5 2000 Matt Wilson <msw@redhat.com>
  - use \_BSD\_SOURCE for hpa's tftpd so we get BSD signal semantics.
  
- \* Fri Feb 11 2000 Bill Nottingham <notting@redhat.com>
  - fix description
  
- \* Wed Feb 9 2000 Jeff Johnson <jbj@redhat.com>
  - compress man pages (again).
  
- \* Wed Feb 02 2000 Cristian Gafton <gafton@redhat.com>
  - man pages are compressed
  - fix description and summary
  
- \*

Tue Jan 4 2000 Bill Nottingham <notting@redhat.com>

- split client and server

\* Tue Dec 21 1999 Jeff Johnson <jbj@redhat.com>

- update to 0.16.

\* Sat Aug 28 1999 Jeff Johnson <jbj@redhat.com>

- update to 0.15.

\* Wed Apr 7 1999 Jeff Johnson <jbj@redhat.com>

- tftpd should truncate file when overwriting (#412)

\* Sun Mar 21 1999 Cristian Gafton <gafton@redhat.com>

- auto rebuild in the new build environment (release 22)

\* Mon Mar 15 1999 Jeff Johnson <jbj@redhat.com>

- compile for 6.0.

\* Fri Aug 7 1998 Jeff Johnson <jbj@redhat.com>

- build root

\* Mon Apr 27 1998 Prospector System <bugs@redhat.com>

- translations modified for de, fr, tr

\* Mon Sep 22 1997 Erik Troan <ewt@redhat.com>

- added check for getpwnam() failure

\* Tue Jul 15 1997 Erik Troan <ewt@redhat.com>

- initial build

Found in path(s):

\* /opt/cola/permits/1127995194\_1611893805.73/0/tftp-hpa-5-2-tar-bz2/tftp-hpa-5.2/tftp.spec.in

No license file was found, but licenses were detected in source scan.

/\* ----- \*/

\*

\* Copyright 2001 H. Peter Anvin - All Rights Reserved

\*

\* This program is free software available under the same license

\* as the "OpenBSD" operating system, distributed at

\* <http://www.openbsd.org/>.

\*

\* ----- \*/

Found in path(s):

\* /opt/cola/permits/1127995194\_1611893805.73/0/tftp-hpa-5-2-tar-bz2/tftp-hpa-5.2/tftpd/tftpd.h

No license file was found, but licenses were detected in source scan.

```

/*
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* The Regents of the University of California. All rights reserved.
*
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*
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* OR SERVICES; LOSS OF USE, DATA, OR PROFITS; OR BUSINESS INTERRUPTION)
* HOWEVER CAUSED AND ON ANY THEORY OF LIABILITY, WHETHER IN CONTRACT, STRICT
* LIABILITY, OR TORT (INCLUDING NEGLIGENCE OR OTHERWISE) ARISING IN ANY WAY
* OUT OF THE USE OF THIS SOFTWARE, EVEN IF ADVISED OF THE POSSIBILITY OF
* SUCH DAMAGE.
*/

```

Found in path(s):

```

* /opt/cola/permits/1127995194_1611893805.73/0/tftp-hpa-5-2-tar-bz2/tftp-hpa-5.2/tftp/main.c
*
* /opt/cola/permits/1127995194_1611893805.73/0/tftp-hpa-5-2-tar-bz2/tftp-hpa-5.2/tftp/tftp.c
* /opt/cola/permits/1127995194_1611893805.73/0/tftp-hpa-5-2-tar-bz2/tftp-hpa-5.2/common/tftpsubs.c

```

No license file was found, but licenses were detected in source scan.

```

/* ----- *
*
* Copyright 2001-2007 H. Peter Anvin - All Rights Reserved
*
* This program is free software available under the same license
* as the "OpenBSD" operating system, distributed at
* http://www.openbsd.org/.

```

\*  
\* ----- \*/

Found in path(s):

\* /opt/cola/permits/1127995194\_1611893805.73/0/tftp-hpa-5-2-tar-bz2/tftp-hpa-5.2/tftpd/remap.c  
\* /opt/cola/permits/1127995194\_1611893805.73/0/tftp-hpa-5-2-tar-bz2/tftp-hpa-5.2/tftpd/misc.c  
\* /opt/cola/permits/1127995194\_1611893805.73/0/tftp-hpa-5-2-tar-bz2/tftp-hpa-5.2/tftpd/remap.h

# 1.89 psmisc 22.6

## 1.89.1 Available under license :

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Version 2, June 1991

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```
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```

```
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Ty Coon, President of Vice
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## 1.90 ganymed-ssh2 262

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## 1.91 berkeley-db 4.7.25

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## 1.92 dmalloc 5.5.2

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```
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#
# dmalloc_summarize -- summarizes dmalloc log files
#
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#
# $Id: dmalloc_summarize.pl,v 1.1.1.1 2012/09/18
```

09:28:11 mohamr1 Exp \$

#

/\*

\*

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\* Author: J"org Wunsch

\*

\* Dumb atexit() implementation. It is far from being elegant. It is  
\* only here to provide a workaround for systems where the existing  
\* atexit() implementation is known to cause problems due to doing  
\* own mallocs. The problem arose originally on a Data General  
\* machine running DG/UX 5.4R\*, along with gcc compiling C++ code.  
\* In order to have global and static variables called their const-  
\* ructors, a chunk of code has been placed by the compiler that  
\* ran before invoking main(). This code registered the destructors  
\* with atexit() at this very early stage, but the existing atexit()  
\* bypassed the normal memory allocation scheme, and hence caused  
\* grievous troubles in combination with the dmalloc library.

\*

\* Known problem for DG/UX: the crt0.o (at least in a COFF environ-  
\* ment) passes the return value from main() to \_real\_exit() instead  
\* of exit().

Hence programs which return from main instead of calling  
\* exit() do not work as expected. I do not see any good workaround  
\* for this so far (since crt0.o always happens to reference the  
\* \_real\_exit() from the library, even if we would provide our very  
\* own symbol for it).

\*

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# 1.98 upstart 0.6.3

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# 1.105 libtasn 1.2

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```
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```

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```

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/\*

Unix SMB/CIFS implementation.

trivial database library

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\*/

## 1.107 gawk 3.1.5

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## 1.113 dosfs-tools 3.0.9

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## 1.115 file 5.03

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## 1.116 gnutls 2.10.5

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```
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@var{one line to give the program's name and a brief idea of what it does.}
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(C) @var{year} @var{name of author}
```

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```
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This program comes with ABSOLUTELY NO WARRANTY;
for details type @samp{show w}.
This is free software, and you are welcome to redistribute it
under certain conditions; type @samp{show c} for details.
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```

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But

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## 1.117 grub2 2

### 1.117.1 Available under license :

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```
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@var{one line to give the library's name and an idea of what it does.}
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```

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```
@end
smallexample
```

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```
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`Frob' (a library for tweaking knobs) written by James Random Hacker.
```

```
@var{signature of Ty Coon}, 1 April 1990
Ty Coon, President of Vice
@end smallexample
```

That's all there is to it!

Description:

Concatenate two arbitrary file names.

Files:

lib/filenamecat.h

lib/filenamecat-lgpl.c

m4/filenamecat.m4

Depends-on:

dirname-lgpl

configure.ac:

gl\_FILE\_NAME\_CONCAT\_LGPL

Makefile.am:

lib\_SOURCES += filenamecat-lgpl.c

Include:

"filenamecat.h"

License:

LGPLv2+

Maintainer:

Jim Meyering

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Version 3, 29 June 2007

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```

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Description:

Provide the GNU Free Documentation License in Texinfo format.

Files:

doc/fdl.texi

Depends-on:

configure.ac:

Makefile.am:

Include:

License:

unmodifiable license text

Maintainer:

all

Legal Issues about Contributing Code to GNU last updated 14 July 2015

Project GNU has to be careful to obey copyright laws, even though these laws are wrong when they stop people from sharing generally useful published information such as software, because we are in the public eye. We also use copyright to defend users' freedom, by means of copyleft (though this does not excuse copyright law for helping to make software proprietary).

This means that if you want to contribute software to GNU, you have to do something to give us legal permission to use it. There are three ways this can be done:

\* Assign the copyright to the Free Software Foundation.

This allows the FSF to act to stop violations of the GPL.

\* Keep the copyright and release the program yourself under the GNU GPL. (This alternative is too impractical for contributions to a preexisting FSF-copyrighted GNU program.)

\* Put the code in the public domain. Then there is nothing to stop hoarding of modified versions, but we can still use the program in GNU.

Most of these alternatives require a signed piece of paper, or in some cases a digital signature, to make it happen.

\* Assigning copyright.

Assigning the copyright means signing a contract that makes the Free Software Foundation the "owner" of the program according to the law. As the copyright holder, the Foundation can sue anyone who tries to distribute the program as a proprietary product. We are willing to keep your name on the program as the author for as long as the program remains recognizably distinct. ("Owner" is in quotes to show that we don't really believe in this kind of ownership.)

The assignment contract commits the foundation to setting distribution terms that permit free redistribution.

Often we don't want to do the work of starting to distribute a program right away. There are many things which we will need in order to have a complete system but which aren't really useful until the rest of the system is done. But signing the assignment does not stop you from distributing the program yourself--as long as you do so under the GNU terms. You don't have to wait for us to start distributing. You can start distributing as soon as you attach our standard copyleft to the files. (Ask for our advice on how to do this.)

The assignment contract we normally use has a clause that permits you to use your code in proprietary programs, on 30 days' notice. (The 30 days' notice is there because, through a legal technicality, it would improve our position in a suit against a hoarder.) Although we believe that proprietary software is wrong, we include this clause because it would serve no purpose to ask you to promise not to do it. You're giving us a gift in the first place.

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\* Public domain.

If you put the program in the public domain, we prefer to have a signed piece of paper--a disclaimer of rights--from you confirming this. If the program is not very important, we can do without one; the worst that could happen is that we might some day be forced to stop using it.

The law says that anyone can copyright a modified version of the public domain work. (This doesn't restrict the original, which remains in the



public domain; only the changes are copyrighted.) If we make extensive changes,  
we will probably do this and add our usual copyleft. If we make small changes, we will leave the version we distribute in the public domain.

\* What about your employer?

If you are employed to do programming, or have made an agreement with your employer that says it owns programs you write, we need a signed piece of paper from your employer disclaiming rights to the program. It should be signed by a vice president or general manager of the company. If you can't get at them, it is almost as good to find someone who signs licenses for software that is purchased. Here is a sample wording:

Digital Simulation Corporation hereby disclaims all copyright interest in the program "sample.el" (a program to direct assemblers to make passes at compilers under GNU Emacs) written by Hugh Hacker.

<signature of Mo Ghoul>, 1 April 1987  
Mo Ghoul, President of Vice, Digital Simulation Corp.

The description of what the program does is just to make it clearer what the disclaimer covers.

If  
what you did was change an existing program, it should say this:

...in the changes and enhancements made by Hugh Hacker to the program "sample.el".

\* Did anyone else contribute?

If someone else contributed more than a few lines here or there to the program, then that person too is an author, and that person too needs to sign papers just as you do. So may that person's employer. However, if his contribution is just a fraction of the whole work, it is satisfactory if he disclaims his own rights, even if you are assigning yours. (If just the minor contributors' work goes in the public domain, that doesn't leave much of a loophole for hoarders.)

If you incorporated packages which you found floating around as "public domain", we might still want to track down their authors, to get disclaimers to reassure us that they really are in the public domain. So keep track of what these packages are and who wrote them.

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Please use your full legal name (in ASCII characters) as the subject line of the message.

-----  
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[Do you have an employer who might have a basis to claim to own your changes? Do you attend a school which might make such a claim?]

[For the copyright registration, what country are you a citizen of?]

[What year were you born?]

[Please write your email address here.]

[Please write your postal address here.]

[Which files have you changed so far, and which new files have you written so far?]

Description:

Ensure `getcwd(NULL, 0)` returns a buffer allocated by the `malloc()` function.

Files:

lib/getcwd-lgpl.c  
m4/getcwd.m4

Depends-on:

unistd  
strdup [test \$REPLACE\_GETCWD = 1]

configure.ac:

```
gl_FUNC_GETCWD_LGPL
if test $REPLACE_GETCWD = 1; then
  AC_LIBOBJ([getcwd-lgpl])
fi
gl_UNISTD_MODULE_INDICATOR([getcwd])
```

Makefile.am:

Include:

<unistd.h>

License:

GPLv2+

Maintainer:

Eric Blake

The files in this directory describe the gnu lib modules.  
The following copyright notice applies to each of these  
description files.

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send you the assignment form that covers the changes you have already  
written. That form will cover subsequent corrections to those  
changes, but it will not cover other unrelated future changes to the  
same program.

Please use your full legal name (in ASCII characters) as the subject line of the message.

-----  
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[For the copyright registration, what country are you a citizen of?]

[What year were you born?]

[Please write your email address here.]

[Please write your  
postal address here.]

[Which files have you changed so far, and which new files have you written so far?]

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If you would like to make further contributions to the same package, and you would like to avoid the need to sign more papers when you contribute them, you have another option: to sign a copyright assignment covering your future changes. If that is what you want to do, please tell the maintainer you would prefer to sign an assignment of past and future changes.

Please use your full legal name (in ASCII characters) as the subject line of the message.

-----  
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material is free software, we need to know about it.]

[Do you have an employer who might have a basis to claim to own  
your changes?]

[Please write your email address here.]

[Please write your snail address here.]

[Please list the files involved, or give a brief description of the changes  
being disclaimed.]

Description:

Extract specific portions of filenames.

Files:

lib/dirname.h

lib/dirname-lgpl.c

lib/basename-lgpl.c

lib/stripslash.c

m4/dirname.m4

Depends-on:

dosname

double-slash-root

malloc-posix

stdbool

configure.ac:

gl\_DIRNAME\_LGPL

Makefile.am:

lib\_SOURCES += dirname-lgpl.c basename-lgpl.c stripslash.c

Include:

"dirname.h"

License:

GPLv2+

Maintainer:

Jim Meyering, Eric Blake

Description:

realpath, canonicalize\_file\_name: Provide canonical absolute file name

Files:

lib/canonicalize-lgpl.c

m4/canonicalize.m4

m4/double-slash-root.m4

Depends-on:

extensions

stdlib

nocrash

alloca-opt [test \$HAVE\_CANONICALIZE\_FILE\_NAME = 0 || test  
\$REPLACE\_CANONICALIZE\_FILE\_NAME = 1]

errno [test \$HAVE\_CANONICALIZE\_FILE\_NAME = 0 || test  
\$REPLACE\_CANONICALIZE\_FILE\_NAME = 1]

lstat [test \$HAVE\_CANONICALIZE\_FILE\_NAME = 0 || test \$REPLACE\_CANONICALIZE\_FILE\_NAME  
= 1]

malloca [test \$HAVE\_CANONICALIZE\_FILE\_NAME = 0 || test  
\$REPLACE\_CANONICALIZE\_FILE\_NAME = 1]

memmove [test \$HAVE\_CANONICALIZE\_FILE\_NAME = 0 || test  
\$REPLACE\_CANONICALIZE\_FILE\_NAME = 1]

pathmax [test \$HAVE\_CANONICALIZE\_FILE\_NAME = 0 || test  
\$REPLACE\_CANONICALIZE\_FILE\_NAME = 1]

readlink [test \$HAVE\_CANONICALIZE\_FILE\_NAME = 0 || test  
\$REPLACE\_CANONICALIZE\_FILE\_NAME = 1]

sys\_stat [test \$HAVE\_CANONICALIZE\_FILE\_NAME = 0 || test  
\$REPLACE\_CANONICALIZE\_FILE\_NAME = 1]

configure.ac:

gl\_CANONICALIZE\_LGPL

if

test \$HAVE\_CANONICALIZE\_FILE\_NAME = 0 || test \$REPLACE\_CANONICALIZE\_FILE\_NAME = 1; then  
AC\_LIBOBJ([canonicalize-lgpl])

fi

gl\_MODULE\_INDICATOR([canonicalize-lgpl])

gl\_STDLIB\_MODULE\_INDICATOR([canonicalize\_file\_name])

gl\_STDLIB\_MODULE\_INDICATOR([realpath])

Makefile.am:

Include:

<stdlib.h>

License:

GPLv2+

Maintainer:

all

Files:

tests/test-update-copyright.sh

Depends-on:

configure.ac:

```
abs_aux_dir=`cd "$ac_aux_dir"; pwd`
```

```
AC_SUBST([abs_aux_dir])
```

Makefile.am:

```
TESTS += test-update-copyright.sh
```

```
TESTS_ENVIRONMENT += abs_aux_dir='${abs_aux_dir}'
```

```
GNU LESSER GENERAL PUBLIC LICENSE
```

```
Version 3, 29 June 2007
```

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@heading Appendix: How to Apply These Terms to Your New Programs

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To do so, attach the following notices to the program. It is safest to attach them to the start of each source file to most effectively convey the exclusion of warranty; and each file should have at least the ``copyright" line and a pointer to where the full notice is found.

@smallexample

@var{one line to give the program's name  
and a brief idea of what it does.}

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@end smallexample

Also add information on how to contact you by electronic and paper mail.

If the program is interactive, make it output a short notice like this when it starts in an interactive mode:

```
@smallexample
Gnomovision version
69, Copyright (C) @var{year} @var{name of author}
Gnomovision comes with ABSOLUTELY NO WARRANTY; for details type `show w'.
This is free software, and you are welcome to redistribute it
under certain conditions; type `show c' for details.
@end smallexample
```

The hypothetical commands @samp{show w} and @samp{show c} should show the appropriate parts of the General Public License. Of course, the commands you use may be called something other than @samp{show w} and @samp{show c}; they could even be mouse-clicks or menu items---whatever suits your program.

You should also get your employer (if you work as a programmer) or your school, if any, to sign a ``copyright disclaimer" for the program, if necessary. Here is a sample; alter the names:

```
@example
Yoyodyne, Inc., hereby disclaims all copyright interest in the program
`Gnomovision' (which makes passes at compilers) written by James Hacker.
```

```
@var{signature of Ty Coon}, 1 April 1989
Ty Coon, President of Vice
@end example
```

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Files:

```
tests/test-canonicalize-lgpl.c
tests/signature.h
tests/null-ptr.h
tests/macros.h
```

Depends-on:

```
ignore-value
same-inode
symlink
```

configure.ac:

Makefile.am:

TESTS += test-canonicalize-lgpl

check\_PROGRAMS += test-canonicalize-lgpl

Description:

Help make libraries relocatable, that is, to allow them to function properly when copied to an arbitrary directory.

Files:

doc/relocatable.texi

lib/relocatable.h

lib/relocatable.c

lib/relocatable.valgrind

m4/relocatable-lib.m4

Depends-on:

strdup

configure.ac:

```
gl_RELOCATABLE_LIBRARY
```

```
if test $RELOCATABLE = yes; then
```

```
  AC_LIBOBJ([relocatable])
```

```
fi
```

Makefile.am:

DEFS += -DNO\_XMALLOC

Include:

"relocatable.h"

License:

LGPLv2+

Maintainer:

Ben Pfaff

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Version 2.1, February 1999

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```
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```

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Files:

tests/test-getcwd-lgpl.c

tests/signature.h

tests/macros.h

Depends-on:

configure.ac:

Makefile.am:

TESTS += test-getcwd-lgpl

check\_PROGRAMS += test-getcwd-lgpl

test\_getcwd\_lgpl\_LDADD = \$(LDADD) \$(LIBINTL)

Description:

Locating a program in PATH (LGPLed version).

Files:

lib/findprog.h

lib/findprog.c

lib/findprog-lgpl.c

m4/findprog.m4

m4/eaccess.m4

Depends-on:

stdbool

strdup

concat-filename

unistd

configure.ac:

gl\_FINDPROG

gl\_MODULE\_INDICATOR([findprog-lgpl])

Makefile.am:

lib\_SOURCES += findprog.h findprog.c

Include:

"findprog.h"

License:

LGPLv2+

Maintainer:

all

## 1.118 iproute 2.6.32

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2 of the License, or  
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```
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The hypothetical commands

```
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```
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```

```
<signature of Ty Coon>, 1 April 1989
Ty Coon, President of Vice
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## 1.121 less 1

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# 1.122 libaio 0.3.106

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@center Preamble

@sp 1

The licenses for most software are designed to take away your freedom to share and change it. By contrast, the GNU General Public Licenses are intended to guarantee your freedom to share and change free software--to make sure the software is free for all its users.

This license, the Lesser General Public License, applies to some specially designated software packages--typically libraries--of the Free Software Foundation and other authors who decide to use it. You can use it too, but we suggest you first think carefully about whether this license or the ordinary General Public License is the better strategy to use in any particular case, based on the explanations below.

When we speak of free software, we are referring to freedom of use, not price. Our General Public Licenses are designed to make sure that you have the freedom to distribute copies of free software (and charge for this service if you wish); that you receive source code or can get it if you want it; that you can change the software and use pieces of it in new free programs; and that you are informed that you can do these things.

To protect your rights, we need to make restrictions that forbid distributors to deny you these rights or to ask you to surrender these rights. These restrictions translate to certain responsibilities for you if you distribute copies of the library or if you modify it.

For example, if you distribute copies of the library, whether gratis or for a fee, you must give the recipients all the rights that we gave you. You must make sure that they, too, receive or can get the source code. If you link other code with the library, you must provide complete object files to the recipients, so that they can relink them with the library after making changes to the library and recompiling it. And you must show them these terms so they know their rights.

We protect your rights with a two-step method: (1) we copyright the library, and (2) we offer you this license, which gives you legal permission to copy, distribute and/or modify the library.

To protect each distributor, we want to make it very clear that there is no warranty for the free library. Also, if the library is modified by someone else and passed on, the recipients should know that what they

have is not the original version, so that the original author's reputation will not be affected by problems that might be introduced by others.

Finally, software patents pose a constant threat to the existence of any free program. We wish to make sure that a company cannot effectively restrict the users of a free program by obtaining a restrictive license from a patent holder. Therefore, we insist that any patent license obtained for a version of the library must be consistent with the full freedom of use specified in this license.

Most GNU software, including some libraries, is covered by the ordinary GNU General Public License. This license, the GNU Lesser General Public License, applies to certain designated libraries, and is quite different from the ordinary General Public License. We use this license for certain libraries in order to permit linking those libraries into non-free programs.

When a program is linked with a library, whether statically or using a shared library, the combination of the two is legally speaking a combined work, a derivative of the original library. The ordinary General Public License therefore permits such linking only if the entire combination fits its criteria of freedom. The Lesser General Public License permits more lax criteria for linking other code with the library.

We call this license the "Lesser" General Public License because it does less to protect the user's freedom than the ordinary General Public License. It also provides other free software developers less of an advantage over competing non-free programs. These disadvantages are the reason we use the ordinary General Public License for many libraries. However, the Lesser license provides advantages in certain special circumstances.

For example, on rare occasions, there may be a special need to encourage the widest possible use of a certain library, so that it becomes a de-facto standard. To achieve this, non-free programs must be allowed to use the library. A more frequent case is that a free library does the same job as widely used non-free libraries. In this case, there is little to gain by limiting the free library to free software only, so we use the Lesser General Public License.

In other cases, permission to use a particular library in non-free programs enables a greater number of people to use a large body of free software. For example, permission to use the GNU C Library in non-free

programs enables many more people to use the whole GNU operating system, as well as its variant, the GNU/Linux operating system.

Although the Lesser General Public License is Less protective of the users' freedom, it does ensure that the user of a program that is linked with the Library has the freedom and the wherewithal to run that program using a modified version of the Library.

The precise terms and conditions for copying, distribution and modification follow. Pay close attention to the difference between a ``work based on the library" and a ``work that uses the library". The former contains code derived from the library, whereas the latter must be combined with the library in order to run.

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A ``library" means a collection of software functions and/or data prepared so as to be conveniently linked with application programs (which use some of those functions and data) to form executables.

The ``Library", below, refers to any such software library or work which has been distributed under these terms. A ``work based on the Library" means either the Library or any derivative work under copyright law: that is to say, a work containing the Library or a portion of it, either verbatim or with modifications and/or translated straightforwardly into another language. (Hereinafter, translation is included without limitation in the term ``modification".)

``Source code" for a work means the preferred form of the work for making modifications to it. For a library, complete source code means all the source code for all modules it contains, plus any associated interface definition files, plus the scripts used to control compilation and installation of the library.

Activities other than copying, distribution and modification are not covered by this License; they are outside its scope. The act of running a program using the Library is not restricted, and output from such a program is covered only if its contents constitute a work based on the Library (independent of the use of the Library in a tool for writing it). Whether that is true depends on what the Library does and what the program that uses the Library does.

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You may modify your copy or copies of the Library or any portion of it, thus forming a work based on the Library, and copy and distribute such modifications or work under the terms of Section 1 above, provided that you also meet all of these conditions:

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The modified work must itself be a software library.

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You must cause the files modified to carry prominent notices stating that you changed the files and the date of any change.

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You must cause the whole of the work to be licensed at no charge to all third parties under the terms of this License.

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If a facility in the modified Library refers to a function or a table of

data to be supplied by an application program that uses the facility, other than as an argument passed when the facility is invoked, then you must make a good faith effort to ensure that, in the event an application does not supply such function or table, the facility still operates, and performs whatever part of its purpose remains meaningful.

(For example, a function in a library to compute square roots has a purpose that is entirely well-defined independent of the application. Therefore, Subsection 2d requires that any application-supplied function or table used by this function must be optional: if the application does not supply it, the square root function must still compute square roots.)

@end enumerate

These requirements apply to the modified work as a whole. If identifiable sections of that work are not derived from the Library, and can be reasonably considered independent and separate works in themselves, then this License, and its terms, do not apply to those sections when you distribute them as separate works. But when you distribute the same sections as part of a whole which is a work based on the Library, the distribution of the whole must be on the terms of this License, whose permissions for other licensees extend to the entire whole, and thus to each and every part regardless of who wrote it.

Thus, it is not the intent of this section to claim rights or contest your rights to work written entirely by you; rather, the intent is to exercise the right to control the distribution of derivative or collective works based on the Library.

In addition, mere aggregation of another work not based on the Library with the Library (or with a work based on the Library) on a volume of a storage or distribution medium does not bring the other work under the scope of this License.

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Once this change is made in a given copy, it is irreversible for that copy, so the ordinary GNU General Public License applies to all subsequent copies and derivative works made from that copy.

This option is useful when you wish to copy part of the code of the Library into a program that is not a library.

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You may copy and distribute the Library (or a portion or derivative of it, under Section 2)

in object code or executable form under the terms of Sections 1 and 2 above provided that you accompany it with the complete corresponding machine-readable source code, which must be distributed under the terms of Sections 1 and 2 above on a medium customarily used for software interchange.

If distribution of object code is made by offering access to copy from a designated place, then offering equivalent access to copy the source code from the same place satisfies the requirement to distribute the source code, even though third parties are not compelled to copy the source along with the object code.

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A program that contains no derivative of any portion of the Library, but is designed to work with the Library by being compiled or linked with it, is called a ``work that uses the Library''. Such a work, in isolation, is not a derivative work of the Library, and therefore falls outside the scope of this License.

However, linking a ``work that uses the Library'' with the Library creates an executable that is a derivative of the Library (because it contains portions of the Library), rather than a ``work that uses the library''. The executable is therefore covered by this License. Section 6 states terms for distribution of such executables.

When a ``work that uses the Library'' uses material from a header file that is part of the Library, the object code for the work may be a derivative work of the Library even though the source code is not. Whether this is true is especially significant if the work can be linked without the Library, or if the work is itself a library. The threshold for this to be true is not precisely defined by law.

If such an object file uses only numerical parameters, data structure layouts and accessors, and small macros and small inline functions (ten lines or less in length), then the use of the object file is



unrestricted, regardless of whether it is legally a derivative work.

(Executables containing this object code plus portions

of the Library

will still fall under Section 6.)

Otherwise, if the work is a derivative of the Library, you may

distribute the object code for the work under the terms of Section 6.

Any executables containing that work also fall under Section 6, whether

or not they are linked directly with the Library itself.

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As an exception to the Sections above, you may also combine or link a

``work that uses the Library" with the Library to produce a work

containing portions of the Library, and distribute that work under terms

of your choice, provided that the terms permit modification of the work

for the customer's own use and reverse engineering for debugging such

modifications.

You must give prominent notice with each copy of the work that the

Library is used in it and that the Library and its use are covered by

this License. You must supply a copy of this License. If the work

during execution displays copyright notices, you must include the

copyright notice for the Library among

them, as well as a reference

directing the user to the copy of this License. Also, you must do one

of these things:

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Accompany the work with the complete corresponding machine-readable

source code for the Library including whatever changes were used in the

work (which must be distributed under Sections 1 and 2 above); and, if

the work is an executable linked with the Library, with the complete

machine-readable ``work that uses the Library", as object code and/or

source code, so that the user can modify the Library and then relink to

produce a modified executable containing the modified Library. (It is

understood that the user who changes the contents of definitions files

in the Library will not necessarily be able to recompile the application

to use the modified definitions.)

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Use a suitable shared library mechanism for linking with the Library. A

suitable mechanism is one that (1) uses at run time a copy of the

library already present on

the user's computer system, rather than copying library functions into the executable, and (2) will operate properly with a modified version of the library, if the user installs one, as long as the modified version is interface-compatible with the version that the work was made with.

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Accompany the work with a written offer, valid for at least three years, to give the same user the materials specified in Subsection 6a, above, for a charge no more than the cost of performing this distribution.

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If distribution of the work is made by offering access to copy from a designated place, offer equivalent access to copy the above specified materials from the same place.

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Verify that the user has already received a copy of these materials or that you have already sent this user a copy.

@end enumerate

For an executable, the required form of the ``work that uses the Library" must include any data and utility programs needed for reproducing the executable from

it. However, as a special exception, the materials to be distributed need not include anything that is normally distributed (in either source or binary form) with the major components (compiler, kernel, and so on) of the operating system on which the executable runs, unless that component itself accompanies the executable.

It may happen that this requirement contradicts the license restrictions of other proprietary libraries that do not normally accompany the operating system. Such a contradiction means you cannot use both them and the Library together in an executable that you distribute.

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You may place library facilities that are a work based on the Library side-by-side in a single library together with other library facilities not covered by this License, and distribute such a combined library, provided that the separate distribution of the work based on the Library and of the other library facilities is otherwise permitted, and provided that you do these two things:

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Accompany the combined library with a copy of the same work based on the Library, uncombined with any other library facilities. This must be distributed under the terms of the Sections above.

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Give prominent notice with the combined library of the fact that part of it is a work based on the Library, and explaining where to find the accompanying uncombined form of the same work.

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@center END OF TERMS AND CONDITIONS

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@center How to Apply These Terms to Your New Libraries

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To apply these terms, attach the following notices to the library. It is safest to attach them to the start of each source file to most effectively convey the exclusion of warranty; and each file should have at least the ``copyright" line and a pointer to where the full notice is found.

@format

@t{

<one line to give the library's name and a brief idea of what it does.>

Copyright (C) <year> <name of author>

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}

@end format

Also add information on how to contact you by electronic and paper mail.

You should also get your employer (if you work as a programmer) or your school, if any, to sign a ``copyright disclaimer" for the library, if necessary. Here is a sample; alter the names:

```
@format
```

```
@t{
```

```
Yoyodyne, Inc., hereby disclaims all copyright interest in the  
library `Frob' (a library for tweaking knobs) written by James Random Hacker.
```

```
<signature of Ty Coon>, 1 April 1990
```

```
Ty Coon, President of Vice
```

```
}
```

```
@end format
```

That's all there is to it!

```
@c @bye
```

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Version 2.1, February 1999

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[This is the first released version of the Lesser GPL. It also counts as the successor of the GNU Library Public License, version 2, hence the version number 2.1.]

### Preamble

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To protect your rights, we need to make restrictions that forbid distributors to deny you these rights or to ask you to surrender these rights. These restrictions translate to certain responsibilities for you if you distribute copies of the library or if you modify it.

For example, if you distribute copies of the library, whether gratis or for a fee, you must give the recipients all the rights that we gave you. You must make sure that they, too, receive or can get the source code. If you link other code with the library, you must provide complete object files to the recipients, so that they can relink them with the library after making changes to the library and recompiling it. And you must show them these terms so they know their rights.

We protect your rights with a two-step method: (1) we copyright the library, and (2) we offer you this license, which gives you legal permission to copy, distribute and/or modify the library.

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- b) You must cause the files modified to carry prominent notices stating that you changed the files and the date of any change.
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- d) If a facility in the modified Library refers to a function or a table of data to be supplied by an application program that uses the facility, other than as an argument passed when the facility is invoked, then you must make a good faith effort to ensure that, in the event an application does not supply such function or table, the facility still operates, and performs whatever part of its purpose remains meaningful.

(For example, a function in a library to compute square roots has a purpose that is entirely well-defined independent of the application. Therefore, Subsection 2d requires that any application-supplied function or table used by this function must be optional: if the application does not supply it, the square root function must still compute square roots.)

These requirements apply to the modified work as a whole. If identifiable sections of that work are not derived from the Library, and can be reasonably considered independent and separate works in themselves, then this License, and its terms, do not apply to those sections when you distribute them as separate works. But when you distribute the same sections as part of a whole which is a work based on the Library, the distribution of the whole must be on the terms of this License, whose permissions for other licensees extend to the entire whole, and thus to each and every part regardless of who wrote it.

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b) Use a suitable shared library mechanism for linking with the

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# 1.124 libgrypt 1.4.0

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"Source code" for a work means the preferred form of the work for making modifications to it. For a library, complete source code means all the source code for all modules it contains, plus any associated interface definition files, plus the scripts used to control compilation and installation of the library.

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table of data to be supplied by an application program that uses the facility, other than as an argument passed when the facility is invoked, then you must make a good faith effort to ensure that, in the event an application does not supply such function or table, the facility still operates, and performs whatever part of its purpose remains meaningful.

(For example, a function in a library to compute square roots has a purpose that is entirely well-defined independent of the application. Therefore, Subsection 2d requires that any application-supplied function or table used by this function must be optional: if the application does not supply it, the square root function must still compute square roots.)

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In addition, mere aggregation of another work not based on the Library with the Library (or with a work based on the Library) on a volume of a storage or distribution medium does not bring the other work under the scope of this License.

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If such an object file uses only numerical parameters, data structure layouts and accessors, and small macros and small inline functions (ten lines or less in length), then the use of the object file is unrestricted, regardless of whether it is legally a derivative work. (Executables containing this object code plus portions of the Library will still fall under Section 6.)

Otherwise, if the work is a derivative of the Library, you may distribute

the object code for the work under the terms of Section 6.

Any executables containing that work also fall under Section 6, whether or not they are linked directly with the Library itself.

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6. As an exception to the Sections above, you may also combine or link a "work that uses the Library" with the Library to produce a work containing portions of the Library, and distribute that work under terms of your choice, provided that the terms permit modification of the work for the customer's own use and reverse engineering for debugging such modifications.

You must give prominent notice with each copy of the work that the Library is used in it and that the Library and its use are covered by this License. You must supply a copy of this License. If the work during execution displays copyright notices, you must include the copyright notice for the Library among them, as well as a reference directing the user to the copy of this License. Also, you must do one of these things:

a)

Accompany the work with the complete corresponding machine-readable source code for the Library including whatever changes were used in the work (which must be distributed under Sections 1 and 2 above); and, if the work is an executable linked with the Library, with the complete machine-readable "work that uses the Library", as object code and/or source code, so that the user can modify the Library and then relink to produce a modified executable containing the modified Library. (It is understood that the user who changes the contents of definitions files in the Library will not necessarily be able to recompile the application to use the modified definitions.)

b) Use a suitable shared library mechanism for linking with the Library. A suitable mechanism is one that (1) uses at run time a copy of the library already present on the user's computer system, rather than copying library functions into the executable, and (2) will

operate properly with a modified version of the library, if the user installs one, as long as the modified version is interface-compatible with the version that the work was made with.

c) Accompany the work with a written offer, valid for at least three years, to give the same user the materials specified in Subsection 6a, above, for a charge no more than the cost of performing this distribution.

d) If distribution of the work is made by offering access to copy from a designated place, offer equivalent access to copy the above



specified materials from the same place.

e) Verify that the user has already received a copy of these materials or that you have already sent this user a copy.

For an executable, the required form of the "work that uses the Library" must include any data and utility programs needed for reproducing the executable from it. However, as a special exception, the materials to be distributed need not include anything that is normally distributed (in either source or binary form) with the major components (compiler, kernel, and so on) of the operating system on which the executable runs, unless that component itself accompanies the executable.

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## 1.125 libnl3 3.2.22

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We call this license the "Lesser" General Public License because it does Less to protect the user's freedom than the ordinary General Public License. It also provides other free software developers Less of an advantage over competing non-free programs. These disadvantages are the reason we use the ordinary General Public License for many libraries. However, the Lesser license provides advantages in certain special circumstances.

For example, on rare occasions, there may be a special need to encourage the widest possible use of a certain library, so that it becomes a de-facto standard. To achieve this, non-free programs must be allowed to use the library. A more frequent case is that a free library does the same job as widely used non-free libraries. In this case, there is little to gain by limiting the free library to free software only, so we use the Lesser General Public License.

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a) Accompany the work with the complete corresponding machine-readable source code for the Library including whatever changes were used in the work (which must be distributed under Sections 1 and 2 above); and, if the work is an executable linked with the Library, with the complete machine-readable "work that uses the Library", as object code and/or source code, so that the user can modify the Library and then relink to produce a modified executable containing the modified Library. (It is understood that the user who changes the contents of definitions files in the Library will not necessarily be able to recompile the application to use the modified definitions.)

b) Use a suitable shared library mechanism for linking with the Library. A suitable mechanism is one that (1) uses at run time a copy of the library already present on the user's computer system, rather than copying library functions into the executable, and (2) will operate properly with a modified version of the library, if the user installs one, as long as the modified version is

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c) Accompany the work with a written offer, valid for at least three years, to give the same user the materials specified in Subsection 6a, above, for a charge no more than the cost of performing this distribution.

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Balzs Dn <balazs.dan@gmail.com>

Benoit Sigoure <tsuna@google.com>

Bharat Mediratta <bharat@menalto.com>

Bogdan Piloa <boo@google.com>

Chandler Carruth <chandlerc@google.com>

Chris Prince <cprince@google.com>

Chris Taylor <taylorc@google.com>

Dan Egnor <egnor@google.com>

Dave MacLachlan <dmaclach@gmail.com>

David Anderson <danderson@google.com>

Dean Sturtevant

Eric Roman <eroman@chromium.org>

Gene Volovich <gv@cite.com>

Hady Zalek <hady.zalek@gmail.com>

Hal Burch <gmock@hburch.com>

Jeffrey Yasskin <jyasskin@google.com>

Jim Keller <jimkeller@google.com>

Joe Walnes <joe@truemesh.com>

Jon Wray <jwray@google.com>  
Ji Sigursson <joi@google.com>  
Keir Mierle <mierle@gmail.com>  
Keith Ray <keith.ray@gmail.com>  
Kenton Varda  
<kenton@google.com>  
Kostya Serebryany <kcc@google.com>  
Krystian Kuzniarek <krystian.kuzniarek@gmail.com>  
Lev Makhlis  
Manuel Klimek <klimek@google.com>  
Mario Tanev <radix@google.com>  
Mark Paskin  
Markus Heule <markus.heule@gmail.com>  
Matthew Simmons <simmonmt@acm.org>  
Mika Raento <mikie@iki.fi>  
Mike Bland <mbland@google.com>  
Mikls Fazekas <mfazekas@szemafor.com>  
Neal Norwitz <nnorwitz@gmail.com>  
Nermin Ozkiranartli <nermin@google.com>  
Owen Carlsen <ocarlsen@google.com>  
Paneendra Ba <paneendra@google.com>  
Pasi Valminen <pasi.valminen@gmail.com>  
Patrick Hanna <phanna@google.com>  
Patrick Riley <pfr@google.com>  
Paul Menage <menage@google.com>  
Peter Kaminski <piotrk@google.com>  
Piotr Kaminski <piotrk@google.com>  
Preston Jackson <preston.a.jackson@gmail.com>  
Rainer Klaffenboeck <rainer.klaffenboeck@dynatrace.com>  
Russ Cox <rsc@google.com>  
Russ Rufer <russ@pentad.com>  
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Takeshi Yoshino <tyoshino@google.com>  
Tracy  
Bialik <tracy@pentad.com>  
Vadim Berman <vadimb@google.com>  
Vlad Losev <vladl@google.com>  
Wolfgang Klier <wklier@google.com>  
Zhanyong Wan <wan@google.com>

## 1.131 parted 1.8.6



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```

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## 1.136 numactl 2.0.3

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## 1.137 autogen 1.2

### 1.137.1 Available under license :

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Metadata-Version: 1.1

Name: argparse-autogen

Version: 1.2

Summary: Parser with automatic creation of parsers and subparsers for paths.

Home-page: <https://github.com/sashgorokhov/argparse-autogen>

Author: sashgorokhov

Author-email: [sashgorokhov@gmail.com](mailto:sashgorokhov@gmail.com)

License: MIT License

Download-URL: <https://github.com/sashgorokhov/argparse-autogen/archive/v1.2.zip>

Description: argparse-autogen

=====

[|PyPI version|](#) [|GitHub release|](#) [|Build Status|](#) [|codecov|](#) [|GitHub license|](#)

Parser with automatic creation of parsers and subparsers for paths.

Installation

-----

Supported versions of python: `**`3.3+`**` (because of inspect.Signature, which was introduced in python 3.3)

```
.. code:: shell
```

```
    pip install argparse-autogen
```

Usage

-----

```
``argparse_autogen.EndpointParser``
```

is intended to replace basic

```
``argparse.ArgumentParser``. It extends subparsers creation logic, and adds a new special method ``add_endpoint``.
```

Simple example:

```
.. code:: python
```

```
import argparse_autogen
```

```
class MyCli():
```

```
    def do_stuff(self, target, force=False):
```

```
        """
```

```
        This does cool stuff!
```

```
        :param str target: Target to execute a cool stuff
```

```
        :param bool force: Force doing cool stuff
```

```
        """
```

```
        print(target, force)
```

```
cli = MyCli()
```

```
parser = argparse_autogen.EndpointParser()
```

```
parser.add_endpoint('do_stuff', cli.do_stuff)
```

```
parser.parse_and_call(['do_stuff', 'my target']) # this will print "my target false"
```

```
parser.parse_and_call(['do_stuff', '--force', 'my target']) # this will print "my target true"
```

```
``add_endpoint`` method is clever enough to parse methods docstring and
```

```
add corresponding helps in arguments. For example,
```

```
``parser.parse_args(['do_stuff', '--help'])`` in above example will show
```

```
something like
```

```
::
```

```
usage: example.py do_stuff [-h] [--force]
```

```
    This does cool stuff!
```

optional arguments:

```
-h, --help show this help message and exit
--force Force doing cool stuff
```

This magic is done by `argparse_autogen.autospec` function. It introspects function signature, and adds corresponding argparse arguments to parser. `*args` arguments in function are not supported - this parameter will be skipped. `**kwargs` are supported and can be passed as `[key=value [key=value ...]]`. You can override argument settings by passing `argument_overrides` option to `add_endpoint`.

This must be a `dict[str, dict]` where keys are parameter name, and values are parameters to override defaults passed to `parser.add_argument`

More endpoint examples

-----

Nested class and complex paths:

```
.. code:: python
```

```
import argparse_autogen

class MyCli():
    def __init__(self):
        self.users = self.Users()
        self.groups = self.Groups()

class Users():
    def get(self, user_id): pass
    def list(self, **filter): pass
    def update(self, user_id, **fields): pass

class Groups():
    def get(self, group_id): pass

cli = MyCli()

parser = argparse_autogen.EndpointParser()

parser.add_endpoint('users.get', cli.users.get, argument_overrides={'user_id':
{'help': 'Users id'}})
parser.add_endpoint('users.list', cli.users.list)
parser.add_endpoint(cli.users.update)
# this will use __qualname__ of update func as path, lowercased and trailing and ending underscores
removed.
```

```
# The first item of qualname is skipped, so it would be `users.update`, not `mycli.users.update`
```

```
groups_get_parser = parser.add_endpoint('groups get', cli.groups.get, autospec=False)  
groups_get_parser.add_argument('group_id', help='Group id')
```

```
users_parser = parser.get_endpoint_parser('users')  
users_parser.description = 'Users operations'
```

```
parser.parse_and_call()
```

## History

-----

1.2 (2017-03-01)

~~~~~

- Ability to automatically generate path from func's qualname

1.1 (2017-02-28)

~~~~~

- Filter args from  
func signature in call method #1

1.0 (2017-02-26)

~~~~~

- First release

0.1 (2017-02-25)

~~~~~

- Initial commit

.. |PyPI version| image:: <https://badge.fury.io/py/argparse-autogen.svg>

:target: <https://badge.fury.io/py/argparse-autogen>

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Keywords: python, argparse, generate

Platform: UNKNOWN

Found in path(s):

```
* /opt/cola/permits/1328610500_1652761164.793856/0/argparse-autogen-1-2-tar-gz/argparse-autogen-1.2/PKG-INFO
```

No license file was found, but licenses were detected in source scan.

```
from distutils.core import setup
```

```
with open('README.md') as readme:
```

```
    with open('HISTORY.md') as history:
```

```
        long_description = readme.read() + '\n\n' + history.read()
```

```
try:
```

```
    import py pandoc
```

```
    long_description = py pandoc.convert(long_description, 'rst', 'markdown')
```

```
except(IOError, ImportError):
```

```
    long_description = long_description
```

```
VERSION = '1.2'
```

```
setup(
```

```
    name='argparse-autogen',
```

```
    py_modules=['argparse_autogen'],
```

```
    version=VERSION,
```

```
    url='https://github.com/sashgorokhov/argparse-autogen',
```

```
    download_url='https://github.com/sashgorokhov/argparse-autogen/archive/v%s.zip' % VERSION,
```

```
    keywords=['python', 'argparse', 'generate'],
```

```
    classifiers=[],
```

```
    long_description=long_description,
```

```
    license='MIT License',
```

```
    author='sashgorokhov',
```

```
    author_email='sashgorokhov@gmail.com',
```

```
    description="Parser with automatic creation of parsers and subparsers for paths.",
```

```
)
```

Found in path(s):

```
*
```

```
/opt/cola/permits/1328610500_1652761164.793856/0/argparse-autogen-1-2-tar-gz/argparse-autogen-1.2/setup.py
```

## 1.138 sqlite 3.3.17

### 1.138.1 Available under license :

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```
/*
```

```
* This code implements the MD5 message-digest algorithm.
```

```

* The algorithm is due to Ron Rivest. This code was
* written by Colin Plumb in 1993, no copyright is claimed.
* This code is in the public domain; do with it what you wish.
*
* Equivalent code is available from RSA Data Security, Inc.
* This code has been tested against that, and is equivalent,
* except that you don't need to include two pages of legalese
* with every copy.
*
* To compute the message digest of a chunk of bytes, declare an
* MD5Context structure, pass it to MD5Init, call MD5Update as
* needed on buffers full of bytes, and then call MD5Final, which
* will fill a supplied 16-byte array with the digest.
*/

```

Found in path(s):

```

* /opt/cola/permits/1332727043_1653392698.341362/0/sqlite-3-3-17-tar-gz/sqlite-3.3.17/src/test_md5.c
No license file was found, but licenses were detected in source scan.

```

```

set rcsid {$Id: copyright.tcl,v 1.6 2007/03/10 20:50:18 drh Exp $}
source common.tcl
header {SQLite Copyright}
puts {
<h2>SQLite Copyright</h2>

```

```

<table align="right" vspace="0" hspace="10" border="1" cellpadding="20">
<tr><td align="center">
<br>
SQLite is in the<br>
<a href="http://en.wikipedia.org/wiki/Public_Domain">Public Domain</a>
</td></tr>
</table>

```

```

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Anyone is free to copy, modify, publish, use, compile, sell, or distribute
the original SQLite code, either in source
code form or as a compiled binary,
for any purpose, commercial or non-commercial, and by any means.
</p>

```

<p>

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</p>

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</p>

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</p>

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<li> You are using SQLite in a jurisdiction that does not recognize the right of an author to dedicate their work to the public domain. </li>

<li> You want to hold a tangible legal document as evidence that you have the legal right to use and distribute SQLite. </li>

<li> Your legal department tells you that you have to purchase a license. </li>

</ul>

<p>

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Please contact:

</p>

<blockquote>

D. Richard Hipp <br />

Hwaci - Applied Software Research <br />

704.948.4565 <br />

<a

href="mailto:drh@hwaci.com">drh@hwaci.com</a>

</blockquote>

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</p>

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We intend this dedication to be an overt act of relinquishment in perpetuity of all present and future rights this code under copyright law.

</i></blockquote>

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Hwaci<br>

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Charlotte, NC 28269<br>

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<a href="copyright-release.html">HTML</a>.  
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</p>  
>  
footer \$rcsid

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/opt/cola/permits/1332727043\_1653392698.341362/0/sqlite-3-3-17-tar-gz/sqlite-3.3.17/art/SQLite.eps: binary file matches

Found in path(s):

\* /bin/grep  
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```
set rcsid {$Id: support.tcl,v 1.6 2005/12/05 22:22:40 drh Exp $}  
source common.tcl  
header {SQLite Support Options}  
puts {  
<h2>SQLite Support Options</h2>
```

<h3>Mailing List</h3>

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sqlite-users-subscribe@sqlite.org</a>.  
If you would prefer to get digests rather than individual  
emails, send a message to to  
<a href="mailto:sqlite-users-digest-subscribe@sqlite.org">  
sqlite-users-digest-subscribe@sqlite.org</a>.  
For additional information about operating and using this  
mailing list, send a message to  
<a href="mailto:sqlite-users-help@sqlite.org">  
sqlite-users-help@sqlite.org</a> and instructions will be  
sent by to you by return email.  
</p>

<p>

There are multiple archives of the mailing list:

</p>

<blockquote>

<a

href="http://www.mail-archive.com/sqlite-users%40sqlite.org/">

http://www.mail-archive.com/sqlite-users%40sqlite.org</a><br>

<a href="http://marc.10east.com/?l=sqlite-users&r=1&w=2">

http://marc.10east.com/?l=sqlite-users&r=1&w=2</a><br>

<a href="http://news.gmane.org/gmane.comp.db.sqlite.general">

http://news.gmane.org/gmane.comp.db.sqlite.general</a>

</blockquote>

</p>

<a name="directemail">

<h3>Direct E-Mail To The Author</h3>

<p>

Use the mailing list.

Please do **not** send email directly to the author of SQLite unless:

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<li>You are working on an open source project.</li>

</ul>

You are welcomed to use SQLite in closed source, proprietary, and/or commercial projects and to ask questions about such use on the public mailing list. But please do not ask to receive free direct technical support. The software is free; direct technical support is not.

</p>

<h3>Professional

Support</h3>

<p>

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For additional information visit

<a href="http://www.hwaci.com/sw/sqlite/prosupport.html">

http://www.hwaci.com/sw/sqlite/prosupport.html</a> or contact:</p>

<blockquote>

```
D. Richard Hipp <br />
Hwaci - Applied Software Research <br />
704.948.4565 <br />
<a href="mailto:drh@hwaci.com">drh@hwaci.com</a>
</blockquote>
```

```
}
footer $rcsid
```

Found in path(s):

```
* /opt/cola/permits/1332727043_1653392698.341362/0/sqlite-3-3-17-tar-gz/sqlite-3.3.17/www/support.tcl
No license file was found, but licenses were detected in source scan.
```

SQLite is in the public domain. This document describes what that means

Found in path(s):

```
* /opt/cola/permits/1332727043_1653392698.341362/0/sqlite-3-3-17-tar-gz/sqlite-3.3.17/www/docs.tcl
No license file was found, but licenses were detected in source scan.
```

```
# 2006 October 1
```

```
#
```

```
# The author disclaims copyright to this source code. In place of
# a legal notice, here is a blessing:
```

```
#
```

```
# May you do good and not evil.
```

```
# May you find forgiveness for yourself and forgive others.
```

```
# May you share freely, never taking more than you give.
```

```
#
```

```
*****
```

```
# This file implements regression tests for SQLite library. The
# focus of this script is testing the FTS1 module, and in particular
# the Porter stemmer.
```

```
#
```

```
# $Id: fts1porter.test,v 1.5 2006/10/03 19:37:37 drh Exp $
```

```
#
```

```
set testdir [file dirname $argv0]
```

```
source $testdir/tester.tcl
```

```
# If SQLITE_ENABLE_FTS1 is defined, omit this file.
```

```
ifcapable !fts1 {
```

```
  finish_test
```

```
  return
```

```
}
```

```
# Test data for the Porter stemmer. The first word of each line
```

```
# is the input. The second word is the desired output.
```

```
#
```

# This test data is taken from <http://www.tartarus.org/martin/PorterStemmer/>

#

There is no claim of copyright made on that page, but you should probably contact the author (Martin Porter - the inventor of the Porter Stemmer algorithm) if you want to use this test data in a commercial product of some kind. The stemmer code in FTS1 is a complete rewrite from scratch based on the algorithm specification and does not contain any code under copyright.

#

```
set porter_test_data {
  a          a
  aaron      aaron
  abaissiez  abaissiez
  abandon    abandon
  abandoned  abandon
  abase      abas
  abash      abash
  abate      abat
  abated     abat
  abatement  abat
  abatements abat
  abates     abat
  abbess     abbess
  abbey      abbei
  abbeys     abbei
  abbominable  abbomin
  abbot      abbot
  abbots     abbot
  abbreviated
  abbrevi
  abed       ab
  abel       abel
  aberga     aberga
  abergavenny  abergavenni
  abet       abet
  abetting   abet
  abhominable  abhomin
  abhor      abhor
  abhorr     abhorr
  abhorred   abhor
  abhorring  abhor
  abhors     abhor
  abhorson   abhorson
  abide      abid
  abides     abid
  abilities  abil
  ability    abil
  abject     abject
```

abjectly	abjectli
abjects	abject
abjur	abjur
abjure	abjur
able	abl
abler	abler
aboard	aboard
abode	abod
aboded	abod
abodements	abod
aboding	abod
abominable	abomin
abominably	abomin
abominations	
abomin	
abortive	abort
abortives	abort
abound	abound
abounding	abound
about	about
above	abov
abr	abr
abraham	abraham
abram	abram
abreast	abreast
abridg	abridg
abridge	abridg
abridged	abridg
abridgment	abridg
abroach	abroach
abroad	abroad
abrogate	abrog
abrook	abrook
abrupt	abrupt
abruption	abrupt
abruptly	abruptli
absence	absenc
absent	absent
absey	absei
absolute	absolut
absolutely	absolut
absolv	absolv
absolver	absolv
abstains	abstain
abstemious	abstemi
abstinence	abstin
abstract	abstract
absurd	absurd

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auger	auger
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augment	augment
augmentation	augment

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augmenting	augment
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augurers	augur
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august	august
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aurora	aurora
auspicious	auspici
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austereness	auster
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austria	austria
aut	aut
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author	author
authorities	author
authority	author
authorized	author
authorizing	author
authors	author
autolycus	autolycu
autre	autr
autumn	autumn
auvergne	auvergn
avail	avail
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avarice	avaric
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avaunt	avaunt
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backwardly	backwardli
backwards	backward
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banbury	banburi
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banding	band
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barbason	barbason
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barber	barber
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bardolph	bardolph

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barley	barlei
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bayonne	bayonn
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beats	beat
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beauteous	beauteou
beautied	beauti
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beaver	beaver
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becks	beck
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becoming	becom
becomings	becom
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bedash	bedash
bedaub	bedaub
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bedclothes	bedcloth
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bedfellows	bedfellow
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befall	befal
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befits	befit



befitted	benefit
befitting	benefit
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before	before
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befriend	befriend
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beggar	beggar
beggared	beggar
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beggars	beggar
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begs	beg
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beguile	beguil
beguiled	beguil
beguiles	beguil
beguiling	beguil
begun	begun
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behav	behav
behaved	behav
behavedst	behavedst
behavior	behavior
behaviors	behavior
behaviour	behaviour

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behest	behest
behests	behest
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behoof	behoof
behooffull	behoofful
behooves	behoov
behove	behov
behoves	behov
behows	behowl
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bel	bel
belarius	belariu
belch	belch
belching	belch
beldam	beldam
beldame	beldam
beldams	beldam
belee	bele
belgia	belgia
belie	beli
belied	beli
belief	belief
beliest	beliest
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belike	belik
bell	bell
bellario	bellario
belle	bell
bellied	belli
bellies	belli
bellman	bellman
bellona	bellona

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bellowed	bellow
bellowing	bellow
bellows	bellow
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belly	belli
bellyful	belly
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belonging	belong
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beloved	belov
beloving	belov
below	below
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benevolence	benevol
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bepray	beprai
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berard	berard
berattle	berattl
beray	berai
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beseeching	beseech

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besides	besid
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bethrothed	bethroth

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betoken	betoken
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between	between
betwixt	betwixt
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bewitch	bewitch
bewitched	bewitch
bewitchment	bewitch
bewray	bewrai
beyond	beyond

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bianco	bianco
bias	bia
bibble	bibbl
bickerings	bicker
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bide	bide
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	bigger
bigness	big
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bilbo	bilbo
bilboes	bilbo
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binds	bind
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bird	bird
birding	bird
birdlime	birdlim

birds	bird
birnam	birnam
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birthday	birthdai
birthdom	birthdom
birthplace	birthplac
birthright	birthright
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births	birth
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biscuit	biscuit
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blenches	blench

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blessed	bless
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blessedli	
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blessings	bless
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blindly	blindli
blindness	blind
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blithild	blithild
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blocks	block
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blooded	blood
bloodhound	bloodhound
bloodied	bloodi
bloodier	bloodier
bloodiest	bloodiest
bloodily	bloodili
bloodless	bloodless
bloods	blood
bloodshed	bloodsh
bloodshedding	bloodshed
bloodstained	bloodstain
bloody	bloodi

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blowse	blows
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blubber	blubber
blubbering	blubber
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bluecaps	
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bluntly	bluntli
bluntness	blunt
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boar	boar
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boasting	
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bobb	bobb
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boding	bode
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body	bodi
bodykins	bodykin
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boggle	boggl
boggler	boggler
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boils	boil
boist	boist
boisterous	boister
boisterously	boister
boitier	boitier
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bolden	bolden

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boldest	boldest
boldly	boldli
boldness	bold
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bolingbroke	bolingbrok
bolster	bolster
bolt	bolt
bolted	bolt
bolter	bolter
bolters	bolter
bolting	bolt
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bombard	bombard
bombards	bombard
bombast	bombast
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bona	bona
bond	bond
bondage	bondag
bonded	bond
bondmaid	bondmaid
bondman	bondman
bondmen	bondmen
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bondslave	bondslav
bone	bone
boneless	boneless
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bonfire	bonfir
bonfires	bonfir
bonjour	bonjour
bonne	bonn
bonnet	bonnet
bonneted	bonnet
bonny	bonni
bonos	bono
bonto	bonto
bonville	bonvil
bood	bood
book	book
bookish	bookish
books	book
boon	boon
boor	boor
boorish	boorish
boors	boor

boot	boot
booted	boot
booties	booti
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boots	boot
booty	booti
bor	bor
bora	bora
borachio	borachio
bordeaux	
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border	border
bordered	border
borderers	border
borders	border
bore	bore
boreas	borea
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borough	borough
boroughs	borough
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borrower	borrow
borrowing	borrow
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bosko	bosko
boskos	bosko
bosky	boski
bosom	bosom
bosoms	bosom
boson	boson
boss	boss
bosworth	bosworth
botch	botch
botcher	botcher
botches	botch
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both	both
bots	bot
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bounteous	bounteou
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bounties	bounti
bountiful	bounti
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bounty	bounti
bourbier	bourbier
bourbon	bourbon
bourchier	bourchier
bourdeaux	bourdeaux
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bow	bow
bowcase	bowcas
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bowl	bowl
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bowsprit	bowsprit
bowstring	bowstr
box	box
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boy	boi
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brained	brain
brainford	brainford
brainish	brainish
brainless	brainless
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brainsick	brainsick
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brawl	brawl
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brawling	brawl
brawls	brawl
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breath	breath
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breathers	breather
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breeches	breech
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brethen	brethen
bretheren	bretheren
brethren	brethren
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briareus	briareu
briars	briar
brib	brib
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briber	briber
bribes	bribe
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bricklayer	bricklay
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bridal	bridal
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brows	brow
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bubble	bubbl
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bullen	bullen
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bullet	bullet
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bullocks	bullock
bulls	bull
bully	bulli
bulmer	bulmer
bulwark	bulwark
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bumper	bumper
bums	bum
bunch	bunch
bunches	bunch
bundle	bundl
bung	bung
bunghole	bunghol
bungle	bungl
bunting	bunt
buoy	buoi
bur	bur
burbolt	burbolt
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burgh	burgh
burgher	burgher
burghers	burgher
burglary	burglari
burgomasters	burgomast
burgonet	burgonet
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burial	burial
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burton	burton
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burying	huri
bush	bush
bushels	bushel
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busily	busili
business	busin
business	busi
businesses	busi
buskin	buskin
busky	buski
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bustle	bustl
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butler	butler
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butterflies	butterfli
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butterwoman	butterwoman
buttery	butteri
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button	button
buttonhole	buttonhol
buttons	button
buttress	buttress
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buxom	buxom
buy	bui
buyer	buyer
buying	bui
buys	bui
buzz	buzz
buzzard	buzzard
buzzards	buzzard
buzzers	buzzer
buzzing	buzz
by	by
bye	bye
byzantium	byzantium
c	c
ca	ca
cabbage	cabbag
cabileros	cabilero
cabin	cabin
cabins	cabin
cable	cabl
cables	cabl
cackling	cackl
cadodemon	cadodemon
caddis	caddi
caddisses	caddiss
cade	cade
cadence	cadenc
cadent	cadent
caes	cade
cadmus	cadmu
caduceus	caduceu
cadwal	cadwal
cadwallader	cadwallad
caelius	caeliu
caelo	caelo
caesar	caesar
caesarion	caesarion
caesars	caesar



cage	cage
caged	cage
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cain	cain
caithness	caith
caitiff	caitiff
caitiffs	caitiff
caius	caiu
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cake	cake
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calaber	calab
calais	calai
calamities	calam
calamity	calam
calchas	calcha
calculate	calcul
calen	calen
calendar	calendar
calendars	calendar
calf	calf
caliban	caliban
calibans	caliban
calipolis	calipoli
cality	caliti
caliver	caliv
call	call
callat	callat
called	call
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calling	call
calls	call
calm	calm
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calms	calm
calpurnia	calpurnia
calumniate	calumni
calumniating	calumni
calumnious	calumni
calumny	calumni
calve	calv
calved	calv
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calveskins	calveskin
calydon	calydon

cam	cam
cambio	cambio
cambria	cambria
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cambridge	cambridg
cambyses	cambys
came	came
camel	camel
camelot	camelot
camels	camel
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camillo	camillo
camlet	camlet
camomile	camomil
camp	camp
campeius	campeiu
camping	camp
camps	camp
can	can
canakin	canakin
canaries	canari
canary	canari
cancel	cancel
cancell	cancel
cancelled	cancel
cancelling	cancel
cancels	cancel
cancer	cancer
candidatus	candidatu
candied	candi
candle	candl
candles	candl
candlesticks	candlestick
candy	candi
canidius	canidiu
cank	cank
canker	canker
cankerblossom	cankerblossom
cankers	canker
cannibally	cannib
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cannon	cannon
cannoneer	cannon
cannons	cannon
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canopies	canopi
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canstick	canstick
canterbury	canterburi
cantle	cantl
cantons	canton
canus	canu
canvas	canva
canvass	canvass
canzonet	canzonet
cap	cap
capability	capabl
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capacities	capac
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caparison	caparison
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capilet	capilet
capitaine	capitain
capital	capit
capite	capit
capitol	capitol
capitulate	capitul
capocchia	capocchia
capon	capon
capons	capon
capp	capp
cappadocia	cappadocia
capriccio	capriccio
capricious	caprici
caps	cap
capt	capt
captain	captain
captains	captain

captainship	captainship
captious	captiou
captivate	captiv
captivated	captiv
captivates	captiv
captive	captiv
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capucius	capuciu
capulet	capulet
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caraways	carawai
carbonado	carbonado
carbuncle	carbuncl
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carcanet	carcanet
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carders	carder
cardinal	cardin
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cardmaker	cardmak
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careers	career
careful	care
carefully	carefulli
careless	careless
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cargo	cargo
carl	carl
carlisle	carlisl
carlot	carlot
carman	carman
carmen	carmen
carnal	carnal
carnally	carnal
carnarvonshire	carnarvonshir
carnation	carnat
carnations	carnat
carol	carol
carous	carou
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carpenter	carpent
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casca	casca
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cash	cash
cashier	cashier
casing	case
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caskets	casket
casque	casqu
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cassado	cassado
cassandra	cassandra
cassibelan	cassibelan
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cassocks	cassock
cast	cast
castalion	castalion
castaway	castawai
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caster	caster
castigate	castig
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casual	casual
casually	casual
casualties	casualti
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cat	cat
cataian	cataian
catalogue	catalogu
cataplasm	cataplasm
cataracts	cataract
catarrhs	catarrh
catastrophe	
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catch	catch

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catches	catch
catching	catch
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catechising	catechis
catechism	catech
catechize	catech
cater	cater
caterpillars	caterpillar
caters	cater
caterwauling	caterwaul
cates	cate
catesby	catesbi
cathedral	cathedr
catlike	catlik
catling	catl
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cats	cat
cattle	cattl
caucasus	caucasu
caudle	caudl
cauf	cauf
caught	caught
cauldron	cauldron
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cautels	cautel
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cautions	caution
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cavalery	cavaleri
cavaliers	cavali
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cavern	cavern
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caves	cave
caveto	caveto
caviary	caviari

cavil	cavil
cavilling	cavil
cawdor	cawdor
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ce	ce
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cedius	cediu
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celebrates	celebr
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celestial	celesti
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cellar	cellar
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celsa	celsa
cement	cement
censer	censer
ensor	ensor
ensorinus	ensorinu
censur	censur
censure	censur
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centuries	centuri
centurion	centurion
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cerberus	cerberu
cerecloth	cerecloth
cerements	
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ceremonial	ceremoni



ceremonies	ceremoni
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certificate	certif
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cesario	cesario
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cetera	cetera
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chafing	chafe
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chalks	chalk
chalky	chalki
challeng	challeng
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challenged	challeng
challenger	challeng
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challenges	challeng

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chamber	chamber
chamberers	chamber
chamberlain	chamberlain
chamberlains	chamberlain
chambermaid	chambermaid
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chameleon	chameleon
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champagne	champagn
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champion	champion
champions	champion
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chancellor	chancellor
chances	chanc
chandler	chandler
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change	chang
changeable	changeabl
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changeful	chang
changeling	changel
changelings	changel
changer	changer
changes	chang
changest	changest
changing	chang
channel	channel
channels	channel
chanson	chanson
chant	chant
chanticleer	chanticl
chanting	chant
chantries	chantri
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chants	chant
chaos	chao
chap	chap
chape	
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chapel	chapel
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chapels	chapel
chaplain	chaplain
chaplains	chaplain
chapless	chapless
chaplet	chaplet
chapmen	chapmen
chaps	chap
chapter	chapter
character	charact
charactered	charact
characterless	characterless
characters	charact
charactery	characteri
characts	charact
charbon	charbon
chare	chare
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charges	charg
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chariest	chariest
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charing	chare
chariot	chariot
chariots	
chariot	
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charlemain	charlemain
charles	charl
charm	charm
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charmer	charmer
charmeth	charmeth
charmian	charmian
charming	charm
charmingly	charmingli
charms	charm
charneco	charneco
charnel	charnel
charolois	charoloi
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charter	charter
charters	charter
chartreux	chartreux
chary	chari
charybdis	charybdi
chas	cha
chase	chase
chased	chase
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chaseth	chaseth
chasing	chase
chaste	chast
chastely	chast
chastis	chasti
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chastity	chastiti
chat	chat
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chatillon	chatillon
chats	chat
chatt	chatt
chattels	chattel
chatter	chatter
chattering	chatter
chattles	chattl
chaud	chaud
chaunted	chaunt
chaw	chaw
chawdron	chawdron
che	che
cheap	cheap
cheapen	cheapen
cheaper	cheaper
cheapest	cheapest
cheaply	cheapli
cheapside	cheapsid
cheat	cheat
cheated	cheat
cheater	cheater
cheaters	cheater
cheating	cheat
cheats	cheat
check	check
checked	check
checker	checker
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cordelia	cordelia
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corollary	corollari
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fearfully	fearfulli
fearfulness	fear
fearing	fear
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ferrers	ferrer
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ferryman	ferryman
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fickle	fickl
fickleness	fickl
fico	fico
fiction	fiction
fiddle	fiddl
fiddler	fiddler
fiddlestick	fiddlestick
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finisher	finish
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firebrand	firebrand
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firk	firk
firm	firm
firmament	firmament
firmly	firml
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first	first
firstlings	firstl
fish	fish
fisher	fisher
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fishified	fishifi
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five	five
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foeman	foeman
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fooleries	fooleri
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foolhardy	foolhardi
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foreknowing	foreknow
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foremost	
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forerun	forerun

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fulfils	fulfil
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gaud	gaud
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gaul	gaul
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gauntlets	gauntlet
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genitivo	genitivo
genius	geniu
gennets	gennet
genoa	genoa
genoux	genoux
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gent	gent
gentilhomme	gentilhomm
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gentlefolks	gentlefolk
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gentlemanlike	gentlemanlik
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gentleness	gentl
gentler	gentler
gentles	gentl
gentlest	gentlest
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gentlewomen	gentlewomen
gently	gentli
gentry	gentri
george	georg
gerard	gerard
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germane	german
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germany	germani
gertrude	gertrud
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gesture	gestur
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getting	get
ghastly	ghastli
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ghostly	ghostli
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gi	gi
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giantess	giantess
giantlike	giantlik
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gibber	gibber
gibbet	gibbet
gibbets	gibbet
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giddily	giddili
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gioucestershire	gioucestershir
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gladded	glad
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glamis	glami
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glansdale	glansdal
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glimpse	glimps

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glories	glori
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goads	goad
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goatish	goatish
goats	goat
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godfather	godfath
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goldsmith	goldsmith
goldsmiths	goldsmith
golgotha	golgotha
goliases	goliath
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guilfords	guilford
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gunpowder	gunpowd
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gurney	gurnei
gust	gust
gusts	gust
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guts	gut
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guy	gui
guynes	guyn
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gypsy	gypsi
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haberdasher	haberdash

habiliment	habili
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habitation	habit
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hacket	hacket
hackney	hacknei
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haeres	haer
hag	hag
hagar	hagar
haggard	haggard

haggards	haggard
haggish	haggish
haggled	haggl
hags	hag
hail	hail
hailed	hail
hailstone	hailston
hailstones	hailston
hair	hair
hairless	hairless
hairs	hair
hairy	hairi
hal	hal
halberd	halberd
halberds	halberd
halcyon	halcyon
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half	half
halfcan	halfcan
halfpence	halfpenc
halfpenny	halfpenni
halfpennyworth	halfpennyworth
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halidom	halidom
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halloing	hallo
hallond	hallond
halloo	halloo
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hallow	hallow
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hamstring	hamstr
hand	hand
handed	hand
handful	hand
handicraft	handicraft
handicraftsmen	handicraftsmen
handing	hand
handiwork	handiwork
handkercher	handkerch
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handkerchief	handkerchief
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handmaid	handmaid
handmaids	handmaid
hands	hand
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handsomely	handsom
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handwriting	handwrit
handy	handi
hang	hang
hanged	hang
hangers	hanger
hangeth	hangeth
hanging	hang
hangings	hang
hangman	hangman
hangmen	hangmen
hangs	hang
hannibal	hannib
hap	hap
hapless	hapless
haply	hapli



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happier	happier
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harbinger	harbing
harbingers	harbing
harbor	harbor
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harbourage	harbourag
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harbours	harbour
harcourt	harcourt
hard	hard
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hardiness	hardi
hardly	hardli
hardness	hard
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hare	hare
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hares	hare
harfleur	harfleur
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harlots	harlot
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headsman	headsman
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healths	health
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helias	helia
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hence	henc
henceforth	henceforth
henceforward	henceforward
henchman	henchman
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herbert	herbert
herblets	herblet

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hereford	hereford
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hight	hight
highway	highwai
highways	highwai
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hildings	hild
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hips	hip
hir	hir
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hisperia	hisperia
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hist	hist
historical	histor
history	histori
hit	hit
hither	hither
hitherto	hitherto
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hitherwards	hitherward
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hitting	hit
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hobbididence	hobbidid
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hobgoblin	hobgoblin
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jacksauce	jacksauc
jackslave	jackslav
jacob	jacob
jade	jade
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january	januari
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jawbone	jawbon
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jelly	jelli
jenny	jenni
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jephtha	jephtha
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jolly	jolli
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jordan	jordan
joseph	joseph
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jupiter	jupit
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laquais	laquai
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latches	latch
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laughter	laughter
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launcelot	launcelot
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lavache	lavach
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lawfully	lawfulli
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lawyer	lawyer
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lazarus	lazaru
lazy	lazi
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learnings	learn
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legacies	legaci
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legate	legat
legatine	legatin
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legion	legion
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leicester	leicest
leicestershire	leicestershir
leiger	leiger
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leisure	leisur
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lend	lend

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liberte	libert
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lieutenant	lieuten
lieutenantry	lieutenantri
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lingers	linger
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livelihood	livelihood
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lock	lock
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lolls	loll
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londoners	london
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lordliness	lordli
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loseth	loseth
losing	lose
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losses	loss
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loudly	loudli
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lt	lt
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lucianus	lucianu
lucifer	lucif



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lucilius	luciliu
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lurch	lurch
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lurketh	lurketh
lurking	
	lurk
lurks	lurk
luscious	luscio

lush	lush
lust	lust
lusted	lust
luster	luster
lustful	lust
lustier	lustier
lustiest	lustiest
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lustihood	lustihood
lustily	lustili
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lustrous	lustrou
lusts	lust
lusty	lusti
lute	lute
lutes	lute
lutestring	lutestr
lutheran	lutheran
luxurious	luxuri
luxuriously	luxuri
luxury	luxuri
ly	ly
lycaonia	lycaonia
lycurguses	lycurgus
lydia	lydia
lye	lye
lyen	lyen
lying	ly
lym	lym
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lynn	lynn
lysander	lysand
m	m
ma	ma
maan	maan
mab	mab
macbeth	macbeth
maccabaeus	maccabaeu
macdonwald	macdonwald
macduff	macduff
mace	mace
macedon	macedon
maces	mace
machiavel	machiavel
machination	machin
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mack	mack
macmorris	macmorri
maculate	macul
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mad	mad
madam	madam
madame	madam
madams	madam
madcap	madcap
madded	mad
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made	made
madeira	madeira
madly	madli
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madness	mad
madonna	madonna
madrigals	madrig
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maecenas	maecena
maggot	maggot
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magic	magic
magical	magic
magician	magician
magistrate	magistr
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magnanimity	magnanim
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mahomet	mahomet
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maid	maid
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maidenhead	maidenhead
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maidenliest	maidenliest
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maidens	maiden
maidhood	maidhood
maids	maid
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malcontent	malcont
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malevolence	malevol
malevolent	malevol
malhecho	malhecho
malice	malic
malicious	malici
maliciously	malici
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malignancy	malign
malignant	malign
malignantly	malignantli
malkin	malkin
mall	mall
mallard	mallard
mallet	mallet
mallows	mallow
malmsey	malmsei
malt	malt
maltworms	maltworm
malvolio	malvolio
mamillius	mamilliu
mammering	mammer
mammet	mammet
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man	man
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mandragora	mandragora
mandrake	mandrak
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manhood	manhood
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manifests	manifest
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manifoldly	manifoldli
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mankind	mankind
manlike	manlik
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manningtree	manningtre
mannish	mannish
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mans	man
mansion	
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manslaughter	manslaught
mantle	mantl
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marcellus	marcellu
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marches	march
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maritime	maritim
marjoram	marjoram
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marketplace	marketplac
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markman	markman
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marseilles	marseil
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marshal	marshal
marshalsea	marshalsea
marshalship	marshalship
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martext	martext
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martin	martin
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martius	martiu
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martlet	martlet
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martyr	martyr
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marullus	marullu
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masterless	masterless
masterly	masterli
masterpiece	masterpiec
masters	master
mastership	mastership
mastic	mastic
mastiff	mastiff
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masts	mast
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matches	match
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matchless	matchless
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material	materi
mates	mate
mathematics	mathemat
matin	matin
matron	matron
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matters	matter
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mattress	mattress
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maud	maud
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mauritania	mauritania
mauvais	mauvai
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maxim	maxim
may	mai
mayday	maydai
mayest	mayest
mayor	mayor
maypole	maypol
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mehercle	mehercl
meilleur	meilleur
meiny	meini
meisen	meisen
melancholies	melancholi
melancholy	melancholi
melford	melford
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mellifluous	melliflu
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memorandums	memorandum
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memorials	memori
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menaphon	menaphon
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menelaus	menelau
menenius	meneniu
mental	mental

menteith	menteith
mention	mention
mentis	menti
menton	menton
mephostophilus	mephostophilu
mer	mer
mercatante	mercatant
mercatio	mercatio
mercenaries	mercenari
mercenary	mercenari
mercer	mercer
merchandise	merchandis
merchandized	merchand
merchant	merchant
merchants	merchant
mercies	merci
merciful	merci
mercifully	mercifulli
merciless	merciless
mercurial	mercuri
mercuries	mercuri
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mercutio	mercutio
mercy	merci
mere	mere
mered	mere
merely	mere
merest	merest
meridian	meridian
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merited	merit
meritorious	meritori
merits	merit
merlin	merlin
mermaid	mermaid
mermaids	mermaid
merops	merop
merrier	merrier
merriest	merriest
merrily	merrili
merriman	merriman
merriment	merriment
merriments	merriment
merriness	merri
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mes	me
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meshes	mesh
mesopotamia	mesopotamia
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metamorphoses	metamorphos
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metellus	metellu
meteor	meteor
meteors	meteor
meteyard	meteyard
metheglin	metheglin
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metropolis	metropoli
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mettled	mettl
meus	meu
mew	mew
mewed	mew
mewling	mewl
mexico	mexico
mi	mi
mice	mice
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michaelmas	michaelma

micher	micher
miching	mich
mickle	mickl
microcosm	microcosm
mid	mid
midas	mida
middest	middest
middle	middl
middleham	middleham
midnight	midnight
midriff	midriff
midst	midst
midsummer	midsumm

midway	midwai
midwife	midwif
midwives	midwiv
miene	mienn
might	might
mightful	might
mightier	mightier
mightiest	mightiest
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mightst	mightst
mighty	mighti
milan	milan
milch	milch
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milder	milder
mildest	mildest
mildew	mildew
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mildly	mildli
mildness	mild
mile	mile
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milford	milford
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military	militari
milk	milk
milking	milk
milkmaid	milkmaid
milks	milk
milksops	milksop
milky	

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mill	mill

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millstones	millston
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mind	mind
minded	mind
mindin	mind
mindless	mindless
minds	mind
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mineral	miner
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minerva	minerva
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minim	minim
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minimus	minimu
mining	mine
minion	minion
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minist	minist
minister	minist
ministers	minist
ministration	ministr
minnow	minnow
minnows	minnow
minola	minola
minority	minor
minos	mino
minotaurs	minotaur
minstrel	minstrel
minstrels	minstrel



minstrelsy	minstrelsi
mint	mint
mints	mint
minute	minut
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mir	mir
mirable	mirabl
miracle	miracl
miracles	miracl
miraculous	miracul
miranda	miranda
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mirror	mirror
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mirthful	mirth
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mis	mi
misadventur	misadventur
misadventure	misadventur
misanthropos	misanthropo
misapplied	misappli
misbecame	misbecam
misbecom	misbecom
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misbeliever	misbeliev
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misbhav	misbhav
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miscarried	miscarri
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miscarrying	miscarri
mischance	mischanc
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mischief	mischief
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misconstruction	misconstruct
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miscreant	miscreant
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misdeeds	misde
misdemean	misdemean
misdemeanours	misdemeanour
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misdoubts	misdoubt
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miserable	miser
miserably	miser
misericorde	misericord
miseries	miseri
misers	miser
misery	miseri
misfortune	misfortun
misfortunes	misfortun
misgive	misgiv
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misgiving	misgiv
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misprizing	mispriz

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missions	mission
missive	missiv
missives	missiv
misspoke	misspok
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misthought	misthought
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mistresses	mistress
mistresss	mistresss
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mistrust	mistrust
mistrusted	mistrust
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mistrusting	mistrust
mists	mist
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modicums	modicum
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moisture	moistur
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molehill	molehil

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monkey	monkei
monkeys	monkei
monks	monk
monmouth	monmouth
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monsieur	monsieur
monsieurs	monsieur
monster	monster
monsters	monster
monstrous	monstrou
monstrously	monstrous
monstrousness	monstrous

monstruosity	monstruos
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montage	montag
montague	montagu
montagues	montagu
montano	montano
montant	montant
montez	montez
montferrat	montferrat
montgomery	montgomeri
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monthly	monthli
months	month
montjoy	montjoi
monument	monument
monumental	monument
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moods	mood
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moonbeams	moonbeam
moonish	moonish
moonlight	moonlight
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moonshine	
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mopsa	mopsa
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mores	more
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morisco	morisco

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mornings	morn
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mortally	mortal
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mortified	mortifi
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mortimer	mortim
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mortis	morti
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mothers	mother
moths	moth
motion	motion
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motions	motion
motive	motiv
motives	motiv
motley	motlei
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mought	mought
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mouldeth	mouldeth
moulds	mould
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moult	moult

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mountaineers	mountain
mountainous	mountain
mountains	mountain
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mountebank	mountebank
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mounting	mount
mounts	mount
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mourner	mourner
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mournful	mourn
mournfully	mournfulli
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mourningly	mourningli
mournings	mourn
mourns	mourn
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mousetrap	mousetrap
mousing	mous
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mouthed	mouth
mouths	mouth
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movables	movabl
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moveable	moveabl
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moved	move
mover	mover
movers	mover
moves	move
moveth	moveth
moving	move
movingly	movingli
movousus	movousu



mow	mow
mowbray	mowbrai
mower	mower
mowing	mow
mows	mow
moy	moi
moys	moi
moyses	moys
mrs	mr
much	much
muck	
	muck
mud	mud
mudded	mud
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pantaloons	pantaloons
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pantheon	pantheon
panther	panther
panthino	panthino
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pantingly	pantingly
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pantry	pantri
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pap	pap
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paphos	papho
papist	papist
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par	par
parable	parabl
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patron	patron
patronage	patronag
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peerless	peerless
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peflur	peflur
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pegasus	pegasu
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peroration	peror
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persecutor	persecutor
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persuasion	persuas
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petitioner	petition
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petitions	petit
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pewterer	pewter
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phaeton	phaeton
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pheebus	pheebu
pheeze	pheez
phibbus	phibbu
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philarmonus	philarmonu

philemon	philemon
philip	philip
philippan	philippan
philippe	philipp
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philomel	philomel
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philosophers	philosoph
philosophical	philosoph
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philostrate	philostr
philotus	philotu
phlegmatic	phlegmat
phoebe	phoeb
phoebus	phoebu
phoenicia	phoenicia
phoenicians	phoenician

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phorbus	phorbu
photinus	photinu
phrase	phrase
phraseless	phraseless
phrases	phrase
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picardy	picardi
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pickaxe	pickax
pickaxes	pickax
pickbone	pickbon
picked	pick
pickers	picker
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pickle	pickl
picklock	picklock

pickpurse	pickpurs
picks	pick
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pickthanks	pickthank
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pilchers	pilcher
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pilgrim	pilgrim
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pinion	pinion
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pintpot	pintpot
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pippin	pippin
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pirate	pirat
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pisanio	pisanio
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pockets	pocket
pocky	pocki
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poetry	poetri
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polonius	poloniu
poltroons	poltroon
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polydore	polydor
polyxena	polyxena
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pomegranate	pomegran
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ponton	ponton
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poorer	poorer
poorest	poorest
poorly	poorli
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pope	pope
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popilius	popiliu
popingay	popingai
popish	popish
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posthorses	posthors
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pourquoi	pourquoi
pours	pour
pout	pout
poverty	poverti
pow	pow
powd	powd
powder	powder
power	power
powerful	power
powerfully	powerfulli
powerless	powerless
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poys	poi
poysam	poysam
prabbles	prabbl
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sol	sol
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soldiers	soldier
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solem	solem
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solemnness	solem
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subject	subject
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subjects	subject
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submission	submit
submissive	submit
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submitting	submit
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viva	viva
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volume	volum
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whether	whether
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wonders	wonder
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woodbine	woodbin
woodcock	woodcock
woodcocks	woodcock
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woodland	woodland
woodman	woodman
woodmonger	woodmong
woods	wood
woodstock	woodstock
woodville	woodvil
woed	woo
woer	woer
woers	woer
woes	woe
woof	woof
woing	woo
woingly	woingli
wool	wool
woollen	woollen
woolly	woolli
woolsack	woolsack
woolsey	woolsei
woolward	woolward
woos	woo
wor	wor
worcester	worcest

word	word
words	word
wore	wore
worins	worin
work	work
workers	worker
working	work
workings	work
workman	workman
workmanly	workmanli
workmanship	workmanship
workmen	workmen
works	work
worky	worki
world	world
worldlings	worldl
worldly	worldli
worlds	world
worm	worm
worms	worm
wormwood	wormwood
wormy	wormi
worn	worn
worried	worri
worries	
worri	
worry	worri
worrying	worri
worse	wors
worser	worser
worship	worship
worshipful	worship
worshipfully	worshipfulli
worshipp	worshipp
worshipper	worshipp
worshippers	worshipp
worshippest	worshippest
worships	worship
worst	worst
worsted	worst
wort	wort
worth	worth
worthied	worthi
worthier	worthier
worthies	worthi
worthiest	worthiest
worthily	worthili
worthiness	worthi

worthless	worthless
worths	worth
worthy	worthi
worts	wort
wot	wot
wots	wot
wotting	wot
wouid	wouid
would	
would	
wouldest	wouldest
wouldst	wouldst
wound	wound
wounded	wound
wounding	wound
woundings	wound
woundless	woundless
wounds	wound
wouns	woun
woven	woven
wow	wow
wrack	wrack
wrackful	wrack
wrangle	wrangl
wrangler	wrangler
wranglers	wrangler
wrangling	wrangl
wrap	wrap
wrapp	wrapp
wraps	wrap
wrapt	wrapt
wrath	wrath
wrathful	wrath
wrathfully	wrathfulli
wraths	wrath
wreak	wreak
wreakful	wreak
wreaks	wreak
wreath	wreath
wreathed	wreath
wreathen	wreathen
wreaths	wreath
wreck	wreck
wrecked	wreck
wrecks	wreck
wren	wren
wrench	wrench

wrenching	wrench
wrens	wren
wrest	wrest
wrested	wrest
wresting	wrest
wrestle	wrestl
wrestled	wrestl
wrestler	wrestler
wrestling	wrestl
wretch	wretch
wretchcd	wretchcd
wretched	wretch
wretchedness	wretched
wretches	wretch
wring	wring
wringer	wringer
wringing	wring
wrings	wring
wrinkle	wrinkl
wrinkled	wrinkl
wrinkles	wrinkl
wrist	wrist
wrists	wrist
writ	writ
write	write
writer	
writer	
writers	writer
writes	write
writhled	writhl
writing	write
writings	write
writs	writ
written	written
wrong	wrong
wronged	wrong
wronger	wronger
wrongful	wrong
wrongfully	wrongfulli
wronging	wrong
wrongly	wrongli
wrongs	wrong
wronk	wronk
wrote	wrote
wroth	wroth
wrought	wrought
wrung	wrung
wry	wry

wrying	wry
wt	wt
wul	wul
wye	wye
x	x
xanthippe	xanthipp
xi	xi
xii	xii
xiii	xiii
xiv	xiv
xv	xv
y	
	y
yard	yard
yards	yard
yare	yare
yarely	yare
yarn	yarn
yaughan	yaughan
yaw	yaw
yawn	yawn
yawning	yawn
ycleped	yclepe
ycliped	yclipe
ye	ye
yea	yea
yead	yead
year	year
yearly	yearli
yearn	yearn
yearns	yearn
years	year
yeas	yea
yeast	yeast
yedward	yedward
yell	yell
yellow	yellow
yellowed	yellow
yellowing	yellow
yellowness	yellow
yellows	yellow
yells	yell
yelping	yelp
yeoman	yeoman
yeomen	yeomen
yerk	yerk
yes	ye
yesterday	yesterdai



yesterdays	yesterdai
yesternight	yesternight
yesty	yesti
yet	yet
yew	yew
yield	yield
yield	yield
yielded	yield
yielder	yielder
yielders	yielder
yielding	yield
yields	yield
yok	yok
yoke	yoke
yoked	yoke
yokefellow	yokefellow
yokes	yoke
yoketh	yoketh
yon	yon
yond	yond
yonder	yonder
yongrey	yongrei
yore	yore
yorick	yorick
york	york
yorkists	yorkist
yorks	york
yorkshire	yorkshir
you	
you	
young	young
younger	younger
youngest	youngest
youngling	youngl
younglings	youngl
youngly	youngli
yunker	yunker
your	your
yours	your
yourself	yourself
yourselves	yourself
youth	youth
youthful	youth
youths	youth
youtli	youtli
zanies	zani
zany	zani
zeal	zeal

```
zealous      zealou
zeals        zeal
zed          zed
zenelophon   zenelophon
zenith       zenith
zephyrs      zephyr
zir          zir
zo           zo
zodiac       zodiac
zodiacs      zodiac
zone         zone
zounds       zound
zwagger      zwagger
}
```

```
# Create a full-text index to use for testing the stemmer.
#
db close
sqlite3 db :memory:
db eval {
  CREATE VIRTUAL TABLE t1 USING fts1(word, tokenize Porter);
}

foreach {pfrom pto} $porter_test_data {
  do_test fts1porter-$pfrom {
    execsql {
      DELETE FROM t1_term;
      DELETE FROM t1_content;
      INSERT INTO t1(word) VALUES($pfrom);
      SELECT term FROM t1_term;
    }
  } $pto
}

finish_test
```

Found in path(s):

```
* /opt/cola/permits/1332727043_1653392698.341362/0/sqlite-3-3-17-tar-gz/sqlite-3.3.17/test/fts1porter.test
No license file was found, but licenses were detected in source scan.
```

```
# 2006 September 14
#
# The author disclaims copyright to this source code.  In place of
# a legal notice, here is a blessing:
#
#   May you do good and not evil.
#   May you find forgiveness for yourself and forgive others.
```

```

# May you share freely, never taking more than you give.
#
#*****
# This file implements regression tests for SQLite library. The
# focus of this script is testing the FTS1 module.
#
# $Id: fts1c.test,v 1.11 2006/10/04 17:35:28 drh Exp $
#

set testdir [file dirname $argv0]
source $testdir/tester.tcl

# If SQLITE_ENABLE_FTS1 is defined, omit this file.
ifcapable !fts1 {
  finish_test
  return
}

# Create a table of sample email data. The data comes from email
# archives of Enron executives that was published as part of the
# litigation against that company.
#
do_test fts1c-1.1 {
  db eval {
    CREATE VIRTUAL TABLE email
    USING fts1([from],[to],subject,body);
    BEGIN TRANSACTION;
    INSERT INTO email([from],[to],subject,body) VALUES('savita.puthigai@enron.com', 'traders.eol@enron.com,
traders.eol@enron.com', 'EnronOnline- Change to Autohedge', 'Effective Monday, October 22, 2001 the following
changes will be made to the Autohedge functionality on EnronOnline.

The volume on the hedge will now respect the minimum volume and volume increment settings on the parent
product. See rules below:

? If the transaction volume on the child is less than half of the parent's minimum volume no hedge will occur.
? If the transaction volume on the child is more than half the parent's minimum volume but less than half the volume
increment on the parent, the hedge will volume will be the parent's minimum volume.
? For all other volumes, the same rounding rules will apply based on the volume increment on the parent product.

Please see example below:

Parent's Settings:
Minimum: 5000
Increment: 1000

Volume on Autohedge
transaction Volume Hedged
1 - 2499 0

```

2500 - 5499 5000  
5500 - 6499 6000');

INSERT INTO email([from],[to],subject,body) VALUES('dana.davis@enron.com', 'laynie.east@enron.com, lisa.king@enron.com, lisa.best@enron.com,', 'Leaving Early', 'FYI:

If it's ok with everyone's needs, I would like to leave @4pm. If you think you will need my assistance past the 4 o'clock hour just let me know; I'll be more than willing to stay.');

INSERT INTO email([from],[to],subject,body) VALUES('enron\_update@concuere workplace.com', 'louise.kitchen@enron.com', '<<Concur Expense Document>> - CC02.06.02', 'The following expense report is ready for approval:

Employee Name: Christopher F. Calger  
Status last changed by: Mollie E. Gustafson Ms  
Expense Report Name: CC02.06.02  
Report Total: \$3,972.93  
Amount Due Employee: \$3,972.93

To approve this expense report, click on the following link for Concur Expense.

<http://expense.ms.enron.com>');

INSERT INTO email([from],[to],subject,body)

VALUES('jeff.duff@enron.com', 'julie.johnson@enron.com', 'Work request', 'Julie,

Could you print off the current work request report by 1:30 today?

Gentlemen,

I'd like to review this today at 1:30 in our office. Also, could you provide me with your activity reports so I can have Julie enter this information.

JD');

INSERT INTO email([from],[to],subject,body) VALUES('v.weldon@enron.com', 'gary.l.carrier@usa.dupont.com, scott.joyce@bankofamerica.com', 'Enron News', 'This could turn into something big....

<http://biz.yahoo.com/rf/010129/n29305829.html>');

INSERT INTO email([from],[to],subject,body) VALUES('mark.haedicke@enron.com', 'paul.simons@enron.com', 'Re: First Polish Deal!', 'Congrats! Things seem to be building rapidly now on the Continent. Mark');

INSERT INTO email([from],[to],subject,body) VALUES('e..carter@enron.com', 't..robinson@enron.com', 'FW:

Producers Newsletter 9-24-2001', '

The producer lumber pricing sheet.

-----Original Message-----

From: Johnson, Jay

Sent: Tuesday,

October 16, 2001 3:42 PM

To: Carter, Karen E.

Subject: FW: Producers Newsletter 9-24-2001

-----Original Message-----

From: Daigre, Sergai  
Sent: Friday, September 21, 2001 8:33 PM  
Subject: Producers Newsletter 9-24-2001

);  
INSERT INTO email([from],[to],subject,body) VALUES('david.delainey@enron.com', 'kenneth.lay@enron.com',  
'Greater Houston Partnership', 'Ken, in response to the letter from Mr Miguel San Juan, my suggestion would  
be to offer up the Falcon for their use; however, given the tight time frame  
and your recent visit with Mr. Fox that it would be difficult for either you  
or me to participate.

I spoke to Max and he agrees with this approach.

I hope this meets with your approval.

Regards  
Delainey');  
INSERT INTO email([from],[to],subject,body) VALUES('lachandra.fenceroy@enron.com',  
'lindy.donoho@enron.com', 'FW: Bus Applications Meeting Follow Up', 'Lindy,

Here is the original memo we discussed earlier. Please provide any information that you may  
have.

Your cooperation is greatly appreciated.

Thanks,

lachandra.fenceroy@enron.com  
713.853.3884  
877.498.3401 Pager

-----Original Message-----

From: Bisbee, Joanne  
Sent: Wednesday, September 26, 2001 7:50 AM  
To: Fenceroy, LaChandra  
Subject: FW: Bus Applications Meeting Follow Up

Lachandra, Please get with David Duff today and see what this is about. Who are our TW accounting business  
users?

-----Original Message-----

From: Koh, Wendy  
Sent: Tuesday, September 25, 2001 2:41 PM  
To: Bisbee, Joanne  
Subject: Bus Applications Meeting Follow Up

Lisa brought up a TW change effective Nov 1. It involves eliminating a turnback surcharge. I have no other

information, but you might check with the business folks for any system changes required.

Wendy');

INSERT INTO email([from],[to],subject,body) VALUES('danny.mccarty@enron.com', 'fran.fagan@enron.com', 'RE: worksheets', 'Fran,

If Julie's merit needs to be lump sum, just move it over to that column. Also, send me Eric Gadd's sheets as well. Thanks.

Dan

-----Original Message-----

From: Fagan, Fran

Sent: Thursday, December 20, 2001 11:10 AM

To: McCarty, Danny

Subject: worksheets

As discussed, attached are your sheets for bonus and merit.

Thanks,

Fran Fagan

Sr. HR Rep

713.853.5219

<< File: McCartyMerit.xls >> << File: mccartyBonusCommercial\_UnP.xls >>

');

INSERT INTO email([from],[to],subject,body) VALUES('bert.meyers@enron.com', 'shift.dl-portland@enron.com', 'OCTOBER SCHEDULE', 'TEAM,

PLEASE SEND ME ANY REQUESTS THAT YOU HAVE FOR OCTOBER. SO FAR I HAVE THEM FOR LEAF. I WOULD LIKE TO HAVE IT DONE BY THE 15TH OF THE MONTH. ANY QUESTIONS PLEASE GIVE ME A CALL.

BERT');

INSERT INTO email([from],[to],subject,body) VALUES('errol.mclaughlin@enron.com', 'john.arnold@enron.com, bilal.bajwa@enron.com, john.griffith@enron.com,', 'TRV Notification: (NG - PROPT P/L - 09/27/2001)', 'The report named: NG - PROPT P/L <[http://trv.corp.enron.com/linkFromExcel.asp?report\\_cd=11&report\\_name=NG+-+PROPT+P/L&category\\_cd=5&category\\_name=FINANCIAL&toc\\_hide=1&sTV1=5&TV1Exp=Y&current\\_efct\\_d ate=09/27/2001](http://trv.corp.enron.com/linkFromExcel.asp?report_cd=11&report_name=NG+-+PROPT+P/L&category_cd=5&category_name=FINANCIAL&toc_hide=1&sTV1=5&TV1Exp=Y&current_efct_d ate=09/27/2001)>, published as of 09/27/2001 is now available for viewing on the website.');

INSERT INTO email([from],[to],subject,body) VALUES('patrice.mims@enron.com', 'calvin.eakins@enron.com', 'Re: Small business supply assistance', 'Hi Calvin

I spoke with Rickey (boy, is he long-winded!!). Gave him the name of our credit guy, Russell Diamond.

Thank for your help!');

INSERT INTO email([from],[to],subject,body) VALUES('legal <.hall@enron.com>', 'stephanie.panus@enron.com', 'Termination update', 'City of Vernon and Salt River Project terminated their contracts. I will fax these notices to you.');

INSERT INTO email([from],[to],subject,body) VALUES('d..steffes@enron.com', 'richard.shapiro@enron.com', 'EES / ENA Government Affairs Staffing & Outside Services', 'Rick --

Here is the information on staffing and outside services. Call if you need anything else.

Jim

');

INSERT INTO email([from],[to],subject,body)

VALUES('gelliott@industrialinfo.com', 'pcopello@industrialinfo.com', 'ECAAR (Gavin), WSCC (Diablo Canyon), & NPCC (Seabrook)', 'Dear Power Outage Database Customer,

Attached you will find an excel document. The outages contained within are forced or rescheduled outages. Your daily delivery will still contain these outages.

In addition to the two excel documents, there is a dbf file that is formatted like your daily deliveries you receive nightly. This will enable you to load the data into your regular database. Any questions please let me know. Thanks.

Greg Elliott

IIR, Inc.

713-783-5147 x 3481

outages@industrialinfo.com

THE INFORMATION CONTAINED IN THIS E-MAIL IS LEGALLY PRIVILEGED AND CONFIDENTIAL INFORMATION INTENDED ONLY FOR THE USE OF THE INDIVIDUAL OR ENTITY NAMED ABOVE. YOU ARE HEREBY NOTIFIED THAT ANY DISSEMINATION, DISTRIBUTION, OR COPY OF THIS E-MAIL TO UNAUTHORIZED ENTITIES IS STRICTLY PROHIBITED. IF YOU HAVE RECEIVED THIS E-MAIL IN ERROR, PLEASE DELETE IT.

- OUTAGE.dbf

- 111201R.xls

- 111201.xls ');

INSERT INTO email([from],[to],subject,body) VALUES('enron.announcements@enron.com', 'all\_ena\_egm\_eim@enron.com', 'EWS Brown Bag', 'MARK YOUR LUNCH CALENDARS NOW !

You are invited to attend the EWS Brown Bag Lunch Series

Featuring: RAY BOWEN, COO

Topic: Enron Industrial Markets

Thursday, March 15, 2001

11:30 am - 12:30 pm

EB 5 C2

You bring your lunch, Limited Seating

We provide drinks and dessert. RSVP x 3-9610');

INSERT INTO email([from],[to],subject,body) VALUES('chris.germany@enron.com',

'ingrid.immer@williams.com', 'Re: About St Pauls', 'Sounds good to me. I bet this is next to the Warick?? Hotel.

"Immer, Ingrid" <Ingrid.Immer@Williams.com> on 12/21/2000 11:48:47 AM

To: "'chris.germany@enron.com'" <chris.germany@enron.com>

cc:

Subject: About St Pauls

<<About St Pauls.url>>

?

?<http://www.stpaulshouston.org/about.html>

Chris,

I like the looks of this place.? What do you think about going here Christmas eve?? They have an 11:00 a.m. service and a candlelight service at 5:00 p.m., among others.

Let me know.?? ii

- About St Pauls.url

');

INSERT INTO email([from],[to],subject,body) VALUES('nas@cpuc.ca.gov', 'skatz@sempratradng.com, kmccrea@sablaw.com, thompson@wrightlaw.com,', 'Reply Brief filed July 31, 2000', '- CPUC01-#76371-v1-Revised\_Reply\_Brief\_\_Due\_today\_7\_31\_.doc');

INSERT INTO email([from],[to],subject,body) VALUES('gascontrol@aglresources.com', 'dscott4@enron.com, lcampbel@enron.com', 'Alert Posted 10:00 AM November 20,2000: E-GAS Request Reminder', 'Alert Posted 10:00 AM November 20,2000: E-GAS Request Reminder

As discussed in the Winter Operations Meeting on Sept.29,2000, E-Gas(Emergency Gas) will not be offered this winter as a service from AGLC. Marketers and Poolers can receive gas via Peaking and IBSS nominations(daisy chain) from other marketers up to the 6 p.m. Same Day 2 nomination cycle.

');

INSERT INTO email([from],[to],subject,body) VALUES('dutch.quigley@enron.com', 'rwoikwitz@powermerchants.com', ", ' "

Here is a goody for you');

INSERT INTO email([from],[to],subject,body) VALUES('ryan.o"rourke@enron.com', 'k..allen@enron.com, randy.bhatia@enron.com, frank.ermis@enron.com,', 'TRV Notification: (West VaR - 11/07/2001)', 'The report named: West VaR

<[http://trv.corp.enron.com/linkFromExcel.asp?report\\_cd=36&report\\_name=West+VaR&category\\_cd=2&category\\_](http://trv.corp.enron.com/linkFromExcel.asp?report_cd=36&report_name=West+VaR&category_cd=2&category_)



name=WEST&toc\_hide=1&sTV1=2&TV1Exp=Y&current\_efct\_date=11/07/2001>, published as of 11/07/2001 is now available for viewing on the website.');

INSERT INTO email([from],[to],subject,body) VALUES('mjones7@txu.com', 'cstone1@txu.com, gggreen2@txu.com, timpowell@txu.com,', 'Enron / HPL Actuals for July 10, 2000', 'Teco Tap 10.000 / Enron ; 110.000 / HPL IFERC

LS HPL LSK IC 30.000 / Enron

');

INSERT INTO email([from],[to],subject,body) VALUES('susan.pereira@enron.com', 'kkw816@aol.com', 'soccer practice', 'Kathy-

Is it safe to assume that practice is cancelled for tonight??

Susan Pereira');

INSERT INTO email([from],[to],subject,body) VALUES('mark.whitt@enron.com', 'barry.tycholiz@enron.com', 'Huber Internal Memo', 'Please look at this. I didn"t know how deep to go with the desk. Do you think this works.

');

INSERT INTO email([from],[to],subject,body) VALUES('m..forney@enron.com', 'george.phillips@enron.com', '', 'George,

Give me a call and we will further discuss opportunities on the 13st floor.

Thanks,

JMForney

3-7160');

INSERT INTO email([from],[to],subject,body) VALUES('brad.mckay@enron.com', 'angusmcka@aol.com', 'Re: (no subject)', 'not yet');

INSERT INTO email([from],[to],subject,body) VALUES('adam.bayer@enron.com', 'jonathan.mckay@enron.com', 'FW: Curve Fetch File', 'Here is the curve fetch file sent to me. It has plenty of points in it. If you give me a list of which ones you need we may be able to construct a secondary worksheet to vlookup the values.

adam

35227

-----Original Message-----

From: Royed, Jeff

Sent: Tuesday,

September 25, 2001 11:37 AM

To: Bayer, Adam

Subject: Curve Fetch File

Let me know if it works. It may be required to have a certain version of Oracle for it to work properly.

Jeff Royed

Enron  
Energy Operations  
Phone: 713-853-5295');  
INSERT INTO email([from],[to],subject,body) VALUES('matt.smith@enron.com', 'yan.wang@enron.com', 'Report  
Formats', 'Yan,

The merged reports look great. I believe the only orientation changes are to  
"unmerge" the following six reports:

31 Keystone Receipts  
15 Questar Pipeline  
40 Rockies Production  
22 West\_2  
23 West\_3  
25 CIG\_WIC

The orientation of the individual reports should be correct. Thanks.

Mat

PS. Just a reminder to add the "\*" by the title of calculated points.);  
INSERT INTO email([from],[to],subject,body) VALUES('michelle.lokay@enron.com', 'jimboman@bigfoot.com',  
'Egyptian Festival', '----- Forwarded by Michelle Lokay/ET&S/Enron on 09/07/2000  
10:08 AM -----

"Karkour, Randa" <Randa.Karkour@COMPAQ.com>  
on 09/07/2000 09:01:04 AM  
To: ""Agheb (E-mail)" <Agheb@aol.com>, "Leila Mankarious (E-mail)"  
<Leila\_Mankarious@mhhs.org>, ""Marymankarious (E-mail)"  
<marymankarious@aol.com>, "Michelle lokay (E-mail)" <mlokay@enron.com>, "Ramy  
Mankarious (E-mail)" <Mankarious@aol.com>  
cc:

Subject: Egyptian Festival

<<Egyptian Festival.url>>

<http://www.egyptianfestival.com/>

- Egyptian Festival.url

);

INSERT INTO email([from],[to],subject,body) VALUES('errol.mclaughlin@enron.com',  
'sherry.dawson@enron.com', 'Urgent!!! --- New EAST books', 'This has to be done.....

Thanks

----- Forwarded by Errol McLaughlin/Corp/Enron on 12/20/2000

08:39 AM -----

From: William Kelly @ ECT

12/20/2000 08:31 AM

To: Kam Keiser/HOU/ECT@ECT, Darron C Giron/HOU/ECT@ECT, David Baumbach/HOU/ECT@ECT, Errol McLaughlin/Corp/Enron@ENRON  
cc: Kimat Singla/HOU/ECT@ECT, Kulvinder Fowler/NA/Enron@ENRON, Kyle R Lilly/HOU/ECT@ECT, Jeff Royed/Corp/Enron@ENRON, Alejandra Chavez/NA/Enron@ENRON, Crystal Hyde/HOU/ECT@ECT

Subject: New EAST books

We have new book names in TAGG for our intramonth portfolios and it is extremely important that any deal booked to the East is communicated quickly to someone on my team. I know it will take some time for the new names to sink in and I do not want us to miss any positions or P&L.

Thanks for your help on this.

New:

Scott Neal : East Northeast

Dick Jenkins: East Marketeast

WK

');

INSERT INTO email([from],[to],subject,body) VALUES('david.forster@enron.com', 'eol.wide@enron.com', 'Change to Stack Manager', 'Effective immediately, there is a change to the Stack Manager which will affect any Inactive Child.

An inactive Child with links to Parent products will not have their calculated prices updated until the Child product is Activated.

When the Child Product is activated, the price will be recalculated and updated BEFORE it is displayed on the web.

This means that if you are inputting a basis price on a Child product, you will not see the final, calculated price until you Activate the product, at which time the customer will also see it.

If you have any questions, please contact the Help Desk on:

Americas: 713 853 4357

Europe: + 44 (0) 20 7783 7783

Asia/Australia: +61 2 9229 2300

Dave');

INSERT INTO email([from],[to],subject,body) VALUES('vince.kaminski@enron.com', 'jhh1@email.msn.com', 'Re: Light reading - see pieces beginning on page 7', 'John,

I saw it. Very interesting.

Vince

"John H Herbert" <jhh1@email.msn.com> on 07/28/2000 08:38:08 AM

To: "Vince J Kaminski" <Vince\_J\_Kaminski@enron.com>

cc:

Subject: Light reading - see pieces beginning on page 7

Cheers and have a nice weekend,

JHHerbert

- gd000728.pdf

');

INSERT INTO email([from],[to],subject,body) VALUES('matthew.lenhart@enron.com',

'mmmarcanel@equiva.com', 'RE:', 'i will try to line up a pig for you ');

INSERT INTO email([from],[to],subject,body)

VALUES('jae.black@enron.com', 'claudette.harvey@enron.com, chaun.roberts@enron.com,

judy.martinez@enron.com', 'Disaster Recovery Equipment', 'As a reminder...there are several pieces of equipment that are set up on the 30th Floor, as well as on our floor, for the Disaster Recovery Team. PLEASE DO NOT TAKE, BORROW OR USE this equipment. Should you need to use another computer system, other than yours, or make conference calls please work with your Assistant to help find or set up equipment for you to use.

Thanks for your understanding in this matter.

T.Jae Black

East Power Trading

Assistant to Kevin Presto

off. 713-853-5800

fax 713-646-8272

cell 713-539-4760');

INSERT INTO email([from],[to],subject,body) VALUES('eric.bass@enron.com', 'dale.neuner@enron.com', '5 X 24', 'Dale,

Have you heard anything more on the 5 X 24s? We would like to get this product out ASAP.

Thanks,

Eric');

INSERT INTO email([from],[to],subject,body) VALUES('messenger@smartreminders.com', 'm..tholt@enron.com', '10% Coupon - PrintPal Printer Cartridges - 100% Guaranteed', '[IMAGE] [IMAGE][IMAGE][IMAGE]

Dear SmartReminders Member,

[IMAGE] [IMAGE] [IMAGE] [IMAGE] [IMAGE] [IMAGE] [IMAGE] [IMAGE]

We respect your privacy and are a Certified Participant of the BBBOnLine Privacy Program. To be removed from future offers,click here.

SmartReminders.com is a permission based service. To unsubscribe click here . ');

INSERT INTO email([from],[to],subject,body) VALUES('benjamin.rogers@enron.com', 'mark.bernstein@enron.com', ', 'The guy you are talking about left CIN under a "cloud of suspicion" sort of speak. He was the one who got into several bad deals and PPA's in California for CIN, thus he left on a bad note. Let me know if you need more detail than that, I felt this was the type of info you were looking for. Thanks!

Ben');

INSERT INTO email([from],[to],subject,body)

VALUES('enron\_update@concreworkplace.com', 'michelle.cash@enron.com', 'Expense Report Receipts Not Received', 'Employee Name: Michelle Cash  
Report Name: Houston Cellular 8-11-01  
Report Date: 12/13/01  
Report ID: 594D37C9ED2111D5B452  
Submitted On: 12/13/01

You are only allowed 2 reports with receipts outstanding. Your expense reports will not be paid until you meet this requirement.');

INSERT INTO email([from],[to],subject,body) VALUES('susan.mara@enron.com', 'ray.alvarez@enron.com, mark.palmer@enron.com, karen.denne@enron.com,', 'CAISO Emergency Motion -- to discontinue market-based rates for', 'FYI. the latest broadside against the generators.

Sue Mara  
Enron Corp.  
Tel: (415) 782-7802  
Fax:(415) 782-7854

----- Forwarded by Susan J Mara/NA/Enron on 06/08/2001 12:24 PM -----

"Milner, Marcie" <MMilner@coral-energy.com> 06/08/2001 11:13 AM To: ""smara@enron.com""  
<smara@enron.com> cc: Subject: CAISO Emergency Motion

Sue, did you see this emergency motion  
the CAISO filed today? Apparently  
they are requesting that FERC discontinue market-based rates immediately and  
grant refunds plus interest on the difference between cost-based rates and  
market revenues received back to May 2000. They are requesting the  
commission act within 14 days. Have you heard anything about what they are  
doing?

Marcie

<http://www.caiso.com/docs/2001/06/08/200106081005526469.pdf>

');

INSERT INTO email([from],[to],subject,body) VALUES('fletcher.sturm@enron.com', 'eloy.escobar@enron.com',  
'Re: General Brinks Position Meeting', 'Eloy,

Who is General Brinks?

Fletch');

INSERT INTO email([from],[to],subject,body) VALUES('nailia.dindarova@enron.com',  
'richard.shapiro@enron.com', 'Documents for Mark Frevert (on EU developments and lessons from', 'Rick,

Here are the documents that Peter has prepared for Mark Frevert.

Nailia

----- Forwarded by Nailia Dindarova/LON/ECT on 25/06/2001

16:36 -----

Nailia Dindarova

25/06/2001 15:36

To:

Michael Brown/Enron@EUEnronXGate

cc: Ross Sankey/Enron@EUEnronXGate, Eric Shaw/ENRON@EUEnronXGate, Peter Styles/LON/ECT@ECT

Subject: Documents for Mark Frevert (on EU developments and lessons from California)

Michael,

These are the documents that Peter promised to give to you for Mark Frevert. He has now handed them to him in person but asked me to transmit them electronically to you, as well as Eric and Ross.

Nailia

);

INSERT INTO email([from],[to],subject,body) VALUES('peggy.a.kostial@accenture.com', 'dave.samuels@enron.com', 'EOL-Accenture Deal Sheet', 'Dave -

Attached are our comments and suggested changes. Please call to review.

On the time line for completion, we have four critical steps to complete:

- Finalize market analysis to refine business case, specifically

- projected revenue stream

- Complete counterparty surveying, including targeting 3 CPs for letters of intent

- Review Enron asset base for potential reuse/ licensing

- Contract

- negotiations

Joe will come back to us with an updated time line, but it is my expectation that we are still on the same schedule (we just begun week three) with possibly a week or so slippage.....contract negotiations will probably be the critical path.

We will send our cut at the actual time line here shortly. Thanks,

Peggy

(See attached file: accenture-dealpoints v2.doc)

- accenture-dealpoints v2.doc ');

INSERT INTO email([from],[to],subject,body) VALUES('thomas.martin@enron.com', 'thomas.martin@enron.com',  
'Re: Guadalupe Power Partners LP', '----- Forwarded by Thomas A Martin/HOU/ECT on 03/20/2001  
03:49 PM -----')

Thomas A Martin

10/11/2000 03:55 PM

To: Patrick Wade/HOU/ECT@ECT

cc:

Subject: Re: Guadalupe Power Partners LP

The deal is physically served at Oasis Waha or Oasis Katy and is priced at either HSC, Waha or Katytailgate GD at buyers option three days prior to NYMEX close.

');

INSERT INTO email([from],[to],subject,body)

VALUES('judy.townsend@enron.com', 'dan.junek@enron.com, chris.germany@enron.com', 'Columbia  
Distribution"s Capacity Available for Release - Sum', '----- Forwarded by Judy Townsend/HOU/ECT  
on 03/09/2001 11:04  
AM -----')

agoddard@nisource.com on 03/08/2001 09:16:57 AM

To: " - \*Koch, Kent" <kkoch@nisource.com>, " -  
\*Millar, Debra" <dmillar@nisource.com>, " - \*Burke, Lynn"  
<lburke@nisource.com>

cc: " - \*Heckathorn, Tom" <heckathorn@nisource.com>

Subject: Columbia Distribution"s Capacity Available for Release - Sum

Attached is Columbia Distribution"s notice of capacity available for release for the summer of 2001 (Apr. 2001 through Oct. 2001).

Please note that the deadline for bids is 3:00pm EST on March 20, 2001.

If you have any questions, feel free to contact any of the representatives listed at the bottom of the attachment.

Aaron Goddard



- 2001Summer.doc

');

INSERT INTO

email([from],[to],subject,body) VALUES('rhonda.denton@enron.com', 'tim.belden@enron.com, dana.davis@enron.com, genia.fitzgerald@enron.com,', 'Split Rock Energy LLC', 'We have received the executed EEI contract from this CP dated 12/12/2000.

Copies will be distributed to Legal and Credit.');

INSERT INTO email([from],[to],subject,body) VALUES('kerrymcelroy@dwt.com', 'jack.speer@alcoa.com, crow@millernash.com, michaelearly@earthlink.net,', 'Oral Argument Request', ' - Oral Argument Request.doc');

INSERT INTO email([from],[to],subject,body) VALUES('mike.carson@enron.com', 'rlmichaelis@hormel.com', ", 'Did you come in town this wk end..... My new number at our house is :

713-668-3712..... my cell # is 281-381-7332

the kid');

INSERT INTO email([from],[to],subject,body) VALUES('cooper.richey@enron.com', 'trycooper@hotmail.com', 'FW: Contact Info', '

-----Original Message-----

From: Punja, Karim

Sent: Thursday, December 13, 2001 2:35 PM

To: Richey, Cooper

Subject: Contact Info

Cooper,

Its

been a real pleasure working with you (even though it was for only a small amount of time)

I hope we can stay in touch.

Home# 234-0249

email: kpunja@hotmail.com

Take Care,

Karim.

');

INSERT INTO email([from],[to],subject,body) VALUES('bjm30@earthlink.net', 'mcguinn.k@enron.com, mcguinn.ian@enron.com, mcguinn.stephen@enron.com,', 'email address change', 'Hello all.

I haven't talked to many of you via email recently but I do want to give you my new address for your email file:

bjm30@earthlink.net

I hope all is well.

Brian McGuinn');

INSERT INTO email([from],[to],subject,body) VALUES('shelley.corman@enron.com', 'steve.hotte@enron.com', 'Flat Panels', 'Can you please advise what is going on with the flat panels that we had planned to distribute to our gas logistics team. It was in the budget and we had the okay, but now I'm hearing there is some hold-up & the units are stored on 44.

Shelley');

INSERT INTO email([from],[to],subject,body) VALUES('sara.davidson@enron.com', 'john.schwartzburg@enron.com, scott.dieball@enron.com, recipients@enron.com,', '2001 Enron Law Conference (Distribution List 2)', ' Enron Law Conference

San Antonio, Texas May 2-4, 2001 Westin Riverwalk

See attached memo for more details!!

? Registration for the law conference this year will be handled through an Online RSVP Form on the Enron Law Conference Website at <http://lawconference.corp.enron.com>. The website is still under construction and will not be available until Thursday, March 15, 2001.

? We will send you another e-mail to confirm when the Law Conference Website is operational.

? Please complete the Online RSVP Form as soon as it is available and submit it no later than Friday, March 30th.

');

INSERT INTO email([from],[to],subject,body) VALUES('tori.kuykendall@enron.com', 'heath.b.taylor@accenture.com', 'Re:', 'hey - thats funny about john - he definitely remembers him - i'll call pat and let him know - we are coming on saturday - i just havent had a chance to call you guys back -- looking forward to it -- i probably need the directions again though');

INSERT INTO email([from],[to],subject,body) VALUES('darron.giron@enron.com', 'bryce.baxter@enron.com', 'Re: Feedback for Audrey Cook', 'Bryce,

I'll get it done today.

DG 3-9573

From: Bryce Baxter

06/12/2000 07:15 PM

To: Darron C Giron/HOU/ECT@ECT

cc:

Subject: Feedback for Audrey Cook

You were identified as a reviewer for Audrey Cook. If possible, could you complete her feedback by end of business Wednesday? It will really help me in the PRC process to have your input. Thanks.

);

INSERT INTO email([from],[to],subject,body) VALUES('casey.evans@enron.com', 'stephanie.sever@enron.com', 'Gas EOL ID', 'Stephanie,

In conjunction with the recent movement of several power traders, they are changing the names of their gas books as well. The names of the new gas books and traders are as follows:

PWR-NG-LT-SPP:

Mike Carson

PWR-NG-LT-SERC: Jeff King

If you need to know their power desk to map their ID to their gas books, those desks are as follows:

EPMI-LT-SPP: Mike Carson

EPMI-LT-SERC: Jeff King

I will be in training this afternoon, but will be back when class is over. Let me know if you have any questions.

Thanks for your help!

Casey');

INSERT INTO email([from],[to],subject,body) VALUES('darrell.schoolcraft@enron.com', 'david.roensch@enron.com, kimberly.watson@enron.com, michelle.lokay@enron.com,', 'Postings', 'Please see the attached.

ds

);

INSERT INTO email([from],[to],subject,body) VALUES('mcominsky@aol.com', 'cpatman@bracepatt.com, james\_derrick@enron.com', 'Jurisprudence Luncheon', 'Carrin & Jim --

It was an honor and a pleasure to meet both of you yesterday. I know we will

have fun working together on this very special event.

Jeff left the jurisprudence luncheon lists for me before he left on vacation. I wasn't sure whether he transmitted them to you as well. Would you please advise me if you would like them sent to you? I can email the MS Excel files or I can fax the hard copies to you. Please advise what is most convenient.

I plan to be in town through the holidays and can be reached by phone, email, or cell phone at any time. My cell phone number is 713/705-4829.

Thanks again for your interest in the ADL's work. Martin.

Martin B. Cominsky  
Director, Southwest Region  
Anti-Defamation League  
713/627-3490, ext. 122  
713/627-2011 (fax)  
MCominsky@aol.com);

INSERT INTO email([from],[to],subject,body) VALUES('phillip.love@enron.com', 'todagost@utmb.edu, gbsonnta@utmb.edu', 'New President', 'I had a little bird put a word in my ear. Is there any possibility for Ben Raimer to be Bush's secretary of HHS? Just curious about that infamous UTMB rumor mill. Hope things are well, happy holidays.

PL');

INSERT INTO email([from],[to],subject,body) VALUES('marie.heard@enron.com', 'ehamilton@fna.com', 'ISDA Master Agreement',  
'Erin:

Pursuant to your request, attached are the Schedule to the ISDA Master Agreement, together with Paragraph 13 to the ISDA Credit Support Annex. Please let me know if you need anything else. We look forward to hearing your comments.

Marie

Marie Heard  
Senior Legal Specialist  
Enron North America Corp.  
Phone: (713) 853-3907  
Fax: (713) 646-3490  
marie.heard@enron.com

');

INSERT INTO email([from],[to],subject,body) VALUES('andrea.ring@enron.com', 'beverly.beaty@enron.com', 'Re: Tennessee Buy - Louis Dreyfus', 'Beverly - once again thanks so much for your help on this.

');

INSERT INTO email([from],[to],subject,body) VALUES('karolyn.criado@enron.com', 'j..bonin@enron.com, felicia.case@enron.com, b..clapp@enron.com,', 'Price List week of Oct. 8-9, 2001', '

Please contact me if you have any questions regarding last weeks prices.

Thank you,  
Karolyn Criado  
3-9441

);

INSERT INTO email([from],[to],subject,body)

VALUES('kevin.presto@enron.com', 'edward.baughman@enron.com, billy.braddock@enron.com', 'Associated', 'Please begin working on filling our Associated short position in 02. I would like to take this risk off the books.

In addition, please find out what a buy-out of VEPCO would cost us. With Rogers transitioning to run our retail risk management, I would like to clean up our customer positions.

We also need to continue to explore a JEA buy-out.

Thanks.');

INSERT INTO email([from],[to],subject,body) VALUES('stacy.dickson@enron.com', 'gregg.penman@enron.com', 'RE: Constellation TC 5-7-01', 'Gregg,

I am at home with a sick baby. (Lots of fun!) I will call you about this tomorrow.

Stacy');

INSERT INTO email([from],[to],subject,body) VALUES('joe.quenet@enron.com', 'dfincher@utilicorp.com', ', 'hey big guy.....check this out.....

w ww.gorelieberman-2000.com/');

INSERT INTO email([from],[to],subject,body) VALUES('k..allen@enron.com', 'jacquestc@aol.com', ', 'Jacques,

I sent you a fax of Kevin Kolb's comments on the release. The payoff on the note would be \$36,248 (\$36090(principal) + \$158 (accrued interest)).

This is assuming we wrap this up on Tuesday.

Please email to confirm that their changes are ok so I can set up a meeting on Tuesday to reach closure.

Phillip');

INSERT INTO email([from],[to],subject,body) VALUES('kourtney.nelson@enron.com', 'mike.swerzbin@enron.com', 'Adjusted L/R Balance', 'Mike,

I placed the adjusted L/R Balance on the Enronwest site. It is under the "Staff/Kourtney Nelson". There are two links:

- 1) "Adj L\_R" is the same data/format from the weekly strategy meeting.
- 2) "New Gen 2001\_2002" link has all of the supply side info that is used to calculate the L/R balance  
-Please note the Data Flag column, a value of "3" indicates the project was cancelled, on hold, etc and is not included in the calc.

Both of these sheets are interactive Excel spreadsheets and thus you can play around with the data as you please. Also, James Bruce is working to get his gen report on the web. That will help with your access to information on new gen.

Please let me know if you have any questions or feedback,

Kourtney

Kourtney Nelson

Fundamental Analysis

Enron North America

(503) 464-8280

kourtney.nelson@enron.com');

INSERT INTO email([from],[to],subject,body) VALUES('d..thomas@enron.com', 'naveed.ahmed@enron.com', 'FW: Current Enron TCC Portfolio', '

-----Original Message-----

From: Grace, Rebecca M.

Sent: Monday, December 17, 2001 9:44 AM

To: Thomas, Paul D.

Cc: Cashion, Jim; Allen, Thresa A.; May, Tom

Subject: RE: Current Enron TCC Portfolio

Paul,

I reviewed NY's list. I agree with all of their contracts numbers and mw amounts.

Call if you have any more questions.

Rebecca

-----Original Message-----

From: Thomas, Paul D.

Sent: Monday, December 17, 2001 9:08 AM

To: Grace, Rebecca M.

Subject: FW: Current Enron TCC Portfolio

<< File: enrontccs.xls >>

Rebecca,

Let me know if you  
see any differences.

Paul

X 3-0403

-----Original Message-----

From: Thomas, Paul D.

Sent: Monday, December 17, 2001 9:04 AM

To: Ahmed, Naveed

Subject: FW: Current Enron TCC Portfolio

-----Original Message-----

From: Thomas, Paul D.

Sent: Thursday, December 13, 2001 10:01 AM

To: Baughman, Edward D.

Subject: Current Enron TCC Portfolio

);

INSERT INTO email([from],[to],subject,body) VALUES('stephanie.panus@enron.com',  
'william.bradford@enron.com, debbie.brackett@enron.com,', 'Coastal Merchant Energy/El Paso Merchant Energy',  
'Coastal Merchant Energy, L.P. merged with and into El Paso Merchant Energy,  
L.P., effective February 1, 2001, with the surviving entity being El Paso  
Merchant Energy, L.P. We currently have ISDA Master Agreements with both  
counterparties. Please see the attached memo regarding the existing Masters  
and let us know which agreement should be terminated.

Thanks,

Stephanie

);

INSERT INTO email([from],[to],subject,body) VALUES('kam.keiser@enron.com', 'c..kenne@enron.com',  
'RE: What about this too???' , '

-----Original Message-----

From: Kenne, Dawn C.

Sent: Wednesday, February 06, 2002 11:50 AM

To: Keiser, Kam

Subject: What about this too???

<< File: Netco Trader Matrix.xls >>

);

INSERT INTO email([from],[to],subject,body) VALUES('chris.meyer@enron.com', 'joe.parks@enron.com',

'Centana', 'Talked to Chip. We do need Cash Committe approval given the netting feature of your deal, which means Batch Funding Request. Please update per my previous e-mail and forward.

Thanks

chris

x31666');

INSERT INTO email([from],[to],subject,body) VALUES('debra.perlingiere@enron.com',  
'jworman@academyofhealth.com', ', 'Have a great weekend! Happy Fathers Day!

Debra Perlingiere

Enron North America Corp.

1400 Smith Street, EB 3885

Houston, Texas 77002

dperlin@enron.com

Phone 713-853-7658

Fax 713-646-3490');

INSERT INTO email([from],[to],subject,body) VALUES('outlook.team@enron.com', ', 'Demo by Martha Janousek  
of Dashboard & Pipeline

Profile / Julia &', 'CALENDAR ENTRY: APPOINTMENT

Description:

Demo by Martha Janousek of Dashboard & Pipeline Profile / Julia & Dir Rpts. - 4102

Date: 1/5/2001

Time: 9:00 AM - 10:00 AM (Central Standard Time)

Chairperson: Outlook Migration Team

Detailed Description:');

INSERT INTO email([from],[to],subject,body) VALUES('diana.seifert@enron.com', 'mark.taylor@enron.com',  
'Guest access Chile', 'Hello Mark,

Justin Boyd told me that your can help me with questions regarding Chile.

We got a request for guest access through MG.

The company is called Escondida and is a subsidiary of BHP Australia.

Please advise if I can set up a guest account or not.

F.Y.I.: MG is planning to put a "in w/h Chile" contract for Copper on-line as  
soon as Enron has done the due diligence for this country.

Thanks !

Best regards

Diana Seifert

EOL PCG');



INSERT INTO email([from],[to],subject,body) VALUES('enron\_update@concuere workplace.com',  
'mark.whitt@enron.com', '<<Concur Expense Document>> - 121001',  
'The Approval status has changed on the following report:

Status last changed by: Barry L. Tycholiz

Expense Report Name: 121001

Report Total: \$198.98

Amount Due Employee: \$198.98

Amount Approved: \$198.98

Amount Paid: \$0.00

Approval Status: Approved

Payment Status: Pending

To review this expense report, click on the following link for Concur Expense.

<http://expense.ms.enron.com>);

INSERT INTO email([from],[to],subject,body) VALUES('kevin.hyatt@enron.com', ', 'Technical Support', 'Outside  
the U.S., please refer to the list below:

Australia:

1800 678-515

[support@palm-au.com](mailto:support@palm-au.com)

Canada:

1905 305-6530

[support@palm.com](mailto:support@palm.com)

New Zealand:

0800 446-398

[support@palm-nz.com](mailto:support@palm-nz.com)

U.K.:

0171 867 0108

[eurosupport@palm.3com.com](mailto:eurosupport@palm.3com.com)

Please refer to the Worldwide Customer Support card for a complete technical support contact list.');

INSERT INTO email([from],[to],subject,body) VALUES('geoff.storey@enron.com', 'dutch.quigley@enron.com',  
'RE:', 'duke contact?'

-----Original Message-----

From: Quigley, Dutch

Sent: Wednesday, October 31, 2001 10:14 AM

To: Storey, Geoff

Subject: RE:

bp corp Albert LaMore 281-366-4962

running the reports now

-----Original Message-----

From: Storey, Geoff  
Sent: Wednesday, October 31, 2001 10:10 AM  
To: Quigley, Dutch  
Subject: RE:

give me a contact over there too  
BP

-----Original Message-----

From: Quigley, Dutch  
Sent: Wednesday, October 31, 2001 9:42 AM  
To: Storey, Geoff  
Subject:

Coral Jeff Whitnah 713-767-5374  
Relaint Steve McGinn 713-207-4000');  
INSERT INTO email([from],[to],subject,body) VALUES('pete.davis@enron.com', 'pete.davis@enron.com', 'Start  
Date: 4/22/01; HourAhead hour: 3; <CODESITE>', 'Start Date: 4/22/01; HourAhead hour: 3; No ancillary  
schedules awarded.  
Variances detected.  
Variances detected in Load schedule.

LOG MESSAGES:

PARSING FILE -->> O:\Portland\WestDesk\California Scheduling\ISO Final  
Schedules\2001042203.txt

---- Load Schedule ----

\$\$\$ Variance found in table tblLoads.

Details: (Hour: 3 / Preferred:

1.92 / Final: 1.89)

TRANS\_TYPE: FINAL

LOAD\_ID: PGE4

MKT\_TYPE: 2

TRANS\_DATE: 4/22/01

SC\_ID: EPMI

');

INSERT INTO email([from],[to],subject,body) VALUES('john.postlethwaite@enron.com',  
'john.zufferli@enron.com', 'Reference', 'John, hope things are going well up there for you. The big day is almost  
here for you and Jessica. I was wondering if I could use your name as a job reference if need be. I am just trying to  
get everything in order just in case something happens.

```
John');
INSERT INTO email([from],[to],subject,body) VALUES('jeffrey.shankman@enron.com',
'Ischiffm@jonesday.com', 'Re:', 'I saw you called on the cell this a.m. Sorry I missed you. (I was in the
shower). I have had a shitty week--I suspect my silence (not only to you,
but others) after our phone call is a result of the week. I'm seeing Glen at
11:15....talk to you');
INSERT INTO email([from],[to],subject,body) VALUES('litebytz@enron.com', ', 'Lite Bytz RSVP', '
This week's Lite Bytz presentation
will feature the following TOOLZ speaker:
```

Richard McDougall  
Solaris 8  
Thursday, June 7, 2001

If you have not already signed up, please RSVP via email to [litebytz@enron.com](mailto:litebytz@enron.com) by the end of the day Tuesday, June 5, 2001.

\*Remember: this is now a Brown Bag Event--so bring your lunch and we will provide cookies and drinks.

Click below for more details.

<http://home.enron.com:84/messaging/litebytztoolzprint.jpg>);

```
COMMIT;
}
} {}
```

```
#####
# Everything above just builds an interesting test database. The actual
# tests come after this comment.
#####
```

```
do_test fts1c-1.2 {
execsql {
SELECT rowid FROM email WHERE email MATCH 'mark'
}
} {6 17 25 38 40 42 73 74}
do_test fts1c-1.3 {
execsql {
SELECT rowid FROM email WHERE email MATCH 'susan'
}
} {24 40}
do_test fts1c-1.4 {
execsql {
SELECT rowid FROM email WHERE email MATCH 'mark
susan'
}
} {40}
do_test fts1c-1.5 {
```

```

execsql {
  SELECT rowid FROM email WHERE email MATCH 'susan mark'
}
} {40}
do_test fts1c-1.6 {
  execsql {
    SELECT rowid FROM email WHERE email MATCH "'mark susan'"
  }
} {}
do_test fts1c-1.7 {
  execsql {
    SELECT rowid FROM email WHERE email MATCH 'mark -susan'
  }
} {6 17 25 38 42 73 74}
do_test fts1c-1.8 {
  execsql {
    SELECT rowid FROM email WHERE email MATCH '-mark susan'
  }
} {24}
do_test fts1c-1.9 {
  execsql {
    SELECT rowid FROM email WHERE email MATCH 'mark OR susan'
  }
} {6 17 24 25 38 40 42 73 74}

# Some simple tests of the automatic "offsets(email)" column. In the sample
# data set above, only one message, number 20, contains the words
# "gas" and "reminder" in both body and subject.
#
do_test fts1c-2.1 {
  execsql {
    SELECT rowid, offsets(email) FROM email
    WHERE email MATCH 'gas reminder'
  }
} {20 {2 0 42 3 2 1 54 8 3 0 42 3 3 1 54 8 3 0 129 3 3 0 143 3 3 0 240 3}}
do_test fts1c-2.2 {
  execsql {

    SELECT rowid, offsets(email) FROM email
    WHERE email MATCH 'subject:gas reminder'
  }
} {20 {2 0 42 3 2 1 54 8 3 1 54 8}}
do_test fts1c-2.3 {
  execsql {
    SELECT rowid, offsets(email) FROM email
    WHERE email MATCH 'body:gas reminder'
  }
} {20 {2 1 54 8 3 0 42 3 3 1 54 8 3 0 129 3 3 0 143 3 3 0 240 3}}

```

```

do_test fts1c-2.4 {
  execsql {
    SELECT rowid, offsets(email) FROM email
    WHERE subject MATCH 'gas reminder'
  }
} {20 {2 0 42 3 2 1 54 8}}
do_test fts1c-2.5 {
  execsql {
    SELECT rowid, offsets(email) FROM email
    WHERE body MATCH 'gas reminder'
  }
} {20 {3 0 42 3 3 1 54 8 3 0 129 3 3 0 143 3 3 0 240 3}}

# Document 32 contains 5 instances of the word "child". But only
# 3 of them are paired with "product". Make sure only those instances
# that match the phrase appear in the offsets(email) list.
#
do_test fts1c-3.1 {
  execsql {
    SELECT rowid, offsets(email) FROM email
    WHERE body MATCH 'child product' AND +rowid=32
  }
} {32 {3 0 94 5 3 0 114 5 3 0 207
5 3 1 213 7 3 0 245 5 3 1 251 7 3 0 409 5 3 1 415 7 3 1 493 7}}
do_test fts1c-3.2 {
  execsql {
    SELECT rowid, offsets(email) FROM email
    WHERE body MATCH "'child product'"
  }
} {32 {3 0 207 5 3 1 213 7 3 0 245 5 3 1 251 7 3 0 409 5 3 1 415 7}}

# Snippet generator tests
#
do_test fts1c-4.1 {
  execsql {
    SELECT snippet(email) FROM email
    WHERE email MATCH 'subject:gas reminder'
  }
} {{Alert Posted 10:00 AM November 20,2000: E-<b>GAS</b> Request <b>Reminder</b>}}
do_test fts1c-4.2 {
  execsql {
    SELECT snippet(email) FROM email
    WHERE email MATCH 'christmas candlelight'
  }
} {{<b>...</b> place.? What do you think about going here <b>Christmas</b>
eve?? They have an 11:00 a.m. service and a <b>candlelight</b> service at 5:00 p.m.,
among others. <b>...</b>}}

```

```

do_test fts1c-4.3 {
  execsql {
    SELECT snippet(email) FROM email
    WHERE email MATCH 'deal sheet potential reuse'
  }
} {{EOL-Accenture <b>Deal</b> <b>Sheet</b> <b>...</b> intent
  Review Enron
  asset base for <b>potential</b> <b>reuse</b>/ licensing
  Contract negotiations <b>...</b>}}
do_test fts1c-4.4 {
  execsql {
    SELECT snippet(email,'<<<','>>>',') FROM email
    WHERE email MATCH 'deal sheet potential reuse'
  }
} {{EOL-Accenture <<<Deal>>> <<<Sheet>>> intent
  Review Enron asset base for <<<potential>>> <<<reuse>>>/ licensing
  Contract negotiations }}
do_test fts1c-4.5 {
  execsql {
    SELECT snippet(email,'<<<','>>>',') FROM email
    WHERE email MATCH 'first things'
  }
} {{Re: <<<First>>> Polish Deal! Congrats! <<<Things>>> seem to be building rapidly now on the }}
do_test fts1c-4.6 {
  execsql {
    SELECT snippet(email) FROM email
    WHERE email MATCH 'chris is here'
  }
} {{<b>chris</b>.germany@enron.com <b>...</b> Sounds good to me. I bet this <b>is</b> next to the Warick??
  Hotel. <b>...</b> place.? What do you think about going <b>here</b> Christmas
  eve?? They have an 11:00 a.m. <b>...</b>}}
do_test fts1c-4.7 {
  execsql {
    SELECT
    snippet(email) FROM email
    WHERE email MATCH "'pursuant to'"
  }
} {{Erin:

<b>Pursuant</b> <b>to</b> your request, attached are the Schedule to <b>...</b>}}
do_test fts1c-4.8 {
  execsql {
    SELECT snippet(email) FROM email
    WHERE email MATCH 'ancillary load davis'
  }
} {{pete.<b>davis</b>@enron.com <b>...</b> Start Date: 4/22/01; HourAhead hour: 3; No <b>ancillary</b>
  schedules awarded.
  Variances detected.

```

Variances detected in <b>Load</b> schedule.

LOG MESSAGES:

PARSING <b>...</b>}}

# Combinations of AND and OR operators:

#

do\_test fts1c-5.1 {

  execsql {

    SELECT snippet(email) FROM email

    WHERE email MATCH 'questar enron OR com'

  }

} {{ matt.smith@<b>enron</b>.<b>com</b> <b>...</b> six reports:

31 Keystone Receipts

15 <b>Questar</b> Pipeline

40 Rockies Production

22 West\_2 <b>...</b>}}

do\_test fts1c-5.2 {

  execsql {

    SELECT snippet(email) FROM email

    WHERE email MATCH 'enron OR com questar'

  }

} {{ matt.smith@<b>enron</b>.<b>com</b> <b>...</b>

six reports:

31 Keystone Receipts

15 <b>Questar</b> Pipeline

40 Rockies Production

22 West\_2 <b>...</b>}}

finish\_test

Found in path(s):

\* /opt/cola/permits/1332727043\_1653392698.341362/0/sqlite-3-3-17-tar-gz/sqlite-3.3.17/test/fts1c.test

No license file was found, but licenses were detected in source scan.

# 2001 September 15

#

# The author disclaims copyright to this source code. In place of

# a legal notice, here is a blessing:

#

# May you do good and not evil.

# May you find forgiveness for yourself and forgive others.

# May you share freely, never taking more than you give.

#

\*\*\*\*\*

```

# This file implements regression tests for SQLite library. The
# focus of this file is testing built-in functions.
#
# $Id: func.test,v 1.60 2007/04/10 13:51:19 drh Exp $

set testdir [file dirname $argv0]
source $testdir/tester.tcl

# Create a table to work with.
#
do_test func-0.0 {
  execsql {CREATE TABLE tbl1(t1 text)}
  foreach word {this program is free software} {
    execsql "INSERT INTO tbl1 VALUES('$word')"
  }
  execsql {SELECT t1 FROM tbl1 ORDER BY t1}
} {free is program software this}
do_test func-0.1 {
  execsql {
    CREATE TABLE t2(a);
    INSERT
  INTO t2 VALUES(1);
    INSERT INTO t2 VALUES(NULL);
    INSERT INTO t2 VALUES(345);
    INSERT INTO t2 VALUES(NULL);
    INSERT INTO t2 VALUES(67890);
    SELECT * FROM t2;
  }
} {1 {} 345 {} 67890}

# Check out the length() function
#
do_test func-1.0 {
  execsql {SELECT length(t1) FROM tbl1 ORDER BY t1}
} {4 2 7 8 4}
do_test func-1.1 {
  set r [catch {execsql {SELECT length(*) FROM tbl1 ORDER BY t1}} msg]
  lappend r $msg
} {1 {wrong number of arguments to function length()}}
do_test func-1.2 {
  set r [catch {execsql {SELECT length(t1,5) FROM tbl1 ORDER BY t1}} msg]
  lappend r $msg
} {1 {wrong number of arguments to function length()}}
do_test func-1.3 {
  execsql {SELECT length(t1), count(*) FROM tbl1 GROUP BY length(t1)
    ORDER BY length(t1)}
} {2 1 4 2 7 1 8 1}
do_test func-1.4 {

```



```

execsql {SELECT coalesce(length(a),-1) FROM t2}
} {1 -1 3 -1 5}

# Check out the substr() function
#
do_test func-2.0 {
  execsql {SELECT substr(t1,1,2) FROM tbl1 ORDER BY t1}
} {fr
is pr so th}
do_test func-2.1 {
  execsql {SELECT substr(t1,2,1) FROM tbl1 ORDER BY t1}
} {r s r o h}
do_test func-2.2 {
  execsql {SELECT substr(t1,3,3) FROM tbl1 ORDER BY t1}
} {ee {} ogr ftw is}
do_test func-2.3 {
  execsql {SELECT substr(t1,-1,1) FROM tbl1 ORDER BY t1}
} {e s m e s}
do_test func-2.4 {
  execsql {SELECT substr(t1,-1,2) FROM tbl1 ORDER BY t1}
} {e s m e s}
do_test func-2.5 {
  execsql {SELECT substr(t1,-2,1) FROM tbl1 ORDER BY t1}
} {e i a r i}
do_test func-2.6 {
  execsql {SELECT substr(t1,-2,2) FROM tbl1 ORDER BY t1}
} {ee is am re is}
do_test func-2.7 {
  execsql {SELECT substr(t1,-4,2) FROM tbl1 ORDER BY t1}
} {fr {} gr wa th}
do_test func-2.8 {
  execsql {SELECT t1 FROM tbl1 ORDER BY substr(t1,2,20)}
} {this software free program is}
do_test func-2.9 {
  execsql {SELECT substr(a,1,1) FROM t2}
} {1 {} 3 {} 6}
do_test func-2.10 {
  execsql {SELECT substr(a,2,2) FROM t2}
} {{} {} 45 {} 78}

# Only do the following tests if TCL has UTF-8 capabilities
#
if {"\u1234"!="u1234"}
{

# Put some UTF-8 characters in the database
#
do_test func-3.0 {

```

```

execsql {DELETE FROM tbl1}
foreach word "contains UTF-8 characters hi\u1234ho" {
  execsql "INSERT INTO tbl1 VALUES('$word')"
}
execsql {SELECT t1 FROM tbl1 ORDER BY t1}
} "UTF-8 characters contains hi\u1234ho"
do_test func-3.1 {
  execsql {SELECT length(t1) FROM tbl1 ORDER BY t1}
} {5 10 8 5}
do_test func-3.2 {
  execsql {SELECT substr(t1,1,2) FROM tbl1 ORDER BY t1}
} {UT ch co hi}
do_test func-3.3 {
  execsql {SELECT substr(t1,1,3) FROM tbl1 ORDER BY t1}
} "UTF cha con hi\u1234"
do_test func-3.4 {
  execsql {SELECT substr(t1,2,2) FROM tbl1 ORDER BY t1}
} "TF ha on i\u1234"
do_test func-3.5 {
  execsql {SELECT substr(t1,2,3) FROM tbl1 ORDER BY t1}
} "TF- har ont i\u1234h"
do_test func-3.6 {
  execsql {SELECT substr(t1,3,2) FROM tbl1 ORDER BY t1}
} "F- ar nt \u1234h"
do_test func-3.7 {
  execsql {SELECT substr(t1,4,2) FROM tbl1 ORDER BY t1}
} "-8 ra ta ho"
do_test func-3.8 {
  execsql {SELECT substr(t1,-1,1)
FROM tbl1 ORDER BY t1}
} "8 s s o"
do_test func-3.9 {
  execsql {SELECT substr(t1,-3,2) FROM tbl1 ORDER BY t1}
} "F- er in \u1234h"
do_test func-3.10 {
  execsql {SELECT substr(t1,-4,3) FROM tbl1 ORDER BY t1}
} "TF- ter ain i\u1234h"
do_test func-3.99 {
  execsql {DELETE FROM tbl1}
  foreach word {this program is free software} {
    execsql "INSERT INTO tbl1 VALUES('$word')"
  }
  execsql {SELECT t1 FROM tbl1}
} {this program is free software}

} ;# End \u1234!=u1234

```

# Test the abs() and round() functions.

```

#
do_test func-4.1 {
execsql {
CREATE TABLE t1(a,b,c);
INSERT INTO t1 VALUES(1,2,3);
INSERT INTO t1 VALUES(2,1.2345678901234,-12345.67890);
INSERT INTO t1 VALUES(3,-2,-5);
}
catchsql {SELECT abs(a,b) FROM t1}
} {1 {wrong number of arguments to function abs()}}
do_test func-4.2 {
catchsql {SELECT abs() FROM t1}
} {1 {wrong number of arguments to function abs()}}
do_test func-4.3 {
catchsql {SELECT abs(b) FROM t1 ORDER BY a}
} {0 {2 1.2345678901234
2}}
do_test func-4.4 {
catchsql {SELECT abs(c) FROM t1 ORDER BY a}
} {0 {3 12345.6789 5}}
do_test func-4.4.1 {
execsql {SELECT abs(a) FROM t2}
} {1 {} 345 {} 67890}
do_test func-4.4.2 {
execsql {SELECT abs(t1) FROM tbl1}
} {0.0 0.0 0.0 0.0 0.0}

do_test func-4.5 {
catchsql {SELECT round(a,b,c) FROM t1}
} {1 {wrong number of arguments to function round()}}
do_test func-4.6 {
catchsql {SELECT round(b,2) FROM t1 ORDER BY b}
} {0 {-2.0 1.23 2.0}}
do_test func-4.7 {
catchsql {SELECT round(b,0) FROM t1 ORDER BY a}
} {0 {2.0 1.0 -2.0}}
do_test func-4.8 {
catchsql {SELECT round(c) FROM t1 ORDER BY a}
} {0 {3.0 -12346.0 -5.0}}
do_test func-4.9 {
catchsql {SELECT round(c,a) FROM t1 ORDER BY a}
} {0 {3.0 -12345.68 -5.0}}
do_test func-4.10 {
catchsql {SELECT 'x' || round(c,a) || 'y' FROM t1 ORDER BY a}
} {0 {x3.0y x-12345.68y x-5.0y}}
do_test func-4.11 {
catchsql {SELECT round() FROM t1 ORDER BY a}
} {1 {wrong number of arguments to function round()}}

```

```

do_test func-4.12 {
  execsql
  {SELECT coalesce(round(a,2),'nil') FROM t2}
} {1.0 nil 345.0 nil 67890.0}
do_test func-4.13 {
  execsql {SELECT round(t1,2) FROM tb1}
} {0.0 0.0 0.0 0.0 0.0}
do_test func-4.14 {
  execsql {SELECT typeof(round(5.1,1));}
} {real}
do_test func-4.15 {
  execsql {SELECT typeof(round(5.1));}
} {real}

# Test the upper() and lower() functions
#
do_test func-5.1 {
  execsql {SELECT upper(t1) FROM tb1}
} {THIS PROGRAM IS FREE SOFTWARE}
do_test func-5.2 {
  execsql {SELECT lower(upper(t1)) FROM tb1}
} {this program is free software}
do_test func-5.3 {
  execsql {SELECT upper(a), lower(a) FROM t2}
} {1 1 {} {} 345 345 {} {} 67890 67890}
do_test func-5.4 {
  catchsql {SELECT upper(a,5) FROM t2}
} {1 {wrong number of arguments to function upper()}}
do_test func-5.5 {
  catchsql {SELECT upper(*) FROM t2}
} {1 {wrong number of arguments to function upper()}}

# Test the coalesce() and nullif() functions
#
do_test func-6.1 {
  execsql {SELECT coalesce(a,'xyz') FROM t2}
} {1 xyz 345 xyz 67890}
do_test
  func-6.2 {
  execsql {SELECT coalesce(upper(a),'nil') FROM t2}
} {1 nil 345 nil 67890}
do_test func-6.3 {
  execsql {SELECT coalesce(nullif(1,1),'nil')}
} {nil}
do_test func-6.4 {
  execsql {SELECT coalesce(nullif(1,2),'nil')}
} {1}

```

```

do_test func-6.5 {
  execsql {SELECT coalesce(nullif(1,NULL),'nil')}
} {1}

# Test the last_insert_rowid() function
#
do_test func-7.1 {
  execsql {SELECT last_insert_rowid()}
} [db last_insert_rowid]

# Tests for aggregate functions and how they handle NULLs.
#
do_test func-8.1 {
  ifcapable explain {
    execsql {EXPLAIN SELECT sum(a) FROM t2;}
  }
  execsql {
    SELECT sum(a), count(a), round(avg(a),2), min(a), max(a), count(*) FROM t2;
  }
} {68236 3 22745.33 1 67890 5}
do_test func-8.2 {
  execsql {
    SELECT max('z+'||a||'abcdefghijklmnopqrstuvwxyABCDEFGHIJKLMNOPQRSTUVWXYZ') FROM t2;
  }
} {z+67890abcdefghijklmnopqrstuvwxyABCDEFGHIJKLMNOPQRSTUVWXYZ}

ifcapable tempdb {
  do_test func-8.3 {
    execsql {
      CREATE TEMP TABLE t3 AS SELECT a FROM t2 ORDER
      BY a DESC;
      SELECT min('z+'||a||'abcdefghijklmnopqrstuvwxyABCDEFGHIJKLMNOPQRSTUVWXYZ') FROM t3;
    }
  } {z+1abcdefghijklmnopqrstuvwxyABCDEFGHIJKLMNOPQRSTUVWXYZ}
} else {
  do_test func-8.3 {
    execsql {
      CREATE TABLE t3 AS SELECT a FROM t2 ORDER BY a DESC;
      SELECT min('z+'||a||'abcdefghijklmnopqrstuvwxyABCDEFGHIJKLMNOPQRSTUVWXYZ') FROM t3;
    }
  } {z+1abcdefghijklmnopqrstuvwxyABCDEFGHIJKLMNOPQRSTUVWXYZ}
}
do_test func-8.4 {
  execsql {
    SELECT max('z+'||a||'abcdefghijklmnopqrstuvwxyABCDEFGHIJKLMNOPQRSTUVWXYZ') FROM t3;
  }
} {z+67890abcdefghijklmnopqrstuvwxyABCDEFGHIJKLMNOPQRSTUVWXYZ}

```

```

# How do you test the random() function in a meaningful, deterministic way?
#
do_test func-9.1 {
    execsql {
        SELECT random() is not null;
    }
} {1}
do_test func-9.2 {
    execsql {
        SELECT typeof(random());
    }
} {integer}
do_test func-9.3 {
    execsql {
        SELECT randomblob(32) is not null;
    }
} {1}
do_test func-9.4 {
    execsql {
        SELECT typeof(randomblob(32));
    }
} {blob}
do_test func-9.5 {
    execsql {
        SELECT length(randomblob(32)),
            length(randomblob(-5)),
            length(randomblob(2000))
    }
} {32 1 2000}

# The "hex()" function was added in order to be able to render blobs
# generated by randomblob(). So this seems like a good place to test
# hex().
#
do_test func-9.10 {
    execsql {SELECT hex(x'00112233445566778899aAbBcCdDeEfF')}
} {00112233445566778899AABBCCDDEEFF}
do_test func-9.11 {
    execsql {SELECT hex(replace('abcdefg','ef','12'))}
} {61626364313267}

# Use the "sqlite_register_test_function" TCL command which is part of
# the text fixture in order to verify correct operation of some of
# the user-defined SQL function APIs that are not used by the built-in
# functions.
#
set ::DB [sqlite3_connection_pointer db]

```

```

sqlite_register_test_function $::DB testfunc
do_test func-10.1 {
catchsql {
    SELECT testfunc(NULL,NULL);
}
} {1 {first argument should be one of: int int64 string double null value}}
do_test func-10.2 {
execsql {
    SELECT testfunc(
        'string', 'abcdefghijklmnopqrstuvwxyABCDEFGHIJKLMNOPQRSTUVWXYZ',
        'int', 1234
    );
}
} {1234}
do_test func-10.3 {
execsql {
    SELECT testfunc(
        'string', 'abcdefghijklmnopqrstuvwxyABCDEFGHIJKLMNOPQRSTUVWXYZ',
        'string', NULL
    );
}
} {{{}}
do_test func-10.4 {
execsql {
    SELECT testfunc(
        'string', 'abcdefghijklmnopqrstuvwxyABCDEFGHIJKLMNOPQRSTUVWXYZ',
        'double', 1.234
    );
}
} {1.234}
do_test func-10.5 {
execsql {
    SELECT testfunc(
        'string', 'abcdefghijklmnopqrstuvwxyABCDEFGHIJKLMNOPQRSTUVWXYZ',
        'int', 1234,
        'string', 'abcdefghijklmnopqrstuvwxyABCDEFGHIJKLMNOPQRSTUVWXYZ',
        'string', NULL,
        'string', 'abcdefghijklmnopqrstuvwxyABCDEFGHIJKLMNOPQRSTUVWXYZ',
        'double', 1.234,
        'string', 'abcdefghijklmnopqrstuvwxyABCDEFGHIJKLMNOPQRSTUVWXYZ',
        'int', 1234,
        'string', 'abcdefghijklmnopqrstuvwxyABCDEFGHIJKLMNOPQRSTUVWXYZ',
        'string', NULL,
        'string', 'abcdefghijklmnopqrstuvwxyABCDEFGHIJKLMNOPQRSTUVWXYZ',
        'double', 1.234
    );
}
} {1.234}

```

```

# Test the built-in sqlite_version(*) SQL function.
#
do_test func-11.1 {
  execsql {
    SELECT sqlite_version(*)
  }
} [sqlite3 -version]

# Test that destructors passed to sqlite3 by calls to sqlite3_result_text()
# etc. are called. These tests use two special user-defined functions
# (implemented in func.c) only available in test builds.
#
# Function test_destructor() takes one argument and returns a copy of the
# text form of that argument. A destructor is associated with the return
# value. Function test_destructor_count() returns the number of outstanding
# destructor calls for values returned by test_destructor().
#
do_test func-12.1 {
  execsql {
    SELECT test_destructor('hello world'), test_destructor_count();
  }
} {{hello world} 1}
do_test func-12.2 {
  execsql {
    SELECT test_destructor_count();
  }
} {0}
do_test func-12.3 {
  execsql {
    SELECT test_destructor('hello')||' world', test_destructor_count();
  }
} {{hello world} 0}
do_test func-12.4
{
  execsql {
    SELECT test_destructor_count();
  }
} {0}
do_test func-12.5 {
  execsql {
    CREATE TABLE t4(x);
    INSERT INTO t4 VALUES(test_destructor('hello'));
    INSERT INTO t4 VALUES(test_destructor('world'));
    SELECT min(test_destructor(x)), max(test_destructor(x)) FROM t4;
  }
} {hello world}
do_test func-12.6 {

```



```

execsql {
  SELECT test_destructor_count();
}
} {0}
do_test func-12.7 {
  execsql {
    DROP TABLE t4;
  }
} {}

# Test that the auxdata API for scalar functions works. This test uses
# a special user-defined function only available in test builds,
# test_auxdata(). Function test_auxdata() takes any number of arguments.
do_test func-13.1 {
  execsql {
    SELECT test_auxdata('hello world');
  }
} {0}

do_test func-13.2 {
  execsql {
    CREATE TABLE t4(a, b);
    INSERT INTO t4 VALUES('abc', 'def');
    INSERT INTO t4 VALUES('ghi', 'jkl');
  }
} {}
do_test func-13.3 {
  execsql {
    SELECT test_auxdata('hello world') FROM t4;
  }
} {0 1}
do_test func-13.4
{
  execsql {
    SELECT test_auxdata('hello world', 123) FROM t4;
  }
} {{0 0} {1 1}}
do_test func-13.5 {
  execsql {
    SELECT test_auxdata('hello world', a) FROM t4;
  }
} {{0 0} {1 0}}
do_test func-13.6 {
  execsql {
    SELECT test_auxdata('hello'||'world', a) FROM t4;
  }
} {{0 0} {1 0}}

```

```

# Test that auxiliary data is preserved between calls for SQL variables.
do_test func-13.7 {
    set DB [sqlite3_connection_pointer db]
    set sql "SELECT test_auxdata( ?, a ) FROM t4;"
    set STMT [sqlite3_prepare $DB $sql -1 TAIL]
    sqlite3_bind_text $STMT 1 hello -1
    set res [list]
    while { "SQLITE_ROW"==[sqlite3_step $STMT] } {
        lappend res [sqlite3_column_text $STMT 0]
    }
    lappend res [sqlite3_finalize $STMT]
} {{0 0} {1 0} SQLITE_OK}

# Make sure that a function with a very long name is rejected
do_test func-14.1 {
    catch {
        db function [string repeat X 254] {return "hello"}
    }
} {0}
do_test func-14.2 {
    catch {
        db function [string repeat X 256] {return "hello"}
    }
} {1}

do_test
func-15.1 {
    catchsql {
        select test_error(NULL);
    }
} {1 {}}

# Test the quote function for BLOB and NULL values.
do_test func-16.1 {
    execsql {
        CREATE TABLE tbl2(a, b);
    }
    set STMT [sqlite3_prepare $::DB "INSERT INTO tbl2 VALUES(?, ?)" -1 TAIL]
    sqlite3_bind_blob $::STMT 1 abc 3
    sqlite3_step $::STMT
    sqlite3_finalize $::STMT
    execsql {
        SELECT quote(a), quote(b) FROM tbl2;
    }
} {X'616263' NULL}

# Correctly handle function error messages that include %. Ticket #1354
#

```

```

do_test func-17.1 {
proc testfunc1 args {error "Error %d with %s percents %p"}
db function testfunc1 ::testfunc1
catchsql {
    SELECT testfunc1(1,2,3);
}
} {1 {Error %d with %s percents %p}}

# The SUM function should return integer results when all inputs are integer.
#
do_test func-18.1 {
execsql {
    CREATE TABLE t5(x);
    INSERT INTO t5 VALUES(1);
    INSERT INTO t5 VALUES(-99);
    INSERT INTO t5 VALUES(10000);
    SELECT sum(x) FROM t5;
}
} {9902}
do_test func-18.2
{
execsql {
    INSERT INTO t5 VALUES(0.0);
    SELECT sum(x) FROM t5;
}
} {9902.0}

# The sum of nothing is NULL. But the sum of all NULLs is NULL.
#
# The TOTAL of nothing is 0.0.
#
do_test func-18.3 {
execsql {
    DELETE FROM t5;
    SELECT sum(x), total(x) FROM t5;
}
} {{} 0.0}
do_test func-18.4 {
execsql {
    INSERT INTO t5 VALUES(NULL);
    SELECT sum(x), total(x) FROM t5
}
} {{} 0.0}
do_test func-18.5 {
execsql {
    INSERT INTO t5 VALUES(NULL);
    SELECT sum(x), total(x) FROM t5
}
}

```

```

} {} 0.0}
do_test func-18.6 {
execsql {
    INSERT INTO t5 VALUES(123);
    SELECT sum(x), total(x) FROM t5
}
} {123 123.0}

# Ticket #1664, #1669, #1670, #1674: An integer overflow on SUM causes
# an error. The non-standard TOTAL() function continues to give a helpful
# result.
#
do_test func-18.10 {
execsql {
    CREATE TABLE t6(x INTEGER);
    INSERT INTO t6 VALUES(1);
    INSERT INTO t6 VALUES(1<<62);
    SELECT sum(x) - ((1<<62)+1) from t6;
}
} 0
do_test func-18.11 {
execsql {
    SELECT typeof(sum(x)) FROM t6
}
} integer
do_test func-18.12 {
catchsql {
    INSERT INTO t6 VALUES(1<<62);
    SELECT sum(x) - ((1<<62)*2.0+1) from t6;
}
} {1 {integer overflow}}
do_test func-18.13 {
execsql {
    SELECT total(x) - ((1<<62)*2.0+1) FROM t6
}
} 0.0
do_test func-18.14 {
execsql {
    SELECT sum(-9223372036854775805);
}
} -9223372036854775805

ifcapable compound&&subquery {

do_test func-18.15 {
catchsql {
    SELECT sum(x) FROM
        (SELECT 9223372036854775807 AS x UNION ALL

```

```

        SELECT 10 AS x);
    }
} {1 {integer overflow}}
do_test func-18.16 {
catchsql {
    SELECT sum(x) FROM
        (SELECT 9223372036854775807 AS x UNION ALL
        SELECT -10 AS x);
    }
} {0 9223372036854775797}
do_test func-18.17 {
catchsql {
    SELECT sum(x) FROM
        (SELECT -9223372036854775807 AS x UNION ALL
        SELECT 10 AS x);
    }
} {0 -9223372036854775797}
do_test func-18.18 {
catchsql {
    SELECT sum(x) FROM
        (SELECT -9223372036854775807
AS x UNION ALL
        SELECT -10 AS x);
    }
} {1 {integer overflow}}
do_test func-18.19 {
catchsql {
    SELECT sum(x) FROM (SELECT 9 AS x UNION ALL SELECT -10 AS x);
    }
} {0 -1}
do_test func-18.20 {
catchsql {
    SELECT sum(x) FROM (SELECT -9 AS x UNION ALL SELECT 10 AS x);
    }
} {0 1}
do_test func-18.21 {
catchsql {
    SELECT sum(x) FROM (SELECT -10 AS x UNION ALL SELECT 9 AS x);
    }
} {0 -1}
do_test func-18.22 {
catchsql {
    SELECT sum(x) FROM (SELECT 10 AS x UNION ALL SELECT -9 AS x);
    }
} {0 1}

} ;# ifcapable compound&&subquery

```

```

# Integer overflow on abs()
#
do_test func-18.31 {
catchsql {
    SELECT abs(-9223372036854775807);
}
} {0 9223372036854775807}
do_test func-18.32 {
catchsql {
    SELECT abs(-9223372036854775807-1);
}
} {1 {integer overflow}}

# The MATCH function exists but is only a stub and always throws an error.
#
do_test func-19.1 {
execsql {
    SELECT match(a,b) FROM t1 WHERE 0;
}
} {}
do_test func-19.2 {
catchsql {
    SELECT
'abc' MATCH 'xyz';
}
} {1 {unable to use function MATCH in the requested context}}
do_test func-19.3 {
catchsql {
    SELECT 'abc' NOT MATCH 'xyz';
}
} {1 {unable to use function MATCH in the requested context}}
do_test func-19.4 {
catchsql {
    SELECT match(1,2,3);
}
} {1 {wrong number of arguments to function match()}}

# Soundex tests.
#
if ![catch {db eval {SELECT soundex('hello')}}] {
set i 0
foreach {name sdx} {
    euler    E460
    EULER    E460
    Euler    E460
    ellery   E460
    gauss    G200
    ghosh    G200

```

```

hilbert    H416
Heilbronn H416
knuth      K530
kant       K530
Lloyd     L300
LADD      L300
Lukasiewicz L222
Lissajous L222
A         A000
12345     ?000
} {
incr i
do_test func-20.$i {
    execsql {SELECT soundex($name)}
} $sdx
}
}

# Tests of the REPLACE function.
#
do_test func-21.1 {
catchsql {
    SELECT replace(1,2);
}
} {1 {wrong number
of arguments to function replace()}}
do_test func-21.2 {
catchsql {
    SELECT replace(1,2,3,4);
}
} {1 {wrong number of arguments to function replace()}}
do_test func-21.3 {
execsql {
    SELECT typeof(replace("This is the main test string", NULL, "ALT"));
}
} {null}
do_test func-21.4 {
execsql {
    SELECT typeof(replace(NULL, "main", "ALT"));
}
} {null}
do_test func-21.5 {
execsql {
    SELECT typeof(replace("This is the main test string", "main", NULL));
}
} {null}
do_test func-21.6 {
execsql {

```

```

SELECT replace("This is the main test string", "main", "ALT");
}
} {{This is the ALT test string}}
do_test func-21.7 {
execsql {
SELECT replace("This is the main test string", "main", "larger-main");
}
} {{This is the larger-main test string}}
do_test func-21.8 {
execsql {
SELECT replace("aaaaaaa", "a", "0123456789");
}
} {0123456789012345678901234567890123456789012345678901234567890123456789}

```

# Tests for the TRIM, LTRIM and RTRIM functions.

```

#
do_test
func-22.1 {
catchsql {SELECT trim(1,2,3)}
} {1 {wrong number of arguments to function trim()}}
do_test func-22.2 {
catchsql {SELECT ltrim(1,2,3)}
} {1 {wrong number of arguments to function ltrim()}}
do_test func-22.3 {
catchsql {SELECT rtrim(1,2,3)}
} {1 {wrong number of arguments to function rtrim()}}
do_test func-22.4 {
execsql {SELECT trim(' hi ');}
} {hi}
do_test func-22.5 {
execsql {SELECT ltrim(' hi ');}
} {{hi }}
do_test func-22.6 {
execsql {SELECT rtrim(' hi ');}
} {{ hi}}
do_test func-22.7 {
execsql {SELECT trim(' hi ','xyz');}
} {{ hi }}
do_test func-22.8 {
execsql {SELECT ltrim(' hi ','xyz');}
} {{ hi }}
do_test func-22.9 {
execsql {SELECT rtrim(' hi ','xyz');}
} {{ hi }}
do_test func-22.10 {
execsql {SELECT trim('xyxzy hi zzy','xyz');}
} {{ hi }}
do_test func-22.11 {

```



```

execsql {SELECT ltrim('xyxzy hi zzy','xyz');}
} {{ hi zzy}}
do_test func-22.12 {
execsql {SELECT rtrim('xyxzy hi zzy','xyz');}
} {{xyxzy hi }}
do_test
func-22.13 {
execsql {SELECT trim(' hi ','');}
} {{ hi }}
do_test func-22.20 {
execsql {SELECT typeof(trim(NULL));}
} {null}
do_test func-22.21 {
execsql {SELECT typeof(trim(NULL,'xyz'));}
} {null}
do_test func-22.22 {
execsql {SELECT typeof(trim('hello',NULL));}
} {null}

```

finish\_test

Found in path(s):

\* /opt/cola/permits/1332727043\_1653392698.341362/0/sqlite-3-3-17-tar-gz/sqlite-3.3.17/test/func.test

No license file was found, but licenses were detected in source scan.

# 2006 September 14

#

# The author disclaims copyright to this source code. In place of

# a legal notice, here is a blessing:

#

# May you do good and not evil.

# May you find forgiveness for yourself and forgive others.

# May you share freely, never taking more than you give.

#

\*\*\*\*\*

# This file implements regression tests for SQLite library. The

# focus of this script is testing the FTS2 module.

#

# \$Id: fts2c.test,v 1.1 2006/10/19 23:36:26 shess Exp \$

#

set testdir [file dirname \$argv0]

source \$testdir/tester.tcl

# If SQLITE\_ENABLE\_FTS2 is defined, omit this file.

ifcapable !fts2 {

finish\_test

return

}

```
# Create a table of sample email data. The data comes from email
# archives of Enron executives that was published as part of the
# litigation against that company.
#
do_test fts2c-1.1 {
  db eval {
    CREATE VIRTUAL TABLE email
    USING fts2([from],[to],subject,body);
    BEGIN TRANSACTION;
    INSERT INTO email([from],[to],subject,body) VALUES('savita.puthigai@enron.com', 'traders.eol@enron.com,
traders.eol@enron.com', 'EnronOnline- Change to Autohedge', 'Effective Monday, October 22, 2001 the following
changes will be made to the Autohedge functionality on EnronOnline.
```

The volume on the hedge will now respect the minimum volume and volume increment settings on the parent product. See rules below:

- ? If the transaction volume on the child is less than half of the parent's minimum volume no hedge will occur.
- ? If the transaction volume on the child is more than half the parent's minimum volume but less than half the volume increment on the parent, the hedge will volume will be the parent's minimum volume.
- ? For all other volumes, the same rounding rules will apply based on the volume increment on the parent product.

Please see example below:

Parent's Settings:

Minimum: 5000

Increment: 1000

Volume on Autohedge

transaction Volume Hedged

1 - 2499 0

2500 - 5499 5000

5500 - 6499 6000');

```
INSERT INTO email([from],[to],subject,body) VALUES('dana.davis@enron.com', 'laynie.east@enron.com,
lisa.king@enron.com, lisa.best@enron.com,', 'Leaving Early', 'FYI:
```

If it's ok with everyone's needs, I would like to leave @4pm. If you think you will need my assistance past the 4 o'clock hour just let me know; I'll be more than willing to stay.');

```
INSERT INTO email([from],[to],subject,body) VALUES('enron_update@concuere workplace.com',
'louise.kitchen@enron.com', '<<Concur Expense Document>> - CC02.06.02', 'The following expense report is ready
for approval:
```

Employee Name: Christopher F. Calger

Status last changed by: Mollie E. Gustafson Ms

Expense Report Name: CC02.06.02

Report Total: \$3,972.93

Amount Due Employee: \$3,972.93

To approve this expense report, click on the following link for Concur Expense.

<http://expense.ms.enron.com>);

INSERT INTO email([from],[to],subject,body)

VALUES('jeff.duff@enron.com', 'julie.johnson@enron.com', 'Work request', 'Julie,

Could you print off the current work request report by 1:30 today?

Gentlemen,

I'd like to review this today at 1:30 in our office. Also, could you provide me with your activity reports so I can have Julie enter this information.

JD');

INSERT INTO email([from],[to],subject,body) VALUES('v.weldon@enron.com', 'gary.l.carrier@usa.dupont.com, scott.joyce@bankofamerica.com', 'Enron News', 'This could turn into something big....

<http://biz.yahoo.com/rf/010129/n29305829.html>);

INSERT INTO email([from],[to],subject,body) VALUES('mark.haedicke@enron.com', 'paul.simons@enron.com', 'Re: First Polish Deal!', 'Congrats! Things seem to be building rapidly now on the Continent. Mark');

INSERT INTO email([from],[to],subject,body) VALUES('e..carter@enron.com', 't..robinson@enron.com', 'FW: Producers Newsletter 9-24-2001', '

The producer lumber pricing sheet.

-----Original Message-----

From: Johnson, Jay

Sent: Tuesday,

October 16, 2001 3:42 PM

To: Carter, Karen E.

Subject: FW: Producers Newsletter 9-24-2001

-----Original Message-----

From: Daigre, Sergai

Sent: Friday, September 21, 2001 8:33 PM

Subject: Producers Newsletter 9-24-2001

');

INSERT INTO email([from],[to],subject,body) VALUES('david.delainey@enron.com', 'kenneth.lay@enron.com', 'Greater Houston Partnership', 'Ken, in response to the letter from Mr Miguel San Juan, my suggestion would

be to offer up the Falcon for their use; however, given the tight time frame and your recent visit with Mr. Fox that it would be difficult for either you or me to participate.

I spoke to Max and he agrees with this approach.

I hope this meets with your approval.

Regards

Delainey');

INSERT INTO email([from],[to],subject,body) VALUES('lachandra.fenceroy@enron.com',  
'lindy.donoho@enron.com', 'FW: Bus Applications Meeting Follow Up', 'Lindy,

Here is the original memo we discussed earlier. Please provide any information that you may have.

Your cooperation is greatly appreciated.

Thanks,

lachandra.fenceroy@enron.com

713.853.3884

877.498.3401 Pager

-----Original Message-----

From: Bisbee, Joanne

Sent: Wednesday, September 26, 2001 7:50 AM

To: Fenceroy, LaChandra

Subject: FW: Bus Applications Meeting Follow Up

Lachandra, Please get with David Duff today and see what this is about. Who are our TW accounting business users?

-----Original Message-----

From: Koh, Wendy

Sent: Tuesday, September 25, 2001 2:41 PM

To: Bisbee, Joanne

Subject: Bus Applications Meeting Follow Up

Lisa brought up a TW change effective Nov 1. It involves eliminating a turnback surcharge. I have no other information, but you might check with the business folks for any system changes required.

Wendy');

INSERT INTO email([from],[to],subject,body) VALUES('danny.mccarty@enron.com', 'fran.fagan@enron.com',  
'RE: worksheets', 'Fran,

If Julie's merit needs to be lump sum, just move it over to that column. Also, send me Eric Gadd's sheets as well. Thanks.

Dan

-----Original Message-----

From: Fagan, Fran

Sent: Thursday, December 20, 2001 11:10 AM

To: McCarty, Danny

Subject: worksheets

As discussed, attached are your sheets for bonus and merit.

Thanks,

Fran Fagan  
Sr. HR Rep  
713.853.5219

<< File: McCartyMerit.xls >> << File: mccartyBonusCommercial\_UnP.xls >>

');

INSERT INTO email([from],[to],subject,body) VALUES('bert.meyers@enron.com', 'shift.dl-portland@enron.com', 'OCTOBER SCHEDULE', 'TEAM,

PLEASE SEND ME ANY REQUESTS THAT YOU HAVE FOR OCTOBER. SO FAR I HAVE THEM FOR LEAF. I WOULD LIKE TO HAVE IT DONE BY THE 15TH OF THE MONTH. ANY QUESTIONS PLEASE GIVE ME A CALL.

BERT');

INSERT INTO email([from],[to],subject,body) VALUES('errol.mclaughlin@enron.com', 'john.arnold@enron.com, bilal.bajwa@enron.com, john.griffith@enron.com,', 'TRV Notification: (NG - PROPT P/L - 09/27/2001)', 'The report named: NG - PROPT P/L <[http://trv.corp.enron.com/linkFromExcel.asp?report\\_cd=11&report\\_name=NG+-+PROPT+P/L&category\\_cd=5&category\\_name=FINANCIAL&toc\\_hide=1&sTV1=5&TV1Exp=Y&current\\_efct\\_d ate=09/27/2001](http://trv.corp.enron.com/linkFromExcel.asp?report_cd=11&report_name=NG+-+PROPT+P/L&category_cd=5&category_name=FINANCIAL&toc_hide=1&sTV1=5&TV1Exp=Y&current_efct_d ate=09/27/2001)>, published as of 09/27/2001 is now available for viewing on the website.');

published as of 09/27/2001 is now available for viewing on the website.');

INSERT INTO email([from],[to],subject,body) VALUES('patrice.mims@enron.com', 'calvin.eakins@enron.com', 'Re: Small business supply assistance', 'Hi Calvin

I spoke with Rickey (boy, is he long-winded!!). Gave him the name of our credit guy, Russell Diamond.

Thank for your help!');

INSERT INTO email([from],[to],subject,body) VALUES('legal <hall@enron.com>', 'stephanie.panus@enron.com', 'Termination update', 'City of Vernon and Salt River Project terminated their contracts. I will fax these notices to you.');

INSERT INTO email([from],[to],subject,body) VALUES('d..steffes@enron.com', 'richard.shapiro@enron.com', 'EES / ENA Government Affairs Staffing & Outside Services', 'Rick --

Here is the information on staffing and outside services. Call if you need anything else.

Jim

');

INSERT INTO email([from],[to],subject,body)

VALUES('gelliott@industrialinfo.com', 'pcopello@industrialinfo.com', 'ECAAR (Gavin), WSCC (Diablo Canyon), & NPCC (Seabrook)', 'Dear Power Outage Database Customer,

Attached you will find an excel document. The outages contained within are forced or rescheduled outages. Your

daily delivery will still contain these outages.

In addition to the two excel documents, there is a dbf file that is formatted like your daily deliveries you receive nightly. This will enable you to load the data into your regular database. Any questions please let me know. Thanks.

Greg Elliott

IIR, Inc.

713-783-5147 x 3481

outages@industrialinfo.com

THE INFORMATION CONTAINED IN THIS E-MAIL IS LEGALLY PRIVILEGED AND CONFIDENTIAL INFORMATION INTENDED ONLY FOR THE USE OF THE INDIVIDUAL OR ENTITY NAMED ABOVE. YOU ARE HEREBY NOTIFIED THAT ANY DISSEMINATION, DISTRIBUTION, OR COPY OF THIS E-MAIL TO UNAUTHORIZED ENTITIES IS STRICTLY PROHIBITED. IF YOU HAVE RECEIVED THIS E-MAIL IN ERROR, PLEASE DELETE IT.

- OUTAGE.dbf

- 111201R.xls

- 111201.xls ');

INSERT INTO email([from],[to],subject,body) VALUES('enron.announcements@enron.com', 'all\_ena\_egm\_eim@enron.com', 'EWS Brown Bag', 'MARK YOUR LUNCH CALENDARS NOW !

You are invited to attend the EWS Brown Bag Lunch Series

Featuring: RAY BOWEN, COO

Topic: Enron Industrial Markets

Thursday, March 15, 2001

11:30 am - 12:30 pm

EB 5 C2

You bring your lunch, Limited Seating

We provide drinks and dessert. RSVP x 3-9610');

INSERT INTO email([from],[to],subject,body) VALUES('chris.germany@enron.com', 'ingrid.immer@williams.com', 'Re: About St Pauls', 'Sounds good to me. I bet this is next to the Warick?? Hotel.

"Immer, Ingrid" <Ingrid.Immer@Williams.com> on 12/21/2000 11:48:47 AM

To: "'chris.germany@enron.com'" <chris.germany@enron.com>

cc:

Subject: About St Pauls

<<About St Pauls.url>>

?

?http://www.stpaulshouston.org/about.html

Chris,

I like the looks of this place.? What do you think about going here Christmas eve?? They have an 11:00 a.m. service and a candlelight service at 5:00 p.m., among others.

Let me know.?? ii

- About St Pauls.url

');

INSERT INTO email([from],[to],subject,body) VALUES('nas@cpuc.ca.gov', 'skatz@sempratrading.com, kmccrea@sablaw.com, thompson@wrightlaw.com,', 'Reply Brief filed July 31, 2000', '- CPUC01-#76371-v1-Revised\_Reply\_Brief\_\_Due\_today\_7\_31\_.doc');

INSERT INTO email([from],[to],subject,body) VALUES('gascontrol@agresources.com', 'dscott4@enron.com, lcampbel@enron.com', 'Alert Posted 10:00 AM November 20,2000: E-GAS Request Reminder', 'Alert Posted 10:00 AM November 20,2000: E-GAS Request Reminder

As discussed in the Winter Operations Meeting on Sept.29,2000,

E-Gas(Emergency Gas) will not be offered this winter as a service from AGLC.

Marketers and Poolers can receive gas via Peaking and IBSS nominations(daisy chain) from other marketers up to the 6 p.m. Same Day 2 nomination cycle.

');

INSERT INTO email([from],[to],subject,body) VALUES('dutch.quigley@enron.com', 'rwoikwitz@powermerchants.com', ", ' "

Here is a goody for you');

INSERT INTO email([from],[to],subject,body) VALUES('ryan.o"rourke@enron.com', 'k..allen@enron.com, randy.bhatia@enron.com, frank.ermis@enron.com,', 'TRV Notification: (West VaR - 11/07/2001)', 'The report named: West VaR

<[http://trv.corp.enron.com/linkFromExcel.asp?report\\_cd=36&report\\_name=West+VaR&category\\_cd=2&category\\_name=WEST&toc\\_hide=1&sTV1=2&TV1Exp=Y&current\\_efct\\_date=11/07/2001](http://trv.corp.enron.com/linkFromExcel.asp?report_cd=36&report_name=West+VaR&category_cd=2&category_name=WEST&toc_hide=1&sTV1=2&TV1Exp=Y&current_efct_date=11/07/2001)>, published as of 11/07/2001 is now available for viewing on the website.');

INSERT INTO email([from],[to],subject,body) VALUES('mjones7@txu.com', 'cstone1@txu.com, ggreen2@txu.com, timpowell@txu.com,', 'Enron / HPL Actuals for July 10, 2000', 'Teco Tap 10.000 / Enron ; 110.000 / HPL IFERC

LS HPL LSK IC 30.000 / Enron

');

INSERT INTO email([from],[to],subject,body) VALUES('susan.pereira@enron.com', 'kkw816@aol.com', 'soccer practice', 'Kathy-

Is it safe to assume that practice is cancelled for tonight??

Susan Pereira');

INSERT INTO email([from],[to],subject,body) VALUES('mark.whitt@enron.com', 'barry.tycholiz@enron.com',

'Huber Internal Memo', 'Please look at this. I didn't know how deep to go with the desk. Do you think this works.

');

INSERT INTO email([from],[to],subject,body) VALUES('m..forney@enron.com', 'george.phillips@enron.com', '', 'George,

Give me a call and we will further discuss opportunities on the 13st floor.

Thanks,

JMForney

3-7160');

INSERT INTO email([from],[to],subject,body) VALUES('brad.mckay@enron.com', 'angusmcka@aol.com', 'Re: (no subject)', 'not yet');

INSERT INTO email([from],[to],subject,body) VALUES('adam.bayer@enron.com', 'jonathan.mckay@enron.com', 'FW: Curve Fetch File', 'Here is the curve fetch file sent to me. It has plenty of points in it. If you give me a list of which ones you need we may be able to construct a secondary worksheet to vlookup the values.

adam

35227

-----Original Message-----

From: Royed, Jeff

Sent: Tuesday,

September 25, 2001 11:37 AM

To: Bayer, Adam

Subject: Curve Fetch File

Let me know if it works. It may be required to have a certain version of Oracle for it to work properly.

Jeff Royed

Enron

Energy Operations

Phone: 713-853-5295');

INSERT INTO email([from],[to],subject,body) VALUES('matt.smith@enron.com', 'yan.wang@enron.com', 'Report Formats', 'Yan,

The merged reports look great. I believe the only orientation changes are to "unmerge" the following six reports:

31 Keystone Receipts

15 Questar Pipeline

40 Rockies Production

22 West\_2

23 West\_3

25 CIG\_WIC



The orientation of the individual reports should be correct. Thanks.

Mat

PS. Just a reminder to add the "\*" by the title of calculated points.);  
INSERT INTO email([from],[to],subject,body) VALUES('michelle.lokay@enron.com', 'jimboman@bigfoot.com',  
'Egyptian Festival', '----- Forwarded by Michelle Lokay/ET&S/Enron on 09/07/2000  
10:08 AM -----')

"Karkour, Randa" <Randa.Karkour@COMPAQ.com>  
on 09/07/2000 09:01:04 AM  
To: ""Agheb (E-mail)" <Agheb@aol.com>, "Leila Mankarious (E-mail)"  
<Leila\_Mankarious@mhhs.org>, ""Marymankarious (E-mail)"  
<marymankarious@aol.com>, "Michelle lokay (E-mail)" <mlokay@enron.com>, "Ramy  
Mankarious (E-mail)" <Mankarious@aol.com>  
cc:

Subject: Egyptian Festival

<<Egyptian Festival.url>>

<http://www.egyptianfestival.com/>

- Egyptian Festival.url

);  
INSERT INTO email([from],[to],subject,body) VALUES('errol.mclaughlin@enron.com',  
'sherry.dawson@enron.com', 'Urgent!!! --- New EAST books', 'This has to be done.....')

Thanks  
----- Forwarded by Errol McLaughlin/Corp/Enron on 12/20/2000  
08:39 AM -----

From: William Kelly @ ECT 12/20/2000 08:31 AM

To: Kam Keiser/HOU/ECT@ECT, Darron C Giron/HOU/ECT@ECT, David  
Baumbach/HOU/ECT@ECT, Errol McLaughlin/Corp/Enron@ENRON  
cc: Kimat Singla/HOU/ECT@ECT, Kulvinder Fowler/NA/Enron@ENRON,  
Kyle R  
Lilly/HOU/ECT@ECT, Jeff Royed/Corp/Enron@ENRON, Alejandra  
Chavez/NA/Enron@ENRON, Crystal Hyde/HOU/ECT@ECT

Subject: New EAST books

We have new book names in TAGG for our intramonth portfolios and it is extremely important that any deal booked to the East is communicated quickly to someone on my team. I know it will take some time for the new names to sink in and I do not want us to miss any positions or P&L.

Thanks for your help on this.

New:

Scott Neal : East Northeast

Dick Jenkins: East Marketeast

WK

');

INSERT INTO email([from],[to],subject,body) VALUES('david.forster@enron.com', 'eol.wide@enron.com', 'Change to Stack Manager', 'Effective immediately, there is a change to the Stack Manager which will affect any Inactive Child.

An inactive Child with links to Parent products will not have their calculated prices updated until the Child product is Activated.

When the Child Product is activated, the price will be recalculated and updated BEFORE it is displayed on the web.

This means that if you are inputting a basis price on a Child product, you will not see the final, calculated price until you Activate the product, at which time the customer will also see it.

If you have any questions, please contact the Help Desk on:

Americas: 713 853 4357

Europe: + 44 (0) 20 7783 7783

Asia/Australia: +61 2 9229 2300

Dave');

INSERT INTO email([from],[to],subject,body) VALUES('vince.kaminski@enron.com', 'jhh1@email.msn.com', 'Re: Light reading - see pieces beginning on page 7', 'John,

I saw it. Very interesting.

Vince

"John H Herbert" <jhh1@email.msn.com> on 07/28/2000 08:38:08 AM

To: "Vince J Kaminski" <Vince\_J\_Kaminski@enron.com>

cc:

Subject: Light reading - see pieces beginning on page 7

Cheers and have a nice weekend,

JHHerbert

- gd000728.pdf

');

INSERT INTO email([from],[to],subject,body) VALUES('matthew.lenhart@enron.com',

'mmmarcanel@equiva.com', 'RE:', 'i will try to line up a pig for you ');

INSERT INTO email([from],[to],subject,body)

VALUES('jae.black@enron.com', 'claudette.harvey@enron.com, chaun.roberts@enron.com,

judy.martinez@enron.com.', 'Disaster Recovery Equipment', 'As a reminder...there are several pieces of equipment that are set up on the 30th Floor, as well as on our floor, for the Disaster Recovery Team. PLEASE DO NOT TAKE, BORROW OR USE this equipment. Should you need to use another computer system, other than yours, or make conference calls please work with your Assistant to help find or set up equipment for you to use.

Thanks for your understanding in this matter.

T.Jae Black

East Power Trading

Assistant to Kevin Presto

off. 713-853-5800

fax 713-646-8272

cell 713-539-4760');

INSERT INTO email([from],[to],subject,body) VALUES('eric.bass@enron.com', 'dale.neuner@enron.com', '5 X 24', 'Dale,

Have you heard anything more on the 5 X 24s? We would like to get this product out ASAP.

Thanks,

Eric');

INSERT INTO email([from],[to],subject,body) VALUES('messenger@smartreminders.com',

'm..tholt@enron.com', '10% Coupon - PrintPal Printer Cartridges - 100% Guaranteed', '[IMAGE]

[IMAGE][IMAGE][IMAGE]

Dear SmartReminders Member,

[IMAGE] [IMAGE] [IMAGE] [IMAGE] [IMAGE] [IMAGE] [IMAGE] [IMAGE]

We respect your privacy and are a Certified Participant of the BBBOnLine Privacy Program. To be removed from future offers,click here.

SmartReminders.com is a permission based service. To unsubscribe click here . ');

INSERT INTO email([from],[to],subject,body) VALUES('benjamin.rogers@enron.com', 'mark.bernstein@enron.com', ', 'The guy you are talking about left CIN under a "cloud of suspicion" sort of speak. He was the one who got into several bad deals and PPA's in California for CIN, thus he left on a bad note. Let me know if you need more detail than that, I felt this was the type of info you were looking for. Thanks!

Ben');

INSERT INTO email([from],[to],subject,body)

VALUES('enron\_update@concuereworkplace.com', 'michelle.cash@enron.com', 'Expense Report Receipts Not Received', 'Employee Name: Michelle Cash

Report Name: Houston Cellular 8-11-01

Report Date: 12/13/01

Report ID: 594D37C9ED2111D5B452

Submitted On: 12/13/01

You are only allowed 2 reports with receipts outstanding. Your expense reports will not be paid until you meet this requirement.');

INSERT INTO email([from],[to],subject,body) VALUES('susan.mara@enron.com', 'ray.alvarez@enron.com, mark.palmer@enron.com, karen.denne@enron.com,', 'CAISO Emergency Motion -- to discontinue market-based rates for', 'FYI. the latest broadside against the generators.

Sue Mara

Enron Corp.

Tel: (415) 782-7802

Fax:(415) 782-7854

----- Forwarded by Susan J Mara/NA/Enron on 06/08/2001 12:24 PM -----

"Milner, Marcie" <MMilner@coral-energy.com> 06/08/2001 11:13 AM To: ""smara@enron.com""  
<smara@enron.com> cc: Subject: CAISO Emergency Motion

Sue, did you see this emergency motion  
the CAISO filed today? Apparently  
they are requesting that FERC discontinue market-based rates immediately and  
grant refunds plus interest on the difference between cost-based rates and  
market revenues received back to May 2000. They are requesting the  
commission act within 14 days. Have you heard anything about what they are  
doing?

Marcie

<http://www.aiso.com/docs/2001/06/08/200106081005526469.pdf>

);

INSERT INTO email([from],[to],subject,body) VALUES('fletcher.sturm@enron.com', 'eloy.escobar@enron.com',  
'Re: General Brinks Position Meeting', 'Eloy,

Who is General Brinks?

Fletch');

INSERT INTO email([from],[to],subject,body) VALUES('nailia.dindarova@enron.com',  
'richard.shapiro@enron.com', 'Documents for Mark Frevert (on EU developments and lessons from', 'Rick,

Here are the documents that Peter has prepared for Mark Frevert.

Nailia

----- Forwarded by Nailia Dindarova/LON/ECT on 25/06/2001

16:36 -----

Nailia Dindarova

25/06/2001 15:36

To:

Michael Brown/Enron@EUEnronXGate

cc: Ross Sankey/Enron@EUEnronXGate, Eric Shaw/ENRON@EUEnronXGate, Peter  
Styles/LON/ECT@ECT

Subject: Documents for Mark Frevert (on EU developments and lessons from  
California)

Michael,

These are the documents that Peter promised to give to you for Mark Frevert. He has now handed them to him in person but asked me to transmit them electronically to you, as well as Eric and Ross.

Nailia

);  
INSERT INTO email([from],[to],subject,body) VALUES('peggy.a.kostial@accenture.com',  
'dave.samuels@enron.com', 'EOL-Accenture Deal Sheet', 'Dave -

Attached are our comments and suggested changes. Please call to review.

On the time line for completion, we have four critical steps to complete:

- Finalize market analysis to refine business case, specifically  
projected revenue stream
- Complete counterparty surveying, including targeting 3 CPs for letters  
of intent
- Review Enron asset base for potential reuse/ licensing  
Contract  
negotiations

Joe will come back to us with an updated time line, but it is my expectation that we are still on the same schedule (we just begun week three) with possibly a week or so slippage.....contract negotiations will probably be the critical path.

We will send our cut at the actual time line here shortly. Thanks,

Peggy

(See attached file: accenture-dealpoints v2.doc)

- accenture-dealpoints v2.doc ');

INSERT INTO email([from],[to],subject,body) VALUES('thomas.martin@enron.com', 'thomas.martin@enron.com',  
'Re: Guadalupe Power Partners LP', '----- Forwarded by Thomas A Martin/HOU/ECT on 03/20/2001  
03:49 PM -----

Thomas A Martin

10/11/2000 03:55 PM

To: Patrick Wade/HOU/ECT@ECT

cc:

Subject: Re: Guadalupe Power Partners LP

The deal is physically served at Oasis Waha or Oasis Katy and is priced at either HSC, Waha or Katytailgate GD at buyers option three days prior to NYMEX close.

');

INSERT INTO email([from],[to],subject,body)

VALUES('judy.townsend@enron.com', 'dan.junek@enron.com, chris.germany@enron.com', 'Columbia Distribution's Capacity Available for Release - Sum', '----- Forwarded by Judy Townsend/HOU/ECT on 03/09/2001 11:04 AM -----')

agoddard@nisource.com on 03/08/2001 09:16:57 AM

To: " - \*Koch, Kent" <kkoch@nisource.com>, " - \*Millar, Debra" <dmillar@nisource.com>, " - \*Burke, Lynn" <lburke@nisource.com>  
cc: " - \*Heckathorn, Tom" <heckathorn@nisource.com>  
Subject: Columbia Distribution's Capacity Available for Release - Sum

Attached is Columbia Distribution's notice of capacity available for release for the summer of 2001 (Apr. 2001 through Oct. 2001).

Please note that the deadline for bids is 3:00pm EST on March 20, 2001.

If you have any questions, feel free to contact any of the representatives listed at the bottom of the attachment.

Aaron Goddard

- 2001Summer.doc

');

INSERT INTO

email([from],[to],subject,body) VALUES('rhonda.denton@enron.com', 'tim.belden@enron.com, dana.davis@enron.com, genia.fitzgerald@enron.com,', 'Split Rock Energy LLC', 'We have received the executed EEI contract from this CP dated 12/12/2000.

Copies will be distributed to Legal and Credit.');

INSERT INTO email([from],[to],subject,body) VALUES('kerrymcelroy@dwt.com', 'jack.speer@alcoa.com, crow@millernash.com, michaelearly@earthlink.net,', 'Oral Argument Request', ' - Oral Argument Request.doc');

INSERT INTO email([from],[to],subject,body) VALUES('mike.carson@enron.com', 'rlmichaelis@hormel.com', 'Did you come in town this wk end..... My new number at our house is : 713-668-3712..... my cell # is 281-381-7332

the kid');

INSERT INTO email([from],[to],subject,body) VALUES('cooper.richey@enron.com', 'trycooper@hotmail.com', 'FW: Contact Info', '

-----Original Message-----

From: Punja, Karim

Sent: Thursday, December 13, 2001 2:35 PM

To: Richey, Cooper

Subject: Contact Info

Cooper,

Its

been a real pleasure working with you (even though it was for only a small amount of time)

I hope we can stay in touch.

Home# 234-0249

email: kpunja@hotmail.com

Take Care,

Karim.

');

INSERT INTO email([from],[to],subject,body) VALUES('bjm30@earthlink.net', 'mcguinn.k@enron.com, mcguinn.ian@enron.com, mcguinn.stephen@enron.com,', 'email address change', 'Hello all.

I haven't talked to many of you via email recently but I do want to give you my new address for your email file:

bjm30@earthlink.net

I hope all is well.

Brian McGuinn');

INSERT INTO email([from],[to],subject,body) VALUES('shelley.corman@enron.com', 'steve.hotte@enron.com', 'Flat Panels', 'Can you please advise what is going on with the flat panels that we had planned to distribute to our gas logistics team. It was in the budget and we had the okay, but now I'm hearing there is some hold-up & the units are stored on 44.

Shelley');

INSERT INTO email([from],[to],subject,body) VALUES('sara.davidson@enron.com', 'john.schwartzenburg@enron.com, scott.dieball@enron.com, recipients@enron.com,', '2001 Enron Law Conference (Distribution List 2)', ' Enron Law Conference

San Antonio, Texas May 2-4, 2001 Westin Riverwalk

See attached memo for more details!!



? Registration for the law conference this year will be handled through an Online RSVP Form on the Enron Law Conference Website at <http://lawconference.corp.enron.com>. The website is still under construction and will not be available until Thursday, March 15, 2001.

? We will send you another e-mail to confirm when the Law Conference Website is operational.

? Please complete the Online RSVP Form as soon as it is available and submit it no later than Friday, March 30th.

');

INSERT INTO email([from],[to],subject,body) VALUES('tori.kuykendall@enron.com', 'heath.b.taylor@accenture.com', 'Re:', 'hey - thats funny about john - he definitely remembers him - i'll call pat and let him know - we are coming on saturday - i just havent had a chance to call you guys back -- looking forward to it -- i probably need the directions again though');

INSERT INTO email([from],[to],subject,body) VALUES('darron.giron@enron.com', 'bryce.baxter@enron.com', 'Re: Feedback for Audrey Cook', 'Bryce,

I'll get it done today.

DG 3-9573

From: Bryce Baxter 06/12/2000 07:15 PM

To: Darron C Giron/HOU/ECT@ECT

cc:

Subject: Feedback for Audrey Cook

You were identified as a reviewer for Audrey Cook. If possible, could you complete her feedback by end of business Wednesday? It will really help me in the PRC process to have your input. Thanks.

');

INSERT INTO email([from],[to],subject,body) VALUES('casey.evans@enron.com', 'stephanie.sever@enron.com', 'Gas EOL ID', 'Stephanie,

In conjunction with the recent movement of several power traders, they are changing the names of their gas books as well. The names of the new gas books and traders are as follows:

PWR-NG-LT-SPP:

Mike Carson

PWR-NG-LT-SERC: Jeff King

If you need to know their power desk to map their ID to their gas books, those desks are as follows:

EPMI-LT-SPP: Mike Carson

EPMI-LT-SERC: Jeff King

I will be in training this afternoon, but will be back when class is over. Let me know if you have any questions.

Thanks for your help!

Casey');

INSERT INTO email([from],[to],subject,body) VALUES('darrell.schoolcraft@enron.com',  
'david.roensch@enron.com, kimberly.watson@enron.com, michelle.lokay@enron.com,', 'Postings', 'Please see the  
attached.

ds

');

INSERT INTO email([from],[to],subject,body) VALUES('mcominsky@aol.com', 'cpatman@bracepatt.com,  
james\_derrick@enron.com', 'Jurisprudence Luncheon', 'Carrin & Jim --

It was an honor and a pleasure to meet both of you yesterday. I know we will have fun working together on this very special event.

Jeff left the jurisprudence luncheon lists for me before he left on vacation.

I wasn't sure whether he transmitted them

to you as well. Would you please

advise me if you would like them sent to you? I can email the MS Excel files or I can fax the hard copies to you. Please advise what is most convenient.

I plan to be in town through the holidays and can be reached by phone, email, or cell phone at any time. My cell phone number is 713/705-4829.

Thanks again for your interest in the ADL's work. Martin.

Martin B. Cominsky

Director, Southwest Region

Anti-Defamation League

713/627-3490, ext. 122

713/627-2011 (fax)

MCominsky@aol.com');

INSERT INTO email([from],[to],subject,body) VALUES('phillip.love@enron.com', 'todagost@utmb.edu, gbsonnta@utmb.edu', 'New President', 'I had a little bird put a word in my ear. Is there any possibility for Ben Raimer to be Bush's secretary of HHS? Just curious about that infamous UTMB rumor mill. Hope things are well, happy holidays.

PL');

INSERT INTO email([from],[to],subject,body) VALUES('marie.heard@enron.com', 'ehamilton@fna.com', 'ISDA Master Agreement',

'Erin:

Pursuant to your request, attached are the Schedule to the ISDA Master Agreement, together with Paragraph 13 to the ISDA Credit Support Annex. Please let me know if you need anything else. We look forward to hearing your comments.

Marie

Marie Heard

Senior Legal Specialist

Enron North America Corp.

Phone: (713) 853-3907

Fax: (713) 646-3490

marie.heard@enron.com

');

INSERT INTO email([from],[to],subject,body) VALUES('andrea.ring@enron.com', 'beverly.beaty@enron.com', 'Re: Tennessee Buy - Louis Dreyfus', 'Beverly - once again thanks so much for your help on this.

');

INSERT INTO email([from],[to],subject,body) VALUES('karolyn.criado@enron.com', 'j.bonin@enron.com, felicia.case@enron.com, b.clapp@enron.com,', 'Price List week of Oct. 8-9, 2001', '

Please contact me if you have any questions regarding last weeks prices.

Thank you,

Karolyn Criado

3-9441

');

INSERT INTO email([from],[to],subject,body)

VALUES('kevin.presto@enron.com', 'edward.baughman@enron.com, billy.braddock@enron.com', 'Associated',

'Please begin working on filling our Associated short position in 02. I would like to take this risk off the books.

In addition, please find out what a buy-out of VEPCO would cost us. With Rogers transitioning to run our retail risk management, I would like to clean up our customer positions.

We also need to continue to explore a JEA buy-out.

Thanks.');

```
INSERT INTO email([from],[to],subject,body) VALUES('stacy.dickson@enron.com', 'gregg.penman@enron.com', 'RE: Constellation TC 5-7-01', 'Gregg,
```

I am at home with a sick baby. (Lots of fun!) I will call you about this tomorrow.

Stacy');

```
INSERT INTO email([from],[to],subject,body) VALUES('joe.quenet@enron.com', 'dfincher@utilicorp.com', '', 'hey big guy.....check this out.....
```

```
w ww.gorelieberman-2000.com/');
```

```
INSERT INTO email([from],[to],subject,body) VALUES('k..allen@enron.com', 'jacqestc@aol.com', '', 'Jacques,
```

I sent you a fax of Kevin Kolb's comments on the release. The payoff on the note would be \$36,248 (\$36090(principal) + \$158 (accrued interest)).

This is assuming we wrap this up on Tuesday.

Please email to confirm that their changes are ok so I can set up a meeting on Tuesday to reach closure.

Phillip');

```
INSERT INTO email([from],[to],subject,body) VALUES('kourtney.nelson@enron.com', 'mike.swerzbin@enron.com', 'Adjusted L/R Balance', 'Mike,
```

I placed the adjusted L/R Balance on the Enronwest site. It is under the "Staff/Kourtney Nelson". There are two links:

- 1) "Adj L\_R" is the same data/format from the weekly strategy meeting.
- 2) "New Gen 2001\_2002" link has all of the supply side info that is used to calculate the L/R balance -Please note the Data Flag column, a value of "3" indicates the project was cancelled, on hold, etc and is not included in the calc.

Both of these sheets are interactive Excel spreadsheets and thus you can play around with the data as you please. Also, James Bruce is working to get his gen report on the web. That will help with your access to information on new gen.

Please let me know if you have any questions or feedback,

Kourtney

Kourtney Nelson  
Fundamental Analysis  
Enron North America  
(503) 464-8280  
kourtney.nelson@enron.com');  
INSERT INTO email([from],[to],subject,body) VALUES('d.thomas@enron.com', 'naveed.ahmed@enron.com',  
'FW: Current Enron TCC Portfolio', '

-----Original Message-----

From: Grace, Rebecca M.  
Sent: Monday, December 17, 2001 9:44 AM  
To: Thomas, Paul D.  
Cc: Cashion, Jim; Allen, Thresa A.; May, Tom  
Subject: RE: Current Enron TCC Portfolio

Paul,

I reviewed NY's list. I agree with all of their contracts numbers and mw amounts.

Call if you have any more questions.

Rebecca

-----Original Message-----

From: Thomas, Paul D.  
Sent: Monday, December 17, 2001 9:08 AM  
To: Grace, Rebecca M.  
Subject: FW: Current Enron TCC Portfolio

<< File: enrontccs.xls >>

Rebecca,  
Let me know if  
you see any differences.

Paul  
X 3-0403

-----Original Message-----

From: Thomas, Paul D.  
Sent: Monday, December 17, 2001 9:04 AM  
To: Ahmed, Naveed  
Subject: FW: Current Enron TCC Portfolio

-----Original Message-----

From: Thomas, Paul D.  
Sent: Thursday, December 13, 2001 10:01 AM  
To: Baughman, Edward D.  
Subject: Current Enron TCC Portfolio

);  
INSERT INTO email([from],[to],subject,body) VALUES('stephanie.panus@enron.com',  
'william.bradford@enron.com, debbie.brackett@enron.com,', 'Coastal Merchant Energy/El Paso Merchant Energy',  
'Coastal Merchant Energy, L.P. merged with and into El Paso Merchant Energy,  
L.P., effective February 1, 2001, with the surviving entity being El Paso  
Merchant Energy, L.P. We currently have ISDA Master Agreements with both  
counterparties. Please see the attached memo regarding the existing Masters  
and let us know which agreement should be terminated.

Thanks,  
Stephanie

);  
INSERT INTO email([from],[to],subject,body) VALUES('kam.keiser@enron.com',  
'c..kenne@enron.com', 'RE: What about this too???' , '

-----Original Message-----

From: Kenne, Dawn C.  
Sent: Wednesday, February 06, 2002 11:50 AM  
To: Keiser, Kam  
Subject: What about this too???

<< File: Netco Trader Matrix.xls >>

);  
INSERT INTO email([from],[to],subject,body) VALUES('chris.meyer@enron.com', 'joe.parks@enron.com',  
'Centana', 'Talked to Chip. We do need Cash Committe approval given the netting feature of your deal, which  
means Batch Funding Request. Please update per my previous e-mail and forward.

Thanks

chris  
x31666');  
INSERT INTO email([from],[to],subject,body) VALUES('debra.perlingiere@enron.com',  
'jworman@academyofhealth.com', ", 'Have a great weekend! Happy Fathers Day!

Debra Perlingiere  
Enron North America Corp.  
1400 Smith Street, EB 3885  
Houston, Texas 77002  
dperlin@enron.com

Phone 713-853-7658

Fax 713-646-3490);

INSERT INTO email([from],[to],subject,body) VALUES('outlook.team@enron.com', ', 'Demo by Martha Janousek of Dashboard & Pipeline Profile / Julia &', 'CALENDAR ENTRY: APPOINTMENT

Description:

Demo by Martha Janousek of Dashboard & Pipeline Profile / Julia & Dir Rpts. - 4102

Date: 1/5/2001

Time: 9:00 AM - 10:00 AM (Central Standard Time)

Chairperson: Outlook Migration Team

Detailed Description:');

INSERT INTO email([from],[to],subject,body) VALUES('diana.seifert@enron.com', 'mark.taylor@enron.com', 'Guest access Chile', 'Hello Mark,

Justin Boyd told me that your can help me with questions regarding Chile.

We got a request for guest access through MG.

The company is called Escondida and is a subsidiary of BHP Australia.

Please advise if I can set up a guest account or not.

F.Y.I.: MG is planning to put a "in w/h Chile" contract for Copper on-line as soon as Enron has done the due diligence for this country.

Thanks !

Best regards

Diana Seifert

EOL PCG');

INSERT INTO email([from],[to],subject,body) VALUES('enron\_update@concuere workplace.com', 'mark.whitt@enron.com', '<<Concur Expense Document>> - 121001',

'The Approval status has changed on the following report:

Status last changed by: Barry L. Tycholiz

Expense Report Name: 121001

Report Total: \$198.98

Amount Due Employee: \$198.98

Amount Approved: \$198.98

Amount Paid: \$0.00

Approval Status: Approved

Payment Status: Pending

To review this expense report, click on the following link for Concur Expense.

<http://expense.ms.enron.com>);

INSERT INTO email([from],[to],subject,body) VALUES('kevin.hyatt@enron.com', '', 'Technical Support', 'Outside the U.S., please refer to the list below:

Australia:

1800 678-515

support@palm-au.com

Canada:

1905 305-6530

support@palm.com

New Zealand:

0800 446-398

support@palm-nz.com

U.K.:

0171 867 0108

eurosupport@palm.3com.com

Please refer to the Worldwide Customer Support card for a complete technical support contact list.');

INSERT INTO email([from],[to],subject,body) VALUES('geoff.storey@enron.com', 'dutch.quigley@enron.com', 'RE:', 'duke contact?')

-----Original Message-----

From: Quigley, Dutch

Sent: Wednesday, October 31, 2001 10:14 AM

To: Storey, Geoff

Subject: RE:

bp corp Albert LaMore 281-366-4962

running the reports now

-----Original Message-----

From: Storey, Geoff

Sent: Wednesday, October 31, 2001 10:10 AM

To: Quigley, Dutch

Subject: RE:

give me a contact over there too

BP

-----Original Message-----

From: Quigley, Dutch

Sent: Wednesday, October 31, 2001 9:42 AM



To: Storey, Geoff

Subject:

Coral Jeff Whitnah 713-767-5374

Relaint Steve McGinn 713-207-4000);

INSERT INTO email([from],[to],subject,body) VALUES('pete.davis@enron.com', 'pete.davis@enron.com', 'Start Date: 4/22/01; HourAhead hour: 3; <CODESITE>', 'Start Date: 4/22/01; HourAhead hour: 3; No ancillary schedules awarded.

Variances detected.

Variances detected in Load schedule.

LOG MESSAGES:

PARSING FILE -->> O:\Portland\WestDesk\California Scheduling\ISO Final Schedules\2001042203.txt

---- Load Schedule ----

\$\$\$ Variance found in table tblLoads.

Details: (Hour: 3 / Preferred:

1.92 / Final: 1.89)

TRANS\_TYPE: FINAL

LOAD\_ID: PGE4

MKT\_TYPE: 2

TRANS\_DATE: 4/22/01

SC\_ID: EPMI

);

INSERT INTO email([from],[to],subject,body) VALUES('john.postlethwaite@enron.com', 'john.zufferli@enron.com', 'Reference', 'John, hope things are going well up there for you. The big day is almost here for you and Jessica. I was wondering if I could use your name as a job reference if need be. I am just trying to get everything in order just in case something happens.

John);

INSERT INTO email([from],[to],subject,body) VALUES('jeffrey.shankman@enron.com', 'Ischiffm@jonesday.com', 'Re:', 'I saw you called on the cell this a.m. Sorry I missed you. (I was in the shower). I have had a shitty week--I suspect my silence (not only to you, but others) after our phone call is a result of the week. I'm seeing Glen at 11:15....talk to you');

INSERT INTO email([from],[to],subject,body) VALUES('litebytz@enron.com', ', ', 'Lite Bytz RSVP', ' This week's Lite Bytz presentation will feature the following TOOLZ speaker:

Richard McDougall

Solaris 8

Thursday, June 7, 2001

If you have not already signed up, please RSVP via email to [litebytz@enron.com](mailto:litebytz@enron.com) by the end of the day Tuesday, June 5, 2001.

\*Remember: this is now a Brown Bag Event--so bring your lunch and we will provide cookies and drinks.

Click below for more details.

<http://home.enron.com:84/messaging/litebytzttoolzprint.jpg>);

```
    COMMIT;
  }
} {}
```

```
#####
# Everything above just builds an interesting test database.  The actual
# tests come after this comment.
#####
```

```
do_test fts2c-1.2 {
  execsql {
    SELECT rowid FROM email WHERE email MATCH 'mark'
  }
} {6 17 25 38 40 42 73 74}
do_test fts2c-1.3 {
  execsql {
    SELECT rowid FROM email WHERE email MATCH 'susan'
  }
} {24 40}
do_test fts2c-1.4 {
  execsql {
    SELECT rowid FROM email WHERE email MATCH 'mark
susan'
  }
} {40}
do_test fts2c-1.5 {
  execsql {
    SELECT rowid FROM email WHERE email MATCH 'susan mark'
  }
} {40}
do_test fts2c-1.6 {
  execsql {
    SELECT rowid FROM email WHERE email MATCH "'mark susan'"
  }
} {}
do_test fts2c-1.7 {
  execsql {
    SELECT rowid FROM email WHERE email MATCH 'mark -susan'
  }
} {6 17 25 38 42 73 74}
do_test fts2c-1.8 {
  execsql {
```

```

SELECT rowid FROM email WHERE email MATCH '-mark susan'
}
} {24}
do_test fts2c-1.9 {
execsql {
SELECT rowid FROM email WHERE email MATCH 'mark OR susan'
}
} {6 17 24 25 38 40 42 73 74}

```

# Some simple tests of the automatic "offsets(email)" column. In the sample  
# data set above, only one message, number 20, contains the words  
# "gas" and "reminder" in both body and subject.  
#

```

do_test fts2c-2.1 {
execsql {
SELECT rowid, offsets(email) FROM email
WHERE email MATCH 'gas reminder'
}
} {20 {2 0 42 3 2 1 54 8 3 0 42 3 3 1 54 8 3 0 129 3 3 0 143 3 3 0 240 3}}
do_test fts2c-2.2 {
execsql {

```

```

SELECT rowid, offsets(email) FROM email
WHERE email MATCH 'subject:gas reminder'
}
} {20 {2 0 42 3 2 1 54 8 3 1 54 8}}

```

```

do_test fts2c-2.3 {
execsql {
SELECT rowid, offsets(email) FROM email
WHERE email MATCH 'body:gas reminder'
}
} {20 {2 1 54 8 3 0 42 3 3 1 54 8 3 0 129 3 3 0 143 3 3 0 240 3}}

```

```

do_test fts2c-2.4 {
execsql {
SELECT rowid, offsets(email) FROM email
WHERE subject MATCH 'gas reminder'
}
} {20 {2 0 42 3 2 1 54 8}}

```

```

do_test fts2c-2.5 {
execsql {
SELECT rowid, offsets(email) FROM email
WHERE body MATCH 'gas reminder'
}
} {20 {3 0 42 3 3 1 54 8 3 0 129 3 3 0 143 3 3 0 240 3}}

```

# Document 32 contains 5 instances of the word "child". But only  
# 3 of them are paired with "product". Make sure only those instances  
# that match the phrase appear in the offsets(email) list.

```

#
do_test fts2c-3.1 {
  execsql {
    SELECT rowid, offsets(email) FROM email
    WHERE body MATCH 'child product' AND +rowid=32
  }
} {32 {3 0 94 5 3 0 114 5 3 0
207 5 3 1 213 7 3 0 245 5 3 1 251 7 3 0 409 5 3 1 415 7 3 1 493 7}}
do_test fts2c-3.2 {
  execsql {
    SELECT rowid, offsets(email) FROM email
    WHERE body MATCH "'child product'"
  }
} {32 {3 0 207 5 3 1 213 7 3 0 245 5 3 1 251 7 3 0 409 5 3 1 415 7}}

# Snippet generator tests
#
do_test fts2c-4.1 {
  execsql {
    SELECT snippet(email) FROM email
    WHERE email MATCH 'subject:gas reminder'
  }
} {{Alert Posted 10:00 AM November 20,2000: E-<b>GAS</b> Request <b>Reminder</b>}}
do_test fts2c-4.2 {
  execsql {
    SELECT snippet(email) FROM email
    WHERE email MATCH 'christmas candlelight'
  }
} {{<b>...</b> place.? What do you think about going here <b>Christmas</b>
eve?? They have an 11:00 a.m. service and a <b>candlelight</b> service at 5:00 p.m.,
among others. <b>...</b>}}

do_test fts2c-4.3 {
  execsql {
    SELECT snippet(email) FROM email
    WHERE email MATCH 'deal sheet potential reuse'
  }
} {{EOL-Accenture <b>Deal</b> <b>Sheet</b> <b>...</b> intent
Review Enron
asset base for <b>potential</b> <b>reuse</b>/ licensing
Contract negotiations <b>...</b>}}
do_test fts2c-4.4 {
  execsql {
    SELECT snippet(email,'<<<','>>>',') FROM email
    WHERE email MATCH 'deal sheet potential reuse'
  }
} {{EOL-Accenture <<<Deal>>> <<<Sheet>>> intent
Review Enron asset base for <<<potential>>> <<<reuse>>>/ licensing

```

```

Contract negotiations }}
do_test fts2c-4.5 {
execsql {
SELECT snippet(email,'<<<','>>>',') FROM email
WHERE email MATCH 'first things'
}
} {{Re: <<<First>>> Polish Deal! Congrats! <<<Things>>> seem to be building rapidly now on the }}
do_test fts2c-4.6 {
execsql {
SELECT snippet(email) FROM email
WHERE email MATCH 'chris is here'
}
} {{<b>chris</b>.germany@enron.com <b>...</b> Sounds good to me. I bet this <b>is</b> next to the Warick??
Hotel. <b>...</b> place.? What do you think about going <b>here</b> Christmas
eve?? They have an 11:00 a.m. <b>...</b>}}
do_test fts2c-4.7 {
execsql {
SELECT
snippet(email) FROM email
WHERE email MATCH "'pursuant to'"
}
} {{Erin:

<b>Pursuant</b> <b>to</b> your request, attached are the Schedule to <b>...</b>}}
do_test fts2c-4.8 {
execsql {
SELECT snippet(email) FROM email
WHERE email MATCH 'ancillary load davis'
}
} {{pete.<b>davis</b>@enron.com <b>...</b> Start Date: 4/22/01; HourAhead hour: 3; No <b>ancillary</b>
schedules awarded.
Variances detected.
Variances detected in <b>Load</b> schedule.

LOG MESSAGES:

PARSING <b>...</b>}}

# Combinations of AND and OR operators:
#
do_test fts2c-5.1 {
execsql {
SELECT snippet(email) FROM email
WHERE email MATCH 'questar enron OR com'
}
} {{matt.smith@<b>enron</b>.<b>com</b> <b>...</b> six reports:

```

31 Keystone Receipts

```
15 <b>Questar</b> Pipeline
40 Rockies Production
22 West_2 <b>...</b>}}
do_test fts2c-5.2 {
  execsql {
    SELECT snippet(email) FROM email
    WHERE email MATCH 'enron OR com questar'
  }
} { {matt.smith@<b>enron</b>.<b>com</b> <b>...</b>
six reports:
```

```
31 Keystone Receipts
15 <b>Questar</b> Pipeline
40 Rockies Production
22 West_2 <b>...</b>}}
```

finish\_test

Found in path(s):

```
* /opt/cola/permits/1332727043_1653392698.341362/0/sqlite-3-3-17-tar-gz/sqlite-3.3.17/test/fts2c.test
No license file was found, but licenses were detected in source scan.
```

```
%define name sqlite
%define version SQLITE_VERSION
%define release 1
```

```
Name: % {name}
Summary: SQLite is a C library that implements an embeddable SQL database engine
Version: % {version}
Release: % {release}
Source: % {name}-% {version}.tar.gz
Group: System/Libraries
URL: http://www.hwaci.com/sw/sqlite/
License: Public Domain
BuildRoot: % {_tmppath}/% {name}-% {version}-root
```

```
%description
SQLite is a C library that implements an embeddable SQL database engine.
Programs that link with the SQLite library can have SQL database access
without running a separate RDBMS process. The distribution comes with a
standalone command-line access program (sqlite) that can be used to
administer an SQLite database and which serves as an example of how to
use the SQLite library.
```

```
%package -n % {name}-devel
Summary: Header files and libraries for developing apps which will use sqlite
Group: Development/C
Requires: % {name} = % {version}-% {release}
```

```

%description
-n %{name}-devel
The sqlite-devel package contains the header files and libraries needed
to develop programs that use the sqlite database library.

%prep
%setup -q -n %{name}

%build
CFLAGS="%optflags -DNDEBUG=1" CXXFLAGS="%optflags -DNDEBUG=1" ./configure --prefix=%{_prefix}

make
make doc

%install
install -d $RPM_BUILD_ROOT/%{_prefix}
install -d $RPM_BUILD_ROOT/%{_prefix}/bin
install -d $RPM_BUILD_ROOT/%{_prefix}/include
install -d $RPM_BUILD_ROOT/%{_prefix}/lib
make install prefix=$RPM_BUILD_ROOT/%{_prefix}

%clean
rm -fr $RPM_BUILD_ROOT

%files
%defattr(-, root, root)
%{_libdir}/*.so*
%{_bindir}/*

%files -n %{name}-devel
%defattr(-, root, root)
%{_libdir}/pkgconfig/sqlite3.pc
%{_libdir}/*.a
%{_libdir}/*.la
%{_includedir}/*
%doc doc/*

Found in path(s):
* /opt/cola/permits/1332727043_1653392698.341362/0/sqlite-3-3-17-tar-gz/sqlite-3.3.17/spec.template
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Found in path(s):
* /opt/cola/permits/1332727043_1653392698.341362/0/sqlite-3-3-17-tar-gz/sqlite-3.3.17/www/index.tcl
No license file was found, but licenses were detected in source scan.

```

feature license {Public domain} {

The source code for SQLite is in the public domain. No claim of copyright

Found in path(s):

\* /opt/cola/permits/1332727043\_1653392698.341362/0/sqlite-3-3-17-tar-gz/sqlite-3.3.17/www/different.tcl

No license file was found, but licenses were detected in source scan.

/\*

\*\* The "printf" code that follows dates from the 1980's. It is in  
\*\* the public domain. The original comments are included here for  
\*\* completeness. They are very out-of-date but might be useful as  
\*\* an historical reference. Most of the "enhancements" have been backed  
\*\* out so that the functionality is now the same as standard printf().

\*\*

\*\*\*\*\*

\*\*

\*\* The following modules is an enhanced replacement for the "printf" subroutines  
\*\* found in the standard C library. The following enhancements are  
\*\* supported:

\*\*

\*\* + Additional functions. The standard set of "printf" functions  
\*\* includes printf, fprintf, sprintf, vprintf, vfprintf, and  
\*\* vsprintf. This module adds the following:

\*\*

\*\* \* snprintf -- Works like sprintf, but has an extra argument  
\*\* which is the size of the buffer written

to.

\*\*

\*\* \* mprintf -- Similar to sprintf. Writes output to memory  
\*\* obtained from malloc.

\*\*

\*\* \* xprintf -- Calls a function to dispose of output.

\*\*

\*\* \* nprintf -- No output, but returns the number of characters  
\*\* that would have been output by printf.

\*\*

\*\* \* A v- version (ex: vsnprintf) of every function is also  
\*\* supplied.

\*\*

\*\* + A few extensions to the formatting notation are supported:

\*\*

\*\* \* The "=" flag (similar to "-") causes the output to be  
\*\* be centered in the appropriately sized field.

\*\*

\*\* \* The %b field outputs an integer in binary notation.

\*\*

\*\* \* The %c field now accepts a precision. The character output  
\*\* is repeated by the number of times the precision specifies.



```
**
**      * The '%' field works like %c, but takes as its character the
**      next character of the
format string, instead of the next
**      argument. For example, printf("%.78'") prints 78 minus
**      signs, the same as printf("%.78c",'-').
**
** + When compiled using GCC on a SPARC, this version of printf is
**   faster than the library printf for SUN OS 4.1.
**
** + All functions are fully reentrant.
**
**/
```

Found in path(s):

```
* /opt/cola/permits/1332727043_1653392698.341362/0/sqlite-3-3-17-tar-gz/sqlite-3.3.17/src/printf.c
No license file was found, but licenses were detected in source scan.
```

public domain.</li>

Found in path(s):

```
* /opt/cola/permits/1332727043_1653392698.341362/0/sqlite-3-3-17-tar-gz/sqlite-3.3.17/www/changes.tcl
No license file was found, but licenses were detected in source scan.
```

<html>

<body bgcolor="white">

<h1 align="center">

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Contributions To SQLite

</h1>

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</p>

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</p>

<ol>

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I agree never to copy and paste code into the SQLite code base from other sources.

I agree never to publish on the SQLite website any information that would violate a law or breach a contract.

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</ol>

<p>

<table width="100%" cellpadding="0" cellspacing="0">

<tr>

<td width="60%" valign="top">

Signature:

<p>&nbsp;</p>

<p>&nbsp;</p>

<p>&nbsp;</p>

</td><td valign="top" align="left">

Date:

</td></tr>

<td colspan=2>

Name (printed):

</td>

</tr>

</table>

</body>

</html>

Found

in path(s):

\* /opt/cola/permits/1332727043\_1653392698.341362/0/sqlite-3-3-17-tar-gz/sqlite-3.3.17/www/copyright-release.html

# 1.139 libnsl 2.24

## 1.139.1 Available under license :

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Version 2.1, February 1999

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# 1.140 smartmontools 5.39

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## 1.141 vim 7.3

### 1.141.1 Available under license :

\*uganda.txt\* For Vim version 7.3. Last change: 2010 Aug 07

VIM REFERENCE MANUAL by Bram Moolenaar

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SUMMARY

\*iccf\* \*ICCF\*

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=====  
Kibaale Children's Centre \*kcc\* \*Kibaale\* \*charity\*

Kibaale Children's Centre (KCC) is located in Kibaale, a small town in the south of Uganda, near Tanzania, in East Africa. The area is known as Rakai District. The population is mostly farmers. Although people are poor, there is enough food. But this district is suffering from AIDS more than any other part of the world. Some say that it started there. Estimations are that 10 to 30% of the Ugandans are infected with HIV. Because parents die, there are many orphans. In this district about 60,000 children have lost one or both parents, out of a population of 350,000. And this is still continuing.

The children need a lot of help. The KCC is working hard to provide the needy with food, medical care and education. Food and medical care to keep them healthy now, and education so that they can take care of themselves in the future. KCC works on a Christian base, but help is given to children of any religion.

The key to solving the problems in this area is education. This has been

neglected in the past years with president Idi Amin and the following civil wars. Now that the government is stable again, the children and parents have to learn how to take care of themselves and how to avoid infections. There is also help for people who are ill and hungry, but the primary goal is to prevent people from getting ill and to teach them how to grow healthy food.

Most of the orphans are living in an extended family. An uncle or older sister is taking care of them. Because these families are big and the income (if any) is low, a child is lucky if it gets healthy food. Clothes, medical care and schooling is beyond its reach. To help these needy children, a sponsorship program was put into place. A child can be financially adopted. For a few dollars a month KCC sees to it that the child gets indispensable items, is healthy, goes to school and KCC takes care of anything else that needs to be done for the child and the family that supports it.

Besides helping the child directly, the environment where the child grows up needs to be improved. KCC helps schools to improve their teaching methods. There is a demonstration school at the centre and teacher trainings are given. Health workers are being trained, hygiene education is carried out and households are stimulated to build a proper latrine. I helped setting up a production site for cement slabs. These are used to build a good latrine. They are sold below cost price.

There is a small clinic at the project, which provides children and their family with medical help. When needed, transport to a hospital is offered. Immunization programs are carried out and help is provided when an epidemic is breaking out (measles and cholera have been a problem).

\*donate\*

Summer 1994 to summer 1995 I spent a whole year at the centre, working as a volunteer. I have helped to expand the centre and worked in the area of water and sanitation. I learned that the help that the KCC provides really helps. When I came back to Holland, I wanted to continue supporting KCC. To do this I'm raising funds and organizing the sponsorship program. Please consider one of these possibilities:

1. Sponsor a child in primary school: 17 euro a month (or more).
2. Sponsor a child in secondary school: 25 euro a month (or more).
3. Sponsor the clinic: Any amount a month or quarter
4. A one-time donation

Compared with other organizations that do child sponsorship the amounts are very low. This is because the money goes directly to the centre. Less than 5% is used for administration. This is possible because this is a small organization that works with volunteers. If you would like to sponsor a child, you should have the intention to do this for at least one year.

How do you know that the money will be spent right? First of all you have my personal guarantee as the author of Vim. I trust the people that are working at the centre, I know them personally. Further more, the centre has been co-sponsored and inspected by World Vision, Save the Children Fund and is now under the supervision of Pacific Academy Outreach Society. The centre is visited about once a year to check the progress (at our own cost). I have visited the centre myself many times, starting in 1993. The visit reports are on the ICCF web site.

If you have any further questions, send me e-mail: <Bram@vim.org>.

The address of the centre is:

Kibaale Children's Centre  
p.o.  
box 1658  
Masaka, Uganda, East Africa

Sending money: \*iccf-donations\*

Check the ICCF web site for the latest information! See |iccf| for the URL.

USA: The methods mentioned below can be used.

Sending a check to the Nehemiah Group Outreach Society (NGOS) is no longer possible, unfortunately. We are looking for another way to get you an IRS tax receipt.

For sponsoring a child contact KCF in Canada (see below). US checks can be sent to them to lower banking costs.

Canada: Contact Kibaale Children's Fund (KCF) in Surrey, Canada. They take care of the Canadian sponsors for the children in Kibaale. KCF forwards 100% of the money to the project in Uganda. You can send them a one time donation directly. Please send me a note so that I know what has been donated because of Vim. Ask KCF for information about sponsorship.

Kibaale Children's Fund c/o Pacific Academy  
10238-168 Street  
Surrey, B.C. V4N 1Z4  
Canada  
Phone: 604-581-5353

If you make a donation to Kibaale Children's Fund (KCF) you will receive a tax receipt which can be submitted with your tax return.

Holland: Transfer to the account of "Stichting ICCF Holland" in Lisse.

This will allow for tax deduction if you live in Holland.

Postbank, nr. 4548774

Germany: It is possible to make donations that allow for a tax return.

Check the ICCF web site for the latest information:

<http://iccf-holland.org/germany.html>

World: Use a postal money order. That should be possible from any country, mostly from the post office. Use this name (which is in my passport): "Abraham Moolenaar". Use Euro for the currency if possible.

Europe: Use a bank transfer if possible. Your bank should have a form that you can use for this. See "Others" below for the swift code and IBAN number.

Any other method should work. Ask for information about sponsorship.

Credit Card: You can use PayPal to send money with a Credit card. This is the most widely

used Internet based payment system. It's really simple to use. Use this link to find more info:

[https://www.paypal.com/en\\_US/mrb/pal=XAC62PML3GF8Q](https://www.paypal.com/en_US/mrb/pal=XAC62PML3GF8Q)

The e-mail address for sending the money to is:

[Bram@iccf-holland.org](mailto:Bram@iccf-holland.org)

For amounts above 400 Euro (\$500) sending a check is preferred.

Others: Transfer to one of these accounts if possible:

Postbank, account 4548774

Swift code: INGB NL 2A

IBAN: NL47 PSTB 0004 5487 74

under the name "stichting ICCF Holland", Lisse

If that doesn't work:

Rabobank Lisse, account 3765.05.117

Swift code: RABO NL 2U

under the name "Bram Moolenaar", Lisse

Otherwise, send a check in euro or US dollars to the address below. Minimal amount: \$70 (my bank does not accept smaller amounts for foreign check, sorry)

Address to send checks to:

stichting ICCF Holland

Bram Moolenaar

Finsterruetihof 1

8134 Adliswil

Switzerland

This address is expected to be valid for a long time.

# 1.142 Isof 4.83

## 1.142.1 Available under license :

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\* /opt/cola/permits/1350150906\_1655994764.9225438/0/lsof-4-83-r1-2-tar-gz/lsof\_4.83\_src/lib/regex.c

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tar/lsof_4.83_src/dialects/freebsd/dnode2.c
* /opt/cola/permits/1350150906_1655994764.9225438/0/lsof-4-83-r1-2-tar-gz/lsof_4.83_src/util.c
* /opt/cola/permits/1350150906_1655994764.9225438/0/lsof-4-83-r1-2-tar-gz/lsof_4.83_src/dialects/freebsd/dzfs.h
* /opt/cola/permits/1350150906_1655994764.9225438/0/lsof-4-83-r1-2-tar-gz/lsof_4.83/lsof-4-83-src-
tar/lsof_4.83_src/dialects/freebsd/dzfs.h
* /opt/cola/permits/1350150906_1655994764.9225438/0/lsof-4-83-r1-2-tar-
gz/lsof_4.83_src/dialects/freebsd/dnode2.c
* /opt/cola/permits/1350150906_1655994764.9225438/0/lsof-4-83-r1-2-tar-gz/lsof_4.83/lsof-4-83-src-
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\*  
/opt/cola/permits/1350150906\_1655994764.9225438/0/lsf-4-83-r1-2-tar-gz/lsf\_4.83\_src/dialects/n+obsd/dnode1.c  
\* /opt/cola/permits/1350150906\_1655994764.9225438/0/lsf-4-83-r1-2-tar-gz/lsf\_4.83\_src/dialects/osr/dfile.c  
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\* /opt/cola/permits/1350150906\_1655994764.9225438/0/lsf-4-83-r1-2-tar-gz/lsf\_4.83/lsf-4-83-src-tar/lsf\_4.83\_src/dialects/uw/dnode3.c  
\* /opt/cola/permits/1350150906\_1655994764.9225438/0/lsf-4-83-r1-2-tar-gz/lsf\_4.83\_src/lib/ckkv.c  
\* /opt/cola/permits/1350150906\_1655994764.9225438/0/lsf-4-83-r1-2-tar-gz/lsf\_4.83/lsf-4-83-src-tar/lsf\_4.83\_src/lib/ckkv.c  
\* /opt/cola/permits/1350150906\_1655994764.9225438/0/lsf-4-83-r1-2-tar-gz/lsf\_4.83\_src/dialects/uw/dnode3.c  
\* /opt/cola/permits/1350150906\_1655994764.9225438/0/lsf-4-83-r1-2-tar-gz/lsf\_4.83/lsf-4-83-src-tar/lsf\_4.83\_src/usage.c

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\*  
\*/

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Found in path(s):

\* /opt/cola/permits/1350150906\_1655994764.9225438/0/lsof-4-83-r1-2-tar-gz/lsof\_4.83/lsof-4-83-src-tar/lsof\_4.83\_src/proto.h  
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 \* /opt/cola/permits/1350150906\_1655994764.9225438/0/lsof-4-83-r1-2-tar-gz/lsof\_4.83\_src/dialects/n+obsd/machine.h  
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 \* /opt/cola/permits/1350150906\_1655994764.9225438/0/lsof-4-83-r1-2-tar-gz/lsof\_4.83/lsof-4-83-src-tar/lsof\_4.83\_src/dialects/aix/dnode.c  
 \* /opt/cola/permits/1350150906\_1655994764.9225438/0/lsof-4-83-r1-2-tar-gz/lsof\_4.83\_src/dialects/freebsd/dnode.c  
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* /opt/cola/permits/1350150906_1655994764.9225438/0/lsf-4-83-r1-2-tar-
gz/lsf_4.83_src/dialects/freebsd/machine.h
* /opt/cola/permits/1350150906_1655994764.9225438/0/lsf-4-83-r1-2-tar-gz/lsf_4.83/lsf-4-83-src-
tar/lsf_4.83_src/store.c
*
/opt/cola/permits/1350150906_1655994764.9225438/0/lsf-4-83-r1-2-tar-gz/lsf_4.83/lsf-4-83-src-
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* /opt/cola/permits/1350150906_1655994764.9225438/0/lsf-4-83-r1-2-tar-gz/lsf_4.83_src/dialects/du/dstore.c
* /opt/cola/permits/1350150906_1655994764.9225438/0/lsf-4-83-r1-2-tar-
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* /opt/cola/permits/1350150906_1655994764.9225438/0/lsf-4-83-r1-2-tar-gz/lsf_4.83_src/dialects/n+obsd/dlsof.h
* /opt/cola/permits/1350150906_1655994764.9225438/0/lsf-4-83-r1-2-tar-gz/lsf_4.83/lsf-4-83-src-
tar/lsf_4.83_src/dialects/n+os/dnode.c
* /opt/cola/permits/1350150906_1655994764.9225438/0/lsf-4-83-r1-2-tar-gz/lsf_4.83_src/arg.c
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tar/lsf_4.83_src/dialects/freebsd/machine.h
*
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* /opt/cola/permits/1350150906_1655994764.9225438/0/lsf-4-83-r1-2-tar-gz/lsf_4.83_src/dialects/sun/ddev.c
* /opt/cola/permits/1350150906_1655994764.9225438/0/lsf-4-83-r1-2-tar-
gz/lsf_4.83_src/dialects/darwin/kmem/dsock.c
* /opt/cola/permits/1350150906_1655994764.9225438/0/lsf-4-83-r1-2-tar-gz/lsf_4.83_src/dialects/du/dlsof.h
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* /opt/cola/permits/1350150906_1655994764.9225438/0/lsf-4-83-r1-2-tar-gz/lsf_4.83_src/dialects/aix/dstore.c
* /opt/cola/permits/1350150906_1655994764.9225438/0/lsf-4-83-r1-2-tar-gz/lsf_4.83_src/dialects/aix/dlsof.h
*

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/opt/cola/permits/1350150906_1655994764.9225438/0/lsf-4-83-r1-2-tar-
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* /opt/cola/permits/1350150906_1655994764.9225438/0/lsf-4-83-r1-2-tar-gz/lsf_4.83/lsf-4-83-src-
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* /opt/cola/permits/1350150906_1655994764.9225438/0/lsf-4-83-r1-2-tar-gz/lsf_4.83/lsf-4-83-src-
tar/lsf_4.83_src/lsf.h
* /opt/cola/permits/1350150906_1655994764.9225438/0/lsf-4-83-r1-2-tar-gz/lsf_4.83/lsf-4-83-src-
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* /opt/cola/permits/1350150906_1655994764.9225438/0/lsf-4-83-r1-2-tar-gz/lsf_4.83/lsf-4-83-src-
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*
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* /opt/cola/permits/1350150906_1655994764.9225438/0/lsf-4-83-r1-2-tar-gz/lsf_4.83_src/store.c
* /opt/cola/permits/1350150906_1655994764.9225438/0/lsf-4-83-r1-2-tar-gz/lsf_4.83_src/dialects/aix/dsock.c
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* /opt/cola/permits/1350150906_1655994764.9225438/0/lsf-4-83-r1-2-tar-
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*
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* /opt/cola/permits/1350150906_1655994764.9225438/0/lsf-4-83-r1-2-tar-gz/lsf_4.83_src/dialects/du/dnode.c
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* /opt/cola/permits/1350150906_1655994764.9225438/0/lsf-4-83-r1-2-tar-gz/lsf_4.83/lsf-4-83-src-
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/opt/cola/permits/1350150906_1655994764.9225438/0/lsf-4-83-r1-2-tar-gz/lsf_4.83/lsf-4-83-src-
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/opt/cola/permits/1350150906_1655994764.9225438/0/lsf-4-83-r1-2-tar-gz/lsf_4.83_src/dialects/aix/dfile.c
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* /opt/cola/permits/1350150906_1655994764.9225438/0/lsf-4-83-r1-2-tar-gz/lsf_4.83/lsf-4-83-src-
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* /opt/cola/permits/1350150906_1655994764.9225438/0/lsf-4-83-r1-2-tar-
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*
/opt/cola/permits/1350150906_1655994764.9225438/0/lsf-4-83-r1-2-tar-gz/lsf_4.83_src/dialects/du/dproc.c
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tar/lsf_4.83_src/misc.c
* /opt/cola/permits/1350150906_1655994764.9225438/0/lsf-4-83-r1-2-tar-gz/lsf_4.83/lsf-4-83-src-

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tar/lsf_4.83_src/dialects/sun/dlsof.h
* /opt/cola/permits/1350150906_1655994764.9225438/0/lsf-4-83-r1-2-tar-gz/lsf_4.83_src/dialects/du/dproto.h
* /opt/cola/permits/1350150906_1655994764.9225438/0/lsf-4-83-r1-2-tar-
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* /opt/cola/permits/1350150906_1655994764.9225438/0/lsf-4-83-r1-2-tar-gz/lsf_4.83/lsf-4-83-src-
tar/lsf_4.83_src/dialects/aix/dstore.c
*
/opt/cola/permits/1350150906_1655994764.9225438/0/lsf-4-83-r1-2-tar-gz/lsf_4.83/lsf-4-83-src-
tar/lsf_4.83_src/dialects/aix/dsock.c
* /opt/cola/permits/1350150906_1655994764.9225438/0/lsf-4-83-r1-2-tar-
gz/lsf_4.83_src/dialects/darwin/kmem/dmnt.c
* /opt/cola/permits/1350150906_1655994764.9225438/0/lsf-4-83-r1-2-tar-gz/lsf_4.83/lsf-4-83-src-
tar/lsf_4.83_src/dialects/freebsd/dlsof.h
* /opt/cola/permits/1350150906_1655994764.9225438/0/lsf-4-83-r1-2-tar-gz/lsf_4.83/lsf-4-83-src-
tar/lsf_4.83_src/dialects/n+obsd/dproc.c
* /opt/cola/permits/1350150906_1655994764.9225438/0/lsf-4-83-r1-2-tar-gz/lsf_4.83/lsf-4-83-src-
tar/lsf_4.83_src/dialects/darwin/kmem/dlsof.h
* /opt/cola/permits/1350150906_1655994764.9225438/0/lsf-4-83-r1-2-tar-gz/lsf_4.83_src/dialects/freebsd/dmnt.c
* /opt/cola/permits/1350150906_1655994764.9225438/0/lsf-4-83-r1-2-tar-
gz/lsf_4.83_src/dialects/hpux/kmem/dstore.c
* /opt/cola/permits/1350150906_1655994764.9225438/0/lsf-4-83-r1-2-tar-gz/lsf_4.83/lsf-4-83-src-
tar/lsf_4.83_src/dialects/sun/dstore.c
*
/opt/cola/permits/1350150906_1655994764.9225438/0/lsf-4-83-r1-2-tar-gz/lsf_4.83/lsf-4-83-src-
tar/lsf_4.83_src/dialects/n+os/dsock.c
* /opt/cola/permits/1350150906_1655994764.9225438/0/lsf-4-83-r1-2-tar-
gz/lsf_4.83_src/dialects/n+obsd/dnode.c
* /opt/cola/permits/1350150906_1655994764.9225438/0/lsf-4-83-r1-2-tar-gz/lsf_4.83/lsf-4-83-src-
tar/lsf_4.83_src/dialects/hpux/kmem/machine.h
* /opt/cola/permits/1350150906_1655994764.9225438/0/lsf-4-83-r1-2-tar-gz/lsf_4.83/lsf-4-83-src-
tar/lsf_4.83_src/dialects/n+os/dstore.c
* /opt/cola/permits/1350150906_1655994764.9225438/0/lsf-4-83-r1-2-tar-gz/lsf_4.83/lsf-4-83-src-
tar/lsf_4.83_src/dialects/freebsd/dmnt.c
* /opt/cola/permits/1350150906_1655994764.9225438/0/lsf-4-83-r1-2-tar-gz/lsf_4.83/lsf-4-83-src-
tar/lsf_4.83_src/dialects/n+obsd/machine.h
* /opt/cola/permits/1350150906_1655994764.9225438/0/lsf-4-83-r1-2-tar-
gz/lsf_4.83_src/dialects/n+os/machine.h
*
/opt/cola/permits/1350150906_1655994764.9225438/0/lsf-4-83-r1-2-tar-gz/lsf_4.83/lsf-4-83-src-
tar/lsf_4.83_src/arg.c
* /opt/cola/permits/1350150906_1655994764.9225438/0/lsf-4-83-r1-2-tar-gz/lsf_4.83_src/dialects/aix/dmnt.c
* /opt/cola/permits/1350150906_1655994764.9225438/0/lsf-4-83-r1-2-tar-gz/lsf_4.83_src/lsf_fields.h
* /opt/cola/permits/1350150906_1655994764.9225438/0/lsf-4-83-r1-2-tar-gz/lsf_4.83/lsf-4-83-src-
tar/lsf_4.83_src/dialects/du/dsock.c
* /opt/cola/permits/1350150906_1655994764.9225438/0/lsf-4-83-r1-2-tar-
gz/lsf_4.83_src/dialects/darwin/kmem/ddev.c
* /opt/cola/permits/1350150906_1655994764.9225438/0/lsf-4-83-r1-2-tar-gz/lsf_4.83/lsf-4-83-src-
tar/lsf_4.83_src/dialects/hpux/kmem/dnode.c

```

```

* /opt/cola/permits/1350150906_1655994764.9225438/0/lsof-4-83-r1-2-tar-gz/lsof_4.83/lsof-4-83-src-
tar/lsof_4.83_src/dialects/darwin/kmem/ddev.c
* /opt/cola/permits/1350150906_1655994764.9225438/0/lsof-4-83-r1-2-tar-gz/lsof_4.83_src/dialects/du/dfile.c
*
/opt/cola/permits/1350150906_1655994764.9225438/0/lsof-4-83-r1-2-tar-gz/lsof_4.83/lsof-4-83-src-
tar/lsof_4.83_src/dialects/sun/dproto.h
* /opt/cola/permits/1350150906_1655994764.9225438/0/lsof-4-83-r1-2-tar-
gz/lsof_4.83_src/dialects/hpux/kmem/dlsof.h
* /opt/cola/permits/1350150906_1655994764.9225438/0/lsof-4-83-r1-2-tar-gz/lsof_4.83/lsof-4-83-src-
tar/lsof_4.83_src/dialects/hpux/kmem/dproto.h
* /opt/cola/permits/1350150906_1655994764.9225438/0/lsof-4-83-r1-2-tar-gz/lsof_4.83_src/dialects/sun/dlsof.h
* /opt/cola/permits/1350150906_1655994764.9225438/0/lsof-4-83-r1-2-tar-
gz/lsof_4.83_src/dialects/darwin/kmem/dnode.c
* /opt/cola/permits/1350150906_1655994764.9225438/0/lsof-4-83-r1-2-tar-gz/lsof_4.83/lsof-4-83-src-
tar/lsof_4.83_src/dialects/n+os/machine.h
* /opt/cola/permits/1350150906_1655994764.9225438/0/lsof-4-83-r1-2-tar-gz/lsof_4.83/lsof-4-83-src-
tar/lsof_4.83_src/dialects/sun/dproc.c
* /opt/cola/permits/1350150906_1655994764.9225438/0/lsof-4-83-r1-2-tar-gz/lsof_4.83/lsof-4-83-src-
tar/lsof_4.83_src/dialects/hpux/kmem/dstore.c
*
/opt/cola/permits/1350150906_1655994764.9225438/0/lsof-4-83-r1-2-tar-
gz/lsof_4.83_src/dialects/hpux/kmem/machine.h
* /opt/cola/permits/1350150906_1655994764.9225438/0/lsof-4-83-r1-2-tar-gz/lsof_4.83_src/dialects/sun/dproto.h
* /opt/cola/permits/1350150906_1655994764.9225438/0/lsof-4-83-r1-2-tar-gz/lsof_4.83/lsof-4-83-src-
tar/lsof_4.83_src/dialects/darwin/kmem/dproto.h
* /opt/cola/permits/1350150906_1655994764.9225438/0/lsof-4-83-r1-2-tar-gz/lsof_4.83/lsof-4-83-src-
tar/lsof_4.83_src/dialects/n+obsd/dlsof.h
* /opt/cola/permits/1350150906_1655994764.9225438/0/lsof-4-83-r1-2-tar-gz/lsof_4.83_src/dialects/du/dmnt.c
* /opt/cola/permits/1350150906_1655994764.9225438/0/lsof-4-83-r1-2-tar-gz/lsof_4.83_src/proc.c
* /opt/cola/permits/1350150906_1655994764.9225438/0/lsof-4-83-r1-2-tar-gz/lsof_4.83/lsof-4-83-src-
tar/lsof_4.83_src/dialects/aix/dmnt.c
* /opt/cola/permits/1350150906_1655994764.9225438/0/lsof-4-83-r1-2-tar-gz/lsof_4.83/lsof-4-83-src-
tar/lsof_4.83_src/dialects/n+os/dlsof.h
*
/opt/cola/permits/1350150906_1655994764.9225438/0/lsof-4-83-r1-2-tar-gz/lsof_4.83/lsof-4-83-src-
tar/lsof_4.83_src/dialects/sun/dsock.c
* /opt/cola/permits/1350150906_1655994764.9225438/0/lsof-4-83-r1-2-tar-gz/lsof_4.83/lsof-4-83-src-
tar/lsof_4.83_src/node.c
* /opt/cola/permits/1350150906_1655994764.9225438/0/lsof-4-83-r1-2-tar-gz/lsof_4.83_src/dialects/sun/machine.h
* /opt/cola/permits/1350150906_1655994764.9225438/0/lsof-4-83-r1-2-tar-gz/lsof_4.83/lsof-4-83-src-
tar/lsof_4.83_src/dialects/n+obsd/dproto.h
* /opt/cola/permits/1350150906_1655994764.9225438/0/lsof-4-83-r1-2-tar-gz/lsof_4.83/lsof-4-83-src-
tar/lsof_4.83_src/dialects/sun/ddev.c
* /opt/cola/permits/1350150906_1655994764.9225438/0/lsof-4-83-r1-2-tar-gz/lsof_4.83_src/dialects/n+os/dnode.c
* /opt/cola/permits/1350150906_1655994764.9225438/0/lsof-4-83-r1-2-tar-gz/lsof_4.83_src/dialects/aix/ddev.c
* /opt/cola/permits/1350150906_1655994764.9225438/0/lsof-4-83-r1-2-tar-gz/lsof_4.83/lsof-4-83-src-
tar/lsof_4.83_src/dialects/sun/machine.h
*

```

/opt/cola/permits/1350150906\_1655994764.9225438/0/lsf-4-83-r1-2-tar-gz/lsf\_4.83\_src/dialects/sun/dmnt.c  
\* /opt/cola/permits/1350150906\_1655994764.9225438/0/lsf-4-83-r1-2-tar-gz/lsf\_4.83\_src/dialects/hpux/kmem/dsock.c  
\* /opt/cola/permits/1350150906\_1655994764.9225438/0/lsf-4-83-r1-2-tar-gz/lsf\_4.83\_src/dialects/n+obsd/dmnt.c  
\* /opt/cola/permits/1350150906\_1655994764.9225438/0/lsf-4-83-r1-2-tar-gz/lsf\_4.83\_src/dialects/aix/dproto.h  
\* /opt/cola/permits/1350150906\_1655994764.9225438/0/lsf-4-83-r1-2-tar-gz/lsf\_4.83\_src/dialects/du/dproto.h  
\* /opt/cola/permits/1350150906\_1655994764.9225438/0/lsf-4-83-r1-2-tar-gz/lsf\_4.83\_src/dialects/du/machine.h  
\* /opt/cola/permits/1350150906\_1655994764.9225438/0/lsf-4-83-r1-2-tar-gz/lsf\_4.83\_src/dialects/n+obsd/dproc.c  
\* /opt/cola/permits/1350150906\_1655994764.9225438/0/lsf-4-83-r1-2-tar-gz/lsf\_4.83\_src/misc.c  
\* /opt/cola/permits/1350150906\_1655994764.9225438/0/lsf-4-83-r1-2-tar-gz/lsf\_4.83\_src/dialects/n+obsd/dnode.c  
\*  
/opt/cola/permits/1350150906\_1655994764.9225438/0/lsf-4-83-r1-2-tar-gz/lsf\_4.83\_src/dialects/du/dproc.c  
\* /opt/cola/permits/1350150906\_1655994764.9225438/0/lsf-4-83-r1-2-tar-gz/lsf\_4.83\_src/dialects/aix/dproc.c  
\* /opt/cola/permits/1350150906\_1655994764.9225438/0/lsf-4-83-r1-2-tar-gz/lsf\_4.83\_src/dialects/n+os/dproc.c  
No license file was found, but licenses were detected in source scan.

/\*  
\* Copyright 2002 Purdue Research Foundation, West Lafayette, Indiana  
\* 47907. All rights reserved.  
\*  
\* Written by V. Abell.  
\*  
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\* misrepresented as being the original software.  
\*  
\* 4. This notice may not be removed or altered.  
\*/  
/\*

\* If this is a regular file with a non-numeric FD, it may be the  
\* executable.  
\*/

Found in path(s):

\* /opt/cola/permits/1350150906\_1655994764.9225438/0/lsof-4-83-r1-2-tar-gz/lsof\_4.83/lsof-4-83-src-tar/lsof\_4.83\_src/tests/LTbasic.c

\* /opt/cola/permits/1350150906\_1655994764.9225438/0/lsof-4-83-r1-2-tar-gz/lsof\_4.83\_src/tests/LTbasic.c

No license file was found, but licenses were detected in source scan.

Notes for the distribution of lsof version 4

\*\*\*\*\*  
| The latest release of lsof is always available via anonymous ftp |  
| from lsof.itap.purdue.edu. Look in pub/tools/unix/lsof. |  
\*\*\*\*\*

## Contents

- Dialects Supported
- How Lsof Works
- Lsof Output
- Getting Started Quickly
- Limiting, Filtering, and Selecting Lsof Output
- Parsing Lsof Output with Another Program
- Repeat Mode
- Distribution Restrictions
- Cautions
- Distribution Contents
- Warranty
- Bug Reports
- The lsof-l Mailing List
- Version 3 Release Notes
- 3.0, May 24, 1994
- ...
- 3.88, February 17, 1997
- What's New in Version 4
- Version 4 Release Notes
- 4.0, February 24, 1997
- 4.01, March 3, 1997
- 4.02, March 21, 1997
- 4.03, April 7, 1997
- 4.04, April 17, 1997
- 4.04
- supplement, April 18, 1997
- 4.05, April 24, 1997
- 4.06, April 30, 1997
- 4.07, May 12, 1997

4.08, May 23, 1997  
4.09, June 1, 1997  
4.10, June 8, 1997  
4.11, June 12, 1997  
4.12, June 24, 1997  
4.13, July 9, 1997  
4.14, July 22, 1997  
4.15, August 15, 1997  
4.16, September 25, 1997  
4.17, October 14, 1997  
4.18, October 25, 1997  
4.19, October 30, 1997  
4.20, November 11, 1997  
4.21, December 1, 1997  
4.22, December 15, 1997  
4.23, January 16, 1998  
4.24, January 28, 1998  
4.25, February 7, 1998  
4.26, February 17, 1998  
4.27, March 6, 1998  
4.28, March 10, 1998  
4.29, March 26, 1998  
4.30, April 9, 1998  
4.31, April 21, 1998  
4.32, May 13, 1998  
4.33, May 22, 1998  
4.34, June 26, 1998  
4.35, July 17, 1998  
4.36, August 4, 1998  
4.37, September 15, 1998  
4.38, November 25, 1998  
4.39, December 29, 1998  
4.40, January 25, 1999  
4.41, February 27, 1999  
4.42, March 30, 1999  
4.43, May 11, 1999  
4.44, June 24, 1999  
4.45, July 30, 1999  
4.46,  
October 23, 1999  
4.47, November 29, 1999  
4.48, January 14, 2000  
4.49, April 3, 2000  
4.50, June 29, 2000  
4.51, August 21, 2000  
4.52, November 8, 2000  
4.53, December 6, 2000  
4.54, January 19, 2001

4.55, February 15, 2001  
4.56, May 3, 2001  
4.57, July 19, 2001  
4.58, September 13, 2001  
4.59, October 20, 2001  
4.60, November 9, 2001  
4.61, January 22, 2002  
4.62, March 7, 2002  
4.63, April 23, 2002  
4.64, June 26, 2002  
4.65, October 10, 2002  
4.66, December 22, 2002  
4.67, March 27, 2003  
4.68, June 18, 2003  
4.69, October 16, 2003  
4.70, January 16, 2004  
4.71, March 11, 2004  
4.72, July 13, 2004  
4.73, October 21, 2004  
4.74, January 17, 2005  
4.75, May 16, 2005  
4.76, August 30, 2005  
4.77, April 10, 2006  
4.78, April 24, 2007  
4.79, April 15, 2008  
4.80, May 12, 2008  
4.81, October 21, 2008  
4.82, March 25, 2009  
4.83, January 18, 2010

#### Dialects Supported

=====

Lsof (for LiSt Open Files) lists files opened by processes on selected

Unix systems. Version 4 is a source reorganization of version 3, itself a major revision of version 2. Version 4 has been tested on:

AIX 5.3

Apple Darwin 9 (Mac OS X 10.5)

FreeBSD 4.9 for x86-based systems

FreeBSD 7.[012], 8.0 and 9.0 for AMD64-based systems

Linux 2.1.72 and above for x86-based systems

Solaris 9, 10 and 11

(The `pub/tools/unix/lsof/contrib` directory on `lsof.itap.purdue.edu`)



contains information on other ports.)

If your favorite Unix dialect is not in the list, or if your version of it is more recent than the ones listed, please contact me at <abe@purdue.edu>.

Version 3 of lsof was tested on:

AIX 3.2.5, 4.1.[1234], and 4.2  
BSDI BSD/OS 2.0, 2.0.1, and 2.1 for x86-based systems  
DC/OSx 1.1 for Pyramid systems  
Digital UNIX (DEC OSF/1) 2.0, 3.0, 3.2, and 4.0  
EP/IX 2.1.1 for the CDC 4680  
FreeBSD 1.1.5.1, 2.0, 2.0.5, 2.1, 2.1.5 for x86-based systems  
HP-UX 8.x, 9.x, 10.01, 10.10, and 10.20  
IRIX 5.2, 5.3, 6.0, 6.0.1, and 6.[124]  
Linux through 2.0.27  
for x86-based systems  
NetBSD 1.0, 1.1, and 1.2 for x86 and SPARC-based systems  
NEXTSTEP 2.1 and 3.[0123]  
OpenBSD 1.2 and 2.0 for x86-based systems  
Reliant UNIX 5.43 for Pyramid systems  
RISC/os 4.52 for MIPS R2000-based systems  
SCO OpenServer Release 1.1, 3.0, and 5.0.x for x86-based systems  
SCO UnixWare 2.1 and 2.1.1 for x86-based systems  
Sequent PTX 2.1.[1569], 4.0.[23], 4.1.[024], 4.2[.1], and 4.3  
Solaris 2.[12345], 2.5.1, and 2.6-Beta  
SunOS 4.1.x  
Ultrix 4.2, 4.3, 4.4, and 4.5

Version 3 and its predecessor, version 2, may be found at:

<ftp://lsof.itap.purdue.edu/pub/tools/unix/lsof/OLD>

#### How Lsof Works

=====

Using available kernel data access methods -- getproc(), getuser(), kvm\_\*( ), nlist(), pstat(), read(), readx(), /proc -- lsof reads process table entries, task table entries, user areas and file pointers to reach the underlying structures that describe files opened by processes.

Lsof interprets most file node structures -- advfsnodes, autonodes, cnodes, cdrnodes, devnodes, fifonodes, gnodes, hsnodes, inodes, mfsnodes, pcnodes, procnodes, rnodes, snodes, specnodes, s5inodes, tmpnodes. It understands NFS connections. It recognizes FIFOs, multiplexed files, Unix and Internet sockets. It knows about streams. It understands /proc file systems for some dialects. On many dialects it recognizes execution text and library references. It knows about AFS on some Unix dialects.

## Lsof Output

=====

The lsof output describes:

- \* the identification number of the process (PID) that has opened the file;
- \* the process group identification number (PGID) of the process (optional);
- \* the process identification number of the parent process (PPID) (optional);
- \* the command the process is executing;
- \* the owner of the process;
- \* for all files in use by the process, including the executing text file and the shared libraries it is using:
  - \* the file descriptor number of the file, if applicable;
  - \* the file's access mode;
  - \* the file's lock status;
  - \* the file's device numbers;
  - \* the file's inode number;
  - \* the file's size or offset;
  - \* the name of the file system containing the file;
  - \* any available components of the file's path name;

- \* the names of the file's stream components;
- \* the file's local and remote network addresses;
- \* the TLI network (typically UDP) state of the file;
- \* the TCP state, read queue length, and write queue length of the file;
- \* the file's TCP window read and write lengths (Solaris only);
- \* other file or dialect-specific values.

### Getting Started Quickly

=====

If you want to get started using `lsof` quickly, or see some examples of how `lsof` can be used, consult the `00QUICKSTART` file of the `lsof` distribution.

The `00QUICKSTART` file won't help you build or install `lsof`, but it will cut through the density of the `lsof` man page, giving you more readily an idea of what you can do with `lsof`.

For information on building and installing `lsof`, consult the `00README` file of the `lsof` distribution.

### Limiting, Filtering, and Selecting `lsof` Output

=====

`lsof` accepts options to limit, filter, and select its output.

These are the possible criteria:

- \* Process ID (PID) number -- to list the open files for a given process;
- \* Process Group ID (PGID) -- to list the open files for all the processes of a given process group;
- \* User ID number or login name -- to list the open files for all the processes of a given user;
- \* Internet address -- to list the open files using a given

Internet address (host name), protocol, or port (number or name); or to list all open Internet files;

\* command name;

\* file descriptor name or number;

\* list all open NFS files;

\* list all open Unix domain socket files;

\* list all uses of a specific file;

\* list all open files on a file system.

Selection options are normally ORed -- i.e., an open file meeting any of the criteria is listed. The selection options may be ANDed so that an open file will be listed only if it meets all the criteria.

In the absence of any selection criteria, lsof lists files open to all processes.

#### Parsing Lsof Output with Another Program

=====

The lsof -F option directs it to produce "field" output that can easily be parsed by another program. The lsof distribution contains sample awk, perl 4, and perl 5 scripts in its scripts subdirectory that show how to post-process field output.

#### Repeat Mode

=====

Lsof can be directed to produce output, delay for a specified time, then repeat the output, cycling until stopped by an interrupt or quit signal. This mode is useful for monitoring the status of some file operation -- e.g., an ftp transfer or a tape backup operation.

Repeat mode is more efficient when combined with lsof's selection options, since they limit lsof overhead.

It's possible to use lsof's field output options to supply repeat mode output to another process for its manipulation. The scripts subdirectory of the lsof distribution has sample Perl scripts

showing how to consume lsof repeat mode output from a pipe.

#### Distribution Restrictions

=====

Lsof may be used and distributed freely, subject to these limitations:

1. Neither the author nor Purdue University is responsible for any consequences of the use of this software.
2. The origin of this software must not be misrepresented, either by explicit claim or by omission. Credit to the author and Purdue University must appear in documentation and sources.
3. Altered versions must be plainly marked as such, and must not be misrepresented as being the original software.
4. This notice may not be removed from or altered in the lsof source files.

#### Cautions

=====

Lsof is a tool that is closely tied to the Unix operating system version. It uses header files that describe kernel structures and reads kernel structures that typically change from OS version to OS version.

**DON'T TRY TO USE AN LSOF BINARY, COMPILED FOR ONE UNIX OS VERSION, ON ANOTHER.**

On some Unix dialects, notably SunOS and Solaris, lsof versions may be even more restricted by architecture type. An lsof binary, compiled for SunOS 4.1.3 on a sun4c machine, for example, won't work on a sun4m machine.

**AN LSOF BINARY, COMPILED FOR ONE SOLARIS 1.X ARCHITECTURE, ISN'T GUARANTEED TO WORK ON A DIFFERENT SOLARIS 1.X ARCHITECTURE.**

#### Distribution Contents

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The lsof distribution is checked for completeness when it is constructed and by the Inventory script when you run the Configure

script. (See The Inventory Script section of the 00README file of this distribution.)

Lsof is organized in these parts:

- \* The main lsof directory, containing common sources, configuration and setup scripts and three subdirectories: dialects/, lib/, and scripts/.

Lsof is compiled in the main lsof directory after configuration. The selected dialect sources are copied or linked from the specified subdirectory. (Symbolic linking is the standard method.)

Common lsof definitions may be found in lsof.h; common function prototypes, proto.h; and common storage, store.c.

- \* The dialects/ subdirectory contains subdirectories with sources specific to UNIX dialect implementations -- e.g., the dialects/sun/ subdirectory contains sources for the SunOS (Solaris 1.x) and Solaris (2.x) implementations of lsof. The dialects subdirectories also contain Makefiles and scripts for assisting dialect source configuration.

Dialect configuration definitions may be found in dlsof.h; other dialect definitions, dlsof.h; dialect prototypes, dproto.h; and dialect storage, dstore.c.

- \* The lib/ subdirectory contains sources for common lsof functions. Not all dialects use the functions -- some have their own versions of them. The lib/ functions are enabled and customized with #define's in the dialect machine.h header files.

- \* The scripts/ subdirectory contains sample scripts for processing lsof field (-F) output. The scripts are written in AWK, Perl 4, and Perl 5.

The 00PORTING file of the lsof distribution has more information on lsof components, configuration, and construction.

Warranty

=====

Lsof is provided as-is without any warranty of any kind, either

expressed or implied, including, but not limited to, the implied warranties of merchantability and fitness for a particular purpose. The entire risk as to the quality and performance of lsof is with you. Should lsof prove defective, you assume the cost of all necessary servicing, repair, or correction.

#### Bug Reports

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Now that the obligatory disclaimer is out of the way, let me hasten to add that I accept lsof bug reports and try hard to respond to them. I will also consider and discuss requests for new features, ports to new dialects, or ports to new OS versions.

PLEASE DON'T SEND A BUG REPORT ABOUT LSOF TO THE UNIX DIALECT VENDOR.

At worst such a bug report will confuse the vendor; at best, the vendor will forward the bug report to me.

Please send all bug reports, requests, etc. to me via email at <abe@purdue.edu>.

#### The lsof-l Mailing List

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Information about lsof, including notices about the availability of new revisions, may be found in mailings of the lsof-l listserv. For more information about it, including instructions on how to subscribe, read the 00LSOF-L file of the lsof distribution.

#### Version 3 Release Notes

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See 00DIST in the last lsof 3 revision 3.88, for its complete set of release notes. Lsof revision 3.88 may be found at:

<ftp://lsof.itap.purdue.edu/pub/tools/unix/lsof/OLD>

3.0 May  
24, 1994

This is the first official release of lsof 3.

...

3.88 February 17, 1997

```
+=====+
| This is the last version 3 revision. |
+=====+
```

Added documentation files -- 00.README.FIRST[\_<version>]  
and 00RELEASE.SUMMARY\_<version> -- to the distribution.

#### What's new in Version 4

```
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```

The main goal of version 4 was to eliminate the confusing common/  
fragment source file technique. Changing the version number also  
provided an opportunity to restart the numbering, which at 3.88  
had risen to a large value.

The sources that appeared in the dialects/common subdirectory of  
version 3 in fragment files have been incorporated into the version  
4 liblsof.a library as \*.c files. This results in significant  
changes to many source files, scripts, and Makefiles of all dialect  
versions. It allows elimination of some source files -- ddev.c,  
dfile.c, dmnt.c -- for dialects now obtaining  
functions from  
liblsof.a that formerly came from making dialect source files by  
combining fragment files.

The version 4 liblsof.a sources are stored in the lib/ subdirectory  
of the main lsof directory. The liblsof.a functions are activated  
and conditioned in their source files by values #define'd in the  
dialect dlsof.h and machine.h header files.

Dialects that provide a private version of a library function refrain  
from #define'ing the symbol that would activate the library function  
code.

#### Version 4 Release Notes

```
=====
```

4.0 February 24, 1997

```
+=====+
| This is the first lsof 4 revision. |
+=====+
```



Reorganized sources: eliminated code fragment files and created a library in their place. Modified or deleted many dialect source and header files. Changed documentation accordingly.

Added a warning to sgi/Makefile and 00FAQ that advises against using the IRIX C compiler -n32 option when compiling lsof. Thanks go to Peter Iliev <peter@memex.co.uk> for bringing this to my attention.

Dropped IRIX 5.2 in mid-stream, because my 5.2 test system was upgraded to 5.3.

4.01 March 3, 1997

Added TFS support for Pyramid dialects.

Added test to Configure and to the IRIX dnode.c for the different cnode struct that appears in <cache/fs/cache/fs.h> on the 6.2 IMPACT distribution. Heddy Boubaker <boubaker@amfou.cenatls.cena.dgac.fr> alerted me to the cnode change and helped test this lsof adjustment.

Shut down the lsof child process before doing a -r sleep(). A comment from Dan Mercer <dam@mmm.com> prompted this.

4.02 March 21, 1997

Based on a report from Pasi Kaara <Pasi.Kaara@atk.tpo.fi>, disabled HP-UX CCIT support in lsof for HP-UX versions 10 and above. Pasi's report also led to changes in the HP-UX machine.h to support use of gcc to compile lsof for HP-UX 10.20 and warnings against using `cc -Aa` or `gcc -ansi` to compile lsof under HP-UX 10.x.

With help from Richard Allen <ra@hp.is> taught HP-UX 10.x lsof to name file systems better by using the virtual file system device number. Elias Halldor Agustsson <elias@rhi.hi.is> provided a test system.

Changed NEXTSTEP and UNIXWARE Makefiles to use safer quoting when generating version.h. The change was suggested by Bob Farmer <ucs\_brf@unx1.shsu.edu>.

Added SHELL=/bin/sh string to all Makefiles.

Added support for Linux 2.1.28 on a test system,  
kindly provided by Jonathan Sergent <sergent@purdue.edu>.

Configure tests the Linux 2.1.x's C library lseek()  
function for proper handling of kernel offsets.

If lseek() appears suspect, Configure activates  
the use of a private lseek() function. Changed  
the private nlist() function to nlist\_private()  
and taught it to use the query\_module() syscall in  
place of the deprecated get\_kernel\_syms() one.

Added rudimentary AX.25 support for Pierfrancesco

Caci <ik5pvx@infogroup.it>

who helped test it.

Updated the old get\_kernel\_syms() code to recognize  
and skip module name entries.

Prompted by Marty Leisner <leisner@sdsp.mc.xerox.com>,

eased the requirement that service name lookup for  
the -i option be accompanied by a protocol name. The  
name is not needed if both TCP and UDP names yield the  
same port number.

Added xusers.awk script from Dan Mercer <damercer@mmm.com>  
to the distribution scripts/ subdirectory.

Changed Configure script to use LSOF\_VERS for all  
UNIX dialect version numbers and to pass LSOF\_VERS  
to the dialect Mksrc functions. Also added the  
ability for a dialect stanza to declare a different  
dialect Makefile source. Modified dialect Mksrc  
files -- e.g., linux and sun -- accordingly.

Added support for BSD/OS 3.0 with help from Jim  
Reid <jim@mpn.cp.philips.com>. Terry Kennedy  
<TERRY@spcvxa.spc.edu> kindly provided a test  
system. During the port corrected a bug that  
prevented proper handling of revoked  
files.

#### 4.03 April 7, 1997

At the suggestion of Dan Mercer <damercer@mmm.com>,  
made HP-UX building of lsof aware of differences  
between the HP-UX bundled and unbundled C compilers.

Added the ability for the lsof builder to define the  
default warning message issuance state. By default the

issuance of warning messages is disabled; defining WARNINGSTATE in machine.h disables it. The Customize script was updated to handle WARNINGSTATE. Dan Mercer suggested this.

Eliminated compiler complaint about improperly cast get\_NI\_value() argument in ncache\_load() in lib/rnch.c.

Corrected zeromem() argument error in SCO dproc.c.  
Sped up parent directory cache lookup slightly.

Updated for PTX 4.4, including additional VxFS (EFS) file system support.

#### 4.04 April 17, 1997

At the suggestion of Bela Lubkin <belal@sco.COM> changed device cache handling to be more tolerant of a device cache file whose [cm]times are older than the ones on /dev or /devices. The change required adding information to Solaris device cache file clone lines, so the first time lsof 4.04 is run under Solaris it will complain about a bad cached clone device in a previous device cache file, then regenerate it.

Added boot file path detection for SCO OSR 5 and above, based on information supplied by Bela.

Fixed two bugs in DEC OSF/1 lsof -- an error in reporting locks and a missing continue statement in readdev() after a failure to open a directory. Jan Ole Suhr <josuhr@informatik.tu-clausthal.de> reported the second bug and supplied a fix.

Fixed XFS problems with IRIX 6.2 by abandoning the idea that SGI will distribute XFS header files and defining an lsof-private xfs\_inode structure. John Paul Morrison <John.Paul.Morrison@MultiActive.com> helped develop and test the 5.3 definition. John R. Vanderpool <fish@daacdev1.gsfc.nasa.gov> helped develop and test the 6.2 definition.

Remove obsolete comments about common/\*.frag files.

Updated  
Linux lsof for Linux version 2.1.35.

4.04 April 18, 1997

Supplement Regenerated the 4.04 distribution to correct a non-device-cache #define misplacement in the Solaris and SunOS dlsof.h. Alexandre Oliva <oliva@dcc.unicamp.br> reported the problem.

4.05 April 24, 1997

Corrected an error in 00DCACHE.

Made sure SCO /etc/ps/booted.systems is closed.

Based on an observation by Bela Lubkin <belal@sco.COM> that the lsof child had needless file descriptors open, closed all but the open pipes between the lsof parent and child.

Decommissioned CDC EP/IX support; I no longer have a test system.

Based on a suggestion from Patrick Connor <connor@phreak.csd.sgi.com>, added -xansi to CFLAGS for IRIX 5.3 and 6.[234].

Also at Patrick's suggestion changed Configure to propagate exact SunOS 4.1.x version to the main and library Makefiles. This allowed the sunos413 and sunos413cc Configure abbreviations to be shortened to sunos and sunoscc.

Updated

obsolete argument uses (-H changed to -n) in count\_pf.perl\* and watch\_a\_file.perl scripts.

Adjusted Solaris 2.6 lsof for Beta\_Update with tips from Casper Dik <casper@holland.Sun.COM>.

Fixed a Solaris 2.4 TCP address reporting bug.

4.06 April 30, 1997

Added a step to the Makefile clean rules that does a make clean in the lib subdirectory; suggested by Casper Dik <casper@holland.Sun.COM>. (Configure's -clean argument already did this.)

Fixed an incorrect awk argument in the sunos\*) Configure stanza, reported by Alexandre Oliva <oliva@dcc.unicamp.br>.

Added CD9660 (aka ISO) file system support to FreeBSD, NetBSD, and OpenBSD with mods and help from Kenneth Stailey <kstailey@disclosure.com>. (BSDI already had CD9660 support.) While at it, added file descriptor system support to BSDI and FreeBSD.

Added /kern file system support to OpenBSD. The support wasn't extended to BSDI, FreeBSD, or NetBSD, because it requires Kenneth Stailey's changes to /sys/miscfs/kernfs/kernfs.h.

Updated IRIX 6.3 support after getting access to a test system, provided by John Paul Morrison <John.Paul.Morrison@MultiActive.com>. Improved the handling of IRIX 5.1 and greater FIFOs.

4.07 May 12, 1997

Based on AIX problem reports from David Capshaw <David.Capshaw@SEMATECH.Org>, changed the aix\* Configure script stanza to avoid -bnolibpath for gcc (which the GNU loader doesn't grok) and AIX below 4.1.4 (where -bnolibpath hasn't been tested or is known to be unimplemented), and to refuse to use gcc for compiling lsof in AIX versions below 4.1 (because of possible structure alignment problems). Updated 00FAQ appropriately.

Added OpenBSD support for EXT2FS. This support has yet to be tested.

Tested lsof under OpenBSD 2.1.

Activated /kern file system support for NetBSD when Configure senses that /sys/miscfs/kernfs/kernfs.h defines the kern\_target structure. This support has not been tested under NetBSD, although it has been tested under OpenBSD.

Made some simple changes to the BSDI machine.h, suggested by Jeffrey C. Honig <jch@bsdi.com>.

Improved handling of alternate dialect Configure abbreviations -- aix and aixgcc, hpux and hpuxgcc, solaris and solariscc, and sunos and sunoscc.

4.08 May 23, 1997

Cleaned up dialect Makefile's, starting with a suggestion from Christopher Schanzle <chris@cam.nist.gov>.

Improved Configure's -clean processing.

Corrected bugs in Solaris lock reporting.

Changed NetBSD Configure stanza to put -I/usr/include before -I/sys.

4.09 June 1, 1997

Adjusted for latest FreeBSD 3.0 release. This required adding a new kernel name cache module for reading BSD-form hashed kernel name cache entries, rnmh.c, to the lsof library, and adding a #define to each machine.h to select it.

Activated rnmh.c for BSDI 2.1, BSDI 3.0, NetBSD 1.2, and OpenBSD 2.1.

4.10 June 8, 1997

Adjusted for Linux 2.1.x (x > 35) kernels with hashed task structure pointers. Marty Leisner <leisner@sdsp.mc.xerox.com> and Jonathan Sergent <sergent@io.com> tested the adjustment.

Replaced readdev() stat() calls with lstat() to reduce device table and cache entries with the same device number and inode values. Added code to remove all remaining duplicates. This fixes a Linux problem reported by Jonathan Sergent and makes device node name output predictable.

Corrected a bug in UnixWare stream file handling that prevented searching for the stream file by its associated character device name.

Added Pyramid code to determine Reliant UNIX clone major device number differently from that of DC/OSx.

4.11 June 12, 1997

Changed Configure to sense that the PTX inp\_[fl]addr members of the inpcb structure of <netinet/in\_pcb.h> have a struct type and set HASINADDRSTR for use in PTX dnode.c and dsock.c tests.

Changed PTX version 4.1.4 tests to use 4.1.3 instead.  
Carson Wilson <carson@mcs.com>  
reported the need  
to do this and tested the change.

Fixed a block device table indexing bug in lib/rdev.c,  
reported by Carson Wilson. The same bug was squashed  
in pyramid/ddev.c.

Added code to the Pyramid Reliant UNIX kread()  
function to compensate for an address boundary  
error in the kernel's /dev/kmem driver.

Verified that lsof compiles and works under AIX  
4.2.1. Added an AIX test for the presence of NFS  
header files, defined HAS\_NFS and adjusted AIX  
dialect sources accordingly.

Based on a suggestion from Gaylord Holder  
<holder@phy.ucsf.EDU>, added DEC OSF/1 code to  
auto-detect the booted file, whence kernel symbol  
addresses are obtained.

4.12 June 24, 1997

Corrected a device number sign extension problem  
in the reading and writing of device cache file.  
The problem was reported by Bela Lubkin <belal@sco.com>  
and he suggested a fix.

Fixed an SCO stream device lookup problem. The  
report and solution came from Bela Lubkin

Enhanced the  
Configure script to enable cross-  
configuration of lsof, based on suggestions from  
Marty Leisner <leisner@sdsp.mc.xerox.com>. A new  
documentation file, 00XCONFIG, describes the process.

Made Pyramid OBJFS support conditional on the  
presence of supporting header files. Corrected  
the Pyramid MkKernOpts script so it generates the  
necessary -D's for the Nile/Jolt architecture.  
Richard Coley <rcoley@pyra.co.uk> helped.

Added another IRIX xfs\_inode variant for 6.2, 32  
bits, no XFS rollup patch.

Tested under UnixWare 2.1.2.

4.13 July 9, 1997

Taught Pyramid lsof to grok ttyfs vnodes with help from Richard Coley <rcoley@pyra.co.uk>. Fixed some minor bugs in Pyramid FIFO reporting. Eliminated use of the Pyramid UCB compatibility library at Richard's suggestion.

Eliminated reporting of "strange" inode numbers for SCO OSR 3.2v5.0.x HPPS files with help from Bela Lubkin <belal@sco.com>

Modified port to service name lookup to use a small number of getservbyport() calls before reading the entire map with getservent(). Changed port reporting to represent a zero as '\*' to be consistent with other prt number reporting tools like netstat. Casper Dik <casper@holland.Sun.COM> suggested these changes -- the getserv\*() one to improve performance for large NIS service name maps.

Changed all readdev() functions to make the absence of block devices a warning instead of a fatal error after Brian Redman <ber@ms.com> reported his IRIX 6.4 system had no block devices. (It really did have block devices, but readdev()'s lstat() use caused it to miss them in a directory symbolically linked from /dev/dsk->/hw/disk.) Fixed Brian's real problem by changing the IRIX readdev() to use stat() on /dev nodes if a Configure test shows /hw is readable. Extended the potential to do the same to all readdev() functions.

For consistency and convenience changed some Configure abbreviations and dialect subdirectory names:

"decosf" abbreviation and "osf" dialect subdirectory name to "du"; "netbsd" dialect subdirectory name to "n+obsd"; "next3" abbreviation and "next" dialect subdirectory name to "ns"; "sco" abbreviation and dialect subdirectory name to "osr"; "sgi" dialect subdirectory name to "irix"; and "unixware" abbreviation and dialect subdirectory name to "uw".

Added #if/#endif clauses to the AIX rmdupdev() function to avoid clone processing for AIX versions



less than 4.1.4. The problem was reported by Toralf Foerster <toralf.foerster@io-warnemuende.de>, who supplied corrective code.

Added support for new style NetBSD inode with `i_ffs` and `i_e2fs` union members.

Improved Configure and 00FAQ information on Digital UNIX configuration subdirectory with suggestions from Brad Krebs <brad@EECS.Berkeley.EDU>.

#### 4.14 July 22, 1997

Reorganized the Solaris handling of the inode structure header file, `ufs_inode.h`, to eliminate VxFS structure definition conflicts

for Solaris

2.4, based on information from Greg Earle <earle@netbsd4me.jpl.nasa.gov>.

Cleaned up some typos and confusion in Configure's help output, based on comments from Bela Lubkin <belal@sco.com>

Added a 00DIALECTS file, containing UNIX dialect version numbers, that can be used by Configure and the man page.

#### 4.15 August 15, 1997

Aligned `Configure -help` output better. Removed Configure's 2.6 Beta test adjustments.

Added improved Solaris VxFS configuration and handling, based on information from Greg Earle <earle@netbsd4me.jpl.nasa.gov>.

Added socket state -- TCO or TPI -- for socket files at the suggestion of Ian Fitchet <I.D.Fitchet@ftel.co.uk>.

#### 4.16 September 25, 1997

Added reporting of TCP/TPI queue lengths and window sizes ala netstat to NAME column. Added -T option to select or de-select TCP/TPI info reporting.

(Window sizes are only reported for Solaris.)

Fixed anomalies along the way in SIZE/OFF processing for some dialects.

Fixed service name argument processor to allow minus signs as part of the name. Consequently this disallows names with embedded minus signs from being specified as the start of a range.

Added 00FAQ entries explaining why lsof won't find a file being edited with vi, why window sizes aren't reported for all dialects, and what the "no more information" message means.

Forced Pyramid CC to be /usr/ccs/bin/cc to avoid accidental use of the BSD variant in /usr/ucb/cc.

Added support for Linux glibc2, including a Configure test; cross-Configure support (00XCONFIG); and much unfortunate and risky sleight-of-hand in lsof Linux dialect header and source files, forced upon lsof by incompatibilities between Linux kernel and glibc2 header files.

Included in scripts/identd.perl5 a Perl 5 implementation of an identd server, using lsof, provided by Kapil Chowksey <kchowksey@hss.hns.com>.

Updated IRIX 6.4 xfs\_inode guess.

#### 4.17 October 14, 1997

Added

-V option for verbose search result reporting.

Verbose reports are prepared for failure to locate file names, command names, Internet addresses or files, login names, NFS files, PIDs, PGIDs, and UIDs.

Augmented Linux NFS file test to cope with kernels whose NFS code is in a loadable module. Need for the test was pointed out by Jonathan Sergent <sergent@csociety.ecn.purdue.edu>. The change required that Linux have private dmnt.c source,

Completed a Linux 2.1.57 port on a system provided by Jonathan Sergent.

#### 4.18 October 25, 1997

Eliminated memory leaks in alloc\_ifile(), lkup\_port(), and NEXTSTEP's process\_text() function.

Added recognition of OpenBSD 2.2 in Configure, supplied by Kenneth Stailey <kstailey@disclosure.com>.

Consolidated print\_file() functions to use the one in lib/prtf.c. Made it configurable and changed it to size print columns dynamically.

!!! WARNING !!!

WITH DYNAMICALLY SIZED PRINT COLUMNS LSOF 4.18  
PRODUCES OUTPUT  
SIGNIFICANTLY DIFFERENT FROM THAT  
OF PREVIOUS REVISIONS. LINES ARE GENERALLY SHORTER  
AND THERE IS GENERALLY LESS BLANK SPACE BETWEEN  
COLUMNS AND THE ITEMS IN THEM. THERE ARE NO LONGER  
ANY SPACES BETWEEN DEVICE NUMBER ELEMENTS, ONLY  
COMMAS.

!!! WARNING !!!

Added special types and print specification modifiers for file size and offset to handle UNIX dialects with 64 bit sizes and offsets. Paul Eggert <eggert@twinsun.com> reported the need for this addition.

With Paul Eggert's help picked lint from the lsof library, the main level lsof sources, and the Sun dialect sources.

Added documentation, including the file 00LSOF-L, about the lsof-l LISTSERV.

Added support for Reliant UNIX on the RM600. Bob Passarella <rmpassar@pyramid.com> supplied the changes. Kevin Smith <kevin@pyramid.com> helped arrange test systems. While incorporating Bob's changes, modified lib/rnch.c to handle kernel ncache structs whose name is accessed via a char \*, rather than in a char array.

Changed #include order of <sys/socketvar.h> for Solaris 2.x. W. Richard Stevens <rstevens@kohala.com> pointed out the need to do this.

4.19 October 30, 1997

Changed Pyramid Reliant RM600 proc scan to skip SSYS (p\_flag) processes, since they don't seem to have a readable u\_cdir vnode.

Enabled Pyramid Reliant UNIX kread() work-around for DC/OSx, too, since its read(/dev/kmem) kernel driver seems to share the page boundary bug this work-around circumvents.

Changed SzOffFtm\_d and SzOffFtm\_dv (new formats at 4.18 to print size and offset) from signed to unsigned. Setting them signed at 4.18 was an oversight.

Plugged a memory leak that caused the loss of 130 bytes per repeat-mode pass. Fixed it with a simple work-around in main(). Lionel Cons <Lionel.Cons@cern.ch> reported the leak.

4.20 November 11, 1997

Tested under BSDI 3.1.

Added support for Reliant UNIX Mesh IPC files with help from Billy Ho <bho@pyramid.com>.

Added support to Digital UNIX lsof that uses the libmsfs tag\_to\_path() function (when it exists) to look up AdvFS path names. The idea and sample code came from Dean Brock <brock@cs.unca.edu>. Converted Dean's code into more general purpose support for private name cache lookups via the HASPRIVNMCACHE #define in the dialect machine.h file and code conditional on it in the printname() function.

Taught Digital UNIX lsof to recognize NFS3 file systems. Corrected Digital UNIX lsof DEVICE column alignment.

4.21 December 1, 1997

Squashed bug, introduced at revision 4.18, that resulted in double reporting of each selected PID when terse mode (-t) was specified.

Corrected minor bug, also introduced at 4.18, that might cause an extra print\_proc() pass when one PID has been specified.

Added -R to lsof options in scripts/idrlogin.perl\*. The option should have been there -- it was supposed to be mandatory for PGID reporting -- but a bug,

corrected  
in revision 4.18, previously made -R  
unnecessary.

Enabled configuring for BSDI BSD/OS 4.0 per a  
suggestion from Jeff Honig <jch@bsdi.com>.

Enabled replacement of scoff\_t with off64\_t (scoff\_t  
is used to type r\_size and r\_localsize in the rnode  
struct) for IRIX 5.3 systems that have the NFS  
kernel rollup patch (1477). This compensates for  
SGI's failure to distribute an updated <sys/fs/rnode.h>  
with their patch.

Validated under Linux 2.0.3[12], Linux 2.1.64, and  
NetBSD 1.3.

Added FreeBSD root directory reporting, courtesy  
of Dan Nelson <dnelson@emsphone.com>.

4.22 December 15, 1997

Made adjustments for Linux 2.1.7[02].

Improved NAME information for Linux UNIX domain  
sockets.

Added option +|-M to control the reporting of  
portmapper registration information in square  
brackets after the TCP or UDP port or service name.  
Kenneth Stailey <kstailey@disclosure.com> suggested  
the feature and provided sample code from OpenBSD.

Reporting  
is disabled by default in the distribution  
and may be enabled with +M; if lsof is compiled  
with HASPMAPENABLED (e.g., from machine.h), reporting  
will be enabled by default and can be disabled with  
-M.

Changed the -w option to +|-w to match the syntax  
of the +|-M option and to eliminate any options  
that flip meaning when a symbol is defined at  
compile time. For both +|-M and +|-w, specifying  
'-' when the default state is disabled or specifying  
'+' when the default state is enabled causes no  
problems.

!!!WARNING The -w option has changed in lsof 4.22. WARNING!!!

Made the +/- prefix legal for most options, but didn't document it in the man page or help panel. Most options that disable something -- e.g., -b, -C, -n, -P -- now disable when the prefix is '-' and enable when it is '+'. Since the states these options disable are enabled by default, I chose to avoid documentation complexity and confusion by not mentioning that they can be used with the '+' prefix.

Condensed the help panel.

Made sure Digital UNIX Configure stanza puts normal include path (e.g., /usr/include) before system include paths.

Added IPX socket information reporting to Linux with help from Jonathan Sergent <sergent@purdue.edu>.

4.23 January 16, 1998

Fixed conflict arising from the quondam replacement of the Sun Solaris <netdb.h> with a BIND/BSD version.

With help from Jonathan Sergent <sergent@purdue.edu> developed a /proc file system based Linux lsof. It needs some Linux 2.1.x release to work -- I'm not sure which, but I tested under 2.1.72, 2.1.76, and 2.1.79. The Configure script selects special sources for this lsof, so the full lsof distribution now contains both /dev/kmem and /proc based sources for Linux lsof. An optional kernel mod, written by Jonathan, enhances the /proc-based lsof ability to recognize IPX socket files. Reorganized and augmented the Linux sections in 00FAQ to explain the two types of Linux lsof.

Defined DOSTAT\_FUNCTION for dostat() in misc.c to select the function, stat() or lstat(), it will use. DOSTAT\_FUNCTION is normally undefined, defaults to lstat(), and is only defined for the /proc-based Linux lsof in its dlsof.h.

Made conditional on the presence of IRIX 6.4 XFS rollup patch #6 an XFS node change introduced in revision 4.16. Identified the patch with help from John R. Vanderpool <fish@daacdev1.gsfc.nasa.gov>.

Added NFS node compensation for NetBSD 1.3. The code and suggestion for it was supplied by Jean-Luc Richier <richier@imag.fr>.

Added diagnostic messages to the /dev/kmem-based Linux Mksrc script to report errors during the construction of the kernel name cache header file, kncache.h. Added 00FAQ information on kncache.h.

Added a new Linux test host, running 2.0.33 and Glibc, provided by Steve Logue <stevel@mail.cdsnet.net>.

Ported to PTX 4.1.3 and 4.4.2. Adjusted lib/rnch.c for 4.4.2 to allow customization of additional ncache struct element names.

4.24 January 28, 1998

Changed /proc-based Linux lsof offset test to use "/" instead of "/etc/passwd".

To assist Jim Mintha <jim@geog.ubc.ca> with the packaging of lsof for Debian Linux, added a DEBIAN\_LINUX\_LSOF #define to trigger the activation of special system map file location code in the /dev/kmem-based dproc.c.

Applied modification to dialects/bsd/dlsof.h from Ingimar Robertson <iar@skyr.is>, enabling lsof to compile for BSDI BSD/OS 2.0.

Corrected a documentation error in 00DCACHE, pointed out by Thomas Anders <anders@hmi.de>. The error was created when the -V option was added at lsof 4.17.

Made IRIX 5.3 through 6.3 lsof aware of IRIX SCSI tape devices (e.g., /dev/tape). Dave Olson of SGI and Randolph J. Herber of FNAL provided valuable advice, and Igor Schein <ischein@air-boston.com> helped test.

Added a machine.h symbol (NEVER\_HASDCACHE) that prevents Customize from offering to change HASDCACHE.

The symbol may appear anywhere in machine.h -- e.g., in a comment. Included the symbol in a comment of the HASDCACHE section of the /proc-based

Linux lsof machine.h, and accompanied it with warnings against #define'ing HASDCACHE. Did the same thing for WARNDEVACCESS (NEVER\_WARNDEVACCESS is the suppressant.)

4.25 February 7, 1998

Corrected an IRIX mis-cast of file offset (position). Igor Schein <ischein@air-boston.com> reported the problem. This was offered as a patch to 4.24. Picked some lint Igor pointed out.

At Igor's suggestion added an optional decimal digit size argument to the -o option. This argument specifies how many file offset decimal digits can follow "0t" before lsof switches to a "0x..." form. The argument size specification doesn't count the two characters of the "0t". A size of 0 means unlimited. The default is OFFDECDIG (8), preserving compatibility with existing lsof output; it can be changed by the lsof builder. When size is specified with -o it does not force offset display; -o without a size still must be used to do that.

Added an IRIX 6.2, 32 bit system, XFS node patch, courtesy of Ulrich Bernhard <rzubu@rzu.unizh.ch>.

For my own convenience enabled Configure to use /usr/local/bin/gcc for NEXTSTEP. This allows circumvention of a gcc 2.8.0 ranlib problem on my test 3.1 `040 cube.

Added flags recommended by the RISC/os and Ultrix compilers for the updated (and longer) main.c.

Updated FreeBSD cd9660\_node.h Configure test.

4.26 February 17, 1998

Added shared process group processing for IRIX 5.3, and IRIX 6.1 and above, based on investigation of a bug report from Igor Schein <ischein@air-boston.com>. Igor helped test this addition.

Improved handling of file system name arguments. It's now done in a manner similar to fuser. The -f argument forces path names to be considered as simple files, rather than as file system names. The



+f flag forces them to be considered as file system names. Normally path arguments are considered file system names when they match a mounted-on directory in the system's mount table, or when they match a mounted file system's block device. Igor Schein helped test this change.

Igor also suggests that the proper compilation of the IRIX 6.4 proc structure after patch 2536 has been installed may need -DPIOMEMOPS. So lsof's MkKernOpts script was updated to propagate that option from CCOPTS in /var/sysgen/system/irix.sm, even though patch 2536 doesn't add -DPIOMEMOPS to it. Added a 00FAQ item on this patch.

Added a fatal warning message about names forced to be file system names (with +f) that have no match in the mount table.

Improved the -V message for files and file systems for which no open files were found. Added reporting of /proc file and file system search failures.

Did some code reorganization to combine the multiple ck\_file\_arg() functions into one. Moved the new function from the library to the top level and put it in arg.c; moved the usage function from arg.c to a new top-level source file, usage.c, to balance top-level source file size. The new usage.c depends on version.h; arg.c no longer does.

Added flag recommended by the DU compiler for the updated (and longer) main.c.

4.27 March 6, 1998

At the request of Igor Schein <ischein@air-boston.com> added a conditional repeat mode option, using the `+' prefix to the `r' option. +r operates as does -r with the exception that it exits the first time no open files have been listed during a cycle. The exit code will be zero when any open files have been listed; one, if none were ever listed.

Ported lsof to HP-UX 11.0 with the help of Richard Allen. This port hasn't been tested on a 64 bit kernel; I'm sure it won't work there without more mods. It may not work on PA 2 architectures; I've

only tested it under PA 1 and a separate, busy tester reported PA 2 problems that I've been unable to investigate.

In anticipation of getting access to a 64 bit HP-UX kernel and the pending start of the Solaris 2.7 Beta test (It will have 64 bit kernel addressing.), started adding support for 64 bit kernel pointers. This includes: ubiquitous use of the KA\_T cast for kernel pointers; a format to print them, KA\_T\_FMT\_X; a function to print them, print\_kptr(); and modifications to most kernel-related functions -- e.g., process\_file(), process\_node(), process\_socket(), readvfs() -- to process kernel addresses as KA\_T types.

Fixed minor bug in handling path name arguments that end with a `/'.

Removed support for RISC/os; its test system is no longer available.

Made modifications to insure that lsof output doesn't contain non-printable characters. All such characters are now printed in the printf form "\x%02x". Several new common functions were installed in misc.c to support "safe" printing.

This second major modification in 4.27 to common and dialect code could have introduced bugs not yet detected.

4.28 March 10, 1998

Refined unprintable format to use \b, \f, \r, \n, \t, and ^\* (for CTRL) forms. Corrected omission of safestprnt() use for field output command name. These changes were offered as patches to 4.27.

Made space an unprintable character (\x20) in the COMMAND column; printable elsewhere, including the NAME column, field output, and error messages.

Made sure FD column is parseable as a single entity -- i.e., has no embedded space. Thus, if the access mode is unknown but there is a known lock mode, (a very rare case) the access mode will be printed as `-'.

Picked lint with gcc 2.8.0 under Solaris 2.6.

With the help of Dave Olson of SGI identified a proc struct element that should have been added to <sys/proc.h> by IRIX 6.4 patch 2536. Added a work-around for it to the lsof Configure script.

Igor Schein

<ischein@air-boston.com> identified that the patch caused a proc structure length complaint from lsof. Removed an obsolete 00FAQ item on the patch, installed at lsof 4.26, explaining that no solution was yet available.

Added a 00FAQ item on how BIND installs its own header files, including <netdb.h>, which may cause the rpcent struct definition to vanish. Solaris has an automatic lsof work-around, but that hasn't been (and probably can't be) propagated to all dialects supported by lsof. The 00FAQ item recommends re-installation of the vendor header files that BIND has replaced. (Others include <rpcent.h>, <sys/bitypes.h>, and <sys/ctypes.h>.)

Made AIX AFS fixes.

4.29 March 26, 1998

Corrected bug in Internet address matching. The matching formerly stopped if the foreign address matched, thus failing to check the local address for a match. That led to a possible false "Internet address not located" warning (i.e., in response to -V)

about the local address, when both foreign and local addresses were specified with -i. This correction was offered as a patch to 4.28.

Changed readmnt() usage in an attempt to defer mount readlink() and stat() delays until they are necessary.

Corrected two bugs in the Digital UNIX readdev() function. Made the correction available as a patch to 4.28 and regenerated the 4.28 DU binaries.

Added a missing argument to a print-kptr() call in the HP-UX dsock.c. The missing argument causes a fatal gcc error. The problem was reported by Eyal

Shaynis <eyal.shaynis@telrad.co.il>. The fix was offered as a 4.28 patch.

Adjusted for Digital UNIX 4.0D; the spec\_node structure is now defined in <sys/specdev.h>. Kris Chandrasekhar <Kris.Chandrasekhar@digital.com> identified the need for the adjustment.

Incorporated a bug fix from Brian McAllister <mcallister@mit.edu> to the DU readmnt() function. This fix was offered as a patch to 4.28.

Added "safe" printing to a SunOS clone device error message.

Corrected bug in tabling of Linux /proc-based lock info.

Corrected bug in handling of SunOS TLI streams. Dan Farmer <zen@trouble.org> reported the problem.

Added a Solaris 2.6 work-around to keep the BIND <sys/bitypes.h> from colliding with the Solaris <sys/int\_types.h>.

Strengthened the Configure test for /proc-based Linux lsof, based on a report from Marty Leisner <leisner@sdsp.mc.xerox.com>.

Tested on OpenBSD 2.3.

Made AIX changes that allow use with 3.2.5. The changes were suggested and tested by Brett Hogden <hogden@rge.com>.

Added Solaris 2.6 AFS support. Disabled reporting of some node numbers for Solaris 2.5 and above open AFS files. The node number computation algorithms used for SunOS 4.1.x and Solaris less than 2.5 no longer always work under Solaris 2.5 and above.

4.30 April 9, 1998

Corrected a pid structure member naming error for UnixWare < 2.1.2. The problem was reported by Richard van Meurs <vanmeurs.anva@atriserv.nl>. He supplied the correction. This was offered as a

patch to 4.29.

Had a report from Igor Schein <ischein@air-boston.com> that IRIX 6.4 patch 2839 is another SGI kernel patch, along with 2536, that changes the size of the proc structure in the kernel without changing the proc structure in <sys/proc.h>. Upon further investigation found that the effect of these patches on the proc structure is not consistent. Therefore, dropped the Configure patch test for IRIX 6.4 and made the code in irix/dproc.c slightly more tolerant of proc structure size differences for IRIX 6.4. Igor help test the change.

Corrected Solaris >= 2.5 AFS inode number generation. Craig Everhart <Craig\_Everhart@transarc.com> helped find the cause of the problem. This was offered as a patch to 4.29.

Refined the Linux /dev/kmem-based glibc evasion for the timeval structure to make it work with glibc version 2.0.7. This required defining a new global symbol, TIMEVAL\_LSOF, default timeval, that the /dev/kmem-based Linux lsof can set to its private glibc timeval name, distinct from the kernel timeval name.

Added support for Alpha to the /dev/kmem-based Linux lsof. Alexandre Oliva <oliva@dcc.unicamp.br> provided a test system. Added an item to 00FAQ about lsof, the Alpha processor, and Linux.

Added a 00FAQ item about lsof year 2000 compliance. Basically it says lsof is probably compliant, because its only date or time computations are done with time\_t values, but I haven't done any specific Y2K validation. I don't have plans to do any.

Added support for UnixWare 7. Chris Daniels <chrisd@dlpco.com> provided a test system and Don Draper <dond@sco.COM> provided technical information. Added BFS and SFS file system support to lsof for UW 2.1.[12] and 7.

Updated Solaris VxFS support for VxFS 3.2.1. Greg Earle <earle@netbsd4me.jpl.nasa.gov> reported the need for

the update. Greg and Roger Klorese  
<rogerk@veritas.com> provided technical information.  
Scott McClung <mcclung@primenet.com> tested.

Changed IRIX XFS patch detection in anticipation of learning there are multiple XFS patches for IRIX 6.4 that require different versions of the lsof-invented xfs\_inode structure.

#### 4.31 April 21, 1998

Added a VxFS #if/#endif wrap to a section of the HP-UX dnode.c that wasn't properly protected. The problem was reported by Peter Klosky <PKlosky@bdm.com>. This was offered as a patch to 4.30.

Added support for Solaris 2.7 (first Beta release). Mike Sullivan <Mike.Sullivan@Eng.Sun.COM> provided technical advice and helped test. Charles Stephens <cfs@jurassic.eng.Sun.COM> also helped test.

Fixed bug in /proc-based Linux that caused it to access /proc/mounts excessively. Marty Leisner <leisner@sdsp.mc.xerox.com> provided a syscall trace that identified the bug. The fix was offered as a patch to 4.30.

Adjusted the IRIX 6.4 private structure definition for the XFS node to accommodate patch 2970. Igor Schein <ischein@air-boston.com> identified the patch and the required adjustment.

#### 4.32 May 11, 1998

Corrected Solaris 2.7 code for reporting PCFS (floppy disk) node numbers. Casper Dik <casper@holland.sun.com> supplied the fix. The fix was offered as a patch to 4.31.

Corrected a bug in conditional repeat mode handling pointed out by Igor Schein <ischein@air-boston.com>. This was offered as a patch to 4.31.

Improved reporting of AIX open(/dev/memory device) errors.

Corrected a Solaris < 2.5 KA\_T declaration error, pointed out by Robert Kiessling <robert@easynet.de>. Changed KA\_T from a #define to a typedef for all

dialects to prevent future problems of this kind.

Changed the sample Perl 5 script `big_brother.perl5` to report a four digit year from `localtime()`.

Added support for AIX 4.3[.1]. Bill Pemberton <wfp5p@tigger.itc.virginia.edu> provided a test system.

Andrew Kephart <akephart@austin.ibm.com> and Tom Weaver <tvweaver@austin.ibm.com> provided technical assistance. Niklas Edmundsson <nikke@ing.umu.se> did 4.3.1 testing.

Added `-qmaxmem` option to CFLAGS for an AIX compilation with an xlc version 4.x compiler.

Adjusted Linux socket handling for changes in the AX25 members of the `sock` struct. Richard Green <rtg@tir.com> pointed out the problem. Tested `/dev/kmem`-based `lsof` under Linux 2.0.34.

#### 4.33 May 22, 1998

Added generic IPv6 support to common `lsof` sources and specific IPv6 support to AIX sources. Andrew Kephart <akephart@austin.ibm.com> supplied the additions and helped with testing. Bill Pemberton <wfp5p@tigger.itc.virginia.edu> provided a test system. The modification affected sources for every dialect, whether it supports IPv6 or not, by changing the interfaces to the common Internet address function `ent_inaddr()`.

Added support for the NetBSD UVM virtual memory system.

Paul Kranenburg <pk@cs.few.eur.nl> supplied technical details.

Bracketed HP-UX 11 use of `<sys/spinlock.h>` with `#if/#endif _KERNEL`.

Corrected printing of PCB address in DEVICE column for IRIX.

#### 4.34 June 26, 1998

Updated 00FAQ to discuss TCP and UDP ports private to the AIX kernel and 00README to describe how ACLs can be used to give `lsof` permission to read the kernel memory devices. Add information to 00FAQ

and 00README about other OpenBSD architectures where lsof is reported to compile and run. Added section to 00FAQ discussing how an incorrect loader path environment variable value can prevent lsof from loading correctly.

Improved Solaris namefs and doorfs support so that it is now possible to search for an open VDOOR file by the path name of its fattached file system object. Igor Schein <igor@txc.com> requested the ability to do such a search. Even with the change, lsof can't always identify path names for open VDOOR files.

Also at Igor's request, improved reporting of information on open Solaris VCHR files that share a common vnode, and Solaris UNIX domain socket files.

Corrected print\_kptr() argument error in PTX dnode.c, reported by Mark Price <mprice@sequent.com>. Compensated for ncache element naming differences, introduced at PTX 4.4.2; Kurtis D. Rader <krader@sequent.com> reported the problem.

Changed output column title from INODE to NODE to better reflect the column's contents of node IDs for more than just inodes.

Improved Configuration and processing for Solaris AFS. Corrected AIX AFS 3.4 afs\_rwlock\_t simulation.

Corrected a cast problem with two AIX knlist() calls, thus quieting an AIX 4.2.1 compiler argument type warning. Jon Champlin <champlin@us.ibm.com> reported the problem.

Added support to most dialect versions (exception: /proc-based Linux) to warn when the identity of the kernel where lsof was compiled doesn't match the running identity. The warning can be suppressed with -w. Note: determining AIX state requires calling oslevel, a potentially slow operation. Jon Champlin <champlin@us.ibm.com> suggested this addition.



!!!! WARNING !!!! !!!! WARNING !!!! !!!! WARNING !!!!

Those using the lsof cross-configuration capability (see 00XCONFIG), should be aware that the kernel identity test feature introduces two new basic cross configuration environment variables, LSOF\_ARCH and LSOF\_VSTR.

!!!! WARNING !!!! !!!! WARNING !!!! !!!! WARNING !!!!

Identified a situation where a Solaris UNIX domain socket name is known and can be searched for by name; added the necessary code.

#### 4.35 July 17, 1998

Made the kernel identity check an option with the HASKERNIDCK #define in machine.h. Enabled altering of HASKERNIDCK with the Customize script. Added a clause to the help output that indicates the build-time HASKERNIDCK status.

Added more information to the NAME column for Solaris UNIX domain sockets. Made them searchable by their clone device path name. Igor Schein <igor@txc.com> requested this.

Completed the HP-UX 11 port with support for its optional 64 bit kernel. Rich Rauenzahn <rrouenza@cup.hp.com> provided a test system. Corrected errors with HP-UX 11 lock reporting and private kernel structure and type definitions. Added support for HP-UX NFS3 files.

Limited mount table warnings -- e.g., when -b is used -- to one set per mount point.

Fixed some mount table scanning and usage bugs, including one in Solaris, reported by Kjetil Torgrim Homme <kjetilho@ifi.uio.no>.

#### 4.36 August 4, 1998

Made corrections and additions to IPv6 support and to AF\_ROUTE socket handling, supplied by Jean-Luc Richier <Jean-Luc.Richier@imag.fr>. Jean-Luc's additions provide IPv6 support for the Inria IPv6 implementations on FreeBSD and NetBSD.

Fixed two Solaris 2.5, 2.5.1, 2.6 and 2.7 TCP and UDP host name or IP address reporting bugs, reported by James Mathiesen <James-Mathiesen@deshaw.com>. This fix was offered as a patch to 4.35.

Updated the Customize script to cause ENTER to use all defaults. Amir J. Katz <amir@ndsoft.com> suggested this and helped test the changes.

Updated Solaris ICMP and IP stream handling, based on a report from Igor Schein <igor@txc.com>.

Fixed a bug in the Digital UNIX mount table handling, reported by Bob Ward <bward@thehartford.com>. While working on the bug, found and updated some obsolete AdvFS code. This fix was offered as a patch to 4.35.

4.37 September 15, 1998

Deactivated SGI IRIX support and archived revision 4.36 sources and binaries in pub/tools/unix/lsf/OLD.

Improved performance of FD searching. This was offered as a patch to 4.36.

Amir J. Katz <amir@ndsoft.com> pointed out that ranlib isn't needed for AIX or Solaris. Made appropriate Configure script changes.

Fixed a file offset reporting bug for HP-UX VCHR and VBLK device nodes located on a VxFS root. Doug Siebert <douglas-siebert@iowa.edu> reported the bug. The fix was offered as a patch to 4.36.

Resolved an HP-UX root device name reporting bug, partly caused by an out-dated local copy of the <sys/mount.h> mount structure, by generating a local header file with the structure that can be compiled without needing \_KERNEL defined. Doug Siebert also reported this bug.

Changed some dialect source code -- Digital UNIX, Solaris, SunOS, and UnixWare -- to make more consistent with ps the user ID lsof reports in the USER column. Added a 00FAQ entry about it. Igor Schein <igor@txc.com> reported the Solaris and

SunOS lsof inconsistencies with what ps(1) reports.

Ported lsof to Pyramid ReliantUNIX 5.44.

Added brackets as comments to case, do, done, else, endif, esac, if, and while statements in Configure to assist in navigating its clauses.

Added more Linux 2.0.x glibc work-arounds.

Added support for UnixWare 7.0.1.

Ralph

Forsythe <ralph@contact-paging.com> provided a new FreeBSD test system.

4.38 November 25, 1998

Added support for recent FreeBSD 3.0 distributions. A 3.0 test system was provided by David O'Brien <obrien@NUXI.com>. This was offered as a patch to 4.37.

Updated the scripts/idrlogin.perl\* files to look for sshd processes in addition to rlogind and telnetd ones.

Added support for DU 5.0 Beta. Berkley Shands <berkley@cs.wustl.edu> provided a test system.

Added support for OpenBSD 2.4 with changes supplied by Kenneth Stailey <kstailey@disclosure.com>.

Changed the Solaris 2.7 tests and documentation to Solaris 7.

Made some changes to the header files for NEXTSTEP 3.3 and added support for OPENSTEP 4.x with help from Michael A. Hovan III <mhovan@BLaCKSMITH.com> and Carl Lindberg <Carl\_Lindberg@BLaCKSMITH.com>. The combined dialect subdirectory is named n+os. One of Carl's changes propagates RC\_CFLAGS to the library Makefile. Timothy J. Luoma <luomat@peak.org> helped test under NEXTSTEP 3.3 and OPENSTEP 4.2.

Made UW 7.x version sensitive to the presence of ptf7038. Added peer PCB address to Unix domain socket Name column, even when a path name has been

located. Information for these changes was supplied by Francis Le Bourse <flebourse@intelcom.fr>. Lee Penn <lee@dlpco.com> provided a test system.

Tested lsof under OSR 5.0.5 on a test system also provided by Lee Penn.

Made path name argument processing more tolerant of errors per a suggestion from Julian Gordon <julian@cadence.com>.

Acquired a new UnixWare 2.x test system, generously provided by Computer Classroom, Inc. -- Matthew Thurmaier <matt@compclass.com>, Ken Laing <ken@compclass.com>, and Andrew Merrill <andrew@compclass.com>. Updated Configure to accept a UnixWare version of 2.1.3.

Updated kmem-based lsof for Linux 2.0.36.

Updated NetBSD sources for a change in a UVM virtual mapping header file.

Corrected a cache allocation bug in Sun format kernel name cache handling. The bug only shows up when the kernel name cache is inaccessible.

4.39 December 29, 1998

Corrected problems with large device number handling for 64 bit Solaris 7. The problems were reported by Steve Bellenot <bellenot@math.fsu.edu>. Steve helped test the fixes. The fixes were offered as two patches to lsof 4.38.

Improved FreeBSD Configure operations for header files that must be obtained from the kernel source tree, based on a suggestion from David O'Brien <obrien@NUXI.com>.

For Bela Lubkin <filbo@deephought.armory.com> made optional with +f[cfn] the display of file structure address, shared use count, and node structure address. /proc-based Linux doesn't implement this feature, because it doesn't read kernel structures from kernel memory. Modified the PTX -X option to take advantage of the new file structure display option. Added shared.perl5 to the scripts/

subdirectory

to provide an example of how `+f[fn]` might be used to track shared file descriptors and files.

Added more `/dev/kmem`-based Linux glibc evasions, provided by Jeff Johnson <bj@redhat.com> and Maciej Lesniewski <nimir@kis.p.lodz.pl>. Jeff helped test them on various Linux architectures.

Tested on AIX 4.3.2; no changes were required. Doug Crabill <dgc@purdue.edu> provided a test system.

Fixed `-c` option to detect missing command name when following option begins with ``+'`.

4.40 January 25, 1999

Added support for using the CDS compiler for Reliant Unix 5.44 and above. Made Reliant Unix MIPC support optional, dependent on the presence of `<sys/mipc.h>`.

Based on a report from Michael Schmitz <MSchmitz@lbl.gov> that `/dev/kmem`-based `lsof` misbehaves on a Linux 2.0.x m68k kernel without module support, made the absence of `query_module()` or `get_kernel_syms()` Linux kernel support a fatal error. Updated relevant sections of 00FAQ to reflect the change.

Added the ability to force the Linux Configure stanza to use the `/proc` or `/dev/kmem` source base via a `LINUX_BASE` environment variable specification. This is a cross-configuration assist.

Added `"+D <dir>"` and `"+d <dir>"` options for directory searching. `+D` searches the entire tree, starting at `<dir>`, including `<dir>`, its contents, and its subdirectory branches; `+d` searches only `<dir>` and its contents, but not its subdirectory branches. Improved `lsof`'s searching of the specified name list to compensate for anticipated long lists from `+d` and `+D`.

Made an `egrep` in the Solaris Configure stanza usable by the standard and XPG4 `egrep`'s. Kenneth Stailey <kstailey@disclosure.com> pointed out the improvement.

Fixed bugs in /dev/kmem-based Linux and UnixWare  
Unix domain socket name searching.

Changed a Linux Alpha #include to be conditional  
on the presence of its named header file, so that  
lsf will compile on Red Hat 5.1 and 5.2 (Linux  
kernel 2.0.35)

where the header file is absent.

The problem was reported by Alexandre Oliva  
<oliva@dcc.unicamp.br>.

Fixed an AIX 4.3+ bug in procinfo struct space  
allocation, reported by Jeff Stewart <jws@purdue.edu>.  
This was offered as a patch to 4.39.

Added an lstatsafely() function to offer the same  
isolation for lstat() calls that statsafely() offers  
for stat() calls. This made DOSTAT\_FUNCTION no  
longer necessary, so deleted it.

With help from Laurent P. Montaron <lpm@sequent.com>  
ported lsf to PTX 4.4.4. Laurent did a monumental  
job of identifying TCP/IP changes by their TCP  
version, rather than by their PTX (With mix 'n  
match PTX and TCP/IP versions, the PTX version  
often has no bearing on the TCP/IP version.), and  
changed the Configure script and pre-processor  
#if/#else/#endif blocks to match. He also updated  
Unix domain socket handling for PTX TCP/IP versions  
4.5 and above.

Updated CLIENT handle acquisition of fill\_portmap()  
in print.c to  
use the more modern RPC function  
clnt\_create() in place of clnttcp\_create() where  
possible. PTX 4.4.4 requires clnt\_create().

4.41 February 27, 1999

Added FreeBSD 3.1 and 4.0 support with help  
from Sheldon Hearn <axl@iafrica.com>, David O'Brien  
<obrien@NUXI.com>, and John Polstra <jdp@polstra.com>.

Corrected bungled AIX 4.3+ patch that went into  
lsf 4.40.

Reorganized the Configure script to improve Makefile  
construction. A specific impetus for this was to  
allow FreeBSD system-wide make flags to be propagated

to the lsof Makefiles, but other goals were to make sure that the DEBUG= make entry can over-ride standard CFLAGS values, and to better manage the identification of compilers and their versions. Two compiler-related values may now be supplied in environment variables: 1) the compiler path in LSOF\_CC; and 2) the compiler version in LSOF\_CCV. 00XCONFIG documents them.

Added support for Pyramid Reliant Unix bsdafs, mssockfs, and sockfs file systems.

Added an optional LSOF\_CINFO string to Configure, producing a CINFO string in selected Makefiles, producing a #define LSOF\_CINFO in selected version.h header files. The purpose of this is to allow Configure the option to propagate information to the lsof -v output. It is now used for Linux to identify the code base, and for HP-UX 10.30 and 11.0 and Solaris 7 to identify the kernel bit size.

Added system information to NEXTSTEP and OPENSTEP -v output, from the second line of hostinfo's output.

Fixed a login name buffer overflow problem in the processing of -u option values. This was offered as a patch to 4.40. **!!!THIS IS A SERIOUS STACK OVERFLOW BUG; A LINUX EXPLOIT EXISTS FOR IT THAT OPENS A BASH SHELL WITH LSOF'S AUTHORITY -- E.G, SETGID(KMEM) POWER!!!**

Improved the Solaris mount table filter so the volume manager's fake mount point, "/vol", is ignored and doesn't supplant "/" in NAME column path assemblies. Igor Schein <igor@txc.com> reported this bug and provided important help in finding it. This was offered as a patch to 4.40.

Changed the Linux /dev/kmem-based lock ownership test to answer a problem reported by Tom Christiansen <tchrist@jherreg.perl.com>. This was offered as a patch to 4.40.

Installed an HP-UX 11 patch, suggested by Kevin Vajk <kvajk@cup.hp.com>, that adjusts a private

lsof kernel header file, derived via Q4, to correspond to an HP-UX patch bundle.

Made NetBSD 1.3I sockproto structure adjustment.

4.42 March 30, 1999

Fixed a typo in the HP-UX dfile.c that caused +fF and +fN output controls to swap effect.

Enabled for OpenBSD 2.5 per notice from Kenneth Stailey <kstailey@kstailey.tzo.com>

Made more VM accommodations for FreeBSD 4.0.

Improved file system search reporting to include path name components when they're available, instead of mindlessly reporting the file system name in the NAME column. Guy Dallaire <gdallair@geocities.com> brought the need for this change to my attention.

Updated Solaris 2.6 VxFS for Veritas Oracle Database Edition 2.0, VxFS version 3.3, and VxVm version 2.5.4, based on a report from Chris Kordish <chris.kordish@East.Sun.COM>. Chris kindly provided a test system.

Improved HP-UX ipc\_s patch detection in Configure, response in ../dialects/hpux/hpux11/ipc\_s.h, and documentation in 00FAQ, Kevin Vajk <kvajk@cup.hp.com> helped test.

Added to Customize the option to suppress HASKERNIDCK selection for specified dialects. Suppressed it for /proc-based Linux lsof, and removed its test and code from there. Tin Le <tin@netimages.com> alerted me to the need for this update.

Ported to official Digital UNIX 5.0 release.

Changed DU lsof to use the knlist(3) function when no kernel file has been specified with -k. This change was suggested by Erich Wimmer <Erich.Wimmer@digital.com>.

Updated Configure for latest NetBSD (1.3I?) with UVM support the



default.

4.43 May 11, 1999

Corrected a typo in the Solaris gcc discussion in 00FAQ. Made changes to the Solaris 2.5[.1] private tcp\_s structure. Both changes were done in response to reports from Igor Schein <igor@txc.com>, who tested the Solaris 2.5 change.

Made more IPv6 adjustments to lsof for Tru64 UNIX (Digital UNIX) 5.0, based on information obtained from Compaq by Berkley Shands <berkley@cs.wustl.edu>.

Corrected HP-UX error message about HP-UX 11 q4 usage. Amir Katz <amir@ndsoft.com> reported the correction.

Fixed a Glibc 2.1 conflict in /proc-based Linux lsof.

Fixed a man page typo reported by Vlad Harchev <hvv@hippo.ru>.

Changed some Solaris 2.7 references to Solaris 7 in Configure and 00XPORTING.

Added a Solaris example to the echo statements that are the install rule in the SunOS/Solaris Makefile.

Added a field to the file structure output -- FILE-FLAG (file structure open flags, f\_flag[s], and process file flags, typically u\_pofile) -- enabled with +f[gG]. Its field output character is 'G'.

Figured out another piece of the HP-UX 11 patched ipc\_s structure puzzle with the help of Keith Kalet <KEITH\_KALET@HP-USA-om41.om.hp.com>.

Fixed a PTX real vnode to real inode interpretation bug.

Added link count to lsof output. Eric Dumazet <dumazet@risgw.ris.fr> requested and helped test it. The new +L option enables and filters it. Its field output character is `k'.

Updated Configure script to recognize NetBSD 1.4.

Updated AFSConfig to handle default answers to questions.

Incorporated patch from Jonathan Sergent <sergent@io.com> that enables /proc-based Linux lsof to run on both 32 and 64 bit kernels.

Updated Configure script with a patch from David O'Brien <obrien@NUXI.com> that recognizes FreeBSD 3.2.

#### 4.44 June 24, 1999

Corrected use of nlink member of hsnode for SunOS

4.1.x High Sierra File System files. John Dzuberka <zube@tlaloc.stat.colostate.edu> reported

the

problem and helped test the fix. Also fixed a SunOS segmentation fault bug. These fixes were offered as a patch to 4.43.

Improved handling of /proc-based Linux UNIX PCB address.

Fixed a NEXTSTEP and OPENSTEP bug that made repeat option (-r) processing malfunction. This fix was offered as a patch to 4.43.

Fixed Configure so it doesn't use -O in the Cflags for the bundled HP-UX C compiler. Jim Ankenbrandt <jankenbrandt@penton.com> reported the problem.

Corrected output ordering of parent PID and process group ID when both -R and -g are specified.

Enhanced the pdev.c and pdvn.c library modules for wider use. These dialect versions use the new library modules: DEC OSF/1, Digital UNIX, and Tru64 UNIX; Pyramid DC/OSx and Reliant UNIX; SCO OSR and UnixWare; and Sequent PTX.

Added basic clone device support to /dev/kmem-based HP-UX lsof for HP-UX 10.30 and higher.

Added raw socket support to /proc-based Linux lsof.

Changed NODE-ADDR column title to NODE-ID in anticipation of using more general identification information in the column.

Ported to UnixWare 7.1, using a test system kindly provided by Matt Thurmaier <matt@compclass.com> and Don Draper <dond@sco.com>.

Updated for NetBSD 1.4C VM changes, and a new current and root working directory structure.

Made minor adjustment for latest Tru64 UNIX 5.0 Beta release.

4.45 July 30, 1999

Fixed quoting problem in DEC OSF/1, Digital Unix, and Tru64 UNIX Makefile's install rule. The problem was reported by Berkley Shands <berkley@cs.wustl.edu>. Fixed bug in Tru64 UNIX 4 lsof that caused FDs to be skipped. These fixes were offered in a patch to 4.44.

Fixed a repeat-mode /proc-based Linux lsof bug, reported by Sami Farin <sfarin@ratol.fi>. This was offered as a patch to 4.44.

Picked lint, some reported by Sami Farin.

Corrected a 00DCACHE documentation error in a sample shell script. The problem was reported by Chad R. Larson <chad@larsons.org>. Changed commented-out entries in machine.h files so they require more thought and work when the comments are removed, based on a remark by Chad.

Compensated for the practice of Solaris 7 and above to record the dev= value in /etc/mnttab in 32 bit mode, even on 64 bit systems. This was offered as a patch to 4.44.

Added a C library test for /proc-based Linux lsof, so that the #include files can be adjusted for a non-Glibc environment. The need for this was reported by Andrew Hill <andrewh@tirin.openworld.co.uk>. This was offered as a patch to 4.44.

Added support for Auspex LFS 1.8.1 and 1.9.2 to SunOS 4.1.4 lsof. The support was requested by Quentin Fennessy <quentin@dvorak.amd.com>, who provided information and did testing.

Enabled IPv6 support code for NetBSD and OpenBSD, conditional on Configure script tests. Wolfgang Rupperecht <wolfgang@wsrcc.com> supplied the NetBSD code and tested it. The OpenBSD code

I constructed

has been compiled but not tested.

Updated the identd Perl 5 script, based on a report from Wendy Lin <af5@taiyang.cc.purdue.edu> that the space in its response line in front of the user name violates RFC 1413.

Added IPv6 support to /proc-based Linux lsof. Jonathan Sergent <sergent@ETLA.NET> and Andrew Thomas Sydelko <sydelko@ecn.purdue.edu> kindly provided a test system.

Updated man page description of AIX multiplexed files to indicate that they might be /dev/ptc or /dev/pts, depending on the AIX version. The correction was suggested by Onno van der Linden <onno@simplex.nl>.

Sylvain Robitaille <syl@alcor.concordia.ca> reports lsof passes his Y2K tests.

#### 4.46 October 23, 1999

Corrected /proc-based Linux lsof to detect that an IPv6 address is a mapped IPv4 address. The problem was reported and analyzed by Arkadiusz Miskiewicz <misiek@misiek.eu.org>, who also tested the fix.

Added a libc5 library /dev/kmem-based Linux lsof circumvention, supplied by Jason Lingohr <lingman@lucid.net.au>.

Corrected a bug in -t (terse) AIX output, reported by Wendy Lin <af5@taiyang.cc.purdue.edu>. I introduced the bug at revision 4.43 when adding FILE\_FLAG reporting. This was offered as a patch to 4.45.

Added a work-around for a problem in the OpenBSD 2.3 <sys/pipe.h> header file. Volker Borchert <bt@tekon.de> provided and tested it.

Improved description of cross-building lsof for a 64 bit Solaris 7 system on a 32 bit system with suggestions from Phillip Edwards <Philip.Edwards@sn.wpafb.af.mil>.

Fixed a gawk POSIX-mode pattern error in the Linux /dev/kmem-based Mksrc script, based on a tip from Ambrose C. Li <acli@mingpaoxpress.com>.

Fixed a bug in the Tru64 UNIX IPv6 handling, courtesy of a report from Casper Dik <casper@holland.sun.com>.

Enabled support for OpenBSD 2.6.

Enabled support for BSDI BSD/OS 4.1, based on a report from Jeffrey C Honig <jch@bsd.com> that only a Configure script change is necessary.

Enabled Configure script to use gcc for building lsof for a 64 bit Solaris 7 and 8 kernels, if the gcc version is 2.95 or above.

Improved -i option handling for systems with IPv6 support so that it will search for a host name in both IPv4 and IPv6 families, when that is possible. As a companion modification, changed -V processing to report a single error when a multiple host name match is requested. Casper Dik <casper@holland.Sun.COM> helped test.

Fixed a DEC OSF/1, Digital UNIX, Tru64 UNIX repeat mode bug, reported by Mayer Ilovitz <mayer@cooper.edu>. Mayer helped test the fix. The fix was offered as a patch to 4.45.

Changed Solaris socket file recognition scheme, so it is (nearly) the same through Solaris 8, where the previous clone device scheme no longer works.

With significant assistance from Casper Dik, added support for Solaris 8 Beta and Beta refresh. The IPv6 support in Solaris 8 is still in some flux, so there are temporary compensations for the differences between Beta IPv6 support and Beta refresh IPv6 support. Casper and I hope those differences disappear by FCS.

Improved the delivery of information on Solaris 2.5.1, 2.6, 7, and 8 door files.

Fixed a repeat mode bug that surfaces when /etc/passwd changes between cycles. The bug report and diagnostic help were supplied by Igor Schein <igor@txc.com>. The fix was offered as a patch to 4.45.

Added support for INRIA IPv6 to NetBSD. Jean-Luc Richier <Jean-Luc.Richier@imag.fr> provided patches and a test system on which to verify them.

Added support for AIX 4.3.3. Jeff W. Stewart <jws@anaconda.cc.purdue.edu> provided a test system.

Made adjustments for FreeBSD 4.0-current.

Improved reporting of information for AIX sockets that lack protocol control blocks.

4.47 November 29, 1999

Based on a query from Jean-Pierre Radley <jpr@jpr.com>, changed the lsof top-level Makefile to propagate CFGF to the library Makefile. (DEBUG was already being propagated.) Added osrgcc and scogcc Configure abbreviations (to use gcc) for Jean-Pierre.

In response to a query from Igor Schein <igor@txc.com>, improved the Configure script test for Solaris 7 and 8 that decides if the compiler can produce 64 bit executables.

Made an ugly hack, based on making a private rnode structure definition from q4 output, to compensate for HP-UX 10.20 and lower recent NFS3 patches. HP didn't supply an updated <nfs/rnode.h> with the patches. The problem was reported by Will Partain <partain@mekb2.sps.mot.com>. Elias Halldor Agustsson <elias@hi.is> helped identify the patches as PHNE\_18173, PHNE\_19426, PHNE\_19937, and PHNE\_20091, and provided a test system.

Switched BSDI test system from 2.1 and 3.1 to 4.0.1, courtesy of Terry Kennedy <terry@tmk.com>.

Added some more dev\_t hacks for Alpha FreeBSD 4.0.

Added support for IPv6 on BSD 4.x. The support hasn't yet been tested, just compiled.

Added support for the mnt file system (mntfs or /etc/mnttab) on Solaris 8. Tested on Solaris 8 BETA-Refresh.

Made selection of optional fields (e.g., PPID with -FR) in a field output specification select the optional field, too, so that the option selector for the field (e.g., -R) isn't also required. This change was made in response to an inquiry from John DuBois <spcedt@armory.com>. This may require some revision to scripts that parse all field output; two scripts in the lsof distribution's scripts/ subdirectory had to be updated.

Corrected handling of Linux IPv4 addresses mapped in IPv6 addresses.

Tested under OpenBSD 2.6.

4.48 January 14, 2000

Modified -i argument processing of colon-separated IPv6 addresses to recognize an IPv4 address mapped in an IPv6 address and handle it as an IPv4 address. This was offered as a patch to 4.47.

Added a defined symbol (NOWARNBLKDEV) to control (inhibit) the issuance of a warning when no block devices are found. This was done anticipating its need in FreeBSD 4.x, but that dialect version no longer has any block devices, so HASBLKDEV was disabled for it instead. NOWARNBLKDEV was left in place for possible use in the future.

Enabled KAME IPv6 Configure support for FreeBSD when <netinet6/in6.h> is found.

Disabled use of gcc to compile lsof for 64 bit HP-UX 11.

Updated Configure to recognize FreeBSD 3.4.

Based on suggestions from Bernt Christandl

<beb@MPA-Garching.MPG.DE> improved AFS configuration for AIX and Solaris, and updated AIX AFS 3.5 support. Johannes Tax <tax@bluedog.oit.unc.edu>, Hung T. Pham <hung\_pham@unc.edu>, and Curt Freeland <curt@grumpy.cse.nd.edu> provided test systems.

Updated lsof's private rnode definition for AIX 4.3.3, since IBM still doesn't ship the <oncpus/nfs/rnode.h> header file and the rnode structure definition in <nfs/rnode.h> doesn't match what the kernel uses. This was offered as a patch to 4.47.

Weakened the test in the Linux /proc-based lsof of the field count of data lines in /proc/net/{tcp,udp}. It appears that recent 2.3.x Linux kernels have added untitled fields to these files. The bug report came from Gabor Liptak <gaborliptak@usa.net>.

Adjusted for a FreeBSD 4.0 change in the definition of [\_]KERNEL. David O'Brien <obrien@NUXI.com> reported the problem and provided a test system.

Removed the HASPPID bracket from Fppid (the -R option state variable) so that the field select table will compile even when HASPPID is not defined. This problem was introduced at revision 4.47 with code that causes some field output characters to set option states. The problem was reported by David Bacon <bacon@birch.eecs.lehigh.edu>.

4.49 April 3, 2000

Made clearer in man page that "Lxx" FDs are AIX loader table references. Also updated the 00FAQ discussion of the Stale Segment ID bug to include AIX

4.3.x.

Modified support for NetBSD 1.4Q to include the <sys/buf.h> header file to cope with an MFS change.

Added support for OpenBSD UVM virtual memory.

Added support for AIX systems with > 2GB of memory. Chris Sylvain <csylvain@itg.ummc.umaryland.edu> reported the problem and provided the solution. Chris also supplied some minor code cleanup. This



was offered as a patch to 4.48.

Based on new information from Igor Schein <igor@txc.com> made additional compensation in Configure script for 64 bit Solaris 7 and 8 gcc.

Added some 00FAQ info on the effect ordering of the +fg and -FG options has on output format.

Improved NetBSD IPv6 configuration, based on a suggestion from Thomas Klausner <wiz@danbala.ifoer.tuwien.ac.at>. Added code to convert IPv4-mapped-in-IPv6 addresses to IPv4 addresses.

Updated the information in 00FAQ and the HP-UX 11 binary directory README files on the HP-UX 11 ipis\_s patch with new information supplied by Eric McWhorter <emcwhorter@xsis.xerox.com>.

Added documentation on changes to HASFSTYPE and HASNCACHE, and the new HASPRIVPRIPP.

Adjusted Configure for FreeBSD 5.0. Made additional, necessary changes to Configure and the BSDI sources to eliminate load errors.

Added KAME IPv6 support to FreeBSD at the request of Ollivier Robert <roberto@eurocontrol.fr>, who provided a test system.

Corrected the script that generates the CHECKSUMS files for binaries to correctly name the detached PGP certificate. The documentation bug was reported by Michael Hennecke <hennecke@rz.uni-karlsruhe.de>.

4.50 June 29, 2000

Added a NetBSD alpha test host, courtesy of Ray Phillips <r.phillips@mailbox.uq.edu.au>. An lsof 4.49 binary, built on Ray's 1.4.1 system was made available prior to the 3.50 release.

Upgraded the system map file tests in /dev/kmem-based Linux lsof, making the use of DEBIAN\_LINUX\_LSOF unnecessary. Tested the changes on a system made available by

Vincent Kujala <kujala@geog.ubc.ca>  
and Jim Mintha <jim@ic.uva.nl>.

Forced AIX to use the large-file-enabled versions of lstat (lstat64) and stat (stat64) if <sys/stat.h> contains stat64. This should allow lsof to stat() AIX files > 2GB even when the builder has not defined the "large file enabled programming environment." Configure tests <sys/stat.h> and puts -DHASSTAT64 in the Makefile's CFLAGS to make this happen. Fernando A.B. Whitaker <whitaker@cenapad.unicamp.br> reported the problem. This was offered as a patch to 4.48.

Enabled Configure script to handle OpenBSD 2.7. Angelos D. Keromytis <angelos@dsl.cis.upenn.edu> reported the availability of OpenBSD 2.7 and supplied the Configure script patch.

Improved handling of DOOR and fattach()'d files in Solaris.

Changed message about missing kernel symbol file from "not yet determined" to "none found".

Updated FreeBSD, NetBSD, NEXTSTEP, OpenBSD, and OPENSTEP support to report "no PCB" and the values of the SO\_CANTSENDMORE and SO\_CANTRCVMORE state flags when a socket structure has no inpcb pointer. This modification was made to AIX lsof at revision 4.46. Added an entry to 00FAQ about sockets that have no inpcb pointer.

Upgraded support for FreeBSD 5.0-CURRENT. Ben Smithurst <ben@scientia.demon.co.uk> supplied patches and did testing. David O'Brien <obrien@NUXI.com> supplied a test system. The update included dropping the FcTTY part of file descriptor file system support, conditional on a Configure script test. I propagated those changes to BSDI, NetBSD, and OpenBSD in anticipation of their having the modification in the future. David also arranged with Michael Haro <mharo@area51.fremont.ca.us> for a FreeBSD 3.4 test system.

In response to an lsof 3.72 bug report from Jim Mewes <jim@corp.phone.com>, added more kernel address

filtering to the lsof function, kread(), that reads Solaris kernel data.

In response to a report from Marc Duponcheel <marc@offline.be>, added tests to the /proc-based Linux lsof to ignore file systems of types "autofs" and "pipfs".

Based on a report and information supplied by Casper Dik <casper@holland.Sun.COM>, updated the ncache\_load() function in lib/rnch.c with new code that deals with a post Solaris 8 change in kernel name cache (DNLC) handling. Casper tested the update, which should be invisible to Solaris versions without the new DNLC code.

Added support for Solaris VxFS QIO files, based on a report from Kieran Broadfoot <kieran.broadfoot@gs.com>. Kieran help test the support.

Added support for PTX 4.4.6 and 4.5[.1] with help from the usual cast of good people at Sequent.

Added support for 64 bit file sizes and offsets on BSDI, FreeBSD, NetBSD, and OpenBSD, based on a report from Dan Nelson <dnelson@emsphone.com>. Dan supplied a patch and did FreeBSD testing.

Added Configure script recognition of NetBSD 1.5, based on a report from Andrew Brown <atatat@atadot.net>. Thomas Klausner <wiz@danbala.ifoer.tuwien.ac.at> updated the NetBSD port package to use a pre-release of this addition.

At the last minute saw a notice via deja.com's UseNet search service that FreeBSD 3.5 had been released and lsof didn't grok it. Added recognition of 3.5 to lsof's Configure script, but didn't have the opportunity to test lsof on 3.5.

4.51 August 21, 2000

Added Configure script support for the upcoming Solaris 9 release based on suggestions from Casper Dik <Casper.Dik@holland.sun.com>.

Changed sample Perl scripts to assume that

/usr/local/bin/perl is Perl 5 and Perl 4 may be found in /usr/local/bin/perl4.

Updated Configure to recognize FreeBSD 4.1 and made a FreeBSD pre-release distribution available.

Bela Lubkin <belal@sco.COM> tested lsof on the upcoming SCO OSR 5.0.6 release and reports that lsof appears to work properly.

Updated the AIX compiler test in Configure to recognize its version 5.

Updated AIX 4.3.3 support with automatic recognition of the proper rnode structure, based on machine bit width. Also added code to detect when processing the -X option that lsof has been compiled with the "other" AIX 4.3.3 user structure and to apply compensations. When a compensation method works, it's applied during subsequent -X processing; when none works, further -X processing is disabled.

Added Tru64 UNIX 5.1 support. Updated Tru64 UNIX library text file support to recognize new kernel support for AdvFS library files. Berkley Shands <berkley@cs.wustl.edu> and Klaus Saggerer USG [saggerer@zk3.dec.com] helped put me in contact with Chang Song <song@zk3.dec.com>, the developer of 5.1's new kernel name cache and he helped me develop new code in lsof to access it.

Corrected reporting of PTX fattach()'d address.

Changed Configure and dlsof.h for NetBSD and OpenBSD to use /usr/include/uvm header files when available.

Andrew

Brown <atatat@atadot.net>, Thomas Klausner <wiz@danbala.ifoer.tuwien.ac.at>, and Wolfgang Rupprecht <wolfgang@wsrcc.com> pointed out the need to do this for NetBSD. Andrew provided access to a NetBSD 1.5 system for verifying the changes.

Installed snprintf() support, including a private version in the lsof library for those UNIX dialects without the function. Changed all sources to use it instead of sprintf() and strcpy().

Fixed a memory leak in the readvfs() functions of BSDI, DEC/OSF1, Digital UNIX, FreeBSD, NetBSD, OpenBSD, and Tru64 UNIX.

Tested on Linux 2.4.

Modified the Pyramid MkKernOpts script to compensate for `uname -s` configuration alternatives. Robert Dahlem <Robert.Dahlem@ffm2.siemens.de> supplied the modification.

Obtained access to an FCS Solaris 8 64 bit system and built lsof on it, using Sun Workshop C 5.0 and gcc 2.96 20000814 (experimental). Both compilers produce a working lsof.

4.52 November 8, 2000

Completed

work on an HP-UX 11.11 port that uses a pstat(2) interface provided by HP. To distinguish it from its predecessors for HP-UX, this lsof version is called PSTAT-based and the predecessor versions are now called /dev/kmem-based. I am indebted to the far-sightedness and support of these good people at HP for making PSTAT-based lsof possible: Carl Davidson, Louis Huemiller, Rich Rauenzahn, and Sailu Yallapragada. The PSTAT-based sources are in lsof\_4.52/dialects/hpux/pstat, the /dev/kmem-based ones in lsof\_4.52/dialects/hpux/kmem.

Ported to IBM Monterey for Merced|Itanium, aka AIX 5L. It configures via the Configure script's "aix" abbreviation and has been tested on AIX 5L Beta 3. Jay Beck, Steve Dibbell, Loc Le, Nasser Momtaheni, and Malcom Zung of IBM provided generous support. Since AIX 5L is still in Beta testing, this port can't be considered complete.

Added Configure support for OpenBSD 2.8. David Mazieres <dm@cs.nyu.edu> provided a test system.

Based on a report from Marc Christensen <marc@mecworks.com> added sockfs to the mount scan exemption list for /proc-based Linux lsof.

Added large file, CDFS, and DOSFS for UnixWare 7.x.

Added UnixWare device memory mapping support. All UnixWare changes were supplied by Eric Dumazet <edumazet@cosmosbay.com> Eric also supplied some miscellaneous bug fixes.

Deferred name cache loading until printname() needs to use the name cache.

Terminated Pyramid, SunOS 4.1.x, and Ultrix support, because test systems are no longer available. Final Pyramid and Ultrix source code distributions for lsof revision 4.51 may be found on lsof.itap.purdue.edu in pub/tools/unix/lsof/OLD/src. The no longer supported SunOS 4.1.x source code is still distributed with the Solaris source code.

Added code to set Solaris node address to real vnode address, when applicable.

John Speno <speno@lopan.isc-net.upenn.edu> provided information that enabled me to update the Tru64 AdvFS (MSFS) node definition for AdvFS version 5.

Added Tru64 5.x CFS support with help from Kris Chandrasekhar <Kris.Chandrasekhar@compaq.com>, Diane Lebel <lebel@zk3.dec.com>, and John Speno. The support only provides information about cached file attributes.

Installed a Configure patch for HP-UX 11 supplied by Kenneth Stailey <kstailey@disclosure.com> that adds another command to q4 input.

Tested on FreeBSD 4.2.

Will Day <willday@rom.oit.gatech.edu> and Frank Winkler <frank.winkler@germany.sun.com> graciously supplied Solaris 8 binaries.

Added Solaris 9 text file support, supplied by Casper Dik <Casper.Dik@holland.sun.com>.

4.53 December 6, 2000

Added the AIX 5L j2\_lock.h to the distribution with a Configure script step to use it when it's missing from /usr/include/j2.

Removed SunOS 4.1.x support.

Removed Linux 2.0.x /dev/kmem support.

Fixed VBLK and VCHR special device file reporting to handle /dev information more accurately.

Added a Apple Darwin / Mac OS X 1.2 port, provided by Allan Nathanson <ajn@apple.com>. Allan also arranged for a test system so I can maintain this port. An additional test system was provided by Dale Talcott.

Dropped claims of support for all UnixWare versions except 7.1.0, since that is the only version on which I can test lsof. Even though lsof 4.53 is deprecated for UnixWare 2.1.3, installed a patch for it with testing done by A. Channing Clark <clark.channing@heb.com>.

Dropped claims of support for all SCO OpenServer versions except 5.0.5, since that is the only version on which I can test lsof.

4.54 January 19, 2001

Added compensation for a change that made the FreeBSD mount structure invisible. I can only test back to 3.2 and the compensation works there, so it's been #ifdef'd for 3.2 and above. David O'Brien <obrien@FreeBSD.org> provided the necessary clue.

Based on a report from Valdis Kletnieks <Valdis.Kletnieks@vt.edu>, changed all IPv6 support to report a TYPE of IPv6 for sockets with IPv4 addresses mapped in IPv6 addresses. The previous lsof behavior was to report their TYPE as IPv4.

Restored the Linux Glibc test to Configure, removed at revision 4.53, based on a report from John Dzubera <zube@cs.colostate.edu>, that RedHat Linux 6.0 still needs the test.

Made setting of link count for Solaris more selective.

Limited Readlink() recursion to MAXSYMLINKS. The bug was reported by Jan Dvorak <johndog@go.cz>.

Dropped the *\*claim\** that lsof runs on Solaris 2.5.1.  
It may well do so, but I no longer have access to a  
test system.

Fixed an #endif comment typo, reported by Igor Schein.

Fixed a typo in a cast for a Tru64 UNIX 5.1 function  
and updated Configure for Tru64 UNIX 5.0 and 5.1 with  
information from Jesse Perry <jesse.perry@compaq.com>.

Corrected non-fatal typos in the AdvFS support in  
dnode.c for Tru64 UNIX.

Added msdos file system support for  
NetBSD and OpenBSD.  
Andrew Brown <atatat@atadot.net> requested and helped  
test it.

4.55 February 15, 2001

Based on a report from Bernd Eckenfels <eck@lina.inka.de>  
added support in lsof for files in /proc/<PID>/maps  
that have been deleted.

Changed PGRP output title to PGID, conforming to  
the most common current abbreviation for Process  
Group ID (PGID). While some systems continue to  
use \*pgrp for internal kernel variable names, most  
systems that support the display of PGID via ps(1)  
now title it PGID. The lsof -g and -Fg options  
operations are unchanged in function; only titles  
and descriptions have changed. Also changed internal  
variable names from \*PGRP and \*pgrp to \*PGID and  
\*pgid where possible.

Dropped the *\*claim\** that lsof runs on HP-UX 9.x.  
It may well do so, but I no longer have access to  
a test system.

In response to a suggestion from Jeff Howie  
<jeff.howie@federated.ca> added support for command  
name selection by regular expression.

A new form  
of the -c option value is use to identify and  
specify a regular expression.

Restore the *\*claim\** that lsof works on UnixWare  
7.0, since I re-acquired a test system.



4.56 May 3, 2001

Corrected some problems Amir Katz <Amir\_Katz@bmc.com> found with Insure++, one in lib/dvch.c, the rest in Solaris sources. Amir's report also helped me find an error in an snpf() call that caused (the unsupported) Solaris 2.5.1 lsof to crash. Wally Winzer, Jr. <wally.winzer@ChampUSA.COM> helped test.

Added support for UnixWare 7.1.1 and above in-kernel UNIX sockets. John Hughes <john@Calva.COM> kindly provided code and access to a test system. John also provided a test system and advice for adding UnixWare 7.1.1 NonStop Cluster and CFS support. More help with that effort came from Kurt Gollhardt (SCO), Barbara Howe (SCO), Bela Lubkin (SCO), and Dewan Rashid <Dewan.Rashid@ir.com>.

Archived a set of compilation hints (patches) from Bill Melvin <Bill.Melvin@esc.edu> that make it possible to compile the old, unsupported lsof 3.08 sources on UnixWare 1.x without NFS or CDFS support.

Installed support supplied by Allan Nathanson <ajn@apple.com> for the Darwin "Gold Master" release, Mac OS X 10.0 (aka Darwin 1.3 in its public source version). Added Allan's CVS repository suggestions to the script that gets additional header files from an open source repository.

Tested an HP-UX 11.11 kernel patch from Sailu Yallapragada that enables reporting of TCP/IP information for telnetd processes that use the telnet multiplexor. I don't yet know the kernel patch ID.

Made the Solaris inclusion of <inet/mi.h> conditional on the Solaris version. (It's apparently not needed at 2.6 and above.) Bill Watson <bill.watson@uk.sun.com> brought this to my attention.

Added alternate Linux 2.4.x lock extent test, supplied by Jim Mintha <jim@ic.uva.nl>.

Rearranged the lines and pre-processor tests in regex.h,

lib/regex.c, and lib/snpf.c so that undef  
can be used to eliminate copyright and GPL statements  
when the files aren't being used for a particular  
dialect. (USE\_LIB\_\* definitions in a dialect's  
machine.h header file determine if one or more of  
those three files are to be used.)

Added preliminary support for Solaris 8 with VxFS  
3.4. This support will be refined as I get  
information from Veritas about how they will  
distribute the kernel header files lsof needs.  
Those header files were omitted from the standard  
VxFS 3.4 distribution. Technical assistance and  
testing were provided by Calle Dybedahl <cdy@algonet.se>,  
Gary Millen <gary.millen@veritas.com>, Rainer Orth  
<ro@TechFak.Uni-Bielefeld.DE>, Peter C. Vernam  
<pvernam@draper.com>, and Donna Yobs  
<Donna.Yobs@veritas.com>

Tested on FreeBSD 4.3-STABLE.

Dropped the \*claim\* that lsof works on UNIX dialects  
where I no longer have test systems: BSDI 2.1,  
3.[01] and 4.0; DEC OSF/1, Digital  
UNIX and True  
64 UNIX 2.0 and 3.2; FreeBSD 2.1.[67], 2.2[.x],  
3.[012345] and 4.[01]; HP-UX 10.20; NetBSD 1.[234];  
SCO OpenServer 5.0.5; and SCO UnixWare 7.0

Tested on Solaris 9 BETA, s81\_36.

4.57 July 19, 2001

Help (-h) and version (-v) output now have URLs  
for the newly created and timeliest lsof FAQ  
(00FAQ in the lsof distribution) at:

<ftp://lsof.itap.purdue.edu/pub/tools/unix/lsof/FAQ>

and the man page for the current lsof distribution  
at:

[ftp://lsof.itap.purdue.edu/pub/tools/unix/lsof/lsof\\_man](ftp://lsof.itap.purdue.edu/pub/tools/unix/lsof/lsof_man)

Based on a report from Steve Laubscher  
<slaubs@woodward.com>, modified dlsof.h for PTX  
4.6[.1] to avoid a temporary dnlc\_t definition  
needed at PTX 4.5.1.

Corrected test for old Linux kernels in Configure.  
Henri Karrenbeld <ishtar@cal044202.student.utwente.nl>  
brought the error to my attention. Limited Linux  
claims to 2.1.72 and above in the documentation.

Improved HP-UX 11 Configure stanza and stream socket  
handling.

Constructed a work-around  
for the HP-UX 11 optional  
OnlineJFS package. The work-around sadly requires  
lsof to have a private version of the vx\_inode  
structure, since the OnlineJFS package doesn't  
update <sys/fs/vx\_inode.h>. Troyan Krastev  
<Troyan.Krastev@ricoh-usa.com> brought the bug to  
my attention and Michael Bracewell  
<michael@ra.TSS.PeachNet.EDU> provided a test system  
where I developed the work-around.

Added locale support to lsof's isprint() test,  
based on a suggestion from Dan Mercer <damercer@mmm.com>.  
lsof will use setlocale(), when that function and  
its supporting <locale.h> header file are available.

Added OpenBSD 2.9 support.

Based on a report from Aaron Rhodes <arhodes@psionic.com>  
and with testing help from Aaron, made the lsof  
4.56 revision compile and work on OpenBSD 2.6.  
While that OpenBSD version is no longer supported,  
Aaron's report exposed a Configure script bug  
affecting OpenBSD versions lsof does support.

Updated for FreeBSD 5.0-CURRENT.  
Szilveszter Adam  
<sziszi@petra.hos.u-szeged.hu> help test. The lsof  
FreeBSD ports packager, David O'Brien <obrien@FreeBSD.org>,  
assisted.

Tested on AIX 5.1. Loc Le and Nasser Momtaheni of  
IBM provided test systems.

4.58 September 13, 2001

Added options to safestrprt() and safestrprtn() to  
surround the string with "" and to suppress the  
printing of an ending '\n'. Use of these functions  
in device cache file error message reporting answers  
a suggestion for better error reporting from John

Jackson <jrj@purdue.edu>.

Fixed a Solaris 2.6 and above problem related to searching for "large" (O\_LARGEFILE) files by name; lsof was using the wrong version of [l]stat(2). The bug was reported by Daniel Trinkle <trinkle@cs.purdue.edu>.

Added AIX 4.1.4 and above XTI socket support.

Added OSR Xenix Shared Data and Semaphore file type support with modifications supplied by Bela Lubkin.

Updated OPENSTEP support with modifications from Carl E. Lindberg <lindberg@clindberg.org>. The changes enable the correct reporting of executable and library open files ("txt" type).

Limited claims of OpenServer support to the versions where I currently test, 5.0.4 and 5.0.6. (Lsof probably works on 5.0.5.)

Enabled processing of -C option for PSTAT-based HP-UX lsof.

Enabled and tested on FreeBSD 4.4.

Corrected a file system test example in 00QUICKSTART, based on a report from Jun Biao WANG <>wangjunb@cn.ibm.com>.

Made available for re-distribution a user-contributed port of lsof 4.51 to Reliant UNIX 5.45. Thomas Mauterer <Thomas.Mauterer@philosys.de> contributed the port.

4.59 October 20, 2001

With the closing of the Sequent Synergy Links Lab by IBM, terminated lsof support for PTX. The last tested PTX lsof revision, 4.58, is available on lsof.itap.purdue.edu in .../lsof/OLD/src.

Adjusted for FreeBSD 5.0-CURRENT NFS header file changes, based on a report from Jos Backus <josb@cncdsl.com>.

Corrected

a bug in the way Linux lsof identifies the owner of a process. Lionel Cons <lionel.cons@cern.ch> reported the problem and tested the fix. Added code to avoid stat(2) calls on regular Linux files whenever possible. Lionel reported the need to do this (AFS files) and tested the new code.

Added new output field for raw device number in hex. The field is identified with 'r'. This field is NOT selected when -F or -F0 is specified so that its appearance won't disturb existing scripts that process field output.

Added support for OpenUNIX 8. A test system was provided by Larry Rosenman <ler@lerctr.org>. Matthew Thurmaier <matt@compclass.com> and many people from Caldera provided technical assistance.

Added an additional UVM test to the NetBSD Configure stanza. Andrew Brown <atatat@atatdot.net> supplied the test; it recognizes NetBSD 1.5Y UVM changes to the vnode structure recently committed by Chuck Silvers.

Applied Configure and get-xnu-headers.sh script changes supplied by Allan Nathanson <ajn@apple.com> for Darwin 1.4.

Added for Bela Lubkin <belal@mammoth.ca.caldera.com> OSR-specific environment variables to supply values to the Configure script. The variables are described in 00XCONFIG.

Added an IP version selector to the -i option parameters.

4.60 November 9, 2001

Added special handling to and corrected bugs in the matching of IPv4 in IPv6 addresses to -i6:<...> selectors.

Made 00FAQ corrections and updates, based on discussions with Igor Schein <igor@txc.com>.

Modified Configure script to detect a 64 bit capable gcc compiler and permit it to be used to build 64 bit (PA-RISC 2) lsof for HP-UX 11.00. Tested with

HP's gcc package, which Rich Rauenzahn of HP kindly installed on a test system at HP. Stefan Marquardt <stefan.marquardt@hagebau.de> helped test.

Made lsof's method of killing its child process more robust, based on a suggestion from Bela Lubkin <belal@caldera.com>.

Modified all dialect Makefile segments to accept select -v #define's from the environment -- a builder's comment, host, logname, system information and user name. This was done for Bela Lubkin, so he can "tune" the -v output when he packages lsof in the upcoming Caldera OSR 5.0.7 release.

Changed Perl scripts in scripts/ to put the lsof path consistently in \$LSOF. Also added a fix from Bela Lubkin to scripts/big\_brother.perl5 that allows it to tolerate SCO OSR "ago" clauses in open UDP file information. Strengthened emphasis in scripts/00README that the scripts are examples that shouldn't be expected to run on all UNIX dialects without modification.

At Bela Lubkin's suggestion changed the device cache file format examples in 00DCACHE and 00FAQ to avoid "%U%". That's an SCCS escape sequence.

Added support for OpenBSD 3.0.

Added +DAportable to CFLAGS for 32 bit HP-UX 11. Amir Katz <Amir\_Katz@bmc.com> suggested the addition.

4.61 January  
22, 2002

Updated field output example Perl scripts in the scripts/ subdirectory to discover the lsof path, starting at .. and proceeding through the PATH environment variable's directories.

Added minor OSR Configure script fixes, provided by Bela Lubkin <belal@caldera.com>.

In response to a report from Joshua Wright <Joshua.Wright@jwu.edu> modified NetBSD and OpenBSD Configure stanzas and sources so that lsof can be built when there is no system source tree (e.g.,

/usr/src/sys).

In response to a report from Peter Valchev <pvalchev@openbsd.org> improved the UVM test in the OpenBSD Configure stanza.

Updated Configure script to recognize FreeBSD 4.5.  
Updated for FreeBSD 5.0 procs and pseudofs changes.

Updated HP-UX stanza to see if the compiler named in the LSOF\_CC environment variable is the bundled compiler. If it is, "-O" is omitted from the compiler flags.

Updated Digital UNIX 4.x and Tru64 UNIX error message related to kernel name list failures. Added an FAQ section about how a kloadsv daemon failure can cause knlist(3) to fail. The condition was reported by Douglas B. Jones <douglas@gpc.peachnet.edu>

Based on a report from Mark W. Eichin <eichin@thok.org> made Linux lsof capable of handling and reporting file sizes greater than 32 bits.

Tested on Solaris 9 BETA-Refresh.

Corrected a bug in the matching of IPv4 addresses, mapped in IPv6 addresses, to an IPv4 parameter to an -i option.

Ported to 64 bit Power AIX 5.1 kernel with advice from David Clissold <cliss@austin.ibm.com> and Marc Stephenson <marc@austin.ibm.com>, and on a test system provided by Loc Le <lple@us.ibm.com>.

4.62 March 7, 2002

Updated 00README to reflect the usefulness of gcc for building AIX lsof. Documented a report from Brian L. Gentry <BGentry@nationsrent.com> of success on AIX 4.3.3. I documented my success on 32 bit Power AIX 5.1 and my lack of success on ia64 AIX 5.1 and 64 bit Power AIX 5.1.

Improved UnixWare >=7.1.1 reporting of UNIX socket NAME field information for NonStop Cluster systems with a patch provided by John Hughes <john@Calva.COM>.

Offered John's improvement as a patch to lsof 4.61.

Corrected bugs in handling of open files on block devices by OSR lsof. The bugs were reported by Bela Lubkin <filbo@deephought.armory.com>.

Fixed bug in writing >32 bit device numbers for block devices to the device cache file.

Added support for reporting block special nodes not in /dev (or /devices). That required "like device special" be changed to "like block special" and "like character special". (00FAQ was updated.)

Based on a report from Peter Valchev <pvalchev@openbsd.org> improved the definition of the source for NetBSD and OpenBSD kernel symbols (the nlist() source file). NetBSD now defaults to getbootfile(3) if it is available, /netbsd otherwise. OpenBSD now defaults to /dev/ksyms if it is available, /bsd otherwise.

Made possible compilation under BSD/OS (BSDI) 5.0 with changes to Configure, dialects/bsdi/dlsof, dialects/bsdi/dproc.c and lib/rnmh.c. The changes were suggested by Steven Hinkle <hinkle@bsdi.com>. Note that these changes do not substantiate a claim that lsof works on BSDI 5.0, because I haven't tested it there.

Updated OpenUNIX private <sys/fs/memfs\_mnode.h>, based on a report from Larry Rosenman <ler@lerctr.org> that it had been updated by Caldera patch OU800PK3. Unfortunately the patch only corrects some of the problems with the header file, so it is still necessary to distribute a private patched version of it with the lsof sources.

Applied a man page correction reported by Frederic Delanoy <max\_ok@yahoo.com>.

Corrected cast bugs related to using the HP-UX bundled C compiler on HP-UX 11.11.

4.63 April 23, 2002

Added HPUX\_BOOTFILE environment variable for use by the Configure script in determining HP-UX kernel



configuration information -- e.g., the state of the ipis\_s structure in the HP-UX 11 kernel. The change was suggested by Marc Bejarano <beej@alum.mit.edu>. Marc also suggested some changes to the HP-UX section in 00FAQ that discusses Configure's use of q4 for HP-UX 11.

Fixed a bug in the Solaris lsof file system matching code. It was not reporting that VCHR files in /devices were in / when /devices was in /, too.

Corrected bugs in device number, file size, file offset, and raw device number field output generation.

Added recognition of OpenBSD 3.1 to the Configure script with a suggestion from Peter Valchev <pvalchev@sightly.net>. Note that this change does not constitute a claim that lsof works on OpenBSD 3.1, because I haven't tested it there.

Built an automated test suite. (See 00TEST and the tests/ sub-directory of the lsof main directory). Bela Lubkin requested it. Dale Talcott, John Hughes, and Larry Rosenman helped me validate it on their systems.

During the development of the test suite I discovered the following lsof bugs or missing features, and corrected or supplied them.

- \* Corrected the reporting of locks for:
  - o Digital UNIX 4.0d and Tru64 Unix 5.[01];
  - o HP-UX 10.30 and 11.00;
  - o OpenUNIX 8;
  - o UnixWare 7.1.1.
  
- \* Enabled HP-UX 10.30 and 11.00 to report open NFS file link counts.
  
- \* Corrected the reporting of UNIX domain socket names for Apple Darwin, FreeBSD 4.5 and above, NetBSD 1.4.1 and above, and for OpenBSD 3.0 and above.
  
- \* Enabled HP-UX 11.11 to stat(2) large files.

\* Fixed handling of combination 32 and 64 bit device numbers in AIX 64 bit architectures.

Updated the AIX 4.3.3 NFS mode recognition code, first installed at revision 4.51. It looks like some IBM update has restored a single rnode structure independent of the machine bit width.

Updated the NetBSD and OpenBSD sources so NetBSD can process DTYPE\_PIPE files, as OpenBSD was already able to do.

Updated Darwin get-xnu-headers.sh script to reflect information about a recent reorganization of the Darwin CVS hierarchy, supplied by Allan Nathanson <ajn@apple.com>.

Added defense against the standard I/O descriptor attack.

4.64 June 26, 2002

Corrected some FreeBSD pre-processor directives. David O'Brien <obrien@NUXI.com> pointed them out.

Updated lsof's main() function to: 1) close all open file descriptors above 2 before starting; and 2) to set a non-interfering umask. Moved GET\_MAX\_FD test from misc.c to proto.h, so that main() could use it. Added multiple-include protection to proto.h.

Moved FAQ's test suite Q's & A's to a more appropriate section. Added a Q&A on HASSECURITY option and its affect on searching for open files. (That was already in the man page.)

Updated hpux/kmem/dnode.c for HP-UX < 11 compilation with information from John Dzuber <Zube@CS.ColoState.EDU>. While lsof doesn't support HP-UX < 11 any more, I try to avoid disabling it there when possible, and a locking fix for HP-UX >= 11 in lsof 4.63 inadvertently disabled compilation of lsof for HP-UX < 11. Fixed long-standing bug in HP-UX 10.20 lock reporting.

Removed language from the test suite programs that

requires an ANSI-C compiler. This allowed the test suite to be validated with cc and gcc on the unsupported HP-UX 10.20.

At the suggestion of Manuel Bouyer <bouyer@antioche.eu.org> switched NetBSD and OpenBSD lsof from using nlist() to using kvm\_nlist(). Made the same change for BSDI, Darwin, and FreeBSD.

Validated test suite on OPENSTEP 4.2.

In response to a suggestion from Jeff Stoner <jstoner@blackboard.com> enhanced support for the FD list of the -d option to allow it to be either an exclusion or inclusion list, using the '^' prefix to denote exclusions.

Made adjustments for FreeBSD 4.6 and 5.0-CURRENT. Fixed a FreeBSD /etc/make.conf CFLAGS extraction bug, reported by Kris Kennaway <kris@obsecurity.org>, and new a bug in the fix, reported by Eric Cronin <ecronin@eecs.umich.edu>

Added nullfs support for FreeBSD, NetBSD, and OpenBSD at the request of Andrew Brown <atatat@atatdot.net>.

Modified all readmnt() functions to ignore mounted-on directory names that don't begin with '/'.

Tested on NetBSD 1.6A and OpenBSD 3.1.

Upgraded to Solaris 9 FCS with two changes to the BETA-Refresh support: 1) an adjustment to dnode.c for a change in the so\_so (sonode) structure; and 2) addition of Solaris 9 FCS specific DNLC code. David Comay <David.Comay@Eng.Sun.COM> sent me the dnode.c change and Casper Dik <Casper.Dik@sun.com> helped with the new DNLC support code.

Applied OpenUNIX changes that permit lsof to compile and run on the upcoming 8.0.1 release. The changes were supplied by Robert Lipe <robertl@caldera.com>. Larry Rosenman <ler@lerctr.org> provided a test system.

Added Solaris fd file system support.

4.65 October

10, 2002

Adjusted for change in FreeBSD 5.0-CURRENT inode structure, reported by David O'Brien <obrien@NUXI.com>.

Adjusted for changes in FreeBSD 5.0-CURRENT <sys/vnode.h>.

One change was reported by Anders Nordby

<anders@FreeBSD.org>. Adjusted for FreeBSD 5.0-CURRENT on sparc64 architecture.

Enhanced the error reporting of Solaris lsof when it detects a kvm\_open() failure, and added a 00FAQ entry on the cause, based on a report from Peter J. Bertoncini <pjb@anl.gov>.

Enabled compiling of lsof for NetBSD 1.5 with the NULL file system, using a patch from Andrew Brown <atatat@atadot.net>.

Removed a hack in the LTbigf test program that was once needed when it was compiled on Solaris 9 BETA-Refresh with gcc. The hack isn't needed on Solaris 9 FCS. Janet Hempstead <jan@library.carleton.ca> brought the need for this change to my attention.

Applied a patch, supplied by Andrew Brown <atatat@atadot.net>, that updates lsof for NetBSD version

1.6F. Corrected handling of the NetBSD nullfs.

Updated to BSDI BSD/OS 4.3 on a test system kindly provided by Terry Kennedy <terry@tmk.com>.

Updated to FreeBSD 4.7.

Updated to Apple Darwin 1.5, 5.x and 6.x with patches supplied by Allan Nathanson <ajn@apple.com>. The patches include IPv6 support.

Updated Configure to use the -bnolibpath loader option when building lsof on a PowerPC, running AIX 5 or greater. Valdis Kletnieks <Valdis.Kletnieks@vt.edu> informed me this was needed. Lsof for AIX 5.x was initially developed on the IA64, where -bnolibpath can't be used and I didn't think to restore it to PowerPC loads when AIX 5.x became available for that architecture.

Updated to UnixWare 7.1.3 on a test system provided by Larry Rosenman <ler@lerctr.org>. Removed claims that lsof works on OpenUNIX 8.0.1, because UnixWare 7.1.3 is the release name of OpenUNIX 8.0.1.

Based on a comment that his e-mail address was wrong in the lsof distribution from Kenneth Stailey <kstailey@disclosure.com>, removed all e-mail addresses from lsof documentation files except this one, 00DIST. The addresses in 00DIST are used to send revision release notices to those who contributed to a revision, but the addresses in this file for previous revisions and in other documentation files sometimes grow stale and are never validated.

4.66 December 22, 2002

Acquired Solaris 7 and 8 test systems, courtesy of John Dzuberka <Zube@CS.ColoState.EDU>. Updated 00TEST and tests/TestDB accordingly.

Clarified FreeBSD 5.0 architecture claims at the suggestion of David O'Brien <obrien@NUXI.com>. Also implemented David's suggestion to change Intel to x86.

Installed changes to DNLC handling in OSR lsof in preparation for handling changes in the OSR 5.0.7 DNLC cache. Information about the changes and patches to handle them were supplied by Bela Lubkin <filbo@deepthought.armory.com>.

Upgraded True 64 UNIX support to the 5.1B release on a test system provided by Berkley Shands <berkley@cse.wustl.edu> Had to use relaxed ANSI compilation because of an error in a system header file and other lsof source usages.

Implemented the HASNOSOCKSECURITY compile-time option. When it and HASSECURITY are defined, lsof will be built to list only the user's open files, but will also list anyone else's open socket files, provided the "-i" option selects their listing. Updated the Customize script to ask about setting HASNOSOCKSECURITY. Left it undefined in all dialect machine.h header files. This change was requested by Kenneth Stailey <kstailey@speakeasy.net> for

use with ntop.

Added support for OpenBSD 3.2 and its kernel trace file.

Improved lsof help (-h) and version (-v) information reporting.

Fixed a FreeBSD 4.7 and above off-by-two UNIX domain socket path termination bug, reported by Ken Stailey <kstailey@speakeasy.net>

4.67 March 27, 2003

Began the transition of the lsof ftp server host name from vic.cc.purdue.edu to lsof.itap.purdue.edu. That reflects Purdue organizational changes. This first step makes the new name an alias to the old one. The old name, vic.cc.purdue.edu, will remain usable for an extended period.

Corrected a revision number reference in section 17.17 of 00FAQ on the appearance of Solaris negative DNLC caching handling.

Updated 00FAQ discussion of compilers for 64 bit Solaris.

Validated test suite for 64 bit Solaris 8 and gcc.

At the request of Alek O. Komarnitsky <alek@komar.org> added the "+c <width>" option to enable optional changing of the COMMAND column output maximum width from the default to <width>. The default maximum width remains CMDL, as defined in lsof.h.

Fixed three AIX kernel bit size detection bugs, one in the AIX Configure script stanza, the second and third in the AIX dproc.c get\_kernel\_access() function. The bugs were reported by Pierre-Yves Fontaniere <pyf@cc.in2p3.fr>, who tested the fixes.

Added kernel event queue file support for FreeBSD, NetBSD and OpenBSD. Andrew Brown <atatat@atadot.net> supplied the code.

Updated to AIX 5.2 on a test system provided by

Dale Talcott <dtalcott@purdue.edu>. Had to build work-arounds for two missing AIX 5.2 header files, <j2/j2\_snapshot> and <proc/proc\_public.h>. Corrected an off-by-one UNIX socket addressing bug. Taught AIX lsof to handle both jfs and jfs2 files at the same time. Adjusted for an IBM mistake in the sizing of the fdsinfo structure in <procinfo.h> Toshiya Nakamura <TOSHIYAN@jp.ibm.com> helped test,

Updated to FreeBSD 4.8. Corrected another bug in FreeBSD UNIX domain socket name handling.

Corrected gcc build problems on HP-UX 11i, reported by Yuliy Minchev <yuliy@mobiltel.bg>.

Updated BSDI BSD/OS support to 4.3.1.

Augmented a lock ID test on NetBSD to check if the ID is an LWP pointer.

4.68 June 18, 2003

Enhanced Configure script's cleanup operations.

Added support for OpenBSD 3.3, based on a report from Peter Valchev <pvalchev@sightly.net>.

Improved the description of the detached PGP signature certificate file in the main lsof README file, based on a suggestion from Diana Stockdale <diana@mpl.ucsd.edu>.

Installed a work-around for FreeBSD 5.0-CURRENT on Alpha to avoid a compiler register use complaint.

Corrected a 'c' option error message. Gnele <blaadeleng@yahoo.com> reported the problem.

Upgraded EXT2FS and UFS support for NetBSD and OpenBSD to handle new inode information, and the fast UFS1 and UFS2 file systems.

With the help of Andrew Brown <atatat@atadot.net> determined the NetBSD snapshot (1.6F) at which <sys/mount.h> could be included under \_KERNEL, thus eliminating the lsof netexport.h hack. The same change applies to OpenBSD versions 3.3 and above.

Applied a patch from Armin Gruner <ag@muc.de> that corrects the use of the HASPROCFS definition in the FreeBSD dialect sources.

Corrected spelling errors in 00FAQ and in the generated 00.README.FIRST\_<version> file of the distribution archive. John Jackson <jrj@purdue.edu> and Ray Phillips <r.phillips@jkmrc.uq.edu.au> spotted and reported the errors.

Corrected a spelling error in a comment and incorrect use of an alarm function in the LTsock test program.

At the suggestion of Stuart Anderson <sba@srl.caltech.edu> added preliminary (and incomplete) SAM-FS file system support to Solaris lsof. Completion awaits availability of SAM-FS internals.

Fixed a Solaris device name printing bug, reported by Ric Anderson <ric@tick.Telcom.Arizona.EDU>, only visible when HASDCACHE is not defined. Ric helped test the fix.

Fixed an AIX kernel bit size handling bug related to the NFS node (rnode) structure.

Corrected a print\_kptr() function call error in the AIX AFS code, reported by David Steiner <david.r.steiner@Dartmouth.EDU>. Upon further reflection and because I no longer have appropriate AIX AFS test systems, disabled AIX AFS support in the Configure script for AIX versions above 4.3.3.0 or AIX AFS versions above 3.5.

Added support for FreeBSD 5.1.

With advice from Allan Nathanson <ajn@apple.com> adjusted the Darwin get-xnu-headers.sh script to access the kernel header files needed by lsof from a new form of the Apple open source repository.

Installed Linux and lsof library bug fixes and improvements, supplied by Marian Jancar <mjancar@suse.cz>. One Linux improvement handles mount strings that have octal escapes in them, eg., \040 for embedded blanks. Marian tested the changes.



4.69 October 16, 2003

Received and applied an OpenBSD patch from Peter Valchev <pvalchev@sightly.net> that replaces a ctob() call with a sysconf() call. Peter claims sysconf() is needed for OpenBSD on SPARC. (It is not needed for NetBSD on SPARC.)

With the upgrade of my only Solaris 7 test system to,

Solaris 8, dropped the \*claim\* that lsof works on Solaris 7. That doesn't mean it won't work there, so those who want lsof for Solaris 7 probably should be able to build it there and it probably will work there.

Revised lsof's DNLC handling for BSD derivatives, including: BSDI; Darwin, DEC OSF/1, Digital UNIX and Tru64 UNIX; FreeBSD; NetBSD; and OpenBSD. The latest NetBSD distribution's dropping of the vnode capability ID (v\_id) required the revision.

Adjusted to the latest FreeBSD 5.1-CURRENT.

Added NetBSD support for using kvm\_getproc2().

Added a patch from Andrew Brown <atatat@atadot.net> to handle NetBSD enum conflicts and changes in the <miscfs/kernfs/kernfs.h> and <miscfs/procfs/procfs.h> header files.

Added a "#define \_KERNEL" to the AIX dnode2.c source file for compatibility with a new <j2/j2\_inode.h> AIX 5.2 header file version. The addition was supplied by Dick Dunbar <Dick.Dunbar@Siebel.com> and was offered as a patch to lsof 4.68/

Added support for a second type of Solaris SAMFS. Stuart Anderson <sba@srl.caltech.edu> provided the support. SAMFS support in lsof SOLARIS remains scanty, because Sun won't release any details on its kernel structures.

Dropped the \*claim\* that lsof works on AIX 4.3.3, because I was unable to test it there. That doesn't mean it won't work there, so those who want lsof for AIX 4.3.3 probably should be able to build it there and it probably will work there.

Updated for Solaris 10 on test systems provided by Mike Miscevic <miscevic@hotmail.com>. Casper Dik <casper@holland.sun.com> provided significant help. During the Solaris 10 port found and fixed an lofs handling bug that prevented reporting of open lofs file lock status.

Updated the DNLC test, LTdnlc, to provide a possible explanation about file systems on which the test might fail.

Modified the procedure for obtaining missing Darwin XNU kernel header files. The new one requires more manual intervention, but is the best that can be done with the way Apple open sources are now organized. 00FAQ explains the new procedures for those not used to downloading Apple open source files.

Added support for Apple Darwin 7.0 (Mac OS X 10.3) with patches supplied by Allan Nathanson <ajn@apple.com>. Dropped the \*claim\* that lsof builds and works on Apple Darwin below 6.0.

Validated lsof on FreeBSD 4.9, using a test system provided by Ben Lewis <bl@purdue.edu>.

Validated lsof on FreeBSD 5.1-CURRENT for Amd64. David O'Brien <obrien@FreeBSD.org> provided a test system.

Changed the NetBSD Configure stanza to do header file searches in /usr/include by default. The LSOF\_INCLUDE and NETBSD\_SYS environment variables may still be used to specify other search paths. Discussions with Andrew Brown and Wolfgang S. Rupprecht <wolfgang@wsrcc.com> led to the change.

4.70 January 16, 2004

Improved shell-portability of the linux stanza of the Configure script with a patch from Paul Jarc <prj@po.cwru.edu>.

Added a "silent" rule to tests/Makefile for Paul. Updated, extended and clarified the test suite documentation in 00FAQ and 00TEST.

Fixed Solaris 10 dlsf.h typo, reported by Mike Miscevic <miscevic@hotpop.com>. The typo prevents lsof from loading cleanly in Solaris 10 builds past 40.

Fixed a Solaris HSFS node number reporting bug and added a structure definition work-around for Solaris 10.

Converted PGP signing to GPG. My previous PGP key can be used, but the gpg "--allow-non-selfsigned-uid" option may have to be used when it is imported into a GPG key ring.

Added bz2 compression.

Updated for OpenBSD 3.4.

Added a work-around for a missing header file in the s10\_44 Solaris 10 build.

Added support for FreeBSD 5.2-BETA and 5.2-CURRENT.

Updated Linux AX25 support with modifications supplied by Lutz Poetschulat <dl9cu@db0zwi.de>.

Added raw IPv6 support to Linux lsof.

Improved handling of parameters after "-i@".

Improved file name test in LTdnlc.c.

Added loop count controls to the reading of Solaris lock chains. The change was implemented as a result of a report from Steve Gonczi <steve@relicore.com>.

Based on a report from John Jackson <jrj@purdue.edu>, enabled a Solaris 10 <sys/lgrp.h> work-around for Solaris 9, too. (Patch 112233 installs an lgrp.h on Solaris 9 that needs the work-around.)

With help from Andrew Brown <atatat@atadot.net> and John Heasley <heas@netbsd.org> added log-structured file system (LFS) support for NetBSD and OpenBSD.

Added AMD64 to the list of FreeBSD 5.x-CURRENT supported architectures. FreeBSD.org provides a test

system, courtesy of (I believe) David O'Brien  
<obrien@FreeBSD.org>.

Added a cast to lseek() in the HP-UX /dev/kmem-based  
kread() function to make it work properly with the  
bundled HP C compiler.

4.71 March 11, 2004

Added text file support to Apple Darwin  
lsof and

enabled the lsof executable portion of the LTbasic  
test. Added support for Darwin kernel queue, POSIX  
semaphore and POSIX shared memory files. Tested on  
Darwin 7.2 (aka Mac OS 10.3.2).

Added process\_kqueue() function prototypes for FreeBSD,  
NetBSD and OpenBSD.

Picked some lint in AIX sources, lib/rnmh.c and  
tests/LTsock.c.

Added "-x [fl]" cross-over option, which enables +d and  
+D processing to cross over symbolic links and/or file  
system mount points. Discussion with Johan Lindquist  
<johan@smilfinken.net> and Eric Williams (aka The Ghost  
In The Machine) <ewill3@earthlink.net> on Linux news  
groups revealed the need for the option.

Updated support for UnixWare 7.1.4.

Added support for the optional reporting of socket  
options, socket states and TCP flags for most currently  
supported dialects. John Smith <lbalbalba@hotmail.com>  
and Tristan Nefzger <tn@bhtrader.com> requested the  
information. The dialects and their versions for which  
this

feature has become available include:

- AIX 4.3.2 and 5.[12]
- Apple Darwin 7.2
- BSDI BSD/OS 4.3.1
- Digital UNIX and Tru64 UNIX 4.0
- FreeBSD 4.9 and 5.2
- HP-UX 11 and 11.11 (aka 11i)
- NetBSD 1.6ZH
- OpenBSD 3.4
- OPENSTEP 4.2
- OpenUNIX 8

SCO OpenServer Release 5.0.6

Solaris 2.6, 8, 9 and 10

UnixWare 7.1.[134]

Modified the Configure stanza for HP-UX 11 with better q4 detection. Steve Bonds <3vhmxxm02@sneakemail.com> supplied the modification.

Applied a patch from Mike Miscevic <miscovic@hotmail.com> to enable lsof to compile with the zone support in the Solaris 10 s10\_b51 release. Added information on lsof zone behavior to 00FAQ.

Added a "-z [z]" option to Solaris 10 lsof. It enables the listing of zone name and can also be used to select the listing of processes and their files from specified zones.

4.72 July 13, 2004

Corrected Solaris 10 ZONE column title display bug with a patch from Joep Vesseur <Joep.Vesseur@Sun.COM>. Joep's fix was offered as a patch to 4.71.

Based on a report from Jean-Pierre Radley <jpr@jpr.com> about an unexpected GNU uname Configure interaction on OSR, and working from information received from Bela Lubkin, changed the OSR Configure stanza to use /bin/uname instead of uname. Added an FAQ entry about Configure version detection problems.

Added the +m and "+m m" options in response to a dialog with Robert T. Brown <rbrown@netmentor.com>. The options allow the creation of a mount table supplement file which can be used on selected dialects to get device numbers when stat(2) and lstat(2) can't deliver them. (That's generally the result of an inaccessible NFS server.) Currently the new options are supported only on Linux.

Made cpumask\_t typedef \_KERNEL compensation for FreeBSD 5.2-CURRENT. Refined it for 5.2.1-RELEASE with testing help from Scott Ellentuch <tuc@tsg.com>.

Added support for FreeBSD

4.10. Larry Rosenmann

<ler@lerctr.org> kindly provided a test system.

Added support for NetBSD 2.0 with patches supplied by Andrew Brown <atatat@atadot.net>. Andrew also provided two test systems.

Made handling of Linux maps file more robust, based on a report from Jan Blunck <J.Blunck@tu-harburg.de>. As a side benefit, made handling of generated stat(2) information more flexible.

As a result of a discussion with Jason Fortezzo <fortezza@mechanicalism.net>, adjusted lsof for Solaris to obtain the maximum user name length from ut\_name of the utmpx structure, if <utmpx.h> exists.

Tested under OpenBSD 3.5.

Updated README information about using gcc (via the Configure aixgcc abbreviation) to compile lsof on AIX. Ann Janssen <ajanssen@nebook.com> made me aware the information was out of date.

Added an AIX SIGDANGER handler and some FAQ sections on lsof memory usage after a discussion with Tom Qin <tom.qin@citigroup.com> about lsof memory usage.

Added scripts/sort\_res.perl5, contributed by Fabian Frederick <fabian.frederick@gmx.fr>. The script displays lsof output sorted by size and path name.

Improved handling of files on Linux NFS mount points that use the root\_squash option, based on discussions with Paul Szabo <psz@maths.usyd.edu.au>.

Updated FreeBSD 5.2-CURRENT support, based on a problem report from Filippo Natali <filippo@widestore.net>.

Corrected improper FreeBSD 5.x-CURRENT #if condition, reported by Kim Culhan <kimc@kim.net>.

Added a Configure script work-around for AIX 5.2 lsof with JFS2, compiled by gcc >= 3.3. The work-around was supplied by Florian M. Weps <fmw@hactrn.ch>.

4.73 October 21, 2004

Added an `__XPG4_CHAR_CLASS__` #define before #include'ing <ctype.h> on Solaris to restore lsof's ability to display special characters such as acute-e.

Added wide-character (e.g., UTF-8) support where possible, prompted by a request from Kyungjoon Lee <kjoonlee@gmail.com>.

Some older dialects -- e.g.,

NetBSD 1.4.1 -- don't support wide characters, so the wide character support is enabled by definitions in each dialect's machine.h. Dialects with wide-character support are listed in 00FAQ.

Make a FreeBSD 5.2-CURRENT adjustment for <sys/pipe.h>, supplied by Sergey A. Osokin <osa@FreeBSD.ORG>.

Implemented a Linux feature request made by Jakub Jelinek <jakub@redhat.com> that enhances lsof's ability to locate UNIX domain sockets whose paths are named as arguments. Jakub supplied suggested code.

Dropped \*claims\* that lsof works on AIX below 5.1, SCO Dropped \*claims\* that lsof works on AIX below 5.1, SCO Openserver 5.0.4, Tru64 UNIX 5.0, and UnixWare below 7.1.4. Lsof will probably build and work on those UNIX dialect versions, but I no longer have any way to test lsof on them.

Added support for FreeBSD 5.3 and 6.0. The FreeBSD 5.3 support hasn't been tested.

Added FD test code that will allow dialect versions to test FD option selections. Used the new code in the PSTAT-based HP-UX lsof to enable it to avoid scanning the mount table when its information is not needed. The addition was made in response to a query from Harvey Garner <Harvey.Garner@championusa.com> about lsof performance in a busy NFS environment.

Upgraded lsof's AIX support level to AIX 5.3, based on a report from Dick Dunbar <Dick.Dunbar@Siebel.com>. (I have not tested lsof under AIX 5.3.) Based on Dick's recommendation and local testing changed the C for AIX version 6 and higher -qmaxmem option value to -1.

Made LSOFF\_AR environment variable more useful and documented it in 00XCONFIG.

Corrected the use of sum(1) to generate signatures for the lsof distribution and binaries to match the

documentation that claims it is `sum -r` output. Jin Guojun <jin@george.lbl.gov> noticed and reported the problem.

Tested under OpenBSD 3.6.

Added checksum and GPG certificate files for the `bz2`, `gz` and `Z` `lsf` distribution archives. The new files reside with the distribution archives and supplement the signature information already inside the archives.

Validated on Solaris 10, `i8xpc`, build `s10_63`.

4.74 January 17, 2005

Fixed a Solaris segment fault bug on systems that lack a `/dev/allkmem` device. Offered the fix as a patch to `lsf` 4.73. The bug was reported by Donald Zoch <donald.zoch@amd.com>.

Updated `lsf` for FreeBSD 6.0 and higher for a change in <`sys/vnode.h`>, based on a report from Sergey A. Osokin <osa@FreeBSD.ORG>. Made the update available in a 4.74 'A' edition pre-release.

Filed an HP bug report about missing `pstat(2)` CWD info for LOFS on HP-UX 11.11 and higher. The missing CWD info was noticed by Ermin Borovac <e.borovac@bom.gov.au>. Added info to 00FAQ about the problem, which can cause the `lsf` test suite's `LTbasic` test to fail.

Updated the `q4`-generated `tcp_s.h` in the `lsf` distribution and added socket option support for HP-UX 11.00. Erwin Reynolds <ereyns@europarl.eu.int> helped test.

Updated for Solaris 10, build `s10_69`, with a patch supplied by Mike Miscevic <miscevic@hotpop.com>.

Added `v_path` support to Solaris 10 `lsf`. That relieves it of having to read and decode the kernel `DNLC`, and delivers full paths more reliably.

Added specialized NFS4 support to Solaris 10 `lsf`.

Applied Solaris 10 patches to `lsf` supplied by Casper Dik <casper@holland.sun.com>.



Updated lsof for NetBSD 2.99.10 and tested it on a system provided by Andrew Brown <atatat@atadot.net>.

Added support for the FreeBSD 6.0-CURRENT `f_vnode` pointer in the file structure.

Added BSDI, FreeBSD, NetBSD and OpenBSD support for the `*effnlink` member of the inode structure. This makes the lsof `LTnlink` test run faster on all modified dialects and correctly on OpenBSD.

Added `ptyfs` support for NetBSD, using modifications provided by Andrew Brown.

Changed the netbsd `Configure` stanza to look by default for system header files in both `/usr/include` and `/usr/src`. (The `NETBSD_SYS` environment variable can still be used to select an alternate for `/usr/src`.)

Corrects two FreeBSD 4.10 RPC/XDR type definitions.

Added an FAQ Q&A about `setuid` and `setgid` restrictions in HP-UX 11.11. The information in the answer was supplied by Frank Sanders <frank.sanders@siemens.com>.

Added abbreviations for AXI FCIO and FSNAPSHOT file flags. Holger VanKoll <Holger.VanKoll@swisscom.com> reported the missing FCIO.

Adjusted lsof's private AIX 64 bit `rnode` structure for 64 bit AIX 5.2 systems. (IBM doesn't distribute a correct `<nfs/rnode.h>` for it.)

Corrected a Linux socket inode printing bug reported by Igor Schein <igor@txc.com>.

Updated for FreeBSD 4.11. The support compiles but hasn't been tested.

Back-ported a FreeBSD 6.0-CURRENT fix to FreeBSD 5.3-RELEASE-p1. That was done to solve a compilation problem reported by Radko Keves <rado@daemon.sk>.

4.75 May  
16, 2005

Dropped the `*claim*` that lsof works on DEC OSF/1 and

Digital UNIX, since my last 4.0 test system has been removed. The last tested distribution of lsof on DEC OSF/1 and Digital UNIX was revision 4.74. It has been archived on lsof.itap.purdue.edu in pub/tools/unix/lsof/OLD/src.

Added negation forms to the values in the -g (PGID) and -p (PID) lists. Negated PGID and PID values, like negated UID or login name values, are applied without ORing or ANDing and take effect before any other selection criteria are applied.

At the request of Marcin Gozdalik <gozdal@gmail.com> added a -X option for Linux. The option inhibits the reading of the /proc/net/tcp\* and /proc/net/udp\* files.

Based on a report from David Gutierrez <davegu1@hotmail.com> changed DEC OSF/1 process table allocation to request memory in smaller increments.

Based on a report from jayjwa <jayjwa@atr2.ath.cx> updated the Customize script to use "tail -n 1" where possible.

Enabled support for FreeBSD 5.4.

Improved the BSDI, FreeBSD, NetBSD, OpenBSD and Solaris kvm\_open() and kvm\_openfiles() error messages.

Enabled support for NetBSD 2.99.12.

Improved HP-UX Configure stanza with help from Piet Starreveld <pstarrev@csc.com>. Picked some lint Piet found.

Enabled IPv6 support for HP-UX > 11. Piet Starreveld helped test it on 11.23, among others.

Updated for HP-UX 11.23 on the ia64 architecture.

Updated to latest FreeBSD 6.0-CURRENT, using a test system provided by Andrzej Tobola <ato@iem.pw.edu.pl>.

Added support for SCO OSR 6.0.0 and UnixWare 7.1.4 with help from Richard at SCO.

Corrected a Linux bug in NFS handling, reported by Karel Zak

<kzak@redhat.com>. Karel supplied a patch.

Improved the code for accessing an AIX 3.2 and higher sockaddr\_un structure, thus eliminating a segmentation fault possibility.

Updated for AIX 5.3.

Added preliminary (DEBUG) support for the AIX SANFS file system.

Fixed a bug in the Solaris 10 processing of the vnode's v\_path pointer with code supplied by Edward Jajko <ejajko@portal.com>. The fix was offered as a patch to 4.74.

Dropped support for OpenUNIX 8, since a test system is no longer available. Archived an OpenUNIX-only distribution of the last revision (4.74) tested on OpenUNIX in pub/tools/unix/lsf/OLD/src.

Tested under Openbsd 3.7.

Tested under Darwin 7.7.0.

Enabled building on amd64 Solaris 10 with hints from Marc Aurele La France <tsi@ualberta.ca>. Marc provided a test system.

Supplied a missing quote in the FreeBSD Configure stanza. Carl Cook <Info@quantum-sci.com> reported the problem.

Removed "-O" option from tests/Makefile so that the HP-UX bundled compiler won't complain.

4.76 August 30, 2005

Corrected an example and spelling errors in man page.

Updated for Apple Darwin 8.x with changes supplied by Allan Nathanson <ajn@apple.com>. Allan also provided a test system.

Completed documentation of CLRLFILEADD in all machine.h files.

At the request of Chris Markle <cmarkle@sendmail.com> added partial listen queue length to socket options displayed when -Tf is specified. Partial queue length is not reported for all dialects. (00FAQ lists the ones where it is reported.)

Updated for FreeBSD 7.0 with information supplied by Andrzej Tobola <ato@iem.pw.edu.pl>.

Updated Solaris VxFS support for VxFS versions 4 and above with technical advice from Craig Harmer <craig\_harmer@symantec.com>, Gary Millen <gary\_millen@symantec.com> and Chuck Silvers <charles\_silvers@symantec.com>. Testing help was provided by Michael Antlitz <mantlitz@prophasys.com>, Steve Ginsberg <steve@dhapdigital.com> and Kenneth Stailey <kstailey@yahoo.com>.

Fixed a Solaris address space map processing bug. Janardhan Molumuri <mjanardhan@gmail.com> reported the bug and help me identify it. Made the fix available as a patch to 4.75.

Added support for Solaris 10 port and CTFS files. The CTFS support is incomplete, because I don't know how to get inode number, size and link count. (There's a new 00FAQ entry about that.)

Investigated a report from Christopher J Warweg <warwegc@GAO.GOV> that the CHECKSUMS for the lsof 4.75 binary for 64 bit Solaris 8 was incorrect. It was my packaging error. I rebuilt and repackaged the binary.

Enabled support for Linux map file names with embedded spaces.

4.77 April 10, 2006

Added -X option support for Solaris 10 and above. When -X is specified lsof will report cached v\_node path names for unlinked files, followed by "(deleted)". Improved cached vnode path name handling by adding "(?)" to the end of path names of questionable accuracy. Updated 00FAQ to reflect these changes.

Updated for FreeBSD 7.0-CURRENT.

Fixed name addition spacing bug, reported by Stuart

Anderson <anderson@ligo.caltech.edu>. Also updated Solaris 10 SAMFS support at Stuart's request.

Added missing "break;" and another HASSTATVFS test to the NetBSD and OpenBSD dnode.c. Bill Behr <bbeh@networkstoragecorp.com> reported those needs.

Fixed an HP-UX 11 file descriptor "chunk" size problem, reported by Per Allansson <per@appgate.com>. Per helped devise the fix and tested it. This fix was offered as a patch to lsof 4.76.

Updated for FreeBSD 6.0-STABLE and FreeBSD 6.1-PRERELEASE.

Updated scripts/sort\_res.perl5 with changes supplied by Frederick Fabian <fabian.frederick@skynet.be>, the author of the script.

Corrected +/-M man page documentation error, reported by Roger Cornelius <rac@tenzing.org>.

Improved FreeBSD user device random seed generation in response to a problem report from Danny Braniss <danny@cs.huji.ac.il>.

Eliminated three syntax error bugs and other compiler complaints from the PSTAT-based lsof. H. Merijn Brand <h.m.brand@xs4all.nl> reported the problems and tested the fixes.

Eliminated compiler complaints in the test suite.

Investigated problems with the building of lsof on PA-RISC HP-UX 11.23, based on a report from John Orndorff <John.Orndorff@sungard.com>. Found that neither the HP bundled C compiler nor gcc would build lsof, but the the HP unbundled ANSI C compiler would. Concluded that HP bundled C compiler can't handle <gssapi/gssapi.h>. Devised a work-around to gcc's omission of the rpercent structure definition of <netdb.h> that allows it to compile lsof's print.c, but the resulting binary doesn't run reliably. Documented the situation in 00FAQ.

Changed reporting of unknown file types. The number of

an unknown type is now reported as four octets. The change was made in response to a Linux lsof bug report from Karel Zak <kzak@redhat.com>.

Dropped the \*claim\* that lsof works on BSDI BSD/OS since my last test system has been removed. The last tested distribution of lsof for BSDI BSD/OS was revision 4.76. It has been archived on lsof.itap.purdue.edu in pub/tools/unix/lsof/OLD/src.

As a result of discussing the lsof source tar's MD5 checksum with Andrew Bell <andrew.bell.ia@gmail.com>, changed the description of a suitable MD5 tool in the lsof distribution's documentation to name the openssl "dgst" command.

Enabled compilation on Solaris 10 1/06 with a fix sent by Jason Fortezzo <fortezza@mechanicalism.net>. Made the fix available as a patch to 4.76.

Adjusted to FreeBSD 5.5-PRERELEASE.

Corrected a bug in the lsof library's process\_file() function to enable the locating of AIX XTI sockets by their TCP/IP address values. The bug was reported by Michel Dubois <Dubois@sears.ca>.

Based on a bug report from Karel Zak <kzak@redhat.com> added command name length checking to as many dialects as possible (Linux for Karel) for the "-c c" option.

Updated for OpenBSD 3.[89]. Tested the 3.9 update on a system provided by David Mazieres. I have not tested on OpenBSD 3.8, but David reports lsof 4.76 worked there.

Ended regression testing of lsof on 32 bit Solaris 8 with the ending of access to a test system. Lsof continues to be tested on 64 bit Solaris 8.

4.78 April 24, 2007

Added more information to the lsof FAQ about missing link counts and sizes on Linux files.

Simplified Linux stat() and lstat() usage.

Relocated #define's that prevent OpenBSD compilation on systems without a /proc file system. Pieter Bowman <bowman@math.utah.edu> reported the problem.

Added code to avoid processing Linux /proc/<PID>/maps file entries with zero device and node numbers. Some such entries now have names associated with them that are not path names -- e.g., "[heap]", "[stack]" or "[vdso]". Scott Worley <sworley@chkno.net> reported Isof's mishandling of such entries.

Added SELinux security context support, provided by James Antill <james.antill@redhat.com>. I have not tested this, but James and Karel Zak <kzak@redhat.com> have.

Added the #include of <sys/types.h> to Solaris Isof to enabled compilation on Solaris 10 6/06. Peter Harvey Peter.Harvey@Sun.COM diagnosed the problem and supplied a patch.

Added better support for JFS2 on AIX 5.2 and 5.3, based on bug reports and help from Thomas Braunbeck <BRAUNBEC@de.ibm.com> and Tom Whitty <TWHITTY@cerner.com>.

Documented that Isof supports AIX 5.3 only up through maintenance level 1 (ML1).

Enabled Solaris Isof to locate the AFS vnode operation address for OpenAFS 1.4.1. The fix was supplied by Robert Jelinek <Robert.Jelinek@MorganStanley.com>.

Enabled support for Solaris 10 ZFS. If the necessary ZFS header files aren't found, Isof offers the option to drop ZFS support, to use internal, possibly inaccurate structure definitions, or to supply a path to the missing header files. Horst Scheuermann <Horst.Scheuermann@uni-trier.de> provided a development system and helped test the support.

Corrected a typo in the man page, reported by Eric S. Raymond <esr@thyrsus.com>.

Changed the spelling of macroes to macros in Isof source and documentations files, based on a suggestion from Josh Soref <timeless@gmail.com> and verification

with the OED.

The following dialects are no longer supported: 32 bit AIX 5.2, HP-UX 11, OpenStep 4.2, Solaris 2.6, Solaris 8, True Unix 64 and UnixWare 7.1.4. Lsof may work on them, but I no longer have test systems for them. Support for OpenBSD ends at its version 3.9 for lack of interest in the port.

4.79 April 15, 2008

```
***** IMPORTANT NOTE *****
*
* Lsof support has been reduced to the following *
* dialects: AIX, FreeBSD, Linux and Solaris, and *
* only in selected versions of those dialects. *
* The selected versions are listed in this file *
* and in other lsof documentation. *
*
*
* I have made this move because of retirement *
* and because I no longer have many test systems *
* available to me. *
*
* Vic Abell *
*
*****
```

Fixed a Solaris VXFS permission problem when accessing the VXFS inode offsets. The bug was reported by Gregory A. Ivanov <ivga@mts.ru>. Gregory tested the fix.

Moved an #include <string.h> later in FreeBSD dlsof.h to enable compilation on recent FreeBSD releases. The change was supplied by Roy Marples <uberlord@gentoo.org>.

Improved Linux /proc file stream reading speed by applying an expanded version of a patch from Eric Dumazet <dada1@cosmosbay.com> that allocates a page size buffer to each stream. Improved TCP, TCP6, UDP and UDP6 hashing by determining the hash bucket count from the /proc/net sockstat and sockstat6 files. The improvement was suggested by Eric and he provided sample code. Eric also tested both improvements.

Modified Configure script to build lsof on FreeBSD



6.2. Tested it on a system provided by Larry Rosenman <ler@lerctr.org>.

Fixed a Linux maps file processing bug that prevented path names from having an embedded colon. James Lingard <jchl@arastra.com> reported the bug and helped with its fix.

Based on reports from Eric Dumazet and Samuel Thibault <samuel.thibault@ens-lyon.org> added support for the Linux 2.6.22 kernel's /proc/<PID>/fdinfo files -- i.e., file offset and flags. Samuel Thibault provided a test system.

Fixed a Linux UNIX socket memory leak, reported by Philip Shin <pshin@xceedium.com>. Phillip supplied the fix.

With generous assistance from HP added support for an HP-UX 11.23 patch that makes TLI/XTI socket address information available.

Fixed a header file problem for FreeBSD 6.2 on the Alpha architecture. The problem was reported by Pekka Honkanen <phonkane@cc.hut.fi>. Pekka tested the fix.

Based on a report and using suggested fixes from Karel Zak <kzak@redhat.com>, made these changes to Linux lsof: corrected a getpidcon() error message; insured that inode numbers are handled correctly for their unsigned long long type; and improved SELinux handling. At the request of Alon Bar-Lev <alonbl@gentoo.org> added the LINUX\_HASSELINUX environment variable to enable or inhibit SELinux support unconditionally.

Updated Configure for FreeBSD 8.0-CURRENT and tested lsof on AMD64 there.

Added a patch provided by Oles Hnatkevych <don\_oles@able.com.ua> for FreeBSD systems where the root file system is on a CD9660 device.

Added compensation for the disappearance of FMARK and FDEFER from the FreeBSD 8.0-CURRENT <sys/file.h>.

Updated FreeBSD lsof with ZFS support. Larry Rosenman <ler@lerctr.org>, Erwin Lansing <erwin@FreeBSD.org>,

Wesley

Shields <wxs@atarininja.org> and Dmitry Morozovsky <marck@rinet.ru> provided test systems.

Fixed a socket file identification problem reported by Pavol Rusnak <stick@gk2.sk>. Pavol also reported the cause of the problem.

Added the ability to format the repeat mode marker line with `strftime(3)`, where the dialect supports the `localtime(3)` and `strftime(3)` C library functions. The addition was suggested by Mike Depot <mdepot@comcast.net>, who also tested it. The addition required creating a new main lsof source module, `util.c`, that contains functions whose compilation conflicts with the general header file tree defined by `lsof.h` and `dlsof.h`.

Based on reports from Andrei V. Lavreniyuk <andy.lavr@reactor-xg.kiev.ua> and Pav Lucistnik <pav@FreeBSD.org> updated the FreeBSD 7.0 and above file lock handling to use new locking structures. The update requires a terrible hack to get a definition for the lock owner structure from a kernel source module into a local lsof header file.

4.80 May 12, 2008

Updated for a FreeBSD 7.0 and above byte level locking change. The problem was reported by Conrad J. Sabatier <conrads@cox.net>, who helped test the update. Wesley Shields <wxs@FreeBSD.org> provided an 8.0-CURRENT test system.

Propagated the FreeBSD 7.0 and above locking changes to FreeBSD 6.x, based on a report from Edwin Groothuis <edwin@FreeBSD.org>.

Added warnings for unsupported dialects or versions.

Added Linux support for the UDPLITE protocol. Eric Dumazet <dada1@cosmosbay.com> supplied a patch.

Added a missing quote to the Configure script's FreeBSD stanza.

Added a `usage.o` rule to the HP-UX PSTAT-based Makefile. I mistakenly deleted the rule at revision 4.79. The missing rule was reported by Kawaljeet Kaur

<kawaljeet.malviya@gmail.com> who tested the corrected Makefile.

4.81 October 21, 2008

Updated the Darwin libproc sources with changes from Allan Nathanson <ajn@apple.com>. Tested them on a iMac mini, provided by Apple Inc.

Changed dummy declarations in library source files to eliminate complaints about unused variables and empty object files. This change may not work on dialects I can no longer test; it has been tested on some versions of AIX, Darwin, FreeBSD, Linux and Solaris.

At the request of Hal Brooks <hal@uga.edu> added support for Linux /proc/net/packet files. Hal tested it.

Added socket file only performance enhancements to Linux and PSTAT-based HPUX lsof.

Added htonl call around improper usage of INADDR\_LOOPBACK; report from an Apple engineer forwarded by Allan Nathanson <ajn@apple.com>.

Adjusted for FreeBSD-8.0 change in device number handling. The adjustment should work for FreeBSD 5 and above, should the 8.0 change be propagated downward. The problem was reported by Pav Lucistnik <pav@FreeBSD.org>. An updated test system was provided by Erwin Lansing <erwin@FreeBSD.org>.

Reduced AIX support to version 5.3, since test systems with older versions are no longer available to me.

At the request of Marjo F. Mercado <mmercado@xceedium.com> and Phil Shin <pschin@xceedium.com> applied some speed improvements to lsof, particularly when the files of interest are /Internet files -- i.e., selected with lsof's -i" option. Added a two new options to assist the improvements: 1) "-c^<command>" to tell lsof to exclude the named command(s); and 2) "-stcp|ud>:[^]state'" to tell lsof to include in its reporting or exclude (^) from its reporting Internet files in the named states (e.g., LISTEN, ^CLOSE\_WAIT, IDLE, etc.) For the most part these changes apply only to AIX, Darwin, FreeBSD, PSTAT-based HP-UX, Linux and Solaris, since those are the only places I could test them. They are controlled by the HASTCPUDPSTATE definition

in each dialect's machine.h header file. Marjo and Phil provided HP-UX 11.23 and 11.31 test systems.

Fixed a stat(2) problem on HP-UX 11.31 while testing the speed improvements.

Adjusted for kernel header file changes in FreeBSD 8.0-CURRENT. Larry Rosenman <ler@lerctr.org> provided a test system.

Added a warning for Solaris systems where VxFS node info can't be obtained from the VxFS utility library. The warning was requested by Tom Matthews <Tom.MATTHEWS@rbs.com>.

Corrected mishandling of file system path name arguments that have trailing slashes, except, of course, the root file system, "/". Allan Nathanson <ajn@apple.com> reported the bug.

4.82 March 25, 2009

Corrected an over-zealous exclusion test that caused lsof to report nothing when it was given no arguments and built with HASSECURITY and HASNOSOCKSECURITY enabled. Joshua Kinard <kumba@gentoo.org> reported the bug and supplied information for reproducing it.

Based on a report from Dan Trinkle <trinkle@cs.purdue.edu> corrected use of <sys/utsname.h> for 32 bit Solaris 10 and above compilations. Simultaneously eliminated a casting complaint in arg.c and updated Configure to use the appropriate 64 bit compilation option (-xarch=v9 or -m64) with the Solaris Sun C compiler.

Updated for FreeBSD 7.1-PRERELEASE with information supplied by Larry Rosenman <ler@lerctr.org>.

Updated the Darwin libproc sources with changes from Allan Nathanson <ajn@apple.com>. Tested them on a iMac mini, provided by Apple Inc. Allan also provided man page corrections.

Updated the FreeBSD Makefile to use the \${MAKE} variable for ZFS dnode2.c module compilation, based on a suggestion from Alexis Ballier <aballier@gentoo.org>.

Improved the Solaris VxFS library location test, based on a

suggestion from Jason Fortezzo <fortezza@mechanicalism.net>.  
Jason tested the change.

Updated Solaris 10 ZFS support for ZFS version 4 and ZFS pool version 10, using a test system kindly provided by Vladislav Nesor <vladislav.nesor@id.ethz.ch>. Renata Maria Dart <renata@slac.stanford.edu> tested on ZFS version 4, verifying that the update works there, too. (ZFS pool version 10 is apparently the ZFS version shipped with the 10/08 update to Solaris. The original ZFS support targeted ZFS version 3.)

I still consider ZFS support in Solaris lsof a hack, because it depends on a znode structure definition that I developed using dbx. Sun is remiss in not distributing the ZFS header files used to build the distributed kernel.

Because of the znode structure definition hack, I can't guarantee that lsof ZFS support will work for any other versions of ZFS.

Solaris 10: adjusted to a change in the way devices are stored in the kernel; fixed a problem in zone handling; and added rudimentary sharedfs support. Carson Gaspar <carson@taltos.org> reported the device number problem, provided a test system, and tested the changes. Peter Vines <psv2b@eservices.virginia.edu> reported the zone handling problem and tested the fix.

Adapted to FreeBSD  
8.0-CURRENT changes in device number computation. Problem was reported by Erwin Lansing <erwin@FreeBSD.org>. Larry Rosenman <ler@lerctr.org> provided a test system.

Corrected Solaris Configure test for appropriate VxFS library when using gcc to compile lsof.

Updated for loss of KAME IPv6 FreeBSD accommodations.

Adapted to FreeBSD 7.2. Made Configure script recognized FreeBSD 6.3.

4.83 January 18, 2010

Converted Solaris 10 and above ZFS support to use the CTF debugger library, libctf. Code was supplied by Robert Byrnes <Robert.Byrnes@deshaw.com>.

Corrected a typo in the testing of the LINUX\_HASSELINUX environment variable in the Configure script. The error was reported by Mike Frysinger <vapier@gentoo.org>. At Mike's request made Configure script accept LSOF\_RANLIB (ranlib command), LSOF\_CFGF (additional configuration flags) and LSOF\_CFGL (additional library specifications) from the environment.

Enabled compilation of Solaris 10 lsof after a recent Sun patch which changed the PC file system's structure. Peter Vernam <pvernam@draper.com> reported the problem and helped with the fix.

Made the sort of configuration CFLAGS in the CkTestDB script impervious to locale settings.

Ported to Solaris 11, using a test system kindly provided by David Day <dday76@gmail.com>.

Adjusted to the disappearance of <nfs/rpcv2.h> in FreeBSD 8.0-BETA1.

Changed Solaris node type lookup to a hashed method and added some ability for it to handle duplicate vnodeop names in /dev/ksyms.

Updated for FreeBSD 9.0-CURRENT. Andrzej Tobola <ato@iem.pw.edu.pl> provided a test system. Extends the fix to FreeBSD 6.0 and above via a Configure test and a compile-time definition. The need for the extension was reported by Erik Trulsson <ertr1013@student.uu.se>>

Made corrections to FAQ typographical errors, suggested by Josh Soref <timeless@gmail.com>.

Added \_\_UCLIBC\_\_ test to Linux dlsof.h so lsof would compile on an Intel ARM XScale processor. The addition was provided by Doug Kehn <rdkehr@yahoo.com>.

Added test for <utmpx.h> to FreeBSD configuration. Improved its use in lsof.h. The changes were supplied by Martin Wilke <miwi@FreeBSD.org>.

Vic Abell <abe@purdue.edu>

January 18, 2010

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\*

/opt/cola/permits/1350150906\_1655994764.9225438/0/lsf-4-83-r1-2-tar-gz/lsf\_4.83\_src/dialects/du/ddev.c

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\* /opt/cola/permits/1350150906\_1655994764.9225438/0/lsof-4-83-r1-2-tar-gz/lsof\_4.83/lsof-4-83-src-  
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\* /opt/cola/permits/1350150906\_1655994764.9225438/0/lsf-4-83-r1-2-tar-gz/lsf\_4.83/lsf-4-83-src-tar/lsf\_4.83\_src/dialects/darwin/libproc/dstore.c

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/\*

\* GetOpt() -- Local get option

\*

\* Borrowed from lsof's main.c source file.

\*

\* Liberally adapted from the public domain AT&T getopt() source,  
\* distributed at the 1985 UNIFORM conference in Dallas

\*

\* The modifications allow '?' to be an option character and allow  
\* the caller to decide that an option that may be followed by a  
\* value doesn't have one -- e.g., has a default instead.

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 \* @(#)cdefs.h 8.2 (Berkeley) 10/4/93  
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 \*  
 /opt/cola/permits/1350150906\_1655994764.9225438/0/lsf-4-83-r1-2-tar-gz/lsf\_4.83/lsf-4-83-src-  
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  - \* /opt/cola/permits/1350150906\_1655994764.9225438/0/lsf-4-83-r1-2-tar-gz/lsf\_4.83/lsf-4-83-src-tar/lsf\_4.83\_src/tests/LTdnlc.c
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\* GetOpt() -- Local get option

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\* Liberally adapted from the public domain AT&T getopt() source,  
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\* The modifications allow '?' to be an option character and allow  
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- \* /opt/cola/permits/1350150906\_1655994764.9225438/0/lsf-4-83-r1-2-tar-gz/lsf\_4.83\_src/dialects/uw/dnode2.c
- \* /opt/cola/permits/1350150906\_1655994764.9225438/0/lsf-4-83-r1-2-tar-gz/lsf\_4.83\_src/dialects/sun/dnode1.c
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- \* /opt/cola/permits/1350150906\_1655994764.9225438/0/lsf-4-83-r1-2-tar-gz/lsf\_4.83\_src/dialects/n+os/dnode1.c
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- \* /opt/cola/permits/1350150906\_1655994764.9225438/0/lsf-4-83-r1-2-tar-gz/lsf\_4.83\_src/dialects/aix/dnode1.c
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- /opt/cola/permits/1350150906\_1655994764.9225438/0/lsf-4-83-r1-2-tar-gz/lsf\_4.83\_src/dialects/uw/machine.h
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- \* /opt/cola/permits/1350150906\_1655994764.9225438/0/lsf-4-83-r1-2-tar-gz/lsf\_4.83/lsf-4-83-src-tar/lsf\_4.83\_src/dialects/uw/dlsf.h
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- \* /opt/cola/permits/1350150906\_1655994764.9225438/0/lsf-4-83-r1-2-tar-gz/lsf\_4.83/lsf-4-83-src-

```
tar/lsof_4.83_src/dialects/hpux/kmem/dnode2.c
*
/opt/cola/permits/1350150906_1655994764.9225438/0/lsof-4-83-r1-2-tar-gz/lsof_4.83_src/dialects/uw/dmmt.c
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* /opt/cola/permits/1350150906_1655994764.9225438/0/lsof-4-83-r1-2-tar-gz/lsof_4.83_src/dialects/uw/dsock.c
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tar/lsof_4.83_src/dialects/uw/machine.h
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tar/lsof_4.83_src/scripts/shared.perl5
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* /opt/cola/permits/1350150906_1655994764.9225438/0/lsof-4-83-r1-2-tar-gz/lsof_4.83/lsof-4-83-src-
tar/lsof_4.83_src/scripts/idrlogin.perl5
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* /opt/cola/permits/1350150906_1655994764.9225438/0/lsof-4-83-r1-2-tar-gz/lsof_4.83_src/scripts/list_fields.awk
*
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tar/lsof_4.83_src/scripts/list_fields.perl
* /opt/cola/permits/1350150906_1655994764.9225438/0/lsof-4-83-r1-2-tar-gz/lsof_4.83_src/scripts/list_fields.perl
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tar/lsof_4.83_src/scripts/idrlogin.perl
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* Written by Victor A. Abell
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tar/lsof\_4.83\_src/dialects/darwin/kmem/dfile.c

\* /opt/cola/permits/1350150906\_1655994764.9225438/0/lsof-4-83-r1-2-tar-  
gz/lsof\_4.83\_src/dialects/darwin/kmem/dfile.c

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\*

\* \$Id: pfsnode.h,v 1.1 1993/12/12 12:26:39 davidg Exp \$

\*/

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\* /opt/cola/permits/1350150906\_1655994764.9225438/0/lsf-4-83-r1-2-tar-  
gz/lsf\_4.83\_src/dialects/freebsd/include/procfs/pfsnode.h

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tar/lsf\_4.83\_src/dialects/freebsd/include/procfs/pfsnode.h

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## Frequently Asked Questions about lsof

\*\*\*\*\*  
| The latest release of lsof is always available via anonymous ftp |  
| from lsof.itap.purdue.edu. Look in pub/lsof.README for its |  
| location. |  
\*\*\*\*\*

---

This file contains frequently asked questions about lsof and answers to them.

Vic Abell <abe@purdue.edu>  
January 18, 2010

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Table of Contents:

- 1.0 General Concepts
  - 1.1 Lsof -- what is it?
  - 1.2 Where do I get lsof?
    - 1.2.1 Are there mirror sites?
    - 1.2.2 Are lsof executables available?
    - 1.2.3 How do I check the validity of an lsof distribution?
    - 1.2.4 Why can't I get the sum(1) result reported in README.lsof\_<revision>?
    - 1.2.5 Why won't gpg accept the lsof-signing PGP public key?
  - 1.3 Where can I get more lsof documentation?
  - 1.4 How do I report an lsof bug?
  - 1.5 Where can I get the lsof FAQ?
    - 1.5.1 How timely is the on-line FAQ?
  - 1.6 Is there a test suite?
  - 1.7 Is lsof vulnerable to the standard I/O descriptor attack?
  - 1.8 Can I alter lsof's make(1) behavior?
  - 1.9 Is there an lsof license?
  - 1.10 Language locale support
    - 1.10.1 Does lsof support language locales? How do I use the support?
    - 1.10.2 Does lsof support wide characters in language locales?
  - 1.11 Are any files in the lsof distribution copyrighted?
  - 1.12 Are there other lsof-related resources?
  - 1.13 What does the "WARNING: unsupported dialect or version" mean?

## 2.0 Lsof Ports

- 2.1 What ports exist?
- 2.2 What about a new port?
  - 2.2.1 User-contributed Ports
- 2.3 Why isn't there an AT&T SVR4 port?
- 2.4 Why isn't there an SGI IRIX port?
- 2.5 Why does lsof's Configure script report "WARNING: unsupported dialect or version"?

## 3.0 Lsof Problems

### 3.1 Configuration

#### Problems

- 3.1.1 Why can't Configure determine the UNIX dialect version?
- 3.2 Compilation Problems
  - 3.2.1 Why does the compiler complain about missing header files?
  - 3.2.2 Why does gcc complain about the contents of header files distributed by the system's vendor?
  - 3.2.3 Other header file problems
- 3.3 Why doesn't lsof report full path names?
  - 3.3.1 Why do lsof -r reports show different path names?
  - 3.3.2 Why does lsof report the wrong path names?
  - 3.3.3 Why doesn't lsof report path names for unlinked (rm'd) files?
  - 3.3.4 Why doesn't lsof report the "correct" hard linked file path

- name?
- 3.3.5 When will lsof report path names for deleted files?
- 3.4 Why is lsof so slow?
- 3.5 Why doesn't lsof's setgid or setuid permission work?
- 3.6 Does lsof have security problems?
- 3.7 Will lsof show remote hosts using files via NFS?
- 3.8 Why doesn't lsof report locks held on NFS files?
  - 3.8.1 Why does lsof report a one byte lock on byte zero as a full file lock?
- 3.9 Why does lsof report different values for open files on the same file system (the automounter phenomenon)?
- 3.10 Why don't lsof and netstat output match?
  - 3.10.1 Why can't lsof find accesses to some TCP and UDP ports?
- 3.11 Why does lsof update the device cache file?
- 3.12 Why doesn't lsof report state for UDP socket files?
- 3.13 I am editing a file with vi; why doesn't lsof find the file?
- 3.14 Why doesn't lsof report TCP/TPI window and queue sizes for my dialect?
  - 3.14.1 Why doesn't lsof report socket options, socket states, and TCP flags and values for my dialect?
  - 3.14.2 Why doesn't lsof report the partial listen queue connection count for my dialect?
- 3.15 What does "no more information" in the NAME column mean?
- 3.16 Why doesn't lsof find a process that ps finds?
- 3.17 Why doesn't -V report a search failure?
- 3.18 Portmap problems
  - 3.18.1 Why isn't a name displayed for the portmap registration?
  - 3.18.2 How can I display only portmap registrations?
  - 3.18.3 Why doesn't lsof report portmap registrations for some ports?
- 3.19 Why is `lsof | wc` bigger than my system's open file limit?
- 3.20 Why doesn't lsof report file offset (position)?
  - 3.20.1 What does lsof report for size when the file doesn't really have one?
- 3.21 Problems with path name arguments
  - 3.21.1 How do I ask lsof to search a file system?
  - 3.21.2 Why doesn't lsof find all the open files in a file system?
  - 3.21.3 Why does the lsof exit code report it didn't find open files when some files were listed?
  - 3.21.4 Why won't lsof find all the open files in a directory?
  - 3.21.5 Why are the +D and +d options so slow?
  - 3.21.6 Why do the +D and +d options produce warning messages?
- 3.22 Why can't my C compiler find the rpercent structure definition?
- 3.23 Why doesn't lsof report fully on file "foo" on UNIX dialect "bar?"
- 3.24 Why do I get a complaint when I execute lsof that some library file can't be found?

- 3.25 Why does lsof complain it can't open files?
- 3.26 Why does lsof warn "compiled for x ... y; this is z."?
- 3.27 How can I disable the kernel identity check?
- 3.28 Why don't ps(1) and lsof agree on the owner of a process?
- 3.29 Why doesn't lsof find an open socket file whose connection state is past CLOSE\_WAIT?
- 3.30 Why don't machine.h definitions work when the surrounding comments are removed?
- 3.31 What do "can't read inpcb at 0x...", "no protocol control block", "no PCB, CANTSENDMORE, CANTRCVMORE", etc. mean?
- 3.32 What do the "unknown file system type" warnings mean?
- 3.33 Installation
  - 3.33.1 How do I install lsof?
  - 3.33.2 How do I install a common lsof when I have machines that need differently constructed lsof binaries?
- 3.34 Why do lsof 4.53 and above reject device cache files built by earlier lsof revisions?
- 3.35 What do "like block special" and "like character special" mean in the NAME column?
- 3.36 Why does an lsof make fail because of undefined symbols?
- 3.37 Command Regular Expressions (REs)
  - 3.37.1 What are basic and extended regular expressions?
  - 3.37.2 Why can't I put a slash in a command regular expression?
  - 3.37.3 Why does lsof say my command regular expression wasn't found?
- 3.38 Why doesn't lsof report on shared memory segments?
- 3.39 Why does lsof report two instances of itself?
- 3.40 Why does lsof report '\n' in device cache file error messages?
- 3.41 Kernel Symbol and Address Problems
  - 3.41.1 What does "lsof: WARNING: name cache hash size length error: 0" mean?
  - 3.41.2 Why does lsof produce "garbage" output?
- 3.42 Why does lsof report open files when run as super user that it doesn't report when run with lesser privileges?
- 3.43 Test Suite Problems
  - 3.43.1 Errors all tests can report:
    - 3.43.1.1 Why do tests complain "ERROR!!! can't execute ../lsof"?
    - 3.43.1.2 Why do tests complain "ERROR!!! can't find ..." a file?
    - 3.43.1.3 Why do some tests fail to compile?
    - 3.43.1.4 Why do some tests always fail?
    - 3.43.1.5 Why does the test suite say it hasn't been validated on my dialect?
    - 3.43.1.6 Why do the tests complain they can't stat() or open() /dev/mem or /dev/kmem?
  - 3.43.2 LTbigf test issues
    - 3.43.2.1 Why does

- the LTbigf test say that the dialect doesn't support large files?
  - 3.43.2.2 Why does LTbigf complain about operations on its config.LTbigf\* file?
  - 3.43.2.3 Why does LTbigf warn that lsof doesn't return file offsets?
  - 3.43.3 Why does the LTbasic test complain "ERROR!!! lsof this ..." and "ERROR!!! lsof that ..."?
  - 3.43.4 LTnfs test issues
    - 3.43.4.1 Why does the LTnfs test complain "couldn't find NFS file ..."?
  - 3.43.5 LTnlink test issues
    - 3.43.5.1 Why does the LTnlink test complain that its test file is on an NFS file system?
    - 3.43.5.2 Why does LTnlink delay and report "waiting for link count update: ..."?
  - 3.43.6 LTdnlc test issues
    - 3.43.6.1 Why won't the LTdnlc test run?
    - 3.43.6.2 What does the LTdnlc test mean by "... <path> found: 100.00%"?
    - 3.43.6.3 Why does the DNLC test fail?
  - 3.43.7 Why hasn't the test suite been qualified for 64 bit HP-UX 11 when lsof is compiled with gcc?
  - 3.43.8 LTszoff test issues
    - 3.43.8.1 Why does LTszoff warn that lsof doesn't return file offsets?
  - 3.43.9 LTlock test issues
  - 3.44 File descriptor list (the ``-d" option) problems
    - 3.44.1 Why does lsof reject a ``-d" FD list?
    - 3.44.2 Why are file descriptors other than those in my FD list reported?
  - 3.45 How can I supply device numbers for inaccessible NFS file systems?
  - 3.46 Why won't lsof find open files on over-mounted file systems?
  - 3.47 What can be done when lsof reports no more space?
  - 3.48 What if the lsof build encounters ar and ld problems?
- 
- 4.0 AIX Problems
    - 4.1 What is the Stale Segment ID bug and why is -X needed?
      - 4.1.1 Stale Segment ID APAR
    - 4.2 Gcc Work-around for AIX 4.1x
    - 4.3 Gcc and AIX 4.2
    - 4.4 Why won't lsof's Configure allow the use of gcc for AIX below 4.1?
    - 4.5 What is an AIX SMT file type?
    - 4.6 Why does AIX lsof start so slowly?
    - 4.7 Why does exec complain it can't find libc.a[shr.o]?
    - 4.8 What does lsof mean when it says, "TCP no PCB, CANTSENDMORE, CANTRCVMORE" in a socket file's NAME column?
    - 4.9 When the -X option is used on AIX 4.3.3, why does lsof disable it, saying "WARNING:

- user struct mismatch; -X option disabled?"
- 4.10 Why doesn't the -X option work on my AIX 5L or 5.[123] system?
  - 4.11 Why doesn't /usr/bin/oslevel report the correct AIX version?
    - 4.11.1 Why doesn't /usr/bin/oslevel report the correct AIX version on AIX 5.1?
  - 4.12 Why does lsof for AIX 5.1 or above Power architecture complain about kernel bit size?
  - 4.13 What can't gcc be used to compile lsof on the ia64 architecture for AIX 5 and above?
  - 4.14 Why does lsof get a segmentation fault when compiled with gcc for a 64 bit Power architecture AIX 5.1 kernel?
  - 4.15 Why does lsof ignore AFS on my AIX system?
  - 4.16 Why does lsof report "system paging space is low" and exit?
  - 4.17 Why does lsof have compilation and execution problems on AIX 5.3 above maintenance level 1?

## 5.0 Apple Darwin Problems

- 5.1 What do /dev/kmem-based and libproc-based mean?
- 5.2 /dev/kmem-based Apple Darwin Questions
  - 5.2.1 Why does Configure ask for a path to the Darwin XNU kernel header files?
    - 5.2.1.1 Why does Configure complain that Darwin XNU kernel header files are missing?
  - 5.2.2 Why doesn't Apple Darwin lsof report text file information?
  - 5.2.3 Why doesn't Apple Darwin lsof support IPv6?
  - 5.2.4 Why does lsof complain about a mismatch between the release for which lsof was compiled and the booted Mac OS X release?
  - 5.2.5 Why does lsof for Apple Darwin 8 and higher report "stat(...): ..." in the NAME column?
  - 5.2.6 What are the limitations of Apple Darwin lsof link count reporting?
- 5.3 Libproc-based Apple Darwin Questions

## 6.0 BSD/OS BSDI Problems

- 6.0.5 Statement of deprecation

## 7.0 DEC OSF/1, Digital UNIX, and Tru64 UNIX Problems

- 7.1 Why does lsof complain about non-existent /dev/fd entries?
- 7.2 Why does the Digital UNIX V3.2 ld complain about Ots\* symbols?
- 7.3 Why can't lsof locate named pipes (FIFOs) under V3.2?
- 7.4 Why does lsof use the wrong configuration header files?  
For example, why can't the lsof compilation find cpus.h?
- 7.5 Why does lsof indicate incomplete paths with "--" for Tru64 UNIX
  - 5.1 files?
- 7.6 Why doesn't lsof report link count, node number, and size for some Tru64 5.x CFS files?

7.7 Why does lsof say it can't read the kernel name list or proc table on Digital UNIX 4.x or Tru64 UNIX?

## 8.0 FreeBSD Problems

8.1 Why doesn't lsof report on open kernfs files?

8.2 Why doesn't lsof work on my FreeBSD system?

8.3 Why doesn't lsof work on the RELEASE version of CURRENT?

8.4 Why can't kvm\_open() can't find some file?

## 8.5 FreeBSD ZFS Problems

8.5.1 Why does FreeBSD lsof report "WARNING: no ZFS support has been

8.6 Why can't Configure create lsof\_owner.h for FreeBSD 6 and above?

8.6.1 Why are there lockf structure compiler errors for FreeBSD 6.0 and higher lsof?

8.6.2 Why don't /usr/src/sys/sys/lockf.h and /usr/include/sys/lockf.h match?

## 9.0 HP-UX Problems

9.1 What do /dev/kmem-based and PSTAT-based mean?

9.2 /dev/kmem-based HP-UX lsof Questions

9.2.1 Why doesn't a /dev/kmem-based HP-UX lsof compilation use -O?

9.2.2 Why doesn't the /dev/kmem-based CCITT support work under 10.x?

9.2.3 Why can't /dev/kmem-based lsof be compiled with `cc -Aa` or `gcc -ansi` under HP-UX 10.x?

9.2.4 Why does /dev/kmem-based lsof complain about no C compiler?

9.2.5 Why does Configure complain about q4 for /dev/kmem-based lsof for HP-UX 11?

9.2.6 When compiling /dev/kmem-based lsof for HP-UX 11 what do the "aCC runtime: ERROR..." messages mean?

9.2.7 Why doesn't /dev/kmem-based lsof for HP-UX 11 report VxFS file link counts, node numbers, and sizes correctly?

9.2.8 Why can't /dev/kmem-based lsof be built with gcc for 64 bit HP-UX 11?

9.2.8.1 How can I acquire a gcc for building lsof for 64 bit HP-UX 11?

9.2.9 Why does /dev/kmem-based lsof for HP-UX 11 report "unknown file system type" for VxFS files?

9.2.10 Why does the ANSI-C compiler complain about comments in HP-UX 11 header files?

9.2.11 Why does dnode1.c cause the HP-UX 11 compiler to complain that <sys/fs/vx\_inode.h> is missing or incorrect?

9.3 PSTAT-based HP-UX lsof Questions

9.3.1 Why

does PSTAT-based lsof complain about pst\_static and other PSTAT structures?

9.3.2 Why does PSTAT-based lsof complain it can't read pst\_\* structures?

9.3.3 Why does PSTAT-based lsof rebuild the device cache file after each reboot?



- 9.3.4 Why doesn't PSTAT-based lsof report TCP addresses for telnetd's open socket files?
- 9.3.5 Why does PSTAT-based lsof cause an HP-UX 11.11 kernel panic?
- 9.3.6 Why doesn't PSTAT-based lsof report a CWD that is on a loopback (LOFS) file system?
- 9.3.7 Why do some swinstall packages for PSTAT-based HP-UX 11.11 packages complain about setgid and setuid bits?
- 9.3.8 Why won't the bundled C compiler build PSTAT-based lsof for PA-RISC HP-UX 11.23?
- 9.3.9 Why won't gcc build PSTAT-based lsof for PA-RISC HP-UX 11.23?
- 9.3.10 Why does PSTAT-based lsof complain, "FATAL: pst\_stream\_size should be: 672; is 72" on HP-UX 11.11 and above?
- 9.4 Why won't the HP-UX depot install?

## 10.0 Linux Problems

- 10.1 What do /dev/kmem-based and /proc-based lsof mean?
- 10.2 /proc-based
  - Linux lsof Questions
    - 10.2.1 Why doesn't /proc-based lsof report file offsets (positions)?
    - 10.2.2 Why does /proc-based lsof report "can't identify protocol" for some socket files?
    - 10.2.3 Why does /proc-based lsof warn about unsupported formats?
    - 10.2.4 Why does /proc-based lsof report "(deleted)" after a path name?
    - 10.2.5 Why doesn't /proc-based lsof report full open file information for all processes?
    - 10.2.6 Why won't Customize offer to change HASDCACHE or WARNDEVACCESS for /proc-based lsof?
    - 10.2.7 /proc-based lsof Linux NFS questions
      - 10.2.7.1 Why can't lsof find files on an accessible NFS file system?
      - 10.2.7.2 Why can't lsof find files on an inaccessible NFS file system?
    - 10.2.8 Why doesn't /proc-based Linux lsof report socket options and values, socket state flags, and TCP options and values?
    - 10.2.9 Does /proc-based Linux lsof use a device cache?
    - 10.2.10 Why doesn't /proc-based Linux lsof report any or all file structure values for its +fcfgn option?
- 10.3 Special Linux file types
  - 10.3.1 Why is ``DEL" reported as a Linux file type?
  - 10.3.2 Why is ``unknown" reported as a Linux file type?
- 10.4 Linux ``mem" Entry Problems
  - 10.4.1 What do ``path dev=xxx" and ``path inode=yyy" mean in the NAME column of Linux ``mem" file types?
  - 10.4.2 Why is neither link count nor size reported for some Linux ``DEL" and ``mem" file types?
- 10.5 Special Linux NAME column messages
  - 10.5.1 What does ``(stat: xxx)" mean in the NAME column of Linux files?
  - 10.5.2 What does ``(readlink: xxx)" mean in the NAME column of

Linux files?

10.6 Why is ``NOFD" reported as a Linux file type?

10.7 Why does Linux lsof report a NAME column value that begins with ``/proc"?

10.8 Linux /proc/net/tcp\* and /proc/net/udp\* issues

10.8.1 Why use the Linux -X option?

10.8.2 Why does lsof say ``-i is useless when -X is specified"?

10.8.3 Why does lsof say ``can't identify protocol (-X specified)"?

11.0 NetBSD Problems

11.1 Why doesn't lsof report on open kernfs files?

11.2 Why doesn't

lsof report on open files on: file descriptor

file systems; /proc file systems; 9660 (CD-ROM) file systems;

MS-DOS (floppy disk) file systems; or kernel file systems?

11.3 Why does lsof produce confusing results for nullfs file systems?

11.4 NetBSD header file problems

11.4.1 Why can't the compiler find some NetBSD header files?

11.4.2 Why does NetBSD lsof produce incorrect output?

11.5 Why isn't lsof feature xxx enabled for NetBSD?

12.0 NEXTSTEP and OPENSTEP Problems

12.1 Why can't lsof report on 3.1 lockf() or fcntl(F\_SETLK) locks?

12.2 Why doesn't lsof compile for NEXTSTEP with AFS?

13.0 OpenBSD Problems

13.1 Why doesn't lsof support kernfs on my OpenBSD system?

13.2 Will lsof work on OpenBSD on non-x86-based architectures?

13.3 <sys/pipe.h> problems

13.3.1 Why does the compiler claim nbpg isn't defined?

13.3.2 What value should I assign to nbpg?

13.4 Why doesn't lsof report on open MS-DOS file system (floppy disk) files?

13.5 Why isn't lsof feature xxx enabled for OpenBSD?

14.0 Output

problems

14.1 Why do the lsof column sizes change?

14.2 Why does the offset have ``0t' and ``0x" prefixes?

14.3 What are the values printed in the FILE\_FLAG column and why is 0x<value> sometimes included?

14.3.1 Why doesn't lsof display FILE\_FLAG values for my dialect?

14.4 Network Addresses

14.4.1 Why does lsof's -n option cause IPv4 addresses, mapped to IPv6, to be displayed in IPv6 notation?

14.5 Why does lsof output \x, ^x, or \xnn for characters

sometimes?

14.5.1 Why is space considered a non-printable character in command names?

14.6 Why doesn't lsof print all the characters of a command name?

14.7 Why does lsof reject some -c command names, saying their lengths are "> what system provides (nn)"?

14.8 Why does lsof sometimes print TYPE numbers instead of names?

14.9 Marker line format problems

14.9.1 Why won't lsof accept a marker line format?

14.9.2 Why does lsof reject the NL (%n) marker line format?

14.10 How are protocol state name exclusion and inclusion used?

14.10.1 Why doesn't my dialect support state name exclusion and inclusion?

15.0 Pyramid Version Problems

15.0.5 Statement of deprecation

16.0 SCO Problems

16.1 SCO OpenServer Problems

16.1.1 How can I avoid segmentation faults when compiling lsof?

16.1.2 Where is libsocket.a?

16.1.3 Why do I get "warning C4200" messages when I compile lsof?

16.2 SCO|Caldera UnixWare Problems

16.2.1 Why doesn't lsof compile on my UnixWare 7.1.1 or above system?

16.2.2 Why does lsof complain about node\_self() on my UnixWare 7.1.1 or above system?

16.2.3 Why does UnixWare 7.1.1 or above complain about -lcluster, node\_self(), or libcluster.so?

16.2.4 Why does UnixWare 7.1.1 or above lsof complain it can't read the kernel name list?

16.2.5 Why doesn't lsof report link count, node number, and size for some UnixWare 7.1.1 or above CFS files?

16.2.6 Why doesn't lsof report open files on all UnixWare 7.1.1 NonStop Cluster (NSC) nodes?

16.2.7 Why doesn't lsof report the UnixWare 7.1.1 NonStop Cluster

(NSC) node a process is using?

16.2.8 Why does the compiler complain about missing UnixWare 2.1[.x] header files?

17.0 Sun Problems

17.0.5 Statement of deprecation

17.1 My Sun gcc-compiled lsof doesn't work -- why?

17.2 How can I make lsof compile with gcc under Solaris 2.[456], 2.5.1, 7, 8 or 9?

17.3 Why does Solaris Sun C complain about system header files?

17.4 Why doesn't lsof work under my Solaris 2.4 system?

- 17.5 Where are the Solaris header files?
- 17.6 Where is the Solaris /usr/src/uts/<architecture>/sys/machparam.h?
- 17.7 Why does Solaris lsof say ``can't read proc table"?
- 17.8 Why does Solaris lsof complain about a bad cached clone device?
- 17.9 Why doesn't Solaris make generate .o files?
- 17.10 Why does lsof report some Solaris 2.3 and 2.4 lock types as `N"?
- 17.11 Why does lsof Configure say "WARNING: no cc in ..."?
- 17.12 Solaris 7, 8 and 9 Problems
  - 17.12.1 Why does lsof say the compiler isn't adequate for Solaris 7, 8 or 9?
  - 17.12.2 Why does Solaris 7, 8 or 9 lsof say "FATAL: lsof was compiled for..."?
  - 17.12.3 How do I build lsof for a 64 bit Solaris kernel under a 32 bit Solaris kernel?
  - 17.12.4 How do I install lsof for Solaris 7, 8 or 9?
  - 17.12.5 Why does my Solaris 7, 8 or 9 system say it cannot execute lsof?
  - 17.12.6 What gcc will produce 64 bit Solaris 7, 8 and 9 executables?
  - 17.12.7 Why does lsof on my Solaris 7, 8 or 9 system say, "can't read namelist from /dev/ksyms?"
- 17.13 Solaris and COMMON
  - 17.13.1 What does COMMON mean in the NAME column for a Solaris VCHR file?
  - 17.13.2 Why does a COMMON Solaris VCHR file sometimes seem to have an incorrect minor device number?
- 17.14 Why don't lsof and Solaris pfiles reports always match?
- 17.15 Why does lsof say, "kvm\_open(namelist=default, core=default): Permission denied?"
- 17.16 Why is lsof slow on my busy Solaris UFS file system?
- 17.17 Why is lsof so slow on my Solaris 8 or 9 system?
- 17.18 Solaris and VxFS
  - 17.18.1 Why doesn't lsof support VxFS 3.4 on Solaris 2.6, and above?
  - 17.18.2 Why does lsof report "vx\_inode: vxfsu\_get\_iooffsets error" for open Solaris 2.6 and above VxFS 3.4 and above files?
  - 17.18.3 Why does Solaris Configure claim there is no VxFS library?
  - 17.18.4 Why doesn't Solaris lsof report VxFS path name components?
  - 17.18.5 Why does Solaris 10 lsof report scrambled VxFS paths?
- 17.19 Large file problems
  - 17.19.1 Why does lsof complain it can't stat(2) a Solaris 2.5.1 large file?
- 17.20 Why does lsof get a segmentation fault on 64 bit Solaris 8 using NIS+?
- 17.21 Will lsof crash the Solaris kernel?
- 17.22 Why does lsof on Solaris 7, 8, or 9 report a kvm\_open() failure?
- 17.23 Solaris and SAM-FS

- 17.23.1 Why does Solaris lsof report "(limited SAM-FS info)"?
- 17.23.2 Why can't lsof locate named SAM-FS files?
- 17.24 Lsof and Solaris 10 zones
  - 17.24.1 How can I make lsof list the Solaris zone?
  - 17.24.2 Why doesn't lsof work in a Solaris 10 zone?
  - 17.24.3 Why does lsof complain it can't stat() Solaris 10 zone file systems?
- 17.25 Solaris 10 problems
  - 17.25.1 Why does Solaris 10 lsof sometimes report the wrong path name?
  - 17.25.2 Why does Solaris 10 lsof sometimes report only the mounted-on directory and device?
  - 17.25.3 What does "(deleted)" mean in the NAME column of a Solaris 10 open file?
  - 17.25.4 What does "(?)" mean in the NAME column of a Solaris 10 open file?
- 17.26 Solaris contract file problems
  - 17.26.1 Why doesn't lsof report size, link count and node number for Solaris 10 contract files?
  - 17.26.2 Why can't lsof locate a Solaris 10 contract file by path name?
- 17.27 Solaris 10 ZFS problems
  - 17.27.1 Why does Configure ask for the location of ZFS header files?
  - 17.27.2 Why do -h and -v output warn about possibly inaccurate ZFS structure definitions?
  - 17.27.3 Why don't the Open Solaris ZFS header files provide correct ZFS kernel structure definitions?

## 18.0 Lsof Features

- 18.1 Why doesn't lsof report on /proc entries on my system?
  - 18.2 How do I disable the device cache file feature or alter it's behavior?
    - 18.2.1 What's the risk with a perverted device cache file?
    - 18.2.2 How do I put the full host name in a personal device cache file path?
    - 18.2.3 How do I put the personal device cache file in /tmp?
  - 18.3 Why doesn't lsof know about AFS files on my favorite dialect?
    - 18.3.1 Why doesn't lsof report node numbers for all AFS volume files, or how do I reveal dynamic module addresses to lsof?
- 

## 1.0 General Concepts

### 1.1 Lsof -- what is it?

Lsof is a UNIX-specific tool. Its name stands for LiSt

Open Files, and it does just that. It lists information about files that are open by the processes running on a UNIX system.

See the lsof man page, the 00DIST file, the 00QUICKSTART file, and the 00README file of the lsof distribution for more information.

## 1.2 Where do I get lsof?

Lsof is available via anonymous ftp from lsof.itap.purdue.edu. Look in the pub/tools/unix/lsof sub-directory.

`ftp://lsof.itap.purdue.edu/pub/tools/unix/lsof`

Bzip2'd, compressed and gzip'd tar files with GPG certificates are available.

### 1.2.1 Are there mirror sites?

On April 28, 2009 these sites appeared to have the latest lsof revision:

`ftp://ftp.fu-berlin.de/pub/unix/tools/lsof`

`ftp://sunsite.ualberta.ca/pub/Mirror/lsof`

### 1.2.2 Are lsof executables available?

Some lsof executables are available in the subdirectory tree `pub/tools/unix/lsof/binaries`. These are neither guaranteed to be current nor cover every dialect and machine architecture.

I don't recommend you use pre-compiled lsof binaries; I recommend you obtain the sources and build your own binary. Even if you're a Sun user without a Sun C compiler, you can use gcc to compile lsof.

If you must use a binary file, please be conscious of the security and configuration implications in using an executable of unknown or different origin. The lsof binaries are accompanied by GPG certificates. Please use them!

Three additional cautions apply to executables:

1. Don't try to use an lsof executable, compiled for one version of a UNIX dialect, on another. Patches can

make the dialect version different.

2. If you want to use an lsof binary on multiple systems, they must be running the same dialect OS version and have the same patches and feature support.

### 1.2.3 How do I check the validity of an lsof distribution?

There are two ways to check the validity of an lsof distribution:

1. Follow the instructions in the CHECKSUMS\_<revision> file found with the lsof distribution.

Checking with GPG is the best method.

2. Follow the instructions in the "Security" section of the README.lsof\_<revision> file found inside the lsof distribution.

Again, checking with GPG is the best method.

### 1.2.4 Why can't I get the sum(1) result reported in README.lsof\_<revision>?

The "Security" section of the README.lsof\_<revision> file found inside the lsof distribution gives md5, sum, and GPG certificate information.

The simplest, the sum(1) signature, seems to be the trickiest. That's because there are different sum(1) methods, BSD systems usually have cksum(1) instead of sum(1), and different systems compute the block size value differently.

First, the lsof sum results are computed with the old, "alternate" algorithm. On newer systems, you can use sum's "-r" option to get that computation result.

Second, on BSD systems you usually must use cksum(1) instead of sum(1), because they have no sum(1). To tell cksum(1) to use the old, "alternate" algorithm, use its "-o1" option.

Third, the second value that sum reports, the block count, may be computed differently on different systems -- usually block size is considered to be 512 or 1,024. The lsof block counts were computed on a system with a sum(1) option that considers block size to be 512. The BSD system cksum(1) -o1 option

considers block size to be 1,024. If your `sum(1)` or `cksum(1)` doesn't report a block count that matches the `sum(1)` signature given in `README.lsof_<revision>`, check its man page to see what block size it uses, then adjust its reported block count appropriately.

### 1.2.5 Why won't gpg accept the lsof-signing PGP public key?

An older PGP key that once signed lsof distributions is included in lsof revisions prior to 4.70. The PGP key is indeed my key, but is incompatible with GPG. It was created about ten years ago and is still acceptable to PGP versions 2.6.2 through 6.5.2.

Lsof revisions 4.70 and above are signed with a copy of my PGP key that has been made acceptable for use with GPG by importing it under GPG's "`--allow-non-selfsigned-uid`" option.

You can find my GPG compatible key in lsof revisions 4.70 and above and at:

```
ftp://lsof.itap.purdue.edu/pub/Victor_A_Abell.gpg
```

If you have an older lsof revision with my PGP key, there are two possible ways to use it:

- \* Use it with a PGP version from 2.6.2 through 6.5.2.

- \* Use GPG's "`--allow-non-selfsigned-uid`" option when you import my PGP key into your GPG key ring.

```
$ gpg --allow-non-selfsigned-uid --import Victor_A_Abell.gpg
```

### 1.3 Where can I get more lsof documentation?

A significant set of documentation may be found in the lsof distribution (See "Where can I get lsof?"). There is a manual page, copious documentation in files whose names begin with 00, and a copy of this FAQ in the file 00FAQ (perhaps slightly less recent than this file if you're reading it via a web browser.)

Two URLs provide some documentation that appears in the lsof distribution:

FAQ: <ftp://lsof.itap.purdue.edu/pub/tools/unix/lsof/FAQ>



man page: [ftp://lsof.itap.purdue.edu/pub/tools/unix/lsof/lsof\\_man](ftp://lsof.itap.purdue.edu/pub/tools/unix/lsof/lsof_man)

#### 1.4 How do I report an lsof bug?

If you believe you have discovered a bug in lsof, you can report it via e-mail to <[abe@purdue.edu](mailto:abe@purdue.edu)>. Do NOT report lsof bugs to the UNIX dialect vendor. Make sure "lsof" appears in the "Subject:" line so my e-mail filter won't classify your letter as Spam.

Before you send me a bug report, please read the "Bug Reports" section of the 00README file of the lsof distribution. It lists the steps you should take before and when reporting a suspected bug.

#### 1.5 Where can I get the lsof FAQ?

This lsof FAQ is available in the file 00FAQ in the lsof distribution and at the URL:

<ftp://lsof.itap.purdue.edu/pub/tools/unix/lsof/FAQ>

##### 1.5.1 How timely is the on-line FAQ?

The on-line FAQ is sometimes too timely. :-)

I update it as soon as new information is available. That may include information about support that won't appear in the lsof source distribution until the next revision. If you encounter something like that, please send me e-mail at <[abe@purdue.edu](mailto:abe@purdue.edu)>. I may be able to point you at a pre-release distribution that contains the support of interest. Make sure "lsof" appears in the "Subject:" line so my e-mail filter won't classify your letter as Spam.

#### 1.6 Is there a test suite?

Yes, as of lsof revision 4.63 there's an automated lsof test suite in the tests/ sub-directory of the lsof top-level directory.

More information on using the test suite, what it does, how to use it and how to configure it may be found in the 00TEST file of the lsof distribution. That file also explains where the test suite has been tested.

Frequently asked questions about the test suite will be asked and answered here in the FAQ. (See "Test Suite Problems.")

After lsof has been configured with the Configure script, lsof can be made and tested with:

```
$ make
$ cd tests
$ make
```

Under normal conditions -- i.e., unless the lsof tree has been cleaned or purged severely -- all tests or individual tests may be run by:

```
$ cd test
$ make
or
$ <run a single test> (See 00TEST.)
```

#### 1.7 Is lsof vulnerable to the standard I/O descriptor attack?

Lsof revisions 4.63 and above are not vulnerable.

Lsof revisions 4.62 and below are vulnerable, but no damage scenarios have so far been demonstrated.

The standard I/O descriptor attack is a local programmed assault on setuid and setgid programs that tricks them into opening a sensitive file with write access on a standard descriptor, usually stderr (2), and writing error messages to stderr. If the attacker can control the content of the error message, the attacker may gain elevated privileges.

The attack was first described in Pine Internet Advisory PINE-CERT-20020401, available at:

<http://www.pine.nl/advisories/pine-cert-20020401.txt>

If you are using an lsof revision below 4.63, you should remove any setuid or setgid permissions you might have given its executable. Then you should upgrade to lsof revision 4.63.

#### 1.8 Can I alter lsof's make(1) behavior?

Yes. There are at least two ways to do that.

You can put replacements for Isof Makefile strings in your environment. If you specify the `-e` make option, make will give environment variable values precedence over strings from the Makefile. For example, to change the compiler string `CC` from the environment, you might do this with the Bourne shell:

```
$ CC=foobar; export CC
$ make -e
```

You can also replace Isof Makefile strings in the make command invocation. Here's the previous example done that way:

```
$ make CC=foobar
```

Changing the `CFGF`, `CFGL`, and `DEBUG` strings used in Isof Makefiles, either from the environment or from the make invocation, can significantly alter Isof `make(1)` behavior. I commonly use `DEBUG` to change the `-O` option to `-g` so I can build an Isof executable for debugging -- e.g.,

```
$ make DEBUG=-g
```

(Look for `DEBUG` in this FAQ for other examples of its use.)

Consult the Makefiles to see what `CFGL`, `CFGL`, and other Isof Makefile strings contain, and to see what influence their alteration might have on Isof `make(1)` behavior.

#### 1.9 Is there an Isof license?

No.

The only restriction on the use or redistribution of Isof is contained in this copyright statement, found in every Isof source file. (The copyright year in or format of the notice may vary slightly.)

```
/*
```

```
* Copyright 2002 Purdue Research Foundation, West Lafayette,  
* Indiana 47907. All rights reserved.
```

```
*
```

```
* Written by Victor A. Abell
```

```
*
```

- \* This software is not subject to any license of the American
  - \* Telephone and Telegraph Company or the Regents of the
  - \* University of California.
  - \*
  - \* Permission is granted to anyone to use this software for
  - \* any purpose on any computer system, and to alter it and
  - \* redistribute it freely, subject to the following
  - \* restrictions:
  - \*
  - \* 1. Neither the authors nor Purdue University are responsible
  - \* for any consequences of the use of this software.
  - \*
  - \* 2. The origin of this software must not be misrepresented,
  - \* either by explicit claim or by omission. Credit to the
  - \* authors and Purdue University must appear in documentation
  - \* and sources.
  - \*
  - \* 3. Altered versions must be plainly marked as such, and must
  - \* not be misrepresented
- as being the original software.
- \*
  - \* 4. This notice may not be removed or altered.
  - \*/

## 1.10 Language locale support

### 1.10.1 Does lsof support language locales? How do I use the support?

Most UNIX dialect versions of lsof support 8 bit language locale characters -- e.g., the ability to print 8 bit characters that have accents and other marks over them.

See the answer to the "Does lsof support wide characters in language locales?" question for information on when lsof's language locale support covers characters wider than 8 bits.

To see if lsof supports language locales for your dialect, look in the dialect's machine.h header file for the HASSETLOCALE definition. If it is present and not disabled, then lsof has language locale support for the dialect.

To enable lsof's language locale support, you must specify in a locale environment variable (e.g., LANG) a language locale known to your system that supports the printing of marked characters -- e.g, en\_US. (On some dialects locale(1) may be used to list the known language locales.)

Note that LANG=C and LANG=POSIX are NOT language locales that support the printing of marked characters.

If the language locale doesn't support the printing of marked characters, lsof's OUTPUT of them follows the rules for non-printable characters described in the OUTPUT section of lsof(8).

Consult your dialect's setlocale(3) man page for the names of environment variables other than LANG -- e.g., LC\_ALL, LC\_TYPE, etc. -- which may be used to define language locales.

#### 1.10.2 Does lsof support wide characters in language locales?

When lsof's language locale support is enabled with the HASSETLOCALE definition, for selected dialects lsof will also print wide characters (e.g., from UTF-8) when iswprint(3) reports them to be printable.

Wide character support is available when HASWIDECHAR is defined in a dialect's machine.h header file. As of this writing on July 22, 2004, the following dialect versions have wide character support:

- AIX >= 4.3.2
- Apple Darwin >= 7.3.0
- FreeBSD >= 5.2
- HP-UX >= 11.00
- /proc-based Linux
- NetBSD >= 1.6
- SCO OpenServer >= 5.0.6
- Solaris >= 2.6
- Tru64 UNIX 5.1

#### 1.11 Are any files in the lsof distribution copyrighted?

Yes. Most files carry the copyright of the Purdue Research Foundation and may be redistributed under the terms that accompany the copyright notice. Those terms may also be found in the answer to the question, "Is there an lsof license?")

A few files carry other copyright notices. Some are BSD notices and they explain the terms under which they are included in the lsof distribution.

Those that carry vendor copyright notices have been reproduced in their original or modified forms with permission from the

copyright owners. That permission is indicated in the README files that accompany the files.

#### 1.12 Are there other lsof-related resources?

There are other resources available, connected to lsof. Among them are FreeBSD and Linux packages whose products use lsof and two particularly interesting resources.

The two interesting resources are a Gnome Tool Kit (GTK) GUI for lsof and a Perl wrapper module.

The GTK GUI is called Glsof and was developed by Gnele. It can be found at:

<http://www.sourceforge.net>

The Perl wrapper module by Marc Beyer can be found at:

<http://search.cpan.org/dist/Unix-Lsof/>

#### 1.13 What does the "WARNING: unsupported dialect or version" mean?

The lsof configure script issues that message for UNIX dialects or their versions where I have been unable to test the current revision of lsof. The message doesn't mean that lsof won't work, just that I have no direct evidence that it will.

If the COntfigure script succeeds, except for the warning, try compiling lsof. If that succeeds, try the lsof test suite.

## 2.0 Lsof Ports

### 2.1 What ports exist?

The pub/lsof.README file carries the latest port information:

AIX

5.[23] and 5.3

FreeBSD 4.9 for x86-based systems

FreeBSD 7.[012] and 8.0 for AMD64-based systems

Linux 2.1.72 and above for x86-based systems

Solaris 9, 10 and 11

In the above list the only UNIX dialects present are ones for which I test the current lsof revision. Lsof may still support unlisted dialect versions -- e.g., HP-UX 10.20, Solaris 7, etc.

-- but I don't have access to systems where I could test lsof on them, so I can't claim lsof works on them. If your dialect isn't in the list, you should try building lsof on it anyway.

Lsof version 4 predecessors, versions 2 and 3, may support older version of some dialects. Contact me via e-mail at <abe@purdue.edu> if you're interested in their distributions. Make sure "lsof" appears in the "Subject:" line so my e-mail filter won't classify your letter as Spam.

## 2.2 What about a new port?

The 00PORTING file in the distribution gives hints on doing a port. I will consider doing a port in exchange for permanent access to a test host. I require permanent access so I can test new lsof revisions, because I will not offer distributions of dialect ports I cannot upgrade and test.

### 2.2.1 User-contributed Ports

Sometimes I receive contributions of ports of lsof to systems where I can't test future revisions of lsof. Hence, I don't incorporate these contributions into my lsof distribution.

However, I do make descriptions of these contributions available. You can find them in the 00INDEX and README files at:

<ftp://lsof.itap.purdue.edu/pub/tools/unix/lsof/contrib>

Consult the 00INDEX file in the contrib/ directory for a list of the available contributions and consult README there for information on how to obtain them.

## 2.3 Why isn't there an AT&T SVR4 port?

I haven't produced an AT&T SVR4 port because I haven't seen a UNIX dialect that is strictly limited to the AT&T System V, Release 4 source code. Every one I have seen is a derivative with vendor additions.

The vendor additions are significant to lsof because they affect the internal kernel structures with which lsof does business. While some vendor derivatives of SVR4 are similar, each one I have encountered so far has been different enough

from its siblings to require special source code.

If you're interested in an SVR4 version of lsof, here are some existing ports you might consider:

- DC/OSx (This obsolete port is only available upon special request.)
- Reliant UNIX (This obsolete port is only available upon special request.)
- SCO|Caldera UnixWare (This is the most likely choice.)
- Solaris

#### 2.4 Why isn't there an SGI IRIX port?

Lsof support for IRIX was terminated at lsof revision 4.36, because it had become increasingly difficult for me to obtain information on the IRIX kernel structures lsof needs to access.

At IRIX 6.5 I decided the obstacles were too large for me to overcome, and I stopped supporting lsof on IRIX. I have sources to the last revision of lsof (4.36) for IRIX, but that version of lsof does not work on IRIX 6.5 and is vulnerable to the standard I/O descriptor attack. (See the "Is lsof vulnerable to the standard I/O descriptor attack?" Q&A for more information.) Contact me to discuss obtaining those sources.

If you wish to pursue the issue, don't contact me, contact SGI. This case was opened with SGI on the subject:

Case ID: 0982584  
Category: Unix  
Priority: 30-Moderate Impact

Problem Summary:  
kernel structure header files needed for continued lsof support

Problem Description:  
Email In 07/17/98 19:09:23

#### 2.5 Why does lsof's Configure script report "WARNING: unsupported dialect or version"?

Lsof's Configure script issues this message when it encounters a dialect or its version that lsof once supported, but no



longer does. Usually I drop support for a dialect or version when I can no longer test lsof on it.

However, it's worth trying to compile and use lsof. Be sure to run the test suite. (See the answer to the "Is there a test suite?" question for information on the test suite.)

If you have problems with an unsupported dialect or version, contact me via e-mail at <abe@purdue.edu> and I may be able to help. Make sure "lsof" appears in the "Subject:" line so my e-mail filter won't classify your letter as Spam.

### 3.0 Lsof Problems

#### 3.1 Configuration Problems

##### 3.1.1 Why can't Configure determine the UNIX dialect version?

The lsof Configure script uses UNIX shell commands, often in a command pipeline, to determine the UNIX dialect version. (Consult the dialect stanza in Configure to determine which commands are used.) If Configure can't determine the dialect version, probably one of the commands is not behaving as Configure expects.

Symptoms of the failure include Configure warning messages and incorrect version definitions in the Makefile CFLAGS.

If you suspect that the lsof Configure script is failing to determine the dialect version correctly, try running the commands from Configure stanza one at a time. That will usually reveal the source of the problem. Be particularly mindful that the PATH environment variable can cause commands to be executed from non-standard directories.

If you can't determine the source of the problem, there is a work-around. You can supply the UNIX dialect version in the LSOF\_VSTR environment variable. Use Configure as a guide to forming what it expects in LSOF\_VSTR. There is also some information on LSOF\_VSTR in the 00XCONFIG documentation file of the lsof distribution.

#### 3.2 Compilation Problems

##### 3.2.1 Why does the compiler complain about missing header files?

When you use make to build lsof, the compiler may complain that it can't find header files -- e.g.,

```
$ make
(cd lib; make DEBUG="-O" CFGF="-DAIXA=0 -DAIXV=4330 \
-DLSOF_VSTR=\"4.3.3.0\"")
gcc -DAIXA=0 -DAIXV=4330 -DLSOF_VSTR="4.3.3.0" -O \
-c ckkv.c
In file
included from ckkv.c:33: ../machine.h:70: \
sys/types.h: A file or directory in the path name \
does not exist. \
```

That type of complaint doesn't represent an lsof problem. It represents a problem with a missing system header file that probably should be found in /usr/include or in the system source tree.

As a first step try using find(1) to locate the problem header file. If it's a system header file and can't be found, here are some possible causes:

1. The file set, RPM or package containing the header files has not been installed. Instructions for doing that are specific to the UNIX dialect and beyond the scope of this document.

2. If the compiler is gcc, the private gcc header files:

- \* May not have been installed;

- \* May have been installed incorrectly;

- \* May not have been updated properly after the last compiler or system update;

- \* Ones from a previous installation may not have been removed.

A path leading to the gcc private header files can be found with `gcc -v`. Consult the gcc documentation for instructions on proper installation of the private gcc header files.

3. On some dialects -- e.g., FreeBSD, NetBSD, OpenBSD -- lsof may need to use header files that are located in

the system source tree -- /sys or /usr/src/sys, for example. Make sure the system source tree has been installed.

### 3.2.2 Why does gcc complain about the contents of header files distributed by the system's vendor?

When you use make to build lsof and gcc to compile it, gcc may complain that it finds errors in system header files -- e.g.,

```
$ make
(cd lib; make DEBUG="-O" CFGF="-Dsolaris=80000 \
-DHASPR_GWINDOWS -m64 -DHASIPv6 -DHAS_VSOCK \
-DLSOF_VSTR=\"5.8\"")
gcc -Dsolaris=80000 -DHASPR_GWINDOWS -m64 -DHASIPv6 \
-DHAS_VSOCK -DLSOF_VSTR="5.8" -O -c dvch.c
In file included from
/usr/include/sys/proc.h:31, \
    from /homes/abe/gnu/gcc-3.2.1/lib/gcc-lib/sparcv9-sun-solaris2/\
3.2.1/include/sys/user.h:267, from /usr/include/kvm.h:13, \
from ../dlsf.h:53, from ../lsof.h:172, from dvch.c:43: \
/homes/abe/gnu/gcc-3.2.1/lib/gcc-lib/sparcv9-sun-solaris2/\
3.2.1/include/sys/task.h:59: parse error before "uint_t"
```

Errors like the above are most likely not problems in the system's header files, but in the private copies of them that were created when gcc was made or installed. Note the presence of  
"../gcc-3.2.1/lib/gcc-lib/sparcv9-sun-solaris2/3.2.1/include/..."  
in the paths for user.h and task.h. It indicates both header files are gcc-specific.

To solve errors like this requires comparing the header files in the vendor's /usr/include tree to the gcc-specific ones in gcc's private gcc-lib/.../include tree. It may be necessary to regenerate gcc-specific header files, correct them or remove them. See the gcc distribution for the appropriate tools.

A possible temporary work-around is to direct gcc to use the vendor's header files instead of its temporary ones by declaring -I/usr/include in the compilation flags.

### 3.2.3 Other header file problems

Don't overlook any vendor tools that might validate the

vendor header files installed on the system -- e.g., the Solaris pkgchk tool can be used to check the header files that were installed from the SUNWhea package.

For other header file problems contact me at <abe@purdue.edu>. Please follow the reporting guidelines in the "How do I report an lsof bug?" section of this FAQ.

### 3.3 Why doesn't lsof report full path names?

Lsof reports the full path name when it is specified as a search argument for open files that match the argument. However, if the argument is a file system mounted-on directory, and lsof finds additional path name components from the kernel name cache, it will report them.

Lsof reports path name for file system types that have path name lookup features -- e.g., some versions of AdvFS for Digital and Tru64 UNIX. The Linux /proc-based lsof reports full path names, because the Linux /proc file system provides them. Lsof on recent builds of Solaris 10 also report full path names, because those Solaris kernels record the full path name in the vnode structure.

Otherwise, lsof uses the kernel name cache, where it exists and can be accessed, and reports some or all path name components (e.g., the sys and proc.h components of /usr/include/sys/proc.h) for these dialects:

Apple Darwin  
DC/OSx  
FreeBSD  
HP-UX, /dev/kmem and PSTAT based  
Linux, /dev/kmem-based  
NetBSD  
NEXTSTEP  
OpenBSD  
OPENSTEP  
Reliant UNIX  
SCO OpenServer  
SCO|Caldera UnixWare  
Solaris 2.x, 7, 8 and 9 (except for some VxFS versions;  
see the "Why doesn't Solaris  
lsof report VxFS path name  
components?" section for more  
information)  
Solaris 10 (early builds) Tru64 UNIX

As far as I can determine, AFS path lookups don't share in kernel name cache operations, so lsof can't identify open AFS path name components. Apparently Solaris VxFS versions 4 and above don't share in kernel name cache operations, either, so lsof can't display path name components for those open files.

Since the size of the kernel name cache is limited and the cache is in constant flux, it does not always contain the names of all components in an open file's path; sometimes it contains none of them.

Lsof reports the file system directory name and whatever components of the file's path it finds in the cache, starting with the last component and working backwards through the directories that contain it. If lsof finds no path components, lsof reports the file system device name instead.

When lsof does report some path components in the NAME column, it prefixes them with the file system directory name, followed by " -- ", followed by the components -- e.g., /usr -- sys/path.h for /usr/include/sys/path.h.

The " -- " is omitted when lsof finds all the path name components of a file's name.

The PSTAT-based HP-UX lsof relies on kernel name cache contents, too, even though its information comes to lsof via pstat() function calls. Consequently, PSTAT-based HP-UX lsof won't always report full paths, but may use the " -- " partial path name notation, or may occasionally report no path name at all but just the file system mounted-on directory and device names.

Lsof can't obtain path name components from the kernel name caches of the following dialects:

#### AIX

Only the Linux kernel records full path names in the structures it maintains about open files; instead, most kernels convert path names to device and node number doublets and use them for subsequent file references once files have been opened.

To convert the device and node number doublet into a complete path name, lsof would have to start at the root

node (root directory) of the file system on which the node resides, and search every branch for the node, building possible path names along the way. That would be a time consuming operation and require access to the raw disk device (usually implying `setuid-root` permission).

If the prospect of all that local disk activity doesn't concern you, think about the cost when the device is NFS-mounted.

Try using the file system mount point and node number `lsof` reports as parameters to find -- e.g.,

```
$ find <mount_point> -inum <node_number> -print
```

and you may get an appreciation of what a file system directory tree search would cost.

### 3.3.1 Why do `lsof -r` reports show different path names?

When you run `lsof` with its repeat (``-r"`) option, you may notice that the extent to which it reports path names for the same files may vary from cycle to cycle. That happens because other processes are making kernel calls affecting the cache and causing entries to be removed from and added to it.

### 3.3.2 Why does `lsof` report the wrong path names?

Under some circumstances `lsof` may report an incorrect path name component, especially for files in a rapidly changing directory like `/tmp`.

In a rapidly changing directory, like `/tmp`, if the kernel doesn't clear the cache entry when it removes a file, a new file may be given the same keys and lead `lsof` to believe that the old cache entry with the same keys belongs to the new file.

`lsof` tries to avoid this error by purging duplicate entries from its copy of the kernel name cache when they have the same device and inode number, but different names.

This error is less likely to occur in UNIX dialects where the keys to the name cache are node address and possibly a capability ID. The Apple Darwin, Digital UNIX, FreeBSD, HP-UX,

NEXTSTEP, OPENSTEP, Solaris, Tru64 UNIX, and UnixWare dialects use node address. Apple Darwin, FreeBSD, NetBSD, OpenBSD, Tru64 UNIX, and also use a capability ID to further identify name cache entries.

### 3.3.3 Why doesn't

ls report path names for unlinked (rm'd) files?

When ls reports path name components from the kernel's name cache, it does not report the path names of a file that has been unlinked from its parent directory -- e.g., deleted via rm, or the unlink() system call -- even when some process may still hold the file open; ls reports only the file system's mounted-on directory and device. That's because path name components are removed from the kernel name cache when the file is unlinked.

Unlinked open files are sometimes used by applications for temporary, but invisible storage (i.e., ls won't show them, and no other process can open them.) However, they may occasionally consume disk space to excess and cause concern for a system administrator, who will be unable to locate them with find, ls, du, or other tools that rely on finding files by examining the directory tree.

By using ls's +L option you can see the link count of open files -- in the NLINK column. An unlinked file will have an NLINK value of zero. By using the option +L1 you can tell ls to display only files whose link count is less than one (i.e., zero).

There are some UNIX dialect-specific exceptions to ls's inability to report unlinked path names. They are described in the answer to the "When will ls report path names for deleted files?" question.

### 3.3.4 Why doesn't ls report the "correct" hard linked file path name?

When ls reports a rightmost path name component for a file with hard links, the component may come from the kernel's name cache. Since the key which connects an open file to the kernel name cache may be the same for each differently named hard link, ls may report only one name for all open hard-linked files. Sometimes that will be "correct" in the eye of the beholder; sometimes it will not. Remember, the file identification keys significant

to the kernel are the device and node numbers, and they're the same for all the hard linked names.

### 3.3.5 When will lsof report path names for deleted files?

Lsof will report path names for deleted files for two dialects: Linux and later builds of Solaris 10.

Deleted Linux path names are reported by default and have "(deleted)" at their ends.

The display of Solaris 10 deleted path names may be selected with the -X option. When selected they are also reported with "(deleted)" at their ends.

### 3.4 Why is lsof so slow?

Lsof may appear to be slow if network address to host name resolution is slow. This can happen, for example, when the name server is unreachable, or when a Solaris PPP cache daemon is malfunctioning.

To see if name lookup is causing lsof to be slow, turn it off with the `--n` option.

Port service name lookup or portmap registration lookup may also be causes of slow-down. To suppress port service name lookup, specify the `--P` option.

Lsof doesn't usually make direct portmap calls -- only when `+M` is specified, or when `HASPMAPENABLED` is defined during lsof construction. (The lsof help panel, produced with `lsof -h`` will display the default portmap registration reporting state.) The quickest first step in checking if lsof is slow because of the portmapper is to use lsof's `--M` option.

Lsof may be slow if UID to login name lookups are slow. Suppress them with `--l`.

On dialects where lsof uses the kernel name cache, try disabling its use with `--C`. (You can tell if lsof uses the kernel name cache by looking for `--C` in lsof's `--h` output.) Of course, disabling kernel name cache use will mean that lsof won't report full or partial path names, just file system and character device names.



If you're just interested in the open files of one process, try using the `--p <Process-ID>` option to limit lsof to that process. (The `--p` option may also be followed with a list of Process-IDs.)

If you're interested in including or excluding certain commands, try lsof's `-c[^]cmd` option.

If you're interested in certain Internet TCP and UDP states (e.g., ESTABLISHED) or in excluding some (e.g., CLOSE\_WAIT), try lsof's `-s p:s` option. More information on it may be found in the answer to the "How are protocol state name exclusion and inclusion used?" question.

Your UNIX dialect may not support `-s p:s` and its associated performance improvements to Internet-only file processing. You can find more information on those topics in the answer to the "Why doesn't my dialect support state name exclusion and inclusion?" question.

Older AIX lsof may be slow to start because of its oslevel identity comparison. (Newer AIX lsof uses `uname(2)`.) See the "Why does AIX lsof start so slowly?" and "Why does lsof warn 'compiled for x ... y; this is z.?' sections for more information.

### 3.5 Why doesn't lsof's setgid or setuid permission work?

If you install lsof on an NFS file system that has been mounted with the `nosuid` option, lsof may not be able to use the setgid or setuid permission you give it, complaining it can't open the kernel memory device -- e.g., `/dev/kmem`.

The only solution is to install lsof on a file system that doesn't inhibit setgid or setuid permission.

### 3.6 Does lsof have security problems?

I don't think so. However, lsof does usually start with setgid permission, and sometimes with setuid-root permission. Any program that has setgid or setuid-root permission, should always be regarded with suspicion.

Lsof drops setgid power, holding it only while it opens access to kernel memory devices (e.g., `/dev/kmem`, `/dev/mem`, `/dev/swap`). That allows lsof to bypass the weaker security

of access(2) in favor of the stronger checks the kernel makes when it examines the right of the lsof process to open files declared with -k and -m. Lsof also restricts some device cache file naming options when it senses the process has setuid-root power.

On a few dialects lsof requires setuid-root permission during its full execution in order to access files in the /proc file system. These dialects include:

- DC/OSx 1.1 for Pyramid systems
- Reliant UNIX 5.4[34] for Pyramid systems

When lsof runs with setuid-root permission it severely restricts all file accesses it might be asked to make with its options.

The device cache file (typically .lsof\_hostname in the home directory of the real user ID that executes lsof) has 0600 modes. (The suffix, hostname, is the first component of the host's name returned by gethostname(2).) However, even when lsof runs setuid-root, it makes sure the file's ownerships are changed to that of the real user and group. In addition, lsof checks the file carefully before using it (See the question "How do I disable the device cache file feature or alter it's behavior?" for a description of the checks.); discards the file if it fails the scrutiny; complains about the condition of the file; then rebuilds the file.

See the 00DCACHE file of the lsof distribution for more information about device cache file handling and the risks associated with the file.

### 3.7 Will lsof show remote hosts using files via NFS?

No. Remember, lsof displays open files for the processes of the host on which it runs. If the host on which lsof is running is an NFS server, the remote NFS client processes that are accessing files on the server leave no process records on the server for lsof to examine.

### 3.8 Why doesn't lsof report locks held on NFS files?

Generally lock information held by local processes on remote NFS files is not recorded by the UNIX dialect kernel. Hence,

lsof can't report it.

One exception is some patch levels of Solaris 2.3, and all versions of Solaris 2.4 and above. Lsof for those dialects does report on locks held by local processes on remotely mounted NFS files.

### 3.8.1 Why does lsof report a one byte lock on byte zero as a full file lock?

When a process has a lock of length one, starting at byte zero, lsof can't distinguish it from a full file lock.

That's because most UNIX dialects represent both locks the same way in their file lock (flock or eflock) structures.

### 3.9 Why does lsof report different values for open files on the same file system (the automounter phenomenon)?

On UNIX dialects where file systems may be mounted by an automounter with the `direct` type, lsof may sometimes report different DEVICE, SIZE/OFF, INODE and NAME values when asked to report files open on the file system.

This happens because some files open on the file system -- e.g., the current directory of a shell that changed its directory to the file system as the file system's first reference -- may be characterized in the kernel with temporary automounter node information. The `cd` doesn't cause the file system to be mounted.

A subsequent reference to the file system -- e.g., an `ls` of any place in it -- will cause the file system to be mounted. Processes with files open to the mounted file system are characterized in the kernel with data that reflects the mounted file system's parameters.

Unfortunately some kernels (e.g., some versions of Solaris 2.x) don't revisit the process that did only a change-directory for the purpose of updating the data associated with the open directory file. The file continues to be characterized with temporary automounter information until it does another directory change, even a trivial `cd .`.

Lsof will report on both reference types, when supplied the file system name as an argument, but the data lsof reports will reflect what it finds in the kernel. For the

different types lsof will display different data, including different major and minor device numbers in the DEVICE column, different lengths in the SIZE/OFF column, different node numbers in the INODE column, and slightly different file system names in the NAME column.

In contrast, fuser, where available, can only report on one reference type when supplied the file system name as an argument. Usually it will report on the one that is associated with the mounted file system information. If the only reference type is the temporary automounter one, fuser will often be silent about it.

### 3.10 Why don't lsof and netstat output match?

Lsof and netstat output don't match because lsof reports the network information it finds in open file system objects -- e.g., socket files -- while netstat often gets its information from separate kernel tables.

The information available to netstat may describe network activities never or no longer associated with open files, but necessary for proper network state machine operation.

For example, a TCP connection in the FIN\_WAIT\_[12] state may no longer have an associated open file, because the connection has been closed at the application layer and is now being closed at the TCP/IP protocol layer.

#### 3.10.1 Why can't lsof find accesses to some TCP and UDP ports?

Lsof stands for LiSt Open Files. If there is no open file connected to a TCP or UDP port, lsof won't find it. That's the most common reason why lsof doesn't find a port netstat might report open.

One reason I've found on some UNIX dialects is that their kernels set aside TCP and UDP ports for communicating with support activities, running in application layer servers -- the automounter daemons, and the NFS biod and nfsd daemons are examples. Netstat may report the ports are in use, but lsof doesn't.

Another reason is that netstat may also be able to report a port is open on a particular dialect, because it uses a source of data different from what lsof uses -- e.g.,

netstat might examine kernel tables or use streams messages to MIB2, while lsof relies on the information it finds in open file structures and their descendants.

Sometimes it's possible to search the data netstat and lsof use. For example, on Linux /proc/tcp and /proc/udp can be examined. There might an entry there for a particular protocol and port, but if the line on which the port appears doesn't have an inode number that matches an inode number of an open file, lsof won't be able to identify the process using the port.

This is a tough question to which there is no easy answer.

### 3.11 Why does lsof update the device cache file?

At the end of the lsof output you may see the message:

```
lsof: WARNING: /Homes/abe/.lsof_vic was updated.
```

In this message /Homes/abe/.lsof\_vic is the path to the private device cache file for login abe. (See 00DCACHE.)

Lsof issues this message when it finds it necessary to recheck the system device directory (e.g., /dev or /devices) and rebuild the device cache file during the open file scan. Lsof may need to do these things it finds that a device directory node has changed, or if it cannot find a device in the cache.

### 3.12 Why doesn't lsof report state for UDP socket files?

Lsof reports UDP TPI connection state -- TS\_IDLE (Idle), TS\_BOUND (Bound), etc. -- for some, but not all dialects. TPI

state is stream-based TCP/IP information that isn't available in many dialects.

A fairly weak general rule is if netstat(1) reports UDP TPI state, lsof may be able to report it, too. But don't be surprised if lsof fails to report UDP TPI state for your dialect. Other factors influence lsof's ability to report UDP TPI state, including the availability of state number data in kernel structures, and state number to state name conversion data.

### 3.13 I am editing a file with vi; why doesn't lsof find the file?

Classic implementations of vi usually don't keep open the file being edited. (Newer ones may do so in order to maintain an advisory lock.) Instead classic vi opens the file, makes a temporary copy (usually in /tmp or /usr/tmp), and does its work in that file. When you save the file being edited from a classic vi implementation, it reopens and rewrites the file.

During a classic vi session, except for the brief periods when vi is reading or rewriting the file, lsof won't find an open reference to the file from the vi process, because there is none.

### 3.14 Why doesn't lsof report TCP/TPI window and queue sizes for my dialect?

lsof only reports TCP/TPI window sizes for Solaris, because only its netstat reports them. The intent of providing TCP/TPI information in lsof NAME column output is to make it easier to match netstat output to lsof output.

In general lsof only reports queue sizes for both TCP and UDP (TPI) connections on BSD-derived UNIX dialects, where both sets of values appear in kernel socket queue structures. SYSV-derived UNIX dialects whose TCP/IP implementations are based on streams generally provide only TCP queue sizes, not UDP (TPI) ones.

While you may find that netstat on some SYSV-derived UNIX dialects with streams TCP/IP may report UDP (TPI) queue sizes, you will probably also find that the sizes are always zero -- netstat supplies a constant zero for UDP (TPI) queue sizes to make its headers align the same for TCP and UDP (TPI) connections. Solaris seems to get it right -- i.e., its netstat does not report UDP (TPI) queue sizes.

When in doubt, I chose to avoid reporting UDP (TPI) queue sizes for UNIX dialects whose netstat-reported values I knew to be a constant zero or whose origin I couldn't determine. OSR is a dialect in this category.

#### 3.14.1 Why doesn't lsof report socket options, socket states, and TCP flags and values for my dialect?

The lsof -T argument, 'f', that selects the reporting of socket options, socket states and TCP flags was implemented at lsof

revision 4.71 for the following UNIX dialects, providing the indicated information:

AIX 4.3.2 and 5.1 and above

All socket options and values, socket states, and TCP flags and values described in `lsof(8)` are reported.

Apple Darwin 7.2 and above

All socket options and values, socket states, and TCP flags and values described in `lsof(8)` are reported.

Digital UNIX and Tru64 UNIX

4.0

All socket options and values, socket states, and TCP flags and values described in `lsof(8)` are reported.

FreeBSD 4.9 and above

All socket options and values, socket states, and TCP flags and values described in `lsof(8)` are reported.

HP-UX 11.00 (/dev/kmem-based `lsof`)

All socket options and values are reported. No socket states are reported. Only the `TF_NODELAY` TCP flag and the `TF_MSS` value are reported.

HP-UX 11.11 and `iiiv2` (PSTAT-based `lsof`)

All socket options and values, and socket states are reported. No TCP flags or values are reported.

Linux

No socket options and values, socket states, or TCP flags and values are reported. The support for `"-Tf"` could not be added to Linux, because socket options, socket states, and TCP flags and values are not available via the `/proc` file system.

NetBSD 1.6G and above

All socket options and values, socket states, and TCP flags and values described in `lsof(8)` are reported.

OpenBSD

3.4 and above

All socket options and values, socket states, and TCP flags and values described in `lsof(8)` are reported.

OPENSTEP 4.2

All socket options and values, socket states, and TCP flags and values described in `lsof(8)` are reported.

OpenUNIX 8

All socket options and values, socket states, and TCP flags and values described in `lsof(8)` are reported.

SCO OpenServer Release 5.0.6

All socket options and values, socket states, and TCP flags and values described in `lsof(8)` are reported.

Solaris 2.6, 8 and above

The socket option display is limited to `BROADCAST`, `DEBUG`, `DGRAM_ERRIND`, `DONTROUTE` and `OOBINLINE`. Socket

values are limited to KEEPALIVE and LINGER. No socket states are reported. The TCP DELACK, NODELAY and SENTFIN flags are reported. The TCP MSS value is reported.

UnixWare 7.1.[134]

All socket options and values, socket states, and TCP flags and values described in lsof(8) are reported.

### 3.14.2 Why doesn't lsof report the partial listen queue connection count for my dialect?

The reporting of partial listen queue connections was added to -Tf processing at lsof revision 4.76. Currently it is reported for these dialects:

AIX 4.3.2

This dialect is no longer supported, so no attempt was made to add partial listen queue length support for it.

AIX 5.1 and above

Partial listen queue information is available.

Apple Darwin 7.2 and above

Partial listen queue information is available.

Digital UNIX 4.0

This dialect is no longer supported, so no attempt was made to add partial listen queue length support for it.

FreeBSD 4.9 and above

Partial listen queue information is available.

HP-UX 11.00 (/dev/kmem-based lsof)

No partial listen queue information is available.

HP-UX 11.11 and iiiiv2 (PSTAT-based lsof)

No partial listen queue information is available.

Linux

No partial listen queue information is available.

NetBSD 1.6G and above

Partial listen queue information is available.

OpenBSD 3.4 and above

Partial listen queue information is available.

OPENSTEP 4.2

Partial listen queue information is available.

OpenUNIX 8

This dialect is no longer supported, so no attempt was made to add partial listen queue length support for it.

SCO OpenServer Release 5.0.6



No partial listen queue information is available.

Solaris 2.6, 8 and above

Partial listen queue information is available.

Tru64 UNIX 5.0

This dialect is no longer supported, so no attempt was made to add partial listen queue length support for it.

Tru64 UNIX 5.1

Partial listen queue information is available.

UnixWare 7.1.[134]

Partial listen queue information is available.

### 3.15 What does "no more information" in the NAME column mean?

When lsof can find no successor structures -- a gnode, inode, socket, or vnode -- connected to the file structure of an open descriptor of a process, it reports "no more information"

in the NAME column. The TYPE, DEVICE, SIZE/OFF, and INODE columns will be blank.

Because the file structure is supposed to contain a pointer to the next structure of a file's processing support, if the pointer is NUL, lsof can go no further.

Some UNIX dialects have file structures for system processes -- e.g., the sched process -- that have no successor structure pointers. The "no more information" NAME will commonly appear for these processes in lsof output.

It may also be the case that lsof has read the file structure while it is being assembled and before a successor structure pointer value has been set. The "no more information" NAME will again result.

Unless lsof output is filled with "no more information" NAME column messages, the appearance of a few should be no cause for alarm.

### 3.16 Why doesn't lsof find a process that ps finds?

If lsof fails to display open files for a process that ps indicates exists, there may be several reasons for the difference.

The process may be a "zombie" for which ps displays the

"(defunct)" state. In that case, the process has exited and has no open file information lsof can display. It does still have a process structure, sufficient for the needs of ps.

Another possible explanation is that kernel tables and structures may have been changing when lsof looked for the process, making lsof unable to find all relevant process structures. Try repeating the lsof request.

### 3.17 Why doesn't -V report a search failure?

The usual reason that -V won't report a search failure is that lsof located the search item, but was prevented from listing it by an option that doesn't participate in search failure reporting.

For example, this lsof invocation:

```
$ lsof -V -i TCP@foobar -a -d 999
```

won't report it can't find the Internet address TCP@foobar, even if there is an open file connected to that address, unless the open file also has a file descriptor number of 999 (the ``-a -d 999" options).

Compile-time options can also affect -V results in much the same way. For example, if HASSECURITY and HASNOSOCKSECURITY are defined at compile time, this lsof invocation, run by a non-root user:

```
$ lsof -V -c inetd
```

won't report that it can't find the inetd command, even if there is a process running the inetd command, because the HASSECURITY and HASNOSOCKSECURITY options prevent the listing of all but the socket files of another user, and no socket file selector (e.g., "-i") was specified.

### 3.18 Portmap problems

#### 3.18.1 Why isn't a name displayed for the portmap registration?

When portmap registration reporting is enabled, any time there is a registration for a local TCP or UDP port, lsof displays it in square brackets, following the port number

or service name -- e.g., ``:1234[name]" or ``:name[100083]".

The TCP or UDP port number or service number (what follows the `:') is displayed under the control of the `lsof -P` option. The registration identity is held by the portmapper and may be a name or a number, depending on how the registration's owner declared it. `lsof` reports what the portmap holds and cannot derive a registration name from a registration number.

`lsof` can be compiled with registration reporting enabled or disabled by default, under the control of the `HASPMAPENABLED` `#define` (usually in `machine.h`). The `lsof` help panel (``lsof -h``) will show the default. `lsof` is distributed with reporting disabled by default.

### 3.18.2 How can I display only portmap registrations?

`lsof` doesn't have an option that will display only TCP or UDP ports with portmap registrations. The `+M` option only enables the reporting of registration information when Internet socket files are displayed; `+M` doesn't select the displaying of Internet socket files -- the `-i` option does that.

This simple `lsof` pipe to `grep` will do the job:

```
$ lsof -i +M | grep "\["
```

This works because `-i` selects Internet socket files, `+M` enables portmap registration reporting, and only output lines with opening square brackets will have registrations.

When portmap registration reporting is enabled by default, because the `lsof` builder constructed it that way, `+M` is not necessary. (The `lsof` help panel, produced with ``lsof -h`` will display the default portmapper registration reporting state.) However, specifying `+M` when reporting is already enabled is acceptable, as is specifying `-M` when reporting is already disabled.

Digression: `lsof` will accept ``+`` or ``-`` as a prefix to most options. (That isn't documented in the man page or help panel to reduce confusion and complexity.) The `-i` option is as acceptable as `+i`, so the above example could be written a little more tersely as:

```
$ lsof +Mi | grep "[
```

But be careful to use the ``Mi" ordering, since ``iM" implies M is an address argument to `i'.

### 3.18.3 Why doesn't lsof report portmap registrations for some ports?

Lsof reports portmap registrations for local TCP and UDP ports only. It identifies local ports this way:

- \* The port appears in the local address section of the kernel structure that contains it.
- \* The port appears in the foreign address section of a kernel structure whose local and foreign Internet addresses are the same.
- \* The port appears in the foreign address section of a kernel address structure whose Internet address is INADDR\_LOOPBACK (127.0.0.1).

Following these rules, lsof ignores foreign portmapped ports. That's done for reasons of efficiency and possible security prohibitions. Contacting all remote portmappers could take a long time and be blocked by network difficulties (i.e., be inefficient). Many firewalls block portmapper access for security reasons.

Lsof may occasionally ignore portmap registration information for a legitimate local port by virtue of its local port rules. This can happen when a port appears in the foreign part of its kernel structure and the local and foreign Internet addresses don't match (perhaps because they're on different interfaces), and the foreign Internet address isn't INADDR\_LOOPBACK (127.0.0.1).

### 3.19 Why is `lsof | wc` bigger than my system's open file limit?

There is a strong temptation to count open files by piping lsof output to wc. If your purpose is to compare the number you get to some Unix system parameter that defines the number of open files your system can have, resist the temptation.

One reason is that lsof reports a number of "files" that

don't occupy Unix file table space -- current working directories, root directories, jail directories, text files, library files, memory mapped files are some. Another reason is that lsof can report a file shared by more than one process that itself occupies only one file table slot.

If you want to know the number of open files that occupy file table slots, use the `+ff` option and process the lsof output's `FILE_ADDR` column information with standard Unix tools like `cut`, `grep`, `sed`, and `sort`.

You might also consider using lsof's field output with `+ff`, selecting the file struct address with `-FF`, and processing the output with an AWK or Perl script. See the `list_fields.awk`, `list_fields.perl`, and `shared.perl5` scripts in the `scripts/` subdirectory of the lsof distribution for hints on file struct post-processing filters.

### 3.20 Why doesn't lsof report file offset (position)?

Lsof won't report a file offset (position) value if the `-s` option has been specified, or if the dialect doesn't support the displaying of file offset (position).

That lsof is reporting only file size is indicated by the fact that the appropriate column header says `SIZE` instead of `SIZE/OFF`.

If lsof doesn't support the displaying of file offset (position) -- e.g., for Linux /proc-based lsof -- the `-h` or `-?` output panel won't list the `-o` option.

Sometimes the availability of file offset information depends on the dialect's kernel. This is particularly true for socket file offsets.

Maintenance of offsets for pseudo-terminal devices varies by UNIX dialect and is related to how the dialect kernel implements pseudo-terminal support. Kernels like AIX, for example, that short-circuit the transfer of data between socket and pseudo devices to reduce TCP/IP daemon interrupt rates won't advance offsets in the TCP/IP daemon socket files. Instead they will advance offsets in the open standard I/O files of the shell child process where the pseudo-terminal devices are used.

When in doubt about the behavior of lsof in reporting file offset information, do some carefully measured experiments, consult the lsof sources, or contact me at <abe@purdue.edu> to discuss the matter. Please follow the reporting guidelines in the "How do I report an lsof bug?" section of this FAQ.

### 3.20.1 What does lsof report for size when the file doesn't really have one?

When a file has no true size -- e.g., it's a socket, a FIFO, or a pipe -- lsof tries to report the information it finds in the kernel that describes the contents of associated kernel buffers.

Thus, for example, size for most TCP/IP files is socket buffer size. The size of the socket read buffer is reported for read-only files; the size of the write buffer for write-only files; and the sum of the buffers sizes for read-write files.

### 3.21 Problems with path name arguments

#### 3.21.1 How do I ask lsof to search a file system?

You can ask lsof to search for all open files on a file system by specifying its mounted path name as an lsof argument -- e.g.,

```
$ lsof /
```

Output of the mount command will show file system mounted path names. It will also show the mounted-on device path for the file system.

If the mounted-on device is a block device (the permission field in output of ``ls -l <device>`` starts with a ``b/``), you can specify it's name, too -- e.g.,

```
$ lsof /dev/sd0a
```

If the mounted-on device isn't a block device -- for example, some UNIX dialects call a CD-ROM device a character device (ls output starts with a ``c``) -- you can force lsof to assume that the specified device names a file system with the `+f` option -- e.g.,

```
$ lsof +f -- /dev/sd0a
```

(Note: you must use ``--" after +f or -f if a file name follows immediately, because +f and -f can be followed by characters that specify flag output selections.)

When you use +f and lsof can't match the device to a file system, lsof will issue a complaint.

The +f option may be used in some dialects to ask lsof to search for an NFS file system by its server name and server mount point. If the mount application reports an NFS file system mounted-on value that way, then this sample lsof request should work.

```
$ lsof +f -- fleet:/home/fleet/u5
```

Finally, you can use -f if you don't want a mounted file system path name to be considered a request to report all open files on the file system. This is useful when you want to know if anyone is using the file system's mounted path name. This example directs lsof to report on open access to the '/' directory, including when it's being used as a current working or root directory.

```
$ lsof -f -- /
```

The lsof -f option performs the same function as -f does in some fuser implementations. However, since the lsof -c option was chosen for another purpose before the -f option was added to lsof, +f was selected as the analogue to the fuser -c option. (Sorry for the potential confusion.)

### 3.21.2 Why doesn't lsof find all the open files in a file system?

Lsof may not find all the open files in a file system for several reasons.

First, some processes with files open on the file system may have been changing status when lsof examined the process table, and lsof "missed" them. Remember, the kernel changes much faster than lsof can respond to the changes.

Second, be sure you have specified the file system correctly. Perhaps you specified a file instead. You can use lsof's -V option to have lsof report in detail on what it couldn't

find. Make sure the report for the file system you specified says "file system." Here's some -V output:

```
$ /lsof -V /tmp ./lsof.h ./lsof
COMMAND PID USER  FD  TYPE DEVICE SIZE/OFF INODE NAME
lsof  2688  abe  txt  VREG 18,1,7 1428583 226641 ./lsof
lsof  2689  abe  txt  VREG 18,1,7 1428583 226641 ./lsof
lsof: no file use located: ./lsof.h
```

You can also use lsof's +f option to force it to consider a path name as a file system. If lsof can't find a file system by the specified name, it will issue a complaint -- e.g.,

```
$ lsof +f -- /usr
lsof: not a file system: /usr
```

(/usr is a directory in the / file system.)

### 3.21.3 Why does the lsof exit code report it didn't find open files when some files were listed?

Sometimes lsof will list some open files, yet return a non-zero exit code, suggesting it hasn't found all the specified files.

The first thing you should when you suspect lsof is incorrect is to repeat the request, adding the -V option. In the resulting report you may find that your file system specification really wasn't a file system specification, just a file specification.

Finally, if you specify two files or two file systems twice, lsof will credit all matches to the first of the two and believe that there were no matches for the second. It's possible to specify a single file system twice with different path names by using both its mounted directory path name and mounted-one device name.

```
$ lsof +f -V spcuna:/sysprog /sysprog
COMMAND PID USER  FD  TYPE DEVICE SIZE/OFF INODE NAME
ksh  11092  abe  cwd  VDIR 39,0,1  1536 226562 /sysprog
(spcuna:/sysprog)
...
lsof: no file system use located: spcuna:/sysprog
```

All matches were credited to /sysprog; none to spcuna:/sysprog.



### 3.21.4 Why won't lsof find all the open files in a directory?

When you give lsof a simple directory path name argument (not a file system mounted-on name), you are asking it to search for processes that have the directory open as a file, or as a process-specific directory -- e.g., root or current working directory.

If you want to list instances of open files inside the directory, you need to specify the individual path names of those files, or use the lsof +D and +d options.

See the answer to the question "Why are the +D and +d options so slow?" before you use +D or +d casually.

See the answer to the question "Why do the +D and +d options produce warning messages?" for an explanation of some process authority limitations of +D and +d.

### 3.21.5 Why are the +D and +d options so slow?

The +D and +d options cause lsof to build a path name search list for a specified directory. +D causes lsof to descend the directory to its furthest subdirectory, while +d restricts it to the top level. In both cases, the specified directory itself is included in the search list. In both symbolic links are ignored.

Building such a search list can take considerable time, especially when the specified directory contains many files and subdirectories -- lsof must call the system readlink() and stat() functions for each file and directory. Storing the search list can cause lsof to use more than its normal amount of dynamic memory -- each file recorded in the search list consumes dynamic memory for its path name, characteristics, and search linkages. Using the list means lsof must search it for every open file in the system.

Building the search list for a directory specified on some file systems can be slow -- e.g., for an NFS directory with many files. Some file systems have special logging features that can introduce additional delays to the building of the search list -- e.g., NFS logging, or logging on a Solaris UFS file system. The bottom line is that slow search list construction may not be so much an lsof problem

as a file system problem. (Hint: if you're using Solaris UFS logging, consider specifying the "logging,noatime" option pair to reduce the number of atime writes to the UFS logging queue and disk.)

A somewhat risky way to speed up lsof's building of the search list is to use lsof's `--O` option. It forces lsof to do all system calls needed to build the search list directly, rather than in a child process. While direct system calls are much faster, they can block in the kernel -- e.g., when an NFS server stops responding -- stopping lsof until the kernel operation unblocks.

As an example of the load +D can impose, consider that an ``lsof +D ^` on a lightly loaded NeXT '040 cube with a 1GB root file system disk took 4+ minutes of real time. It also generated several hundred error messages about files and directories the lsof process didn't have permission to access with `stat(2)`.

The bottom line is that +D and +d should be used cautiously. +D is more costly than +d for deeply nested directory trees, because of the full directory descent it causes. So use +d where possible. And you might need to consider the performance of the file system that holds the directory you name with +d or +D.

In view of these warnings, when is it appropriate to use +D or +d? Probably the most appropriate time is when you would specify the directory's contents to lsof with a shell globbing construct -- e.g., ``lsof *``. If that's what you need to do, ``lsof +d .`` is probably more efficient than having the shell produce a directory list, form it into an argument vector, and pass the vector to lsof for it to unravel.

See the answer to the question "Why do the +D and +d options produce warning messages?" for an explanation of some process authority limitations of +D and +d.

### 3.21.6 Why do the +D and +d options produce warning messages?

+D and +d option processing is limited by the authority of the lsof process -- i.e., lsof can only examine (with `lstat(2)` and `stat(2)`) files the owner

of the process can access.

If the ownership, group membership, or permissions of the specified directory, file within it, or directory within it prevents the owner of the lsof process from using lstat(2) or stat(2) on it, lsof will issue a warning message, naming the path and giving the system's (lstat(2)'s or stat(2)'s) reason (errno explanation text) for refusing access.

As an example, assume user abc has a subdirectory in /tmp, owned by abc and readable, writable and searchable by only its owner. If user def asks lsof to search for all /tmp references with +D or +d, lsof will be unable to lstat(2) or stat(2) anything in abc's private subdirectory, and will issue an appropriate warning.

Lsof warnings can usually be suppressed with the -w option. However, using -w with +D or +d means that there will be no indication why lsof couldn't find an open reference to a restricted directory or something contained in it.

Hint: if you need to use +D or +d and avoid authority warnings, and if you have super-user power, su and use lsof with +D or +d as root.

### 3.22 Why can't my C compiler find the rpercent structure definition?

When you try to compile lsof your compiler may complain that the rpercent structure is undefined. The complaints may look like this:

```
>print.c: In function `fill_portmap':
>print.c:213: dereferencing pointer to incomplete type
>...
```

The most likely cause is that someone has allowed a BIND installation to update /usr/include/netdb.h (or perhaps /usr/include/rpc/netdb.h), removing the rpercent structure definition that lsof expects to find there.

Only Solaris has an automatic work-around. (See dlsof.h in dialects/sun.). The Solaris work-around succeeds because there is another header file, <rpc/rpercent.h>, with the rpercent structure definition, and there is a Solaris C pre-processor test that can tell when the BIND <netdb.h> is in place and hence <rpc/rpercent.h> must be included.

Doubtlessly there are similar work-arounds possible in other UNIX dialects whose header files have been "touched" by BIND, but in general I recommend restoration of the vendor's <netdb.h> and any other header files BIND might have replaced. (I think BIND replaces <resolv.h>, <sys/bitypes.h>, <sys/cdefs.h> -- and maybe others.)

### 3.23 Why doesn't lsof report fully on file "foo" on UNIX dialect "bar?"

Lsof sometimes won't report much information on a given file, or may even report an error message in its NAME column. That's usually because the file is of a special type -- e.g., in a file system specific to the UNIX dialect -- and I haven't used a system where the file appeared during my testing.

If you encounter such a situation, send me e-mail at <abe@purdue.edu> and we may be able to devise an addition to lsof that will report on the file in question. Please follow the reporting guidelines in the "How do I report an lsof bug?" section of this FAQ. Make sure "lsof" appears in the "Subject:" line so my e-mail filter won't classify your letter as Spam.

### 3.24 Why do I get a complaint when I execute lsof that some library file can't be found?

On systems where the LIBPATH (or the equivalent) environment variable is used to record the library search path in executable files when they are built, an incorrect value may make it impossible for the system to find the shared libraries needed to load lsof for execution.

This may be particularly true on systems like AIX >= 4.1.4, where the lsof Makefile takes the precautionary step of using the -bnolibpath loader flag to insure that the path to the private static lsof library is not recorded in the lsof binary. Should LIBPATH be invalid when lsof is built, it will be recorded in the lsof binary as the default library path search order and lead to an inability to find libraries when lsof is executed.

So, if you get missing library complaints when you try to execute lsof, check LIBPATH, or whatever environment

variable

is used on your system to define library search order in executable files. Use the tools at your disposal to look at the library paths recorded in the lsof binary -- e.g., `chatr` on HP-UX, `dump` on AIX, `ldd` on Solaris.

Make sure, too, that when the correct library search path has been recorded in the executable file, the required library files exist at one or more of the search paths.

### 3.25 Why does lsof complain it can't open files?

When lsof begins execution, unless it has been asked to report only help or version information, typically it will attempt to access kernel memory and symbol files -- e.g., `/unix`, `/dev/kmem`. Even though lsof needs only permission to open these files for reading, read access to them might be restricted by ownerships and permission modes.

So the first step to diagnosing lsof problems with opening files is to use `ls(1)` to examine the ownerships and permission modes of the files that lsof wants to open. You may find that lsof needs to be installed with some type of special ownership or permission modes to enable it to open the necessary files for reading. See the "Installing Lsof" section of `00README` for more information.

### 3.26 Why does lsof warn "compiled for x ... y; this is z."?

Unless warnings are suppressed (with `-w`) or the kernel identity check symbol (`HASKERNIDCK`) definition has been deleted, all but one lsof dialect version (exception: `/proc`-based Linux lsof) compare the identity of the running kernel to that of the one for which lsof was constructed. If the identities don't match, lsof issues a warning like this:

```
lsof: WARNING: compiled for Solaris release 5.7; this is 5.6.
```

Two kernel identity differences can generate this warning -- the version number and the release number.

Build and running identity differences are usually significant, because they usually indicate kernels whose structures are different -- kernel structures commonly change at dialect version releases. Since

lsof reads data from the kernel in the form of structures, it is sensitive to changes in them. The general rule is that an lsof compiled for one UNIX dialect version will not work correctly when run on a different version.

There are three work-arounds: 1) use `-w` to suppress the warning -- and risk missing other warnings; 2) permanently disable the identity check by deleting the definition of `HASKERNIDCK` in the dialect's `machine.h` header file -- with the same risk; or 3) rebuild lsof on the system where it is to be run. (Deleting `HASKERNIDCK` can be done with the `Customize` script or by editing `machine.h`.)

Generally checking kernel identity is a quick operation for lsof. However, it is potentially slow under AIX, where lsof must run `/usr/bin/oslevel`. To speed up lsof, use `-w` to suppress the `/usr/bin/oslevel` test. See "Why does AIX lsof start so slowly?" for more information.

### 3.27 How can I disable the kernel identity check?

The kernel identity check is controlled by the `HASKERNIDCK` definition. When it is defined, most dialects (exclusion: /proc-based Linux lsof) will compare the build-time kernel identity with the run-time one.

To disable the kernel identity check, disable the `HASKERNIDCK` definition in the dialect's `machine.h` header file. The `Customize` script can be used to do that in its section about the kernel identity check.

Caution: while disabling the kernel identity check may result in smaller lsof startup overhead, it comes with the risk of executing an lsof that may produce warning messages, error messages, incorrect output, or no output at all.

### 3.28 Why don't ps(1) and lsof agree on the owner of a process?

Generally the user ID lsof reports in its `USER` column is the process effective user ID, as found in the process structure. Sometimes that may not agree with what `ps(1)` reports for the same process.

There are sundry reasons for the difference. Sometimes `ps(1)` uses a different source for process information, e.g.,

the /proc file system or the psinfo structure.

Sometimes the kernel is lax or confused (e.g., Solaris 2.5.1) about what ID to report as the effective user ID. Sometimes the system carries only one user ID in its process structure (some BSD derivatives), leaving lsof no choice.

The differences between lsof and ps(1) user identifications should be small and normally it will be apparent that the confusion is over a process whose application has changed to an effective user ID different from the real one.

### 3.29 Why doesn't lsof find an open socket file whose connection state is past CLOSE\_WAIT?

TCP/IP connections in states past CLOSE\_WAIT -- e.g., FIN\_WAIT\_1, CLOSING, LAST\_ACK, FIN\_WAIT\_2, and TIME\_WAIT -- don't always have open files associated with them. When they don't, lsof can't identify them. When the connection state advances from CLOSE\_WAIT, sometimes the open file associated with the connection is deleted.

### 3.30 Why don't machine.h definitions work when the surrounding comments are removed?

The machine.h header files in dialect subdirectories have some commented-out definitions like:

```
/* #define HASSYSDC "/your/choice/of/path */
```

You can't simply remove the comments and expect the definition to work. That's intended to make you think about what value you are assigning to the symbol. The assigned value might have a system-specific convention. HASSYSDC, for example, might be /var/db/lsof.dc for FreeBSD, but it might be /var/adm/lsof.dc for Solaris.

Symbols defined in the lsof documentation are described in 00PORTING, other machine.h comments, and other lsof documentation files. HASSYSDC, for example, is discussed in 00DCACHE. When comments and documentation don't suffice, consult the source code for hints on how the symbol is used.

### 3.31 What do "can't read inpcb at 0x...", "no protocol control block", "no PCB, CANTSENDMORE, CANTRCVMORE", etc. mean?

Sometimes lsof will report "can't read inpcb at 0x00000000",

"no protocol control block", "no PCB, CANTSENDMORE, CANTRCVMORE" or a similar message in the NAME column for open TCP socket files. These messages mean the file's socket structure lacks a pointer to the INternet Protocol Control Block (inpcb) where lsof expects to find connection addresses -- local and foreign ports, local and foreign IP addresses. The socket file has probably been submitted to the shutdown(2) function for processing.

In some implementations lsof issues the "no PCB, CANTSENDMORE, CANTRCVMORE" message, which tries to explain the absence of a protocol control block by showing the socket state settings that have been made by the shutdown(2) function.

If a non-zero address follows the "0x" in the "can't read inpcb" message, it means lsof couldn't read inpcb contents from the indicated address in kernel memory.

### 3.32 What do the "unknown file system type" warnings mean?

Lsof may report a message similar to"

```
unknown file system type, v_op: 0x10472f10
```

in the NAME column for some files.

This means that lsof has encountered a vnode for the file whose operation switch address (from v\_op) references a file system type for which there is no support in lsof. After lsof identifies the file system type, it uses pre-compiled code to locate the file system specific node for the file where lsof finds information like file size, device number, node number, etc.

To get some idea of what the file system type might be, use nm on your kernel symbol file to locate the symbol name that corresponds to the v\_op address -- e.g., on Solaris do:

```
$ nm -x /dev/ksyms | grep 0x10472f10
0x10472f10 ... |file_system_name_vnodeops
```

Where "file\_system\_name" is the clue to the unsupported file system.

Lsof doesn't use the v\_op address to identify file system



types on all dialects. Sometimes it uses an index number it finds in the vnode. It will translate that symbol to a short name in the warning message -- e.g., "nfs3" -- if possible.

### 3.33 Installation

#### 3.33.1 How do I install lsof?

There is no "standard" way to install lsof. Too much depends on local conditions for me to be able to provide working install rules in the lsof make files. (The skeleton install rules you will find just give "hints.") See the "Installing lsof" section of 00README for a fuller explanation.

To install lsof you will need to consider these questions:

- \* Who should be able to use lsof? (See HASSECURITY and HASNOSOCKSECURITY in the "Security" section of 00README.)

- \* Where should lsof be installed? This is a decision mostly dictated by local conditions. Somewhere in /usr/local -- etc/ or sbin/ -- is a common choice.

- \* What permissions should I give the lsof executable? The answer to this varies by dialect. The make files have install rules that give hints. The "Installing lsof" section of 00README gives information, too.

- \* What if I want to install lsof in a shared file system

for machines that require different lsof configurations? See the next question and answer, "How do I install a common lsof when I have machines that need differently constructed lsof binaries?"

#### 3.33.2 How do I install a common lsof when I have machines that need differently constructed lsof binaries?

A dilemma that faces some system administrators when they install lsof in a shared file system -- e.g., NFS -- is that they must have different lsof executables for different systems.

The answer is to build an lsof wrapper script that is executed in place of lsof. The script can use system commands to determine which lsof binary should be executed.

Consider this example. You have HP-UX machines with 32 and 64 bit kernels that share the /usr/local/sbin directory where you want to install lsof. Consequently, on each system you must use a different lsof executable, built for the system's bit size. (That's because lsof reads kernel structures, sized by the kernel's bit size.)

One answer is to install three things in /usr/local/sbin:

1) a 32 bit lsof as lsof32; 2) a 64 bit lsof as lsof64; and 3) an lsof script. The script might look like this one, based on work by Amir J. Katz:

```
#!/bin/sh
x=`/usr/bin/getconf KERNEL_BITS` # returns 32 or 64
if /usr/bin/test "X$x" = "X32"
then
  lsof32 $*
else
  if /usr/bin/test "X$x" = "X64"
  then
    lsof64 $*
  else
    echo "Can't determine which lsof executable to use;"
    echo "getconf KERNEL_BITS says: $x"
  fi
fi
exit 1
```

Solaris users should consult "How do I install lsof for Solaris 7, 8 or 9?" for information on a similar trick using the Solaris isaexec command.

Users of other dialects might be able to use a command like uname(1) that can identify a distinguishing feature of the system to be incorporated in pre-installed lsof executable names. For example, use `uname -r` and install binaries with suffixes that match `uname -r` output.

3.34 Why do lsof 4.53 and above reject device cache files built by earlier lsof revisions?

When lsof revisions 4.53 run and encounter a device cache file built by an earlier revision, it will reject the file and build a new one. The rejection will be advertised with these messages:

lsof: WARNING: no /dev device in <name>: 2 sections

...

lsof: WARNING: created device cache file: <name>

This happens because the header line of the device cache file was changed at revision 4.53 to contain the number of the device on which the device directory resides. The old device cache file header line -- the "2 sections" line in the above warning message, now reads "2 sections, dev=600".

This is not a serious problem, since lsof automatically rebuilds the device cache file with the correct header line.

3.35 What do "like block special" and "like character special" mean in the NAME column?

When lsof comes across an open block or character file whose device, raw device and inode place it somewhere other than /dev (or /devices), lsof doesn't report the /dev (or /devices) name in the NAME column. Instead lsof reports the file system name and device or path name in the NAME column and parenthetically adds "like block special <path>" or "like character special <path>".

The value for <path> will point to a block or character device in /dev (or /devices) whose raw device number matches that of the open file being reported, but whose device number or node number (or both) don't match.

Such an open file is connected to a device node that has been created in a directory other than /dev (or /devices.) See `mknode(8)` for information on how such nodes are created. (Generally one needs root power to create device nodes with `mknode`.)

3.36 Why does an lsof make fail because of undefined symbols?

When lsof is compiled via the `make` step and the final load step fails because of missing symbols, the problem may not be lsof. The problem may be that `ld`, called by the compiler as part of the `make` step, can't find some library that lsof needs.

First check the last compiler line of the make operation

-- e.g., the last line with cc or gcc in it before the undefined symbol report -- for loader arguments, i.e., ones beginning with "-l". Except for "-lsof" the rest name system libraries. ("-L./lib" precedes "-lsof" to tell the loader its location.)

Check that all the named system libraries exist. Look in /lib and /usr/lib as a start, but that may not be the only place system libraries live. Consult your dialect's documentation, e.g., the compiler and loader man pages, for other possible locations.

If some system library doesn't exist, that may mean it was never installed or was removed. You'll have to re-install the missing library.

You may find that all the system libraries lsof uses exist. Your next step might be to use nm and grep to see if any of them contain the undefined symbols.

```
$ nm library | grep symbol
```

If the undefined symbol exists in some library named by the lsof make step, then you might have a problem with some environment variable that controls the load step. The most common is LD\_LIBRARY\_PATH. It may have a setting that causes ld to ignore a directory containing a library lsof names. If this is the case, try unsetting LD\_LIBRARY\_PATH in the environment of the ld process -- e.g., do:

```
$ unset LD_LIBRARY_PATH  
or  
% unsetenv LD_LIBRARY_PATH
```

Consult your ld man page for other environment variables that might affect library searching -- e.g., LIBPATH, LPATH, SHLIB\_PATH, etc.

If the undefined function doesn't exist in any libraries lsof names, check other libraries. See if the function has a man page that names its library. If the latter is true, please let me know, because that is an lsof problem I need to fix.

If none of these solutions work for you, send me some documentation via e-mail at <abe@purdue.edu>. Include

`\uname`

`-a` output, the output of the `ls of` `Configure ...` and `make` steps, and the contents of the environment in force when the `make` step was executed -- e.g., `env` or `printenv` output. If you've located the libraries `ls of` names, send me that information, too. Make sure "ls of" appears in the "Subject:" line so my e-mail filter won't classify your letter as Spam.

### 3.37 Command Regular Expressions (REs)

#### 3.37.1 What are basic and extended regular expressions?

`ls of`'s `-c` option allows the specification of regular expressions (REs), enclosed in two slash (`/`) characters and followed by these modifiers:

- `b` the RE is a basic RE.
- `i` ignore case.
- `x` the RE is an extended RE (the default).

Note: the characters of the regular expression may need to be quoted to prevent their expansion by the shell.

Example: this RE is an extended RE that matches exactly four characters, whose third may be an upper (`O`) or lower case (`o`) oh:

```
-c /^..o.$/i
```

For simplicity's sake, an RE that is acceptable to `egrep(1)` is usually called an extended RE.

REs suitable for the old line editor, `ed(1)`, are often called basic REs (and sometimes also called obsolete).

These are some ways basic REs usually differ from extended REs. (There are other differences.)

\* `\|`, `\+`, `\?`, `\{`, and `\}` are ordinary characters.

\* `\^` is an ordinary character except at the beginning of the RE.

\* `\$` is an ordinary character except at the end of the RE.

\* `\*` is an ordinary character if it appears at the

beginning of the RE.

For more information on REs and the distinction between basic and extended REs, consult your dialect's man pages for `ed(1)`, `egrep(1)`, `sed(1)`, and possibly `regex(5)` or `regex(7)`.

### 3.37.2 Why can't I put a slash in a command regular expression?

Since a UNIX command name is the last part of a path to the command's executable, the `lsof` command regular expression (RE) syntax uses slash (`/`) to mark the beginning and end of an RE. Slash may not appear in the RE and the `\` back-slash escape is ineffective for "hiding" it.

More likely than not, if you try to put a slash in an `lsof` command RE, you'll get this response:

```
$ lsof -s/.\/ / ...
lsof: invalid regexp modifier: /
```

`lsof` is complaining the the first character it found after the second slash isn't an `lsof` command RE modifier -- `'b'`, `'i'`, or `'x'`.

### 3.37.3 Why does `lsof` say my command regular expression wasn't found?

When you use both forms of `lsof`'s `-c` option -- ```-c <command>"` and ```-c /RE/[m]"` -- and ask that `lsof` do a verbose search (```-V"`), you may be surprised that `lsof` will say that the regular expression wasn't found.

This can happen if the ```-c <command>"` form matches first, because then the ```-c/RE/[m]"` test will never have been applied. For example:

```
$ ./lsof -clsof -c/^..o.$/ -V -adcwd
COMMAND PID USER  FD  TYPE DEVICE SIZE/OFF  NODE NAME
lsof  7850  abe  cwd  VDIR  6,0  2048
96442 / (/dev/sd0a)
lsof: no command found for regex: ^..o.$
```

The ```-clsof"` option matched first, so the ```-c/^..o.$/` option wasn't tested.

### 3.38 Why doesn't `lsof` report on shared memory segments?

Lsof reports on shared memory segments only if they're associated with an open file. That's consistent with lsof's mission -- to list Open Files. Shared memory segments with no file associations aren't open files.

That's not to say that a report on shared memory segments and their associated processes wouldn't be useful. But it calls for a new tool, not more baggage for lsof.

### 3.39 Why does lsof report two instances of itself?

When you ask lsof to report all open files and it has permission to do so, you may see two lsof processes in the output. The processes are connected via pipes -- e.g., here's an HP-UX 11 example.

```
COMMAND  PID USER  FD  TYPE  DEVICE ...
...
lsof    29450  abe   7w  PIPE 0x48732408 ...
lsof    29450  abe   8r
PIPE 0x48970808 ...
...
lsof    29451  abe   6r  PIPE 0x48732408 ...
lsof    29451  abe   9w  PIPE 0x48970808 ...
```

The first process will usually be the lsof you initiated; the second, an lsof child process that is used to isolate its parent process from kernel functions that can block -- e.g., readlink() or stat().

Information to and from the kernel functions is exchanged via the two pipes. When the parent process detects that the child process has become blocked, it attempts to kill the child. Depending on the UNIX dialect that may succeed or fail, but the parent won't be blocked in any event.

See the "BLOCKS AND TIMEOUTS" and "AVOIDING KERNEL BLOCKS" sections of the lsof man page for more information on why the child process is used and how you can specify lsof options to avoid it. (Caution: that may be risky.)

### 3.40 Why does lsof report '\n' in device cache file error messages?

Lsof revisions prior to 4.58 may report '\n' in error messages it delivers about problems in the device cache file -- e.g.,

lsof: WARNING: no ...: 4 sections\n

That's deliberately done to show the exact contents of the device cache file line about which lsof is complaining, including its terminating NL (New Line) '\n' character. In the above example the line in the device cache file causing the lsof complaint contains "4 sections" and ends with a '\n'.

At revision 4.58 and above, device cache error messages like the one in the above example have been changed to read:

lsof: WARNING: no ...: line "4 sections"

The terminal '\n' is no longer reported, the line contents are enclosed in double quote marks (""), and the word "line" has been added as a prefix to denote that what follows is a line from the device cache file.

### 3.41 Kernel Symbol and Address Problems

#### 3.41.1 What does "lsof: WARNING: name cache hash size length error: 0" mean?

When run on some systems, lsof may issue this warning:

lsof: WARNING: name  
cache hash size length error: 0

That is an example from a FreeBSD system where lsof reads the kernel's `_nchash` variable and finds its value is zero.

Similar warnings include:

WARNING: kernel name cache size:  
WARNING: can't read kernel's name cache:  
WARNING: no name cache address  
WARNING: name cache hash size length error:  
WARNING: unusable name cache size:

These warnings are issued when lsof is attempting to read the kernel's name cache information. They are usually the result of a mis-match between the addresses for kernel symbols lsof gets via `nlist(2)` and the addresses in use by the kernel.

Lsof usually gets kernel symbol addresses from what it



believes to be the kernel boot file. In FreeBSD, for example, that's the path returned by `getbootfile(3)`, usually `/kernel`. The boot file can have other names in other UNIX dialects -- `/unix`, `/vmunix`, `/bsd`, `/netbsd`, `/mach`, `/stand/vmunix`, etc.

Lsof will get incorrect (mismatched) addresses from the boot file if it has been replaced by a newer one which hasn't yet been booted -- e.g., if this is done in FreeBSD:

```
# mv /kernel /kernel.OLD
# mv /kernel.NEW /kernel
```

Until the FreeBSD system is rebooted, the booted kernel is `/kernel.OLD`, but `getbootfile()` says it is `/kernel`. If symbol addresses important to lsof in `/kernel.OLD` and `/kernel` don't match, the lsof WARNING messages result.

#### 3.41.2 Why does lsof produce "garbage" output?

Kernel name cache warnings may not be the only sign that lsof is using incorrect symbol addresses to read kernel values. If there's no reasonable test lsof can make on what it reads from the kernel, it may issue other warnings or even report nonsensical results.

The warnings may appear on `STDERR`, such as:

```
lsof: can't read proc table info
```

Or the warnings may appear in the `NAME` column as messages saying lsof can't read or interpret some kernel structure -- e.g.,

```
... NAME
... can't read file struct from 0x12345
```

One possible work-around is to point lsof's kernel symbol address gathering at the proper boot file. That can be done with lsof's `-k` option -- e.g.,

```
$ lsof -k /kernel.OLD
```

The best work-around is to make sure the standard boot file is properly sited -- e.g., if you've moved a new `/kernel` in place, boot it.

3.42 Why does lsof report open files when run as super user that it doesn't report when run with lesser privileges?

The most likely cause is that the HASSECURITY option was selected when the lsof executable was built.

If HASSECURITY is defined when lsof is built, and lsof is run with the privileges of a non-ROOT user, it will only list open files belonging to the user. The same lsof executable, when run with root user privileges, will list all open files.

However, if HASSECURITY and HASNOSOCKSECURITY are both defined when lsof is built, lsof will list open files belonging to the user and will also list anyone else's open socket files, provided their listing is selected with the "-i" option.

So first ask yourself if the process whose open files lsof won't list belong to a user other than the one under which you're running lsof, and are not open socket files. If either is true, use lsof's help (-h or -?) option and look for a line near the bottom of the help panel that says:

```
"... can list all files..."
```

If the leading "..." says "Only root" then HASSECURITY was defined when lsof was built. If the trailing "..." says ", but anyone can list socket files" then HASNOSOCKSECURITY was also defined.

Should you want an lsof not built with HASSECURITY defined, rerun the lsof Configure script. If you let Configure do customization, make sure you answer 'n' when it asks if you want to enable HASSECURITY and HASNOSOCKSECURITY. If you don't need to do customization, you can rebuild lsof with the "-n" option to Configure. Here's an example of such a rebuild sequence:

```
$ Configure -clean
$ Configure -n <dialect-abbreviation>

$ make
```

More information on the HASSECURITY and HASNOSOCKSECURITY options may be found in the "Security" section of the

00README file of the lsof distribution.

### 3.43 Test Suite Problems

#### 3.43.1 Errors all tests can report:

##### 3.43.1.1 Why do tests complain "ERROR!!! can't execute ../lsof"?

All tests in the test suite expect an executable lsof file to exist in the tests parent directory, ../lsof.

If there's none there, the tests/Makefile has a rule to make it, but there are probably circumstances where that rule may fail.

The work-around is to re-Configure and re-make lsof, then run the test suite.

##### 3.43.1.2 Why do tests complain "ERROR!!! can't find ..." a file?

Many tests create (or use from a supplied environment variable path) a test file and use lsof to find it. When lsof can't find the file, the tests report the error with messages of the form:

```
ERROR!!! can't find ... : <some file path>
```

or

```
ERROR!!! lsof couldn't find ...
```

These type of error messages mean that the lsof field output delivered to the test didn't contain a file that the test could identify as the one it intended lsof to find. It might also mean that the process information -- command name, PID or parent PID -- didn't match what the test expected.

This could imply a bug in the test or a bug in lsof. Try using lsof to find a known file that is open. For example, while in the tests sub-directory, do this:

```
$ sleep 30 < Makefile
$ ../lsof Makefile
```

If lsof doesn't report that Makefile is open, then the fault may be with lsof. If lsof reports the file is open, search further in the test code for the failure cause.

### 3.43.1.3 Why do some tests fail to compile?

If a test suite program fails to compile, it may be because I've never had an opportunity to compile the test on the particular UNIX version you are using.

See Appendix B in 00TEST for a list of the UNIX dialects where the test suite has been validate.

### 3.43.1.4

Why do some tests always fail?

There are several tests in the optional group that have conflicting or special requirements:

LTbigf needs a dialect and file system that support large files.

LTlock won't work if the tests/ sub-directory is on an NFS file system.

LTnfs won't work if the tests/ sub-directory is not on an NFS file system.

So for two tests in particular, LTlock and LTnfs, one will generally fail.

Some failing tests can be run successfully by supplying to them a path to the appropriate type of file system with the -p option.

### 3.43.1.5 Why does the test suite say it hasn't been validated on my dialect?

When you use the default rule of the test suite's Makefile, it may issue this complaint:

```
$ cd tests
$ make
!!!WARNING!!!
```

This dialect or its particular version may not have been validated with the lsof test suite. Consequently some tests may fail or may not even compile.

```
!!!WARNING!!!
```

You

are then given the opportunity to answer 'y' to have the test suite operation continue.

This message means that the tests/TestDB file in the tests sub-directory doesn't show that the test suite has been run with the combination of compiler flags found in tests/config.cflags. The tests might not run; they may encounter compiler failures.

See 00TEST for more information on the UNIX dialects where the test suite has been validated and on the workings of TestDB and its supporting scripts.

When the tests/Makefile "auto" rule is used, the message is more terse and the condition is fatal.

This suite has not been validated on:

<dialect\_description>

No opportunity to continue is offered.

The tests/Makefile "silent" rule will skip checking for the validation footprint.

#### 3.43.1.6 Why do the tests complain they can't stat() or open() /dev/mem or /dev/kmem?

When the tests detect that lsof for the dialect reads its information from kernel memory (i.e., the LT\_KMEM definition is present in tests/config.cflags), and when the lsof executable path is ../lsof, the tests make sure they can stat() and open() for read access the relevant kernel memory devices, /dev/kmem and possibly /dev/mem.

If those stat() or open() operations fail, the tests issue an error message and quit. The message explains why the system rejected the operation in terms of system "errno" symbols and messages. More often than not the explanation will be that the process lacks permission to access the indicated device node.

One work-around is to give the lsof executable being tested the necessary permission -- e.g., via chgrp, chmod, etc. -- and set its path in the LT\_LSOF\_PATH environment variable. (See 00TEST.)

Another work-around is to make sure the process that runs the tests has the necessary permissions -- e.g., run it as root, or enable the process login to access the resources. For example, I can run the tests on my personal work-station because /dev/kmem and /dev/mem are readable by the "kmem" group and my login is in that group.

### 3.43.2 LTbigf test issues

#### 3.43.2.1 Why does the LTbigf test say that the dialect doesn't support large files?

Large file support is defined dialect by dialect in the lsof source files and Configure script. If large file support isn't defined there, it isn't defined in the LTbigf test.

If you think that's wrong for a particular dialect, contact me via e-mail at <abe@purdue.edu>. Make sure "lsof" appears in the "Subject:" line so my e-mail filter won't classify your letter as Spam.

#### 3.43.2.2 Why does LTbigf complain about operations on its config.LTbigf\* file?

The LTbigf must be able to write a large file test (size > 32 bits) and seek within it and the process file ulimit size must permit the operation. If the default location for the test file, tests/, isn't on a file system enabled for large file operations or if the process ulimit file block size is too small, lsof will get file operation errors, particularly when seeking

There may be a work-around. Specify the path to a file LTbigf can write in a file system enabled for large file operations a the -poption. Make sure that the ulimit file block size permits writing a large file. For example, presuming /scratch23 is large-file-enabled, and presuming you have permission to raise the ulimit file block size, this shell commands will allow the LTbigf test to run on AIX:

```
$ ./LTbigf -p /scratch23/abe/bigfile
```

(Note: syntax for the ulimit command varies by dialect and

by shell. Discovering the proper variant is left to the reader.)

More information on this subject can be found in the LTbigf description in the 00TEST file. Of course, the LTbigf.c source file in tests/ is the ultimate source of information,

#### 3.43.2.3 Why does LTbigf warn that lsof doesn't return file offsets?

On some dialects (e.g., Linux) lsof can't report file offsets, because the data access method underlying lsof doesn't provide them. If LTbigf knows that lsof can't report file offsets for the dialect, it issues this warning:

```
LTbigf ... WARNING!!! lsof can't return file offsets
for this dialect, so offset tests have
been disabled.
```

LTbigf then performs the size test and skips the offset tests.

For more information see 00TEST and the "Why doesn't /proc-based lsof report file offsets (positions)?" Q&A of this file.

#### 3.43.3 Why does the LTbasic test complain "ERROR!!! lsof this ..." and "ERROR!!! lsof that ..."?

The LTbasic test program uses lsof to examine a running lsof process. It looks for the lsof current working directory, executable (if possible), and kernel memory file (if applicable).

Failures to find those things result in the LTbasic error messages. More information on how LTbasic produces the error messages may be found in the LTbasic.c source file.

On HP-UX 11.11 and higher, for example, if the test's current working directory is on a loopback (LOFS) file system, LTbasic won't be able to find the current working directory of the lsof process because of a bug in the HP-UX kernel.

The solution for that HP-UX problem is to install an HP-UX patch. See the answer to the "Why doesn't PSTAT-based lsof report a CWD that is on a loopback (LOFS) file system?" question for more information on the patch.

### 3.43.4 NFS test issues

#### 3.43.4.1 Why does the LTnfs test complain "couldn't find NFS file ..."?

The LTnfs test must work with an NFS test file. After it opens the file it asks lsof to find it on an NFS file system. If the file isn't on an NFS file system, lsof won't find it, and the NFS test script complains and fails.

The work-around is to use -p option to supply a path to a regular NFS file (not a directory) that is on an NFS file system that LTnfs can read. Presuming /share/bin/file is such a file and can be opened for reading by the LTnfs test, this sample shell command could be used to run the LTnfs test successfully:

```
$ ./LTnfs -p /share/bin/file
```

(If the NFS file system is enabled for large files, the NFS test will produce the error message described in the following Q&A.)

### 3.43.5 LTnlink test issues

#### 3.43.5.1 Why does the LTnlink test complain that its test file is on an NFS file system?

The LTnlink test may complain:

```
LTnlink ... WARNING!!! test file <path> is NFS mounted.
```

and then issue an explanation and a hint about using the -p option.

The LTnlist test does this because of the way NFS file links are managed when an NFS file is unlinked and the unlinking process still has the file open. Unlike with files on a local file system, when an NFS file that is still open is unlinked, its link count is not reduced.

The file name is changed to a name of the form .nfsxxxx and the link count is left unchanged until the process holding the file open closes it. That's done by NFS so it can keep proper track of the file on NFS clients and servers.

Since



the link count isn't reduced when the LTnlink test program closes the NFS test file it still has open, lsof won't find it for LTnlink with a link count of zero. Consequently, LTnlink disables that test section and issues its warning.

The warning suggests that the unlink test section can be run by giving LTnlink a path to a test file with the -p option. That path must name a file LTnlink can write and unlink. Presuming /scratch23/abe/nlinkfile is on a local file system and the LTnlink test can write to it and unlink it, this sample shell command can be used to run the complete LTnlink test successfully:

```
$ LTnlink -p /scratch23/abe/nlinkfile
```

### 3.43.5.2 Why does LTnlink delay and report "waiting for link count update: ..."?

On some UNIX dialects and file system combinations the updating of link count after a file has been unlinked can be delayed. Consequently, lsof won't be able to report the updated link count to LTnlink for a while.

When lsof doesn't report the proper link count to LTnlink, it sleeps and repeats the lsof call, using the "waiting for link count update: ..." message as a signal that it is waiting for the expected lsof response. The wait cycle duration is limited to approximately one minute.

### 3.43.6 LTdnlc test issues

#### 3.43.6.1 Why won't the LTdnlc test run?

Lsof is unable to access the DNLC cache on AIX, because the kernel symbols for the DNLC aren't exported. Contact IBM to learn why that decision was made.

The LTdnlc test won't work on Apple Darwin because lsof can't obtain reliable DNLC information.

The LTdnlc test may fail on other dialects. Failure causes include: a busy system with a DNLC that is changing rapidly; path name components too large for the DNLC; a file system -- e.g., NFS, /tmp, loopback -- which doesn't fully participate in the DNLC; or DNLC limitations (Many DNLC implementations will only store path name components if

they are 31 characters or less.)

If you suspect the file system doesn't fully participate in kernel DNLC processing, as a work-around rebuild and test lsof on one that does.

#### 3.43.6.2 What does the LTdnlc test mean by "... <path> found: 100.00%"?

Even when it succeeds the LTdnlc test will report:

```
LTdnlc ... /export/home/abe/src/lsof4/tests found: 100.00%
```

This message means that the LTdnlc test asked lsof to find the file at the indicated path five times and lsof found the full path name in the indicated percentage of calls. The LTdnlc test considers it a failure if the percentage falls below 50.0%

#### 3.43.6.3 Why does the DNLC test fail?

The DNLC test may fail when some component of the lsof tests/ sub-directory can't be cached by the kernel DNLC. Some kernels have a limit on the length of individual components (typically) 32.

#### 3.43.7 Why hasn't the test suite been qualified for 64 bit HP-UX 11 when lsof is compiled with gcc?

When I attempted to qualify lsof for HP-UX 11, compiled with gcc 3.0, the LTsock test failed. I traced the failure to a gcc compilation error. Because LTsock is an important test, I didn't feel that the test suite was qualified if it failed.

LTsock compiles and runs correctly on 64 bit HP-UX 11 when compiled with HP's ANSI-C.

#### 3.43.8 LTzsoff test issues

##### 3.43.8.1 Why does LTzsoff warn that lsof doesn't return file offsets?

On some dialects (e.g., Linux) lsof can't report file offsets, because the data access method underlying lsof doesn't provide them. If LTzsoff knows that lsof can't report file offsets for the dialect, it issues this warning:

LTszoff ... WARNING!!! lsof can't return file offsets for this dialect, so offset tests have been disabled.

LTszoff then performs the size test and skips the offset tests.

For more information see 00TEST and the "Why doesn't /proc-based lsof report file offsets (positions)?" Q&A of this file.

### 3.43.9 LTlock test issues

## 3.44 File descriptor list (the ``-d" option) problems

### 3.44.1 Why does lsof reject a ``-d" FD list?

Lsof rejects ``-d" FD lists that contain both exclusions and inclusions with messages like:

```
lsof: exclude in an include list: ^1
lsof: include in an exclude list: 2
```

That's because ``-d" FD lists are processed as ORed lists, so it makes no sense for them to contain both exclusions and inclusions.

I.e., if a ``-d" FD list were to contain ``^cwd,1", the ``^cwd" member is useless, because the ``1" member dominates by saying "include only FD 1". That effectively excludes ``cwd" FD.

Note that lists may have multiple members of the same type, exclude or include. They are processed as an ORed set. If an FD isn't excluded by any member of an exclude list, it is selected. If an FD is included by any member of an include list, it is selected.

### 3.44.2 Why are file descriptors other than those in my FD list reported?

The FD list that follows ``-d" excludes or includes file descriptors, but unless the ``-a" (AND) option is specified, the FD list selections are ORed to the other selections.

For example, the following lsof command will cause all file

descriptors to be listed for the lsof command, and all but the cwd descriptor for all other commands, probably not what was intended.

```
$ lsof -clsof -d^cwd
```

Hint: use ``-a" -- e.g.,

```
$ lsof -clsof -a -d^cwd
```

3.45 How can I supply device numbers for inaccessible NFS file systems?

When lsof can't get device numbers for inaccessible NFS file systems via stat(2) or lstat(2), it attempts to get them from the mount table's dev=xxx options. Successes are reported with a warning message that indicates the source of the device number and that output might be incomplete as a consequence of the warnings.

Some system mount tables -- e.g., Linux /proc/mounts -- don't have a dev=xxx option. In that case, and provided lsof for the dialect supports them, you can use the +m option to create a mount table supplement file and the "+m m" option to use it.

First check the lsof -h (help) output to see if the +m and "+m m" options are supported. If they are, use +m to create a mount table supplement file when all mounted file systems are accessible. Use "+m m" later to make the supplement available when some mounted file systems might not be available.

Here's an example that creates a mount supplement file in \$HOME/mnt-sup and later makes it available to lsof.

```
$ rm -f $HOME/mnt-sup
$ lsof +m > $HOME/mnt-sup
...
$ lsof +m $HOME/mnt-sup <other lsof options>
```

If lsof has to get the device number from the supplement, it will issue an informative warning message. The warning can be suppressed with lsof's -w option.

Caution! Since the mount table supplement file is static, it is its supplier's responsibility to update it as file system mounts change.

For more information, consult the lsof man page. The "ALTERNATE DEVICE NUMBERS" section has useful information on how lsof acquires device numbers when stat(2) or lstat(2) fail.

### 3.46 Why won't lsof find open files on over-mounted file systems?

When a file system, /xyz for example, is mounted on the same mount point as another file system, /abc for example, running lsof with an argument of the path of the first file system's mount point -- the over-mounted one, /abc -- probably will not reveal any files open on /abc.

That's because lsof looks for open files on a file system by looking for files with the file system's device number. The two file systems usually have different device numbers and lsof determines the device number search key from the supplied name of the second file system.

A general work-around exists only for Linux. On that UNIX dialect, when you know the over-mounted file system's mount point path, you can ask lsof to report on all open files and grep that output for the path of the over-mounted file system mount point.

### 3.47 What can be done when lsof reports no more space?

Many lsof methods cache information in memory, using the dialects malloc() library function. When malloc() can't allocate the requested amount of memory, lsof exits with warning messages similar to this AIX message:

```
lsof: no more dev-ch space at pid 2257750: 0x82a8e600
```

Lsof then exits immediately and produces no more output.

A possible work-around is to increase the memory foot print of the shell that runs lsof. That is often done with the ulimit(1) shell command.

### 3.48 What if the lsof build encounters ar and ld problems?

The lsof main and library Makefiles use the library archiver, ar, and the system loader, ld, applications. Improperly located, installed or configured versions of them may cause the lsof build to encounter errors with them.

The application producing the error should identify itself in its error messages.

The first thing to check the path of the application that is being used. Try `which ar` or `which ld` to see if perhaps the PATH used during the build might be causing the wrong archiver or loader to be used.

If the problem is with the use of the wrong archiver, and it's not possible to correct the PATH to it, try using the LSOF\_AR environment variable to specify the path to and arguments for the correct archiver. See 00XCONFIG for more information and note that LSOF\_AR must specify the path to the archive application and the arguments for it, less the terminating library and module name arguments.

If the problem is with the loader, there is no lsof work-around. That's because lsof calls the loader via the C compiler, so the problem must be fixed at the compiler (system) level.

## 4.0 AIX Problems

### 4.1 What is the Stale Segment ID bug and why is -X needed?

Kevin Ruderman reports that he has been informed by IBM that processes using the AIX 3.2.x, 4.1[.12345], 4.2[.1], and 4.3.x kernel's `readx()` function can cause other AIX processes to hang because of what appears to be file system corruption.

This failure, known as the Stale Segment ID bug, is caused by an error in the AIX kernel's journaled segment memory handler that causes the kernel's `dir_search()` function erroneously to believe directory entries contain zeroes. The process using the `readx()` call need not be doing anything wrong. Usually the system must be under such heavy load that the segment ID being used in the `readx()` call has been freed and then reallocated to another process since it was obtained from kernel memory.

Lsof uses the `readx()` function to access library entry structures, based on the segment ID it finds in the `proc` structure of a process. Since IBM probably will never fix

the kernel bug, I've added an AIX-specific option to lsof that controls its use of the readx() function.

By default lsof readx() use is disabled; specifying the ``-X" option enables readx() use.

If you want to change the default readx() behavior of AIX lsof, change the HASXOPT, HASXOPT\_ROOT, and HASXOPT\_VALUE definitions in dialects/aix/machine.h.

You can also use these definitions to enable or disable readx() -- consult the comments in machine.h. You may want to disable readx() use permanently if you plan to make lsof publicly executable.

When HASXOPT\_ROOT is defined, lsof will restrict use of the -X option to processes whose real UID is root; if HASXOPT\_ROOT isn't defined, any user may specify the -X option. The Customize script offers the option to change HASXOPT\_ROOT when HASXOPT is defined and HASXOPT\_ROOT is named in any dialect's machine.h header file.

I have never seen lsof cause a problem with its use of readx(), but I believe there is some chance it could, given the right circumstances.

#### 4.1.1 Stale Segment ID APAR

Here are the details of the Stale Segment ID bug and IBM's response, provided by Kevin Ruderman.

AIX V3

APAR=ix49183

user process hangs forever in kernel due to file system corruption

STAT=closed prs TID=tx2527 ISEV=2 SEV=2

(A "closed prs" is

one closed with a Permanent

ReStriction.)

RCOMP=575603001 aix v3 for rs/6 RREL=r320

AIX V4 (internal defect, no apar #)

prefix p

name 175671

abstract KERMP: loop for ever in dir\_search()

Problem description:

1. Some user application -- e.g., lsof -- gets the segment

ID (SID) for the process private segment of a target process from the process table.

2. The target process exits, deleting the process private segment.
3. The SID is reallocated for use as a persistent segment.
4. The user application runs again and tries to read the user area structure from /dev/mem, using the SID it read from the process table.
5. The loads done by the driver for /dev/mem cause faults in the directory; new blocks are allocated; the size changed; and zero pages created.
6. The next application that looks for a file in the affected directory hangs in the kernel's dir\_search() function because of the zero pages.

This occurs because the kernel's dir\_search() function loops through the variable length entries one at a time, moving from one to the next by adding the length of the current entry to its address to get the address of the next entry. This process should end when the current pointer passes the end of the known directory length.

However, while the directory length has increased, the entry length data has not, so when dir\_search() reaches the zero pages, it loops forever, adding a length of zero to the current pointer, never passing the end of the directory length. The application process is hung; it can't be killed or stopped.

IBM closed the problem with a PRS code (Permanent Restriction) under AIX Version 3 and had targeted a fix for AIX 4.2. They have recently (I became aware of it September 10, 1996) cancelled the defect report altogether and have indicated they are not going to fix the defect.

#### 4.2 Gcc Work-around for AIX 4.1x

When gcc is used to compile lsof for AIX 4.1x, it doesn't align one element of the user structure correctly. Xlc sees the U\_irss element as a type "long long" and aligns it on an 8 byte boundary. That's because the default mode of xlc is -qlonglong; when -qlonglong is enabled, the



`_LONG_LONG` symbol is also defined.

Gcc sees `U_irss` as a two element array of type long, because `_LONG_LONG` isn't defined. Hence gcc aligns the `U_irss` element array on a 4 byte boundary, rather than an 8 byte one, making the gcc incantation of the user structure 4 bytes shorter than xlc's.

When the length of gcc's user structure is supplied as argument 4 to the undocumented `getuser()` function of the AIX kernel, `getuser()` rejects it as an incorrect size and returns `EINVAL`.

Lsof has a work-around for this problem. It involves a special test in the `Configure` script when the "aixgcc" `Configure` abbreviation is used -- e.g.,

```
$ Configure -n aixgcc
```

The test is to compile a small program with gcc and check the alignment of `U_irss`. If it's not aligned on an 8 byte boundary, the `Configure` script makes a special copy of `<sys/user.h>` in `./dialects/aix/aix<AIX_version>` whose `U_irss` will align properly, and generates compile time options to use it.

While I have tested this work-around only with 4.1.4, it should work with earlier versions of AIX 4.1. It does not work for AIX 4.2; a different work-around is employed there. (See the next section.)

If you want to use this technique to compile other AIX 4.1x programs with gcc for using `getuser()`, check the `Configure` script.

Stuart D. Gathman identified this gcc AIX alignment problem.

### 4.3 Gcc and AIX 4.2[.1]

Alignment problems with gcc and AIX 4.2[.1] inside the user structure are more severe, because there are some new 64 bit types in AIX that gcc doesn't yet (as of 2.7.x) support. The `<sys/user.h>` `U_irss` element problem, discussed in 4.3 above, doesn't exist in 4.2[.1].

The AIX lsof machine.h header file

has a work-around, provided by Henry Grebler, that bypasses gcc alignment problems. Later versions of gcc (e.g., 2.8.x) will probably bypass the problems as well.

#### 4.4 Why won't lsof's Configure allow the use of gcc for AIX below 4.1?

Gcc can't reliably be used to compile lsof for AIX versions below AIX 4.1 because of possible kernel structure element alignment differences between it and xlc.

#### 4.5 What is an AIX SMT file type?

When you run AIX X clients with the DISPLAY environment variable set to ``:0.0" they communicate with the AIX X server via files whose kernel file structure has an undefined type (f\_type == 0xf) -- at least there's no definition for it in <sys/file.h>.

These are Shared Memory Transport (SMT) sockets, an artifact of AIXWindows, designed for more efficient data transfers between the X server and its clients.

Henry Grebler and David J. Wilson alerted me to the existence of these files. Mike Feldman and others helped me identify them as SMT sockets.

The curious reader can find more about SMT sockets in /usr/lpp/X11/README.SMT.

#### 4.6 Why does AIX lsof start so slowly?

When AIX lsof starts it compares the running kernel's identity to the one for which it was built, using /usr/bin/oslevel. That comparison can sometimes take a long time to complete, depending on the system's maintenance level and how recently it was examined with oslevel.

AIX revisions 4.67 and above for AIX 5 and above don't use oslevel to determine the kernel identity. They use uname(2) instead, and it is much faster.

You can skip the oslevel test by suppressing warning messages with lsof's -w option. Doing that carries with it the risk of missing other warning messages, however.

You can also disable the kernel identity check by disabling the definition of the HASKERNIDCK symbol by editing AIX machine.h header file or by using the Customize script to disable it.

See the "Why does lsof warn "compiled for x ... y; this is z.?" section for more information.

#### 4.7 Why does exec complain it can't find libc.a[shr.o]?

When you try to execute lsof you may get this complaint:

```
exec(): 0509-036 Cannot load program ./lsof because of
the following errors:
0509-022 Cannot load library libc.a[shr.o].
0509-026 System error: A file or directory in
the path name does not exist.
```

This is probably the result of making lsof when the LIBPATH environment variable contained a directory path that doesn't contain libc.a. You can see what LIBPATH contained when lsof was made by using the dump application on lsof. For example, if LIBPATH contained /foo/bar when lsof was made, you will see this (partial) dump output:

```
$ dump -H lsof
...
***Import File Strings***
INDEX PATH          BASE      ...
0    /foo/bar
```

To correct the problem, revisit the lsof source directory and remake lsof this way:

```
$ unset LIBPATH; make (sh or ksh)
or
% unsetenv
LIBPATH; make (csh or tcsh)
```

#### 4.8 What does lsof mean when it says, "no PCB, CANTSENDMORE, CANTRCVMORE" in a socket file's NAME column?

When an AIX application calls shutdown(2) on an open socket file, but hasn't called close(2) on the file, the file will remain visible to lsof as an open socket file without any extended protocol information.

Lsof reports that state in the NAME column by saying that there is "no PCB" (Protocol Control Block) for the protocol (e.g., TCP in the NODE column). If the open socket file has the state variables SO\_CANTSENDMORE and SO\_CANTRCVMORE set -- i.e., from the shutdown(2) call -- lsof reports them with the CANTSENDMORE and CANTRCVMORE notes in the NAME column.

4.9 When the -X option is used on AIX 4.3.3, why does lsof disable it, saying "WARNING: user struct mismatch; -X option disabled?"

The -X option causes lsof to read the loader information of the user structure from virtual memory via the readx() system call. It does that with the user structure definition from <sys/user.h> that was compiled into the lsof executable.

On AIX 4.3.3 there are two different user structure definitions in two separate <sys/user.h> header files, distributed at different times by IBM. If lsof was compiled with one and the kernel on which lsof is being run was compiled with the other, lsof normally won't get correct loader information when it calls readx().

In an attempt to compensate for that difference, lsof makes an independent check of the loader information by getting the user structure's open file count via readx() and comparing it to the open file count obtained independently via getprocs(). When the two counts don't match, lsof tries to read the count (and re-read the loader information) with two offsets, based on observed differences between the two user structures.

When one of the three attempts produces a correct open file count, lsof uses its corresponding offset on subsequent readings of the loader information.

When none of the three attempts produces a correct open file count, lsof issues the WARNING message and disables -X processing.

To eliminate this problem, obtain an lsof binary that matches the kernel of the AIX 4.3.3 system where you want to run lsof. Compiling lsof on the target system is the preferred way to get a matching binary.

4.10 Why doesn't the -X option work on my AIX 5L or 5.[123] system?

If your AIX 5L or 5.[123] system uses the ia64 architecture, lsof needs setuid-root permission to be able to do the processing that -X requires.

Check the output of ``uname -a`` to determine the architecture type.

The work-around is to give lsof setuid-root permission.

#### 4.11 Why doesn't /usr/bin/oslevel report the correct AIX version?

The oslevel man page says, "The oslevel command reports the level of the operating system using a subset of all filesets installed on your system."

You can see which fileset is below the expected level with oslevel's

-l option. For example, if you believe your system is at AIX level 4.3.3, but oslevel reports 4.3.2, use this oslevel command to find the filesets below 4.3.3:

```
$ /usr/bin/oslevel -l 4.3.3.0
```

If you don't know what level argument to supply to oslevel's -l option, use oslevel's -q option first.

##### 4.11.1 Why doesn't /usr/bin/oslevel report the correct AIX version on AIX 5.1?

The subset list for oslevel on AIX 5.1 seems to include at least two filesets, `xlsmplib.msg.en_US.rte` and `xlsmplib.rte`, that do not install from AIX 5.1 media with a 5.1.0.0 level. Hence, oslevel reports 5.0.0.0 instead of the expected 5.1.0.0.

If either `xlsmplib.msg.en_US.rte` or `xlsmplib.rte` is installed, lsof's Configure script and run-time tests will identify the AIX version incorrectly. The run-time test will issue a complaint message of this form:

```
lsof: WARNING: compiled for AIX version xxx; this is yyy.
```

You can correct the Configure test by pre-defining the oslevel value, setting the correct value in the `LSOF_VSTR` environment variable before running the Configure script -- e.g., to pre-define AIX 5.1 when using ksh, do this:

\$ LSOF\_VSTR=5.1.0.0 Configure -n aix

You can't affect oslevel output without uninstalling xlsmp.msg.en\_US.rte and xlsmp.rte. If you can't do that, you'll have to put up with the run-time complaint.

#### 4.12 Why does lsof for AIX 5.1 or above Power architecture complain about kernel bit size?

When you run an lsof binary on an AIX 5.1 or above Power system, it might complain:

```
lsof: FATAL: compiled for a 32 bit kernel.
```

```
The bit size of this kernel is 64.
```

or

```
exec: 0509-036 Cannot load program ./lsof because of  
the following errors:
```

```
0509-032 Cannot run a 64-bit program on a 32-bit  
machine.
```

Starting at lsof revision 4.61, lsof binaries for Power architecture systems running AIX 5.1 or above are closely tied to the kernel bit size. lsof must do that so it can read and understand kernel structures.

lsof's

Configure script tunes the lsof configuration so that the binary built in the make(1) step is adjusted to the kernel bit size.

An lsof binary knows the bit size for which it was constructed, tests the bit size of the kernel under which it is running, and objects if the two sizes don't match. To see the bit size for which lsof was constructed, run it with its -v option and look for these lines in the output:

```
configuration info: 32 bit kernel
```

or

```
configuration info: 64 bit kernel
```

(Note: these lines will appear only in -v output for AIX 5.1 and above lsof binaries, built for Power architecture.)

You can see the kernel bit size test method in the aix stanza of the lsof Configure script and in the get\_kernel\_access() function of the lsof .../dialects/aix/dproc.c source file.

There is more information on pre-defining the kernel bit size when building lsof in Configure, 00PORTING, and 00XCONFIG.

The only work-around is to use an lsof binary built to match the running kernel bit size.

#### 4.13 What can't gcc be used to compile lsof on the ia64 architecture for AIX 5 and above?

Gcc can't be used to compile lsof on the ia64 architecture for AIX 5 and above because I haven't had access to a system that has a working gcc compiler. The gcc compiler on my one and only ia64 AIX 5.1 test system, provided by IBM, didn't work at all.

#### 4.14 Why does lsof get a segmentation fault when compiled with gcc for a 64 bit Power architecture AIX 5.1 kernel?

When lsof is configured with the lsof "aixgcc" Configure abbreviation, the resulting lsof executable may cause a segmentation violation when it is run. I've observed this with gcc version 2.9-aix43-010414-7.

As far as I have been able to tell, the segmentation fault is the result of a gcc compilation, loading, or library error. Watching lsof run with gcc's companion debugger, gdb, shows no error in the lsof source code that might explain the fault.

The only work-around I know is to use the IBM C compiler in place of gcc -- i.e., use the "aix" lsof Configure abbreviation.

#### 4.15 Why does lsof ignore AFS on my AIX system?

The lsof Configure script quits on AIX when AFS is present, the AIX version is greater than 4.3.3.0 or the AFS version is greater than 3.5. That's because I have no test systems available for those AIX and AFS version combinations.

When the lsof Configure script detects an AIX and AFS version combination that is unsupported, it will report:

```
!!!FATAL: Lsof does not support AFS on this combination of
AIX and AFS versions. To disable AFS, set the
```

value of the AIX\_HAS\_AFS environment variable to "no".

The only work-around is to set the AIX\_HAS\_AFS environment variable as explained in the error message:

```
$ AIX_HAS_NSF=no; export AIX_HAS_NSF
$ ./Configure -n aix
```

#### 4.16 Why does lsof report "system paging space is low" and exit?

When AIX paging space runs low, the AIX kernel sends a SIGDANGER signal to processes, warning them that they should reduce their memory usage.

When lsof receives that signal, it issues the following fatal error message and exits:

```
lsof: FATAL: system paging space is low.
```

A possible work-around is to limit the amount of information lsof must cache in its process memory with the "-c", "-g", "-l" and "-p" options.

Also see the answer to the "What can be done when lsof reports no more space?" question.

#### 4.17 Why does lsof have a compilation problem on AIX 5.3 above maintenance level 1?

On some AIX 5.3 systems with maintenance levels 2 and higher installed, lsof 4.77 and below may not compile properly. The compiler complains the snapshotObject structure definition, needed by <j2/j2\_inode.h>, is missing.

That problem is fixed in the 4.78 revision.

## 5.0 Apple Darwin Problems

### 5.1 What do /dev/kmem-based and libproc-based mean?

Lsof for Apple Darwin currently uses /dev/kmem to read kernel data structures from which it gathers and reports open file information. That version of lsof is called /dev/kmem-based lsof.



At an upcoming release lsof will use a library called libproc to obtain information about open files. That version of lsof will be called libproc-based lsof.

The /dev/kmem-based lsof sources may be found in the kmem subdirectory of the dialects/darwin branch of the lsof source tree. When the supporting version of Apple Darwin is released, the libproc-based lsof sources will be found in .../dialects/darwin/libproc.

## 5.2 /dev/kmem-based Apple Darwin Questions

### 5.2.1 Why does Configure ask for a path to the Darwin XNU kernel header files?

When lsof was ported to Apple Darwin by Allan Nathanson at revision 4.53, some kernel header files needed by lsof weren't being exported by the developers. (That's still true at lsof revision 4.76.)

At first a shell script that Allan provided would get the missing header files by checking them out from the CVS root. Although the script was updated from time to time, eventually the re-organization of Darwin sources has made it impossible to update the script to do an automatic download of the missing header files.

At lsof revision 4.69 and above it is necessary for the Darwin lsof builder to download the Darwin XNU kernel headers before attempting to build lsof. The download may be done via a web browser, starting at this URL:

<http://www.opensource.apple.com/darwinsource/index.html>

Once there, select the link to the Mac OS X version that matches the one on the system where lsof is to be built.

Follow that link's "[ Source ]" link. Once there, select the tar.gz link of the xnu\* entry near the bottom of the page. That entry should have a name that matches the xnu\* name shown by ``uname -a`` -- e.g., if `uname` reports:

```
$ uname -a
... root:xnu/xnu-517.7.21 ...
```

Then the appropriate xnu\* entry is xnu-517.7.21. Clicking

its link should lead to an "Apple Open Source" page requesting an Apple ID and password.

Enter

them if they're available. If an Apple ID and password are not available, get them by following the instructions on the page -- i.e., follow the `signin.apple.com` link.

Once a valid Apple ID and its password have been entered, the download will begin. Select the saving of the downloaded `xnu*.tar.gz` file in an appropriate place on the Mac OS X system.

Once the download completes, install it. Use `gunzip` to decompress the download and `tar` to extract the archive -- e.g.,

```
$ gunzip -c xnu-517.7.21.tar.gz | tar xf -
```

Remember the absolute path to the extracted archive. That is its installed place. E.g., if the `xnu-517.7.21.tar` archive was extracted to the `lsf` builder's home directory, its full installation path will be something like:

```
~/xnu-517.7.21
```

Now run the `lsf` Configure script. When it asks for the path to the installed Darwin XNU kernel header files, supply the path to the `gunzip'd` and extracted `xnu*` archive -- e.g., `~/xnu-517.7.21`.

The

path to the Darwin XNU kernel headers may also be supplied to the Configure script in the `DARWIN_XNUDIR` environment variable, eliminating the need to enter it interactively -- e.g.,

```
$ DARWIN_XNUDIR=~/xnu-344.49 ./Configure -n darwin
```

#### 5.2.1.1 Why does Configure complain that Darwin XNU kernel header files are missing?

These are some reasons why the `lsf` Configure script might claim that Darwin XNU header files are missing:

- \* The wrong path to them was specified.
- \* The files and directories in the path are not readable and searchable -- i.e., check the modes and ownerships.

\* The downloaded archive doesn't match the Mac OS X version of the system.

If in doubt, revisit the Darwin XNU kernel header file download instructions in the answer to the question "Why does Configure ask for a path to the Darwin XNU kernel header files?"

If Configure still can't find Darwin XNU kernel header files, contact me via e-mail at <abe@purdue.edu> for help.

Make sure "lsf" appears in the "Subject:" line so my e-mail filter won't classify your letter as Spam.

#### 5.2.2 Why doesn't Apple Darwin lsf report text file information?

At the first port of lsf to Apple Darwin, revision 4.53, insufficient information was available -- logic and header files -- to permit the installation of VM space scanning for text files. As of lsf 4.70 it is still not available.

Text file support will be added to Apple Darwin lsf after the necessary information becomes available.

#### 5.2.3 Why doesn't Apple Darwin lsf support IPv6?

At the first port of lsf to Apple Darwin, revision 4.53, Apple Darwin lacked IPv6 support. IPv6 became available in Apple Darwin version 1.5 and support for it was added to lsf then.

#### 5.2.4 Why does lsf complain about a mismatch between the release for which lsf was compiled and the booted Mac OS X release?

When lsf is started on the "Gold Master" Darwin release (aka Mac OS X), it complains:

```
lsf: compiled
for 1.0 release; this is 1.3.2.
```

This happens because the lsf binary released with Mac OS X was built on a system whose release number (1.0) doesn't match that of the released system -- usually 1.3.x. Lsf makes this check because UNIX dialect OS changes are often accompanied by header file changes that affect lsf.

In this specific case, this error can be ignored. If you

don't want to do that, get the lsof distribution and build lsof so its built-on and running-on Mac OS X release numbers match.

#### 5.2.5 Why does lsof for Apple Darwin 8 and higher report "stat(...): ..." in the NAME column?

Lsof for Apple Darwin 8 may report messages like these in the NAME column:

```
stat(/private/var/run/asl_prune): No such file or directory
or
stat(/private/var/db/netinfo/local.nidb/Config): Permission denied
```

Those messages indicate that lsof was unable to collect open file information for the paths enclosed in "stat(...)" with the stat(2) function, because the function encountered the reported error.

A work-around for the "Permission denied" error is to run lsof with elevated privileges -- e.g., when logged on as the super user.

If the stat(2) error message is "No such file or directory", the file probably has been unlinked (removed) and there is no lsof work-around.

#### 5.2.6 What are the limitations of Apple Darwin lsof link count reporting?

Lsof for Apple Darwin cannot report link count information reliably.

For Apple Darwin below 8 link count information is not always available in the kernel node structures available to lsof.

When link count information is available, however, it includes link counts of zero. Thus, using lsof's +L1 option may result in the finding of some files whose link counts are zero.

Lsof can report only some link count information for Apple Darwin 8 and above. Link count information is only available for files where lsof can assemble the full file path and has permission to apply stat(2) to it.

(See the answer to the "Why does lsof for Apple Darwin 8 and higher report "stat(...): ..." in the NAME column?" question for more information on stat(2) failures.)

Apple Darwin 8 and above files that have been unlinked and thus have a link count of zero cannot be found by `stat(2)` -- i.e., `stat(2)` returns a "No such file or directory" error. As a result `ls` never displays link counts of zero and the use of `ls`'s `+L1` option to find them always fails.

### 5.3 Libproc-based Apple Darwin Questions

## 6.0 BSD/OS BSDI Problems

### 6.0.5 Statement of deprecation

As of `ls` revision 4.76 support for BSDI BSD/OS has been dropped. The 4.76 distribution of `ls` for BSDI BSD/OS may be found on `lsf.itap.purdue.edu` in `pub/tools/unix/lsf/OLD/src`.

## 7.0 DEC OSF/1, Digital UNIX, and Tru64 UNIX Problems

### 7.1 Why does `ls` complain about non-existent `/dev/fd` entries?

When you run `ls` for Digital UNIX 3.2, `ls` may complain:

```
ls: can't lstat /dev/fd/xxx: No such file or directory
```

```
ls: can't lstat /dev/fd/yyy: No such file or directory
```

(Or it may warn about other missing `/dev/fd` paths.) When you do an `ls /dev/fd` none of the missing paths are listed.

This is caused by a bug in the DEC library function `getdirenties()`. For some reason, when `/dev/fd` is a file system mount point, `getdirenties()` returns an incorrect size for it to `readdir()`. (`ls` calls `readdir()` in its `ddev.c readdev()` function.) Because of the incorrect size, `readdir()` goes past the end of the `/dev/fd` directory buffer, encounters random paths and returns them to `ls`. `ls` then attempts to `lstat(2)` the random paths, gets error replies from `lstat(2)`, and complains about the paths.

Duncan McEwan discovered this error and has reported it to DEC. Duncan also supplied an alternate `readdir()` function as a work-around. I've incorporated his `readdir()` in `dialects/osf/ddev.c` (as the static `ReadDir()` function) with some slight modifications, and enabled its use when the `USELOCALREADDIR`

symbol is defined.

The Configure script defines USELOCALREADDIR for Digital UNIX version and 3.2. If you don't want to use Duncan's local readdir() function, edit the Makefile and remove -DUSELOCALREADDIR from the CFGF string. When DEC releases a corrected getdirentries() function, I'll modify the Configure script to stop defining USELOCALREADDIR.

## 7.2 Why does the Digital UNIX V3.2 ld complain about Ots\* symbols?

When you compile lsof on your Digital UNIX V3.2 system, ld may complain:

```
ld:
Unresolved:
knlist
_OtsRemainder32Unsigned
_OtsDivide64Unsigned
_OtsRemainder64Unsigned
_OtsDivide32Unsigned
_OtsMove
_OtsDivide32
_OtsRemainder32
*** Exit 1
```

Chris Eleveld reports this happens on Digital UNIX V3.2 systems after the Fortran compiler has been installed.

The best work-around seems to be to remove -lmdl from the CFGF string in the Makefile produced by Configure -- i.e., change:

```
CFGF= -lmdl
to
```

```
CFGF=
```

According to the V3.2 man page for nlist(3), this shouldn't work, but my testing shows that it does. Although I haven't been able to test this second work-around, you might try adding -lots to CFGF, rather than removing -lmdl -- i.e., change:

```
CFGF= -lmdl
to
CFGF= -lmdl -lots
```

WARNING: my testing also shows that the V2.0 nlist(3) man page means what it says when it calls for -lml -lsof loaded without -lml under V2.0 can't locate the proc (process) table address.

DON'T REMOVE -lml FROM THE DIGITAL UNIX V2.0 MAKEFILE.

If you run into this problem, please let me know what problem you encountered and how you solved it.

### 7.3 Why can't lsof locate named pipes (FIFOs) under V3.2?

While lsof for V3.2 can report on named pipes (FIFOs), it can't find them by name. That appears to happen because of the way the V3.2 kernel lstat(2) function reports named pipe device numbers.

The V3.2 kernel reports the device number as 0xffffffff, while the kernel structures for named pipes that lsof examines contain the device number of the file system on which the named pipe resides.

Consequently, lsof can't match the device and inode number pair it receives from applying lstat(2) to the named pipe with any device and inode number pair it finds when scanning kernel structures.

I don't have a work-around. You can, of course, ask for full lsof output and use a post-processing filter (e.g., grep) to locate the named pipe of interest.

This problem doesn't exist under V2.0.

### 7.4 Why does lsof use the wrong configuration header files?

For example, why can't the lsof compilation find cpus.h?

DEC OSF/1, Digital UNIX, and Tru64 UNIX configuration header files describe the hardware and software environment for which your kernel boot file was constructed. For example, /sys/<name>/cpus.h defines the number of CPUs in its NCPUS #define.

Lsof searches for the configuration header file subdirectory in /sys (/usr/sys for Digital UNIX version 4.0 and Tru64 UNIX) by converting the first host name component to capital letters -- e.g., TOMIS is derived from tomis.bio.purdue.edu.

If that subdirectory exists, lsof uses header files from it. (Configure reports what subdirectory is being used.)

If Configure doesn't find a host-name derived subdirectory, it prompts you for the entry of a subdirectory name. If you can't find one, quit Configure and run the kernel generation process to create a proper configuration subdirectory. If you don't identify a proper configuration subdirectory and you try to compile lsof, the compiler will complain about missing header files -- e.g., a missing cpus.h.

Once you have located or generated a proper configuration subdirectory, rerun Configure. If you have generated a configuration subdirectory whose name is derived from the host name, Configure will find and use it. If not, you will have to specify its name to Configure.

#### 7.5 Why does lsof indicate incomplete paths with "--" for Tru64 UNIX 5.1 files?

When lsof can't find a component of a path in the kernel's name cache (aka DNLC), or can't determine that the left-most component has as its parent the file system root, it uses an "incomplete path" notation. That notation begins with the file system root name, followed by "--", followed by the consecutive path name components lsof was able to find in the DNLC -- e.g., "/ -- init".

Because the DNLC was significantly redesigned in Tru64 UNIX 5.1, lsof's handling of the cache had to be completely redone. As part of the DNLC redesign a name cache entry parameter lsof formerly used to locate the file system root of a path was removed. With help from Chang Song I've been able to implement an alternate method for detecting the root of these file system types: AdvFS (MSFS), CDFS, DVDFS, FDFS, NFS, NFS3, and UFS.

When lsof doesn't know how to identify the root for a file system type, it will resort to the "--" incomplete path notation.

#### 7.6 Why doesn't lsof report link count, node number, and size for some Tru64 5.x CFS files?

lsof reports link count, node number, and size for open



CFS files as recorded in their kernel node structure's cached attributes. Sometimes not all attributes are cached on the system where lsof runs, so lsof cannot report them.

### 7.7 Why does lsof say it can't read the kernel name list or proc table on Digital UNIX 4.x or Tru64 UNIX?

By default on Digital UNIX 4 and Tru64 UNIX lsof reads the addresses for kernel symbols with the knlist(3) function. That function can fail, for example, when the kloadsv daemon isn't running or is malfunctioning. When that happens, lsof may abort with one of these error messages:

```
lsof: can't read kernel name list from knlist(3): ...
```

or

```
lsof: can't read proc table info
```

The first message suggests a complete knlist(3) or kloadsv failure; the second, a partial one.

If you know the name of the file from which the running system was booted, e.g., /vmunix, you can use lsof's -k option to direct it to read kernel symbol addresses from the name list of that file --

```
$ lsof -k /vmunix ...
```

If that works, then knlist(3) is malfunctioning and you need to fix it.

## 8.0 FreeBSD Problems

### 8.1 Why doesn't lsof report on open kernfs files?

Lsof doesn't report on open FreeBSD kernfs files because the structures lsof needs aren't defined in the kernfs.h header file in /sys/misc/kernfs.

### 8.2 Why doesn't lsof work on my FreeBSD system?

If lsof doesn't work on your FreeBSD system, first make sure you have the latest lsof revision. See the answer to the "Where do I get lsof?" question for information on how to get the latest lsof revision.

Once you have gotten the latest lsof revision, Configure

and make it. If Configure fails -- e.g., it complains about an unknown FreeBSD version -- then lsof probably hasn't been ported to your FreeBSD version yet, and there's no need to go any further. Follow the answer to the "How do I report an lsof bug" to report the Configure complaint to me.

If you are able to Configure and make lsof, run its test suite. (See the answer to the "Is there a test suite?" question for more information on how to use lsof's test suite.)

If lsof still fails, make sure your kernel sources, kernel header files, kernel boot file, standard header files and libraries are synchronized. They should all be built from the same CVS refresh. (Don't forget to do a "make buildworld" followed by a "make installworld".) If they aren't, then the KVM library or lsof may be using kernel structure definitions that don't match the booted kernel; or lsof may fail to compile properly because of header files in /usr/src/sys/sys and /usr/include/sys that don't match.

If you have synchronized your kernel, header files and libraries, and still can't get lsof to work, follow the steps in the answer to the "How do I report an lsof bug" question to report the problem to me.

### 8.3 Why doesn't lsof work on the RELEASE version of CURRENT?

Lsof tracks the CURRENT release of the current leading edge FreeBSD version, because my access to leading edge FreeBSD is limited to FreeBSD.org reference systems, all running the CURRENT release.

Sometimes that tracking leads to changes in lsof that won't work on an earlier RELEASE version of the current leading edge version.

When that happens, please send e-mail to me <abe@purdue.edu>. Make sure "lsof" appears in the "Subject:" line so my e-mail filter won't classify your letter as Spam.

### 8.4 Why does kvm\_open() complain it can't find some file?

If lsof issues this complaint:

```
lsof: kvm_open(execfile=/boot/kernel/kernel,
corefile=/dev/mem: No such file or directory
```

Your FreeBSD system might not have a /dev/mem device. If not, create one -- e.g., as root do:

```
# mknod /dev/mem c <major> 0
# chmod 440 /dev/mem
# chgrp kmem /dev/mem
```

For <major> use /dev/kmem's major device number.

You may have to run kldload, too -- again as root do:

```
# kldload mem
```

## 8.5 FreeBSD ZFS Problems

### 8.5.1 Why does FreeBSD lsof report "WARNING: no ZFS support has been defined."?

Lsof issues that message when it detects a file on a ZFS file system, but has not been built with support for ZFS. Lsof's Configure script detects support can be added for ZFS when it finds this file:

```
/usr/src/sys/contrib/opensolaris/uts/common/fs/zfs/sys/zfs_znode.h
```

That header file and others in the OpenSolaris files in /usr/src enable lsof to extract information about ZFS files from the kernel structures associated with them.

### 8.6 Why can't Configure create lsof\_owner.h for FreeBSD 6 and above?

Lsof may report:

```
Creating ./lockf_owner.h from /usr/src/sys/kern/kern_lockf.c
FATAL ERROR: can't read /usr/src/sys/kern/kern_lockf.c
FATAL ERROR: ./lockf_owner.h creation failed (see 00FAQ)
or
Creating ./lockf_owner.h from /usr/src/sys/kern/kern_lockf.c
```

```
FATAL ERROR: ./lockf_owner.h creation failed (see 00FAQ)
```

Those messages mean that lsof's Configure script failed to create a local header file, ./lockf\_owner.h, needed to use the new kernel file locking code of some versions of FreeBSD 6 and

above.

The changes that implement that new locking code alter the lockf structure in `<sys/lockf.h>` and introduce a new structure, `lockf_entry`, to that header file. When Configure detects the presence of the `lockf_entry` definition in `<sys/lockf.h>`, it tries to construct the local header file, `./lockf_owner.h`.

Configure has to do that because an unfortunate side effect of the new kernel file locking code is that `<sys/lockf.h>` doesn't contain the `lockf_owner` structure definition referenced in its own lockf structure. Lsof needs to access elements of that `lockf_owner` structure to determine if a lock belongs to the process that has a file open.

The missing `lockf_owner` structure definition is in the kernel source file, typically `/usr/src/sys/kern/kern_lockf.c`. Configure tries to extract the `lockf_owner` structure definition from `kern_lockf.c` into lsof's local header file, `./lockf_owner.h`. If Configure can't do that, it reports:

```
FATAL ERROR: ./lockf_owner.h creation failed
```

If Configure can't even read `kern_lockf.c`, it first reports:

```
FATAL ERROR: can't read /usr/src/sys/kern/kern_lockf.c
```

The work-around for this problem is to update the FreeBSD kernel `/usr/src` tree (e.g., do a CVSup or csup) on the system where lsof is to be built and then do a "make buildworld" followed by a "make installworld".

#### 8.6.1 Why are there lockf structure compiler errors for FreeBSD 6.0 and higher lsof?

If, when compiling lsof, the compiler complains with error messages like:

```
dnode.c: In function 'get_lock_state':
dnode.c:113: error: 'struct lockf' has no member named 'lf_flags'
dnode.c:115: error: 'struct lockf' has no member named 'lf_id'
...
```

Then lsof is being built on a system that has new kernel file locking code and lsof's Configure script failed to build a local `lockf_owner.h` header file with a structure definition

lsof needs.

See the "Why can't Configure create lsof\_owner.h for FreeBSD 6 and above?" section for more information and a work-around.

#### 8.6.2 Why don't /usr/src/sys/sys/lockf.h and /usr/include/sys/lockf.h match?

This mismatch can cause the errors explained in the answer to the "Why are there lockf structure compiler errors for FreeBSD 6.0 and higher lsof?" question.

If /usr/src/sys/sys/lockf.h has been updated with a CVSup or csup, the new lockf.h won't be propagated to /usr/include/sys until the "make buildworld" and "make installworld" steps have been completed.

### 9.0 HP-UX Problems

#### 9.1 What do /dev/kmem-based and PSTAT-based mean?

Lsof for HP-UX 11.0 and below uses /dev/kmem to read kernel data structures from which it gathers and reports open file information. That version of lsof is called /dev/kmem-based lsof.

##### Starting

with HP-UX 10.10, finding definitions for the necessary kernel structures became more difficult as HP no longer distributed header files in /usr/include that defined all kernel structures. So I started "inventing" structure definitions by using Q4 to display them.

By HP-UX 11, the process of invention became extremely intensive to support. Following a patch to the ipc\_s structure in early 1999, my invented definition of that structure became incorrect. Although I was able to devise a work-around test for the patch with Q4, it was clear that my inventions were bound to cause more problems.

Discussion with HP about the patch led to my proposing that an lsof API in the HP-UX kernel was the proper solution. Much to my surprise, HP agreed. I believe Carl Davidson was the prime mover behind that decision, but I know others participated, among them Louis Huemiller, Rich Rauenzahn, and Sailu Yallapragada. I am indebted to these folks and HP for their

willingness to do this work.

The API was added to the PSTAT interface in a project named PEGLE, Pstat Enhancements for Glance and Lsof. Louis and Sailu did the bulk of the design and implementation work and testing began in March, 2000

HP-UX 11.11 is the first version that provides PSTAT support for lsof. HP-UX versions in between 11.0 and 11.11 -- all Beta versions as far as I can determine -- have no lsof support.

See the "PSTAT-based HP-UX lsof Questions" section for questions and answers specific to PSTAT-based HP-UX lsof. The next section, "Why doesn't a /dev/kmem-based HP-UX lsof compilation use -O?" covers /dev/kmem-based HP-UX lsof.

The /dev/kmem-based lsof sources may be found in the kmem subdirectory of the dialects/hpux branch of the lsof source tree. The PSTAT-based lsof sources may be found in .../dialects/hpux/pstat.

## 9.2 /dev/kmem-based HP-UX lsof Questions

The sources for /dev/kmem-based lsof for HP-UX may be found in lsof\_<revision>/dialects/hpux/kmem.

Lsof's

Configure shell script decides to use these sources when it finds that the /usr/include/sys/pstat subdirectory doesn't exist.

Lsof can be forced to use the /dev/kmem sources by setting "/dev/kmem" in the HPUX\_BASE environment variable. Consult the Configure shell script and OXPORTING for more information.

### 9.2.1 Why doesn't a /dev/kmem-based HP-UX lsof compilation use -O?

If you only have the standard (bundled) HP-UX C compiler and haven't purchased and installed the optional one, then you can't use cc's -O option. The HP-UX cc(1) man page says this:

"Options

Note that in the following list, the cc and c89 options -A , -G , -g , -O , -p , -v , -y , +z , and +Z are not supported by the C compiler provided as part of the standard HP-UX operating system. They are supported

by the C compiler sold as an optional separate product."

Lsof's Configure script tries to detect what C compiler product you have installed by examining your compiler. If that examination reveals a standard (bundled) compiler, lsof avoids using -O.

If the Configure compiler test fails, the C compiler will complain that it doesn't support -O. You can suppress that complaint with this make invocation:

```
$ make DEBUG=""
```

#### 9.2.2 Why doesn't the /dev/kmem-based CCITT support work under 10.x?

Pasi Kaara, who originally provided the HP-UX CCITT support, reports that it no longer works under HP-UX 10.x. Consequently, at lsof revision 4.02 it has been disabled.

#### 9.2.3 Why can't /dev/kmem-based lsof be compiled with `cc -Aa` or `gcc -ansi` under HP-UX 10.x?

Some HP-UX 10.x header files, needed by lsof, can't be compiled properly in ANSI\_C mode; structure element definition and alignment problems result. The `f_offset` member of the file structure, for example, is incorrect.

This ANSI-C obstacle extends to using the `-Aa` option of the HP C compiler and the `-ansi` option of `gcc`.

#### 9.2.4 Why does /dev/kmem-based lsof complain about no C compiler?

Lsof's Configure script looks in `/bin` and `/usr/ccs/bin` for an HP C compiler, because it needs to know if the compiler is the standard (bundled) one or the optional separate product. If it finds no compiler in either place, Configure quits after complaining:

```
No executable cc in /bin or /usr/ccs/bin
```

If you don't have a C compiler in either of these standard places, you should consider installing it. If you have `gcc` installed, you can use it by declaring the ```hpuxgcc''` abbreviation to lsof's Configure script.

If you have a C compiler in a non-standard location, you

can use the HPUX\_CCDIR[12] environment variables to name the path to it. Consult the 00XCONFIG file of the lsof distribution for more information.

### 9.2.5 Why does Configure complain about q4 for /dev/kmem-based lsof for HP-UX 11?

When you run Configure on an HP-UX 11 system, it may complain:

```
!!!ERROR!!! !!!ERROR!!! !!!ERROR!!! !!!ERROR!!!  
Configure can't  
use /usr/contrib/bin/q4 to examine the ipis_s  
structure. You must do that yourself, report the result in  
the HPUX_IPC_S_PATCH environment variable, then repeat the  
Configure step. Consult the Configure script's use of  
/usr/contrib/bin/q4 and the 00XCONFIG file for information  
on ipis_s testing and the setting of HPUX_IPC_S_PATCH.  
!!!ERROR!!! !!!ERROR!!! !!!ERROR!!! !!!ERROR!!!
```

This message states that Configure cannot use q4 from /usr/contrib/bin to examine the kernel's boot image for the ipis\_s structure. Maybe q4 hasn't been installed, or perhaps Configure can't execute it.

lsof needs to gather information about ipis\_s to determine if the ipis\_s structure is defined in the kernel boot image, if the ipis\_s structure of the kernel boot image has an ipis\_msgsqueued member, and if the ipc\_s structure of the kernel boot image uses has an ipc\_ipis member.

The ipis\_s structure isn't described in any header file HP-UX releases with HP-UX 11. It appears in the private lsof header file ../dialects/hpux/kmem/hpux11/ipc\_s.h. lsof gets local and remote connection addresses (IP and port numbers) from ipc\_s, so an incorrect ipc\_s definition may cause incorrect reporting of TCP/IP connection addresses. It definitely will cause incorrect reporting on 32 bit kernels. In any case lsof should be compiled with a correct ipc\_s definition no matter the kernel bit size, so the Configure script always tests for it when the HP-UX version is 11.

For lsof's Configure script to gather the necessary ipis\_s information q4 needs to be installed in /usr/contrib/bin and the kernel boot image, /stand/vmunix, needs to have been processed with pxd. If either is untrue, lsof issues the above error message, perhaps preceded by q4 messages.



(Note: lsof's use of q4 may also fail if q4 can't execute nm -- e.g., it can't find /usr/bin/nm, or there is a conflicting, private version of nm earlier in the path.)

If /stand/vmunix hasn't been processed by pxdB, the q4 messages will include:

```
q4: (error) vmunix not pxdB'd
or
q4: (warning) /stand/vmunix has not been processed by pxdB.
```

It's possible to make a suitable private copy of /stand/vmunix for configuring lsof. That requires /opt/langtools/bin/pxdB or the q4 version of pxdB from /usr/contrib/bin/q4pxdB. The path to the result is supplied to the lsof Configure script in the HPUX\_BOOTFILE environment variable. Configure still requires /usr/contrib/bin/q4.

The following sample Bourne shell commands make a private copy of /stand/vmunix in /tmp, process it with pxdB or q4pxdB, and supply its path to lsof's Configure script in HPUX\_BOOTFILE.

```
$ cp /stand/vmunix /tmp/vmunix.lsof

$ /opt/langtools/bin/pxdB /tmp/vmunix.lsof
or
$ /usr/contrib/bin/q4pxdB /tmp/vmunix.lsof

... pxdB messages ...
$ HPUX_BOOTFILE=/tmp/vmunix.lsof Configure -n hpux
```

It may also be necessary to use q4 outside the lsof Configure script. In that case q4 can be used to determine the state of ipis\_s and ipc\_s with these q4 commands:

```
$ /usr/contrib/bin/q4 /stand/vmunix
...
q4> fields -c struct ipc_s
...
q4> fields -c struct ipis_s
```

Look in the q4 output for the ipc\_ipis member of the ipc\_s structure, and look in the q4 output for the ipis\_s structure for the ipis\_msgsqueued member. If ipc\_s has ipc\_ipis but ipis\_s lacks ipis\_msgsqueued, set HPUX\_IPC\_S\_PATCH environment

variable to "1". If ipc\_s has ipc\_ipis and ipis\_s has ipis\_msgsqueued, set HPUX\_IPC\_S\_PATCH to "2" -- e.g.,

```
$ HPUX_IPC_S_PATCH=1 Configure -n hpux
```

or

```
$ HPUX_IPC_S_PATCH=2 Configure -n hpux
```

If ipc\_s has no ipc\_ipis member, set HPUX\_IPC\_S\_PATCH to "N" -- e.g., use this Configure step:

```
$ HPUX_IPC_S_PATCH=N Configure -n hpux
```

9.2.6 When compiling /dev/kmem-based lsof for HP-UX 11 what do the "aCC runtime: ERROR..." messages mean?

When the lsof Makefile asks the HP-UX unbundled compiler to load lsof, it may complain:

```
/bin/cc -o lsof -DHPUXV=1100 -DHASVXFS -DHPUXKERNBITS=64 \  
-I/home/abe/src/lsof4/dialects/hpux/kmem/hpux11 +DD64 \  
-DHAS_IPC_S_PATCH=2 -I/home/abe/src/lsof4/dialects/hpux/kmem \  
-DLSOF_VSTR="B.11.00" -g dfile.o dmnt.o dnode.o dnode1.o \  
dnode2.o dproc.o dsock.o dstore.o arg.o main.o misc.o \  
node.o print.o proc.o store.o usage.o -L./lib -llsof -lelf \  
-lnsl  
aCC runtime: ERROR: Unexpected use of shared libraries  
aCC runtime: ERROR: Read aCC manpage, +A option  
/usr/lib/nls/loc/locales.1//is_IS.iso88591
```

This is a bug in the HP-UX national language support. (Notice the last message with "locales" in it?) Complain to HP -- then use this work-around before executing make:

```
$ unset LANG  
$ make
```

9.2.7 Why doesn't /dev/kmem-based lsof for HP-UX 11 report VxFS file link counts, node numbers, and sizes correctly?

This is usually the result of running an lsof binary whose revision number is less than 4.57 on a system that has OnlineJFS support installed. It can also happen with lsof 4.57 binaries when the OnlineJFS support with which they were built doesn't match the OnlineJFS status of the system on which they are run.

The OnlineJFS status of lsof 4.57 and higher binaries can be determined by running:

```
$ lsof -v 2>&1 | grep HASONLINEJFS
```

If that shell pipe produces output, lsof was compiled with OnlineJFS support enabled; no output, disabled.

If OnlineJFS is installed on an HP-UX 11 system the /sbin/fs/vxfs/subtype executable exists and outputs "vxfs3.3" when run.

The problem occurs because the optional OnlineJFS support installation doesn't update <sys/fs/vx\_inode.h>. Consequently lsof can be compiled with an incorrect definition of the vx\_inode structure and look for link counts, node numbers, and sizes in the wrong places in the structure.

The current response I have gotten from HP is that no <sys/fs/vx\_inode.h> update will be provided for OnlineJFS.

I've addressed this problem temporarily with a work-around (hack) in lsof revision 4.57.

#### 9.2.8 Why can't /dev/kmem-based lsof be built with gcc for 64 bit HP-UX 11?

When Configure is given the "hpuxgcc" abbreviation, the HP-UX version is 11, and the kernel bit size is 64, the lsof Configure script may abort with the messages:

```
!!!!!!!!!!!!!!!!!! FATAL ERROR !!!!!!!!!!!!!!!!!!!
```

```
APPARENTLY GCC CANNOT BUILD 64 BIT EXECUTABLES.  
A COMPILER MUST BE USED THAT CAN. SEE 00FAQ  
FOR MORE INFORMATION.
```

(This is the "more information" in 00FAQ.)

This means the Configure script compiled a test program with gcc the result wasn't an ELF-64 binary. lsof tries two gcc modes, one with no options and another with the -mlp64 option, before it concludes gcc can't be used.

See the "How can I acquire a gcc for building lsof for 64 bit HP-UX 11?" answer for information on where you might be able to get a gcc for HP-UX 11 that can produce ELF-64

executables.

### 9.2.8.1 How can I acquire a gcc for building lsof for 64 bit HP-UX 11?

Check this HP URL:

[http://h21007.www2.hp.com/dspp/tech/tech\\_TechSoftwareDetailPage\\_IDX/1,1703,547,00.html](http://h21007.www2.hp.com/dspp/tech/tech_TechSoftwareDetailPage_IDX/1,1703,547,00.html)

(That's one very long link; be careful you cut 'n paste it all.)

In November 2001 that URL led to a web page whose title was "gcc for hp-ux 11." The page offered a link for downloading a 64 bit gcc 3.0 compiler for HP-UX 11.0 and 11i. Rich Rauenzahn of HP installed that compiler on an HP test system he allows me to use and I successfully built a 64 bit lsof with it.

The HP package may install the 64 bit capable gcc in `/usr/local/pa20_64/bin/gcc`, so you may have to adjust your path or set the `LSOF_CC` environment variable to compensate.

### 9.2.9 Why does `/dev/kmem`-based lsof for HP-UX 11 report "unknown file system type" for some open files?

The lsof binary being used probably doesn't have support for the VxFS file system.

To confirm that, check ``lsof -v`` output for `"-DHASVXFS"`. If it's not present, lsof doesn't have VxFS support.

You

also need to establish that lsof really is complaining about VxFS files by checking the kernel boot file for the symbol associated with the hexadecimal address reported in the "unknown file system type" message -- e.g., `"v_op: 0x8711c8."` Use `nm(1)` to do that:

```
$ nm -x /stand/vmunix | grep 8711c8
```

If `nm` reports the symbol associated with the address is `vx_vnodeops`, then lsof is complaining about an open VxFS file.

The solution in that case is to build lsof yourself (The bundled C compiler will do it.), making sure that lsof's `Configure` script detects the presence of VxFS. `Configure` does that by finding these two header files:

```
/usr/include/sys/fs/vx_hpux.h
/usr/include/sys/fs/vx_inode.h
```

If the system where you are building lsof doesn't have those header files, but does have VxFS, you might be able to install the header files by installing the HP JournalFS package from the CoreOS CD -- in particular the file set JournalFS.VXFS-PRG and its associated patch, PHKL\_18543. (My thanks to Steve Bonds for that information.)

Finally, if you find that lsof isn't complaining about VxFS when it complains about an unknown file system type, send e-mail to me <abe@purdue.edu> for further assistance. Make sure "lsof" appears in the "Subject:" line so my e-mail filter won't classify your letter as Spam.

#### 9.2.10 Why does the ANSI-C compiler complain about comments in HP-UX 11 header files?

When compiling lsof on HP-UX 11, the HP ANSI-C compiler's pre-processor, cpp, may complain about comments in HP-UX header files -- e.g.,

```
cpp: "/usr/include/sys/cdfs.h", line 232: warning 2028:
Found comment inside comment started on line 232.
cpp: "/usr/include/sys/cdnode.h", line 196: warning 2028:
Found comment inside comment started on line 196.
cpp: "/usr/include/nfs/snodel.h", line 30: warning 2028:
Found comment inside comment started on line 30
```

This is not a problem with lsof. It is a problem with the HP-UX header files; they have non-compliant ANSI-C comment sequences in them -- e.g.,

```
<sys/cdfs.h>: 232
/* struct cdfs *cdfs_link; /* linked list of file systems */
```

The initial "/\*" is not terminated by an ending "\*/" before the appearance of a second "/\*".

#### 9.2.11 Why does dnodel.c cause the HP-UX 11 compiler to complain that <sys/fs/vx\_inode.h> is missing or incorrect?

If CFLAGS in the lsof Makefile for an HP-UX 11 compilation includes HASONLINEJFS, indicating the system has OnlineJFS

support, lsof needs the <sys/fs/vx\_inode.h> header file.  
Sometimes it is missing from /usr/include/sys/fs.

<sys/fs/vx\_inode.h> is a header file that must be obtained from Veritas. If that proves impossible, please contact me via e-mail at <abe@purdue.edu>. Make sure "lsof" appears in the "Subject:" line so my e-mail filter won't classify your letter as Spam.

### 9.3 PSTAT-based HP-UX lsof Questions

The sources for PSTAT-based lsof for HP-UX may be found in lsof\_<revision>/dialects/hpux/pstat.

lsof's

Configure shell script decides to use these sources when it finds that the /usr/include/sys/pstat subdirectory exists.

lsof can be forced to use the PSTAT-based sources by setting "pstat" in the HPUX\_BASE environment variable. Consult the Configure shell script and O0XPORTING for more information.

#### 9.3.1 Why does PSTAT-based lsof complain about pst\_static and other PSTAT structures?

When lsof starts it may issue one of these fatal error messages:

```
lsof: FATAL: can't determine PSTAT static size
lsof: FATAL: can't read <n> bytes of pst_static
lsof: FATAL: pst_static doesn't contain <name>_size
lsof: FATAL: <name>_size should be <n>
```

These messages indicate that lsof's tests for the proper level of PSTAT support have failed. The structure names, given in <name>, and sizes, given in <n>, identify the support deficiency more precisely.

You may need to upgrade the PSTAT support in your kernel to be able to use PSTAT-based lsof.

#### 9.3.2 Why does PSTAT-based lsof complain it can't read pst\_\* structures?

lsof may put messages like the following in the NAME

column of its output.

```
can't read cwd pst_filedetails: Permission denied
can't read mem pst_filedetails: Permission denied
can't read rtd pst_filedetails: Permission denied
can't read txt pst_filedetails: Permission denied
can't read pst_filedetails: Permission denied
can't read 3 stream structures: Permission denied
can't read pst_socket: Permission denied
```

These messages indicate that the lsof binary lacks the authority to read the name structures for processes other than ones belonging to the UID under which lsof is running. Authority to read the structures of other processes is limited to root processes -- i.e., lsof must have setuid-root permission if it is to list open files for arbitrary processes.

If you want to eliminate these errors, you must run lsof as root or install it with setuid-root permission.

### 9.3.3 Why

does PSTAT-based lsof rebuild the device cache file after each reboot?

After each HP-UX rebuild, the first time a user runs lsof it will report:

```
lsof: WARNING: device cache mismatch: /dev/tun...
lsof: WARNING: created device cache file: /<user_path>
```

This happens because the device numbers on /dev/tun\* device nodes are recalculated at each reboot. When lsof detects a change in the device number of a /dev/tun\* file, it rebuilds its local device cache file.

### 9.3.4 Why doesn't PSTAT-based lsof report TCP addresses for telnetd's open socket files?

When lsof can't report TCP addresses for telnetd's open socket files it is because an unpatched PSTAT kernel interface doesn't report the addresses to lsof.

This has been addressed in PSTAT kernel patch PHKL\_24047. It is available from the HP IT Resource Center at:

<http://itrc.hp.com>

In the page's "maintenance / support" box select the "individual patches" link. Once at its page, select the "hp-ux" link.

On that page select the "Series 800" or "Series 700" radio button and select "11.11" from the pull-down list to the right of the button. Under "search or browse the path list" select "Search by Patch IDs" from the pull down list, enter PHKL\_24047 in the following text box, and select search. That should lead to information about PHKL\_24047 and a link for downloading it. (You may have to log in first and you may have to create a login identity by registering before you can log in.)

Some time in March 2006 the PHKL\_24047 patch was "lost" by the HP-UX networking lab. It has been "found" again in August 2006 and will be re-released as a GRO patch "some time." I don't yet know when that will be. You must contact HP to learn about the availability of the GRO patch.

### 9.3.5 Why does PSTAT-based lsof cause an HP-UX 11.11 kernel panic?

When PSTAT-based lsof runs on some HP-UX 11.11 kernels, the kernel may panic. Symptoms include:

Console message:

```
0xFBE000301100EF00
00000000 0000EF00 -
type 31 = legacy PA HEX chassis-code
```

/var/adm/syslog:

```
... vmunix: Trap Type 15 (Data page fault)
... vmunix: Instruction Address (pcsq.pcoq) = 0x...
```

The panic is caused by a bug in the way PSTAT's pstat\_getstream() function obtains module names from streams managed by the otsam stream driver (part of OSI Transport Services). Lsof calls pstat\_getstream() when it encounters an open otsam stream file. An HP-UX 11.11 system uses otsam if otsam appears in /stand/system.

HP-UX 11.11 patch PHKL\_24507 (available some time after July 15, 2001) fixes the pstat\_getstream() bug. See the information in the answer to the "Why doesn't PSTAT-based lsof report TCP addresses for telnetd's open socket files?" question for information on how to obtain the patch.

### 9.3.6 Why doesn't PSTAT-based lsof report a CWD that is on a loopback



(LOFS) file system?

When PSTAT-based lsof reports on processes whose current working directory (CWD) is on a loopback file system, lsof can't report the open CWD file. The reason is that the HP-UX 11.11 and above kernel's loopback file system code is not passing the CWD file ID to the kernel's pstat(2) code. Hence lsof is given no information on the lofs CWD.

The problem was first reported to me by Ermin Borovac and an internal bug report was filed with the HP-UX file system group on October 26, 2004. That report has now been answered by the patch PHKL\_33200 -- s700\_800 11.11 lofs cumulative patch. The HP IT Resource Center (<http://itrc.hp.com>) is a source for the patch.

9.3.7 Why do some swinstall packages for PSTAT-based HP-UX 11.11 packages complain about setgid and setuid bits?

First, let me explain that I do not provide lsof swinstall packages for lsof. Others provide them and they should be contacted about problems with their packages.

However, I have become aware of a problem with one package about which I have some information I can share. The problem shows up in these swinstall messages:

```
ERROR: Unknown owner and/or group for file
"/usr/local/bin/lsof". SUID and/or SGID bit was
not set.
```

```
ERROR: Failed installing fileset "lsof.lsof-RUN,r=4.73".
Check the above output for details.
```

The swpackage SUID/SGID functionality was restricted by changes for POSIX compliance, breaking backward compatibility. The patch PHCO\_27671 allows SUID/SGID for uid/gid of 0 only, as a compromise between backward compatibility and POSIX conformance.

If the setuid bit is to be set on the executable, the UID and GID of the executable must be 0 (zero).

9.3.8 Why won't the bundled C compiler build PSTAT-based lsof for PA-RISC HP-UX 11.23?

A PA-RISC HP-UX 11.23 bundled C compiler dated May 2005 or later will not build PSTAT-based lsof. It will deliver error

messages related to the system's `<gssapi/gssapi.h>` header file.

There is nothing wrong with that header file or `lsf`. The problem is that the bundled C compiler can't cope with the `gssapi.h` header file.

The work-around is to use the HP ANSI C compiler. Using `gcc` is not a satisfactory work-around. See the answer to the "Why won't `gcc` build PSTAT-based `lsf` for PA-RISC HP-UX 11.23?" question for more information.

### 9.3.9 Why won't `gcc` build PSTAT-based `lsf` for PA-RISC HP-UX 11.23?

`Gcc` will not even compile PSTAT-based `lsf` revisions below 4.77 for PA-RISC HP-UX 11.23 dated May 2005 or later. It reports errors in `lsf`'s `print.c` `fill_portmap()` function about missing members of the `rpcent` structure. That happens because `gcc` defines `_XOPEN_SOURCE_EXTENDED` which disables the definition of the `rpcent` structure in `<netdb.h>`.

Using the HP bundled C compiler is not a viable work-around. That is explained in the answer to the "Why won't the bundled C compiler build PSTAT-based `lsf` for PA-RISC HP-UX 11.23?"

While an `lsf` revision 4.77 or higher can be compiled with `gcc`, the results are unreliable. `lsf` will compile, but it occasionally produces segment faults when it runs. I have not been able to reproduce the failure reliably or locate a debugger that will work with the `gcc`-compiled `lsf`.

The only reliable work-around is to use the HP ANSI C compiler.

### 9.3.10 Why does PSTAT-based `lsf` complain, "FATAL: `pst_stream_size` should be: 672; is 72" on HP-UX 11.11 and above?

This message indicates a mismatch between the PSTAT header files used to build `lsf` (`<sys/pstat.h>` and those in the `/usr/include/sys/pstat` subdirectory), and those that built the running kernel.

Unfortunately the June 2008 patch set for HP-UX 11.23 creates this inconsistency, because it does not contain all the patches needed to match the kernel with the PSTAT header files. Even more serious is that the missing patches update the kernel's

PSTAT support to provide TCP/UDP endpoint information to lsof from TCP/TLI streams.

The patch inconsistency comes about because, while the following patch is installed,

PHKL\_36577

1.0 PM-PSTAT section 2 manpage changes

other kernel patches are not.

The PHKL\_36577 patch updates the PSTAT header files and manual pages to match kernel changes that other patches with the following numbers (or patches that contain or supersede them) contain:

PHNE\_36575 1.0 Cumulative STREAMS Patch

PHNE\_37670 1.0 cumulative ARPA Transport patch

PHNE\_37851 1.0 NFS cumulative patch

Those patches implement the kernel changes that support the delivery of information promised in patch PHKL\_36577.

The work-around is to install the missing patches.

#### 9.4 Why won't the HP-UX depot install?

I don't distribute lsof depots, so I can't support them.

From time to time depots prepared by various sites -- e.g., usually HP-UX software collection sites -- will contain errors that cause installation of the depot to fail.

Do not contact me when this happens. Instead, contact the administrator of the site that prepared the depot.

As should be clear from the bulk of the lsof documentation, I do not recommend you use pre-built lsof binaries in any form. Instead, I recommend you obtain the lsof source distribution and build lsof yourself.

#### 10.0 Linux

##### 10.1 What do /dev/kmem-based and /proc-based lsof mean?

At approximately Linux 2.1.72 and exactly at lsof revision

4.23 support for Linux forks. The first fork, containing the oldest lsof form is based on access to kernel memory structures, and is called /dev/kmem-based lsof. A /dev/kmem-based lsof is heavily intertwined with the Linux kernel version, its header files, and its system map file. Typically a /dev/kmem-based lsof needs only setgid permission to local all open file information.

After approximately Linux 2.1.72 and at revision 4.23 lsof obtains all its information from the /proc file system. That lsof is called the /proc-based lsof. A /proc-based lsof does not read kernel memory, needs neither kernel header files nor the system map file, and is less likely to be affected by Linux kernel changes. However, it does require setuid-root permission to list all open files, and it can't report file offsets (positions).

After revision 4.52 the /dev/kmem-based Linux sources for lsof are no longer distributed. Information about them may be found in the 00INDEX and README files at:

`ftp://lsof.itap.purdue.edu/pub/tools/unix/lsof/OLD/src`

## 10.2 /proc-based Linux lsof Questions

### 10.2.1 Why doesn't /proc-based lsof report file offsets (positions)?

/proc-based lsof revisions 4.79 and above can only report file offsets (positions) for the files of Linux kernels 2.6.22 and above.

During its initialization /proc-based lsof tests to see if offset information can be obtained. If it cannot, lsof disables offset reporting. If the -o option was selected, lsof also issues this warning:

```
lsof: WARNING: can't report offset; disregarding -o.
```

### 10.2.2 Why does /proc-based lsof report "can't identify protocol" for some socket files?

/proc-based  
lsof may report:

```
COMMAND PID ... TYPE ... NODE NAME  
pump 226 ... sock ... 309 can't identify protocol
```

This means that it can't identify the protocol (i.e., the AF\_\* designation) being used by the open socket file. Lsof identifies protocols by matching the node number associated with the /proc/<PID>/fd entry to the node numbers found in selected files of the /proc/net sub-directory. Currently /proc-based lsof examines these protocol files:

```
/proc/net/ax25 (untested)
/proc/net/ipx (needs kernel patch)
/proc/net/raw
/proc/net/raw6
/proc/net/tcp
/proc/net/tcp6
/proc/net/udp
/proc/net/udp6
/proc/net/unix
```

If /proc-based lsof says it can't identify the protocol for an open socket file, you may be able to identify the protocol yourself by using `grep` to look for the specific node number in the files of /proc/net -- e.g.,

```
$ grep <node_number> /proc/net/*
```

You may not be able to find the desired node number, because not all kernel protocol modules fully support /proc/net information.

If you find a matching node number in a /proc/net file that is not currently being processed by lsof, contact me via e-mail at <abe@purdue.edu>. I'll discuss adding support to /proc-based lsof for the protocol of the /proc/net file with you. Make sure "lsof" appears in the "Subject:" line so my e-mail filter won't classify your letter as Spam.

The code that matches node numbers of open IPX protocol socket files to those in /proc/net/ipx requires Jonathan Sergent's Linux 2.1.79 patch to /usr/src/linux/net/ipx/af\_ipx.c. The patch, suitable for input to Larry Wall's patch program, may be found in the lsof distribution file:

```
../dialects/linux/proc/patches/net_ipx_af_ipx.c.patch
```

### 10.2.3 Why does /proc-based lsof warn about unsupported formats?

Lsof may issue the following warning:

lsof: WARNING: unsupported format: /proc/net/<file>

if the header line of the indicated <file> in  
/proc/net --  
ax25, ipx, raw, tcp, udp, or unix -- doesn't match what  
lsof expects to find.

When the header line of a /proc/net file isn't what lsof  
expects, lsof probably can't parse the rest of the file  
correctly and doesn't try. As a result, lsof can't report  
any NAME column information (e.g., local and remote addresses)  
for socket files bound to the indicated network protocol.

If you get this warning, please send me e-mail at <abe@purdue.edu>.  
Include the contents of the file lsof claims has an unsupported  
format. Make sure "lsof" appears in the "Subject:" line so my  
e-mail filter won't classify your letter as Spam.

#### 10.2.4 Why does /proc-based lsof report "(deleted)" after a path name?

The "(deleted)" notation following a path name in /proc-based  
lsof's NAME column comes from the /proc/<PID>/fd/<FD> entry  
for the open file. It's the Linux kernel's way of indicating  
the file is open but has been unlinked (rm'd).

#### 10.2.5 Why doesn't /proc-based lsof report full open file information for all processes?

/proc-based lsof can only report on processes whose /proc  
files it has permission to read. /proc normally grants  
permission to read all its files only to root or to the  
owning user ID.

Without permission to read most /proc files, lsof can only  
report full information for processes belonging to the user  
who is running lsof. /proc-based lsof may be able to report  
some information for all processes, depending on the  
permissions of their associated /proc files, but usually  
/proc-based lsof won't be able to access the files in  
/proc/<PID>/fd/ that describe regular open files.

If you want /proc-based lsof to report on all processes, you  
must install it with setuid-root permission.

#### 10.2.6 Why won't Customize offer to change HASDCACHE or WARNDEVACCESS for /proc-based lsof?

/proc-based lsof doesn't read device information from /dev or the device cache file, so it makes no sense to change the state of device cache processing or /dev node accessibility warnings.

## 10.2.7 /proc-based lsof Linux NFS questions

### 10.2.7.1 Why can't lsof find files on an accessible NFS file system?

On occasion lsof may be unable to identify that an open file is on an NFS file system. This is most likely the result of a bug in the way the Linux kernel supplies information to the reader of /proc/mounts (lsof) -- sometimes that pseudo-file is truncated by the kernel.

One way to see if this is the case is to search for the NFS file system in /proc/mounts -- e.g.,

```
$ grep <NFS_file_system_mount_point> /proc/mounts
```

If you get no output or the third word of the output isn't "nfs", then lsof won't consider the file system an NFS file system.

A second test is to look at the end of /proc/mounts -- e.g.,

```
$ tail /proc/mounts
```

If tail reports "# truncated" then /proc/mounts is incomplete because of a Linux kernel bug. The bug is documented at:

<http://www.xss.co.at/sysinfo/mounts.html>

The bug is fixed in Linux kernel 2.4.18, and possibly in some earlier Linux kernel versions.

### 10.2.7.2 Why can't lsof find files on an inaccessible NFS file system?

If lsof issues this message about a Linux file system, mounted from an NFS server:

```
lsof: WARNING: can't stat() nfs file system /xxx/yyy
```

Then lsof won't be able to find any open files on the file

system.

That's because of an inadequacy in the Linux /proc file system. Its /proc/mounts file doesn't give the device doublet (major and minor numbers) of the file system as do many UNIX systems (e.g., Solaris). The only way lsof can get the device doublet for a Linux file system is to call stat(2) on the file system path, which fails if the NFS server isn't accessible.

When lsof doesn't know the device doublet of a file system, it can't find open files on the inaccessible file system, because it can't match the doublets of open files to the doublet of the inaccessible file system.

This topic is covered extensively in lsof(8) in its ALTERNATE DEVICE NUMBERS and BLOCKS AND TIMEOUTS sections.

10.2.8 Why doesn't /proc-based Linux lsof report socket options and values, socket state flags, and TCP options and values?

The Linux /proc file system doesn't report socket options and values, socket states, and TCP options and values to lsof.

10.2.9 Does /proc-based Linux lsof use a device cache?

No. The Linux /proc/<PID>/fd/\* entries provide device names to lsof via readlink(2). It is not necessary to enable device cache processing for /proc-based Linux lsof via the Customize script or modifications to the Linux machine.h header file.

10.2.10 Why doesn't /proc-based Linux lsof report any or all file structure values for its +fcfgn option?

/proc-based lsof revisions 4.79 and above can only report some file structure values for Linux kernels below 2.6.22.

When running on Linux kernels at 2.6.22 and above lsof 4.79 can report some file flag values -- i.e., in response to the +fg or +fG options.

The flag values are obtained from the /proc/<PID>/fdinfo/ files introduced at Linux kernel 2.6.22.

/proc-based Linux lsof tests its availability to obtain file flag values at initialization. If values are not available, lsof disables file flag reporting. If the flags were requested



with +fg or +fG, lsof displays this warning:

```
lsof: WARNING: can't report file flags; disregarding +f.
```

As a special note, when Linux lsof can report flag bits, it will not report 'R' for a read-only file. There is no read-only flag bit O\_\* symbol in <fcntl.h> (or <bits/fcntl.h>) and lsof reports only bits that are set. The absence of O\_RDWR and O\_WRONLY flag bits implies the file is read-only.

### 10.3 Special Linux file types

#### 10.3.1 Why is ``DEL" reported as a Linux file type?

Lsof usually reports entries from the Linux /proc/<PID>/maps file with ``mem" in the TYPE column. However, when lsof can't stat(2) a path in the process' ``maps" file and the ``maps" file entry contains ``(deleted)", indicating the file was deleted after it had been opened, lsof reports the file type as ``DEL".

#### 10.3.2 Why is ``unknown" reported as a Linux file type?

Lsof may report a Linux file's type as ``unknown" in the TYPE column when lsof can't obtain complete stat(2) results for the file.

Usually the NAME column will contain a ``(stat: xxx)" error message, but that could have been suppressed with the lsof ``-w" option.

### 10.4 Linux ``mem" Entry Problems

#### 10.4.1 What do ``path dev=xxx" and ``path inode=yyy" mean in the NAME column of Linux ``mem" file types?

When the device or inode number in the process' ``maps" file entry doesn't match the stat(2) results from the file path, lsof reports the inconsistent information from the stat(2) of the path parenthetically after the path in the NAME column in one of these forms:

```
(path dev=xxx)      only the device number,  
``xxx", from a stat(2) of the  
``maps" file entry path  
differs
```

from the ```maps"` file  
entry value reported in the  
DEVICE column.

(`path inode=yyy`) only the inode number,  
```yyy"`, from a `stat(2)` of the  
```maps"` file entry path  
differs from the ```maps"` file  
entry value reported in the  
NODE column.

(`path dev=xxx inode=yyy`) Both device and inode numbers  
differ.

Lsof reports the ```maps"` file device number in the DEVICE  
column and the inode number in the NODE column.

When device and inode mismatches occur, lsof suppresses the  
reporting of link count and size. See the answer to the "Why  
is neither link count nor size reported for some Linux ```DEL"`  
and ```mem"` file types?" question for more information.

Device and inode inconsistencies can occur when a file at a  
```maps"` path is replaced after the process has started, or  
when a different file system with similar path names is mounted  
on top of the original file system.

The device inconsistency parenthetical messages can be  
suppressed  
with lsof's ```-w"` option.

#### 10.4.2 Why is neither link count nor size reported for some Linux ```DEL"` and ```mem"` file types?

Link count and size are not reported for some entries from the  
process' ```maps"` file because a `stat(2)` of the entry file path  
failed or `stat(2)` delivered device or inode numbers that don't  
match the ones in the ```maps"` entry.

When the `stat(2)` device or inode numbers don't match those in  
the ```maps"` file entry, it is likely that the `stat(2)` results  
don't apply to the file that was originally mapped by the  
process and whose path appears in the ```maps"` file entry, so  
lsof tries to avoid reporting possibly incorrect information.

See the answer to the "What do ```path dev=xxx"` and ```path  
inode=yyy"` mean in the NAME column of Linux ```mem"` file  
types?" for more information on how mismatched `stat(2)` device

and inode numbers are reported.

## 10.5 Special Linux NAME column messages

### 10.5.1 What does "(stat: xxx)" mean in the NAME column of Linux files?

When

lsof tried to stat(2) the path in the NAME column, the stat(2) system call failed and produced an error message of "(xxx)".

This situation usually occurs if the lsof process lacks permission to stat(2) the path -- e.g., the lsof executable lacks root permission, or lsof is attempting to stat(2) a path on an NFS device mounted with the root\_squash option.

The message can be suppressed with lsof's "-w" option.

### 10.5.2 What does "(readlink: xxx)" mean in the NAME column of Linux files?

When lsof tried to convert the /proc/<PID>/fd path, reported in the NAME column, to its full and more meaningful path, the readlink(2) system call used to do the conversion failed. The readlink(2) failure message is "(xxx)".

This situation usually occurs if the lsof process lacks permission to readlink(2) some part of the path -- e.g., the lsof executable lacks root permission, or lsof is attempting to stat(2) a path on an NFS device mounted with the root\_squash option.

The

message can be suppressed with lsof's "-w" option.

### 10.6 Why is "(NOFD)" reported as a Linux file type?

When lsof lacks permission to use opendir() on the fd/ subdirectory of a process' /proc/<PID> directory, it reports a single file of the type "(NOFD)" (for no file descriptors).

lsof reports the the /proc/<PID>/path in the NAME column, followed by "(opendir: xxx)", where "(xxx)" is the error message returned by opendir().

The "(NOFD)" entry can be suppressed with lsof's "-w" option.

10.7 Why does Linux lsof report a NAME column value that begins with `"/proc"`?

When lsof has problems processing a `"/proc/<PID>"` entry -- e.g., it can't convert the entry to a full and more meaningful path name, or it can't access the `/proc/<PID>/fd` subdirectory with `opendir()` -- it will report the `/proc/<PID>` path in the NAME column.

10.8 Linux `/proc/net/tcp*` and `/proc/net/udp*` issues

10.8.1 Why use the Linux `-X` option?

If you're not interested in TCP/IP socket information for a particular use of lsof, adding the `-X` option will make lsof run more quickly, because `-X` inhibits the reading of the `/proc/net/tcp*` and `/proc/net/udp*` files. For example, you may only be interested in knowing what process has a particular file open.

When the Linux system has a large number of open TCP/IP socket files, the time savings provided by `-X` can be significant.

10.8.2 Why does lsof say `"-i is useless when -X is specified"`?

If `-X` is specified, lsof can't report much information on open TCP/IP socket files. However, lsof's `-i` option requests that information. Hence, the two options conflict and can't be used together.

10.8.3 Why does lsof say `"can't identify protocol (-X specified)"`?

If the Linux lsof `-X` option is specified and an open socket file can't be identified without accessing the `/proc/net/tcp*` and `/proc/net/udp*` files, lsof will report that it can't identify the socket's protocol and that the failure may be caused by the `-X` specification

11.0 NetBSD Problems

11.1 Why doesn't lsof report on open kernfs files?

Lsof doesn't report on open NetBSD kernfs files because the structures lsof needs aren't defined in the `kernfs.h` header file in `/sys/misc/kernfs`.

11.2 Why doesn't lsof report on open files on: file descriptor file systems; /proc file systems; 9660 (CD-ROM) file systems; MS-DOS (floppy disk) file systems; or kernel file systems?

Lsof is not able to report on open files on certain file system if /usr/src/sys/msdosfs didn't exist when the lsof Configure script ran and lsof was made. /usr/src/sys/msdosfs contains header files lsof needs for collecting data on certain file system files.

You can tell if an lsof executable above) lacks support for a file system if the following test of `lsof -v` produces nothing:

```
$ lsof -v 2>&1 | grep <support_enabled_definition>
```

The <support-enabled\_definition> will be:

File System Type Definition Note

-----

```
File descriptor HASFDESCFS
/proc HASPROCFS
9660 HAS9660FS
MS-DOS HASMSDOSFS (lsof 4.61 and above)
Kernel HASKERNFS
```

The work-around is to install /usr/src/sys, rerun the lsof Configure script, and remake lsof.

11.3 Why does lsof produce confusing results for nullfs file systems?

Consider this report from /sbin/mount:

```
/usr/home on /home type null (local)
```

(According to /sbin/mount /usr/home is the mounted-on device and /home is the mounted-on directory.)

When lsof is asked to report on open files on /home, it will report them as files on /usr/home instead. That's an artifact of the NetBSD kernel's dynamic name lookup cache (DNLC) and the way the kernel handles nullfs mounted-on directories.

While lsof will report all open files on /home when given

/home as a file system directory argument, even though reporting them as located on /usr/home, lsof will not find the same files when asked to report on all open files on /usr/home when given /usr/home as a file system device argument. That's because from the mount perspective /usr/home is equivalent to a device, but from the device perspective it is still a directory.

So, what this lsof command reports:

```
$ lsof /home
... NAME
... /usr/home/...
```

Won't be duplicated by this lsof command:

```
$ lsof /usr/home
```

Another way to look at this confusing /home and /usr/home example is to consider what stat(2) reports. For /home stat(2) reports a device doublet that matches what lsof finds in open file node structures, while the device doublet stat(2) reports for /usr/home won't match what lsof finds. Nor does the mode reported by stat(2) indicate a block devices, as is the expected case.

There is no simple answer to this confusion, nor is there even a simple explanation. Simply be aware that when supplying file system arguments to lsof on NetBSD, use the mounted-on directory name for a nullfs as the lsof argument, and don't be surprised when the NAME column reports the mounted-on device name.

## 11.4 NetBSD header file problems

### 11.4.1 Why can't the compiler find some NetBSD header files?

If the compiler's pre-processor complains it can't find some header files when it compiles lsof source files, /usr/include and /usr/src may not have all the header files lsof needs.

As a work-around use the NETBSD\_SYS environment variable to specify to lsof the location of the additional header files -- e.g.,

```
% setenv NETBSD_SYS /my_source
```

```
% ./Configure -n netbsd
```

or

```
$ NETBSD_SYS=/mys_source ./Configure -n netbsd
```

Caution: using this work-around may cause the lsof Configure script to activate or omit different features, depending on where it finds the header files that determine the state of the features.

#### 11.4.2 Why does NetBSD lsof produce incorrect output?

If the NetBSD system's kernel was built from header files that don't match those in /usr/include -- e.g., //usr/src has the ones from which the kernel was built -- lsof may build, but won't produce correct output.

As a possible work-around, try directing the C compiler to select header files from /usr/src before it selects them from /usr/include. That can be done with the DEBUG make string -- e.g.,

```
$ make DEBUG="-I/usr/src -I/usr/include"
```

If that work-around fails, try using the LSOF\_INCLUDE and NETBSD\_SYS environment variables to swap /usr/include and /usr/src when running the Configure script, then use the make DEBUG string when running make -- e.g.,

```
$ LSOF_INCLUDE=/usr/src; export LSOF_INCLUDE  
$ NETBSD_SYS=/usr/include; export NETBSD_SYS  
$ ./Configure -n netbsd  
$ make DEBUG="-I/usr/src -I/usr/include"
```

#### 11.5 Why isn't lsof feature xxx enabled for NetBSD?

lsof's Configure script enables NetBSD features by locating and examining header files associated with the features, and based on what it finds, setting compile-time definitions in Makefiles. (See 00PORTING for a list of the definitions.)

When Configure doesn't find header files or doesn't find appropriate values in header files, that may mean the header file tree lsof is searching is incomplete or out of date.

lsof normally looks for NetBSD header files in /usr/include.

It can also be directed to look in other directories --  
e.g., /sys -- if told to do so with the contents of the  
LSOF\_INCLUDE and NETBSD\_SYS environment variables.

To determine what header file enables a missing feature,  
check the NetBSD stanza in the Configure script. Then  
check the locations it checks for the indicated header  
files and contents.

See 00XCONFIG for more information on LSOF\_INCLUDE and  
and NETBSD\_SYS.

## 12.0 NEXTSTEP and OPENSTEP Problems

### 12.1 Why can't lsof report on 3.1 lockf() or fcntl(F\_SETLK) locks?

Lsof has code to test for locks defined with lockf() or  
fcntl(F\_SETLK) under NEXTSTEP 3.1, but that code has never  
been tested. I couldn't test it, because my NEXTSTEP 3.1  
lockf() and fcntl(F\_SETLK)  
functions return "Invalid  
argument" every way I have tried to invoke them.

If your NEXTSTEP 3.1 system does allow you to use lockf()  
and fcntl(F\_SETLK) and lsof doesn't report locks set with  
them, then the code in ../dialects/next/dnode.c probably  
isn't correct. Please contact me via e-mail at <abe@purdue.edu>  
and tell me how you got your lockf() and fcntl(F\_SETLK) system  
calls to work. Make sure "lsof" appears in the "Subject:" line  
so my e-mail filter won't classify your letter as Spam.

### 12.2 Why doesn't lsof compile for NEXTSTEP with AFS?

I no longer have a NEXTSTEP test system that has AFS.  
Changes to lsof since I once had a test system have caused  
me to change the AFS code in NEXTSTEP without being able  
to test the changes.

If you need AFS support for NEXTSTEP and can't get it to  
compile, please contact me. Perhaps we can jointly fix  
the problems.

## 13.0 OpenBSD Problems

### 13.1 Why doesn't lsof support kernfs on my OpenBSD system?



Lsof supports the kernel file system on OpenBSD versions whose `/sys/miscfs/kernfs/kernfs.h` (or `<miscfs/kernfs/kernfs.h>` header file correctly defines the `kern_target` structure. The Lsof Configure script's `openbsd` stanza checks for the presence of the structure's `kt_name` element and activates `kernfs` support for the `CFLAGS -DHASKERNFS` definition only when it finds `kt_name`.

The `kernfs.h` header file is scheduled to be updated in the OpenBSD 2.1 release, according to Kenneth Stailey, who authored its changes.

### 13.2 Will lsof work on OpenBSD on non-x86-based architectures?

I've not tested lsof on an OpenBSD system that uses a non-x86-based architecture, but I've had one report that lsof 4.33 compiles and works on OpenBSD for the `pmax` architecture (decstation 3100).

### 13.3 `<sys/pipe.h>` problems

#### 13.3.1 Why does the compiler claim `nbpg` isn't defined?

When compiling lsof on some (older) OpenBSD SPARC versions, the compiler may complain:

```
In file included from ../dlsof.h:191,
  from ../lsof.h:166,

  from fino.c:52:
/usr/include/sys/pipe.h:83: `nbpg' undeclared here
(not in a function)
/usr/include/sys/pipe.h:83: size of array `ms' has
non-integer type
```

This happens because `<sys/pipe.h>` uses `NBPG` from `<machine/param.h>` to size the ``ms'` array, and some OpenBSD systems define `NBPG` in terms of a kernel integer variable, `nbpg`.

Lsof revisions 4.46 and above have a hack to `dlsof.h`, developed by Volker Borchert that avoids the compiler problem for SPARC OpenBSD 2.3. The hack might work for other OpenBSD SPARC versions, but hasn't been tested there.

If you want to enable the hack for your OpenBSD SPARC

version, modify this code in .../dialects/n+obsd/dlsof.h:

```
# if defined(OPENBSDV)
# if OPENBSDV==2030 && defined(__sparc__)
# if defined(nbpg)
#undef nbpg
# endif /* defined(nbpg) */
#define nbpg 4096 /* WARNING!!! ... */
# endif /* OPENBSDV==2030 && defined(__sparc__)
*/
#include <sys/pipe.h>
#endif /* defined(OPENBSDV) */
```

You will probably want to change the second #if test to match your OpenBSD version. You may also want to change what value is assigned to nbpg. See the next section, "What value should I assign to nbpg?"

### 13.3.2 What value should I assign to nbpg?

If you need to enable the nbpg hack, described in "Why does the compiler claim nbpg isn't defined?", you may also need to assign a value other than 4096 to nbpg. 4096 works for the sun4c processor and should work for sun4m, but 8192 may be needed for sun4.

Check <machine/param.h> and other OpenBSD documentation to determine the correct nbpg assignment.

### 13.4 Why doesn't lsof report on open MS-DOS file system (floppy disk) files?

lsof is not able to report on open MS-DOS file system files if /usr/src/sys/msdosfs didn't exist when the lsof Configure script ran and lsof was made. /usr/src/sys/msdosfs contains header files lsof needs for collecting data on MS-DOS file system files.

You can tell if an lsof executable (revisions 4.61 and above) lacks MS-DOS file system support if the following command reports nothing:

```
$ lsof -v 2>&1 | grep HASMSDOSFS
```

The work-around is to install /usr/src/sys, rerun the lsof Configure script, and remake lsof.

### 13.5 Why isn't lsof feature xxx enabled for OpenBSD?

Lsof's Configure script enables OpenBSD features by locating and examining header files associated with the features, and based on what it finds, setting compile-time definitions in Makefiles. (See 00PORTING for a list of the definitions.)

When Configure doesn't find header files or doesn't find appropriate values in header files, that may mean the header file tree lsof is searching is incomplete or out of date.

Lsof normally looks for OpenBSD header files in /usr/include and /sys. It can also be directed to look in other directories if told to do so with the contents of the LSOF\_INCLUDE and NETBSD\_SYS environment variables.

To determine what header file enables a missing feature, check the OpenBSD stanza in the Configure script. Then check the locations it checks for the indicated header files and contents.

See 00XCONFIG for more information on LSOF\_INCLUDE and NETBSD\_SYS.

## 14.0 Output Problems

### 14.1 Why do the lsof column sizes change?

Lsof dynamically sizes its output columns each time it runs to make sure that each column takes the minimum space. Column parsing -- e.g., with awk -- is possible, because each column is guaranteed to be separated from the preceding one by at least one space, and no column except the last (NAME) contains embedded spaces.

### 14.2 Why does the offset have ``0t' and ``0x" prefixes?

The offset value that appears in the SIZE/OFF column has ``0t' and ``0x" prefixes to distinguish it from size values that may appear in the same column.

Normally if the offset value is less than 100,000,000 (8 digits), it appears in decimal with a ``0t' prefix; over 99,999,999, in hexadecimal with a ``0x" prefix.

A decimal offset is handy, for example, when tracking the progress of an outbound ftp transfer. When lsof reports on the ftp process, it will report the size of the file being sent with its open descriptor; it will report the progress of the transfer via the offset of the outbound open ftp data socket descriptor.

The ```-o [n]"` option may be used to specify the maximum number of decimal digits to be printed after ```0t"` before lsof switches to the hexadecimal digits after ```0x"`. As already noted, the default decimal digit count is 8.

14.3 What are the values printed in the FILE\_FLAG column and why is `0x<value>` sometimes included?

The two comma separated lists, separated by a semicolon, printed in the FILE-FLAG column (when the `"+fg"` option is specified), are short-hand names or hexadecimal values for the bits lsof finds in the `f_flag` or `f_flags` member of file structures for files (the first list, the one before the semicolon), and process open files flags found in various kernel structures, often named `"pofile"` (the second list, the one after the semicolon).

Lsof determines the short-hand names from symbols in the `<fcntl.h>`, `<linux/fs.h>`, `<sys/fcntl.h>`, `<sys/fcntlcom.h>`, `<sys/file.h>`, and `<sys/user.h>` header files.

See the discussion of FILE-FLAG in the OUTPUT section of the lsof man page, and the `FF_*` and `POF_*` symbols in `lsof.h` for a list of the names.

Bits with no names defined for them are represented by an `0x<value>` member of the comma-separated list -- a hexadecimal integer. When `"+fG"` is specified (instead of `"+fg"`), lsof will list all flag values as two hexadecimal integers, separated by a semicolon.

When `"-FG"` is specified to get the flags in an output field, the format defaults to hexadecimal. You can get names instead by following `"-FG"` with `"+fg"` -- e.g.,

```
$ lsof -FG +fg ...
```

However, when you precede `"-FG"` with `"+fg"` -- e.g.,

```
$ lsof +fg -FG
```

the format will be hexadecimal; order is important.

#### 14.3.1 Why doesn't lsof display FILE\_FLAG values for my dialect?

All versions of lsof except the /proc-based Linux lsof report FILE-FLAG values. Lsof can't obtain FILE-FLAG information from the Linux /proc interface.

#### 14.4 Network Addresses

##### 14.4.1 Why does lsof's -n option cause IPv4 addresses, mapped to IPv6, to be displayed in IPv6 notation?

When you use the -n option to tell lsof to display numeric network addresses, and an IPv4 address has been mapped to IPv6, lsof displays the address in IPv6 format and puts "ipv4" in the TYPE column. That combination indicates the IPv4 address has been mapped to IPv6.

For example, the IPv4 address 1.2.3.4, when mapped to an IPv6 address, will be displayed by lsof as:

```
[::ffff:1.2.3.4]
```

The enclosing brackets are lsof's signal that this is an IPv6 address. Inside the brackets is a standard IPv6 address, reported by inet\_ntop(). The first two colons, signifying zeroes in the first 64 bits of the IPv6 address, and the hexadecimal ffff in the next 32 bits, indicate that the last 32 bits contains a mapped IPv4 address, which is then displayed in IPv4 dot notation.

##### 14.5 Why does lsof output \x, ^x, or \xnn for characters sometimes?

Lsof displays only printable ASCII characters. Lsof considers a character printable if isprint(3) says it is. If isprint(3) says a character isn't printable, the lsof man page explains:

```
"... Non-printable characters are printed in one of three forms: the C ``\[bfrnt]" form; the control character ``^' form (e.g., ``^@"); or hexadecimal leading ``\x' form (e.g., ``\xab"). Space is non-printable in the COMMAND column (``\x20") and
```

printable elsewhere."

#### 14.5.1 Why is space considered a non-printable character in command names?

Space is considered an unprintable character in command names because it is sometimes possible to hide the full command name from scripts that parse `ps(1)` output by embedding a space in the name.

#### 14.6 Why doesn't `lsOf` print all the characters of a command name?

By default `lsOf` prints the first nine characters of the names of commands associated with processes. If more characters are required, the "w" value of the "+c w" option may be used to specify a larger width.

If "w" is zero (0) `lsOf` will print all characters of all command names up to the limit of the number of characters supplied by the particular UNIX dialect. When reporting command names, `lsOf` replaces non-printable characters as discussed in the answer to "Why does `lsOf` output `\x`, `^x`, or `\xnn` for characters sometimes?"

See the answer to the "Why is space considered a non-printable character in command names?" question for an explanation of why spaces are replaced by the ```\x20`" representation in command names.

The number of command name characters supplied to `lsOf` by UNIX dialects in files and structures varies by dialect. For example, Linux 2.4.27 supplies `lsOf` the first 15 characters of command names and Solaris 9 supplies 16. Thus, even if "w" is zero (0), `lsOf` can't report more characters for command names on those two UNIX dialects than they provide `lsOf`.

#### 14.7 Why does `lsOf` reject some -c command names, saying their lengths are "> what system provides (nn)"?

The command name length that a specific system provides varies from dialect to dialect. As noted in the answer to the "Why doesn't `lsOf` print all the characters of a command name?" question, Linux and Solaris provide a limited number of command name characters.

When more characters are specified in the parameter to the -c

option, lsof considers it an error and issues a fatal error message -- e.g.,

lsof: "-c xxxxyyyy" length (8) > what system provides (7)

The only work-around is to specify no more characters to -c than the system provides to lsof.

#### 14.8 Why does lsof sometimes print TYPE numbers instead of names?

When lsof can't convert a type number to a name for printing in the TYPE column, it will report the number as four octets.

#### 14.9 Marker line format problems

##### 14.9.1 Why won't lsof accept a marker line format?

lsof's Configure script must find the localtime(3) and strftime(3) functions in the dialect's C library in order to enable support for marker line formats.

Check the output of lsof's -v option for the presence of -DHAS\_STRFTIME in the compiler flags. If it isn't there, Configure didn't find the necessary two C library functions.

If you think lsof should have found the functions, make a copy of the C test program in the Configure script that it uses to find the functions. Then use the copy, or a more informative modification of it, to learn why Configure can't find the functions. You can find that program by searching for strftime.

##### 14.9.2 Why does lsof reject the NL (%n) marker line format?

When repeat mode and field output (with -F) have both been specified, lsof won't allow new line (NL) formats to be specified with ``%n''. That's because the marker line is always guaranteed to be a single line.

There is no work-around to this restriction.

#### 14.10 How are protocol state name exclusion and inclusion used?

Protocol state name inclusion and exclusion with the ``-s p:s'' option and its arguments have some issues to consider.

First, there is the problem of determining what state names, if any, the dialect produces. Try running this lsof command to find them:

```
$ lsof -i
```

Knowing the state names of interest, the next problem is to decide on the lsof options and their parameters that will produce the desired output. Here some examples are probably the most useful.

To list only TCP socket files in LISTEN and CLOSE\_WAIT states, use:

```
$ lsof -itcp -stcp:listen,close_wait
```

or

```
$ lsof -iTCP -sTCP:LISTEN,CLOSE_WAIT
```

Case isn't important to lsof in protocol and state names.

To exclude TCP socket files in CLOSE\_WAIT state, use:

```
$ lsof -itcp -stcp:^close_wait
```

Note the '^' preceding close\_wait; it selects exclusion. You can mix included and excluded names in a comma separated list, but you may not include and exclude the same name for the same protocol.

To list TCP files in LISTEN state and UDP files in Idle state, use:

```
$ lsof -i -stcp:listen -sudp:idle
```

Note: if you don't accompany the '-s p:s' list option and arguments with the -i option, lsof will list all other regular files, while applying the specified inclusion and exclusion specifications to network files. Generally, then, you want to use -i with -s.

#### 14.10.1 Why doesn't my dialect support state name exclusion and inclusion?

When state name inclusion and exclusion was added, I had access to test systems for AIX, Darwin, FreeBSD, Linux, PSTAT-based HP-UX and Solaris.

Therefore, I was unable to add and test the support to any other



UNIX dialects.

If a dialect has the support, then the HASTCPUDPSTATE definition in its machine.h header file will be active; if not, it will be absent or commented out.

If your dialect doesn't have the support and you want it added, you will have to provide me Internet access to a test host, where I can compile lsof and have the credentials to test the changes the support requires. If that's possible for you, please contact me via e-mail at <abe@purdue.edu>. Make sure "lsof" appears in the "Subject:" line so my e-mail filter won't classify your letter as Spam.

## 15.0 Pyramid Version Problems

### 15.0.5 Statement of deprecation

As of lsof revision 4.52 support for all Pyramid versions has been dropped. Contact me via e-mail at <abe@purdue.edu> if you are interested in obtaining the last lsof Pyramid distribution. Make sure "lsof" appears in the "Subject:" line so my e-mail filter won't classify your letter as Spam.

## 16.0 SCO Problems

### 16.1 SCO OpenServer Problems

#### 16.1.1 How can I avoid segmentation faults when compiling lsof?

If you have an older SCO OpenServer compiler, it may get a segmentation fault when compiling some lsof modules. That appears to happen because of the -Ox optimization action requested in the lsof Makefile.

Try changing -Ox to -O with this make invocation:

```
$ make DEBUG=-O
```

Bela Lubkin supplied this tip and Steve Williams verified it.

#### 16.1.2 Where is libsocket.a?

If you compile lsof and the loader says it can't find the socket library, libsocket.a, called by the -lsocket option in the lsof compile flags, you probably are running an SCO OpenServer release earlier than 5.0 and don't have the TCP/IP Development System package installed.

You may have the necessary header files, because you have the TCP/IP run-time package installed, but if you don't have the TCP/IP Development System package installed, you won't have libsocket.a.

Your choices are to install the TCP/IP Development System package or upgrade to OpenServer Release 5.0. You will find libsocket.a in 5.0 -- you'll find all the libraries and header files there, in fact -- and you can use gcc to compile lsof if you don't want to install the 5.0 Development System package.

### 16.1.3 Why do I get "warning C4200" messages when I compile lsof?

When you compile lsof under OSR 3.2v4.2 (and perhaps under earlier versions as well), you may get many compiler warning messages of the form:

```
node.c(183) : warning C4200: previous declarator is not
compatible with default argument promotion
```

In my opinion this is a bug in the OSR compiler. Because the compiler cannot handle full ANSI-C prototypes, it assumes default types for function parameters as it encounters untyped in a function prototype -- e.g., in this function declaration from node.c,

```
readrnode(ra, r)
KA_T ra;
struct rnode *r;
{
...

```

the compiler assigns default int types to the ra and r arguments.

Then, when the compiler encounters the fully typed parameters after the function skeleton and sees parameters with types that don't match the assumptions it previously made, it whines about its own assumptions.

You can ignore these messages.

## 16.2 SCO|Caldera UnixWare Problems

### 16.2.1 Why doesn't lsof compile on my UnixWare 7.1.1 or above system?

When you Configure lsof with the "uw" abbreviation and try to compile it for UnixWare 7.1.1, you may get compiler error messages like this:

```
UX:acomp: ERROR: "dproc.c", line 98:  
undefined struct/union member: p_pgidp
```

This suggests that you probably have a non-stop cluster UnixWare 7.1.1 system. Its <sys/proc.h> header file differs from the one on the system where I did the lsof port to UnixWare 7.1.1. I currently don't have access to a non-stop cluster system to be able to develop changes to lsof that would make it compile and work there.

If you have a non-stop cluster UnixWare 7.1.1 system, want lsof for it, and can offer me a test account on the system, please contact me via e-mail at <abe@purdue.edu>. Make sure "lsof" appears in the "Subject:" line so my e-mail filter won't classify your letter as Spam.

If you have a system with nsc\_cfs and can offer me a test account on it, please contact me via e-mail at <abe@purdue.edu>. Make sure "lsof" appears in the "Subject:" line so my e-mail filter won't classify your letter as Spam.

### 16.2.2 Why does lsof complain about node\_self() on my UnixWare 7.1.1 or above system?

If lsof exits immediately after issuing this message:

```
can't identify process NSC node; node_self(): <message>
```

It means that lsof has been built to run on a NonStop Cluster (NSC) UnixWare 7.1.1 or higher system and can't get the number of the node on which it is running. Lsof uses the node number to determine the path to the kernel boot file.

You can tell if lsof has been built for NSC by looking for

"-DHAS\_UW\_NSC" in lsof's "-v" option output.

If the system on which you're trying to run lsof isn't running an NSC kernel, you will need to build a non-NSC lsof.

### 16.2.3 Why does

UnixWare 7.1.1 or above complain about -lcluster, node\_self(), or libcluster.so?

When you build, compile, and load lsof for UnixWare 7.1.1 and above, ld may complain that it can't find the -lcluster library or that the node\_self symbol is undefined. When you try to run an existing lsof binary it may complain that libcluster.so can't be found.

These messages mean the tests made by Configure on your system led it to believe your system is running a NonStop Cluster (NSC) kernel, or the lsof binary you're trying to use was built on a NonStop Cluster system. If an lsof binary was built for NSC, this shell command produces output:

```
$ strings <lsof_binary> | grep HAS_UW_NSC
```

If that's not the case, and you can rebuild lsof, set the UW\_HAS\_NSC environment variable to "N" and do this:

```
$ Configure -n clean
$ UW_HAS_NSC=N
$ export UW_HAS_NSC
$ Configure -n uw
$ make
```

You can also edit Makefile and lib/Makefile. Remove -DHAS\_UW\_NSC from the CFGF strings.

Remove -lcluster from the CFGL strings. Then run make again.

If you have an existing NSC lsof binary and you want one for a non-NSC system, you will have to build lsof yourself on the system where you want to use it. (That's always a good idea anyway.)

### 16.2.4 Why does UnixWare 7.1.1 or above lsof complain it can't read the kernel name list?

If lsof complains:

```
can't read kernel name list from <path>
```

It means that lsof can't find the booted kernel image file at <path>. On NonStop Cluster (NSC) UnixWare 7.1.1 or higher systems lsof determines the booted file path by examining this file:

```
/stand/node_self/boot
```

If examining that file doesn't lead to an NSC path, lsof uses:

```
/stand/1/unix
```

On non-NSC systems lsof expects the booted kernel image to be in /stand/unix.

If your booted kernel image is in a different place, use lsof's "-k <path>" option to specify its path.

16.2.5 Why doesn't lsof report link count, node number, and size for some UnixWare 7.1.1 or above CFS files?

Lsof reports link count, node number, and size for open CFS files as recorded in their kernel node structure's cached attributes. Sometimes not all attributes are cached on the node where lsof runs, so lsof cannot report them.

16.2.6 Why doesn't lsof report open files on all UnixWare 7.1.1 NonStop Cluster (NSC) nodes?

Lsof can only report on files open on the node on which it runs, because the information lsof reports comes from the private kernel memory of the node. This may mean that asking lsof to find a specific open file, or use of a specific Internet address or port, may not report all open instances on nodes other than the one used to run lsof.

You can use the NSC onnode(1) command to run lsof on specific nodes, or the onall(1) command to run lsof on all nodes -- e.g.,

```
$ onall lsof [options] 2>&1 | less
```

or

```
$ onnode node-number lsof [options] 2>&1 | less
```

Note that, when lsof is run all nodes, the path name component assembly results it reports in its NAME column may vary, because the dynamic name cache from which lsof gets the components is private to the kernel of each node.

Also note the use of shell redirection in the examples to merge the standard error file information from onnode and onall with lsof's standard output file output. That will put the onnode and onall node announcements in proper sequence with lsof's output.

#### 16.2.7 Why doesn't lsof report the UnixWare 7.1.1 NonStop Cluster (NSC) node a process is using?

To induce lsof to report the node on which a process runs would be a significant, non-standard modification to lsof. It has much wider implications than merely the printing of a number in an output column. I'm not currently (April 2001) prepared to undertake such a modification.

If you want node-specific NSC information about open files, run lsof under the control of onall(1) or onnode(1).

```
$ onall lsof [options] 2>&1 | less
or
$ onnode
node-number lsof [options] 2>&1 | less
```

#### 16.2.8 Why does the compiler complain about missing UnixWare 2.1[.x] header files?

SCO|Caldera didn't ship the following header files with UnixWare 2.1 through 2.1.3:

```
<fs/proc/prdata.h>
<fs/procfs/prdata.h>
<sys/fs/fifonode.h>
<sys/fs/namenode.h>
```

Lsof needs those header files for its compilation. Contact SCO|Caldera to get copies of those header files.

If you can't get the header files from SCO|Caldera, please contact me via e-mail at <abe@purdue.edu>. Make sure "lsof" appears in the "Subject:" line so my e-mail filter won't classify your letter as Spam.

## 17.0 Sun Problems

### 17.0.5 Statement of deprecation

Lsof support for SunOS 4.1.x was last tested at revision 4.51. Contact me via e-mail at <abe@purdue.edu> if you're interested in obtaining it. Make sure "lsof" appears in the "Subject:" line so my e-mail filter won't classify your letter as Spam.

### 17.1 My Sun gcc-compiled lsof doesn't work -- why?

Gcc can be used to build lsof successfully. However, an improperly installed Sun gcc compiler will usually not produce a working lsof.

If your Sun gcc-compiled lsof doesn't report anything, or reports "can't read proc table," or gcc refuses to compile lsof without error, check that the gcc step that "fixes" Sun header files was run on the system where you're using gcc to compile lsof. As an alternative, if you have the SunPro C 5.0 compiler or later available, use it to compile lsof -- e.g., use the solariscc Configure abbreviations.

### 17.2 How can I make lsof compile with gcc under Solaris 2.[456], 2.5.1, 7, 8 or 9?

Presuming your gcc-specific header files are wrong for Solaris, edit the lsof Configure-generated Makefile and lib/Makefile and make this change:

```
CFGF= -Dsolaris=20400 ...  
to  
CFGF= -Dsolaris=20400 -D__STDC__=0 -I/usr/include ...
```

or change:

```
CFGF= -Dsolaris=20500 ...  
to  
CFGF= -Dsolaris=20500 -D__STDC__=0 -I/usr/include ...
```

or change:

```
CFGF=  
-Dsolaris=20501 ...  
to
```

```
CFGF= -Dsolaris=20501 -D__STDC__=0 -I/usr/include ...
```

This is only a temporary work-around. You really should instruct gcc to update your gcc-specific header files or install a recent gcc (e.g., 3.2), which has no need for private copies of Solaris include files.

### 17.3 Why does Solaris Sun C complain about system header files?

You're probably trying to use `/usr/ucb/cc` if you get compiler complaints like:

```
cc -O -Dsun -Dsolaris=20300 ...
"/usr/include/sys/machsig.h", line 81: macro BUS_OBJERR
redefines previous macro at "/usr/ucbinclude/sys/signal.h",
line 444
```

Note the reference to `/usr/ucbinclude/sys/signal.h`. It reveals that the BSD Compatibility Package C compiler is in use. `lsof` requires the ANSI C version of the Solaris C compiler, usually found in `/usr/opt/bin/cc` or `/opt/SUNWspro/bin/cc`.

Try adding a `CC` string to the `lsof` Makefile that points to the Sun ANSI C version of the Sun C compiler -- e.g.,

```
CC= /usr/opt/bin/cc
or
CC= /opt/SUNWspro/bin/cc.
```

### 17.4 Why doesn't `lsof` work under my Solaris 2.4 system?

If `lsof` doesn't work under your Solaris 2.4 system -- e.g., it produces no output, little output, or the output is missing command names or file descriptors -- you may have a pair of conflicting Sun patches installed.

Solaris patch 101945-32 installs a kernel that was built with a `<sys/auxv.h>` header file whose `NUM_*_VECTORS` definitions don't match the ones in the `<sys/auxv.h>` updated by Solaris patch 102303-02.

`NUM_*_VECTORS` in the kernel of patch 101945-32 are smaller than the ones in the `<sys/auxv.h>` of patch 102303-02. The consequence is that when `lsof` is compiled with the `<sys/auxv.h>` whose `NUM_*_VECTORS` definitions are larger than the ones used to compile the patched kernel, `lsof`'s user structure



does not align with the one that the kernel employs.

If you have these two patches installed, contact Sun and complain about the mis-match.

You

may be able to work around the problem by editing `/usr/include/sys/auxv.h` to have the following `NUM_*_VECTORS` definitions:

```
#define NUM_GEN_VECTORS 4
#define NUM_SUN_VECTORS 8
```

The Configure script issues a prominent WARNING that you should try the work-around.

I thank Leif Hedstrom for identifying the offending patches.

#### 17.5 Where are the Solaris header files?

If you try to compile `lsof` under Solaris and get a compiler complaint that it can't find system header files, perhaps you forgot to add the header file package, `SUNWhea`.

#### 17.6 Where is the Solaris `/usr/src/uts/<architecture>/sys/machparam.h`?

When you try to Configure `lsof` for Solaris 2.[23456], 2.5.1, and 7 -- e.g., on a ``uname -m` == sun4m` system -- Configure complains:

```
grep: /usr/src/uts/sun4m/sys/machparam.h:
No such file or directory
grep: /usr/src/uts/sun4m/sys/machparam.h:
No such file or directory
```

And when you try to compile the configured `lsof`, `cc` or `gcc` complains:

```
dproc.c:530:
`KERNELBASE' undeclared (first use this function)
```

The explanation is that somehow your Solaris system doesn't have the header files in `/usr/src/uts` it should have. Perhaps someone removed the directory to save space. Perhaps you're using a `gcc` installation, copied from another system. In any event, you will have to load the header files from the `SUNWhea` package of your Solaris distribution.

KERNELBASE is an important symbol to lsof -- it keeps lsof from sending an illegal kernel value to kvm\_read() where a segmentation violation might result (a bug in the kvm library). Lsof can get illegal kernel values because it reads kernel values slowly with kvm\_read() calls that the kernel is changing rapidly.

Lsof doesn't need KERNELBASE at Solaris 2.5 and above, because it has a KERNELBASE value whose address lsof can find with /dev/ksyms and whose value it can read with kvm\_read(). Under Solaris 2.5 /usr/src/uts has moved to /usr/platform.

### 17.7 Why does Solaris

lsof say "can't read proc table"?

When lsof collects data on processes, using the kvm\_\*() functions to scan the kernel's proc structure table, it checks to make sure it has identified a reasonable number of them -- a minimum of three. When lsof can't identify three processes during a scan, it repeats the scan.

When five scans fail to yield three processes, lsof issues the fatal message:

```
lsof: can't read proc table
```

and exits.

Usually lsof fails to identify three processes during a scan because its idea of the form of the proc structure differs from that being used by the kernel. Since the proc structure is defined in <sys/proc.h> and other /usr/include header files, the root cause of a proc structure discrepancy usually can be found in the composition of /usr/include.

One common way that /usr/include header files can be incorrect is that gcc was used to compile lsof, gcc used its special (i.e., "fixed") header files instead of the ones in /usr/include, and the special gcc header files weren't updated when Solaris was. Answers to these questions:

My Sun gcc-compiled lsof doesn't work -- why?

How can I make lsof compile with gcc under Solaris 2.[456], 2.5.1, 7, 8 or 9?

Why does Solaris Sun C complain about system header files?

discuss the gcc header file problem and offer suggestions on how to fix it or work around it.

It may also be that you are trying to run a version of lsof that was compiled on an older version of Solaris. For example, an lsof executable, compiled for Solaris 2.4, will produce the "can't read proc table" message if you try to run it under Solaris 2.5. If you have compiled lsof under Solaris 2.5 and it still won't work, see if the header files in /usr/include have been updated to 2.5, or still represent a previous version of Solaris.

Another source of header file discrepancies to consider is the Solaris patch level and whether a binary kernel patch was not matched with a corresponding header file update.

See the "Why doesn't lsof work under my Solaris 2.4 system?" question for an example of one in Solaris 2.4 -- there may be other such patch conflicts I don't know about.

17.8 Why does Solaris lsof complain about a bad cached clone device?

When lsof revisions below 4.04 have been run on a Solaris system and have been allowed to create a device cache file, the running of revisions 4.04 and above on the same systems may produce this complaint:

```
lsof: bad cached clone device: ...  
lsof: WARNING: created device cache file: ...
```

This is the result of a change in the device cache file that took place at lsof revision 4.04. The change introduced a node number into the clone device lines of the device cache file and was done in such a way that lsof could detect device cache files whose clone lines don't have node numbers (lines created by previous lsof revisions) and recognize the need to regenerate the device cache file.

17.9 Why doesn't Solaris make generate .o files?

Solaris /usr/ccs/bin/make won't generate .o files from .c files if /usr/share/lib/make/make.rules is missing. It may be found in and installed from the SUNWsport package.

17.10 Why does lsof report some Solaris 2.3 and 2.4 lock types as `N'?

For Solaris 2.3 with patch P101318 installed at level 45 or above, and for all versions of Solaris 2.4, NFS locks are represented by a NFS-specific kernel lock structure that sometimes lacks a read or write lock type indicator. When lsof encounters such a lock structure, it reports the lock type as `N`.

#### 17.11 Why does lsof Configure say "WARNING: no cc in ..."?

When lsof's Configure script is executed with the solariscc abbreviation it tries to make sure it's using the Sun C compiler and not the UCB substitute from /usr/ucb/cc. Thus, it looks for cc in the "standard" Sun compiler location, /opt/SUNWspr/bin.

If Configure can't find cc there, it issues the warning:

```
lsof: WARNING: no
cc in /opt/SUNWspr/bin;
using cc without path.
```

and uses cc for the compiler name, letting the shell find cc with its PATH environment variable.

You can tell Configure where to find your cc with the SOLARIS\_CCDIR cross-configuration environment variable. (See 00XCONFIG for more information on SOLARIS\_CCDIR). For example, use this Configure shell command:

```
SOLARIS_CCDIR=/usr/special/bin Configure -n solariscc
```

(SOLARIS\_CCDIR should be the full path to the directory containing your cc.)

#### 17.12 Solaris 7, 8 and 9 Problems

##### 17.12.1 Why does lsof say the compiler isn't adequate for Solaris 7, 8 or 9?

Solaris 7, 8 and 9 kernels come in two flavors, 32 and 64 bit. 64 bit kernels run on machines that support the SPARC v9 instruction set architecture. Separate executables for some programs, -- e.g., ones using libkvm like lsof -- must be built for 32 and 64 bit kernels.

Previous Sun (e.g., SC4.0) and earlier gcc compilers will build lsof for 32 bit kernels, but

they won't build it for  
64 bit kernels. Compilers that will build lsof for 64 bit  
Solaris 7, 8 and 9 kernels are the Sun WorkShop Compilers  
C 5.0 and above, and recent gcc versions, e.g., 3.2.

When given the ``-xarch=v9" flag, the C 5.0 compiler and  
above, and associated loader and 64 bit libraries will  
build a 64 bit lsof executable; when given the "-m64" or  
"-mcpu=v9" (deprecated) flags, an appropriate gcc compiler  
will build a 64 bit lsof executable.

When the lsof Configure script detects a 64 bit kernel is  
in use (e.g., by executing ``/bin/isainfo -kv``), and when  
it finds that the specified compiler is inappropriate,  
it complains with these messages:

For gcc:

```
!!!!WARNING!!!=====!!!!WARNING!!!=====!!!!WARNING!!!!  
"!                               !"  
"! LSOF NEEDS TO BE CONFIGURED FOR A 64 BIT KERNEL, BUT !"  
"! THIS GCC DOESN'T SUPPORT THE BUILDING OF 64 BIT    !"  
"! SOLARIS EXECUTABLES. LSOF WILL BE CONFIGURED  
FOR A    !"  
"! 32 BIT echo KERNEL.                               !"  
"!                               !"  
!!!!WARNING!!!=====!!!!WARNING!!!=====!!!!WARNING!!!!
```

For Sun C:

```
!!!WARNING!!!=====!!!WARNING!!!=====!!!WARNING!!!  
!                               !  
! LSOF NEEDS TO BE CONFIGURED FOR A 64 BIT KERNEL, BUT |  
! THE VERSION OF SUN C AVAILABLE DOESN'T SUPPORT THE  !  
! -xarch=v9 FLAG. LSOF WILL BE CONFIGURED FOR A 32 BIT !  
! KERNEL.                               !  
!                               !  
!!!WARNING!!!=====!!!WARNING!!!=====!!!WARNING!!!
```

17.12.2 Why does Solaris 7, 8 or 9 lsof say "FATAL: lsof was compiled  
for..."?

Solaris 7, 8 or 9 lsof may say:

```
lsof: FATAL: lsof was compiled for a xx bit kernel,  
but this machine has booted a yy bit kernel.
```

Where: xx = 32 or 64

yy = 64 or 32

(xx and yy won't match.)

This message indicates that lsof was compiled for one size kernel and is being asked to execute on a different size one. That's not possible for programs like lsof that use libkvm.

Depending on the instruction sets for which you need Solaris 7, 8 or 9 lsof, you may need two or more versions of lsof, compiled for each kernel size, installed for use with /usr/lib/isaexec. See the "How do I install lsof for Solaris 7, 8 or 9?" section of this document for more information on that.

#### 17.12.3 How do I build lsof for a 64 bit Solaris kernel under a 32 bit Solaris kernel?

If your Solaris system has an appropriate compiler (e.g., WorkShop Compilers C 5.0 and above, or a recent gcc like 3.2) and the 64 bit libraries have been installed, you can force lsof's Configure script to build a 64 bit version of lsof with:

```
$ SOLARIS_KERNBITS=64 Configure -n solarisc
```

The SOLARIS\_KERNBITS environment variable is part of the lsof cross-configuration support, described in the 00XCONFIG file of the lsof distribution.

#### 17.12.4 How do I install lsof for Solaris 7, 8 or 9?

If you are installing lsof where it will be used only under the bit size kernel for which it was built, no special installation is required.

If, however, you are installing different versions of lsof for different bit sizes -- e.g., for use on a 64 bit NFS server and from its 32 bit clients -- you should read the man page for isaexec(3C) and install lsof according to its instructions.

The executable at the directory where lsof is to be found should be a hard link to /usr/lib/isaexec or a copy of it. In the directory there must be instruction architecture

subdirectories -- e.g., `.../sparc/` and `.../sparcv9/`. The `lsof` for 64 bit size kernels is installed in the `.../sparcv9/` subdirectory; the one for 32 bit size kernels, in `.../sparc/`.

For example, if you're installing 32 and 64 bit `lsof` executables in `/usr/local/etc`, you would:

```
# cd /usr/local/etc
#
ln /usr/lib/isaexec lsof
# mkdir sparc sparcv9
# install the 32 bit lsof as sparc/lsof
# install the 64 bit lsof as sparcv9/lsof
# chmod, chown, and chgrp sparc/lsof and
  sparcv9/lsof appropriately
```

`lsof` permissions and ownerships are the same whether one or more `lsof` executables are being installed, with or without the `/usr/lib/isaexec` hard link.

17.12.5 Why does my Solaris 7, 8 or 9 system say it cannot execute `lsof`?

When you attempt to execute `lsof`, your Solaris 7, 8 or 9 shell may complain:

```
ksh: ./lsof: cannot execute
```

If the `lsof` executable exists and has the proper execution permissions, this error may be the result of trying to execute an `lsof`, built for a 64 bit kernel, on a 32 bit kernel.

This will tell you about the `lsof` executable:

```
$ file lsof
lsof: ELF 64-bit MSB executable SPARCV9 Version 1,
dynamically linked, not stripped
```

The "64-bit" notation indicates the binary was built for a 64 bit kernel. To see the running kernel bit size, use this command:

```
$ isainfo -kv
32-bit sparc kernel modules
```

The "32-bit" notation indicates a 32 bit kernel has been

booted.

The only work-around is to obtain, or Configure and make, an lsof for the appropriate kernel bit size. If you Configure and make lsof on the kernel where you wish to run it the proper compiler, the lsof Configure step will generate Makefiles that can be used with make to build an appropriate lsof executable.

To compile a 64 bit lsof, you must have an appropriate compiler -- i.e., Sun WorkShop Compilers C 5.0 or higher or a recent gcc like 3.2.

17.12.6 What gcc will produce 64 bit Solaris 7, 8 and 9 executables?  
8 and 9 executables?

Properly built and installed recent gcc versions -- e.g., 3.2 -- will build lsof for 64 bit Solaris kernels.

If you update your gcc version to 3.2 or later, make sure the private gcc header files become current -- i.e., clear out any private header files from a previous gcc or Solaris installation before installing the new ones, or build to a new --prefix root and replace the old root with it after the build and installation are complete.

17.12.7 Why does lsof on my Solaris 7, 8 or 9 system say, "can't read namelist from /dev/ksyms?"

You're probably trying to use an lsof executable built for an earlier Solaris release on a 64 bit Solaris 7, 8 or 9 kernel. The output from `lsof -v` will tell you the build environment of your lsof executable. You should also have gotten a warning message that lsof is compiled for a different Solaris version than the one under which it is running -- something like this:

```
lsof: WARNING: compiled for Solaris release X; this is Y
```

You need to build lsof on the system where you want to use it. For 64 bit Solaris 7, 8 and 9 you need a compiler that can generate 64 bit Solaris executables -- e.g., the Sun Workshop 5 C compiler or later, or a recent gcc version like 3.2. See the "Why does lsof say the compiler isn't adequate for Solaris 7, 8 or 9?" section and the ones following it for a discussion of building lsof for 64 bit



Solaris 7, 8 or 9.

### 17.13 Solaris and COMMON

17.13.1 What does COMMON mean in the NAME column for a Solaris VCHR file?

When lsof puts COMMON or (COMMON) in the NAME column of a Solaris VCHR file, it means that the file is handled by the special file system functions of the kernel through a common vnode.

17.13.2 Why does a COMMON Solaris VCHR file sometimes seem to have an incorrect minor device number?

When lsof reports on an open file in a Solaris special file system that uses a COMMON vnode, and the file is a VCHR file, lsof tries to locate the associated device node by looking for matches on the major and minor device numbers first.

If no major and minor match results, lsof then looks for a match on pseudo and clone device files. (See /devices/pseudo.) Those device nodes are matched specially by either their major or minor device numbers, but not both. Hence, when lsof finds a match under those special conditions, it may report a value in its output DEVICE column that differs from one of the major and minor numbers of the device node.

Here's an example from a sun4m Solaris 7 system:

```
$ ls -li /devices/pseudo/pm@0:pm
151261 crw-rw-rw- 1 root  sys  117, 0 ...
$ lsof /devices/pseudo/pm@0:pm
COMMAND ... DEVICE ...  NODE NAME
powerd    117,1 ... 151261 /devices/pseudo/pm@0:pm (COMMON)
Xsun     ... 117,0 ... 151261 /devices/pseudo/pm@0:pm
```

Note that the DEVICE value for the file with (COMMON) in its name field has a different minor device number (1) from what ls reports (0), while the DEVICE value for the file without (COMMON) matches the ls output exactly. Both match on the major device number, 117. The minor device number mis-match is a result of the way the Solaris kernel handles special file system common vnodes, and it's the reason lsof puts (COMMON) after the name

to signal that a mis-match is possible.

#### 17.14 Why don't lsof and Solaris pfiles reports always match?

`/usr/proc/bin/pfiles` for Solaris 2.6, 7, 8, and 9 also reports information on open files for processes. Sometimes the information it reports differs from what lsof reports.

There are several reasons why this might be true. First, because pfiles is a Sun product, based on Sun kernel features, its developers have a better chance of knowing exactly how open file information is organized. I sometimes have to guess at how kernel file structure linkages are constructed by gleaning hints from header files.

Second, lsof is aimed at providing information, specifically device and node numbers, that can be used to identify named file system objects -- i.e., path names. Thus, lsof tries to make sure its device and node numbers match those reported by `stat(2)`. Pfiles doesn't always report numbers that match `stat(2)` -- e.g., for files using clone and pseudo devices via common vnodes like the `nlist() /dev/ksyms` usage.

Here's the Solaris 7 COMMON VCHR example again with additional pfiles output:

```
$ ls -li /devices/pseudo/pm@0:pm
151261 crw-rw-rw- 1 root  sys  117, 0 ...
$ lsof /devices/pseudo/pm@0:pm
vic1: 10 = lsof /dev/pm
COMMAND ... DEVICE ...  NODE NAME
powerd ... 117,1 ... 151261 /devices/pseudo/pm@0:pm (COMMON)
Xsun ... 117,0 ... 151261 /devices/pseudo/pm@0:pm
$ pfiles ...
0: S_IFCHR ... dev:32,24 ino:61945 ... rdev:117,1
...
14: S_IFCHR ... dev:32,24 ino:151261 ... rdev:117,0
```

Note that the NODE number, reported by lsof, matches what `ls(1)` and `stat(2)` report, while the ino value pfiles reports doesn't. Lsof also indicates with the (COMMON) notation that the DEVICE number is a pseudo one, derived from the character device's value. The lsof DEVICE value matches the pfiles rdev value, correct behavior for a character device, but pfiles gives no sign that it's not possible

to  
find that character device number in /devices with ls(1)  
or stat(2).

17.15 Why does lsof say, "kvm\_open(namelist=default, core=default):  
Permission denied?"

Lsof needs permission to read from the /dev/kmem and /dev/mem  
memory devices. Access to them is opened via a call to  
the kvm\_open() library function and it reports the indicated  
message.

You must give lsof permission to read the memory devices.  
The super user can almost always do that, but other lsof  
users can do it if some group -- e.g., sys -- has permission  
to read the memory devices, and the lsof binary is installed  
with the group's ownership and with the setgid permission  
bit enabled.

17.16 Why is lsof slow on my busy Solaris UFS file system?

Lsof may be slow on a busy Solaris UFS file system when  
UFS logging has been enabled with the "logging" mount  
option. That option can significantly increase disk  
operations under certain conditions -- e.g., when a lot of  
files are accessed quickly.

When  
only the "logging" option is specified to mount, all  
file accesses (atime updates) are logged to the UFS logging  
queue. Each atime update requires two writes to the disk  
to complete it.

If you want to do UFS logging -- and there are reliability  
advantages to it -- consider using the "logging,noatime"  
mount options instead. That will shift atime updates from  
the logging queue to fewer and independent asynchronous  
operations, consequently making the UFS logging queue a  
smaller bottleneck.

Consult mount\_ufs(1M) for more information on the logging  
and noatime options.

(My thanks to Casper Dik for this tip on improving the  
performance of UFS logging.)

17.17 Why is lsof so slow on my Solaris 8 or 9 system?

Solaris 8 has a post-release feature upgrade modifying kernel name cache (DNLC) handling that can slow lsof throughput dramatically. The feature, sometimes called negative DNLC caching, is standard in Solaris 9.

As best I can tell, when you install the Solaris 8 MU1 package, you get negative DNLC caching. If this pipe produces any output, your system has negative DNLC caching.

```
$ nm /dev/ksyms | grep negative_cache_vnode
```

The reason negative DNLC caching perturbs lsof is that a single vnode address (found in the `negative_cache_vnode` kernel variable) is used to mark entries in the DNLC that are not (the negative part) found on disk.

Since a single vnode address (the DNLC key lsof uses) can represent many (I've seen upwards of 30,000.) DNLC entries, their presence overloads lsof's internal DNLC hashing function. An overloaded hash function is a slow hash function, and lsof's slows to a crawl when it encounters thousands of keys that produce the same value when the lsof DNLC hash function is applied to them.

The solution is simple -- ignore negative DNLC cache keys. They don't represent path name components lsof can use. Lsof revisions 4.50 and above have an addition that ignores them and the performance of those lsof revisions improves significantly when presented with negative DNLC cache keys.

If you don't have an lsof revision at 4.51 or later, there's a work-around. Use lsof's `--C` option. It disables lsof's DNLC caching. Of course, that also inhibits the reporting of any path name components from the kernel DNLC. When `--c` is used, lsof will continue to report file system and character device paths.

## 17.18 Solaris and VxFS

### 17.18.1 Why doesn't lsof support VxFS 3.4 on Solaris 2.6, and above?

Lsof will not support VxFS version 3.4 on Solaris 2.6 and above unless some files from VxFS Update 2 have been installed. VxFS 3.4 FCS and VxFS 3.4 update 1 lack the header files lsof normally uses to obtain information from the VxFS 3.4 kernel node structure, `vx_inode`. VxFS 3.4 Update 2 provides a method

whereby lsof can obtain the necessary vx\_inode information from the vxfsu\_get\_ioffsets() function in Veritas utility libraries.

The utility libraries (32 bit and 64 bit versions) may be found in /opt/VRTSvxfs/lib. An ancillary header file may be found in /opt/VRTSvxfs/include/sys/fs/vx\_libutil.h. Documentation of the vxfsu\_get\_ioffsets(3) function may be found in /opt/VRTS/man/man3/vxfsu\_get\_ioffsets.3.

Those files of VxFS 3.4 Update 2 may be downloaded from:

```
ftp://ftp.veritas.com/pub/support/vxfs_34.i64243.tar
```

The vxfs\_34.i64243.tar archive will unpack into an i64243 directory containing these files:

```
$ ls i64243
README
libvxfsutil.sol26.sums
libvxfsutil.sol26.tar.Z
libvxfsutil.sol27.sums
libvxfsutil.sol27.tar.Z
libvxfsutil.sol28.sums
libvxfsutil.sol28.tar.Z
```

Read README. Select the \*.tar.Z file appropriate for your Solaris version. Its contents will unpack into /opt/VRTS and /opt/VRTSvxfs, so you will need sufficient permission -- e.g., do it as root -- to unpack the uncompressed archive. Once you've done that, it's a good idea to compare the checksums of the archive you unpacked with the ones recorded in the appropriate \*.sums file. Use `sum -r` to verify the checksums.

For example, if you want the Solaris 8 version, uncompress and unpack libvxfsutil.sol28.tar.Z -- e.g.,

```
$ su
...
# cd i6423
# zcat libvxfsutil.sol28.tar.Z | tar xf -
```

That should create these new files and subdirectories with the indicated checksums:

File or subdirectory `sum -r`

```
/opt/VRTSvxfs/include/vxfsutil.h 03938
/opt/VRTSvxfs/lib/libvxfsutil.a 51794
/opt/VRTSvxfs/lib/sparcv9/
/opt/VRTSvxfs/lib/sparcv9/libvxfsutil.a 07420
/opt/VRTS/man/man3/
/opt/VRTS/man/man3/vxfsu_get_ioffsets.3 62480
```

Once these files are in place, run `lsof`'s `Configure` script for the `solaris` or `solariscc` abbreviation. `Configure` will locate the appropriate VxFS 3.4 Update 2 files and set up for the making of an `lsof` that will properly display open VxFS 3.4 file information.

17.18.2 Why does `lsof` report "`vx_inode: vxfsu_get_ioffsets error`" for open Solaris 2.6 and above VxFS 3.4 and above files?

Even when `lsof` supports VxFS 3.4 and above on Solaris 2.6 and above, it may report "`vx_inode: vxfsu_get_ioffsets error`" in the `NAME` column for all VxFS files.

The usual cause is that `lsof` doesn't have permission to read the file at the end of the `/dev/vxportal` symbolic link. If, for example, `lsof` has been installed `setgid(sys)`, then the `/dev/vxportal` symbolic link destination should be owned by the `sys` group and readable by it.

Update 2 for VxFS 3.4 sets the modes of the `/dev/vxportal` symbolic link destination to `0640` and the group ownership to `sys`. But I have had a report that the modes are wrong in a VxFS 4.0 installation.

Another cause may be that the system has more than one version of VxFS installed (Only one can be active.), and `lsof`'s `Configure` script did not choose the header files and libraries for the active VxFS version. `Configure` opts for VxFS 4.0 and above header files and libraries (in `/opt/VRTS`) in preference to those for VxFS below 4.0 (in `/opt/VRTSvxfs`).

Look for the directories `/opt/VRTS` and `/opt/VRTSvxfs`. If you have `/opt/VRTS`, make sure its header and library symbolic links point to those of the active VxFS version.

If you have both directories, look at the `CFLAGS` that `Configure` constructed for making `lsof` and see which directory path

follows a -I option. If that doesn't match the directory path of the active VxFS version, try pointing Configure at the correct directory with the SOLARIS\_VXFSINCL environment variable -- e.g.,

```
$ SOLARIS_VXFSINCL=/opt/.../include ./Configure -n solaris
```

### 17.18.3 Why does Solaris Configure claim there is no VxFS library?

The Isof Configure script, when configuring for Solaris, may report:

```
FATAL: no VxFS .../libvxfsutil.a
```

That fatal error message indicates Isof has found the VxFS utility library's header files, but can't find the library itself in the expected location adjacent to the header files.

One possible cause is an incorrect symbolic link from /opt/VRTS/lib/sparcv9/libvxfsutil.a to the library's real location. (Some VxFS distributions declared the link incorrectly.) Use `ls -lL` on that path to see if it exists. If it doesn't exist, the link may be missing an additional leading "../" component.

If the problem is a missing "../" from the library's link, you can correct the link or check with Veritas/Symantec for the patch that corrects it.

If the problem is not a missing "../", and you know the libvxfsutil.a location, you can define its path in the SOLARIS\_VXFSLIB environment variable before running the Isof Configure script. (See 00XCONFIG for information about using the SOLARIS\_VXFSLIB environment variable.)

If you have no libvxfsutil.a, you must obtain it from Veritas/Symantec or find it in your VxFS installation package.

### 17.18.4 Why doesn't Solaris Isof report VxFS path name components?

Solaris Isof will report path name components for VxFS versions that use the common Solaris Dynamic Name Lookup Cache (DNLC) or on some file systems of VxFS versions that support the VxFS Reverse Name Lookup (RNL) facility.

VxFS versions 3.3 (approximately) and below use the common

Solaris DNLC. (I haven't been able to determine exactly when VxFS stopped using the DNLC.) For versions above that boundary, but below 4.0, lsof can't report path name components.

At VxFS 4.0 and above, lsof can be compiled to use the VxFS RNL facility for reporting path names. If "-DHASVXFSRNL" appears in the compiler flags section of lsof "-v" option output, then the lsof Configure script detected the VxFS RNL facility and lsof has been compiled to use it.

Lsof's use of the RNL facility can fail when the VxFS file system disk layout version is below 6. In that case, lsof can report no path name components. For more information, see the vxfs\_inotopath(3) manual page. any of the following commands will show the disk layout version for a VxFS file system, when supplied the block device or mount point on which the file system is mounted.

```
fstyp -v <block_device>  
or  
mkfs -m <block_device>  
or  
vxupgrade <mount_point>
```

You must have permission to read the block device -- e.g., be the root user.

You may also be able to upgrade an older disk layout to one that will work with the RNL. See the vxupgrade(1M) man page for more information on that.

When lsof can't report VxFS path name components, it reports the file system mount point and the path name of device on which it is mounted. The device path name is enclosed in parentheses.

#### 17.18.5 Why does Solaris 10 lsof report scrambled VxFS paths?

Solaris 10 lsof may report a bogus, scrambled path for an open VxFS file, when lsof obtains the path from a vnode's cached path. Veritas/Symantec reports that their Solaris 10 implementation has bugs in the way it handles the Solaris 10 vnode cached path and those bugs will be fixed in an upcoming patch some time after August 15, 2005.

When Solaris 10 lsof reports a path for an open VxFS file



obtained via the VxFS Reverse Name Lookup facility, the path will be correct.

Also see the answers to the questions "Why does Solaris 10 lsof sometimes report the wrong path name?" and "Why doesn't Solaris lsof report VxFS path name components?"

## 17.19 Large file problems

### 17.19.1 Why does lsof complain it can't stat(2) a Solaris 2.5.1 large file?

When given an argument that is the path to a Solaris 2.5.1 file, enable for large file operations with the O\_LARGEFILE open(2) option, lsof complains that it can't stat(2) the file. That's because lsof isn't using a stat(2) call and associated structure enabled for large files.

This error has been fixed, starting at lsof revision 4.58 for Solaris 2.6 and above. That fix won't work on Solaris 2.5.1 and I no longer have access to a Solaris 2.5.1 test system to develop a separate fix.

The work-around is to avoid specifying a O\_LARGEFILE path as an argument to lsof on Solaris 2.5.1. Instead use a combination of lsof and grep to achieve the same results, albeit more clumsily.

### 17.20 Why does lsof get a segmentation fault on 64 bit Solaris 8 using NIS+?

I have received a report from Gary Craig that lsof produces a segmentation fault on his 64 bit Solaris 8 system using NIS+. Via an independent test program we have exonerated lsof and tracked the fault to the NIS+ `__nis_server_name()` function in the C name server library, -lnsl.

Lsof causes the `__nis_server_name()` NIS+ function to be called by calling `getservent()` to read entries of the port number to service name map.

The only Sun bug ID that appears to describe the problem is 4304244, although its text is unclear enough to leave room for doubt.

Until Sun eliminates the `__nis_server_name()` segmentation fault cause, a work-around for lsof is to use its "-P"

option, causing lsof to avoid port to service name lookups.

#### 17.21 Will lsof crash the Solaris kernel?

I've received and investigated one report that it has when the Sun hardware (a QME interface) was faulty. Today (May 23, 2002) I've learned that Sun has reports of kernel crashes caused by adb, lsof, and mdb.

The Sun investigation pinpointed a problem in the /dev/kmem kernel driver and there is a Sun bug report, 4344513, about the problem. There is a fix in Solaris 9, and patches for Solaris 7 and 8 (SPARC and x86).

To see if your Solaris system is fixed, look for a /devices/pseudo/\*allkmem node.

Extensive address filtering was added to lsof revision 4.50 to forestall what I then (July 2001) believed to be only the possibility that lsof might crash Solaris. However, the filtering isn't perfect, since a filtered address might become invalid after lsof has filtered it but before lsof has delivered it to /dev/kmem. That filtering work is described in ../dialects/sun/solaris\_kaddr\_filters, also available at:

[ftp://lsof.itap.purdue.edu/pub/tools/unix/lsof/solaris\\_kaddr\\_filters](ftp://lsof.itap.purdue.edu/pub/tools/unix/lsof/solaris_kaddr_filters)

The best and safest work-around is to upgrade to Solaris 9 or install an appropriate patch or its equivalent from this list:

Solaris	SPARC	x86
Version	Patch	Patch
=====	=====	=====
7	106541-20	106542-20
8	108528-14	108529-14

#### 17.22 Why does lsof on Solaris 7, 8, or 9 report a kvm\_open() failure?

When lsof is started on some Solaris 7, 8, and 9 systems it may report:

```
lsof: kvm_open(namelist=default, corefile=default): \
No such file or directory
```

Lsof revisions 4.65 and later will first report:

```
lsof: cannot stat /dev/allkmem
```

The second message, not delivered in lsof revisions below 4.65, explains the cause of the `kvm_open()` failure; it can't find `/dev/allkmem`.

`/dev/allkmem` is a device added to Solaris 7 and 8 in patches and in the Solaris 9 FCS. See the preceding "Will lsof crash the Solaris kernel?" section for more information on `/dev/allkmem` and the patches.

The `kvm_open(3KVM)` function in the KVM library of patched Solaris 7 and 8 systems and in Solaris 9 expects to find `/dev/allkmem` and exits on error when it does not.

If you have installed the patch that updated your KVM library to a version that expects `/dev/allkmem` to be present and it is not, you may need to reconfigure your system's devices with `devfsadm(1M)` or enter "boot -r" to the OpenBoot monitor's prompt (usually "ok").

## 17.23 Solaris and SAM-FS

### 17.23.1 Why does Solaris lsof report "(limited SAM-FS info)"?

Lsof 4.68 and above report "(limited SAM-FS info)" on Solaris in the NAME column after the path or file system name for all files it finds on SAM-FS file systems.

That's because no more information is known about the composition of the nodes that follow SAM-FS vnodes. If you can provide that information, please contact me via e-mail at <abe@purdue.edu>. Make sure "lsof" appears in the "Subject:" line so my e-mail filter won't classify your letter as Spam.

### 17.23.2 Why can't lsof locate named SAM-GS files?

Solaris lsof 4.68 and above can't locate files on SAM-FS file systems when the files are named as lsof arguments because lsof doesn't know how to locate open SAM-FS file device and node number information. (See also "Why does Solaris lsof report "(limited SAM-FS info)?"

## 17.24 Lsof and Solaris 10 zones

### 17.24.1 How can I make lsof list the Solaris zone?

Use the lsof "-z [z]" option.

### 17.24.2 Why doesn't lsof work in a Solaris 10 zone?

When run from within a Solaris 10 zone, lsof will usually report:

```
lsof: can't stat(/devices): No such file or directory
```

That's because a Solaris zone usually has no /devices subdirectory, a restriction of the zone implementation intended to limit the ability of zone processes to control global system resources, including physical devices.

While a zone may have a /dev subdirectory, that subdirectory usually lacks the /dev/allkmem, /dev/mem and /dev/kmem devices lsof and the KVM library it uses require.

The work-around is to run lsof in the global zone. When it is run in a global zone lsof will be able to report on processes running in any zone, including the global zone.

### 17.24.3 Why does lsof complain it can't stat() Solaris 10 zone file systems?

When run from the global zone on Solaris 10 lsof may complain:

```
lsof: WARNING: can't stat() 15 zone file systems;  
using dev= options
```

The warning message means lsof found the reported number of file system entries in the mount table for which it didn't have permission to get stat(2) results, but which had "zone=" and "dev=" mount table options.

That is a normal restriction of Solaris 10 zones. Since the lsof warning message indicates it was able to find "dev=" options for the file systems, lsof will probably work correctly.

One work-around is to relax the restrictions on zone mount points, so that lsof can stat() them. While that may be

possible by changing directory modes or group ownerships, it is probably not a good idea, because it weakens the restrictions zones are intended to provide.

Another work-around is to suppress the warning message with lsof's "-w" option. The down side of that is that it causes the suppression of all warning messages, leading to the possibility that some non-stat() warning messages will be suppressed.

## 17.25 Solaris 10 problems

### 17.25.1 Why does Solaris 10 lsof sometimes report the wrong path name?

When a path name component is renamed -- e.g., with mv(1) -- Solaris 10 lsof may report the old component for an open file that used the component in its path before the rename. That's because Solaris 10 lsof reports the path name cached in the open file's vnode and the Solaris 10 kernel doesn't update the open vnode's cached path name when a component of it is changed.

When an open file is deleted -- e.g., with rm(1) -- the path name by which it was opened remains cached in the vnode. Lsof can be instructed to display that path name with the -X option. The path name might be incorrect because of the rename problem described above. See the answer to the "What does "(deleted)" mean in the NAME column of a Solaris 10 open file?" question for more information.

Lsof is sometimes able to detect that cached path name is incorrect. In that case lsof may report only the mounted-on directory and device of the file system or it may report that the path name is of questionable accuracy by appending a trailing "(?)" to it in the NAME column.

See the answer to the "Why does Solaris 10 lsof sometimes report only the mounted-on directory and device?" and "What does "(?)" mean in the NAME column of a Solaris 10 open file?" questions for more information.

### 17.25.2 Why does Solaris 10 lsof sometimes report only the mounted-on directory and device?

For some regular open files lsof may report only the mounted-on directory and device of the file system on which the file resides. That's because lsof was able to determine that the

path

name cached in the open file's vnode is incorrect.

Lsof detects the cached path name is incorrect by applying `stat(2)` to it, provided that no error was detected when `stat(2)` was applied to the file system mounted-on directory during lsof setup. If a mounted-on directory `stat(2)` error was detected during setup, lsof does no cached path name analysis and simply reports it.

When the application of `stat(2)` to the cached path name returns a no-entry reply (the `ENOENT` error number), lsof concludes the path no longer exists (i.e., has been unlinked) and reports the mounted-on directory and device of the file system. That behavior can be modified with the `-X` option in lsof revisions 4.77 and above. See the answer to the 'What does "(deleted)" mean in the NAME column of a Solaris 10 open file?' for more information.

When the application of `stat(2)` to the cached path name returns a permission error reply (the `EACCES` or `EPERM` error numbers), lsof reports the cached path name and adds a trailing "?" to indicate the reported path name is of questionable accuracy. See the answer to the question 'What does "?" mean in the NAME column of a Solaris 10 open file?' for more information.

If the application of `stat(2)` to the cached path name yields any other error reply, lsof reports the mounted-on directory and device of the file system.

When the application of `stat(2)` to the cached path name succeeds, lsof compares the reported device and node numbers to what it has obtained for the open file from kernel structures. If they match, lsof reports the cached path name. If they don't match, lsof instead reports the mounted-on directory and device of the file system.

A work-around that allows lsof to apply `stat(2)` successfully to cached path names is to give lsof sufficient permission to do it -- i.e., run lsof as the root user.

17.25.3 What does "(deleted)" mean in the NAME column of a Solaris 10 open file?

When the `-X` option is specified to Solaris 10 lsof, it will report in its NAME column the path name cached for a deleted

file in its vnode. The path name will be followed by "(deleted)".

Note that the path name cached in a file's vnode is the path name by which the file was opened. It is not updated by the Solaris kernel when any path name component is changed. Hence, it may not represent the final path name the open file had.

See the answer to the "Why does Solaris 10 lsof sometimes report the wrong path name?" question for more information on how changing a path name component affects the correctness of a what lsof reports.

17.25.4 What does "(?)" mean in the NAME column of a Solaris 10 open file?

When lsof encounters a path name cached in the open file's vnode that stat(2) reports lsof lacks permission to access, lsof adds "(?)" to the path name reported in the NAME column to indicate the path name is of questionable accuracy.

See the answers to the "Why does Solaris 10 lsof sometimes report the wrong path name?" and "Why does Solaris 10 lsof sometimes report only the mounted-on directory and device?" questions for more information on why lsof may report a path name of questionable accuracy.

A work-around that allows lsof to apply stat(2) successfully to cached path names is to give lsof sufficient permission to do it -- i.e., run lsof as the root user.

17.26 Solaris contract file problems

17.26.1 Why doesn't lsof report size, link count and node number for Solaris 10 contract files?

Lsof doesn't report size, link count or node number for Solaris 10 contract files because I don't know how to obtain them from contract file kernel structures.

17.26.2 Why can't lsof locate a Solaris 10 contract file by path name?

Because lsof can't find the node number of Solaris contract files, it can't match the device and node numbers it gets from applying stat(2) to the contract file path name with what it finds in kernel data.

## 17.27 Solaris 10 ZFS problems

### 17.27.1 Why

does Configure ask for the location of ZFS header files?

To provide ZFS support when lsof is compiled it needs to have access to the definitions of ZFS structures used by the kernel. Those definitions are contained in header files that Sun does not distribute with Solaris 10.

When the Configure script detects the system might support ZFS by finding the <sys/fs/zfs.h> header file, it checks for the required ZFS kernel structure definition header files. When they are not found, it asks if ZFS support should be included and if so, with what definitions.

Two sources can be declared for definitions: 1) lsof's internal ones; or 2) the necessary header files at some location other than /usr/include/sys.

The necessary header files are:

```
dmu.h zfs_acl.h   zfs_debug.h zfs_rlock.h zil.h
spa.h zfs_context.h zfs_dir.h  zfs_vfsops.h zio.h
txg.h zfs_ctldir.h zfs_ioctl.h zfs_znode.h zio_impl.h
```

The necessary header files might have been obtained, for example, from the <http://src.opensolaris.org> Open Solaris source site. However, the Open Solaris header files might not be adequate -- see the answer to the "Why don't the Open Solaris ZFS header files provide correct ZFS kernel structure definitions?" question for information on why the Open Solaris ZFS header files might not provide correct ZFS kernel structure definitions.

The supplied header file path must point to a directory that contains a sys/ subdirectory where the matching header files are located -- e.g., if the supplied path is /tmp/zfs, then /tmp/zfs/sys must contain the necessary header files.

See the answer to the "Why do -h and -v output warn about possibly inaccurate ZFS kernel structure definitions?" question for information on the risks associated with using lsof's internal definitions.

### 17.27.2 Why do -h and -v output warn about possibly inaccurate ZFS kernel structure definitions?



When lsof is configured to use its internal ZFS kernel structure definitions, there is the chance that the definitions may be out of date. Hence, an lsof built with them may report incorrect device numbers, file sizes, node numbers and link counts.

Please contact me via e-mail at <abe@purdue.edu> for work-around suggestions. Make sure "lsof" appears in the "Subject:" line so my e-mail filter won't classify your letter as Spam.

### 17.27.3 Why don't the Open Solaris ZFS header files provide correct ZFS kernel structure definitions?

The Open Solaris ZFS header files may not provide correct ZFS kernel definitions. An lsof built with them may report incorrect device numbers, file sizes, node numbers and link counts.

The definitions may be incorrect because the Open Solaris header files are not synchronized with any particular Solaris 10 release. Consequently they might contain modifications to the structures not in the structure definitions used to build the running kernel. It may be that only Sun has header files that match the kernel structures of the running Solaris 10 kernel.

Please contact me via e-mail at <abe@purdue.edu> for work-around suggestions. Make sure "lsof" appears in the "Subject:" line so my e-mail filter won't classify your letter as Spam.

## 18.0 Lsof Features

### 18.1 Why doesn't lsof report on /proc entries on my system?

/proc file system support is generally available only for BSD, SYSV R4 dialects, and Tru64 UNIX (Digital UNIX, DEC OSF/1). It's also available for Linux, and Pyramid DC/OSx and Reliant UNIX.

Even on some SYSV R4 dialects I encountered many problems while trying to incorporate /proc file system support. The chief problem is that some vendors don't distribute the header file that describes the /proc file system node

-- usually called prdata.h.

## 18.2 How do I disable the device cache file feature or alter its behavior?

To disable the device cache file feature for a dialect, remove the HASDCACHE definition from the machine.h file of the dialect's machine.h header file. You can also use HASDCACHE to change the default prefix (`.lsof`) of the device cache file.

Be sure you consider disabling the device cache file feature carefully. Having a device cache file significantly reduces lsof startup overhead by eliminating a full scan of /dev (or /devices) once the device cache file has been created. That full scan also overloads the kernel's name cache with the names of the /dev (or /devices) nodes, reducing the opportunity for lsof to find path name components of open files.

If you're worried about the presence of mode 0600 device cache files in the home directories of the real user IDs that execute lsof, consider these checks that lsof makes on the file before using it:

1. To read the device cache file, lsof must gain permission from access(2).
2. The device cache file's modes must be 0600 (0644 if lsof is reading a system-wide device cache file) and its size non-zero.
3. There must be a correctly formatted section count line at the beginning of the file.
4. Each section must have a header line with a count that properly numbers the lines in the section. Legal sections are device, clone, pseudo-device, and CRC.
5. The lines of a section must have the proper format.
6. All lines are included in a 16 bit CRC, and it is recorded in a non-checksummed section line at the end of the file.

7. The checksum computed when the file is read must match the checksum recorded when the file was written.

8. The checksum section line must be followed by end-of-information.

9. Lsof must be able to get matching results from stat(2) on a randomly chosen entry of the device section.

For more information on the device cache file, read the 00DCACHE file of the lsof distribution.

#### 18.2.1 What's the risk with a perverted device cache file?

Even with the checks that lsof makes on the device cache file, it's conceivable that an intruder could modify it so it would pass lsof's tests.

The only serious consequence I know of this change is the removal of a file whose major device number identifies a socket from some user ID's device cache file. When such a device has been removed from the device cache file, and when lsof doesn't detect the removal, lsof may not be able to identify socket files when executed by the affected user ID. Only certain dialects are at risk to this attack -- e.g., SCO OpenServer and Solaris 2.x, 7, 8, and 9.

If you're tracking a network intruder with lsof, that could be important to you. If you suspect that someone has corrupted the device cache file you're using, I recommend you use lsof's -Di option to tell it to ignore it and use the contents of /dev (or /devices) instead; or remove the device cache file (usually .lsof\_hostname, where hostname is the first component of the host's name returned by gethostname(2)) from the user ID's home directory and let lsof create a new one for you.

#### 18.2.2 How do I put the full host name in a personal device cache file path?

Lsof constructs the personal device cache file path name from a format specified in the HASPERSDC #define in the dialect's machine.h header file. As distributed HASPERSDC declares the path to be ``.lsof\_" plus the first component

of the host name with the format ``.lsof\_%L".

If you want to change the way lsof constructs the personal device cache file path name, you can change the HASPERSDC #define and recompile lsof. If, for example, you #define HASPERSDC to be ``.lsof\_%l" (note the lower case `l'), Configure and remake lsof, then the personal device cache file path will be ``.lsof\_" plus the host name returned by gethostname(2).

See the 00DCACHE file of the lsof distribution for more information on the formation of the personal device cache file path and the use of the HASPERSDC #define.

### 18.2.3 How do I put the personal device cache file in /tmp?

Change the HASPERSDC definition in your dialect's machine.h header file.

When you redefine HASPERSDC, make sure you put at least one user identification conversion in it to keep separate the device cache files for each user of lsof. Also give some thought to including the ``%0" conversion to define an alternate path for setuid-root and root processes.

Here's a definition that puts a personal device cache file in /tmp with the name ``.lsof\_login\_hostname\_pers".

```
#define HASPERSDC "/tmp/.lsof_%u_%l_pers"
```

Thus the /tmp personal device cache file path for login "abe" on host "lsof.itap.purdue.edu" would be:

```
/tmp/.lsof_abe_lsof.itap.purdue.edu_pers
```

You can add the User ID (UID) with the "%U" conversion and the first host name component with the ``%L" conversion.

**CAUTION:** be careful using absolute paths like /tmp lest lsof processes that are setuid-root or whose real UID is root be used to exploit some security weakness via /tmp. Elect instead to add an alternate path for those processes with the ``%0" conversion. Here's an extension of the previous HASPERSDC format for /tmp that declares an alternate path:

```
#define HASPERSDC "/tmp/.lsof_%u_%l_pers%0%h/.lsof_%L"
```

When the lsof process is setuid-root or its real UID is root, presuming root's home directory is `~/` and the host's name is `lsof.itap.purdue.edu`, the extended format yields:

```
/.lsof_vic
```

### 18.3 Why doesn't lsof know about AFS files on my favorite dialect?

lsof currently supports AFS for these dialects:

```
AIX 4.1.4 (AFS 3.4a)
Linux 1.2.13 (AFS 3.3)
NEXTSTEP 3.2 (AFS 3.3)
Solaris 2.[56] (AFS 3.4a)
```

It may recognize AFS files on other versions of these dialects, but I have no way to test that. lsof may report correct information for AFS files on other dialects, but I can't test that either.

AFS support must be custom crafted for each UNIX dialect and then tested. If lsof supports your favorite dialect, but doesn't recognize its AFS files, probably I don't have access to a test system. If you want AFS support badly for your dialect, consider helping me do the development and testing.

#### 18.3.1 Why doesn't lsof report node numbers for all AFS volume files, or how do I reveal dynamic module addresses to lsof?

When AFS is implemented via dynamic kernel modules -- e.g., in NEXTSTEP -- lsof can't obtain the addresses of AFS variables in the kernel that it uses to identify AFS vnodes. It can guess that a vnode is assigned to an AFS file and it can obtain other information about AFS files, but it has trouble computing AFS volume node numbers.

To determine node numbers for AFS volumes other than the root volume, `/afs`, lsof needs access to a hashed volume structure pointer table. When it can't find the address of that table, because AFS support is implemented via dynamic kernel modules, lsof will return blanks in the INODE column for AFS volume files. lsof can identify the root volume's node

number (0), and can compute the node numbers for all other AFS files.

If you have a name list file that contains the addresses of the AFS dynamic modules -- e.g., you saved module symbols when you created a loadable module kernel with `modload(8)` by specifying `-sym` -- `lsof` may be able to find the kernel addresses it needs in that file.

`lsof` looks up AFS dynamic kernel addresses for these dialects at these default paths:

```
NEXTSTEP 3.2 /usr/vice/etc/afs_loadable
```

A different path to a name list file with AFS dynamic kernel addresses may be specified with the `-A` option, when the `-A` option description appears in `lsof`'s `-h` or `-?` (help) output.

If any addresses appear in the `-A` name list file that also appear in the regular kernel name list file -- e.g., `/vmunix` -- they must match, or `lsof` will silently ignore the `-A` addresses on the presumption that they are out of date.

Found in path(s):

```
* /opt/cola/permits/1350150906_1655994764.9225438/0/lsof-4-83-r1-2-tar-gz/lsof_4.83/lsof-4-83-src-tar/lsof_4.83_src/00FAQ
```

```
*
```

```
/opt/cola/permits/1350150906_1655994764.9225438/0/lsof-4-83-r1-2-tar-gz/lsof_4.83_src/00FAQ
```

No license file was found, but licenses were detected in source scan.

## Making and Installing `lsof` 4

```
*****  
| The latest release of lsof is always available via anonymous ftp |  
| from lsof.itap.purdue.edu. Look in pub/tools/unix/lsof.      |  
*****
```

### Contents

#### Pre-built `lsof` Binaries

#### Making `lsof`

- Other Configure Script Options

- Environment Variables

- Security

- Run-time Warnings

- Device Access Warnings

- NFS Blocks

- Caches -- Name and Device

- Raw Sockets
- Other Compile-time Definitions
- The AFSConfig Script
- The Inventory Script
- The Customize Script
- Cautions
- Warranty
- License
- Bug Reports
- The 00FAQ File
- The lsof-l Mailing List
- Field Output Example Scripts
- Field Output C Library
- Testing Lsof
- Dialect Notes
  - AFS
  - AIX
  - Apple Darwin
  - Auspex LFS (no longer maintained)
  
- BSDI BSD/OS
- DEC OSF/1, Digital UNIX, Tru64 UNIX
- FreeBSD
- HP-UX
- IPv6
- Linux
- NetBSD
- NEXTSTEP and OPENSTEP
- OpenBSD
- Pyramid DC/OSx and Reliant UNIX (no longer available)
- Caldera OpenUNIX
- SCO OpenServer
- SCO|Caldera UnixWare
- Solaris 2.x, 7, 8, 9 and 10
- Ultrix (no longer available)
- Veritas VxFS and VxVM
- User-contributed Dialect Support
- Dialects No Longer Supported
- Installing Lsof
  - Setuid-root Lsof Dialects
  - Setgid Lsof Dialects
- Porting lsof 4 to a New UNIX Dialect
- Quick Start to Using lsof
- Cross-configuring Lsof
- Environment Variables Affecting the Configure Script

=====

## Pre-built Lsof Binaries

=====

Avoid using pre-built lsof binaries if you can; build your own instead.

I do not support lsof binaries built and packaged by third parties nor lsof binaries built from anything but the latest lsof revision. (See the Bug Reports section for more information on the details of lsof support.)

One important reason for those support restrictions is that when lsof is built its Configure script tunes lsof to the features available on the building system, often embodied in supporting header files and libraries. If the building system doesn't have support for a particular feature, lsof won't be built to support the feature on any system.

The Veritas VxFS file system is a good example of a feature that requires build-time support.

UNIX dialect version differences -- Solaris 8 versus 9, AIX 4.3.3 versus 5.2, etc. -- can also render a pre-built lsof binary useless on a different version. So can kernel bit size.

There are so many potential pitfalls to using an lsof binary improperly that I strongly recommend lsof be used only where it is built.

=====

## Making Lsof

=====

```
$ cd <lsof source directory>
$ ./Configure <your dialect's abbreviation>
$ make
```

(Consult the 00FAQ and 00XCONFIG files of the lsof distribution for information about using make command invocations and environment variables to override lsof default Makefile strings.)

This lsof distribution can be used with many UNIX dialects. However, it must be configured specifically for each dialect. Configuration is done in three ways: 1) by changing definitions in the machine.h header file of the UNIX dialect of interest; 2) by defining



environment variable values prior to calling Configure (see the 00XCONFIG file, the Environment Variables and Environment Variables Affecting the Configure Script sections of this file); and 3) by running the Configure shell script found in the top level of the distribution directory.

You may not need to change any machine.h definitions, but you might want to look at them anyway. Pay particular attention to the definitions that are discussed in the Security section of this file. Please read that section.

The Configure script calls three other scripts in the lsof distribution: AFSConfig; Inventory; and Customize. The AFSConfig script is called for selected dialects (AIX, HP-UX, NEXTSTEP, and Solaris) to locate AFS header files and determine the AFS version. See The AFSConfig Script section of this file for more information.

The Inventory script checks the completeness of the lsof distribution. Configure calls Inventory after it has accepted the dialect abbreviation, but before it configures the top-level directory for the dialect. See The Inventory Script section of this file for more information.

Configure calls the Customize script after it has configured the top-level lsof directory for the declared dialect. Customize helps you modify some of the important compile-time definitions of machine.h. See the The Customize Script section.

You should also think about where you will install lsof and its man page, and whom you will let execute lsof. Please read the Installing Lsof section of this file for information on installation considerations.

Once you have inspected the machine.h file for the dialect for which you want to build lsof, and made any changes you need, run the Configure script, supplying it with the abbreviation for the dialect. (See the following table.) Configure selects the appropriate options for the dialect and runs the Mksrc shell script in the dialect sub-directory to construct the appropriate source files in the top-level distribution directory.

Configure may also run the MkKernOpts script in the dialect sub-directory to propagate kernel build options to the dialect Makefile. This is done for only a few dialects -- e.g., DC/OSx, and Reliant UNIX.

Configure creates a dialect-specific Makefile. You may want to inspect or edit this Makefile to make it conform to local conventions. If you want the Makefile to install lsof and its man page, you will have to create an appropriate install rule.

Lsof may be configured using UNIX dialect abbreviations from the following table. Alternative abbreviations are indicated by a separating `|'. For example, for SCO OpenServer you can use either the ``osr" or the ``sco" abbreviation:

```
$ Configure osr
or
$ Configure sco
```

#### Abbreviations UNIX Dialect

-----

```
aix  IBM AIX 5.[23] and 5.3-ML1 using IBM's C Compiler
aixgcc IBM AIX 5.[12] and 5.3-ML1 using gcc
darwin Apple Darwin 7.x and 8.x for Power Macintosh systems
decosf DEC OSF/1, Digital UNIX, Tru64 UNIX 4.0 and 5.1
digital_unix Digital UNIX, DEC OSF/1, Tru64 UNIX 4.0 and 5.1
du    Digital UNIX, DEC OSF/1, Tru64 UNIX 4.0 and 5.1
freebsd FreeBSD 4.x, 4.1x, 5.x and [67].x
hpux  HP-UX 11.00, 11.11 and 11.23, using HP's C
      Compiler, both /dev/kmem-based and PSTAT-based
hpuxgcc HP-UX 11.00, 11.11 and 11.23, using gcc, both
      /dev/kmem-based and PSTAT-based
linux Linux 2.1.72 and above for x86-based systems
netbsd NetBSD 1.[456], 2.x and 3.x
next  NEXTSTEP 3.[13]
nextstep NEXTSTEP 3.[13]
ns    NEXTSTEP 3.[13]
nxt   NEXTSTEP 3.[13]
openbsd OpenBSD
      2.[89] and 3.[0-9]
openstep OPENSTEP 4.x
os    OPENSTEP 4.x
osr   SCO OpenServer Release 5.0.6, using the C compiler
      from the SCO developer's kit
osrgcc SCO OpenServer Release 5.0.6, using gcc
osr6  SCO OpenServer 6.0.0, using the SCO C compiler
sco   SCO OpenServer Release 5.0.6, using the C compiler
      from the SCO developer's kit
scogcc SCO OpenServer Release 5.0.6, using gcc
solaris Solaris 2.x, 7, 8, 9 and 10 using gcc
solarisc  Solaris 2.x, 7, 8, 9 and 10 using Sun's cc
```

tru64 Tru64 UNIX, DEC OSF/1, Digital UNIX 4.0 and 5.1  
unixware SCO|Caldera UnixWare 7.1.4  
uw SCO|Caldera UnixWare 7.1.4

If you have an earlier version of a dialect not named in the above list, lsof may still work on your system. I have no way of testing that myself. Try configuring for the named dialect -- e.g., if you're using Solaris 2.1, try configuring for Solaris 2.5.1.

After you have configured lsof for your UNIX dialect and have selected options via the Customize script (See the The Customize Script section.) , use the make command to build lsof -- e.g.,

```
$ make
```

### Other Configure Script Options

=====

There are three other useful options to the Configure script besides the dialect abbreviation:

-clean      may be specified to remove all traces of a dialect configuration, including the Makefile, symbolic links, and library files.

-h            may be specified to obtain a list of  
-help        Configure options, including dialect abbreviations.

-n            may be specified to stop the Configure script from calling the Customize and Inventory scripts.

Caution: -n also suppresses the AFSConfig step.

### Environment Variables

=====

Lsof configuration, building, and execution may be affected by environment variable settings. See the Definitions That Affect Compilation section in the 00PORTING file, the General Environment Variables section in the 00XCONFIG

file, the Dialect-Specific Environment Variables section in the 00XCONFIG file, and the Environment Variables Affecting the Configure Script section of this file for more information.

Note in the General Environment Variables section of the 00XCONFIG file that there are five environment variables that can be used to pre-define values in lsof's -v output: LSOF\_BLDCMT, LSOF\_HOST, LSOF\_LOGNAME, LSOF\_SYSINFO, and LSOF\_USER.

## Security

=====

If the symbol HASSECURITY is defined, a security mode is enabled, and lsof will allow only the root user to list all open files. Non-root users may list only open files whose processes have the same user ID as the real user ID of the lsof process (the one that its user logged on with).

However, if HASNOSOCKSECURITY is also defined, anyone may list anyone else's open socket files, provided their listing is enabled with the "-i" option.

Lsof is distributed with the security mode disabled -- HASSECURITY is not defined. (When HASSECURITY is not defined, the definition of HASNOSOCKSECURITY has no meaning.) You can enable the security mode by defining HASSECURITY in the Makefile or in the machine.h header file for the specific dialect you're using -- e.g. dialects/aix/machine.h.

The Customize script, run by Configure when it has finished its work, gives you the opportunity to define HASSECURITY and HASNOSOCKSECURITY. (See the The Customize Script section.)

The lsof -h output indicates the state HASSECURITY and HASNOSOCKSECURITY had when lsof was built, reporting:

```
"Only root can list all files;"
if HASSECURITY was defined and HASNOSOCKSECURITY wasn't
defined;
```

```
"Only root can list all files, but anyone can list socket files."
if HASSECURITY and HASNOSOCKSECURITY were both defined;
```

```
"Anyone can list all files;"
if HASSECURITY wasn't defined. (The definition of
```

HASNOCKSECURITY doesn't matter when HASSECURITY isn't defined.)

You should carefully consider the implications of using the default security mode.

When lsof is compiled in the absence of the HASSECURITY definition, anyone who can execute lsof may be able to see the presence of all open files. This may allow the lsof user to observe open files -- e.g., log files used to track intrusions -- whose presence you would rather not disclose.

All pre-compiled binaries on lsof.itap.purdue.edu and mirrored from it were constructed without the HASSECURITY definition.

As distributed, lsof writes a user-readable and user-writable device cache file in the home directory of the real user ID executing lsof. There are other options for constructing the device cache file path, and they each have security implications.

The 00DCACHE file in the lsof distribution discusses device cache file path construction in great detail. It tells how to disable the various device cache file path options, or how to disable the entire device cache file feature by removing the HASDCACHE definition from the dialect's machine.h file. There is also information on the device cache file feature in the 00FAQ file. (The 00DCACHE and 00FAQ files are part of the lsof distribution package.)

The Customize script, run by Configure after it has finished its work, gives you the opportunity to change the compile-time options related to the device cache file. (See The Customize Script section.)

Since lsof may need setgid or setuid-root permission (See the Setgid Lsof Dialects and Setuid-root Lsof Dialects sections.), its security should always be viewed with skepticism. Lest the setgid and setuid-root permissions allow lsof to read kernel name list or memory files, declared with the -k and -m options, that the lsof user can't normally access, lsof uses access(2) to establish its real user's authority to read such files when it can't surrender its power before opening them. This change was added at the suggestion of Tim Ramsey.

Lsof surrenders setgid permission on most dialects when it has gained access to the kernel's memory devices. There are exceptions to this rule, and some lsof implementations need to run setuid-root. (The Setgid Lsof Dialects and Setuid-root Lsof Dialects sections

contains a list of lsof implementations and the permissions recommended in the distribution's Makefiles.)

The surrendering of setgid permission is controlled by the WILLDROPGID definition in the dialect machine.h header files.

In the end you must judge for yourself and your installation the risks that lsof presents and restrict access to it according to your circumstances and judgement.

### Run-time Warnings

=====

Lsof can issue warning messages when it runs -- e.g., about the state of the device cache file, about an inability to access an NFS file system, etc. Issuance of warnings are enabled by default in the lsof distribution.

Issuance of warnings may be disabled by default by defining WARNINGSTATE in the dialect's machine.h. The Customize script may also be used to change the default warning message issuance state. (See The Customize Script section.)

The ``-w" option description of the ``-h" option (help) output will indicate the default warning issuance state. Whatever the state may be, it can be reversed with ``-w".

### Device Access Warnings

=====

When lsof encounters a /dev (or /devices) directory, one of its sub-directories, or one of their files that it cannot access with opendir(3) or stat(2), it issues a warning message and continues. Lsof will be more likely to issue such a warning when it has been installed with setgid(<some group name>) permission; it won't have trouble if it has been installed with setuid(root) permission or is being run under the root login.

The lsof caller can inhibit or enable the warning with the -w option, depending on the issuance state of run-time warnings. (See the Run-time Warnings section.)

The warning messages do not appear when lsof obtains device information from a device cache file that it has built and believes to be current or when warning

message issuance is disabled by default. (See the "Caches -- Name and Device" section for more information on the device cache file.)

The lsof builder can inhibit the warning by disabling the definition of WARNDEVACCESS in the dialect's machine.h or disable all warnings by defining WARNINGSTATE. WARNDEVACCESS is defined by default for most dialects. However, some dialects have some device directory elements that are private -- e.g., HP-UX -- and it is more convenient for the lsof user if warning messages about them are inhibited.

Output from lsof's -h option indicates the status of WARNDEVACCESS. If it was defined when lsof was compiled, this message will appear:

```
/dev warnings = enabled
```

If WARNDEVACCESS was not defined when lsof was compiled, this message will appear instead:

```
/dev warnings = disabled
```

The Customize script, run by Configure after it has finished its work, gives you the opportunity to change the WARNDEVACCESS definition. (See The Customize Script section.)

## NFS

### Blocks

=====

Lsof is susceptible to NFS blocks when it tries to lstat() mounted file systems and when it does further processing -- lstat() and readlink() -- on its optional file and file system arguments.

Lsof tries to avoid being stopped completely by NFS blocks by doing the lstat() and readlink() functions in a child process, which returns the function response via a pipe. The lsof parent limits the wait for data to arrive in the pipe with a SIGALRM, and, if the alarm trips, terminates the child process with a SIGINT and a SIGKILL.

This is as reliable and portable a method for breaking NFS deadlocks as I have found, although it still fails under some combinations of NFS version, UNIX dialect, and NFS file system mount options. It generally succeeds when the "intr" or "soft" mount options are used; it generally fails when the "hard" mount option is used.

When lsof cannot kill the child process, a second timeout causes

it to stop waiting for the killed child to complete.

While the second timeout allows lsof to complete, it may leave behind a hung child process. Unless warnings are inhibited by default or with the -w option, lsof reports the possible hung child.

NFS block handling was updated with suggestions made by Andreas Stolcke. Andreas suggested using the alternate device numbers that appear in the mount tables of some dialects when it is not possible to stat(2) the mount points.

The -b option was added to direct lsof to avoid the stat(2) and readlink(2) calls that might block on NFS mount points and always use the alternate device numbers. If warning message issuance is enabled and you don't want warning messages about what lsof is doing, use the -w option, too.

The -O option directs lsof to avoid doing the potentially blocking operations in child processes. Instead, when -O is specified, lsof does them directly. While this consumes far less system overhead, it can cause lsof to hang, so I advise you to use -O sparingly.

## Caches

-- Name and Device

=====

Robert Ehrlich suggested that lsof obtain path name components for open files from the kernel's name cache. Where possible, lsof dialect implementations do that. The -C option inhibits kernel name cache examination.

Since AFS apparently does not use the kernel's name cache, where lsof supports AFS it is unable to identify AFS files with path name components.

Robert also suggested that lsof cache the information it obtains via stat(2) for nodes in /dev (or /devices) to reduce subsequent running time. Lsof does that, too.

In the default distribution the device cache file is stored in .lsof\_hostname, mode 0600, in the home directory of the login of the user ID that executes lsof. The suffix, hostname, is the first component of the host's name returned by gethostname(2). If lsof is executed by a user ID whose home directory is NFS-mounted from several hosts, the user ID's home directory may collect several device cache files, one for



each host from which it was executed.

Lsof senses accidental or malicious damage to the device cache file with extensive integrity checks, including the use of a 16 bit CRC. It also tries to sense changes in /dev (or /devices) that indicate the device cache file is out of date.

There are other options for forming the device cache file path. Methods the lsof builder can use to control and employ them are documented in the separate 00DCACHE file of the lsof distribution.

#### Raw Sockets

=====

On many UNIX systems raw sockets use a separate network control block structure. Display of files for applications using raw sockets -- ping, using ICMP, for example -- need special support for displaying their information. This support is so dialect-specific and information to provide it so difficult to find that not all dialect revisions of lsof handle raw sockets completely.

#### Other Compile-time Definitions

=====

The machine.h and dlsof.h header files for each dialect contains definitions that affect the compilation of lsof. Check the Definitions That Affect Compilation section of the 00PORTING file of the lsof distribution for their descriptions. (Also see The Customize Script section.)

#### The AFSConfig Script

=====

Lsof supports AFS on some combinations of UNIX dialect and AFS version. See the AFS section of this document for a list of supported combinations.

When configuring for dialects where AFS is supported, the Configure script calls the AFSConfig script to determine the location of AFS header files and the AFS version. Configure will not call AFSConfig, even for the selected dialects, unless the file /usr/vice/etc/ThisCell exists.

The AFS header file location is recorded in the AFSHeaders file;

version, AFSVersion. Once these values have been recorded, Configure can be told to skip the calling of AFSConfig by specifying its (Configure's) -n option.

### The Inventory Script

=====

The lsof distribution contains a script, called Inventory, that checks the distribution for completeness. It uses the file 00MANIFEST in the distribution as a reference point.

After the Configure script has accepted the dialect abbreviation, it normally calls the Inventory script to make sure the distribution is complete.

After Inventory has run, it creates the file ".ck00MAN" in the top-level directory to record for itself the fact that the inventory has been check. Should Inventory be called again, it senses this file and asks the caller if another check is in order, or if the check should be skipped.

The -n option may be supplied to Configure to make it bypass the calling of the Inventory script. (The option also causes Configure to avoid calling the Customize script.)

The lsof power user may want to define (touch) the file ".neverInv". Configure avoids calling the Inventory script when ".neverInv" exists.

### The Customize Script

=====

Normally when the Configure script has finished its work, it calls another shell script in the lsof distribution called Customize. (You can tell Configure to bypass Customize with its -n option.)

Customize leads you through the specification of these important compile-time definitions for the dialect's machine.h header file:

HASDCACHE device cache file control  
HASENVDC device cache file environment  
variable name  
HASPERSDC personal device cache file path  
format

HASPERSDCPATH name of environment variable that provides an additional component of the personal device cache file path  
HASSYSDC system-wide device cache file path  
HASKERNIDCK the build-time to run-time kernel identity check  
HASSECURITY the security option  
HASNOSOCKSECURITY the open socket listing option when HASSECURITY is defined  
WARNDEVACCESS /dev (or /devices) warning message control  
WARNINGSTATE warning message issuance state

The Customize script accompanies its prompting for entry of new values for these definitions with brief descriptions of each of them. More information on these definitions may be found in this file or in the 00DCACHE and 00FAQ files of the lsof distribution.

You don't need to run Customize after Configure. You can run it later or you can edit machine.h directly.

The -n option may be supplied to Configure to make it bypass the calling of the Customize script. (The option also causes Configure to avoid calling the Inventory script.)

The lsof power user may want to define (touch) the file ".neverCust". Configure avoids calling the Customize script when ".neverCust" exists.

Customize CAUTION: the Customize script works best when it is applied to a newly configured lsof source base -- i.e., the machine.h header file has not been previously modified by the Customize script. If you have previously configured lsof, and want to rerun the Customize script, I recommend you clean out the previous configuration and create a new one:

```
$ Configure -clean
$ Configure
<dialect_abbreviation>
...
```

Customize in response to the Customize script prompts.

Cautions

=====

Lsof is a tool that is closely tied to the UNIX operating system version. It uses header files that describe kernel structures and reads kernel structures that typically change from OS version to OS version, and even within a version as vendor patches are applied.

DON'T TRY TO USE AN LSOF BINARY, COMPILED FOR ONE UNIX OS VERSION, ON ANOTHER. VENDOR PATCHES INFLUENCE THE VERSION IDENTITY.

On some UNIX dialects lsof versions may be even more restricted by architecture type.

The bottom line is use lsof where you built it. If you intend to use a common lsof binary on multiple systems, make sure all systems run exactly the same OS version and have exactly the same patches.

#### Warranty

=====

Lsof is provided as-is without any warranty of any kind, either expressed or implied, including, but not limited to, the implied warranties of merchantability and fitness for a particular purpose.

The

entire risk as to the quality and performance of lsof is with you. Should lsof prove defective, you assume the cost of all necessary servicing, repair, or correction.

#### License

=====

Lsof has no license. Its use and distribution are subject to these terms and conditions, found in each lsof source file. (The copyright year in or format of the notice may vary slightly.)

/\*

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\*

\* Written by Victor A. Abell

\*

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## Bug Reports

=====

Now that the obligatory disclaimer is out of the way, let me hasten to add that I accept lsof bug reports and try hard to respond to them. I will also consider and discuss requests for new features, ports to new dialects, or ports to new OS versions.

PLEASE DON'T SEND BUG REPORTS ABOUT LSOF TO THE UNIX DIALECT OR DIALECT OPTION VENDOR.

At worst such bug reports will confuse the vendor; at best, the vendor will forward the bug report to me.

PLEASE DON'T SEND BUG REPORTS  
ABOUT LSOF BINARIES BUILT OR DISTRIBUTED  
BY SOMEONE ELSE, BECAUSE I CAN'T SUPPORT THEM.

I do support binaries I built, obtained ONLY from lsof.itap.purdue.edu. Before reporting a problem with a lsof.itap.purdue.edu binary, please verify the correctness of the signatures found in its associated CHECKSUMS file.

Before you send me a bug report, please do these things:

- \* Make sure you try the latest lsof revision.

+ Download the latest revision from:

<ftp://lsof.itap.purdue.edu/pub/tools/unix/lsof>

- + Verify the signatures of what you have downloaded;
- + While connected to `lsof.itap.purdue.edu`, check for patches:

`ftp://lsof.itap.purdue.edu/pub/tools/unix/lsof/patches`

- + If patches exist, install them in the latest revision you just downloaded. Then build the latest revision and see if it fixes your bug.
- \* If you're having trouble compiling lsof with gcc, try the UNIX dialect vendor's compiler. I don't have access to gcc on all test systems, so my support for it is hit-and-miss, and so is my ability to respond to gcc compilation problem reports.
- \* Check the lsof frequently asked questions file, `00FAQ`, to see if there's a question and answer relevant to your problem.
- \* Make sure you're running the lsof you think you are by checking the path to it with `which(1)`. When in doubt, use an absolute path to lsof. Make sure that lsof binary has sufficient permissions to do what you ask, including internal permissions given it (e.g., restrictions on what files lsof may report for whom) during its build.

When you send a bug report, make sure you include output from your running of lsof's `Configure` script. If you were able to compile a running lsof, please also include:

- \* Output from `which(1)` that shows the absolute path to the lsof binary in question;
- \* Output from running lsof with its `-h` and `-v` options at lsof's absolute path;
- \* Output from `"ls -l"` directed to lsof's absolute path.

If you weren't able to compile a running lsof, please send me: the compiler error output; identification of the lsof revision you're using (contents of the `lsof version.c` file); identification of your system (full `uname` output or output from whatever other tool identifies the system); and compiler identification (e.g., `gcc -v` output).

Either set of output will help me understand how lsof was configured and what UNIX dialect and lsof revision is involved.

Please send all bug reports, requests, etc. to me via e-mail at <abe@purdue.edu>. Make sure "Isof" appears in the "Subject:" line so my e-mail filter won't classify your letter as Spam.

#### The 00FAQ File

=====

The Isof distribution contains an extensive frequently asked questions file on Isof features and problems. I recommend you consult it before sending me e-mail. Use your favorite editor or pager to search 00FAQ -- e.g., supplying as a search argument some fixed text from an Isof error message.

#### The Isof-l Mailing List

=====

Information about Isof, including notices about the availability of new revisions, may be found in mailings of the Isof-l listserv. For more information about it, including instructions on how to subscribe, read the 00LSOF-L file of the Isof distribution.

#### Field Output Example Scripts

=====

Example AWK and Perl 4 or 5 scripts for post-processing Isof field output are locate in the scripts sub-directory of the Isof distribution. The scripts sub-directory contains a 00README file with information about the scripts.

#### Field Output C Library

=====

The Isof test suite (See "Testing Isof."), checks basic Isof operations using field output. The test suite has its own library of C functions for common test program operations, including processing of field output. The library or selections of its functions could be adapted for use by C programs that want to process Isof field output. See the library in the file LTlib.c in the tests/ sub-directory

## Testing Lsof

=====

Lsof has an automated test suite in the tests/ sub-directory that can be used to test some basic lsof features -- once lsof has been configured and made. Tests are arranged in three groups: basic tests that should run on all dialects; standard tests that should run on all dialects; and optional tests that may not run on all dialects or may need special resources to run. See 00TEST for more information.)

CAUTION!!! Before you attempt to use the test suite make sure that the lsof you want to test can access the necessary kernel resources -- e.g., /dev/mem, /dev/kmem, /proc, etc. Usually you want to test the lsof you just built, so this is an important check. (See 00TEST.)

To run the basic and standard tests, using the lsof in the parent directory of tests/, do this:

```
$ cd tests
$ make test
  or $ make std
  or $ make standard
```

The basic and standard tests may be run as silently as possible, using the lsof in the parent directory of tests/, with:

```
$ cd tests
$ make auto
```

This is the "automatic" test mode, designed for use by scripts that build lsof. The caller is expected to test the make exit code to determine if the tests succeeded. The caller should divert standard output and standard error to /dev/null to suppress make's error exit message.

The optional tests may be run, using the lsof in the parent directory of tests/, with:

```
$ cd tests
$ make opt
  or $ make optional
```

It's possible to excute individual tests, too. See the 00TEST file of this distribution for more informaiton on the tests, what they do, and how to run and possibly customize each test.



It's possible to run the tests, using an lsof other than the one in the parent directory of /tests, too. See 00TEST for information about using the LT\_LSOF\_PATH environment variable to do that.

=====

## Dialect Notes

=====

### AFS

====

#### Lsof

recognizes AFS files on the following combinations of UNIX dialect and AFS versions:

- AIX 4.1.4 (AFS 3.4a)
- Linux 1.2.13 (AFS 3.3)
- NEXTSTEP 3.2 (AFS 3.3) (untested on recent lsof revisions)
- Solaris 2.6 (AFS 3.4a)
- Ultrix 4.2 RISC (AFS 3.2b) (no longer available)

Lsof has not been tested under other combinations -- e.g. HP-UX 10.10 and AFS 3.4a -- and probably won't even compile there. Often when a UNIX dialect version or AFS version changes, the new header files come into conflict, causing compiler objections.

### AIX

====

Specify the aix Configure abbreviation for AIX 4.1.[45], 4.2[.1], 4.3[.123], 5L, and 5.[123].

Specify aixgcc on AIX above 4.1 to use the gcc compiler. (Gcc can't be used to compile lsof on AIX 4.1 and below because of kernel structure alignment differences between it and xlc.) Gcc results sometimes depend on the version of the gcc compiler that is used.

Compilation of lsof with gcc on AIX 4.3[.123], 5L, and 5.[123] has been sparsely tested with varying degrees of success: it has been reported to succeed on AIX 4.3.3 and 32 bit Power AIX 5.1; to fail on ia64 AIX 5.1 and 64 bit Power AIX 5.1; and to succeed on 32 and 64 bit Power AIX 5.2. Lsof compilation with gcc hasn't been tested on AIX 5.3.

At revision 4.61 and above lsof is configured and built to match the bit size of the kernel of Power architecture AIX 5.1 systems. Lsof binaries built for 32 and 64 bit kernels are not interchangeable. See 00FAQ for more information.

The Configure script uses /usr/bin/oslevel to determine the AIX version for AIX less than 5 and ``uname -rv" for AIX 5 and higher. If /usr/bin/oslevel isn't executable on AIX less than 5, the Configure script issues a warning message and uses ``uname -rv" to determine the AIX version.

When Configure must use ``uname -rv" on AIX less than 5 to determine the AIX version, the result will lack a correct third component -- e.g., the `4' of ``4.1.4". If your AIX less than 5 system lacks an executable oslevel,

I suggest you edit the Configure-produced Makefile and complete the \_AIXV definition in the CFGF string.

By default lsof avoids using the kernel's readx() function, causing it to be unable to report information on some text and library file references. The ``-X" option allows the lsof user to ask for the information readx() supplies.

Lsof avoids readx() to avoid the possibility of triggering a kernel problem, known as the Stale Segment ID kernel bug. Kevin Ruderman reported this bug to me. The bug shows up when the kernel's dir\_search() function hangs, hanging the application process that called it so completely that the application process can neither be killed nor stopped. The hang is the consequence of another process (perhaps lsof) making legitimate use of the kernel's readx() function to access the kernel memory that dir\_search() is examining. IBM has indicated they have no plans to fix the bug.

A fuller discussion of this bug may be found in the 00FAQ file of the lsof distribution.

There you will find a description of the Stale Segment ID bug, the APAR on it, and a discussion of the sequence of events that exposes it.

I added the ``-X" function so you can tell lsof to use readx(), but if you use ``-X", you should be alert to its possibly serious side effects. Although readx() is normally disabled, its state is controlled with the HASXOPT, HASXOPT\_ROOT, and HASXOPT\_VALUE definitions in dialects/aix/machine.h, and you can change its default state by changing those definitions. You can also change HASXOPT\_ROOT via the Customize script.

You can also compile lsof with readx() use permanently enabled or

disabled -- see the comments about the definitions in the dialects/aix/machine.h header file. You may want to permanently disable lsof's use of readx() if you plan to make lsof publicly executable. You can also restrict -X to processes whose real UID is root by defining HASXOPT\_ROOT.

I have never seen lsof cause the Stale Segment ID bug to occur and haven't had a report that it has, but I believe there is a possibility it could.

AFS support for AIX was added with help help from Bob Cook and Jan Tax who provided test systems.

Henry Grebler and David J. Wilson helped with lsof for AIX 4.2.

Bill Pemberton provided an AIX 4.3 test system. Andrew Kephart and Tom Weaver provided AIX 4.3 technical assistance. Niklas Edmundsson did 4.3.1 testing. Doug Crabill provided an AIX 4.3.2 test system. Jeff W. Stewart provided an AIX 4.3.3 test system.

The SMT file type for AIX 4.1.[45], 4.2[.1], and 4.3[.12] is my fabrication. See the 00FAQ file more information on it.

Loc Le and Nasser Momtaheni of IBM provided test systems for AIX 5L and 5.1. Lsof for AIX 5L and 5.1 needs setuid-root permission to process the -X option on systems whose architecture type is ia64.

Dale Talcott of Purdue provided AIX 5.1 and 5.2 test systems. Dale and John Jackson of Purdue provided an AIX 5.3 test system.

Apple Darwin  
=====

The Apple Darwin port was provided by Allan Nathanson for version 1.2. Allan also arranged for access to a test system for maintenance and regression testing. Dale Talcott provided a test system, too.

Allan supplied patches for updates to 1.4, 5.x, 6.x, 7.x and 8.x.

BSDI BSD/OS  
=====

As of lsof revision 4.77 support for BSDI BSD/OS has been discontinued. Lsof revision 4.76 with BSDI BSD/OS support may be found

on lsof.itap.purdue.edu in pub/tools/unix/lsof/src.

## DEC OSF/1, Digital UNIX, Tru64 UNIX

=====

Robert Benites, Dean Brock, Angel Li, Dwight McKay, Berkley Shands, Ron Young and Steve Wilson have kindly provided test systems. Jeffrey Mogul has provided technical assistance. Dave Morrison and Lawrence MacIntyre did Digital UNIX V3.2 testing.

Lsof supports the ADVFS/MSFS layered file system product. Lsof can locate all the open files of an ADVFS/MSFS file system when its path is specified, provided the file system is listed in /etc/fstab with an ``advfs" type. (This /etc/fstab caveat applies only to Digital UNIX 2.0.) At Digital UNIX 4.0 and Tru64 UNIX, using code provided by David Brock, lsof 4.20 and above can locate ADVFS file paths.

Testing of lsof on DEC OSF/1 and Digital UNIX 4.0 ended with lsof revision 4.74. Hence, the lsof documentation has dropped the claim that it works there. For a distribution of lsof 4.74 that was tested on DEC OSF/1 and Digital UNIX 4.0, check pub/tools/unix/lsof/OLD/src on the lsof ftp home, lsof.itap.purdue.edu.

Lsof revisions past 4.74 have only been tested on Tru64 UNIX 5.1.

## FreeBSD

=====

Bill Bormann of Purdue University provided access to several FreeBSD test systems. Ade Barkah, John Clear, Ralph Forsythe, Michael Haro, Kurt Jaeger, and William McVey have also provided FreeBSD test systems.

The FreeBSD distribution header files are augmented by header files in the dialects/freebsd/include directory.

David O'Brien maintains the lsof FreeBSD port package.

## HP-UX

=====

Lsof has

two HP-UX bases: /dev/kmem for HP-UX 11.0 and earlier; and PSTAT for HP-UX 11.11 and later. The lsof Configure script will pick the appropriate base.

To use the CCITT x.25 socket support for HP-UX, you must have the x.25 header files in /etc/conf/x25

Pasi Kaara helped with the HP-UX port, especially with its CCITT x.25 socket support.

Richard Allen provided HP-UX 10.x and 11.x test systems, as did Mark Bixby, and Elias Halldor Agustsson. Marc Winkler helped test the 10.20 port. Richard J. Rauenzahn provided a 64 bit HP-UX 11 test system and an HP-UX 11.11 development system.

AFS support for HP-UX was added thanks to help from Chaskiel Moses Grundman, who provided a test system.

The /dev/kmem-based HP-UX 11.00 support is extremely fragile. It depends on privately developed kernel structure definitions. (See ../dialects/hpux/hpux11 for the header files making the definitions.) Those header files and their definitions will not be updated by HP-UX 11.00 patches, making it likely that any patch changing a kernel structure critical to lsof will break lsof in some way.

It's possible to build a 64 bit lsof for 64 bit HP-UX 11.00 with gcc, but you must have a gcc compiler capable of producing 64 bit executables. See the 00FAQ file for more information.

The PSTAT-based lsof for HP-UX 11.11 and later is much more solid. I am indebted to the vision of HP for providing an lsof kernel API through the PSTAT implementation. Specifically I appreciate the help of HP staff members Carl Davidson, Louis Huemiller, Rich Rauenzahn, and Sailu Yallapragada that made PSTAT-based HP-UX lsof possible.

## IPv6

====

Lsof has IPv6 support that has been tested for these UNIX dialects: AIX 4.3.x; Apple Darwin 5.[12] and 6.0; the INRIA and KAME FreeBSD IPv6 implementations; PSTAT-based HP-UX; /proc-based Linux; the INRIA and KAME NetBSD implementations; and Solaris 8 and 9. Lsof has IPv6 support that hasn't been tested for: OpenBSD (KAME); OpenUNIX 8; Tru64 Unix 5.[01]; and UnixWare

7.1.[34].

Please let me know if your UNIX dialect has IPv6 support and I'll see if it can be supported by lsof.

## Linux

=====

Tim Korb, Steve Logue, Joseph J. Nuspl Jr., and Jonathan Sergent have provided Linux test systems.

Michael Shields helped add and test automatic handling of ELF/COFF form names in /System.map, Marty Leisner and Keith Parks have helped test many lsof revisions. Marty has provided valuable suggestions, Linux hints, and code, too.

The 00FAQ file gives some Linux tips, including information on coping with system map file problems.

To determine the state of the Linux 2.1.x C library lseek() function, the lsof Configure script runs a test program that must have permission to read /dev/kmem. The test determines if the lseek() function properly handles kernel offsets, which appear to be negative because their high order bit is set. If the lseek() test reveals a faulty lseek(), Configure activates the use of a private lseek() function for kernel offset positioning.

See the Linux problems section of the 00FAQ file of the lsof distribution for more information.

## NetBSD

=====

Greg Earle and Paul Kranenburg have assisted with the NetBSD ports. Paul has provided test systems. Ray Phillips provided a NetBSD Alpha test system. Andrew Brown also provided a test system.

The NetBSD dialect version of lsof is compiled using the dialect sources it shares with OpenBSD in the n+obsd dialect sub-directory.

## NEXTSTEP and OPENSTEP

=====

Virtual memory header files that allow lsof to display text references were derived from the contents of /usr/include/vm of NEXTSTEP 2.0.

NeXT did not ship the virtual memory header files with other NEXTSTEP or OPENSTEP versions.

You may use the RC\_FLAGS environment variable to declare compiler options outside the Makefile. A common use of this variable is to define the architecture types to be included in a "fat" executable. See the comments in dialects/next/Makefile for an example.

## OpenBSD

=====

David

Mazieres has provided OpenBSD test systems. The OpenBSD dialect version of lsof is compiled using the dialect sources it shares with NetBSD in the n+obsd dialect sub-directory.

Kenneth Stailey has provided OpenBSD testing and advice.

John Dzuber (Zube) reports, "lsof 4.33 compiles and runs on OpenBSD 2.3 for the pmax architecture (decstation 3100)."

I have not tested lsof on OpenBSD 3.8, but David Mazieres reports revision 4.76 worked on OpenBSD 3.8.

## Pyramid DC/OSx and Reliant UNIX

=====

As of lsof revision 4.52 support for all Pyramid dialects has been discontinued. Lsof revision 4.51 with Pyramid support may be obtained upon request. Send the request to [abe@purdue.edu](mailto:abe@purdue.edu).

These two UNIX dialects are very similar and share dialect-specific source files from the pyramid sub-directory.

The Reliant Unix Pyramid C compiler issues warning messages that I haven't found a convenient way to suppress. You can ignore warning messages about casts and conversions that lose bits. The message "warning: undefining \_\_STDC\_\_" is intentionally caused by the lsof MkKernOpts configuration script to suppress warning messages about cast and conversion problems in standard system header files, such as <stdio.h> and <string.h>.

Bruce Beare and Kevin Smith provided test systems.

## Caldera OpenUNIX

=====

Larry Rosenman provided an OpenUNIX 8 test system. Matthew Thurmaier provided technical assistance, along with these people from Caldera: Jack Craig, Robert Lipe, and Bela Lubkin.

Robert Lipe supplied changes to lsof for OpenUNIX 8.0.1. Those changes were also incorporated in UnixWare 7.1.3 when it became the release name for OpenUNIX 8.0.1.

Support for lsof on OpenUNIX ended at lsof revision 4.74. The last lsof revision, 4.74, tested on OpenUNIX, may be found at the lsof "home" ftp site, [lsof.itap.purdue.edu](ftp://lsof.itap.purdue.edu), in `pub/tools/unix/lsof/OLD/src`.

## SCO OpenServer

=====

Dion Johnson, Bela Lubkin, and Nathan Peterson of SCO gave me copies of SCO OpenServer and the SCO OpenServer Development System 3.0 and provided technical advice for the lsof port.

Hugh Dickins, Bela Lubkin, Craig B. Olofson, and Nathan Peterson provided version 5.0 and gave technical advice for porting lsof to it. Bela provided the 5.0.4 changes. D. Chris Daniels provided a 5.0.4 test system, Lee Penn provided one for 5.0.5, and John Dubois for 5.0.6.

The `<netdb.h>` header file was accidentally omitted from some SCO OpenServer Development System releases. The Configure script will sense its absence and substitute an equivalent from the BSD distribution. The BSD `<netdb.h>` and the `<sys/cdefs.h>` header file it includes are located in the `dialects/os/include` sub-directory tree.

To compile lsof from its distribution sources you must have the TCP/IP and NFS headers in `/usr/include`. While those are optional OpenServer packages, I have access to no system that doesn't have them, so I'm unable to build lsof for such a configuration.

However, it should be possible to modify the lsof Configure script and sources so lsof would compile and work without those optional packages.

If you have an OpenServer system configured without the TCP/IP and NFS packages, and want to tackle the job of building lsof for it,



contact me via e-mail at <abe@purdue.edu>. I'll identify the Configure script, header file, and source file changes you will need to make. (Caution: this is not a simple task, or I would have already done it.)

The optional osrgcc and scogcc Configure abbreviations construct Makefiles for compiling lsof with gcc.

The UnixWare 7.1.4 sources are used for OpenServer Release 6.0.0. Hence there is a separate Configure abbreviation for it, "osr6". Richard of SCO provided a test system and technical assistance.

SCO|Caldera UnixWare

=====

D. Chris Daniels, John Hughes, Ken Laing, Andrew Merrill, Lee Penn, and Matthew Thurmaier provided test systems. Bela Lubkin provided technical assistance. Larry Rosenman provided 7.1.[34] test systems.

Solaris 2.x, 7, 8, 9 and 10

=====

SEE THE CAUTIONS SECTION OF THIS DOCUMENT.

The latest Solaris revision of lsof 4 might work under Solaris 2.[1-4] and 2.5[.1] and 7 but hasn't been tested there. I have no test systems for those Solaris versions.

Lsof will compile with gcc and the Sun C compiler under Solaris. If you want to use the Sun compiler, use the solarisc compiler abbreviation. If you use a gcc version less than 2.8 on Solaris, make sure the gcc-specific includes have been updated for your version of Solaris -- i.e., run the gcc fixincludes script.

Solaris 7, 8, 9 and 10 support for 64 bit kernels depends on a Sun WorkShop or Forte C compiler version that supports the "-xarch=v9" flag -- usually 5.0 or greater. Gcc versions 2.95 and above \*may\* be configured and built for 64 bit support, but it takes some extra work, the resulting compiler may be fragile, and the gcc developers discourage it. I've built 64 bit capable gcc compilers for Solaris 7, 8 and 9 from gcc versions 2.95 through 3.0.1 and produced working lsof executables with them. More information on 64 bit gcc for Solaris may be found in the 00FAQ file.

Solaris 10 ZFS support is questionable, because Sun does not distribute the ZFS kernel structure definition header files. The lsof Configure script and source code use some risky work-arounds. ZFS file system support was made possible with help from Horst Scheuermann.

Dave Curry and Steve Kirsch provided resources for Solaris 2.x ports. Casper Dik and Gerry Singleton consulted and provided valuable assistance.

Henry Katz, Joseph Kowalski, Charles Stephens, Mike Sullivan, and Mike Tracy provided technical assistance.

AFS support was added to Solaris lsof with help from Curt Freeland, Heidi Hornstein, Michael L. Lewis, Terry McCoy, Phillip Moore, and Sushila R. Subramanian.

Casper Dik provided valuable assistance for the Solaris 8 support.

Sun has graciously provided me access to BETA versions of Solaris 2.5, 2.6, 7, 8, and 9.

John Dzuberger provided Solaris 7 and 8 test systems.

Mike Miscevic provided Solaris 10 test systems.

Ultrix

=====

As of lsof revision 4.52 support for Ultrix is no longer available, because I no longer have an Ultrix test system.

Terry Friedrichsen, Dwight McKay, and Jeffrey Mogul helped me with this port.

DECnet support was added to Ultrix lsof with the help of John Beacom, who kindly provided a test system. The Configure script decides that DECnet support is available if /usr/lib/libdnet.a and /usr/include/netdnet/dn.h exist and are readable.

Veritas VxFS and VxVM

=====

lsof supports some versions of Veritas VxFS and VxVM on some UNIX dialects. Consult the lsof Configure script for the specific dialect, and consult the lsof dialect-specific source files for

the UNIX dialect of interest. Veritas support will usually be found in a source file named dnode[1-9].c.

Since Veritas rarely has a version number that can be extracted with shell commands, lsof doesn't use it. Instead, when lsof supports Veritas, the Configure script will form compile-time definitions starting with HASVXFS. Check the lsof 00PORTING documentation file for more information.

Lsof Veritas support requires that the supporting Veritas header files be installed -- e.g., in /usr/include/sys/fs. (The location will depend in the dialect's header file conventions.)

Some information on lsof support for Veritas extensions may be found in the lsof 00DIST file.

Chris Kordish and Andy Thomas have provided Solaris VxFS test systems.

=====  
User-contributed Dialect Support  
=====

There are some user-contributed dialect versions of lsof; more information on them can be found at:

<ftp://lsof.itap.purdue.edu/pub/tools/unix/lsof/contrib>

Check the 00INDEX file there for details.

=====  
Dialects No Longer Supported  
=====

Because I don't have access to test systems, these UNIX dialects are no longer supported by lsof:

- CDC EP/IX
- /dev/kmem-based Linux
- MIPS RISC/os
- Motorola V/88
- Pyramid DC/OSx
- Pyramid Reliant UNIX
- Sequent DYNIX

SGI IRIX  
SunOS 4.x  
Ultrix  
UnixWare below 7.0

Remnants of the support lsof once provided for these dialects may be found in:

<ftp://lsof.itap.purdue.edu/pub/tools/unix/lsof/OLD/binaries>  
and  
<ftp://lsof.itap.purdue.edu/pub/tools/unix/lsof/OLD/dialects>

=====  
Installing Lsof  
=====

The distributed Makefiles do not have actions that will install lsof. I've come to the conclusion there is no standard for installing lsof or its man page, so I no longer distribute make rules for installing them. You should adjust the Makefile for your local preferences.

The Makefile does have an install rule that will cause lsof to compile by virtue of its dependency clause. Some Makefiles also have a dependency that causes the production of a man page that is ready to install.

However, the actions of the install rule will not cause the lsof executable or its man page to be installed in any UNIX system-wide directory.

Instead, after the compilation and optional man page production are completed, the install rule will produce a brief description of what actions you might add to the install rule. The description will suggest the possible modes, ownerships, permissions, and destinations your install rule might employ to install the lsof executable and man page.

As you form your install rule, keep in mind that lsof usually needs some type of special permission to do its job. That may be permission to read memory devices such as /dev/kmem, /dev/mem, or /dev/swap, or it may be authorization to read entries in the /proc file system.

Memory device access can usually be provided by setting the modes of the lsof executable so that its effective group identifier when it runs is the same as the group that has permission to read the memory devices -- i.e., it

is setgid-group. The privileged group is usually kmem, sys, or system.

Don't overlook using ACLs -- e.g., on AIX or Solaris 8 -- to give lsof permission to access memory devices. ACLs, coupled to a separate group like kmem, can be safer than giving lsof setgid authorization to a commonly used system group.

When lsof needs to read /proc file system entries, it must be installed with modes that make its effective user identifier root when it runs -- i.e., it must be setuid-root. If lsof must be installed setuid-root (only the AIX 5L, PSTAT-based HPUX, and /proc-based Linux, ports need such power.), then access to memory devices is automatic (or not needed in the case of /proc-based Linux).

Your choice of permissions for lsof may also be affected by your desire to allow anyone to use it or your need to restrict its usage to specific individuals. You will have to be guided by local policy and convention in this case.

The next two sections, Setgid Lsof Dialect Versions and Setuid-root Lsof

Dialect Versions, list recommended install permissions.

The system directory where you install the lsof executable is also open to choice. A traditional place for a tool like lsof is /usr/local/etc, but recent changes in directory structure organization suggest that somewhere in /opt may be more suitable.

Bear one other factor in mind when choosing a location for the lsof executable -- it usually is a shared executable, requiring access to shared libraries. Thus, locations like /sbin or /usr/sbin are probably unsuitable.

Once you've chosen a location for the executable you may find that the location for the man page follows -- e.g., if the executable goes in /usr/local/etc, then the man page goes in /usr/local/man. If the executable location doesn't imply a location for the man page, you'll have to let local custom guide you.

#### Setuid-root Lsof Dialect Versions

=====

These dialect versions should be installed with setuid-root permission -- i.e.,

the lsof binary should be owned by root and its setuid execution bit (04000) should be set.

AIX 5L and above for full use of the -X option  
Apple Darwin 8.x for Power Macintosh systems  
PSTAT-based HP-UX 11.11 and 11.23  
/proc-based Linux (generally 2.1.72 and above)

#### Setgid Lsof Dialect Versions

=====

These dialect versions should be installed with setgid permission, owned by the group that can read kernel memory devices such as /dev/drum, /dev/kmem, /dev/ksyms, /dev/mem, /dev/swap. ACLs may be another mechanism (e.g., under AIX or Solaris 8) you can use to grant read permission to the kernel memory devices.

AIX 4.1.[45], 4.2[.1], and 4.3[.123]  
Apple Darwin 7.x for Power Macintosh systems  
DEC OSF/1, Digital UNIX, Tru64 UNIX 2.0, 3.2, 4.0, and 5.[01]  
FreeBSD 2.1.6, 2.2[.x], 3.x, 4.x, 5.x and [67].x  
/dev/kmem-based 11.00  
NetBSD 1.[456], 2.x and 3.x  
NEXTSTEP 3.[13]  
OpenBSD 2.[89] and 3.[0-9]  
OPENSTEP 4.x  
Caldera OpenUNIX 8  
SCO OpenServer 5.0.[46]  
SCO  
UnixWare 7.0 and 7.1.[0134]  
Solaris 2.6, 8, 9 and 10  
Ultrix 4.2 (no longer available)

=====

#### Porting Lsof 4 to a New UNIX Dialect

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If you're brave enough to consider this, look at the 00PORTING file. Please contact me before you start. I might be able to help you or even do the port myself.

Don't overlook the contrib/ directory in pub/tools/unix/lsof on my ftp server, lsof.itap.purdue.edu. It contains user-contributed ports of lsof to dialects I don't distribute, because I can't test new revisions of lsof on them.

=====

## Quick Start to Using Lsof

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For information on how to get started quickly using Lsof, consult the 00QUICKSTART file of the Lsof distribution. It cuts past the formal density of the Lsof man page to provide quick examples of using Lsof to solve common open file display problems.

=====

## Cross-configuring Lsof

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### Using

environment variables it is possible to Configure (and possibly build) Lsof for one UNIX dialect on a different one -- e.g., you are running Configure on a Linux 2.3 system and you want to Configure and build Lsof for Linux 2.4.

See the 00XCONFIG file of the Lsof distribution for a discussion of how to do this.

=====

## Environment Variables Affecting the Configure Script

=====

Configure script actions can be modified by introducing values to the script via environment variables. In many cases the environment variable values take the place of test operations the Configure script makes.

For more information on environment variables that can affect Configure, consult the 00XCONFIG file of the Lsof distribution. See the General Environment Variables sections for descriptions of ones that affect all dialects. Consult the Dialect-Specific Environment Variables section for ones that might affect the dialect you are trying to configure.

Vic Abell <abe@purdue.edu>

April 24, 2007

Found in path(s):

\* /opt/cola/permits/1350150906\_1655994764.9225438/0/lsof-4-83-r1-2-tar-gz/lsof\_4.83\_src/00README

\* /opt/cola/permits/1350150906\_1655994764.9225438/0/lsof-4-83-r1-2-tar-gz/lsof\_4.83/lsof-4-83-src-

# 1.143 sqlite 3.6.7

## 1.143.1 Available under license :

The author disclaims copyright to this source code. In place of a legal notice, here is a blessing:

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May you find forgiveness for yourself and forgive others.  
May you share freely, never taking more than you give.

# 1.144 lvm2 2.02.64

## 1.144.1 Available under license :

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Version 2.1, February 1999

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## 1.145 libdevmapper 1.02.47

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Alexander

Demakin <alexander.demakin@gmail.com>  
Alexander Dring <email@alex.d.ch>  
Alexander Larsson <alexander.larsson@gmail.com>  
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Andrei Korzhevskii <a.korzhevskiy@gmail.com>  
Andrei Vieru <euvieru@gmail.com>  
Andres Erbsen <andreser@google.com>  
Andrew Austin <andrewacht@gmail.com>  
Andrew Balholm <andybalholm@gmail.com>  
Andrew Bonventre <andybons@chromium.org>  
Andrew Bursavich <abursavich@gmail.com>  
Andrew Ekstedt <andrew.ekstedt@gmail.com>  
Andrew Etter <andrew.etter@gmail.com>  
Andrew Gerrand <adg@golang.org>  
Andrew Harding <andrew@spacemonkey.com>  
Andrew Lutomirski <andy@luto.us>  
Andrew Pilloud <andrewpilloud@igneoussystem.com>  
Andrew Pogrebnoy <absourd.noise@gmail.com>  
Andrew Pritchard <awpritchard@gmail.com>  
Andrew Radev <andrey.radev@gmail.com>

Andrew Skiba <skibaa@gmail.com>  
Andrew Szeto <andrew@jabagawee.com>  
Andrew Werner <andrew@upthere.com> <awerner32@gmail.com>  
Andrew Wilkins <axwalk@gmail.com>  
Andrew  
Williams <williams.andrew@gmail.com>  
Andrey Mirtchovski <mirtchovski@gmail.com>  
Andrey Petrov <andrey.petrov@shazow.net>  
Andriy Lytvynov <lytvynov.a.v@gmail.com>  
Andy Balholm <andy@balholm.com>  
Andy Davis <andy@bigandian.com>  
Andy Finkenstadt <afinkenstadt@zynga.com>  
Andy Maloney <asmaloney@gmail.com>  
Anfernee Yongkun Gui <anfernee.gui@gmail.com>  
Angelo Bulfone <mbulfone@gmail.com>  
Anh Hai Trinh <anh.hai.trinh@gmail.com>  
Anmol Sethi <anmol@aubble.com>  
Anschel Schaffer-Cohen <anschelsc@gmail.com>  
Anthony Canino <anthony.canino1@gmail.com>  
Anthony Eufemio <anthony.eufemio@gmail.com>  
Anthony Martin <ality@pbrane.org>  
Anthony Starks <ajstarks@gmail.com>  
Anthony Woods <awoods@raintank.io>  
Antonio Bibiano <antbbn@gmail.com>  
Antonio Murdaca <runcom@redhat.com>  
Apisak Darakananda <pongad@gmail.com>  
Aram Hvrneanu <aram@mgk.ro>  
Areski Belaid <areski@gmail.com>  
Arkadi Pyuro <arkadi@google.com>  
Arlo Breault <arlolra@gmail.com>  
Arnaud Ysmal <arnaud.ysmal@gmail.com>  
Arne Hormann <arnehormann@gmail.com>  
Arnout  
Engelen <arnout@bzzt.net>  
Aron Nopanen <aron.nopanen@gmail.com>  
Artyom Pervukhin <artyom.pervukhin@gmail.com>  
Arvinth Rajesh Tamilmanni <art@a-30.net>  
Asim Shankar <asimshankar@gmail.com>  
Atin Malaviya <amalaviy@akamai.com>  
Ato Araki <ato.araki@gmail.com>  
Audrey Lim <audreylh@gmail.com>  
Augusto Roman <aroman@gmail.com>  
Aulus Egnatius Varialus <varialus@gmail.com>  
Austin Clements <austin@google.com> <aclements@csail.mit.edu>  
awaw fumin <awawfumin@gmail.com>  
Ayanamist Yang <ayanamist@gmail.com>  
Aymerick Jhanne <aymerick@jehanne.org>  
Baiju Muthukadan <baiju.m.mail@gmail.com>



Balazs Lecz <leczb@google.com>  
Ben Burkert <ben@benburkert.com>  
Ben Eitzen <eitzenb@golang.org>  
Ben Fried <ben.fried@gmail.com>  
Ben Lubar <ben.lubar@gmail.com>  
Ben Lynn <benlynn@gmail.com>  
Ben Olive <sionide21@gmail.com>  
Benjamin Black <b@b3k.us>  
Benjamin Prosnitz <bprosnitz@google.com>  
Benjamin Wester <bwester@squareup.com>  
Benny Siegert <bsiegert@gmail.com>  
Benoit Sigoure <tsunanet@gmail.com>  
Berengar  
  Lehr <Berengar.Lehr@gmx.de>  
Bill Neubauer <wcn@golang.org> <wcn@google.com> <bill.neubauer@gmail.com>  
Bill O'Farrell <billo@ca.ibm.com>  
Bill Thiede <couchmoney@gmail.com>  
Billie Harold Cleek <bhcleek@gmail.com>  
Billy Lynch <wlynch@google.com>  
Bjorn Tillenius <bjorn@tillenius.me>  
Bjorn Tipling <bjorn.tipling@gmail.com>  
Blake Gentry <blakesgentry@gmail.com>  
Blake Mizerany <blake.mizerany@gmail.com>  
Blixt <me@blixt.nyc>  
Bobby Powers <bobbypowers@gmail.com>  
Boris Nagaev <nagaev@google.com>  
Brad Fitzpatrick <bradfitz@golang.org> <bradfitz@gmail.com>  
Brad Garcia <bgarcia@golang.org>  
Braden Bassingthwaite <bbassingthwaite@vendasta.com>  
Brady Catherman <brady@gmail.com>  
Brady Sullivan <brady@bsull.com>  
Brandon Gilmore <varz@google.com>  
Brendan Daniel Tracey <tracey.brendan@gmail.com>  
Brendan O'Dea <bod@golang.org>  
Brett Cannon <bcannon@gmail.com>  
Brian Dellisanti <briandellisanti@gmail.com>  
Brian G. Merrell <bgmerrell@gmail.com>  
Brian Gitonga Marete <marete@toshnix.com> <bgmarete@gmail.com>  
  <bgm@google.com>  
Brian Kennedy <btkennedy@gmail.com>  
Brian Ketelsen <bketelsen@gmail.com>  
Brian Slesinsky <skybrian@google.com>  
Brian Smith <ohohvi@gmail.com>  
Bryan Alexander <Kozical@msn.com>  
Bryan C. Mills <bcmills@google.com>  
Bryan Chan <bryan.chan@ca.ibm.com>  
Bryan Ford <brynosaurus@gmail.com>  
Caine Tighe <arctanofyourface@gmail.com>

Caio Marcelo de Oliveira Filho <caio.oliveira@intel.com>  
Caleb Spare <cespare@gmail.com>  
Carl Chatfield <carlchatfield@gmail.com>  
Carl Jackson <carl@stripe.com>  
Carl Johnson <me@carlmjohnson.net>  
Carl Mastrangelo <notcarl@google.com>  
Carl Shapiro <cshapiro@google.com> <cshapiro@golang.org>  
Carlos Castillo <cookieo9@gmail.com>  
Carlos Cirello <uldericofilho@gmail.com>  
Carlos Eduardo Seo <cseo@linux.vnet.ibm.com>  
Cary Hull <chull@google.com>  
Case Nelson <case.nelson@gmail.com>  
Casey Marshall <casey.marshall@gmail.com>  
Catalin Nicutar <cnicutar@google.com>  
Catalin Patulea <catalinp@google.com>  
Cedric Staub <cs@squareup.com>  
Cezar S Espinola <cezarsa@gmail.com>  
ChaiShushan  
<chaishushan@gmail.com>  
Charles L. Dorian <cldorian@gmail.com>  
Charles Lee <zombie.fml@gmail.com>  
Charles Weill <weill@google.com>  
Cherry Zhang <cherryyz@google.com>  
Chris Broadfoot <cbro@golang.org>  
Chris Dollin <ehog.hedge@gmail.com>  
Chris Farmiloe <chrisfarms@gmail.com>  
Chris Hines <chris.cs.guy@gmail.com>  
Chris Howey <howeyc@gmail.com>  
Chris Hundt <hundt@google.com>  
Chris Jones <chris@cjones.org> <chris.jones.yar@gmail.com>  
Chris Kastorff <encryptio@gmail.com>  
Chris Lennert <calennert@gmail.com>  
Chris Manghane <cmang@golang.org>  
Chris McGee <sirnewton\_01@yahoo.ca> <newton688@gmail.com>  
Chris Stockton <chrisstocktonaz@gmail.com>  
Chris Zou <chriszou@ca.ibm.com>  
Christian Couder <chriscool@tuxfamily.org>  
Christian Himpel <chressie@googlegmail.com> <chressie@gmail.com>  
Christine Hansmann <chhansmann@gmail.com>  
Christoffer Buchholz <christoffer.buchholz@gmail.com>  
Christoph Hack <christoph@tux21b.org>  
Christopher Cahoon <chris.cahoon@gmail.com>  
Christopher Guiney  
<chris@guiney.net>  
Christopher Nelson <nadiasvertex@gmail.com>  
Christopher Nielsen <m4dh4tt3r@gmail.com>  
Christopher Redden <christopher.redden@gmail.com>  
Christopher Swenson <cswenson@google.com>

Christopher Wedgwood <cw@f00f.org>  
Christy Perez <christy@linux.vnet.ibm.com>  
CL Sung <clsung@gmail.com> <cl\_sung@htc.com>  
Clement Skau <clementskau@gmail.com>  
Colby Ranger <cranger@google.com>  
Colin Cross <ccross@android.com>  
Colin Edwards <colin@recursivepenguin.com>  
Colin Kennedy <moshen.colin@gmail.com>  
Conrad Irwin <conrad.irwin@gmail.com>  
Conrad Meyer <cemeyer@cs.washington.edu>  
Corey Thomasson <cthom.lists@gmail.com>  
Cosmos Nicolaou <cnicolaou@google.com>  
Cristian Staretu <unclejacksons@gmail.com>  
Cuihtlauac ALVARADO <cuihtlauac.alvarado@orange.com>  
Cyrill Schumacher <cyrill@schumacher.fm>  
Damian Gryski <dgryski@gmail.com>  
Damien Neil <dneil@google.com>  
Dan Caddigan <goldcaddy77@gmail.com>  
Dan Callahan <dan.callahan@gmail.com>  
Dan Harrington <harringtond@google.com>  
Dan Jacques <dnj@google.com>  
Dan  
Peterson <dpiddy@gmail.com>  
Dan Pupius <dan@medium.com>  
Dan Sinclair <dan.sinclair@gmail.com>  
Daniel Fleischman <danielfleischman@gmail.com>  
Daniel Johansson <dajo2002@gmail.com>  
Daniel Kerwin <d.kerwin@gini.net>  
Daniel Krech <eikeon@eikeon.com>  
Daniel Lidn <daniel.liden.87@gmail.com>  
Daniel Mart <mvdan@mvdan.cc>  
Daniel Morsing <daniel.morsing@gmail.com>  
Daniel Nadasi <dnadasi@google.com>  
Daniel Ortiz Pereira da Silva <daniel.particular@gmail.com>  
Daniel Skinner <daniel@dasa.cc>  
Daniel Speichert <daniel@speichert.pl>  
Daniel Theophanes <kardianos@gmail.com>  
Daria Kolistratova <daria.kolistratova@intel.com>  
Darren Elwood <darren@textnode.com>  
Datong Sun <dndx@idndx.com>  
Dave Borowitz <dborowitz@google.com>  
Dave Bort <dbort@golang.org>  
Dave Cheney <dave@cheney.net>  
Dave Day <djd@golang.org>  
Dave Grijalva <dgrijalva@ngmoco.com>  
David Anderson <danderson@google.com>  
David Barnett <dbarnett@google.com>  
David Benjamin <davidben@google.com>

David Brophy <dave@brophy.uk>  
David  
Brgin <676c7473@gmail.com>  
David Calavera <david.calavera@gmail.com>  
David Chase <drchase@google.com>  
David Covert <davidhcovert@gmail.com>  
David Crawshaw <david.crawshaw@zentus.com> <crawshaw@google.com> <crawshaw@golang.org>  
David du Colombier <0intro@gmail.com>  
David Forsythe <dforsythe@gmail.com>  
David G. Andersen <dave.andersen@gmail.com>  
David Glasser <glasser@meteor.com>  
David Howden <dhowden@gmail.com>  
David Hubbard <dsp@google.com>  
David Jakob Fritz <david.jakob.fritz@gmail.com>  
David Lazar <lazard@golang.org>  
David Leon Gil <coruus@gmail.com>  
David McLeish <davemc@google.com>  
David Presotto <presotto@gmail.com>  
David R. Jenni <david.r.jenni@gmail.com>  
David Sansome <me@davidsansome.com>  
David Stainton <dstainton415@gmail.com>  
David Symonds <dsymonds@golang.org>  
David Thomas <davidthomas426@gmail.com>  
David Titarenco <david.titarenco@gmail.com>  
Davies Liu <davies.liu@gmail.com>  
Dean Prichard <dean.prichard@gmail.com>  
Deepak Jois <deepak.jois@gmail.com>  
Denis Bernard <db047h@gmail.com>  
Denis  
Brandolini <denis.brandolini@gmail.com>  
Denis Nagorny <denis.nagorny@intel.com>  
Denys Honsiorovskyi <honsiorovskyi@gmail.com>  
Derek Buitenhuis <derek.buitenhuis@gmail.com>  
Derek Che <drc@yahoo-inc.com>  
Derek Parker <parkerderek86@gmail.com>  
Derek Shockey <derek.shockey@gmail.com>  
Devon H. O'Dell <devon.odell@gmail.com>  
Dhaivat Pandit <dhaivatpandit@gmail.com>  
Dhananjay Nakrani <dhananjayn@google.com>  
Dhiru Kholia <dhiru.kholia@gmail.com>  
Didier Spezia <didier.06@gmail.com>  
Dimitri Tcaciuc <dtcaciuc@gmail.com>  
Dirk Gadsden <dirk@esherido.com>  
Diwaker Gupta <diwakergupta@gmail.com>  
Dmitri Popov <operator@cv.dp-net.com>  
Dmitri Shuralyov <shurcool@gmail.com>  
Dmitriy Dudkin <dudkin.dmitriy@gmail.com>  
Dmitriy Shelenin <deemok@googlemail.com> <deemok@gmail.com>

Dmitriy Vyukov <dvyukov@google.com>  
Dmitry Chestnykh <dchest@gmail.com>  
Dmitry Savintsev <dsavints@gmail.com>  
Dmitry Yakunin <nonamezeil@gmail.com>  
Dominik Honnef <dominik.honnef@gmail.com>  
Dominik Vogt <vogt@linux.vnet.ibm.com>  
Donald  
Huang <don.hcd@gmail.com>  
Donovan Hide <donovanhide@gmail.com>  
Doug Anderson <douga@google.com>  
Drew Hintz <adhintz@google.com>  
Duncan Holm <mail@frou.org>  
Dustin Carlino <dcarlino@google.com>  
Dustin Herbison <djherbis@gmail.com>  
Dustin Long <dustmop@gmail.com>  
Dustin Sallings <dsallings@gmail.com>  
Dustin Shields-Cloues <dcloues@gmail.com>  
Dvir Volk <dvir@everything.me> <dvirsky@gmail.com>  
Eden Li <eden.li@gmail.com>  
Edward Muller <edwardam@interlix.com>  
Egon Elbre <egonelbre@gmail.com>  
Ehren Kret <ehren.kret@gmail.com>  
Eivind Uggedal <eivind@uggedal.com>  
Elias Naur <elias.naur@gmail.com>  
Elliot Morrison-Reed <elliotmr@gmail.com>  
Emil Hessman <c.emil.hessman@gmail.com> <emil@hessman.se>  
Emmanuel Odeke <emm.odeke@gmail.com> <odeke@ualberta.ca>  
Eoghan Sherry <ejsherry@gmail.com>  
Eric Clark <zerohp@gmail.com>  
Eric Engestrom <eric@engestrom.ch>  
Eric Garrido <ekg@google.com>  
Eric Koleda <ekoleda+devrel@google.com>  
Eric Lagergren <ericscottlagergren@gmail.com>  
Eric Milliken  
<emilliken@gmail.com>  
Eric Roshan-Eisner <eric.d.eisner@gmail.com>  
Erik Aigner <aigner.erik@gmail.com>  
Erik Dubbelboer <erik@dubbelboer.com>  
Erik St. Martin <alakriti@gmail.com>  
Erik Staab <estaab@google.com>  
Erik Westrup <erik.westrup@gmail.com>  
Ernest Chiang <ernest\_chiang@htc.com>  
Esko Luontola <esko.luontola@gmail.com>  
Ethan Burns <eaburns@google.com>  
Ethan Miller <eamiller@us.ibm.com>  
Euan Kemp <euank@euank.com>  
Evan Broder <evan@stripe.com>  
Evan Brown <evanbrown@google.com>

Evan Kroske <evankroske@google.com>  
Evan Martin <evan.martin@gmail.com>  
Evan Phoenix <evan@phx.io>  
Evan Shaw <chickencha@gmail.com>  
Ewan Chou <coocood@gmail.com>  
Fabian Wickborn <fabian@wickborn.net>  
Fabrizio Milo <mistobaan@gmail.com>  
Faiyaz Ahmed <ahmedf@vmware.com>  
Fan Hongjian <fan.howard@gmail.com>  
Fatih Arslan <fatih@arslan.io>  
Fazlul Shahriar <fshahriar@gmail.com>  
Federico Simoncelli <fsimonce@redhat.com>  
Fedor Indutny <fedor@indutny.com>  
Felix Geisendrfer <haimuiba@gmail.com>  
Filippo Valsorda <hi@filippo.io>  
Firmansyah  
Adiputra <frm.adiputra@gmail.com>  
Florian Uekermann <florian@uekermann-online.de> <f1@uekermann-online.de>  
Florian Weimer <fw@deneb.enyo.de>  
Florin Patan <florinpatan@gmail.com>  
Folke Behrens <folke@google.com>  
Ford Hurley <ford.hurley@gmail.com>  
Francesc Campoy <campoy@golang.org>  
Francisco Claude <fclaude@recoded.cl>  
Francisco Souza <franciscossouza@gmail.com>  
Frederick Kelly Mayle III <frederickmayle@gmail.com>  
Fredrik Enestad <fredrik.enestad@soundtrackyourbrand.com>  
Frithjof Schulze <schulze@math.uni-hannover.de> <sfrithjof@gmail.com>  
Frits van Bommel <fvbommel@gmail.com>  
Fumitoshi Ukai <ukai@google.com>  
Gaal Yahas <gaal@google.com>  
Gabriel Aszalos <gabriel.aszalos@gmail.com>  
Gabriel Russell <gabriel.russell@gmail.com>  
Gareth Paul Jones <gpj@foursquare.com>  
Garrick Evans <garrick@google.com>  
Gary Burd <gary@beagledreams.com> <gary.burd@gmail.com>  
Gary Elliott <garyelliott@google.com>  
Gaurish Sharma <contact@gaurishsharma.com>  
Gautham Thambidorai <gautham.dorai@gmail.com>  
Geert-Johan  
Riemer <gjr19912@gmail.com>  
Geoffroy Lorieux <lorieux.g@gmail.com>  
Georg Reinke <guelfey@gmail.com>  
George Shammass <george@shamm.as> <georgyo@gmail.com>  
Gerasimos Dimitriadis <gedimitr@gmail.com>  
Gideon Jan-Wessel Redelinghuys <gjredelinghuys@gmail.com>  
Giles Lean <giles.lean@pobox.com>  
Giovanni Bajo <rasky@develer.com>

Giulio Iotti <dullgiulio@gmail.com>  
Gleb Stepanov <glebstepanov1992@gmail.com>  
Glenn Brown <glennb@google.com>  
Glenn Lewis <gmlewis@google.com>  
Gordon Klaus <gordon.klaus@gmail.com>  
Graham King <graham4king@gmail.com>  
Graham Miller <graham.miller@gmail.com>  
Greg Ward <greg@gerg.ca>  
Guillaume J. Charmes <guillaume@charmes.net>  
Guobiao Mei <meiguobiao@gmail.com>  
Gustav Paul <gustav.paul@gmail.com>  
Gustavo Franco <gustavorfranco@gmail.com>  
Gustavo Niemeyer <gustavo@niemeyer.net> <n13m3y3r@gmail.com>  
Gwenael Treguier <gwenn.kahz@gmail.com>  
Gyu-Ho Lee <gyuhox@gmail.com>  
H. brahim Gngr <igungor@gmail.com>  
Hajime Hoshi <hajimehoshi@gmail.com>  
Hallgrimur Gunnarsson  
<halg@google.com>  
Han-Wen Nienhuys <hanwen@google.com>  
Hari haran <hariharan.uno@gmail.com>  
Hariharan Srinath <srinathh@gmail.com>  
Harley Laue <losinggeneration@gmail.com>  
Harry Moreno <morenoh149@gmail.com>  
Harshavardhana <hrshvardhana@gmail.com>  
Hvard Haugen <havard.haugen@gmail.com>  
Hector Chu <hectorchu@gmail.com>  
Hector Martin Cantero <hector@marcansoft.com>  
Henning Schmiedehausen <henning@schmiedehausen.org>  
Henrik Edwards <henrik.edwards@gmail.com>  
Henrik Hodne <henrik@hodne.io>  
Herbert Georg Fischer <herbert.fischer@gmail.com>  
Hironao OTSUBO <motemen@gmail.com>  
Hiroshi Ioka <hirochachacha@gmail.com>  
Hitoshi Mitake <mitake.hitoshi@gmail.com>  
Holden Huang <ttyh061@gmail.com>  
Hong Ruiqi <hongruiqi@gmail.com>  
Hossein Sheikh Attar <hattar@google.com>  
Hsin-Ho Yeh <yhh92u@gmail.com>  
Hu Keping <hukeping@huawei.com>  
Hyang-Ah Hana Kim <hakim@google.com> <hyangah@gmail.com>  
Ian Gudger <ian@loosescre.ws>  
Ian Lance Taylor <iant@golang.org>  
Icarus Sparry <golang@icarus.freeuk.com>  
Idora  
Shinatose <idora.shinatose@gmail.com>  
Igor Bernstein <igorbernstein@google.com>  
Igor Dolzhiikov <bluesriverz@gmail.com>

Ilya Tocar <ilya.tocar@intel.com>  
INADA Naoki <songofacandy@gmail.com>  
Ingo Krabbe <ikrabbe.ask@gmail.com>  
Ingo Oeser <nightlyone@googlemail.com> <nightlyone@gmail.com>  
Irieda Noboru <irieda@gmail.com>  
Isaac Wagner <ibw@isaacwagner.me>  
Ivan Babrou <ivan@cloudflare.com>  
Ivan Krasin <krasin@golang.org>  
Ivan Ukhov <ivan.ukhov@gmail.com>  
Jaana Burcu Dogan <jbd@google.com> <jbd@golang.org> <burcujdogan@gmail.com>  
Jack Lindamood <jlindamo@justin.tv>  
Jacob Baskin <jbaskin@google.com>  
Jacob H. Haven <jacob@cloudflare.com>  
Jacob Hoffman-Andrews <github@hoffman-andrews.com>  
Jae Kwon <jae@tendermint.com>  
Jakob Borg <jakob@nym.se>  
Jakub ajka <jcajka@redhat.com>  
Jakub Ryszard Czarnowicz <j.czarnowicz@gmail.com>  
James Aguilar <jaguilar@google.com>  
James Bardin <j.bardin@gmail.com>  
James Chacon <jchacon@google.com>  
James Clarke <jrtc27@jrtc27.com>  
James David Chalfant <james.chalfant@gmail.com>  
James  
Fysh <james.fysh@gmail.com>  
James Gray <james@james4k.com>  
James Meneghello <rawrz0r@gmail.com>  
James P. Cooper <jamespcooper@gmail.com>  
James Robinson <jamesr@google.com> <jamesr.gatech@gmail.com>  
James Schofield <james@shoeboxapp.com>  
James Sweet <james.sweet88@googlemail.com>  
James Toy <nil@opensesame.st>  
James Tucker <raggi@google.com>  
James Whitehead <jnwhiteh@gmail.com>  
Jamie Beverly <jamie.r.beverly@gmail.com>  
Jamie Gennis <jgennis@google.com> <jgennis@gmail.com>  
Jamie Turner <jamwt@dropbox.com>  
Jamie Wilkinson <jaq@spacepants.org>  
Jamil Djadala <djadala@gmail.com>  
Jan H. Hosang <jan.hosang@gmail.com>  
Jan Kratochvil <jan.kratochvil@redhat.com>  
Jan Mercl <0xjnml@gmail.com>  
Jan Mercl <befelemepeseveze@gmail.com>  
Jan Newmarch <jan.newmarch@gmail.com>  
Jan Ziak <0xe2.0x9a.0x9b@gmail.com>  
Jani Monoses <jani.monoses@ubuntu.com> <jani.monoses@gmail.com>  
Jaroslavas Poepko <jp@webmaster.ms>  
Jason Barnett <jason.w.barnett@gmail.com>



Jason Buberel <jbuberel@google.com>  
Jason  
Del Ponte <delpontej@gmail.com>  
Jason Hall <jasonhall@google.com>  
Jason Smale <jsmale@zendesk.com>  
Jason Travis <infomaniac7@gmail.com>  
Jay Weisskopf <jay@jayschwa.net>  
Jean-Marc Eurin <jmeurin@google.com>  
Jean-Nicolas Moal <jn.moal@gmail.com>  
Jed Denlea <jed@fastly.com>  
Jeff Craig <jeffcraig@google.com>  
Jeff Hodges <jeff@somethingsimilar.com>  
Jeff R. Allen <jra@nella.org> <jeff.allen@gmail.com>  
Jeff Sickel <jas@corpus-callosum.com>  
Jeff Wendling <jeff@spacemonkey.com>  
Jens Frederich <jfrederich@gmail.com>  
Jeremiah Harmsen <jeremiah@google.com>  
Jeremy Jackins <jeremyjackins@gmail.com>  
Jeremy Schlatter <jeremy.schlatter@gmail.com>  
Jeroen Bobbeldijk <jerbob92@gmail.com>  
Jess Frazelle <me@jessfraz.com>  
Jesse Szwedko <jesse.szwedko@gmail.com>  
Jihyun Yu <yjh0502@gmail.com>  
Jim Cote <jfcote87@gmail.com>  
Jim Kingdon <jim@bolt.me>  
Jim McGrath <jimmc2@gmail.com>  
Jimmy Zelinskie <jimmyzelinskie@gmail.com>  
Jingcheng Zhang <diogin@gmail.com>  
Jingguo Yao <yaojingguo@gmail.com>  
Jiong Du <londdevil@gmail.com>  
Jirka  
Dank <dnk@mail.muni.cz>  
Joakim Sernbrant <serbaut@gmail.com>  
Joe Farrell <joe2farrell@gmail.com>  
Joe Harrison <joehazzers@gmail.com>  
Joe Henke <joed.henke@gmail.com>  
Joe Poirier <jdpoirier@gmail.com>  
Joe Shaw <joe@joeshaw.org>  
Joe Sylve <joe.sylve@gmail.com>  
Joe Tsai <joetsai@digital-static.net>  
Joel Sing <jsing@google.com>  
Joel Stemmer <stemmertech@gmail.com>  
Johan Euphrosine <proppy@google.com>  
Johan Sageryd <j@1616.se>  
John Asmuth <jasmuth@gmail.com>  
John Beisley <huin@google.com>  
John C Barstow <jbowtie@amathaine.com>  
John DeNero <denero@google.com>

John Dethridge <jcd@golang.org>  
John Graham-Cumming <jgc@jgc.org> <jgrahamc@gmail.com>  
John Howard Palevich <jack.palevich@gmail.com>  
John Jeffery <jjeffery@sp.com.au>  
John Jenkins <twodopeshaggy@gmail.com>  
John Newlin <jnewlin@google.com>  
John Potocny <johnp@vividcortex.com>  
John Schnake <schnake.john@gmail.com>  
John Shahid <jvshahid@gmail.com>  
John Tuley <john@tuley.org>  
Jon Chen <jchen@justin.tv>  
Jonathan Allie  
<jonallie@google.com>  
Jonathan Amsterdam <jba@google.com>  
Jonathan Boulle <jonathanboulle@gmail.com>  
Jonathan Feinberg <feinberg@google.com>  
Jonathan Gold <jgold.bg@gmail.com>  
Jonathan Hseu <jhseu@google.com>  
Jonathan Mark <jhmark@xenops.com> <jhmark000@gmail.com>  
Jonathan Nieder <jrn@google.com>  
Jonathan Pittman <jmpittman@google.com> <jonathan.mark.pittman@gmail.com>  
Jonathan Rudenberg <jonathan@titanous.com>  
Jonathan Wills <runningwild@gmail.com>  
Jongmin Kim <atomaths@gmail.com>  
Joonas Kuorilehto <joneskoo@derbian.fi>  
Joop Kiefte <ikojba@gmail.com> <joop@kiefte.net>  
Jordan Lewis <jordanthelewis@gmail.com>  
Jos Visser <josv@google.com>  
Jose Luis Vazquez Gonzalez <josvazg@gmail.com>  
Joseph Bonneau <jcb@google.com>  
Joseph Holsten <joseph@josephholsten.com>  
Josh Bleecher Snyder <josharian@gmail.com>  
Josh Chorlton <jchorlton@gmail.com>  
Josh Goebel <dreamer3@gmail.com>  
Josh Hoak <jhoak@google.com>  
Josh Holland <jrh@joshh.co.uk>  
Joshua Boelter <joshua.boelter@intel.com>  
Joshua Chase <jcjosuachase@gmail.com>  
Jostein  
Stuhaug <jjs@solidsystem.no>  
JP Sugarbroad <jpsugar@google.com>  
JT Olds <jtolds@xnet5.com>  
Jukka-Pekka Kekkonen <karatepekka@gmail.com>  
Julia Hansbrough <flowerhack@google.com>  
Julian Kornberger <jk+github@digineo.de>  
Julian Phillips <julian@quantumfyre.co.uk>  
Julien Schmidt <google@julienschmidt.com>  
Jungho Ahn <jhahn@google.com>

Jure Ham <jure.ham@zemanta.com>  
Justin Nu <nuss.justin@gmail.com>  
Justyn Temme <justyntemme@gmail.com>  
Kai Backman <kaib@golang.org>  
Kale Blankenship <kale@lemnisis.com>  
Kamal Aboul-Hosn <aboulhosn@google.com>  
Kamil Kisiel <kamil@kamilkisiel.net> <kamil.kisiel@gmail.com>  
Kang Hu <hukangustc@gmail.com>  
Karan Dhiman <karandhi@ca.ibm.com>  
Kato Kazuyoshi <kato.kazuyoshi@gmail.com>  
Katrina Owen <katrina.owen@gmail.com>  
Kaviraj Kanagaraj <kavirajkanagaraj@gmail.com>  
Kay Zhu <kayzhu@google.com>  
KB Sriram <kbsriram@google.com>  
Keegan Carruthers-Smith <keegan.csmith@gmail.com>  
Kei Son <hey.calmdown@gmail.com>  
Keith Ball <inflatablewoman@gmail.com>  
Keith  
Randall <khr@golang.org>  
Keith Rarick <kr@xph.us>  
Kelsey Hightower <kelsey.hightower@gmail.com>  
Kelvin Foo Chuan Lyi <vmirage@gmail.com>  
Ken Friedenbach <kenliz@cruzio.com>  
Ken Rockot <ken@oz.gs> <ken.rockot@gmail.com>  
Ken Sedgwick <ken@bonsai.com>  
Ken Thompson <ken@golang.org>  
Kenji Kaneda <kenji.kaneda@gmail.com>  
Kenneth Shaw <kenshaw@gmail.com>  
Kenny Grant <kennygrant@gmail.com>  
Kevin Ballard <kevin@sb.org>  
Kevin Burke <kev@inburke.com>  
Kevin Kirsche <kev.kirsche@gmail.com>  
Kevin Klues <klueska@gmail.com> <klueska@google.com>  
Kevin Malachowski <chowski@google.com>  
Kevin Vu <kevin.m.vu@gmail.com>  
Kim Shrier <kshrier@racktopsystems.com>  
Kirklin McDonald <kirklin.mcdonald@gmail.com>  
Klaus Post <klauspost@gmail.com>  
Konstantin Shaposhnikov <k.shaposhnikov@gmail.com>  
Kris Rousey <krousey@google.com>  
Kristopher Watts <traetox@gmail.com>  
Kun Li <likunarmstrong@gmail.com>  
Kyle Consalus <consalus@gmail.com>  
Kyle Isom <kyle@gokyle.net>  
Kyle Lemons <kyle@kylelemons.net> <kevlar@google.com>  
L  
Campbell <unpantsu@gmail.com>  
Lai Jiangshan <eag0628@gmail.com>

Larry Hosken <lahosken@golang.org>  
Larz Conwell <larzconwell@gmail.com>  
LE Manh Cuong <cuong.manhle.vn@gmail.com>  
Lee Hinman <hinman@gmail.com>  
Lee Packham <lpackham@gmail.com>  
Lewin Bormann <lewin.bormann@gmail.com>  
Lloyd Dewolf <foolswisdom@gmail.com>  
Lorenzo Stoakes <lstoakes@gmail.com>  
Louis Kruger <louisk@google.com>  
Luan Santos <cfcluan@gmail.com>  
Luca Greco <luca.greco@alcacoop.it>  
Lucien Stuker <lucien.stuker@gmail.com>  
Lucio De Re <lucio.dere@gmail.com>  
Luigi Riefolo <luigi.riefolo@gmail.com>  
Luit van Drongelen <luitvd@gmail.com>  
Luka Zakrajek <tr00.g33k@gmail.com>  
Luke Curley <qpingu@gmail.com>  
Luna Duclos <luna.duclos@palmstonegames.com>  
Luuk van Dijk <lvd@golang.org> <lvd@google.com>  
Lynn Boger <laboger@linux.vnet.ibm.com>  
Maksym Trykur <maksym.trykur@gmail.com>  
Mal Curtis <mal@mal.co.nz>  
Manfred Touron <m@42.am>  
Manoj Dayaram <platform-dev@moovweb.com> <manoj.dayaram@moovweb.com>  
Manu Garg <manugarg@google.com>  
Manu  
S Ajith <neo@codingarena.in>  
Manuel Mendez <mmendez534@gmail.com>  
Marc Weistroff <marc@weistroff.net>  
Marc-Antoine Ruel <maruel@chromium.org>  
Marcel Edmund Franke <marcel.edmund.franke@gmail.com>  
Marcel van Lohuizen <mpvl@golang.org>  
Marco Hennings <marco.hennings@freiheit.com>  
Marga Manterola <marga@google.com>  
Marin Bai <marin.basic02@gmail.com>  
Marius Nuennerich <mnu@google.com>  
Mark Bucciarelli <mkbucc@gmail.com>  
Mark Severson <miquella@gmail.com>  
Mark Theunissen <mark.theunissen@gmail.com>  
Mark Zavislak <zavislak@google.com>  
Marko Juhani Silokunnas <marko.silokunnas@gmail.com>  
Marko Mikulicic <mkm@google.com>  
Marko Tiikkaja <marko@joh.to>  
Markus Duft <markus.duft@salomon.at>  
Markus Sonderegger <marraison@gmail.com>  
Markus Zimmermann <zimmski@gmail.com>  
Martin Bertschler <mbertschler@gmail.com>  
Martin Garton <garton@gmail.com>

Martin Hamrle <martin.hamrle@gmail.com>  
Martin Kreichgauer <martinkr@google.com>  
Martin Mohrmann <moehrmann@google.com> <martisch@uos.de>  
Martin  
Neubauer <m.ne@gmx.net>  
Martin Olsson <martin@minimum.se>  
Marvin Stenger <marvin.stenger94@gmail.com>  
Mateusz Czapliski <czapkofan@gmail.com>  
Mathias Beke <git@denbeke.be>  
Mathias Leppich <mleppich@muhqu.de>  
Mathieu Lonjaret <mathieu.lonjaret@gmail.com>  
Mats Lidell <mats.lidell@cag.se> <mats.lidell@gmail.com>  
Matt Aimonetti <mattaimonetti@gmail.com>  
Matt Bostock <matt@mattbostock.com>  
Matt Brown <mdbrown@google.com>  
Matt Drollette <matt@drollette.com>  
Matt Jibson <matt.jibson@gmail.com>  
Matt Joiner <anacrolix@gmail.com>  
Matt Jones <mrjones@google.com>  
Matt Layher <mdllyher@gmail.com>  
Matt Reiferson <mreiferson@gmail.com>  
Matt Robenolt <matt@ydekproductions.com>  
Matt T. Proud <matt.proud@gmail.com>  
Matt Williams <gh@mattyw.net> <mattyjwilliams@gmail.com>  
Matthew Brennan <matty.brennan@gmail.com>  
Matthew Cottingham <mattcottingham@gmail.com>  
Matthew Dempsky <mdempsky@google.com>  
Matthew Denton <mdenton@skyportsystems.com>  
Matthew Holt <Matthew.Holt+git@gmail.com>  
Matthew Horsnell <matthew.horsnell@gmail.com>  
Matthieu  
Hauglustaine <matt.hauglustaine@gmail.com>  
Matthieu Olivier <olivier.matthieu@gmail.com>  
Max Riveiro <kavu13@gmail.com>  
Maxim Khitrov <max@mxcrypt.com>  
Maxim Pimenov <mpimenov@google.com>  
Maxim Ushakov <ushakov@google.com>  
Maxwell Krohn <themax@gmail.com>  
Meir Fischer <meirfischer@gmail.com>  
Meng Zhuo <mengzhuo1203@gmail.com>  
Mhd Sulhan <m.shulhan@gmail.com>  
Micah Stetson <micah.stetson@gmail.com>  
Michael Chaten <mchaten@gmail.com>  
Michael Darakananda <pongad@google.com>  
Michael Elkins <michael.elkins@gmail.com>  
Michael Fraenkel <michael.fraenkel@gmail.com>  
Michael Gehring <mg@ebfe.org> <gnirheg.leahcim@gmail.com>  
Michael Hoisie <hoisie@gmail.com>

Michael Hudson-Doyle <michael.hudson@linaro.org>  
Michael Kufl <golang@c.michael-kaeufl.de>  
Michael Kelly <mjk@google.com>  
Michael Lewis <mikelikespie@gmail.com>  
Michael MacInnis <Michael.P.MacInnis@gmail.com>  
Michael Marineau <michael.marineau@coreos.com>  
Michael Matloob <matloob@google.com>  
Michael McConville  
<momconville@gmail.com>  
Michael McGreevy <mcgreevy@golang.org>  
Michael Munday <munday@ca.ibm.com>  
Michael Pearson <mipearson@gmail.com>  
Michael Piatek <piatek@google.com>  
Michael Pratt <mpratt@google.com>  
Michael Schaller <michael@5challer.de>  
Michael Shields <mshields@google.com>  
Michael Stapelberg <michael@stapelberg.de> <mstplbrg@googlemail.com>  
Michael T. Jones <mtj@google.com> <michael.jones@gmail.com>  
Michael Teichgrber <mteichgraeber@gmx.de> <mt4swm@googlemail.com>  
Michael Vetter <g.bluehut@gmail.com>  
Michal Bohuslvek <mbohuslvek@gmail.com>  
Michal Cierniak <cierniak@google.com>  
Micha Derkacz <zitek@inet.pl>  
Michalis Kargakis <michaliskargakis@gmail.com>  
Michel Lespinasse <>walken@google.com>  
Miek Gieben <miek@miek.nl> <remigius.gieben@gmail.com>  
Miguel Mendez <stxmendez@gmail.com>  
Mihai Borobocea <MihaiBorobocea@gmail.com>  
Mikael Tillenius <mikti42@gmail.com>  
Mike Andrews <mra@xoba.com>  
Mike Appleby <mike@app.leby.org>  
Mike Danese <mikedanese@google.com>  
Mike Houston <mike@kothar.net>  
Mike  
Rosset <mike.rosset@gmail.com>  
Mike Samuel <mikesamuel@gmail.com>  
Mike Solomon <msolo@gmail.com>  
Mike Strosaker <strosake@us.ibm.com>  
Mikhail Gusarov <dottedmag@dottedmag.net>  
Mikhail Panchenko <m@mihasya.com>  
Miki Tebeka <miki.tebeka@gmail.com>  
Mikio Hara <mikioh.mikioh@gmail.com>  
Mikkel Krautz <mikkel@krautz.dk> <krautz@gmail.com>  
Miquel Sabat Sol <mikisabate@gmail.com>  
Miroslav Genov <mgenov@gmail.com>  
Mohit Agarwal <mohit@sdf.org>  
Momchil Velikov <momchil.velikov@gmail.com>  
Monty Taylor <mordred@inaugust.com>

Moriyoshi Koizumi <mozo@mozo.jp>  
Morten Siebuhr <sbhr@sbhr.dk>  
Mshe van der Sterre <moshevds@gmail.com>  
Mrunal Patel <mrunalp@gmail.com>  
Muhammed Uluyol <uluyol0@gmail.com>  
Nan Deng <monnand@gmail.com>  
Nathan John Youngman <nj@nathany.com>  
Nathan Otterness <otternes@cs.unc.edu>  
Nathan P Finch <nate.finch@gmail.com>  
Nathan VanBenschoten <nvanbenschoten@gmail.com>  
Nathan Youngman <git@nathany.com>  
Nathan(yinian) Hu <nathanhu@google.com>  
Neelesh Chandola <neelesh.c98@gmail.com>  
Nevins  
Bartolomeo <nevins.bartolomeo@gmail.com>  
Niall Sheridan <nsheridan@gmail.com>  
Nic Day <nic.day@me.com>  
Nicholas Katsaros <nick@nickkatsaros.com>  
Nicholas Presta <nick@nickpresta.ca> <nick1presta@gmail.com>  
Nicholas Sullivan <nicholas.sullivan@gmail.com>  
Nicholas Waples <nwaples@gmail.com>  
Nick Cooper <nmvc@google.com>  
Nick Craig-Wood <nick@craig-wood.com> <nickcw@gmail.com>  
Nick Harper <nharper@google.com>  
Nick Leli <nicholasleli@gmail.com>  
Nick Patavalis <nick.patavalis@gmail.com>  
Nick Petroni <npetroni@cs.umd.edu>  
Nicolas Kaiser <nikai@nikai.net>  
Nicolas Owens <mischief@offblast.org>  
Nicolas S. Dade <nic.dade@gmail.com>  
Niels Widger <niels.widger@gmail.com>  
Nigel Kerr <nigel.kerr@gmail.com>  
Nigel Tao <nigeltao@golang.org>  
Nik Nyby <nnyby@columbia.edu>  
Niko Dziemba <niko@dziemba.com>  
Nikolay Turpitko <nikolay@turpitko.com>  
Noah Campbell <noahcampbell@gmail.com>  
Nodir Turakulov <nodir@google.com>  
Norberto Lopes <nlopes.ml@gmail.com>  
Odin Ugedal <odin@ugedal.com>  
Oleg  
Vakheta <helginet@gmail.com>  
Oleku Konko <oleku.konko@gmail.com>  
Oling Cat <olingcat@gmail.com>  
Oliver Hookins <ohookins@gmail.com>  
Olivier Antoine <olivier.antoine@gmail.com>  
Olivier Duperray <duperray.olivier@gmail.com>  
Olivier Poitrey <rs@dailymotion.com>

Olivier Saingre <osaingre@gmail.com>  
Omar Jarjur <ojarjur@google.com>  
zgr Kesim <oec-go@kesim.org>  
Padraig Kitterick <padraigkitterick@gmail.com>  
Paolo Giarrusso <p.giarrusso@gmail.com>  
Paolo Martini <mrtnpaolo@gmail.com>  
Parker Moore <parkrmoore@gmail.com>  
Pascal S. de Kloe <pascal@quies.net>  
Patrick Crosby <patrick@stathat.com>  
Patrick Gavlin <pgavlin@gmail.com>  
Patrick Higgins <patrick.allen.higgins@gmail.com>  
Patrick Lee <pattyshack101@gmail.com>  
Patrick Mzard <patrick@mezard.eu>  
Patrick Mylund Nielsen <patrick@patrickmn.com>  
Patrick Riley <pfr@google.com>  
Patrick Smith <pat42smith@gmail.com>  
Paul A Querna <paul.querna@gmail.com>  
Paul Borman <borman@google.com>  
Paul Chang <paulchang@google.com>  
Paul Hammond <paul@paulhammond.org>  
Paul  
Hankin <paulhankin@google.com>  
Paul Lalonde <paul.a.lalonde@gmail.com>  
Paul Marks <pmarks@google.com>  
Paul Meyer <paul.meyer@microsoft.com>  
Paul Nasrat <pnasrat@google.com>  
Paul Rosania <paul.rosania@gmail.com>  
Paul Sbarra <Sbarra.Paul@gmail.com>  
Paul Smith <paulsmith@pobox.com> <paulsmith@gmail.com>  
Paul van Brouwershaven <paul@vanbrouwershaven.com>  
Paul Wankadia <junyer@google.com>  
Paulo Casaretto <pcasaretto@gmail.com>  
Pavel Paulau <pavel.paulau@gmail.com>  
Pavel Zinovkin <pavel.zinovkin@gmail.com>  
Pawel Knap <pawelknap88@gmail.com>  
Pawel Szczur <filemon@google.com>  
Percy Wegmann <ox.to.a.cart@gmail.com>  
Perry Abbott <perry.j.abbott@gmail.com>  
Petar Maymoukov <petarm@gmail.com>  
Peter Armitage <peter.armitage@gmail.com>  
Peter Collingbourne <pcc@google.com>  
Peter Froehlich <peter.hans.froehlich@gmail.com>  
Peter Gonda <pgonda@google.com>  
Peter Kleiweg <pkleiweg@xs4all.nl>  
Peter McKenzie <petermck@google.com>  
Peter Moody <pmoody@uber.com>  
Peter Mundy <go.peter.90@gmail.com>  
Pter



Surnyi <speter.go1@gmail.com>  
Pter Szab <pts@google.com>  
Pter Szilgyi <peterke@gmail.com>  
Peter Tseng <ptseng@squareup.com>  
Peter Waldschmidt <peter@waldschmidt.com>  
Peter Waller <peter.waller@gmail.com>  
Peter Weinberger <pjw@golang.org>  
Peter Williams <pwil3058@gmail.com>  
Phil Pennock <pdp@golang.org>  
Philip Brgesen <philip.brgesen@gmail.com>  
Philip Hofer <phofer@umich.edu>  
Philip K. Warren <pkwarren@gmail.com>  
Pierre Durand <pierredurand@gmail.com>  
Pierre Roullon <pierre.roullon@gmail.com>  
Pieter Droogendijk <pieter@binky.org.uk>  
Pietro Gagliardi <pietro10@mac.com>  
Prasanna Swaminathan <prasanna@mediamath.com>  
Prashant Varanasi <prashant@prashantv.com>  
Preetam Jinka <pj@preet.am>  
Quan Tran <qeed.quan@gmail.com>  
Quan Yong Zhai <qyzhai@gmail.com>  
Quentin Perez <qperez@ocs.online.net>  
Quentin Smith <quentin@golang.org>  
Quinn Slack <sqs@sourcegraph.com>  
Quoc-Viet Nguyen <afelion@gmail.com>  
Radu Berinde <radu@cockroachlabs.com>  
Rafal Jeczalik <rjeczalik@gmail.com>  
Rahul Chaudhry <rahulchaudhry@chromium.org>  
Raif  
S. Naffah <go@naffah-raif.name>  
Rajat Goel <rajat.goel2010@gmail.com>  
Ralph Corderoy <ralph@inputplus.co.uk>  
Ramesh Dharan <dharan@google.com>  
Raph Levien <raph@google.com>  
Raphael Geronimi <raphael.geronimi@gmail.com>  
Raul Silvera <rsilvera@google.com>  
Rebecca Stambler <rstambler@golang.org>  
Reinaldo de Souza Jr <juniorz@gmail.com>  
Rmy Oudompheng <oudomphe@phare.normalesup.org> <remyoudompheng@gmail.com>  
Rhys Hiltner <rhys@justin.tv>  
Ricardo Padilha <ricardospadilha@gmail.com>  
Richard Barnes <rlb@ipv.sx>  
Richard Crowley <r@rcrowley.org>  
Richard Eric Gavaletz <gavaletz@gmail.com>  
Richard Gibson <richard.gibson@gmail.com>  
Richard Miller <miller.research@gmail.com>  
Richard Musiol <mail@richard-musiol.de> <neelance@gmail.com>  
Rick Arnold <rickarnoldjr@gmail.com>

Rick Hudson <rlh@golang.org>  
Riku Voipio <riku.voipio@linaro.org>  
Risto Jaakko Saarelm <rsaarelm@gmail.com>  
Rob Earhart <earhart@google.com>  
Rob Norman <rob.norman@infinitycloud.com>  
Rob Pike <r@golang.org>  
Robert  
Daniel Kortschak <dan.kortschak@adelaide.edu.au>  
Robert Dinu <r@varp.se>  
Robert Figueiredo <robfig@gmail.com>  
Robert Griesemer <gri@golang.org>  
Robert Hencke <robert.hencke@gmail.com>  
Robert Iannucci <iannucci@google.com>  
Robert Obryk <robryk@gmail.com>  
Robert Seseek <rseseek@google.com>  
Robert Snedegar <roberts@google.com>  
Robert Stepanek <robert.stepanek@gmail.com>  
Robin Eklind <r.eklind.87@gmail.com>  
Rodrigo Moraes de Oliveira <rodrigo.moraes@gmail.com>  
Rodrigo Rafael Monti Kochenburger <divoxx@gmail.com>  
Roger Pau Monn <royger@gmail.com>  
Roger Peppe <rogpeppe@gmail.com>  
Roland Shoemaker <rolandshoemaker@gmail.com>  
Ron Hashimoto <mail@h2so5.net>  
Ron Minnich <rminnich@gmail.com>  
Ross Light <light@google.com> <rlight2@gmail.com>  
Rowan Worth <sqweek@gmail.com>  
Rui Ueyama <rui@google.com>  
Russ Cox <rsc@golang.org>  
Russell Haering <russellhaering@gmail.com>  
Ryan Bagwell <ryanbagwell@outlook.com>  
Ryan Barrett <ryanb@google.com>  
Ryan Brown <ribrd@b@google.com>  
Ryan Hitchman  
<hitchmanr@gmail.com>  
Ryan Lower <rpjlower@gmail.com>  
Ryan Seys <ryan@ryanseys.com>  
Ryan Slade <ryanslade@gmail.com>  
Ryuzo Yamamoto <ryuzo.yamamoto@gmail.com>  
S.alar Onur <caglar@10ur.org>  
Sai Cheemalapati <saicheems@google.com>  
Salmn Aljammz <s@0x65.net>  
Sam Ding <samding@ca.ibm.com>  
Sam Hug <samuel.b.hug@gmail.com>  
Sam Thorogood <thorogood@google.com> <sam.thorogood@gmail.com>  
Sam Whited <sam@samwhited.com>  
Sameer Ajmani <sameer@golang.org> <ajmani@gmail.com>  
Sami Commerot <samic@google.com>

Samuel Tan <samueltan@google.com>  
Samuele Pedroni <pedronis@lucediaruna.net>  
Sanjay Menakuru <balasanjay@gmail.com>  
Sarah Adams <shadams@google.com>  
Sasha Lionheart <lionhearts@google.com>  
Sasha Sobol <sasha@scaledinference.com>  
Scott Barron <scott.barron@github.com>  
Scott Bell <scott@sctsm.com>  
Scott Ferguson <scottwferg@gmail.com>  
Scott Lawrence <bytbody@gmail.com>  
Scott Mansfield <smansfield@netflix.com>  
Scott Schwartz <scotts@golang.org>  
Scott Van Woudenberg <scottvw@google.com>  
Sean Burford <sburford@google.com>  
Sean  
Dolphin <Sean.Dolphin@kpcompass.com>  
Sean Harger <sharger@google.com>  
Sean Rees <sean@erifax.org>  
Sebastien Binet <seb.binet@gmail.com>  
Sbastien Paolacci <sebastien.paolacci@gmail.com>  
Sergei Skorobogatov <skorobo@rambler.ru>  
Sergey 'Snake' Gromov <snake.scaly@gmail.com>  
Sergey Arseev <sergey.arseev@intel.com>  
Sergio Luis O. B. Correia <sergio@correia.cc>  
Seth Hoenig <seth.a.hoenig@gmail.com>  
Seth Vargo <sethvargo@gmail.com>  
Shahar Kohanim <skohanim@gmail.com>  
Shane Hansen <shanemhansen@gmail.com>  
Shaozhen Ding <dsz0111@gmail.com>  
Shawn Ledbetter <sledbetter@google.com>  
Shawn Smith <shawn.p.smith@gmail.com>  
Shawn Walker-Salas <shawn.walker@oracle.com>  
Shenghou Ma <minux@golang.org> <minux.ma@gmail.com>  
Shinji Tanaka <shinji.tanaka@gmail.com>  
Shivakumar GN <shivakumar.gn@gmail.com>  
Shun Fan <sfan@google.com>  
Silvan Jegen <s.jegen@gmail.com>  
Simon Jefford <simon.jefford@gmail.com>  
Simon Rawet <simon@rawet.se>  
Simon Thulbourn <simon+github@thulbourn.com>  
Simon Whitehead  
<chemnova@gmail.com>  
Sina Siadat <siadat@gmail.com>  
Sokolov Yura <funny.falcon@gmail.com>  
Song Gao <song@gao.io>  
Spencer Nelson <s@spenczar.com>  
Spring Mc <heresy.mc@gmail.com>  
Srdjan Petrovic <spetrovic@google.com>

Sridhar Venkatakrishnan <sridhar@laddoo.net>  
StalkR <stalkr@stalkr.net>  
Stan Schwertly <stan@schwertly.com>  
Stefan Nilsson <snilsson@nada.kth.se> <trolleriprofessorn@gmail.com>  
Stphane Travostino <stephane.travostino@gmail.com>  
Stephen Ma <stephenm@golang.org>  
Stephen McQuay <stephen@mcquay.me>  
Stephen Weinberg <stephen@q5comm.com>  
Steve Francia <spf@golang.org>  
Steve McCoy <mccoyst@gmail.com>  
Steve Newman <snewman@google.com>  
Steve Phillips <elimistev@gmail.com>  
Steve Streeting <steve@stevestreeting.com>  
Steven Elliot Harris <seharris@gmail.com>  
Steven Hartland <steven.hartland@multiplay.co.uk>  
Sugu Sougoumarane <ssougou@gmail.com>  
Suharsh Sivakumar <suharshs@google.com>  
Suyash <dextrous93@gmail.com>  
Sven Almgren <sven@tras.se>  
Sven Blumenstein <svbl@google.com>  
Syohei  
YOSHIDA <syohex@gmail.com>  
Szabolcs Nagy <nsz@port70.net>  
Tad Glines <tad.glines@gmail.com>  
Taj Khattrra <taj.khattrra@gmail.com>  
Takashi Matsuo <tmatsuo@google.com>  
Takeshi YAMANASHI <9.nashi@gmail.com>  
Takuya Ueda <uedatakuya@gmail.com>  
Tal Shprecher <tshprecher@gmail.com>  
Tamir Duberstein <tamird@gmail.com>  
Tarmigan Casebolt <tarmigan@gmail.com>  
Taru Karttunen <taruti@taruti.net>  
Tatsuhiko Tsujikawa <tatsuhiko.t@gmail.com>  
Terrel Shumway <gopher@shumway.us>  
Tetsuo Kiso <tetsuokiso9@gmail.com>  
Than McIntosh <thanm@google.com>  
Thiago Fransosi Farina <thiago.farina@gmail.com> <tfarina@chromium.org>  
Thomas Alan Copeland <talan.copeland@gmail.com>  
Thomas de Zeeuw <thomasdezeeuw@gmail.com>  
Thomas Desrosiers <thomasdesr@gmail.com>  
Thomas Habets <habets@google.com>  
Thomas Kappler <tkappler@gmail.com>  
Thorben Krueger <thorben.krueger@gmail.com>  
Thordur Bjornsson <thorduri@secnorth.net>  
Tilman Dilo <tilman.dilo@gmail.com>  
Tim Cooijmans <timcooijmans@gmail.com>  
Tim Ebringer <tim.ebringer@gmail.com>  
Tim

Henderson <tim.tadh@gmail.com>  
Tim Hockin <thockin@google.com>  
Tim Swast <swast@google.com>  
Timo Savola <timo.savola@gmail.com>  
Timo Truys <alkaloid.btx@gmail.com>  
Timothy Studd <tim@timestudd.com>  
Tipp Moseley <tipp@google.com>  
Tobias Columbus <tobias.columbus@gmail.com> <tobias.columbus@googlemail.com>  
Toby Burress <kurin@google.com>  
Todd Neal <todd@tneal.org>  
Todd Wang <toddwang@gmail.com>  
Tom Bergan <tombergan@google.com>  
Tom Heng <zhm20070928@gmail.com>  
Tom Linfoord <tomlinfoord@gmail.com>  
Tom Szymanski <tgs@google.com>  
Tom Wilkie <tom@weave.works>  
Tommy Schaefer <tommy.schaefer@teecom.com>  
Tor Andersson <tor.andersson@gmail.com>  
Tormod Erevik Lea <tormodlea@gmail.com>  
Totoro W <tw19881113@gmail.com>  
Travis Cline <travis.cline@gmail.com>  
Trevor Strohman <trevor.strohman@gmail.com>  
Trey Lawrence <lawrence.trey@gmail.com>  
Trey Tacon <ttacon@gmail.com>  
Tristan Amini <tamini01@ca.ibm.com>  
Tristan Colgate <tcolgate@gmail.com>  
Tristan Ooohry <ooohry@gmail.com>  
Tudor Golubenco  
<tudor.g@gmail.com>  
Tuo Shan <sturbo89@gmail.com> <shantuo@google.com>  
Tyler Bunnell <tylerbunnell@gmail.com>  
Tyler Treat <ttreat31@gmail.com>  
Tzu-Jung Lee <roylee17@currant.com>  
Ugorji Nwoke <ugorji@gmail.com>  
Ulf Holm Nielsen <doktor@dyregod.dk>  
Ulrich Kunitz <uli.kunitz@gmail.com>  
Uriel Mangado <uriel@berlinblue.org>  
Uttam C Pawar <uttam.c.pawar@intel.com>  
Vadim Grek <vadimprog@gmail.com>  
Vadim Vygonets <unixdj@gmail.com>  
Vega Garcia Luis Alfonso <vegacom@gmail.com>  
Victor Chudnovsky <vchudnov@google.com>  
Vincent Ambo <tazjin@googlemail.com>  
Vincent Batts <vbatts@hashbangbash.com> <vbatts@gmail.com>  
Vincent Vanackere <vincent.vanackere@gmail.com>  
Vinu Rajashekhar <vinutheraj@gmail.com>  
Vish Subramanian <vish@google.com>  
Vishvananda Ishaya <vishvananda@gmail.com>

Vitor De Mario <vitordemario@gmail.com>  
Vlad Krasnov <vlad@cloudflare.com>  
Vladimir Mihailenco <vladimir.webdev@gmail.com>  
Vladimir Nikishenko <vova616@gmail.com>  
Vladimir Stefanovic <vladimir.stefanovic@imgtec.com>  
Volker  
Dobler <dr.volker.dobler@gmail.com>  
Volodymyr Paprotski <vpaprots@ca.ibm.com>  
Walter Poupore <wpoupore@google.com>  
Wedson Almeida Filho <wedsonaf@google.com>  
Wei Guangjing <vcc.163@gmail.com>  
Will Chan <willchan@google.com>  
Will Norris <willnorris@google.com>  
Willem van der Schyff <willemvds@gmail.com>  
William Chan <willchan@chromium.org>  
William Josephson <wjosephson@gmail.com>  
William Orr <will@worrbase.com> <ay1244@gmail.com>  
Wisdom Omuya <deafgoat@gmail.com>  
Xia Bin <snyh@snyh.org>  
Xing Xing <mikespook@gmail.com>  
Xudong Zhang <felixmelon@gmail.com>  
Xuyang Kang <xuyangkang@gmail.com>  
Yan Zou <yzou@google.com>  
Yann Kerherv <yann.kerherve@gmail.com>  
Yao Zhang <lunaria21@gmail.com>  
Yasuharu Goto <matope.ono@gmail.com>  
Yasuhiro Matsumoto <mattn.jp@gmail.com>  
Yesudeep Mangalapilly <yesudeep@google.com>  
Yissakhar Z. Beck <yissakhar.beck@gmail.com>  
Yo-An Lin <yoanlin93@gmail.com>  
Yongjian Xu <i3dmaster@gmail.com>  
Yorman Arias <cixtords@gmail.com>  
Yoshiyuki Kanno <nekotaroh@gmail.com> <yoshiyuki.kanno@stoic.co.jp>  
Yu  
Heng Zhang <annita.zhang@cn.ibm.com>  
Yu Xuan Zhang <zyxsh@cn.ibm.com>  
Yuki Yugui Sonoda <yugui@google.com>  
Yusuke Kagiwada <block.rxckin.beats@gmail.com>  
Yuusei Kuwana <kuwana@kumama.org>  
Yuval Pavel Zholkover <paulzhol@gmail.com>  
Yves Junqueira <yvesj@google.com> <yves.junqueira@gmail.com>  
Zac Bergquist <zbergquist99@gmail.com>  
Zev Goldstein <zev.goldstein@gmail.com>  
Zhongwei Yao <zhongwei.yao@arm.com>  
Ziad Hatahet <hatahet@gmail.com>  
Zorion Arrizabalaga <zorionk@gmail.com>  
<faxriddinjon@gmail.com>  
<bronze1man@gmail.com>

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