Configuring IP Services

This module describes how to configure optional IP services. For a complete description of the IP services commands in this chapter, refer to the *Cisco IOS IP Application Services Command Reference*. To locate documentation of other commands that appear in this module, use the master command list, or search online.

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest caveats and feature information, see Bug Search Tool and the release notes for your platform and software release. To find information about the features documented in this module, and to see a list of the releases in which each feature is supported, see the feature information table.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Information About IP Services

IP Source Routing

The software examines IP header options on every packet. It supports the IP header options Strict Source Route, Loose Source Route, Record Route, and Time Stamp, which are defined in RFC 791. If the software finds a packet with one of these options enabled, it performs the appropriate action. If it finds a packet with an invalid option, it sends an Internet Control Message Protocol (ICMP) parameter problem message to the source of the packet and discards the packet.

IP provides a provision known as source routing that allows the source IP host to specify a route through the IP network. Source routing is specified as an option in the IP header. If source routing is specified, the software forwards the packet according to the specified source route. IP source routing is employed when you want to force a packet to take a certain route through the network. The default is to perform source routing. IP source

routing is rarely used for legitimate purposes in networks. Some older IP implementations do not process source-routed packets properly, and it may be possible to crash devices running these implementations by sending them datagrams with source routing options. Disable IP source routing whenever possible. Disabling IP source routing will cause a Cisco router to never forward an IP packet that carries a source routing option.

ICMP Overview

Originally created for the TCP/IP suite in RFC 792, the Internet Control Message Protocol (ICMP) was designed to report a small set of error conditions. ICMP can also report a wide variety of error conditions and provide feedback and testing capabilities. Each message uses a common format and is sent and received by using the same protocol rules.

ICMP enables IP to perform addressing, datagram packaging, and routing by allowing encapsulated messages to be sent and received between IP devices. These messages are encapsulated in IP datagrams just like any other IP message. When the message is generated, the original IP header is encapsulated in the ICMP message and these two pieces are encapsulated within a new IP header to be returned as an error report to the sending device.

ICMP messages are sent in several situations: when a datagram cannot reach its destination, when the gateway does not have the buffering capacity to forward a datagram, and when the gateway can direct the host to send traffic on a shorter route. To avoid the infinite regress of messages about messages, no ICMP messages are sent about ICMP messages.

ICMP does not make IP reliable or ensure the delivery of datagrams or the return of a control message. Some datagrams may be dropped without any report of their loss. The higher-level protocols that use IP must implement their own reliability procedures if reliable communication is required.

ICMP Unreachable Error Messages

Type 3 error messages are sent when a message cannot be delivered completely to the application at a destination host. Six codes contained in the ICMP header describe the unreachable condition as follows:

- 0—Network unreachable
- 1—Host unreachable
- 2—Protocol unreachable
- 3—Port unreachable
- 4—Fragmentation needed and the “don’t fragment﷯? (DF) bit is set
- 5—Source route failed

software can suppress the generation of ICMP unreachable destination error messages, which is called rate-limiting. The default is no unreachable messages more often than once every half second. Separate intervals can be configured for code 4 and all other unreachable destination error messages. However, there is no method of displaying how many ICMP messages have not been sent.

The ICMP Unreachable Destination Counters feature provides a method to count and display the unsent Type 3 messages. This feature also provides console logging with error messages when there are periods of excessive rate limiting that would indicate a Denial of Service (DoS) attack against the router.

If the software receives a nonbroadcast packet destined for itself that uses an unknown protocol, it sends an ICMP protocol unreachable message back to the source. Similarly, if the software receives a packet that it is

unable to deliver to the final destination because it knows of no route to the destination address, it sends an ICMP host unreachable message to the source. This functionality is enabled by default.

Disable ICMP host unreachable messages whenever possible. ICMP supports IP traffic by relaying information about paths, routes, and network conditions. These messages can be used by an attacker to gain network mapping information.

Because the null interface is a packet sink, packets forwarded there will always be discarded and, unless disabled, will generate host unreachable messages. In that case, if the null interface is being used to block a Denial-of-Service attack, these messages flood the local network with these messages. Disabling these messages prevents this situation. In addition, because all blocked packets are forwarded to the null interface, an attacker receiving host unreachable messages could use those messages to determine Access Control List (ACL) configuration. If the “null 0 interface is configured on your router, disable ICMP host unreachable messages for discarded packets or packets routed to the null interface.

ICMP Mask Reply Messages

Occasionally, network devices must know the subnet mask for a particular subnetwork in the internetwork. To obtain this information, such devices can send ICMP mask request messages. ICMP mask reply messages are sent in reply from devices that have the requested information. The software can respond to ICMP mask request messages if this function is enabled.

These messages can be used by an attacker to gain network mapping information.

ICMP Redirect Messages

Routes are sometimes less than optimal. For example, it is possible for the router to be forced to resend a packet through the same interface on which it was received. If the router resends a packet through the same interface on which it was received, the software sends an ICMP redirect message to the originator of the packet telling the originator that the router is on a subnet directly connected to the receiving device, and that it must forward the packet to another system on the same subnet. The software sends an ICMP redirect message to the originator of the packet because the originating host presumably could have sent that packet to the next hop without involving this device at all. The redirect message instructs the sender to remove the receiving device from the route and substitute a specified device representing a more direct path. This functionality is enabled by default.

In a properly functioning IP network, a router will send redirects only to hosts on its own local subnets, no end node will ever send a redirect, and no redirect will ever be traversed more than one network hop. However, an attacker may violate these rules; some attacks are based on this. Disabling ICMP redirects will cause no operational impact to the network, and it eliminates this possible method of attack.

Denial of Service Attack

Denial of service has become a growing concern, especially when considering the associated costs of such an attack. DoS attacks can decrease the performance of networked devices, disconnect the devices from the network, and cause system crashes. When network services are unavailable, enterprises and service providers suffer the loss of productivity and sales.

The objective of a DoS attack is to deprive a user or organization access to services or resources. If a Website is compromised by a DoS attack, millions of users could be denied access to the site. DoS attacks do not typically result in intrusion or the illegal theft of information. Instead of providing access to unauthorized users, DoS attacks can cause much aggravation and cost to the target customer by preventing authorized

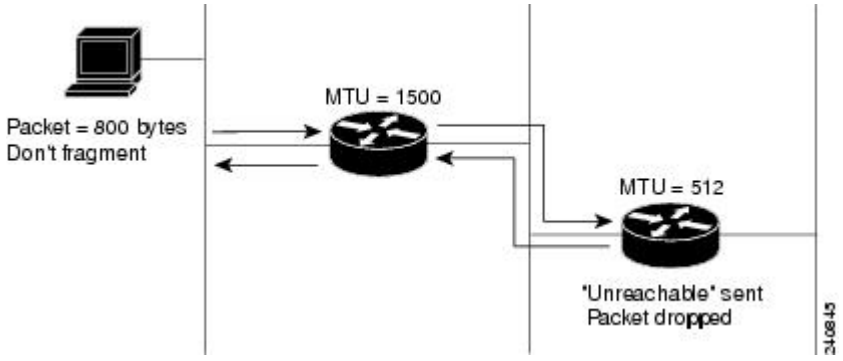
access. Distributed DoS (DDoS) attacks amplify DoS attacks in that a multitude of compromised systems coordinate to flood targets with attack packets, thereby causing denial of service for users of the targeted systems.

A DoS attack occurs when a stream of ICMP echo requests (pings) are broadcast to a destination subnet. The source addresses of these requests are falsified to be the source address of the target. For each request sent by the attacker, many hosts on the subnet will respond flooding the target and wasting bandwidth. The most common DoS attack is called a “smurf” attack, named after an executable program and is in the category of network-level attacks against hosts. DoS attacks can be easily detected when error-message logging of the ICMP Unreachable Destination Counters feature is enabled.

Path MTU Discovery

The software supports the IP Path MTU Discovery mechanism, as defined in RFC 1191. IP Path MTU Discovery allows a host to dynamically discover and cope with differences in the maximum allowable maximum transmission unit (MTU) size of the various links along the path. Sometimes a router is unable to forward a datagram because it requires fragmentation (the packet is larger than the MTU you set for the interface with the **ip mtu** interface configuration command), but the “don’t fragment?? (DF) bit is set. The software sends a message to the sending host, alerting it to the problem. The host will need to fragment packets for the destination so that they fit the smallest packet size of all the links along the path. This technique is shown in the figure below.

Figure 1: IP Path MTU Discovery



IP Path MTU Discovery is useful when a link in a network goes down, forcing the use of another, different MTU-sized link (and different routers). As shown in the figure above, suppose a router is sending IP packets over a network where the MTU in the first router is set to 1500 bytes, but the second router is set to 512 bytes. If the “don’t fragment?? bit of the datagram is set, the datagram would be dropped because the 512-byte router is unable to forward it. All packets larger than 512 bytes are dropped in this case. The second router returns an ICMP destination unreachable message to the source of the datagram with its Code field indicating “Fragmentation needed and DF set.?? To support IP Path MTU Discovery, it would also include the MTU of the next hop network link in the low-order bits of an unused header field.

IP Path MTU Discovery is also useful when a connection is being established and the sender has no information at all about the intervening links. It is always advisable to use the largest MTU that the links will bear; the larger the MTU, the fewer packets the host must send.

Note IP Path MTU Discovery is a process initiated by end hosts. If an end host does not support IP Path MTU Discovery, the receiving device will have no mechanism to avoid fragmenting datagrams generated by the end host.

If a router that is configured with a small MTU on an outbound interface receives packets from a host that is configured with a large MTU (for example, receiving packets from a Token Ring interface and forwarding them to an outbound Ethernet interface), the router fragments received packets that are larger than the MTU of the outbound interface. Fragmenting packets slows the performance of the router. To keep routers in your network from fragmenting received packets, run IP Path MTU Discovery on all hosts and routers in your network, and always configure the largest possible MTU for each router interface type.

Cisco IP Accounting

Cisco IP accounting support provides basic IP accounting functions. By enabling IP accounting, users can see the number of bytes and packets switched through the software on a source and destination IP address basis. Only transit IP traffic is measured and only on an outbound basis; traffic generated by the software or terminating in the software is not included in the accounting statistics. To maintain accurate accounting totals, the software maintains two accounting databases: an active and a checkpointed database.

Cisco IP accounting support also provides information identifying IP traffic that fails IP access lists. Identifying IP source addresses that violate IP access lists alerts you to possible attempts to breach security. The data also indicates that you should verify IP access list configurations. To make this functionality available to users, you must enable IP accounting of access list violations using the **ip accounting access-violations** interface configuration command. Users can then display the number of bytes and packets from a single source that attempted to breach security against the access list for the source destination pair. By default, IP accounting displays the number of packets that have passed access lists and were routed.

Show and Clear Commands for IOS Sockets

The Show and Clear Commands for IOS Sockets feature introduces the **show udp**, **show sockets**, and **clear sockets**commands. These new commands are useful for monitoring and managing the Cisco IOS Socket library.

In Cisco IOS software, sockets are a per process entity. This means that the maximum number of sockets is per process and all sockets are managed on a per process basis. For example, each Cisco IOS process could have a socket with file descriptor number 1. This is unlike UNIX or other operating systems that have per system file descriptor allocations.

The **show**and **clear** commands operate on a per process basis to be consistent with the current functionality. Thus, any action taken by the commands will be applicable only to a particular process at a time as selected by the process ID entered on the CLI.

Many applications have a need for **show** and **clear**commands, which primarily aid in debugging. The following scenarios provide examples of when these commands might be useful:

- The application H.323 is using sockets for voice calls. According to the current number of calls, there is still space for more sockets. However, no more sockets can be opened. You can now use the the **show sockets** command to find out if the socket space is indeed exhausted or if there are unused sockets available.

- An application is waiting for a particular socket event to happen. A UDP segment was seen, but the application never became active. You can use the **show udp** command to display the list of events being monitored to determine if a UDP socket event is being monitored or if the socket library failed to activate the application.
- An application wants to forcibly close all the sockets for a particular process. You can use the **clear sockets** command to close both the sockets and the underlying TCP or UDP connection or Stream Control Transmission Protocol (SCTP) association.

How to Configure IP Services

Protecting Your Network from DOS Attacks

ICMP supports IP traffic by relaying information about paths, routes, and network conditions. ICMP messages can be used by an attacker to gain network mapping information. IP source routing allows the source IP host to specify a route through the IP network and is rarely used for legitimate purposes in networks. Some older IP implementations do not process source-routed packets properly, and it may be possible to crash devices running these implementations by sending them datagrams with source routing options.

Whenever possible, ICMP messages and IP source routing should be disabled.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **no ip source-route**
4. **interface** *type/number/slot*
5. **no ip unreachables**
6. **no ip redirects**
7. **no ip mask-reply**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 3	**no ip source-route** **Example:**	Disables IP source routing.

	Command or Action	Purpose
	`Device(config)# no ip source-route`	
Step 4	**interface** *type/number/slot* **Example:** `Device(config)# interface GigabitEthernet 0/0/0`	Specifies the interface to configure and enters interface configuration mode.
Step 5	**no ip unreachables** **Example:** `Device(config-if)# no ip unreachables`	Disables the sending of ICMP protocol unreachable and host unreachable messages. This command is enabled by default. **Note** Disabling the unreachable messages also disables IP Path MTU Discovery because path discovery works by having the software send unreachable messages.
Step 6	**no ip redirects** **Example:** `Device(config-if)# no ip redirects`	Disables the sending of ICMP redirect messages to learn routes. This command is enabled by default.
Step 7	**no ip mask-reply** **Example:** `Device(config-if)# no ip mask-reply`	Disables the sending of ICMP mask reply messages.

Configuring ICMP Unreachable Rate Limiting User Feedback

Perform this task to clear all of the unreachable destination packet statistics and to specify an interval number for unreachable destination messages. This task also configures a packet counter (threshold) and interval to trigger a logging message to a console. This task is beneficial to begin a new log after the thresholds have been set.

SUMMARY STEPS

1. **enable**
2. **clear ip icmp rate-limit** [*interface-type interface-number*]
3. **configure terminal**
4. **ip icmp rate-limit unreachable** [**df**] [*ms*] [**log** [*packets*] [*interval-ms*]]
5. **exit**
6. **show ip icmp rate-limit** [*interface-type interface-number*]

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable**	Enables privileged EXEC mode.

	Command or Action	Purpose
	Example: `Router> enable`	• Enter your password if prompted.
Step 2	**clear ip icmp rate-limit** [*interface-type interface-number*] **Example:** `Router# clear ip icmp rate-limit ethernet 2/3`	Clears all current ICMP unreachable statistics for all configured interfaces. The optional *interface-type* and *interface-number* arguments clear the statistics for only one interface.
Step 3	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.

Step 4	**ip icmp rate-limit unreachable** [**df**] [*ms*] [**log** [*packets*] [*interval-ms*]]
	Example:
	`Router(config)# ip icmp rate-limit unreachable df log 1100 12000`
		Specifies the rate limitation of ICMP unreachable destination messages and the error message log threshold for generating a message. The default is no unreachable messages are sent more often than once every half second.
		The arguments and keywords are as follows:
		• **df** --(Optional) When "don't fragment" (DF) bit is set in the ICMP header, a datagram cannot be fragmented. If the **df** keyword is not specified, all other types of destination unreachable messages are sent.
		• *ms* --(Optional) Interval at which unreachable messages are generated. The valid range is from 1 to 4294967295.
		• **log** --(Optional) List of error messages. The arguments are as follows:
		  • *packets*--(Optional) Number of packets that determine a threshold for generating a log. The default is 1000.
		  • *interval-ms*--(Optional) Time limit for an interval for which a logging message is triggered. The default is 60000, which is 1 minute.
		Note Counting begins as soon as this command is configured.

Step 5	**exit** **Example:** `Router# exit`	Exits to privileged EXEC mode.
Step 6	**show ip icmp rate-limit** [*interface-type interface-number*] **Example:**	(Optional) Displays all current ICMP unreachable statistics for all configured interfaces. The optional *interface-type*

	Command or Action	Purpose
	`Router# show ip icmp rate-limit ethernet 2/3`	and *interface-number* arguments display the statistics for only one interface.

Example

The following output using the**show ip icmp rate-limit** command displays the unreachable destinations by interface:

```
Router# show ip icmp rate-limit
                          DF bit unreachables       All other unreachables
Interval (millisecond)    500                       500
Interface                 # DF bit unreachables     # All other unreachables
---------                 ---------------------     ------------------------
Ethernet0/0               0                         0
Ethernet0/2               0                         0
Serial3/0/3               0                         19
The greatest number of unreachables is on serial interface 3/0/3.
```

Setting the MTU Packet Size

All interfaces have a default MTU packet size. You can adjust the IP MTU size so that the software will fragment any IP packet that exceeds the MTU set for an interface.

Changing the MTU value (with the **mtu** interface configuration command) can affect the IP MTU value. If the current IP MTU value is the same as the MTU value and you change the MTU value, the IP MTU value will be modified automatically to match the new MTU. However, the reverse is not true; changing the IP MTU value has no effect on the value for the **mtu** interface configuration command.

All devices on a physical medium must have the same protocol MTU in order to operate.

Perform this task to set the MTU packet size for a specified interface.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface** *type/number/slot*
4. **ip mtu** *bytes*
5. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device> enable`	Enables privileged EXEC mode. • Enter your password if prompted.

	Command or Action	Purpose
Step 2	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 3	**interface** *type/number/slot* **Example:** `Device(config)# interface GigabitEthernet 0/0/0`	Specifies the interface to configure and enters interface configuration mode.
Step 4	**ip mtu** *bytes* **Example:** `Device(config-if)# ip mtu 300`	Sets the IP MTU packet size for an interface.
Step 5	**end** **Example:** `Device(config-if)# end`	Returns to privileged EXEC mode.

Configuring IP Accounting

To configure IP accounting, perform this task for each interface.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ip accounting-threshold** *threshold*
4. **ip accounting-list** *ip-address wildcard*
5. **ip accounting-transits** *count*
6. **interface** *type number*
7. **ip accounting** [**access-violations**] [**output-packets**]
8. **ip accounting mac-address** {**input** | **output**}

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:**	Enters global configuration mode.

	Command or Action	Purpose
	`Router# configure terminal`	
Step 3	**ip accounting-threshold** *threshold* **Example:** `Router(config)# ip accounting-threshold 500`	(Optional) Sets the maximum number of accounting entries to be created.
Step 4	**ip accounting-list** *ip-address wildcard* **Example:** `Router(config)# ip accounting-list 192.31.0.0 0.0.255.255`	(Optional) Filters accounting information for hosts.
Step 5	**ip accounting-transits** *count* **Example:** `Router(config)# ip accounting-transits 100`	(Optional) Controls the number of transit records that will be stored in the IP accounting database.
Step 6	**interface** *type number* **Example:** `Router(config)# interface GigabitEthernet 1/0/0`	Specifies the interface and enters interface configuration mode.
Step 7	**ip accounting** [**access-violations**] [**output-packets**] **Example:** `Router(config-if)# ip accounting access-violations`	Configures basic IP accounting. • Use the optional **access-violations** keyword to enable IP accounting with the ability to identify IP traffic that fails IP access lists. • Use the optional **output-packets** keyword to enable IP accounting based on the IP packets output on the interface.
Step 8	**ip accounting mac-address** {**input** | **output**} **Example:** `Router(config-if)# ip accounting mac-address output`	(Optional) Configures IP accounting based on the MAC address of received (input) or transmitted (output) packets.

Monitoring and Maintaining the IP Network

IP Accounting collects the number of bytes and packets processed by the network element on the source or destination IP address, or on the basis of the **ip precedence** command. The information collected can be used to identify users for network usage billing, monitoring, and troubleshooting.

SUMMARY STEPS

1. **clear ip traffic**
2. **clear ip accounting** [**checkpoint**]

3. **clear sockets** *process-id*
4. **show ip accounting** [**checkpoint**] [**output-packets** | **access-violations**]
5. **show interface** *type number* **mac**
6. **show interface** [*type number*] **precedence**
7. **show ip redirects**
8. **show sockets** *process-id* [**detail**] [**events**]
9. **show udp** [**detail**]
10. **show ip traffic**

DETAILED STEPS

Step 1 **clear ip traffic**

To clear all IP traffic statistical counters on all interfaces, use the following command:

Example:

```
Router# clear ip traffic
```

Step 2 **clear ip accounting** [**checkpoint**]

You can remove all contents of a particular cache, table, or database. Clearing a cache, table, or database can become necessary when the contents of the particular structure have become or are suspected to be invalid. To clear the active IP accounting database when IP accounting is enabled, use the following command:

Example:

```
Router# clear ip accounting
```

To clear the checkpointed IP accounting database when IP accounting is enabled, use the following command:

Example:

```
Router# clear ip accounting checkpoint
```

Step 3 **clear sockets** *process-id*

To close all IP sockets and clear the underlying transport connections and data structures for the specified process, use the following command:

Example:

```
Router# clear sockets 35

All sockets (TCP, UDP and SCTP) for this process will be cleared.
Do you want to proceed? [yes/no]: y
Cleared sockets for PID 35
```

Step 4 **show ip accounting** [**checkpoint**] [**output-packets** | **access-violations**]

To display access list violations, use the **show ip accounting** command. To use this command, you must first enable IP accounting on a per-interface basis.

Use the **checkpoint** keyword to display the checkpointed database. Use the **output-packets** keyword to indicate that information pertaining to packets that passed access control and were routed should be displayed. Use the **access-violations** keyword to display the number of the access list failed by the last packet for the source and destination pair. The number of packets reveals how aggressive the attack is upon a specific destination. If you do not specify the **access-violations** keyword, the command defaults to displaying the number of packets that have passed access lists and were routed.

If neither the **output-packets** nor **access-violations** keyword is specified, **output-packets** is the default.

The following is sample output from the **show ip accounting** command:

Example:

```
Router# show ip accounting

   Source           Destination              Packets               Bytes
 172.16.19.40    192.168.67.20               7                    306
 172.16.13.55    192.168.67.20               67                   2749
 172.16.2.50     192.168.33.51               17                   1111
 172.16.2.50     172.31.2.1                  5                    319
 172.16.2.50     172.31.1.2                  463                  30991
 172.16.19.40    172.16.2.1                   4                    262
 172.16.19.40    172.16.1.2                  28                    2552
 172.16.20.2     172.16.6.100                39                    2184
 172.16.13.55    172.16.1.2                  35                    3020
 172.16.19.40    192.168.33.51              1986                   95091
 172.16.2.50     192.168.67.20               233                   14908
 172.16.13.28    192.168.67.53               390                   24817
 172.16.13.55    192.168.33.51             214669                9806659
 172.16.13.111   172.16.6.23               27739                 1126607
 172.16.13.44    192.168.33.51              35412                1523980
 192.168.7.21    172.163.1.2                   11                    824
 172.16.13.28    192.168.33.2                  21                   1762
 172.16.2.166    192.168.7.130                797                 141054
 172.16.3.11     192.168.67.53                  4                    246
 192.168.7.21    192.168.33.51              15696                 695635
 192.168.7.24    192.168.67.20                 21                    916
 172.16.13.111   172.16.10.1                   16                   1137
 accounting threshold exceeded for 7 packets and 433 bytes
```

The following is sample output from the **show ip accounting access-violations** command. The output pertains to packets that failed access lists and were not routed:

Example:

```
Router#  show ip accounting access-violations

   Source           Destination      Packets        Bytes        ACL
172.16.19.40    192.168.67.20             7          306         77
172.16.13.55    192.168.67.20            67         2749        185
172.16.2.50     192.168.33.51            17         1111        140
172.16.2.50     172.16.2.1               5          319        140
172.16.19.40    172.16.2.1               4          262         77
Accounting data age is 41
```

Step 5 **show interface** *type number* **mac**

To display information for interfaces configured for MAC accounting, use the **show interface mac** command. The following is sample output from the **show interface mac** command:

Example:

```
Router# show interface ethernet 0/1 mac

Ethernet0/1
Input  (511 free)
0007.f618.4449(228):  4 packets, 456 bytes, last: 2684ms ago
Total:  4 packets, 456 bytes
Output  (511 free)
0007.f618.4449(228):  4 packets, 456 bytes, last: 2692ms ago
Total:  4 packets, 456 bytes
```

Step 6 **show interface** [*type number*] **precedence**

To display information for interfaces configured for precedence accounting, use the **show interface precedence** command.

The following is sample output from the **show interface precedence** command. In this example, the total packet and byte counts are calculated for the interface that receives (input) or sends (output) IP packets and sorts the results based on IP precedence.

Example:

```
Router# show interface ethernet 0/1 precedence

Ethernet0/1
Input
Precedence 0:  4 packets, 456 bytes
Output
Precedence 0:  4 packets, 456 bytes
```

Step 7 **show ip redirects**

To display the address of the default router and the address of hosts for which an ICMP redirect message has been received, use the **show ip redirects**command.

Example:

```
Router#  show ip redirects

Default gateway is 172.16.80.29

Host               Gateway           Last Use    Total Uses  Interface
172.16.1.111      172.16.80.240        0:00             9  Ethernet0
172.16.1.4        172.16.80.240        0:00             4  Ethernet0
```

Step 8 **show sockets** *process-id* [**detail**] [**events**]

To display the number of sockets currently open and their distribution with respect to the transport protocol process specified by the *process-id* argument, use the **show sockets** command. The following sample output from the **show sockets** command displays the total number of open sockets for the specified process:

Example:

```
Router# show sockets 35

Total open sockets - TCP:7, UDP:0, SCTP:0
```

The following sample output shows information about the same open processes with the **detail** keyword specified:

Example:

```
Router# show sockets 35 detail

   FD LPort FPort Proto Type    TransID

   0  5000  0     TCP   STREAM  0x6654DEBC
State: SS_ISBOUND
Options: SO_ACCEPTCONN

   1  5001  0     TCP   STREAM  0x6654E494
State: SS_ISBOUND
Options: SO_ACCEPTCONN

   2  5002  0     TCP   STREAM  0x656710B0
State: SS_ISBOUND
Options: SO_ACCEPTCONN
```

```
   3  5003  0     TCP   STREAM  0x65671688
State: SS_ISBOUND
Options: SO_ACCEPTCONN

   4  5004  0     TCP   STREAM  0x65671C60
State: SS_ISBOUND
Options: SO_ACCEPTCONN

   5  5005  0     TCP   STREAM  0x65672238
State: SS_ISBOUND
Options: SO_ACCEPTCONN

   6  5006  0     TCP   STREAM  0x64C7840C
State: SS_ISBOUND
Options: SO_ACCEPTCONN

Total open sockets - TCP:7, UDP:0, SCTP:0
```

The following example displays IP socket event information:

Example:

```
Router# show sockets 35 events

Events watched for this process: READ
FD Watched Present Select Present

0 --- --- R-- R--
```

Step 9 **show udp** [**detail**]

To display IP socket information about UDP processes, use the **show udp** command. The following example shows how to display detailed information about UDP sockets:

Example:

```
Router# show udp detail

 Proto    Remote      Port      Local       Port  In Out Stat TTY OutputIF
 17       10.0.0.0    0         10.0.21.70  67    0  0   2211 0
 Queues: output 0
         input  0 (drops 0, max 50, highwater 0)
 Proto    Remote      Port      Local       Port  In Out Stat TTY OutputIF
 17       10.0.0.0    0         10.0.21.70  2517  0   0  11   0
 Queues: output 0
         input  0 (drops 0, max 50, highwater 0)
 Proto    Remote      Port      Local       Port  In Out Stat TTY OutputIF
 17       10.0.0.0    0         10.0.21.70  5000  0  0   211  0
 Queues: output 0
         input  0 (drops 0, max 50, highwater 0)
 Proto    Remote      Port      Local       Port  In Out Stat TTY OutputIF
 17       10.0.0.0    0         10.0.21.70  5001  0  0   211  0
 Queues: output 0
         input  0 (drops 0, max 50, highwater 0)
 Proto    Remote      Port      Local       Port  In Out Stat TTY OutputIF
 17       10.0.0.0    0         10.0.21.70  5002  0  0   211  0
 Queues: output 0
         input  0 (drops 0, max 50, highwater 0)
 Proto    Remote      Port      Local       Port  In Out Stat TTY OutputIF
 17       10.0.0.0    0         10.0.21.70  5003  0  0   211  0
 Queues: output 0
         input  0 (drops 0, max 50, highwater 0)
 Proto    Remote      Port      Local       Port  In Out Stat TTY OutputIF
 17       10.0.0.0    0         10.0.21.70  5004  0  0   211  0
```

```
 Queues: output 0
         input  0 (drops 0, max 50, highwater 0)
```

Step 10 **show ip traffic**

To display IP protocol statistics, use the **show ip traffic** command. The following example shows that the IP traffic statistics have been cleared by the **clear ip traffic** command:

Example:

```
Router# clear ip traffic

Router# show ip traffic

IP statistics:
 Rcvd:  0 total, 0 local destination
        0 format errors, 0 checksum errors, 0 bad hop count
        0 unknown protocol, 0 not a gateway
        0 security failures, 0 bad options, 0 with options
 Opts:  0 end, 0 nop, 0 basic security, 0 loose source route
        0 timestamp, 0 extended security, 0 record route
        0 stream ID, 0 strict source route, 0 alert, 0 cipso
        0 other
 Frags: 0 reassembled, 0 timeouts, 0 couldn't reassemble
        0 fragmented, 0 couldn't fragment
 Bcast: 0 received, 0 sent
 Mcast: 0 received, 0 sent
 Sent: 0 generated, 0 forwarded
 Drop: 0 encapsulation failed, 0 unresolved, 0 no adjacency
       0 no route, 0 unicast RPF, 0 forced drop

ICMP statistics:
 Rcvd: 0 format errors, 0 checksum errors, 0 redirects, 0 unreachable
       0 echo, 0 echo reply, 0 mask requests, 0 mask replies, 0 quench
       0 parameter, 0 timestamp, 0 info request, 0 other
       0 irdp solicitations, 0 irdp advertisements
 Sent: 0 redirects, 0 unreachable, 0 echo, 0 echo reply
       0 mask requests, 0 mask replies, 0 quench, 0 timestamp
       0 info reply, 0 time exceeded, 0 parameter problem
       0 irdp solicitations, 0 irdp advertisements

UDP statistics:
 Rcvd: 0 total, 0 checksum errors, 0 no port
 Sent: 0 total, 0 forwarded broadcasts

TCP statistics:
 Rcvd: 0 total, 0 checksum errors, 0 no port
 Sent: 0 total

Probe statistics:
 Rcvd: 0 address requests, 0 address replies
       0 proxy name requests, 0 where-is requests, 0 other
 Sent: 0 address requests, 0 address replies (0 proxy)
       0 proxy name replies, 0 where-is replies

EGP statistics:
 Rcvd: 0 total, 0 format errors, 0 checksum errors, 0 no listener
 Sent: 0 total

IGRP statistics:
 Rcvd: 0 total, 0 checksum errors
 Sent: 0 total

OSPF statistics:
 Rcvd: 0 total, 0 checksum errors
```

```
       0 hello, 0 database desc, 0 link state req
       0 link state updates, 0 link state acks

 Sent: 0 total

IP-IGRP2 statistics:
 Rcvd: 0 total
 Sent: 0 total

PIMv2 statistics: Sent/Received
 Total: 0/0, 0 checksum errors, 0 format errors
 Registers: 0/0, Register Stops: 0/0, Hellos: 0/0
 Join/Prunes: 0/0, Asserts: 0/0, grafts: 0/0
 Bootstraps: 0/0, Candidate_RP_Advertisements: 0/0

IGMP statistics: Sent/Received
 Total: 0/0, Format errors: 0/0, Checksum errors: 0/0
 Host Queries: 0/0, Host Reports: 0/0, Host Leaves: 0/0
 DVMRP: 0/0, PIM: 0/0
```

Configuration Examples for IP Services

Example: Protecting Your Network from DOS Attacks

The following example shows how to change some of the ICMP defaults for Gigabit Ethernet interface 0/0/0 to prevent ICMP from relaying information about paths, routes, and network conditions, which can be used by an attacker to gain network mapping information.

Disabling the unreachable messages will have a secondary effect: it will also disable IP Path MTU Discovery, because path discovery works by having the software send Unreachable messages. If you have a network segment with a small number of devices and an absolutely reliable traffic pattern—which could easily happen on a segment with a small number of rarely used user devices—you would be disabling options that your device would be unlikely to use anyway.

```
Device(config)# no ip source-route
Device(config)# interface GigabitEthernet 0/0/0
Device(config-if)# no ip unreachables
Device(config-if)# no ip redirects
Device(config-if)# no ip mask-reply
```

Example: Configuring ICMP Unreachable Destination Counters

The following example shows how to clear all of the unreachable destination packet statistics and to specify an interval number for unreachable destination messages. This example also shows how to configure a packet counter threshold and interval to trigger a logging message to a console.

```
Router# clear ip icmp rate-limit ethernet 0/0
Router# configure terminal
Router(config)# ip icmp rate-limit unreachable df log 1100 12000
```

Example: Setting the MTU Packet Size

The following example shows how to change the default MTU packet size for Gigabit Ethernet interface 0/0/0:

```
Device(config)# interface GigabitEthernet 0/0/0
Device(config-if)# ip mtu 300
```

Example: Configuring IP Accounting

The following example shows how to enable IP accounting based on the source and destination MAC address and based on IP precedence for received and transmitted packets:

```
Router# configure terminal
Router(config)# interface ethernet 0/5
Router(config-if)# ip accounting mac-address input
Router(config-if)# ip accounting mac-address output
Router(config-if)# ip accounting precedence input
Router(config-if)# ip accounting precedence output
```

The following example shows how to enable IP accounting with the ability to identify IP traffic that fails IP access lists and with the number of transit records that will be stored in the IP accounting database limited to 100:

```
Router# configure terminal
Router(config)# ip accounting-transits 100
Router(config)# interface ethernet 0/5
Router(config-if)# ip accounting output-packets
Router(config-if)# ip accounting access-violations
```

Additional References For IP Services

Related Documents

Related Topic	Document Title
Cisco IOS commands	Cisco IOS Master Commands List, All Releases
IP application services commands	Cisco IOS IP Application Services Command Reference

Standards and RFCs

Standard	Title
RFC 1256	ICMP Router Discovery Messages

Technical Assistance

Description	Link
The Cisco Support and Documentation website provides online resources to download documentation, software, and tools. Use these resources to install and configure the software and to troubleshoot and resolve technical issues with Cisco products and technologies. Access to most tools on the Cisco Support and Documentation website requires a Cisco.com user ID and password.	http://www.cisco.com/cisco/web/support/index.html

Feature Information for IP Services

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Table 1: Feature Information for IP Services

Feature Name	Releases	Feature Information
Clear IP Traffic CLI	12.4(2)T 12.2(31)SB2	The Clear IP Traffic CLI feature introduced the **clear ip traffic**command to clear all IP traffic statistics on a router instead of reloading the router. For added safety, the user will see a confirmation prompt when entering this command. In Cisco IOS Release 12.4(2)T, this feature was introduced. The following command was introduced by this feature: **clear ip traffic**.
ICMP Unreachable Rate Limiting User Feedback	12.4(2)T 12.2(31)SB2	The ICMP Unreachable Rate Limiting User Feedback feature enables you to clear and display packets that have been discarded because of an unreachable destination, and to configure a threshold interval for triggering error messages. When message logging is generated, it displays on your console. In Cisco IOS Release 12.4(2)T, this feature was introduced. The following commands were introduced or modified by this feature: **clear ip icmp rate-limit**, **ip icmp rate-limit unreachable**, **show ip icmp rate-limit**.

Feature Name	Releases	Feature Information
IP Precedence Accounting	12.2(21) 12.1(27b)E1 12.1(5)T15 12.2(25)S 12.2(33)SRA 12.2(18)SXF13 12.2(33)SXH1 15.0(1)S	The IP Precedence Accounting feature provides accounting information for IP traffic based on the precedence of any interface. This feature calculates the total packet and byte counts for an interface that receives or sends IP packets and sorts the results based on the IP precedence. This feature is supported on all interfaces and subinterfaces and supports CEF, dCEF, flow, and optimum switching. The following command was introduced by this feature: **show interface precedence**, **ip accounting precedence**.
Show and Clear Commands for IOS Sockets	12.4(11)T	The Show and Clear Commands for IOS Sockets feature introduces the **show udp**, **show sockets**, and **clear sockets**commands. These new commands are useful for monitoring and managing the Cisco IOS Socket library. The following commands were introduced or modified by this feature: **clear sockets**, **show sockets**,**show udp**. The following command was replaced by this feature:**show ip sockets**.