High Latency on ATM Cisco 800 DSL Router Series

Document ID: 43141

Contents

Introduction

The purpose of this document is to explain the unusual latency which may be measured on Cisco 8xx routers using a DSL connection.

There are two parameters which can influence the latency in this case:

- Traffic Shaping
- DSL Parameters

For Cisco 8xx DSL routers, ATM traffic shaping is done with software and as a result is not very accurate. Shaping is achieved by sending idle cells during the time there is no data to send and when the PVC exceeds its PCR. The latency is usually observed while performing ping tests from the router. Because the ping is not in continuous traffic, there is an additional delay when the ping is done. Because the connection is idle, idle cells may be sent once a ping is performed on an already idle connection. The ping cells are sent only after those idle cells are sent.

This additional latency is more predominant when the line speed is very small, like 64k or 128k. It is not very predominant for high upstream speed.

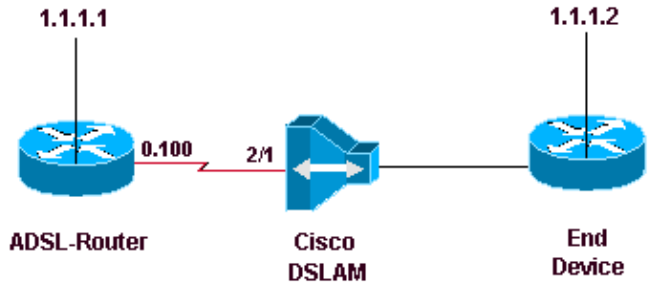
On the other hand, DSL parameters will also increase the latency (FEC bytes, interleaving and so on) due to the overhead they introduce. The tasks that can be done to reduce the impact of this problem are:

1. Completely disabling traffic shaping using the **no atm traffic−shaping** command. No idle cells are sent as there is no shaping.
2. Using the **no atm cell−clumping−disable** command to reduce latency. Shaping is performed here, but data cells may be sent in a clump instead of being sent constantly. Tuning CDVT may be required if policing is done on the ATM switches. In addition, no idle−cells are sent in this scenario.

    **Caution:** The use of this command is not recommended, however.
3. Tuning DSL parameters to reduce the overhead induced by them. However, this solution is to be used carefully as it could lead to bad performances if the DSL line is inducing errors.

This behavior has been described in the bug CSCdy44786 which has been closed as this is a limitation on the 8xx router.

This document contains several performance tests that illustrate this behavior. The setup used is the following:



ADSL−router is a 827 router running 12.2(8)YM

```
Cisco Internetwork Operating System Software
IOS (tm) C820 Software (C820−SV6Y6−M), Version 12.2(8)YM, EARLY DEPLOYMENT RELEASE SOFTWAR
Synched to technology version 12.2(11.2u)T
TAC Support: http://www.cisco.com/tac
Copyright (c) 1986−2002 by cisco Systems, Inc.
Compiled Fri 23−Aug−02 00:53 by ealyon
Image text−base: 0x80013170, data−base: 0x80C4FA74

ROM: System Bootstrap, Version 12.2(1r)XE2, RELEASE SOFTWARE (fc1)
ROM: C820 Software (C820−V6Y6−M), Version 12.2(8)T5,  RELEASE SOFTWARE (fc1)

ADSL−router uptime is 7 weeks, 22 hours, 40 minutes
System returned to ROM by power−on
System image file is "flash:c820−sv6y6−mz.122−8.YM.bin"

CISCO C827−4V (MPC855T) processor (revision 0xD01) with 31744K/1024K bytes of memory.
Processor board ID JAD050767V4 (2609117246), with hardware revision 5916
CPU rev number 5
Bridging software.
4 POTS Ports
1 Ethernet/IEEE 802.3 interface(s)
1 ATM network interface(s)
128K bytes of non−volatile configuration memory.
16384K bytes of processor board System flash (Read/Write)
2048K bytes of processor board Web flash (Read/Write)

Configuration register is 0x2102
```

Before You Begin

Conventions

For more information on document conventions, see the Cisco Technical Tips Conventions.

Prerequisites

There are no specific prerequisites for this document.

Components Used

This document is not restricted to specific software and hardware versions.

The information presented in this document was created from devices in a specific lab environment. All of the devices used in this document started with a cleared (default) configuration. If you are working in a live network, ensure that you understand the potential impact of any command before using it.

Test 1: 128K Upstream

For this first test, the upstream and downstream speeds will be configured to 128Kbps. We will compare the RTT time when:

1. VBR−nrt is used as 128kbps
2. VBR−nrt is not used
3. There is no traffic shaping

```
ADSL−router#show dsl int atm 0
                ATU−R (DS)                      ATU−C (US)
Modem Status:    Showtime (DMTDSL_SHOWTIME)
DSL Mode:        ITU G.992.1 (G.DMT)
ITU STD NUM:     0x01                            0x01
Vendor ID:       'ALCB'                          'ANDV'
Vendor Specific: 0x0000                          0x0000
Vendor Country:  0x00                            0x00
Capacity Used:    7%                             31%
Noise Margin:    29.0 dB                         23.0 dB
Output Power:    18.0 dBm                        12.5 dBm
Attenuation:      1.0 dB                          7.0 dB
Defect Status:   None                            None
Last Fail Code:  None
Selftest Result: 0x49
Subfunction:     0x02
Interrupts:      49941 (1 spurious)
Activations:     41
Init FW:         embedded
Operartion FW:   embedded
SW Version:      3.8129
FW Version:      0x1A04

                 Interleave             Fast    Interleave              Fast
Speed (kbps):           128                0           128                 0
Reed−Solomon EC:          0                0             0                 0
CRC Errors:               0                0             0                 0
Header Errors:            0                0             0                 0
Bit Errors:               0                0
BER Valid sec:            0                0
BER Invalid sec:          0                0
<skip>
```

- The first situation is to ensure the vbr−nrt is 128Kbps on the ADSL−router by configuring this explicitly as shown below:

```
interface ATM0.100 point−to−point
 ip address 1.1.1.1 255.255.255.0
 pvc 2/100
  vbr−nrt 128 128
  encapsulation aal5snap
```

Ping the end device several times, measure the RTT time, and then take an average as shown below:

```
ADSL-router#ping 1.1.1.2

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 1.1.1.2, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 72/73/80 ms
ADSL-router#ping 1.1.1.2

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 1.1.1.2, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 64/71/76 ms
```

- The second situation is to not use VBR-nrt under the PVC. The configuration should then look like this:

```
interface ATM0.100 point-to-point
 ip address 1.1.1.1 255.255.255.0
 pvc 2/100
  encapsulation aal5snap
```

Ping the end device several times, measure the RTT time, and then take an average as shown below:

```
ADSL-router#ping 1.1.1.2

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 1.1.1.2, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 40/40/44 ms
ADSL-router#ping 1.1.1.2

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 1.1.1.2, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 40/41/44 ms
```

- The third situation is to not use atm traffic-shaping. To remove traffic shaping, use the **no atm traffic-shaping** interface command as shown below. In this case the configuration would be as follows:

```
interface ATM0
 no atm traffic-shaping
```

Ping the end device several times, measure the RTT time, and then take an average as shown below:

```
ADSL-router#ping 1.1.1.2

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 1.1.1.2, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 36/40/44 ms
ADSL-router#ping 1.1.1.2

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 1.1.1.2, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 36/40/44 ms
```

We can see in the above tests that ATM traffic shaping increases the RTT of the pings even though the value at which the PVC is shaped is equal to the line bandwidth.

Test 2: 64K Upstream

This test repeats the three situations performed in Test 1 but with less bandwith. In this case we will only use 64kbps upstream.

```
ADSL-router#show dsl int atm 0
                ATU-R (DS)                      ATU-C (US)
Modem Status:    Showtime (DMTDSL_SHOWTIME)
DSL Mode:        ITU G.992.1 (G.DMT)
ITU STD NUM:     0x01                            0x01
Vendor ID:       'ALCB'                          'ANDV'
Vendor Specific: 0x0000                          0x0000
Vendor Country:  0x00                            0x00
Capacity Used:    6%                             14%
Noise Margin:    31.0 dB                         27.0 dB
Output Power:    18.0 dBm                        12.0 dBm
Attenuation:      1.0 dB                          7.0 dB
Defect Status:   None                            None
Last Fail Code:  None
Selftest Result: 0x49
Subfunction:     0x02
Interrupts:      49948 (1 spurious)
Activations:     42
Init FW:         embedded
Operartion FW:   embedded
SW Version:      3.8129
FW Version:      0x1A04

                 Interleave             Fast    Interleave              Fast
Speed (kbps):            64                0           64                 0
Reed-Solomon EC:          0                0            0                 0
CRC Errors:               0                0            0                 0
Header Errors:            0                0            0                 0
Bit Errors:               0                0
BER Valid sec:            0                0
BER Invalid sec:          0                0
<skip>
```

- Make sure the vbr-nrt is 64Kbps on the ADSL-router by configuring this explicitly as shown below:

```
interface ATM0.100 point-to-point
 ip address 1.1.1.1 255.255.255.0
 pvc 2/100
  vbr-nrt 64 64
  encapsulation aal5snap
```

  Ping the end device several times, measure the RTT time, and then take an average as shown below:

```
ADSL-router#ping 1.1.1.2

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 1.1.1.2, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 104/113/120 ms
ADSL-router#ping 1.1.1.2

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 1.1.1.2, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 104/113/120 ms
```

- The second situation is to not use VBR-nrt under the PVC. To achieve this, use the **no vbr-nrt 64 64**configuration command from the interface. The configuration then looks like:

```
interface ATM0.100 point-to-point
 ip address 1.1.1.1 255.255.255.0
 pvc 2/100
  encapsulation aal5snap
```

Ping the end device several times, measure the RTT time, and then take an average as shown below:

```
ADSL-router#ping 1.1.1.2

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 1.1.1.2, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 56/64/80 ms
ADSL-router#ping 1.1.1.2

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 1.1.1.2, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 56/60/72 ms
```

- The third situation is to not use atm traffic-shaping. In this case, the **no atm traffic-shaping**configuration command is used from the config in step 2

Ping the end device several times, measure the RTT time, and then take an average as shown below:

```
ADSL-router#ping 1.1.1.2

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 1.1.1.2, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 52/56/60 ms
ADSL-router#ping 1.1.1.2

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 1.1.1.2, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 52/56/60 ms
```

As shown in the examples above, the RTT of the pings at 64kbps is higher than at 128kbps.

Test 3: Impact of Cell-Clumping

This test will show us the impact of cell-clumping on the overall RTT. The upstream bitrate will be 128Kbps, and a 64Kbps VBR-nrt PVC will be used.

```
interface ATM0
 no atm cell-clumping-disable
!
interface ATM0.100 point-to-point
 ip address 1.1.1.1 255.255.255.0
 pvc 2/100
  vbr-nrt 64 64
  encapsulation aal5snap

ADSL-router#show dsl int atm 0
                ATU-R (DS)                      ATU-C (US)
Modem Status:    Showtime (DMTDSL_SHOWTIME)
DSL Mode:        ITU G.992.1 (G.DMT)
ITU STD NUM:     0x01                            0x01
Vendor ID:       'ALCB'                          'ANDV'
Vendor Specific: 0x0000                          0x0000
Vendor Country:  0x00                            0x00
Capacity Used:    7%                             32%
```

```
Noise Margin:    30.0 dB                          23.0 dB
Output Power:    18.0 dBm                         12.0 dBm
Attenuation:      1.0 dB                           7.0 dB
Defect Status:   None                             None
Last Fail Code:  None
Selftest Result: 0x49
Subfunction:     0x02
Interrupts:      50011 (1 spurious)
Activations:     50
Init FW:         embedded
Operartion FW:   embedded
SW Version:      3.8129
FW Version:      0x1A04

                 Interleave             Fast    Interleave              Fast
Speed (kbps):           576                0           128                 0
Reed-Solomon EC:          0                0             0                 0
CRC Errors:               0                0             0                 0
Header Errors:            0                0             0                 0
Bit Errors:               0                0
BER Valid sec:            0                0
BER Invalid sec:          0                0
<skip>
```

- Ping the end device several times, measure the RTT time, and then take an average as shown below:

```
ADSL-router#ping 1.1.1.2

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 1.1.1.2, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 40/42/44 ms
ADSL-router#ping 1.1.1.2

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 1.1.1.2, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 40/43/44 ms
```

Remove cell-clumping and witness the impact on the RTT:

```
interface ATM0
 atm cell-clumping-disable
```

Ping the end device several times, measure the RTT time, and then take an average as shown below:

```
ADSL-router#ping 1.1.1.2

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 1.1.1.2, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 76/79/84 ms
ADSL-router#ping 1.1.1.2

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 1.1.1.2, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 76/80/88 ms
```

The above test shows that significantly enabling clumping can reduce the RTT. However, the use of clumping is not recommended. Since cells are sent in clumps, if the attached ATM switch/DSLAM is doing policing, some of the cells may be dropped because they are violating the contract.

Test 4: Impact of the DSL Overhead

This final test will show the impact of the DSL overhead on the overall RTT. For this test, the DSLAM has been configured so the line uses 0 check bytes (which is configured in the DSLAM's profile). The configuration used on the router is the following:

```
interface ATM0.100 point-to-point
 ip address 1.1.1.1 255.255.255.0
 pvc 2/100
  vbr-nrt 64 64
  encapsulation aal5snap

ADSL-router#sh dsl int atm 0
                ATU-R (DS)                      ATU-C (US)
Modem Status:    Showtime (DMTDSL_SHOWTIME)
DSL Mode:        ITU G.992.1 (G.DMT)
ITU STD NUM:     0x01                            0x01
Vendor ID:       'ALCB'                          'ANDV'
Vendor Specific: 0x0000                          0x0000
Vendor Country:  0x00                            0x00
Capacity Used:    7%                             27%
Noise Margin:    26.5 dB                         21.0 dB
Output Power:    18.0 dBm                        12.0 dBm
Attenuation:      1.0 dB                          7.0 dB
Defect Status:   None                            None
Last Fail Code:  None
Selftest Result: 0x49
Subfunction:     0x02
Interrupts:      50025 (1 spurious)
Activations:     52
Init FW:         embedded
Operartion FW:   embedded
SW Version:      3.8129
FW Version:      0x1A04

                 Interleave             Fast    Interleave              Fast
Speed (kbps):           576                0           128                 0
Reed-Solomon EC:          0                0             0                 0
CRC Errors:               0                0             0                 0
Header Errors:            0                0             0                 0
Bit Errors:               0                0
BER Valid sec:            0                0
BER Invalid sec:          0                0
<skip>

ADSL-router#ping 1.1.1.2

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 1.1.1.2, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 56/62/68 ms
ADSL-router#ping 1.1.1.2

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 1.1.1.2, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 56/59/68 ms
```

As you can see, reducing the DSL overhead also improves the overall RTT. By reducing the DSL overhead, however, you are increasing the chances that data will be lost if the DSL line is producing errors. This is because the errors occurring on the DSL link could not be corrected. As a result, tuning the DSL parameters should be done carefully.

Conclusion

As can seen from all of the data above, there is less latency while the ping RTT remains relatively the same with/without traffic shaping at high upstream speed. The smaller the upstream bandwidth, however, the bigger the difference is with and without traffic shaping.

In addition, even though cell−clumping improves the RTT because the cells are sent in clumps, the attached ATM switch/DSLAM may drop cells if the CDVT configuration is too tight. Such a configuration is thus not recommended.

Related Information

- **Tools and Utilities − Cisco Systems**
- **Technical Support − Cisco Systems**
- **More ATM Information**

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