Traffic Shaping with the Cisco 2600 and 3600 Router Series E3/T3/OC3 ATM Interfaces

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Introduction

This document describes how to configure ATM traffic shaping on Cisco 2600, 3600, 4000, and 4500 Router Series. The main difference in the support of ATM traffic shaping on the 4000/4500 in comparison to the 2600/3600 router series is that the 4000/4500 platforms support only three service classes while the 2600/3600 Router Series support all traffic types. Other differences are discussed in the Features and Benefits section of this document.

The service classes supported on the 4000/4500 Router Series are:

- Unspecified Bit Rate (UBR)

- Non-real time variable bit rate (VBR-nrt)

- Unspecified Bit Rate Plus (UBR+)

Cisco 2600/3600 Router Series support real time variable bit rate (VBR-rt), Constant Bit Rate (CBR), and Available Bit Rate (ABR) in addition to UBR, VBR-nrt, and UBR+.

The table below shows the Network Modules (NPs) for 2600/3600 Router Series and Network Processor Modules (NPMs) for 4000/4500 Router Series that support ATM traffic shaping.

2600 and 3600 Router Series NMs	4000 and 4500 Router Series NPMs
NM-1A-E3	NP-1A-E3
NM-1A-T3	NP-1A-DS3
NM-1A-OC3	NP-1A-SM
	NP-1A-MM
	NP-1A-SM-LR

For background information on how these modules work with Cisco 2600 and 3600 routers, please see the Related Information section of this document. See the Related Information section for information related to the NPMs on the 4000 and 4500 routers, as well.

Prerequisites

Requirements

This document requires an understanding of ATM traffic shaping and the different service classes. The following resources provide information on these features:

- Understanding the UBR Service Category for ATM VCs

- Understanding the Variable Bit Rate Real Time (VBR-rt) Service Category for ATM VCs

- Understanding the VBR-nrt Service Category and Traffic Shaping for ATM VCs

- Understanding the CBR Service Category for ATM VCs

- Understanding the Available Bit Rate (ABR) Service Category for ATM VCs

- Understanding the UBR+ Service Category for ATM VCs

Components Used

The information in this document is based on these software and hardware versions:

- Cisco 2600/3600 and 4000/4500 series routers

- Cisco IOS® Software (versions specified in the Features and Benefits section)

The information in this document was created from the devices in a specific lab environment. All of the devices used in this document started with a cleared (default) configuration. If your network is live, make sure that you understand the potential impact of any command.

Conventions

Refer to Cisco Technical Tips Conventions for more information on document conventions.

Features and Benefits

ATM network modules have the following common features for Cisco 2600/3600 and 4000/4500 Router Series:

- They require an IOS "Plus" or Service Provider "p" feature set. If you are a registered user and you have logged in, you can view more information.

- Minimum Cisco IOS Software support varies with each card. Registered users can use the Software Advisor (registered customers only) tool to find the IOS version that supports their card.

- They support per-virtual circuit (VC) traffic shaping.

- They do not support Generic Traffic Shaping (GTS).

ATM features specific for the network modules in the 2600/3600 Series Router do the following:

- Provide hardware support for UBR, VBR-rt, VBR-nrt, CBR, ABR, and UBR+ service classes.

- Support traffic shaping up to full interface bandwidth at increments of 32 Kbps.

If you do configure Maximum Burst Size (MBS) and it is larger than 200 cells, it will be truncated to 200 cells. If you do not configure MBS, then:

- The maximum burst size (MBS) is 32 cells If the peak rate is less than 4 MB.

- The MBS is 200 cells if the peak rate is more than 4 MB.

ATM features specific for the network processor modules in the 4000/4500 Series Router include the following:

- Hardware support for, VBR-nrt, UBR, UBR+ service classes only.

- Cisco IOS Software Release 11.2(9)P or later is required for the NP-1A-SM-LR module. Full traffic shaping requires Cisco IOS Software Release 11.1 (17), 11.2(12)P or 11.3(2)T or later.

- Traffic shaping in Cisco IOS Software Releases 11.1(17), 11.2(12)P, and 11.3(2)T in Q1'98. Up to four user-definable peak rate queues can be used to limit the peak rate of cells transmitted, in addition to user-definable average rate and burst size limits for each virtual connection (VC).

- Defaults to 95 cells is if the MBS value is not configured.

Note: The support that Cisco 3620 routers provide for this card depends on the chassis hardware revision. Check this Field Notice for more information. This field notice also refers to Cisco bug ID CSCdk69671.

Note: The NP-1A-SM-LR module is supported only in the Cisco 4500, 4700, 4500-M, and 4700-M routers; it is not supported on the Cisco 4000 or 4000-M.

Service Classes

These ATM network modules on the 2600/3600 Router Series support the following service classes:

- UBR

- VBR-rt

- VBR-nrt

- CBR

- ABR

- UBR+

For the 4000 and 4500 Router Series, only the first three service classes are supported.

The configuration of each service class is explained below. You can configure these service classes using command line interface (CLI) commands under the permanent virtual connection (PVC) submode. Note that the CLI syntax for the 2600/3600 and 4000/4500 Router Series is the same.

The following sections provide some examples.

UBR

This traffic category has the lowest priority. The hardware schedules all UBR connections on a round robin basis.

```
vpd2004(config)#interface a5/0
vpd2004(config-if)#pvc 0/100
vpd2004(config-if-atm-vc)#ubr ?*
  <64-155000>  Peak Cell Rate(PCR) in Kbps
vpd2004(config-if-atm-vc)#ubr 1112
vpd2004(config-if)#end
```

Note: *If you do not specify a peak cell rate (PCR), the system sets it to 155 Kbps by default on the OC-3 network module. For E3 and T3 network modules, this is based on the line rate of the T3 and E3 cards.

VBR-rt

This traffic category has a higher priority than VBR-nrt and a lower priority than CBR. The hardware uses a dual leaky bucket algorithm to schedule this traffic type.

```
vpd2004(config)#interface a5/0
vpd2004(config-if)#pvc 0/102
vpd2004(config-if-atm-vc)#vbr ?
  <64-155000>  Peak Cell Rate(PCR) in Kbps
vpd2004(config-if-atm-vc)#vbr-rt ?
  <64-155000>  Peak Cell Rate(PCR) in Kbps
vpd2004(config-if-atm-vc)#vbr-rt 2005 ?
<64-100>  Average Cell Rate in Kbps
vpd2004(config-if-atm-vc)#vbr-rt 2005 1002 ?
  <1-64000>  Burst cell size in number of cells
  <cr>
vpd2004(config-if-atm-vc)#vbr-rt 2005 1002 32 ?
  <cr>
vpd2004(config-if-atm-vc)#end
```

VBR-nrt

This traffic type has a higher priority than UBR, but lower than VBR-rt. The hardware uses a dual leaky bucket algorithm to schedule this traffic type.

```
vpd2004(config)#interface a5/0

vpd2004(config-if)#pvc 0/103
```

```
vpd2004(config-if-atm-vc)#vbr-nrt ?
<64-155000>  Peak Cell Rate(PCR) in Kbps
vpd2004(config-if-atm-vc)#vbr-nrt 2005 ?
  <64-180>  Sustainable Cell Rate(SCR) in Kbps
vpd2004(config-if-atm-vc)#vbr-nrt 2005 1002 ?
  <1-64000>  Maximum Burst Size(MBS) in Cells
  <cr>
vpd2004(config-if-atm-vc)#vbr-nrt 2005 1002 32
vpd2004(config-if-atm-vc)#end
```

The recommended values of PCR for VBR are listed below:

PCR Values in Kbps

119999, 117024, 114122, 111291, 108532, 105840, 103216, 100656, 98160,
95726, 93352, 91037, 88779, 86578, 84431, 82337, 80295, 78304, 76362, 74469,
72622, 70821, 69065, 67353, 65683, 64054, 62466, 60917, 59406, 57933, 56497,
55096, 53730, 52397, 51098, 49831, 48596, 47391, 46216, 45070, 43952, 42863,
41800, 40763, 39752, 38767, 37805, 36868, 35954, 35063, 34193, 33345, 32519,
31712, 30926, 30159, 29412, 28682, 27971, 27278, 26601, 25942, 25299, 24672,
24060, 23463, 22882, 22314, 21761, 21222, 20695, 20182, 19682, 19194, 18718,
18254, 17802, 17361, 16930, 16510, 16101, 15702, 15313, 14934, 14563, 14203,
13851, 13507, 13172, 12846, 12527, 12217, 11914, 11619, 11331, 11051, 10777,
10510, 10249, 9995, 9748, 9506, 9270, 9040, 8817, 8598, 8385, 8178, 7975, 7777,
7585, 7397, 7214, 7035, 6861, 6691, 6525, 6364, 6206, 6052, 5902, 5756, 5613,
5474, 5339, 5206, 5077, 4951, 4782, 4619, 4461, 4308, 4161, 4019, 3882, 3749,
3621, 3497, 3378, 3262, 3151, 3043, 2939, 2839, 2742, 2648, 2557, 2470, 2386,
2304, 2226, 2150, 2076, 2005, 1937, 1871, 1807, 1746, 1686, 1629, 1573, 1519,
1467, 1417, 1369, 1322, 1277, 1234, 1192, 1151, 1112, 1074, 1038, 1003, 969,
936, 904, 873, 843, 814, 787, 760, 734, 709, 685, 662, 639, 618, 597, 577, 557,
538, 520, 502, 485, 468, 453, 437, 423, 408, 395, 382, 369 357, 345, 333, 322, 311,
301, 290, 281, 271, 262, 253, 245, 237, 229, 221, 214, 207, 200, 193, 187, 181,
175, 169, 163, 158, 153, 147, 143, 138, 133, 129, 125, 121, 117, 113, 109, 106,
103, 99, 96, 93, 90, 87, 84, 81, 79, 76, 74, 72, 69, 67, 65 or 63 Kbps.

CBR

This is the highest priority traffic type:

```
vpd2004(config)#interface a5/0
vpd2004(config-if)#pvc 0/104
vpd2004(config-if-atm-vc)#cbr ?
  <64-155000>  Peak Cell Rate in Kbps
vpd2004(config-if-atm-vc)#cbr 2005 ?
  <cr>
vpd2004(config-if-atm-vc)#cbr 2005
vpd2004(config-if-atm-vc)#end
```

ABR

This traffic type is scheduled at the same priority as VBR-nrt:

```
vpd2004(config-if)#pvc 0/105
vpd2004(config-if-atm-vc)#abr ?
  <64-155000>  Peak Cell Rate(PCR) in Kbps
vpd2004(config-if-atm-vc)#abr 76 ?
```

```
       <0-100>  Minimum Cell Rate(MCR) in Kbps
    vpd2004(config-if-atm-vc)#abr 76 0 ?
      <cr>
    vpd2004(config-if-atm-vc)#abr 76 0
    vpd2004(config-if-atm-vc)#end
```

The ABR traffic type supports 14 different PCRs and a Minimum Cell Rate (MCR) of zero. The 14 PCRs it supports are listed below:

PCR Values in Kbps

14877, 12487, 9996, 7497, 4397, 2559, 1597, 999, 399, 191,153, 76, 38 or 6 Kbps.

UBR+

UBR+ is a special ATM service class developed by Cisco Systems. Under non-congested traffic conditions, UBR+ behaves in the same way as the UBR default. However, under heavy traffic, UBR+ guarantees the MCR.

```
    vpd2004(config)#interface a5/0
    vpd2004(config-if)#pvc 0/106
    vpd2004(config-if-atm-vc)#ubr+ 2005 ?
     <0-1000>  Minimum Guaranteed Cell Rate(MCR) in Kbps
    vpd2004(config-if-atm-vc)#ubr+ 2005 1002 ?
     <0-1000>
    vpd2004(config-if-atm-vc)#ubr+ 2005 1002 ?
      <cr>
    vpd2004(config-if-atm-vc)#ubr+ 2005 1002
    vpd2004(config-if-atm-vc)#end
```

Related Information

- **Traffic Management for ATM**
- **ATM OC-3 Network Module for the Cisco 3600 Series Routers**
- Cisco 3600 Series Multiservice Platforms Product Support Page
- Cisco 2600 Series Multiservice Platforms Product Support Page
- **Cisco 2600/3600/3700 Series ATM OC-3 155-Mbps Network Modules Data Sheet**
- **Cisco 3600 Series ATM OC-3 Network Modules Overview**
- **DS3/E3 ATM Network Modules for the Cisco 2600/3600/3700 Series**
- **Installing Network Processor Modules in the Cisco 4000 Series**
- **Cisco 4000 Series Product Support**
- Cisco 4000 Series Documentation
- Technical Support & Documentation - Cisco Systems

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