

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

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Introduction

The ATM Forum publishes multi-vendor recommendations to further the use of ATM technology. The Traffic Management Specification [\[3\]](#) Version 4.0 defines five ATM service categories that describe both the traffic transmitted by users onto a network as well as the Quality of Service (QoS) that a network needs to provide for that traffic. The five service categories are:

- Constant bit rate (CBR)
- Variable bit rate non-real-time (VBR-nrt)
- variable bit rate real-time (VBR-rt)
- available bit rate (ABR)
- unspecified bit rate (UBR) and UBR+

This document focuses on VBR-rt.

Prerequisites

Requirements

There are no specific requirements for this document.

Components Used

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

Conventions

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

What is Variable Bit Rate Real-Time?

VBR-rt is intended for real-time applications, such as compressed voice over IP (VoIP) and video conferencing. These require tightly constrained delays (cell transfer delay [CTD]) and delay variation (cell delay variation [CDV]). In some cases, the cells on a permanent virtual circuit (PVC) experience CDV when two or more VCs share a single ATM interface. Cells of PVC 1 may be delayed when the ATM interface schedules cells of PVC 2 for transmission, or when physical layer overhead or operations, administration, and maintenance (OAM) cells are inserted into a particular cell timeslot and scheduled for transmission. As a result, the inter-arrival time between consecutive cells of a connection may vary. This phenomenon is known as jitter.

All five ATM service classes support a set of traffic parameters and QoS parameters. VBR-rt is characterized by a peak cell rate (PCR), sustained cell rate (SCR), and maximum burst size (MBS). You can expect the source device to transmit in bursts and at a rate that varies with time.

To configure a VBR-rt VC, enter VC configuration mode and issue the **vbr-rt peak-rate average-rate [burst]** command:

```
router(config)#interface atm 1/0
router(config-if)#pvc 0/100
router(config-if-atm-vc)#vbr-rt ?
    <64-155000> Peak Cell Rate(PCR) in Kbps
router(config-if-atm-vc)#vbr-rt 600 ?
    <64-600> Average Cell Rate in Kbps
router(config-if-atm-vc)#vbr-rt 600 300 ?
    <1-64000> Burst cell size in number of cells
    <cr>
router(config-if-atm-vc)#vbr-rt 600 300 32 ?
    <cr>
```

The peak rate and average rate values implement traffic shaping on the ATM PVC. Traffic shaping requires the ATM interface to control the amount of traffic that exits the VC at any point in time. This ensures that the ATM network provider does not drop any traffic due to policing.

VBR-rt is most commonly used to support voice over ATM (VoATM). When you configure VoATM, take care when you calculate sufficient peak, average and burst values, and ensure that the PVC can effectively handle the bandwidth for the number of voice calls. Use these formulas to calculate the values:

- $[2 \times \text{maximum number of calls}] \times 16 \text{ Kbps} = \text{peak cell rate}$
- $[1 \times \text{maximum number of calls}] \times 16 \text{ Kbps} = \text{sustained cell rate}$
- $[4 \times \text{maximum number of calls}] = \text{burst size in cells (MBS)}$

Compare VBR-rt and CBR Service Classes

Both CBR and VBR-rt are typically used for voice and video applications. So why use one service class in preference to the other class?

Cisco ATM interfaces use a schedule table that determines when cells for a particular virtual circuit are inserted into the interface's cell timeslots for transmission. All physical interface types, from OC-3 to T1, can be broken down into some number of ATM cell timeslots. For example, a T1 line offers 1.536 Mbps of payload bandwidth.

- $1.536 \text{ Mbps} / 424 \text{ bits per ATM cell} = 3622 \text{ cell timeslots or cells per second}$

Unless your PVC transmits at the line rate, it only uses some of the 3622 cell timeslots.

CBR is used by connections that request a static amount of bandwidth that is available during the connection lifetime. This bandwidth is characterized by PCR. Based on the PCR of the CBR traffic, specific cell slots are assigned for the VC in the schedule table. The ATM interface always sends a single cell during the CBR connection's assigned cell slot.

In contrast, both real-time and non-real-time VBR services are characterized by PCR, SCR and MBS or burst tolerance (BT). VBR-rt makes better use of bandwidth if the traffic is bursty, since the ATM interface reserves bandwidth equal to the SCR only.

There are also configuration differences between CBR and VBR-rt. While both service classes place a bound on the cell delay variation or variability in the arrival of adjacent cells that make up the kbps rate of a VC, only CBR PVCs on some Cisco interfaces allow you to set a CDV. For example, the NM-1A-OC3-1V supports the **ces-cdv {time}** command to specify the maximum tolerable cell arrival jitter.

Note: The **ces-cdv** command is a receive-side value that configures reassembly buffers large enough to accommodate the largest CDV present on a VC to prevent underflow and overflow. However, it is not so large as to induce excessive overall delay.

VBR-rt Interface Hardware

Cisco now offers several interface hardware modules and adapters that support the VBR-rt service class.

- MFT (MC3810)
- NM-1A-T3 and NM-1A-E3
- NM-4T1/8T1-IMA and NM-4E1/8E1-IMA
- NM-1A-OC3 and NM-1A-OC3-1V
- PA-A3

On the PA-A3, configuring a VBR-nrt PVC provides equivalent real-time service class performance. Cisco IOS® Software Release 12.2 introduces two new SAR priority levels to support proper prioritization for CBR and VBR-rt when competition for cell timeslots arises. It also introduces the ability to configure CBR and VBR-rt at the command line. Refer to Understanding Router Support for ATM Real-Time Service Categories.

- AIM-ATM and AIM-ATM-VOICE-30 – Refer to the data sheet.
- WIC-1ADSL – Refer to Configuring an ADSL WAN Interface Card on Cisco 1700 Series Routers.
- WIC-1SHDSL – Refer to Installing the G.SHDSL ATM WIC on the Cisco 1700 Series Router.

Note: The Cisco IOS Software Release 12.0 Configuration Guides state that only the Cisco MC3810 supports VBR-rt. The Cisco IOS Software Release 12.1 Configuration Guides indicate that additional support is provided for VBT-rt on the inverse multiplexing over ATM (IMA) network module. Cisco IOS Software Release 12.1(2)T introduced support for the T3/E3 and OC3 ATM network modules.

VBR-rt on the MC3810 MFT

The multiflex trunk module (MFT) for the MC3810 multiservice concentrator provides one T1/E1 port with a built-in CSU/DSU. The MFT is software-configurable to support either T1 or E1 as well as support one of two modes:

- **Multiflex mode** – Frame relay, high-level data link control (HDLC), or point-to-point protocol (PPP).

- **ATM mode** – Data and video in structured AAL1 format, or compressed voice or data in AAL5 format.

The **mode atm** command in controller configuration mode specifies that the controller supports ATM encapsulation. The **mode atm** command also creates the logical interface atm 0, under which you create the ATM PVCs.

```
router(config)#controller {t1 | e1} 0
router(config-controller)#mode atm
```

Configuring ATM on the MFT port requires a VoATM IOS image on the MC3810. You can identify whether your MC3810 supports ATM services by looking for an "a" in the image name in the output generated by the **show version** command. An example image name that supports ATM services is mc3810-a2i5s-mz for IP Plus VoATM no ISDN.

After you create the ATM interface, you need to configure the ATM encapsulation. The MFT supports these five ATM encapsulation types:

Encapsulation	ATM Service Category
aal1	CBR
aal5snap (with traffic shaping parameters)	VBR- nrt
aal5snap (without traffic shaping parameters)	UBR
aal5mux voice	VBR- rt
aal5muxframe-relay	VBR- nrt

The MC3810 supports voice over AAL5 using **aal5mux voice** encapsulation. In this configuration, the ATM interface is configured for this encapsulation type:

```
interface atm0
 pvc 1 1 100
 encapsulation aal5mux voice
 vbr-rt 384 192 48
```

Here are the commands you would use for this configuration:

Command	Description
pvc <i>[name] vpi/vci</i>	Create an ATM PVC for voice traffic and enter virtual circuit configuration mode.
encapsulation aal5mux voice	Set the encapsulation of the PVC to support voice traffic.
vbr-rt <i>peak-rate average-rate [burst]</i>	Configure the peak rate, average rate, and the burst cell size to perform traffic shaping.

For further information on configuring ATM services on the MFT, refer to Configuring Voice over ATM.

Related Information

- [Understanding the CBR Service Category for ATM VCs](#)
 - [Understanding the VBR–nrt Service Category and Traffic Shaping for ATM VCs](#)
 - [Understanding the Available Bit Rate \(ABR\) Service Category for ATM VCs](#)
 - [Understanding the UBR Service Category for ATM VCs](#)
 - [Understanding the UBR+ Service Category for ATM VCs](#)
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