

Understanding the UBR+ 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 Version 4.0 defines five ATM service categories that describe both the traffic transmitted by users onto a network and the quality of service 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 UBR+.

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 UBR+?

UBR is typically used for data communications applications such as file transfer and email. UBR is a best effort service and is the lowest class of service in the hierarchy. There are no guarantees to the actual

bandwidth allowed. Therefore, UBR virtual circuits (VCs) are susceptible to a large number of cell drops or a high cell transfer delay as cells move from the source to the destination. This is because UBR also has no bounds on Cell Delay Variation Tolerance (CDVT) and is only a best effort service.

The transmit priority for ATM class of services are:

1. CBR (highest priority)
2. VBR-rt (real time)
3. VBR-nrt (non real time)
4. ABR
5. UBR and UBR+

One can change the transmit priority for these classes of service but the default is what is listed above.

The only parameter you can specify on a Cisco router for UBR is the peak cell rate (PCR). Some ATM switches do not enforce the PCR, and the value of PCR becomes informational only. On switched virtual circuits (SVCs) defined for UBR, a router communicates to the network that a virtual circuit is UBR by using the best effort indicator field in the ATM User Cell Rate Information Element (IE) of a signaling packet.

UBR+ is a special ATM service class developed by Cisco Systems. UBR+ has been available in CLI as of Cisco IOS® Software Release 11.3(T) for SVCs. The minimum cell rate (MCR) configuration for UBR+ was introduced as of Cisco IOS Software Release 12.0(T). While UBR defines only (an optional) PCR, UBR+ also defines a MCR and (on the switch) a cell delay variation tolerance (CDVT). Below are two examples:

```
router(config-if-vc)# ubr output-pcr

router(config-if-vc)# ubr+ output-pcr output-mcr
```

What is important to understand about UBR+ is that the MCR is a "soft guarantee" of minimum bandwidth. A router signals the MCR value at call setup time when a switched VC is created. The ATM switch is then responsible for the guarantee of the bandwidth specified in the MCR parameter. A UBR+ VC is a UBR VC for which the MCR is signaled by the router and guaranteed by the ATM switch. Therefore, UBR+ affects connection admission control and resource allocation on ATM switches.

With UBR+, Cisco offers ATM interfaces the ability to communicate both the minimum and the maximum cell rates to the ATM network. As a result, the router can have some assurance of a range of bandwidth values necessary for Quality of Service (QoS).

When you configure SVCs, you can specify **input-pcr** and **input-mcr** parameters for a UBR+ VC. You typically specify the input parameters if your output and input parameters are different. If the input parameters on the UBR+ VC are omitted, the router automatically assigns the same values to these parameters as the output parameters.

```
ubr+ output-pcr output-mcr [input-pcr] [input-mcr]
```

In this example, different output and input parameters are specified for both PCR and MCR.

```
svc TEST nsap 47.0091.81.000000.0040.0B0A.2501.ABC1.3333.3333.05

ubr+ 10000 3000 9000 1000
```

Currently, LAN emulation (LANE) QoS supports the creation of UBR+ VCCs. If the switch cannot guarantee the rate you have specified for the UBR+ VCC, the LEC reverts to UBR with no MCR guarantee.

Notes:

- The **ubr+** command first appeared in Cisco IOS® Software Release 11.3 T. In Cisco IOS Software Release 12.0(3)T, the **ubr+** command was enhanced to support the selection of UBR+ QoS and configuration of output PCR and output MCR for VC bundles.
- The **ubr+** command was removed from the VC bundle command line interface (CLI) on the PA–A3 after Cisco IOS Software Release 12.0(6)T. Refer to Cisco bug ID CSCdm55109 (registered customers only) for additional information.

UBR+ Mechanism

The ATM Forum allows for a minimum guaranteed cell rate on UBR VCs. This actually follows Cisco System's implementation of UBR+ on ATM switches and routers (as in the 7x00 and 2600/3600 series routers). minimum desired cell rate (MDCR) is how the ATM Forum defines MCR. MDCR is optionally signaled or configured on either a virtual circuit or virtual path connection.

UBR+ differs from UBR+ MDCR in how the minimum cell rate is signaled to the ATM network. Cisco's UBR+ uses the MCR information element (IE) of ABR VCs. The ATM Forum's UBR+ MDCR uses a new MDCR IE. With UBR+ MDCR, ATM switches do not need to police the ATM cells and determine whether the minimum cell rate conforms to the signaled value.

The ATM Forum also defines a second service class that implements MCR called guaranteed frame rate (GFR). GFR is specified by the Forum in the 4.1 update to its Traffic Management Specification. GFR guarantees MCR at the frame level or at the AAL5, pre–SAR frame level. Only cells with CLP=0 are eligible for the minimum bandwidth guarantee. An ATM switch can mark the CLP bit on frames in which the measured cell rate exceeds the signaled MCR.

UBR+ on the PA–A3

The **ubr+** command is not available on the PA–A1 and PA–A2.

The PA–A3 ATM port adapter supports UBR+ on SVCs only. It does not support UBR+ on PVCs. Cisco IOS Software Release 12.0(7)T removed the **ubr+** command from PVC configuration mode. The VC is now created as a standard UBR VC from a traffic–shaping perspective. The **ubr+** command was also removed from PVC bundles (refer to Cisco bug ID CSCdp56549 (registered customers only)) and VC classes when these commands were applied to PVCs. If you apply a VC class with the **ubr+** command, Cisco IOS assigns the UBR class internally to the PVCs. The router rejects a VC class on a PVC if the PCR and MCR defined in the **ubr+** command are higher than the line rate of the underlying physical interface (refer to Cisco bug ID CSCds58878 (registered customers only)).

The **ubr+** command was removed from the CLI because of how scheduling works on an ATM edge device. The PA–A3 and other edge devices are designed to rate limit to a value like PCR or available cell rate, as with the ABR service category. They are not designed to provide a minimum bandwidth guarantee through active scheduling. In contrast, an ATM switch is designed to ensure that a VC receives a guaranteed rate. On Cisco campus ATM switches like the Catalyst 8500 series and the LS1010, the interface scheduler uses weighted round–robin (WRR) to allocate the remaining bandwidth among VCs of all ATM service categories other than CBR. (Refer to Configuring the Scheduler and Service Class.) With UBR+ VCs, the PA–A3 is responsible for limiting the VC to its PCR, and the ATM switch is responsible for the guarantee of the MCR to the VC.

ABR's use of MCR differs from UBR+'s use. ABR uses MCR as a "lowest–ever" maximum shaping rate. UBR+ uses MCR as an *active scheduling mechanism* for guaranteeing a minimum.

Instead of scheduling a minimum, a router can guarantee a form of Layer 3 QoS to complete packets. It can also ensure that any excess traffic above the PCR is queued so that the QoS policies can apply to the queued

excess. Refer to Configuring IP to ATM Class of Service for further information.

UBR+ on PA-A6

UBR is supported on the PA-A6 OC3 and PA-A6 OC 12. Only UBR and VBR-nrt CoS is configurable on the PA-A6 OC 12. On the PA-OC12 there is no **transmit priority** command under the PVC. This prevents a user from changing the transmit priority from something other than the default.

If there is no higher priority traffic, each timeslot may be filled by UBR traffic. This is due to the scheduling on the SAR chip on the PA-A6 where the cell timeslots are filled per the transmit priority. This may potentially lead to sending more traffic than the PCR and is why it is recommended that PVCs on the PA-A6 OC12 be configured with the SCR value rather than the PCR.

Future Cisco IOS Software releases will not display an option for configuring a PCR parameter at the command line with the **ubr** command. All UBR VCs will be forced to use a PCR of the line rate. Refer to Cisco bug ID CSCdu83983 (registered customers only) .

Related Information

- [ATM Technology Support Pages](#)
- [Constant bit rate \(CBR\)](#)
- [Variable bit rate non-real-time \(VBR-nrt\)](#)
- [Variable bit rate real-time \(VBR-rt\)](#)
- [Available bit rate \(ABR\)](#)
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