The ATM Forum

Technical Committee

Addendum to Traffic Management V4.1 for an Optional Minimum Desired Cell Rate Indication for UBR

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1. UBR Service Category with Optional MDCR Parameter

The Unspecified Bit Rate (UBR) service category is intended for non-real-time applications, i.e., those not requiring tightly constrained delay and delay variation. It is also the only service category reserved for applications that do not require a network commitment to low cell loss. However, some UBR applications may want to indicate to the network a preference for a minimum bandwidth objective. This objective is indicated by the optional Minimum Desired Cell Rate (MDCR) parameter, as defined in this addendum.

This specification does not define a service commitment for UBR connections utilizing the optional MDCR parameter. However, network specific service commitments for such connections are not precluded. Informative Appendix I provides an example of network specific policies regarding MDCR.

The MDCR parameter identifies an optional minimum bandwidth objective for UBR connections, which facilitates a useful information flow between devices in a network. One example application that may find this extension useful is interconnecting IP routers with VCCs or VPCs, where a minimum flow of availability, diagnostic and other system data is desirable. Also, this type of service allows the end user to indicate an objective for the lower bound on the bandwidth available for user data.

The MDCR parameter differs from the parameters associated with other ATM service categories in that its semantics are intentionally implementation and/or network specific. The impact of the MDCR parameter on the end-to-end service is not defined in this specification. The effect of specifying a particular value of the MDCR parameter may be different in different networks or in connections that span multiple networks.

2. Modifications to TM 4.1

The following sections indicate the changes to be made to the ATM Forum Traffic Management Specification Version 4.1 [1] in order to define a MDCR indication for UBR. Changes relative to TM4.1 are represented by underline and strikethrough markings.

2.1.4/TM4.1 Unspecified Bit Rate (UBR) Service Category Definition

To define a MDCR indication for UBR, modify Section 2.1.4 of TM4.1 as follows:

The Unspecified Bit Rate (UBR) service category is intended for non-real-time applications, i.e., those not requiring tightly constrained delay and delay variation. Examples of such applications are traditional computer communications applications, such as file transfer and email.

UBR service does not specify traffic related service guarantees. No numerical commitments are ~~made~~ specified with respect to the CLR experienced by a UBR connection, or as to the CTD experienced by cells on the connection. A network may or may not apply PCR to the CAC and UPC functions. In the case where the network does not enforce PCR, the value of PCR is informational only. When PCR is not enforced it is still useful to have PCR negotiated, since this may allow the source to discover the smallest bandwidth limitation along the path of the connection. Congestion control for UBR may be performed at a higher layer on an end-to-end basis.

A user may indicate a minimum bandwidth objective via the optional Minimum Desired Cell Rate (MDCR) parameter. Regardless of the presence and/or value of MDCR, this specification does not define a service commitment for UBR connections. However, network specific service commitments for UBR connections with MDCR > 0 are not precluded. Appendix I provides an example of network specific policies regarding MDCR.

The UBR service is indicated by use of the Best Effort Indicator in the ATM ~~User Cell Rate Information Element~~ Traffic Descriptor.

2.2/TM4.1 ATM Service Category Parameters and Attributes

To define a MDCR indication for UBR, modify Section 2.2 of TM4.1 as follows:

Table 2-1 provides a list of ATM attributes (traffic parameters, QoS parameters, congestion control and other attributes ~~feedback characteristics~~) and identifies whether and how these are supported for each service category. Traffic parameters and congestion control mechanisms are defined in Section 4 and Section 5. QoS parameters are defined in Section 3.

	ATM Layer Service Category					
Attribute	CBR	rt-VBR	nrt-VBR	UBR	ABR	GFR
Traffic Parameters[4]:						
PCR and CDVT[5]	Specified			Specified [2]	Specified [3]	Specified
SCR, MBS, CDVT[5]	n/a	Specified		n/a		
MCR	N/a				Specified	n/a
MCR, MBS, MFS, CDVT[5]	n/a					Specified
QoS Parameters[4]:						
Peak-to-peak CDV	Specified		Unspecified			
MaxCTD	Specified		Unspecified			
CLR	Specified			Unspecified	See Note 1	See Note 7
Congestion Control[8]:						
Feedback	Unspecified				Specified [6]	Unspecified
Other Attributes:						
MDCR[9]	n/a			Optional	n/a	

Table 2-1: ATM Service Category Attributes

Notes:

1. CLR is low for sources that adjust cell flow in response to control information. Whether a quantitative value for CLR is specified is network specific.
2. Might not be subject to CAC and UPC procedures.
3. Represents the maximum rate at which the ABR source may ever send. The actual rate is subject to the control information.
4. These parameters are either explicitly or implicitly specified for PVCs or SVCs.
5. CDVT refers to the Cell Delay Variation Tolerance (see Section 4.4.1). CDVT is not signaled. In general, CDVT need not have a unique value for a connection. Different values may apply at each interface along the path of a connection.
6. See Section 2.4.
7. CLR is low for frames that are eligible for the service guarantee. Whether a quantitative value for CLR is specified is network specific.
8. See Section 5 for details of ABR feedback and other congestion control mechanisms.
9. The MDCR parameter is not considered a traffic parameter because this specification does not define a service commitment based on MDCR.

2.3.1/TM4.1 Nature of Service Guarantees

To define a MDCR indication for UBR, modify Section 2.3.1 of TM4.1 as follows:

The nrt-VBR service category provides commitments for a cell loss ratio for those connections that remain within the traffic contract negotiated with the network at the time the connection is established. The CLR for cells sent that do not conform to the traffic contract is not guaranteed. Also, some degree of isolation is assumed; that is, connections that exceed their traffic contract are expected not to cause the negotiated CLR to be exceeded on connections that do not exceed their traffic contract.

The UBR service category offers no traffic related service commitments. No numeric commitment is ~~made~~ specified as to the cell loss ratio experienced by a connection, or as to the cell transfer delay experienced by cells on the connection. Regardless of the presence and/or value of MDCR, this specification does not define a service commitment for UBR connections. However, network specific service commitments for UBR connections with MDCR > 0 are not precluded. Fairness among connections cannot be assumed, although local policy in some network elements may have this effect.

The ABR service category provides a low cell loss ratio for those connections whose end-stations obey a specified reference behavior. No numeric commitment is made about cell transfer delay. If the endpoints fail to observe the reference behavior, the cell loss ratio may degrade. Fairness among connections is assumed, modified by the MCR, local policy in network elements, and a potentially significant error term. Specific examples of fairness criteria are documented in Appendix I.3. A sufficient degree of isolation between connections is necessary so that connections that fail to observe the reference behavior do not cause quality degradation on connections that do observe the reference behavior.

With the GFR service category, the user may always send cells at a rate up to PCR, but the network only commits to carry cells in complete unmarked frames at MCR. Traffic in excess of MCR and MBS will be delivered within the limits of available resources. It is expected that GFR connections will have fair access to available resources. The fairness policy is network specific.

4.5.3/TM4.1 Traffic Contract and Conformance Definition for UBR Service

To define a MDCR indication for UBR, modify Section 4.5.3 of TM4.1 as follows:

Conformance for a UBR connection is characterized by a single PCR and corresponding CDVT for the CLP=0+1 flow. The use of PCR for CAC, and enforcement of PCR by UPC, is network specific. However, if the user requests a non-zero minimum acceptable PCR that cannot be supported by the network, then the network may reject the call.

(R) PCR for CLP=0+1 is a mandatory traffic parameter in any source traffic descriptor of a UBR connection.

(R) The CDVT is a mandatory parameter in any connection traffic descriptor for a UBR connection.

(R) The CDVT shall be either explicitly specified at subscription time or implicitly specified for a UBR connection.

(R) For UBR SVCs, the PCR for CLP=0+1 shall be explicitly specified for each direction in the initial establishment message.

(O) MDCR for CLP=0+1 is an optional parameter of a UBR connection.

(O) The value of MDCR for CLP=0+1 applicable to each direction of a UBR connection may be different.

It is desirable that the source end-system conforms to PCR, but the enforcement of this is network specific.

3. References

[1] ATM Forum Technical Committee, “Traffic Management Specification Version 4.1”, AF-TM-0121.000, March 1999

[2] ITU-T Recommendation I.371, “Traffic Control and Congestion Control in B-ISDN”, ITU-T Study Group 13, Geneva, August 1996

Informative Appendix I: Example of Network Specific Policies Using the MDCR Parameter

This informative appendix provides an example of a network specific use of the optional MDCR parameter for UBR. Alternative policies for the use of the MDCR parameter are not precluded.

The interpretation of MDCR described in this appendix is not specified by this addendum, either as a requirement or as an option; it is merely a network specific example. The behaviors and expectations described below should be understood to exist only in this network specific context. The ATM Forum does not endorse the use of this appendix as the basis for interoperability requirements.

I.1: Use of the MDCR Parameter to Offer a Minimum Bandwidth Commitment for UBR Connections

This section describes an example of network specific policies that are intended to provide a long term minimum bandwidth commitment for UBR connections.

A network that supports this example provides:

1. A commitment to minimum bandwidth, based on the MDCR Parameter.
2. Access to available bandwidth above the MDCR, according to a network specific policy.

If the user transmits at a rate less than or equal to MDCR, a low cell loss ratio can be expected. If the user sends cells at a rate in excess of MDCR, the excess traffic will only be delivered within the limits of the available resources.

I.1.1 Minimum Bandwidth Commitment for UBR with Optional MDCR

In this example, if an MDCR(0+1) is specified for a UBR connection, then that connection will experience a low Cell Loss Ratio for a number of cells at least equal to the number of cells:

1. That are conforming (see Section 4.5.3 of TM 4.1) and
2. Pass the GCRA(1/MDCR, T) test.

The GCRA test is described here as an example of how a network decides on the number of cells to which the service commitment is applicable.

No mechanism is provided to negotiate the value of the tolerance (T) associated with the MDCR commitment. It is appropriate that T be chosen to exceed the time interval 1/MDCR for the reasons given in Appendix III of I.371 [2].

In this example the network applies CAC based on MDCR(0+1) to support the minimum bandwidth commitment. It also applies frame discard (see Section 5.8 of TM4.1), where applicable, to the connection.

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