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Terminology for ATM ABR Benchmarking
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Status of this Memo

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Abstract

This memo discusses and defines terms associated with performance benchmarking tests and the results of these tests in the context of Asynchronous Transfer Mode (ATM) based switching devices supporting ABR. The terms defined in this memo will be used in addition to terms defined in RFCs 1242, 2285, and 2544 and in ID Terminology for ATM Benchmarking. This memo is a product of the Benchmarking Methodology Working Group (BMWG) of the Internet Engineering Task Force (IETF).

1. Introduction.

This document provides terminology for benchmarking ATM based switching

devices supporting ABR. It extends terminology already defined for benchmarking network interconnect devices in RFC's 1242, 2285, and 2544 and in ID Terminology for ATM Benchmarking. Although some of the definitions in this memo may be applicable to a broader group of network interconnect devices, the primary focus of the terminology in this memo

is on ATM ABR.

This memo contains two major sections: Background and Definitions. The background section provides the reader with an overview of the technology and IETF formalisms. The definitions section is split into two sub- sections. The formal definitions sub-section is provided as a courtesy to the reader. The measurement definitions sub-section contains performance metrics with inherent units.

This document assumes that necessary services are available and active. For example, IP connectivity requires SSCOP connectivity between signaling entities. Further, it is assumed that the SUT has the ability to configure ATM addresses (via hard coded addresses, ILMI or PNNI neighbor discovery), has the ability to run SSCOP, and has the ability to perform signaled call setups (via UNI or PNNI signaling). Finally, this document presents only the terminology associated with benchmarking IP performance over ATM; therefore, it does not represent a total compilation of ATM test terminology.

The BMWG produces two major classes of documents: Benchmarking Terminology documents and Benchmarking Methodology documents. The Terminology documents present the benchmarks and other related terms. The Methodology documents define the procedures required to collect the benchmarks cited in the corresponding Terminology documents.

2. Existing Definitions.

RFC 1242 "Benchmarking Terminology for Network Interconnect Devices" should be consulted before attempting to make use of this document. RFC 2544 "Benchmarking Methodology for Network Interconnect Devices" contains discussions of a number of terms relevant to the benchmarking of switching devices and should be consulted. RFC 2285 "Benchmarking Terminology for LAN Switching Devices" contains a number of terms pertaining to traffic distributions and datagram interarrival. For the sake of clarity and continuity, this RFC adopts the template for definitions set out in Section 2 of RFC 1242.

3. Requirements

In this document, the words that are used to define the significance of each particular requirement are capitalized. These words are:

* "MUST" This word, or the words "REQUIRED" and "SHALL" mean that the item is an absolute requirement of the specification.

* "SHOULD" This word or the adjective "RECOMMENDED" means that there may exist valid reasons in particular circumstances to ignore this item, but the full implications should be understood and the case carefully

weighed before choosing a different course.

* "MAY" This word or the adjective "OPTIONAL" means that this item is truly optional. One vendor may choose to include the item because a particular marketplace requires it or because it enhances the product, for example; another vendor may omit the same item.

An implementation is not compliant if it fails to satisfy one or more of the MUST requirements for the protocols it implements. An implementation that satisfies all the MUST and all the SHOULD requirements for its protocols is said to be "unconditionally compliant"; one that satisfies all the MUST requirements but not all the SHOULD requirements for its protocols is said to be "conditionally compliant".

II. Definitions

The definitions presented in this section have been divided into two groups. The first group is formal definitions, which are required in the definitions of the performance metrics but are not themselves strictly metrics. These definitions are subsumed from other work done in other working groups both inside and outside the IETF. They are provided as a courtesy to the reader.

1. Formal Definitions

1.1. Definition Format (from RFC 1242)

Term to be defined.

Definition: The specific definition for the term.

Discussion: A brief discussion of the term, its application and any restrictions on measurement procedures.

Specification: The working group and document in which the terms are specified and are listed in the references section.

1.2. Related Definitions.

1.2.1. Allowed Cell Rate (ACR)

Definition: An ABR service parameter, ACR is the current rate (cells/second) at which a source is allowed to send.

Discussion: For ABR traffic, ACR constitutes the actual data throughput for a particular VC. The time change of this value effects TCP round trip time calculations, which in turn effects TCP throughput.

Specification: AF-TM4.0

1.2.2. ACR Decrease Time Factor (ADTF)

Definition: This is the time permitted between sending RM-cells before the rate is decreased to ICR (Initial Cell Rate). The time units are
.01 to 10.23 seconds

with a granularity of 10 ms.

Discussion: For ABR traffic, ADTF constitutes the time rate of the ACR. This value effects TCP round trip time calculations, which in turn effects TCP throughput.

Specification: AF-TM4.0

1.2.3. Additive Increase Rate (AIR)

Definition: An ABR service parameter, AIR controls the rate at which the cell transmission rate increases. It is signaled as AIRF, where
AIRF = AIR*Nrm/PCR.

Discussion: For ABR traffic, AIR effects the time rate of change of the ACR. This value effects TCP round trip time calculations, which in turn effects TCP throughput.

Specification: AF-TM4.0

1.2.4. Additive Increase Rate Factor (AIRF)

Definition: Refer to AIR.

Discussion: Refer to AIR.

Specification: AF-TM4.0

1.2.5. Available Bit Rate (ABR)

Definition: ABR is an ATM layer service category for which the limiting ATM layer transfer characteristics provided by the network may change subsequent to connection establishment. A flow control mechanism is specified which supports several types of feedback to control the source rate in response to changing ATM layer transfer characteristics.

Discussion: It is expected that an end-system that adapts its traffic in accordance with the feedback will experience a low cell loss ratio and obtain a fair share of the available bandwidth according to a network specific allocation policy. Cell delay variation is not controlled in

this service, although admitted cells are not delayed unnecessarily.

Specification: AF-TM4.0

1.2.6. Cutoff Decrease Factor (CDF)

Definition: CDF controls the decrease in ACR (Allowed Cell Rate) associated with CRM (missing RM cell count).

Discussion: For ABR traffic, CDF effects the time rate of change of the ACR. This value effects TCP round trip time calculations, which in turn effects TCP throughput.

Specification: AF-TM4.0

1.2.7. Initial Cell Rate (ICR)

Definition: An ABR service parameter, in cells/sec, that is the rate at which a source should send initially and after an idle period.

Discussion: none.

Specification: AF-TM4.0

1.2.8. Minimum Cell Rate (MCR)

Definition: An ABR service traffic descriptor, in cells/sec, that is the rate at which the source is always allowed to send.

Discussion: none.

Specification: AF-TM4.0

1.2.9. Mrm

Definition: An ABR service parameter that controls allocation of bandwidth between forward W-cells, backward RM-cells, and data cells.

Discussion: none.

Specification: AF-TM4.0

1.2.10. Nrm

Definition: An ABR service parameter, Nrm is the maximum number of cells a source may send for each forward RM-cell.

Discussion: none.

Specification: AF-TM4.0

1.2.11. Rate Decrease Factor (RDF)

Definition: An ABR service parameter, RDF controls the decrease in the cell transmission rate. RDF is a power of 2 from 1/32,768 to 1.

Discussion: For ABR traffic, RDF effects the time rate of change of the ACR. This value effects TCP round trip time calculations, which in turn effects TCP throughput.

Specification: AF-TM4.0

1.2.12. Rate Increase Factor (RIF)

Definition: This controls the amount by which the cell transmission rate may increase upon receipt of a RM-cell. The additive increase rate AIR=PCR*RIF. RIF is a power of 2, ranging from 1/32,768 to 1.

Discussion: For ABR traffic, RIF effects the time rate of change of the ACR. This value effects TCP round trip time calculations, which in turn effects TCP throughput.

Specification: AF-TM4.0

1.2.13. Resource Management (RM) Cells

Definition: RM cells are used to convey network status (available bandwidth, congestion levels) and request peak cell rates for ATM blocks. The RM cell has the following format:

Header: 5 bytes, same as the ATM cell header
Protocol ID: 3 bytes, value is ID1
Function specific field: 45 bytes, data required for the specific protocol
Rsvd: 6 bytes, reserved for future specification
EDC: 10 bytes, CRC-10 error detection code computed over the cell payload
(except the CRC-10 field) and used to check for data corruption

Discussion: RM information can exist at the VP and/or VC level. VP level cells are identified with a VCI value of 6. VC level cells are identified with a PT of 6.

Specification: AF-TM4.0

1.2.14. Tagged Cell Rate (TCR)

Definition: An ABR service parameter, TCR limits the rate at which a source may send out-of-rate forward RM-cells. TCR is a constant fixed at

10 cells/second.

Discussion: none.

Specification: AF-TM4.0

1.2.15. TDF

Definition: An ABR service parameter, TDF controls the decrease in ACR associated with TOF. TDF is signaled as TDFF, where TDF=TDFF/RDF times the smallest power of 2 greater or equal to PCR. TDF is in units of 1/seconds.

Discussion: For ABR traffic, TDF effects the time rate of change of the ACR. This value effects TCP round trip time calculations, which in turn effects TCP throughput.

Specification: AF-TM4.0

1.2.16. TDFF

Definition: Refer to TDF. TDFF is either zero or a power of two in the range 1/64 to 1 in units of 1 /cells.

Discussion: Refer to TDF.

Specification: AF-TM4.0

1.2.17. Time Out Factor (TOF)

Definition: An ABR service parameter, TOF controls the maximum time permitted between sending forward RM-cells before a rate decrease is required. It is signaled as TOFF where TOF=TOFF+1. TOFF is a power of 2 in the range: 1/8 to 4,096.

Discussion: For ABR traffic, TOF effects the time rate of change of the ACR. This value effects TCP round trip time calculations, which in turn effects TCP throughput.

Specification: AF-TM4.0

1.2.18. Time Out Factor (TOFF)

Definition: Refer to TOF.

Discussion: none.

Specification: AF-TM4.0

1.2.19. Trm

Definition: An ABR service parameter that provides an upper bound on the time between forward RM-cells for an active source. It is 100 times a power of two with a range of 100*2-7 to 100*20

Discussion: For ABR traffic, Trm effects the time rate of change of the ACR. This value effects TCP round trip time calculations, which in turn effects TCP throughput.

Specification: AF-TM4.0

1.2.20. Virtual Source/Virtual Destination (VSND)

Definition: An ABR connection may be divided into two or more separately controlled ABR segments. Each ABR control segment, except the first, is sourced by a virtual source. A virtual source implements the behavior of an ABR source endpoint. Backward RM-cells received by a virtual source are removed from the connection. Each ABR control segment, except the last, is terminated by a virtual destination. A virtual destination assumes the behavior of an ABR destination endpoint. Forward RM-cells received by a virtual destination are turned around and not forwarded to the next segment of the connection.

Discussion: none.

Specification: AF-TM4.0

1.2.21. Xrm Decrease Factor (XDM)

Definition: An ABR service parameter, XDF controls the decrease in ACR associated with Xrm. It is a power of two in range: [0, 1].

Discussion: For ABR traffic, XDM effects the time rate of change of the ACR. This value effects TCP round trip time calculations, which in turn effects TCP throughput.

Specification: AF-TM4.0

1.2.22. Xrm

Definition: An ABR service parameter, Xrm limits the number of forward RM- cells which may be sent in the absence of received backward PM-cells. The range is 0-255.

Discussion: For ABR traffic, Xrm effects the time rate of change of the ACR. This value effects TCP round trip time calculations, which in turn effects TCP throughput.

Specification: AF-TM4.0

2. Performance Metrics

2. 1. Definition Format (from RFC 1242)

Metric to be defined.

Definition: The specific definition for the metric.

Discussion: A brief discussion of the metric, its application and any restrictions on measurement procedures.

Measurement units: Intrinsic units used to quantify this metric. This includes subsidiary units; e.g., microseconds are acceptable if the intrinsic unit is seconds.

2.2. Definitions

2.2.1. ABR Rate Decrease Response Time (ARDRT)

Definition: The amount of time required by the SUT to adjust its transmission rate based on an ABR rate decrease request.

Discussion: During the ARDRT, cells transmitted by the SUT may be dropped by the network due to traffic policing. These dropped cells may contain a portion of an IP datagram. This may cause IP and TCP packet loss.

Measurement Units: seconds

2.2.2. ABR Rate Increase Response Time (ARIRT)

Definition: The amount of time required by the SUT to adjust its transmission rate based on an ABR rate increase request.

Discussion: During the ARIRT, the SUT will not fully utilize the available bandwidth. This will negatively impact IP and TCP throughput.

Measurement Units: seconds

2.2.3. RM Cell Loss Ratio (RM-CLR)

Definition: The ratio of lost RM cells in a transmission in relation to the total RM cells sent in a transmission associated with a given traffic load, orientation and distribution, as well as an integration period.

RM-CLR = Lost RM Cells / Total RM Cells Transmitted.

Discussion: RM-CLR may cause the SUT to transmit data cells at a rate larger than the available bandwidth. These data cells may be dropped by the network due to traffic policing. These dropped cells may contain a portion of an IP datagram. This may cause IP and TCP packet loss.

It is expressed as an order of magnitude, having a range of 10^-1 to 10^- 15 and unspecified.

Measurement Units: dimensionless.

3. Security Considerations.

As this document is solely for providing terminology and describes neither a protocol nor an implementation, there are no security considerations associated with this document.

4. Notices

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5. Disclaimer

6. References

[AF-ILMI4.0] ATM Forum Integrated Local Management Interface Version 4.0, af-ilmi-0065.000, September 1996.

[AF-TEST-0022] Introduction to ATM Forum Test Specifications, af-test-0022.00, December 1994.

[AF-TM4.0] ATM Forum, Traffic Management Specification Version 4.0, af-tm- 0056.00, April 1996.

[AF-TM4.1] ATM Forum, Traffic Management Specification Version 4.1 (final ballot), btd-tm-01.02, July 1998.

[AF-UNI3.1] ATM Forum, User Network Interface Specification Version 3.1, September 1994.

[AF-UNI4.0] ATM Forum, User Network Interface Specification Version 4.0, July 1996.

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