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Title: Performance Management Requirements of ATM Networks

Abstract:

Requirements for the performance management of the M4 interface are proposed.

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1 Introduction

Performance management of ATM networks is useful to determine the current performance of the networks as well as planning for future capacity of the networks. The performance has to be measured in terms of metrics that are meaningful for the users. Over the last few years, there has been a shift from cell-level performance metrics to frame-level performance metrics. This is because the cell-level metrics do not reflect the performance seen by the users. For example, a cell loss ratio of 10% may be too high if each cell that is lost belongs to a different frame and hence there is a 10% frame

loss. On the other hand, if most of the cells dropped belong to a few frame, the resulting frame loss rate may be very low and may be acceptable. The purpose of this contribution is to consider the frame level metrics and design requirements that will help ATM service providers, users, and equipment vendors with meaningful performance management.

Frame level performance allows users to compare the performance of their ATM networks with non-ATM networks. Since most networks consist of both ATM and non-ATM parts, it is useful to have metrics that apply to both parts.

Frame level performance is being emphasized in the upcoming "Guaranteed Frame Rate" (GFR) service being considered in the traffic management group. In that service, the loss rates are guaranteed for frames. When a frame is dropped all cells of the frame are dropped (without any additional harm to the user).

Note that in this contribution, the term "frame" refers to AAL5 protocol data unit (PDU). ATM switches can identify beginning and end of frames by looking at the "End of Frame" (EOF) code in the PTI field of the ATM cell header. All frame level counts discussed in this contribution apply only to frame level service. This can apply to all data services: UBR, ABR, and GFR.

To measure the performance of ATM networks, certain performance metrics (1) need to be calculated for both permanent (PVP or PVC) and switched (SVP or SVC) connections. These metrics should be calculated with reference to a

- i) switch
- ii) port
- iii) link
- iv) connection (VP or VC)

In other words, the performance metrics should be applied to all the permanent and switched connections passing through the switch. Similarly, the metrics should be applied for each port as well as each link. [It is necessary to collect metrics for a switch and link separately. Aggregates will not work. For example, for a 1->N multicast, the counts for the links will be different from the counts for connections. For a switch, loss of cells (frames) from any queue in the switch that does not belong to any links would have to be accounted for separately for the switch.]

In section 2, we define additional requirements needed to monitor performance on a cell based level and frame based level for the M4 Network Element View Interface.

In section 3, we define additional requirements needed for performance management of the M4 Network View (4).

2 Performance Management for Network Element View

2.1 Cell Level Monitoring Requirements

(R1) The M4 interface should support the ability to retrieve current (15 minute) counts of cells discarded due to frame discard for each connection from each ATM interface terminating on the ATM NE.

If a cell is dropped by a switch for any reason, the remaining cells in that frame are also dropped by the switch. This is called frame discard. This parameter is required where frame discard is

practiced.

This parameter keeps a separate count of the total number of ATM cells dropped due to frame discard for each permanent connection and each switched connection.

(R2) The M4 interface should support the ability to set threshold values for "Cells discarded due to frame discard" for each connection as given in R1 to one or more interfaces terminating on the ATM NE on which frame discard is applicable.

(R3) The M4 interface should allow modification of the threshold values for the "Cells discarded due to frame discard" for each connection as given in R1.

(R4) The M4 interface should support autonomous notifications by the ADM NE indicating threshold crossings for the parameter "Cells discarded due to frame discard" for each connection as given in R1.

(R5) The M4 interface should provide the ability to reset each count of the performance parameters listed in requirement R1 to zero.

(R6) The M4 interface should allow retrieval of history counts (thirty-two 15 minute counts) of the parameters listed in R1.

(R7) If the collection of data listed in R1 becomes suspect due to failures, testing routines, and reconfigurations of UNIs, BISSIs, and BICIs, the ATM NE should mark such data as "suspect". It should also be possible to retrieve information regarding whether the counts of parameters in R1 are suspect. [This is already being done for the other counts currently defined in the MIB, for example, (R) PM-11, (R) PM-22 in NE view(2).]

2.2 Frame Level Monitoring Requirements

(R8) The M4 interface should support the ability to retrieve current (15 minute) counts of the following data from each ATM interface (UNI, InterNNI, IntraNNI) terminating on the ATM NE as well as for each VP/VC connection:

1) Frames received on each connection

This parameter keeps a separate count of the total number of incoming ATM frames received on each permanent connection and each switched connection.

2) Frames successfully passed on each connection

This parameter keeps a count of the number of ATM frames that have been passed (i.e. not discarded) on each permanent and each switched connection.

3) Discarded frames due to UPC/NPC disagreements

This parameter keeps a count of the number of ATM frames discarded due to traffic descriptor violations detected by the combined CLP=0 and CLP=1 UPC/NPC policing function.

4) Discarded frames due to congestion

This parameter keeps a count of the number of ATM frames discarded due to congestion in the switch. Discard counts are incremented only if the switch implements frame level discard.

5) Total discarded frames

This parameter keeps a count of the number of ATM frames discarded for reasons other than congestion and UPC/NPC disagreements.

6) Successfully passed frames due to UPC/NPC disagreements

This parameter keeps a count of the number of ATM frames that have been passed (i.e. not discarded) by the combined CLP=0 and CLP=1 UPC/NPC policing function.

(R9) The M4 interface should support the ability to set threshold values for parameters 3, 4, and 5 listed in R8 to one or more interfaces terminating on the ATM NE.

(R10) The M4 interface should allow modification of the threshold value for the parameters 3, 4, and 5 listed in R8.

(R11) The M4 interface should support autonomous notifications by the ATM NE indicating threshold crossings for the parameters 3, 4 and 5 listed in R8.

(R12) The M4 interface should provide the ability to reset to zero each count of the performance parameters listed in R8.

(R13) The M4 interface should allow retrieval of history counts (thirty-two 15 minute counts) of the parameters listed in R8.

(R14) If the collection of data listed in R8 becomes suspect due to failures, testing routines, and reconfigurations of VPCs and/or VCCs, the ATM NE should mark such data as "suspect". It should also be possible to retrieve information regarding whether the counts of parameters in R8 are suspect. [This is already being done for the other counts currently defined in the MIB, for example, (R) PM-11, (R) PM-22 in NE view(2).]

3 Performance Management for M4 Network View

(R15) The M4 network view interface should support management requests for the performance information (specified in section 2) about the entire subnetwork. The element manager should in turn retrieve this information from the network elements, then aggregate this information and communicate it to the network manager.

(R16) The M4 network view interface should support management requests for performance information (specified in section 2) about a specific part of the subnetwork. The subnetwork should in turn retrieve this information from the network elements, aggregate it and communicate it to the network manager.

4 Motion

It is moved that the ATM Forum adds section 2 of this contribution to the current M4 Interface Requirements and Logical MIB: ATM Network Element View and section 3 to the current M4 Interface Requirements and Logical MIB: ATM Network View. The portion of the text within square brackets need not be added and has been included in this contribution by way of explanation only.

5 References

- 1) ATM Forum, ATM Forum Performance Testing Specification, February 1997.
- 2) ATM Forum, M4 Interface Requirements and Logical MIB: ATM Network Element View, October 1994.
- 3) J. Kenney, "Open Issues on GFR Frame Discard and Frame Tagging," contribution 97-0385, April 1997.
- 4) ATM Forum, M4 Interface Requirements and Logical MIB: ATM Network View, March 1996.