

Subject: Usage Parameter Control and VBR Video Traffic Monitoring

Source: Bellcore

Purpose: Discussion

1. Introduction

The purpose of the Usage Parameter Control (UPC) feature is to monitor a connection's resource usage for compliance with appropriate limits and to act on observed violations of those limits. A variety of UPC algorithms have been discussed in the literature, such as jumping windows, sliding windows, and leaky buckets, but no specific algorithm is being standardized in CCITT's 1992 Recommendations. However, efforts are underway to characterize the effectiveness of a UPC algorithm (operating under a specified set of traffic conditions) in terms of 1) the fraction of noncompliant traffic for which no UPC action is taken, 2) the fraction of compliant traffic for which UPC action is (erroneously) taken, and 3) the time needed for the UPC implementation to detect a given noncompliant situation. The first two relate to the steady state properties and are known as accuracy parameters, while the third one assesses the dynamic property of a UPC mechanism. Recently, Bellcore has proposed definitions for metrics for these performance parameters [1].

A UPC algorithm operates on network-based measurements of a traffic descriptor, such as peak cell rate associated with a given ATM connection¹. Possible actions taken by the UPC function when an ATM connection's resource usage is found to be in violation of appropriate limits are: cell dropping, cell tagging, cell rescheduling (an application of cell spacing), and connection dropping. Cell tagging based on a cell header's CLP bit is an option in CCITT's 1992 Recommendations.

2. Traffic Descriptor in CCITT's 1992 Recommendation

Peak cell rate is the mandatory traffic parameter to be explicitly or implicitly declared in any Source Traffic Descriptor. Additional standardized parameters beyond the peak cell rate, e.g., average rate, may be specified in the future. The network operator can allocate resources less than the peak rate if operational experience suggests that the actual usage by the particular traffic source has been less than the contracted peak rate, thereby improving the network utilization.

3. Implication on VBR Video Traffic

As stated in the previous section, the only mandatory traffic descriptor parameter in the CCITT Rec. 1992 is the peak rate. For peak rate monitoring, the need to define the above

1. ATM connections that may be subject to a UPC feature are Virtual Channel Connections (VCCs) and Virtual Path Connections (VPCs).

performance metrics arises due to the presence of cell delay variation (CDV) between where the cells are generated inside the video codec and where it is monitored at the User Network Interface, UNI. Because of CDV the peak rate of the video traffic may exceed the contracted rate momentarily and UPC may act erroneously upon the cell stream. So, while there is a need to define performance metrics for a UPC to account for CDV inherent in the arriving traffic, there may be no such need for buffer rate control inside a codec. Therefore, the two devices, the buffer rate controller and the UPC, may monitor the traffic using different methods.

In the longer term, additional standardized parameters beyond the peak cell rate, e.g., sustained average cell rate, and the maximum number of cells in a burst at the peak cell rate may be specified for the purposes of more accurately characterizing VBR video traffic and increasing its efficiency of transport over ATM-based networks. Three examples of UPC algorithms that operates on these additional parameters are considered in the document [2]. But since there is no agreement on what additional parameters are needed to characterize the variability in the traffic, as well as their definitions, it is difficult to visualize the relationship between the UPC needed to enforce these parameters at the UNI and the related buffer rate controller. However, it appears that some kind of congruency may be needed between the UPC parameters and the buffer rate controller parameters, so that the two devices have the same view of the traffic parameter being monitored. For example, if average rate is being monitored, it appears that the length of the interval over which averaging is performed and the phasing would have to be the same.

References

- [1] N. Endo, D. K. Hsing and R. P. Singh, "On Performance Metrics of a UPC/NPC Mechanism," T1S1 Contribution, T1S1.5/92-061, March 2-6, Denver, CO.
- [2] Rapporteur on Traffic Control and Resource Management, "CCITT Working Party XVIII/8 Meeting Report - Annex 2, Sub-Working Party Reports," Temporary Document 44 (PLEN), 2-13 December 1991, Melbourne.