ITU-T Telecommunication Standardization Sector
Study Group 15
Experts Group for Video Coding and Systems
in ATM and Other Network Environments

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Title: ATM Performance Assumptions
Purpose: Report

1. Introduction

During the last ATM Video Coding (AVC) Experts Group meeting in Paris [1], the group agreed to establish a set of ATM network performance scenarios in order to facilitate the process of specifying the H.32X (including H.22X), H.32Y, and H.32Z recommendations. In this report, the performance numbers of key ATM-related parameters are summarized. The data contained here represents the best available information that the AVC group can *assume* at this stage. As additional and more accurate information becomes available, the AVC group will modify the appropriate performance numbers. *It is important to note that the performance numbers summarized here do not represent official numbers from any national or international standardization bodies, or from any industrial affiliations.*

2. ATM Performance Assumptions

Table 1 summarizes the ATM performance assumptions for three scenarios. The end-to-end delay and Cell Delay Variation (CDV) numbers depend on:

- the number of ATM nodes in the ATM layer (virtual path/channel) connection[1],
- the characteristics of the arrival processes of the different queues in the system[2],
- and the cell's service time[3].

In addition, the performance numbers vary depending if one assumes that the arrival processes at the different nodes are independent or not. These and other factors explain the wide range of performance numbers shown in the table.

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1. Examples of ATM nodes are ATM multiplexers, ATM cross-connects, and ATM switches. A connection may have a very few ATM switches but a large number of ATM nodes (eight or more nodes in a national connection and even a larger number in an international connection).

2. Assuming a Poisson arrival process, as done in some simulations or queuing models, does not represent the most conservative assumption. Other arrival processes might be more suitable especially when VBR traffic is considered.

3. The service time can be modeled as a deterministic process with a constant value equals to the cell transmission time. Therefore, the service time represents the inverse of the cell transmission rate. Using an exponential distribution for the service time provides conservative CDV numbers [3].

Parameters	CBR (DRAFT ASSUMPTIONS)		
	Worst Case	Average Case	Best Case
Cell Loss Ratio (Without FEC)	10^{-6}	10^{-9}	10^{-11}
Cell Loss Ratio (With FEC)	See note[a]		
Severely Errored Cell Block (SECB) Ratio	See note[b]		
BER	10^{-5}	10^{-7}	10^{-9}
Burst BER Events	See note[c]		
End-to-End Delay[d] (UNI-UNI)	20 milliseconds + (propagation delay)	10 milliseconds + (propagation delay)	< [10 milliseconds + (propagation delay)][e]
End-to-End Delay (AAL/H.22X SAP)	See note[f]		
CDV (UNI-UNI)	1-3 milliseconds	0.5-1 millisecond	0.3-0.5 millisecond[g]
PDU Delay Variation (PDV) (AAL/H.22X SAP)	See note[h]		

TABLE 1. Performance Parameters' Assumptions

a. These performance numbers depend on the particular FEC method selected.

b. SECB is defined as *a block of N cells with M (or more) errored or lost cells* [4].The values of the parameters *N* and *M* are under study by ITU-T. The ATM Video Coding Experts Group may consider (1) influencing the selection of the values *N* and *M*, or (2) defining a similar parameter which is meaningful for video services over ATM. For example, if a video service employs the short interleaver [16 cell-based (94,88) Reed-Solomon] FEC method, then it is important in this case to characterize the performance based on the *event of having more than two lost cells or four errored cells in a 16-cell block*.

c. An example of a burst BER event is Severely Errored Second (SES) which is defined as a second with a BER of 10^{-3} or worse [5]. SES, however, does not provide a meaningful characterization of the end-to-end performance for video services. Similar to the previous case (footnote b.), the AVC Experts Group (and in collaboration with other ITU groups) may consider defining video service-related burst BER parameter(s). For example, a *30 millisecond burst with a BER of 10^{-3} or worse* can cause an H.320 terminal to loose synchronization due to the loss of H.221 framing.

d. This represents the unidirectional (i.e., not the round-trip) delay. This delay does not include the extra delay encountered in the terminals.

e. As mentioned above, the end-to-end delay depends on, among other things, the number of nodes in the virtual connection or path.

f. The end-to-end delay at this interface depends on the specific AAL selected, and the amount of smoothing required to reduce (or eliminate) the CDV.

g. Similar to the end-to-end delay, CDV depends on the number of nodes in the virtual connection or path. It also depends heavily on the characteristics of the traffic arriving at the different nodes.

h. At this interface, the delay variation value depends on the AAL layer selected and the amount of buffering and delay that can be tolerated.

References

[1] Okubo, S., "Report of the fifteenth experts group meeting in Paris (16-25 March 1994) - Part I and Part II," Document AVC-632R, March 25, 1994.

[2] CCITT Recommendation G.801 (Blue Book), "Digital Transmission Models," Volume III - Fascicle III.5, Geneva 1989.

[3] Kleinrock, L., "Queueing Systems,", John Wiley & Sons, 1975.

[4] ITU Draft Recommendation I.356, "B-ISDN ATM Layer Cell Transfer Performance," March 3, 1993.

[5] CCITT Recommendation G.821 (Blue Book), "Error Performance of an International Digital Connection Forming Part of an Integrated Services Digital Network," Volume III - Fascicle III.5, Geneva 1989.