TSG-RAN Working Group 3, meeting 6 ***TSG R3 #3(99)999***

Sophia Antipolis, France 24-27 August 1999

Agenda Item: 6.5

Source: Nokia

Title: Delay component TN1 (AAL delay)

Document for: Approval

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1 Introduction

This contribution discusses the effect of the allowed AAL multiplexing delay on the ATM link utilisation. The AAL multiplexing delay is shown to have a crucial role in the achieved ATM link efficiency.

The current version of the Delay budget template [1] specifies the delay component TN1 to include AAL Packetisation, Multiplexing and De-packetisation delays. In addition it has been stated in a note in [1] that the CPS scheduling component needs to be integrated into TN1.

2 Discussion

The multiplexing and scheduling process in an AAL2 transmitter involves the queuing of the CPS Packets of different users in order to assemble them into a shared ATM cell payload and the scheduling and sending of the assembled ATM cells into the VCC link. In the following it is shown that a too small value of TN1 should be avoided as it results in poor ATM link utilisation.

The intention of the initial calculation result below is to show the effect of TN1 on the basic multiplexing phenomenon. The queuing is based on the application of N*D/D/1 model. Furthermore, it has been assumed that all the independent sources (8kbit/s, 20ms TTI) are continuously in on-state. The link utilisation is defined as the ratio of the payload bit rate (speech frames) and the link rate. For AAL2 over ATM the theoretical maximum achievable link utilisation is 83%.

It can be seen from the figure 1 that the achievable link utilisation clearly depends on the allowed TN1. The dependency is in its strongest in the area of 1ms - 5ms. Furthermore it is seen that the link utilisation in general is dependent on the amount of users sharing the link. The conclusion is that the value of TN1 should be bigger than the current 1 ms, especially on I_{ub} and I_{ur} interfaces, where both the number of users may be small and the cost of transmission capacity is expected to be high. On I_u interface it can be assumed that the number of users sharing the same ATM VC is high (up to 248) so the efficient multiplexing can be achieved with smaller TN1. The given result of the simulation in figure 2 shows the effect of multiplexing delay on the VCC utilisation (i.e., the needed VCC bit rate to support 248 speech users with the loss ratio of 1e-5). From the curve it is seen that increasing the multiplexing delay from 1ms to 2ms improves the link utilisation significantly. In this case the independent sources are 12.2kbit/s with DTX. The TTI is 20ms.

The end-to-end delay budget and the existing requirements it has, must be taken into account when specifying any of its component. However, there are also other arguments involved in the specification of these delay components. Considering the shown effect of the TN1 on the end-to-end delay with relation to the favourable effect of increasing the TN1 values on the link utilisation and transmission costs, it is seen justifiable to increase the value of TN1 from its current values.

In this contribution only the 8kbit/s RT service has been discussed. For higher rate data services the value of TN1 may have even bigger effect mainly due to the different source behaviour (TTI, bit rate, etc.). It is recommended that the TN1 values for other services than speech be also revised before the completion of the Delay budget.

3 Proposal

The following three proposals are made:

1. To define the delay component TN1 in [1] to include the CPS scheduling in addition to Multiplexing, Packetisation and De-packetisation.

"*TN1): AAL Packetisation, De-Packetisation, Multiplexing and CPS Scheduling delay*"

2. To change the maximum value of TN1 for 8kbit/s RT service from the current 1ms as follows.

TN1-I_u = 2ms, TN1-I_{ur} = 5ms, TN1-I_{ub} = 5ms

3. To set the TN1 values for other services listed in [1] as FFS until their values have been revised.

4 References

[1] Italtel: Delay budget template for TSG RAN WG3

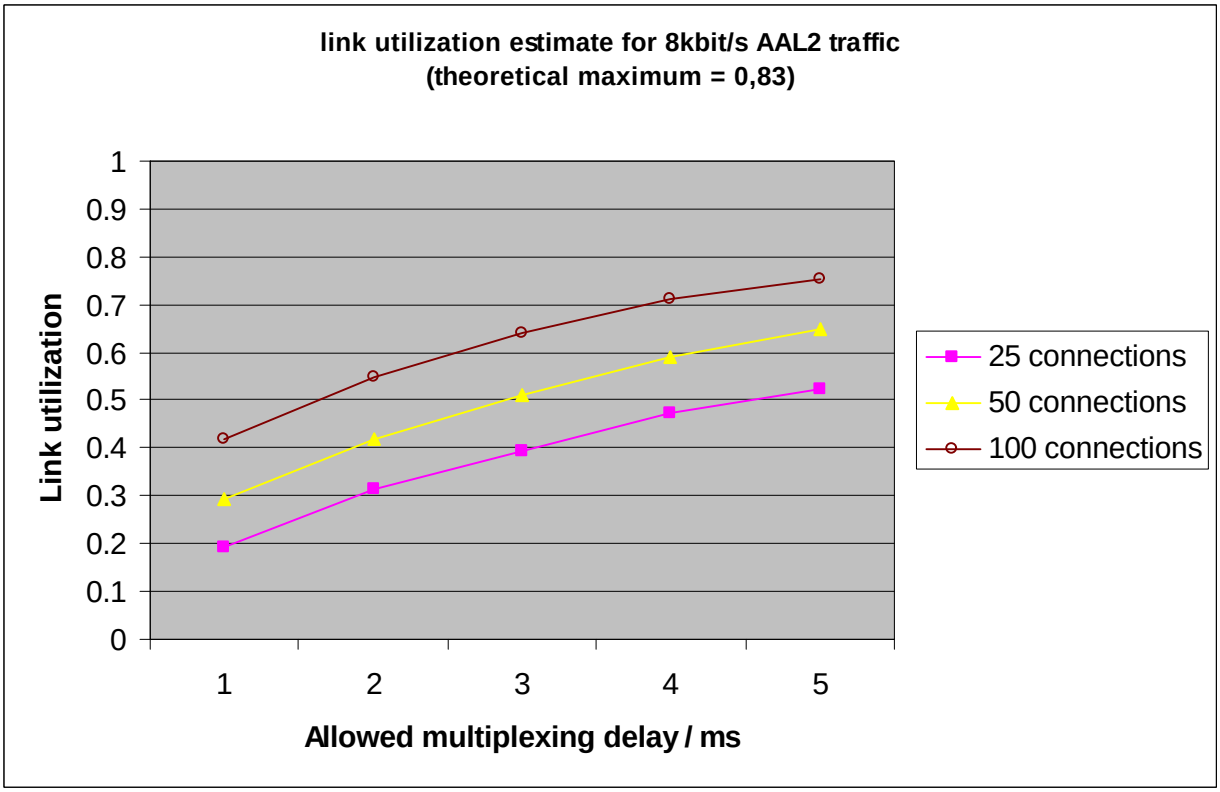

Figure 1 – Calculation: Link utilisation vs. multiplexing delay. Initial results.

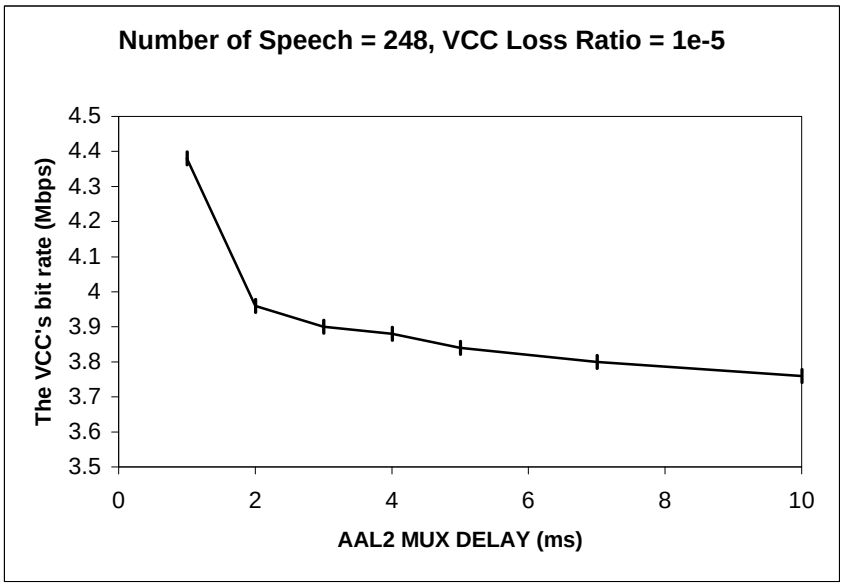

Figure 2 – Simulation result: VCC bit rate vs. AAL2 multiplexing delay.