

Title: LS about Overall Delay Budget within the Access Stratum Results and Requirements

**To: TSG SA WG1
TSG SA WG2
TSG RAN WG2**

Source: TSG RAN WG3

Document for: Information and Request for Comment

1 Introduction

This Liaison Statement informs the recipients about the results relevant to the Overall Delay Budget within the Access Stratum obtained during the ad-hoc session of TSG RAN WG3 meeting #5 in Helsinki on July, 5th 1999.

These results are to be considered as initial values which still need to be validated.

Moreover, it is asked whether the assumed requirements, described in the following, are correct.

2 Evaluation Results

In Annex Tdoc. TSGR3#5(99)800 is reported as reference.

The following global delays are reported from the Annex for information:

- a) Max End-to-End delay: 134 ms
- b) Round trip delay: 348 ms
(without switching delay in CN)

Notes:

a) has been computed as specified in UMTS 21.01, reference model for transmission delay, considering all delay components: start point on lu downlink, loopback in the UE and end point on lu uplink.

b) assumed different Codecs in UEs, this requires four transcoding actions in the CN. No switching and media delays in the CN have been considered.

3 Assumed Requirements

The definition of end-to-end delay is derived from the definition of one-way delay given in [2]: the difference between the two definitions is that the former also includes intermediate components (e.g. inter-node delays, processing times, speech encoding) not present in the latter definition, but significant for the overall delay.

According to references [3] and [4], the total one-way end-to-end delay for voice services should be kept within 40 ms, but the results of the evaluation clearly show that the delay introduced by UTRAN goes far beyond this limit.

Moreover, [1] defines requirements in an apparently different way from [3] and [4].

4 Request for Comment

RAN WG3 identified different requirements related to delay figures in UTRAN.

It is not clear to RAN WG3 which definition should be adopted to give further UTRAN delay evaluations or whether the procedure followed by RAN WG3 to provide first results is more appropriate.

RAN WG3 would like to have from the pertinent recipients an opinion about which requirements should be assumed to provide UTRAN Delay Budget figures.

5 References

- [1]: Selection procedures for the choice of radio transmission technologies of the UMTS (UMTS 30.03 version 3.2.0) - TR 101 112 V3.2.0 (1998-04)
- [2]: Requirements for the UMTS Terrestrial Radio Access system (UTRA) (UMTS 21.01 version 3.0.1)- TR 101 111 V3.0.1 (1997-10)
- [3]: Quality of Service and Network Performance (UMTS 22.25 version 3.1.0) - TR 22.25 V3.1.0 (1998-03)
- [4]: ITU-T Recommendation G.174: Transmission Performance Objectives for Terrestrial Digital Wireless Systems using Portable Terminals to access the PSTN (6/94)

Annex

TSG-RAN Working Group 3 meeting #5
5th – 9th July 1999
Helsinki, Finland

TSGR3#5(99)800

Agenda Item: 6.5

Source: Ad-hoc rapporteur

Title: Revision of Summary of Ad-hoc Overall Delay Budget within the Access Stratum

Document for: Report

1 Introduction

This document summarises the results of the ad-hoc on Overall Delay Budget within the Access Stratum, held on July 5th 1999 during TSG RAN WG3 meeting #5 in Helsinki.

2 Report of the meeting

No new contributions have been presented during the session, the discussion was based on the Status Report TSGR3#5(99)700 "Overall Delay Budget within the Access Stratum" by Siemens/Italtel already approved during the plenary session.

The delay due to the components described in TSGR3#5(99)653 has not been included in the evaluation, since no figures have been available during the discussion.

Some additional information has been provided by Siemens during the meeting.

Comments have been noted of the importance to give the requirements of the overall delay budget and of individual network elements for the User Plane, e.g. RNC, for Release 99 to help operators in network planning.

The interest in delay evaluations on signalling flows was also clear, but the effort required to provide useful results suggests a postponement to a further analysis.

The bottom-up approach followed in the document to derive the delay results has been confirmed and agreed.

It has been decided to analyse the individual functional components of one service (RT 8kbit/s) to produce a first result: during the discussion it was unsure whether some delay components may require a refinement. This item has been left ffs.

The network topology originally described in TSGW3#3(99)305 was discussed, it has been agreed to report it explicitly in the Delay Budget Template.

The validity of the original requirements specification quoted in UTRAN recommendations has been brought into question, as the findings have no correlation with the original objectives.

3 Results and Conclusion

The Delay Budget Template updated with the results and decisions of the ad-hoc is given in the Appendix.

The requirements produced by the study item for release 99 shall cover the User Plane only and define:

- lu-UE (source encoding/decoding excluded) worst case delay;
- Node B, RNC worst case delay;
- maximum branch delay difference allowed (service dependent).

The following figures for 8 kbit/s RT service have been computed (see Annex):

- a) Total T1 delay worst case: 53.5 ms
- b) Total T2 delay worst case: 67 ms
- c) Max T2-T1 delay difference: 47 ms

Processing delays have not been considered since still ffs.

From these values the following overall figures are derived (T_t = Transcoding Time assumed to be 20ms):

- d) Max End-to-End delay: 134 ms ($2 \cdot b$)
- e) Round trip delay: 348 ms ($2 \cdot d + 4 \cdot T_t$)
(without switching delay in CN)

Notes:

- d) has been computed as specified in UMTS 21.01, reference model for transmission delay, considering all delay components: start point on lu downlink, loopback in the UE and end point on lu uplink.
- e) assumed different Codecs in UEs, this requires four transcoding actions in the CN. No switching and media delays in the CN have been considered.

It is proposed to issue an informative LS to (at least) SA1 about the results obtained so far. The LS should also ask whether the assumed requirements are correct and, in case they are not, provide the updated requirements.

Appendix

Delay Budget Template

Delay Components

UTRAN Nodes

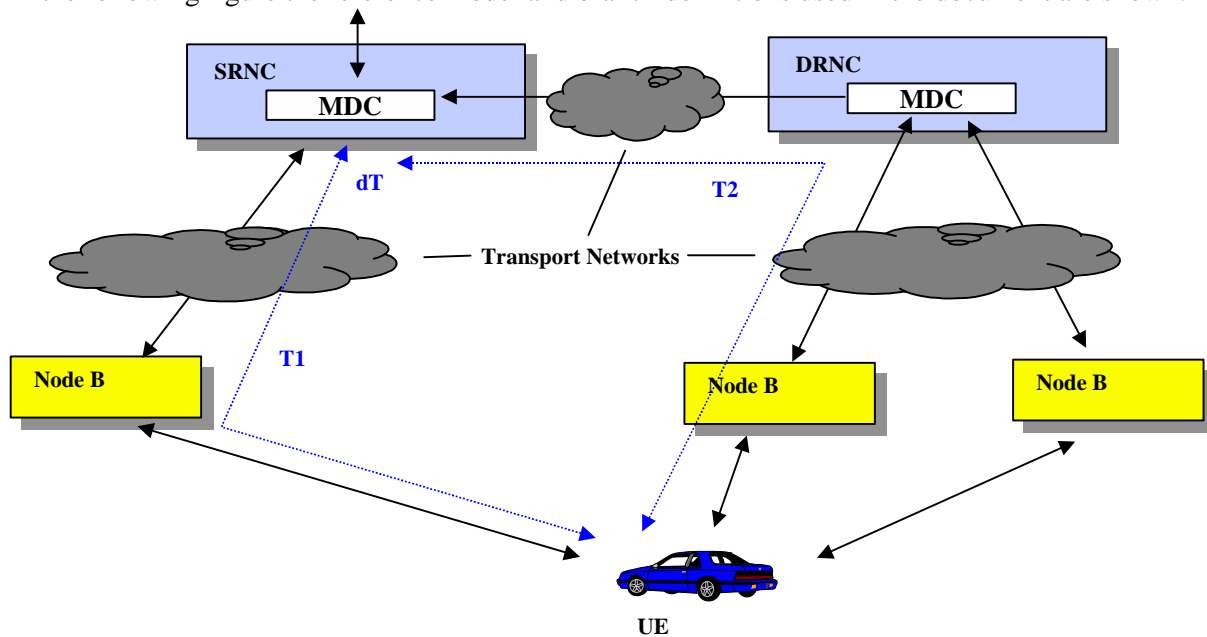
- U1): Packetisation, De-packetisation and End-System Play-Out Delay
- U3): Interleaving, De-interleaving and Turbo Decoding
- U4): MAC Scheduling Delay
- U5): Re-transmission Delay
- U6): Uu delay

Transport Network

- TN1): AAL Packetisation, Multiplexing and De-packetisation Delay
- TN2): Media Delay
- TN3): Switch Delay

UTRAN Reference Configuration

In the following figure the reference model and branch definitions used in the document are shown.



Network Assumptions

For the evaluation of delay components introduced by the transport network the following assumptions for a typical worst case scenario have been made:

- Iub interface: 6-hop PDH wave link
- Iub interface: 6-hop SDH wave link
- Iur interface: 600 km STM-1, optical fiber
- Iur interface: 9 ATM switches/cross-connects

Iu interface: 200 km STM-1, optical fiber
4 ATM switches/cross-connects

For a best case scenario, branch T1 is assumed to consist of co-located RNC and Node B.

Delay Budget Template

Service (kbit/s)	8 (RT)	32	64	144	384	2048	Source/Reference
Delay Component (Note 1)	Delay (ms)						
T1 Branch							
U3	20	100	100	100	100	100	
U6	0.05						
TN1 – I _{ub}	1	1	1	1	1	1	
TN2 – I _{ub}	14						TSGR3#3(99)313, Nokia
TN3 – I _{ub}	0						
U1	<14	1	1	1	1	1	
U4	0	10	10	10	10	10	
U5	0						
T1 Branch Delay	49						
T2 Branch							
U3	20	100	100	100	100	100	
U6	0.5						
TN1 – I _{ub}	1	1	1	1	1	1	
TN2 – I _{ub}	14						TSGR3#3(99)313, Nokia
TN3 – I _{ub}	0						
U1 – DRNC	<14	2	2	2	2	2	
TN1 – I _{ur}	1	1	1	1	1	1	
TN2 – I _{ur}	3						
TN3 – I _{ur}	2.7						
U1 – SRNC	<6	2	2	2	2	2	
U4	0	10	10	10	10	10	
U5	0						
T2 Branch Delay	62.5						
I_u Interface							
U1 (packetisation only)	0	1	1	1	1	1	
TN1 – I _u	0.5	0.5	0.5	0.5	0.5	0.5	
TN2 – I _u	1						
TN3 – I _u	2.5						
Iu Delay	4.5						

Note 1) processing times are not considered, their evaluation requires further study

In the following table the delay estimation results are reported; delay definitions are reported after the table.

U3 + TN1