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TSG-RAN Working Group 3 meeting #10
24th – 28th January 2000
Gothenburg, Sweden

R3-000393

Title: **Answer to LS from TSG-SA4 Codec on Delay Figures**

To: **TSG SA WG4 Codec**

Source: **TSG RAN WG3**

Document for: **Information**

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1 Introduction

RAN3 has been appointed by TSG_RAN to draft an answer to the 'Liaison Statement to SA2 and TSG_RAN on Delay Figures' (TSG-RAN RP99722) since the evaluation of delay budget in UTRAN for the most representative services is under discussion and analysis in this Sub-working group.

At present an evaluation for a real time 12.2 kbit/s service (AMR) has been carried out, while evaluations for NRT services are still under discussion and will be completed in Release 2000.

H.324 services have not been considered so far, since not included in the minimum set of services to be supported by UTRAN, as described in reference [1].
RAN3 has anyway considered the request originated by TSG-SA WG4 Codec also to analyse delay figures for H.324 multimedia services and is going to provide more detailed information as soon as possible.

In the following, the results for a RT 12.2 kbit/s service are given, while in the Appendix an excerpt from the Status Report of the Study Item 'Overall Delay Budget in the Access Stratum' is enclosed to provide further details.

2 Delay Budget Results

The following overall figures are given for a RT 12.2 kbit/s service (T_t = Transcoding Time assumed to be 20ms):

a) Max One Way delay 99.2 ms
b) Max End-to-End delay: 198.4 ms ($2*a$)
c) Round trip delay: 476.8 ms ($2*a + 4*T_t$)
(without switching and media delays in CN)

Notes:

a) see Appendix ‘Total delay T2 worst case’
b) has been computed as specified in UMTS 21.01, reference model for transmission delay, considering all delay components: start point on Iu downlink, loopback in the UE and end point on Iu uplink.

3 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]: Tdoc. R3-000133 ‘Study Item (ARC/3) “Overall Delay Budget within the Access Stratum”’, TSG-RAN WG3#10, 24th - 28th Jan. 2000, Gothenburg, Sweden

Annex (from [3])

1 Delay Budget Template

1.1 Delay Components

3.1.1 UTRAN Nodes

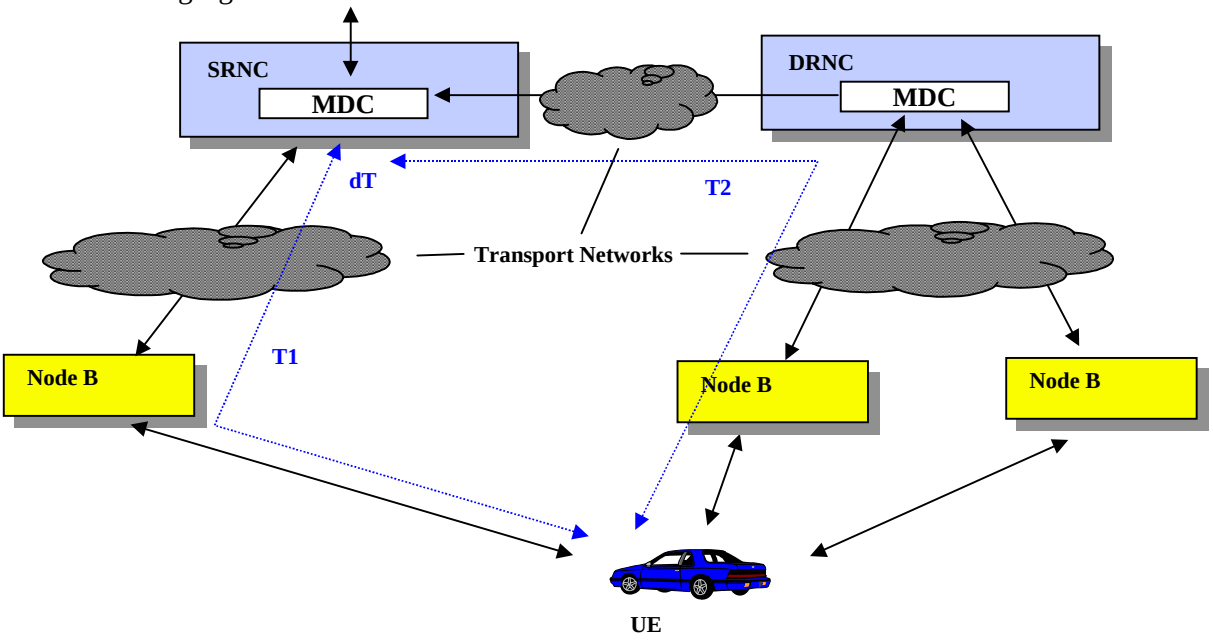
U1): Packetisation, De-packetisation and End-System Play-Out Delay
U2) Processing Delay
U3): Interleaving and Turbo Coding
U4): MAC Scheduling Delay
U5): Re-transmission Delay
U6): Uu delay

3.1.2 Transport Network

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

1.2 UTRAN Reference Configuration

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



3.2 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 µwave link
6-hop SDH µwave link
50 km per hop
(see TSGR3#3(99)313, Nokia)

Iur interface: 600 km STM-1, optical fiber
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.

1.3 Delay Budget Template

Service (kbit/s)	**AMR 12.2**	**Notes**
Delay Component	Delay (ms)	
T1 Branch		
U3	20	
U6	0.05	
U2 – Node B	15	UL value. 2 ms for DL
TN1 – I_{ub}	7	
TN2 – I_{ub}	2	
TN3 – I_{ub}	14	
U2 – SRNC	5	
U1	<14	
U4	0	
U5	0	
T1 Branch Delay	***77***	
T2 Branch		
U3	20	
U6	0.05	
U2 – Node B	15	UL value. 2 ms for DL
TN1 – I_{ub}	7	
TN2 – I_{ub}	2	
TN3 – I_{ub}	14	
U2 – DRNC	5	
U1 – DRNC	<14	
TN1 – I_{ur}	5	
TN2 – I_{ur}	3	
TN3 – I_{ur}	2.7	
U2 – SRNC	5	
U1 – SRNC	<6	
U4	0	
U5	0	
T2 Branch Delay	***99.2***	
I_u Interface		
U1 (packetisation only)	0	
TN1 – I_u	2	
TN2 – I_u	1	
TN3 – I_u	2.5	

Service (kbit/s)	**AMR 12.2**	**Notes**
Delay Component	Delay (ms)	
Iu Delay	***5.5***	

Note 1) processing times are not considered, their evaluation requires further study; TN1 has still to be integrated with CPS scheduling component.

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

Service (kbit/s)	**AMR 12.2**
Delays (one way)	Delay (ms)
α) Total delay T1 worst case	77
β) Total delay T2 worst case	99.2
γ) Total delay T1 best case	45.5
δ) Max T2-T1 delay difference	53.7
ε) SRNC delay	28
θ) DRNC delay	24
η) Node B delay	42

Definitions (with reference to template):

α = T1 Branch Delay + Iu Delay

β = T2 Branch Delay + Iu Delay

γ = T1 Branch Delay + Iu Delay

The evaluation of γ) assumes that components U3, U6 and U2 are unchanged and components TN1 TN2 TN3 U1, U4 and U5 are neglectable.

$\delta = \beta - \gamma$

The maximum delay difference between T1 and T2 branches has been compared, T1 being the best case and T2 being the worst case.

ε = U1 + U4 + U2 + TN1

θ = U1DRNC + U2DRNC + TN1

η = U3 + U2 + TN1