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Technical Specification

Telecommunications and Internet Protocol Harmonization Over Networks (TIPHON) Release 4; End-to-end Quality of Service in TIPHON Systems; Part 9: Call performance Classification (Voice)

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Foreword

This Technical Specification (TS) has been produced by ETSI Project Telecommunications and Internet Protocol Harmonization Over Networks (TIPHON).

The present document is part 9 of a multi-part deliverable covering the End-to-end Quality of Service in TIPHON Systems, as identified below:

TR 102 024-1: "General aspects of Quality of Service (QoS)";

TS 102 024-2: "Definition of Speech Quality of Service (QoS) Classes";

TS 102 024-3: "Signalling and Control of End-to-end Quality of Service (QoS) in a multi-media environment";

TS 102 024-4: "Quality of Service Management";

TS 102 024-5: "Quality of Service (QoS) measurement methodologies";

TR 102 024-6: "Actual measurements of network and terminal characteristics and Performance parameters in TIPHON networks and their influence on voice quality";

TR 102 024-7: "Design Guide for elements of a TIPHON connection from an End-to-end speech transmission performance point of view";

TS 102 024-9: "Call performance Classification (Voice)";

TS 102 024-10: "QoS Requirements for TIPHON Terminals".

1 Scope

The present document, "TIPHON call performance classification", specifies the signalling aspects associated with the control of End-to-end QoS within and between TIPHON domains for Voice over IP. It defines call and media processing parameters, bounds on the values of these parameters and a possible classification system. The specified parameters apply to session and media flow set-up and close-down as well as to mid-session changes and include issues of signalling accuracy, signalling latency and signalling reliability.

NOTE: The present document only applies to guaranteed QoS classes. Hence it is not applicable to the best effort class.

2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication and/or edition number or version number) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies.

Referenced documents which are not found to be publicly available in the expected location might be found at http://docbox.etsi.org/Reference.

[1] ETSI TS 101 314: "Telecommunications and Internet Protocol Harmonization Over Networks (TIPHON) Release 3; Abstract Architecture and Reference Points Definition; Network Architecture and Reference Points".

[2] ETSI TS 101 882: "Telecommunications and Internet Protocol Harmonization Over Networks (TIPHON) Release 3; Protocol Framework Definition; General (meta-protocol)".

[3] ITU-T Recommendation Y.1530 (February 2002): "Call processing performance for voice service in hybrid IP networks".

[4] ITU-T Recommendation Y.1541: "Network performance objectives for IP-based services".

[5] ITU-T Recommendation Q.766: "Performance objectives in the integrated services digital network application".

[6] ITU-T Recommendation Q.706: "Message transfer part signalling performance".

[7] ITU-T Recommendation Q.709: "Hypothetical signalling reference connection".

[8] Directive 98/10/EC of the European Parliament and of the Council of 26 February 1998 on the application of open network provision (ONP) to voice telephony and on universal service for telecommunications in a competitive environment.

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the following terms and definitions apply:

unsuccessful call: call attempt to a valid number, properly dialled following dial tone, where neither called party busy tone, nor ringing tone, nor answer signal, is recognized on the access line of the calling user within 30 s from the instant when the address information required for setting up a call is received by the network

unsuccessful call ratio: ratio of unsuccessful calls to the total number of call attempts in a specified time period

3.2 Abbreviations

For the purposes of the present document, the following abbreviations apply:

CASD	Call Answer Signal Delay
CPDP	Call Premature Disconnect Probability
CPRP	Call Premature Release Probability
CRFP	Call Release Failure Probability
CRD	Call Release Delay
CSD	Call Setup Delay
CSEP	Call Setup Error Probability
CSFP	Call Setup Failure Probability
DNS	Domain Name Server
FFS	For Further Study
ISDN	Integrated Service Digital Network
QoS	Quality of Service
SCN	Switched Circuit Network
TE	Terminal Equipment

4 Parameters

In this clause a set of parameters and values is proposed for consideration for the specification of the call completion performance classification.

4.1 Signalling failure probability

4.1.1 Call Setup Failure Probability

The Call Setup Failure Probability (CSFP) is the ratio of total call setup attempts that result in call setup failure to the total call setup attempts in a population of interest.

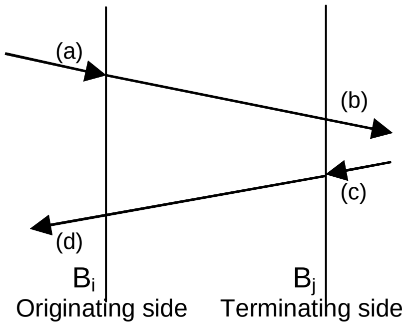


Figure 1: Reference events occurring during successful call setup

With reference to figure 1, the CSFP is defined to occur on any call setup attempt in which either one of the following outcomes is observed prior to expiration of timer T_{max}:

- both events (b) and (d) do not occur;
- events (b) and (c) occur, but event (d) does not.

Events (a) to (d) are observable events at specific reference points:

(a) illustrates setup at originating side;

(b) illustrates setup at terminating side;

(c) illustrates alerting at terminating side;

(d) illustrates alerting at originating side.

The reference points for TIPHON Release 4, corresponding to reference points B_i and B_j in figure 1 are specified in TS 101 314 [1]. The events occurring at those reference points correspond to specific TIPHON Metaprotocol messages as defined in TS 101 882 [2].

In case of TIPHON Scenario 0, reference point B_i in figure 1 relates to reference point C1 at the originating side, while B_j relates to reference point C1 at the terminating side. Reference point B_j relates to TIPHON reference point C3 in case of TIPHON scenario 1. B_i relates to TIPHON reference point C3 in case of TIPHON scenario 2.

The relationship between events (a) to (d) and the TIPHON Metaprotocol messages are as follows:

(a) corresponds to the entry of *U_CallRequest* at reference point C1 between the originating terminal device and the SpoA for call control;

(b) corresponds to the exit of *D_CallRequest* at reference point C1 between the terminating SpoA and the terminating terminal device;

(c) corresponds to the entry of U*_CallAltert* at reference point C1 between the terminating terminal device and the terminating SpoA;

(d) corresponds to the exit of *D_CallReport* at reference point C1 between the originating SpoA and the originating terminal device.

NOTE 1: The exact value of T_{max} is for further study.

NOTE 2: Call setup attempts that are cleared by the network portion as a result of incorrect performance or non-performance on the part of an entity outside the network portion are excluded.

NOTE 3: A call setup attempt can fail as a result of user blocking. Such failures are excluded from network performance measurement. Examples of user blocking include the following:

- the called user issues a message to reject the call setup attempt;
- the connect message reference event fails to occur at the originating MPT boundary due to the lack of a connect message reference event at the terminating MPT boundary;
- the called user delays excessively in generating the connect message reference event during the call period, with the result that a call is not established before the time-out;
- all channels at the called TE are in use.

Objective: The Call Setup Failure Probability as defined above for a TIPHON network shall not exceed 3×10^{-5}.

NOTE 4: This is a provisional value. The actual target value is for further study.

4.1.2 Call setup error probability

Call setup error probability is the ratio of total call setup attempts that result in call setup error to the total call setup attempts in a population of interest.

With reference to figure 1, a call setup error is defined to occur on any call setup attempt in which event (d) occurs, but event (c) does not occur at an appropriate boundary prior to expiration of timer T.

Call setup error is essentially the case of a network-caused "wrong number". It occurs when the network responds to a valid call request by erroneously establishing a call to a destination Terminal Equipment (TE) other than the one designated in the call request, and does not correct the error prior to the user information transfer. It may be caused, for example, by network operator administrative or maintenance actions.

Call setup error is distinguished from successful call setup by the fact that the intended called user is not contacted and not committed to the session during the call setup attempt.

4.1.3 Signalling route unavailability

Important remark: The signalling route unavailability parameter is only applicable to the SCN network portions of TIPHON systems. Hence it is not an End-to-end parameter.

The availability of a signalling route set is determined by the availability of the individual components of the signalling network and by the structure of the signalling network. (i.e. the arrangements for redundancy and alternative routing in the event of the unavailability of a component.)

ITU-T recommendation [6] Q.706, clause 1.1, recommends that the availability of a signalling route set should be not less than 0,99998. This corresponds to a downtime of not more than ten minutes per year.

4.1.4 Call Premature Release Probability

The Call Premature Release Probability (CPRP) for a network portion is the probability, in any given second, that a call experiences a premature disconnect generated within that portion.

A premature disconnect is defined as an occurrence of a *Disconnect request* or a R*elease* message [2] exiting the network portion at its originating or terminating network boundary,

- either in the absence of a previous corresponding *Modify* or *Release* message occurring at the other boundary of the network;
- or when a premature disconnect stimulus occurs within the network boundaries and is transferred across its originating or terminating boundaries.

The network portion boundaries are the same (B_i, B_j) as shown in figure 1. They also correspond to the reference point between FE5 and FE6 for the originating side of a TIPHON network and the reference point between FE8 and FE9 for the terminating side.

Objective: The Call Premature Disconnect Probability (CPDP) as defined in this clause should not exceed $1,5 \times 10^{-5}$.

NOTE: This is a provisional value. The actual target value is for further study.

4.1.5 Call Release Failure Probability

The Call Release Failure Probability (CRFP) is the ratio of total call clearing failures to the total call clearing attempts in a population of interest.

A call clearing failure is defined with reference to events at the originating and terminating boundaries of a network portion (B_i and B_j respectively as indicated in figure 1).

A call clearing attempt occurs when a *U_CallClear* message [2] enters the network portion at the originating reference point B_i. A call clearing failure occurs when no corresponding *D_CallClear* event [2] occurs at the terminating reference point B_j within $\mathbf{T_{ccf}}$ seconds.

Objective: For CCFP: for further study. In clause 2.5.1.2 of [3] a value of 2 out of 10^5 is specified.

NOTE: The value of T_{ccf} is for further study.

4.1.6 Percentage of unsuccessful call attempts

The percentage of unsuccessful call attempts is the ratio of the number of unsuccessful call attempts divided by the total number of call attempts in a population of interest. It is the sum of 2 elements as defined above:

- CSFP (Call Setup Failure Probability);
- CSEP (Call Setup Error Probability).

4.2 Call signalling delays

The call setup time depends on a number of elements:

- The number of times messages must traverse the signalling path between the calling party (or its local exchange, depending on the access technology used) and the called party or the called party's local exchange.
- The propagation time within the signalling path.
- The processing delay for signalling messages within each routing point within the signalling domain.
- The delay involved in accessing database information, for instance in number portability scenarios.

NOTE: Although mandatory objectives can be set by national regulators according to the ONP Telephony Directive 98/10/EC [8], no regulations specifying call setup times have been identified.

4.2.1 Call setup delay

The Call Setup Delay (CSD) is the time between the calling terminal providing sufficient address information to set up the call, and the calling party receiving a confirmation from the called terminal that the called party is being alerted.

Objective:

Draft Recommendation Y.1530 [3] defines the following objectives for the CSD:

Table 1: Call setup delay

Statistic	Objective
Mean	7 500 ms
95 % ile	8 450 ms
NOTE: Provisional values; the actual target values are for further study.	

4.2.2 Call Answer Signal Delay

The Call Answer Signal Delay (CASD) is the time between the called terminal indicating that it is ready to initiate the call and receipt of that indication by the calling terminal.

Table 2: Call Answer Signal Delay objectives

Statistic	Objective
Mean	FFS
95 % ile	FFS
NOTE: Provisional values; the actual target values are for further study.	

4.2.3 Call Release Delay

The Call Release Delay (CRD) is the time between the clearing terminal initiating a call cleardown, and its receipt of clearing confirmation by the called terminal.

NOTE: The resources should be made available for a new call within the same time period.

Table 3: Call Release Delay objectives

Statistic	Objective
Mean	3 500 ms
95 % ile	FFS
NOTE: Provisional values; the actual target values are for further study.	

Annex A (normative): Summary of objectives

Table 4: Summary of objectives

Parameter	Objective	Remark
Call Setup Failure Probability	$<3 \times 10^{-5}$	Provisional
Call Premature Disconnect Probability	$<1{,}5 \times 10^{-5}$	Provisional
Call Release Failure Probability	FFS	
Call setup delay	7 500 ms	Mean
	8 450 ms	95 % -ile
Call Release Delay	3 500 ms	Mean
	FFS	95 % -ile

Annex B (informative): Signalling reference connection

NOTE: The clause dealing with the reference model will be moved to a new specification dealing with a common reference model for Call Completion performance, Service Availability and IP domain budget allocation. In addition the delay figures appearing in this clause have to be revised and be based on specific call setup scenarios. Hence the conclusion below is based on inaccurate information. Therefore the complete clause 5 has been moved to this annex until solid information is available. This annex is for internal reference only.

B.1 General

The following configurations are analysed in this annex:

1) Basic intra-domain configuration where both the originating and terminating terminal FE are within the same domain;
2) Basic inter-domain configuration comprising three or four domains without roaming;
3) Configuration including gateway and SCN part;
4) Configuration supporting roaming.

In each case, any of the domains may be a TIPHON packet mode domain or an equivalent domain of a circuit-switched network. For the purpose of the present document, figures derived from ITU-T Recommendations for the ISDN will be used.

B.2 TIPHON call signalling elements

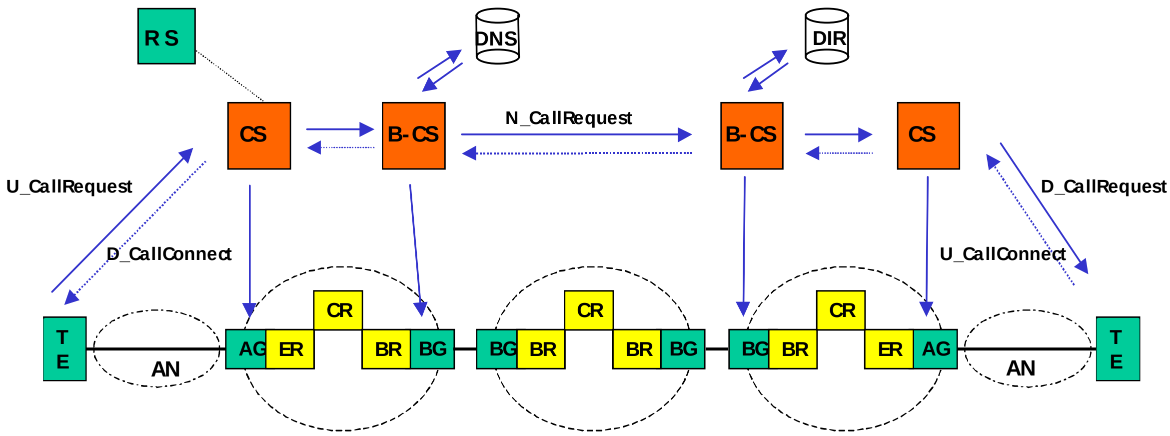
For the purpose of the present document, within a TIPHON call signalling connection the following elements are included.

Originating domain:

- The originating terminal;
- The access network;
- The call server providing the call control related to the originating terminal;
- The registration server related to the origination domain;
- A border call server serving the egress gateways;
- A DNS server for resolving the address of the called party;
- One access gateway;
- One edge router;
- One core router;
- One border router;
- One border gateway.

Transit or backbone domain

- One core router;
- Two border routers;
- Two border gateways;
- Two border call servers serving the border gateways.

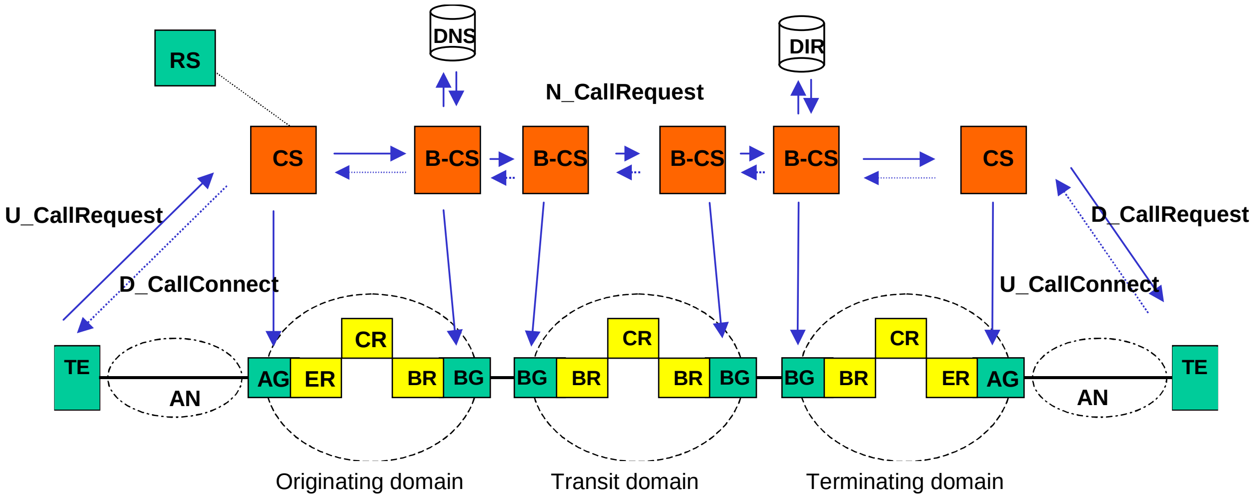


TE	Terminal	BR	Border Router
AN	Access Node	BG	Border Gateway
AG	Access Gateway	CS	Call Server
BG	Border Gateway	B-CS	Border Call Server
ER	Edge Router	RS	Registration Server
CR	Core Router	DIR	Directory

Terminating domain

- A border call server;
- A directory server for address look-up;
- A call server related to the terminating terminal;
- One border gateway;
- One border router;
- One core router;
- One edge router;
- One access gateway;
- The access network;
- The terminating terminal.

An inter-domain connection involving one of each of these domains is shown in figure 2.



TE	Terminal	BR	Border Router
AN	Access Node	BG	Border Gateway
AG	Access Gateway	CS	Call Server
BG	Border Gateway	B-CS	Border Call Server
ER	Edge Router	RS	Registration Server
CR	Core Router	DIR	Directory

Figure 2: Model of an interdomain signalling connection

B.3 Signal processing delays of TIPHON components

The elements of the various domains each will add delay to the process of call control message transfer between the originating and terminating terminals. Estimates for the appropriate figures are given in tables 5, 6 and 7.

NOTE 1: The figures for routers are taken from ITU-T Recommendation Y.1541 [4], appendix 3, table 1.

NOTE 2: The figures for Call Servers are taken from the Transit exchange cross-office transfer times described in ITU-T Recommendation Q.766 [5], table 1. Although this is a recommendation concerned with the ISDN rather than a TIPHON network, an ISDN Transit exchange performs the same functions, i.e. call routing and transport domain resource reservation.

The domain described in table 5 is roughly equivalent to a national component of the ISDN network for an average-size country, as described in table 8 of ITU-T Recommendation Q.709 [7].

Table 5: Processing delays in an originating domain of a TIPHON network

	Processing delay (ms) Simple messages		Processing delay (ms) Processor intensive messages	
	Mean	**95 %**	**Mean**	**95 %**
Originating domain				
The Originating Terminal	N/A (see note 1)	N/A (see note 1)	N/A (see note 1)	N/A (see note 1)
The Access Network	10	10	10	10
The Call Server providing the call control related to the originating terminal	110	220	180	360
The Registration server related to the origination domain	N/A (see note 2)	N/A (see note 2)	N/A (see note 2)	N/A (see note 2)
A Border Call Server serving the egress Gateways	110	220	180	360
A DNS Server for resolving the address of the called party	(see note 3)	(see note 3)	(see note 3)	(see note 3)
One Access Gateway	10	10	10	10
One Edge Router	3	3	3	3
One Core Router	2	2	2	2
One Border Router	3	3	3	3
One Border Gateway	3	3	3	3
Total	**251**	**571**	**491**	**851**

NOTE 1: Processing delays in the terminal are not within the control of the TIPHON network.
NOTE 2: Registration is usually performed when a terminal is first connected and/or the subscription is first activated, and so does not need to be counted within the signalling delays associated with call control.
NOTE 3: The DNS lookup is included within the delay of the associated Call Server.

The domain described in table 6 is roughly equivalent to the international component of the ISDN network between two average-size countries, as described in table 6 of ITU-T Recommendation Q.709 [7]. Q.709 indicates that in such a connection there would need to be a maximum of 4 signal relay points in an international connection between two average-size countries. This would be equivalent to having up to two transit domains within a TIPHON connection, each with two call servers in the signalling path.

Table 6: Processing delays in a transit domain of a TIPHON network

	Processing delay (ms) Simple messages		Processing delay (ms) Processor intensive messages	
	Mean	**95 %**	**Mean**	**95 %**
Transit or backbone domain				
One Core Router	2	2	2	2
Two Border Routers	6	6	6	6
Two Border Gateways	6	6	6	6
Two Border Call Servers	220	440	360	720
Total	**234**	**454**	**374**	**734**

The domain described in table 7 is roughly equivalent to a national component of the ISDN network for an average-size country, as described in table 8 of ITU-T Recommendation Q.709 [7].

Table 7: Processing delays in a terminating domain of a TIPHON network

	Processing delay (ms) Simple messages		Processing delay (ms) Processor intensive messages	
	Mean	**95 %**	**Mean**	**95 %**
Terminating domain				
A Border Call Server	110	220	180	360
A Directory Server for address look-up	(see note 1)	(see note 1)	(see note 1)	(see note 1)
A Call Server related to the Terminating Terminal	110	220	180	360
One Border Gateway	3	3	3	3
One Border Router	3	3	3	3
One Core Router	2	2	2	2
One Edge Router	3	3	3	3
One Access Gateway	10	10	10	10
The Access Network	10	10	10	10
The Terminating Terminal	N/A (see note 2)	N/A (see note 2)	N/A (see note 2)	N/A (see note 2)
Total	**251**	**571**	**491**	**851**
NOTE 1: The directory lookup is included within the delay of the associated Call Server. NOTE 2: Processing delays in the terminal are not within the control of the TIPHON network.				

B.4 Total Signalling processing delay for call setup

The following tables give the worst-case contribution to round-trip message delay by the signalling elements, where it is assumed that the longest signal transmission path for call setup is a single message exchange between the originating and destination terminals. Other signalling exchanges take place within the network in parallel to this exchange, but will normally be completed more quickly as they have fewer signalling points to pass through.

For a call setup, the outward message is a processing-intensive message (such as SETUP) and the return message is a simple message (such as CONNECT or ALERTING). This is generally the terminal-to-terminal message round trip that occurs when setting up a call. Other messages may be exchanged between network elements in order to reserve the physical connection through the network between the terminals.

NOTE: These figures are not applicable if a more complex message sequence is required for call setup, such as might occur if there is a need for a multiple exchange of messages to determine apportionment of transmission delay between the transport domains that comprise a connection.

B.4.1 Intra-domain TIPHON connection

An intra-domain connection will have the necessary elements of both the originating and terminating domain, as described in table 8.

Table 8: Round-trip signal processing delays in an intra-domain TIPHON connection

	Processing delay (ms) Simple messages		Processing delay (ms) Processor intensive messages	
	Mean	**95 %**	**Mean**	**95 %**
Originating portion				
The Originating Terminal	N/A (see note 1)	N/A (see note 1)	N/A (see note 1)	N/A (see note 1)
The Access Network	10	10	10	10
The Call Server providing the call control related to the originating terminal	110	220	180	360
The Registration server related to the origination domain	N/A (see note 2)	N/A (see note 2)	N/A (see note 2)	N/A (see note 2)
A Core Call Server serving the Domain	110	220	180	360
One Core Router	2	2	2	2
A DNS Server for resolving the address of the called party	(see note 3)	(see note 3)	(see note 3)	(see note 3)
One Access Gateway	10	10	10	10
Terminating portion				
A Call Server related to the Terminating Terminal	110	220	180	360
One Access Gateway	10	10	10	10
The Access Network	10	10	10	10
The Terminating Terminal	N/A (see note 1)	N/A (see note 1)	N/A (see note 1)	N/A (see note 1)
Total	**372**	**702**	**582**	**1122**
NOTE 1: Processing delays in the terminal are not within the control of the TIPHON network. NOTE 2: Registration is usually performed when a terminal is forst connected and/or the subscription is first activated, and so does not need to be counted within the signalling delays associated with call control. NOTE 3: The DNS lookup is included within the delay of the associated Call Server.				

For a call setup, the outward SETUP message is a processor intensive message, while the return message (ALERTING or CONNECT is a simple message. Therefore, the total processing delay of a round-trip message path for a call setup is as follows:

- Mean, 954 ms;
- 95 %, 1 824 ms.

B.4.2 Inter-domain TIPHON connections

The following inter-domain connections may occur.

1) Connection involving an originating domain and terminating domain only.

2) Connection involving an originating domain and terminating domain and one transit domain.

3) Connection involving an originating domain, terminating domain and two transit domains.

NOTE: The second case is equivalent to the worst-case international connection within the ISDN between two average-size countries, as described in ITU-T Recommendation Q.709 [7].

Table 9: Round-trip signal processing delays in interdomain TIPHON connections

Connection type	Round-trip processing delay (ms)	
	Mean	**95 %**
Originating and terminating domain	1 284	2 844
One transit domain	1 892	4 032
Two transit domains	2 500	5 220

In the case of a very long-distance connection, there would be a significant propagation delay in addition to the processing delays. For the longest possible connection not involving a satellite hop (approx 25 000 km), the one-way propagation delay is approximately 125 ms. The round-trip propagation delay is therefore 250 ms. In addition, it is possible that a long-distance connection may involve a satellite hop. In the case of a satellite hop, no more than one transit domain is likely to be involved. The one-way delay of a satellite hop is 320 ms giving a round-trip delay of 640 ms. The results for round trip processing delay for a number of sample connections are shown in the figures in table 10.

Table 10: Round-trip signal processing delays in inter-domain TIPHON connections including propagation delay

Connection type	Round-trip processing delay (ms)	
	Mean	**95 %**
One transit domain, terrestrial connection	2 142	4 282
Two transit domains, terrestrial connection	2 750	5 470
Originating and terminating domain, satellite connection	1 920	3 484
One transit domain, satellite connection	2 542	4 672

B.4.3 Inter-domain connections involving TIPHON and Switched Circuit networks

To calculate the signalling delay for inter-domain connections involving both TIPHON and switched circuit networks (usually the ISDN), it is necessary to know the signal processing delays within the ISDN. The figures in tables 11 and 12 describe the signalling delays respectively for a national component of an average-size country and international connection between two average-size countries.

Table 11: Maximum delay at the signalling nodes for each national component

Percent of connections	Delay (ms)	
	Message type	
	Processing simple	**Processing intensive**
50 % 95 %	260 300	400 440
NOTE: The maximum signalling nodes delay is the sum of all cross-office delays involved.		

Table 12: Maximum delay at the signalling nodes for international component

Percent of connections	Delay (ms)	
	Message type	
	Processing simple	**Processing intensive**
50 % 95 %	380 600	520 880
NOTE: The maximum signalling nodes delay is the sum of all cross-office delays involved.		

Based on these figures and the TIPHON figures described earlier, the delay figures for the following mixed inter-domain connections can be derived.

Table 13: Round-trip signal processing delays in inter-domain mixed connections including propagation delay

Connection type				Round-trip processing delay (ms)	
Originating domain	**Transit Domain**	**Terminating domain**	**Propagation**	**Mean**	**95 %**
TIPHON	None	ISDN	Short-distance	1 402	2 902
TIPHON	1 x TIPHON	ISDN	Long-distance	2 260	4 340
TIPHON	2 x TIPHON	ISDN	Long-distance	2 868	5 528
TIPHON	None	ISDN	Satellite	2 042	3 542
TIPHON	1 x TIPHON	ISDN	Satellite	2 650	4 730
TIPHON	ISDN	TIPHON	Short-distance	2 284	4 324
TIPHON	ISDN	TIPHON	Long-distance	2 534	4 574
TIPHON	ISDN	TIPHON	Satellite	2 924	4 964
TIPHON	ISDN	ISDN	Short-distance	2 202	5 382
TIPHON	ISDN	ISDN	Long-distance	2 452	5 632
TIPHON	ISDN	ISDN	Satellite	2 842	6 022

B.4.4 Inter-domain connections involving roaming

In a connection involving a destination terminal which is roaming outside its home network, the message exchange is more complex, as the call setup is normally first routed to the destination terminal's home network. The response indicates the correct network to contact, after which there is a simple message exchange to set up the call to the terminal in the visited network.

As the roaming case involves two out-and-back message exchanges, the worst-case call setup time for such a connection is double that of a non-roaming inter-domain connection as described in tables 10 and 13.

History

Document history		
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