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SERIES Y: GLOBAL INFORMATION
INFRASTRUCTURE, INTERNET PROTOCOL ASPECTS
AND NEXT-GENERATION NETWORKS

Internet Protocol aspects – Quality of service and network
performance

Call processing performance for voice service in hybrid IP networks

ITU-T Recommendation Y.1530

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ITU-T Recommendation Y.1530

Call processing performance for voice service in hybrid IP networks

Summary

ITU-T Recommendation Y.1530 defines performance parameters and objectives for point-to-point call processing for voice service provided by hybrid IP networks. The parameter definitions are based on the principles and generic performance parameters defined in ITU-T Recommendation I.350, and make use of relevant definitions from ISDN call processing performance Recommendations where appropriate.

Source

ITU-T Recommendation Y.1530 was approved on 13 November 2007 by ITU-T Study Group 12 (2005-2008) under the ITU-T Recommendation A.8 procedure.

FOREWORD

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ITU-T Recommendation Y.1530

Call processing performance for voice service in hybrid IP networks

1 Scope

This Recommendation defines performance parameters and objectives for point-to-point call processing in voice service provided by hybrid IP networks. Call processing delay parameters for ISDN are defined in [ITU-T I.352]. Call processing accuracy and dependability parameters for ISDN are defined in [ITU-T I.359]. The parameters defined in this Recommendation are general in that no particular hybrid IP network call processing protocol is assumed. The protocols used at different signalling interfaces traversed in processing a particular call may differ, and may include (for example) SIP, H.323 and BICC. Call processing protocol events defined in ISDN Recommendations are used for illustration in some cases. Call processing performance measurement architectures are presented in Appendix II.

The parameters defined in this Recommendation are applicable only when the network is available. Assessment of the availability of hybrid IP networks is not addressed in this Recommendation.

Table 1 illustrates the application of the three generic performance criteria defined in [ITU-T I.350] to the call processing functions defined for hybrid IP networks.

Table 1 – Performance parameters for call processing functions

Call processing function	Speed	Accuracy	Dependability
1) Connection set-up	Connection set-up delay Connection post-selection delay (Note 1) Connection answer signal delay (Note 1)	Connection set-up error probability	Connection set-up failure probability
2) Connection disengagement	Connection disconnect delay Connection release delay (Note 2)	Connection premature disconnect probability	Connection clearing failure probability
NOTE 1 – These parameters are defined for traffic engineering; objectives are not set for network performance. NOTE 2 – This parameter has local significance only; objectives are not set.			

2 References

The following ITU-T Recommendations and other references contain provisions which, through reference in this text, constitute provisions of this Recommendation. At the time of publication, the editions indicated were valid. All Recommendations and other references are subject to revision; users of this Recommendation are therefore encouraged to investigate the possibility of applying the most recent edition of the Recommendations and other references listed below. A list of the currently valid ITU-T Recommendations is regularly published. The reference to a document within this Recommendation does not give it, as a stand-alone document, the status of a Recommendation.

[ITU-T E.671] ITU-T Recommendation E.671 (2000), *Post-selection delay in PSTN/ISDN networks using Internet telephony for a portion of the connection*.

[ITU-T H.225.0] ITU-T Recommendation H.225.0 (2003), *Call signalling protocols and media stream packetization for packet-based multimedia communication systems*.

- [ITU-T H.245] ITU-T Recommendation H.245 (2003), *Control protocol for multimedia communication.*
- [ITU-T H.323] ITU-T Recommendation H.323 (2003), *Packet-based multimedia communications systems.*
- [ITU-T H.450.1] ITU-T Recommendation H.450.1 (1998), *Generic functional protocol for the support of supplementary services in H.323.*
- [ITU-T I.350] ITU-T Recommendation I.350 (1993), *General aspects of quality of service and network performance in digital networks, including ISDNs.*
- [ITU-T I.352] ITU-T Recommendation I.352 (1993), *Network performance objectives for connection processing delays in an ISDN.*
- [ITU-T I.359] ITU-T Recommendation I.359 (1999), *Accuracy and dependability of ISDN 64 kbit/s circuit-mode connection types.*
- [ITU-T Q.764] ITU-T Recommendation Q.764 (1999), *Signalling System No. 7 – ISDN User Part signalling procedures.*
- [ITU-T Q.931] ITU-T Recommendation Q.931 (1998), *ISDN user-network interface layer 3 specification for basic call control.*
- [ITU-T Y.1540] ITU-T Recommendation Y.1540 (2002), *Internet protocol data communication service – IP packet transfer and availability performance parameters.*

3 Definitions

This Recommendation defines the following terms:

3.1 end-to-end call processing performance: Network performance for call processing from UNI to UNI.

3.2 hybrid IP networks: Networks in which end-to-end services are provided through interworking between IP-based networks and networks employing other technologies, e.g., PSTN, ISDN, xDSL and CATV.

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

ACM	Address Complete Message
ANM	Answer Message
BICC	Bearer Independent Call Control
CASD	Connection Answer Signal Delay
CCFP	Connection Clearing Failure Probability
CDD	Connection Disconnect Delay
CPDP	Connection Premature Disconnect Probability
CPDS	Connection Premature Disconnect Stimulus
CPE	Customer Premises Equipment
CPSD	Connection Post Selection Delay
CRD	Connection Release Delay
CSD	Connection Set-up Delay

CSEP	Connection Set-up Error Probability
CSFP	Connection Set-up Failure Probability
DD	Deregistration Delay
FFS	For Further Study
HRX	Hypothetical Reference Connection
IAM	Initial Address Message
ISDN	Integrated Services Digital Network
IWF	InterWorking Function
MP	Measurement Point
MPT	Measurement Point Terminal
RD	Registration Delay
RE	Reference Event
REL	Release
SCN	Switched Circuit Network
SCTP	Stream Control Transmission Protocol
SIP	Session Initiation Protocol
TE	Terminal Equipment
UNI	User-Network Interface
VoIP	Voice over Internet Protocol

5 Reference model

Within the context of this Recommendation, a reference model is intended to establish the context for the definition of performance parameters and the specification of objectives. This reference model provides a baseline reference connection that includes measurement points at which performance-significant reference events are observed and values for call processing performance parameters are determined, and a specification of the traffic loading conditions under which objectives are to be met. This reference model consists of a reference configuration, a set of performance-significant reference events, and time intervals for establishing the conditions under which objectives are to be met.

5.1 Reference configuration

The general reference configuration used in describing the call processing performance of voice service provided by hybrid IP networks is illustrated in Figure 1.

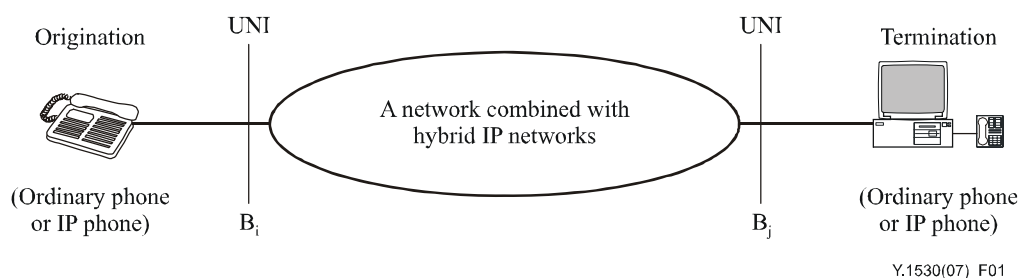


Figure 1 – General reference configuration

A reference configuration for ISDN/IP networking under TIPHON scenario 2 is described in Appendix I. A reference architecture for BICC is illustrated in Appendix III.

5.2 Reference events

The reference events in ISDN can be uniquely specified by [ITU-T I.352] and [ITU-T I.359] based on signalling protocols in [ITU-T Q.931] and [ITU-T Q.764], but the call processing reference events in IP networks depend on the method used for IP telephony, such as H.323, BICC and SIP.

Therefore, the general model of reference events in this Recommendation should be based on a model composed of pairs of portion boundaries (B_i , B_j) in Figure 1 and exit and entry events at (B_i , B_j) uniquely.

5.3 Performance objectives for delay parameters

End-to-end delay parameters are defined using reference events, therefore, performance objectives applied to this set of parameters reflect the quality of service provided by a provider's network.

The performance objectives for the set of delay parameters can be expressed in terms of:

- mean delay; and
- 95%-ile delay.

However, this approach does not take into account the impact of traffic load on call processing performance parameters (i.e., speed, dependability and accuracy). An alternative worst-case objective is addressed in clause 5.4. Assumptions regarding the call set-up attempt rate are stated in Annex A.

5.4 Alternate specification of objectives

In general, while the value taken by a particular call processing performance parameter is sensitive to the traffic load that exists on each portion of the network through which a call is being processed, the worst-case objectives specified in this Recommendation are meant to apply to any one hour of time.

NOTE – To allow for the impact of random, short-term traffic load fluctuations during any hour, the probability that a particular call processing performance parameter value, V , fails to meet its objective, O , may be specified. That is:

$$\text{Prob} \{V > O\} \leq X$$

where:

V = actual parameter value

O = objective

The exact conditions or assumptions under which these worst-case objectives may apply are for further study. Use of an hour or possibly 15-minute interval of time would facilitate support by existing operations systems. It is recognized that the objective would be developed taking into consideration peak traffic factors such as "busy hour".

6 Call processing delays

The model for determining call processing delays (see Figure 2) allows for single-portion and between-portion definitions using the reference events. Parameters involving round trip delays (e.g., connection establishment) are defined by portion boundaries (i.e., B_i and B_j below). Unidirectional delay parameters (e.g., connection disconnect delay) are defined only between two portion boundaries. This approach ensures that performance is attributable to specific portions.

For each parameter, performance-significant reference event (RE) tables are provided containing those REs used in the parameter's definition. These REs are listed by relevant boundary. The boundaries are described according to Figure 1.

NOTE – The model and parameter definition regarding call processing delays for SIP and stream control transmission protocol (SCTP) is FFS.

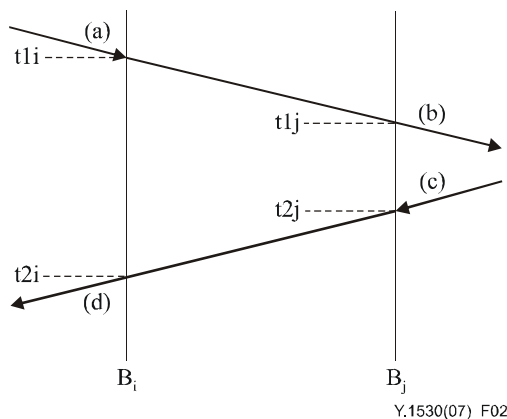


Figure 2 – Call processing delays

6.1 Call establishment delays

The boundaries (B_i and B_j) from Figure 3 for call establishment delays are measurement points. Figure 3 illustrates aspects of call establishment processing that are observable at measurement points. (a) illustrates set-up at origination and (b) illustrates set-up at termination. (c) illustrates alerting at termination and (d) illustrates alerting at origination. (e) illustrates connect at termination and (f) illustrates connect at origination.

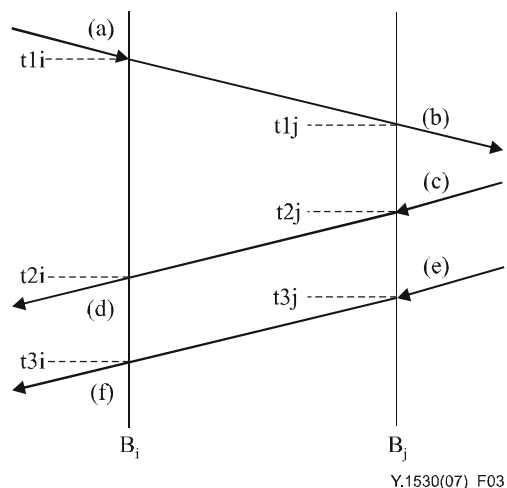


Figure 3 – Call establishment delays