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SERIES I: INTEGRATED SERVICES DIGITAL NETWORK

Overall network aspects and functions – Performance objectives

Accuracy and dependability of ISDN 64 kbit/s circuit mode connection types

ITU-T Recommendation I.359

(Previously CCITT Recommendation)

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ITU-T RECOMMENDATION I.359

ACCURACY AND DEPENDABILITY OF ISDN 64 kbit/s CIRCUIT MODE CONNECTION TYPES

Summary

This Recommendation defines parameters for assessing the accuracy and dependability performance of call processing in an Integrated Services Digital Network (ISDN) provided in accordance with Recommendations identified herein. The defined parameters apply to ISDN services using a single B-channel and associated D-channel; planned revisions to this Recommendation will address other ISDN bearer services (e.g. n × 64 kbit/s and primary rate connection types).

Source

ITU-T Recommendation I.359 was prepared by ITU-T Study Group 13 (1997-2000) and was approved under the WTSC Resolution No. 1 procedure on the 15th of February 1999.

FOREWORD

ITU (International Telecommunication Union) is the United Nations Specialized Agency in the field of telecommunications. The ITU Telecommunication Standardization Sector (ITU-T) is a permanent organ of the ITU. The ITU-T is responsible for studying technical, operating and tariff questions and issuing Recommendations on them with a view to standardizing telecommunications on a worldwide basis.

The World Telecommunication Standardization Conference (WTSC), which meets every four years, establishes the topics for study by the ITU-T Study Groups which, in their turn, produce Recommendations on these topics.

The approval of Recommendations by the Members of the ITU-T is covered by the procedure laid down in WTSC Resolution No. 1.

In some areas of information technology which fall within ITU-T's purview, the necessary standards are prepared on a collaborative basis with ISO and IEC.

NOTE

In this Recommendation the term *recognized operating agency (ROA)* includes any individual, company, corporation or governmental organization that operates a public correspondence service. The terms *Administration, ROA* and *public correspondence* are defined in the *Constitution of the ITU (Geneva, 1992)*.

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The ITU draws attention to the possibility that the practice or implementation of this Recommendation may involve the use of a claimed Intellectual Property Right. The ITU takes no position concerning the evidence, validity or applicability of claimed Intellectual Property Rights, whether asserted by ITU members or others outside of the Recommendation development process.

As of the date of approval of this Recommendation, the ITU had not received notice of intellectual property, protected by patents, which may be required to implement this Recommendation. However, implementors are cautioned that this may not represent the latest information and are therefore strongly urged to consult the TSB patent database.

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Recommendation I.359

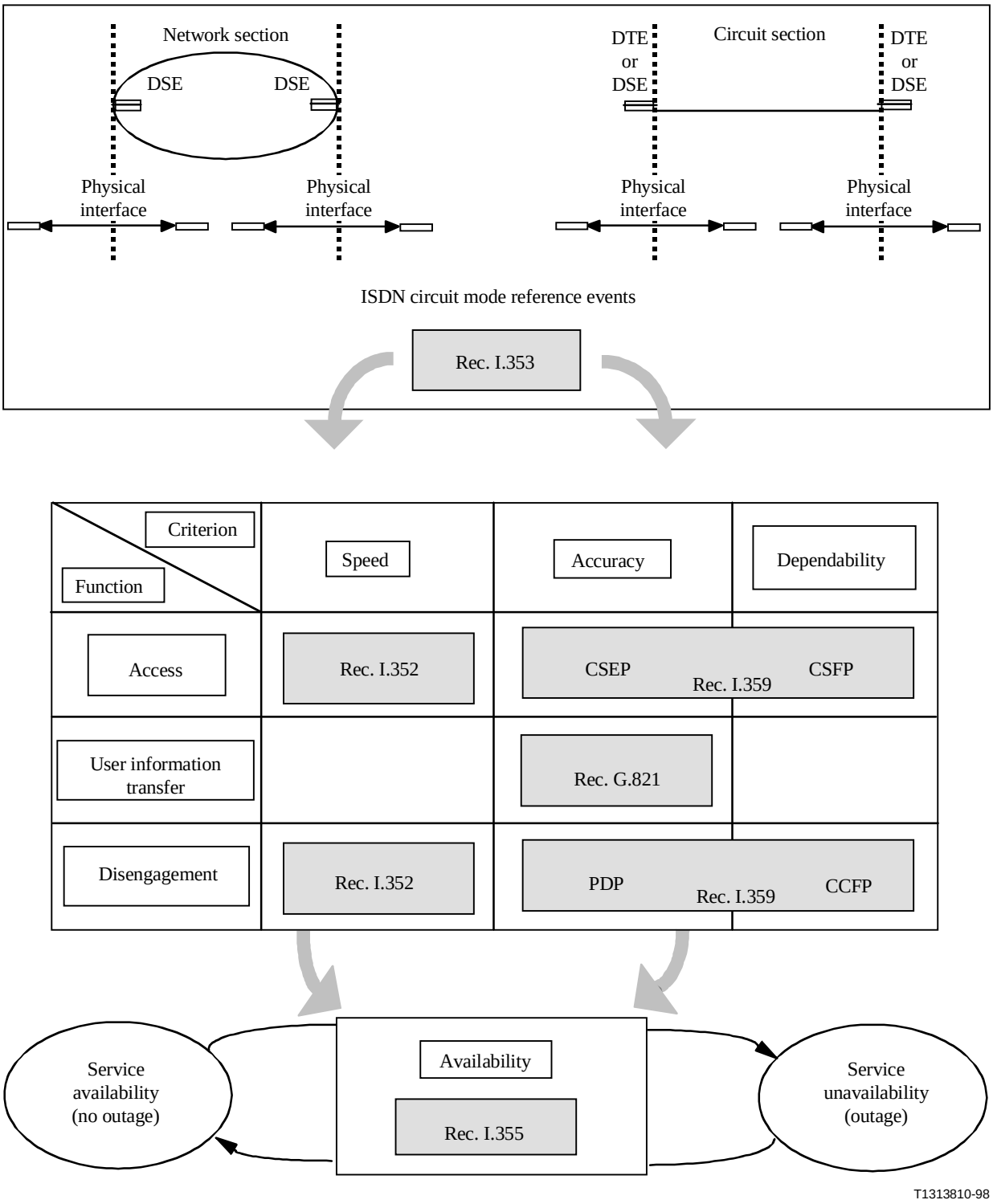
ACCURACY AND DEPENDABILITY OF ISDN 64 kbit/s CIRCUIT MODE CONNECTION TYPES

(Geneva, 1999)

1 Scope

This Recommendation defines parameters for assessing the accuracy and dependability performance of call processing in an Integrated Services Digital Network (ISDN) provided in accordance with Recommendations identified herein. The defined parameters apply to ISDN services using a single B-channel and associated D-channel; planned revisions to this Recommendation will address other ISDN bearer services (e.g. $n \times 64$ kbit/s and primary rate connection types).

The scope of this Recommendation and its relationship with other Recommendations is illustrated in Figure 1. Recommendation I.353 defines measurement points and reference events at which ISDN circuit mode connection processing performance parameters may be defined. Recommendation I.353 also defines a 3×3 matrix that can be used in organizing and classifying performance parameters. Three protocol-independent data communication functions are identified in the matrix: access, user information transfer, and disengagement. Each function is considered with respect to three general performance concerns (or "performance criteria"): speed, accuracy, and dependability. Recommendation I.359 defines a set of primary parameters that describe accuracy and dependability performance relative to the access and disengagement functions. Specified values for these parameters may be compared with corresponding outage thresholds in determining 64 kbit/s availability performance. The availability function and availability parameters are defined in Recommendation I.355. Additional 64 kbit/s performance parameters applicable to ISDNs are defined in Recommendations I.352 and G.821.



CSEP Connection Set-up Error Probability
CSFP Connection Set-up Failure Probability
PDP Premature Disconnect Probability
CCFP Connection Clearing Failure Probability

Figure 1/I.359 – Scope of Recommendation I.359

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; all 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.

[1] ITU-T Recommendation I.352 (1993), *Network performance objectives for connection processing delays in an ISDN*.

[2] ITU-T Recommendation I.353 (1996), *Reference events for defining ISDN and B-ISDN performance parameters*.

[3] ITU-T Recommendation I.355 (1995), *ISDN 64 kbit/s connection type availability performance*

[4] ITU-T Recommendation Q.921 (1997), *ISDN user-network interface – Data link layer specification*.

[5] ITU-T Recommendation Q.931 (I.451) (1998), *ISDN user-network interface layer 3 specification for basic call control*.

[6] ITU-T Recommendation Q.764 (1997), *Signalling System No. 7 – ISDN User Part signalling procedures*.

3 Abbreviations

This Recommendation uses the following abbreviations:

ANS	Answer
CCFP	Connection Clearing Failure Probability
CSEP	Connection Set-up Error Probability
CSFP	Connection Set-up Failure Probability
DSE	Data Service Equipment
DTE	Data Terminal Equipment
IAM	Initial Address Message
ISDN	Integrated Services Digital Network
ITU-T	International Telecommunications Union – Telecommunication Standardization Sector
MPI	Measurement Point International
MPT	Measurement Point Terminal
PDP	Premature Disconnect Probability
PDS	Premature Disconnect Stimulus
RE	Reference Event
SS7	Signalling System 7
TE	Terminal Equipment

4 Accuracy and dependability parameters and objectives

This clause defines accuracy and dependability parameters for unrestricted digital connection types provided using ISDN circuit mode bearer services. These accuracy and dependability parameters can be measured or estimated at any pair of boundaries delimiting a portion or concatenation of portions.

4.1 Access parameters

Two circuit mode access parameters, connection set-up error probability and connection set-up failure probability, are defined in 4.1.1 and 4.1.2.

Connection set-up error and connection set-up failure are defined between pairs of portion boundaries (B_i, B_j). B_j is one of the set of boundaries to which the connection set-up attempt can properly be routed. Figure 2 identifies the sequence of four particular events that occur at these boundaries during a successful connection set-up. A connection set-up attempt over this portion is a sequential occurrence of corresponding events [a), b), c), d)] prior to expiration of timer T301 [5]. Connection set-up errors and connection set-up failures within this portion are defined below. Any other unsuccessful connection set-up attempt is caused by problems outside the portion and is excluded from the measurement.

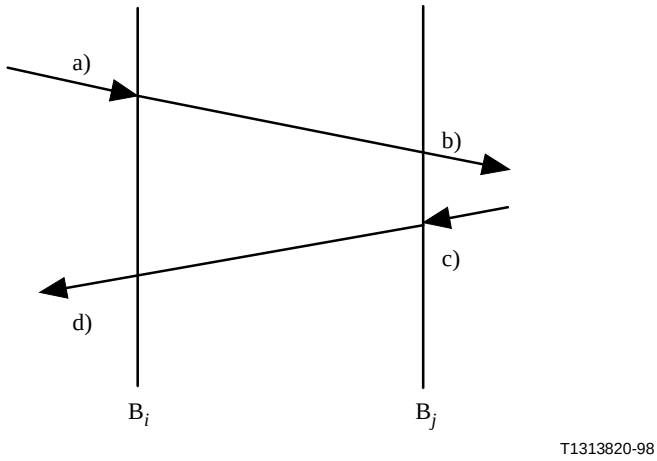


Figure 2/I.359 – Circuit mode reference events occurring during successful connection set-up

4.1.1 Connection set-up error probability (CSEP)

Connection set-up error probability is the ratio of total connection set-up attempts that result in connection set-up error to the total connection set-up attempts in a population of interest.

With reference to Figure 2, a connection set-up error is defined to occur on any connection set-up attempt in which event d) occurs, but event c) does not occur at an appropriate boundary prior to expiration of timer T301.

Connection set-up error is essentially the case of a network-caused "wrong number". It occurs when the network responds to a valid connection request by erroneously establishing a connection to a destination Terminal Equipment (TE) other than the one designated in the connection 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.

Connection set-up error is distinguished from successful connection set-up by the fact that the intended called user is not contacted and not committed to the session during the connection set-up attempt.

The specific Recommendation I.353 Reference Events (REs) used in measuring successful connection set-up at each portion boundary are those identified in Table 1 and Table 2.

Table 1/I.359 – REs at B_i occurring during successful ISDN circuit mode connect set-up

Boundary B_i	Reference event	
	a)	d)
MPT_1	P1a (SETUP exit)	P6b (CONNECT entry)
MPI_1	S1a (IAM exit)	S3b (ANS entry)
MPI_2	S1b (IAM entry)	S3a (ANS exit)
MPT_2	Not applicable	Not applicable
NOTE – *En bloc* and overlap sending options are defined at the MPT_1 interface.		

Table 2/I.359 – REs at B_j occurring during successful ISDN circuit mode connect set-up

Boundary B_j	Reference event	
	b)	c)
MPT_1	Not applicable	Not applicable
MPI_1	S1a (IAM exit)	S3b (ANS entry)
MPI_2	S1b (IAM entry)	S3a (ANS exit)
MPT_2	P1b (SETUP entry)	P6a (CONNECT exit)
NOTE – *En bloc* and overlap sending options are defined at the MPT_1 interface.		

4.1.2 Connection set-up failure probability (CSFP)

Connection set-up failure probability is the ratio of total connection set-up attempts that result in connection set-up failure to the total connection set-up attempts in a population of interest.

With reference to Figure 2, connection set-up failure is defined to occur on any connection set-up attempt in which either one of the following outcomes is observed prior to expiration of timer T301.

– both events b) and d) do not occur;

– events b) and c) occur, but event d) does not.

The specific reference events are those defined in Tables 1 and 2. Connection set-up attempts that are cleared by the portion as a result of incorrect performance or non-performance on the part of an entity outside the portion are excluded.

A connection set-up 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 set-up attempt;

– the CONNect message (P6b) reference event fails to occur at the originating MPT boundary due to the lack of a CONNect message (P6a) reference event at the terminating MPT boundary;

– the called user delays excessively in generating the CONNect message (P6a) reference event during the connection period, with the result that a connection is not established before the time-out;

– all channels at the called TE are in use.

4.2 Disengagement parameters

This subclause defines two new disengagement parameters: premature disconnect probability and connection clearing failure probability. The definition of a third parameter, premature disconnect stimulus probability, is for further study.

4.2.1 Premature disconnect parameters

4.2.1.1 Premature disconnect probability (PDP)

The premature disconnect probability for a portion is the probability, in any given second, that a connection experiences a premature disconnect generated within that portion.

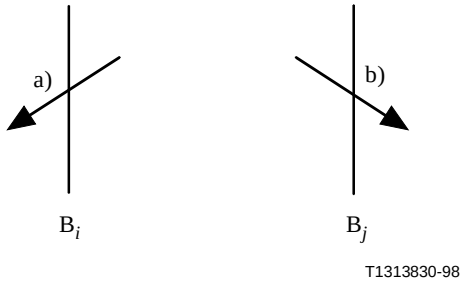


Figure 3/I.359 – Circuit mode Reference Events (REs) defining premature disconnect at B_i and B_j

Referring to Figure 3, a premature disconnect is defined to have been generated within a portion when, in the absence of an external disconnect event (e.g. a premature disconnect stimulus or a disconnect request), any of the Recommendation I.353 reference events a) or b) specified in Table 3 a) or Table 3 b) occur, or when a premature disconnect stimulus occurs within the portion and is transferred across a boundary of the portion.

Table 3 a)/I.359 – Category a) REs at B_i defining ISDN circuit mode premature disconnect probability

Boundary B_i	Reference event
MPT	P8b DISCONNECT entry
MPI_1	S4b RELEASE entry S6b CIRCUIT RESET entry S7b RESET entry
MPI_2	S4a RELEASE exit S6a CIRCUIT RESET exit S7a RESET exit

Table 3 b/I.359 – Category b) REs at B_j defining ISDN circuit mode premature disconnect probability

Boundary B_j	Reference event
MPT	P8b DISCONNECT entry
MPI_1	S4a RELEASE exit S6a CIRCUIT RESET exit S7a RESET exit
MPI_2	S4b RELEASE entry S6b CIRCUIT RESET entry S7b RESET entry

NOTE – The reference events in Tables 3 a) and 3 b) are for further study (including, for example, Q.931 group disconnect).

4.2.1.2 Premature disconnect stimulus (PDS)

The complete definition of premature disconnect stimulus is for further study. However, ten consecutive severely errored seconds is an instance of a premature disconnect stimulus.

4.2.2 Connection clearing failure probability (CCFP)

Connection clearing failure probability is the ratio of total connection clearing failures to the total connection clearing attempts in a population of interest.

Connection clearing failure is defined with reference to events at the boundaries of a portion (B_i, B_j). A connection clearing attempt occurs when a DISConnect or RELease message enters the portion creating a reference event at B_i. A connection clearing failure occurs when no corresponding connection clearing reference event occurs at B_j within T_{ccf} seconds. The relevant reference events used in measuring connection clearing failure probability at each portion boundary are those identified in Table 4 and Table 5.

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

Table 4/I.359 – REs at B_i used in defining ISDN circuit mode connection clearing failure probability

Boundary B_i	Reference event
MPT_1	P8a (DISCONNECT exit)
MPI_1	S4a (RELEASE exit)
MPI_2	S4b (RELEASE entry)
MPT_2	Not applicable

Table 5/I.359 – REs at B_j whose non-occurrence is used in defining ISDN circuit mode set-up connection clearing failure probability

Boundary B_j	Reference event
MPT_1	Not applicable
MPI_1	S4a (RELEASE exit)
MPI_2	S4b (RELEASE entry)
MPT_2	P8b (DISCONNECT entry)

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