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SERIES I: INTEGRATED SERVICES DIGITAL
NETWORK

Overall network aspects and functions – Performance
objectives

ISDN 64 kbit/s connection type availability performance

ITU-T Recommendation I.355

(Previously CCITT Recommendation)



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ITU-T RECOMMENDATION I.355

ISDN 64 kbit/s CONNECTION TYPE AVAILABILITY PERFORMANCE

Summary

The purpose of this Recommendation is to define parameters and objectives describing availability performance of the following 64 kbit/s ISDN connection types:

- Packet-Switched Connection Type (PSCT);
- Circuit-Switched Connection Type (CSCT);
- Dedicated-Circuit Connection Type (DCCT).

Connection types are categorized according to their characteristics into different portion types, with Measurement Points (MPs) delimiting each portion. Parameters defined are Connection Portion Availability (A) and Mean Time Between Connection Portion Outages (M_0). Availability performance is described by specifying worst-case objectives for these parameters for each portion type. These objectives are intended to assist in network design and planning by limiting the aggregate effect of network impairments, including blocking, equipment failures and transmission errors, on ISDN network availability.

In order to define the availability function for the different connection types, the approach taken is to specify a set of performance decision items and associated outage criteria. A two-state availability model is used whereby the availability state of a portion over a specific measurement interval is determined by comparing observed performance with the particular outage criteria. Guidance is provided on practical measurement of the parameters, including statistical techniques for sampling. Examples are also included illustrating how representative end-to-end availability performance can be calculated using the observed performance of the individual portions.

Source

ITU-T Recommendation I.355 was revised by ITU-T Study Group 13 (1997-2000) and was approved by the WTSA (Montreal, September 27-October 6, 2000).

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 Assembly (WTSA), 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 WTSA Resolution 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 expression "Administration" is used for conciseness to indicate both a telecommunication administration and a recognized operating agency.

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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.355**ISDN 64 kbit/s CONNECTION TYPE AVAILABILITY PERFORMANCE****1 Introduction****1.1 Purpose**

The purpose of this Recommendation is to define network performance parameters describing the availability of 64 kbit/s ISDN connection types and to establish values and allocations for these values. This Recommendation also provides guidance on the measurement of these parameters.

The worst-case objectives specified in this Recommendation are intended to assist providers in network design and planning by limiting the aggregate effect of network impairments, including blocking, equipment failures, and transmission errors, on ISDN network availability.

The objectives given in this Recommendation for connection type availability do not directly correspond to the level of Quality of Service to be expected by customers.

1.2 Scope

This Recommendation defines availability parameters and specifies worst-case availability objectives for national and international portions of three 64 kbit/s ISDN connection types (see Table 1): packet-switched connection type (PSCT), circuit-switched connection type (CSCT), and dedicated-circuit connection type (DCCT).¹ This Recommendation also provides methods for estimating the defined availability parameters.

Table 1/I.355 – I.355 Connection types

I.355 Connection type	Information transfer mode	Information transfer rate (layer 1)	Establishment of connection
PSCT (Note 1)	Packet	64 kbit/s	Switched
CSCT (Note 2)	Circuit	64 kbit/s	Switched
DCCT (Note 3)	Circuit	64 kbit/s	Semi-permanent, permanent
NOTE 1 – Packet-switched connection type (PSCT) includes ISDN connection types B1 in Table 2/I.340 for access via B-channel (Case B) (Figure 2-2/X.31).			
NOTE 2 – Circuit-switched connection type (CSCT) includes ISDN connection type A1 in Table 2/I.340.			
NOTE 3 – Dedicated-circuit connection type (DCCT) includes ISDN connection types A2 and A3 in Table 2/I.340.			

1.3 Abbreviations

This Recommendation uses the following abbreviations:

- A() Connection portion availability
- CEP Call set-up Error Probability
- CFP Call set-up Failure Probability

¹ Availability performance of other ISDN connection types is for further study.

CSCT	Circuit-Switched Connection Type
DCCT	Dedicated-Circuit Connection Type
ISC	International Switching Centre
ISDN	Integrated Services Digital Network
$M_O()$	Mean time between connection portion outages
MP	Measurement Point
MPI	Measurement Point I
MPT	Measurement Point T
PD	Premature Disconnect
PDP	Premature Disconnect Probability
PDSP	Premature Disconnect Stimulus Probability
PSCT	Packet-Switched Connection Type
RE	Reference Event
RER	Residual Error Ratio
RP	Reset Probability
RSP	Reset Stimulus Probability
SES	Severely Errored Second
SPRT	Sequential Probability Ratio Test
TC	Throughput Capacity

1.4 Related Recommendations

In characterizing availability performance, this Recommendation applies concepts and definitions provided in related ISDN performance Recommendations. These include Recommendations I.350 and X.140 (General framework), Recommendation I.353 (Relevant measurement points) and Recommendations I.354, I.352 and G.821 (Primary performance parameters).

ISDN performance is considered in the context of the 3×3 matrix defined in Recommendations I.350 and X.140. Three protocol-independent communication functions are identified in the matrix: access, user information transfer, and disengagement. These general functions correspond to connection set-up, data transfer, and clearing of 64 kbit/s connections conforming to recommended ISDN protocols. Each function is considered with respect to three general performance concerns (or "performance criteria"): speed, accuracy, and dependability. These express, the delay or rate, degree of correctness, and degree of certainty with which the function is performed, respectively.

Recommendation I.353 defines the following:

- physical measurement points (MPs) at which ITU-T recommended ISDN protocols may be observed;
- particular MPs (designated MPT and MPI) that delimit portions of an end-to-end ISDN connection for which performance objectives may be specified;
- a set of performance-significant reference events (REs), each of which corresponds to the transfer of a discrete unit of control or user information across an MP in accordance with an ITU-T recommended protocol;
- rules for identifying the time of occurrence of any RE at any MP.

Recommendation I.354 defines protocol-specific speed, accuracy, and dependability performance parameters for packet-switched ISDN connections. Recommendation I.352 defines protocol-specific speed, accuracy, and dependability performance parameters for circuit-switched ISDN connection set-up and clearing. Recommendation G.821 defines error (accuracy) performance parameters for user information transfer in circuit-switched and dedicated-circuit ISDN connections. The ISDN performance parameters defined in these three Recommendations are used in distinguishing available and unavailable periods. They are called "primary parameters" to emphasize their direct derivation from ISDN performance-significant reference events.

1.5 Methodology of availability specification

A two-state model establishes the basis for describing the overall availability of 64 kbit/s ISDN connection portions. Specified availability functions compare the values for subsets of the primary parameters with corresponding outage thresholds to classify the connection portion as "available" (no portion outage) or "unavailable" (portion outage) during planned available time. This Recommendation specifies the availability functions and defines the availability parameters and objectives that characterize the resulting binary random process.

The term "portion availability" refers to the ability of a user at one MP to establish and maintain a useful connection to (or through) another specific MP. This ability is evaluated by the specified availability functions. If a connection cannot be established despite repeated trials, or if the quality of the connection is unacceptable (as determined by the outage thresholds), the connection portion is said to be unavailable between those two MPs. (Note that the connection portion may be unavailable between MP_x and MP_y and at the same time the connection portion may be available between MP_x and MP_z). The connection portion delimited by a pair of MPs may also be unavailable if connections established between the specified MPs are repeatedly disconnected. A single premature disconnect of a switched connection is insufficient to declare the portion unavailable – in other words the user should reestablish the connection. However, if several successive connections between two MPs are disconnected during a short time interval, then the portion is declared unavailable between these MPs.²

Two generic availability parameters are defined in this Recommendation:

- *connection portion availability (A); and*
- *mean time between connection portion outages (M_O).*

Each parameter can be assessed between any pair of MPs associated with an end-to-end ISDN 64 kbit/s connection. This generality makes the parameters useful in performance allocation and concatenation.

NOTE – The performance parameter mean time between connection portion outages describes time-related aspects of availability performance. This parameter is analogous to the parameter MTBSO in Recommendation X.137.

This Recommendation specifies availability objectives up to four portion types (see Table 2). Performance values for ISDN terminal equipment are not specified, but the parameters defined in this Recommendation may be employed in such specification to assist users in establishing quantitative relationships between network performance and Quality of Service (see Recommendation I.350).

² Often, a connection can be established between two specific MPs over more than one physical path. The availability measures defined in this Recommendation apply to the set of network facilities that can be used to interconnect a specific pair of MPs, rather than the path used to interconnect the MPs in a particular instance.