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ETSI

European Telecommunications Standards Institute

ETSI Secretariat

Postal address: F-06921 Sophia Antipolis CEDEX - FRANCE
Office address: 650 Route des Lucioles - Sophia Antipolis - Valbonne - FRANCE
X.400: c=fr, a=atlas, p=etsi, s=secretariat - **Internet:** secretariat@etsi.fr

Tel.: +33 92 94 42 00 - Fax: +33 93 65 47 16

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Foreword

This Interim European Telecommunication Standard (I-ETS) has been produced by the Network Aspects (NA) Technical Committee of the European Telecommunications Standards Institute (ETSI).

An ETSI standard may be given I-ETS status either because it is regarded as a provisional solution ahead of a more advanced standard, or because it is immature and requires a "trial period". The life of an I-ETS is limited to three years after which it can be converted into an ETS, have it's life extended for a further two years, be replaced by a new version, or be withdrawn.

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Introduction

From an availability and retainability point of view, a portion of a Broadband Integrated Services Digital Network (B-ISDN) semi-permanent connection should have the following properties:

- **unavailability**

  The unavailability of a B-ISDN semi-permanent connection portion is the fraction of time during which it cannot accommodate a transaction (i.e. it is in a down state). This down state is to be characterized by a set of decision parameters, specific to the information transfer phase, and their associated outage criteria.

  The fraction of time during which it is in a down state should be as low as possible;

- **retainability**

  The retainability performance of B-ISDN semi-permanent connection portions is defined in this I-ETS as the probability that a transaction using a B-ISDN semi-permanent connection portion once obtained (i.e. is available), will neither be interrupted nor prematurely released (i.e. does not become unavailable) for a given duration. In this I-ETS the retainability performance is specified in terms of outage intensity.

  Once a transaction is started on a B-ISDN semi-permanent connection, it should have a low probability of being either interrupted (because of insufficient data transfer performance) or prematurely released (due to the failure of some network component) before the requested end of the transaction.

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1 Scope

This Interim European Telecommunication Standard (I-ETS) specifies availability and retainability parameters for Broadband Integrated Services Digital Network (B-ISDN) semi-permanent connections (VPCs and VCCs)

An international B-ISDN semi-permanent connection is partitioned into two national portions and an international portion. The international portion is further partitioned into connection portions delimited by International Measurement Points (MPIs) as defined in prI-ETS 300 464 [1].

A futur version of this I-ETS will specify objectives for the availability and retainability performance of each of these portions, and measurement methods will be defined.

2 Normative references

This I-ETS incorporates by dated and undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this I-ETS only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

[1] I-ETS 300 464: "Asynchronous Transfer Mode (ATM); Broadband Integrated Services Digital Network (B-ISDN); ATM layer cell transfer performance for B-ISDN connection types".

[2] ITU-T Recommendation I.610 (1994): "B-ISDN operation and maintenance principles and functions".

[3] ITU-T Recommendation E.800 (1994):."Terms and definitions related to quality of service and network performance including dependability".

3 Symbols and abbreviations

For the purposes of this I-ETS, the following abbreviations apply:

AIS	Alarm Indication Signal
ATM	Asynchronous Transfer Mode
FS	Frontier Station
ISC	International Switching Center
MPI	International Measurement Point
MTBO	Mean Time Between Outages
MTTR	Mean Time To Restore
OAM	Operation Administration and Maintenance
SECB	Severely Errored Cell Block
SES_{ATM}	Severely Errored Second

4 Definition of parameters

The decision parameters which characterize the down state of a B-ISDN semi-permanent connection portion are based on a subset of the performance parameters defined in prI-ETS 300 464 [1].

NOTE: It is likely that CLR and SECBR will be the parameters that form this subset.

The observation process of these decision parameters will include the specification of time during which they are estimated. It is necessary to base the outage criteria for the unavailable state on successive observations of decision parameters.

In order to classify available and unavailable states, entry/exit criteria are defined.

4.1 Definition of entry/exit criterion for the unavailable state

The entry/exit criterion for the unavailable state of a B-ISDN connection is defined on the basis of the Severely Errored Second (SES_{ATM}) outcome.

4.1.1 Definition of SES_{ATM}

An SES_{ATM} outcome occurs when either:

- an interruption has occurred that prevents cells from being transferred during the one second period of time (see notes 1 and 2); or

- cell transfer performance parameters computed over the one second period of time exceed given threshold values (see note 3).

NOTE 1: An interruption corresponds to a failure either of the physical layer or of the Asynchronous Transfer Mode (ATM) layer (see ITU-T Recommendation I.610).

NOTE 2: Interruptions due to user should not to be considered.

NOTE 3: Cell transfer performance parameters to be considered are defined in prI-ETS 300 464 [1]. The subset of these parameters to be used for defining SES_{ATM} outcome is to be defined in this I-ETS. Annex A gives an example of an observation method for SES_{ATM}.

4.1.2 Definition of the unavailable state

A period of unavailable time for one direction of a portion of a B-ISDN connection begins when the SES_{ATM} continues for a period of ten consecutive seconds. These ten seconds are considered to be unavailable time. A new period of available time for one direction of a portion of a B-ISDN connection begins with the first second of a period of ten consecutive seconds, none of which are SES_{ATM}. These ten seconds are considered to be available time.

A portion of a bi-directional[1)] B-ISDN connection is available if both directions are available.

4.2 Specified parameters

Two dependability performance parameters (asymptotic unavailability and outage intensity) are defined in this subclause.

4.2.1 Asymptotic unavailability

The asymptotic unavailability for a B-ISDN semi-permanent connection portion is the limit, when t tends to infinity, of the probability that this portion is in the unavailable state at time t.

In practice, the asymptotic unavailability for a B-ISDN semi-permanent connection portion is estimated by measuring the ratio of the total accumulated unavailable time for that portion during an observation period to the duration of that observation period. The observation period is under study.

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1) According to ITU-T Recommendation I.150 an ATM connection may be unidirectional or bi-directional.

4.2.2 Outage intensity

The outage intensity $\lambda(t)$ for a B-ISDN semi-permanent connection portion is defined as the limit of the ratio of the mean number of outages in a time interval [t, t + Δt] to the length of this interval Δt, when Δt tends to 0. Namely, if $N_0(t)$ is the number of outages in the time interval [0,t] and E(X) denotes the mean value of X:

$$\lambda(t) = \lim_{\Delta t \to 0^+} \frac{E\left[N_0(t+\Delta t) - N_0(t)\right]}{\Delta t}$$

In practice, the outage intensity for a B-ISDN semi-permanent connection portion is estimated by measuring the number of unavailable periods for this portion during the observation period divided by the duration of the observation period. The observation period is under study.

NOTE: Relationships between these parameters and other dependability parameters are defined in ITU-T Recommendation E.800, some example of relationships derived from ITU-T Recommendation E.800 are presented in annex B.

5 Performance objectives

Performance objectives will be defined in a later version of this I-ETS.

The values which will be given in this clause will be long term values. Achieving and testing the compliance with these objectives is under the responsibility of each network operator. Guidance for testing the compliance with these objectives is given in annex C.

Annex A (informative): Example of observation method for SES_{ATM}

Only one direction of a connection portion is considered in this annex.

In this example it is assumed that cell transfer performance parameter compliance testing is monitored by Operation Administration and Maintenance (OAM) cell stream.

The SES_{ATM} outcome is based on the occurrence of Severely Errored Cell Block (SECB) outcomes (other parameters could also be considered).

A SES_{ATM} outcome occurs either:

- if the observed proportion of SECBs during this second is higher than X% (see note 1); or

- if at least one Operation Administration and Maintenance - Alarm Indication Signal (OAM-AIS) cell is observed during this second; or

- if no cell has been observed during this second and a continuity check cell was expected (see note 2). (A continuity check cell is sent when no user cell has been sent for a period of t.[2)] In instances where t is less or equal to one second, continuity check cells can be used for determining SES_{ATM} outcomes. Instances where t is greater than one second require further study).

  NOTE 1: The value of X is for further study.

  NOTE 2: Continuity check cells could be affected by CDV and this should be taken into account.

In order to observe in-service SES_{ATM} outcomes due to degraded performance, the performance offered to the ATM semi-permanent connection portion should be monitored by a performance monitoring OAM flow. When it is the case, successive performance monitoring OAM cells are numbered. If an out of sequence performance monitoring OAM cell is detected, blocks are assumed to be missing, and severely errored. Therefore, it is possible to evaluate the proportion of SECB outcomes during a second.

Since the generation frequency of OAM-AIS cells is nominally one cell per second (see ITU-T Recommendation I.610), the reception of one single OAM-AIS cell triggers a SES_{ATM} outcome.

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2) The bounds for t are fixed in ITU-T Recommendation I.610 .

Annex B (informative): Related B-ISDN semi-permanent connection dependability parameters

In addition to asymptotic unavailability **U** and outage intensity λ, other parameters may be used in describing dependability performance. These parameters are defined as follows:

- the Mean Time Between Outages (MTBO) for a B-ISDN semi-permanent connection portion (the average duration of continuous intervals during which the portion is available);

- the asymptotic availability **A** for a B-ISDN semi-permanent connection portion (the (long term) probability that this portion is in the available state);

- the Mean Time To Restore (MTTR) for a B-ISDN semi-permanent connection portion (the average duration of continuous intervals during which the portion is unavailable).

The retainability **R** over a given interval [0, t] is the probability that a transaction using a B-ISDN semi-permanent connection portion which was available at time 0 will not become unavailable before time t.

If it is assumed that $\lambda(t)$ is constant, i.e. $\lambda(t) = \lambda$, and that the distribution of the restoration time is exponential, the following relationships apply:

$$\mathbf{U} = \frac{\mathrm{MTTR}}{\mathrm{MTTR} + \mathrm{MTBO}}$$

$$\mathbf{A} = \frac{\mathrm{MTBO}}{\mathrm{MTTR} + \mathrm{MTBO}}$$

$$\mathbf{R} = \exp(- \lambda t)$$

NOTE: This is true under regenerative assumptions.

Irrespective of these assumptions the following relationship applies:

$$\mathbf{A} = 1 - \mathbf{U}$$

Annex C (informative): Guidance for compliance testing for availability and retainability performance

The availability and outage intensity of a given connection portion has a long term value which can only be measured over a very long period of time (theoretically over infinity). In practice the evaluation of availability and retainability of a connection portion will take place in a relatively short observation period such as one year. Therefore, the value observed over this period will only be an estimate (in the statistical sense) of the true, but unknown, long term value.

For compliance testing, the estimate is compared with limits. The limits derived from the objective values will be stated in future issue of this I-ETS, by means of the statistical tools given in the reference below. This derivation assumes an a priori agreement on the probability of taking a false decision at the end of the test, due to sampling.

To determine the duration of the observation period and the values of the limits (i.e. the maximum accumulated unavailable time, and the maximum number of outages allowed during the observation period of time), the following documents should be used:

- IEC Publication 1170; and

- IEC Publication 1124.

Annex D (informative): Bibliography

- ITU-T Recommendation I.350 (1993): "General aspects of quality of service and network performance in digital networks, including ISDNs".

- ITU-T Recommendation I.150 (1993): "B-ISDN asynchronous transfer mode functional characteristics".

- IEC Publication 1170: "Compliance test procedures for steady-state availability".

- IEC Publication 1124: "Compliance test plans for constant failure rate and constant failure intensity".

History

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