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international end-to-end ISDN traffic relations**

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Foreword

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

This ETS specifies the accessibility of international end-to-end circuit-switched 64 kbit/s Integrated Services Digital Network (ISDN) traffic relations between T reference points.

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1 Scope

This European Telecommunication Standard (ETS) specifies the accessibility of international end-to-end circuit-switched 64 kbit/s Integrated Services Digital Network (ISDN) traffic relations between T reference points.

This ETS does not cover blocking at the user-network interface nor catastrophic situations, e.g. earth quakes, floods, etc.

NOTE: A corresponding compliance ETS is planned for September 1994. Until the document is available, this ETS may be used for design purposes.

2 Normative references

This 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 ETS only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

- [1] Supplement No. 6 to CCITT E series Recommendations: "Terms and definitions of Quality of Service, Network Performance, Dependability and Trafficability studies".
- [2] ETR 044: "Network Aspects (NA); Reference events for network performance parameters in an ISDN".
- [3] DE/NA-042104: "Network performance objectives for circuit-switched connection processing delays in an ISDN".
- [4] ETS 300 297: "Integrated Services Digital Network (ISDN); Access Digital Section for ISDN basic rate".
- [5] DI/NA-042117: "Network Aspects (NA); Accessibility for 64 kbit/s circuit-switched international end-to-end ISDN traffic relations Conformance test specification".

3 Definitions

For the purpose of this ETS, the following definitions apply:

Accessibility performance: the ability of a network to provide a connection within a specified delay when a correct request is received from the user at the T interface.

NOTE: The request includes activation of layer 1.

Accessibility: a measure for accessibility performance. The explicit definition of the measure is given in Clause 5 of this ETS.

Measure: a function or quantity used to describe a random variable or a random process (definition number 3011 in Supplement No. 6 to CCITT E series Recommendations [1]).

Short Term Accessibility (STA): the explicit definition of the STA is given in Clause 5 of this ETS.

4 Symbols and abbreviations

For the purpose of this ETS, the following symbols and abbreviations are used:

| | |
|-------|---|
| MPT1 | Measurement Point 1 |
| NP | Network Performance |
| STA | Short Term Accessibility |
| T_a | Time interval over which the random variable STA is defined |
| T | interface at reference point T |
| SABME | Set Asynchronous Balanced Mode Extended |
| UA | Unnumbered Acknowledgement |

5 Explicit definition for a measure for accessibility performance

5.1 Introduction

A Network Performance (NP) measure for accessibility performance should be as simple and easy to evaluate as possible. On the other hand, as the quality of service measure for accessibility performance depends mainly on the corresponding NP measure of the used network, a NP measure for accessibility performance has to characterise, as accurately as possible, the aspects which are important for the user. These requirements are conflicting and therefore, a compromise has to be taken.

Accessibility performance varies very much in time. One reason is changing traffic load. A second reason is changing traffic handling capacity of the network, e.g. because of equipment faults, preventive maintenance, etc. The influence of the first factor can be reduced by concentrating on specific periods of time, e.g. busy hours.

For network design purposes it is not sufficient to specify a long term average access probability, even during busy hours. For example, no access during 3 % and full access during 97 % of busy hours will be perceived differently by the users than a constant access probability of 0,97 during the same period. But in both cases the long-term average access probability is the same.

When a connection attempt is blocked, a user will retry if the connection is important for that user. Therefore, for users, both the chance of getting through with the first attempt and, if this one is unsuccessful, the chance of getting through with repeated attempts, is important. For the first attempt, the long term average success probability for connection attempts is an adequate measure, however, this quantity gives no indication about the chance of getting through with repeated attempts, in case the first one is unsuccessful. Therefore, the proportion of a short time interval which allows an additional successful connection is used in this ETS for specifying an acceptable network performance for repeated attempts.

5.2 Principles and definitions

From a location in the network to a specific destination, sometimes call set-up is possible and sometimes not, because somewhere in the network no resources are available (e.g. because of high traffic load, faults, etc.). If, at a given point in time, an interval of duration T_a is taken, the proportion of the interval in which an additional call is possible (within the specified delay) is a random variable (see figure 1).

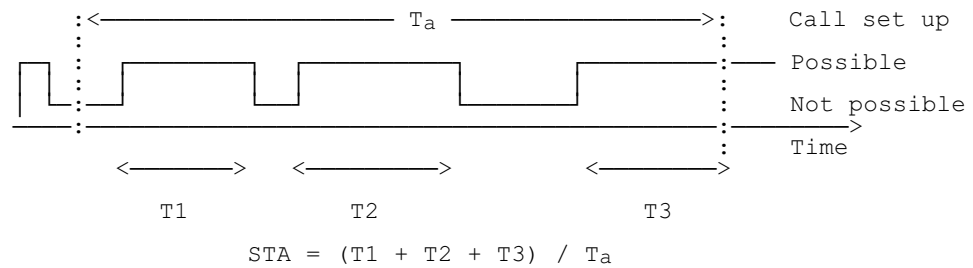


Figure 1: Example for illustrating the definition of the random variable STA

The distribution function of the random variable STA is the measure for accessibility performance defined here for repeated attempts. Practically, this distribution function represents the proportion of time during which STA is equal to, or less than, a given value.

To reflect successive trials of users when encountering blocked connection attempts, the following value for T_a is specified: $T_a = 5$ minutes.

6 Requirements

Accessibility is specified here for the 64 kbit/s circuit-switched connection type between two T reference points in two different countries.

The objective for accessibility is specified by means of a long term average access probability and a mask for the distribution function of the STA, as shown in figure 2.

In order to comply with this ETS, two conditions shall be met for all time-consistent, one-hour intervals:

- 1) the average access probability (P_a) shall be:

$$P_a \geq 0,96$$

- 2) any actual distribution function of the STA shall be below the mask given in figure 2.

Blocking at the T reference point because of lack of B channels shall not be included in the objective.

The practical meaning of the mask is as follows. Assume that a large sample of non-overlapping intervals of duration T_a is taken. The proportion of those intervals having an average probability for successful connection attempts smaller than the value given on the x-axis shall be less than the corresponding value on the mask.

The mask in figure 2 is defined by the following values:

$$\begin{aligned} P_u &= 0,001 \\ P_t &= 0,03 \\ A_n &= 0,97 \\ A_t &= 0,7 \end{aligned}$$

- NOTE 1: This ETS covers effects of varying traffic load and faults of equipment including faulty subscriber lines, but not blocking due to the lack of B channels at the T reference points.
- NOTE 2: The mask reflects the idea that network states with lower STA have to be less probable than states with higher STA.
- NOTE 3: P_u can be interpreted as the maximum acceptable unavailability of the traffic relation.
- NOTE 4: The objective in this ETS is a minimum requirement. It is up to the concerned network operators to provide a better network performance.

7 Success criteria for connection attempts

Table 1 sets the maximum delays between reference events for the characterisation of a successful connection attempt.

Table 1: Characterisation of successful connection attempts

| Call phase | Parameter criteria | Reference events codes* | | Success criteria |
|-----------------|--|---|------------------------------------|--|
| | | Start | Stop | |
| Before dialling | Activation time of layer 1 (for basic access) | INFO1 | INFO4 | } SUM < 20 s (See subclause 8.5 of ETS 300 297 [4]) |
| | Establishment delay of layer 2 | Q5 | Q9a | |
| After dialling | Connection set-up delay (according to the definition of DE/NA-042104 [3]) | P1 _a (en bloc) P3 (overlap) | P6 _b P6 _b | Connection set-up delay < 10 s |
| NOTE 1: | This table does not take into account all the possible situations where the success criteria are not satisfied: for instance, neither misrouteing, nor double connections, nor bad initial connection are covered. | | | |
| NOTE 2: | The measurement should be performed at a single measurement point (MPT1). | | | |
| * | Reference events codes are defined in ETS 300 297 [4], subclause 8.5, for the activation time of layer 1, and in ETR 044 [2], table 2 and table 3, for the establishment delay of layer 2. | | | |

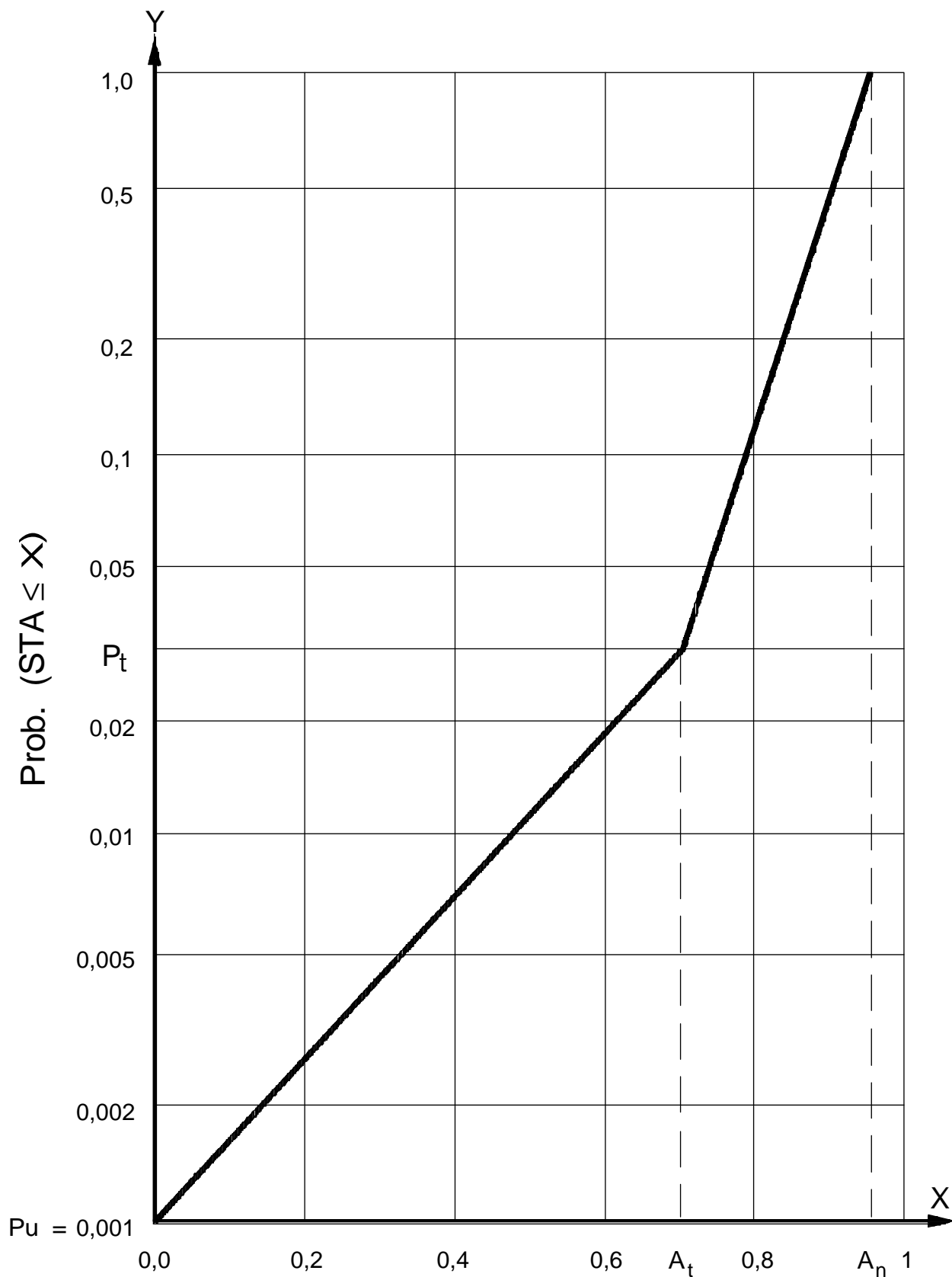
8 Evaluation of the NP measure for accessibility

By counting successful and total connection attempts over successive intervals T_a and dividing the first by the second, successive samples of STA are obtained. They can be used to evaluate an empirical distribution function. This can be done by observing real traffic or additional test traffic. A sufficient number of connection attempts within the T_a intervals are necessary to achieve sufficient precision of the results.

The problem with this direct kind of measurement is the long observation time necessary to get enough data for covering rare situations. This is the same problem as with measuring availability. To reduce the observation time, many similar traffic relations in the network, which do not use the same equipment, can be measured simultaneously.

An alternative is to estimate the STA from operational data such as availability of equipment and traffic measurement results.

The method for testing the compliance of a network to this ETS is described in DI/NA-042117 [5].



This mask shows on the Y axis the proportion of intervals having an average probability of successful connection smaller than the value given on the X axis.

Figure 2: Mask for the distribution function of the STA

History

| Document history | |
|------------------|---|
| August 1993 | First Edition |
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