INTERNATIONAL TELECOMMUNICATION UNION

ITU-T

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

X.147

Amendment 1
(04/2004)

SERIES X: DATA NETWORKS AND OPEN SYSTEM COMMUNICATIONS

Public data networks – Network aspects

Frame relay network availability

Amendment 1: Specification of availability objective values

ITU-T Recommendation X.147 (2003) – Amendment 1

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ITU-T Recommendation X.147

Frame relay network availability

Amendment 1

Specification of availability objective values

Source

Amendment 1 to ITU-T Recommendation X.147 (2003) was approved on 29 April 2004 by ITU-T Study Group 17 (2001-2004) under the ITU-T Recommendation A.8 procedure.

FOREWORD

The International Telecommunication Union (ITU) is the United Nations specialized agency in the field of telecommunications. The ITU Telecommunication Standardization Sector (ITU-T) is a permanent organ of ITU. 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 turn, produce Recommendations on these topics.

The approval of ITU-T Recommendations 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.

Compliance with this Recommendation is voluntary. However, the Recommendation may contain certain mandatory provisions (to ensure e.g. interoperability or applicability) and compliance with the Recommendation is achieved when all of these mandatory provisions are met. The words "shall" or some other obligatory language such as "must" and the negative equivalents are used to express requirements. The use of such words does not suggest that compliance with the Recommendation is required of any party.

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As of the date of approval of this Recommendation, 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.

CONTENTS

ITU-T Recommendation X.147

Frame relay network availability

Amendment 1

Specification of availability objective values

1) Clause 2

Add the following references alphanumerically to clause 2:

– ITU-T Recommendation G.827 (2003), *Availability performance parameters and objectives for end-to-end international constant bit-rate digital paths*.

– ITU-T Recommendation X.111 (2003), *Principles for the routing of international frame relay traffic*.

2) Clause 8

Replace the existing clause 8 with the following:

8 Availability performance objectives

This clause specifies performance objectives for the Availability Ratio and MTBSO parameters for the following connection portion types:

- Access Circuit Section;
- National Network Portion;
- International Transit Network Portion;
- International Interoperator Portion.

The network portion objectives define long-term performance of a frame relay virtual connection. It is recognized that some frame relay virtual connections might not meet the long-term objectives when the assessment is made over a shorter period, e.g., one month. The recommended period for assessing long-term performance is one year.

A single set of objectives is specified which are worst-case and which are applicable to each individual connection portion. All values are provisional and they need not be met by networks until they are revised (up or down) based on real operational experience.

The end-to-end availability performance of an international Frame Relay virtual connection can be calculated by simply multiplying the availability values for each portion.

8.1 Availability ratio

The Availability Ratio objective for each connection portion type is specified in Table 1. Availability objectives for specific virtual connections may be calculated by using the formulas given in 8.3 and applying the method specified in 8.4. Specific examples for calculating the end-to-end objective of a virtual connection are given in Appendix II.

Table 1/X.147 – Objectives for availability ratio

Connection portion or section	Availability ratio objective
Access Circuit Section (Notes 1 and 2)	(in accordance with ITU-T Rec. G.827) See 8.3
National Network Switching Portion (Notes 3 and 4)	99.98%
International Transit Network Portion (Notes 3 and 4)	99.98%
International Interoperator Portion (Notes 1 and 2)	(in accordance with ITU-T Rec. G.827) See 8.3
NOTE 1 – The Availability Ratio objectives of an Access Circuit Section and an International Interoperator Portion, of a given length, are calculated using guidelines based on the availability of objective formulas specified in ITU-T Rec. G.827. These formulas, adapted for Frame Relay, are given in 8.3. In the case of the Access Circuit Section, the achieved availability may be also impacted by geographical and climatic extremes. NOTE 2 – ITU-T Rec. G.827 defines availability performance parameters and objectives for end-to-end international constant bit-rate digital paths. NOTE 3 – All Network Portion or Section Availability objectives are provisional and need not be met by networks until they are revised (up or down) based on real operational experience. NOTE 4 – It is recognized that over short-term periods, e.g., one month, the performance of an individual virtual connection might not meet the objective. However, network operators should endeavour to ensure that in the long term, the availability of an individual virtual connection meets the objective.	

8.2 Mean time between outages

The MTBO objective for each connection portion type is specified in Table 2.

Table 2/X.147 – Objectives for mean time between service outages

Connection portion or section	MTBSO objective
Access Circuit Section (Notes 1, 2 and 3)	1200 hours
National Network Portion (Note 4)	1200 hours
International Transit Network Portion (Note 4)	1200 hours
International Interoperator Portion (Notes 1 and 2)	1200 hours
NOTE 1 – The MTBSO values for the Access Circuit Section and the International Interoperator Portion are consistent with the Outage Intensity objectives defined in ITU-T Rec. G.827. NOTE 2 – ITU-T Rec. G.827 defines availability performance parameters and objectives for end-to-end international constant bit-rate digital paths. NOTE 3 – ITU-T Rec. G.827 defines a performance objective for Outage Intensity. Outage Intensity is the reciprocal of MTBO when the MTBO is expressed as a fraction of the long-term assessment period (usually taken to be one year). NOTE 4 – The MTBSO objectives specified for the National and International Transit Network Portions are provisional and need not be met by networks until they are revised (up or down) based on real operational experience.	

8.3 Formulas for availability objectives for access circuit sections and international interoperator portions

The lengths of the access circuit sections and international interoperator portions of an international Frame Relay virtual connection have a major impact on the availability of a virtual connection. The formulas provided in this clause are based on the concepts specified in ITU-T Rec. G.827 (2003). It should also be noted that despite these formulas and the specification of objectives for the access circuit section and the national network switching portion, the only commitment of Frame Relay

network operators is to the availability objective of the national portion, that is to say, the concatenation of the availability objectives for the access circuit section and the national network (switching) portion.

8.3.1 Length

Except for Access Circuit Section or International Interoperator Portions carried on undersea cables, the lengths refer to the actual route lengths or the air-route distance multiplied by a routing factor, whichever is smaller.

The routing factor is as follows:

- if the air-route distance is less than 1000 km, then the routing factor is 1.5;
- if the air-route distance is larger than 1000 km and less than 1200 km, then the calculated route length is taken to be 1500 km;
- if the air-route distance is larger or equal to 1200 km, then the routing factor is 1.25.

For an Access Circuit Section or an International Interoperator Portion carried on an undersea cable, the actual cable route length is used.

The length value of an Access Circuit Section is denoted by L_{ACS}, and the length of an International Interoperator Portion is denoted by L_{IIOP}.

NOTE – If the length of an Access Circuit Section or an International Interoperator Portion is greater than 10 500 km, its length, for the purpose of calculating its availability objective, is taken to be 10 500 km.

8.3.2 Availability objectives

Availability objectives for the Access Circuit Section and the International Interoperator Portion are determined by the following equations which are consistent with the guidelines specified in ITU-T Rec. G.827:

For an Access Circuit Section or an International Interoperator Portion:

$$AR = 1 - k \times x$$

where:

$x = 0.0005$ and

k = [1 + integer part of (L/100)] with L being either L_{ACS} or L_{IIOP} as appropriate.

The National Portion availability objective is:

$$A = 1 - (0.0002 + k \times x)$$

where:

$x = 0.0005$ and

k = [1 + integer part of (L_{ACS}/100)].

NOTE – The National Portion availability objective may alternatively be estimated as the product of the Access Circuit Section and National Network Portion availability objectives.

8.4 Method of concatenation for calculating availability objective for a frame relay virtual connection

The end-to-end availability objective of an international frame relay virtual connection is calculated as follows:

Define the following parameters:

- ACO is the Availability objective of the Originating Access Circuit Section;
- ACD is the Availability objective of the Destination Access Circuit Section;

- NNO is the Availability objective of the Originating National Network Portion;
- NND is the Availability objective of the Destination National Network Portion;
- ITN_k is the Availability objective of the International Transit Network Portion ($_k$);
- IIP_k is the Availability objective of the International Interoperator Portion ($_k$).

Assume that international frame relay virtual connection transits through three transit networks ITN_1, ITN_2 and ITN_3.

The end-to-end availability of an international frame relay virtual connection is given by:

Availability Ratio = ACO × NNO × IIP_1 × ITN_1 × IIP_2 × ITN_2 × IIP_3 × ITN_3 × IIP_4 × NND × ACD

NOTE 1 – ITU-T Rec. X.111 recommends a maximum of 3 transit networks on any international connection.

NOTE 2 – In the case where less than 3 International Transit Network portions are employed to establish the frame relay connection, the appropriate terms in the expression (ITN_1 × IIP_2 × ITN_2 × IIP_3 × ITN_3 × IIP_4) are set to unity as required.

3) New Appendix II

Add new Appendix II as follows:

Appendix II

Example calculations of end-to-end availability objectives

II.1 Illustrative example 1

Assume that both access circuit sections have a 1000 km route length (an access circuit of 1000 km is representative of an extreme case). Using the formulas in 8.3, the availability objective of each Access Circuit Section is calculated to be 99.45%.

For the example where two international transit networks are required to establish the end-to-end connection, three International Interoperator Portions are required. Assume that the International Interoperator Portions have route lengths of 1000 km, 6000 km and 3300 km.

Using the formulas in 8.3, the availability objectives of the International Interoperator Portions are calculated to be 99.45%, 96.95%, and 98.30%, respectively.

From Table 1 the Availability objective for each Network Portion is 99.98%.

Hence the end-to-end availability objective is:

(0.9945 × 0.9998 × 0.9945 × 0.9998 × 0.9695 × 0.9998 × 0.9830 × 0.9998 × 0.9945) =
0.9366 = 93.66%

II.2 Illustrative example 2

Assume that both access circuits are less than 100 km route length. Using the formulas in 8.3, the availability objective for each Access Circuit Section is calculated to be 99.95%.

For the example where two international transit networks are required to establish the end-to-end connection, three International Interoperator Portions are required. Assume that the International Interoperator Portions have route lengths of 1000 km, 6000 km and 3300 km.

Using the formulas in 8.3, the availability objectives of the International Interoperator Portions are calculated to be 99.45%, 96.95%, and 98.30%, respectively.

From Table 1 the Availability objective of each International Transit Network portion is 99.98%. The national portion objectives can be calculated as the product of the National Network Portion and the Access Circuit Section for an availability objective of (0.9995 × 0.9998) = 99.93%.

Hence the end-to-end availability objective is:

(0.9993 × 0.9945 × 0.9998 × 0.9695 × 0.9998 × 0.9830 × 0.9993) = 0.9461 = 94.61%

The above examples clearly illustrate that the Access Circuit Section has a significant impact on the achieved end-to-end availability of a frame relay virtual connection.

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