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SERIES I: INTEGRATED SERVICES DIGITAL NETWORK

ISDN user-network interfaces – Multiplexing, rate adaption and support of existing interfaces

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Multiplexing, rate adaption and support of existing interfaces

ITU-T Recommendation I.460

(Previously CCITT Recommendation)

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ITU-T RECOMMENDATION I.460

MULTIPLEXING, RATE ADAPTION AND SUPPORT OF EXISTING INTERFACES

Source

ITU-T Recommendation I.460 was revised 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)*.

INTELLECTUAL PROPERTY RIGHTS

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.460

MULTIPLEXING, RATE ADAPTION AND SUPPORT OF EXISTING INTERFACES

(Malaga-Torremolinos, 1984; amended at Melbourne, 1988; revised in 1999)

This Recommendation describes procedures to be used to:

a) adapt the rate of one stream, of rate lower than 64 kbit/s, into a 64 kbit/s B-channel;

b) multiplex several streams, of rates lower than 64 kbit/s, into a 64 kbit/s B-channel.

The rates lower than 64 kbit/s are of two types:

1) binary rates of 8, 16 and 32 kbit/s; and

2) other rates including those associated with DTEs conforming to the X- and V-series Recommendations.

The detailed procedures for support of X-series circuit mode DTEs, X-series packet mode DTEs, and V-series DTEs are given in Recommendations I.461/X.30, I.462/X.31, I.463/V.110 and I.465/V.120), respectively.

Rate adaption, multiplexing and support of existing interfaces for restricted 64 kbit/s transfer capability is covered in Recommendation I.464.

1 Rate adaption to a 64 kbit/s channel

1.1 Rate adaption of 8, 16 and 32 kbit/s streams

The procedure in this subclause will be used to adapt the rate of a *single* stream at 8, 16 or 32 kbit/s into a 64 kbit/s B-channel. In this Recommendation, bit positions in the B-channel octet are assumed to be numbered from 1 to 8 with bit position 1 being the first transmitted.

The procedure requires that:

i) the 8 kbit/s stream occupies bit position 1,

the 16 kbit/s stream occupies bit positions (1, 2),

the 32 kbit/s stream occupies bit positions (1, 2, 3, 4);

ii) the order of transmission of the bits of the subrate stream is identical before and after rate adaption; and

iii) all unused bit positions be set to binary "1".

1.2 Rate adaption of streams other than 8, 16 and 32 kbit/s

Information streams at bit rates less than 64 kbit/s need to be rate adapted to be carried on the B-channel. The approaches in this subclause are for adapting *single* information streams.

1.2.1 The rate adaption of bit rates of less than 24 kbit/s uses a multi-stage approach. One stage is described in Recommendations I.461/X.30, I.462/X.31, I.463/V.110. For example, user rates of 4.8 kbit/s and below are mapped to 8 kbit/s, 9.6 kbit/s is mapped to 16 kbit/s, and 19.2 kbit/s is mapped to 32 kbit/s.

Another stage of rate adaption is from 8 kbit/s, 16 kbit/s, or 32 kbit/s to 64 kbit/s and is described in 1.1.

A third stage for asynchronous data is described in Recommendation I.463/V.110.

1.2.2 Rate adaption of bit rates equal to or greater than 24 kbit/s uses a single-stage approach as described in Recommendations I.461/X.30 and I.463/V.110. For example, 48 kbit/s and 56 kbit/s rates are adapted to 64 kbit/s in one stage.

1.2.3 Rate adaption for packet mode operation may be performed in two ways as described in Recommendation I.462/X.31:

a) the preferred method: in using HDLC flag stuffing between HDLC frames; or

b) using the two-stage approach.

1.2.4 Rate adaption of bit rates up to 48 kbit/s on a B-channel may be performed by insertion of HDLC frames as described in Recommendation I.465/V.120.

2 Multiplexing into a 64 kbit/s channel

2.1 Time division multiplexing of 8, 16 and 32 kbit/s

Multiplexing of 8, 16 and 32 kbit/s streams is done by interleaving the subrate streams within each B-channel octet.

Using the procedures described in 2.1.2, any number of 8, 16 and 32 kbit/s streams may be combined up to the limit of 64 kbit/s aggregate bit rate in one B-channel.

Using the procedure described in 2.1.1 can lead to situations where the full 64 kbit/s capacity cannot be utilized; however, this will not occur if the mixture of substreams is known in advance. The procedures in 2.1.2 are recommended when the mixture will change during the duration of the 64 kbit/s connection.

2.1.1 Fixed format multiplexing

This procedure will multiplex any combination of 8, 16 and 32 kbit/s streams by allocating bit positions in each B-channel octet to each subrate stream. The fixed format procedure requires that:

i) an 8 kbit/s stream be allowed to occupy any bit position; a 16 kbit/s stream occupies bit positions (1, 2) or (3, 4) or (5, 6) or (7, 8); a 32 kbit/s stream occupies bit positions (1, 2, 3, 4) or (5, 6, 7, 8);

ii) a subrate stream occupies the same bit position(s) in each successive B-channel octet;

iii) the order of transmission of the bits at each subrate stream is identical before and after multiplexing; and

iv) all unused bit positions be set to binary "1".

2.1.2 Flexible format multiplexing

This procedure will multiplex any combination of 8, 16 and 32 kbit/s streams by allocating bits in each B-channel octet to each subrate stream. This procedure always allows subrate streams to be multiplexed up to the 64 kbit/s limit of the B-channel. This procedure first attempts to accommodate the subrate streams by using the fixed format procedure of 2.1.1. Although there may be a sufficient number of available bits in the B-channel octet, the attempt may fail because rule i) of 2.1.1 cannot be satisfied. If this attempt does fail, then flexible format procedure requires that:

i) a subrate stream occupy the same bit position(s) in each successive B-channel octet;

ii) the new subrate stream be added to the existing multiplex by inserting each successive bit of the new subrate stream into the earliest (lowest numbered) available bit position in the B-channel octet; and

iii) all unused bit positions be set to binary "1".

2.2 Multiplexing of rates other than 8, 16 and 32 kbit/s

Two technical approaches for multiplexing lower bit rate information streams (e.g. Recommendation X.1 rates) can be used:

i) *Time division multiplexing*

In this case, the two-stage approach (rate adaption up to 8, 16 or 32 kbit/s followed by multiplexing to 64 kbit/s) as defined in 1.2 and 2.1 should be used.

NOTE – Multiplexing schemes according to X-series Recommendations (e.g. X.50) may be used only in the context of 64 kbit/s access through the ISDN to existing dedicated networks.

ii) *Statistical multiplexing*

a) for supporting packet mode terminals using either the D-channel or Recommendation X.25 protocols;

b) for circuit mode terminals or terminal adaptors on the B-channel, see Recommendation V.120.

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