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Network Aspects (NA); Support of existing services with guaranteed constant bit rate and specified transfer delay on Metropolitan Area Network (MAN)

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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).

The need has been identified for the support of applications that require guaranteed constant bandwidth and specified transfer delay on a Distributed Queue Dual Bus (DQDB) subnetwork.

Therefore, the DQDB protocol has to be enhanced for the provision of Constant Bit Rate (CBR) connection types.

This final draft ETS addresses the use of pre-arbitrated functions as defined in IEEE Standard 802.6 [1] to support CBR connection types.

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1 Scope

This European Telecommunication Standard (ETS) details enhancements to the Distributed Queue Dual Bus (DQDB) access method as defined in IEEE Standard 802.6 [1] in order to provide Constant Bit Rate (CBR) connection types for the support of existing services (guaranteed constant bandwidth, specified transfer delay) on MANs, using semi-permanent connections in the range of n x 64 kbit/s to 2 Mbit/s bit rate capability. Therefore, signalling protocol specifications are outside the scope of this ETS.

This ETS does not cover the broadband specific aspects and the interworking of MANs with broadband networks. For the broadband related aspects the CBR services are defined in CCITT Recommendations I.362 and I.363 and the protocol reference model to be used in the Asynchronous Transfer Mode (ATM) based networks to support these services is included in CCITT Recommendation I.321.

Annex B provides the Protocol Implementation Conformance Statement (PICS) proforma for this ETS, in compliance with the relevant requirements, and in accordance with the relevant guidance, given in ISO/IEC 9646-2.

2 Normative references

This ETS incorporates, by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed below. For dated references, subsequent amendments to or revisions 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] IEEE Standard 802.6 (1990): "Distributed Queue Dual Bus (DQDB) Subnetwork of a Metropolitan Area Network (MAN)".

[2] CCITT Recommendation G.101 (1988): "The transmission plan".

[3] CCITT Recommendation G.114 (1988): "Mean one-way propagation time".

[4] CCITT Recommendation G.131 (1988): "Stability and Echo (General characteristics of the 4-wire chain formed by the international circuits and national extension circuits)".

[5] CCITT Recommendation G.823 (1988): "The Control of jitter and wander within digital networks which are based on the 2 048 kbit/s hierarchy".

3 Definitions

For the purposes of this ETS, the definitions defined in IEEE Standard 802.6 [1] apply.

In addition, this Clause contains those definitions that are considered to be essential for the understanding of this ETS.

Access delay: the time which an octet spends in the transmit queue of a CBR access unit before it can gain access to the bus.

Basic data rate: a data rate out of the following list:

- 64 kbit/s;
- 192 kbit/s;
- 384 kbit/s;
- 768 kbit/s;
- 1 536 kbit/s;
- 2 048 kbit/s.

The use of the term "basic data rate" implies that the Pre-Arbitrated (PA) slot generation process for a CBR connection at a basic data rate is based on the frequency parameter pairs (M, N) where M=1 and N=2, 4, 8, 16, 48 or M=2 and N=3.

CBR Access Unit (CAU): a DQDB node supporting a CBR interface.

CBR Convergence Functions (CCF) block: consists of the CCF transmit functions block and the CCF receive functions block.

CBR Service User (CSU): sends and receives octets at a constant bit rate across a CBR interface of a DQDB subnetwork.

CCF receive functions block: receives octets from the PA functions block and stores them in a buffer. It forwards the octets to the CBR service user at precisely regular intervals according to the rate of the CBR service.

CCF transmit functions block: receives service octets from the CBR interface. It stores these octets in a buffer until they are requested by the PA functions block. Then they are passed on to the PA functions block.

Common Functions (CF) block: provides functions which are needed by some or all of the other functional blocks in the local DQDB layer subsystem. It provides the DQDB layer function of relaying the slot octets and management information octets between the service access points to the local physical layer subsystem.

Composite slot-switching: the service octets of a CBR connection may gain access to an offset in the payload of a PA slot on one of the busses if, and only if, the pair virtual channel identifier of the PA slot, offset is contained in a list of such pairs associated at connection set-up with the CBR connection on that bus.

Compound data rate: is a (necessarily unique) sum of two or more basic data rates. The use of the term "compound data rate" implies that the PA slot generation process for a CBR connection at a compound data rate consists in generating the PA slots for the basic data rates of which it is the sum.

Constant Bit Rate (CBR): the time characteristic of an event or signal recurring at known periodic time intervals, i.e. guaranteed constant bandwidth, specified transfer delay.

NOTE: The term for this characteristic which is used in IEEE Standard 802.6 [1] is "CBR".

CBR Service Data Unit (CSDU): are presented by the CSU at the specified rate for the CBR connection. Similarly, the CBR service periodically delivers a CSDU to a CSU at the rate specified for the connection.

Dedicated slot-switching: the service octets of a CBR connection may gain access to an offset in the payload of a PA slot on one of the busses if, and only if, the Virtual Channel Identifier (VCI) of the PA slot has been associated at connection set-up with the CBR connection on that bus.

Delay end-to-end, one way: the time it takes for a CBR service octet to be transferred between two corresponding terminal equipments.

Frame: refers to the 125 µs transmission frame of the Physical Layer Convergence Procedure (PLCP).

Frequency: is a pair of positive integer numbers (M, N). It implies that the PA slot generation for a CBR connection is required to maintain the frequency of M slots every N frames.

PA functions block: controls the transfer in PA segment payloads of CBR service octets received from the CBR convergence functions block. For this purpose it maintains one transmit table and one receive table.

Receive table: is part of the PA receive functions block. It associates a CBR connection end-point identifier with the bus and with the VCI of the PA slots on which the service octets of the connection are received.

Slot number: slots in a frame are numbered by starting with the first slot fully contained in the frame and numbering from 1 to the last slot fully contained in that frame.

Transmit table: is part of the PA transmit functions block. It associates a CBR connection end-point identifier with the bus and with the VCI of the PA slots on which the service octets of the connection are transmitted.

Variability: is the maximum difference in the slot number between the k-th and the (k+M)-th PA slots allocated to a connection with slot generation frequency = (M, N).

4 Symbols and abbreviations

For the purposes of this ETS, the symbols and abbreviations defined in IEEE Standard 802.6 [1] apply.

In addition, those symbols and abbreviations that are essential for the understanding of this ETS are listed:

CAU	CBR Access Unit
CBR	Constant Bit Rate
CCF	CBR Convergence Functions
CF	Common Functions
CRC	Cyclic Redundancy Check
CSDU	CBR Service Data Unit
CSU	CBR Service User
DQDB	Distributed Queue Dual Bus
HCS	Header Check Sequence
HOB	Head Of Bus
ISPBX	Integrated Services Private Branch Exchange
LM-ACTION	Layer Management Action
MAC	Media Access Control
MSS	MAN Switching System
NMP	Network Management Process
PA	Pre-Arbitrated
PBX	Private Branch Exchange
PDU	Protocol Data Unit
PICS	Protocol Implementation Conformance Statement
PLCP	Physical Layer Convergence Procedure
QA	Queued Arbitrated
SDH	Synchronous Digital Hierarchy
VCI	Virtual Channel Identifier
V_{def}	default Variability

5 Basic principles

The CBR capability shall provide for the following data rates defined by CCITT:

- 64 kbit/s;
- 384 kbit/s;
- 1 536 kbit/s;
- 2 048 kbit/s.

The CBR capability provides for these basic data rates and combinations thereof, e.g. n x 64 kbit/s.

The PLCP of a DQDB subnetwork providing CBR capability shall have a 125 µs frame structure. In order to allow for simple and efficient bandwidth allocation/management algorithms, the Head Of Bus (HOB) node shall generate slots used for CBR services which fit as a whole into a single 125 µs frame. Therefore, the use of a 1,5 Mbit/s or 2 Mbit/s transmission system for the DQDB subnetwork is excluded. All other standardised PLCPs are supported.

6 DQDB layer service model

The CBR service provided by the DQDB layer is described abstractly by means of the service primitives notation defined in ISO/TR 8509.

NOTE: The abstract description does not constrain an implementation in any way. For example, an implementation might use a service data unit consisting of a number of octets or only a single bit.

The primitives used to describe the service are the following:

- CSU-DATA request;

- CSU-DATA indication.

CSDUs to be sent via the CBR service are presented by the CSU at the specified rate for the constant bit rate connection. Similarly, the CBR service periodically delivers a CSDU unit to a CSU at the rate specified for the connection.

CSU-DATA request

Function:

- this primitive requests the transfer of a CSDU over an established CBR connection.

Semantics of the Service Primitive:

- CSU-DATA request;

- the CSDU parameter conveys a single CSDU.

When generated:

- this primitive is generated by an CSU whenever a CSDU is required to be transferred over a connection.

Effect on receipt:

- the receipt of this primitive by the DQDB layer results in the DQDB layer attempting to transfer the CSDU over the established connection. CSDUs are transferred in the same order in which they are submitted by the CSU.

CSU-DATA indication

Function:

- this primitive indicates the arrival of a CSDU over an established CBR connection.

Semantics of the service primitive:

- CSU-DATA indication (CSDU).

The CSDU parameter conveys a single CSDU.

When generated:

- this primitive is generated by the DQDB Layer to deliver a CSDU that has arrived over an established CBR connection.

Effect on receipt:

- the effect of receipt of this primitive is dependent upon the CSU;

- the CSDUs shall be received by the receiving CSU in the same order in which they were sent by the sending CSU.

7 Functional architecture

7.1 Access method

CBR service octets will be carried in the payload of PA slots. For the format of PA slots see Clause 8. In particular, the payload of PA slots contains 48 octets. PA slots are generated by the slot generation function at the HOB according to algorithms which are discussed in subclause 7.2.

Dedicated slot-switching shall be used for the nodes to gain access to CBR bandwidth in the payload of the PA-slots on a DQDB bus.

In dedicated slot-switching, the octets of the payload of a PA-slot are associated with only one connection, and there is a one-to-one correspondence between CBR connections and VCIs in the headers of PA-slots on each bus.

NOTE: This is in contrast to "composite slot-switching" where different octet positions in one PA slot may be associated with different connections. There is no contradiction between the two access methods as dedicated slot-switching may be viewed as just a particular way to use composite slot-switching.

7.2 Slot generation function at the HOB

In order to achieve interoperability of equipment it has to be specified how the PA slots associated with a CBR connection (i.e. with a particular VCI) are generated by the HOB. The bandwidth provided by all PA slots with a particular VCI defines a CBR connection on a DQDB subnetwork.

For a PLCP based on CCITT Recommendation G.703 at 34 Mbit/s or at 140 Mbit/s, all slots are fully contained in a frame and may be used as PA slots.

For certain PLCPs, however, slots can cross frame boundaries. Furthermore, the number of slots which are fully contained in a frame varies between Max and Max+1 where Max is an integer. In this case, in order to simplify PA slot generation procedures, only the first Max complete slots in a frame may be used as PA slots.