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Širokopasovno digitalno omrežje z integriranimi storitvami (B-ISDN) – Krmiljenje prometa in zamašitev v B-ISDN

Broadband Integrated Services Digital Network (B-ISDN); Traffic control and congestion control in B-ISDN

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Foreword

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

The Broadband Integrated Services Digital Network (B-ISDN), which is based on the Asynchronous Transfer Mode (ATM) technique, is designed to transport a wide variety of traffic classes satisfying a range of transfer capacity needs and Network Performance (NP) objectives.

The primary role of traffic control and congestion control parameters and procedures is to protect the network and the user in order to achieve NP objectives. An additional role is to optimize the use of network resources.

The uncertainties of broadband traffic patterns, traffic control and congestion control complexity suggest a step-wise approach for defining traffic parameters and network traffic control and congestion control mechanisms. This ETS defines a restricted initial set of traffic control and congestion control capabilities, aiming at simple mechanisms and realistic network efficiency.

It may subsequently be appropriate to consider additional sets of such capabilities, for which additional traffic control mechanisms will be used to achieve increased network efficiency.

Transposition dates	
Date of latest announcement of this ETS (doa):	30 June 1995
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1 Scope

This European Telecommunication Standard (ETS) describes traffic control and congestion control procedures for the Broadband Integrated Services Digital Network (B-ISDN):

- the main body describes the objectives and mechanisms of traffic control and congestion control (see CCITT Recommendation I.371 [1]);

- examples of application of monitoring functions are given in annex A.

In B-ISDN, congestion is defined as a state of network elements (e.g. switches, concentrators, cross-connects and transmission links) in which the network is not able to meet the negotiated NP objectives for the already established connections and/or for the new connection requests.

In general congestion can be caused by:

- unpredictable statistical fluctuations of traffic flows;

- fault conditions within the network.

Congestion should be distinguished from the state where buffer overflow is causing cell losses, but still meets the negotiated Quality of Service (QoS).

Asynchronous Transfer Mode (ATM) layer traffic control refers to the set of actions taken by the network to avoid congested conditions.

ATM layer congestion control refers to the set of actions taken by the network to minimize the intensity, spread and duration of congestion. These actions are triggered by congestion in one or more network elements.

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 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] CCITT Recommendation I.371: "Traffic control and congestion control in B-ISDN".

[2] CCITT Recommendation I.150: "B-ISDN Asynchronous Transfer Mode functional characteristics".

[3] CCITT Recommendation I.311: "B-ISDN General Networks Aspects".

3 Abbreviations

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

AAL	ATM Adaptation Layer
ATM	Asynchronous Transfer Mode
CAC	Connection Admission Control
CBR	Constant Bit Rate
CDV	Cell Delay Variation
CEQ	Customer Equipment
CLP	Cell Loss Priority
CLR	Cell Loss Ratio
CRF	Connection Related Functions
CRF(VC)	Virtual Channel Connection Related Functions
CRF(VP)	Virtual Path Connection Related Functions
EFCI	Explicit Forward Congestion Indication
FIFO	First In First Out
FRM	Fast Resource Management
GFC	Generic Flow Control
NNI	Network-Network Interface
NP	Network Performance
NPC	Network Parameter Control
NRM	Network Resource Management
OAM	Operation And Maintenance
PC	Priority Control
PCR	Peak Cell Rate
PDU	Protocol Data Unit
QoS	Quality of Service
SAP	Service Access Point
SDU	Service Data Unit
UNI	User-Network Interface
VBR	Variable Bit Rate
VC	Virtual Channel
VCC	Virtual Channel Connection
VCI	Virtual Channel Identifier
VPC	Virtual Path Connection
VP	Virtual Path
VPI	Virtual Path Identifier

4 General framework

4.1 General objectives

The objectives of ATM layer traffic control and congestion control for B-ISDN are as follows:

- ATM layer traffic control and congestion control should support a set of ATM layer QoS classes sufficient for all foreseeable B-ISDN services; the specification of these QoS classes should be consistent with NP recommendations;

- ATM layer traffic control and congestion control should not rely on ATM Adaptation Layer (AAL) protocols, which are B-ISDN service specific, nor on higher layer protocols, which are application specific. Protocol layers above the ATM layer may make use of information which may be provided by the ATM layer, in order to improve the utility that those protocols can derive from the network;

- the design of an optimum set of ATM layer traffic controls and congestion controls should minimize network and end-system complexity while maximising network utilization.

4.2 Generic functions

To meet these objectives, the following functions form a framework for managing and controlling traffic and congestion in ATM networks and may be used in appropriate combinations:

- Network Resource Management (NRM): provisioning may be used to allocate network resources in order to separate traffic flows according to service characteristics;

- Connection Admission Control (CAC): is defined as the set of actions taken by the network during the call set up phase (or during call re-negotiation phase) in order to establish whether a Virtual Channel (VC)/Virtual Path Connection (VPC) request can be accepted or rejected (or whether a request for re-allocation can be accommodated). Routeing is part of CAC actions;

- feedback controls are defined as the set of actions taken by the network and by the users to regulate the traffic submitted on ATM connections according to the state of network elements;

- Usage Parameter Control/Network Parameter Control (UPC/NPC) is defined as the set of actions taken by the network to monitor and control traffic, in terms of traffic offered and validity of the ATM connection, at the user access and the network access respectively. Their main purpose is to protect network resources from malicious, as well as unintentional, misbehaviour which can affect the QoS of other already established connections by detecting violations of negotiated parameters and taking appropriate actions;

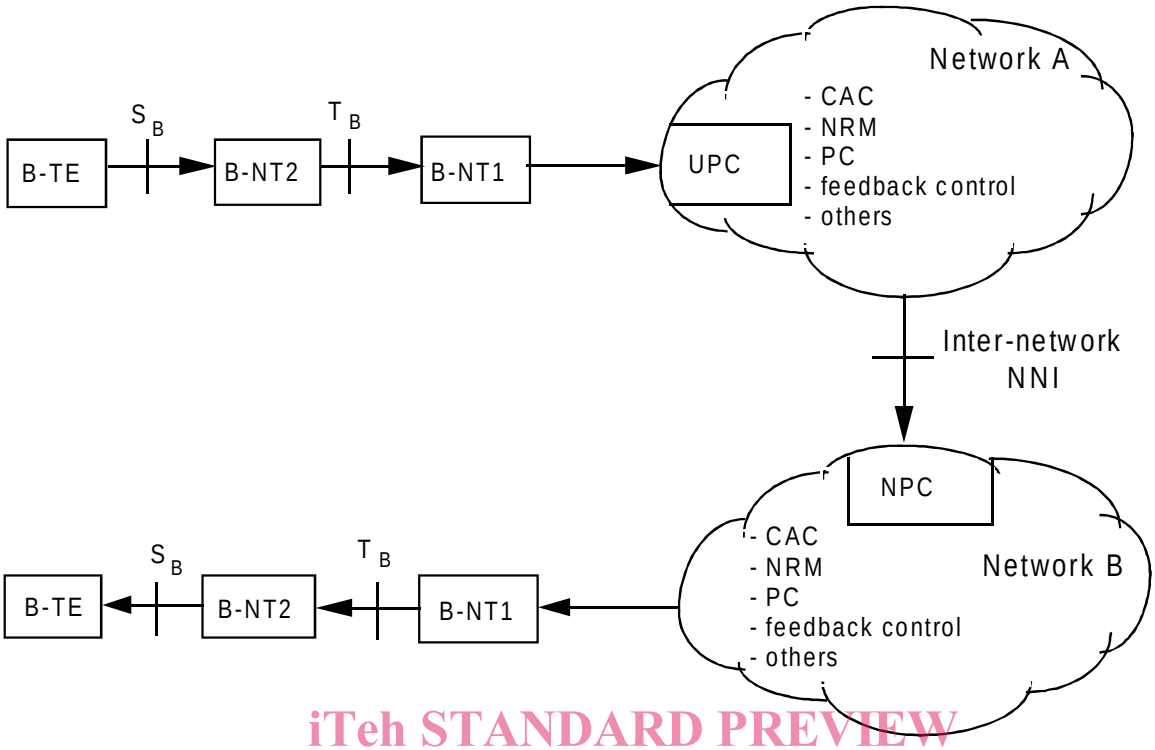
- Priority Control (PC): the user may generate different priority traffic flows by using the Cell Loss Priority (CLP) bit, see CCITT Recommendation I.150 [2]. A congested network element may selectively discard cells with low priority if necessary to protect, as far as possible, the NP for cells with high priority;

- other control functions are for further study.

As a general requirement, it is desirable that a high level of consistency be achieved between the above traffic control capabilities.

4.3 A reference configuration for traffic control and congestion control

The reference configuration used for traffic control and congestion control is given figure 1.



UPC: Usage Parameter Control
NPC: Network Parameter Control
CAC Connection Admission Control
NRM: Network Resource Management
PC: Priority Control
Others for further study

NOTE 1: NPC may also apply at some intra-network Network-Network Interfaces (NNIs).

NOTE 2: The arrows indicate the direction of the cell flow.

Figure 1: Reference configuration for traffic control and congestion control

4.4 Events, actions, time scales and response times

Figure 2 illustrates the time-scales over which various traffic control and congestion control functions operate. The response time defines how quickly the controls react. For example, cell discarding can react on the order of the insertion time of a cell. Similarly, feedback controls can react on the time scale of round-trip propagation times. Since traffic control and resource management functions are needed at different time-scales, no single function is likely to be sufficient.