ETSI TECHNICAL REPORT

ETR 264

January 1996

Source: ETSI TC-NA

Reference: DTR/NA-053211

ICS: 33.040

Key words: ATM, CBDS

Connectionless Broadband Data Service (CBDS); Asynchronous Transfer Mode (ATM); CBDS over ATM - complementary information to ETS 300 479

ETSI

European Telecommunications Standards Institute

ETSI Secretariat

Postal address: F-06921 Sophia Antipolis CEDEX - FRANCE
Office address: 650 Route des Lucioles - Sophia Antipolis - Valbonne - FRANCE
X.400: c=fr, a=atlas, p=etsi, s=secretariat - **Internet:** secretariat@etsi.fr

Tel.: +33 92 94 42 00 - Fax: +33 93 65 47 16

*

Contents

Blank page

Foreword

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

ETRs are informative documents resulting from ETSI studies which are not appropriate for European Telecommunication Standard (ETS) or Interim European Telecommunication Standard (I-ETS) status. An ETR may be used to publish material which is either of an informative nature, relating to the use or the application of ETSs or I-ETSs, or which is immature and not yet suitable for formal adoption as an ETS or an I-ETS.

This ETR provides additional information to ETS 300 478 [3] and ETS 300 479 [4] describing the connectionless protocols, and specifies provision of the hop count and enhanced multicast capabilities for Connectionless Broadband Data Service (CBDS) via Asynchronous Transfer Mode (ATM) based networks. The changes and additions to the above ETSs are described in this ETR. Equivalent work is ongoing in ITU-T.

Blank page

1 Scope

This ETSI Technical Report (ETR) complements ETS 300 478 [3] and ETS 300 479 [4]. It describes the support of two additional capabilities for the connectionless protocols of the Connectionless Broadband Data Service (CBDS) in accordance with:

- ETS 300 217 [2], which details the stage 1 aspects for CBDS;

- ITU-T Recommendation F.812 [1], which provides a service description of a broadband CBDS,

namely:

- the hop count which prevents a Protocol Data Unit (PDU) from endlessly looping in networks in case of misrouting;

- the enhanced multicast which improves the efficiency of multicast transport in networks.

This ETR describes the enhancements of the Connectionless Network Interface Protocol (CLNIP) protocol used to support these additional capabilities.

In addition, this ETR redefines the structure, coding and usage of the Reserved and HE Post-PAD fields of the CLNIP PDU specified in ETS 300 479 [4] needed to support these additional functionalities. The description of these fields updates the respective ones contained in ETS 300 479 [4].

2 References

This ETR incorporates by dated and undated reference, provisions from other publications. These 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 part of ETR only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

[1] ITU-T Recommendation F.812 (1992): "Broadband connectionless data bearer service".

[2] ETS 300 217 (1992): "Network Aspects (NA); Connectionless Broadband Data Service (CBDS)".

[3] ETS 300 478 (1995) "Network Aspects (NA); Connectionless Broadband Data Service (CBDS) over Asynchronous Transfer Mode (ATM); Framework and protocol specification at the User-Network Interface (UNI)".

[4] ETS 300 479 (1995) "Network Aspects (NA); Connectionless Broadband Data Service (CBDS) over Asynchronous Transfer Mode (ATM); Network Node Interface (NNI) specification".

[5] ETR 260: "Network Aspects (NA); Connectionless Broadband Data Service (CBDS); Addressing principles and related aspects for the CBDS".

3 Definitions and abbreviations

3.1 Definitions

For the purposes of this ETR, the definitions given in ETS 300 478 [3] and ETS 300 479 [4] apply.

3.2 Abbreviations

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

ATM	Asynchronous Transfer Mode
CBDS	Connectionless Broadband Data Service
CLAI	Connectionless Access Interface
CLNAP	Connectionless Network Access Protocol
CLNI	Connectionless Network Interface
CLNIP	Connectionless Network Interface Protocol
CLS	Connectionless Server
CRC	Cyclic Redundancy Check
DA	Destination Address
GAA	Group Address Agent
GAP	Group Addressed CLNAP PDU
HCe	external Hop Count (inter-domain)
HCi	internal Hop Count (intra-domain)
IA	Individual Address
IGAP	Individually Group Addressed PDU
LOCi	Location i ($i \in \{1, 2, 3\}$)
NGA	Nested Group Address
NGAA	Nested Group Address Agent
NGAP	Nested Group Addressed PDU
NGID	NGAA Identifier
PDU	Protocol Data Unit
SMDS	Switched Multi-megabit Data Service

4 Framework and protocol for the hop count capability

4.1 General

In case of an error in routing tables, a PDU could circulate between networks or between nodes in a network endlessly contributing to the load or overload of the connectionless network(s). This is prevented by ageing the PDU via a hop count technique.

Hop counts are to be used at inter-network and intra-network levels:

- at inter-network level, the hop count is named external Hop Count (HCe); networks need to update the HCe received from other networks and forward the updated count, if it did not reach 0, to the following network on the route to the destination. The originating network or domain needs to initialise the HCe when it has to send the CLNIP PDU to another network/domain. In order to minimise interworking complexity with other connectionless networks (e.g. Switched Multi-megabit Data Service (SMDS)), a convenient location for the HCe is in the HE-Post PAD (Location 1 (LOC1));

- at intra network level hop count is more a domain matter. The field dedicated for this purpose is named internal Hop Count (HCi). HCi is initialised in the ingress Connectionless Server (CLS) of a domain and decremented by the other CLSs of the domain. When the HCi reaches 0, the CLNIP PDU is discarded.

At intra-network level, the HCe value shall not be altered.

NOTE: A single field would serve the same purpose efficiently, however, interworking with SMDS would become more complicated.

Two options are available to an operator inside its domain for the HCi:

- the first uses a subfield (LOC2) in the HE-PostPAD. This subfield is only available in encapsulating PDUs;

- the second uses a subfield (LOC3) of the reserved field. In non encapsulating PDUs, it is the only field which does not affect a possible Cyclic Redundancy Check (CRC). This option is applicable for both encapsulating and non encapsulating PDUs.

Figure 1 illustrates the use of the hop count.

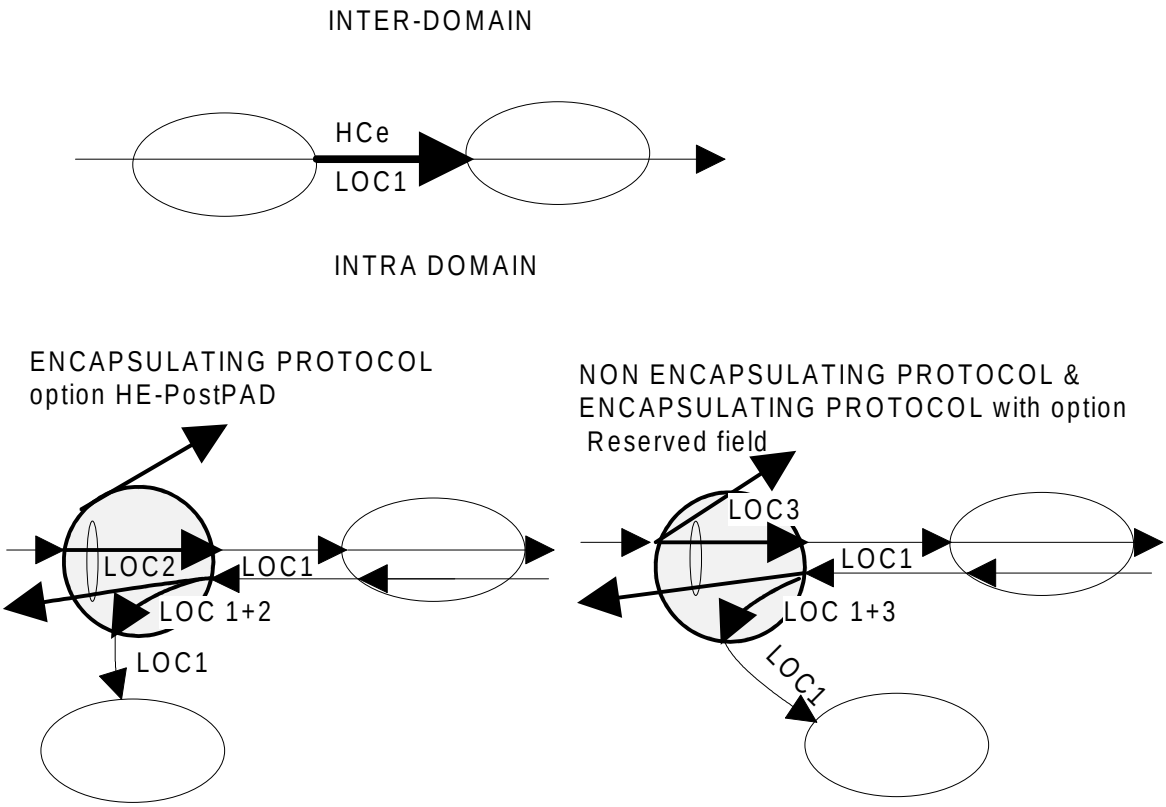


Figure 1

4.2 Operation of the hop counts

4.2.1 Operation rules

A node which does not handle the hop count functionality is transparent to the received value of any potential hop count location defined. If it encapsulates a received PDU it puts by default zero in the following fields:

- Reserved;
  HE-PostPAD except for the version subfield (see subclause 6.4.10 of ETS 300 479 [4]), which carry the above hop counts (this results from ETS 300 478 [3] and ETS 300 479 [4]).

For a node, which handles the hop count functionality, the hop count process is as follows:

```
if hop count is 0:
    initialisation of the hop count
else
    decrementation by one of the hop count
endif
if hop count is 0
    discard the PDU
else
    continue PDU handling
endif
```

This general procedure applies to both HCi and HCe.

4.2.2 HCi

The following configuration parameters direct the processing of HCi for the different interfaces:

- **Connectionless Access Interface (CLAI):**
  no parameter.

- **Connectionless Network Interface (CLNI) intra-domain outgoing (from the CLS):**
  parameter: HCi location & processing mode:
  - Reserved field and normal processing;
  - HE-PostPAD and normal processing;
  - HE-Post PAD and forced resetting.

- **CLNI inter-domain incoming (to the CLS):**
  parameter: HCi location to initialize:
  - Reserved field;
  - HE-PostPAD field.

Handling of HCi is as follows:

- **for a Connectionless Network Access Protocol (CLNAP) PDU received over a CLAI:**
  no action.

- **for a CLNIP PDU received over an incoming CLNI inter-domain:**
  initialise the field designated by the value of parameter “HCi location to initialise” for the interface.

- **for a CLNIP PDU to be sent over an outgoing CLNI inter-domain:**
  set to 0 the location HCi in the HE-PostPAD.

- **for a CLNIP PDU to be sent over an outgoing CLNI intra-domain:**
  if the value of the parameter “location & processing mode” of the interface is “Reserved field and normal processing” or “HE-PostPAD field and normal processing” then

  process HCi

  else
  set to 0 the HE-PostPAD HCi location

  end if

4.2.3 HCe

The following configuration parameters direct the processing of HCe for the different interfaces:

- **CLNI inter-domain incoming (to CLS):**
  no parameter.

- **CLNI inter-domain outgoing (from the CLS):**
  parameter: processing mode:
  - normal;
  - set HCe to 0.

Handling of HCe is as follows:

- **for a CLNI-PDU received over an incoming CLNI inter-domain:**
  no action.

- **for a CLNIP-PDU to be sent over an outgoing CLNI inter-domain:**
  if the parameter “processing mode” value of the interface is “normal” then

    process HCe
  else

    set HCe to 0

  end if

  NOTE 1: The HCi location of the HE-PostPAD is set by default to 0 before emitting a CLNIP PDU over a CLNI inter-domain.

  NOTE 2: The operation of the hop count is compatible for both networks which are transparent to the field or networks which set it to 0.

4.2.4 Multicast PDUs

Group Addressed CLNAP PDU (GAP) from the user to the Group Address Agent (GAA):

- the HCs for this PDU are handled as described above in the networks between the originating network and the GAA.

PDUs generated in the GAA after resolution:

- when a network, after resolution of a group address PDU, either complete or partial, generates Nested Group Addressed PDU(s) (NGAP(s)) towards other network(s) and/or Individually Group Addressed PDU(s) (IGAP(s)) towards other member(s) outside its domain, it shall initialise in these PDUs the HCe, and the HCi, if relevant, as described above for a network which supports the hop count functionality.

5 Framework and protocol for the enhanced multicast capability

The use of nested group addresses to perform CBDS multicast is described in ETS 300 479 [4] and ETR 260 [5]. It allows a more efficient multicast by delegating to participating networks the task of doing the multicast in their own domain.

NOTE: For each group address G, there is one network acting as the GAA.

The purpose of the enhanced multicast capability is to improve this process by allowing a network which has a nested group address set up in relation with a given group address to start the multicast (also known as "local multicast" or "preresolution") in his domain (by using its nested group address) before sending the group-addressed PDU to the network which is the GAA of the group.

The operation of the enhanced multicast capability is fully compatible with the existing multicast capability (see ETS 300 479 [4] and ETR 260 [5]). A network not using this additional feature will go on relaying the group-addressed CLNIP PDUs as usual.

5.1 Required configuration information

For a given group address G, a certain service provider is the GAA for this particular group. It is possible (nested group addresses approach) that another service provider (Nested Group Address Agent (NGAA)) is participating in the group address resolution process, and that this service provider creates a nested group address NG associated with G. In further steps, new nested group addresses associated with NG can be created, yielding multiple-level address-resolution trees.

In the enhanced multicast functionality, each of these NGAAs is identified by a NGAA Identifier (NGID), which is relative to the group address G. This NGID value shall always be non-zero. A new NGID value is allocated by the GAA each time a nested group address relative to G is created (even through several levels of hierarchy). Each NGID is unique for a given group address G, but its significance is purely limited to this group address. The goal of the NGID is to allow an unambiguous identification of each service provider taking part in the resolution of the group address G.

For the group address G, the following information is required:

- for each nested group address NG_i associated with G: a couple (NG_i, NGID).

This information is held by the GAA of the group address G.

For a nested group address NG_i associated with the group address G (even through multiple levels of hierarchy), the following information is required:

- the group address G;

- for each nested group address $NG_{i;j}$ associated with NG_i, a couple ($NG_{i;j}$, NGID).

Therefore, the NGAA for NG_i has to get a value of NGID from the GAA of G each time it creates an nested group address associated with NG_i.

5.2 Procedures

With the enhanced multicast functionality, a service provider's network processes all group-addressed CLNIP PDUs, whether or not the group Destination Address (DA) in the CLNIP encapsulating header belongs to its domain.

An encapsulating CLNIP PDU is first built with its NGID field set to 0.

In the following descriptions, the text in boxes is applicable only to entities (GAA and NGAA) aware of the enhanced multicast. The remainder of the text captures the behavior of the entities when the "centralized database with nested group address" approach as specified in ETS 300 479 [4] and ETR 260 [5] is used.

The following notation is used:

- NGID (NG_i): this is the value of the NGID associated with the nested group address NG_i;

- CLNIP PDU field names are in ***bold italic*** (example: ***DA***).

5.2.1 GAA's resolution algorithm

```
IF DA = G THEN
        FOR each individual address IAi associated with G
            send a copy of the PDU with DA=IAi
        END FOR
        FOR each nested group address NGi associated with G
            IF NGID = NGID(NGi) THEN
                do nothing
            ELSE
                send a copy of the PDU with DA = NGi
            END IF
        END FOR
END IF
```

5.2.2 NGAA's resolution algorithm

This section describes the operation of the NGAA for the group address NG which is a nested group address associated with the group address G.

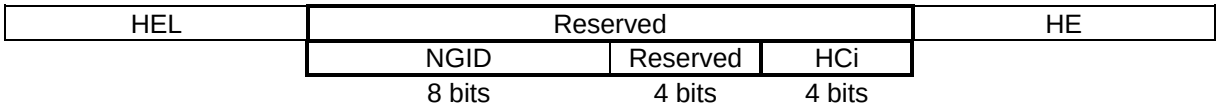
```
IF DA = NG AND NGID ≠ NGID(NG) THEN
        FOR each individual address IAi associated with NG
            send a copy of the PDU with DA = IAi
        END FOR
        FOR each nested group address NGi associated with NG
            IF NGID ≠ NGID(NGi) THEN
                send a copy of the PDU with DA = NGi
            END IF
        END FOR

ELSE IF DA = NG AND NGID = NGID(NG) THEN
    discard the PDU

ELSE IF DA = G AND (NGID = 0 OR the NGID of one of the nested group addresses NGi
associated with NG) THEN
        FOR each individual address IAi associated with NG
            send a copy of the PDU with DA = IAi
        END FOR
        FOR each nested group address NGi associated with NG
            IF NGID ≠ NGID(NGi) THEN
                send a copy of the PDU with DA = NGi
            ENDIF
        END FOR
        forward a copy of the PDU in the direction of the GAA with :
            DA = G and NGID = NGID (NG)

ELSE
        forward a copy of the PDU in the direction of the GAA with the DA and NGID fields
unchanged
ENDIF
```

6 CLNIP fields

6.1 Reserved field

This text supersedes the existing subclause 6.4.8 of ETS 300 479 [4]. This field is used by the additional capabilities of CBDS; its default value is '0'.

The 8 higher order bits of the reserved field are the NGID subfield and are used for enhanced multicast described in clause 5. In non-encapsulating PDUs, the 4 lower order bits of this field are used to carry a hop count internal (HCi) to a network described in clause 4.



6.1.1 HCi

The HCi represents the number of CLNIs intra-domain that a given CLNIP-PDU can cross before being considered as looping. It is initialised in the ingress CLS of a network and decremented by one by the other CLSs of the domain. If the HCi becomes 0 before the CLNIP PDU reaches the egress CLS (it is the last CLS the PDU visits before leaving the network over a CLAI or CLNI inter-domain), the CLNIP PDU is discarded. The initial value shall be in the range [1,15] and shall be configurable: its default value is 15.

When the HCi functionality is supported but this location is not used for the HCi subfield (see clause 4) its content is not constrained by this document.

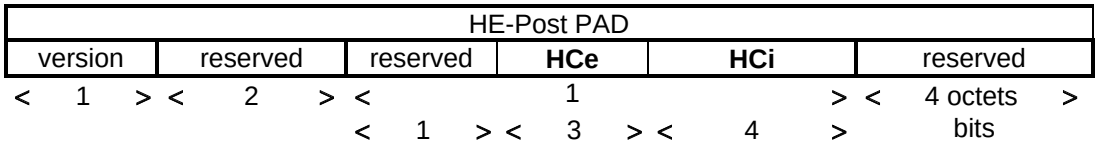
When the HCi functionality is not supported, the CLNIP entity shall force the corresponding subfield to 0 (whether encapsulating or not) to prevent mishandling.

6.1.2 NGID

The 8-bit wide NGID subfield of the Reserved field is used by the enhanced multicast capability to carry the identification (NGID value) of the last network which did a partial resolution on the destination Group Address of the encapsulated CLNAP PDU.

6.2 HE-Post-PAD

In addition to subclause 6.4.10 of ETS 300 479 [4], the remainder of the HE-Post-PAD is structured to provide two subfields, one for HCe and one for HCi:



6.2.1 HCe

The HCe represents the number of CLNIs inter-domain that a given CLNIP PDU could cross before being considered as looping.

The HCe is initialised by the originating network and decremented once by each transit network the CLNIP PDU crosses. If the HCe becomes 0, the CLNIP PDU is discarded. The initial value of the HCe shall be in the range [1,7] and shall be configurable: the default value is 7.

6.2.2 HCi

When the HCi functionality is supported but this location is not used for the HCi subfield (see clause 4) its content is not constrained by this document.

History

Document history	
January 1996	First Edition

ISBN 2-7437-0469-1
Dépôt légal : Janvier 1996