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DPNSS/DASS 2 extensions to the IUA protocol
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Abstract

   This document defines a mechanism for backhauling of DPNSS [2] and
   DASS2 [3] messages over IP by extending the ISDN User Adaptation
   Layer Protocol [1]. This document aims to become an Appendix to
   IUA [1] and to be the base for a DPNSS/DASS User Adaptation (DUA)
   implementation.

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1.0 Introduction

This document describes a method of implementing DPNSS [2] and
DASS 2 [3] backhaul messaging over IP using a modified version
of the ISDN User Adaptation Protocol (IUAP) [1]. The DUA builds
on top of IUA defining the necessary extensions to IUA for a
DPNSS/DASS2 implementation.

1.1 Scope

There is a need for Switched Circuit Network (SCN) signaling
protocol delivery from a DPNSS Signaling Gateway (SG) to a Media
Gateway Controller (MGC). The delivery mechanism should support the
following protocols:

     - DPNSS (Digital Private Network Signaling System) [2]
     - DASS 2 (Digital Access Signaling System No 2) [3]

Unless specifically mentioned, the details in this document are
applicable to both DPNSS and DASS2.

1.2 Terminology

Data channel (D-channel) - A 64 kbit/s time slot which functions
as a common signaling channel on a 2048 kbits/s interface or a
1544 kbits/s interface which is provisioned to carry DPNSS
signaling.

DPNSS channel - Time slots 1 to 15 and 17 to 31 on a 2048
kbits/s interface or Time slots 1 to 23 on a 1544 kbits/s
interface are termed as DPNSS channels. These are the
traffic channels which carry voice or data traffic.

        - DPNSS supports 60 Channels (30 Real and 30 Virtual)
        - DASS2 supports 30 Channels (All Real)

   Data Link Connection(DLC) - A DLC is the level 2 process that
   controls the transfer of level 3 messages on behalf of one
   DPNSS channel. A DLC uniquely identifies one DPNSS channel.
        - DPNSS supports 60 DLCs (30 Real and 30 Virtual)
        - DASSII supports 30 DLCs (All Real)

   DPNSS Link - A logical collection of the D-channel and the
   associated DPNSS channels in a 2048 kbits/s interface or a
   1544 kbits/s interface is called a "DPNSS Link".

1.3 DPNSS Overview

   DPNSS is an industry standard interface (reference BTNR 188) [2]
   defined between a PBX and an Access Network (AN). DPNSS extends
   facilities normally only available between extensions on a single
   PBX to all extensions on PBXs that are connected together in a
   private network. DPNSS was originally derived from BT's Digital
   Access Signaling System I (DASS I) enhanced where necessary to
   meet the private network requirements. Some of these enhancements
   were incorporated in DASS 2 [3]. DPNSS uses a 2048 kbits/s or
   1544 kbits/s Digital Transmission System Interface as shown in
   Figure 1 below.

```
          ----------               ----------         o--o
          |        | 2048 kbits/s |         |------- /\
          |        |--------------|         |          --
          |  PBX   | 1544 kbits/s |  AN     |
          |        |--------------|         |         o--o
          |        |              |         |------- /\
          ----------               ----------         --
```

                        Figure 1

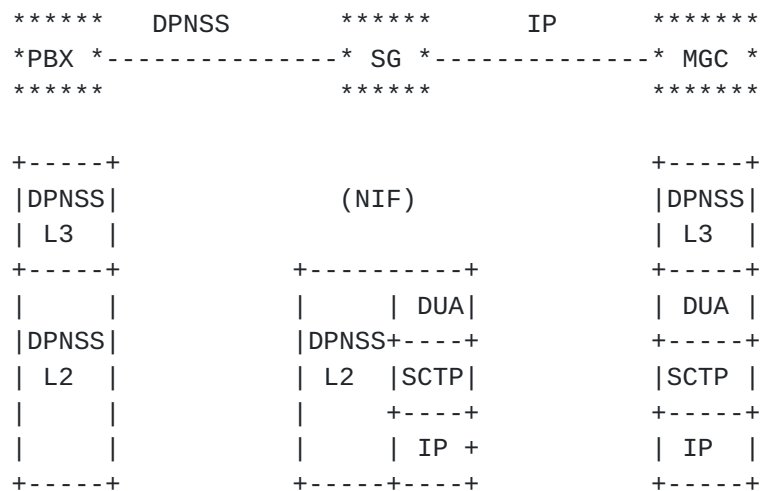   Channel 16 on a 2048 kbits/s interface and channel 24 on a
   1544 kbits/s interface is reserved for data communication
   between LE and AN. The channels reserved for data are called
   "Data Channels" or "D-Channels."

   The D-Channels are the physical media to exchange data between the
   DPNSS protocol peer entities. A logical collection of the D-channel
   and the associated DPNSS channels is called a "DPNSS Link".

1.4 **Proposed DPNSS Backhaul Architecture**

```
           ******    DPNSS        ******      IP     *******
           *PBX *---------------* SG *--------------* MGC *
           ******                ******            *******


           +-----+                              +-----+
           |DPNSS|              (NIF)            |DPNSS|
           | L3  |                               | L3  |
           +-----+           +----------+        +-----+
           |     |           |     | DUA|        | DUA |
           |DPNSS|           |DPNSS+----+        +-----+
           | L2  |           | L2  |SCTP|        |SCTP |
           |     |           |     +----+        +-----+
           |     |           |     | IP +        | IP  |
           +-----+           +-----+----+        +-----+


        NIF  - Nodal Interworking function
        SCTP - Stream Control Transmission Protocol
        DUA  - DPNSS User Adaptation Layer Protocol
```

2.0 **Changes from IUA**

   This section outlines the differences between DUA and IUA.

2.1 **New Message Class for DUA**

   The DPNSS/DASS2 Layer 2 to Layer 3 primitives [2] [3] need to be
   handled in a different way from the IUA boundary primitive transport
   messages and the boundary primitive transport messages of other
   IUA extensions (i.e. V5 or GR-303). Therefore, it is neccessary to
   distinguish between these from other IUA-based boundary primitive
   transport message types [1] by means of the Message Class parameter.

   For all DPNSS/DASS2 interface boundary primitives, a new Message
   Class is introduced:

        10   DPNSS/DASS2 Boundary Primitives Transport Messages
               (DPTM)

   Similar to IUA, other valid message classes for DUA are:

        0   Management (MGMT) Message
        3   ASP State Maintenance (ASPSM) Messages
        4   ASP Traffic Maintenance (ASPTM) Messages

2.2 **Message Header**

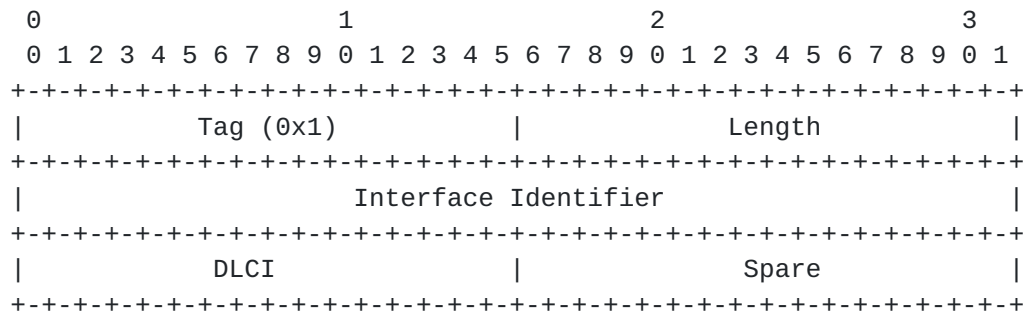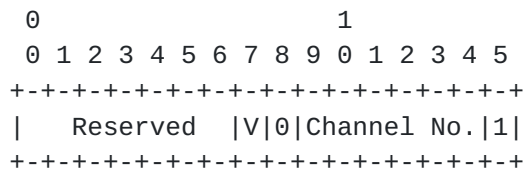IUA Message header [1] has the format as shown in Figure 2 below.

```
  0                   1                   2                   3
  0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
 +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
 |            Tag (0x1)           |             Length            |
 +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
 |                     Interface Identifier                      |
 +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
 |             DLCI              |             Spare              |
 +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

                    Figure 2 IUA Message Header

In DUA header DLCI field has a different format in accordance with
the BTNR 188 [2].

```
      0                   1
      0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5
     +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
     |   Reserved   |V|0|Channel No.|1|
     +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```


Reserved: 7 bits

Should be set to all '0's and ignored by the receiver.

V-bit: 1 bit

The V-bit is used to determine whether the message is for
a particular DLC or it is applicable for all the DLCs in the
carrier. The possible values of the V-bit are listed below:

        Value   Description
          0   Action is to be performed on all DLCs
                        Channel number parameter is ignored.
          1   Action is to be performed on a single
                        DLC specified by channel number.

This V-bit value is used only by the Establish and Release
messages. Data messages should ignore this value. This indicator
is provided so that a single command can be issued to establish or
release all the DLCs in one DPNSS Link.

For Channel Number (Channel No.), the valid values are 0 to 63 for
DPNSS and 0 to 31 for DASS 2. This is because DASS 2 does not

support virtual DLCs and hence has only 32 DLCs.

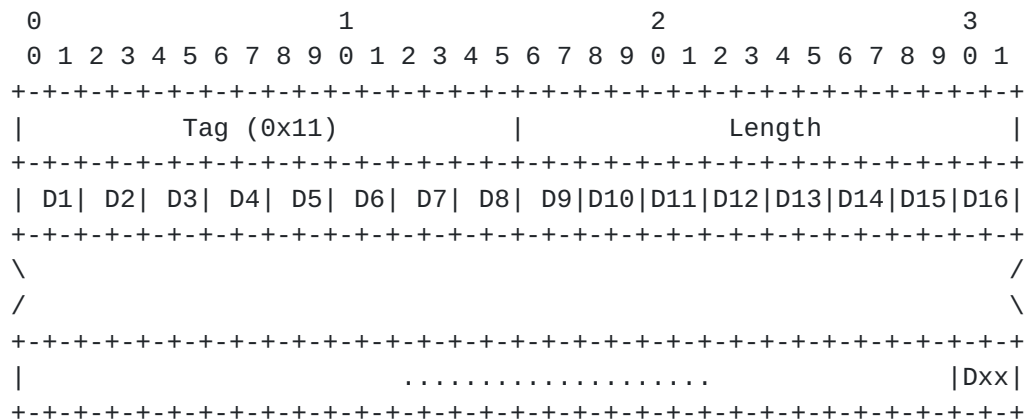**2.3** **Unit Data Message**

   DPNSS layer 2 does not have a unit data primitive and hence the

Unit Data Messages (Request, Indication) are invalid for a DUA
application.

2.4   DLC Status Message

For DUA, a new message is necessary to carry the status of the DLCs.
This message will be a Management message (i.e. its message class
will be a value of 0 for Management). A message type of 0x5 will be
used for this message.

The DLC Status messages are exchanged between IUA layer peers to
request, confirm and indicate the status of the DLCs. The DLC
Status messages contain the common message header followed by IUA
message header as described in section 2.1.


```
 0                   1                   2                   3
 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|          Tag (0x11)           |             Length            |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
| D1| D2| D3| D4| D5| D6| D7| D8| D9|D10|D11|D12|D13|D14|D15|D16|
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
\                                                               /
/                                                               \
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                   ...................                    |Dxx|
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```


The parameter carries the status of DLCs using two bits for each
DLC.

The possible values for the two bits are shown below:

```
        Value           Description
         00          Out Of Service
         01          Reset Attempted
         10          Reset Completed
         11          Information Transfer
```

For DASS 2 the value 00 (Out Of Service) is invalid since the DASS 2
DLC does not have this state.

For DASS 2 there are no virtual DLCs and hence information about
only 32 DLCs need to be carried. Therefore the status message will
have a length of 12 for a DASS 2 DLC Status message.

2.5 Error Message

The ERR message is sent when an invalid value or unrecognized
message is found in an incoming message.

The Error Code parameter indicates the reason for the Error Message.
These are the supported values in IUA.

        Invalid Version   0x01
        Invalid Interface Identifier   0x02
        Unsupported Message Class   0x03
        Unsupported Message Type   0x04
        Unsupported Traffic Handling Mode   0x05
        Unexpected Message   0x06
        Protocol Error   0x07
        Unsupported Interface Identifier Type   0x08
        Invalid Stream Identifier   0x09
        Unassigned TEI   0x0a
        Unrecognized SAPI   0x0b
        Invalid TEI, SAPI combination   0x0c

In DUA the error codes 0x0a to 0x0c are invalid as they are specific
to ISDN.

The following additional error codes are supported in DUA:

        Channel Number out of range   0x16
        Channel Number not configured   0x17

The "Channel Number out of range" error is sent if a message is
received with a channel number greater than 63 for DPNSS or 31 for
DASS 2.

The "Channel Number not configured" error is sent if a message is
received with a channel number that is not configured.

3.0 IANA Considerations

A request will be made to IANA to assign a DUA value for the SCTP
Payload Protocol Identifier field used in SCTP Payload Data chunks.
The following SCTP Payload Protocol Identifier will be registered:

        DUA   "??"

The SCTP Payload Protocol Identifier is included in each SCTP Data
chunk, to indicate which protocol the SCTP is carrying. This Payload
Protocol Identifier is not directly used by SCTP but may be used by
certain network entities to identify the type of information being

carried in a Data chunk.

The User Adaptation peer may use the Payload Protocol Identifier as a way of determining whether the message is for IUA or DUA.

4.0 Message Sequence in DUA

An example of the message flows for establishing a data link on a signaling channel, passing PDUs and releasing a data link on a DPNSS channel is shown below. An active association between MGC and SG is established prior to the following message flows.

4.1 Resetting of single DLC

```
    i)  Successful
     PBX                      SG                      MGC
         <----------- SABMR          <----------- Est Req(Ind=1)
      UA    ----------->       Est Cfm -----------> (DLC in RC State)
                                 Ind=1)


    ii) Unsuccessful(Link Failure)
        PBX                      SG                      MGC
         <----------- SABMR          <----------- Est Req(Ind=1)
         Retransmissions over
         NT1 and NT2 expired
                              Rel Ind -----------> (DLC in RA state)
                           (RELEASE_PHYS,Ind=1)
```

4.2 Resetting all DLCs in a link

```
       PBX                      SG                      MGC
         <----------- SABMR(1)    <----------- Est Req(Ind=0)
         <----------- SABMR(2)
         <----------- SABMR(3)
         .............
         <----------- SABMR(N)
         In each DLC either
         UA is received or
         NT1/NT2 is expired
                              Est Cfm -----------> (Status of DLCs
                               (Ind=0)               are not updated )
                                     <----------- Status Req
                           Status cfm ---------> (Mark DLC status
                                                   based on
                                                   status bits)
```

4.3 Information Transfer on a DLC

```
          PBX                      SG                      MGC
            <----------- UI(C)         <----------- Data Req
        UI(C)----------->       Data Ind ----------->
```

4.4 Link Takedown(Single DLC)

```
          PBX                      SG                      MGC
            (For DPNSS, mark DLC as OOS)   <----------- Rel Req
            (For DASSII, mark DLC as RA)         (RELEASE_MGMT,
                                                     Ind=1)
                               Rel Cfm  ---------->
                               (Ind=1)
```

4.5 **Link Takedown(All DLCs)**

```
        PBX                     SG                      MGC
         (For DPNSS, mark all DLCs as OOS) <-------- Rel Req
         (For DASSII, mark DLC as RA)              (RELEASE_MGMT,
                                                       Ind=0)
                          Rel Cfm   ---------->
                          (Ind=0)
```

4.6 **Getting link Status**

```
        PBX                     SG                      MGC
                          <-----------  Stat Req
                    Stat Res -----------> (Mark DLC status
                                            based on
                                            status bits)
```

4.7 **Error conditions**

```
        PBX                     SG                      MGC
                     Invalid Message <-----------Est/Rel/Data/-
                                                     Stat Req
                       Error Ind   ----------->
                       (Error Code)
```

5.0 **Glossary of terms**

```
        Real channel   : The signalling channel with associated
                         traffic channel (TS).
        Virtual channel: The signalling channel with no
                         associated traffic channel.
        NT1            : Retransmission period of 500msec.
        NT2            : Recommended value is 64.
```

6.0 **Security Considerations**

The security considerations discussed for the ISDN User Adaptation
Protocol (IUAP) [1] Section 6.0 apply to this document as well.

7.0 **References**

[1] Morneault, et al., "ISDN Q.921-User Adaptation Layer", RFC 3057,
February 2001.

[2] BTNR (British Telecom Network Requirements) 188 Issue 6 Digital
Private Network Signaling System 1.

[3] BTNR (British Telecom Network Requirements) 190 Issue 2
Digital Access Signaling System No 2

   [4] ETS 300 167 (08/1993) : Transmission and Multiplexing;
        Functional characteristic of 2048 kbits/s interfaces
        (Standard is based on G.704, G.706).

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8.0 Acknowledgments

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