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The Transmission of Flow Labelled IPv4 on ATM Data Links

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Abstract

   This document specifies the manner for transmitting IPv4 datagrams
   over an ATM data link, both in a default manner and in the presence
   of flow labelling via Ipsilon Flow Management Protocol [IFMP].

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Introduction

   This document specifies the manner for transmitting IPv4 datagrams
   over an ATM data link, both in a default manner and in the presence
   of flow labelling via Ipsilon Flow Management Protocol [IFMP]. ATM
   specific functions such as OAM cells, the CLP bit, and ABR RM cells
   are not used. There are no reserved VCIs other than VPI = 0, VCI =
   0, which indicates an unassigned cell; and VPI = 0, VCI = 16, which
   is used for the default encapsulation. IFMP messages must be sent
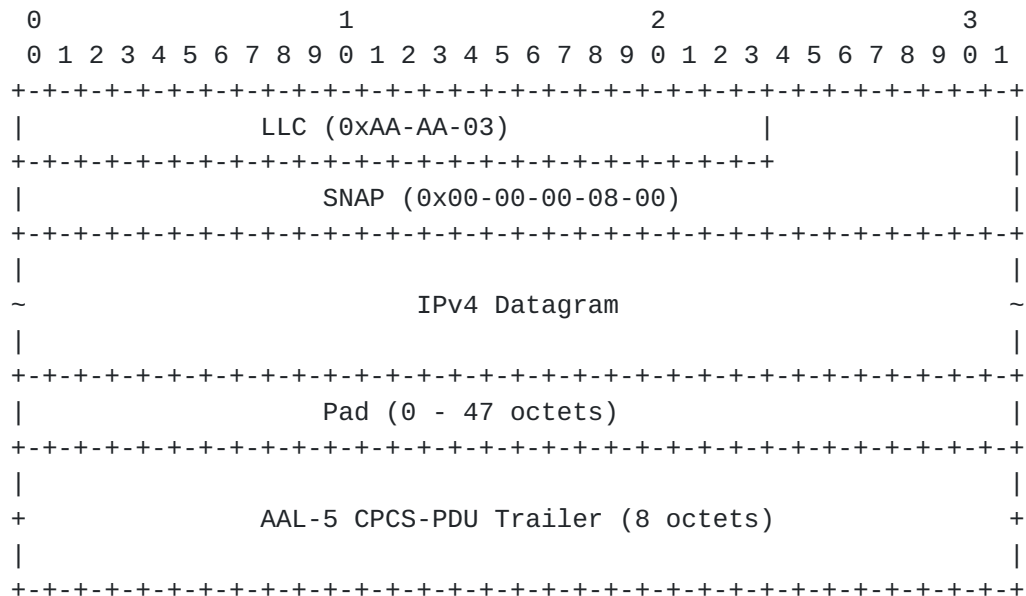   using the default encapsulation.

1. **Labels**

   Labels, as carried by IFMP, are realized on an ATM data link as
   specific VPI/VCIs. The format of the Label field for ATM labels is:

```
 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
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|Reservd|         VPI           |             VCI               |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

   The low order 16 bits of the label correspond to the VCI, with the
   least significant bit of the Label field corresponding to the least
   significant bit of the VCI. If the link cannot support a full 16 bit
   VCI the unused bits of the VCI must be the most significant bits and
   they must be set to zero.

   The next 12 higher order bits of the label correspond to the VPI,
   with the least significant of these bits corresponding to the least
   significant bit of the VPI. If the link cannot support a full 12 bit
   VPI, then the unused bits of the VPI must be the most significant
   bits and they must be set to zero. The most significant four bits of
   the label are reserved. They should be set to zero by the sender and
   ignored by the receiver.

2. **Default Encapsulation**

   The default encapsulation for IPv4 packets on ATM data links is the
   LLC/SNAP encapsulation specified in section 4.1 "LLC encapsulation
   for routed protocols" of RFC 1483 [RFC1483]. Such frames begin with
   the octets 0xAA 0xAA 0x03 0x00 0x00 0x00 0x08 0x00 (the LLC/SNAP
   header for IPv4). The LLC/SNAP header is prefixed to the IP datagram
   and the entire packet is encapsulated within the payload of an AAL-5
   CPCS-PDU as specified in RFC 1483 and illustrated 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
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|               LLC (0xAA-AA-03)            |                   |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+                  |
|               SNAP (0x00-00-00-08-00)                         |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                                                               |
~                       IPv4 Datagram                           ~
|                                                               |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                     Pad (0 - 47 octets)                       |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                                                               |
+               AAL-5 CPCS-PDU Trailer (8 octets)              +
|                                                               |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

The maximum transmission unit (MTU) of an IPv4 datagram using the
default encapsulation is 1500 octets.

Frames using the default encapsulation are sent to: VPI = 0, VCI =
16.

3. **Flow Type 0 Encapsulation**

All IPv4 frames using Flow Type 0 are encapsulated within the payload
of an AAL-5 CPCS-PDU. This is the null encapsulation of section 5.1
"VC based multiplexing of routed protocols" from RFC 1483 [RFC1483].
There is no LLC/SNAP header. The first octet of the frame
corresponds to the first octet of the IPv4 datagram (i.e., the octet
that contains the IP version number (4) and Internet Header Length
(IHL)). The IP datagram is encapsulated within the payload of an
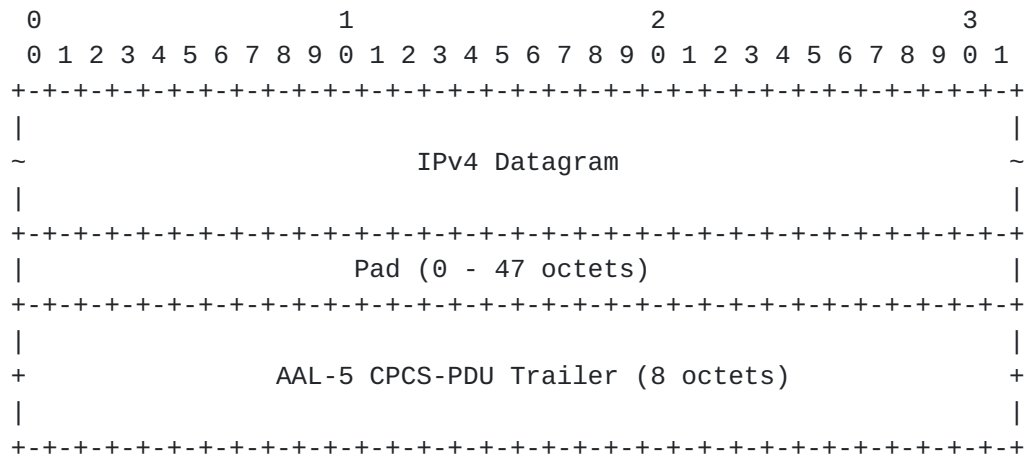AAL-5 CPCS-PDU as specified in RFC 1483 and illustrated below:

```
 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
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                                                               |
~                        IPv4 Datagram                          ~
|                                                               |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                     Pad (0 - 47 octets)                       |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                                                               |
+               AAL-5 CPCS-PDU Trailer (8 octets)              +
|                                                               |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

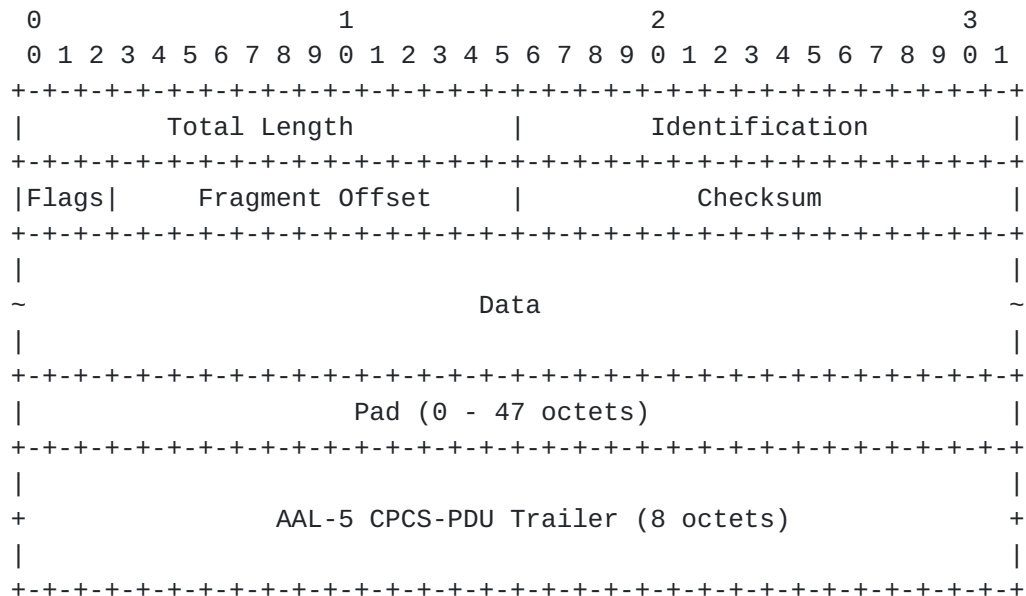The MTU of an IPv4 datagram using Flow Type 0 encapsulation is 1500 octets.

Frames using Flow Type 0 encapsulation are sent to the VPI/VCI specified in the Label field of the corresponding IFMP Flow Type 0 Redirect message element [IFMP].

4. **Flow Type 1 Encapsulation**

All IPv4 frames using Flow Type 1 are encapsulated directly in the payload of an AAL-5 CPCS-PDU. This is the null encapsulation of section 5.1 "VC based multiplexing of routed protocols" from RFC 1483 [RFC1483]. There is no LLC/SNAP header. Also, the following fields of the IP header are not transmitted: Version, Internet Header Length (IHL), Type of Service (TOS), Time to Live (TTL), Protocol, Source Address, and Destination Address. In addition, the first 4 octets immediately following the IP header (as determined by the IHL field) are not transmitted. (These 4 octets correspond to the source and destination ports for TCP and UDP datagrams.) The value of the Total Length field is not changed; it remains the total length of the IP datagram before the above fields were removed. The transmitted value of the Checksum field is the checksum value that would have been computed for the entire IP header if the TTL field had been set to zero (i.e., the actual value of the TTL field is "subtracted", using one's-complement arithmetic, from the Checksum before transmission).

The IP datagram is encapsulated within the payload of an AAL-5 CPCS-PDU as specified in RFC 1483 and illustrated 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
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|           Total Length        |          Identification       |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|Flags|    Fragment Offset      |            Checksum           |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                                                               |
~                           Data                                ~
|                                                               |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                      Pad (0 - 47 octets)                      |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                                                               |
+               AAL-5 CPCS-PDU Trailer (8 octets)              +
|                                                               |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```
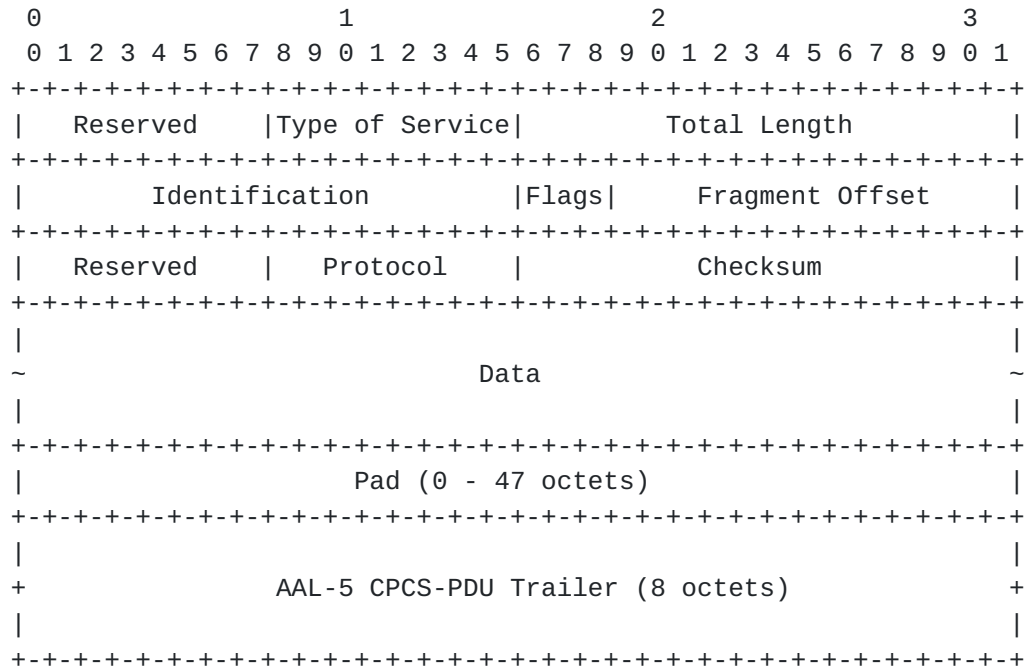
The MTU of the IPv4 datagram using Flow Type 1 encapsulation is 1484
octets (1500 octets minus the 16 octets specified above).

Frames using Flow Type 1 encapsulation are sent to the VPI/VCI
specified in the Label field of the corresponding IFMP Flow Type 1
redirect message element [IFMP].

5. **Flow Type 2 Encapsulation**

All IPv4 frames using Flow Type 2 are encapsulated directly in the
payload of an AAL-5 CPCS-PDU. This is the null encapsulation of
section 5.1 "VC based multiplexing of routed protocols" from RFC 1483
[RFC1483]. There is no LLC/SNAP header. Also, the following fields
of the IP header are not transmitted: Version, Internet Header Length
(IHL), Time to Live (TTL), Source Address, and Destination Address.
The first 4 octets immediately following the IP header (as determined
by the IHL field) are transmitted. (These 4 octets correspond to the
source and destination ports for TCP and UDP datagrams.) The value of
the Total Length field is not changed; it remains the total length of
the IP datagram before the above fields were removed. The
transmitted value of the Checksum field is the checksum value that
would have been computed for the entire IP header if the TTL field
had been set to zero (i.e., the actual value of the TTL field is
"subtracted", using one's-complement arithmetic, from the Checksum
before transmission).

The IP datagram is encapsulated within the payload of an AAL-5 CPCS-
PDU as specified in RFC 1483 and illustrated 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
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|   Reserved    |Type of Service|         Total Length          |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|        Identification         |Flags|      Fragment Offset    |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|   Reserved    |   Protocol    |           Checksum            |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                                                               |
~                             Data                              ~
|                                                               |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                      Pad (0 - 47 octets)                      |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                                                               |
+               AAL-5 CPCS-PDU Trailer (8 octets)              +
|                                                               |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

The Reserved fields are not used and should be set to zero by the
sender and ignored by the receiver.

The MTU of the IPv4 datagram using Flow Type 2 encapsulation is 1492
octets (1500 octets minus the 8 octets specified above).

Frames using Flow Type 2 encapsulation are sent to the VPI/VCI
specified in the Label field of the corresponding IFMP Flow Type 2
redirect message element [IFMP].

References

    [IFMP]   P. Newman, et. al., "The IFMP Protocol Specification for
              IPv4," Ipsilon Networks Inc., RFC-XXXX, February 1996.

    [RFC1483] J. Heinanen, "Multiprotocol Encapsulation over ATM
              Adaptation Layer 5", RFC 1483, July 1993.

 SECURITY CONSIDERATIONS

    Security issues are not discussed in this document.

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