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GSMP Packet Encapsulations for ATM, Ethernet and TCP

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Abstract

This memo specifies the encapsulation of GSMP packets in ATM, Ethernet and TCP.

1. Introduction

GSMP packets are defined in [1] and may be encapsulated in several different protocols for transport. This memo specifies their encapsulation in ATM AAL-5, in Ethernet or in TCP. Other encapsulations may be defined in future version of this document or in other documents.

2. ATM Encapsulation

GSMP packets are variable length and for an ATM data link layer they are encapsulated directly in an AAL-5 CPCS-PDU [3] with an LLC/SNAP header as illustrated:

```
  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 (0x00-00-00-88-0C)                     |
 +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
 |                                                               |
 ~                         GSMP Message                          ~
 |                                                               |
 +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
 |                     Pad (0 - 47 octets)                       |
 +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
 |                                                               |
 +            AAL-5 CPCS-PDU Trailer (8 octets)                  +
 |                                                               |
 +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

(The convention in the documentation of Internet Protocols Error! Reference source not found. is to express numbers in decimal. Numbers in hexadecimal format are specified by prefacing them with the characters "0x". Numbers in binary format are specified by prefacing them with the characters "0b". Data is pictured in "big-endian" order. That is, fields are described left to right, with the most significant octet on the left and the least significant octet on the right. Whenever a diagram shows a group of octets, the order of transmission of those octets is the normal order in which they are read in English. Whenever an octet represents a numeric quantity the left most bit in the diagram is the high order or most significant bit. That is, the bit labelled 0 is the most significant bit. Similarly, whenever a multi-octet field represents a numeric quantity the left most bit of the whole field is the most significant bit. When a multi-octet quantity is transmitted, the most significant octet is transmitted first. This is the same coding convention as is used in the ATM layer [1] and AAL-5 [3].)

The LLC/SNAP header contains the octets: 0xAA 0xAA 0x03 0x00 0x00 0x00 0x88 0x0C. (0x880C is the assigned Ethertype for GSMP.)

The maximum transmission unit (MTU) of the GSMP Message field is 1492 octets.

The virtual channel over which a GSMP session is established between a controller and the switch it is controlling is called the GSMP control channel. The default VPI and VCI of the GSMP control channel for LLC/SNAP encapsulated GSMP messages on an ATM data link layer is:

```
VPI = 0
VCI = 15.
```

3. Ethernet Encapsulation

GSMP packets may be encapsulated on an Ethernet data link as illustrated:

```
    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
  +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
   |                      Destination Address                      |
   |                               +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
   |                               |                               |
   +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+                               |
   |                         Source Address                        |
   +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
   |     Ethertype (0x88-0C)       |                               |
   +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+                               |
   |                                                               |
   ~                         GSMP Message                          ~
   |                                                               |
   +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
   |                        Sender Instance                        |
   +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
   |                       Receiver Instance                       |
   +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
   |                              Pad                              |
   +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
   |                       Frame Check Sequence                    |
   +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

Destination Address

For the SYN message of the adjacency protocol the Destination Address is the broadcast address 0xFFFFFFFFFFFF. (Alternatively, it is also valid to configure the node with the unicast 48-bit IEEE MAC address of the destination. In this case the configured unicast Destination Address is used in the SYN message.) For all other messages the Destination Address is the unicast 48- bit IEEE MAC address of the destination. This address may be discovered from the Source Address field of messages received during synchronisation of the adjacency protocol.

Source Address

For all messages the Source Address is the 48-bit IEEE MAC address of the sender.

Ethertype

The assigned Ethertype for GSMP is 0x880C.

GSMP Message

The maximum transmission unit (MTU) of the GSMP Message field is 1492 octets.

Sender Instance

The Sender Instance number for the link obtained from the adjacency protocol. This field is already present in the adjacency protocol message. It is appended to all non- adjacency GSMP messages in the Ethernet encapsulation to offer additional protection against the introduction of corrupt state.

Receiver Instance

The Receiver Instance number is what the sender believes is the current instance number for the link, allocated by the entity at the far end of the link. This field is already present in the adjacency protocol message. It is appended to all non-adjacency GSMP messages in the Ethernet encapsulation to offer additional protection against the introduction of corrupt state.

Pad

The minimum length of the data field of an Ethernet packet is 46 octets. If necessary, padding should be added such that it meets the minimum Ethernet frame size. This padding should be octets of zero and it is not considered to be part of the GSMP message.

After the adjacency protocol has achieved synchronisation, for every GSMP message received with an Ethernet encapsulation, the receiver must check the Source Address from the Ethernet MAC header, the Sender Instance, and the Receiver Instance. The incoming GSMP message must be discarded if the Sender Instance and the Source Address do not match the values of Sender Instance and Sender Name stored by the "Update Peer Verifier" operation of the GSMP adjacency protocol. The incoming GSMP message must also be discarded if it arrives over any port other than the port over which the adjacency protocol has achieved synchronisation. In addition, the incoming message must also be discarded if the

Receiver Instance field does not match the current value for the Sender Instance of the GSMP adjacency protocol.

4. TCP/IP Encapsulation

GSMP messages may be transported over an IP network using the TCP encapsulation. TCP provides reliable transport, network flow control, and end-system flow control suitable for networks that may have high loss and variable or unpredictable delay. The GSMP encapsulation in TCP/IP also provides sender authentication using an MD5 digest.

For TCP encapsulations of GSMP messages, the controller runs the client code and the switch runs the server code. Upon initialisation, the server is listening on GSMP's TCCP port number: 6068. The controller establishes a TCP connection with each switch it manages. Adjacency protocol messages, which are used to synchronise the controller and switch and maintain handshakes, are sent by the controller to the switch after the TCP connection is established. GSMP messages other than adjacency protocol messages may be sent only after the adjacency protocol has achieved synchronisation.

4.1 Message Formats

GSMP messages are sent over a TCP connection. A GSMP message is processed only after it is entirely received. A four-byte TLV header field is prepended to the GSMP message to provide delineation of GSMP messages within the TCP stream.

```
  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
 +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
 |        Type (0x60-68)         |           Length              |
 |-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
 |                                                               |
 ~                         GSMP Message                          ~
 |                                                               |
 +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

Type

This 2-octet field indicates the type code of the following message. The type code for GSMP messages is 0x00-0C (i.e. the same as GSMP's Ethertype).

Length: This 2-octet unsigned integer indicates the total length of the GSMP message only. It does not including the 4-byte TLV header.

4.2 TCP/IP Security consideration

Security between the controller and client MUST be provided by IP Security [IPSEC]. In this case, the IPSEC Authentication Header(AH) SHOULD be used for the validation of the connection; additionally IPSEC Encapsulation Security Payload (ESP) MAY be used to provide both validation and secrecy.

5. Security Considerations

The security of GSMP's TCP/IP control channel has been addressed in Section 4.2. Security over ATM and Ethernet must be provided at the link layer.

References

[1] A. Doria, "General Switch Management Protocol," Internet-Draft draft-ietf-gsmp-06, July 2000. Work in Progress

[2] "B-ISDN ATM Layer Specification," International Telecommunication Union, ITU-T Recommendation I.361, Mar. 1993.

[3] "B-ISDN ATM Adaptation Layer (AAL) Specification," International Telecommunication Union, ITU-T Recommendation I.363, Mar. 1993.

[4] http://www.isi.edu/in-notes/iana/assignments/port-numbers

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