Liaison to IEEE RPRWG

SONET/SDH and OTN Generic Framing Procedure (GFP) Adaptation/Encapsulation of 802.17 MAC Clients

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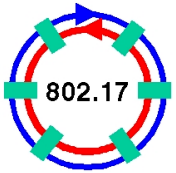
IEEE 802.17 - May 17, 2001



T1X1 Technical Subcommittee - Digital Hierarchy and Synchronization

- T1X1 is the ANSI T1 technical subcommittee responsible for network transport telecommunications standards development.
- Current Projects: GFP, OTN, ASTN/ASON, SONET/OTN Network Interface Synchronization Specifications
- Voting Organizations Represented:
  - Service Providers - AT&T, Bell Canada, BellSouth, Qwest, SBC, Sprint, Verizon, Worldcom, 360Networks, . . .
  - System Suppliers - Alcatel, Ciena, Cisco, Ericsson, Fujitsu, Hitachi, Lucent, Marconi, NEC, Nortel, Siemens, Tellabs, Zaffire
  - Others - AMCC, Corning, PMC-Sierra, Telcordia, Vitesse . . . .

T1X1 and ITU-T GFP Work History

- Initially proposed in 1999 as part of T1X1 Data over SONET (DoS) work project.
- Prior liaison to IEEE 802(.3) in October 1999 - “Generic Format for Carrying Ethernet MAC Frames over SONET”
- Became consolidated GFP proposal in July 2000 with proposed Ethernet, HDLC (IP/PPP) and Token Ring PDU clients. (**Frame-mapped GFP** client signal adaptation)
- Extended to block-coded clients (Fibre Channel, ESCON, FICON, Gigabit Ethernet, Infiniband..) in October 2000. (**Transparent GFP** client signal adaptation)

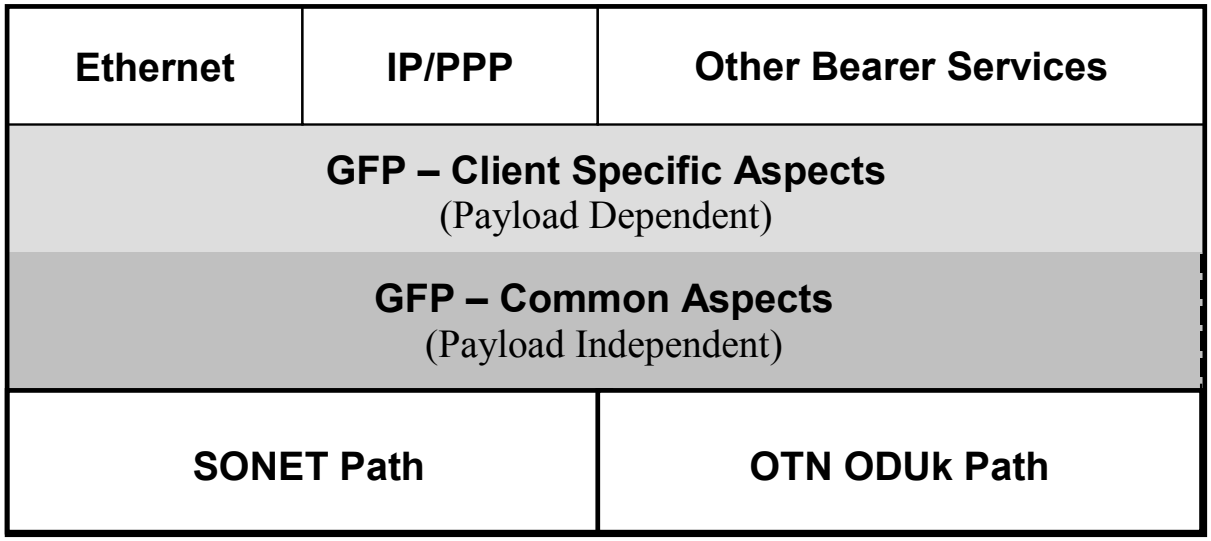
T1X1 and ITU-T Work Schedule on GFP Standardization

- T1X1 is lead committee contributing GFP standardization proposals to ITU-T Study Group 15 (Question 11).
- Most recent work on support of new specific block-coded client transparent mappings and per-client fault management.
- Latest GFP draft specification is T1X1.5/2000-024R3 (posted to 802.17 as gfp.pdf or t1x1_gfp.pdf)
- ITU-T Recommendation G.gfp is planned for determination in October 2001. Parallel T1.105.xx Draft Standard for T1 Letter Ballot.
- Next meetings: ITU-T Q.11/15 Experts Meeting, 6/18-19; T1X1, 6/25-29; T1X1, 9/17-21; ITU-T SG 15, 10/15-26

Basics of GFP

- GFP provides a generic mechanism to adapt traffic from higher-layer client signals over an octet synchronous transport network. Client signals may be PDU-oriented, such as IP/PPP or Ethernet MAC (frame-mapped GFP), or block-code oriented, such as Fibre Channel or ESCON (transparent GFP).
- In the Frame-Mapped adaptation mode the Client/GFP adaptation function may operate at the physical or data link layer of the client signal. Client PDU visibility is required.
- For the Transparent adaptation mode, the Client/GFP adaptation function operates on the coded character stream, rather than on the incoming client PDUs.

Basics of GFP

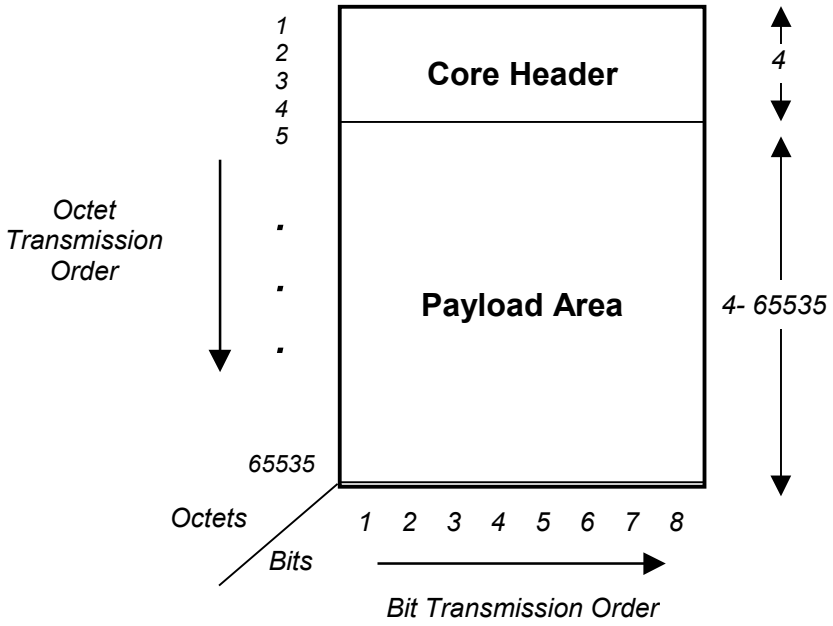


GFP Relationship to Client Signals and Transport Paths

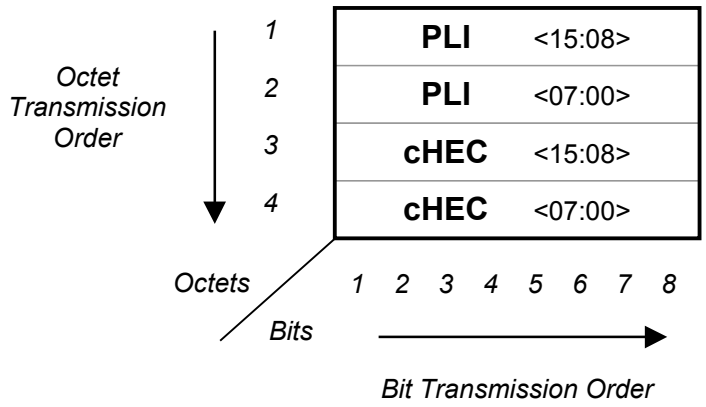
- T1.105.02 defines GFP Payload Mappings to SONET STS-1, concatenated STS-Nc or High Order virtual concatenated STS-1-Xv, STS-3c-Xv path SPEs.
- ITU-T Recommendation G.709 (17.3) defines GFP Payload Mappings to OTN Optical Channel ODUk path payload units (OPUk) at nominal rates of 2.5 Gb/s (OPU1), 10 Gb/s (OPU2) and 40 Gb/s (OPU3).

Basic GFP Process - User Frame Format

- GFP Payload Area size is variable (4 to 65,536 octets).
- Implementations must support GFP MTU sizes of at least 1600 octets.
- Packet Size is always required by GFP Core Header in a 2 octet PDU Length Indicator (PLI) Field.



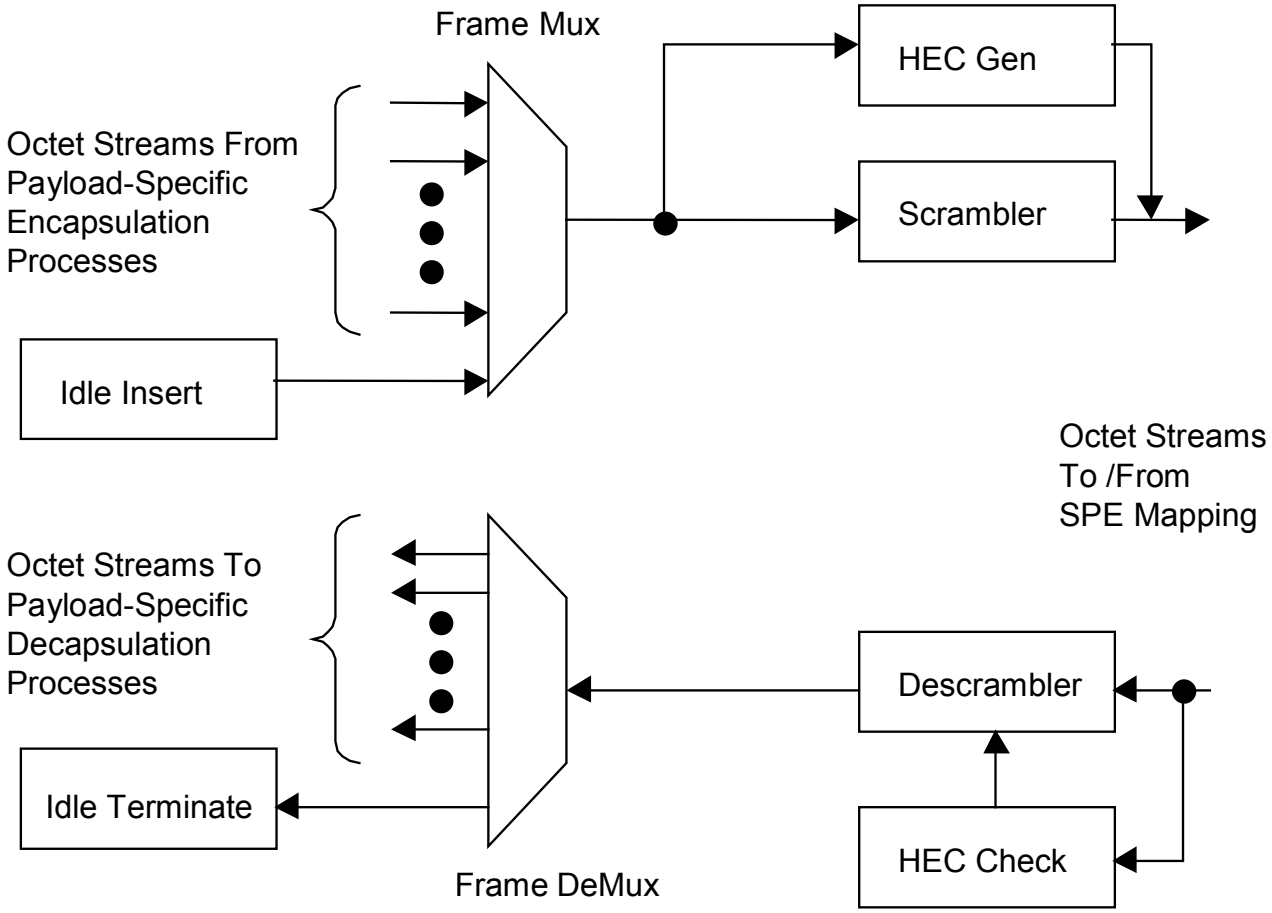
Frame Format for GFP User Frames



GFP Core Header Format

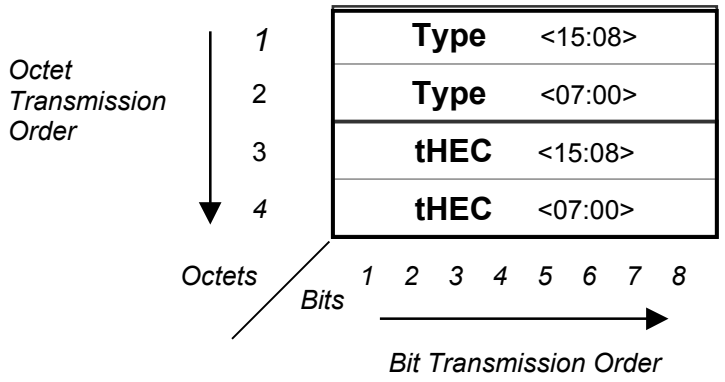
Basics of GFP - Optional Frame Multiplexing

• GFP frames from multiple ports may be multiplexed on a frame-by-frame basis.
• Multiplexing of multiple clients to SPE will be provisioned, based on the active clients' predetermined peak data rates, without over-subscription or flow control.



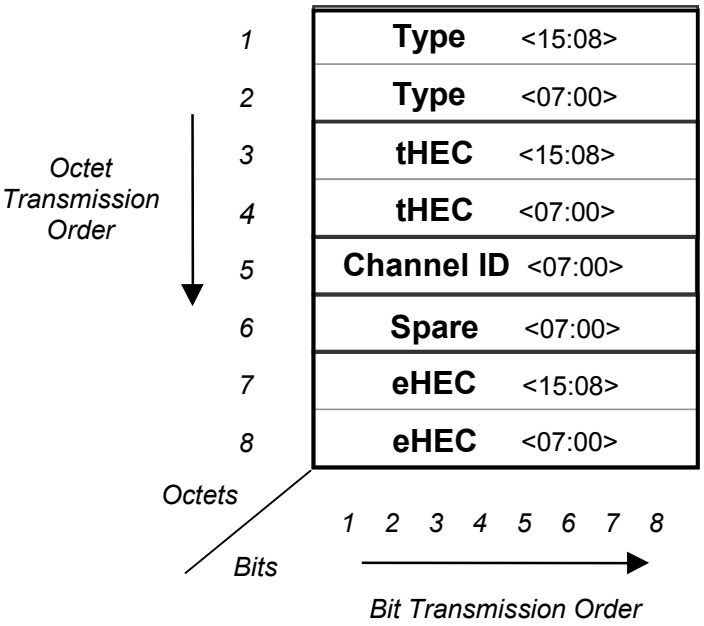
Basics of GFP - Extension Header Types

Three GFP Extension Header Types are currently defined to support optional frame multiplexing of client specific data over logical Point-to-Point (Linear) or logical Ring configurations.



Null Extension Header

Used where transport path is **dedicated** to one client signal. (i.e., no frame multiplexing.

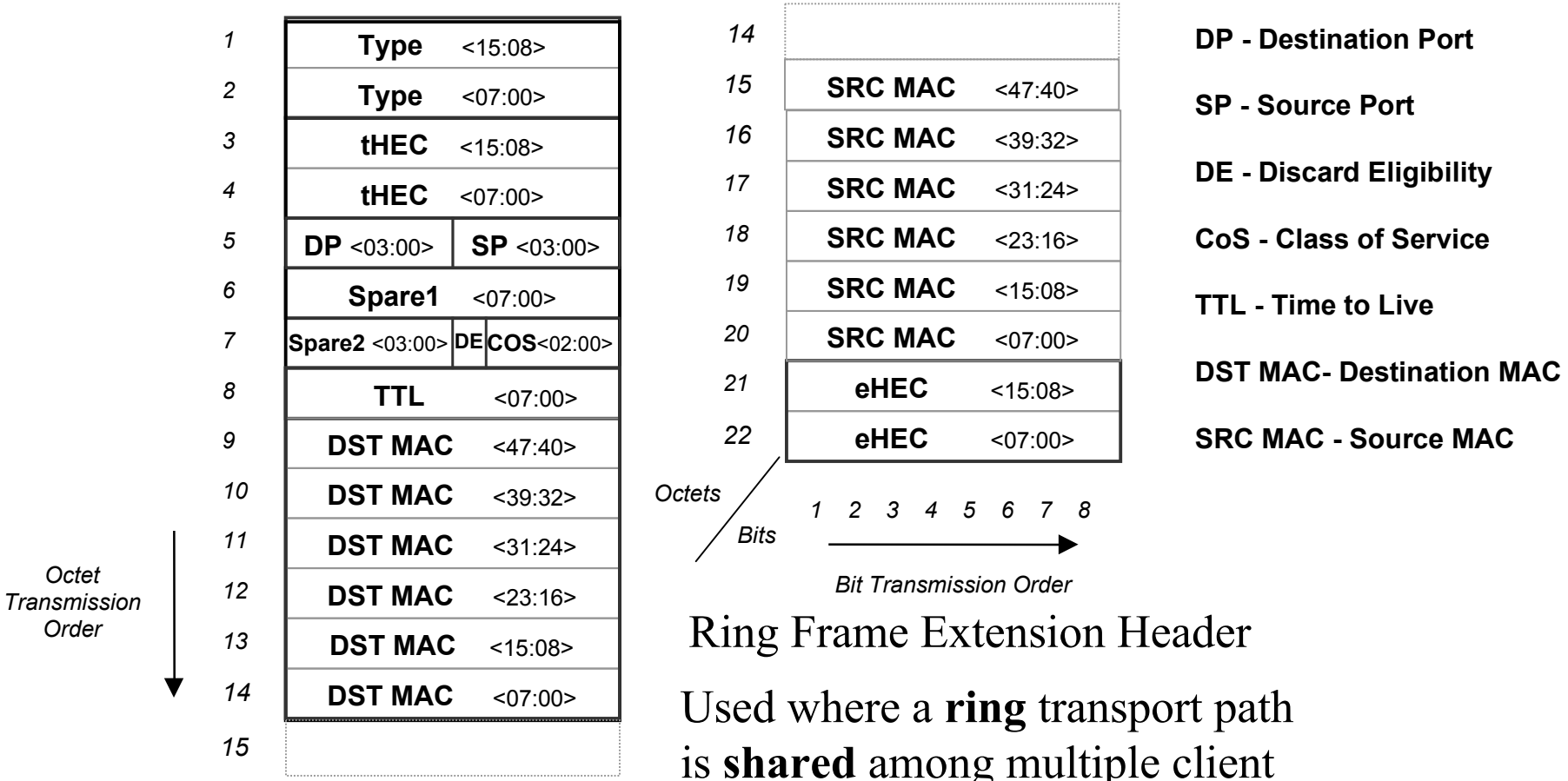


Linear (Point-to-Point) Frame Extension Header

Used where a **point-to-point** transport path is **shared** among multiple client signals.

Basics of GFP - Extension Header Types

Three GFP Extension Header Types are currently defined to support optional frame multiplexing of client specific data over logical Point-to-Point (Linear) or logical Ring configurations.



Ring Frame Extension Header

Used where a **ring** transport path is **shared** among multiple client signals.

Current Ring Frame Extension Header Field Definitions

Spare1 Field: An 8-bit spare field reserved for future use.

Priority Field: A 4-bit field used for traffic prioritization purposes. The field is subdivided into 2 components:
- Discard Eligibility (DE) bit
- Class of Service (CoS) bits

Time to Live (TTL) Field: An 8-bit binary number representing the remaining number of GFP hops that the GFP PDU will persist. A value of zero indicates that the associated GFP PDU will be terminated at the next GFP termination element.

Current Ring Frame Extension Header Field Definitions (continued)

Destination Port (DP) Field: A 4-bit binary number used to indicate one of 16 destination ports at a GFP termination element.

Source Port (SP) Field: A 4-bit binary number used to indicate one of 16 source ports at a GFP initiation element.

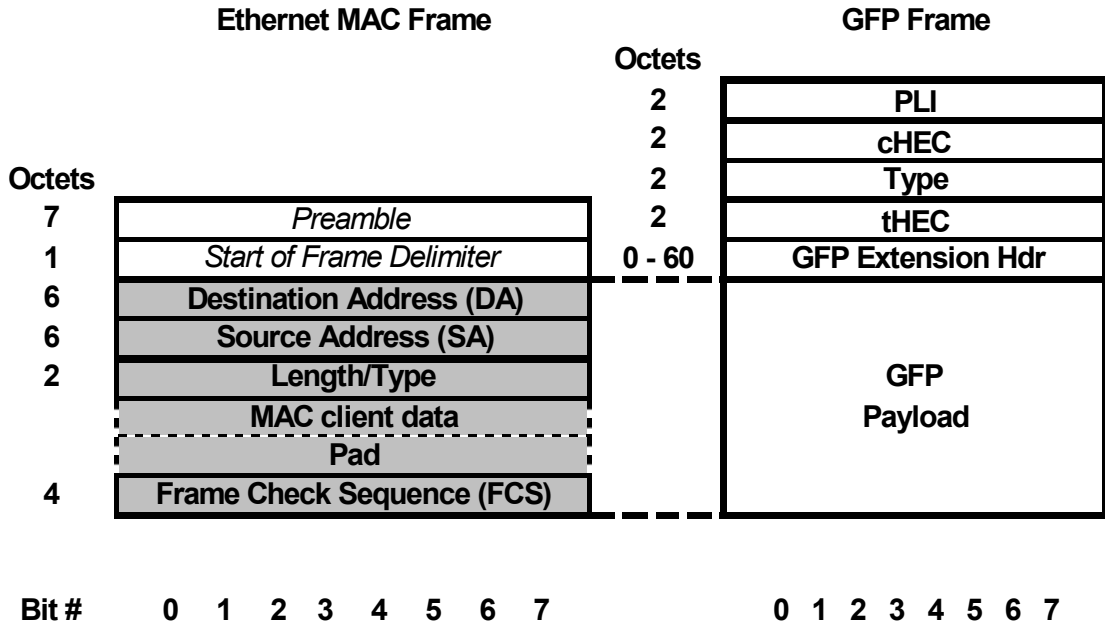
Destination MAC Address Field: A 48-bit binary number that contains the destination MAC address of the GFP termination element.

Source MAC Address Field: A 48-bit binary number that contains the source MAC address of the GFP initiation element.

Spare2 Field: A 4-bit spare field reserved for future use.

Payload-Specific Aspects for Frame-Mapped GFP

Section 7 of the T1.105.xx GFP Draft Standard contains clauses describing those aspects of the generic encapsulation specific to the adaptation of client signals using a frame-by-frame mapping of the client payload via GFP. Currently, Section 7.1 covers Ethernet MAC Payload and Section 7.2 IP/PPP Payload.



Current T1X1 Liaison Letter

May 11, 2001

IEEE 802.17 Resilient Packet Ring Working
Group Chair Mike Takefman

Mr. Mike Takefman,

T1X1.5 understands that 802.17 is defining a new ring-based MAC and intends to use SONET/SDH and OTN physical layers (among others) for this new MAC. We wish to inform you that T1X1.5 has recently drafted a standard adaptation method called Generic Framing Procedure (GFP) for mapping of variable length data frames into SONET/SDH and OTN. This draft is being forwarded to the ITU SG15/Q11 interim group meeting in June.

Current T1X1 Liaison Letter (cont.)

The purpose of GFP is to provide a single flexible mechanism to map/adapt any client signal into SONET/SDH and OTN. It supports both point-to-point and ring applications.
GFP provides frame delineation using a length/HEC mechanism. This mechanism is more robust than single octet flag based delineation and eliminates the need for byte/bit stuffing and the resulting payload specific frame expansion.
GFP mandatory fields are divided into a Core Header and a Payload Header. The Core Header is used for frame delineation. The Payload Header is primarily used to identify the presence and format of an Extension Header and which client protocol is being carried. The Extension Header mechanism allows for topology/application specific information to be added to the GFP frame.

Current T1X1 Liaison Letter (cont.)

The following is a list of features of GFP:
1. More robust frame delineation than flag-based mechanisms such as HDLC
2. No payload dependent frame expansion (no byte stuffing)
3. Flexibility of Extension Headers. This is allows for topology/application specific fields to be defined without affecting frame delineation functions.
4. Ability to identify the encapsulated client protocol separately from the Extension Header. This could be used for example to allow frame forwarding based on Extension Header fields without requiring recognition of the encapsulated client protocol.
5. GFP FCS. This allows for fault location on a GFP frame basis without requiring recognition of the encapsulated client protocol. It also provides a data integrity mechanism for encapsulation of protocols which may not have such a mechanism.

Current T1X1 Liaison Letter (cont.)

We believe that these features make GFP ideally suited for the carriage of variable length frames over SONET/SDH and OTN rings.

T1X1 has begun definition of an Extension Header which may be appropriate for ring applications. Further study of the contents and format of this Extension Header is required. Two possible ways for 802.17 to make use of GFP could be:

1. Provide T1X1 with input for the fields and format of an Extension Header currently under study.
2. Define a new Extension Header and co-ordinate with T1X1 to obtain an Extension Header Type field value to identify the 802.17 Extension Header.

Current T1X1 Liaison Letter (cont.)

We anticipate that the work from 802.17 will become a very important client for SONET/SDH and OTN networks. We would like to collaborate with 802.17 to understand your particular requirements and ensure that GFP is further developed with these in mind in order realize Resilient Packet Rings over SONET/SDH and OTN as quickly as possible.

Sincerely,

Albert White
Chair, T1X1

Questions and Discussion