GFP Considerations for RPR

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Agenda

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GFP Background

- T1X1.5 Generic Framing Procedure (GFP) Draft Revision 4 (T1X1.5/2001-024R4)
  - "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), block-code oriented (such as Fibre Channel or ESCON), or a constant bit rate stream."
  - GFP is used to delineate octet-aligned, variable-length payloads from higher-level client signals for subsequent mapping into octet-synchronous payload envelopes such as those defined in ANSI T1.105.02 (SONET) and ITU-T G.709 (OTN).

Why GFP? (1)

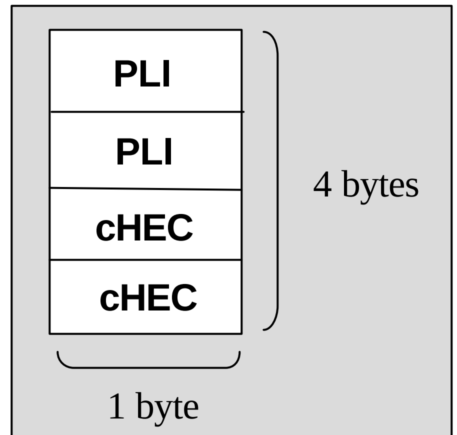
- RPR can use GFP for mapping RPR packets into SONET/SDH
  - GFP would provide frame delineation
  - GFP may add idle frames depending on the rate of RPR packets and the rate of the SONET/SDH signal
- GFP framing is expected to be THE standard for mapping any PDU-based signal into a Constant Bit Rate server layer (e.g., SONET/SDH)
- But RPR can also use Packet over SONET (POS) for that

Why GFP? (2)

- Main advantages of GFP compared to POS
  - Bandwidth Expansion
    - Deterministic bandwidth: Byte-stuff HDLC has unpredictable bandwidth inflation due to the need for escape characters whenever the client data emulates flag/control characters. But it <u>is not</u> a big issue in networks.
    - Network vulnerability standpoint: Malicious user can send max. length frames with payloads consisting entirely of flag/control characters, thus virtually doubling the bandwidth required by that packet. GFP prevents that possibility.
  - Ability to multiplex different protocols
    - GFP allows the multiplexing of multiple protocol or multiple instances of the same protocol onto the same SONET interface (while POS allows multiplexing of different protocols onto the same SONET interface)
    - However, multiplexing of RPR signals with other client signals <u>is not</u> an advantage if delay-sensitive clients are being supported in RPR

GFP Core Header

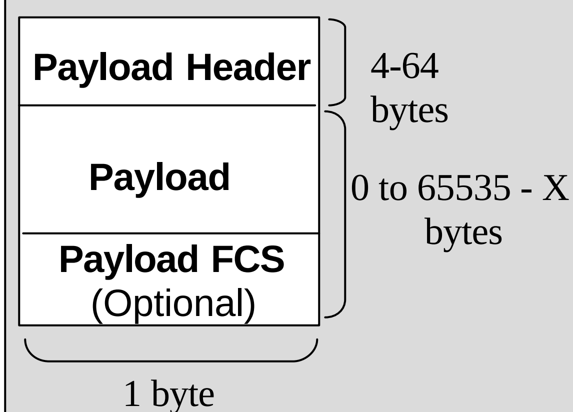
- GFP Core Header is composed of PDU Length Indication (PLI) and Core HEC (cHEC)
  - used for frame delineation
- PLI contains the GFP payload length (in octets)
  - GFP uses the PDU Length to find the end of the GFP frame (for delineation)
  - RPR will have to pass its packet length to GFP
    - Do we have situations where RPR may not know the size of its packet?
    - If so, can RPR layer simply not tell the packet length and leave it for GFP? (i.e., GFP buffers it and check the length)
    - Simpler situation if RPR packets are fixed-length



GFP Core Header Format

GFP Payload Area

- GFP Payload Area consists of Payload Header and Payload field, with an optional Payload FCS.
- Although Payload Area supports PDUs up to 64K, GFP implementations should support reception of GFP frames with GFP Payload Areas of at least 1600 bytes
  - RPR packets will probably be under 1600 bytes
- Problem if Jumbo frames are allowed
  - GFP draft v4 has that “prior arrangements between two GFP implementations will be needed”
  - However, GFP has no negotiation mechanisms for that (and this is considered to be a client issue)
  - Do we need fragmentation?



GFP Payload Area Format

GFP Options

- GFP provides options in terms of signal adaptation, Error detection (FCS) and Extension Header
  - RPRWG has to decide which one is most applicable to RPR applications
- Signal Adaptation
  - GFP supports both Frame-GFP and Transparent-GFP
- Error Detection
  - GFP provides a FCS for its payload, which can be turned on or off
- Extension Headers
  - Depending on the application, GFP provides (Linear), Ring-frame, and Null Extension Header
- Next slides will provide some advantages and disadvantages of those options, when used for RPR

Signal Adaptation - Transparent GFP (1)

- Intended to facilitate the transport of 8B/10B block-coded client signals for scenarios that require very low transmission latency
- Client/GFP adaptation function operates on the coded character stream
  - That means that GFP sends/receives bit streams to/from higher layers instead of PDUs
- Currently Transparent GFP supports only 8B/10B coded signals
- Theoretically it is possible to use transparent GFP in mapping the RPR client layer signal into SONET/SDH

Signal Adaptation - Transparent GFP (2)

- The following functions are needed if Transparent GFP is used
  - map the RPR packets into a 8B/10B physical signal (e.g., 1 GbE)
  - and then map this signal into a SONET/SDH signal using Transparent GFP
  - However, frame-mapped GFP with direct access to the RPR packets saves RPR the intermediate Ethernet PHY processing and line coding overhead
- RPR add/drops packets at the ring nodes and therefore requires access to the packet structure
  - RPR need to perform frame delineation if Transparent GFP is used
- What is the purpose of Transparent GFP for RPR?
  - RPR would be already providing frame delineation
  - The signal coming from RPR toward SONET/SDH would be a bit stream that could be mapped into the SONET/SDH payload

Signal Adaptation - Frame-mapped GFP

- Frame-mapped GFP uses a PDU-oriented client signal adaptation
- e.g., IP/PPP, Ethernet MAC
- Client/GFP adaptation function operates on the incoming client PDU
  - RPR layer sends/receives the RPR packet, i.e., no frame delineation is required for RPR to perform on the GFP outcome
- More efficient for RPR than Transparent GFP
  - No intermediate Ethernet PHY processing and line coding overhead (like the Transparent GFP case)

Error Detection - FCS (1)

- GFP provides an optional FCS (on/off) to protect GFP payload (i.e., RPR packet)
  - on: allows GFP to check if payload (i.e., RPR frame) is corrupted
  - off: corrupted RPR packet will only be checked at RPR layer
- T1X1.5 has not defined yet what to do with the GFP frame once it detects that the payload is corrupted (FCS on)
- Allowing GFP to detect corrupt payload (and probably take action upon it, e.g., discarding GFP frame) may not give a chance to RPR to act upon it
  - If RPR packet is corrupted only in the payload, RPR may still want to deliver it
  - RPR will not be able to use it for monitoring the quality of the signal (based on corrupted CRC count accumulated on the node)

Error Detection - FCS (2)

- RPR cannot rely on signal degradation to be detected at the physical layer
  – Even though GFP may be capable of providing detection for signal degradation via the FCS [on] capability, when using GbE as the physical layer such functionality may not provided
- Therefore RPR should not use the FCS option in GFP (i.e., turn FCS off), but rather leave detection of signal degradation to the RPR CRC

Extension Header - Ring Frame

- Ring Frame Extension Header allows for multiplexing of RPR packets together with other client signals onto a single SONET interface
  - Multiplexing removes the total control of the bandwidth that RPR is planning on having
    - GFP provides no bandwidth reservation or priority capabilities, i.e., there is no way to guarantee capacity to the RPR client
    - Negative impact for bandwidth management mechanisms that are trying to arbitrate medium access
    - Also not good for delay bound control of certain classes of service, since the transmission time will depend on the traffic of all the client layers multiplexed together via GFP
- Ring Frame Extension Header allows RPR to use the ring frame Extension Header as the RPR header (i.e., framing for RPR)
  - Does it provide support for all functions RPR is planning on having?

Extension Header - Null

- Null Extension Header applies to logical point-to-point configuration
- Intended for scenarios where transport path is dedicated to one client signal
  - no multiplexing of client signal (Good!)
- Would that allow for simpler RPR implementation?
  - Can RPR have the same frame format whether it will be used with PPP/HDLC or GFP?
  - This may allow vendors to have the same RPR MAC implementation whether mapping PPP/HDLC or GFP.

Conclusions

- We need to discuss more these issues.
  - Form an ad-hoc group to discuss it during the meeting
- Conclusion
  - Do not use the GFP FCS for the payload, i.e., use FCS off
  - For Signal adaptation, Frame-mapped GFP should be used rather than Transparent GFP
  - RPR should use the GFP Null Extension Header rather than the Ring Frame (or Linear) Extension Header

Proposed Requirement Text

- GFP Frame Check Sequence (FCS)
  - “When using GFP to map RPR packets into SONET/SDH/OTN the GFP Frame Check Sequence (FCS) option shall be set to OFF.”
- RPR/GFP Signal Adaptation
  - “Frame-mapped GFP with Null Extension Header shall be used to map RPR packets into SONET/SDH/OTN.”

References

- T1X1.5 Generic Framing Procedure (GFP) Draft Revision 4 (T1X1.5/2001-024R4)
- T1X1.5 Mailing List discussions