Export of Gigabit Passive Optical Network Encapsulation Mode in IPFIX

draft-netana-opsawg-ipfix-gpon-gem

Enabling **data plane visibility** in passive optical transport
of the optical distribution network in broadband access

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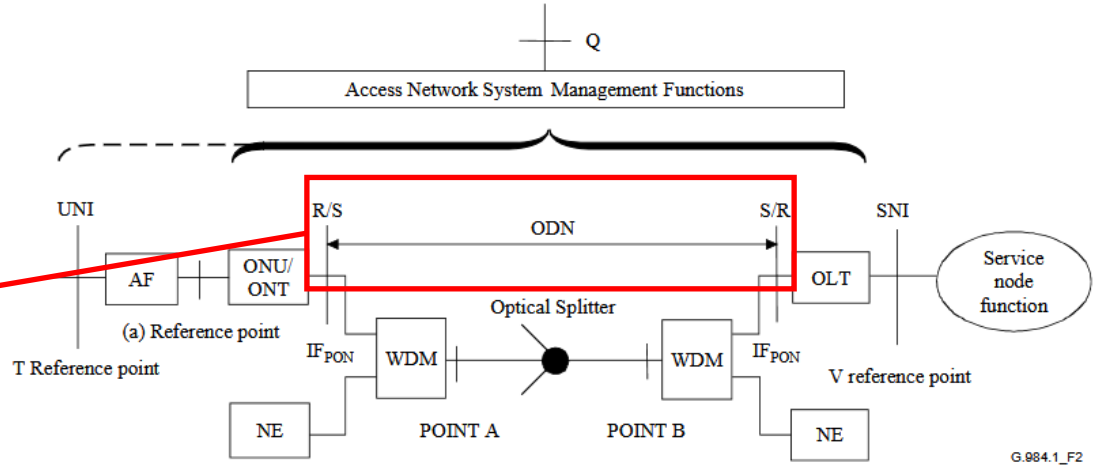
Export of GPON Encapsulation Mode in IPFIX

ITU-T G.984.1 defines the General characteristics

- ITU-T G.984.1 defines the General characteristics of GPON.
- Figure 2 in Section 5.2 shows the Reference Configuration.
- Red marked highlights the Optical Distribution Network (ODN) where GPON Encapsulation Mode (GEM) is used between ONU/ONT and OLT.



ONU	Optical Network Unit
ONT	Optical Network Terminal
ODN	Optical Distribution Network
OLT	Optical Line Termination
WDM	Wavelength Division Multiplex Module (If WDM is not used, this function is not necessary.)
NE	Network Element which uses the different wavelength from the OLT and the ONU
AF	Adaptation Function (Sometimes, it may be included in the ONU.)
SNI	Service Node Interface
UNI	User Network Interface
S	Point on the optical fibre just after the OLT (Downstream)/ONU (Upstream) optical connection point (i.e., optical connector or optical splice)
R	Point on the optical fibre just before the ONU (Downstream)/OLT (Upstream) optical connection point (i.e., optical connector or optical splice)
(a) Reference point	If AF is included in the ONU, this point is not necessary.
POINT A/B	If WDM is not used, these points are not necessary.

NOTE – Whether or not the AF is an operating object of the Q interface depends on the service.

Figure 2 – Reference configuration for GPON

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ITU-T G.984.3 defines the transmission convergence layer

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- Figure 8-11 in Section 8.3.1 shows the GEM header.
- The GEM header contains the payload length indicator (PLI), Port-ID, payload type indicator (PTI) and a 13-bit header error control (HEC) field.
- Red marked highlights the GEM Port-ID and PTI which is of interest to account frames and bytes in IPFIX [RFC 7011], [RFC 7012] and [RFC 7015].
- Payload length indicator (PLI) and header error control (HEC) are for tracing and debugging purposes interesting but not relevant for accounting. Therefore, excluded from IPFIX.

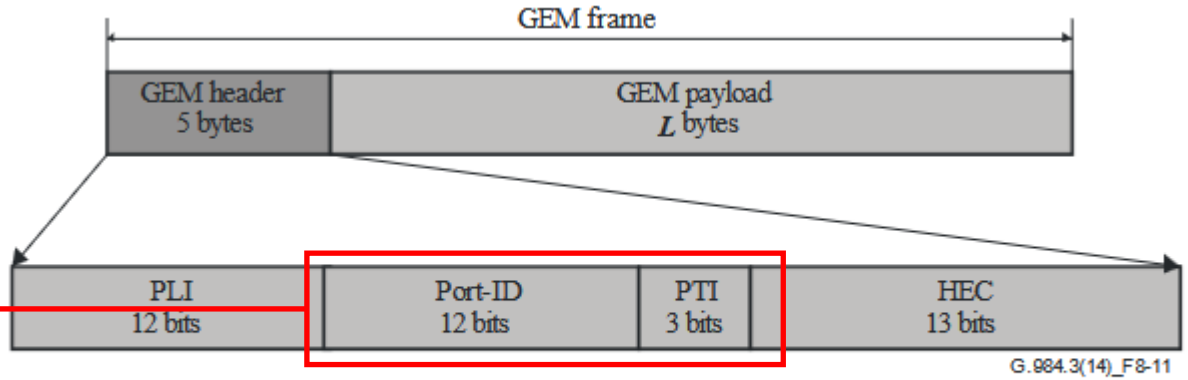

Figure 8-11 – GEM header and frame structure

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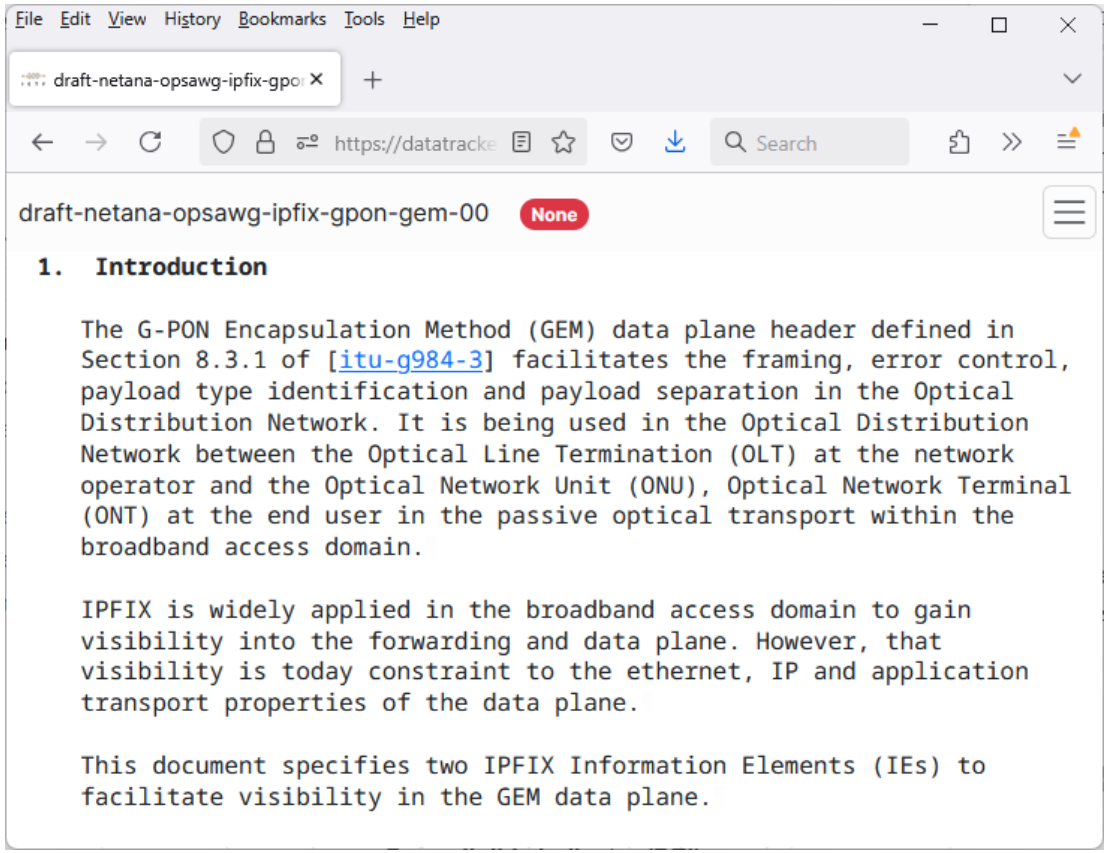
draft-netana-opsawg-ipfix-gpon-gem defines IPFIX entities

- **5.1.1. gponGemPti**

Name:	gponGemPti
ElementID:	TBD1
Description:	Values for this Information Element are listed in the Section 8.3.1 of [itu-g984-3]. "G-PON Encapsulation Method PTI" subregistry, see [IANA-IPFIX].
Abstract Data Type:	unsigned8
Data Type Semantics:	flags
Range:	The valid range is 0-7.
Additional Information:	See the assigned types in [IPFIX G-PON content type list. Encapsulation Method PTI Subregistry]. The values encoded in the 3 least significant bits of the IE.
Reference:	[RFC-to-be]

- **5.1.2. gponGemPortId**

Name:	gponGemPortId
ElementID:	TBD2
Description:	The 12-bit GEM Port-ID field defined in Section 8.3.1 of [itu-g984-3].
Abstract Data Type:	unsigned16
Data Type Semantics:	identifier
Additional Information:	See Section 8.3.1 of [itu-g984-3] for the content type list.
Reference:	[RFC-to-be]



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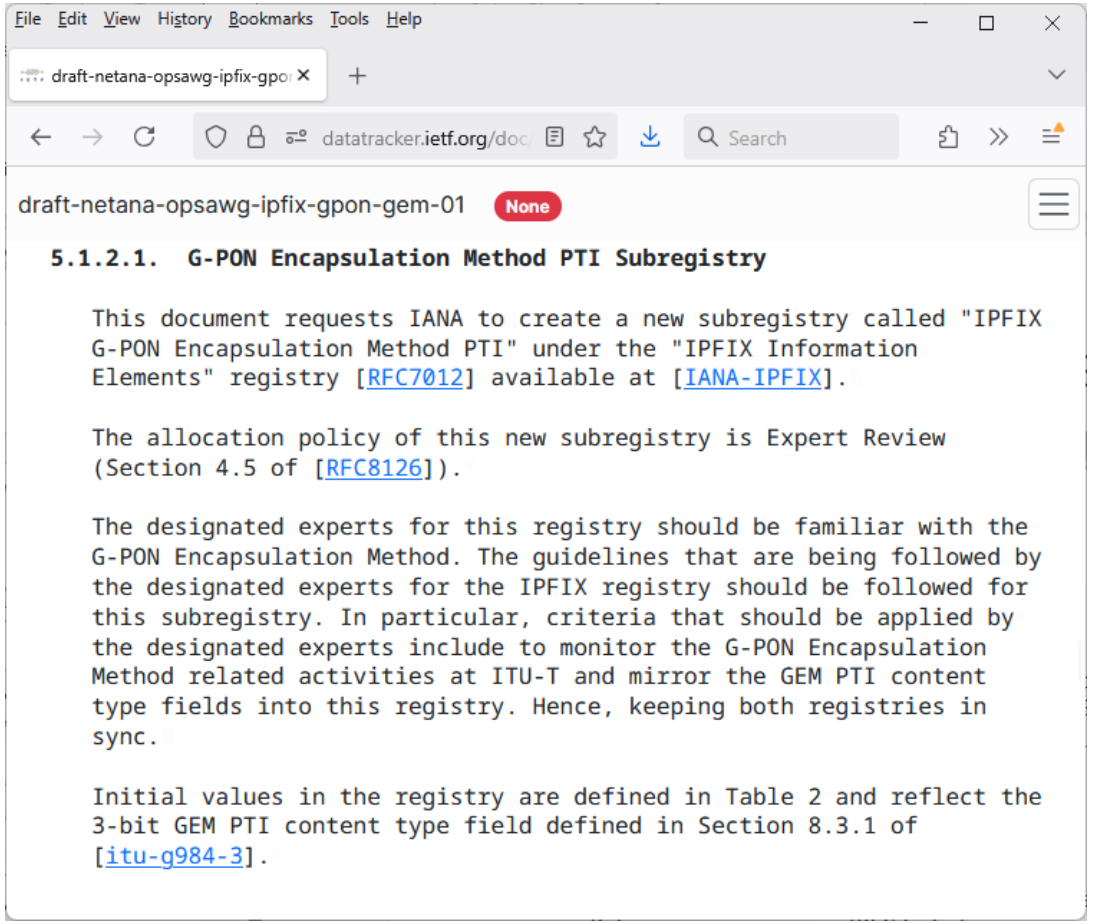
IPFIX G-PON Encapsulation Method PTI Subregistry

- Based clarifications with Paul Aitken (IE doctor) and Amanda Baber (IANA), the best approach is to mirror the PTI registry from ITU-T G.984.3 as a IPFIX Subregistry.

Value	GEM PTI Content Type Meaning	Additional Information
000	User data fragment, not the end of a frame	[RFC-to-be]
001	User data fragment, end of a frame	[RFC-to-be]
010	Reserved	[RFC-to-be]
011	Reserved	[RFC-to-be]
100	GEM OAM, not the end of a frame	[RFC-to-be]
101	GEM OAM, end of a frame	[RFC-to-be]
110	Reserved	[RFC-to-be]
111	Reserved	[RFC-to-be]

Table 2: "IPFIX G-PON Encapsulation Method PTI" Subregistry



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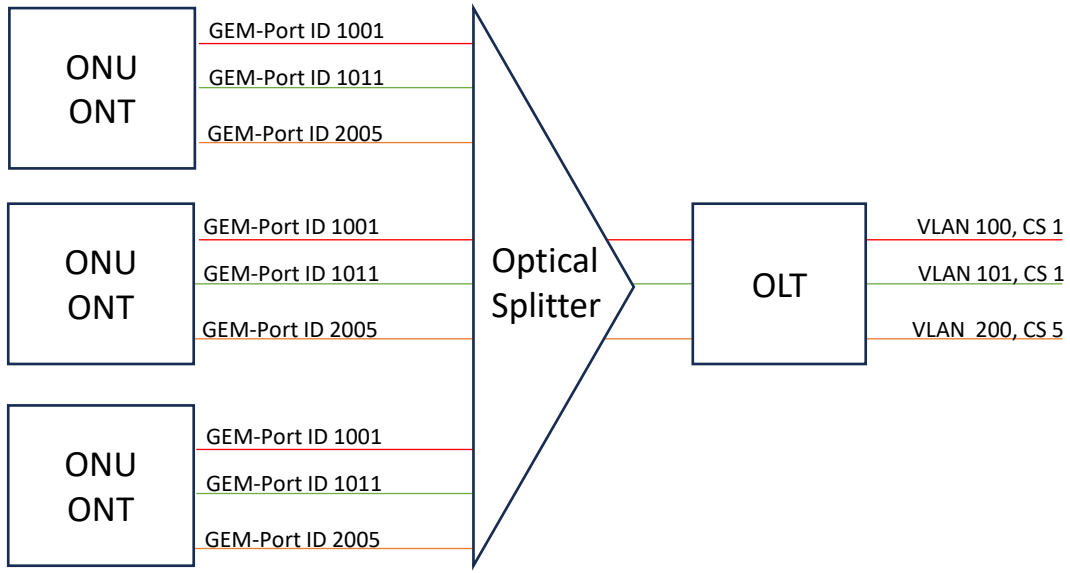
Sample Use Case

GEM Port-ID is usually mapped to IEEE 802.1Q into VLAN identifier (VID) and Priority code point (PCP, IEEE 802.1p class of service) which is used for Network Slicing related use cases. Differentiate between different application and their Quality-of-Service properties.

The IPFIX IEs **gponGemPti (TBD1) or gponGemPortId (TBD2),** sourceMacAddress (56), destinationMacAddress (80), ingressInterface (10), egressInterface (14) and forwardingStatus (89)[RFC5102] [RFC7270] [IANA-IPFIX], and some existing counter information's [IANA-IPFIX] providing answers to the following questions (amongst others):

- **How many user or OAM frames are forwarded or dropped to which ONU on which egress interface and GEM Port-ID?**
- **If dropped, for which reasons?**

The received ONU frames on an OLT are mapped and forwarded depending on GEM Port-ID to a dot1qVlanId (243) and dot1qPriority (244) upstream to the provider network.



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Document Status and Next Steps

- First document revision published on April 7th 2025 and presented at CCAMP.
- Second revision includes review from Paul Aitken and IANA.
- Implementation planned on Huawei MA5800T-X17 with IETF hackathon verification.
- **Request feedback, review and working group adoption from OPSAWG.**
- Is a ITU-T liaison needed?

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