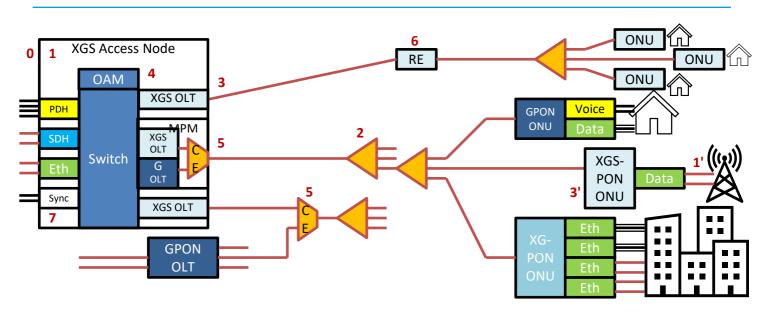# G.9807 10-Gigabit Symmetric Passive Optical Networks

- G-PON compatibility via a wavelength plan, blocking filters, loss budget for coexistence on a common ODN, and a combo OLT
- Support for single-sided and mid-span reach extension, with reach up to 60 km
- Full-service support with symmetric rate – including voice, TDM, Ethernet (up to Gigabit rates), xDSL, wireless xhaul

- Powerful OAM&P capabilities providing a feature rich service management system
- Advanced security features including authentication, rogue detection, and information privacy
- Power saving features on top of the already considerable low power nature of fibre access

0. ITU-T G.9807.1, Clauses 3-5 – 10-Gigabit-capable symmetric passive optical network (XGS-PON), definitions/acronyms/conventions
Establish the common terms and acronyms used in the series, and delineate the various optical access topologies.

1. ITU-T G.9807.1, Annex A – General requirements of XGS-PON
Provides examples of services, User Network Interfaces (UNI) and Service Node Interfaces (SNI) that are required by network operators. In addition, it shows the principal deployment configuration. The most important requirement is the backward compatibility with existing Optical Distribution Networks (ODN) that comply with ITU-T G.984.x, ITU-T G.987.x and ITU-T G.989.x series of Recommendations.

1'. ONU applications and services
The XGS-PON system is intended to be a full-service access network. A key part of that is the extreme diversity of optical network unit (ONU) types and form factors. In addition to all the applications described for G-PON, the higher capacity of XGS-PON opens new possibilities. Examples of these are serving 4G cell sites and various enterprises. Existing G-PON ONUs can remain in service alongside the XGS-PON ONUs, allowing for easier system upgrades.

2. ITU-T G.9807.1, Annex B – Physical media dependent (PMD) layer specifications of XGS-PON
Specifies the physical layer requirements and specifications for the PMD layer. This Recommendation covers systems with nominal line rates of 9953.28 Mbit/s in both the downstream and upstream directions. The PMD is designed to operate bidirectionally over a single strand of single mode optical fibre (ITU-T

G.652). The basic wavelength plan specifies downstream wavelength band as 1575 to 1580 nm, and upstream wavelength band as 1260 to 1280 nm. This wavelength plan allows wavelength division multiplex (WDM) coexistence with G-PON and NG-PON2, and time division multiplex (TDM) coexistence with XG-PON and XGS-PON ONUs. The optional wavelength plan contains downstream wavelength band of 1480 to 1500 nm, and upstream wavelength band of 1300 to 1320 nm which allows WDM coexistence with XGS-PON and NG-PON2.

3. ITU-T G.9807.1, Annex C – Transmission convergence layer specification of XGS-PON
Defines the frame format and media access control method, which are largely based upon the XG-PON system with small adjustments for 10G symmetry. It describes the ranging and activation processes, dynamic bandwidth allocation (DBA), and the physical layer management (PLOAM) functionality that supports them. Security, power saving, protection, and rogue ONU mitigation are described.

3'. ONU behaviour
The approach taken in ITU-T G.9807.1, Annex C is to describe in detail the behaviour of the ONU, leaving the detailed behaviour of the optical line terminal (OLT) to the implementer. The approach makes it possible to test for ONU conformance to the specifications. This makes the interoperability of different vendor's ONUs on a single PON possible. There are conformance and interoperability testing programs organized by the Broadband Forum (BBF).

4. ITU-T G.988 – ONU management and control interface (OMCI) specification
Defines the managed entities of a protocol-

independent Management Information Base (MIB) that models the exchange of information between the Optical Line Termination OLT and the ONU, not only for XGS-PON, but all PON systems. The MIB implicitly describes in detail the wide range of UNIs that an ONU may support. It covers the ONT management and control channel, protocol and detailed messages.

5. ITU-T G.9805 – Coexistence of Passive Optical Network Systems
Describes the methods and parameters for PON coexistence, where two or more PON systems share a common ODN.

6. ITU-T G.9807.2 – 10 Gigabit-capable passive optical networks (XG(S)-PON): Reach extension
Outlines the architecture and interface parameters for XGS-PON systems with extended reach using a physical layer reach extension device, including regenerators or optical amplifiers. Wavelength converting, continuous mode, 1:N and combination type reach extenders (REs) are also described. The maximum reach is up to 60 km with loss budgets in excess of 28.5 dB being achievable in both spans. This new capability will allow operators to provide optical access service to areas that were previously out of reach, and also explore new network designs for greater central office consolidation.

7. Synchronization and timing are supported as part of the XGS-PON system. G.9807.1 Annex C describes methods for transferring precision timing information over the PON system. This is important for various wireless applications.