# GPON Technology

Gigabit Passive Optical Networks (GPON) provides a capacity boosts in both the total bandwidth and bandwidth efficiency through the use of larger, variable-length packets in PON technology. GPON is standardized in ITU-T G.984 (GPON) that permits several choices of bit rate, but the industry has converged on 2.488 Gbps of downstream bandwidth, and 1.244 Gbps of upstream bandwidth [1]. GPON Encapsulation Method (GEM) allows very efficient packaging of user traffic, with frame segmentation to allow for higher QoS for delay-sensitive traffic such as voice and video communications.

The beneficial features of GPON based upon requirements set forth by service providers are as follows [2]:

- Full Service Support, including voice (TDM), Ethernet, ATM, leased lines, and others
- Physical reach of at least 20 km with a logical reach support within the protocol of 60 km
- Support for various bit rate options using the same protocol, including symmetrical 622 Mbps, symmetrical 1.25 Gbps, 2.5 Gbps downstream, 1.25 Gbps upstream, and others
- Strong Operations, Administration, Maintenance, and Provisioning (OAM&P) capabilities offering end-to-end service management
- Security at the protocol level for downstream traffic due to the multicast nature of PON

When comparing various PON systems such as APON, EPON, or GPON, and assuming a similar bit rate of 1.25 Gbps, it can be safely assumed that the system cost itself will be very similar. A substantial portion of the system cost originates from the optical interface, which is independent of the PON protocol. The rest of the system components should be similarly priced based on application-specific integrated circuits (ASICs) and other standard components.

GPON not only provides substantially higher efficiency as a transport network, but also delivers simplicity and superb scalability for future expansion in supporting additional services.

GPON, through the Generic Framing Procedure (GFP)-based adaptation method, offers a clear migration path for adding services onto the PON without disrupting existing equipment or altering the transport layer in any way. In contrast to both APON and EPON--which require a specific adaptation method for each service and the development of new methods for emerging services--the core foundation of GPON is a generic adaptation method, which already covers adaptation schemes for any possible service.

GPON is the most advanced PON protocol in the marketplace today, offering multiple-service support with the richest possible set of OAM&P features. It offers far higher efficiency when compared to ATM- and Ethernet-based PON technologies.

GPON also offers the lowest cost for all modes of operation. Not only is the system cost itself expected to be lower as no external adaptation is required, but exceptionally higher efficiency also leads to more "revenue bits" from the same system, i.e., a much shorter payback period.

Ensuring simplicity and scalability when dealing with new and emerging services, GPON offers a clear migration path for emerging services without any disruption to existing GPON equipment or alterations to the transport layer.

**References:**

[1] GPON study at Wikipedia. URL: http://en.wikipedia.org/wiki/Passive_optical_network
[2] Online study at URL: http://lw.pennnet.com