ACTIVE ETHERNET: FREQUENTLY ASKED QUESTIONS

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APPLICATION NOTE

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The concept of active Ethernet was first introduced in 2004 with the IEEE 802.3ah standard, Ethernet in the first mile (EFM). With this standard, it became possible to use a standard Ethernet architecture as an access technology for residential access. Triple-play services (voice, video and data) can now be delivered over Ethernet architecture. The standard defined two different architectures to deliver Ethernet access: active Ethernet and Ethernet passive optical network (EPON). This application note addresses the active Ethernet.

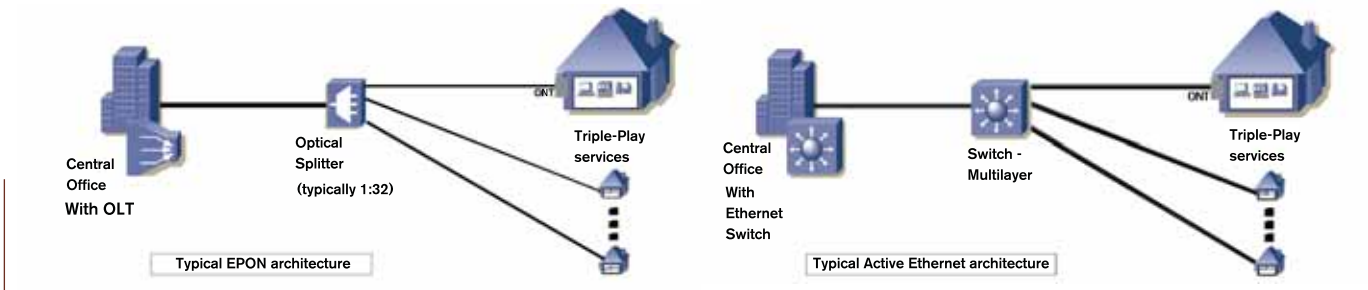

Figure 1: *Architecture comparison between active Ethernet and EPON*

The motivation for service providers to deploy active Ethernet over other technologies such as EPON are:

- **Large dedicated bandwidth**. Each customer has a dedicated 100 Mbit/s Ethernet connection to the network (could be upgraded to Gigabit Ethernet down the road by keeping the same fiber). This provides enough bandwidth to deliver all current triple-play services and more.
- **Simplicity**. The installation of the fiber can be the same as in xPON, but there is no need for the 1xn optical splitter as the multiplexing of customer signals is done by an Ethernet switch located in a street cabinet. There is also simplicity in the power budget, distance and number of splits. As active Ethernet is point-to-point, there is no limitation on the ratio of distances from the CO to optical splitter or splitter to homes.
- **Quality of service (QoS)**. Since the bandwidth in active Ethernet is dedicated, service providers have full control over bandwidth distribution and can promise and deliver different QoS levels.

In the IEEE 802.3ah standard, there was a new set of interfaces created to address the residential access; Figure 1 describes these new interfaces.

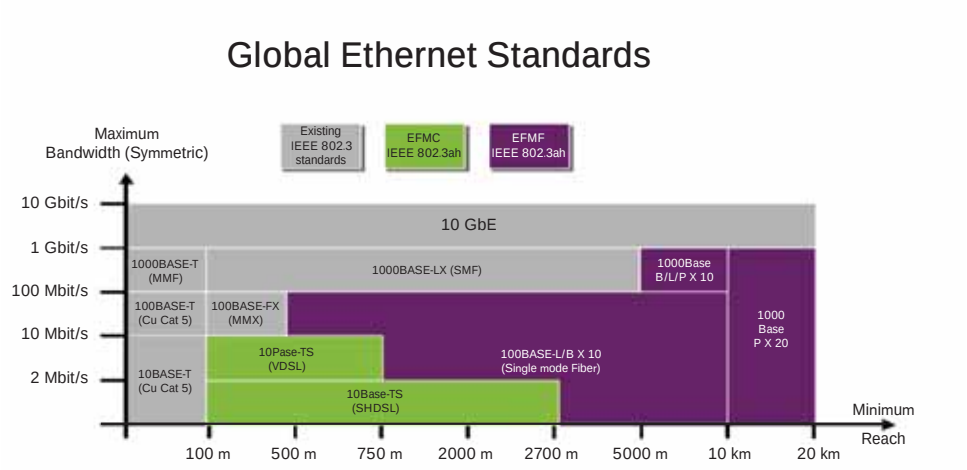

Figure 2: *Global Ethernet standards* [a]

[a] *Reproduced with permission of the Metro Ethernet Forum.*

There were two different types of interfaces defined in the EFM standard: copper and fiber. The copper interfaces (EMFC) were defined to leverage the unshielded twisted-pair (UTP) cable plant from the service providers. It allows the delivery of Ethernet-based services at 2 Mbit/s at a distance of up to 2.7 km. The other method of delivering Ethernet in the access was to use a direct fiber connection (EFMF). Depending on the fiber type and interface used, it is now possible to deliver a full Gbit/s bidirectionally at a distance of up to 20 km. Table 1 provides more information on the fiber interface type, its wavelength and maximum distance.

As defined in the standard, it is also possible to use one fiber to deliver bidirectional 100 Mbit/s or 1000 Mbit/s Ethernet traffic to the end customer. Figure 3 illustrates one methodology that could be used to implement a 100BASE-BX10 transceiver. By using optical filters, it is possible to decouple the different wavelengths so that the upstream and downstream signals co-exist on the same fiber.

Interface Type	Fiber Type	Number of Fibers	Wavelength (nm)		Distance (m)	Access Type
			Upstream	Downstream		
100BASE-LX10	SMF	2	1310		10 000	Active
100BASE-BX10	SMF	1	1310	1550	10 000	
1000BASE-LX10	MMF	2	1310		550	
	SMF	2	1310		10 000	
1000BASE-BX10	SMF	1	1310	1490	10 000	
1000BASE-PX10	SMF	1			10 000	PON
1000BASE-PX20	SMF	1			20 000	

Table 1: *Ethernet standard for interface type*

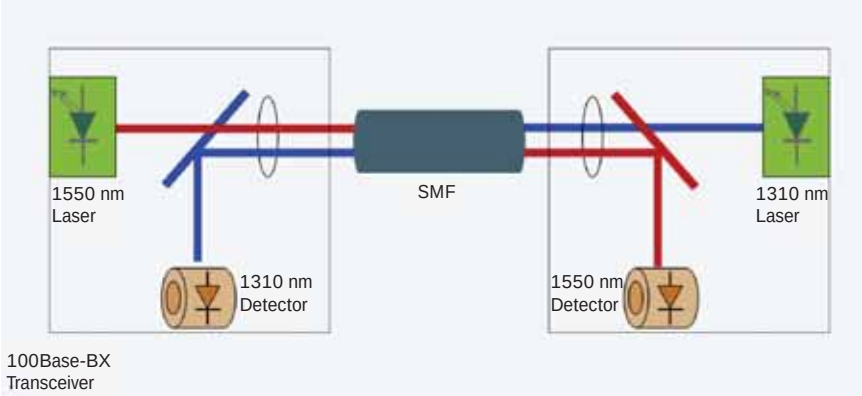

Figure 3: *Example of a 100BASE-BX transceiver implementation*

The following section provides a list of frequently asked questions and their answers.

1) In a two-fiber configuration (Tx, Rx), is the wavelength used always 1310 nm?

As described in Table 1, when using a two-fiber topology, the wavelength used is 1310 nm. In a single-fiber topology, the upstream wavelength used is 1310 nm, whereas the one used for downstream is 1550 nm.

2) Does active Ethernet use a "burst" mode?

In active Ethernet, each end-device has dedicated bandwidth; therefore, there is no burst mode used. This mode is usually found in EPON.

3) Is there continuous traffic on the fiber? Are the three levels 1, 0 and off?

In active Ethernet, there is continuous traffic on the fiber as in regular Ethernet. When there is no frame being transmitted, idle frames will be sent to keep the link “alive”. Since there is always traffic on the link, the only levels available are 1 and 0. An Off value only occurs when there is no light on the fiber link, which results in a link loss condition (link down). The encoding used is 4B/5B for 100BASE-BX/LX and 8B/10B for 1000BASE-BX/LX/PX.

4) In the one-fiber configuration, what are the wavelengths used?

For 100BASE-BX10 SMF, 1310 nm is used for upstream and 1550 nm is used for downstream. For 1000BASE-BX10, -PX10 and -PX20 SMF, 1310 nm is used for upstream and 1490 nm is used for downstream. For details, see Table 1.

5) Does Active Ethernet support video? If so, what wavelength does it use?

Active Ethernet supports video in the form of IPTV (video frames encoded with IP over Ethernet). There is no such thing as video overlay in active Ethernet.

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