Synopsis

In response to the insatiable need for speed, and hot on the heels of 10 Gigabit Ethernet, an industry study group has been formed investigate the market requirements and feasibility of even higher speeds. Multiple approaches may be necessary to address the future traffic needs of metropolitan core networks, supercomputing, data centres and corporate backbones. Products are expected by 2010 and it is quite possible that wavelength division multiplexing technology will be used to support a 100 Gigabit solution.

1. Higher Speed Study Group Formed

An IEEE 802.3 study group was established in July 2006 to explore the feasibility of higher speed Ethernet for LAN, MAN and WAN use. The study group is targeting speeds well in excess of 10 Gigabit but has been cautious about choosing a particular number. Champions Cisco Systems, IBM, HP Procurve, Quake Technologies and Force 10 Networks provided the following rationale to support this new project:

Rising volumes of data are causing congestion to occur at various aggregation points, such as within internet exchanges, data centres, cluster computing, and the enterprise. 10 Gigabit Ethernet links in combination with 802.3ad Link Aggregation are being deployed at these aggregation points; however, projected bandwidth requirements indicate that in the future this will be insufficient. It is time to study the effort, scope the task, and start towards the development of a standards-based solution to bring relief to these congestion points.

Study group recommendations are expected in July 2007.

2. The Market Need for Higher Speed

The early adopters for higher speed Ethernet are mapped chronologically in figure 1. The earliest markets are anticipated to be Internet exchanges/data centres, ISP backbones and content providers.

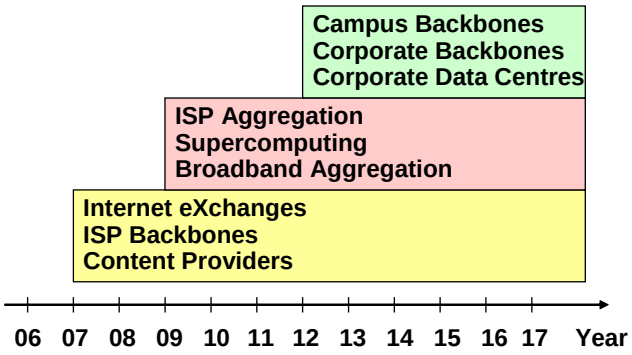

Figure 1: Early Adopters of Higher Speed Ethernet

The main driver for higher speed is anticipated to be IP-rich media applications, primarily video. Broadband access and the future digital home will require growing support of TV + Internet + telephony, with the capacity required for 30 minutes of TV viewing equivalent to 30 days of typical Internet surfing. Interactive HDTV Video on Demand (VoD) is expected to be main driver for metropolitan aggregation networks. 100 Gigabits will be needed for the metropolitan core network in the 2008-2010 timeframe. Compatibility with the telecommunications network hierarchy will be prerequisite. Estimated bandwidth requirements are listed for residential applications. Forecast growth in global subscriber access traffic is also shown in figure 2, assuming 50 million IPTV subscribers in 2011, each viewing 4 hours/day from 2007.

Application	Bandwidth
VoIP	100k
Video-conferencing	0.7 to 1.5M
Internet	0.2 to 5.0M
Gaming	0.2 to 0.5M
SDTV (MPEG-2)	6M
SDTV (MPEG-4)	3M
HDTV (MPEG-2)	20M
HDTV (MPEG-4)	10M

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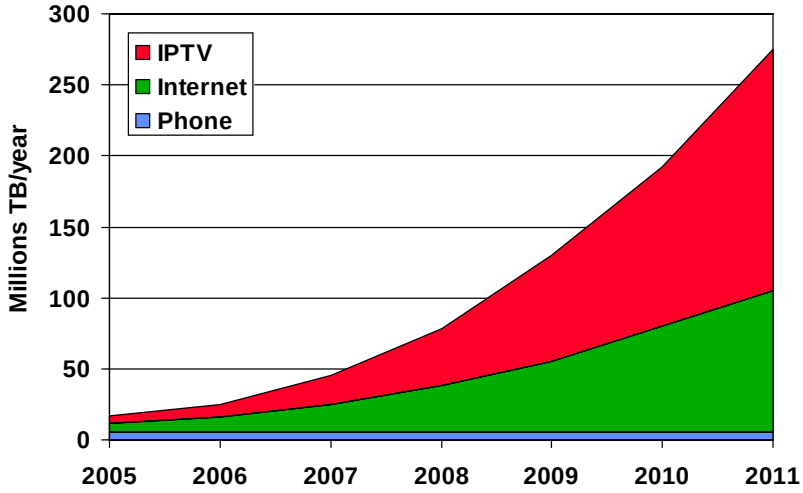

Figure 2: Global Subscriber Access Traffic

The majority of applications in the 10 Gigabit Ethernet early adopter market are supported by singlemode fibre (SMF), as its deployment started in the network core (SMF was 85% in 2004 reducing to 50% in 2006). The main early adopters of 10 Gigabit Ethernet have been service providers and large corporates.

It's quite plausible that the early adopter phase for higher speed Ethernet will last several years and service providers/large enterprise customers will drive initial volumes. It's therefore important to prioritise different solutions for the needs of early adopters.

Multimode Fibre (MMF) solutions are being considered for data centre applications, although data centre managers also have a lot of flexibility in choosing cable type. An SMF solution may therefore represent a viable option for data centres, particularly for early adopters.

3. The Need for a Multi-lane Solution

In the absence of very high speed lasers, the design approach for higher speed Ethernet will need to use multiple lanes. Figure 3 shows some implementation options for 80, 100 and 120 Gigabit channels. Telecom-grade 40 Gigabit lasers exist however these are too expensive for LAN applications. 10 Gigabit devices are preferred as they are available as lower-cost VCSELs (Vertical Cavity Surface Emitting Lasers). Multi-lane solutions may use either WDM (Wavelength Division Multiplexing) techniques or parallel optics.

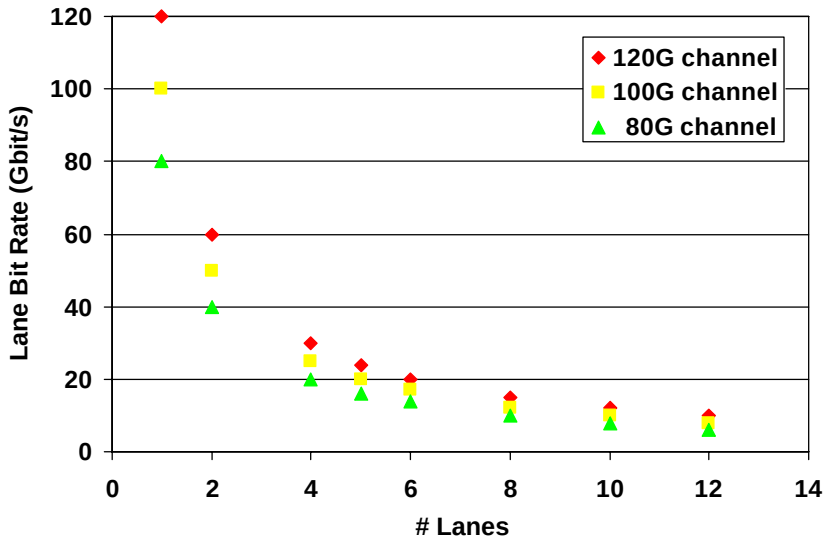

Figure 3: Number of Lanes vs. Lane Bit Rate

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4. Higher Speed Long Haul Approaches

Approximately 80% of 10 Gigabit Ethernet metropolitan links today are between 5km and 40km. A reach objective of at least 10km is therefore considered to be a critical success factor.

10-lane 1310nm DWDM transceivers operating at 10 Gigabits per lane are available today, and Layer 2 CMOS implementations are expected to be feasible in the near future. 10-lane DWDM is a very appealing solution for long haul SMF applications.

5. Higher Speed Short Haul Approaches

A Corning survey of installed data centre links indicated that 96% of all lengths were less than 200m. 90% of data centre links use MMF today. High performance computing requires only 100m reach and the majority of corporate backbones need up to 300m reach. A recent IBM customer survey identified 70-80% links in these 3 market sectors to be less than 100m.

10 Gigabit VCSELs are much less expensive than conventional 10 Gigabit lasers. 850nm VCSEL arrays are built in 4-lane and 10/12-lane format to support parallel optics, and are also available in CWDM solutions.

A reach objective of 100m could therefore represent a low-cost approach for short haul MMF applications.

6. Project Objectives

Project objectives agreed within early stages of the higher speed study group are as follows:

- Support full-duplex operation only.
- Preserve the IEEE 802.3 Ethernet frame format.
- Preserve min and max frame sizes of IEEE 802.3.
- Adopt a speed of 100 Gigabits at the MAC/PLS interface.
- Adopt a reach objective to support at least 10km on SMF.
- Adopt a reach objective to support at least 100m on OM3 fibre.

7. Development Plan

The following initial development plan is envisaged, with a formal standards project sanctioned in September 2007 and the standard approved in November 2009. This is a 3-year gestation period, which is ambitious for a project of this complexity.

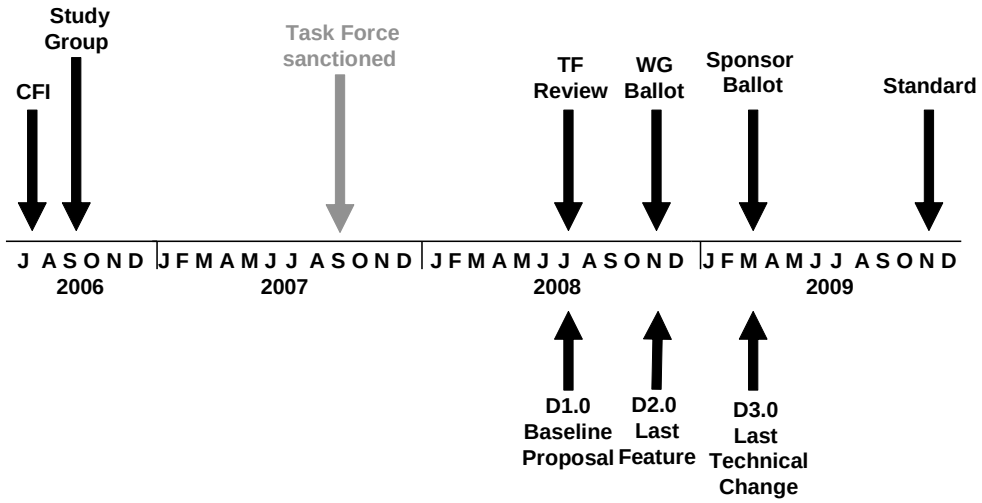

Figure 4: Higher Speed Ethernet Standard Development Plan

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About Brand-Rex

Brand-Rex is a designer and manufacturer of copper and fibre based cabling systems, headquartered in Glenrothes, Scotland with facilities across Europe. Brand-Rex has two primary businesses: Connectivity and Speciality. Its Connectivity division designs and manufactures cabling systems (both copper and fibre) for data communications and is the No.2 player in Europe. The Speciality division exclusively produces cables that are used for control, communications, power and instrumentation within hostile environments.

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