40 Gigabit Ethernet and 100 Gigabit Ethernet

Frequently Asked Questions (FAQ)

Q: What is the role of the High Speed Ethernet (HSE) subcommittee?

A: The HSE subcommittee was formed by Ethernet Alliance members committed to the development and success of 40 Gigabit Ethernet and 100 Gigabit Ethernet. The HSE subcommittee initially served as a forum for the incubation of the effort that led to the call-for-interest (CFI) in the IEEE 802.3 Working Group. As the project progressed, the HSE subcommittee became a forum for consensus building. As the project moves closer to ratification, it will serve as an industry resource for end users and focuses on certification and demonstrating multi-vendor interoperability.

Q: What is the highest speed of Ethernet?

A: Currently, the maximum interface rate in the IEEE 802.3 standard and approved amendments is 10 Gb/s. Virtual links – capable of supporting greater bandwidth capacities – can be created by combining 10 Gigabit Ethernet links with link aggregation (LAG). These virtual links may help satisfy a network's needs for higher bandwidth capacities, but come with performance and physical limitations that can only be overcome by increasing the rate of operation.

Q: What is the purpose of the IEEE P802.3ba 40 Gb/s and 100 Gb/s Ethernet project?

A: The purpose of the IEEE P802.3ba 40 Gb/s and 100 Gb/s Ethernet project is to extend the Ethernet protocol to operating speeds of 40 gigabits per second and 100 gigabits per second. As part of this project several new physical layer specifications are being developed for transmission across an electrical backplane, twin-ax cabling, OM3 multimode fiber, and single-mode fiber.

Q: Why were two rates chosen for IEEE P802.3ba?

A: Two primary application areas for Ethernet are the computing and the network aggregation spaces. As shown in Figure 1, the bandwidth requirements for these two areas are growing at different rates: computing has been doubling approximately every 24 months, while network aggregation has been doubling approximately every 18 months. Prior to IEEE P802.3ba, Ethernet has always increased in 10x increments and has applied a "one-size-fits-all" mentality. However, given the two different growth rates, it was decided that the two primary application spaces would be best served with two distinct rates.

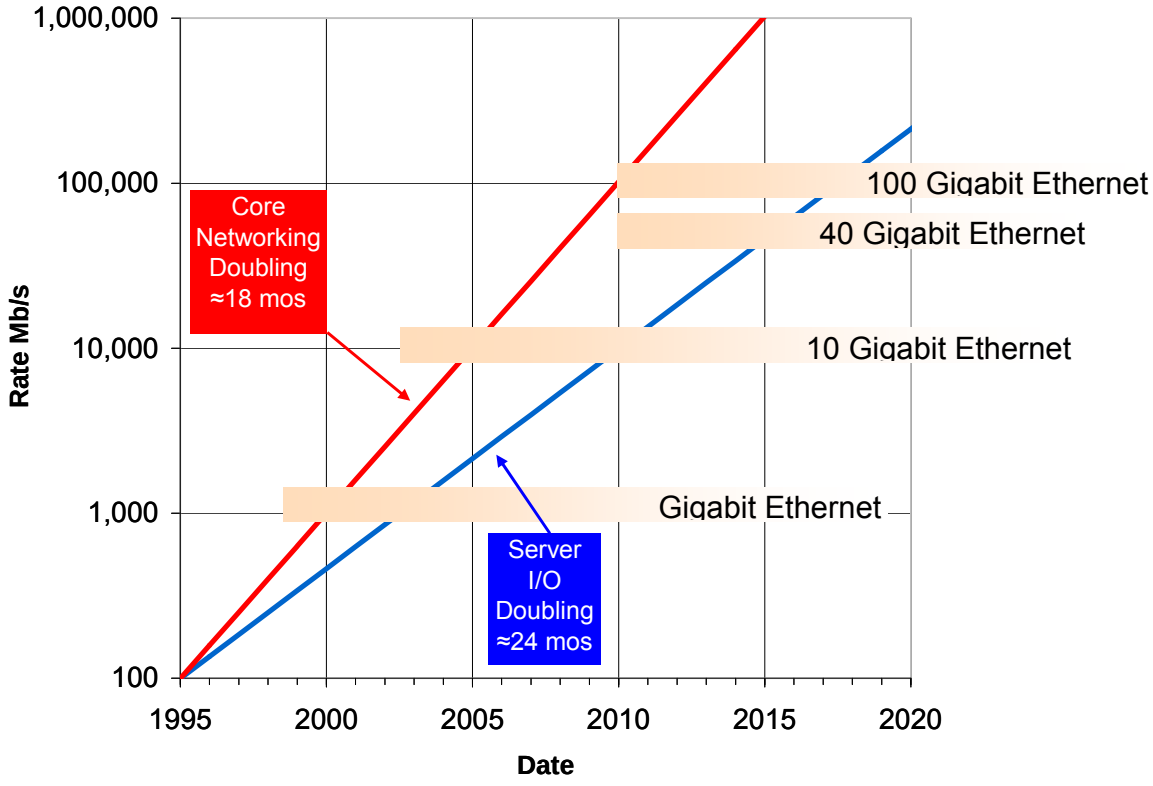

Figure 1- Bandwidth Growth and Application Spaces

Q: What are the main applications driving the demand for 40 Gigabit Ethernet?

A: Bandwidth demand for data center computing and storage resources is driven by several emerging technologies including multi-core processing, virtualization, networked storage, and I/O convergence. These server and storage applications will benefit from the smaller bandwidth step which more closely matches server and storage performance improvements.

Please see the Ethernet Alliance's "Overview of Requirements and Applications for 40 Gigabit and 100 Gigabit Ethernet," which can be found at: http://www.ethernetalliance.org/attachments/126_OVERVIEW_AND_APPLICATIONS2.PDF.

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Q: What are the main applications driving the demand for 100 Gigabit Ethernet?

A: Traffic demand in the network backbone continues to grow rapidly, driven by a number of popular applications such as IPTV, video-on-demand services, remote storage, IP data transit, mobile broadband services, VPN services, peer-to-peer streaming, etc. While each application on its own has small impact, the cumulative effect of the growth in usage and bandwidth requirements of these applications is having a huge impact.

A similar bandwidth requirement is observed at the aggregation points within today's large data centers. The capacity strain felt in these core networking and data center aggregation applications will benefit from a 10x speed increment which has proven effective in matching the cost/performance requirements of the aggregation equipment.

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Q: How do I understand the naming of the IEEE P802.3ba family of PHYs?

A: The family of PHYs specified by IEEE P802.3ba includes: 40GBASE-KR4, 40GBASE-CR4, 40GBASE-SR4, 40GBASE-LR4, 100GBASE-CR10, 100GBASE-SR10, 100GBASE-LR4, and 100GBASE-ER4. The nomenclature is explained in Table 1.

Prefix	Suffix				
Speed	Medium		Coding Scheme	Lanes	
	Copper	Optical		Copper	Optical
40G = 40Gb/s 100 = 100Gb/s	K = Backplane C = Cable Assembly	S = Short Reach (100m) L = Long Reach (10km) E = Extended Long Reach (40km)	R = 64B/66B Block Coding	n = 4 or 10	n = Number of Lanes or Wavelengths
				n=1 is not required as serial is implied	

Table 1: IEEE P802.3ba PHY Naming Nomenclature

Note: The nomenclature for Optical medium defines the reach capability of the PHY. This is a departure from previous naming nomenclatures, but is necessary, as the IEEE P802.3ba "L" and "E" PHYs both utilize the same wavelengths.

Q: What are the key technology developments?

A: 40 Gigabit Ethernet and 100 Gigabit Ethernet is built upon a combination of technology developments and refinements. A single architecture has been developed that supports both rates, as well as multiple physical layer specifications selected for the project. Please see "40 Gigabit Ethernet and 100 Gigabit Ethernet Technology Overview" for further details at http://www.ethernetalliance.org/images/40G_100G_Tech_overview(2).pdf

Q: What is the status and schedule?

A: In March 2008, the IEEE P802.3ba Task Force adopted the schedule shown in Figure 2. As shown, the Task Force entered the Working Group (WG) ballot stage in March 2009. The next major milestone for the project is in November 2009 with the objective to go to Sponsor (LMSC) ballot. Based on this schedule, ratification of the standard is expected in June 2010.

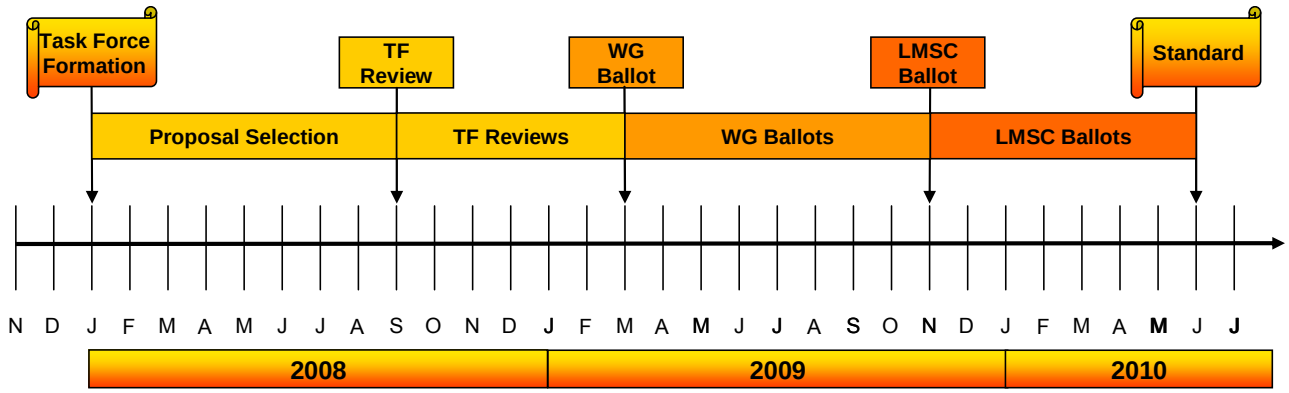

Figure 2 - IEEE P802.3ba Project Schedule

Q: What are the next steps for the HSE subcommittee?

A: As IEEE P802.3ba progresses towards ratification, the HSE subcommittee will shift its focus to certification and demonstrating multi-vendor interoperability. Efforts to educate the industry on the IEEE P802.3ba standard will continue, which in turn, will lead to further exploration of how Ethernet can evolve to meet industry needs. One such evolution that is likely is a future IEEE 802.3 project that will apply IEEE P802.3az Energy Efficient Ethernet, which is currently in development, to the IEEE P802.3ba architecture.

Q: What other physical layer specifications may be developed for 40Gigabit Ethernet and 100 Gigabit Ethernet?

A: While IEEE P802.3ba is developing a number of physical layer specifications, there are still a number of PHYs that can be envisioned as future projects. As the technology matures, projects become feasible for enhancements such as a serial solution for 40 Gigabit Ethernet over multimode or single-mode fiber, a

twisted pair cabling solution for 40 or 100 Gigabit Ethernet, or a backplane solution for 100 Gigabit Ethernet.

Q: What will be the next higher speed of Ethernet?

A: The demand for bandwidth progresses unabated. As shown in Figure 1, by 2015 the predicted bandwidth requirement for network aggregation will be 1 terabit per second. However, given the decision to do 40 Gigabit Ethernet in IEEE P802.3ba, some have argued that 400 Gigabit Ethernet may be the next logical choice.

Whether it is 400 Gigabit Ethernet or Terabit Ethernet, the Ethernet Alliance and the HSE subcommittee are already serving as a forum for the discussion of this topic.