SPEED AND CONVERGENCE

FOLLOWING THE FCIA ROADMAP TO SUCCESS!

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The heart and soul of any technology, and the industry association that stewards the technology, is its technology roadmap. Just like the term suggests, a roadmap shows the history of a technology. It is also a guide to where it is going and when it is going to get there. The three primary audiences for a technology roadmap are the user base that deploys the technology, the development, manufacturing and distribution base that supplies the technology, and the industry standards bodies that develop standards for the technology.

An accurate roadmap provides a reliable guide for suppliers to plan their product development and release cycles based upon the features and timing of the technology migration for the future.

A consistently trustworthy roadmap provides the user with a planning document. Additionally, the roadmap provides the user with confidence that their investments in the technology will be preserved into the foreseeable future. The roadmap shows that the technology has legs to run with and thereby ensures their investments today are future-proofed for tomorrow.

A dependable and responsible roadmap provides standards bodies a planning cookbook by which they can initiate and complete standards within the timeframe defined by the roadmap. The roadmap also directs suppliers on when to begin product development using with said technology. The supplier's development efforts are based upon open standards that are technically complete. Some technology developments are required building blocks for further product development. For example, lasers in optical modules need to be developed before the modules can be developed that will eventually be used in a switch or host bus adapter. With a solid roadmap and standards, multiple companies can develop products in parallel that will eventually interoperate when they reach the market.

So how does a technology roadmap become a responsible, reliable, trustworthy and consistently accurate planning document? The short answer is that it takes time and commitment. It takes time for the roadmap to have a sufficiently deep history that has year-in and year-out kept its promise to become credible. It must be a stable and consistent document that did not frequently change and reset expectations in the industry. A changing roadmap causes confusion and could cause faulty planning by users and suppliers based upon an erroneous, ever-changing inaccurate roadmap. In order to avoid loss of credibility and trust from standards creators, technology suppliers and end users, it simply must have a rich history of being solidly accurate in its past forecasts.

One of the best industry examples of a roadmap that meets this proven reliable, trustworthy criterion is the FCIA roadmap. Since 1997, the FCIA roadmap has been spot-on with its mapping of Fibre Channel speeds. In addition to the Fibre Channel

Product Naming	Throughput (MBps)	Line Rate (GBaud)†	T11 Spec Technically Completed (Year) ‡	Market Availability (Year) ‡
1GFC	200	1.0625	1996	1997
2GFC	400	2.125	2000	2001
4GFC	800	4.25	2003	2005
8GFC	1600	8.5	2006	2008
16GFC	3200	14.025	2009	2011
32GFC	6400	28.05	2012	2014
64GFC	12800	TBD	2015	Market Demand
128GFC	25600	TBD	2018	Market Demand
256GFC	51200	TBD	2021	Market Demand
512GFC	102400	TBD	2024	Market Demand

FIBRE CHANNEL ROADMAP

- "FC" used throughout all applications for Fibre Channel infrastructure and devices, including edge and ISL interconnects. Each speed maintains backward compatibility at least two previous generations (I.e., 8GFC backward compatible to 4GFC and 2GFC.
- †Line Rate: All "FC" speeds are single-lane serial stream
- ‡Dates: Future dates estimated

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speeds, the FCIA has also mapped the timeline and speed migration for FCoE. FCIA success in delivering 15 years of accurate roadmaps come from the seriousness FCIA takes in this huge responsibility and obligation to the industry.

FCIA has a Roadmap Committee that is closely associated with INCITS T11.2 Task Group, the standards body that defines Fibre Channel speeds. Since FCIA meets at the T11 meetings, and its roadmap committee includes many of the key T11.2 standards engineers as well as key Fibre Channel supplier corporate and technical marketing experts, the resulting roadmap is the refined product of an intense iterative process that pinpoints highly attractive market propositions balanced with sound engineering feasibility. The end result is an official FCIA roadmap and set of MRDs (Marketing Requirement Documents) that becomes T11.2's map of speeds and timelines. The MRDs define sets of features and benefits that are both feasible within the roadmap timelines, and they also result in actual products delivered in the prescribed timeframe that realize massive market success.

Product Naming	Throughput (MBps)	Equivalent Line Rate (GBaud)†	T11 Spec Technically Completed (Year) ‡	Market Availability (Year) ‡
10GFCoE	2400	10.315	2008	2009
40GFCoE	9600	41.225	2010*	Market Demand
100GFCoE	240000	103.125	2010*	Market Demand

FCoE ROADMAP

- Fibre Channel over Ethernet tunnels FC through Ethernet. For compatibility all 10GFCoE FCFs and CNAs are expected to use SFP+ devices, allowing the use of all standard and non standard optical technologies and additionally allowing the use of direct connect cables using the SFP+ electrical interface. FCoE ports otherwise follow Ethernet standards and compatibility guidelines.
- †Line Rate: All "FC" speeds are single-lane serial stream
- ‡Dates: Future dates estimated
- *It is expected that 40GFCoE and 100GFCoE based on 2010 standards will be used exclusively for Inter-Switch Link cores, thereby maintaining 10GFCoE as the predominant FCoE edge connection

T11.2, like any standards body, is allergic to wasting time developing standards that never see the light of day in successful markets. That is one key reason that FCIA's roadmap, different from other industry roadmaps, takes great pains in accurately defining when a technically stable standards document is required to enable a specific speed migration and products based upon that speed.

FCIA's process for roadmap development has over the years earned the trust from T11.2 to the point that its MRDs and resulting roadmap become INCITS documents embedded in the standards development process. The roadmap ensures that what goes down on paper for official standards are within its guidelines.

This successful FCIA/T11 process of roadmap development and relentless execution results in reliable, relevant standards. The resulting standards are stable and ready in time for suppliers to begin their development. They are standards that meet feature/benefit criteria and guarantee functionality, cost, compatibility, power, length, and other components for a successful market. The user benefits by having a wide selection of products based upon open standards in a timeframe that meets the user's demand.

Product Naming	Throughput (MBps)	Equivalent Line Rate (GBaud)†	T11 Spec Technically Completed (Year) ‡	Market Availability (Year) ‡
10GFC	2400	10.52	2003	2004
20GFC	4800	21.04	TBD	2008
40GFC/ FCoE	9600	41.225	2010	Market Demand
100GFC/ FCoE	24000	103.125	2010	Market Demand
400GFC/ FCoE	96000	TBD	TBD	Market Demand
1TFC/FCoE	240000	TBD	TBD	Market Demand

ISL (INTER-SWITCH LINK) ROADMAP

- ISLs are used for non-edge, core connections, and other high speed applications demanding maximum bandwidth. Except for 100GFC (which follow Ethernet)
- †Equivalent Line Rate: Rates listed are equivalent data rates for serial stream methodologies.
- ‡ Some solutions are Pre-Standard Solutions: There are several methods used in the industry to aggregate and/or "trunk" 2 or more ports and/or data stream lines to achieve the core bandwidth necessary for the application. Some solutions follow Ethernet standards and compatibility guidelines. Refer to the FCoE roadmap for 40GFCoE and 100GFCoE.

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FCIA's Roadmap, version V14, is the latest descendent of a long successful history of the FCIA roadmap and can be found at: www.fibrechannel.org/fibre-channel-roadmaps.html It maps the doubling of Fibre Channel speeds from 1GFC (Gigabits per second Fibre Channel), 2GFC, 4GFC all the way out to 512GFC in factors of 2 GFC for edge connectivity. Each doubling of speed has taken about 3 years to complete and the 32GFC standard is expected to be stable in 2012. It also maps FC and FCoE ISL's (Inter-Switch Links) out to 1TFC (1 Terabit/s Fibre Channel) and 1TFCoE (1Terabit/s Fibre Channel over Ethernet). The V14 Roadmap also pinpoints standard stability and general market availability for 16GFC and 32GFC edge connectivity (16GFC in 2011 and 32GFC in 2014, respectively). This roadmap shows the long legs that Fibre Channel has going into the future.

Other important elements defined in the roadmap include backward compatibility. For instance, just like 1GFC, 2GFC, 4GFC, and 8GFC edge connectivity, 16GFC and 32GFC are required to be backward compatible at least two generation. These speeds are auto-negotiated with no user intervention required, - i.e., 16GFC will automatically run at 4GFC and 8GFC, whilst 32GFC will automatically run at 8GFC and 16GFC. This important level of backward compatibility has been and will continue to be a major benefit in Fibre Channels continued success.

ABOUT THE FCIA

The Fibre Channel Industry Association (FCIA) is a non-profit international organization whose sole purpose is to be the independent technology and marketing voice of the Fibre Channel industry.

We are committed to helping member organizations promote and position Fibre Channel, and to providing a focal point for Fibre Channel information, standards advocacy, and education.

Today, Fibre Channel technology continues to be the data center standard for storage area networks and enterprise storage, with more than 80 percent market share.

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