INCITS Fibre Channel (T11) Technical Committee (FC-TC) Annual Report

March 19, 2013 to March 13, 2014

Informal Description of Work

The Fibre Channel (T11) Technical Committee (FC-TC) is responsible for storage interconnect and networking families of standards, including Fibre Channel, Fibre Channel protocol mappings to higher level architectures, Fibre Channel mappings to alternate physical transports, SBCON, HIPPI, and a number of related management and API standards. FC-TC is co-TAG to ISO/IEC/JTC 1/SC 25/WG 4 along with INCITS TC T10. Fibre Channel is the main technology used to implement Storage Area Networks, allowing the many benefits from storage consolidation and remote storage access. Most standards development for FC-TC projects is actually performed within the TC.

1. Executive Summary

The reporting period is marked by the completion of several Fibre Channel standards and technical reports. Standards nearing publication include FC-SB-5 which defines additional functionality for the FICON environment, and SM-HBA-2 which enhances HBA management. Completed standards recently sent to INCITS for public review and further processing include FC-BB-6 which enhances and adds functionality to the Fibre Channel over Ethernet protocols, FC-PI-6 which defines 32GFC for Fibre Channel, and FC-SP-2 AM1 which enhances the Fibre Channel security environment. The FC-MSQS-2 technical report is nearing completion and serves as a companion document to FC-PI-6. In addition work continues on classical Fibre Channel in the Fabric and Fabric services area (FC-SW-6, FC-GS-7, FC-FS-4, FC-LS-3).

Going forward T11 continues the development of both classical Fibre Channel and the new Fibre Channel over Ethernet protocols. In addition work continues on classical Fibre Channel in the Fabric and Fabric services area. T11 is considering the impact of green and energy efficiency, solid state storage devices (SSDs), and the impact that cloud and software defined storage technologies has on Fibre Channel and SANs.

T11 maintains active liaison with a number of standards organizations and provides liaison for some organizations publishing standards through INCITS.

Most of standards developed by FC-TC are later forwarded to ISO/IEC JTC1 SC25 WG4 for international standardization.

2. Significant Accomplishments

The committee has completed two standards that are nearing publication and completed 3 standards/technical reports which are at INCITS for public review and further processing as described in the executive summary. In addition, several hundred documents and presentations have been prepared supporting the technical and administrative activities of the committee in the period this report covers. Here are the details:

Extended capability of the core standards:

The core standards of Fibre Channel continue to be refined, clarifying implementation requirements and adding new capabilities. Work continues on the projects FC-SW-6, FC-GS-7, FC-LS-3, and FC-FS-4 that enhance the classical Fibre Channel protocols. The FC-SW-6 project is working on a new switch model known as the Distributed Switch which provides a new topology for the Fabric. In addition, FC-GS-7 is providing additional functionality for the management of the distributed switch environment and cloud.

Physical layer:

The physical layer technologies continue to improve in performance and cost-effectiveness. Work is complete for the FC-PI-6 and FC-MSQS-2 projects that double the data rate of 16GFC to 32GFC Fibre Channel. Additionally, a new project was approved to define the multi-lane 128GFC protocols that are based on 32GFC. Later in 2014 a 64GFC project (FC-PI-7) is likely to be proposed.

Remote access and alternate link technology:

Fibre Channel is important as a high-performance secure mechanism for remote access to storage. To extend the already defined capabilities for transmitting Fibre Channel over SONET, TCP/IP, Generic Framing Protocol links, and Pseudo-Wire environments.

FICON:

To support the large system FICON environment, the FC-SB-5 specification was completed and is nearing publication at INCITS. Most likely there will be an FC-SB-6 proposal in the near future.

Security:

The use of Fibre Channel links in more sensitive environments and outside secure computer rooms has increased the requirements for security. The FC-SP-2 standard extends the security protection for Fibre Channel environments already defined in FC-SP. A new project FC-SP-2 AM1 was approved and completed. This project amends FC-SP-2 to document the modifications needed to transition to the use of stronger cryptographic keys and more robust algorithms (see NIST Special Publication 800-131A).

Energy Efficiency:

The FC-EE project continues to provide inputs into the core Fibre Channel standards (FC-FS-4, FC-SW-6, and FC-LS-3) that define the requirements and features for energy efficient Fibre Channel.

HBA Management:

The SM-HBA-2 specification was completed and is nearing publication at INCITS. No new work is planned for HBA management.

New Work:

In addition to the formal T11 work, the committee is looking at new areas of Fibre Channel work in the protocol area. New work areas include solid state storage device support(SSD), cloud, virtualization, and software defined storage (SDS). In addition T11 is looking at new protocol mappings. For example, an NVMe mapping to Fibre Channel will be proposed during the next couple of meeting cycles.

As a result of these activities, the total program of work of FC-TC during the period of this annual report is summarized as follows:

Family	Projects in Development	Projects in FC-TC or INCITS Approval	Published Standards	Total
FC-TC T11	1	1	0	2
FC Physical T11.2	1	2	0	3
FC Protocol T11.3	4	3	0	7
TOTAL	6	6	0	12

FC-TC work continues to be recognized and supported by the industry. FC-TC has 28 voting members and 12 advisory member organizations in March 2014,

compared with 28 voting and 15 advisory member organizations in April of 2013. The total Emeritus members remain at seven.

The following is the outline of the task groups of FC-TC and the project allocation to the TC and TGs:

FC-TC: Technical Committee for Fibre Channel Interfaces

FC-TC is developing the FC-EE standard and looking at new FC work in the protocol area. The SM-HBA-2 document is nearing publication. Work completed in FC-EE is being proposed to FC-FS-4, FC-SW-6, and FC-LS-3 for inclusion in those standards.

FC-TC is one of the Technical Advisory Groups (TAGs) for ISO/IEC/JTC 1/SC 25/WG 4. Most of its TAG activity addresses standards and technical reports that FC-TC has first developed as ANSI/INCITS standards, including Fibre Channel, HIPPI, and IPI standards. It has provided and will continue to provide guidance on other WG 4 proposed standards as required. In addition, FC-TC provides support for the international standardization of certain standards fast-tracked by SNIA through INCITS.

TG T11.2: Physical Variants

The projects currently allocated to this task group are: FC-MSQS-2, FC-PI-6, and FC-PI-6P (in development). Good progress is being made on all three documents. These documents describe the 32GFC speeds and define the multi-lane 128GFC variant.

TG T11.3 Interconnection Schemes

The projects currently allocated to this task group are: FC-BB-6, FC-SW-6, FC-FS-4, FC-LS-3, FC-GS-7, FC-SP-2 AM1, and FC-SB-5. FC-SB-5 is nearing publication, and FC-BB-6 and FC-SP-2 AM1 are in further processing at INCITS. Good progress is being made on the other standards as well.

3. Significant Challenges

The most significant challenges are the consolidation of the FC industry and the maturing nature of the FC technologies. In addition, many companies have restricted their travel to industry functions in order to improve themselves economically. The consolidation of the FC industry may result in fewer member companies participating in T11. T11's goal is to spawn new FC work items that will hopefully add new member companies and offset the impact of consolidation. The maturing nature of the FC technologies is requiring that T11 examine new areas of work that include SSDs, cloud, and software defined storage. Another

challenge is that member companies have cut their travel budget and this is making it more difficult for representatives to participate in the meetings. T11 is working with existing member companies and potential new companies to ensure physical participation in the T11 activities.

4. Expected Challenges

Going forward the continuing challenge for T11 is to spawn new types of work into Fibre Channel. Much of the current technical work will be finishing up in the next couple of years prompting T11 to examine new areas of work. As mentioned before work areas being investigated include virtualization (SDS), cloud, and SSD support. An additional challenge will be the transition from FCIA hosted T11 meetings, to meetings hosted by member companies. Beginning in 2015 the FCIA will no longer host T11 meetings and therefore T11 member companies will be required to host meetings. T11 is working with potential hosting companies to ensure that our 2015 dates are covered. In addition, in 2015 T11 may go from a four day meeting week to a three day meeting week.

5. Committee Activities

5.a Previous meetings for the reporting period

Apr 8-12, 2013	Albuquerque, NM
Jun 3-7, 2013	Coeur d'Alene, ID
Aug 5-9, 2013	Chicago, Il
Oct 7-11, 2013	Duluth, MN
Dec 2-6, 2013	Austin, TX
Feb 3-7, 2014	New Orleans, LA

5.b Next 12 months of meetings

March 31-April 4, 2014	Scottsdale, AZ
June 2-6, 2014	Philadelphia, PA
August 4-8, 2014	Anchorage, AK
October 6-10, 2014	Cour d'Alene, ID
December 1-5, 2014	Saint Petersburg, FL

February 2-6, 2015	Fort Lauderdale, FL

Full details of these meetings can be found at *www.t11.org/t11/meet.nsf/sch*. Currently the plenary meetings of the TC and TGs occur on Thursday of the meeting week. Typically eight or so ad hoc meetings are held during the meeting weeks. In 2014 meetings start on Monday but we are looking at having the adhoc meetings starting on Tuesday in 2015. Related non-FC-TC such as the FCIA Board and Marketing meetings are often co-located with T11. Interim meetings and teleconferences, when necessary, are also announced on the FC-TC e-mail reflectors and posted on the FC-TC website.

6 Liaison Activities

FC-TC and its task groups maintain formal or informal liaison with the following organizations. Most liaison representatives are member organizations with representatives in both INCITS FC-TC and the liaison organization. Liaison relationships vary during the life of relevant projects and are strongest during the development and FC-TC review periods. During the past year T11 has dropped liaison activities with the IETF and the IBTA because there is no dependent or common work being done between T11 and those organizations.

INCITS T10:

Liaison is maintained with INCITS TC T10 (Technical Committee on SCSI Interfaces). The SCSI command set and protocols are carried across the majority of Fibre Channel connections. The breadth of the work requires multiple liaison representatives. For more information about T10 see *www.t10.org/*.

FCIA:

Liaison is maintained with the FCIA, the Fibre Channel Industry Association. The FCIA is a trade and technical organization that involves most of the manufacturers of products compliant with FC-TC standards. For FC-TC, one of the most important activities is its Fibre Channel Technology Road Map. The road map provides up-to-date guidance about user requirements for the technologies being standardized by FC-TC. For more information about FCIA, see *www.fibrechannel.org/*.

SNIA:

Liaison is maintained with SNIA, the Storage Networking Industry Association. SNIA is a trade and technical organization that addresses the use of Fibre Channel and other technologies for the creation of large

storage area networks (SANs). SNIA's technical committees provide many inputs into the FC-TC activities, especially with respect to SAN management functions and the security of SANs. For more information about SNIA, see *www.snia.org/*.

IEEE 802.3

Liaison is maintained with IEEE 802.3. Relevant projects include the definitions of the new Ethernet speeds and interfaces.

See *www.ieee802.org/3/*.

DMTF

Liaison is maintained with the DMTF (Distributed Management Task Force), an organization that develops management standards for computer systems and networks based on CIM (Common Information Model). FC-TC is involved with providing the necessary input to DMTF to properly represent and manage storage area networks. For more information about DMTF, see *www.dmtf.org/*.

INCITS CS1

Liaison is maintained with INCITS CS1. For more information about CS1 see *cs1.incits.org*

OIF

Liaison is maintained with the OIF (Optical Internetworking Forum). For more information on OIF see http://www.oiforum.com/

SFF Committee:

Liaison is maintained with the SFF Committee, formerly named the "Small Form Factor" committee, but now known by its letters. The SFF is an industry organization that documents industry standards in areas typically avoided by accredited standards organizations. Such areas include optical transceiver modules used by Fibre Channel, mechanical standards for Fibre Channel and SCSI storage devices, and connectors for Fibre Channel. Formal liaison is maintained with three SFF Special Subject Working Groups; Transceivers, High Performance Electrical Interconnect, and High Speed Optical Interconnect. For more information about SFF, see *www.sffcommittee.org/ie/*.

Summary of liaisons

Liaison Organization	Representative
INCITS T10	John Lohmeyer
FCIA	Mark Jones
INCITS CS1	Eric Hibbard
SNIA	Craig Carlson
SFF	Dave Lewis
DMTF	Steve Wilson
IEEE 802.3	Adam Healey
OIF	Tom Palkert

7 Membership and Officers

The membership lists for FC-TC are available on the T11 web site under the "members" button (see http://www.t11.org/t11/mem.nsf). The officers of FC-TC and its TGs are shown below:

Officers

Position	Name	Appointed	Organization
T11 Chair	Steven Wilson	5/23/2009	Brocade 130 Holger Way. San Jose, CA 95134 Phone: 408-333-8128 Email: swilson at brocade dot com
T11 International Representative	Peterson, David A.	10/03/2006	Brocade 6000 Nathan Lane North Plymouth, MN 55442 US Phone: +1 612-802-3299 E-mail: david.peterson at brocade dot com
T11 Vice-Chair	DeSanti, Claudio	11/14/2003	Cisco Systems 170 West Tasman Drive San Jose, CA 95134 US Phone: +1 408-853-9172 E-mail: cds at cisco dot

			com
T11 Secretary	Richard Johnson	2/2/2013	Finisar 1389 Moffett Park Drive Sunnyvale, CA 94089 US Phone: +1 408-400-1093 E-mail: richard.johnson at finisar dot com
T11.2 Chair	Palkert, Tom	05/23/2006	Luxtera 255 62nd St. West Excelsior, MN 55331 US Phone: +1 952 200 8542 E-mail: tpalkert at luxtera dot com
T11.2 Vice-Chair	Wallace, Dean	05/23/2006	QLogic CA, US Phone: +1 949-389-6480 E-mail: dean.wallace at qlogic dot com
T11.2 Secretary	Richard Johnson	08/05/2008	Finisar 1389 Moffett Park Drive Sunnyvale, CA 94089 US Phone: +1 408-400-1093 E-mail: richard.johnson at finisar dot com
T11.3 Chair	Carlson, Craig	02/01/2001	QLogic 4601 Dean Lakes Blvd Shakopee, MN 55379 US Phone: +1 952-687-2431 E-mail: craig.carlson at qlogic dot com
T11.3 Vice-Chair	Lou Ricci	10/08/2013	EMC 5 Spruce Road Hyde Park, NY 12538 US Phone: +1 845-705-8884 E-mail: louis.ricci at emc dot com
T11.3 Secretary	Landon Curt Noll	06/05/2008	Cisco Systems 170 West Tasman Drive San Jose, CA 95134 US Phone: +1 408-424-1102

			E-mail: chongo at cisco dot com

8. Future Trends and Related Technical Activities

The work of FC-TC remains very important because of the requirements of the changing economy and the requirement to protect corporate data. The implementation of Fibre Channel based systems for Storage Area Networks (SANs) has demonstrated that more efficient use can be made of computer and storage resources in many environments. At the same time, the long-distance capabilities provided by Fibre Channel allow high performance mirroring and backup to assure the continuation of normal business in the event of natural or man-made damage to a part of the system. It is likely that both these requirements will continue to build the marketplace for FC-TC technology over the next several years.

The work is also very important because of the very high bandwidth and transmission efficiency achieved by Fibre Channel implementations. As computing resources grow more powerful and are distributed across more processors, Fibre Channel is the principal technology capable of meeting the performance and connectivity requirements for storage devices in large enterprise data processing environments. Virtualization and Cloud computing will further drive the need for very high bandwidth and transmission efficiency.

Fibre Channel has proven itself a very "green" technology. Power consumption of high bandwidth optical transceivers and the relatively simple switch and host bus adapter implementations enabled by Fibre Channel are generally lower in power and smaller in footprint than competitive technologies of comparable performance. The consolidation of storage and servers that Fibre Channel allows additionally provides power savings. The FC-EE project addresses the general energy efficiency aspects of Fibre Channel.

Fibre Channel has proven itself a relatively secure technology. The simple structures, optical interconnects, and the inability to access the data paths from the control paths create an environment where good security policies are relatively easy to implement. Additional security tools are now being made available in Fibre Channel environments. The Fibre Channel specific portions of this work are being done in FC-TC.

Other technologies, including TCP/IP and SONET connections, are used to extend SANs even beyond the 80 km distance supported by FC-TC-defined Fibre Channel links. Definition of these technologies will be done within other standards organizations, including the IETF and the IEEE, although Fibre

Channel specific portions of the work will be done within T11.3 or by liaison with FC-TC.

For the class of servers that use Ethernet as an I/O convergence technology, FCoE is proving to be an exciting new technology. It is likely to significantly increase the marketplace for Fibre Channel SANs and provide significant cost/performance and power/performance benefits for a large number of computational environments.

The management of SANs will continue to become an increasingly important activity. While it is likely that significant parts of the work will be carried forward within FC-TC, other parts of the work may be carried forward in other standards organizations or industry consortia, including IETF, T10, SNIA, and DMTF. Much of the work specific to Fibre Channel for these broader organizations will be carried on with liaison with FC-TC.

As previously discussed the goal of T11 is to spawn new FC work based on SSDs, cloud, virtualization, and software defined networks/storage.

Industry consortia remain an important source of new standards activities. There is a strong desire by many organizations to create more formal standards based on those standards activities. INCITS will continue to be an important mechanism for carrying such documents forward into the standards world.

9. Other Administrative Information

Financial Statement:

FC-TC meeting activities are financed and hosted by volunteer organizations. The individual participants and their member organizations finance all travel, room, and related business expenses. FC-TC has no direct financial activities.

Public access policy:

FC-TC has discovered that the simplest way to meet the goal of a fair and equal opportunity for participation of interested parties is to maintain a public participation policy. The FC-TC allows the participation of all directly and materially affected parties in any meeting with very few exceptions. Any interested party may access the documents provided during the development process, the agenda and minutes of the meetings, and the draft of standards in development. Any interested party may join the announcement and discussion e-mail reflectors. For those documents from other organizations that are being considered as part of a liaison activity, the contributing organization may request that the FC-TC protect these documents with a password. Any interested party may attend the FC-TC meetings. Constructive contributions from non-member companies, including papers and meeting participation, are welcomed by the

committee, since such contributions often provide technical review, unique insights, and expertise not available within the committee. All frequent participants are encouraged to become voting members of the committee and most actually do become members. Voting and advisory membership is closely monitored to be sure that only fully qualified members participate in voting. The public access to development documents enables member organizations to communicate with their suppliers and customers about the optimum technical content in a developing standard. A public access policy simplifies e-mail reflector management, web-site management, and meeting logistics reducing load on officers and staff.

FC-TC believes that maintaining a public participation policy is vital to the continued success of the committee. In August 2009 the T11 Website was modified to support the public access policy.

Web-based procedures:

FC-TC made a major transition in 1998 from paper-based operating procedures to completely web-based, interactive procedures. The web-based system has been improved continuously since that time such that it now provides, among others, the following critical capabilities. These capabilities require wireless access at all meeting venues.

An online document register allows documents to be numbered automatically, submitted via ftp or web-based utilities, and linked into the register for web access. Documents distinguished as agendas or minutes are given special forms and simplified access procedures. The documents and document database may be accessed through a number of different indexes. Automated procedures are in place for preparing document mailings, accessing archives, and performing backups.

A database provides access to contact information for all attendees of any FC-TC plenary meeting and for all representatives of TC or TG member organizations. Individuals may update their access information on line using password protected procedures. Representatives of member organizations may update their representation information, but only officers may change the status of a member organization. Update information is automatically transmitted to INCITS.

Letter balloting and comment collection is performed using an automated procedure.

Meeting announcements are submitted to a special data base, from which schedules and automated notifications are prepared.

Attendance for all meetings is taken electronically. If network access is not available, meeting attendance may be taken using a special java-enabled USB storage device.

Documents are distributed during meetings by Wi-Fi network access and by USB storage device.

Special capabilities are provided for the officers, the administrator, and INCITS to facilitate access to particular sets of required information. As an example, access to all annual reports is provided at the webpage http://www.t11.org/t11/docreg.nsf/ar

All FC-TC documents are provided electronically in accordance with guidelines established by the TC.

The website and e-mail reflectors are presently administered entirely by volunteers and financed by corporate donations. If the required functionality and a smooth cost effective transition can be provided, we look forward to INCITS providing support for hosting our web-site and mail reflectors in the future.