**INCITS Annual Report**

**Annual Report for: [INCITS Fibre Channel (T11) Technical Committee FC-TC, (T11-2018-00TBD-v000)]**

**Covering the Period from [April 2017] to [March 2018]**

#### 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 and INCITS TC T13. 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.

#### Executive Summary

This reporting period is marked by the completion or near completion of several Fibre Channel standards and technical reports. The published standard is the FC-GS-7 standard which defines the Fabric Services for Fibre Channel. The standards nearing completion are FC-NVMe which describes the mapping of NVMe to Fibre Channel, the FC-PI-7 and FC-FS-5 standards which provide the next speed bump for Fibre Channel (64/256GFC), the FC-SB-6 standard which defines the next revision of FICON, and the FC-LS-3 standard which enhances the base Fibre Channel architecture.

The FC-EE technical report which addresses energy efficiency for Fibre Channel is also nearing completion.

Going forward T11 continues to establish news areas of work for Fibre Channel. T11 is considering the impact of solid state storage devices (SSDs), cloud, virtualization, and software defined storage technologies have on Fibre Channel and SANs.

The FC-NVMe-2 project enhances NVMe over Fibre Channel by developing new error recovery mechanisms. This work is in concert with the Fibre Channel over Fabrics work being done in the NVM Express group. Also a new project is being formed to develop a 128 GFC serial variant of Fibre Channel.

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.

#### Accomplishments

The committee has published one new standard and is awaiting the publication of several more standards which are in the final stages of INCITS and/or ANSI processing. 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. The FC-GS-7 standard was published in 2017. FC-LS-3 and FC-FS-5 are in the final stages of approval and publication. A new project FC-FS-6 and FC-LS-4 will further enhance the base Fibre Channel architecture.

**Physical layer**: The physical layer technologies continue to improve in performance and cost-effectiveness. FC-PI-7 is almost complete which doubles the data rate of 32GFC to 64GFC.Work has started on FC-PI-7P which defines the four lane variant of 64GFC to achieve the 256GFC speed. A new project FC-PI-8 is coming which will define 128GFC serial.

**Remote access and alternate link technology**: No new work is planned for alternative link technologies.

**Security**: While no current project is underway for Fibre Channel security, TC T11 understands the importance for considering security whenever new standards are defined.

**FICON:** To support the large system FICON environment, the FC-SB-6 project is at INCITS in the final stages of approval and publication.

**Energy Efficiency**: The FC-EE project has completed its technical work by providing inputs into the core Fibre Channel standards: FC-FS-4, FC-SW-6, and FC-LS-3. Recently the FC-EE project transitioned from a standard to a technical report. The FC-EE TR completed T11 letter ballot and will soon be on its way to publication.

**HBA Management**: No new work is planned for HBA management.

**NVMe Support**: The FC-NVMe project which describes the mapping of NVMe to Fibre Channel is completed and is nearing publication. This work was completed in concert with the Fibre Channel over Fabrics work being done in the NVM Express group. To assist in this effort an official MOU and liaison has been established between ITI/INCITS and the NVM Express group. A new project FC-NVMe-2 was formed to enhance the error recovery functionality defined in FC-NVMe.

**New Work**: TC T11 is looking at new areas of Fibre Channel work in the protocol area. New work areas include cloud, virtualization, and software defined storage (SDS).

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 | 0 | 1 | 0 | 1 |
| FC Physical T11.2 | 3 | 0 | 0 | 3 |
| FC Protocol T11.3 | 5 | 3 | 1 | 9 |
| TOTAL | 8 | 4 | 1 | 13 |

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#### 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 has resulted 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. T11 is working with existing member companies and potential new companies to ensure physical participation in the T11 activities.

The T11 committee has successfully transitioned back to meeting hosting by individual companies rather than the FCIA. Also the T11 committee has transitioned to a 3 day plenary meeting week to minimize travel and hosting costs.

#### 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.

**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 whose members are 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 which impact Fibre Channel. 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 the INCITS CS1 security TC. For more information about CS1 see cs1.incits.org/.

**NVM Express**: Liaison is maintained with the NVM Express group to assist in the development of the NVMe over Fabrics specification and the FC-NVMe standards. An official MOU exists between ITI/INCITS and NVM Express. For more information about NVMe see www.nvmexpress.org/.

**COBO**: Liaison is maintained with COBO (Consortium for On-Board Optics Standards Development Group). For more information on COBO see cobo.azurewebsites.net/.

**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. SFF is now a SNIA Technology Affiliate. For more information about SFF, see [https://ta.snia.org](https://ta.snia.org/)/.

#### Membership and Officers

FC-TC work continues to be recognized and supported by the industry. FC-TC has 21 voting members and 13 advisory member organizations in February 2018, compared with 24 voting and 12 advisory member organizations in March of 2017. It is expected that the voting membership will remain roughly the same throughout 2017. There are now 8 Emeritus members.

#### Officers:

The name and organization of each person that held an office during the year should be included. If an office was held by more than one person, list each and indicate dates in office.

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| **Officer Position** | **Name and organization represented** |
| T11 Chair | Steven Wilson Broadcom |
| T11 Vice Chair | Craig Carlson Qlogic |
| T11 Secretary | Richard Johnson Finisar |
| T11 International Representative | Dave Peterson Broadcom |
| T11.2 Chair | Tom Palkert Macom |
| T11.2 Vice Chair | Dean Wallace Qlogic |
| T11.2 Secretary | Richard Johnson Finisar |
| T11.3 Chair | Craig Carlson Qlogic |
| T11.3 Vice Chair | Roger Hathorn IBM |
| T11.3 Secretary | Patty Driever IBM |

#### Membership:

The membership lists for FC-TC are available on [www.incits.org](http://www.incits.org).

#### 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 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 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. The enthusiasm around the FC-NVMe project is evidence of this view.

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.

#### 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 makes use of the INCITS public access process in Section 3.11 in the procedures.

**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 (t11.org) has been improved continuously since that time. These capabilities require wireless access at all meeting venues.

In 2017 FC-TC completed the migration to the INCITS Committee Management System (ICMS). The ICMS system includes most of the functionality provided by t11.org. This includes document data bases, balloting, meeting notification and scheduling, attendance, and committee membership. Great care has been given during the migration to ICMS such that the public notification policy is still maintained. The FCIA has agreed to host t11.org in read only mode and now owns the t11.org domain name.

Plenary meeting documents are distributed during meetings by Wi-Fi network access to the ICMS document database and by USB storage device.

#### Marketing Information

FC-TC has a close working relationship with the Fibre Channel Industry association (FCIA) which functions as the industry marketing arm for Fibre Channel and TC-T11.

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| Committee Membership is added by the Secretariat. |