The Evolution of Structured Cabling Standards
By Herb Congdon

In the early 1990s, when the data communications market really started taking off, the lack of a unifying standard proved problematic. There were a proliferation of proprietary solutions from companies with no way to ensure performance and no guarantee of interoperability. The lack of standardization hindered the ability of this industry to both meet the needs of users and to grow as a market.

EIA/TIA-568-A, the Commercial Building Cabling Standard was first ratified in 1991, and its publication revolutionized the industry. Its purpose was to specify a structured cabling system that would provide a minimum level of performance, support a multi-vendor environment, provide direction for the design of telecommunications equipment and cabling products and establish performance and technical criteria for various types of cable and connecting hardware. The goal was to specify a structured cabling system with a projected usable life of at least 10 years.

The Commercial Building Cabling Standard is, like all standards, voluntary. However, end users and network designers like to have a standards-compliant structured cabling system; it provides a known quantity that they can count on and it helps to ensure that they have a system that is robust and reliable. That's why changes to this document and other related documents generate so much interest.

Currently TIA TR-42 is on the verge of releasing TIA-568-C, the third generation of this standard. The evolution of this standard provides an interesting perspective into the development and implementation of solutions that network designers employ to meet the ever-increasing demands on their Local Area Networks.

Who Develops Standards?

Most Standards in the telecommunications industry are voluntary and consensus based. The two primary organizations that develop standards for this industry are the IEEE, which focuses on the Ethernet applications, and the Telecommunications Industry Association (TIA), which focuses on the passive network to support applications like Ethernet.

TIA is accredited by the American National Standards Institute (ANSI) to develop voluntary industry standards for a wide variety of telecommunications products. The TIA-568 standard is developed by the User Premises Equipment Division under the auspices of the TR-42 Engineering committee. This committee comprises representatives from manufacturers, service providers, consultants and end users, including the government. Participation in the Engineering Committees can be as a TIA member company or as an individual and is open to all companies who wish to participate in the development of industry standards.

Standards projects and technical documents at TIA are formulated according to the guidelines established by ANSI and in the association's Engineering Manual. Any potential project is initiated by a technical contribution to one of the engineering committees or subcommittees from an individual or company requesting the creation of a new standard or technical document in a particular area of technology.

What is the Process for Developing a Standard?

The time to develop a new standard depends on many factors and can takes anywhere from a few months to many years (the TR-42.9 subcommittee, for example, has been working in excess of 10 years on an industrial cabling standard). Once a project has been approved, contributions are reviewed in subcommittee, draft documents are created then balloted to remove or resolve contentious issues. When there is consensus that the document is ready for publication, the subcommittee can release the document.

How Long are Standards Valid?

Standards are living documents, which must constantly be revised to reflect emerging market needs. ANSI mandates a maximum 5-year lifespan for standards, after which they must be revised, re-affirmed or withdrawn. During that lifespan, many addenda may be added to keep the document growing with advances in technology. These addenda may then be incorporated into the new revision of the standard. For example, since the ratification of TIA 568-B in 2001, there have been 6 addenda to 568-B.1, ten addenda to 568-B.2 and one addendum to 568-B.3. Of course, a Standard may be withdrawn at any time by the responsible Engineering Committee.

How has TIA-568 Changed Since its Inception?

When TIA-568-A was ratified, copper cabling – mostly Category 3 and Category 5 UTP -- was used almost exclusively throughout building LANs in North America. This meant that the standard was based on the characteristics of these media in hierarchical star architectures. It was at this time that specific distance limitations, such as 100 meters in the horizontal, came into being as benchmarks for media performance and structured cabling design. Since then, several new applications and grades of media have been introduced into the market and users have started to deploy them. Multimode optical fiber, for example, evolved as an accepted media through addenda and revisions to TIA 568.

- 1995: TSB-72 introduced “Centralized Fiber Optic Guidelines”
- 2001: TIA-568-B.1 incorporated centralized cabling into the standard.
- 2005: TIA 569-B and 568-B.1, Addendum 5 were added to support the use of Telecomm Enclosures (TEs) that enable fiber to be used for zone cabling.

Similar addenda were added and revisions were completed as new applications (such as Gigabit Ethernet) and new grades of cabling (such as Category 6 and 850nm laser-optimized 50-micron fiber) became available.

Also, over the years, specialized cabling standards documents were published to address the specific needs of networks that were not office-oriented. The data center standard (TIA-942) is a good example.

What’s New in TIA-568-C?

The new Commercial Building Cabling Standard gives users and network designers

more standards compliant solutions: new media choices are included along with their appropriate installation and testing procedures. However, in addition to the technical updates, 568-C reflects a new organizational structure that is designed to simplify and streamline future standards processes by reducing duplicated information, and establishing a common foundation for future documents.

The standard is comprised of four documents:

1. **TIA 568-C.0 Generic Telecommunications Cabling** (targeted to users/designers/installers). This document houses most information common to structured cabling in one place and becomes the foundation for future standards. This is where the minimum requirements for generic telecommunications cabling are specified such as cabling architecture, what applications the cabling is intended to support and over what distances, and other general requirements. The document thus serves two purposes - as a "default" standard for structured cabling in locations that are not office-oriented or covered by another standard, and as a foundation for future standards that can now focus on exceptions and allowances for that location rather than having to reconstruct all the generic information.

   Status: The 1st default ballot closed in May 2008. Comments were resolved during a June meeting. A second default ballot has been issued and may allow for publication in the August/September timeframe.

2. **TIA 586-C.1 Commercial Building** (Targeted to users/designers/installers). This document specifies the requirements for telecommunications cabling within and between commercial (office-oriented) buildings. This document builds on 568-C.0 and focuses on the requirements and guidance for office-oriented buildings. There are some technical changes to the information in 568-B.1 that are reflected in this document. These include the addition of:

   - Category 6 balanced twisted-pair cabling
   - Augmented category 6 twisted-pair cabling
   - 850 nm laser-optimized 50/125 µm MM fiber
   - Telecommunications enclosures (TEs)
   - Centralized cabling
   - A recommendation to select 850 nm laser-optimized 50/125 µm as the multimode fiber for commercial buildings

   Some information was also removed:
   - 150-Ohm STP cabling
   - Category 5 cabling
   - 50-ohm and 75-ohm coaxial cabling
   - Balanced twisted-pair cabling performance and test requirements (these will be in the ANSI/TIA-568-C.2 document)

   Status: the 1st default ballot closed in May 2008. Comment resolution was completed in June. The standard is out for its 2nd default ballot, and a third default ballot – in the August timeframe – is possible. This may allow publication as early as September, or maybe in October.

3. **568-C.2 Copper Cabling Components** (Targeted to manufacturers). This standard includes component and cabling specifications for copper cabling, including testing requirements. The document incorporates Cat 3, Cat 5e, Cat 6 and Cat 6A.

   Status: The first committee ballot closed in March. A second committee (30-day) ballot was issued and plans to review comments at an interim August meeting are in place. The timeline for this document shows publication in mid-2009.

4. **TIA-568-C.3 Optical Cabling Components** (Targeted to manufacturers). This document addresses component and cabling specifications for fiber optic cabling. The standard now includes all three types of multimode fiber (82.5-micron, 50-micron and 850nm laser-optimized 50-micron). The addition of array connectors is particularly noteworthy.

   Status: This document has been released for publication.

That's Not All, Folks

In addition to the changes to TIA-568, there is continued effort to refine other documents to address the installation needs of specific types of end use applications.

The Data Center Standard (TIA-942), which was released in 2005, recognizes that the needs of the data center and storage area network require different guidelines than commercial building local area networks. A recent addendum on coaxial cabling was released for specific data center applications. A new project to address subjects such as temperature and humidity guidelines was started in June.

The TR-42.9 Industrial Cabling subcommittee continues to work on an Industrial Cabling Standard (to be TIA-1005). This standard, which will have been 11 years in the making, looks specifically at industrial applications and their unique challenges: very long cabling runs, excessive RFI/EMI, and exposure to extreme temperature variations, vibrations, dirt, gases and liquids. The standard is currently out for default ballot and may be published as soon as October 2008.

Another vertical market that is attracting interest is Multi-tenant/Multi-dwelling Units (MTU/MDU). TR-42.2, TR-42.12 and TR-42.13 are looking at the challenges facing this emerging application with an eye toward defining the optical infrastructure for both MDU residential (apartments, townhouses and condominiums) and MTU commercial properties included mixed-use builds and extending the reach of single-mode fiber services. This may become a standards development project in October.

Thinking Healthy and Green

TIA has established the TR-49 Engineering Committee for Healthcare Communications Technology. TR-42 had already been working on a project to develop a Technical Services Bulletin (TSB) for a Healthcare Facility Cabling. The task group is creating a draft now that the new 568-C.0 document is nearly complete. To successfully complete such a project, TR-42 is soliciting contributions from experienced experts on what makes

healthcare facility cabling different from commercial building cabling.

TIA, recognizing the widespread and widely defined "green initiative" has taken steps to establish a knowledge and document base to address this subject. Another new Engineering Committee will be established for this effort. In the meantime, Engineering Committees such as TR-42 are collecting ideas and submitting contributions to TIA for consideration.

Fine Tuning the Structure of the Structured Cabling System Committees

In addition to re-issuing the major standard for Commercial Building Structured Cabling, the Engineering Committee that produces the work has also undergone some restructuring. In February 2008, the TIA FO-4, *Committee on Fiber Optics*, Engineering Committee merged into the TIA TR-42, *User Premises Telecommunications Cabling Infrastructure*, Engineering Committee. While there will be little short-term impact on the responsibilities and activities of these committees and their subcommittees, there are some longer-term benefits expected.

From an administrative perspective, the Telecommunications Industry Association's Technical Committee saw an opportunity to bolster the FO-4 Engineering Committee, which was addressing standards development in new areas such as the MDU market.

The growth of optical fiber in customer-owned networks, such as commercial buildings and data centers, and the recognized absence of optical fiber component and testing expertise meant that the TIA TR-42 Engineering Committee was a likely partner for FO-4. So, in February 2007, the two Engineering Committees started co-locating their meetings and hosting joint leadership meetings. Through the year, it became apparent that there were multiple synergistic benefits to be realized from the merger, such as:

- Balancing the component and testing expertise for balanced twisted-pair cabling in TR-42.7 with component and testing expertise for optical fiber cabling in TR-42.8
- Incorporating optical fiber into new and existing common and premise standards, and
- Capitalizing on new applications that are based on optical fiber.

Half way through 2008, the effects of the merger of these committees are very positive. With more resources and expertise, TR-42 is well positioned make sure that the standards that the industry depends upon can keep up with emerging markets and technologies.

It Takes an Industry

Standards development works best with balanced input from all segments of the industry and the TR-42 Engineering Committee counts on contributions, comments and constructive criticism to produce effective, useful and competent documents. Working closely with members of BICSI, end-users and manufacturers has been an effective way to achieve those goals. Your participation and input are welcome and often necessary. So feel free to speak up and be part of the success!

Herb Congdon, Systems Market Manager for Tyco Electronics, is Chair of TIA TR-42 and serves as the Standards Chair of the TIA's Fiber Optics LAN Section. FOLS members include 3M, Berk-Tek, a Nexans Company, CommScope, Corning, Draka Communications, Fluke Networks, OFS, Ortronics Legrand, Panduit, Sumitomo Electric Lightwave, Superior Essex, and Tyco Electronics. Visit the Fiber Optics LAN Section at www.fols.org.