Introduction to Structured Cabling

History

Until the beginning of 1980's, the majority of computer networks worked in a host/terminal mode. Applications as well as data were stored centrally on a host computer and user stations called terminals handled them in this centralized way. Considering the text character of this type of communication, it was not necessary to build special high capacity transmission paths for terminal networks. However, their prevalence ended in 1981 when IBM launched their first personal computer onto the market. This new type of workstation was equipped with a local memory and outputs for connecting various peripherals. This resulted in a different—decentralized—mode of operation. This greater independence brought two important issues: (1.) difficult administration and (2.) mutual user co-operation.

Therefore, it was necessary to find a way that would enable to connect new PCs` into a computer network through which it would be possible to share files, applications, and costly peripherals in the same manner as previously in terminal networks.

In the beginning, several solutions arose from different producers. However, differences in technologies and diversity in components of these new systems led to their mutual incompatibility. A solution to this situation was to design a universal system that would set recommended standards determining electrical and physical characteristics of cables as well as connecting hardware. At the beginning of 1990's, American National Standards Institute (ANSI) asked Telecommunications Industry Association (TIA) and Electronic Industries Alliance (EIA) to propose a universal standard for metallic cabling systems. One of the most suitable ways for the new cabling system design was to use the already existing solution introduced by AT&T. These networks used telephone distribution systems that were installed in most office buildings at that time. They had a star topology and used a twisted pair cable as the main transmission medium. The outcome of the commission work was the first specification for structured cabling published in July 1991. It was referred to as ANSI/TIA/EIA 568. Together with the technical bulletins TSB-36 and TSB-40 issued a little later, the new documents defined basic transmission requirements for Category 3, 4, and 5.

In 1995, the first update of the above mentioned standard and also the first version of the international ISO/IEC 11801 standard were issued. In 1996, CENELEC published the first European specification for structured cabling cables and components named EN 50173. As the result of a new high-speed protocol development (i.e. Gigabit Ethernet), all these standards were updated in 2000 and 2002. The updates defined new parameters that must be met by structured cabling components in order to comply with the new protocol requirements. The documents were supplemented with further measured or numerated parameters, such as PSNEXT, PSACR, PSELFEXT, Delay Skew etc. In these specification updates, the new Category 5 (today known as Category 5E), Category 6, and Category 7 were introduced.

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Currently Existing Categories

Category 3—this is the first and therefore oldest category in structured cabling. In the beginning, Category 3 components were used for both voice and data transmissions. The bandwidth was defined up to 16 MHz with data rates of 10 Mbps. Today, Category 3 is predominantly used for telephone distribution systems (e.g. connection from ISDN patch panels to telephone PBX board, telephone equipment cords etc).

Category 5E—at present, Category 5E (or Enhanced Category 5) is still one of the most frequently used categories in structured cabling. The first standard for Category 5E was published in 2000 and was referred to as ANSI/TIA/EIA 568B.1 for the American standards, CENELEC EN 50173-1:2000 for the European standards, and ISO/IEC 11801:2000 for the international standards. In CENELEC as well as ISO/IEC specifications, it is still referred to as Category 5 (i.e. not Category 5E). The term "Category 5E" is used only in the ANSI/TIA/EIA standard. It was originally introduced by manufactures in order to distinguish between the already existing Category 5 components and the "new" improved Category 5E. As mentioned previously, Category 5E cabling components are suitable for the Gigabit Ethernet protocol (i.e. 1000BaseT), which should fit requirements of most company networks with regular data traffic. However, the 1 Gbps transmission rate is the limit for all Category 5E products and no further improvements are possible.

Category 6—the final specification for Category 6 was published in 2002. The document update is known as ANSI/TIA/EIA 568B.2-1 for the American standards, CENELEC EN 50173-1:2002 for the European standards, and ISO/IEC 11801:2002 for the international standards. Category 6 is specified up to 250 MHz. The double available bandwidth in comparison with Category 5E requires higher component quality. On the other hand, if these quality requirements are met, Category 6 components offer improved performance and transmission reliability, especially in connection with the 1000BaseT and 1000BaseTX protocols.

Category 6A—this is a new category that was finalized in April 2008 in the American ANSI/TIA/EIA 568B.2-10 standard and at the end of 2009 in the international ISO/IEC 11801 Amendment 2 standard. This "new" category is referred to as "Augmented Category 6" or "Category 6A". It was developed specifically for the new 10GBaseT Ethernet protocol in mind. Category 6A offers 500 MHz bandwidth and thus is suitable for the most data-intensive applications used on metallic computer networks. You can learn more about the 10GBaseT protocol as well as Category 6A further on in this catalogue.

Category 7—this category was first mentioned in 1997, however, its specification was not finished before 2002. Category 7 was specified in the CENELEC EN 50173:2002 and ISO/IEC 11801:2002 standards but for installation cables only. In the ANSI/TIA/EIA standards Category 7 is not mentioned. The bandwidth that is defined for Category 7 is 600 MHz.

Category 7A—a new category that has just come into reality specifying installation cables up to 1000 MHz. The primary purpose for introducing Category 7A was to keep sufficient bandwidth distance from Augmented Category 6.

The table bellow shows supported protocols, bandwidth, maximum transmission rates, and recommended use for all categories.

	CAT 3	CAT 4	CAT 5	CAT 5E	CAT 6	CAT 6A	CAT 7	CAT 7A
Supported Protocols	Analog. Voice, ISDN, 10BaseT	IBM Token Ring	100BaseT and lower	1000BaseT and lower	1000BaseTX and lower	10GBaseT and lower	10GBaseT and lower	10GBaseT and lower
Bandwidth	16 MHz	20 MHz	100 MHz	100 MHz	250 MHz	500 MHz	600 MHz	1,000 MHz
Maximum Transmission Rate	10 Mbps	16 Mbps	100 Mbps (Fast Ethernet)	1,000 Mbps (Gigabit Ethernet)	1,000 Mbps (Gigabit Ethernet)	10 Gbps	10 Gbps	10 Gbps
Usability	Predominantly telephone distribution systems	No longer installed	No longer installed	Regular data and voice traffic	Higher data traffic (multimedia, streaming)	High data traffic, backbone distribution sytems, SAN	High data traffic, backbone distribution sytems, SAN	High data traffic, backbone distribution sytems, SAN

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In the ISO/IEC 11801 and CENELEC EN 50173 generic cabling documents, further copper cabling distinctions referred to as "Classes" were introduced. Classes are used for classifying the permanent link or channel performance rather than for rating individual cabling components. The brief description of all classes as specified in the ISO/IEC and CENELEC standards is the following:

Class A—specifies analogue voice telephony with the bandwidth of up to 10 KHz.

Class B—defines frequencies up to 1 MHz for voice and slow data links (i.e. IBM 3270 terminals etc.)

Class C—this class corresponds to permanent link and channel performances using Category 3 components. Similarly to Category 3, it covers the bandwidth of up to 16 MHz. Its primary application today is to classify telephone distribution systems.

Class D—the class was first ratified in 1995 and updated in 2000. Today Class D covers permanent link and channel topologies built with Category 5E cables and connecting hardware with the bandwidth of up to 100 MHz.

Class E—this class was specified in 2002 and corresponds to data links with Category 6 components with the bandwidth of up to 250 MHz.

Class E_A—this is a new class that was defined at the end of 2009 in ISO/IEC 11801 Amendment 2. Class E_A specifies permanent link and channel systems up to 500 MHz. Similarly to Category 6A, Class E_A links are aimed to be used with the 10GBaseT protocol.

Class F—this class covers the standard bandwidth of up to 600 MHz and corresponds to Category 7 links.

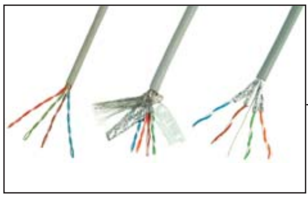
Class F_A—with reference to Class E_A and its 500 MHz frequency, it was necessary to re-define the original Class F with a new class with 1,000 MHz bandwidth named Class F_A. As with Category 7/Class F, the Category 7A/ Class F_A document specifies double shielded installation cables only.

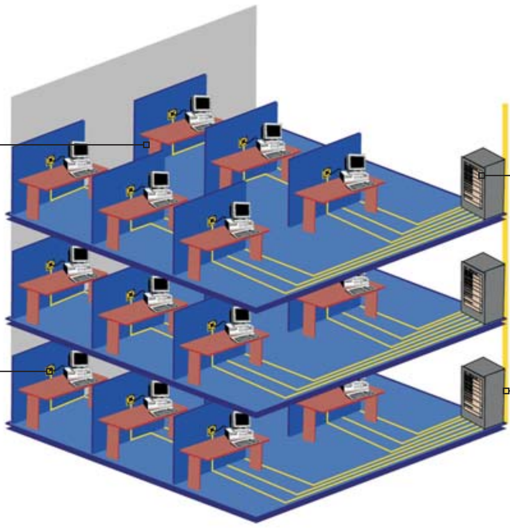
What is Structured Cabling?

Structured cabling is a universal system,

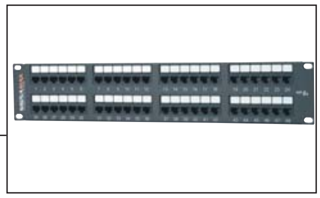
- that supports digital as well as analog signal transmissions,
- in which telecommunication outlets are installed even in locations where they are not needed at the time of installation,
- that use data cables with four twisted pairs and fiber optic cables,
- in which long technical and also moral service life is expected,
- whose correct functionality is as important for a company as the functioning of the electrical distribution system or any other system in company's infrastructure.

Installation Cables





Patch Panels



Work Area Outlet System

Fiber Optic System