Author

Mike Gilmore, Senior Partner of The Cabling Partnership, is involved at the highest level in UK and European cabling standardisation. Mike is Chairman of the BSI Premises Cabling Experts Panels (TCT7/-/1 and TCT7/-/3) and Convenor of CENELEC TC215 Working Group 1 (its European partner). The two groups control the development of UK and European standards for the design and installation of telecommunications cabling. Mike also acts as the Technical Director of the UK Fibreoptic Industry Association. He can be contacted at mike.gilmore@btinternet.com.

Data centres and cabling standards

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Introduction

The development of cabling standards within normal office environments where users at their desktops are allocated between two and twelve telecommunications outlets, depending on their importance in the revenue stream, has been ongoing since the late 1980's. The technical objective of standards such as ISO/IEC 11801, EN 50173-1 and ANSI/TIA/EIA568-B has been to define a set of transmission channels that match the demands of the relevant transmission networks to the structures of cabling needed in office-type premises.

Although many of the applications are universal, such as 10/100/1000 Mb/s Ethernet, and are common to all types of premises (industrial, homes etc.) - the cabling structures of the office do not map across to other buildings or even other locations in office buildings.

Most office buildings contain one or more areas that can be described as data centres and some buildings contain little else but data centres. The cabling structures in such areas are dramatically different to those of the office. There are currently two different standardisation activities, one in Europe - the other in the USA, which aim to define such structures and the components that can be used to implement "data centre cabling". This article explains some of the approaches that have been adopted in the European work.

What is a "data centre"?

For the purposes of the future European standard, a data centre is a collection of cabinets, frames or closures containing transmission equipment interconnected by passive cabling which, in combination, acts as one or more of the following:

- a source of services to external networks via an external network interface (i.e. the concept of co-location/data-hosting facilities);
- a source of services to other premises distribution cabling used in office, industrial or residential premises (in other words, acting as a traditional computer room containing servers etc.);
- a recipient of services from external networks via an external network interface (in other words a PBX, ISDN or broadband connection).

Most readers of this article will focus on the first two bullets as being relevant to them. However, as far as cabling is concerned, a PABX is a data centre. As VoIP becomes more common, it is increasingly difficult to differentiate between the second and third bullets.

What are the standards currently in development?

As mentioned above there are two standardisation activities. The first, being undertaken in the United States is the development of TIA/EIA-942 "Telecommunications Infrastructure Standard for Data Centers". The second, the topic of this article, is managed by CENELEC, a European standards body, and will result in EN 50173-5 "Generic Cabling Systems - Data Centres".

Why do we need standards for cabling in data centres?

Why is data centre cabling different from that used in the office? The first and most obvious difference is the way in which change is managed.

Moves, additions and changes to the services delivered to the office are generally achieved by patching at distributors or by the replacement of transmission equipment therein. Distributors are typically rooms or "closets" in which the number of cabinets and frames is defined by space allocated to the distributor. The opportunity for adding new cabinets or frames is very restricted. This means that the total amount of fixed cabling entering the distributors is an important initial design consideration.

In comparison, the number of cabinets in a data centre may, initially, be quite low but moves, additions and changes to the function of the data centre will be achieved by the building of new cabinets and changes to the connectivity between old and new cabinets. This means that the fixed has to be modified - typically by the installation of new cabling routes in addition to basic patching and equipment connection.

There are other differences between the data centre and office environment involving the data-rate and equipment densities, the criticality of connectivity failure and the need for resilience but the impact of additions and changes remains the primary differentiating factor.

In the eyes of the CENELEC cabling experts, data centre cabling standards are required to

- provide owners of such premises to design the cabling to evolve in a controlled manner - minimising the risk to service provision as the data centre grows;
- allow the data centre to be considered as an integral part of the premises infrastructure - allowing re-use by future occupants.

Data centre "Luddites"

Before addressing the detail of the proposed standards, it is worth pointing out that our standardisation efforts are not universally welcomed. When I gave a presentation of the forthcoming data centre cabling standards at the London Datacentre Facilities and Engineering Conference (November 2004), I was struck by the conflict between data centre "builders" and "users". There are many people in the latter group who believe that implementing a "standard" cabling structure will constrain the flexibility that they find desirable. These people are generally of the same group that prefer not to think too deeply about thermal management within data centres or mains power provision for the same reason - a demand for "ultimate flexibility" and "an inability to plan effectively" are often confused.

In order to win the backing of all involved in data centre design and operation, it is vital that the structure of the cabling does not restrict the freedom of the users to install their new cabinets and equipment as they wish - or at least the freedom allowed after other critical non-cabling design factors have been addressed (such as thermal and power provision aspects referred to above).

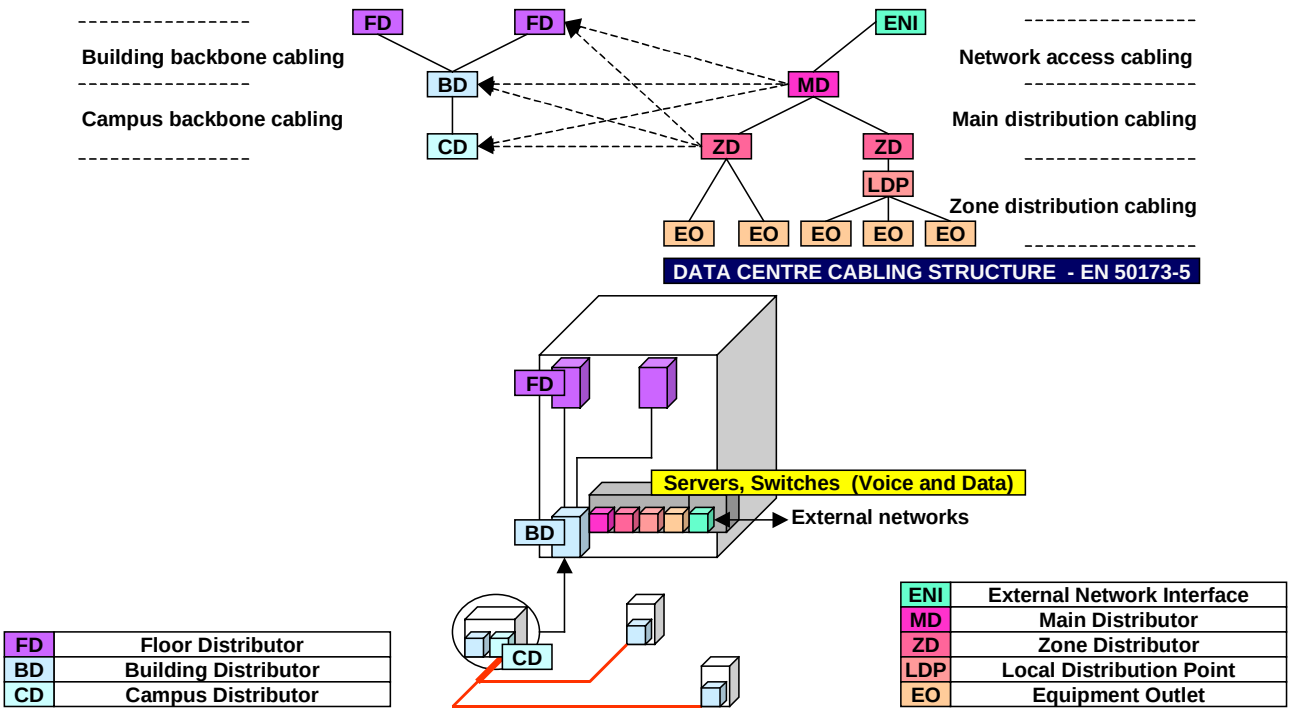

Figure 1: Data centres structures of EN 50173-5 in conjunction with office cabling systems

The Cabling Partnership
P. O. Box MT 65, LEEDS, West Yorkshire, LS17 8YD, England
Telephone: +44 (0) 113 232 3721 Fax: +44 (0) 113 293 2632

What does EN 50173-5 offer?

The European standard, EN 50173-5, has created a structure that allows the interconnection of any two cabinets (or any cabinet and the outside world) on a plug-and-play basis while providing transmission channels capable of delivering the highest bit rate communications currently available.

As can be seen in Figure 1, the data centre cabling has a structure comprising three cabling sub-systems: zone distribution cabling, main distribution cabling and network access cabling. The zone distribution cabling runs from the Equipment Outlets (situated in server cabinets) to Zone Distributors (ZDs). The ZDs may be connected to other premises cabling distributors, Main Distributors or External Network Interfaces. The exact configuration will depend upon the size and purpose of the data centre

One important feature of the structure is the Local Distribution Point or LDP. The LDP is not a point of connection to transmission equipment but it is a potential cabinet connection point. This means that a skeletal fixed cabling structure can be "first-fit" installed to the LDP. Such an infrastructure can be easily accessed, for example by the removal of floor tiles, and appropriate cabling connected between a cabinet and the LDP.

The total number of LDPs and their locations would be defined by the "future" cabinet layout based upon cabling-independent considerations of thermal management and power provision. However, even the most complex structures allowed within EN 50173-5 allow any EO to be passively connected to another EO and, in most circumstances, still support 10 Gigabit Ethernet services.

The support of 1 and 10 Gigabit Ethernet applications over multimode optical fibre channels containing many connections is a radical new step for cabling standards and is critical to the plug-and-play philosophy offered by EN 50173-5. The combination of a root-and-branch review of the detailed network models together with the use of statistical approaches to performance modelling of multiple connections shows that high bit rates can be supported over considerably greater distances than previously considered feasible. In Figure 2, OM3 MMF supports 10GBASE-SR over channel lengths in excess of 200 metres even when the channels contain ten mated connections.

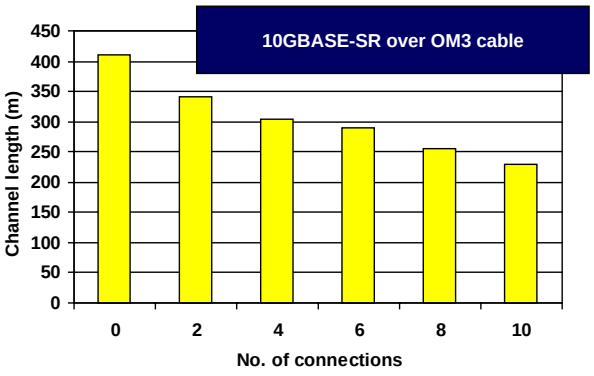

Figure 2: Channel options for 10GBASE-SR using OM3 cable

Optical fibre is not the only cabling medium specified within the forthcoming EN 50173-5. Balanced cabling is also included for shorter channels but cannot achieve the high number of channel connections offered by optical fibre. It should also be highlighted that there are no plans to include cabling to support 10GBASE-T in the EN 50173-5 to be published in 2006 (although a subsequent amendment is expected to include the appropriate specifications).

In general, EN 50173-5 is careful not to restrict technical developments - particularly for connecting hardware. The development of multi-fibre array connections, enabling using a single interface to connect a complete cabinet at an LDP is fully supported by the standard.

Timescales

EN 50173-5 is now at Secretariat Enquiry stage. This means that national body members of CENELEC are now reviewing the document for the first time. It is expected that EN 50173-5 will be published in early 2006.

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