SELECT LAN MEDIA THAT MEETS YOUR FUTURE NEEDS

Specifying a structured cabling system is a business-critical decision. A vital utility with a lifecycle of possibly 15+ years, it represents a major capital investment.

The chosen infrastructure will need to support a wide array of network services for both current and future applications, as well as complying with environmental and regulatory demands.

Compliance with international standards and local regulations is essential when commissioning a new network. To provide a seamless transmission network, LAN media must comply with standards that ensure interoperability and optimum performance. The volume of specifications should not be underestimated, and those listed in Table 1 and set out by the International Standards Organisation (ISO), International Electrotechnical Commission (IEC) and CENELEC (European Committee for Electrotechnical Standardisation) are legislative requirements in Europe, and should be your first port of call.

A standard or code of practice is widely regarded as the approved mode of compliance and the wording used is extremely precise. Verifiable requirements are denoted by the use of 'shall'/'shall not', 'it is essential that', and 'under no circumstances', and their interpretation is detailed in a British Standards Institute (BSI) guide.

Table 1: Cabling Systems Design Standards Checklist

CENELEC	ISO/IEC
EN 50173-1 Ed.2:2007 Generic cabling systems – General requirements	ISO/IEC 11801:2002 and A.1:2008 Generic cabling for customer premises
EN 50173-2:2007 Office premises	
EN 50173-3:2007 Industrial premises	ISO/IEC 24702:2006 Industrial premises
EN 50173-4:2007 Homes	ISO/IEC 15018:2004 Homes
EN 50173-5:2007 Data centres	ISO/IEC 24764 (draft) Data centres
Additional design documents:	ISO/IEC TR 24704:2004 Customer premises cabling for wireless access points ISO/IEC TR 29106:2007 Introduction to the MICE environmental classification
TR 50173-99-1:2007 Cabling guidelines in support of 10GBASE-T	ISO/IEC TR 24750:2007 Assessment and mitigation of installed balanced cabling channels in order to support 10GBASE-T

LAN media and drive distances

LAN media comprises three transmission mediums – copper, fibre and wireless. Each has characteristics suited for particular situations, with selection governed by several factors:

- Environment – as set-out within the EN50173 specifications for system design (see Table 1)
- Performance – as described in EN50173-1
- Efficiency
- Cost
- Ease of installation, operation and maintenance
- Availability
- Distance covered

Copper

There are two basic types of copper cabling: twisted-pair and/or twin-axial twisted cables ('balanced' cabling); and coaxial cable ('un-balanced' cabling), which has a centre conductor of copper wire and an outer concentric conductor. Primarily used in LAN applications, twisted-pair copper cabling is designed to provide a 100-metre length transmission line and comes in either shielded or un-shielded (UTP) forms.

Rated by performance class, Category 5 (Cat5), Cat6 and Cat6A products are RJ45 connectivity-based, fully interoperable and backwards compatible. Meanwhile, Cat7 and 7A products are backwards compatible to lower classes using hybrid cords.

Copper cabling classification:

- Class D – rated to 100MHz, uses Cat5e components and supports Ethernet, Fast Ethernet, Gigabit Ethernet, PoE (see below) and ATM
- Class E – characterised to 250MHz, employs Cat6 components and supports Class D and ATM1200
- Class EA – a 500MHz system using Cat6A components developed for transmission of 10GBASE-T
- Class F and Class FA systems – rated to 600Mhz and 1GHz, use Cat7 and Cat7A components respectively, and are designed to distribute multiple services in a building and terminate to RJ45 connectivity via hybrid cords

Traditionally, UTP was favoured in the UK for Class D and Class E systems because it was smaller, lighter and more flexible, making it simpler to install than screened cabling. However, with ClassEA the reverse is true, while screened cabling also provides a higher degree of immunity to EMI, making it a preferred option for critical areas of the network (e.g. data centres).

Inside buildings, cables with an LSZH-FR (Low Smoke Zero Halogen – Fire Resistant) sheath are strongly recommended. For installation, conduit runs can be in ceilings, walls or under floors, but use should be restricted to permanent workstation outlet locations. Plenum or dropped ceiling/raised floor runs are often the easiest to install, while cable trays or 'ladder racks' provide a safe and efficient alternative.

Optical Fibre

Fibre optic cabling is available in two formats – multimode and singlemode – and supports transmission between 300m and 10km depending on application and cabling class. These systems are generally SC or LC connector-based and rated to the following:

- OM1 (62.5/125 fibre) – limited by relatively low bandwidth and restricted drive distances in higher-speed applications (more expensive transceivers and mode-conditioning patchcords required)
- OM2 (50/125) – higher bandwidth and supports greater transmission distances than OM1, but more expensive transceivers and mode-conditioning patchcords are required to achieve a 300m run
- OM3 (laser optimised 50/125) – uses better quality fibre and is the optimum solution for transmission of gigabit and 10GBASE-SX
- OS1 – uses singlemode fibre with an attenuation of 1dB/km and is typically specified for indoor or campus building links up to 2km
- OS2 – uses singlemode fibre, with attenuation lower than OS1, although drive distances are longer per protocol (OS2 is generally used at the network edge for distances up to 10km)

Selection is determined by several parameters, the most significant being system costs, distance traversed and transmission bit-rate. Installation methods include:

- Laying cables conventionally indoors in tray, basket or conduit
- Pulling cables into existing exterior ductwork
- Blowing micro cable or fibre units into microduct systems using compressed gas
- Laying of direct buried type standard fibre optic cable in the ground

Wireless

Wireless LAN (WLAN) is today accepted as complementing, rather than replacing structured cabling. ROI has proved to be fast, but issues with security, radio propagation and cost of upgrading hardware limits its scope. Most organisations retain their fixed network, because they believe it to be faster and more reliable than wireless.

Three flavours of WLAN are available based on the IEEE's 802.11 standard (see Table 2). Cellular operators are now looking to standardise WLAN access points that can be used for Ethernet or cellular (GSM) applications, while fibre to the access point for ultra wideband connectivity is being developed.

Table 2: Wireless Technology Choice

IEEE & WiFi WLAN technology	802.11a	802.11b	802.11g
Raw Data Rate	54 Mbit/s	11 Mbit/s	54 Mbit/s
Average Throughput	27 Mbit/s	4-5 Mbit/s	27 Mbit/s
Typical Indoor Operating Range	12m	30m	12m

Power over Ethernet (PoE)

The IEEE's 802.3af-2003 Power over Ethernet (PoE) standard allows Ethernet ports to both connect and power devices such as WLAN access points and IP phones. Power-sourcing equipment (such as PoE switches) is required for delivery of a maximum 12.95 watts to the powered devices. However, the development of 'PoE Plus' (IEEE P802.3at) has increased power levels to support battery-based devices such as laptops.

Backwards compatible with powered devices based on 802.3af-2003, the PoE Plus standard extends its application to devices requiring more power, such as 802.11n access points and pan-tilt-zoom (PTZ) security cameras. It requires Cat 5 (8-wire) instead of Cat 3 (4-wire) cabling and will be attractive to organisations installing higher-speed systems such as 10GBASE-T.

System selection

LAN media selection is today much more involved, as applications require ever higher bandwidth, plus delivery of both power and data, in environments ranging from heavy industrial to open offices. In general, distance traversed will govern choice and copper remains the most viable and economic option for connections up to 100m. Fibre is best employed for hops over 100 metres, for backbone applications and, in some scenarios, can be used throughout the building. But copper will be required for power, while WLAN enables mobility.

A detailed plan of all structured cabling, outlets and wireless access points is essential for fully-centralised network management, and provision of a seamless, invisible interconnection medium on which current and next generations of networking equipment can be readily installed and maintained.