SHORT GUIDE TO STRUCTURED CABLING

Deciding on a Structured Cabling System can be a challenge. Too much choice is as unwelcome as too little. Ken Hodge, Chief Technology Officer at Brand-Rex has created this easy to understand 'Short Guide to Structured Cabling' to help simplify the selection process.

In the Enterprise LAN

For thousands of smaller LANs (Local Area Networks) there is unlikely to be a need for data speeds greater than the one Gigabits per second (1Gb/s) used by modern PCs and laptops during the cabling system's lifetime.

For such networks Category 5e (sometimes referred to as Class D) is both cost effective and technically adequate.

Category 5e is also the ideal choice for short-term networks. For example when a company takes on a two or three year lease on a building for expansion, or during renovations so that staff can be 'shuffled' around. Think also of the great 'Portakabin cities' that appear on major construction sites. These are rarely around for more than a few years.

Safe and Sure

If you're deploying a new network for your enterprise, it's a long-term investment for let's say seven to fifteen years. But if you don't foresee the need for data speeds over 1Gb/s in that timeframe then Category 6 is only a little more expensive and has what's known as 'headroom' – effectively safety margin – compared to Category 5e.

The upshot of this is that it's a safer long-term choice.

Multi Gigabit

For ten years forward thinking network managers have been 'future-proofing' their networks by installing cabling networks capable of 10Gigabits per second (10Gb/s).

These were people who strongly suspected that their user communities would need 10Gb/s data speeds during the lifetime of the network. And they were right.

Because now 10Gb/s switches are readily available, plus many servers have 10Gb/s interfaces and - following the release by Intel of its 'on-motherboard' 10Gb/s Ethernet chipset this year - I think that it will only be a short time before desktop PCs and Laptops sport 10Gb/s interfaces too.

Category 7 is effectively obsolete. Category 7A is overkill in most situations and is looking highly unlikely to be capable of 40Gb/s, so it doesn't offer the next 'future-proofing' option.

This leaves only one option for 10Gb/s –Category 6A (Class EA) which was designed specifically for 10Gigabit Ethernet.

Grab your Shield

All of the cabling categories come in two flavours – shielded and unshielded (UTP). So which do you need?

With Category 5e and Category 6 it is really a matter of personal preference. Shielded is however technically superior wherever the site is electrically 'noisy'.

When it comes to 10Gb/s Category 6A systems however, most users and consultants are tending towards the shielded option.

Thinner shielded cables are easier for installers and engineers to work with and they have immunity to electrical interference.

So, in the majority of cases, shielded is the safer option for 10Gb/s.

Data Centre LAN

Avoidance of 'downtime' is absolutely key – requiring the cables and connections hardware to have far higher physical and mechanical quality and reliability. Transmission quality is paramount too.

And in the data centre everything is squashed close together so higher density solutions are essential.

Data centres also are the most demanding in terms of data speeds. The need to transfer data rapidly between switches, servers and storage meant that in data centres, 10Gigabit speeds were needed long before the electronic interfaces for category 6A were available. Other cabling systems and electronics were used, optics and twinax. For the very short distances – a maximum of 15 metres – twinax links cost ten times more than Category 6A.

Now that Category 6A interface electronics are available, Category 6A is the preferred choice for all links needing up to 10Gb/s. Indeed it is specified in all of the data centre design standards* as the minimum level to use.

For speeds higher than 10Gb/s in the data centre LAN, the fibre options we're about to discuss under the data centre backbone heading can be used.

Data Centre Backbone

At data speeds up to 10Gb/s, a fibre link consists of two fibres regardless of whether you are using single-mode or multi-mode.

But as we move to the higher speeds needed by many servers, for the 'aggregated' traffic between switches in the data centre and out to the wide area networks (WAN) this changes.

Single-mode fibre can carry up to 100Gb/s (potentially faster) using only one pair of fibres per link.

But the standards which have been developed for multi-mode fibre require eight fibres per link for 40Gigabits and twenty fibres per link for 100Gb/s.

You might assume from this that one pair of single-mode fibres would be the best solution since it will work from 1Gb/s right through to 100Gb/s without any modification. And indeed it is the most elegant solution from an engineering perspective.

But of course Murphy's laws still apply – and the cost of 40Gb/s and 100Gb/s opto-electronics for single-mode are, and seem set to remain, more expensive than the multi-fibre multi-mode opto-electronics for 40Gb/s and 100Gb/s.

** European EN 51073-5, ISO/IEC 24764 and American TIA 942A.*

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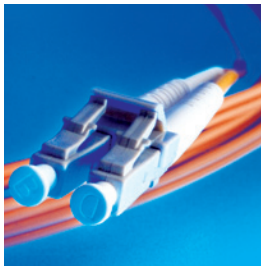
2? 8? 20?



Unless you decide that you can afford to go for the technically elegant two-fibre single-mode approach - do you:

(a) Install just two multi-mode fibres per link for 10Gb/s then take these out and replace with eight or twenty fibres per link when you upgrade the active equipment to 40Gb/s or 100Gb/s?

(b) Do you install eight or twenty fibres per link now but just use two now?

Or

(c) find some alternative that gives a planned migration path without disruption and downtime?

There is also an issue of connector types to consider. Currently the favoured fibre connector for data centres is the high density 'LC' type.

For eight or twenty fibres then a multi-fibre connector type MPO (multi-fibre parallel optics) is needed. The basic MPO type has a higher insertion loss and doesn't really support multiple patching point topology needed for full flexibility.

Whilst MPO comfortably supports 2-connector links a very high performance variant of the MPO, called the MTP® connector, – allows the user to configure between four to six connector pairs in the network, allowing cross-connect topologies to be used.

10 to 40 to 100

Networks to be migratable from 10 to 40 and possibly 100Gb/s.

One – called 'Base-8' because of the 40Gb/s need for eight fibres – simply formats LC connectors together in physical groups of eight – at both ends of the links.

As soon as you need to connect some 40Gb/s equipment instead, a new patch cord with eight LC connectors at one end and a multi-fibre MTP connector at the other will allow the connection of a 40Gb/s server or switch port. So in seconds you've transformed from 10Gb/s to 40Gb/s.

Other modular alternatives exist – which allow fibre patch-panel modules to be changed quickly from LC to MTP types when the need for 40Gb/s arises Also allowing lots more 40Gb/s circuits to be installed within the same patching space.

Enterprise Backbone

Historically, fibre was the only real choice for enterprise backbones. But a lot of enterprise backbone links are under 100 metres – and for these, 10Gb/s over Category 6A copper cabling will now become a cheaper option.

For networks with Category 6A – allowing 10Gb/s to the workstation - it follows that the backbone links will need to operate at faster speeds to accommodate the aggregated traffic. For these, multi-mode fibre with the Base-8 and LC to MTP interchangeable patching modules will be one of the best options.

Eights into twenty

You may have noticed in both data centre and enterprise backbone sections I didn't talk about the upgrade to 20 fibres for 100Gb/s.

That's because if you need 100Gb/s in the next two or three years then 20 fibre multi-mode or 2-fibre single-mode are your only options and you might as well install them straight away.

But - and this is currently only a maybe - it is looking possible that on a five year time horizon 100Gb/s could be re-engineered to an eight fibre Base 8 format. In which case the same eight fibres could carry 40Gb/s or 100Gb/s giving a great future-proofing capability.

All this means that installing eight or planning migration to eight is possibly the most cost/future-proofing balances for the majority of new enterprise backbones.

Last word

Structured cabling is decidedly 'horses for courses' and not 'one size fits all'. Whilst this short guide will help de-mystify the topic and bring you right up to date there is no substitute for getting a highly knowledgeable consultant or one of the top-tier manufacturers to help you make the best choice.

Because, at the end of the day, your company will have to live with your decision for a great many years. And the cost plus disruption of having to re-cable too early is massive.

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Ken Hodge was educated at Liverpool University and Warwick University. He is a Chartered Engineer and a Fellow of the Institute of Engineering Technology.

Ken has been involved in the industry since 1982, researching, designing and developing optical fibre and high frequency cabling for LAN and Telecom networking. He is actively involved in standardisation activities in International Standardisation in the cabling sector.