IS COPPER DIVERGING?

With Cat 6_A now firmly mainstream and Cat8 being much talked about, where exactly is copper progressing to over the next few years? Will we see a divergence between copper cabling for the data centre and a different approach for the enterprise network?

We asked Brand-Rex Chief Technology Officer Ken Hodge to help us unravel the answers.

Divergence hasn't really happened yet – but it's looking more likely over the coming years. For some years now Cat 6_A 10Gb/s cabling has been declared by the relevant standards as the minimum level for data centres. This effectively rules Cat 5e and Cat6 to be enterprise-only solutions.

Cat 6_A is increasingly becoming the 'category of choice' for enterprise networks. As such it enjoys ubiquity across both sectors.

Category 8 will potentially offer 40Gb/s over twisted pair copper in a few years time, but with a much reduced physical link length of 30 to 50 metres it will have limited applications in the enterprise horizontal.

Let's look at how the market drivers in the two sectors have diverged.

Data Centre

Data centre traffic is forecast at 4.1 Zettabytes (ZB) in 2014 and by 2016 it will be up to 6.6ZB. By 2017 two thirds of servers will ship with 40Gb/s connectivity.

Already short-range co-ax copper solutions are handling the early need for very high speed interconnects at 40Gb/s. These short-range solutions have simpler electronics than BASE-T, so they are far quicker to bring to market. The downside is that the cables and connectors are extremely expensive.

History shows that the BASE-T solution arrives around two years later at a fraction of the cost. A similar cycle is likely with 40Gb/s Category 8.

What is Cat 8?

Currently there are a number of possible 'Cat8' solutions being looked at by the standards bodies for 40Gb/s over twisted pair copper. In the USA, TIA/EIA is considering Cat8 based on an extended performance Cat 6_A cable. Meanwhile in Europe ISO/IEC is looking at two options currently tagged Cat8.1 based on an extended Cat6_A cable and Cat 8.2 based on an extended Cat7A cable.

There is as yet no choice of connector - though there is a significant body of weight in favour of the RJ-45 footprint rather than the larger 'square' contender. Even this however is unlikely to be backward compatible due to different pin configurations.

Cat 8 is forecast to be published as a standard in late 2015.

Topology Considerations

In an ideal world, the LAN connectivity would not place constraints on the designers' choice of architecture or topology. But worlds are seldom ideal!

BASE-T standards have historically been based on a 100 metres link length. However back in 2008 we launched a data centre Zone Cable product that had a maximum reach of 70 metres but was as thin as a Cat 5 cable. Our research had shown that this would cover 85% of existing data centre link requirements and that with only a minor amount of re-planning data centres could use 100% of this Zone Cable. The space savings made this highly worth-while.

In the early implementations of Gigabit and 10Gb/s - and now early 40Gb/s the only possible topology was ToR (top of rack) switches due to the very short interconnect reach.

Later, as each BASE-T solution became available, designers could choose EoR (end of row), MoR (middle of row) or, in many cases, in-rack or in-row patching connected to centralised switches.

Cat 8 will however be different. That's because it's only going to have 30 metres or possibly 50 metres link length. This effectively rules out the option for centralised switching. EoR or MoR switches will become essential to stay with the 30 or 50 metres reach of the network cabling.

Enterprise LAN

Speed is not such a big driver as in the data centre, though many customers are installing Cat6_A to give them a guaranteed future-proofing to 10Gb/s.

Current factors driving towards multi-gigabit speeds are applications like Wi-Fi, where multi-channel wireless access points are becoming necessary to serve the high-speed access needs of mobile devices within the enterprise. This of course is fuelled by BYOD (bring your own device) and CYOD (choose your own device).

And just about to make a major hike in bandwidth requirements is 4K video (ultra high definition video) with four times the pixels of HDTV and twice the bandwidth.

Power users will also need 10Gb/s soon. For example; CAD, graphics, media editing and rendering, X-ray, CT and MRI scanners and users involved with Big Data. In fact I'd go so far as to suggest that Cat6_A should be considered as the minimum standard to be installed for such user areas.

Convergence

Perhaps the biggest driver in the enterprise network now however is network convergence and the rapid uptake of IP for peripheral devices from CCTV to door locks and card/fingerprint/iris readers. And for building automation system components from lighting controllers to sunblinds, thermostat valves, aircon and boiler controls.

All of these peripherals need additional RJ-45 outlets and nearly all require PoE (power over Ethernet) since this avoids the need to install hundreds of expensive mains power outlets.

However, there is one area that I do want to highlight and that's Power over Structured Cabling.

Turning Up The Heat

There are currently two standards for Power over Ethernet known as PoE and PoE+.

At 25.5 watts, PoE+ is a relatively high power for the thin conductors in a Cat 5e/6/6_A cable and can lead to a 10C rise in temperature in certain installation scenarios.

Not only does this temperature rise reduce the reach of a cabling link, but could comprise the cable integrity over the long-term. That's enough to cause slight concern, but what readers need to become aware of are the even more potentially hazardous non-standard Power-over-Structured cabling approaches being used.

A number of vendors are selling non-standard PoE solutions with up to 60 watts per outlet. HDBASE-T (see box-out) claims up to 100 Watts over a 'standard' Cat 5e/6/6_A channel and devices using up to 200W have been seen on the market.

RJ-45 jacks and plugs are not designed to cope with such levels of power, there's a risk of arcing when de-latching live connectors and some risk to the contact regions of the connectors. There's also a significantly higher temperature rise in bundles of Cat 5e/6/6_A cables when higher powers are transmitted.

My advice is this: Until the thermal effects on cables and the detrimental effects to connectors have been properly understood please be careful, be aware that the use of non-standard higher wattage PoE or HDBASE-T technology or other may present a risk on your structured cabling.

HDBASE-T

A new connectivity standard devised to allow the distribution of uncompressed video up to and including the new 4K standard plus Ethernet at up to 100Mb/s and an astounding 100 watts of power over a Cat5e or Cat6 cable.

Unlike normal BASE-T, HDBASE-T is asymmetric with a high speed forward channel. Although this has strong similarities to Ethernet (and an 100Mb/s channel can be transported within it) it is not Ethernet and needs different switches and terminal equipment.

It can however be run over any installed Cat 5e/6/6_A channel – though the 100 watt power could lead to dangerous levels of heating in enterprise installations.

Horses For Courses

But what about Cat5e and Cat6 I hear you ask. "Surely they must be obsolete by now?" Absolutely not!

Cat5e is perfectly capable of Gigabit Ethernet and of PoE+. It doesn't have the capability of 10Gb/s and so offers no future proofing but its cost and ease of installation still make it many installers 'category of choice' for limited-life networks such as building sites, temporary offices and the like.

And Cat6 is still very much specified for networks where the peace of mind of extra headroom is desired for longer-term deployments where the owner does not foresee the need for 10Gb/s in the network's lifetime.

So while there's some divergence with Cat5e and Cat 6 only in the enterprise LAN and Cat 8 likely to be data centre only, Cat6_A looks to be the cross-sector choice for many years to come.

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