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THE AMAZING SHRINKING WORLD OF 10GBASE-T

by
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for Networking+ (June 2006)

The IEEE standard for 10 Gigabit Ethernet over balanced cabling (twisted pair to most of us) has been approved and is ready for publication. This work, initiated to provide lower cost equipment solutions to replace optical fibre in data centres, has spawned a range of cabling standards activities. But is 10GBASE-T (or more correctly IEEE 802.3an) all that it is cracked up to be? It appears not to be - at least for the moment - and some significant technical have been required to deliver it on time.

The intention of 10GBASE-T was to provide a delivery system for 10 Gigabit Ethernet over 100 metres of twisted pair cabling containing the usual four connections (not counting those on the equipment itself). This is already possible using screened Category 7 cabling components (producing a Class F channel). However, Category 7/Class F is only specified in European and international standards - not in the USA. So in order to provide their Category 6 components with some of the attributes of screened Category 7, the USA began to develop Augmented Category 6. The particular parameters addressed by this specification are a higher frequency range (up to 500 MHz), a lower insertion loss and, for the first time, a specification for alien crosstalk - the interference created by adjacent cables.

The proposals for Augmented Category 6 cabling being developed by ANSI/TIA/EIA represent the pinnacle of unscreened cabling performance. However, in Europe EN 50173:2002 contains a Class F channel that has already been specified to 600 MHz, already has the required insertion loss and has, by means of screening, delivered the required protection against alien crosstalk.

Therefore, we have to consider the US-inspired Augmented Category 6 and the future European equivalent channel specification (Class E_A) as being an interim, or may be the last, roll of the dice before everyone recognises the need for screened cabling in support of high bitrate applications.

Nevertheless, we must not forget why 10GBASE-T itself, rather than the cabling, was being developed - to offer a low cost alternative to optical fibre in terms of the transmission equipment. The primary focus of this work was on data centres - the natural home of high bitrate applications. The Fibreoptic Industry Association has already pointed out that the replacement of optical fibre infrastructures by copper had some fundamental disadvantages in terms of channel lengths, connectivity options, cabling volumes and loads (both physical and burning). The thesis produced in support of my own Certified Optical Fibre Expert status (available for download at www.fia-online.co.uk/eexperts-01.htm) provides much more detail than we have space for here.

However, no one disputes a role for twisted pair cabling within data centres and the maximum channel length of 100 metres represents a sensible template for such areas. Indeed many infrastructure designers have adopted the 100 metre template for construction and it has been embodied in data centre standardisation both in the USA, via ANSI/TIA/EIA-942, and in Europe in the forthcoming EN 50173-5.

So what has gone wrong? Well, for the time being at least, it looks like 10GBASE-T has gone wrong. In order to encode the 10 Gigabit signal and to provide signal processing to protect that encoded signal from the ravages of electromagnetic noise, the chips obviously have to contain an enormous number of circuits. Circuits create heat –

to address this we can either package the circuits to run cool or we can shrink the silicon. The standard packages on our network cards are designed to handle 4 watts. Using current silicon fabrication techniques the 10GBASE-T power dissipation approaches 12 watts.

This represented a stumbling block for the IEEE802.3an project - the solutions were limited and are quite simple. First, wait for the new silicon: second, find some new packaging and third, turn off some of the functions to reduce the heat output. The third option will allow shipments ahead of the other two. Unfortunately, the functions that have had to be turned off are quite important for cabling - i.e. removal of some of the noise cancellation processing. This has led to the last minute inclusion of a “short reach” option that is only targeted to operate over a 30 metre channel. It is expected that such equipment will be the only product that ships, at least for while. Last minute changes to standards are always risky and just two of those risks are interoperability and forward compatibility.

So where does this leave 10GBASE-T? In the short to medium term, support over channel lengths greater than 30 metres may not be guaranteed whatever type of balanced cabling is installed. It is possible that some types of cabling may provide better support than others. For example PIMF cables may go further but that is not a topic for debate here - there will no doubt be a queue of experts wanting to discuss it and in any case such guarantees may be equipment-specific.

In the meantime, optical fibre offers exactly what it always did. Check out the FIA web-site - particularly the hyperlink mentioned above – for more information on this subject.