White Paper

Horizontal Cabling Solutions for 10G Ethernet

excel
without compromise.

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ISO/IEC 11801 and BS/EN 50173-1 outlines a channel length based on 100m, the performance limits for balanced cabling channels are given in 6.4. These limits are derived from the component performance limits of Clause 9 and 10 assuming the channel is composed of 90 m of solid conductor cable, 10 m of cord(s) and four connections for Class E_A (Cat 6_A).

BS/EN 50173 references BS/EN50288 (Multi-Element Metallic Cables used in Analogue and Digital communication and control), which specifies the horizontal cable for both unscreened and screened cables, for example 50288-5-1 is the screened horizontal cable and 50288-5-2 defines the work area and patch cord cables for Class E.

At this moment in time the standard for Class E_A cables has not been ratified however the respective cables are referenced as follows: 50288-10-1 for the screened horizontal cable and 50288-10-2 for the screened work area and patch cord cables.

The major difference between *-1 and *-2 in both documents is the diameter of the conductors, the first has to be a minimum of 0.5mm and the second limit being 0.4mm, this being defined by their intended use.

Alternatives

There are some alternative solutions for providing 10G Ethernet horizontal system, they include Fibre to the Desk, Class E (Cat 6) cabling over a limited length as well as a smaller diameter Class E_A solid conductor work area cable being used in the Horizontal.

Each one of these has their pros and cons however only one of these options is truly compliant with the standards we have outlined. That being, Fibre to the Desk whilst its performance cannot be questioned it does come with a price and is usually deployed in high security environments.

A few years ago the TIA/EIA came up with TSB155 which was an interim proposal to allow 'existing' installations of CAT 6 to run 10G, this involved a long list of actions to be taken to mitigate the risks, however it was limited to very short runs (below 55m). It was also only ever developed to assist 'existing' installations and was not designed for New Installations.

The third alternative looks at utilising a cable that complies with 50288-5-2 and designed to meet 50288-10-2 (work area and patch cord) these are typically 26AWG cable with a higher attenuation therefore the distance needs to be de-rated accordingly.

Attenuation = Reduction of signal strength during transmission. Attenuation is the opposite of amplification, and is normal when a signal is sent from one point to another. If the signal attenuates too much, it becomes unintelligible; Attenuation is measured in decibels (dB).

Solid conductor cable meeting these standards was originally designed for use as Harness and Switch Links, predominantly in Inter Cabinet links within major communication rooms and Data Centres.

In this environment it is not a major issue that some of these cables have an Attenuation factor/rating of 1.5, which means a reduction in the permanent link length from 90metres to 60metres as anything over this length in a data centre would typically involve fibre. There are some that state they are 'zero loss' which has been achieved by a higher quality construction but they can still suffer one of the following key issue if not deployed in a suitable manner.

Furthermore the reduced dimensions and lower cost can be seen as a distinct advantage in some high density applications within the DC and Major Comms Rooms.

Now comes the key issue, possibly the largest concern about using 26 AWG cable throughout; it involves Power over Ethernet (PoE) it is being increasingly deployed to power devices such as a phones or cameras etc. The standard PoE has the capability to handle 15.4W over 4 pairs.

In September 2009 IEEE 802.3at (PoE Plus) was approved and devices are now starting to appear on the market that utilise enhanced PoE to support 34.2W for 2 pair powering, however this does not mean you can use all 4 pairs to double the power. This will have a dramatic knock on effect in ways we have never previously considered when designing structured cabling installations.

continued overleaf

Number of cables	Temperature rise [a] °K				
	Category 5	Category 6	Category 6_A	Category 7 [a]	Category 7_A [a]
1	0,76	0,63	0,56	0,56	0,56 ffs
7	1,39	1,11	0,97	0,97	0,97 ffs
19	2,64	2,08	1,81	1,81	1,81 ffs
37	4,65	3,68	3,19	3,19	3,19 ffs
61	6,88	5,49	4,79	4,79	4,79 ffs
91	9,65	7,71	6,67	6,67	6,67 ffs
127	13,06	10,42	9,03	9,03	9,03 ffs
169	16,88	13,47	11,67	11,67	11,67 ffs

[a] Calculated values for worst case

The ISO/IEC TR 29125 lays out guidelines for remote powering and gives worst case temp rise for cable bundles of different Category vs. current carried per pair however it only covers down to 24 AWG Cat 5e cable. The table above gives an indication of the potential temperature rises.

At 600mA, which is the upper limit of PoE Plus, a bundle of 127, 24 AWG Cat5e cables will see a temperature rise equivalent to over 13o Centigrade. Using the above, it is not hard to imagine the heat produced by the not un-realistic number of 300 cables in a run.

To date no detailed analysis has been done to estimate the temperature increase that will result from using thinner 26 AWG cable, however if, as we have already established, the cable has a greater resistance, it is only reasonable to assume this will be reflected in an additional temperature increase.

As all twisted-pair cables are referenced in the cabling standards at 20°C +/- 3o C, beyond this the Attenuation is adjusted by a factor of 0.2% per degree Celsius. In turn the performance of the cable could be dramatically reduced as temperatures within bundles could be well above this level.

Conclusions

Consideration must be given to the first paragraph of this paper. The IEEE agreed to use Class E_A as defined by ISO/IEC 11801, BS/EN 50173 as the basis for any future developments around 10G Ethernet. Trying to implement a non standards based solution runs the risk of not being able to support future applications as they are developed.

To give an example, if IEEE were to come up with a High Definition Interactive Video Solution over 10G Ethernet, over a Class E_A system, there are no guarantees this would work over a bespoke solution using either Cat 6 cabling or the 26AWG work area cable.

It is imperative to weigh up the very limited numbers of benefits against a large number of potential risks by going with either of the two options mentioned. The IEEE is constantly developing new applications and relevant standards, and are doing this based upon the physical medium i.e. the Cabling System meeting what ISO/IEC and BS/EN have defined.

The result may be a risk too far.

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