STANDARDS UPDATE ›
NEXT GENERATION BASE-T

Jim Duran, Product Manager

WHITE PAPER

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EXECUTIVE SUMMARY

On July 16, 2012 the IEEE (Institute Electrical and Electronics Engineers) 802.3 approved the formation of a study group to develop objectives for the Next Generation Base-T (NGBase-T) application over balanced twisted pair cabling. The intent of the study group is to explore technical feasibility and market potential for speeds higher than 10Mb/sec over twisted pair cabling. Copper based twisted pair cabling continues to be the most popular media used for Ethernet networks. This article highlights considerations that led to the decision to approve the IEEE study group for NGBase-T.

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The IEEE NGBase-T study group officially began its work in September 2012. The study group is composed of industry experts from the PSY layer, active equipment, premise cabling, and test equipment manufacturers. The decision to move forward with development of NGBase-T was based on agreement by the IEEE 802.3 study group that bandwidth requirements will continue to grow. The study group determined that 40GbE over twisted pair cabling is feasible and will provide an upgrade path from 10GbE. This will allow twisted pair cabling to be positioned alongside fiber and copper Twinax cabling to support 40GbE. NGBase-T is expected be more cost effective than fiber cabling and Twinax cabling for Ethernet networks. NGBase-T will also support distances longer than Twinax’s 7 meter limitation which would make NGBase-T an ideal choice for data centers. The study group also stipulated that backward compatibility with RJ45 connector interface is a requirement for NGBase-T. This is a key factor because in addition to backwards compatibility with legacy Base-T applications, it also it eliminates proprietary compatibility issues with copper cabling systems that do not use industry standard RJ45 connector interface. Another key advantage of Base-T technology is auto-negotiation. Auto-negotiation allows interoperability between higher speed equipment and lower speed equipment without manual configuration. This is not possible with fiber cabling.

The TIA (Telecommunication Industry Association) and the ISO (International Standards Organization) cabling standards bodies are also developing specifications for 40GbE channel requirements. Back in 2011, the TIA TR42.7 Copper Cabling Engineering Sub-committee setup a task group to establish parameters to support 40GbE bandwidth applications. The TIA 42.7 is now fast tracking this work and is meeting every two months. The new structured cabling standard is expected to be published as “ANSI/TIA-568-C.2-1 Balanced Twisted-Pair Telecommunication’s Cabling and Components Standard, Addendum 1: Specifications for 100 Ω Next Generation Cabling”. This new cabling category will be referred to as Category 8. This new cabling system is expected to be backwards compatible with prior Category twisted pair cabling systems (i.e. Cat 5e, Cat 6, and Cat 6A) as desired by the IEEE.

In September 2012, the ISO WG3 (Working Group 3) submitted its technical report on channel transmission requirements to support 40GbE to the IEEE 802.3 for consideration to support NGBase-T. The report is composed of two major parts. The first part of the report describes “Class I” channels constructed out of existing Cat 6A and Cat 7A components used in Class EA and FA channels with bandwidth up to 1.6GHz. The second part of the report describes “Class II” channels constructed out of components that have not been yet developed. The Class II channels are based on an improved version of ISO Class FA channels with bandwidth up to 2.0GHz. The conclusion of the report indicates that existing Class EA channels may support 40GbE but only up to 10-15m, while Class FA channels are able to support 40GbE up to 50m. Therefore, a 2-connector

Class FA channels, up to 50m, maybe a valid option for 40GbE. In addition the ISO WG3 is also developing qualification limits to determine if currently installed Class EA and FA systems will support the IEEE NGBase-T protocol. It's unlikely that installed Class EA cabling systems will support 40GbE, but they are hoping existing Class FA installations will. It's important to point that while the ISO WG3 has indicated that a 50m Class FA channel may support 40GbE, it's unlikely that this channel will be compatible with the IEEE NGBase-T standard. This is because existing Class FA channels use proprietary Cat 7A connectors that are inoperable with the RJ45 connector interface. The IEEE study group has stipulated that backward compatibility with RJ45 connector interface is a "must have" for NGBase-T. The IEEE specified this requirement because this will allow backward compatibility with existing Base-T Ethernet technology (i.e. 1000Base-T and 10GBase-T).

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Other topics being cover by the NGBase-T study group include considerations for shorter lengths specifically for data center environments. This is important because it's likely that NGBase-T Ethernet application will primarily be used in data centers where switch-to-server end-of-row links are typically 35m or less. Experts agree that 50m would cover 95% of all length requirements for data center applications. Therefore, the conventional 100m maximum channel length is not being considered at this time. It's also likely that the NGBase-T standard will specify maximum length of 50m.

The study groups are also focusing on specifications around a shielded twisted pair cabling system instead of UTP (unshielded twisted pair). UTP cabling has not been ruled out; however, experts agree that shielded cable is the best way to mitigate alien crosstalk (AXT). Alien cross talk is defined as unwanted signal coupling from one balanced twisted-pair cable or connector to another. AXT is not a problem for lower bandwidth network applications such as 10/100Base-T and 1000Base-T; however, AXT is a major problem for higher bandwidth applications such as 10GBase-T. This was revealed when 10GBase-T was developed. Experts form the TIA and ISO cabling bodies agree that AXT was the most significant t barrier to overcome when 10GBase-T was developed. There are two known methods to mitigate AXT. The first method is achieved by adding space between cables and port outlets. Cable manufactures typically increase the cable's outer jacket diameter to create space between adjacent cables. The other, and more effective, mitigation method is achieved by wrapping a metal foil around the twisted pairs. The study groups have also specified that EMI (electromagnetic interference) suppression is highly desired. A well-known method to suppress EMI is to use shielded cables and shielded connectors. This is why many structured cabling manufactures decided to only offer 10GbE shielded twisted pair cabling systems when the IEEE ratified its standard for 10GBase-T back in 2006.

CONCLUSION

In conclusion the IEEE 802.3 study group, as well as the TIA TR42.7 and ISO WG3 cabling standards bodies, are hard at work developing specifications and requirements for the Next Generation Base-T Ethernet application. Requirements such as 40GbE, auto-negotiation, PoE+ support, backwards compatibility with prior Base-T technology, RJ45 connector compatibility, and reach for end-of-row (50m) targets have been specified. Many other factors and criteria are being considered. However, much of the work being done by the study groups is still at preliminary stage. While the ISO WG3 study group has not indicated when it plans to release its standard for 40GbE, the TIA TR42.7 study group has indicated it hopes to release TIA-568-C.2-1 Category 8 standard sometime in late 2013. The IEEE 802.3 hopes to release the NGBase-T standard sometime in late 2014.

References:

http://www.ieee802.org/3/NGBASET/index.html