

The Hidden Costs of 10G UTP Systems

With both the 10GBASE-T application standard for 10Gb/s Ethernet over copper and the category 6A cabling standard now ratified, there has been much flurry over UTP versus F/UTP and S/FTP cabling systems.

by Carrie Higbie



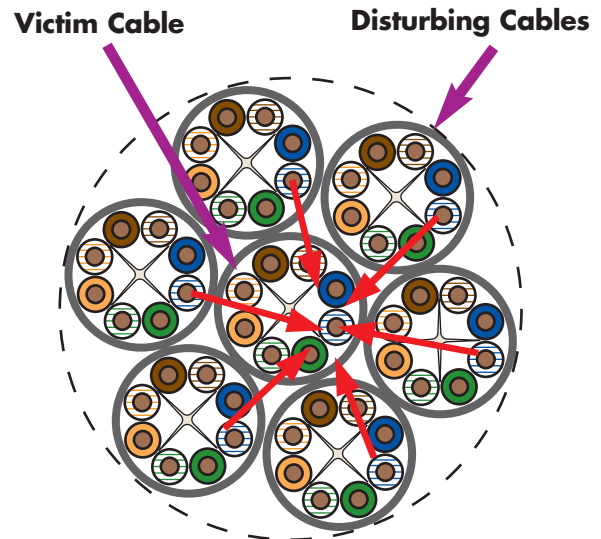
While a consideration, channel costs are only a part of the equation in today's 10Gb/s world. In order to properly evaluate the benefits of each 10Gb/s copper cabling option, it is important to understand all the facts. This paper will provide current facts regarding 10Gb/s channels, pathways, labor and performance.

The systems supported in the 10GBASE-T 802.3an standard are:

- Limited distance category 6 (designed for existing installations)
- Category 6A (screened and unshielded)
- Category 7 (fully shielded only)

Understanding the feasibility of different types of 10Gb/s capable copper systems requires a brief explanation of alien crosstalk. Alien crosstalk (AXT) is cable to cable noise that is seen at higher frequencies and is more

problematic in unshielded (UTP) systems. The noise coupling occurs on like pairs (for instance blue-white to blue-white) as they will have roughly the same twist lay. This is not a concern with screened or shielded systems as the shield prevents alien crosstalk from affecting adjacent cables.



Existing category 6 systems are the most costly for 10Gb/s due to the amount of mitigation practices necessary to support 10Gb/s, which translates into labor dollars. Mitigation techniques for category 6 include unbundling all cables, changing to shielded patchcords, reterminating to 6A hardware, and energizing every other port only, to name a few. Testing these systems requires a significant amount of time because after applying one mitigation technique, you may need to try another and retest, then another and retest, etc. For this reason, it is recommended that new installations utilize a category 6A system or better for 10Gb/s transmissions.

In order to mitigate the effects of alien crosstalk at 10Gb/s, a new cabling category/class was introduced. Designated as Augmented category 6 or category 6A by the TIA and, as class EA within ISO/IEC, the standard applies to screened F/UTP systems as well as UTP. Category 7/Class F was accepted without modification and in fact for years was the only standardized 100 meter 10 Gigabit capable copper solution.

Among the most immediately noticeable differences between category 6 and 10Gb/s capable category 6A is that the maximum allowable diameter of the category 6A cable has been increased to 0.354" (9.1mm). This increase allows for the separation between the disturbing cable and the cable that is disturbed in UTP configurations. Because F/UTP cable eliminates AXT through the use of an overall foil screen, this additional separation is not required and has typically allowed category 6A F/UTP cable to be smaller than its UTP counterparts. While there are some newer smaller diameter 10Gb/s capable UTP cables on the market, it is still important that they pass the AXT testing parameters in the 6-around-1 configuration. End users should be aware of waiving AXT field testing for UTP systems. This is being done in some cases because AXT field testing can add up to 3.5-4 hours for each 24-port patch panel, but in these cases, the manufacturer and the end-user are taking a risk that they wouldn't take if installing a screened or shielded system.

In order for UTP cables to remain viable as a 10Gb/s option, other factors must be considered. One is pathway fill. Should the time come where the pathway fill is greater than 40%, the cables on the bottom may become crushed and the resulting deformation of the cable will undo the separation benefits. This will certainly affect AXT and other performance parameters. Noise will be introduced back into the system and this is one of the hardest problems to troubleshoot as it is sporadic and intermittent.

Noise, in the form of AXT, occurs not only between cables but in closely placed connectors. In order to mitigate AXT at the patch panel, various methods are used such as increased spacing and varying punch down practices, the latter of which may increase installation time and certainly increases the potential for errors. In some installations, one end of the cable is wired differently than the other, further complicating installation. The same AXT protection offered by shielded cable is extended to shielded connectors, eliminating the need for varied termination practices.

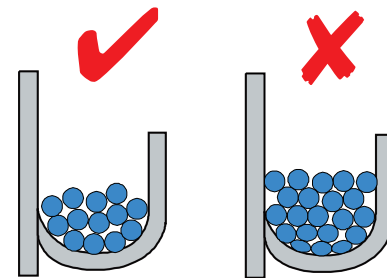


Illustration A

A costly caveat to a 10Gb/s UTP system is that you cannot mix different categories of unshielded cable in the same pathway. Bundling of category 6A UTP cabling with other category UTP cables can result in alien crosstalk levels that exceed industry requirements and potentially impact operation of the 10GBASE-T application. This means that if you choose category 6A UTP, you must use it for everything! In a typical installation, there is a combination of cabling categories within a single pathway. In the horizontal, there may be building automation systems, detection

systems, access control, analog voice or VoIP. Wherever such systems are installed, the only options are to run them all on the more expensive category 6A UTP cable plant or run additional pathways and spaces to separate the lower categories of UTP cabling.

In a data center that will have a partial upgrade for 10Gb/s as new equipment is phased in, there will likely be access control, fire monitoring, cooling monitoring and other systems that do not require 10Gb/s copper cable systems. Again, in the UTP scenario, you are forced to do an entire upgrade for all channels with category 6A UTP, or provide separate pathways and spaces. With real estate at a premium, there may not be enough room for additional pathways and spaces especially in equipment cabinets. Screened or shielded cabling may be bundled and/or share pathways with all other categories of cabling without concern.

If we examine just the cabling installation, without respect to additional pathways, the cost for 500 drops fully installed would look similar to the following:

Cat 5e/Class D UTP	\$ 85,492.92
Cat 6/Class E UTP	\$115,848.75
10G 6A UTP	\$169,372.08
10G 6A F/UTP	\$188,046.67
TERA - Cat 7 _A /Class F _A	\$232,386.67

The above figures use plenum cable, retail pricing, \$65 per hour average installation time, with a 50 meter channel and 2 connectors and patch cords. Of course, these figures will vary by installation. (A more thorough explanation of the total cost of ownership (TCO) model available at:

http://www.siemon.com/us/white_papers/06-05-18-tco.asp.

In addition, an interactive whitepaper is available for end users through their local Siemon sales representative.) Assuming these averages for 500 drops, we can see a significant savings over category 6A UTP with a screened system when two categories are needed in the same pathway. It is likely that category 5e and 6 will both support voice applications over the next 10 years as it is not expected that voice

applications will go above gigabit in that time.

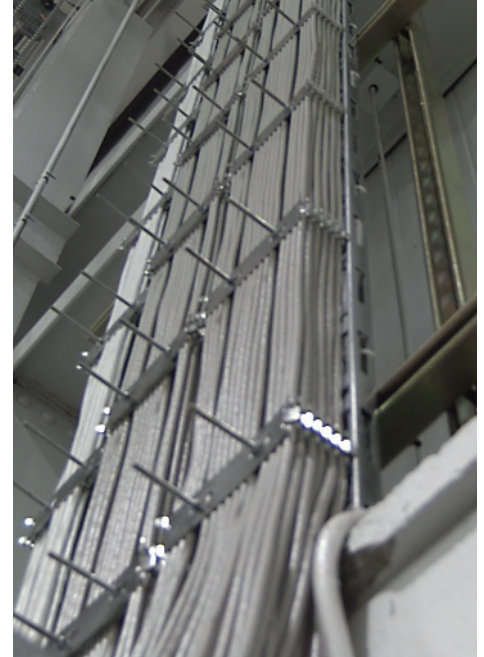
In new building construction or during an upgrade, in order to use category 6A UTP cabling you would need to run all channels as category 6A UTP or run separate pathways.

Assuming two drops per work area, the total cost for 500

category 6A UTP would be \$169,372.08. The same scenario utilizing one category 5e UTP channel for voice, modem, or lower speed connections and one category 6A F/UTP channel for higher speed data would decrease costs to \$127,432.50. Similarly, one category 6 UTP and one category 6A F/UTP in the same pathway would cost just \$151,947.71. This translates into a savings of \$41,393.59 and \$36,098.96 respectively.

In an existing building, it may be impossible to add new pathways for high speed UTP cable, or to accommodate larger diameter category 6A UTP cable. The same may hold true for a data center that is at capacity. If a full 10Gb/s upgrade is performed, it is likely that KVM, modem connections, monitoring and control systems will continue using category 5e or category 6 UTP for several years. In this case, the same cost savings benefits would apply if installing a screened system to support 10Gb/s channels within the same pathways that also carry category 5e or 6 UTP channels.

Running secondary trays and pathways to allow category 5e and 6 systems to coexist in a network with category 6A UTP would significantly impact project cost for both materials and labor; costs that are not required with screened or shielded systems used for high speed data.



Pathways at Capacity

Those who argue against shielded systems state the additional termination time and cost of grounding/bonding as an additional cost. The fact is that you must have a grounding and bonding (earthing) system for every network, even if it is 100% fiber. The only incremental, albeit small, is the cost to install one piece of #6 AWG wire per 24 port patch panel that attaches to the equipment rack which should already be attached to the existing grounding system. While a screened or shielded connector may take slightly longer to terminate than a UTP connector, this is not enough to impact the savings and performance benefits realized.

At Siemon, we offer all systems for our end users, however the vast majority of our end users are moving to 10Gb/s and taking advantage of the benefits of screened and shielded systems. In fact, in a recent Data Center study performed by BSRIA, 75% of respondents who plan to choose copper cabling for their 10G links plan for shielded cabling." For more information on screened and shielded systems including the top reasons to specify a screened/shielded cabling system, please visit www.siemon.com or contact your local sales representative.

ABOUT THE AUTHOR

Carrie Higbie has been involved in the computing and networking for 25+ years in executive and consultant roles. She is Siemon's Global Network Applications Manager supporting end-users and active electronics manufacturers. She publishes columns and speaks at industry events globally. Carrie is an expert on TechTarget's SearchNetworking, SearchVoIP, and SearchDataCenters and authors columns for these and SearchCIO and SearchMobile forums and is on the board of advisors. She is on the Board of Directors and former President of the BladeSystems Alliance. She participates in IEEE, the Ethernet Alliance and IDC Enterprise Expert Panels. She has one telecommunications patent and one pending.

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