The Future of UTP

Although UTP cables have existed in one form or another for decades, they have only been used in data communications networks for just over 10 years. While data cables existed in different forms for several decades before UTP cables were predominantly used, they were quickly replaced by UTP cables for several reasons.

Coax and shielded cabling solutions, such as ThickNet, ThinNet and IBM type 1, were very good cables for transmitting data within Local Area Networks (LANs). With the advent and proliferation of computer networking technologies, more and more cables occupied spaces "behind the scenes" where cables had only existed for telecommunications purposes in the past. Telecommunications closets were expanded to allow for connectivity between networking devices (hubs), servers and workstation terminals. Data rates were on the order of 1 to 16Mbps and ran on proprietary cabling solutions. Several protocols existed for proprietary to somewhat standardized, networks, such as Token Ring, ISDN and ATM.

WHY UTP?

Space, time and cost constraints led to the development of a more cost effective medium for transmitting data in UTP cables. By eliminating the need for shielded solutions, the end user now needed less space for installation, and saved money on materials and labor for installation. Grounding issues were also mitigated. Most importantly, UTP solutions are used as a baseline interoperability media for the most prevalent protocols.

In most cases a cabling solution is developed to support a faster transmission protocol. Today's fastest protocol over UTP cable is 1000BaseT transmission. This is supported by both Category 5e and Category 6.

UTP AND THE END OF THE PROTOCOL WAR

To better understand why UTP cable has evolved from Category 1 to Category 6, we must first understand the primary driver i.e., data rate progression. In the early '90s a war was raging as to which protocol would become the industry standard for LAN applications. ATM, Token Ring and Ethernet were all in contention. By the mid '90s Ethernet had come out on top. It provided a highly accessible technology with an outstanding cost basis that ultimately proved to provide the "QoS" needed at the right price. In addition, the progression to 100Mbps transport assured that data rates would be sufficient to support the needed bandwidth for existing and up-and-coming applications.

The following chart provides a good example of the progression of Ethernet as the default standard

UTP CABLE CATEGORIES BY PROTOCOL SUPPORTED TO A MINIMUM 100M LENGTH

Category	POTS	ISDN	Token Ring 4Mbps	10BaseT	Token Ring 16Mbps	100BaseT4	100BaseTX	ATM 155	ATM 622	1000BaseT	10GBaseT
1	X	X									
2	X	X	X								
3	X	X	X	X	X*	X					
4	X	X	X	X	X	X					
5	X	X	X	X	X	X	X	X			
5e	X	X	X	X	X	X	X	X	X	X	
6	X	X	X	X	X	X	X	X	X	X	

*Active "Powered" equipment only.

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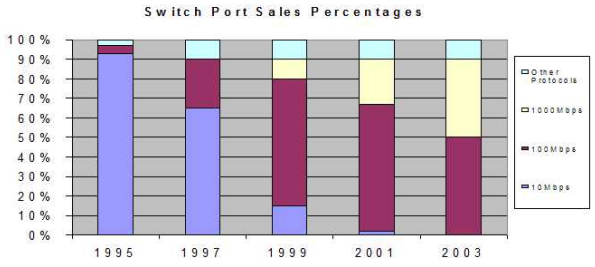
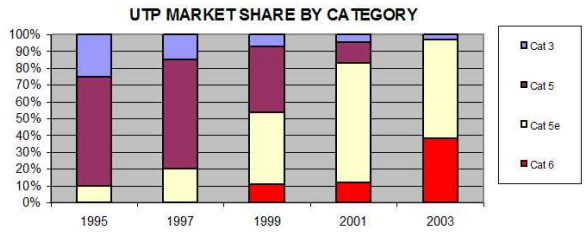
for today's LAN applications. As evidenced from the chart 10Mbps was the largest market share holder in 1995. By 1999 100Mbps led the market as the protocol of choice. At this time 1000Mbps had almost gained as much market share as 10Mbps protocol. 2003 saw the demand for 10Mbps completely dissipate. Currently, the market is split between 100Mbps and 1000Mbps, with 100Mbps quickly on the decline.



Source: Dell'Oro Group

Note: The "Other Protocols" in the first chart consist of 10 percent of the market consistently over the last six years. These protocols are legacy systems, such as Token Ring and ATM, and/or security systems.



Source: BSRIA

The second chart above shows how historically the cabling category installed has always led well before the speed of the protocol supported is used. For example, in 1995 the primary UTP cabling being installed was Category 5, which could support 100Mbps, but the switch ports sold that same year were primarily 10Mbps. In 1999 the primary switch port speed sold was 100Mbps, but the primary cabling solutions, Category 5e and Category 6, supported 1000Mbps.

What this data tells us is that the cabling installed always leads the primary data rate. This was the case until 2003. Today our fastest data rate is 1000Mbps over UTP. The cabling being sold today is only capable of supporting 1000Mbps. Customers will want a cabling solution that will support the next generation leap in data transmission, 10Gbps.

WHY DO I NEED CAT 6?

Originally Category 6 was developed to support a more cost effective way of running 1000Mbps, by using two pairs within the cable instead of all four. This is the same way we currently run 100BaseTX and the reason that 100BaseT4 never caught on. This would cut the cost of transceivers within the active hardware. At the time, a leader in the telecommunications industry was developing the hardware/protocol in question and needed a cable that would extend the frequency bandwidth used from the current 1-100MHz out to 250MHz. This allowed for higher bandwidth potential.

At the same time the development of four pair transceivers using PAM5 encoding supported 1000BaseT over Category 5e cables. These transceivers weren't as costly as initially expected. Today we see workstation PCs shipped with 10/100/1000BaseT NIC's integrated directly on motherboards. Switch prices have come down substantially and copper remains the most economical way to run Gigabit within the LAN.

1000BaseT transmission was being embraced as the latest, greatest protocol technology. Both Category 5e and Category 6 cables were being sold to support it. That's right, Category 5e and Category 6 both support up to 1000BaseT (Gigabit) Ethernet transmission protocol.

An argument has been made for installing Category 6 over 5e. Category 6 does give a much better signal to noise ratio than 5e, at all frequencies. This allows for anomalies within the active hardware that might otherwise cause a greater number of errors on a lesser performing 5e cabling system. Category 6 does support broadband video applications to a greater extent as well. However, Category 6 doesn't support any additional protocols that 5e doesn't o 100m. At the same time, the extended frequency to 250MHz of Category 6 also gave the customer a certain level of "future proofing", or did it? The industry seemed to adopt Category 6 with

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an attitude of "build it and the protocol will come". The Telecommunications Industry Association (TIA) has since ratified Category 6 and now that the cable has been standardized, the question still remains, "did it meet expectations"?

WHAT IS THE NEXT LEAP?

The active hardware manufacturers and the IEEE are key to understanding where the cable needed to go. The TIA must then respond by supporting the IEEE with a cabling standard.

Each leap in Ethernet has meant a tenfold increase in data transmission throughput i.e. 10 - 100 – 1000Mbps. The next logical step would then be to meet 10Gbps, which is already supported by fiber. The IEEE P802.3 10GBASE-T study group was then formed to investigate ways of running the new transmission speeds.

It quickly became evident, through interaction with the active hardware manufacturers, that Category 5e wasn't going to support the needed electrical requirements for the distance. Category 6, it turns out, didn't make the grade either. Its electrical characteristics are tuned to a knife's edge, to say the least, and we still couldn't support the next wave of transmission to the expected 100m distance. The study group is looking at limited length runs to support 10Gigabit over Category 6 up to 55m, but that's a far cry short of the magic 100m mark.

WHAT CABLE WILL SUPPORT THE FUTURE?

All along we thought that the pair-to-pair relationship within the cable was paramount to making good cable. Then came the "A" word, Alien Crosstalk. Did that mean aliens were trying to corrupt our data? Not exactly. Alien Crosstalk is the noise heard on a pair within a cable, generated by another cable directly adjacent to it. The active community are worried about random events or events that are unpredictable. While the noise between pairs within a cable can be predicted and eliminated within the active hardware, unpredictable Alien Crosstalk cannot.

This raised the bar yet again, but this time for a reason! The actives now need a better cable to proceed. Limits have been established and testing commenced to understand what is needed from the UTP realm to achieve the goal of 10Gigabit transmission over 100m.

Through innovative thinking, KRONE is first to achieve the necessary performance to support 10Gigabit all the way out to 100m, with a new CopperTen™ solution. The results for the new cabling innovation were presented at the November meeting of the IEEE P802.3 10GBASE-T working group with a vote of 64 to 0 to move forward. Alien Crosstalk performance can now be achieved, as well as the needed insertion loss levels, for transmission over the full-length requirement.

WHAT DOES THIS MEAN TO THE INDUSTRY?

Now that KRONE has proven that a UTP cable and connectivity can achieve the needed electrical parameters, the active hardware manufacturers can now develop their components/protocols. Copper will again support LANs to the next level of transmission performance and match the current highest speed offered by fiber, in 10Gigabit. LANs will once again be future-proofed today for the protocol of tomorrow, all at a better price.

With CopperTen™ now a reality consumers have three options: install a cabling solution that supports today's protocols by using Category 5e, implement tomorrow's protocol, 10Gigabit, to a limited length of 55m by using Category 6, or support tomorrow's protocol to the full 100m with CopperTen™.

For more information regarding CopperTen™ and all other KRONE products please contact the following:

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Sales Engineer near you
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