

Gigabit Ethernet and the Need for Available, Low-Cost Twisted Pair Links

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For Gigabit Ethernet to deliver on the promise of being low-cost, easy to use and widely deployed, a UTP-5 complement to fiber optic cabling systems must be made available during 1997.

There is consensus among GEA vendors that early deployment of Gigabit Ethernet, illustrated in Figure 1, will occur in the backbone and in high-end server connections. Optical fiber is the primary choice for 1000 Mbps backbone applications because it has achieved wide deployment for 100 Mbps backbones, has proven reliability, can achieve distances of up to 500 meters with multi-mode fiber, and can achieve longer distances with single-mode fiber. To serve this application, Gigabit Ethernet links using optical technology borrowed from Fiber-Channel have been the primary focus of the Gigabit Ethernet Alliance and the IEEE 802.3z standards committee efforts.

The IEEE 802.3z committee is considering several other cable alternatives to meet immediate equipment room needs and the vision of 1000 Mbps to the desktop. Besides the available optical fiber solutions, 25 m coax (twinax) jumpers, and 100 meter UTP-5 'long-haul' interconnect are under investigation. Coax jumpers up to 25 meters are expedient, but costly, and coax is now a foreign wiring system in the majority of installations which have standardized on UTP-5 twisted pair and fiber optic cabling interconnect systems. Long-haul UTP-5 is ideal for horizontal wiring runs, such as desktop applications, but both the need and the solutions are two to three years out.

However, according to the Tam Del'Orro Group¹, illustrated in Figure 2, up to 70% of all server connections are located less than 50 meters from a hub or switch, and 96% are located less than 100 meters away. Adding in 'glass house' equipment room interconnect, it can be deduced that a substantial application segment exists for short-haul interconnect up to 50m and that a technology that can scale to 100 meters provides additional benefit.

Therefore, an application gap exists for a wiring solution that can address the substantial short-haul (<50m) segment. It is also highly desirable to employ the ubiquitous UTP-5 cable and to address the long-haul segment (<100m) in a timely fashion.

¹ As presented to the IEEE 802.3z interim meeting, Sept 10, 1996

Figure 1: Early Deployment of Gigabit Ethernet

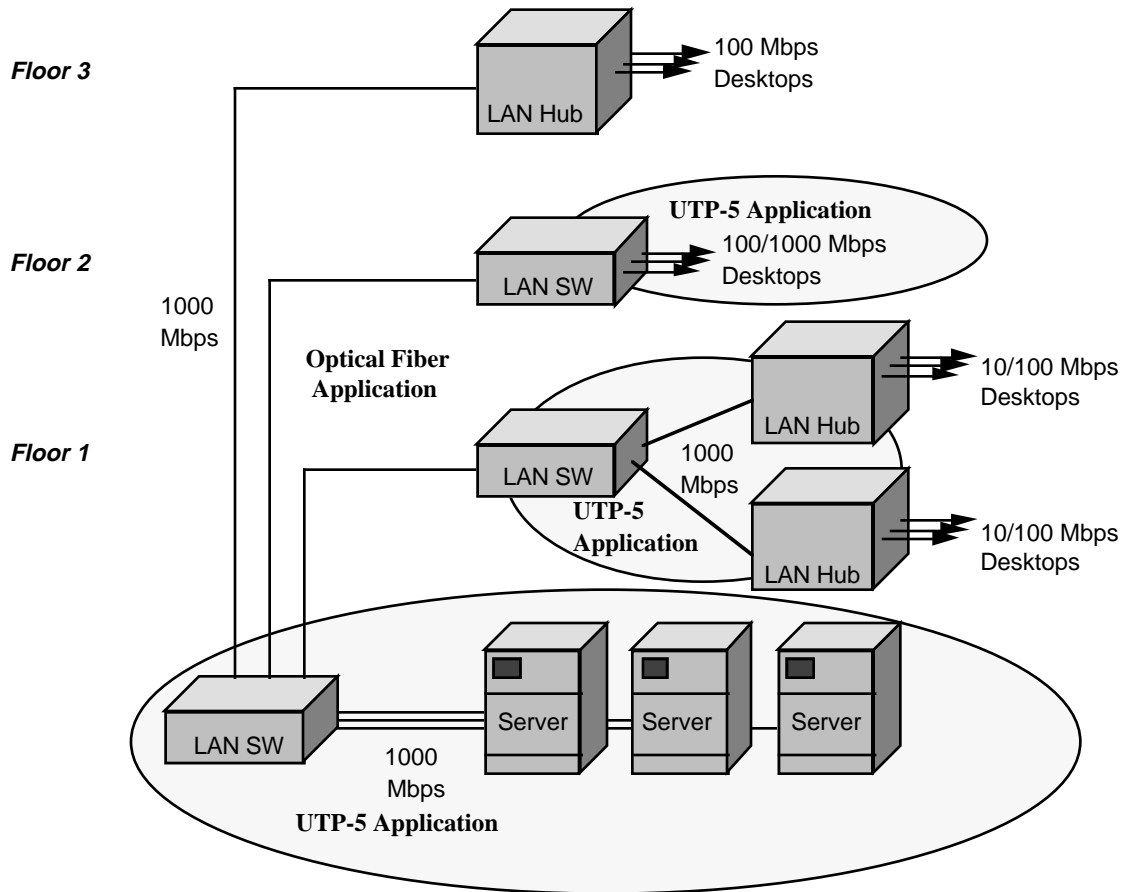
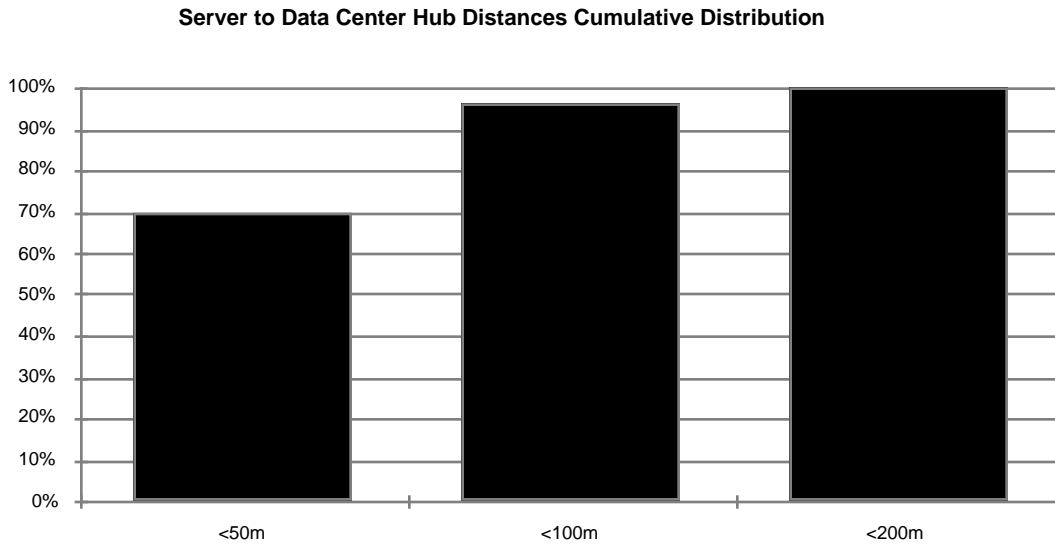


Figure 2: Tam Del'Orro Group Data



Early Gigabit Ethernet standards development focused on optical fiber for backbone and coax jumpers for the short-haul interconnect. This was done out of necessity because no low-cost or timely UTP-5 solution existed. Most equipment rooms, however, are wired with UTP-5 cabling and support UTP-5 punch-downs and patch panels. Introducing fiber or coax into this environment for local connections may be expensive and disruptive. This expense and disruption may be the limiting factor that delays the mass deployment of gigabit technology. A comparison of the physical layer solutions proposed for standardization is illustrated in figure 3.

Figure 3: Comparison of proposed Jumper and Horizontal PHY solutions

PHY Type	8B10B -Copper	PMC -50m	PMC -100m	"DSP"- 100m	SWL Multi-Mode optics
<ul style="list-style-type: none"> • distance (max) • cable type • availability • based on existing production technology • risk 	27m twinax now yes low	50 m UTP-5 1997 yes moderate	100m 2* UTP-5 1997 yes moderate	100m UTP-5 1999? no high	200m MMF 62.5µm 1997 yes low
Equipment Room Jumpers <ul style="list-style-type: none"> • components cost/port • jumper cable cost (2 ports) • cost/port (normalized) • cable compatible w/ 10 & 100 Base-T/F 	0.50 1.00/2 1.00 no	1.50 0.10/2 1.55 yes- preferred	not required	2.30? 0.10/2 2.35 yes	2.40 1.60/2 3.20 yes
<ul style="list-style-type: none"> • Horizontal Drops (installed cost) • components cost/port • "cable drop" cost (installed - 2 ports) • cost/port (normalized) • cable compatible w/ 10 & 100 Base-T/F 	not applicable	0.68 0.64 /2 1.00 yes	1.36 0.73/2 1.73 yes	1.05? 0.64/2 1.36 yes- preferred	1.09 1.91/2 2.05 yes

To address this application segment, PMC-Sierra has proposed to the IEEE 802.3z Task Force, an open, scalable UTP-5 interface that will address both short-haul and intermediate-haul applications. The proposal defines a one-bundle (4-pairs) or two-

bundle (8-pairs) interface for 50 or 100 meter applications, respectively. The technology for such a solution is readily available from a number of semiconductor vendors and it is expected that a complete chip solution can be introduced in 1997, with multiple alternate sources available shortly thereafter.

It may be possible to extend the one-bundle link distance to 100 meters, and the two-bundle distance to 200 meters, through improvements in receiver sensitivity or by employing new UTP wiring, such as UTP-6. While this requires a new cabling type, it may be more favourable than fiber optic or coaxial cable in many applications.