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Terabit Ethernet Is in Your Future

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NEWS ANALYSIS: Over the past 40 years, Ethernet—a standard that a bunch of tinkerers at Xerox PARC created to run a printer—continues to deliver as it grows bigger and faster.

"So, are you still over at *eWEEK,* causing trouble?" Bob Metcalfe was chuckling as he shook my hand at the reception before the two days of sessions heralding the 40th anniversary of Ethernet at the Computer History Museum in Mountain View, Calif.

I'd been covering Ethernet since around 1980, when 3Com, a company Metcalfe helped start after he'd co-invented Ethernet, shipped its first products. I still remembered looking at the first Ethernet equipment, which in those days consisted of cables the size of a garden hose, connectors that clamped on to that cable to pierce its insulation and separate transceivers.

Shortly after that, I wrote my first article about Ethernet and perhaps it caused trouble, but I don't know about that. I do know that nobody knew in those days that Ethernet would achieve the level of dominance it has today. Certainly nobody knew that it would grow from moving data at what now seems like a leisurely 10M bps to data rates that now are about to move at 40 times that rate.

But the real strength of Ethernet isn't what's been. It's what this networking protocol is about to become. These days, Ethernet, which was once characterized by its unique ability to sense when the shared network is in use and allow that use to continue before another station tried to use it, has changed. No longer does Ethernet depend on sensing a carrier and looking for data collisions. Now, with switched Ethernet, data is moving faster than ever and the need for those old ideas is gone forever.

But the real basics of Ethernet still remain. According to inventor Bill Hawe, who helped develop Ethernet when he was at Digital Equipment Corp., the things that made Ethernet a successful networking technology are the structure of the Ethernet packet frame and the addressing scheme. Ethernet's 48-bit absolute address, which gives each Ethernet device a unique identifier, was designed to provide enough addresses to last forever.

Of course, forever is a long time and with that time, Ethernet must also change. Because of Ethernet's success, this protocol is now on more than 90 percent of all networked devices globally, according to a recent study by Intel. That percentage will grow as the "Internet of things" allows a huge number of additional devices to communicate with each other and with us.

Because of this and because of the expanding traffic volumes that Ethernet must carry, the available bandwidth must change. Even while the standards committees are debating the 400M-bps standard for Ethernet, Metcalfe noted that it's time to start thinking about terabit Ethernet. Terabit Ethernet? Is that even possible?

I discussed the terabit networks in our future with *eWEEK*'s Chris Preimesberger, who was also at the event, and we decided that not only are they in our future, they're probably not that far away. Considering the rate of innovation that Ethernet seems to spawn, we think Terabit Ethernet will appear in 10 years or less, perhaps much less, depending on the speed of the standards committee, not the network itself.

But the growing need for Ethernet bandwidth is about more than just speed. As each device enters into communication with another device, the bandwidth demand increases. Just as the demand on a municipal water system grows as new homes and businesses are built in a community, so the demand for data grows. While each device doesn't by itself create a need for huge quantities of data, the sheer number of them adds up. It's already at a point where one has to ask what the next step beyond Terabit Ethernet might be.

And those devices also demand something else—an address. Intel's Radia Perlman, inventor of Spanning Tree, noted that the 48-bit address that was once thought to be enough to last forever may now be in danger. So what's next beyond that? Perhaps we'll start to see addresses that are defined by a 64-bit number.

Right now, the 48-bit address system isn't in immediate danger. But Perlman said that more than a third of those possible addresses have already been exhausted. Is the next step to combine Terabit Ethernet with a 64-bit addressing system? Perhaps it is, but one way or another, these changes must take place.

But the good thing about Ethernet is that the basic design of the network does not need to change. The packet structure is independent of the addressing, and if the addressing must change, it does not need to change on all networks. What must change is the core switches that handle the backbones of Ethernet must change to allow those addresses and higher speeds. Doing both at the same time will save trouble and cost. But either way, there's a terabit network with a lot more space in your future.