Looking Back on 40 Years of Ethernet

In the late 70s, Bob Metcalfe was asked to put personal computers on the desk and create a local area network for Xerox’s Palo Alto Research Center (PARC). Little did he know that his creationwould revolutionize the world.

At the time, Metcalfe, David Boggs and other members of the PARC team were looking somewhat closer to ALOHA.net and having decided to exploit his idea and get access to Ethernet technology, Metcalfe and his colleagues eventually opted for a system that used one wire of coaxial cable. In choosing the name of the technology, Metcalfe opted for the 19th century phrase Ether. Luminous ether was the name given to the medium through which light travelled.

"Given that everybody had access to Ethernet technology, how did 3Com win in those days? It’s very simple. We had a time machine. The group of us had gone into the future at Xerox PARC and we lived there for eight years and we knew what the future looked like. Then in 1979, we flew back into the present, we knew what the future was going to be, and it was buildings full of PCs," Metcalfe notes when looking back at the success of 3Com.

It was not until 1983 that the IEEE 802 committee approved Ethernet as a standard, or at least the CSMA/CD version of it. By then, Ethernet had evolved in Ethernet II and was becoming increasingly popular. This was partly due to the fact that it had become easier to deploy. The arrival of the IBM PC two years earlier, in 1981, also contributed to Ethernet’s success, with previous computer systems having been unable to use the technology to its full effectiveness.

It was during the 1980s that what Metcalfe describes as the "LAN wars" occurred between Ethernet and the IBM backed Token Ring, a protocol that resided in the data link layer and used a special three byte frame called a token. Token Ring ran at LAN speeds of 4Mbps and 16Mbps and initially appeared to have theoretical advantages over Ethernet due to its greater efficiency, with larger packet sizes and faster speed.

Metcalfe himself admits the technology did have him worried because for a decade, he was being told from across the industry that Ethernet was doomed, due to IBM having the muscle when it came to making standards.

The conflict changed Ethernet, with the technology switching from coaxial cable to the twisted pair system used by Token Ring. We were fighting in the market with the IBM Token Ring, which used twisted pair, and the customers kind of liked that, so Ethernet decided to become twisted pair too, and that sealed the doom of the Token Ring," says Metcalfe.

The key disadvantage of Token Ring was in its lack of compatibility with non IBM equipment, while Ethernet was able to drum up support from over 20 companies with standards based products that worked together. This meant the technological gap between the two was closed quickly and in 1990, the 10BaseT IEEE standard allowed the use of hubs and switches in Ethernet, switching it from a bus architecture to one with the flexibility of a star architecture and made management for network administrators much easier.

By the early 90s, this form of Ethernet was much cheaper than Token Ring and then with the development of Ethernet switching, and 1Gbps Fast Ethernet in 1995, Token Ring could not keep up.

"What they underestimated was the power of an open standard, and I’m referring to the old IBM. Now there’s a new company called IBM which is different, but in that old IBM, in its dark little heart, it was not committed to open standards and its products were not interoperable," says Metcalfe.

In the years that followed, Ethernet was to extend its reach far beyond the LAN, first entering the WAN, where it was slowly wiping out SONET and then over the airwaves, supplying WiFi access points.

The work of the Metro Ethernet Forum (MEF), which was launched in 2001 to develop business services for enterprise users accessed over optical metropolitan networks, has now transformed Ethernet into becoming a service offering for carriers “going across the telechasm between the LAN, the WAN and Ethernet,” as Metcalfe puts it. The speed of Ethernet also continues to increase with the IEEE recently starting a project to standardize 400GE, while terabit is also on the horizon.

Ethernet in its role as the plumbing of the internet has disrupted many industries over time including music, books, telecoms and television, and Metcalfe now predicts the technology will go even further. In his presentation at the Ethernet Innovation Summit, he predicted that three more industries - energy health care and education - are set to be impacted via new types of video, mobile and embedded traffic.

"Even though Ethernet is 40 years old, it is not dead. And apparently it is blooming. It is blooming. And so there’s something like a $100 billion industry for us to pay attention to, and that’s what we’re doing today," says Metcalfe.

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NetEvents Celebrates the 40th Anniversary of Ethernet

On May 22 and 23, press, analysts and representatives from across the world celebrated the 40th anniversary of Ethernet technology at a special event held at the heart of Silicon Valley in Mountain View, California. Over the course of two days, a tightly packed schedule of keynote speeches, presentations and roundtables gave those in attendance unique and informative insight into the development of Ethernet, its expansion to become a global standard and its growing potential outside of the Local Area Network (LAN) space. Among those invited were individuals who have shaped Ethernet technology over the past 40 years, including Bob Metcalfe, widely credited as its inventor.

Opening the summit was Steve Hoover, CEO of Palo Alto Research Center, the facility where Ethernet was conceived. Hoover observed, "The creation of the Ethernet and associated technologies really are the fabric of our lives today, as I look in the room and I see the set of computers we have, and handheld devices, and how important the Ethernet was to the creation of this highly distributed network," he said during his welcome speech.

Technology forecaster, Paul Saffo, who followed Hoover on stage, then began proceedings by raising questions to be answered over the next two days of keynotes, panels and interviews.

"Events that happened 40 years ago are extremely relevant today, because this is about innovation. This is about whitespace. This is about changing the world. And our computers have changed - I haven't even seen one of these things connected to a phone for about a decade. But amidst all the changes, the constant is: how do you change the world? How do you change the world for the better? How do you create innovation?" One point he was keen to emphasize is how the biggest consequences of developing a standard often come after it is accepted, because as Ethernet has shown, standards stay around for much longer than imagined.

"Good standards become a platform for further innovation. They evolve, they change, they expand other opportunities for devices that nobody ever imagined would exist. And so this is a story about innovation. It's a story about evolving standards. It's about something that happened 40 years ago that sent events running off in absolutely the right direction, to create innovations that are still continuing today. That's why we're here."

Saffo was then joined on stage by Bob Metcalfe who gave his personal perspective on how Ethernet was invented and who was involved, with his keynote presentation 'From ALOHA to Ethernet.' Highlights of the presentation included a timeline of Ethernet, the cover of Metcalfe's PhD dissertation and a map of computers on the internet in 1973.

"We really haven't said goodbye to the Ethernet, but we have said hello to ALOHA again, after a hiatus of perhaps 20 years. That hiatus, by the way, was not a technology hiatus; it was a regulatory hiatus. Until the frequencies were available for the connections that we all use today, there was no sense in going from Ethernet to WiFi or ALOHA," he said.

Pitt also shared his experiences during the LAN wars competing against Ethernet, stating, "No one was happy to see me walk into the room," but he expressed there was largely no personal animosity between him and the Ethernet supporters and he later went on to work with some of them.

John Shoich, from Alley Ventures, who was also on the panel, described the discussion of the arguments back then as feeling like 'he'd gone back in time.'

Pitt closed the panel with his thoughts on the standards process and produced a limerick he wrote during the late 80s during the time of Token Ring, Ethernet and Token Bus.

"Any nitwit with standards acuity. Soon learns of their self-perpetuity. The work was all done. Back in March '91. But these trips are a lifetime annuity!"

Carrier Ethernet

Presentations and panelists also sought to chart the future of Ethernet, looking into areas including research funding, the rise and evolution of Carrier Ethernet standards and the future of networking.

Major industry analysts presented their own key facts and figures on how the Ethernet market is developing. Among them was Tam Dell'Oro, founder and President of Dell'Oro Group, who showed in her slides how the market for Carrier Ethernet switches and routers has been growing since...
arriving in the early 2000s, with it set to reach nearly $9 billion by the end of the year. During Dell’Oro’s subsequent Q&A panel session, James Walker, Vice President of Managed Network Services at Tata Communications, explained how the company’s Ethernet business has grown fifteen fold over the past five years and customers were increasingly demanding Ethernet services to perform certain tasks.

Meanwhile, Verizon’s Executive Director of International Network Planning, Yali Liu, said that Ethernet was one of the carrier’s fastest growing products for the telco because it provides higher speed and differentiated class of service. She stated that Verizon had experienced double digit growth in Ethernet services over the past few years and had seen very high adaption of native Ethernet as access to the conference the availability of gigabit Ethernet to 120,000 new office buildings in the US under its FiOS service.

There were two further announcements made during the conference in relation to Carrier Ethernet. First was the launch of the Metro Ethernet Forum’s first new committee in eight years. The Service Operations Committee (SoC) has been created to define streamlined and standardize processes for buying, selling, delivering and operating Ethernet services. The committee aims to help service providers with more consistent contracts and to standardize ordering processes that take into account national regulatory factors and the greater diversity of Ethernet services compared to TDM.

Following this, Walker announced the formation of the CloudEthernet Forum, an organization designed to address the specific issues of scaling and applying suitable Ethernet services to meet the stringent demands of delivering cloud services.

The Innovation Awards

On the evening of May 22, the Computer History Museum played host to the annual Innovation Awards, which honor organizations and individuals that lead the world by innovation and performance in the networking and telecommunications sector.

This year the awards ceremony was combined with a gala dinner and charity auction with all the proceeds donated to the Science, Technology, Engineering and Math (STEM) education project. The event was streamed live to the world via Carrier Ethernet broadcast services from Comcast Business and Tata Communications.

Among the highlights was a special honorary award for the Greatest Contribution to the Networking Age, presented to Bob Metcalfe in his role as Co-Inventor of Ethernet & UT Austin Professor of Innovation.

There was also the Ethernet Idol award presented to the individual considered to have successfully continued the work of the original Ethernet inventors and made the most outstanding contribution to Ethernet in the last 15 years. The award was presented to industry legend Andy Bechtolsheim, following an online vote by more than 300 delegates in attendance.

“It’s ironic that Andy would be voted ‘Ethernet Idol’ for his work in the last 15 years of Ethernet when he was my Ethernet Idol for the first 15 years,” Metcalfe commented when handed the award to Bechtolsheim.

The other seven award categories for organizations were:

- Carrier Ethernet Business Services – won by Verizon for the most innovative new business service to enterprise clients within the past 18 months.
- Telecoms Product – won by RAD Data Communications for "best in class" infrastructure equipment and innovative solutions to service providers’ current challenges.
- Enterprise Wireless Solutions – won by Xirrus for the most innovative solution to managing the BYOD challenge. Xirrus founder Dirk Gates was presented with the award by ALOHAnet inventor Norm Abramson.
- Cloud/Datacenter Solution – won by Arista Networks for the most innovative Cloud/Datacenter solution, providing major business benefits.
- Security Solution – won by ClickSecurity for the most innovative contribution to countering the latest threats, including organized crime and government sanctioned hacking and cyber attacks.
- SDN Solution – won by HP for the most innovative SDN solution.
- Hottest ‘NEW’ Networking Company – won by Gigamon amid fierce competition. This award was not for a company that meets specific criteria, but rather one that surprises the judges with something truly fresh and original.

Metcalfe’s Closing Remarks

Bob Metcalfe took to the stage to give his closing comments on the last day of the conference. He spent much of his keynote discussing what had been learnt from the past two days and sought to highlight some of the goals that had been in mind when the idea for the event was first conceived.

“Of course it was intention all along that it would be more than a celebration of the 40th. I’m not a professor of innovation, so I thought it’d be useful if we collected and gathered some lessons from Ethernet history about how to innovate.”

In an interview after his speech, Metcalfe told Telecom Review of the irony that he himself had predicted the demise of Ethernet in an article years ago when ATM technology was tipped to replace it.

“I remember writing that I thought Ethernet’s last product would be introduced in 2003 and it would be replaced by ATM. I interviewed a group of people and they all said ATM was going to kill Ethernet, and being in the guise of a journalist I wrote that. The amount of investment going into ATM was huge so it was expected.”

When asked if he thought that there was any technology that could replace Ethernet, Metcalfe was frank, citing the examples of how IBM and Microsoft had risen and fallen from dominance in the past. He did, however, suggest that lambda switching, a technology used in optical networking to switch individual wavelengths of light on separate paths for specific routing in conjunction with wavelength division multiplexing (WDM), could replace Ethernet.

“The idea is that we’re going more and more towards flows, towards large transmissions instead of really small ones, so one could imagine a switching infrastructure involving optical fibers, and lambdas being allocated on the fly and various transmissions with a control plane handling it all,” said Metcalfe. “That’s the only thing I can think of that would mean the death of Ethernet.”

The conference fittingly ended where it all began 40 years previously with a reception at the Palo Alto Research Center, which featured an exhibition charting the invention of Ethernet and a video of the PARC during a failed test of the first laser printer.

As well as the power of innovation and open standards, the 40th birthday celebration of Ethernet proved that the technology is showing no signs of dying off any time soon. Here’s hoping Telecom Review is invited back to celebrate Ethernet’s 50th anniversary in ten years’ time.