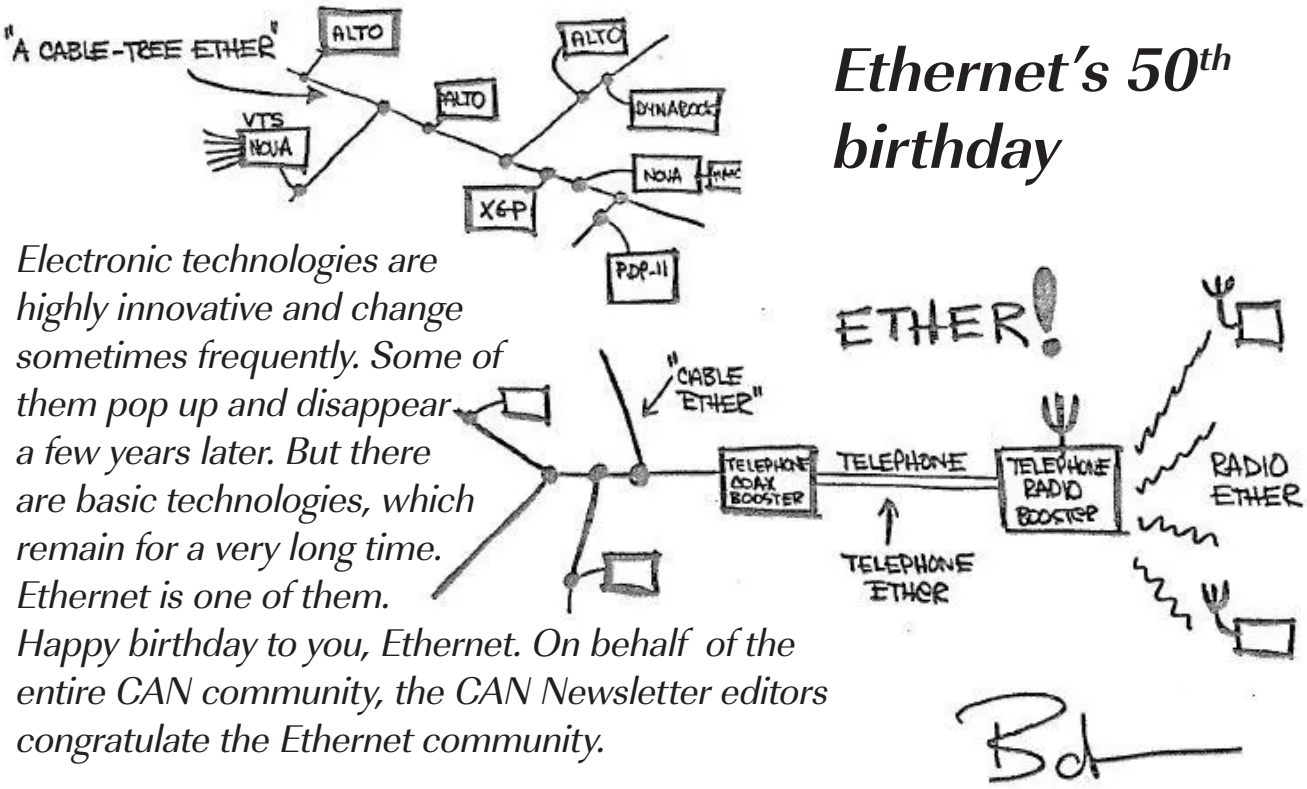
Ethernet's 50th birthday



Bob Metcalfe's Ethernet sketch in the 1973 memo (Source: Xerox)

Electronic technologies are highly innovative and change sometimes frequently. Some of them pop up and disappear a few years later. But there are basic technologies, which remain for a very long time. Ethernet is one of them.
Happy birthday to you, Ethernet. On behalf of the entire CAN community, the CAN Newsletter editors congratulate the Ethernet community.

Once upon the time, in 1973, Robert Metcalfe wrote at the Xerox Palo Alto Research Center (PARC) a first document mentioning Ethernet. Of course, there was a team involved in the Ethernet development. In the 1976 granted patent, David Boggs, Butler Lampson, and Chuck Thacker were co-credited as inventors. At this time, Xerox handed over its Ethernet trademark to the IEEE (Institute of Electrical and Electronics Engineers) association, which standardized Ethernet.

Metcalfe said that Ethernet was born on May 22, 1973, the day he circulated a memo titled "Alto Ethernet". This sheet of paper contained a rough schematic of how Ethernet would work. "That is the first time Ethernet appears as a word, as does the idea of using coax as ether, where the participating stations, like in Alohanet or Arpanet, would inject their packets of data, they'd travel around at megabits per second, there would be collisions, and retransmissions, and back-off," explained Metcalfe. For Boggs, November 11, 1973, is the Ethernet birthday: It is the first day the system actually functioned. It does not matter, what is historically "correct", the year of birth for Ethernet is the same: 1973. Happy birthday!

The first version, 10BASE5, featured a stiff cable nearly a half-inch in diameter, and was later joined by 10BASE2, using a cable about half as thick and much more flexible. In 1979, Metcalfe founded 3Com Corporation to make money of Ethernet. The company offered Ethernet circuit boards for mini-computers before releasing an Ethernet card (plug-in circuit board) for the IBM personal computer (PC) in 1982.

Nowadays, Ethernet is scalable by means of bit rates. But some variants are incompatible regarding the physical layer, the so-called PHY. Ethernet has been improved several times regarding the speed grade. Starting with a 10-Mbit/s copper coaxial-type approach (10Base5), the next step, in 1995 was the introduction of the well-known 100-Mbit/s Ethernet (better known as 100Base-TX) followed in 1999 by 1000Base-T providing a 1-Gbit/s bit rate. There are electrical, optical, and wireless physical transmission variants available. In 2002, the 10-Gbit/s Ethernet (10GBase-T) was born. Currently, the 40-Gbit/s solution is the highest speed grade, but research is already going to 100-Gbit/s bit rates.

IEEE has accompanied the Ethernet community and maintains the related documents. A number of IEEE 802.3 standards specify the physical and data-link layer for Ethernet:

- 10Base-T (IEEE 802.3): 10-Mbit/s with category 3 unshielded twisted pair (UTP) wiring for up to 100-m networks.
- 100Base-TX (IEEE 802.3u): Known as Fast Ethernet using category 5, 5E, or 6 UTP wiring for up to 10-m networks.
- 100Base-FX (IEEE 802.3u): Fast Ethernet that uses multi-mode optical fiber for up to 412-m networks.
- 1000Base-CX (IEEE 802.3z): So-called Gigabit Ethernet using copper twisted-pair cabling for up to 25-m networks.
- 1000Base-T (IEEE 802.3ab): Gigabit Ethernet that uses Category 5 UTP wiring for up to 100-m networks.
- 1000Base-SX (IEEE 802.3z): Gigabit Ethernet running over multi-mode fiber-optic cable.
- 1000Base-LX (IEEE 802.3z): Gigabit Ethernet running over single-mode fiber.
- 10GBase-T (802.3.an): 10-Gbit/s connections over category 5e, 6, and 7 UTP cables.

The first number in the name represents the speed of the network in Megabits per second. The word "Base" refers to baseband, meaning that the signals are transmitted without modulation. The last part of the name indicates the used cabling to carry symbols. For example, 1000Base-T means that the speed of the network is up to 1000 Mbit/s, baseband signaling is used, and the twisted-pair cabling is used (T stands for twisted-pair).

The success of Ethernet in office applications is not questionable. There is no real competing communication technology, except USB, which is used for completely other purposes. ▷

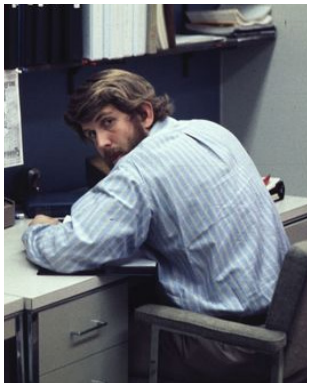


Figure 1: Robert Metcalfe in 1973, one of the Ethernet fathers (Source: Metcalfe)

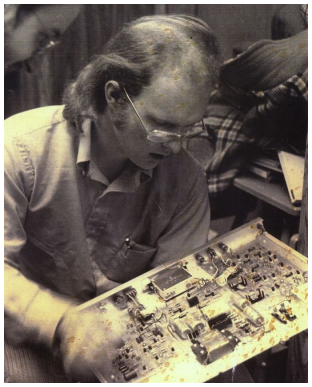


Figure 2: David Boggs, one of the other Ethernet fathers, with an Alto Ethernet card (Source: Boggs)

From the office into the factory and into road vehicles

Beginning of this millennium, Martin Jetter introduced Ethernet into the industrial automation markets. His Jetweb was commercially not that successful; his company became not the market-leading supplier for industrial Ethernet. The automation industry made the same mistake during the so-called “fieldbus war” beginning of the 90ties. All big players in this business invented their own flavor of industrial Ethernet, which were not compatible to each other. Nevertheless, the different industrial Ethernet variants were successful in high-speed-requiring network applications as well as in their captive markets. But the industrial Ethernet market nowadays is still highly fragmented.

Automotive Ethernet is another success story – not yet by number of nodes in the car, but by publicity. It is the base of the upcoming so-called software-based vehicles and is intended to be used for autonomous driving, too. In the future, it also will backbone CAN-based networks. This means, CAN classic (CC) as well as CAN FD are not competing with 100-Mbit/s and faster Ethernet variants. Fast Ethernet and CAN FD will complete each other. Both network technologies, CAN and Ethernet, will be the two dominating automotive network technologies in the next decade. But they will compete in the 10-Mbit/s domain, because CAN XL and 10Base-T1S address the same applications. The CAN community is prepared for this contest. CAN fellows congratulate Ethernet to the 50th anniversary. Fifty years in electronics is a Methuselah age. CAN is a little bit younger – just 37 years counted from the first presentation in 1986 on the SAE congress in Detroit. Ethernet and CAN are somehow mature and successful communication technologies. ◀

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