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Barry Leiba

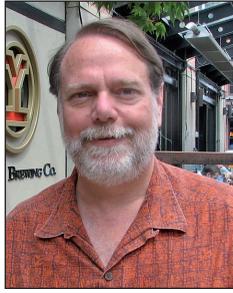
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From Stone Knives and Bearskins to Mobile and Cloud Computing

Barry Leiba • Huawei Technologies

I think, from time to time, about science and engineering through the ages. I think about the times I might have lived in and the things I might have done. I imagine how it would have been to discover basic elements such as oxygen. I imagine what it would have been like to invent the steam engine. I would have found it fascinating to explore the world at a time when much of it was uncharted territory. Going beyond the world, when I was a child, I wanted to be an astronaut, when there were but seven astronauts, and reaching the moon was still years away.

But as I consider all that, I think that the most amazing time in history to be involved with technology is now, and the most exciting field involves computers and the Internet. Have we ever made the sorts of technological leaps in just half a century as we have in the past 50 years? Just look at where we were, and where we have come:

Edith Keeler: “What ... what on earth is that?”

Mr Spock: “I am endeavoring, ma’am, to construct a mnemonic memory circuit using stone knives and bearskins.”

– *Star Trek*, “The City on the Edge of Forever” (1967)

In 1962, I was five years old. Most television was in black and white, and those programs that were in color explicitly told us so, displaying logos such as the NBC “peacock.” Only a handful of television stations were available in any area, and many rural parts of the US had none. They didn’t broadcast all the time, and we saw “test patterns” and “snow” when they were off the air. We listened to AM radio and phonograph records. Telephone communication was often

still on “party lines,” and we got excited when someone called and we heard, “He’s calling long distance!”

That’s what communications and media were like then. Computers? They existed in large companies and research facilities, and they filled large, chilled rooms. Only one person at a time could use the computer, and “timesharing systems” were early research projects. The Massachusetts Institute of Technology ran a TV program in 1963 in which Fernando Corbató, then associate director of the MIT Computation Center, showed how such a thing could work (www.youtube.com/watch?v=Q07PhW5sCEk).

By 1972, color television was widespread, though many people still used black-and-white TV sets to watch. Cable TV was becoming available, providing better service to people in areas with few broadcasters or poor reception. We listened to FM radio, and cassette and 8-track tapes.

My school had a computer that a select group of students – which I was lucky to be in – could use and learn on. It had 2,000 words of memory, no hard drive, and a paper-tape reader. More powerful computers were affordable then for medium-sized businesses, but they still occupied whole rooms and needed specialized support. Timesharing was widely available.

Remote computer connections, when they were available, ran at around 100 bits per second – 300 bps was the leading edge. You could type faster than that, and when the computer responded, you watched the lines slowly appear, letter by letter. The beginnings of what would become the Internet had been developed – Arpanet made its first cross-country connection between the University of California, Los Angeles, and MIT in 1970. The first email messages

were sent around this time as well, and they made up the majority of Arpanet traffic.

I finished high school and college in the next decade, studying mathematics and computer science, to the extent that degrees in the latter were available at the time. My university computing involved punch-cards with self-service card readers, and 300-bps terminals for use with APL (you couldn't do that on punch-cards!).

In 1982, I was in the real world, gainfully employed as a computer programmer. In the communications and entertainment world, color television was the norm, and many TVs had remote controls. Cable TV was prevalent in many areas, and was scheduled to be installed in my neighborhood "soon." CD players were new, but little music was available for them yet.

Personal computers had been around for a few years. The most powerful had 30-Mbyte hard drives and processors with 10-MHz clocks. Remote computer connections ran at 1,200 bits per second, and 2,400 bps was soon to come. Email had been around for a decade but was pretty much available only to scientists and academics, and in closed systems in some large companies.

The beginnings of the Internet had continued to develop, as CSNET led into the upcoming NSFNET. Key Internet standards were being published (having been developed and tested a few years before), including TCP (RFC 793) and IP (RFC 791), and a relative handful of people were working on routing and other issues that needed to be resolved before things could expand to a fully distributed, global scale.

From there to 1992 some big changes occurred in communications, entertainment, and computing. Everyone had color TV with remote controls, cable, and VCRs. Everyone had CD players, and it was hard to find music on phonograph records any more. PCs were widespread, and we were using processors with clock speeds on the order of 100 MHz, with hard drives of 1 Gbyte. Dial-up speeds were up to 14,400 and 28,800 bits per second, with 56 kbps coming.

But the biggest changes were in the Internet and how we used it. The early 1990s saw the formation of the World Wide Web. To some of the technologists who had been using FTP and Gopher, this seemed an incremental step. To the Internet world as a whole, it would soon be life-changing. In 1992, a few companies were establishing Web presences, but consumer business on

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the Web was still uncommon. Many people were using pre-Web services such as Prodigy, CompuServ, and AOL. Other ISPs were starting up, and “regular people” were just beginning to use email. The IETF saw its attendance jump to more than 500 for the first time in 1992, a 40 percent-plus increase over the prior year’s meetings.

By the time we got to 2002? Cable, satellite, TiVo, DVD. Netflix. iPods, Napster, DVD audio, XM radio. Who needs CDs? We carry our entire music collection in our breast pocket. PC clock speeds higher than 2,000 MHz and hard drives of at least 40 Gbytes are standard; much larger are widely available, and cost is on the order of a dollar per gigabyte. Everything is on the Web. Everyone uses email, if they can find it through the spam. As for dial-up speeds: What, you don’t have broadband? How do you watch the YouTube videos?

Now it’s 2012. We all have smartphones, and it’s sobering to think

that the computer I used in college is dwarfed in raw computing power, internal memory, and data storage capabilities by a device that I carry on my belt. We carry iPads and Android tablets, and all of our devices are tied together with data services “in the cloud.” We have the world at our fingertips: the Internet is truly the font of all human knowledge, instantly accessible not only to large corporations and the wealthy few, but to every 10-year-old with a smartphone.

We live in an unfathomable world of information, entertainment, communication, and connectivity. We have come so unbelievably far in the past 50 years, and I feel completely amazed and privileged to have experienced it, and to have been a part of it professionally for 35 of those years.

Where will we be in 2022? It’s impossible to tell; the technological leaps of each of the previous 10-year periods could never have been predicted. How exciting! I can’t imagine a better time to be living in.

So much has already been discovered, and yet there’s always more to find, to create. To be sure, it will be a challenge to impress a society that’s inured, by now, to every advance in technology. If you have any doubt about how we take it all for granted, note that emergency communications now come through, among other channels, text messages on our mobile phones.

From “stone knives and bearskins” to the modern Internet. Wow! ☐

Barry Leiba is a standards manager at Huawei Technologies and is serving as Applications Area Director in the IETF. He currently focuses on the Internet of Things, messaging and collaboration on mobile platforms, security and privacy of Internet applications, and Internet standards development and deployment. Leiba is IC’s newest associate editor in chief and edits the Standards department. Contact him at barryleiba@computer.org.

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