MIME @ 20: A Happy Anniversary

Nathaniel Borenstein '80 – *the co-inventor of the email attachment – reflects on time, technology, and innovation.*

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majored in math and religious studies at Grinnell, received the College's President's Medal, and in 1998 became Grinnell's first Robert Noyce '49 Visiting Professor. Borenstein earned a Ph.D. in computer science from Carnegie Mellon University, was named a "geeks' geek" in 2001 by Salon, founded several tech start-ups, wrote three books and numerous articles, and holds three patents. In 2010 he gave up a sinecure as an IBM distinguished scientist to become Chief Scientist at Mimecast, a unified email services company.

In 1992, only a few people had cell phones, or even knew what email was. South African whites were voting to end apartheid; the first shouts of "Wayne's World!" echoed through the newly opened EuroDisney in the newly constituted European Union; Isaac Asimov and Benny Hill died; Miley Cyrus and Selena Gomez were born; and Microsoft finally found a market with version 3.1 of Windows.

Also new that year was MIME [Multipurpose Internet Mail Extensions], the now-ubiquitous Internet standard for multimedia data — for me, the culmination of seven years of work researching, developing, and standardizing multimedia email. Twenty years later, my best guess is that MIME is used roughly a trillion times daily. But in 1992, a single MIME message made a bit of a splash among the few who saw it.

That message — often referred to as the first MIME message, but more accurately called the first *interesting* MIME message — circled the globe in March 1992, sharing a JPEG image and an audio clip of my barbershop chorus, Bellcore's Telephone Chords, singing "Let Me Send You Email" to the tune of "Let Me Call You Sweetheart:"

> *Let me send you email if you have the time*
> *Let me sing you email now that we have MIME*
> *You have lots of bandwidth, I have lots of bits*
> *Let's use MIME for email, plain text is the pits!*

Where has the time gone? Can it really be 20 years?

Well, yes; it's a whole different world. Twenty years ago, when people asked why I was so passionate about this technology, I'd say, "Someday I'll have grandchildren, and I want to get pictures of them by email." This generally made people laugh — it was an absurd notion, given the costs of computers, bandwidth, and digitizing photographs.

Today, as I receive regular in-utero pictures of my third grandchild, I find it hard to explain to younger folks why this ever seemed unlikely.

As proud as I am of the MIME work, I don't really believe it deserves as much attention as it gets. We made several mistakes, but fortunately not enough to make up for being in the right place at the right time. I've done plenty of things in my career that I thought were under-recognized, so I can't shed too many tears about this one being over-recognized. It all feels rather random.

I've had plenty of adventures in the last 20 years, raised a family, made and lost a fortune, and gotten thicker and grayer. MIME hasn't given me a fraction of the joy that I've gotten from my children and grandchildren. Yet the word MIME is probably as inevitable in my future obituary as the obituary itself. I figure I should simply relax and enjoy the show. Meanwhile, here are some lessons MIME might teach about how to create a successful technology standard.

1. **Where you work matters**. I devoted roughly two years of my life to defining MIME. Not that many employers would tolerate that, but I was a researcher at Bellcore, with a broad mandate to promote more bandwidth use. Few companies support standards work to the extent that Bellcore supported me.

2. **Address a real need.** Most people didn't know it yet, but the world really needed an interoperable, open standard for multimedia data; almost everything on today's Internet reflects this. I realized it early because I had built a multimedia email system at Carnegie Mellon, and Steve Jobs had followed up with something similar at NeXT, but the two systems couldn't exchange multimedia data with each other. I knew that someday I wanted to get pictures of my grandchildren by email, but I didn't want my kids and me to have to use the same email software.

3. **Address another real need.** Any standard will face barriers to adoption, at least from the inertia of the installed base; meeting two major needs can increase the number of people who care, and hence the pressure for adoption. In the case of MIME, multimedia junkies like me were able to make common cause with the deep desire of people around the world to send email in languages other than English. And my co-author, Ned Freed, was largely motivated by the need for a better email format standard to facilitate handling email at gateways without losing important information These problems could have been solved separately, but a standard that solved both surely hastened adoption, perhaps even making the difference between success and failure.

4. **Connect the dots and share the credit.** Some successful teams self-assemble, but behind most successful teams

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is a visionary who figured out what parts needed to be brought together. In the case of MIME, the visionary was the late Einar Stefferud, who introduced me to Ned Freed and suggested that we collaborate on the work that became MIME. Sharing the credit is remarkably useful in leading argumentative technology gurus to consensus. At the end of the MIME standard, there's a long list of acknowledgements of people who helped draft the standard. I found that adding someone to this list made them less argumentative. There's no downside to sharing credit generously.

5. Keep your goals modest, realistic, and limited. I know, extending email to include all human languages and all media types doesn't sound like a limited goal, but the truth is that we achieved those goals via a very limited mechanism. We avoided trying to settle as many battles as we could, preferring instead to create a framework for the debate to continue. Thus, MIME doesn't declare JPEG a better image format than GIF, or PDF superior to HTML and DOC; we just made it possible to unambiguously define labels for these types, such as image/gif and image/jpeg. (The wisdom of this approach is clearest when you consider applying it to the natural language problem: Had we tried to specify that everyone should always speak English, or Chinese, we would never have found consensus.)

6. Acknowledge that your vision is limited. Standards designers tend to overspecify; MIME was designed in the aftermath of X.400, a proposed email standard that failed in large part due to its complexity. Rather than try to imagine every future use of MIME, we created an initial set of media types, and a registry for defining new ones. The result is that the number of media types has grown from less than 20 in the original standard to more than 1,300 today.

7. Worry about branding and marketing. This is the lesson I find hardest to convey to technically oriented people, who tend to dismiss anything nontechnical as fluff. The fact is, technologies are adopted (or not) by people, who are subject to a wide range of influences. Good publicity and catchy names really matter. In fact, the best advice I've gotten in my entire career came from Dave Crocker, the author of the original Internet email

standards, who convinced me to come up with a clever name or acronym. I laughed, but he was insistent, so after 15 minutes I came up with "Multipurpose Internet Mail Extensions" — MIME, which, because it is much catchier than, say, RFC 1341, is often used conversationally, and the term "MIME types" is sometimes used to refer to "media types." Essentially, because people have heard the name MIME and perhaps have a vague idea what it is, I have instant credibility with total strangers. It's a good thing I didn't know it would be used in so many non-email contexts, or I might not have come up with such a catchy name.

8. Give it away. If you want to see a standard adopted, it helps to produce a solid implementation and release it as open-source software. I built a software package called metamail, a stand-alone MIME implementation for UNIX that could be plugged into any mail reader, and released it to the world when the MIME spec was stable. Combine real need and free software, and things happen fast. Within a few days, I received patches that made it work on DOS, while Macintosh, Amiga, and others were not far behind. Again, credit is due Bellcore, for supporting building such software only to give it away.

There are other lessons, I'm sure, but most relate to technical details and are unlikely to be of wider value. So now, perhaps, I can stop writing about MIME for another 10 or 20 years and see what it looks like then. ■