A Personal view:
Impact of Email Work at The Rand Corporation in the mid-1970's

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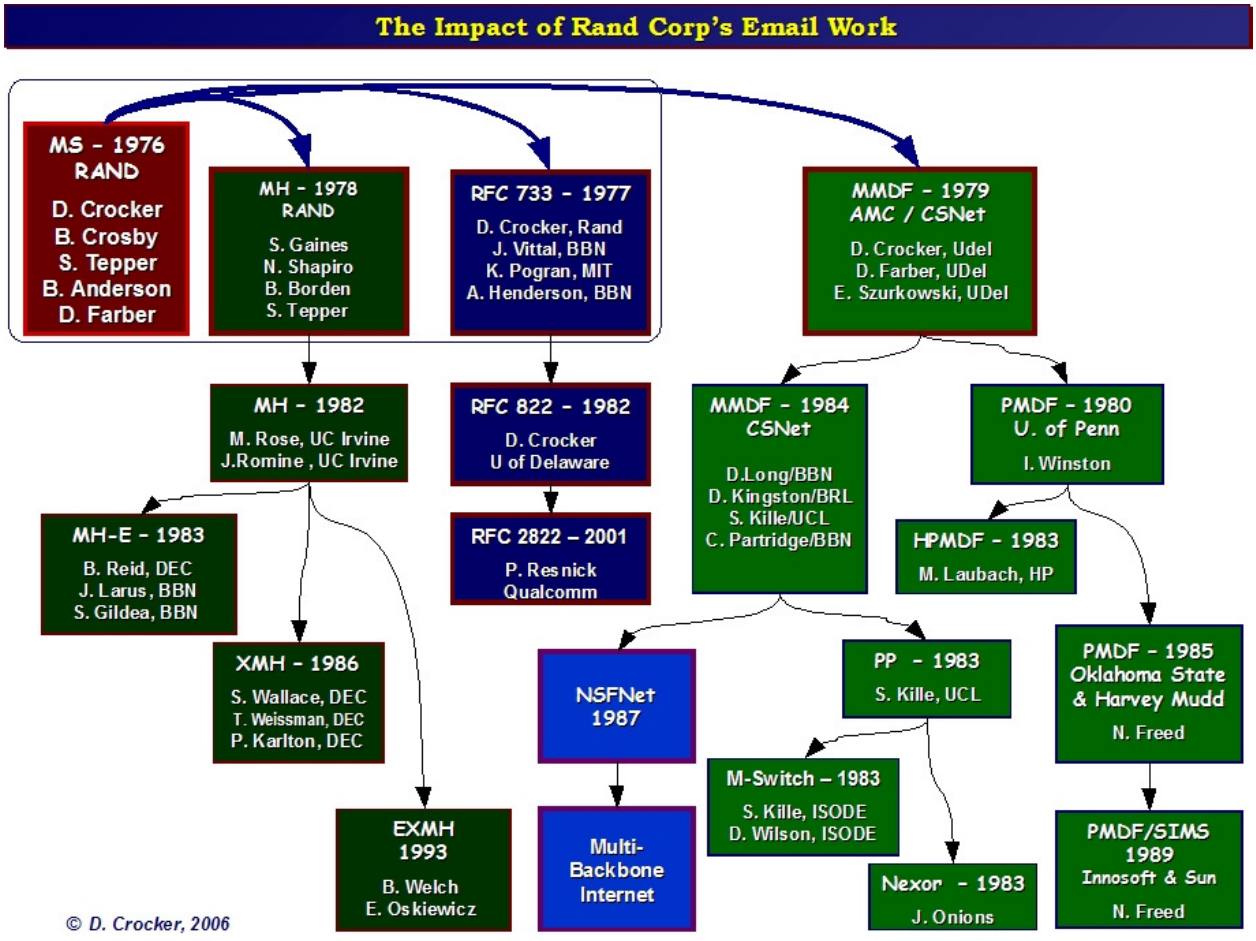
In the mid-1970's the dominant platform, used by U.S.-based computers science research groups, was BBN's Tenex time-sharing system, running on a Digital Equipment's PDP-10.[TENEX] Network-based email was created in 1971 at BBN, with Ray Tomlinson's modification to the existing Tenex SNDMSG sending program.[SNDMSG] Mail was initially viewed by using a simple program that displayed the text of all new mail, all at once. By 1975 Tenex email users had moved to MSG, written by USC-ISI's John Vittal.[MSG] It provided integrated, incremental mailbox management and contained the unique contribution of the first Reply command. This made iterative, extended email-based conversations markedly easy. Students of communication theory will note that the command completed the classic Shannon-Weaver model enhancement by permitting easy "feedback".[SHAN]

By the mid 1970's Unix was starting to propagate widely, outside of Bell Labs, running on the less expensive DEC PDP-11. Unix was an open platform, with operating system source code provided to organizations licensing it from AT&T. However, its email capabilities were quite primitive. So, Tenex had good email. Unix needed it, and DARPA noted the confluence of folk with email interest who were around Rand Corp. in the summer of 1976. DARPA tasked Rand with producing a fully-capable email system for Unix. The resulting project produced 30 years of effects. Perhaps more…



MS:

The DARPA project at Rand produced the MS message system.[MS] Its purpose was to give Unix users email capabilities that would be on a par with what the Tenex community already enjoyed. MS was developed from the ground up, as an integrated, generalized email creation, processing, sending and receiving engine. It aggregated messages into folders comprising a clear-text file, with a parallel index file.

MS implemented a functional module that supported multiple user interfaces, including emulation of Tenex's MSG, as well as the email command that came with Unix. MS supported a reasonably powerful set of functions, although it is striking that it had no searching mechanism. Unfortunately, MS' folder index file's implementation was far too general and the system was painfully slow. This prompted the follow-on work to develop MH. MS, itself, quickly expired.

MH:

MH took MS user functionality and implemented it in a style better suited to the Unix operating and file system, as well as the Unix quick-commands user model.[MH1] That is, each function was a separate Unix command, with inter-command context being stored externally. Follow-on efforts with MH produced unifying user interfaces, returning to the model of a persistent context.[MHHIST]

MH affected an entire generation of network R&D engineers. It was the email client of choice around the Arpanet and Internet for at least 15 years.

Standards:

The project on email encouraged participation in an effort to produce the first Arpanet standard for email format, which was later revised for the operational Internet.[RFC733, RFC822, RFC2822] RFC 733 was produced after a brief period of community discussion and it sought to codify and enhance existing practice.

What is astonishing is that a message from the early 1970's looks quite similar to a basic message of today. The only major difference worthy of note is that addresses now use hierarchical, dotted domain names, rather than the original, "flat" host names. (The later addition of a standardized mechanism to support multi-media attachments was, of course, a major improvement.[MIME] However non-standard mechanisms for this had been present from the earliest days of email.)

Mail Transport:

The Multi-channel Memo Distribution (MMDF) facility was developed to extend email service out to sites that did not have a permanent connection to the Arpanet.[MMDF] Hence it did relaying between a primary, networked email service gateway and sites accessible through telephone dial-up. Funding was initially from the Army Materièl Command and later from the US National Science Foundation. The first version of MMDF derived from the email transport portion of MS, which had been written by Steve Tepper.

MMDF's software design provided an extensible framework for supporting multiple email transport mechanisms. It isolated transport-related dependencies into discrete "channels". Queuing and management of messages in transit was rigorous and the security model of MMDF isolated special privileges, thereby limiting the ability of code to cause collateral damage.

Although on a far smaller scale than MH, MMDF provided an experiential base to a core of the email transport development community for quite a few years. On the downside, the system was large and

complex. Although it was relatively easy to add features that fit into the existing MMDF model, making other changes was quite challenging.

Multi-Backbone Internet:

One impact of the MMDF project is rather indirect, but arguably substantial: MMDF provided the original functionality for CSNet. The utility of that service motivated the NSFNet project, which led to the modern, multi-backbone, hierarchical Internet.[CSNET, NSFNET] CSNet was an NSF project to provide cost-reduced access to the Arpanet, and then Internet, for computer science research facilities. This was initially for email, through telephone dial-up. Although highly useful in its own right, CSNet also served as a kind of "market research" project for NSF, with NSF's creation of the more ambitious NSFNet being the result.

Although the Internet is will-known in terms of TCP, IP, and a basic set of applications, a key enabling mechanism is the Internet's ability to route IP packets among independent networks. Until the NSFNet, the Internet was able to achieve this only by having a single, centrally managed backbone.[EGP] The NSFNet created a second, independent, backbone, with others quickly following. This broke the Internet's backbone routing model, requiring the research community to develop a new mechanism that supported multiple backbones.[BGP] In addition, NSF created a number of regional, IP transit networks and these later provided seed capabilities as competitive, commercial Internet service providers. Hence, without NSFNet, we likely would have had an Internet with a centralized telecommunication backbone, similar to that of the international telephone service of the past.

References

[SNDMSG] <http://openmap.bbn.com/%7Etomlinso/ray/firstemailframe.html>

[MSG] <http://www.cbi.umn.edu/iterations/kilker.html>

[MS] D. Crocker, “Framework and Functions of the MS Personal Message System”, Rand Report R-2134, 1977

[MH1] Bruce S. Borden, R. Stockton Gaines, Norman Shapiro , “The MH message handling system : user's manual”, R-2367-AF / ISBN: 0-8330-0168-X, 1979

[MHHIST] <http://www.ics.uci.edu/~mh/book/>

[RFC733] <http://www.ietf.org/rfc/rfc0733.txt?number=733>

[RFC822] <http://www.ietf.org/rfc/rfc0822.txt?number=822>

[RFC2822] <http://www.ietf.org/rfc/rfc2822.txt?number=2822>

[MIME] <ftp://ftp.rfc-editor.org/in-notes/rfc2045.txt>

[MMDF1] Crocker, D. H., Szurkowski, E. S., and Farber, D. J., An Internetwork Memo Distribution Facility -- MMDF. 6th Data Communication Symposium, Asilomar. November 1979.

[MMDF2] <http://www.faqs.org/faqs/mail/mmdf-faq/part1/>

[CSNET] <http://www.isoc.org/internet/history/documents/Comm83.pdf>

[NSFNET] <http://www.nsf.gov/about/history/nsf0050/internet/launch.htm>

[BGP] <ftp://ftp.rfc-editor.org/in-notes/rfc4271.txt>

[EGP] <ftp://ftp.rfc-editor.org/in-notes/rfc904.txt>

[TENEX] <http://en.wikipedia.org/wiki/TENEX>

[SHAN] <http://www.cultsock.ndirect.co.uk/MUHome/cshtml/introductory/sw.html>