The impact from email work done at The Rand Corporation in the mid-1970's

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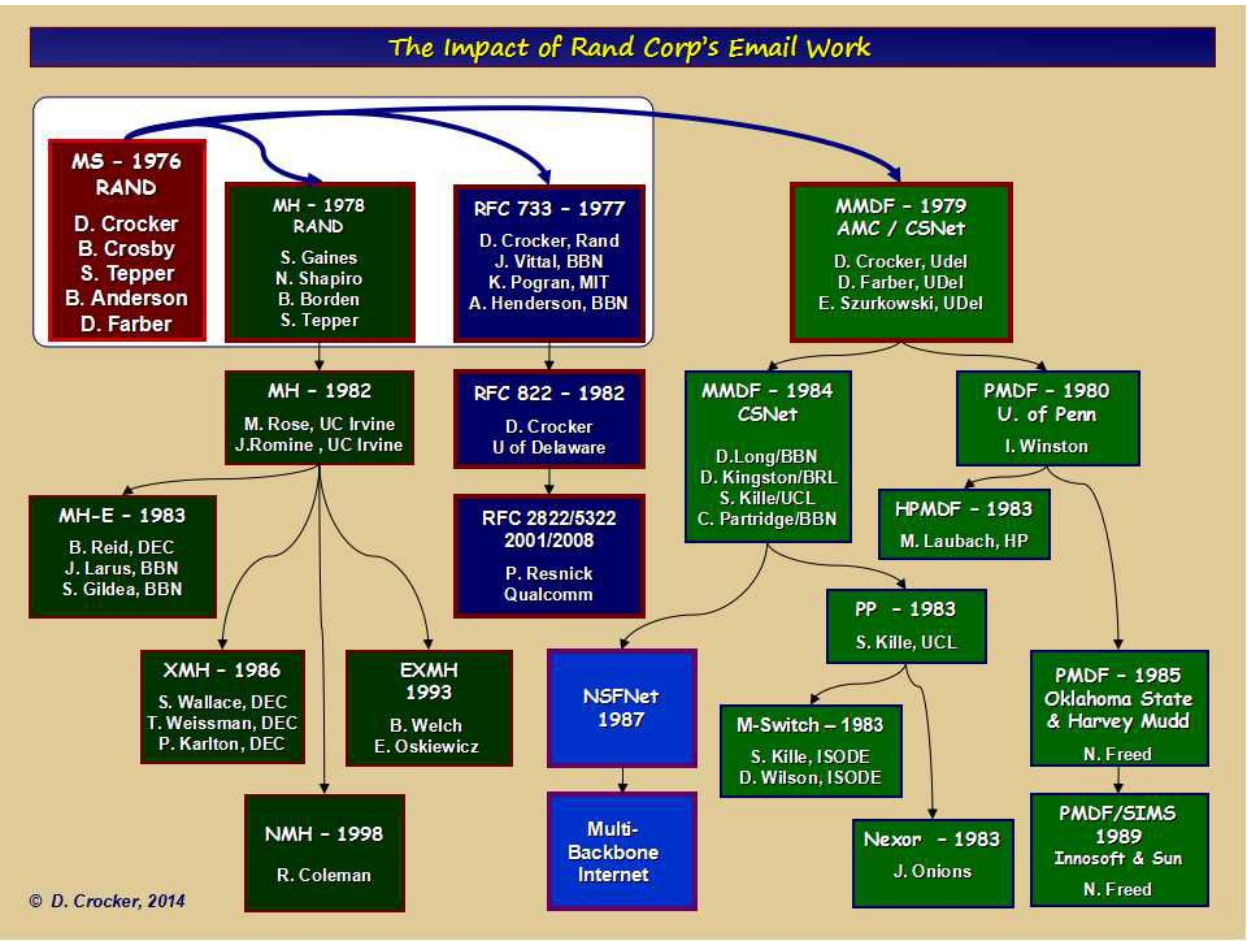
August 18, 2008
Revised March 9, 2014

In the mid-1970's the dominant computer system that was 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, by Ray Tomlinson's modification to the existing Tenex SNDMSG sending program.[SNDMSG] Mail was initial read by using a simple program that displayed 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 it much easier to conduct iterative, extended email-based conversations. Students of communication theory will note that the command completed the classic Shannon-Weaver model 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 that licensed 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 an 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 produce, for Unix, 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 and sending and receiving engine. It aggregated messages into folders, comprising a clear-text file and a parallel index file.

MS implemented a functional engine that supported multiple user interfaces, including emulation of 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, with separate transport work spinning off to create MMDF. MS, itself, quickly expired.

MH:

MH adapted the specification for MS user functionality and implemented it in a style tailored to the Unix operating and file system, as well as the Unix quick-commands user model.[MH] That is, each function was a 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 user-visible context.[MHHIST]. Its continuing use includes nmh's targeting POSIX conformance, with enhancement for MIME.

MH affected an entire generation of network R&D engineers, since it was the email client of choice around the Arpanet and Internet for perhaps 15 years.

Standards:

Rand's project facilitated participation in the effort to produce the first Arpanet standard for email, which was later revised for the operational Internet.[RFC733, RFC822, RFC2822] RFC 733 was produced after a few years 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 additional of a standardized mechanism to support multi-media attachments was, of course, nearly revolutionary in its impact on email's utility.[MIME] However non-standard mechanisms for this were present from the earliest days of email.)

Mail Transport:

The Multi-channel Memo Distribution (MMDF) facility was developed to extend email to sites that did not have a permanent connection to the Arpanet.[MMDF] It provided message relaying, between the primary networked email service and sites accessible through the dial-up telephone system. Funding was initially from the Army Materièl Command and later from NSF. The first version of MMDF derived from the the email transport portion of MS, which was written by Steve Tepper at Rand.

As software development, MMDF provided a highly extensible framework for email transport, and especially the then-needed capability of gatewaying among heterogeneous mail services. It isolated transport-related dependencies into discrete "channels". Queuing and management of messages in transit was fairly rigorous and the security model of MMDF tended to isolate special privileges, thereby limiting the ability of code to do collateral damage.

Although on a far smaller scale than MH, MMDF provided an experiential base to a core of the email transport and gatewaying technical 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 MMDF's existing architecture, other changes were quite challenging to make.

Multi-Backbone Internet:

One impact of the MMDF project is rather indirect, but arguably was substantial: MMDF provided the original functionality for – and therefore the operational benefit that justified funding – CSNet, which led to the NSFNet, 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 NSF's later creation of the more ambitious NSFNet.

Although the Internet is will-known in terms of TCP and IP, as well as various application, a key enabling mechanism is its 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, and therefore required development of a new mechanism that could support multiple backbones.[BGP] In addition, NSF created a number of "regional" intermediary IP transport networks and these later provided seed capabilities as a number of 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

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

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