

Internet Meeting Notes - 4, 5, & 6 February 1980

I. INTRODUCTION - Kunzelman, Shoch

This meeting was held at SRI on Monday and Wednesday and at XEROX PARC on Tuesday. Ron Kunzelman was the coordinator at SRI, and John Shoch was the coordinator at XEROX.

II. OVERVIEW AND OBJECTIVES - Cerf

Vint briefly restated the current issues of concern in the internet program. The principal issue is now performance. The Fort Bragg users and the european users depend on the internet for access to their host computers.

III. STATUS REPORTS

A. DARPA - Cerf

Vint reported that ARPA as a whole had been reorganized to better balance the various offices. IPTO itself had not been affected. Vint noted that in the last few years IPTO had put more emphasis on test beds and demonstration projects to promote technology transfer, and that this had hurt basic research. Vint thinks that there will be an increase in support for research.

Vint reported that the protocol standardization effort in DOD is moving forward, and that IP and TCP as documented in IENs 128 and 129 form the basis for the standards.

Vint repeated his desire for each contractor to identify milestones and to make monthly progress reports. Jon Postel will coordinate these reports.

B. BBN - Plummer, Strazisar, Haverty, Wingfield, McNeill, Brescia, Flood Page, Nelson

Bill reported that TCP and IP on TOPS 20 are working and that he is beginning work on the Tenex versions. For this he is using a new host at BBNG. The XNET program has been converted. FTP on TCP is in the queue but not top priority.

Ginny reported that all gateways but one have been converted to MOS based systems, and that conversion of the bootstraps and loaders to use IP is in progress. The gateways do participate with the CMCC by sending the monitoring reports. A port expander has arrived at BBN.

Jack reported on the development of XNET programs in the UNIX environment. The Unix debugger has been extended to allow debugging of processes on another machine via XNET. Two XNET servers have been created, one for debugging at the system level, and another for debugging at the process level.

Jack also discussed the problems with connecting things via 1822 style interfaces. The problems arise because the available specification is for a host side interface, and the host side is allowed to be sloppy about its signals while the IMP side is not. Plugging two host side interfaces together sometimes doesn't work due to differences in signal levels allowed by the host side specification. If these interfaces were built to the more stringent (and undocumented) IMP side specification these problems could be avoided. ACTION: Vint will investigate provision of 1822 interfaces that meet IMP side specification.

Jack noted that BBN is implementing IP and TCP for an HP3000 data management system for ARPA.

Mike Wingfield reported that the "C" version of the unix IP and TCP will be used for both the ARPA Internet and AUTODIN II environments, and the macro version will be phased out. MOS2 has been rewritten in "C." The TCP has been studied for performance bottlenecks, with the current suspicion falling on the interprocess communication facility. Fragmentation and reassembly are being added to TCP. The AUTODIN II FTP is being implemented.

Dale reported that SATNET is working well except for a 5 day period where there were hardware problems at Goonhilly. SATNET continues to support ARPANET traffic to/from Europe via "line 77." Performance between the channel protocol modules has been measured. A gateway between MATNET (a secure shipboard SATNET) and a secure subset of the ARPANET will come into existence.

Mike Brescia discussed gateway operation and monitoring operations. An NCC style gateway monitoring center is being setup. A gateway is being developed for connecting the ARPANET and an X.25 net. The X.25 side is still under development.

David briefly mentioned the status of the Catenet monitoring programs. These are discussed in another session of the meeting.

Ruth reported on the development of a local net for the ACCAT testbed at NOSC. There will be a gateway to the secure subset of the ARPANET. An MBB Unix will be used. This work is in the design stage. IP and TCP will be used in the local network, which uses an 8 megabit base band cable with collision detection. This is based on the MIT CHAOS net experience.

C. DCA - Cain

Ed reported that the local net which has operated for several years based on an old version of the ARPANET IMPs will now have to be brought up to date to use 96 bit leaders so this net can participate in experiments with BCRs.

D. COMSAT - Mills

Dave reported that work continues on the PSP and NET, however the main effort in recent months has been the demonstration for the NTC. The "demo" system has been configured to run on a variety of PDP-11 models. In the process of preparing for the demo some performance problems were detected, and since the demo some study has been done to isolate them (more on this in a later session). These performance issues also prompted some tuning of parameters and strategy in the MOS TCP. On another front Dave found a way to decode compressed FAX files. Dave has several written reports giving more detail on the work of COMSAT.

E. DOD - McFarland

Ray reported that Ken Shottling is attempting a formal specification of IP in SPECIAL, and may be ready to give a report at the next meeting.

F. ISI - Postel

Jon noted that ISI is working in three task areas: (1) Protocol Development, which includes the work on IP and TCP specifications; (2) Internet Mail, which includes development of mechanisms for delivery of mail in an internet and provision for multi-media data in the mail; and (3) protocol verification, which aims at the analysis of IP and TCP for correct operation.

G. Linkabit - Hoversten

Estil noted Linkabit's involvement in SATNET and the WBC experiment, and his participation in the development of the ST protocol. Estil claimed to be the advocate of wild ideas. [Danny

Cohen immediately claimed to be the advocate of tame ideas.] Linkabit is also considering a set of local networks.

H. LL - Forgie

Jim reported on efforts to make the SATNET voice conferencing more robust. Dale McNeill helped by fine tuning the SATNET but there were still problems in the overall path. It seems that the ELF based gateway introduces too much delay into the system. The idea of a film on SATNET conferencing has been canceled due to the poor performance of the system. There appears to be no further need for the ELF gateway in SATNET.

Jim also briefly mentioned the status of the ST protocol, which will be reviewed in a later session. Jim did discuss the WBC experiment and indicated the goals of having the LL, ISI, and SRI sites up for point-to-point packet voice by September 1980, and multiplexing of cells through a Voice Funnel by September 1981.

I. MIT - Clark

Dave noted that version 1 of the LCSNET is in operation with a PDP 11 Unix system and a VAX connected, and the MIT-XX TOPS 20 to be connected in April. Version 2 of the LCSNET is being debugged. Version 2 operates the cable at 8 megabits (version 1 operates at 1 megabit).

Dave described the development of a personal terminal to be built for LCS by Zenith. The prototype was built by Steve Ward at MIT. LCS expects to have 10 of these by the end of May, 40 by the end of 1980 and 150 by the end of 1981. These personal computers will interface directly to the LCSNET.

Dave also reported continuing problems with the port expander and ARPANET hosts. A testing session will be set up at BBN involving people from BBN and SRI. ACTION: Ron Kunzelman and Bill Plummer will test port expander with BBNF.

Dave also noted that MIT received a gift of 20 Altos and an ethernet from XEROX, and that some effort will be needed to integrate them into the environment. A common Trivial FTP is in progress, the plan is to develop IP, TCP, and Telnet for the Altos.

There will be an improved Telnet server on Multics soon, and a mail queuer for local net users. IP reassembly code will be added.

Dave did not prepare a memo for this meeting on congestion control, but expects to have a presentation on the topic for the next meeting.

J. NDRE - Lundh

Yngvar reported that the plans of NDRE are quite behind schedule due to lack of staff. The problems with the VDH connection have been solved and TCP is working. NDRE is developing a local net involving NORD-10 and NORD-100 computers.

K. RSRE - Davies

Brian reported on the development of the RSRE gateway and the experiences with the gateway-gateway protocol and CMCC monitoring protocol. Things seem to work well except for a few special cases. For example, when a "tail" gateway crashes it takes many gateway routing update steps to get the hop count up to "infinity." The temporary fix is to use a smaller value for "infinity" (today "infinity" = 5).

Another problem is that the host routing in TOPS 20s does not switch to the NDRE gateway when the BBN gateway is down. ACTION: Bill Plummer to change TOPS 20 host routing procedures, Vint Cerf to get the priority for this task.

RSRE has also experienced problems using TCP between RSRE and ISIE. There may be a data stream capture problem. Even when all is going well there are many duplicates, seemingly due to the round trip time being longer than the TOPS 20 TCP retransmission timeout. Brian estimates the delay at six (6) seconds.

RSRE will be working on a connection to PSS and a new X.25-TCP interconnection.

L. SRI - Kunzelman, Cone, Nelson, Frankel

Ron discussed the status of the TIU, and reported that it is now fully converted to IP and TCP. The PRNET at SRI has been converted to the CAP5 protocol. A PDP-11/44 will be installed as a PRNET measurement facility.

Don reported that six port expanders have been delivered and that five more are in the works.

Holly discussed the state of the port expander software.

Mike discussed the Ft. Bragg PRNET status. Six radio units are

installed. There are problems of response delays to the users from Ft. Bragg to ISIE. There may be a data stream capture problem. The gateway seems to be a thrupt bottleneck.

Raphi reported on a local network development at SRI. This will be based on XEROX Ethernet PDP-11 interface boards. These come from XEROX with a unibus interface, SRI will convert them to Qbus interface to be able to use LSI-11s to front end the host systems. The hosts will be the TOPS20, Unix, B6700 systems now at SRI. The first service will be computer mail based on the Delaware MMDF and the SRI Deafnet. Telex and TWX will also be connected into the online mail system.

M. UCL - Jones

Ron discussed the UCL involvement in the NTC demonstrations, and in the RSRE interconnection to the internet. Several tasks were delayed due to the development machine being out of service for 6 weeks. An ARPANET/PSS gateway is under development. This will be a protocol translation gateway converting between X.25 and TCP and eventually up to the Telnet protocol level. Experiments are beginning with a connection to IPSS. An NCP/TCP gateway was demonstrated on ISIE. The NIFTP now runs on both ISIE and UCL Unix. UCL has also been active with the development of a FAX protocol. The UCL local net (a cambridge ring) now has 5 stations. It is planned to use TCP as the protocol above the ring driver.

N. MITRE - Skelton

Anita reported that the local net (a cable bus) is up and running. There is work to upgrade the BIUs to allow larger packets and higher data rates on the net. A second net is to be installed at DCEC. There is also work to create an X.25 BIU interface.

O. UCLA - Braden

Bob reported that the machine at UCLA-CCN is now a 3033 running OS/MUT. IP and TCP are up, and a server telnet is in place.

IV. DOCUMENT STATUS - Postel

Jon reported that the following documents were issued since the last meeting:

IEN 120 by Radia Perlman on "Internet Routing and the Network Portion Problem."

This memo discusses ways in which gateway routing data could be used to overcome the problems of partitioned networks.

IEN 121 by Postel on "Internet Meeting Notes - 10, 11, 12, 13 September 1979."

This is simply the notes of the last meeting.

IEN 122 by Cohen on "Addressing and Related Issues (or Fuel for a Discussion)."

A suggestion that not all local networks need to be registered as full networks in the internet and some ways of addressing the hosts on such unregistered networks.

IEN 123 and 124 were the December versions of the IP and TCP specifications. These were the first try at the DOD Standard versions.

IEN 125 by Cerf on "Pre-emption."

This is a note detailing how pre-emption can be handled at the application level.

IEN 126 by Cohen on a "Summary of the ARPA/ETHERNET Community Meeting."

This describes a plan for the co-existence of the PUP internet and the ARPA internet protocols.

IEN 127 by Postel on "Assigned Numbers."

This is the latest edition of the list of network, protocols, ports socket, and links.

IEN 128 and 129 by Postel on IP and TCP.

These are the second try at the DOD Standard versions of the IP and TCP specifications. These are also the current specifications for our own (ARPA internet) use.

In addition to these, four more IENs were received since the Thursday before the meeting:

IEN 130 is a "Comparison of X.25 and TCP as Cable Bus Network Protocols" by International Computing.

IEN 131 and IEN 132 by David Flood Page on "Gateway Monitoring Protocol" and "The CMCC Terminal Process."

IEN 133 by Karen Sollins on "The TFTP Protocol."

Two IENs which were desired but not produced were:

"How to Build a Host IP" by Bill Plummer

and

"Congestion Control" by Dave Clark.

V. FAX STATUS - Cerf

Vint reported that Duane Adams of ARPA/IPTO is starting a program on graceful interaction and the test application will be multi-media computer mail. Since some of the internet project participants have FAX equipment there was a small meeting on how to cooperate to exchange FAX data. The internet program has interest in seeing that the exchange of multi-media data is possible in the internet and that the representation of such data is compatible between these programs.

VI. INTERNET MAIL - Postel

Jon presented the current status of the internet mail system. The system replaces the traditional "Mailer-FTPSRV" processes with new processes called MPM's. The MPM exchange messages which are list structured data of various types (not just text). The MPMs use TCP to transmit these messages. Some other programs have been modified or created to create test messages in this new format. No user interface to this new system exists yet.

VII. BBN - FAX - MAIL - Myer

Ted described BBN's work on a user interface program to manipulate messages composed of mixtures of text and FAX data. The focus is on the creation of such messages and on their presentation. The RAPICOM 450 will be used experimentally, and the files will be kept in a format very close to that used by Postel's MPMs.

VIII. GATEWAY MONITORING - Flood Page

David reviewed the operation of the Catenet monitoring center and the terminal process, indicating the types of information available. Please see IENs 131 and 132 for more details.

IX. DEMOS

- A. David Flood Page gave a demo of the CMCC by using a terminal process to examine the statistics sent in by various gateways.
- B. Greg Finn gave a demo of the Internet Mail system by running instrumented versions of the MPMs such that the progress of message processing could be followed.

X. PUP - Shoch, Tuft, Boggs, Stewart

John presented a review of the PARC developed ETHERNET and PUP protocol environment. This was a very thorough presentation. Rather than try to capture it here the reader is referred to "PUP - An Internetwork Architecture", a paper to appear in the IEEE Transactions on Communication in April, and available as a Xerox report from John.

John demonstrated some simple programs which use the PUP protocols and some monitoring programs. Ed demonstrated the Laural Mail Program, Dave demonstrated a cross network debugger, and Larry demonstrated the PRNET/ETHERNET interconnection and some digital audio transmission on the ETHERNET.

XI. PUP-IP COEXISTENCE - Cohen

Danny presented the scheme described in IEN 126 for the "mutual encapsulation" (credit Bob Metcalfe for the term) of PUP in IPs and IPs in PUPs.

XII. DELTA-T PROTOCOL - Watson

Dick made a presentation highlighting the critical assumptions about time in both the Delta-T protocol and TCP. The claim is that for either of these protocols to operate correctly these critical time factors must exceed specific minimum values based on the Maximum Packet Lifetime, the retransmission time, and the Ack holding time.

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XIII. LIMITING PACKET LIFETIMES - Sloan

Lansing presented a scheme for measuring the time a packet spends on a link. This would enable a network to age packets and if necessary kill them off if they get older than an established maximum packet lifetime. This method will be reported in a paper to appear in Computer Networks.

XIV. ST - Forgie

Jim reviewed the discussion and evolution of ST since last meeting. IEN 119 remains a reasonable reference to the intention and general mechanisms of ST, though some details may now differ. A revised version is to be issued soon. Plans are moving ahead for implementations of a host and a gateway ST at LL and a host ST at ISI.

XV. PORT EXPANDER - Lieb

Jim presented a very detailed explanation of the Port Expander. This simple concept of multiplexing the IMP port for a set of host becomes fairly tricky when all the IMP emulation tasks are identified.

XVI. SERVICES IN AN INTERNET ENVIRONMENT - Rom

Raphi proposed that some gateways may wish to offer services to higher level protocols by having application-dependent modules that could be invoked to process messages of that application. These modules could be called "functional agents."

XVII. NBS STANDARDIZATION - Wingfield

Mike reported that BBN is under contract to NBS to prepare a host-to-host protocol specification to be a Federal Information Processing Standard. This is part of a larger effort by NBS which includes the following contractors and protocols:

BBN - Host, FTP, IP, Interprocess.

SDC - Telnet, Remote Job Entry, Common Command Language.

SEI - Computer Mail.

NAC - Cost/Benefit of Standards.

XVIII. INTERNET PERFORMANCE - Davies

Brian discussed some measurements of TCP conducted by RSRE to various other places in the internet. The performance is regular for round trips from RSRE to various points at UCL, and is consistent with the physical facilities. Once the round trip path includes the SATNET, however, the performance becomes irregular, with a few messages subject to very high delay. Also some unnecessary retransmissions are detected in the tests from RSRE to ISIE and back, these may be due to a too low retransmission threshold.

This prompted some discussion of the source of the variability in the delay. Jim Forgie presented some data from the SATNET speech testing that seemed to confirm Brian's data. Dale McNeill showed some data on the SATNET channel delays which show performance at that level to be very regular. Suspicion seems to be cast on the SIMPs or the Gateways or their interface.

XIX. CONGESTION CONTROL - Mills

Dave described some measurements of TCP traffic between the COMSAT DEMO Terminal and ISIE. There is evidence of lost and delayed packets.

It seems clear from this and the preceding discussion that a definite effort is needed to isolate and correct these performance problems.

XX. MISCELLANEOUS - Cerf

Vint noted the following loose ends that need to be tied up:

1. 96 bit leader changes to all ARPANET hosts, and carried through system and application software.
2. TCP implementations brought up to the JAN 80 specifications.
3. IP implementations brought up to the JAN 80 specifications, and modified to including reassembly/fragmentation, gateway routing advice, alternate gateway selection, and source quenching.
4. Gateway addresses needed in all host IP tables.

Vint also noted that work on a TCP TIP has been started. That an ARPANET/TELENET gateway is in progress, and that an ARPANET AUTODIN II gateway is expected in first quarter of 1981.

XXI. NEXT MEETING - Cerf

The next meeting is scheduled for 14 & 15 May at MIT. The contact is Dave Clart (DClark@MIT-Multics).

XXII. DOCUMENTS DISTRIBUTED

IEN	Author	Title
127	Postel	Assigned Numbers
128	Postel	IP Spec
129	Postel	TCP Spec
130	Watson	Comparison of TCP & X.25
	Lieb	Comparison of TCP & Delta-T
	Mills	Port Expander
	Postel	COMSAT Reports
	Postel	Internet Host and Gateways
	Postel	IEN Index

XXIII. ATTENDEES

Vint Cerf	ARPA	Cerf@ISIA
Mike Brescia	BBN	Brescia@BBNE
Jack Haverty	BBN	JHAVERTY@BBND
Dale McNeill	BBN	DMCNEILL@BBNE
David Flood Page	BBN	DFLOODPAGE@BBNE
Ted Myer	BBN	Myer@BBNA
Ruth Nelson	BBN	RNelson@BBND
William Plummer	BBN	Plummer@BBNA
Bob Resnick	BBN	Resnick@BBNA
Virginia Strazisar	BBN	STRAZISAR@BBNA
Mike Wingfield	BBN	Wingfield@BBND
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David Mills	COMSAT	Mills@ISIE
Chris Elliott	CTEC	c/o Chips@BBNC
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