

IEN # 3
Supercedes: None
Replaces: None

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ISI
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1.4.1 INTERNET Meeting Notes 15 August 1977

Editors Remarks

Here are some notes from the Internet meeting held at ISI on 15 August 1977. The notes are incomplete, and remarks attributed to individuals may be in error.

Agenda

- Opening Remarks - Danny Cohen
- Meeting Objectives - Vint Cerf
- Current Internet Plans - Vint Cerf
- Issues in Interneting - Andrew Hinchley & Chris Bennett
- Gateway Monitoring - Bob Bressler
- International Standards - Vint Cerf
- X.25 Gateway Interface Experiment - Peter Kirstein
- Type of Service Issues - Danny Cohen
- Internet Mail Service - Steve Crocker
- Wrap Up - Vint Cerf
- Future Meetings - Vint Cerf

Opening Remarks - Danny Cohen

Cohen discussed the agenda and the rules of the meeting, Danny is moderator and can recognize people to speak or cut people off if necessary.

Meeting Objectives - Vint Cerf

Cerf presented the following meeting objectives:

- Review the current internet plans
- Raise and discuss internet research issues
- Compose a list of objectives of internet research
- Prepare a prioritized list of internet tasks
- Prepare a prioritized list of internet experiments

Current Internet Plans - Vint Cerf

Cerf reviewed the current (FY 78) Internet Plan:

TCP Development

- UCLA - 360/91
- MIT - Multics
- BBN - Tenex, Tops 20, Unix
- SRI - LSI-11
- NDRE - NORD-10
- UCL - PDP-9 (?)

Network Development

- BBN - ARPANET (gateway routing, flow control, broadcasting)
- MIT/LCS - LCSNET, CHAOSNET
- Collins & BBN - Packet Radio Network Broadcasting
- MIT/EE - Theory (spanning trees...)

Gateways

- BBN - Packet Radio / ARPANET
- BBN - Packet Satellite / ARPANET
- BBN - ARPANET / RCCNET
- BBN - Gateway Control Center
- XEROX - Packet Radio / Ethernet
- MIT - ARPANET / LCSNET(s)
- UCL - EPSS / ARPANET
- UCL - EPSS / Packet Satellite
- UCL - X.25 Net Issues
- BBN - Gateway flow control, routing, reporting, checks and balances, etc.
- UCLA - Internet performance modelling and analysis, gateway flow and congestion control
- MIT/EE - Reliability of internetworking, alternate routing
- ISI - Fast network deployment, addressing, authentication

Internet Performance Measurement

- UCLA - Internet Measurement Center
- UCL - Internet Gateway traffic generation and performance measurement

Internet Services

- ISI - Internet Mail

Protocol Development

- ISI - Internet Types of Service (TOS)
- ISI - Conferencing, multi-connection synchronization
- LL - Packet Satellite / internet speech (NDRE, UCL, LL, BBN, LPCMs)
- SRI - Impact of TOS on Packet Radio
- ISI - Protocol Modelling and Testing/Evaluation System

Cerf: We need a specification for a gateway so that other implementations will come out the same.

Cerf reviews related working groups:

TCP working group (V. Cerf - ARPA) focuses on TCP as an end to end protocol in an internet environment, technical orientation.

Packet Radio working group (D. Neilson - SRI)

Packet Satellite working group (I. Jacobs - Linkabit)

Internet working group (D. Cohen - ISI) focuses on network interconnection problems and plans internetwork experiments.

Cerf reviews the "number czars" for various note series etc:

PSPWNs - Lin-Nan Lee (Linkabit) [JACOBS@ISI]
PRTNs - Ron Kunzelman (SRI) [PRSETD@ISIC]
IENs - Jon Postel (ISI) [POSTEL@ISIB]
Network Identifiers - Jon Postel (ISI) [POSTEL@ISIB]
Internet Messages Types - Jon Postel (ISI) [POSTEL@ISIB]

Cerf reviews the forecast of events in interneting:

TCP Development

Sep 77 - Experimental small-machine Top20 TCP
Oct 77 - Unix TCP
Nov 77 - Operational small-machine Tops20 TCP
Dec 77 - Nord 10 TCP
Jan 78 - Tenex TCP
May 78 - large-machine Tops20 TCP
Jul 78 - 360/91 TCP

Network Development

Sep 77 - 2 node PR test cell in Boston
Jan 78 - LCS Net
Jun 78 - PR Net Broadcast
Dec 78 - ARPANET Broadcast

Gateways

Oct 77 - Ethernet/PR net
Dec 77 - Gateway monitoring center
Jan 78 - LCSNet/ARPANET
Jan 78 - X.25 Epps interface / SATNET
Apr 78 - Gateway flowcontrol, routing etc specification
Oct 78 - Gateway flow control, routing, etc. Pass 1 implemented
Jan 79 - PR Net in Army C2 test bed

Performance Measurements

- May 78 - SATNET/ARPANET/EPSS/PRNET performance tests (UCL)
- Oct 78 - Internet Measurement Center (UCLA)
- Jan 79 - Internet performance tests
- Mar 79 - Rapid deployment tests

Protocol Development

- Sep 77 - TCP 2.5 specification
- Jan 78 - Unix telnet
- Mar 78 - Tenex & Tops20 Telnet
- Apr 78 - Draft IOS Specification
- May 78 - Prototype FAX specification from UCL
- Jul 78 - Prototype internet mail service
- Aug 78 - Tenex & tops20 FTP
- Sep 78 - Internet speech conferencing specification
- Oct 78 - 360/91 telnet & ftp
- Mar 79 - Internet speech conferencing tests
- Jun 79 - Speech & Video conferencing specification

Demos

- Sep 77 - Point to point raw internet speech demo
- May 79 - Internet services demo

Cerf: We need a specification of how a gateway should behave to cooperate with a gateway control center.

Kirstein: EPSS and SATNET will have X.25 interfaces but there is no plan for an X.25 interface to the ARPANET.

Cerf: The issue of secure internetting is postponed.

Cerf: There is consideration of an effort to develop a new ftp, but there is no plan as yet.

Kirstein: FAX might be worked into the speech and video conferencing system.

Kirstein: Are LLL or Commercial nets to be involved in internet experiments?

Cerf: LLL is interested in TCP for the local to Livermore Octopus net not the CTR net.

Cerf: No current plans to get commercial nets involved.

Kirstein: What is happening about AUTODIN II and ARPANET as described at TCP Meeting?

Cerf: That plan is no longer active, and it is not expected that there will be any move to get people off the ARPANET until 1980, after that AUTODIN II service may be offered instead of ARPANET on a customer by customer basis.

Kirstein: It seems more likely that university type users will have to go to a commercial net than get on AUTODIN II, so shouldn't we be exploring internetting with commercial nets now?

Issues in Internetting - Andrew Hinchley & Chris Bennett

Hinchley & Bennett discussed the paper (PSPWN 76, INDRA 637) "Issues in the Interconnection of Datagram Networks" that was distributed prior to the meeting.

Hinchley: there are three categories of interconnections:

- 1) ARPA like datagram networks,
- 2) PTTs X.25 networks, note that the PTTs are moving very fast with a model of an internetwork system composed of a small number of very large national networks,
- 3) Interconnection of private networks via public X.25 networks.

The SATNET experience is the basis for these (PSPWN 76) comments.

Cerf: Is a gateway a piece of hardware physically connected to two or

more networks, or is it pair(s) of software modules connected by physically complicated networks ?

Kirstein: We should be more aware of what is going to be possible with PTT provided "virtual call networks".

Bennett: Addressing is a topic discussed in the memo.

Cerf: Up to now we have not had names for gateways, but now we may need names if gateway control centers are to communicate directly with gateways.

Cerf and Crocker discuss gateway models, one point was that one should try a model with a three or more connected gateways since sometimes a two connected model may make things seem simpler than they really are, another point is that a gateway is a kind of a forwarder, and Crocker argues that the forwarder is logically a network.

Postel: An address is just a string of bits, with each address parser consuming part of the string, to give a gateway an address reserve one value of the set of values representable in the bits the gateway parses, that reserved value means "here".

Kirstein expressed concern about the address space in the individual networks. Also concerned about translations necessary when going between datagram and virtual call networks.

Cerf: Does the way a thing is named specify the way one gets to it? Especially if a thing is multi-homed?

Shoch: One way is all gates are in the same net and have exactly one address. Another way is that a gateway has distinct host address on each net it is connected to.

Cerf: If the gateway control center has to talk to the gateway and the gateway has two names, which name does the control center use?

Shoch: Someone has to take responsibility for choosing.

Jacobs: Where do the global unique names come from?

Postel: They are external. We always have a unique description, usually by location, for objects. The gateway control center will have to have for each gateway a unique (external) name, and associated with that a list of internal addresses.

Cerf designates that there be a committee to study addressing and naming of gateways to (1) figure out what things there are, and (2) figure out how to address them. Crocker is chairman.

Bennett: Routing in the Internet is discussed in PSPWN 76. The main ideas are that adaptive routing in internet is not likely to be much good due to the larger delays in information propagation. Fixed routing with a number of alternatives (this is also called "Explicit Path Routing") might be useful. [Naylor says this is explored by IBM Zurich.] Could use alternate routing in a event driven form to recover from service outages. One issue is what to base the adaptation on.

Postel: Most of the things normally used could get washed out by local traffic.

Crocker: Perhaps there are some things...

Postel: for example queue lengths in the gateways.

Cerf: Adaptive routing is not a substitute for congestion control.

Jacobs: The information available to a gateway includes both facts about its directly attached networks and information received from other gateways.

Cerf: Gateways may have to exchange information about what paths are viable. If one packet from a gateway to a host in the ARPANET results in a "host dead" error what does the gateway do about other packets to the ARPANET? We should avoid having a lot of state information in the gateways.

Postel: What happens when the ARPANET says to a gateway "host dead"?

Jacobs: Nothing.

Cerf: Try to pass an error message back to source TCP. We have no conventions for this as yet.

Mathis: Out thinking has been: Gateways do routing; TCPs do not do routing.

Cohen: Routing algorithms need to be smarter.

Hinchley: Flow Control Possibilities

- 1) No control at gateway level (expect end-to-end control to take care of any problems)
- 2) Gateway to Gateway control
- 3) Terminating Gateway Control (source - destination gateways control flow)
- 4) X7X virtual circuit control

This is a range of possibilities.

Postel favors a hop by hop (that is gate by gate) flow control.

Cohen: Why should there be a single type of flow control? The type of service (drops, streams, floods) should get different kinds of flow control.

Jacobs: In SATNET there are a whole range of strategies from try once to try very hard to get a message through.

There occurred at this point a discussion of the cost of hop by hop acknowledgements.

Jacobs: This should all be in terms of bump to bump, that is a gateway consist of a bump for each connected network and a core, any network is between a pair of bumps, and the bumps should decide how much error control etc is needed across that network.

There was a discussion of status information, particularly error

reports. If a gateway has a problem then it is an internet error and "the internet" ought to tell the source about it. If a destination host has a problem then a service center could know the problem and a query to the services center could tell the source what is happening.

Hinchley: Gateway Control, Once gateways get above a certain level of complexity there needs to be a control function, that suggest that the reshould be a gateway control language which is standard throught the internet.

Gateway Monitoring - Bob Bressler

Bressler described the current gateway monitoring center as a fairly simple program that summarized reports from the SIIIP and some other gateway. The information reported was:

- number of messages sent and received on each port of each gateway
- and the number of messages dropped by the gateway

The gateways spontaneously generate the reports to the control center, the control center curenly sends no messages to the gateways. There are data generators and data sinks in the gateways now controlled by XNET a ddt like cross net debugger.

Kirstein: One of the simplest services one could provide is reliable delivery but allow duplicates to be delivered as well.

Hinchley: What common functions can be listed?

- restart
- reload
- run a diagnostic
- update routing information

Shoch: Gateways exchange routing tables perodically gratuitously. Many processes in a gateway for example time server, name lookup server, boot loaders, measurement process, echo server, source, sink, trace.

Shoch: There is a distinction between Routing, Addressing, and Naming.

Kirstein: There will need to be several monitoring centers. There may be a central control center that forwards suggestion for control to national control centers.

Burchfiel: No gateway in the ARPANET currently does fragmentation.

International Standards - Vint Cerf

Cerf reviews international standards organizations:

ITU - International Telecommunications Union (established by treaty)

CCIR - International Radio Consultative Committee (issues recommendations on the use of electromagnetic spectrum)

CCITT - International Telegraph and Telephone Consultative Committee (issues recommendations on telephone and telegraph communication)

PTTs - Government operated Post, Telephone & Telegraph Systems

ATT - American Telephone and Telegraph Corporation

IFIP - International Federation for Information Processing

ANSI - American National Standards Institute

cats & dogs

common carriers

manufacturers

EIA - Electronic Industry Association

government

NBS - National Bureau of Standards

DCA - Defense Communications Agency

ISO - International Standards Organization

ANSI

PTTs

manufacturers

IFIP

CEPT -

UK

France

DBP

ECMA - European Computer Manufacturers Association
CII
HB
Phillips
ICL

Cerf reviews relevant standards activity:

Analog

V.24 (CCITT recommendation) = RS232C (EIA)

Digital

X.21 <-> RS232C

HDLC (ISO) <-> [SDLC (IBM), UDLC (Univac), ADCCP (ANSI)]

X.25 packet network interface, virtual call, asymmetric

X.C PAD control

X.7X packet net / packet net interface (virtual circuit)

X.25 Gateway Interface Experiment - Peter Kirstein

Kirstein discussed the work UCL is going to be doing with EPSS and X.25 interfaces.

Type of Service Issues - Danny Cohen

Cohen discussed Type of Service issues. He suggests the following dimensions to service selection:

- priority
- reliability/cost
- delay/cost
- Floods / Streams / Drops
- Message/Wire
- Sort Messages
- Acknowledgement / Negative acknowledgement/ No acknowledgement
- Security
- Synchronization
- Multidestination addressing
- End of Letter
 - Buffer Runout
 - Receiver Wakeup

Cohen: Whether ACK or NACK or both or neither are used should depend on statistics.

Jacobs: The Host-SIMP protocol paper may be relevant.

Hoversten: Is the user helping the network by telling it what type of demands the user is going to make?

Internet Mail Service - Steve Crocker

Crocker discussed a model of how to make mail services available in the internet system in a straightforward way. Also of interest is possibility for authentication and privacy.

Wrap Up - Vint Cerf

Binders for an Internet Notebook were distributed, and Cerf explained the intention to use it to collect the current information for internet experiments. Jon Postel is the Notebook coordinator.

Cerf summarized as follows:

Addressing alternatives need to be written down - assigned Steve Crocker to coordinate. Please supply him with your thoughts. What objects exist and what names should they have. John Shoch will provide a one page note on nomenclature. A Gateway Specification is to be prepared by Bob Bressler. Cerf will distribute a current version of the X.25 specification. Kirstein will distribute a document on the UCL X.25 experiments.

Future Meetings - Vint Cerf

Cerf reviewed the plans for future meetings:

15 Aug 77 - Internet meeting at ISI
17-19 Aug 77 - PSPWG meeting at Linkabit
13-14 Oct 77 - TCP meeting at SRI
31 Oct-2 Nov 77 - PSPWG meeting at BBN
3 Nov 77 - Internet meeting at BBN
30-31 Jan 78 - TCP meeting at ISI
1-2 Feb 78 - PSPWG meeting at UCLA
3 Feb 78 - Internet meeting at UCLA
20-21 Apr 78 - TCP meeting at BBN
1-2 May 78 - Internet meeting at UCL
3-5 May 78 - PSPWG meeting at UCL
13-14 Jul 78 - TCP meeting at PARC
2-3 Aug 78 - Internet meeting at LL
4 Aug 78 - PSPWG meeting at LL
12-13 Oct 78 - TCP meeting at LCS
2-3 Nov 78 - Internet meeting at SRI

Attendees:

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