

History of Unix and the Internet

The father and mother of Open Technology

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Question for the audience

- ▶ Why did Internet start?
- ▶ When did Internet start?
- ▶ And when did Unix originate?

Why did Internet start

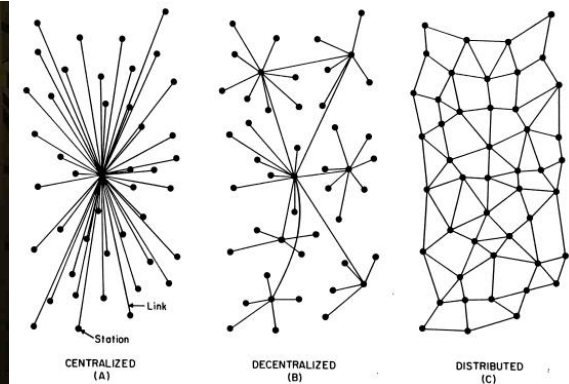


FIG. 1 - Centralized, Decentralized and Distributed Networks

Source: <http://www.nationalmuseum.af.mil/>

1963-1966 Internet

- ▶ Leonard Kleinrock studies message switching in his PhD thesis in 1963
- ▶ Packet Switching
 - ▶ Paul Baran (UCLA/RAND)
 - ▶ RAND Corporation
 - ▶ On Distributed Communications (1964)
 - ▶ Message blocks
 - ▶ Donald Davies
 - ▶ National Physics Laboratory, England
 - ▶ Introduced the term "packet" (1965-1966)

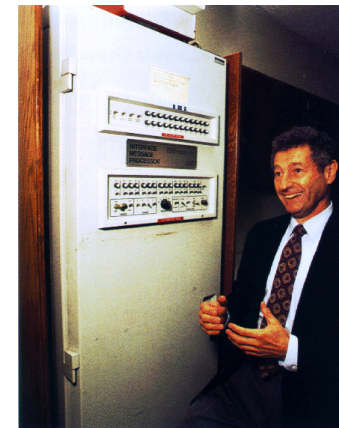
1967 Internet (1)

- ▶ IPTO
 - ▶ Information Processing Techniques Office
 - ▶ Agency of (D)ARPA
- ▶ Larry Roberts (MIT/ARPA)
 - ▶ Father of the ARPANET
 - ▶ Fourth director of IPTO

1967 Internet (2)

- ▶ IMP
 - ▶ Interface Message Processor
 - ▶ Wesley Clark (MIT)
 - ▶ IPTO investigator who suggested the use of mini-computers for network packet switches
 - ▶ Leonard Kleinrock (UCLA)
 - ▶ Scientist who connected the first IMP or ARPANET node in 1969

1967 Internet (3)



Source:
http://www.lk.cs.ucla.edu/personal_history.html

1969 Internet (1)

- ▶ ARPANET
 - ▶ Based on IMP's and NCP (Network Control Program)
- ▶ BBN (Bolt, Beranek and Newman)
 - ▶ Company that got the development contract (January 1969)
- ▶ UCLA
 - ▶ Steve Crocker
 - ▶ Father of the RFC's
 - ▶ RFC #1 on "Host Software"

1969 Unix

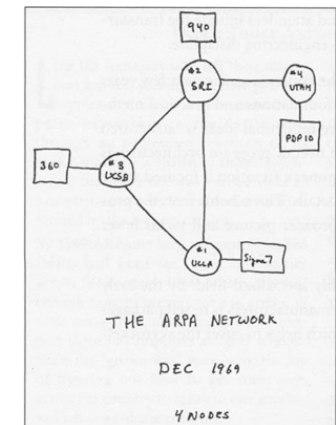
- ▶ Bell Laboratories
 - ▶ Ken Thompson (B) and Dennis Ritchie (C)
- ▶ Unics (PDP-7), influenced by
 - ▶ CTSS (Compatible Time-Sharing System)
 - ▶ Multics (Multiplexed Information and Computing Service)
 - ▶ Interactive Timesharing

1969 Internet (2)

- ▶ First TELNET connection
 - ▶ UCLA (Kleinrock) ↔ SRI (Engelbart)
 - ▶ University of California, Los Angeles
 - ▶ Stanford Research Institute, near San Francisco

1969 Internet (3)

- ▶ Four node ARPANET
 - ▶ UCLA (Sigma 7)
 - ▶ SRI (SDS 940)
 - ▶ UCSB (IBM 360/75)
 - ▶ University of Utah (PDP-10)



Source: "Casting the Net", Peter Salus

Question for the audience

- ▶ What were the first available protocols?
- ▶ What were the first applications?

1971 Internet

- ▶ Available protocols
 - ▶ FTP, TELNET
- ▶ First ARPANET email
 - ▶ Tomlinson (inventor of @)
 - ▶ FTP email subcommands
 - ▶ MAIL, MLFL (Mail File), ...

1971 Unix

- ▶ Unix V1 (version 1)
 - ▶ chmod, chown, chdir, cmp, date, cp, db, df, du
 - ▶ ld, ln, mail, mv, od, pr, roff, ...
 - ▶ No pipes
 - ▶ Runs on PDP-11

Ritchie and Thompson running Unix on a PDP-11



Source:

<http://www.bell-labs.com/history/unix/firstport.html>

1973 Unix

- ▶ Unix V4 (version 4)
 - ▶ Completely written in C
 - ▶ High level of portability
 - ▶ Pipes
 - ▶ Simple modular programming
 - ▶ Filters
 - ▶ Introduced in version 3

1974 Internet

- ▶ TCP/IP specified
 - ▶ Vinton Cerf (Stanford)
 - ▶ Bob Kahn (DARPA)
 - ▶ replaces NCP
- ▶ First use of term “Internet”
 - ▶ RFC #675
 - ▶ specification of Internet Transmission Control Program

Question for the audience

- ▶ What important fact happened in 1975?
 - ▶ Except from the prototype of the Apple I by Steve Wozniak :-?

1975 Internet

- ▶ Unix on The Net
 - ▶ Better than VMS (Bill Joy of UCB)
- ▶ The Net on Unix
 - ▶ Steve Holmgren (University of Illinois)
 - ▶ RFC #681 (Network UNIX)
- ▶ The Net == ARPANET

1976 Internet

- ▶ ARPANET mailing lists
 - ▶ list@hostname
 - ▶ SFL@SRI-CSL (SF-Lovers)
 - ▶ Uses SNDMSG as MTA
 - ▶ Uses READMAIL as MUA

1977 Internet

- ▶ The great controversy
 - ▶ TCP/IP versus ISO¹-OSI²
 - ▶ Theory versus Practice
 - ▶ Notice the chiasmus
- ▶ Seven layer network model (OSI model)
- ▶ Five layer network model (TCP/IP)

¹International Organization for Standardization

²Open Systems Interconnection

1979 Unix (1)

- ▶ Unix V7 (version 7)
 - ▶ UUCP
 - ▶ Mike Lesk (Bell Labs)
 - ▶ Message passing/switching system
 - ▶ Usenet/Netnews
 - ▶ Steven Bellovin (Columbia University)
 - ▶ "A" News (Duke University)
 - ▶ fa.* newsgroups ("From ARPANET")

1979 Unix (2)

- ▶ Unix ported to the VAX
 - ▶ Affordable computer from DEC
 - ▶ Available to many universities
- ▶ 3BSD
 - ▶ Berkeley Software Distribution 3.0
 - ▶ Based on UNIX/32V
 - ▶ Implements virtual memory³

³Still recognizable from the kernel name /vmunix

1981 Unix

- ▶ “A” News → “B” News
 - ▶ Mark Horton (University of California, Berkeley)
 - ▶ Rick Adams (maintainer, later founded UUNET)
 - ▶ Moderated newsgroups
 - ▶ Coping with volume and complexity
 - ▶ Fourth “killer app”

1982 Internet

- ▶ SMTP introduced
 - ▶ RFC 821
 - ▶ sendmail (Eric Allman)
 - ▶ complex e-mail routing
 - ▶ @ (ARPANET)
 - ▶ ! (UUCP)
 - ▶ : (Berknet)
 - ▶ based on rewrite sets

1983 Internet

- ▶ The Great Switch
 - ▶ NCP → TCP/IP
 - ▶ Almost ten years after the Cerf/Kahn paper
 - ▶ We will never do this again (Jon Postel/UCLA/IANA)
 - ▶ What about IPv4 → IPv6?

1983 Unix

- ▶ 4.2BSD
 - ▶ Includes TCP/IP
 - ▶ More hardware support
 - ▶ Portable
 - ▶ r-progs
- ▶ HoneyDanBer UUCP
 - ▶ Improved security and performance

Question for the audience

- ▶ What important thing happened in 1984?
 - ▶ Except from the introduction of the Apple Macintosh :-?

1984 Internet (1)

- ▶ DNS specified (RFC 882 is from November 1983)
 - ▶ Paul Mockapetris (ISI/USC)
 - ▶ Information Sciences Institute, University of Southern California
 - ▶ RFC 1034, 1035 (November 1987)
 - ▶ Replaces hosts.txt
 - ▶ cmu-cs-c → cmu-cs-c.arpa → c.cs.cmu.edu

1984 Internet (2)

First Soviet email

```
From: chernenko@kremvax.UUCP Sun Apr 1 15:02:52 1984
Relay-Version: version B 2.10.1 6/24/83 (MC840302); site mcvax.UUCP
Posting-Version: version B 2.10.1 4/1/84 (SU840401); site kremvax.UUCP
Path: mcvax!moskvax!kremvax!chernenko
From: chernenko@kremvax.UUCP
Newsgroups: net.general,eunet.general,net.politics,eunet.politics
Subject: USSR on Usenet
Message-ID: <0001@kremvax.UUCP>
Date: Sun, 1-Apr-84 15:02:52 GMT
Article-I.D.: kremvax.0001
Posted: Sun Apr 1 15:02:52 1984
Date-Received: Mon, 1-Apr-84 12:26:02 GMT
Organization: MIIA, Moscow
Lines: 41
```

1986 Internet

- ▶ NNTP specified
 - ▶ RFC 977
 - ▶ Brian Kantor (UC, San Diego)
 - ▶ Phil Lapsley (UC, Berkeley)
 - ▶ Uses port 119
 - ▶ Promoted Netnews to a real Internet application

1986 Unix

- ▶ 4.3BSD
 - ▶ Includes DNS implementation
 - ▶ Easily available
 - ▶ Widely deployed

1987 Unix

- ▶ “B” News → “C” News
 - ▶ Geoff Collyer (University of Toronto)
 - ▶ Henry Spencer (University of Toronto)
 - ▶ Better performance
 - ▶ Could use NNTP via nntpd
 - ▶ Superseded by INN (Rich Salz, 1991, Open Software Foundation)

1988 Internet

- ▶ NSFNET T1 (1.5 Mbps) in the United States
- ▶ Start of SURFnet in the Netherlands
- ▶ NREN-operated networks
- ▶ IRC invented
 - ▶ Jarkko Oikarinen
 - ▶ Inspired by Bitnet Relay
 - ▶ BITNET: Dialup, “store and forward” network
 - ▶ BITNET: Because It's Time/There Network

1988 Unix

- ▶ 4.3-Tahoe → NET/1
 - ▶ Open Source
 - ▶ BSD style license

1990 Internet and Unix

- ▶ NSFNET T3 (45 Mbps)
- ▶ 4.3-Reno
 - ▶ More hardware support

1990-1992 Internet and Unix

- ▶ 1991
 - ▶ Gopher
 - ▶ ISOC started
 - ▶ NET/2 released (Berkeley)
 - ▶ Still UUCP improvements (Taylor UUCP)
- ▶ 1990-1992
 - ▶ WWW invented and introduced

1993-1994 Internet and Unix

- ▶ 1993
 - ▶ 4.4BSD
 - ▶ Mosaic launched
- ▶ 1994
 - ▶ 4.4BSD Lite 1
 - ▶ 386BSD Release 1.0
 - ▶ Origin of FreeBSD, NetBSD and OpenBSD
 - ▶ Linux 1.0
 - ▶ Origin of Red Hat, (open)SUSE, Debian, Ubuntu, ...

1995 Internet

- ▶ (Graphical) Web browsing takes off
- ▶ “Death of the net”
 - ▶ Commercialization
 - ▶ Lack of security
 - ▶ Legacy obstructs innovation
 - ▶ IPv4 → IPv6?

1995-2012 Internet and Unix

- ▶ The “modern” era
 - ▶ Internet everywhere
 - ▶ Unix open source movement
 - ▶ Immense security problems

1999 Internet

- ▶ XMPP
 - ▶ Extensible Messaging and Presence Protocol
 - ▶ Jabber
 - ▶ Google Talk
 - ▶ Facebook IM
- ▶ Blogging
- ▶ Napster
 - ▶ File sharing
 - ▶ P2P technology

2003-2012 :-)

- ▶ SNE education started (2003)
 - ▶ First academic education on System and Network Engineering
- ▶ Tenth year starts (2012)
 - ▶ New bright students enroll that will change the world :-)
 - ▶ Largest SNE group ever
- ▶ Social Networking
- ▶ Facebook (2004)
- ▶ Twitter (2006)
- ▶ Virtualization
- ▶ Grid (2004) and Cloud (2007)