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How Did This Mess Arise?

A brief history of computers and the Internet

510 - Data Security and Privacy: Legal, Policy, and Enterprise Issues
University of Michigan School of Information
Week 11

Roots

- The abacus?
- The telegraph – 1840s
    - Electronic signal standard still used in network interface cards

More to the Point

- Hollerith machines – 1886
  - Punch cards
  - Used for census
  - Still best systems into 1930s and 1940s
- ENIAC – unveiled 1946
  - First digital computer
  - From military World War II research effort
- IBM 360 – 1964
  - Mainframes took hold
- PCs – 1970
  - Datapoint 2200
  - 1977 – Apple II, Commodore PET, TRS-80

Roots II

- Sputnik – 1957
- Advanced Research Projects Agency (ARPA) created within DoD – 1958
  - Computer system development, strong communications and command/control were among mandates
  - Later became Defense ARPA (DARPA)
- Packet-switched network concept formalized – 1962-1964

Internet System Evolution

- A global network of networks
  - to share information and see how communications might be continued in the event of nuclear war
- Begins as DoD network in 1969
  - First packet switched network
- Splits into two networks (civilian and military) in 1975
- National Science Foundation takes over in 1986 - NSFNet

ARPAnet

- First packet-switched *network*
  - DARPA (Defense Advanced Research Projects Agency) contracted with BBN (Bolt, Beranek & Newman) to create ARPAnet – 1968

- Online - 1969
- All of first five nodes up - 1970
  - UCLA
  - Stanford
  - UC Santa Barbara
  - U of Utah, and
  - BBN (later BBN Planet, an early ISP)
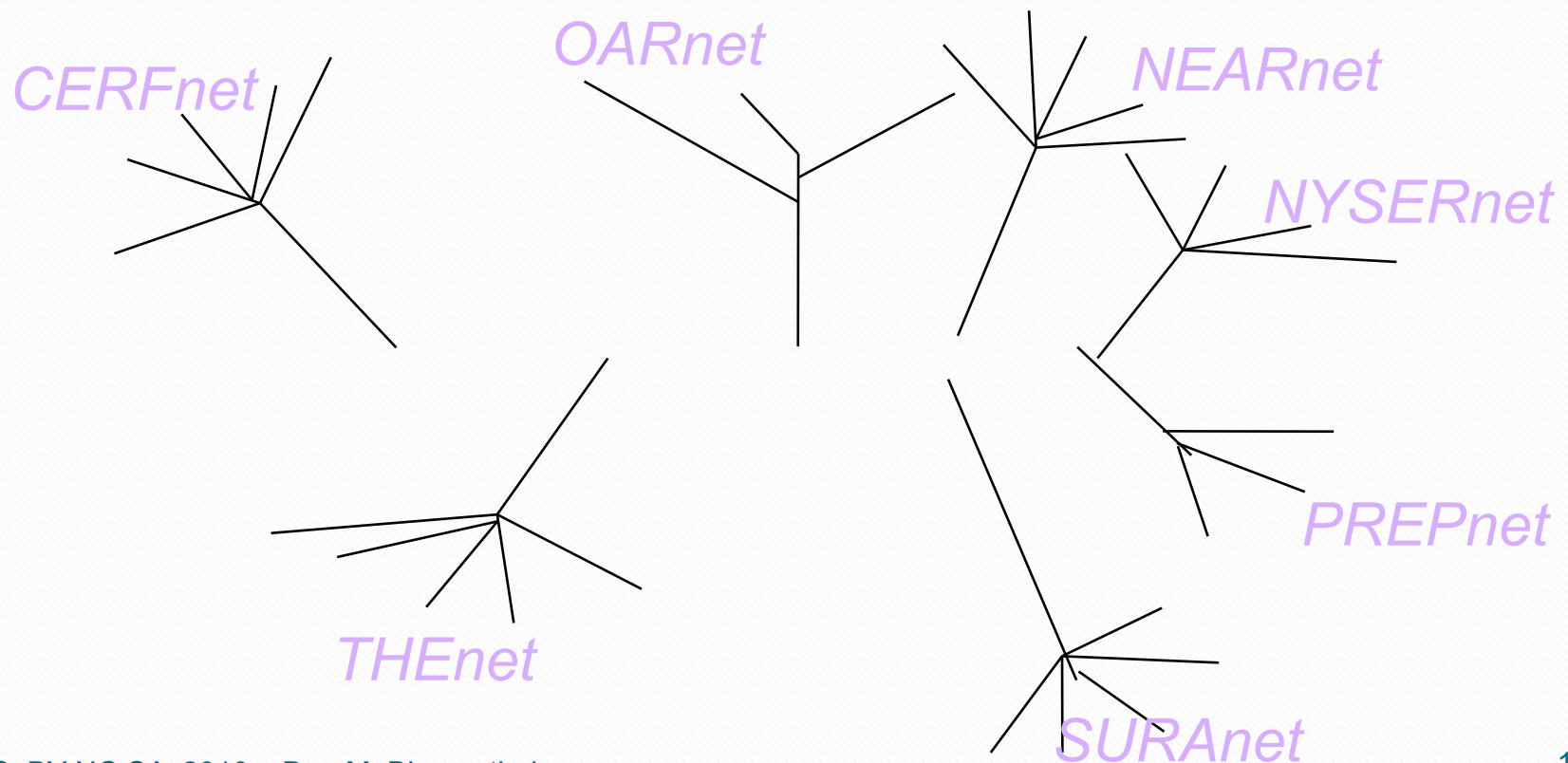
- First public demonstration - 1972

Backbone

➢ Series of high capacity links that carry large volumes of network traffic
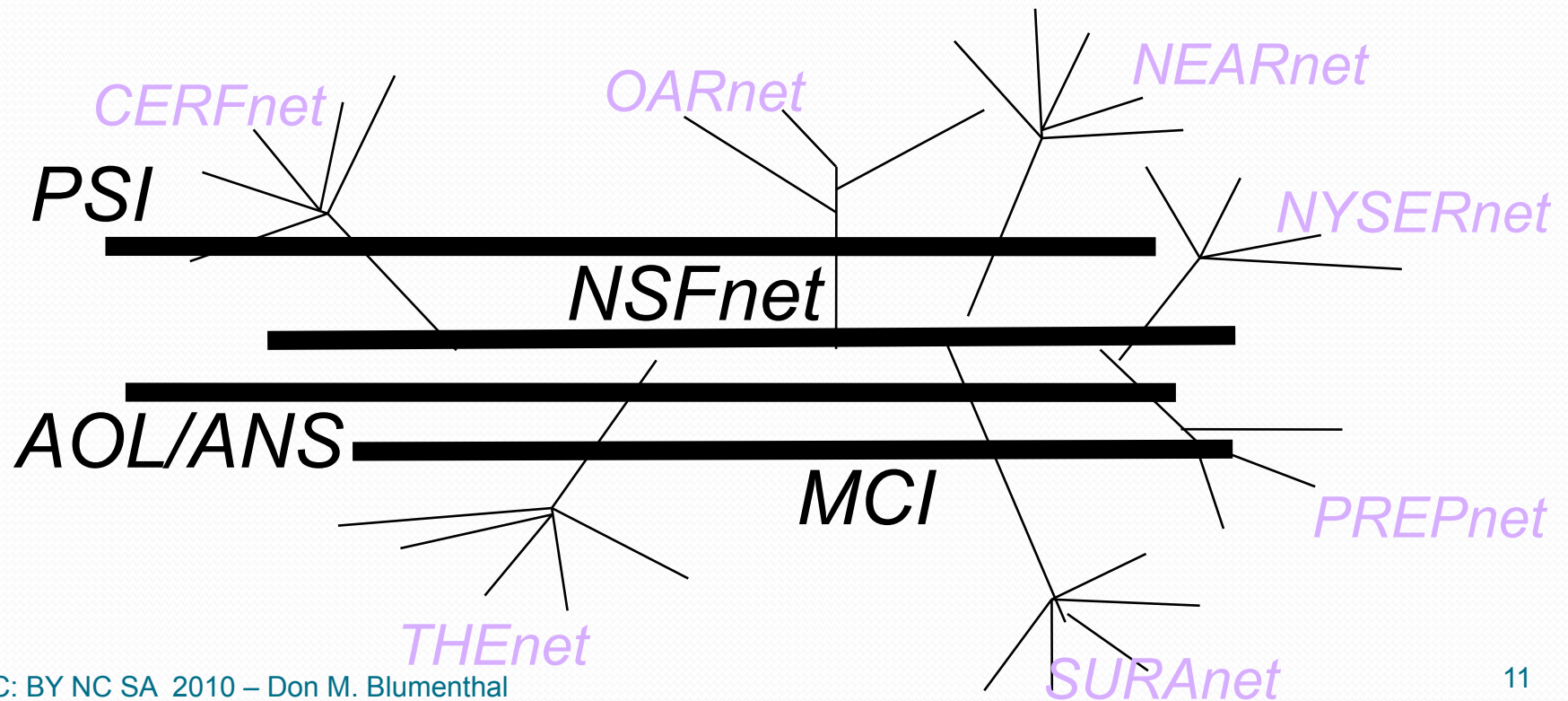
BACKBONE

➢ Mid 1980's- U.S. National Science Foundation (NSF) provided funding for individual and regional networks throughout the US (for research and academic use)

OARnet

CERFnet

NEARnet

NYSERnet

PREPnet

THEnet

SURAnet

BACKBONE

➢1986- NSF began linking networks using TCP/IP- protocol developed for ARPANET = NSFNET

CERFnet

OARnet

NEARnet

PSI

NYSERnet

NSFnet

AOL/ANS

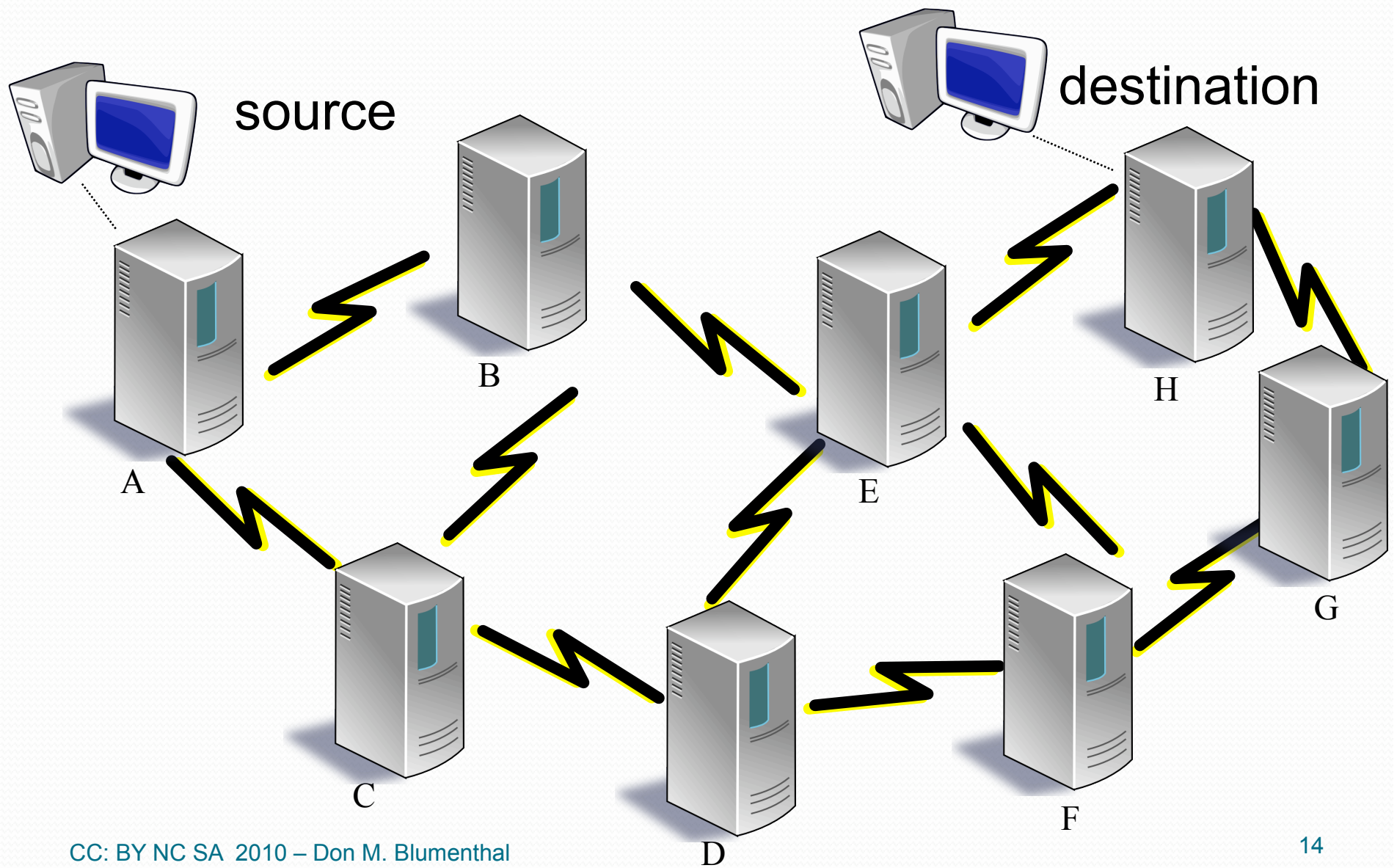*MCI*

PREPnet

THEnet

SURAnet

BACKBONE TODAY

➢Late 1980's/early 1990's – privatization of the backbone led to end of NSFNET (April 30, 1995)

➢ AOL, MCI and others have since taken over the backbone
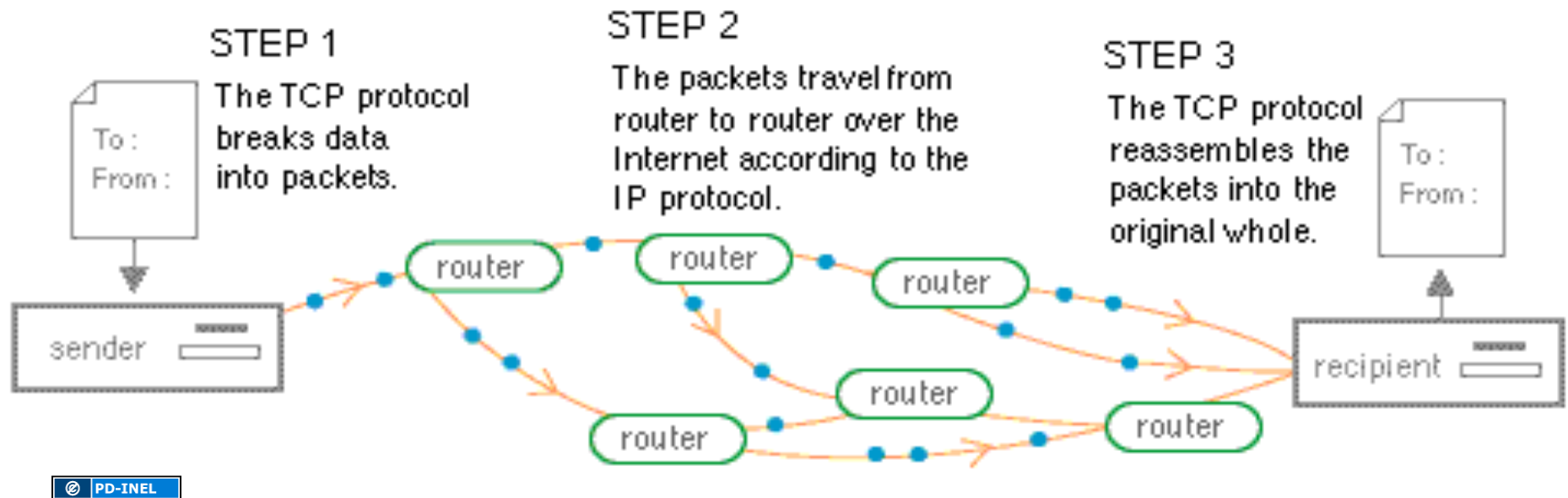
➢ Now there are multiple backbones

Source: http://www.caida.org/tools/visualization/mapnet/Backbones/
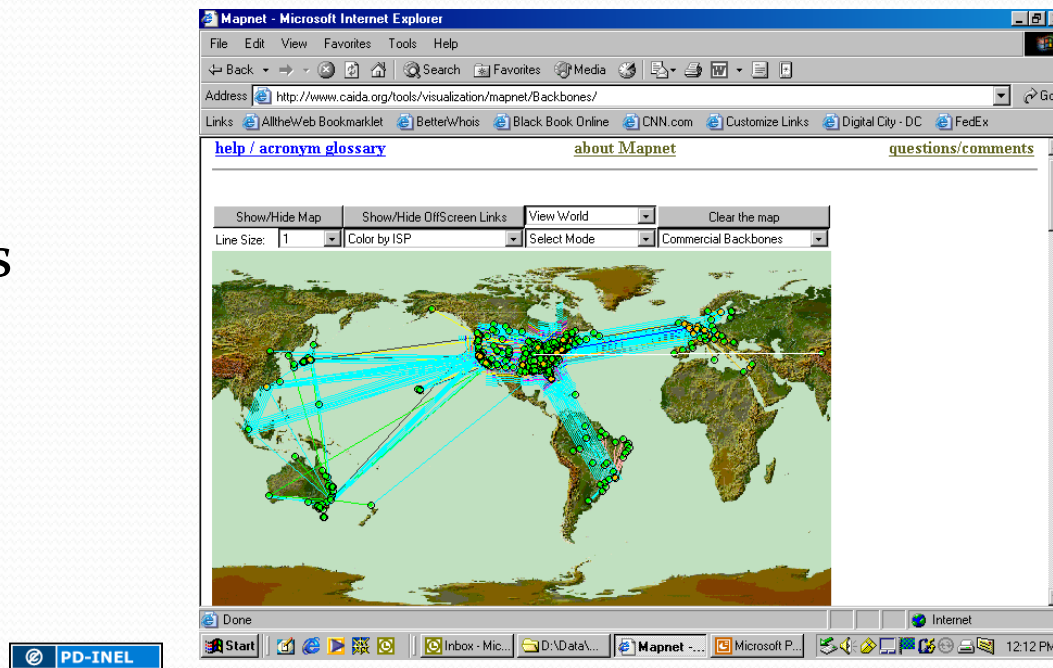
Critical Core Elements Added

- TCP/IP
  - Specification published – 1973-74
  - Became core protocol when system, with approximately 1000 hosts, converted to using it for messaging – 1983-1984
- DNS introduced - 1983

source

destination

A

B

C

D

E

F

G

H

TCP/IP Structure

STEP 1
The TCP protocol breaks data into packets.

STEP 2
The packets travel from router to router over the Internet according to the IP protocol.

STEP 3
The TCP protocol reassembles the packets into the original whole.

✓ **TCP** – **T**ransmission **C**ontrol **P**rotocol
   Breaks down and reassembles packets of information

✓ **IP** – **I**nternet **P**rotocol
   Responsible for making sure packets reach the correct destination

Management History

- ARPANET in the DoD days
- 1986 - NSF takes over
- 1990s – NSF gradually spins system off to US Department of Commerce. Network Solutions managed under contract
- 1998 – ICANN/new IANA
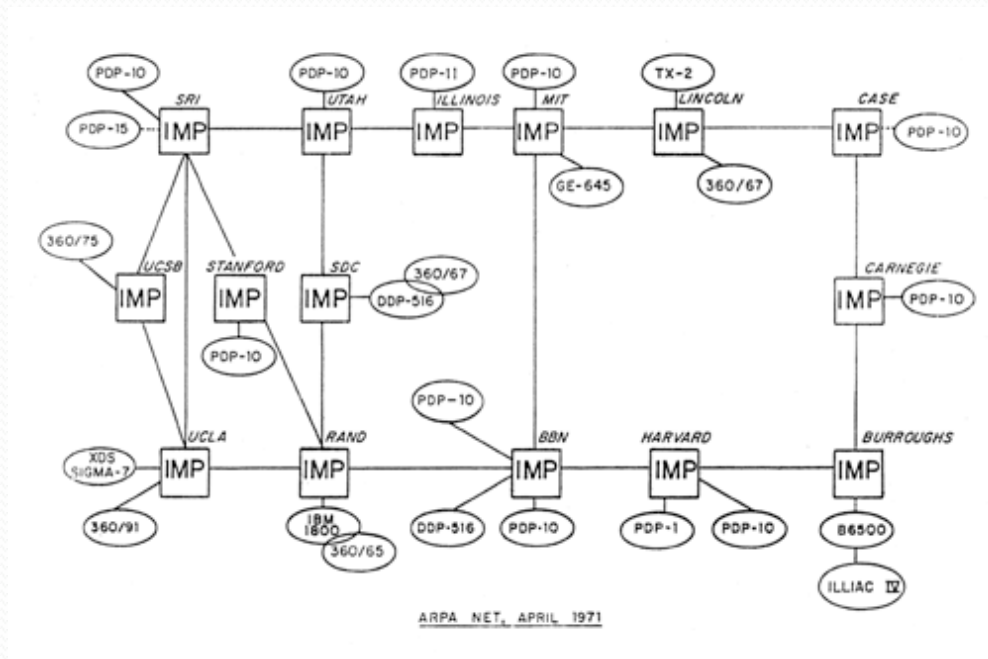
Evolution to Modern Internet

- 1989 – Tim Berners-Lee creates WWW
  - to allow physicists all over the world to share graphical AND text based information
- Spelled end for command line tools
  - Gopher – distributed document system
  - WAIS – Wide Area Information Server - search
  - Finger
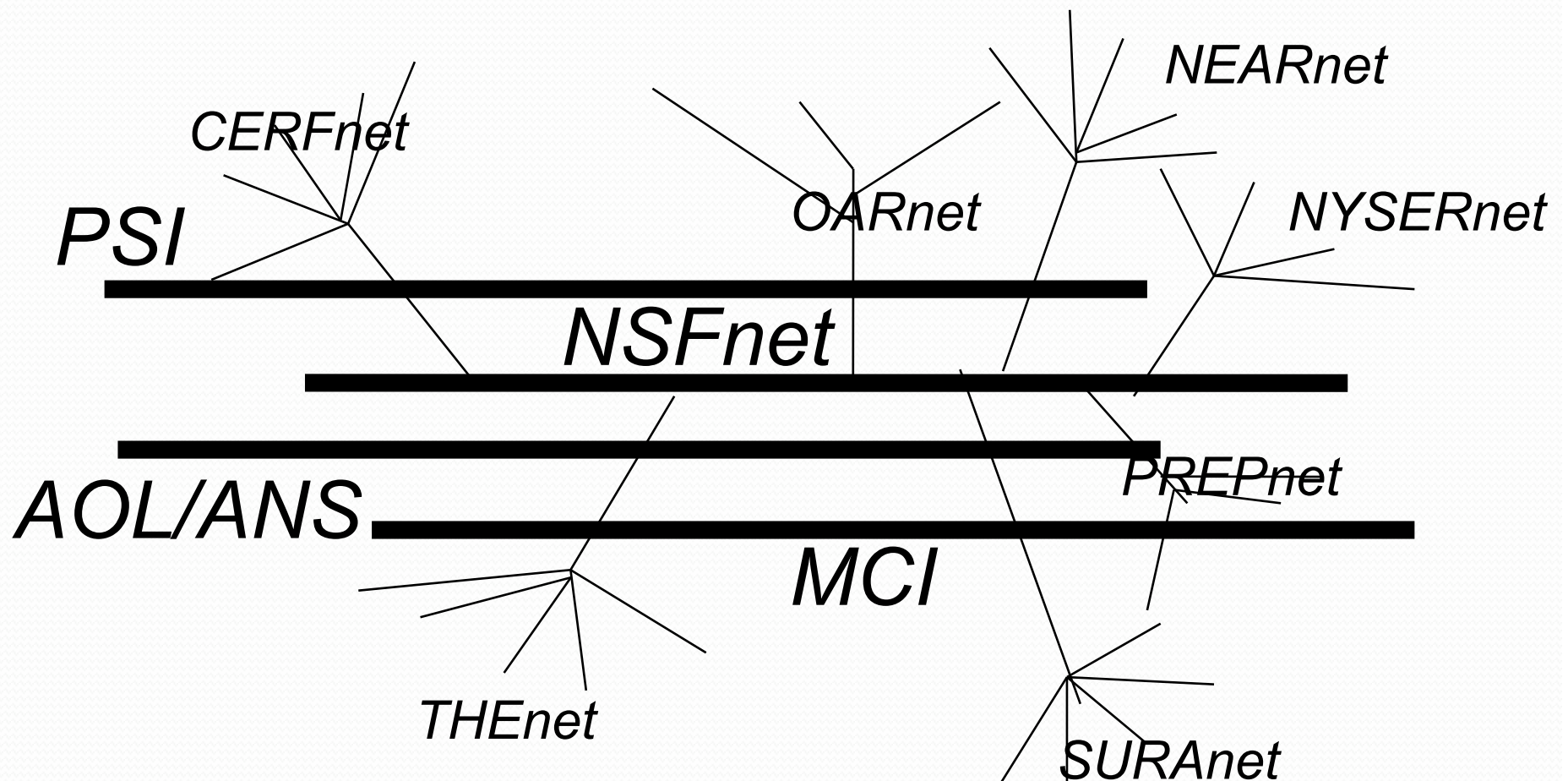   - Security issues also part of its disappearance
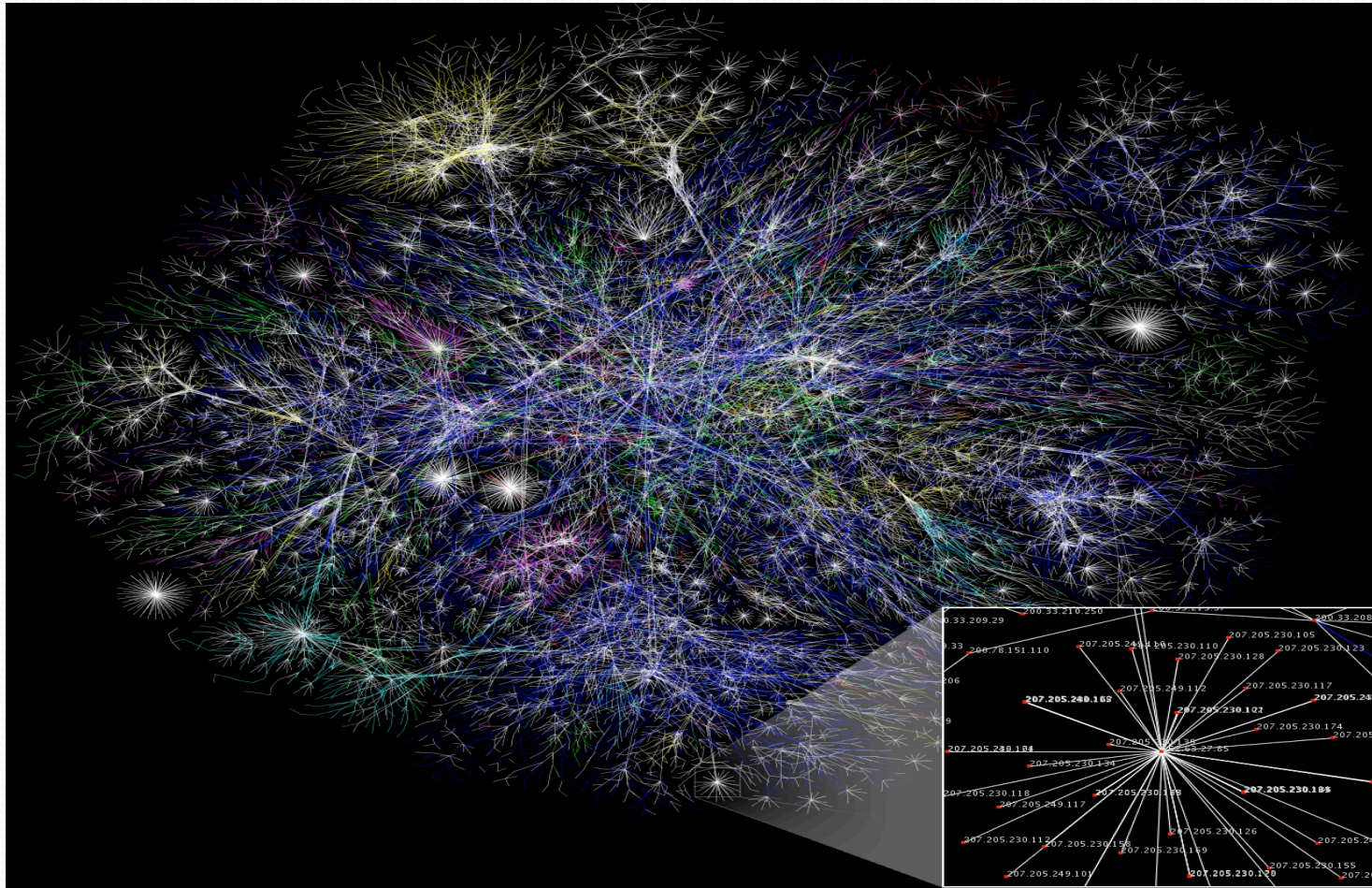
The 'Net Mushrooms

- 1990 – First commercial services appear
- 1991 – Commercialization restrictions removed
- 1992 – WWW released by CERN
- 1992 – Mosaic, first graphical browser, introduced
- 1994 – Netscape incorporates

Arpanet - 1971

ARPA NET, APRIL 1971

The Internet-Academic 1984

NEARnet

CERFnet

PSI

OARnet

NYSERnet

NSFnet

AOL/ANS

PREPnet

MCI

THEnet

SURAnet

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The Internet - 2008

Early Ethos

- Segue to the "mess" part
- Messaging and exchange of information
- Open
- Small; everybody knew everybody
  - Whois database for reporting problems
- Hacking was a challenge/sport
  - Led to jobs

Issues with Openness

- Published standards
- Non-proprietary
- Led to security problems and other nuisances

E-Mail

- SMTP
  - dblumenthal@ftc.gov
- X.400
  - s=blumenthal
  - g=don
  - c=us
  - a=telemail
  - p=gov+ftc
  - o=wpo
  - dda.wpmail=HQo1(dblumenthal)
  - s=blumenthal;g=don;c=us;a=telemail;p=gov+ftc;o=wpo;dda.wpmail=HQo1(dblumenthal)