“Supercomputing from the Desktop Workstation”

Invited Zoom Presentation
Internet Reunion Club, Sponsored by Internet2
“Using the Internet (1983-1992)”
June 7, 2022

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UC San Diego

Abstract

**Computational physics drove NSF
to create an Office of Advanced Scientific Computing.
Within 2 years (1984-86) the Macintosh,
NSF Supercomputer Centers, and NSFnet appeared.
I will explore their essential interactions
and show how the networked personal computer software
used to interpret supercomputer output
led directly to NSCA Mosaic and the explosion of the WWW.**

Supercomputing Always
Assumed Visualization by a User's Workstation

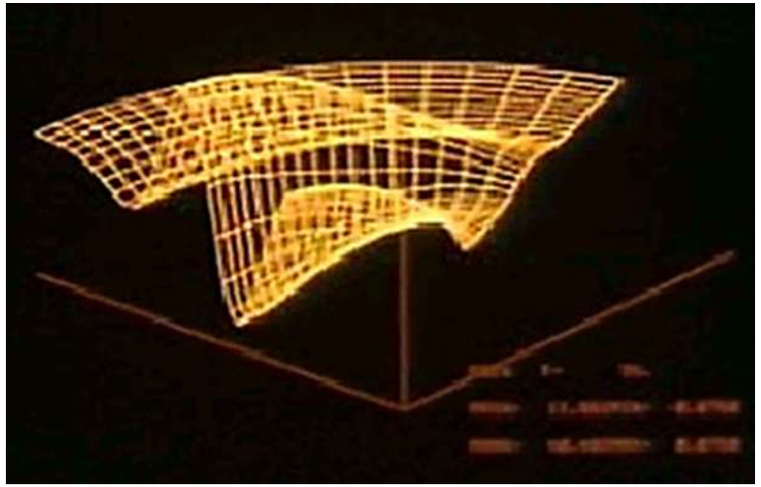
"In the early days,
von Neumann said digital computers would generate so much data
that it would overwhelm the human mind and
so we needed to turn the data stream flowing from the computer
into a visualization by
running the output of the computer into an oscilloscope.

So this idea was there from the very beginning,
but NCSA took it to a whole another level."

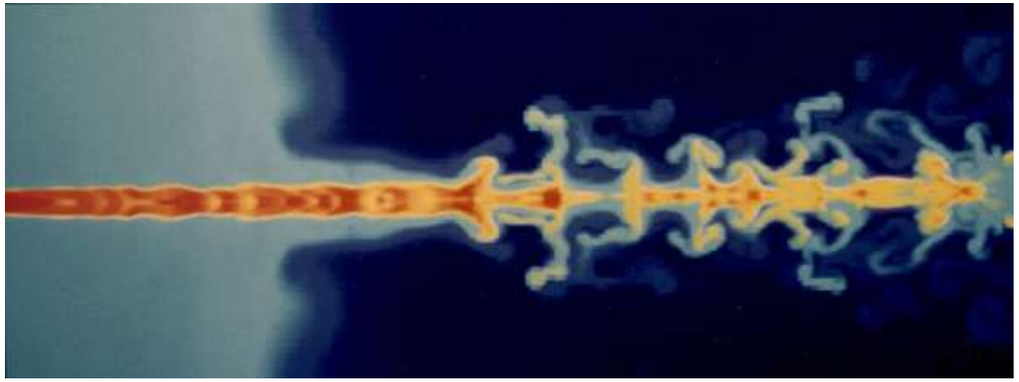
- Larry Smarr in HPCWire Article by John Russell, September 20, 2016

www.hpcwire.com/2016/09/20/larry-smarr-helps-ncsa-celebrate-30th-anniversary/

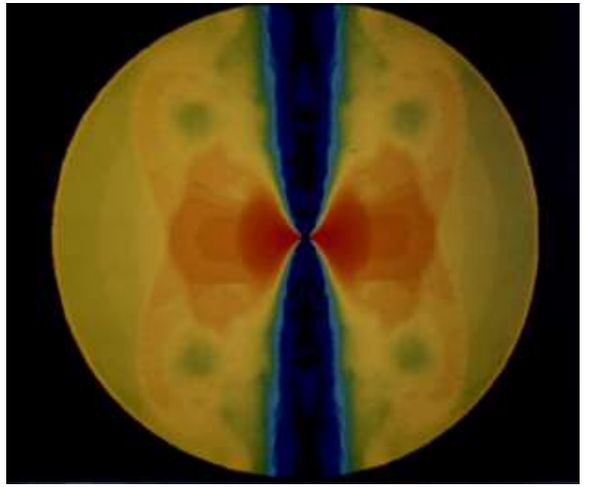
1972-1985: My Early Computational Astrophysics Research Made Essential Use of Visualization of the Supercomputer's Output



Gravitational Radiation From Black Hole Collisions
With Eppley
1978



Cosmic Jets Emerging From Galactic Centers
With Norman and Winkler
1981

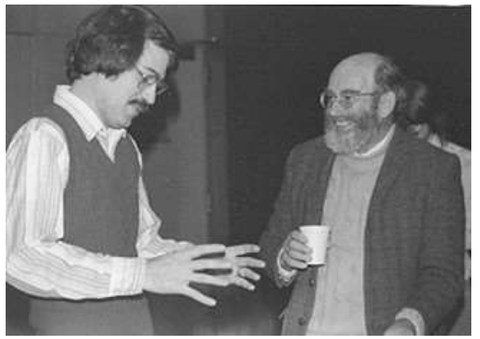


Gas Accretion Onto a Black Hole
With Wilson and Hawley
1982











I Spent a Decade Supercomputing at LLNL (with Jim Wilson) and
Then at The Max Planck Institute for Physics and Astrophysics (with Mike Norman and Karl-Heinz Winkler)

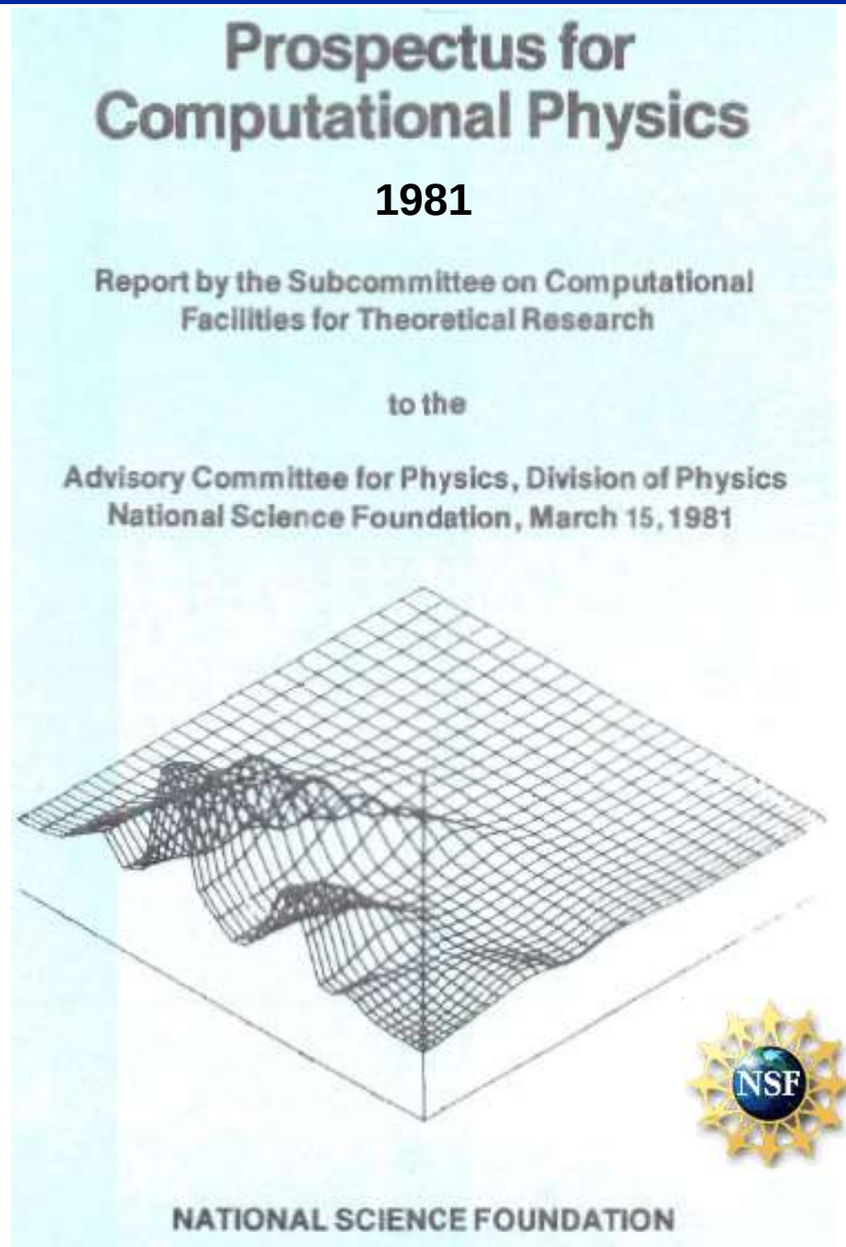
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1981 NSF's Press Report: "Distribution of Balanced Computational Capacity at the Local Nodes is as Important as the Provision of Maximum Capability of the Principal Node"

Subcommittee Members Included:

- Ken Wilson
- Steven Orszag
- Larry Smarr

All Became NSF Supercomputer Center Directors in 1985



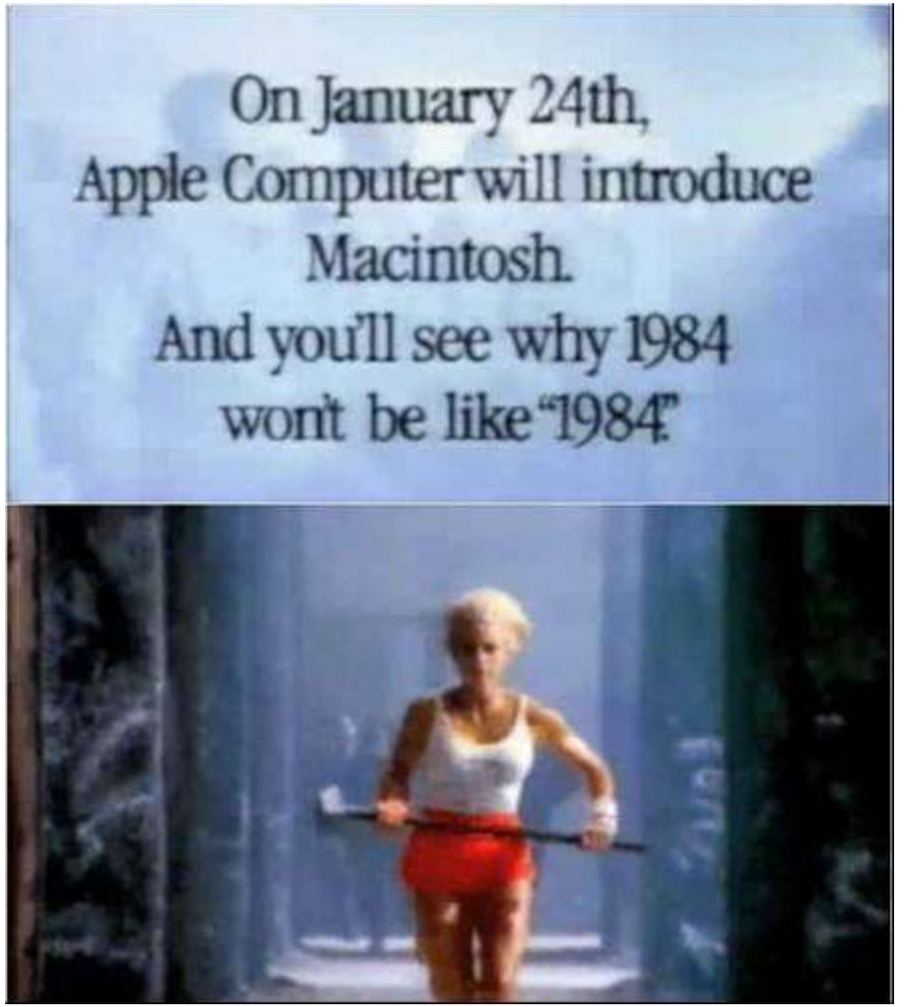
- **The Local Nodes Make Possible Modes of Operation and Scientific Investigations Not Possible via Remote Acess to the Central Node**
- **A Local Node Also Provides for Much Higher I/O Rates to the User than can be Provided with Remote Access to a Central Facility**
- **Any Commitment to Increased Computational Resources Must be Accompanied by an Expansion of Graphics Facilities to Help Manage the Increased Data Flow**

www.nr.com/whp/NSFCompPhys1981.pdf

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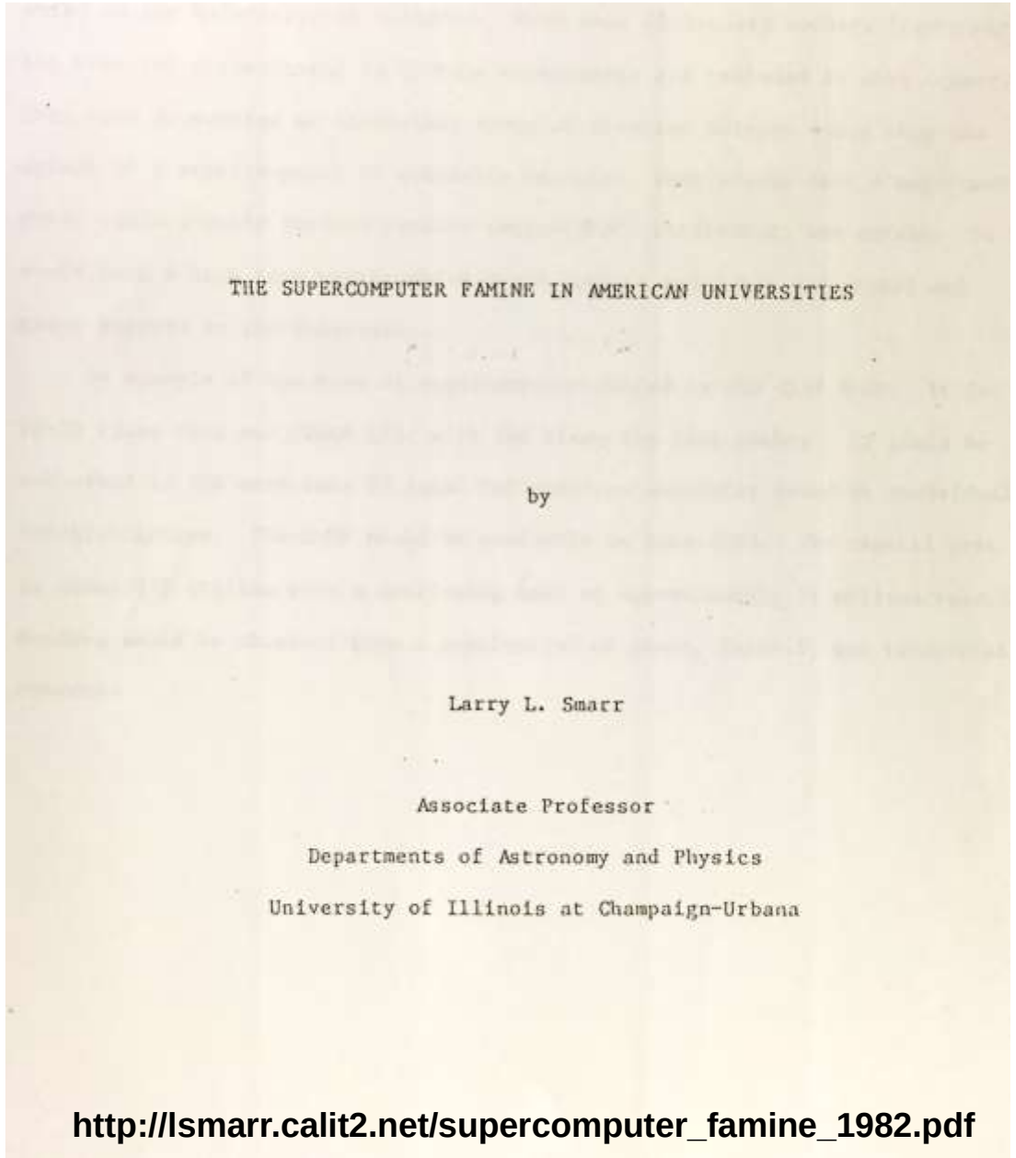
1981-1984: IBM PC and Apple Macintosh Introduced, Vastly Expanding Local Nodes for Remote Users





1982-83: Documenting The Unmet Supercomputing Needs of A Broad Range of Disciplines Led to the NCSA Proposal to NSF

1982



THE SUPERCOMPUTER FAMINE IN AMERICAN UNIVERSITIES

by

Larry L. Smarr

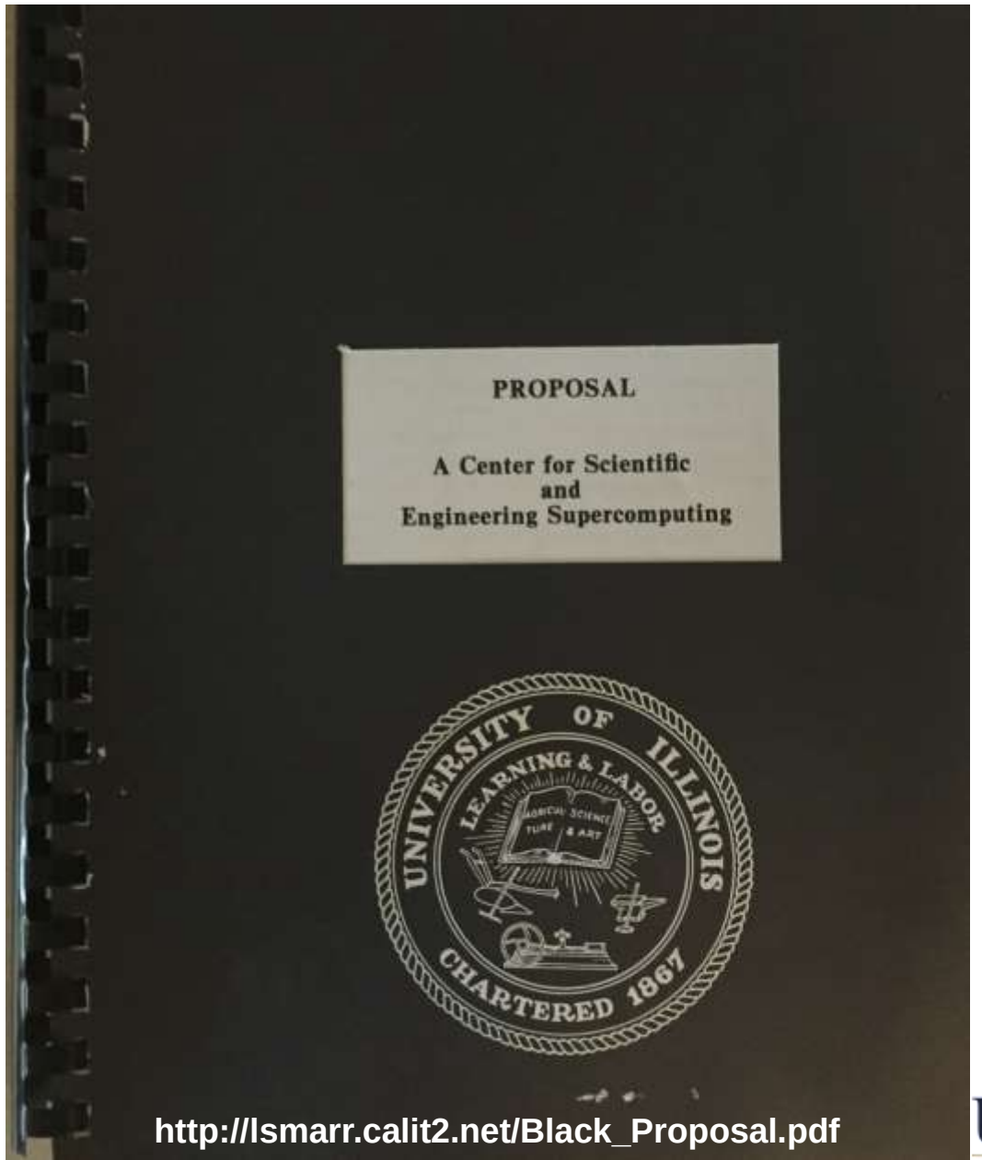
Associate Professor

Departments of Astronomy and Physics

University of Illinois at Champaign-Urbana

http://lsmarr.calit2.net/supercomputer_famine_1982.pdf

1983



http://lsmarr.calit2.net/Black_Proposal.pdf

NSF

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1985: NSF OASC Adopted DOE's High-Performance Computing Models In Creating Two of the Five New Academic Supercomputing Centers

1985



NCSA Was Modeled on LLNL



SDSC Was Modeled on MFEnet

NCSA

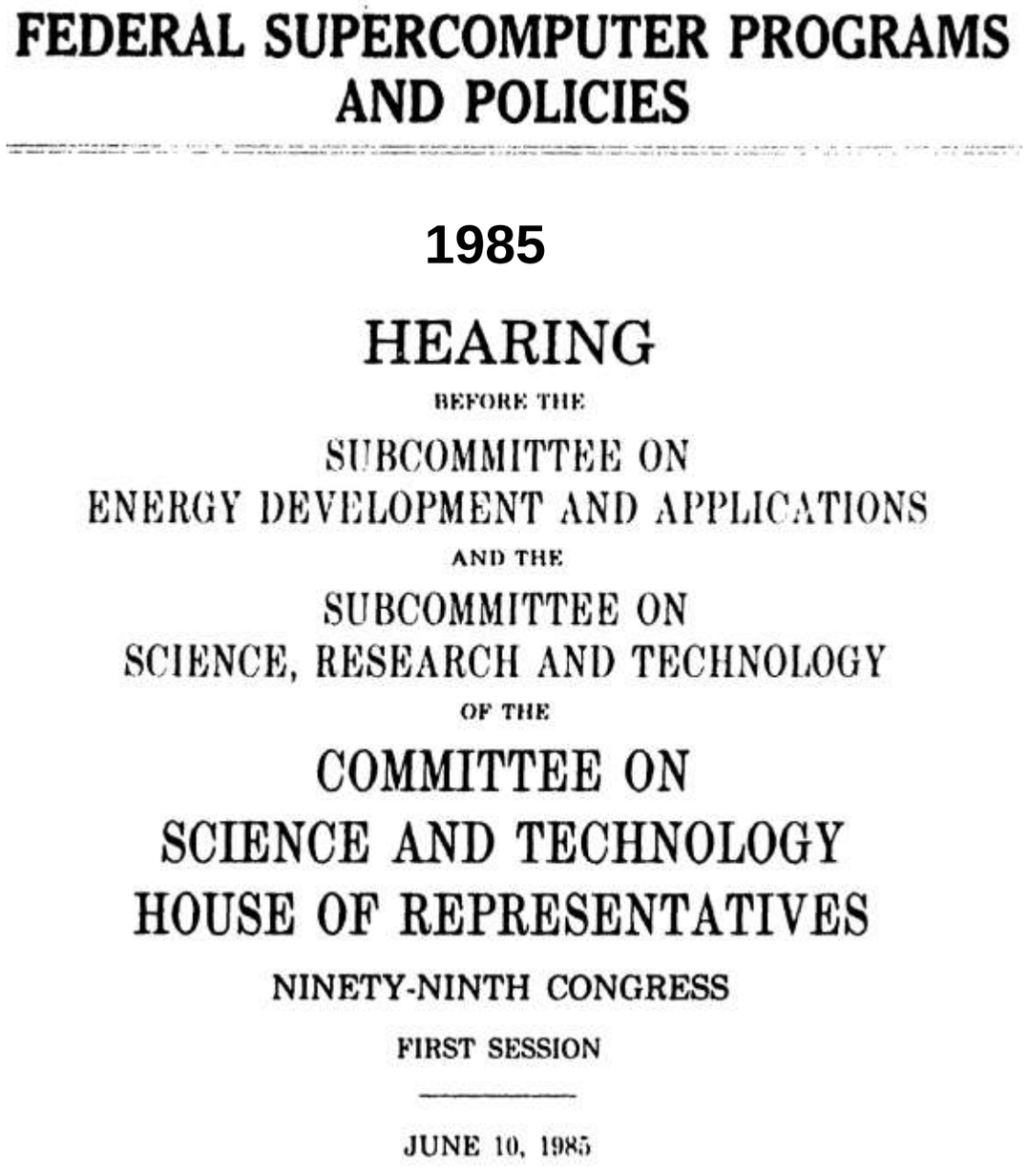
SDSC

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1985: NSF Supercomputer Center Directors Ken Wilson and I Testified to Congress, but SuperNetworks Were Just as Important

“We ought to consider a national initiative to build interstate highways for information with a fiber optics network connecting the major computational centers in this country”

-Senator Al Gore



FEDERAL SUPERCOMPUTER PROGRAMS AND POLICIES

1985

HEARING

BEFORE THE

SUBCOMMITTEE ON
ENERGY DEVELOPMENT AND APPLICATIONS

AND THE

SUBCOMMITTEE ON
SCIENCE, RESEARCH AND TECHNOLOGY

OF THE

COMMITTEE ON
SCIENCE AND TECHNOLOGY
HOUSE OF REPRESENTATIVES

NINETY-NINTH CONGRESS

FIRST SESSION

JUNE 10, 1985

“The University of Illinois will be experimenting with fiber optic ‘information flow pipes,’ which promise to be able to reach billions of bits per second.”

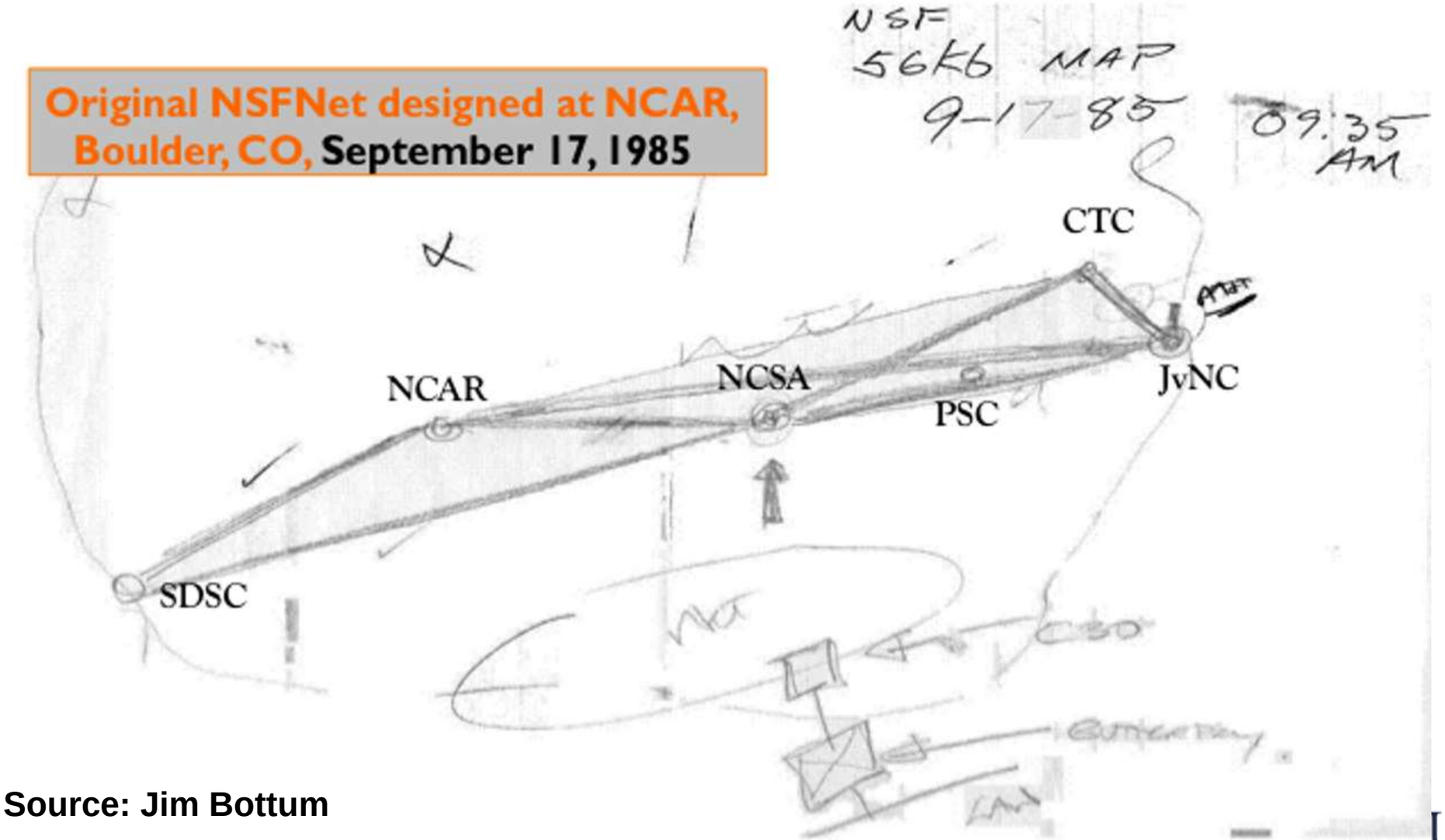
-NCSA Director Larry Smarr

http://lsmarr.calit2.net/hrg-1985-tec-0068_from_1_to_806_s.pdf

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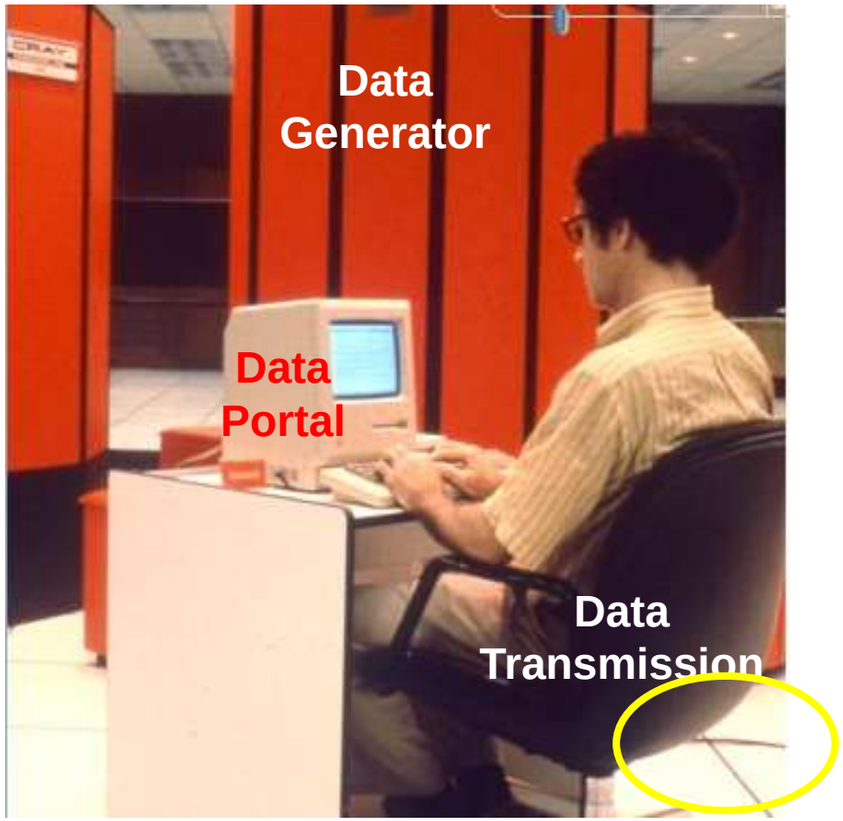
1986-88: Launching the Nation's Information Infrastructure - NSFnet Supernetwork and the Six NSF Supercomputers

NSFNET 56 Kb/s Backbone (1986-8)



Source: Jim Bottum

1986: *NCSA Telnet* Enabled Local Nodes to Network to Central Supercomputer Nodes

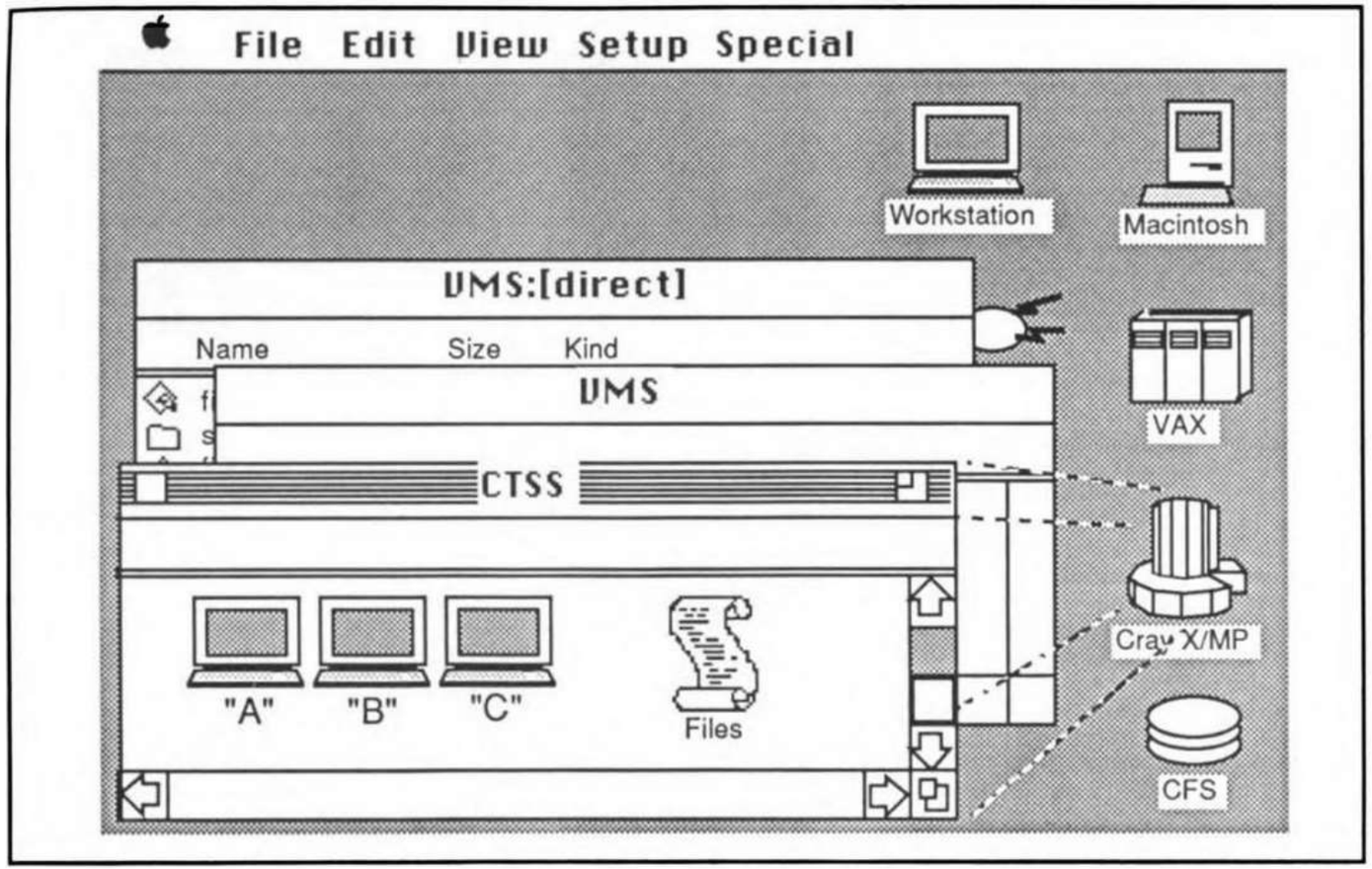


Professor John Kogut Simulating Quantum Chromodynamics
He Uses a Mac - The Mac Uses the Cray

- **NCSA Telnet -- Interactive Access**
  - **From Macintosh or PC Computer**
  - **To Telnet Hosts on TCP/IP Networks**
- **Allows for Simultaneous Connections**
  - **To Numerous Computers on The Net**
  - **Standard File Transfer Server (FTP)**
  - **Enables Users to Transfer Files to and from Remote Machines**

Source: Larry Smarr 1986

NCSA's Vision Was to "Hide the Cray" on the Remote User's Personal Computer



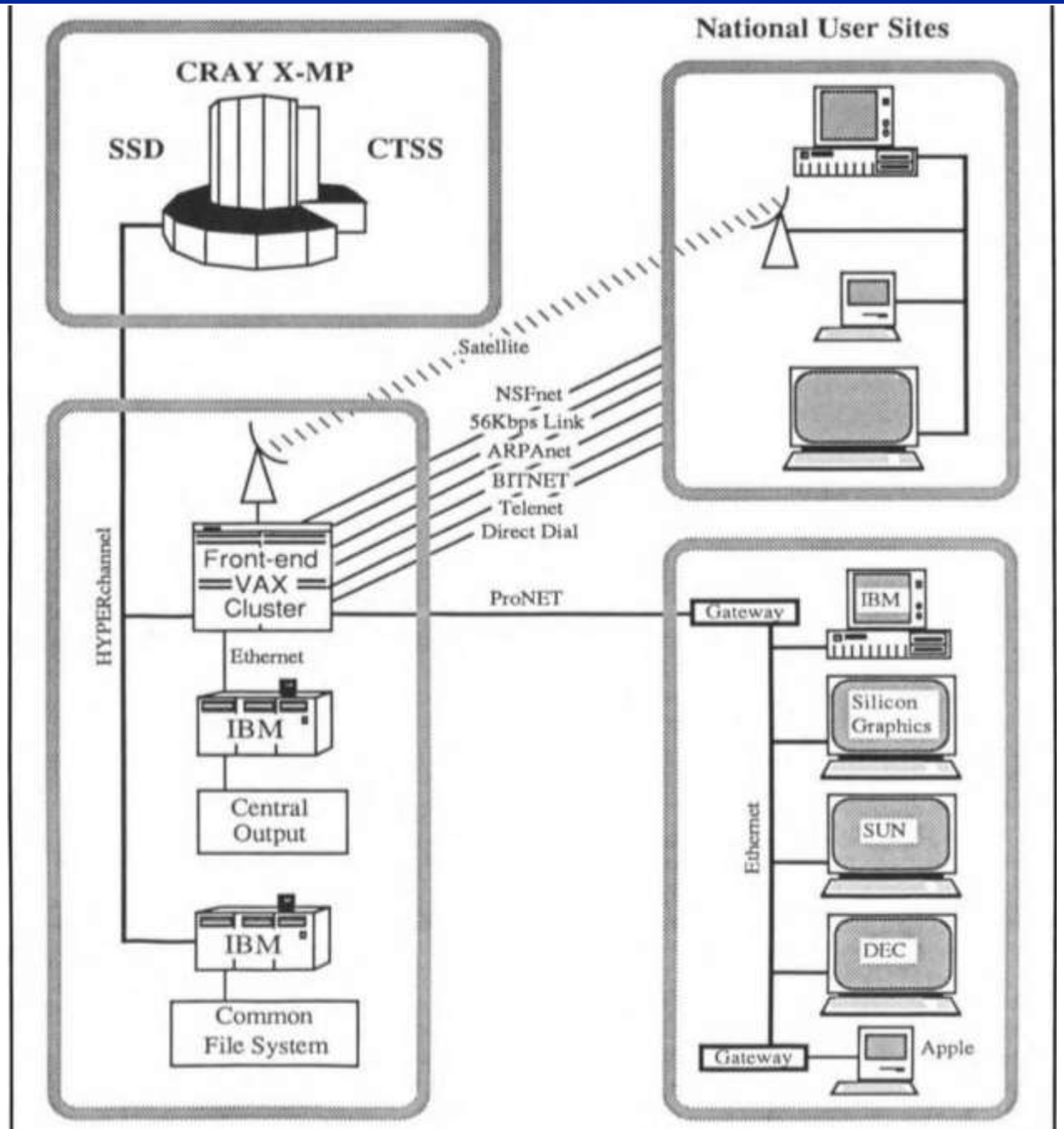
Multiple Computers And Remote Files Became Icons on the User's Desktop

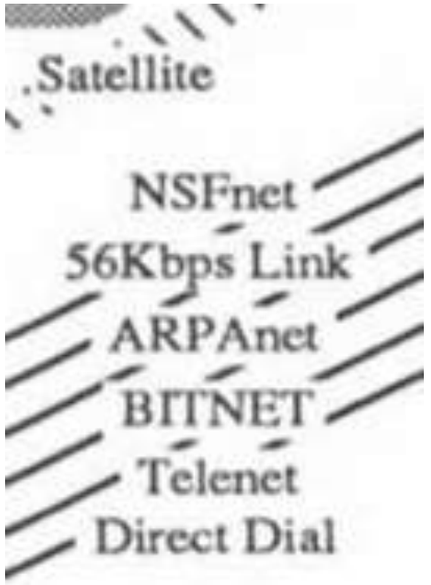
"Once the supercomputer itself has UNIX operating system and the entire network has a uniform protocol (such as TCP/IP), the unification of the workstation with the supercomputer will be straightforward."

From The Computational Science Revolution: Technology, Methodology, and Sociology, by Larry Smarr In High-Speed Computing: Scientific Applications and Algorithm Design, ed. R. B. Wilhelmson (1988)

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Researchers Used Desktop Software to Plan the Integration of Their PC/Workstation, Across Multiple Networks, to Central Supercomputers

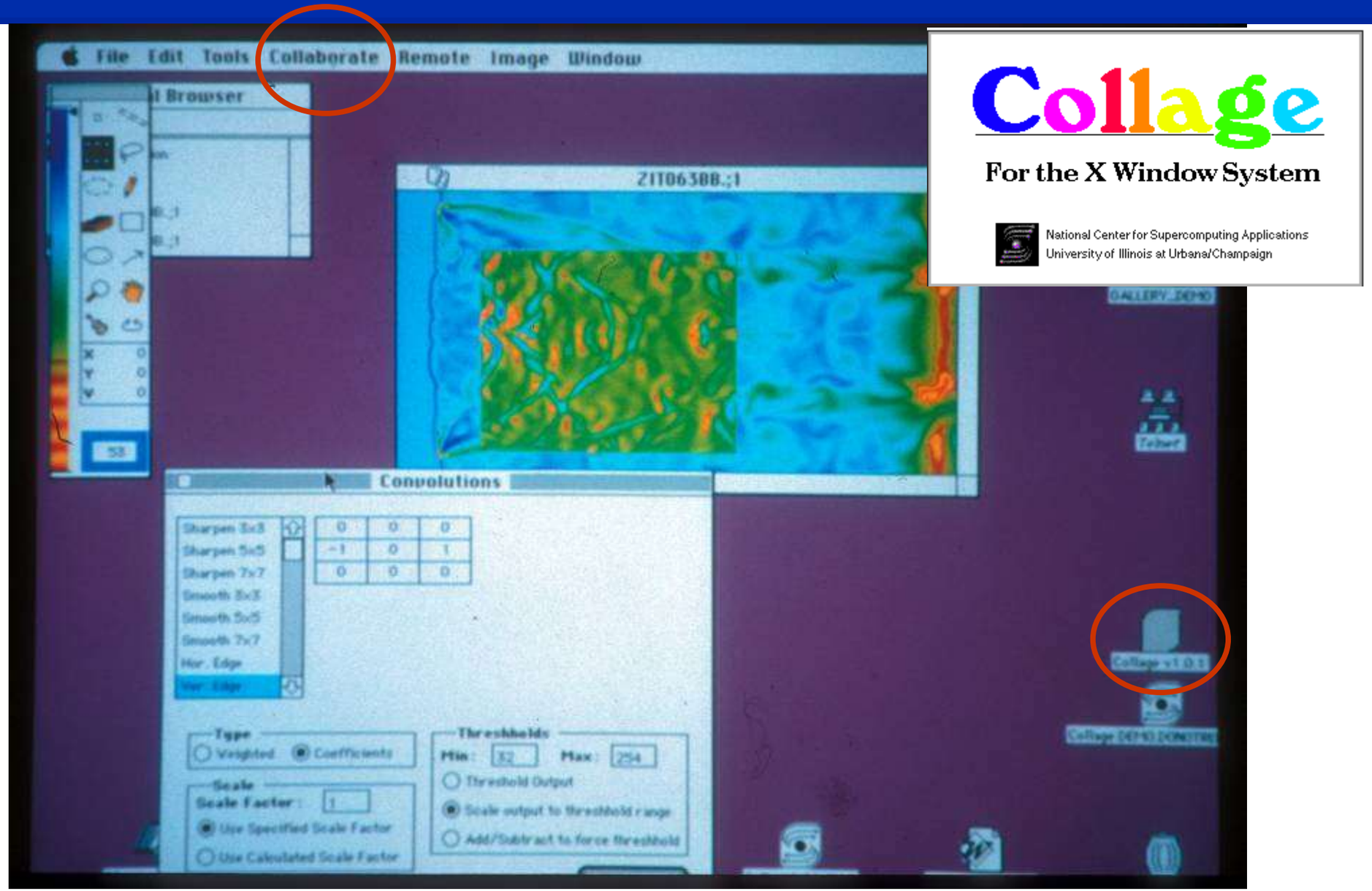




From The Computational Science Revolution: Technology, Methodology, and Sociology, by Larry Smarr In High-Speed Computing: Scientific Applications and Algorithm Design, ed. R. B. Wilhelmson (1988)

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1990-91: NCSA Collage-a Synchronous Desktop Collaboration Tool For Sharing Mac, PC, and UNIX Desktops Across the Network Led to NCSA Mosaic

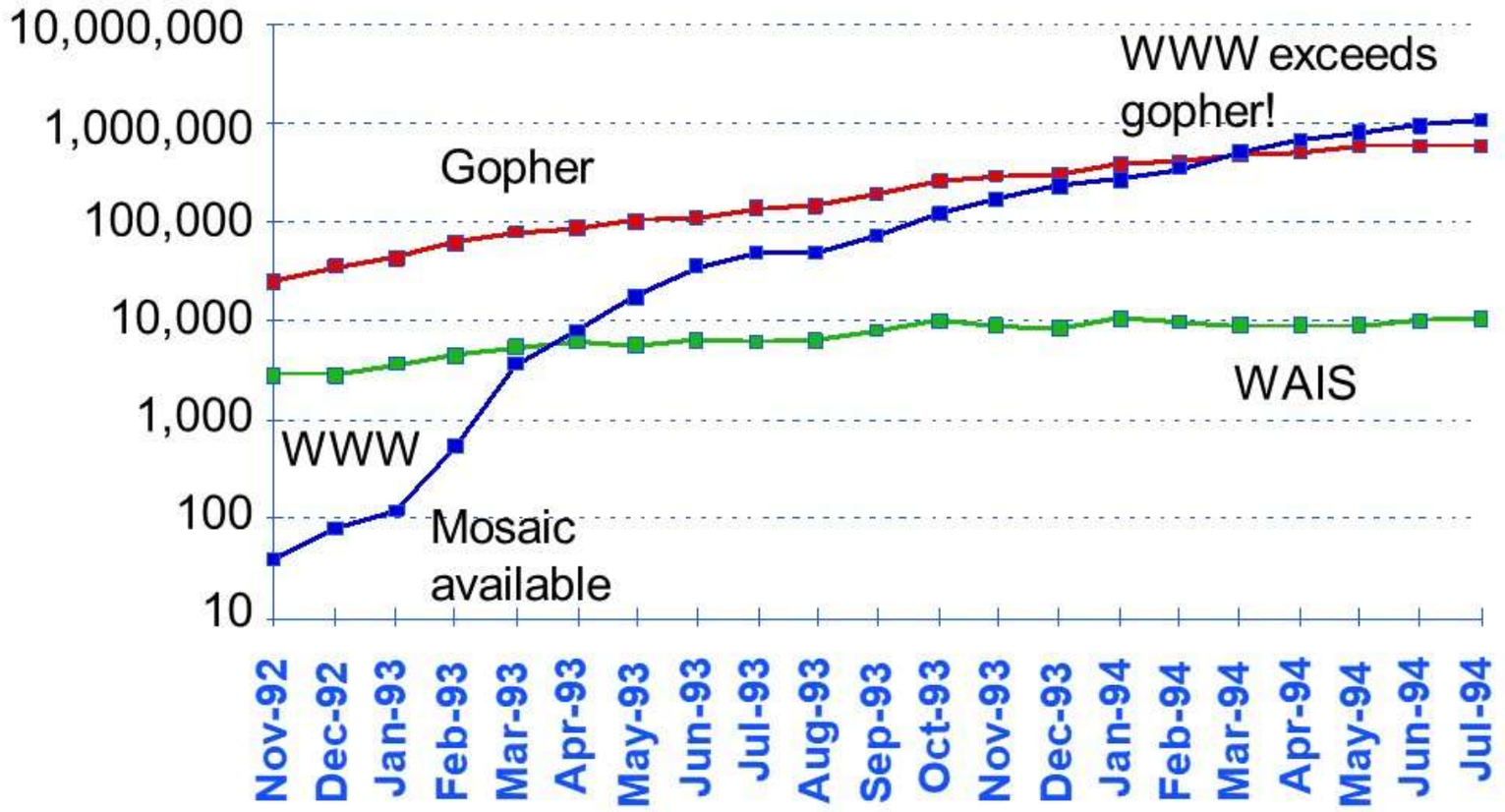


Source: Susan Hardin, NCSA

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1993-94: NCSA Mosaic Induces Exponential Growth of Clients Coupling to Servers Across the Network

MBytes Transferred over NSF Backbone per Month



Mosaic Induces 10,000-Fold Increase in WWW Traffic!!

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