

A Short History of the Internet

NANOG

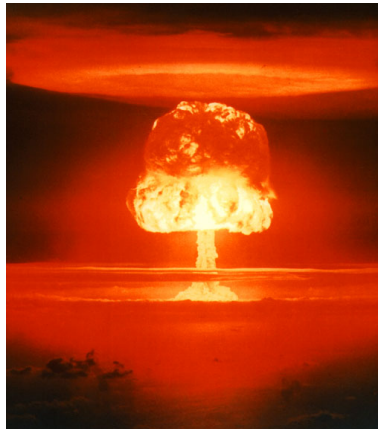
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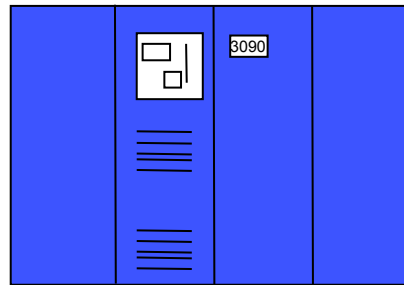
net his-1

Why?

net his-2



or



net his-3

What was there?

net his-4

The Phone Net from **The** Phone Company (TPC)
(trivia alert)

circuit-based

assumed simple & predictable interconnections
between ends

assumed requirement for QoS

assumption of being carrier-provided

voice-oriented

net his-5

What Was Wrong With That?

nothing, if you just wanted to talk

nothing, if you just wanted to talk to Joe

nothing, if you just wanted one service

trick question - what does a **fast busy** signal mean?

nothing, if you thought that AT&T innovated

note: this was pre breakup & pre Carterphone

nothing, if you wanted your data service provided
to the wall by a carrier

net his-6

So, Lets Make (Not Build) our own

net his-7

multiple unrelated efforts (early to mid 1960' s)

packet switching theory: (Kleinrock) 1961

day dreaming: (Licklider' s Galactic Network) 1962

make use of remote expensive computers: (Roberts) 1964

survivable infrastructure for voice and data: (Baron) 1964

ARPANET (late 1960' s)

Roberts ARPANET paper 1967

RFP for Interface Message Processor won by BBN 1968

four ARPANET hosts by 1969

public demo and email in 1972

net his-8

Make What?

net his-9

Dest Addr	Src Addr	payload
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- 0/ multiplexed utilization of **existing** networks
 - 1/ **survivability** in the face of failure
 - 2/ support **multiple types** of communications service
 - 3/ accommodate a **variety** of network types
 - 4/ permit **distributed management** of resources
 - 5/ **cost effective**
 - 6/ **low effort** to attach a host
 - 7/ **account** for use of resources
- !security**
!QoS
!efficiency

net his-10

e2e!

net his-11

Non Goal

*“the lesson of the Internet is that **efficiency is not the primary consideration**. Ability to grow and adapt to changing requirements is the primary consideration. This makes simplicity and uniformity very precious indeed.”*

Bob Braden

IETF mailing list 2-Feb-2001

“Huh?” (says the phone world)

net his-12

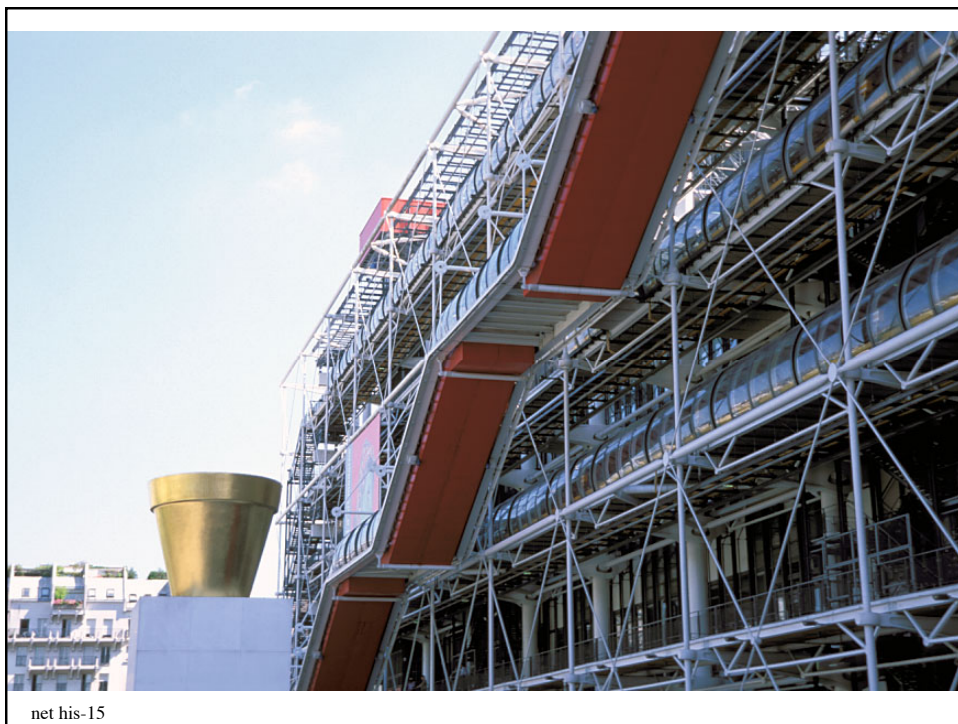
What did *they* think the Internet was?

net his-13



by definition

net his-14



net his-15

Architecture Feature

service can be provided by 3rd parties - not just by carriers

a quote from an IETF mailing list

Hi Roy,

I still don't understand why it is a "users" choice where the "services" are executed - I would have thought that this would be networks choice

net his-16

Feature of Architecture Feature

ISP does not profit from services running
over network

telcos do not grok concept

AT&T building “content aware” next-gen network

“We do not know how to route money”

Dave Clark

net his-17

Another Feature of Architecture Feature

no “tapping” point

traffic does not flow in a tree

security (authentication, encryption) is e2e

where “e” could be server somewhere

not even in an ISP

traffic between customers on same POP stays
in POP

no knowledge of geographical location

governments do not grok concept

net his-18

The Importance of Phones (or emergency traffic, or ...)

I' m more important!

I' m more important!

I' m more important!

I' m more important!

I' m more important!

ME!

I' m

I' m more important!

net his-19

Are Differentiated Services an Answer?

pay more to get a better service?

a way for ISP to get application-based revenue

but the Internet is not consistently crappy enough

"It fails to fail often enough so it looks like it works."

Mike O' Dell

assumption:

you will pay more every time to make the service better
some of the time

e.g., IAD- vs. Ethernet-attached phones (**IQ test**)

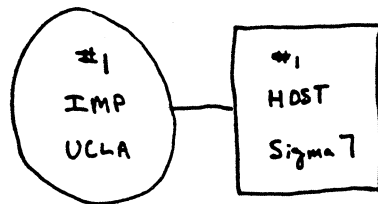
IT managers: yes, real world: ???

e.g. VoIP in enterprises

net his-20

obligatory topology maps

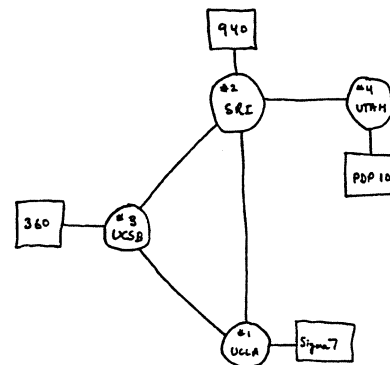
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THE ARPA NETWORK

SEPT 1969

1 NODE

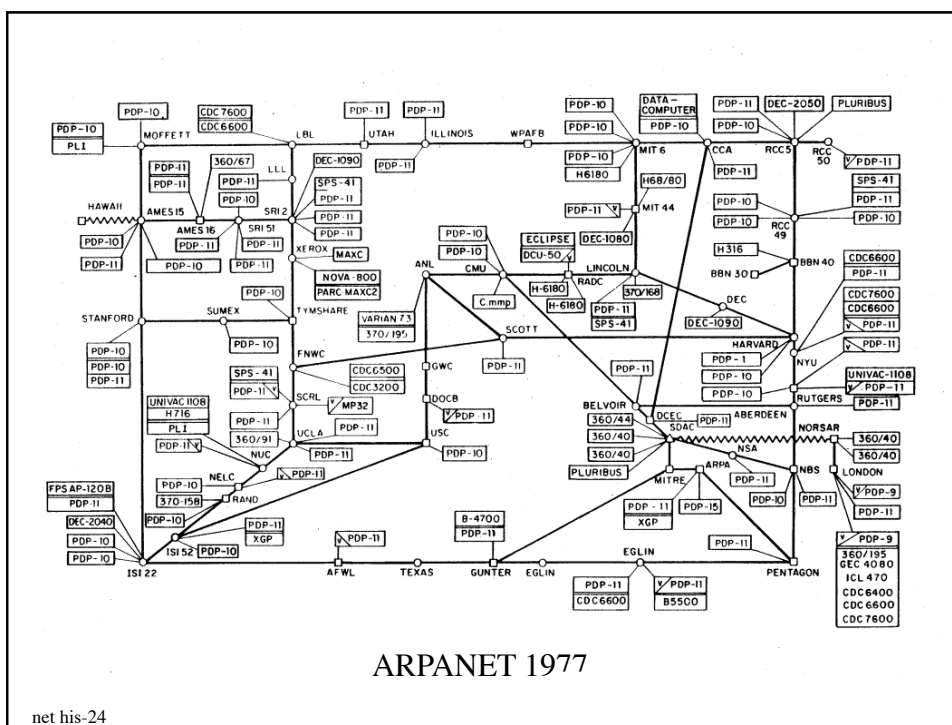
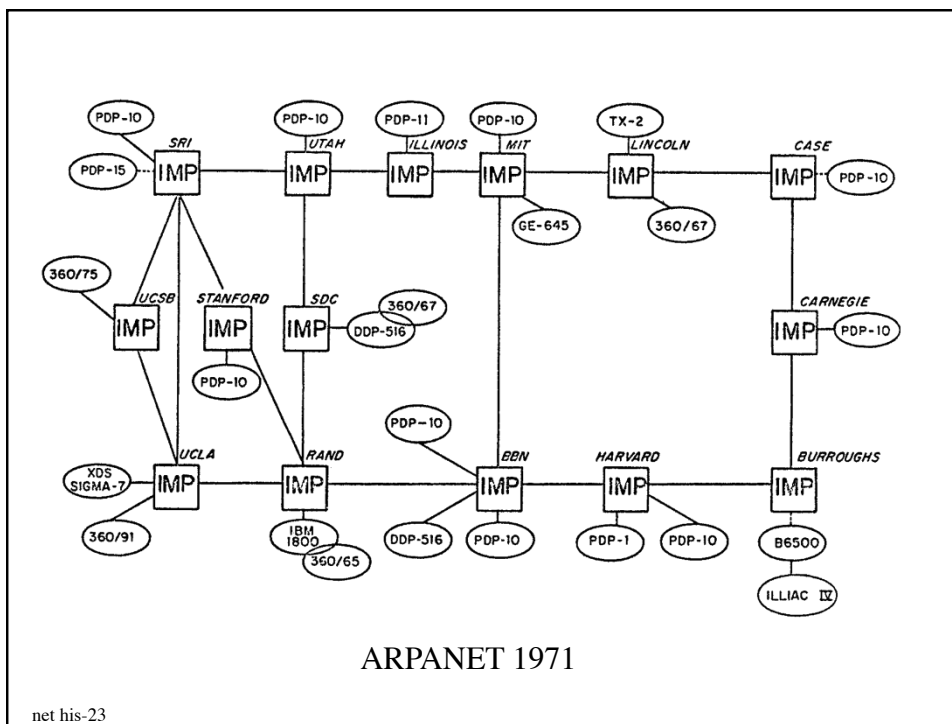


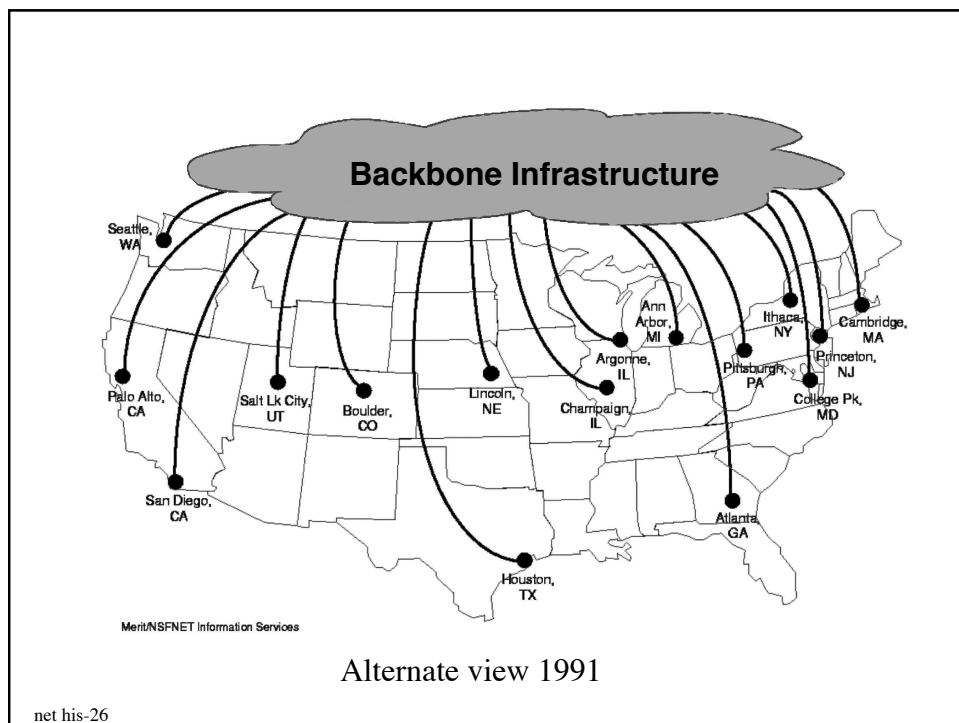
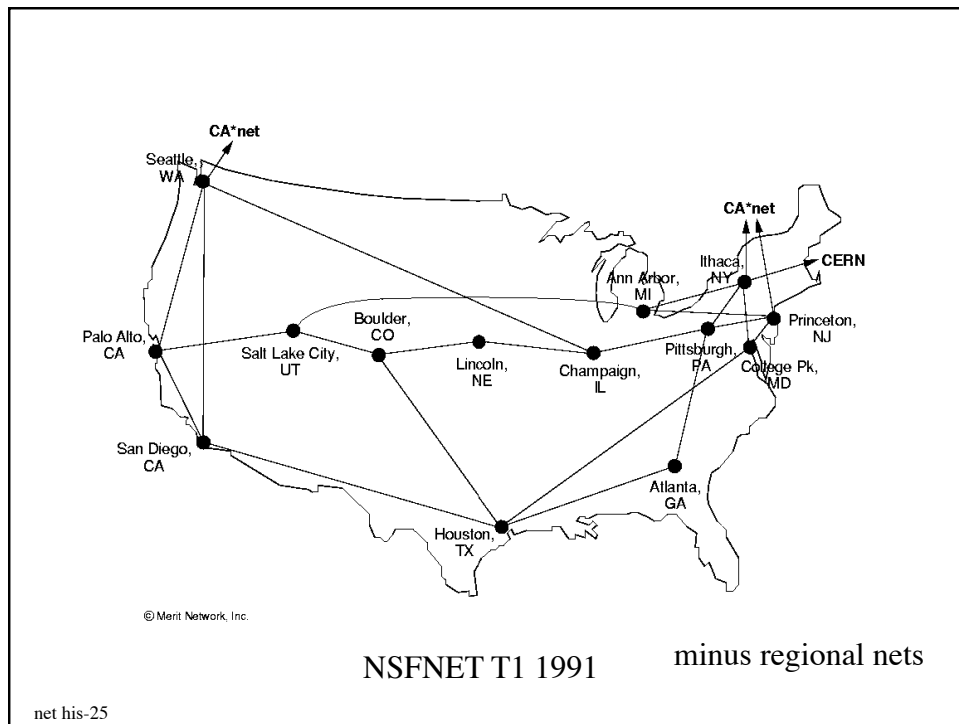
THE ARPA NETWORK

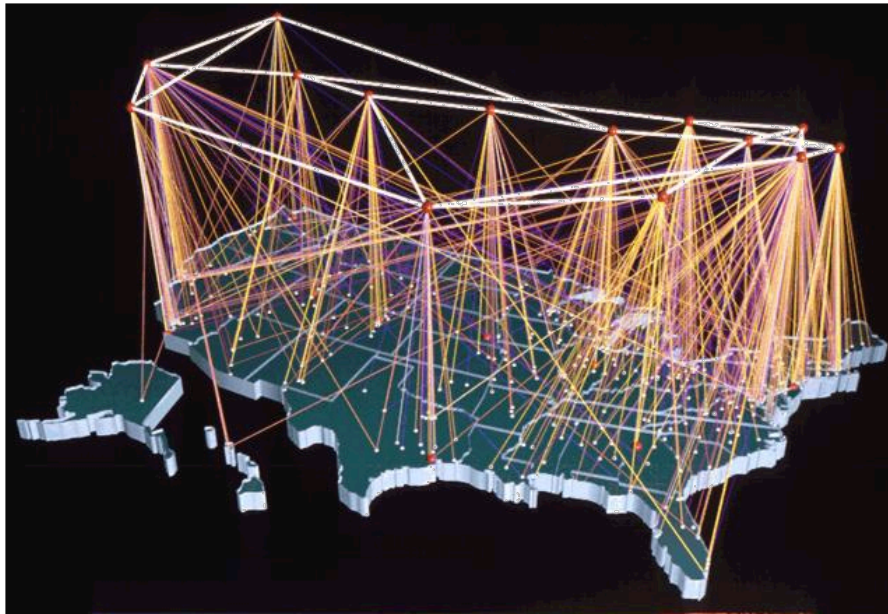
DEC 1969

4 NODES

net his-22

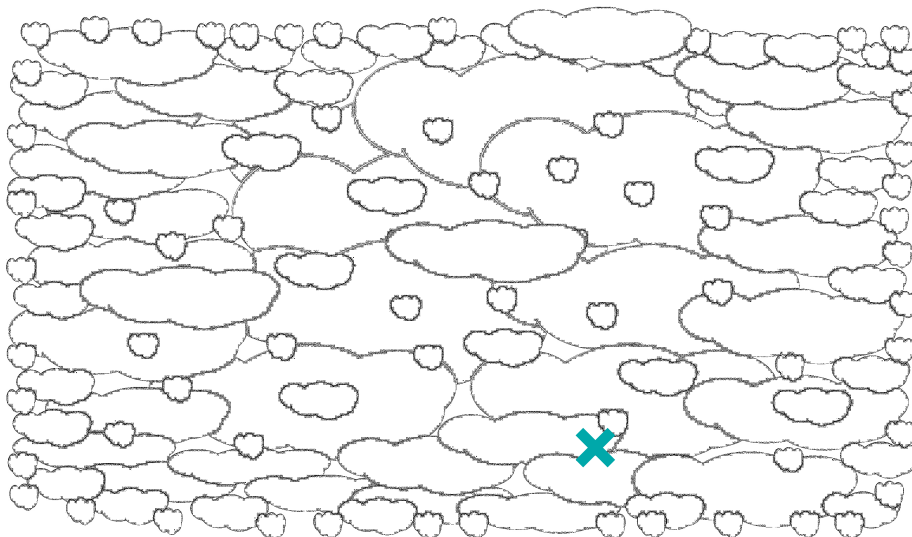







NSFNET PR graphic

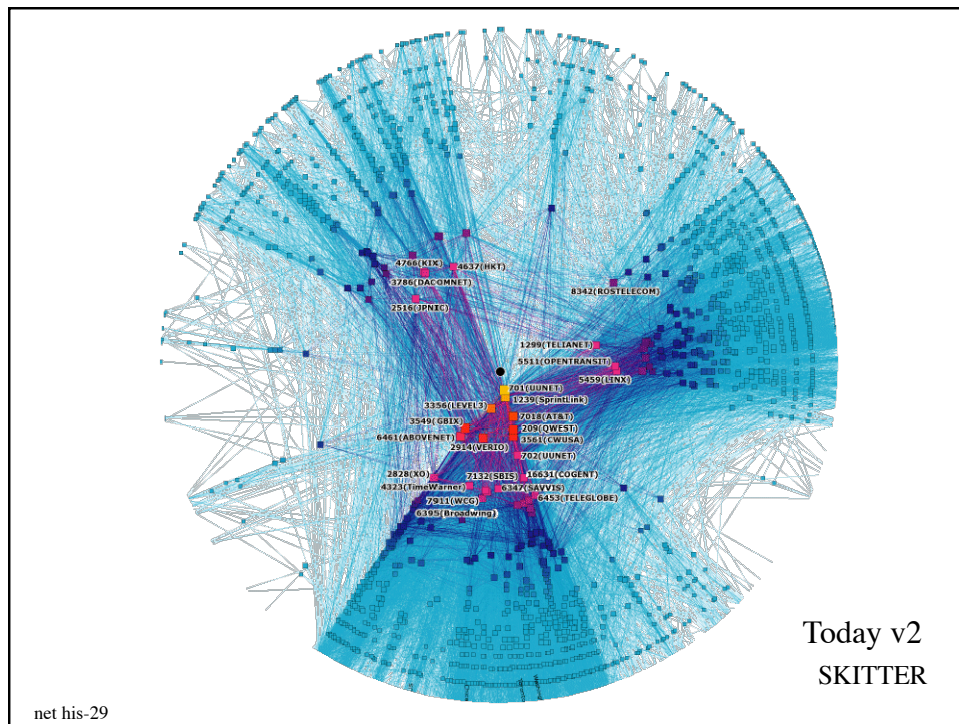
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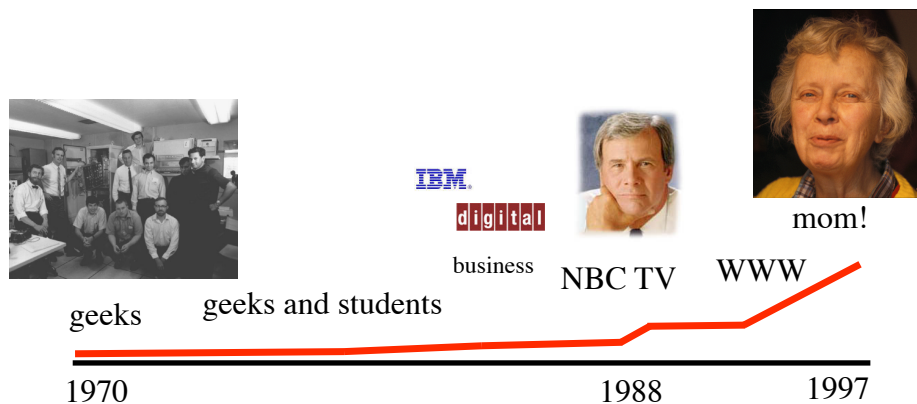
Today v1

 you are here

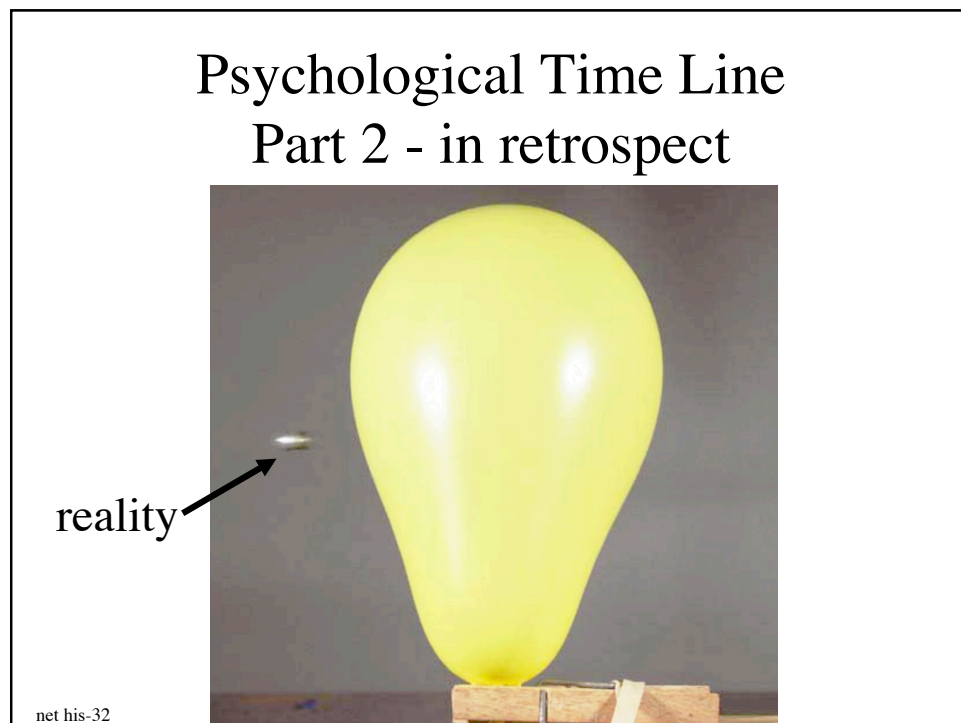
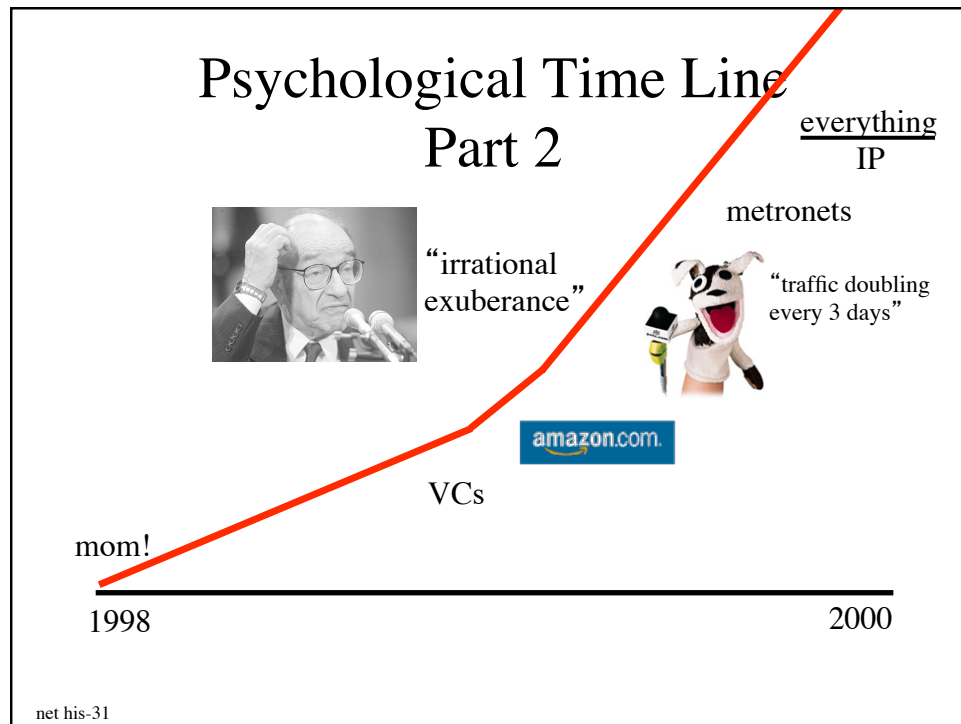
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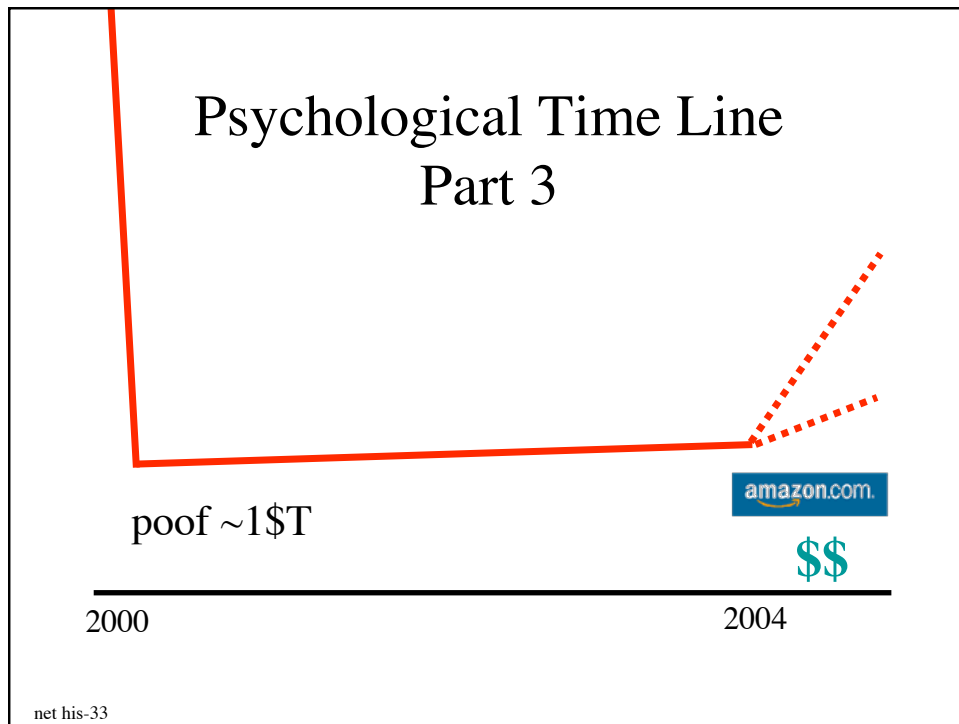


Psychological Time Line Part 1



net his-30





diversions

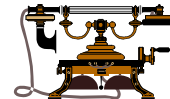
“he has an out of balance ego to clue ratio”

Dave Clark



there is no need to fund the
'NSFnet', we can provide
data connectivity with ISDN
late '80s

Charles L. Brown
AT&T Chairman & CEO



net his-35

OSI is the answer, what
was the question?

various governments
and corporations



GOSIP

net his-36



Internet collapse
imminent - .gif at 11



Bob Metcalfe
ex-pundit

net his-37

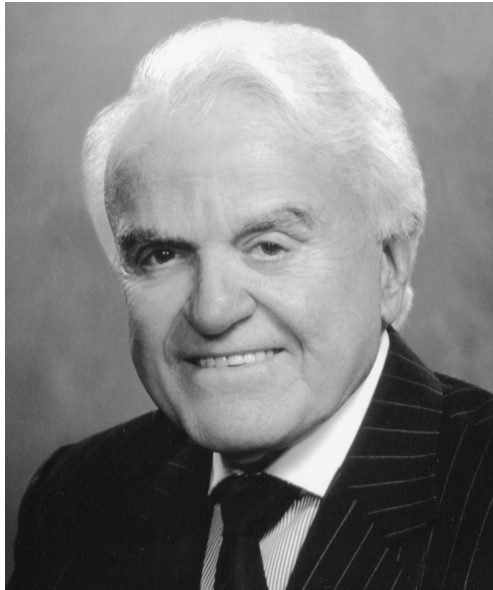


John McQuillan
one of the idle rich

ATM is the answer, do
we need a question?

\$\$\$\$\$\$
\$\$\$\$\$\$

net his-38



what makes you
think you own the
movie you bought?



Jack Valenti
president & CEO MPAA

net his-39



and I say that 200
years *is* a limited period



Michael Eisner
chairman, Walt Disney

net his-40



the answer is
National Security
but the question is
secret



John Ashcroft
US Attorney General

net his-41

Innovation?

net his-42

PBS American Experience show on “1900”

*“The turn of the century, particularly in America, represented a period that will someday be compared to the Renaissance. Within a period of very short time, 15-20 years, most of the breakthroughs in technology occurred that now influence our lives so heavily. Everything since then has been engineering. You capture motion. Motion picture comes about this time. Now everything since is engineering. It's technology. Sure, the picture's better, but the idea of seeing people move on a screen is new. The telephone. “Hello? I'm talking to Chicago.” A miracle. But we take it for granted. You break through and record sound. It's gotten better, but everything since is **simply engineering**.”*

net his-43

Imitation

good for learning
but one needs to move
beyond



net his-44

New Inet (since 1900) Applications

web

mail (increasingly a.k.a spam), FAX, **IM**

remote login

data transfer, storage

commerce

audio & video

search

content

net his-45

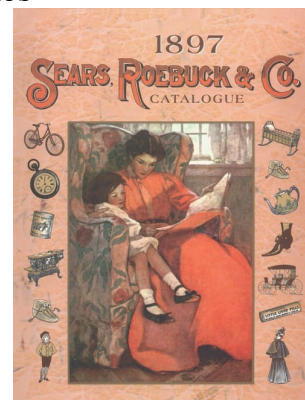
How Important is the E?

how much in **e**-commerce is new?

i.e., not just Sears, Roebuck & Co. with near-instant gratification & better indexes

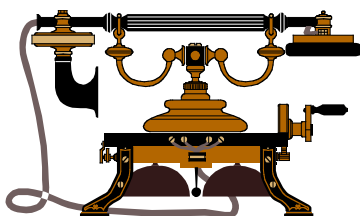
is moving a postal-based system to the Internet innovative?

important, yes - but innovative?



net his-46

IP Telephony or Internet Telephony?



IP

“make sure it stays good”

or

voice

IP

“it is good enough”

ITU & others want to “define” voice over IP

but no way to know what it *will* be

net his-47

“New” Networks

Sprint conversion to ‘packet’ technology

(the quotes were in the Nortel 2001 press release)

Verizon, SBC and BellSouth FTTH

but what technology?



net his-48

What Would Be Innovative?

how about Internet Telephony
with

smart voice terminals
downloadable applications
open to the Internet
standard open protocols

actually this is **not** innovation

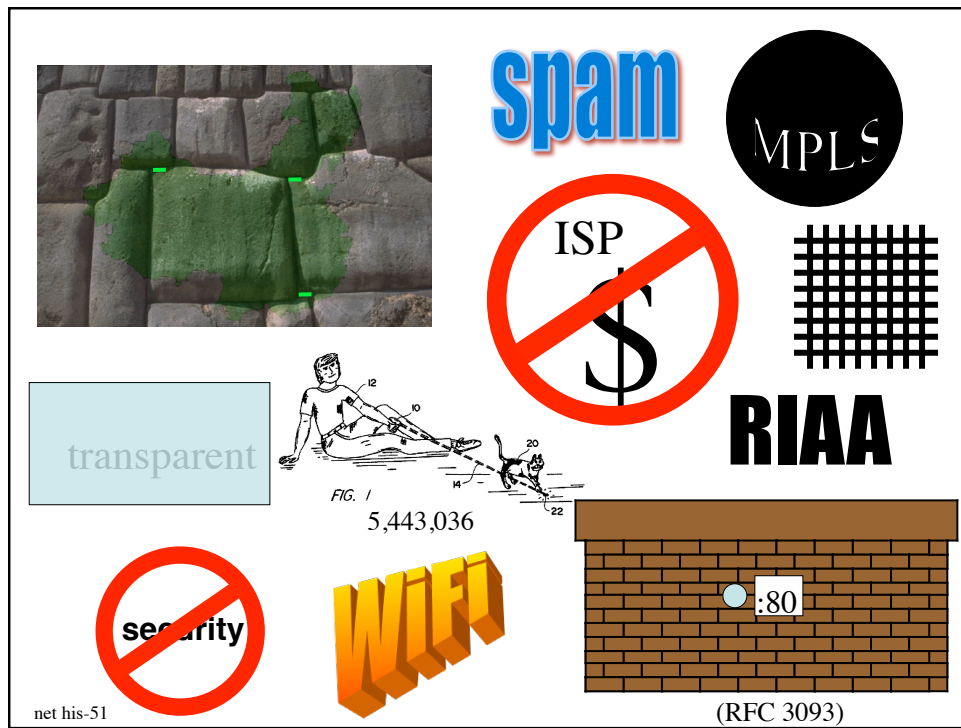
but would (does) **enable** innovation



net his-50

What is the Internet now?

net his-50



Alternate Future Histories?

net his-52

we built it so we own it!

Internal Revenue Service
DEPARTMENT OF THE TREASURY

far too important for the geeks

IP

"make sure it stays good"

world summit
on the information society
Geneva 2003 - Tunis 2005

FCC
FEDERAL COMMUNICATIONS COMMISSION
USA

European Commission

U.S. Department of Homeland Security

net his-53

verizon

content

BT

SBC

Qwest
Spirit of Service™

me2you

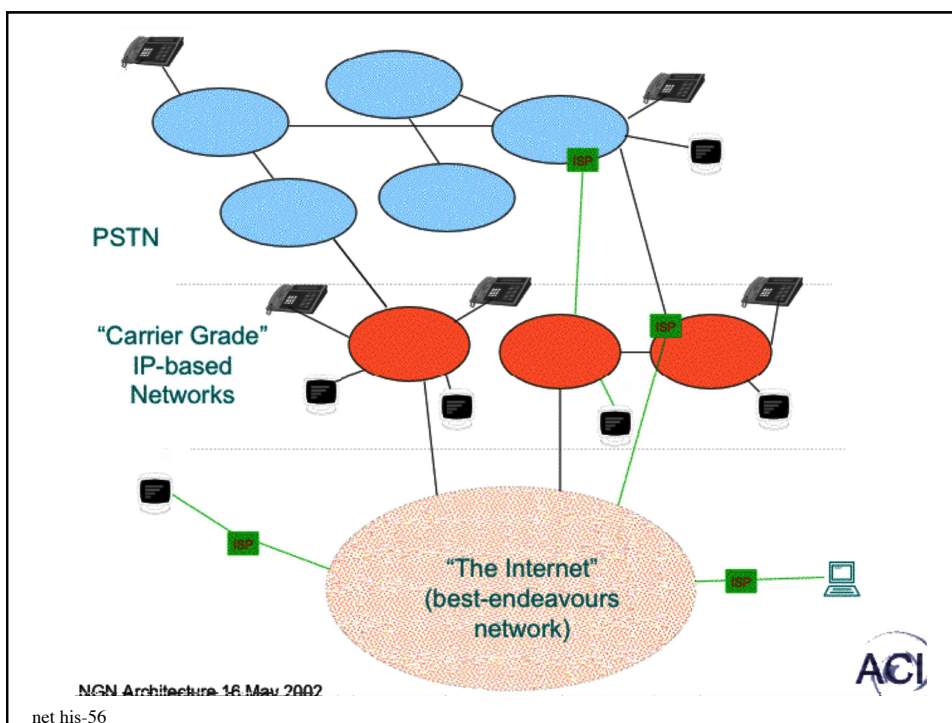
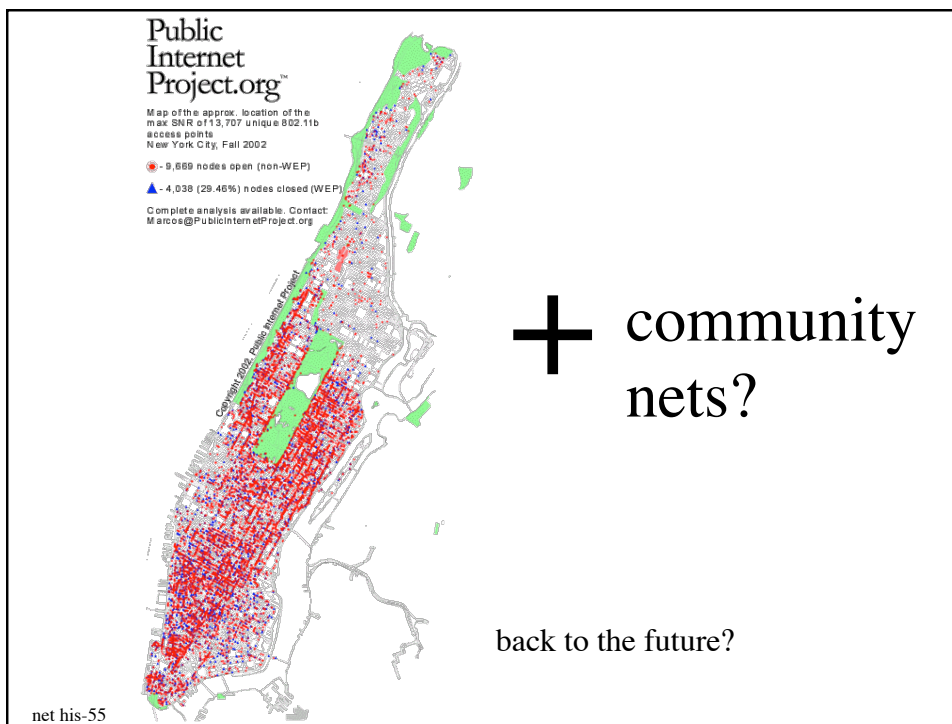
france telecom

VoD

BELLSOUTH

games

net his-54



Then again the ISPs might survive
to keep providing the Internet
rather than a Disney-controlled



as a driver, the Internet has quite a
future if there is any traditional
Internet in it

net his-57

next time? (or is it now?)

support **existing** networks

datagram-based

creating the **router** function

split TCP **and** IP

DARPA fund Berkeley to add TCP/IP to **UNIX**

CSNET and **CSNET/ARPANET** deal

NSF **require TCP/IP** on NSFnet

ISO **turn down** TCP/IP

NSF Acceptable Use Policy (**AUP**)

minimal regulation

**decisions that made
a difference**

net his-58

Some Current Decisions

path openness
standards?
security
privacy
ISP business model
regulations



or



net his-59

Key Open Questions

Who says who makes the rules?

Who says who pays for what?

watch out for WSIS
answering these questions



net his-60



net his-61

it is **NOW**
(and it is us)

I' m pessimistically optimistic

net his-62

