

# A Short History of the Internet

NANOG

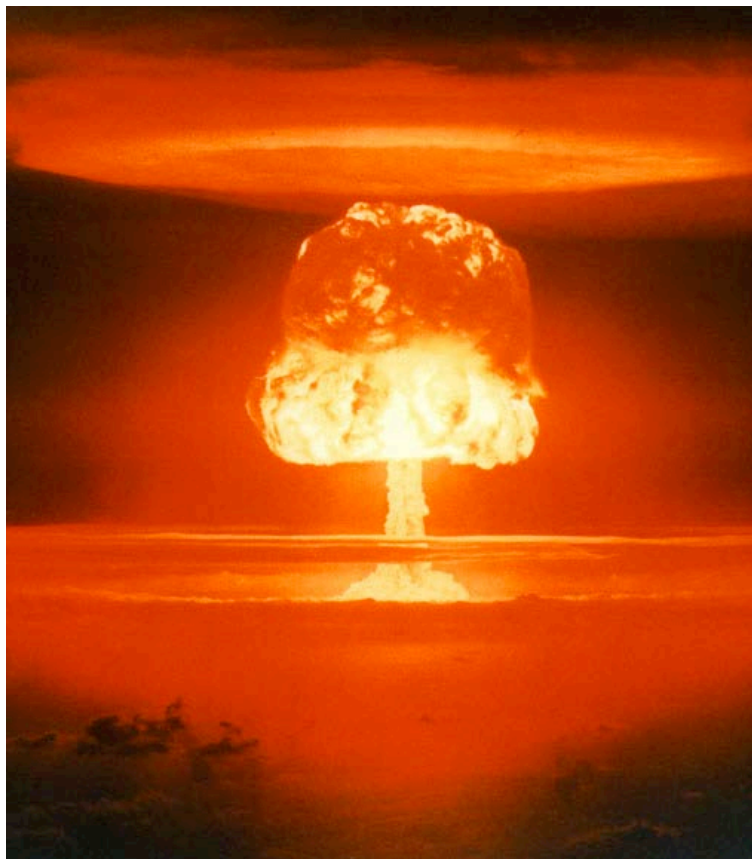
February 9, 2003

Scott Bradner

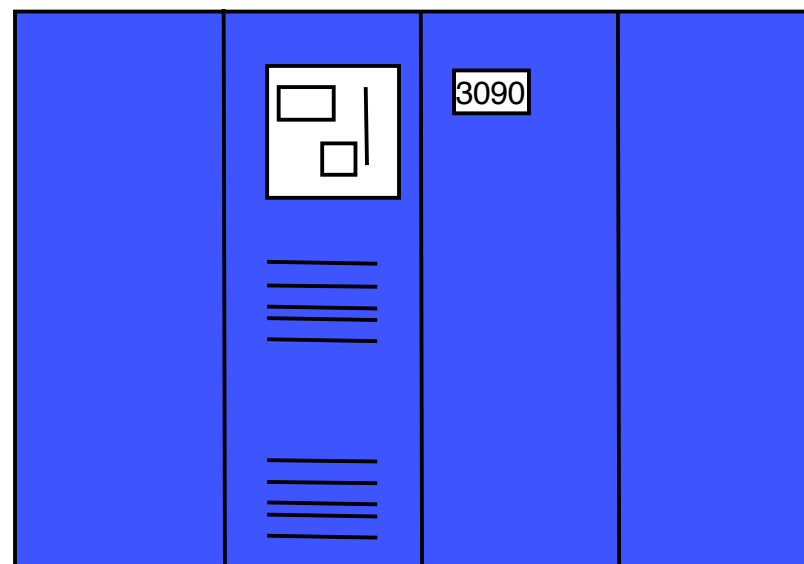
Harvard University

sob@harvard.edu

# Why?



or



What was there?

# **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

# 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

So, Lets Make (Not Build) our own

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



# Make What?



- 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**

**e2e!**

# 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)

What did *they* think the Internet was?



by definition



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



# 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

# 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

# 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!**

# 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:

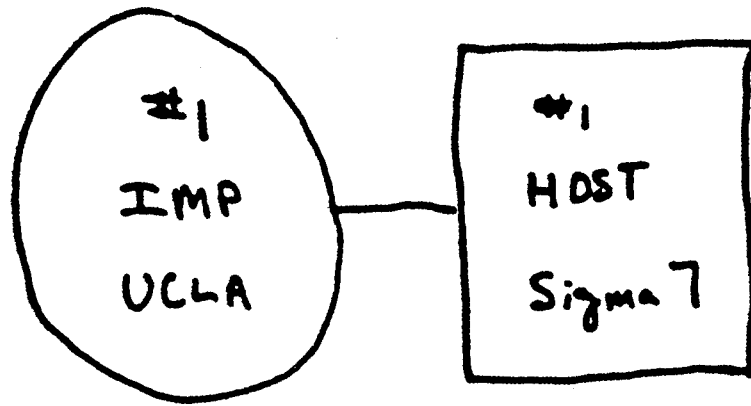
you will pay more every time to make the service better  
some of the time

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

IT managers: yes, real world: ???

e.g. VoIP in enterprises

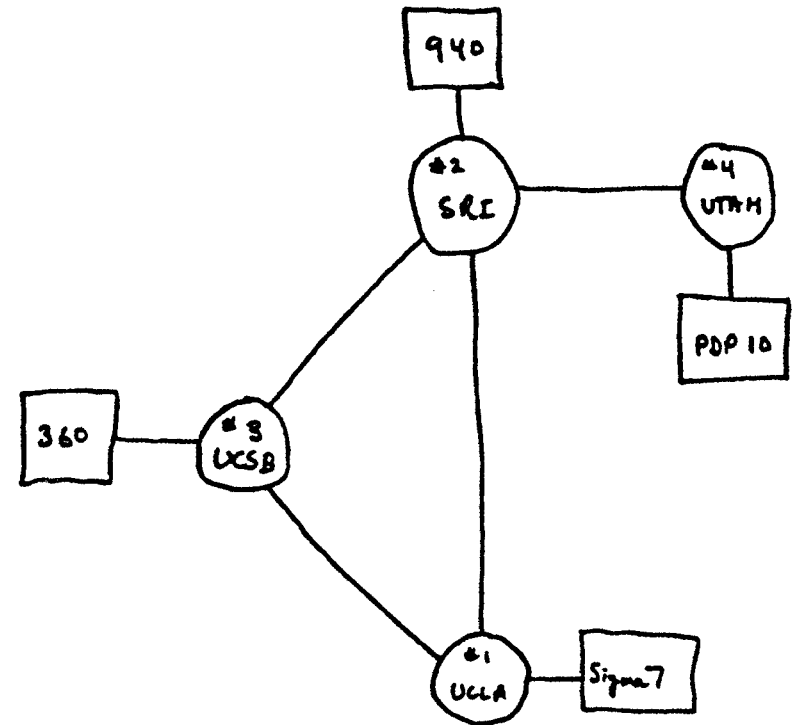
# obligatory topology maps



THE ARPA NETWORK

SEPT 1969

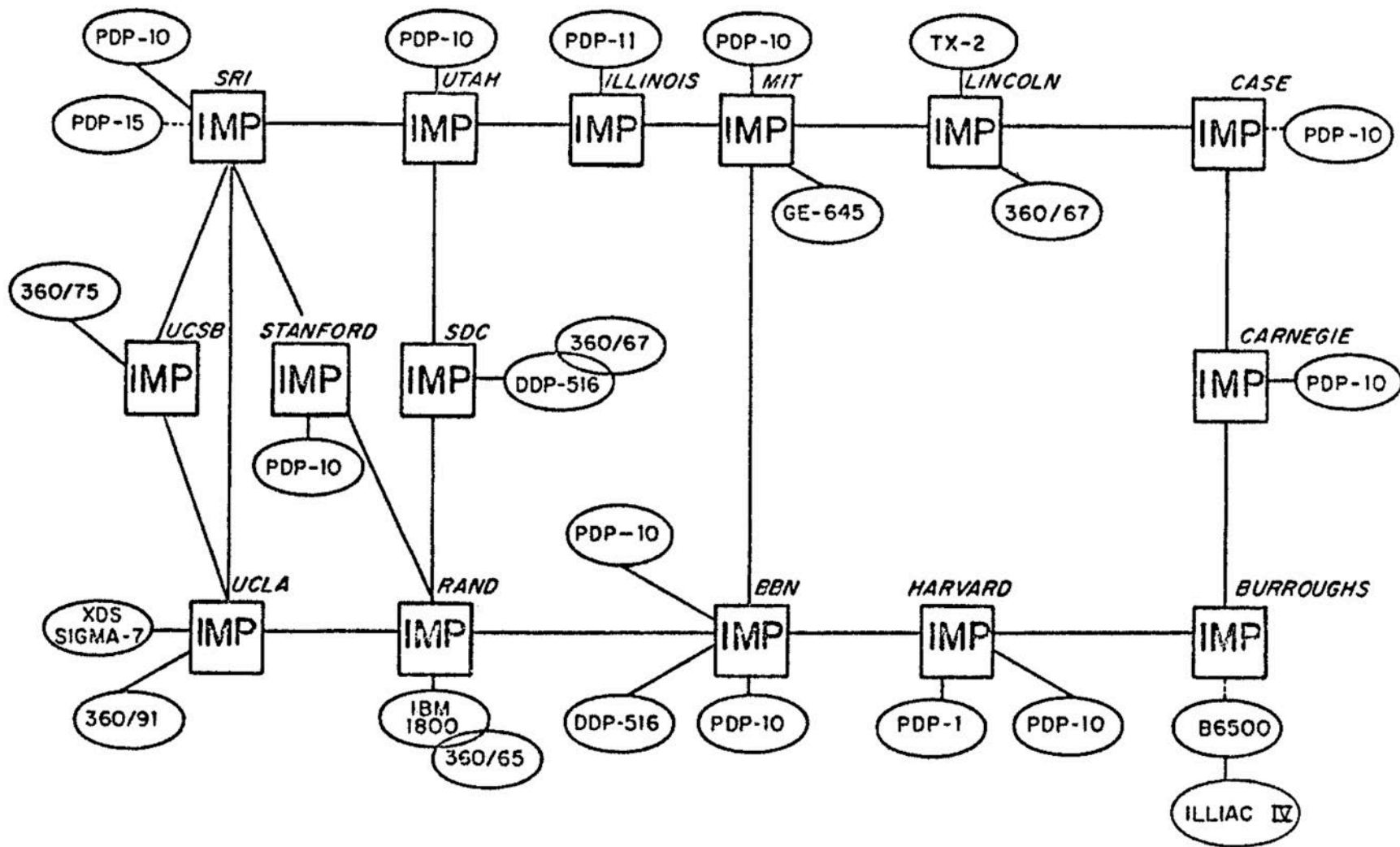
1 NODE



THE ARPA NETWORK

DEC 1969

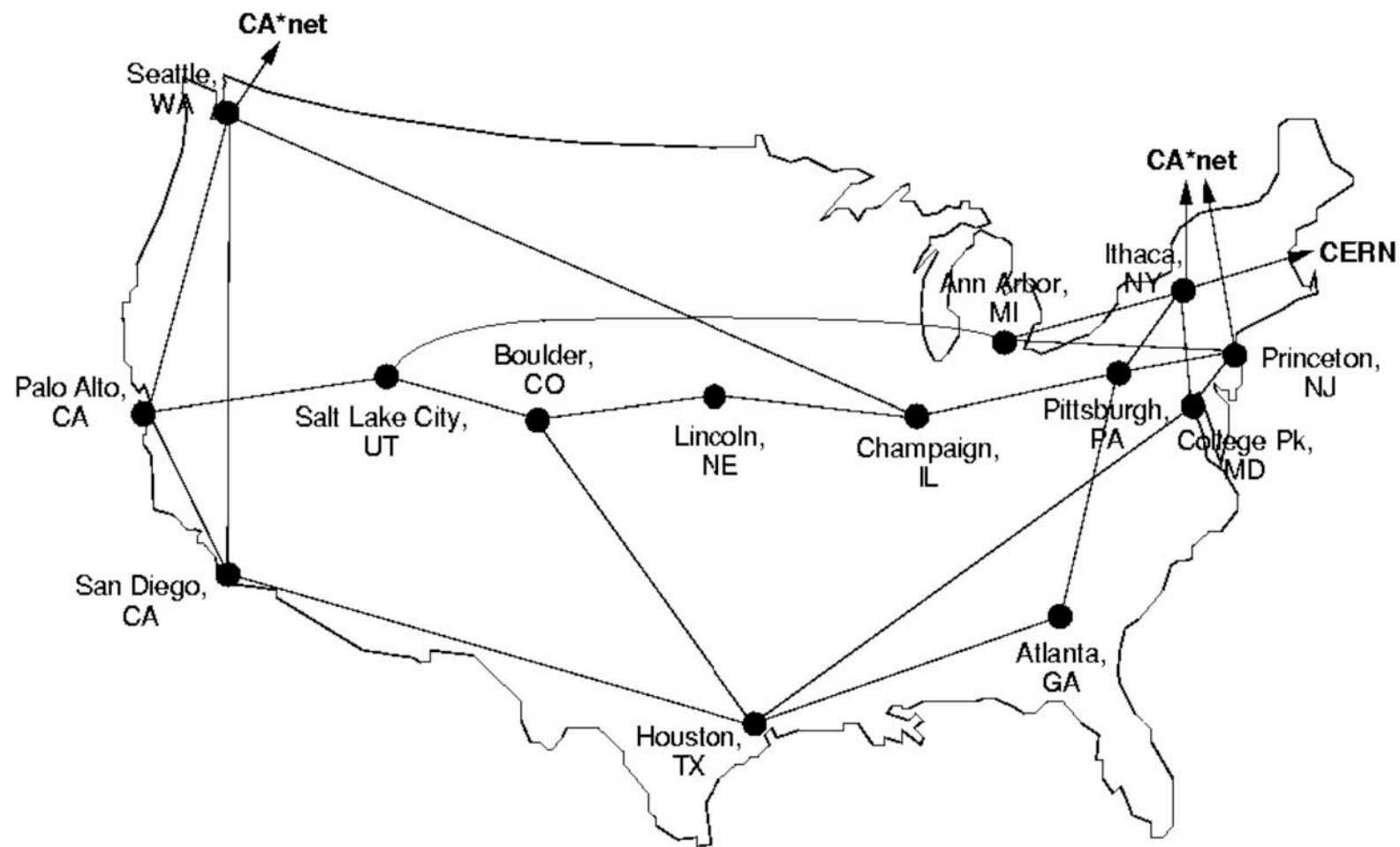
4 NODES



ARPANET 1971



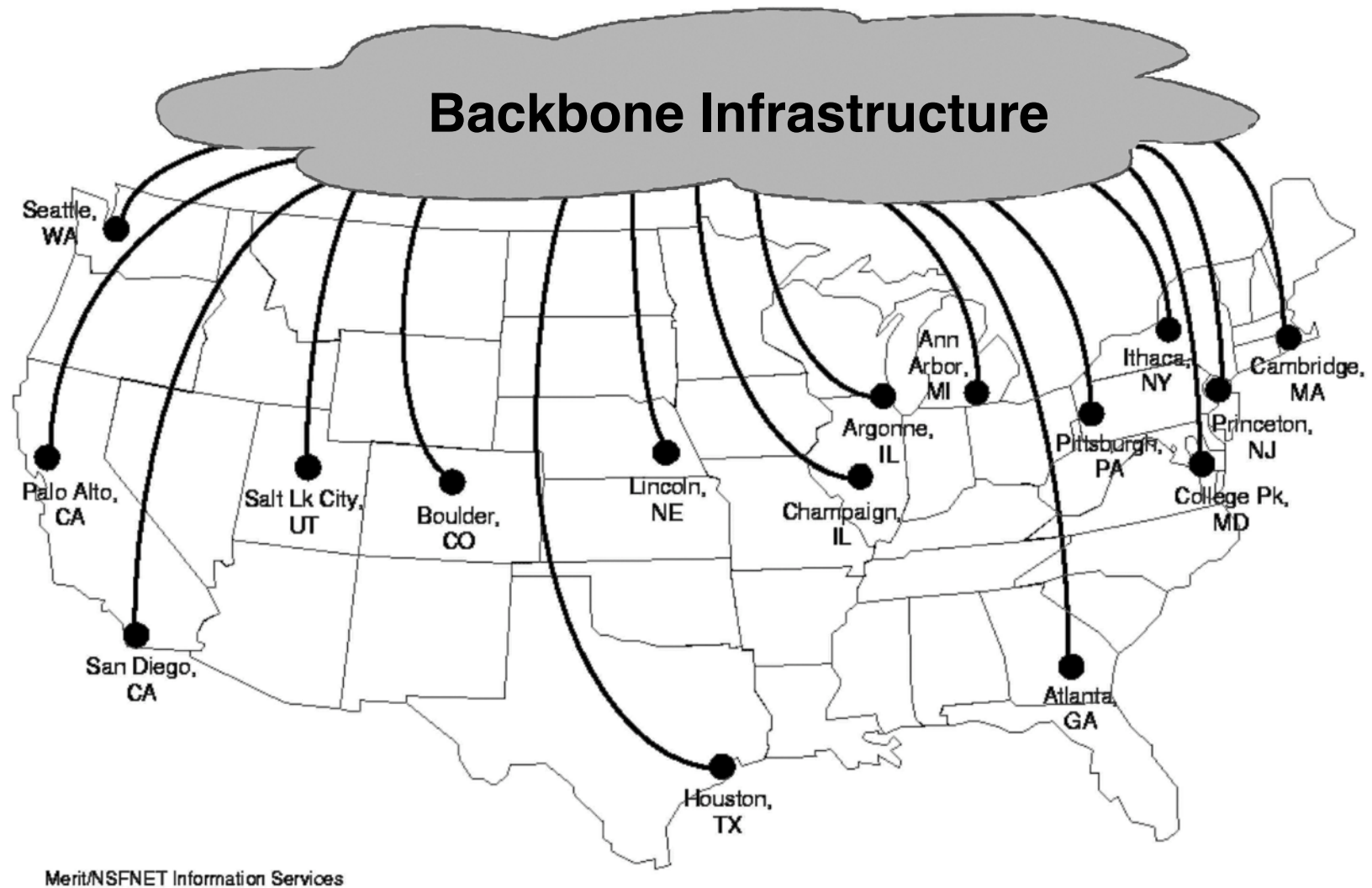




© Merit Network, Inc.

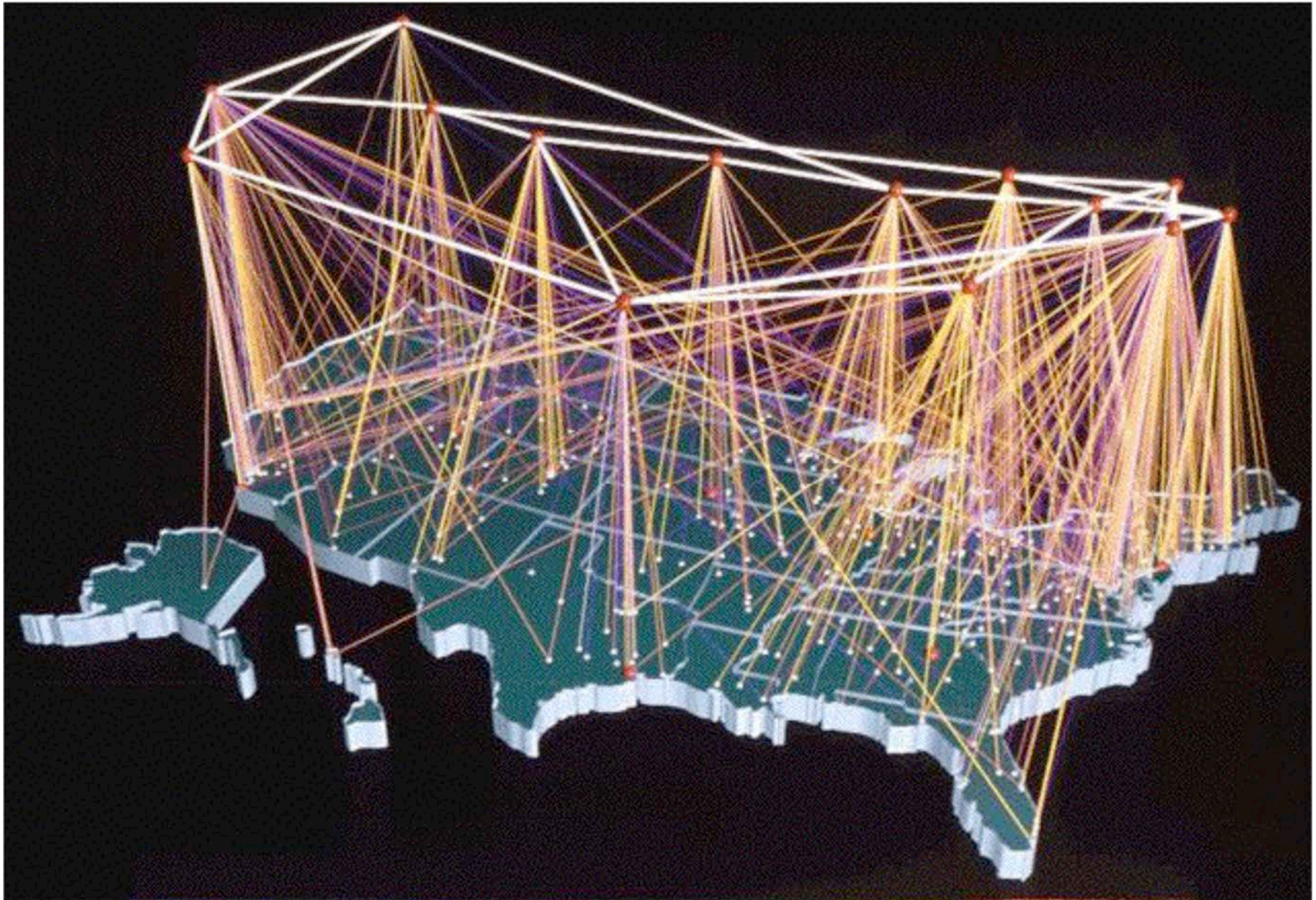
NSFNET T1 1991

minus regional nets

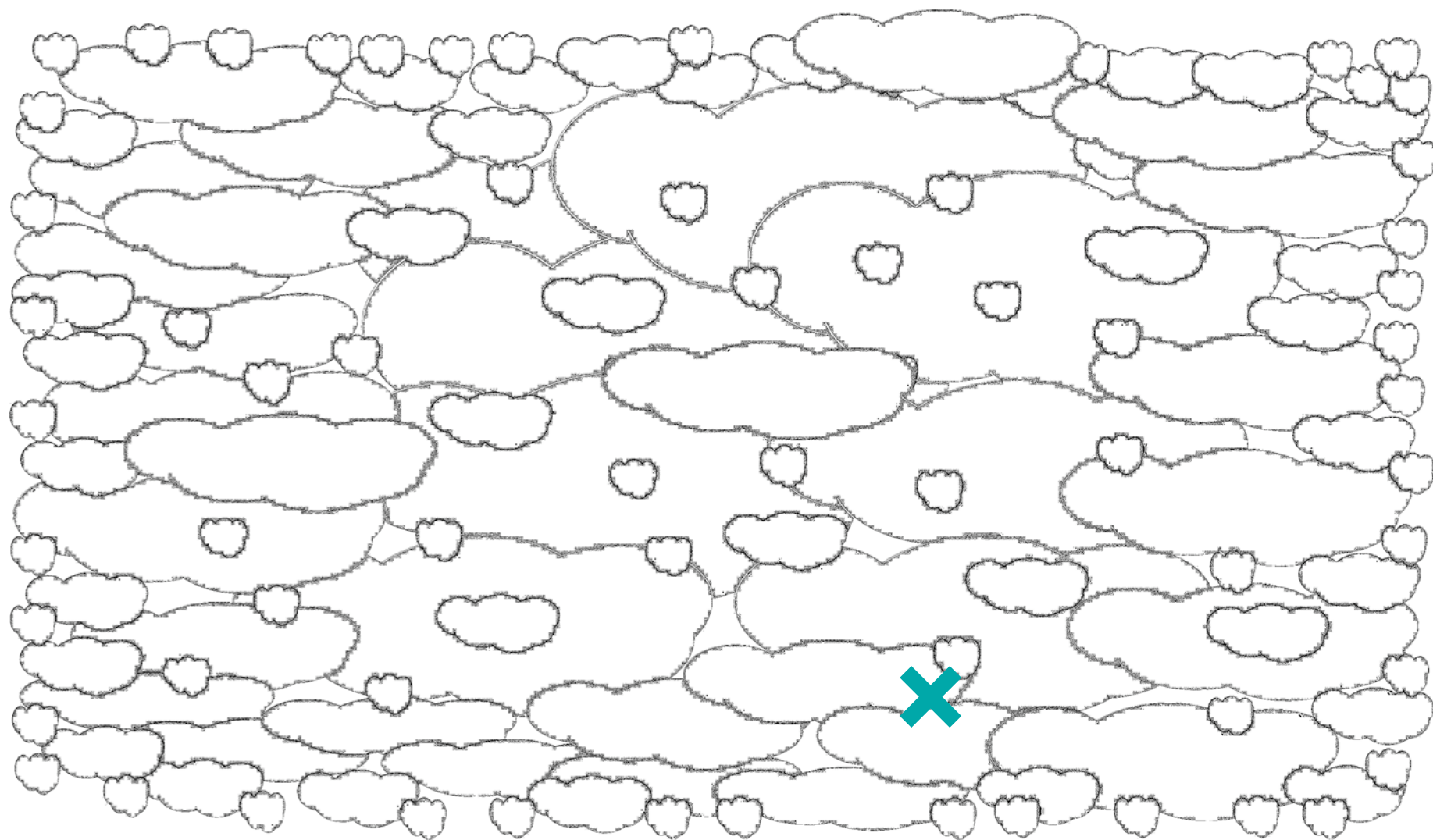


Alternate view 1991






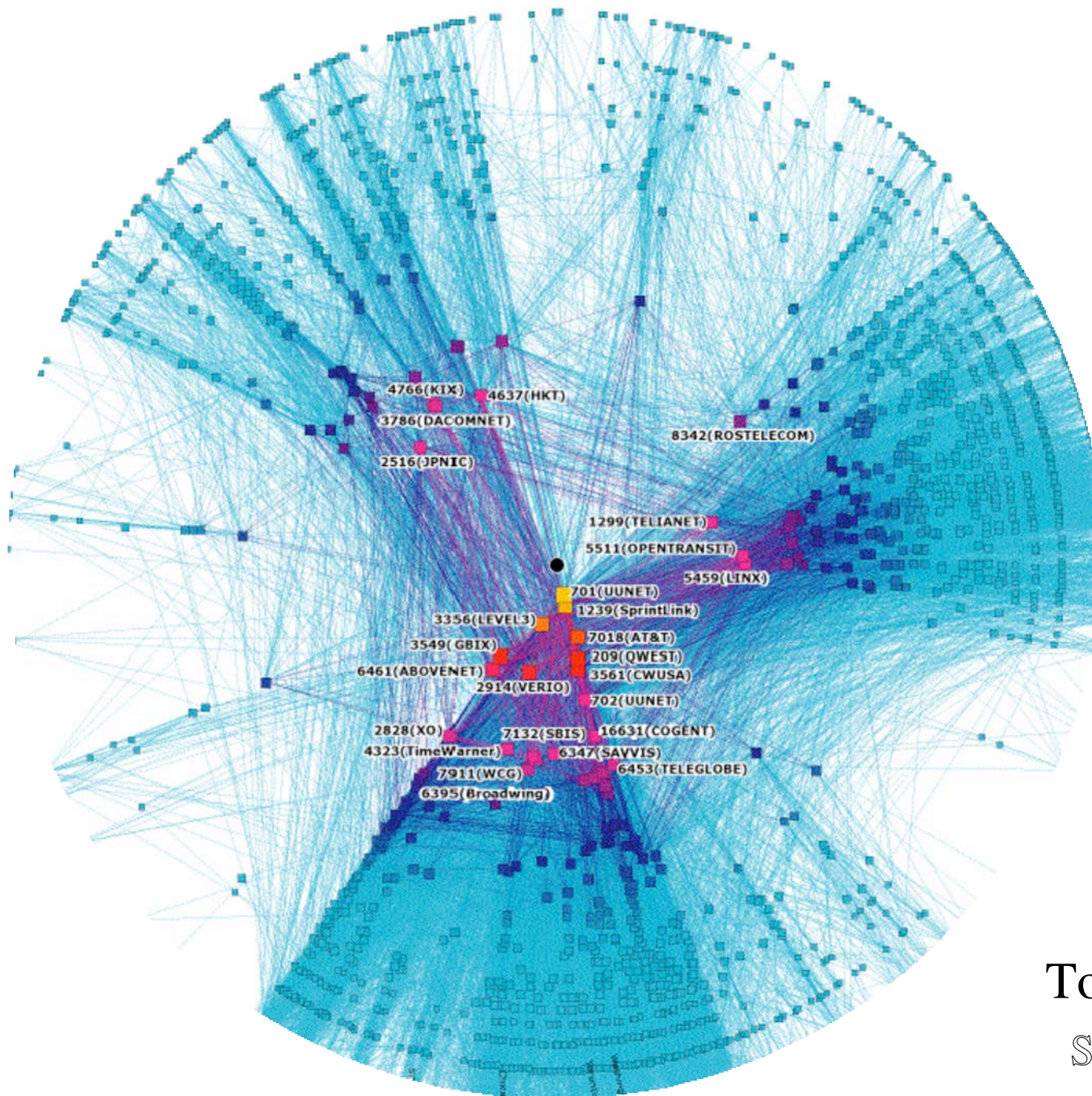
NSFNET PR graphic



Today v1

 you are here





Today v2  
SKITTER

# Psychological Time Line

## Part 1



geeks

geeks and students

IBM

digital

business



NBC TV



mom!

WWW

1970

1988

1997

# Psychological Time Line

## Part 2

everything  
IP

metronets

“irrational  
exuberance”

“traffic doubling  
every 3 days”



VCs

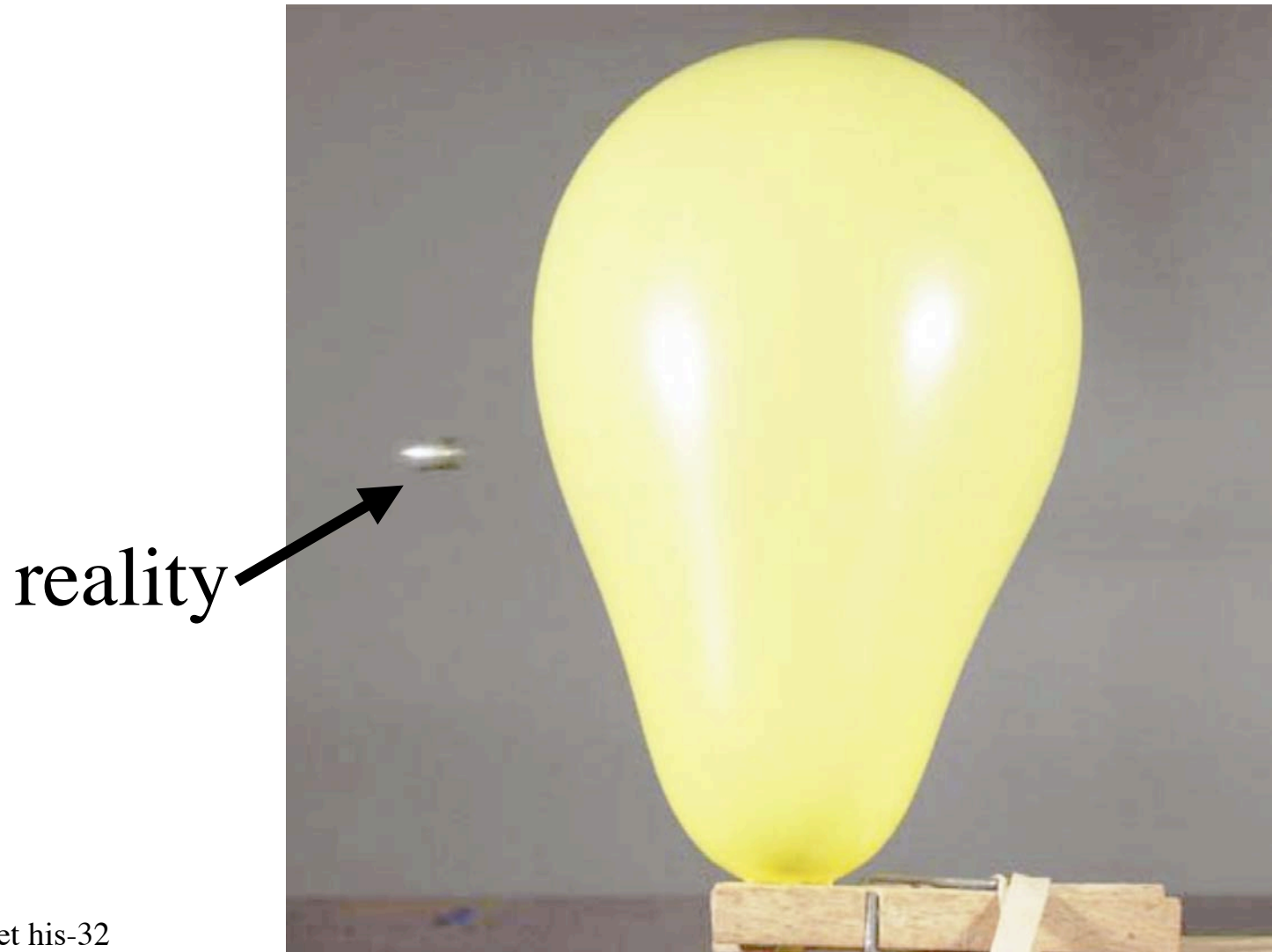
mom!

1998

2000

# Psychological Time Line

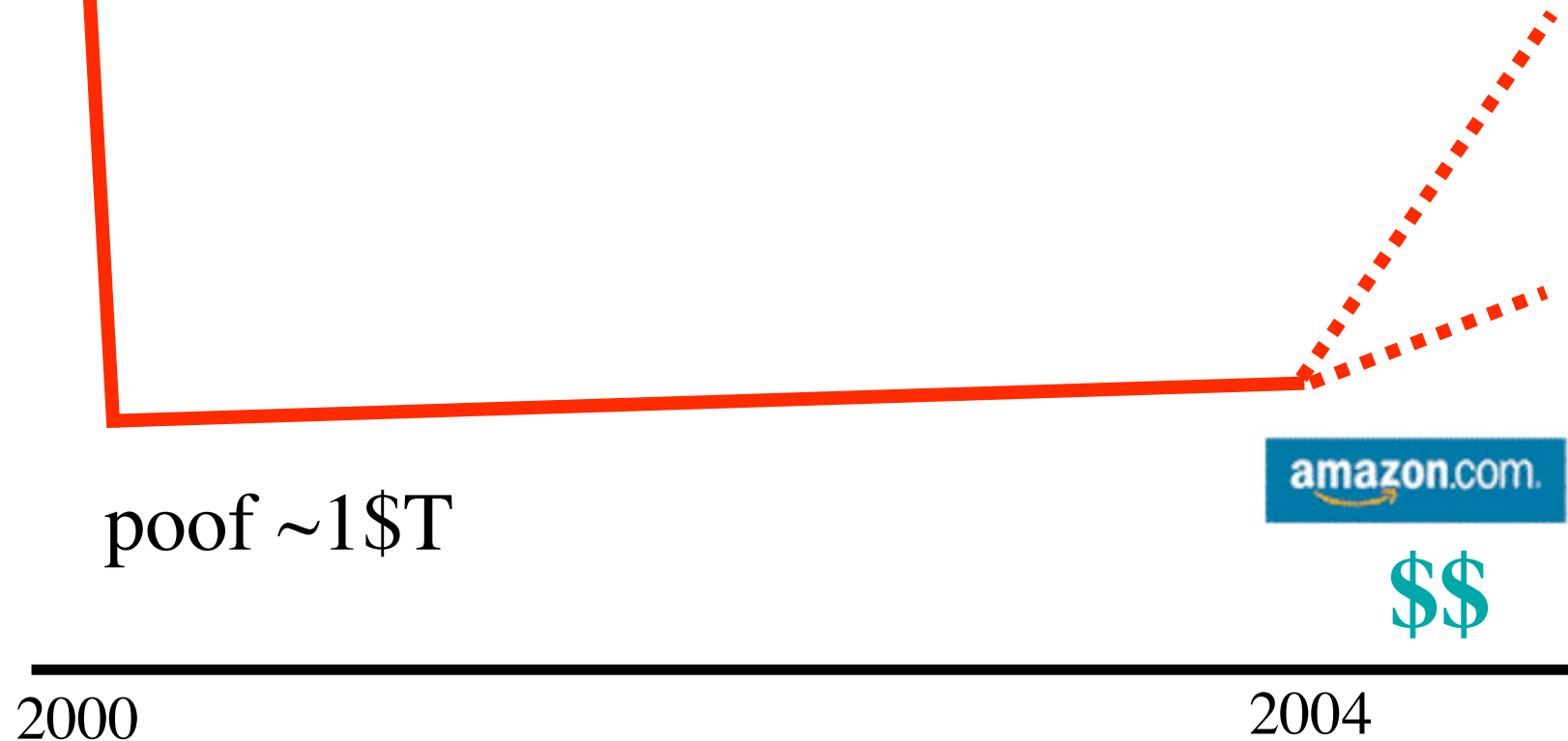
## Part 2 - in retrospect





# Psychological Time Line

## Part 3



diversions

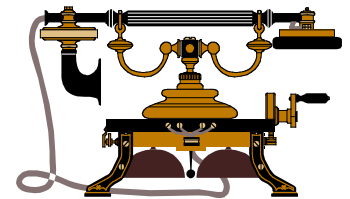
*“he has an out of balance ego to clue ratio”*

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



OSI is the answer, what  
was the question?



various governments  
and corporations

GOSIP



Internet collapse  
imminent - .gif at 11



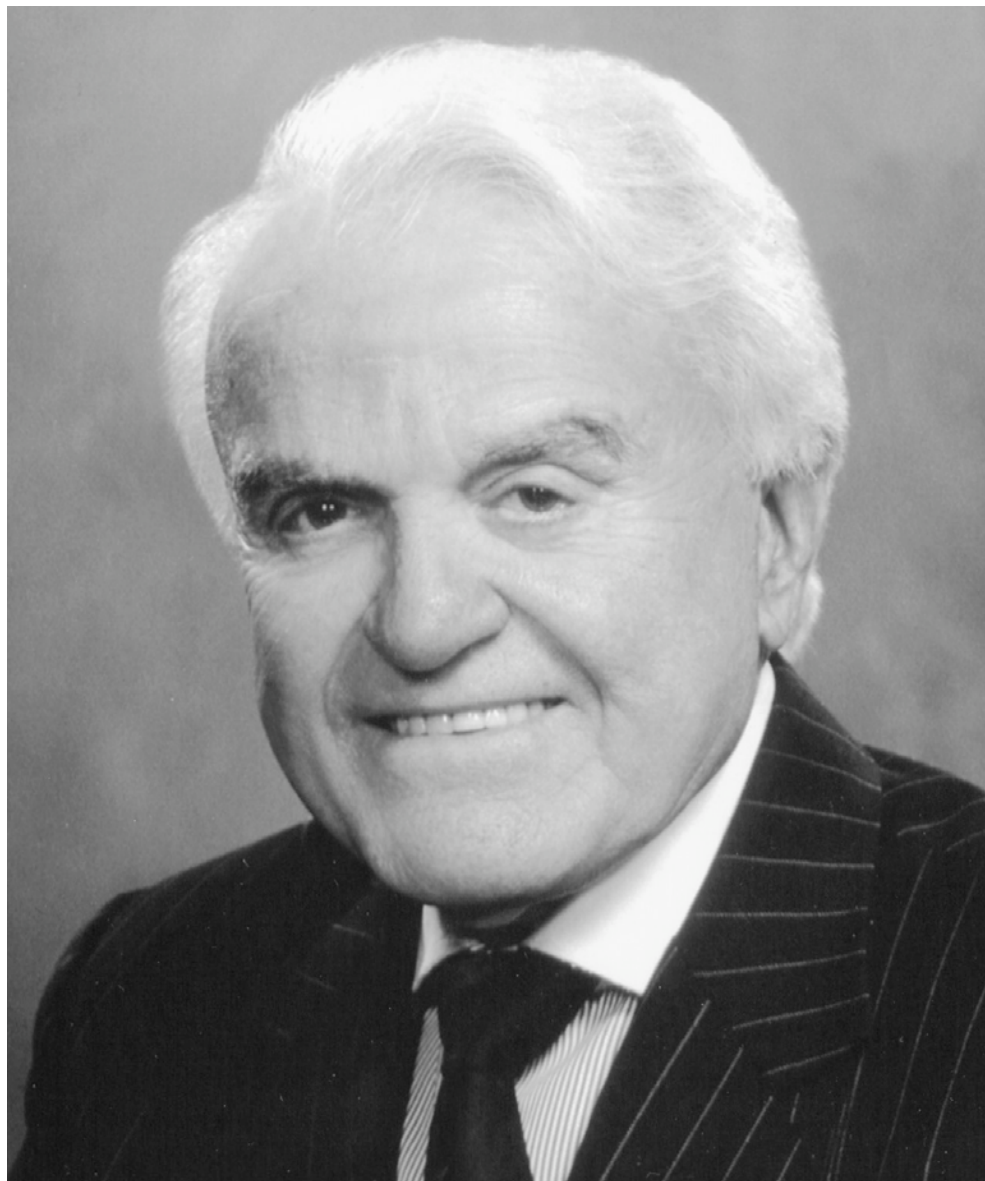
Bob Metcalfe  
ex-pundit

ATM is the answer, do  
we need a question?



John McQuillan  
one of the idle rich

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



what makes you  
think you own the  
movie you bought?



Jack Valenti  
president & CEO MPAA



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

Michael Eisner  
chairman, Walt Disney







the answer is  
National Security  
but the question is  
secret



John Ashcroft  
US Attorney General

# Innovation?

## 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.**”*

# Imitation

good for learning  
but one needs to move  
beyond



# New Inet (since 1900) Applications

**web**

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

**remote login**

data transfer, storage

commerce

audio & video

search

content

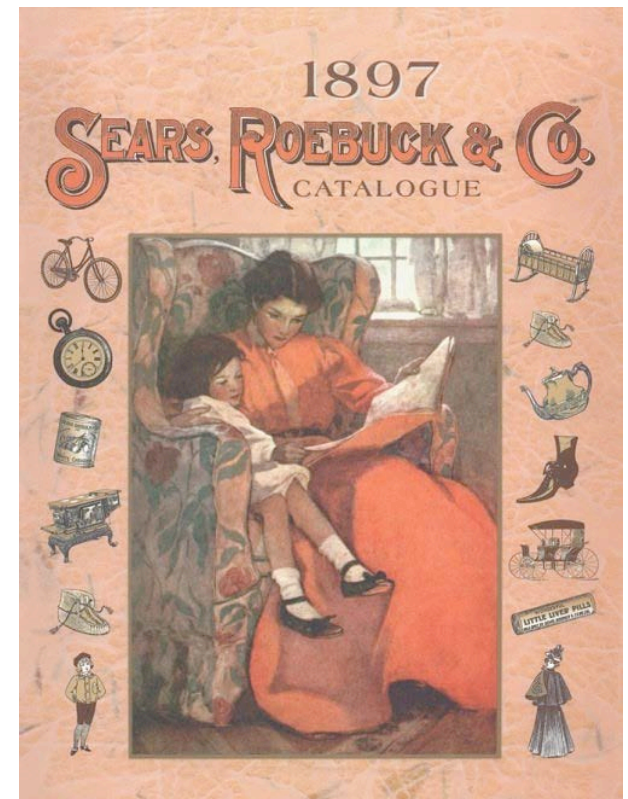
# How Important is the E?

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

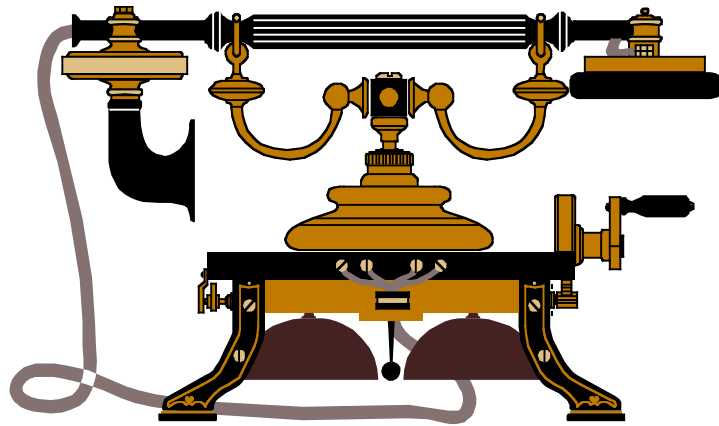
i.e., not just Sears, Roebuck & Co. with near-instant gratification & better indexes

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

important, yes - but innovative?



# IP Telephony or Internet Telephony?



---

IP

or

---

IP

voice

“make sure it stays good”

“it is good enough”

ITU & others want to “define” voice over IP

but no way to know what it *will* be



# “New” Networks

Sprint conversion to ‘packet’ technology

(the quotes were in the Nortel 2001 press release)

Verizon, SBC and BellSouth FTTH

but what technology?





# What Would Be Innovative?

how about Internet Telephony  
with

smart voice terminals

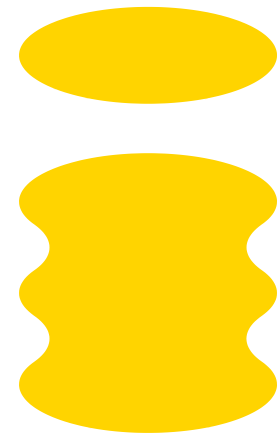
downloadable applications

**open** to the Internet

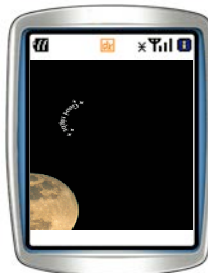
standard open protocols

actually this is **not** innovation

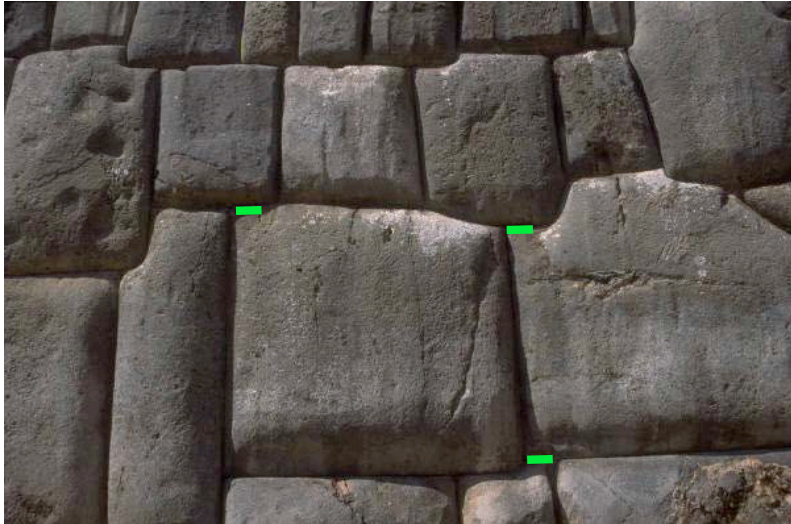
but would (does) **enable** innovation



**M O D E**



What is the Internet now?



spam

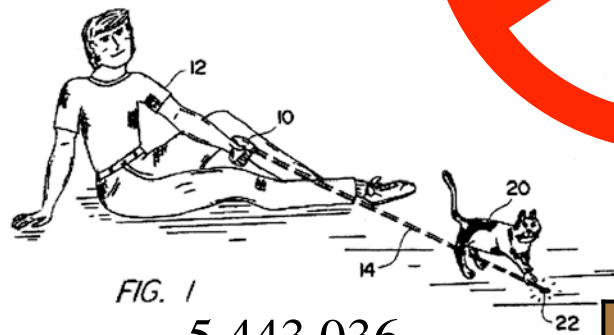
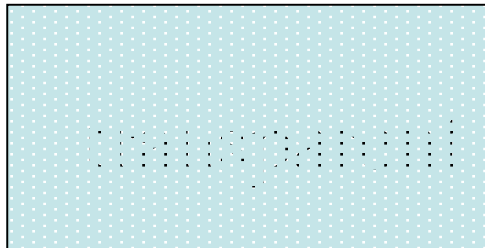
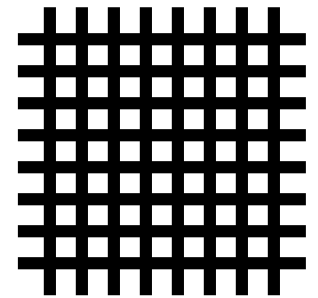
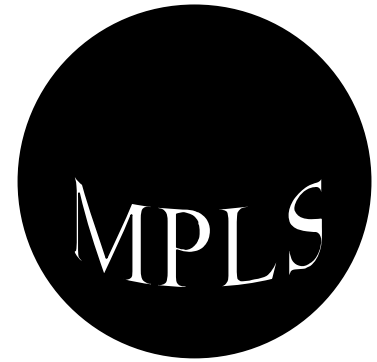
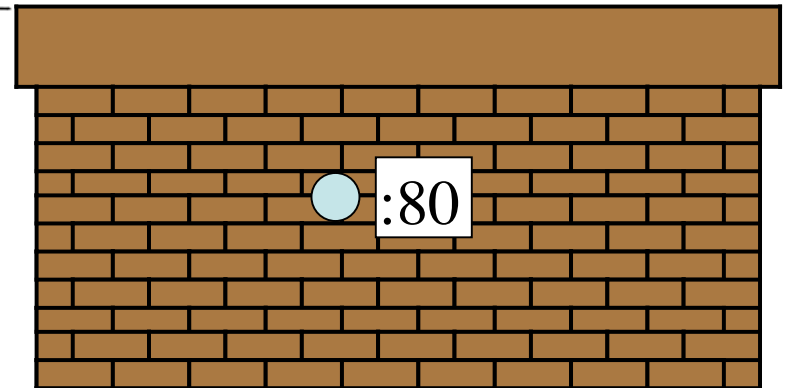


FIG. 1  
5,443,036

RIAA



WIFI



# Alternate Future Histories?

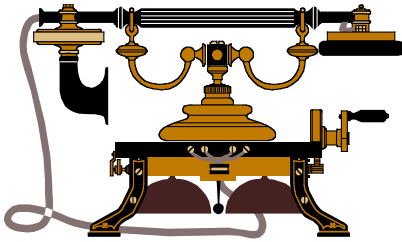


**we built it so we own it!**



**Internal Revenue Service**

DEPARTMENT OF THE TREASURY



**IP**

*far too important for the geeks*



world summit  
on the information society  
Geneva 2003 - Tunis 2005



*“make sure it stays good”*





content



Qwest



*Spirit of Service™*



VOD

@ Bellsouth

games  
games

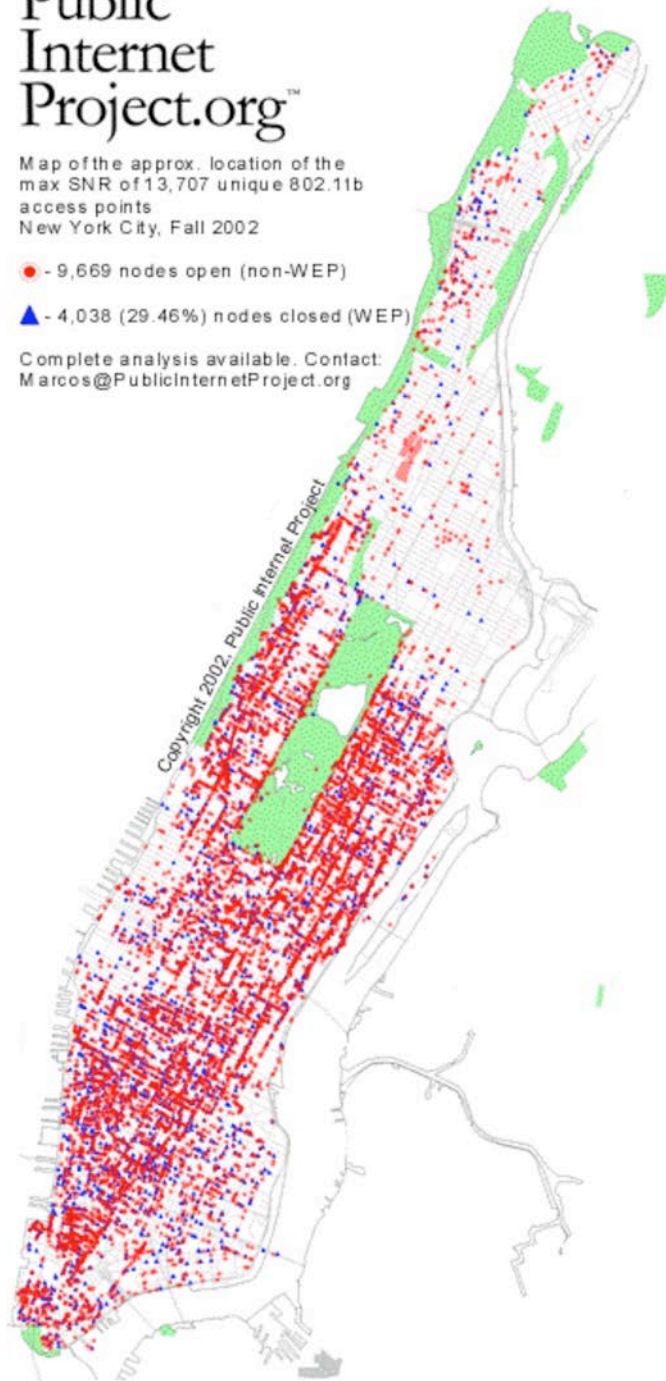
# Public Internet Project.org™

Map of the approx. location of the  
max SNR of 13,707 unique 802.11b  
access points  
New York City, Fall 2002

● - 9,669 nodes open (non-WEP)

▲ - 4,038 (29.46%) nodes closed (WEP)

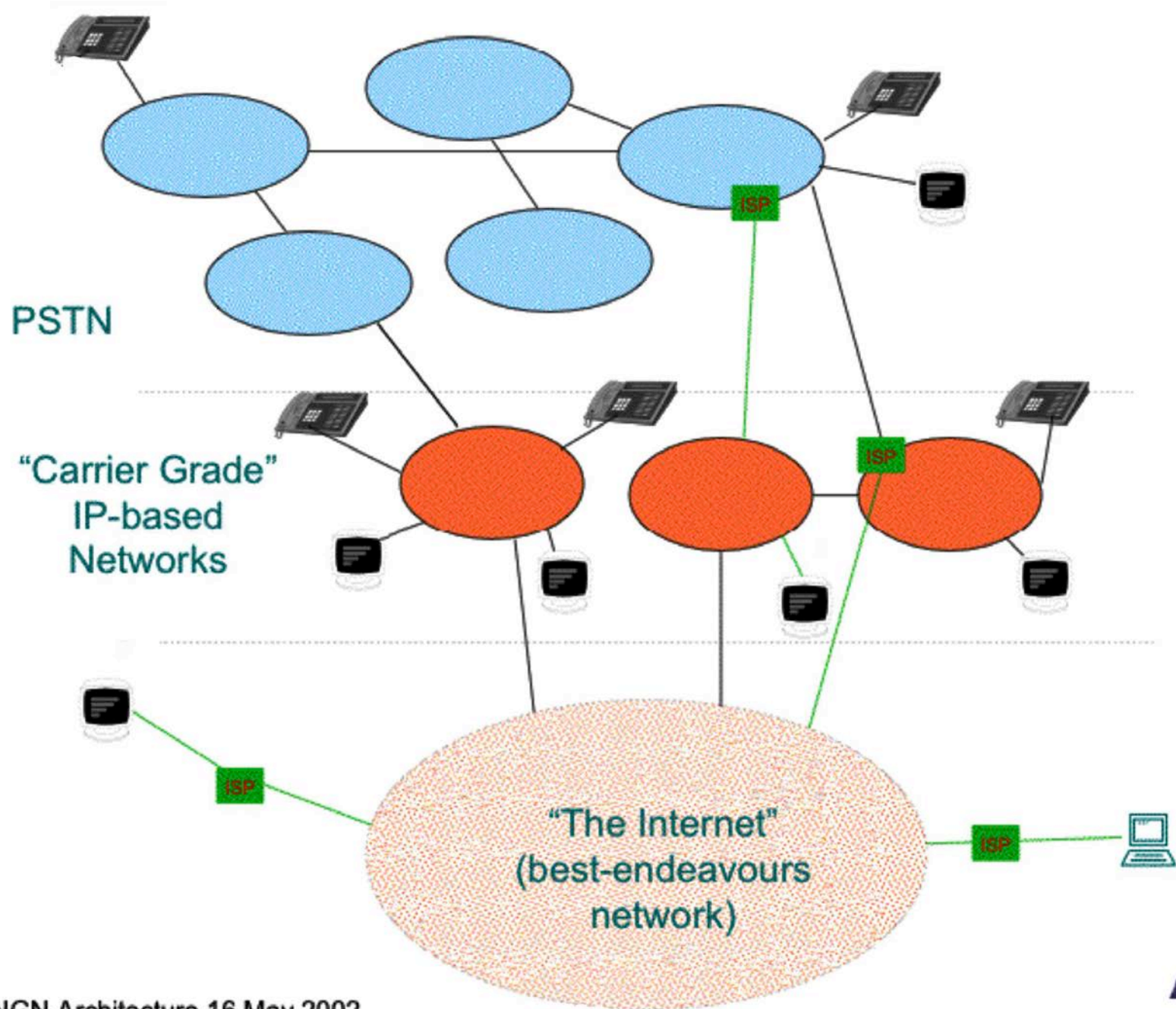
Complete analysis available. Contact:  
Marcos@PublicInternetProject.org



+ community  
nets?

back to the future?





NGN Architecture 16 May 2002





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

# 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**

# Some Current Decisions

path openness

standards?

security

privacy

ISP business model

regulations



or



# Key Open Questions

**Who says who makes the rules?**

**Who says who pays for what?**

watch out for WSIS  
answering these questions





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

I'm pessimistically optimistic

net his-63