This Internet Thing

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22 October 2005

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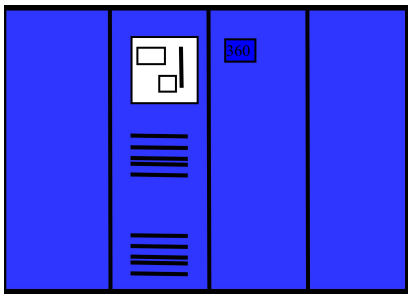
The Original Reason(s)

or



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What to Do?

use self-describing packets

connect existing networks

design for

- survivability
- to support multiple types of communications
- over a variety of network types
- with distributed management
- cost effectiveness
- low cost attachment
- accounting for use of resources

!security
!QoS
!efficiency

The Design Philosophy of the DARPA Internet Protocols - Dave Clark nms.lcs.mit.edu/6829-papers/darpa-internet.pdf

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What Else?

support diverse technologies

use global "internetwork" addresses

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Architectural Principle

e2e

let the ends do it

(or control it)

let the user decide

(a.k.a., The Stupid Network)

End-to-End Arguments in System Design - Saltzer, Reed & Clark
http://web.mit.edu/Saltzer/www/publications/endtoend/endtoend.txt
The Rise of the Stupid Network - David Isenberg http://www.isen.com/stupid.html

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But!

no QoS!

no business model!

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QoS

can you sell better QoS at a higher price?

multiple levels per customer

"the Internet is not reliably crappy enough"

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

Mike O'Dell

IAD = IQ test

enterprise VoIP?

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ISP Business Model

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

and ISP does not profit from applications using network - i.e., Internet is a commodity

"We do not know how to route money" Dave Clark

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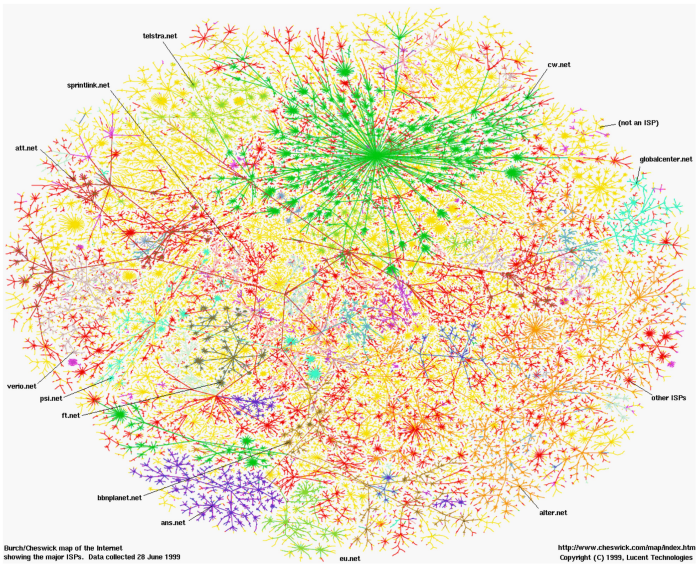
Internet Architecture



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Thus

Internet & IP networks

by definition - to traditional networking folk

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History of the Internet

some bees do fly

Psychological Time Line: Part 1

mom!

IBM

digital

business

CSNet

NBC TV

WWW

geeks

geeks and students

1970 1981 1988 1997

Psychological Time Line: Part 2

"irrational exuberance"

everything IP

metronets

"traffic doubling every 3 days" (or something like that)

amazon.com.

VCs

mom!

1998

2000

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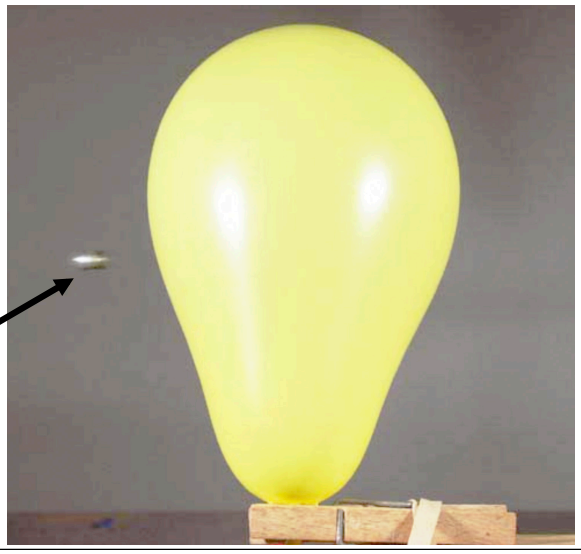
Part 2 - in retrospect

reality



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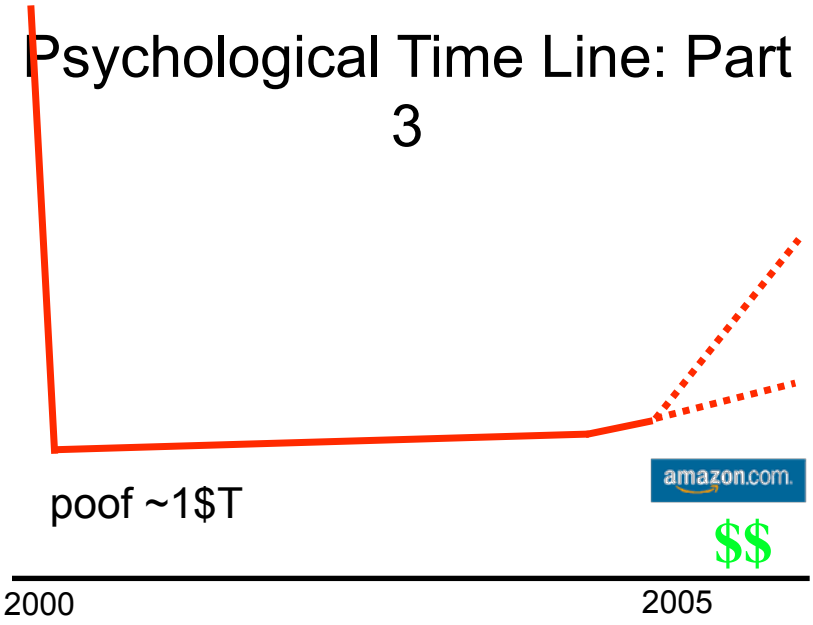
Psychological Time Line: Part 3



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Psychology and reality may not be the same thing (some other trends)

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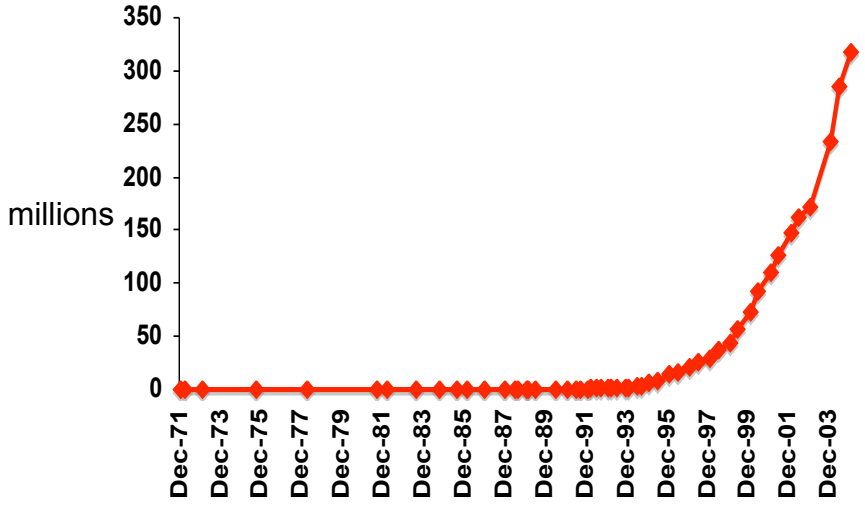
Internet Hosts



http://www.mit.edu/people/mkgray/net/
http://www.oclc.org/research/projects/archive/wcp/stats/size.htm
http://news.netcraft.com

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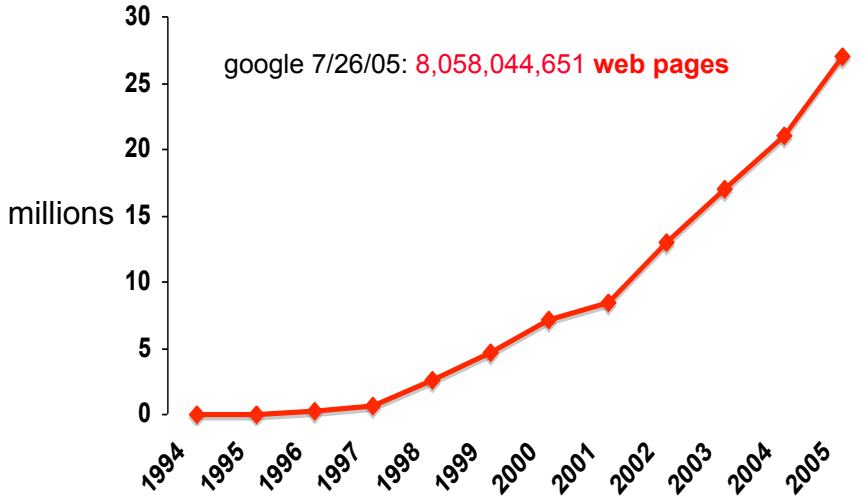
Active Web Sites



http://www.mit.edu/people/mkgray/net/
http://www.oclc.org/research/projects/archive/wcp/stats/size.htm
http://news.netcraft.com

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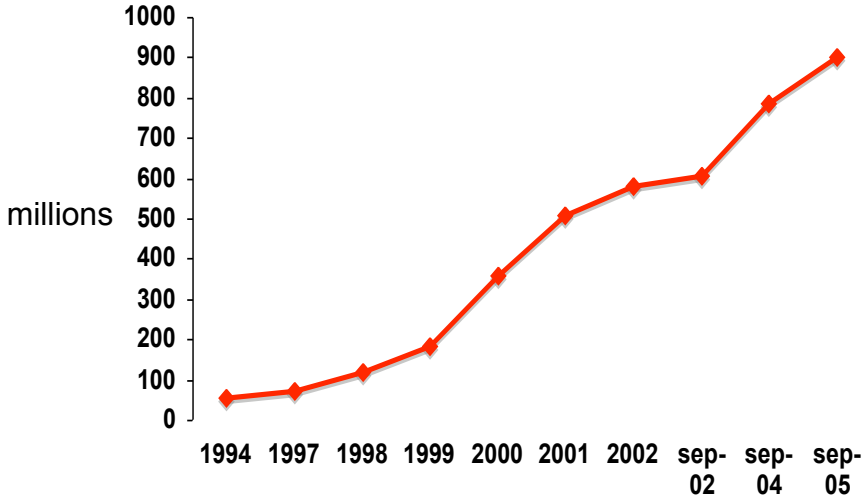
Internet Users



http://www.esa.doc.gov/TheEmergingDigitalEconomy.cfm
http://www.esa.doc.gov/DigitalEconomy2003.cfm (2002 & 2004 are estimates)

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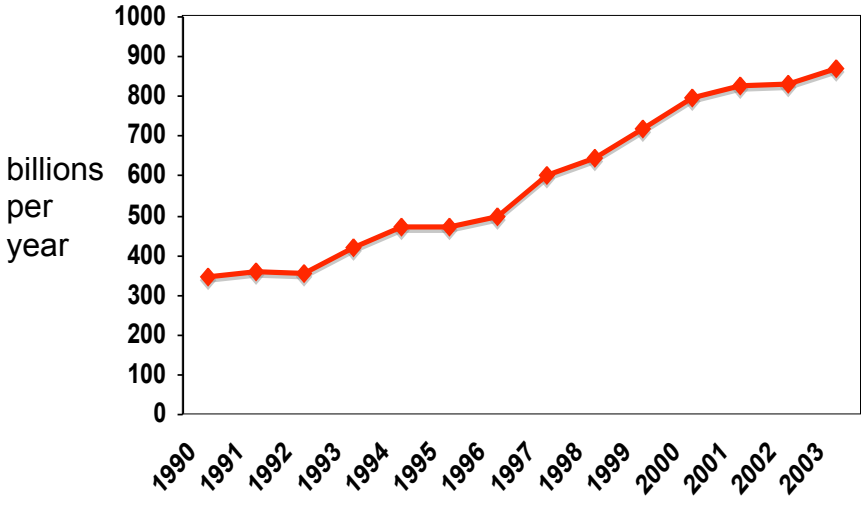
U.S. Information Technology



http://www.esa.doc.gov/TheEmergingDigitalEconomy.cfm
http://www.esa.doc.gov/DigitalEconomy2003.cfm (2002 & 2003 are estimates)

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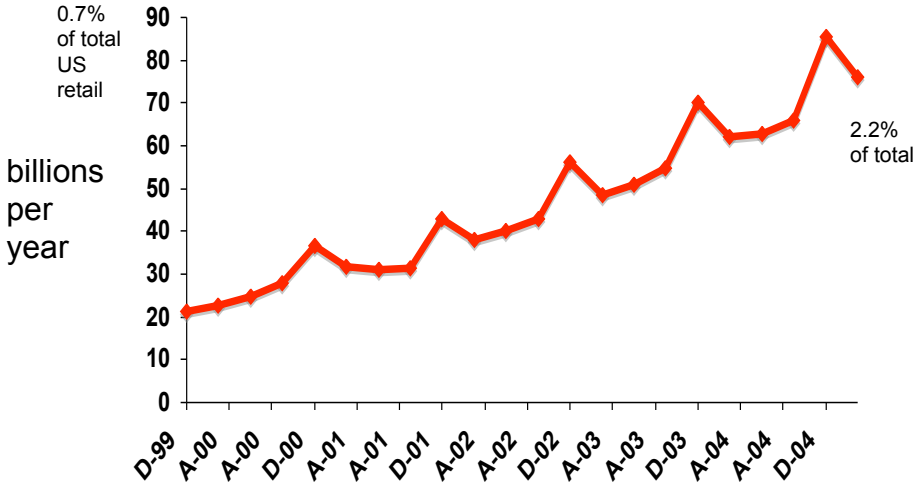
U.S. Retail E-Commerce



http://www.census.gov/estats

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So, the real IT/Internet world did not end

(but the ride did cost a $T or so)

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But

some people do not believe in flying bees

need to fix the Internet

- to make it as reliable as the phone net
- to make it as secure as the phone net
- to make it as controllable as the phone net
- to make it as profitable as the phone net

Current Alternative

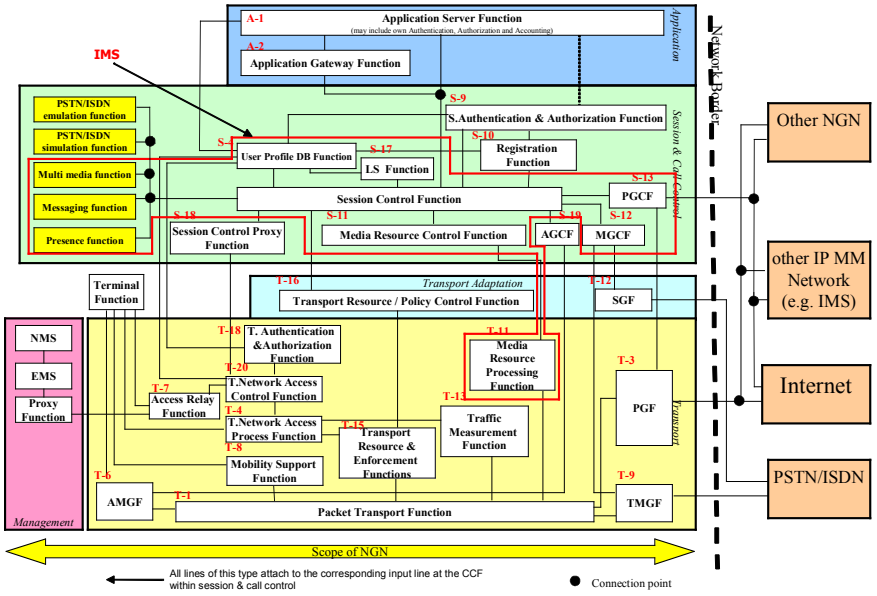
Intelligent Network (IN)

let the carrier do it

(or control it)

carrier decides

Future Alternative: ITU-T?



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No E2E

alternatives assume carrier involvement in application use of the network

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Regulations

current list of effective US government regulations on the Internet

- ~~traditional fraud/business regulations~~
- ~~CANSPAM~~
- ~~CDA~~
- DNS squatting
- ~~anti porn~~
- ...

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Regulatory Approaches

openists

- net must be open to enable *innovation commons*
  - require *network neutrality*
    - e.g., power grid does not favor toasters
- to let people at edge/end innovate **e2e**
- mandatory *dumb pipe* available

deregulationists

- if network is property then companies will innovate
  - note: "property" specifically includes right to exclude
- network owner needs incentive to invest **IN**
- forced *smart pipe* OK

The Broadband Debate: A User's Guide - Tim Wu http://ssrn.com/abstract=557330

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FCC

4 "principles" (5 August 2005)

- *consumers are entitled to access the **lawful** Internet content of their choice*
- *consumers are entitled to run applications and use services of their choice, **subject to the needs of law enforcement***
- *consumers are entitled to connect their choice of legal devices that **do not harm the network***
- *consumers are entitled to competition among network providers, application and service providers, and content providers*

http://hraunfoss.fcc.gov/edocs_public/attachmatch/FCC-05-151A1.pdf

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FCC: CALEA

Internet & interconnected VoIP providers subject to CALEA (wiretapping) law

- VoIP provider "*must necessarily use a router or other server*" thus is facilities-based

logic in FCC Order & principles logically leads to a requirement that the FBI pre-approve applications

- something they requested

http://hraunfoss.fcc.gov/edocs_public/attachmatch/FCC-05-153A1.pdf

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U.S. House

House Energy and Commerce Committee draft
covers BITS, VoIP & video providers
preempt state & local regulations
all types of providers must register with govt.
requires BITS providers to

provide subscribers with access to lawful content, applications, and services provided over the Internet, and to not block, impair, or interfere with the offering of, access to, or use of such content, applications or services

http://energycommerce.house.gov/108/News/09152005_staff_disc.pdf

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Non Transparent Net

transparency of end2end network mostly gone

- enterprise edge issues
  - NATs, firewalls, proxies, content caches, TCP reshapers
- core issues
  - deregulationists want to let carriers block/impact traffic
- governmental issues
  - e.g., China blocking access to "bad" sites
  - PA law blocking access to "child porn" sites

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Trust-Free Net

mistrust IP address (e.g., NAT)

mistrust privacy (e.g., wiretapping)

mistrust identity of other end (e.g., proxy)

mistrust identity (spoof)

Security in a Trust-Free Net

must be e2e

- as noted in original e2e paper

cannot include network devices/systems in trust envelope and be sure of security

thus e2e identification & encryption is key

secure web browsers often provide this

- some use SSL offload engines so not actual e2e

firewalls do not provide security

- unless firewall is in the end system

e2e encryption is a problem for law enforcement

- Clipper II on the way?

Tussle in Cyberspace

- describes requirement conflicts in today's Internet as "tussles" between needs
- advises designing protocols/applications to split along tussle boundaries and to let users express choice
  - e.g. tie QoS to packet markings not port #s
  - what is good tussle boundary for e2e security?
- biggest tussle may be economics
  - commodity service vs. compensating non-local ISPs
  - "routing money" from service providers to ISPs

Tussle in Cyberspace: Defining Tomorrow's Internet - Clark et al
www.acm.org/sigcomm/sigcomm2002/papers/tussle.pdf

e.g., QoS Tussle

- widespread belief that the Internet needs QoS controls
- intserv, diffserv & RSVP used in enterprises
- MPLS for bulk QoS (traffic engineering) used in some ISPs
- but different prices for different service levels is a hard ISP sell
  - maybe because today's Internet is not reliability crappy enough to provide business model
    - e.g., VoIP "just works" most of the time - see Skype
  - but telcos do not believe that, nor do regulators

QoS Tussle, contd.

where (if) QoS needed - what should drive it?

- carrier-run "content-aware" network?
- application request special handling for its packets - per session
- application/site mark packets for special handling - class of service

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Thus

significant pressures to block end2end

- especially at boundaries (e.g., enterprise edge)
- but also home NATs & computer firewalls

blocks possible to circumvent

- e.g., HTTP tunnels (see RFC 3093)
- e.g., HTTPS from browser to "server"

enterprise ISPs still mostly open

- but a few "protect" by blocking "dangerous" ports

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Why e2e is(was) Important

- customer freedom to access information & content
  - psychology important - not clear economically vital
- allows widespread innovation activity
  - dramatic (and chaotic) innovation using Internet
    - (chaos does bother some people)
- non-transparent net restricts ability to innovate
  - must get permission of block owner or hide in HTTP

CDA testimony - Bradner - http://www.sobco.com/papers/index.htm
The Future and its Enemies - Postrel - http://www.dynamist.com/tfaie/

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MU Rules!

- many innovators particularly important when user desires are unclear
  - High Market Uncertainty (High MU)
- low MU: all implementers know what user wants
  - product becomes commodity (low profit)
  - implemented in most economically efficient way
    - often centrally
- high MU: implementers have to guess
  - implementer that gets it right gets high profit
  - thus high value in many implementers
  - e2e facilitates implementers

A Real Options Metric to Evaluate Network , Protocol, and Service Architecture - Gaynor, Bradner - http:www.sobco.com/papers/ccr-10-2005.pdf

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e2e

convinced that the e2e principle is important?

- Google & Skype are

Internet Directions

thoughts on a few topics

- ISPs
- users
- content
- applications

ISPs

what is an ISP?

- traditional ISPs have IP history
- telco-based have circuit history

what will it be?

- telcos have the $ but generally not the clue
  - try to remake the Internet into telco model
  - but assume that content will rule

Who Owns the User?

real ISPs (traditional Internet)

- a service provider owns the customer for that specific service

telco-based ISPs

- the connectivity provider owns the customer for all services
- e.g., WAP
- inhibits innovation and restricts competition

Will Content Ever Succeed?

has not to date
- all video-on-demand trials to date have failed

long-term carrier assumption of revenue future

if you are asking "what is the application?"
- you have already lost

many looking for "the killer app"
- what was killer app for telephone?
- what was killer app for auto?

if you must have one: connectivity

content will be a service but not the only service

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Social Pressures

the Internet is aggressively non-national
- the 1st amendment is a local ordinance

threat to "order"
- as information sometimes is

governments feel they must "protect" citizens
- e.g., China

Internet routes around censorship

what global authority does the FCC have?

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Applications

too many applications are replicating function from some other medium

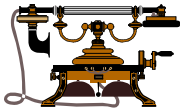
"keep it the same" so users are not confused

not enough thinking

IP-ness is lost

often not really Internet

IP-telephony or Internet-telephony?



IP

or

voice

IP

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Imitation

good for learning

but one needs to move beyond

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Today's Internet

some perception, some reality

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Fears, Threats and Effectors

phone companies have noticed the Internet

they want to "help" the geeks

they worry about QoS and predictability

- QoS predictability and investment predictability

but their help would destroy what created the Net

I'd rather do without the help

- but they are there and the regulators on their side (regulators don't like chaos)

Internet Myths

is free

is flat rate

is government run/funded

is just U.S. (or U.S. owns it)

is regulation-free

has a viable business model (will pay for itself)

is inherently poor quality

is the right answer to all telecommunications questions

Projections

Internet model clouds the economic model

- other than selling shovels to the gold miners
- and the shovel business is getting hard

"but who is going to make money on that?"

John McQuillan

(i.e., is there a business model for the Internet as Internet?)

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Beyond Standards

Internet was ignored for a long time

- by most governments, regulators & telcom SDOs

no longer ignored

- ITU-T is in the telcom standards business
- telcom is moving to the Internet ...

governments worry about confused citizens

regulators worry about disrupting incumbents

- (and cash flow)

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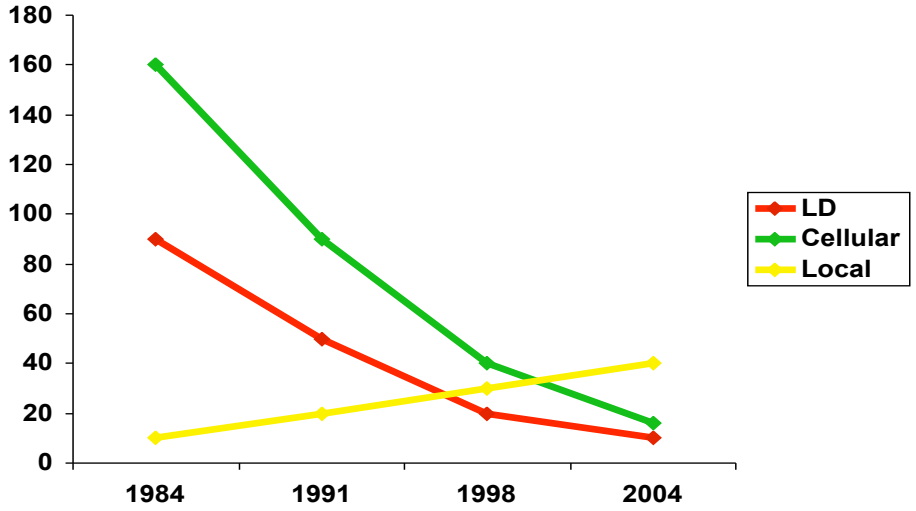
Competition is your friend



from Daniel Berninger

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Alternate Future Histories?

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we built it so we own it!
IRS
Department of the Treasury
Internal Revenue Service
International Telecommunication Union
far too important for the geeks
IP
world summit
on the information society
Geneva 2003 - Tunis 2005
FEDERAL COMMUNICATIONS COMMISSION
FCC
USA
"make sure it stays good"
Europäische Kommission
U.S. DEPARTMENT OF HOMELAND SECURITY
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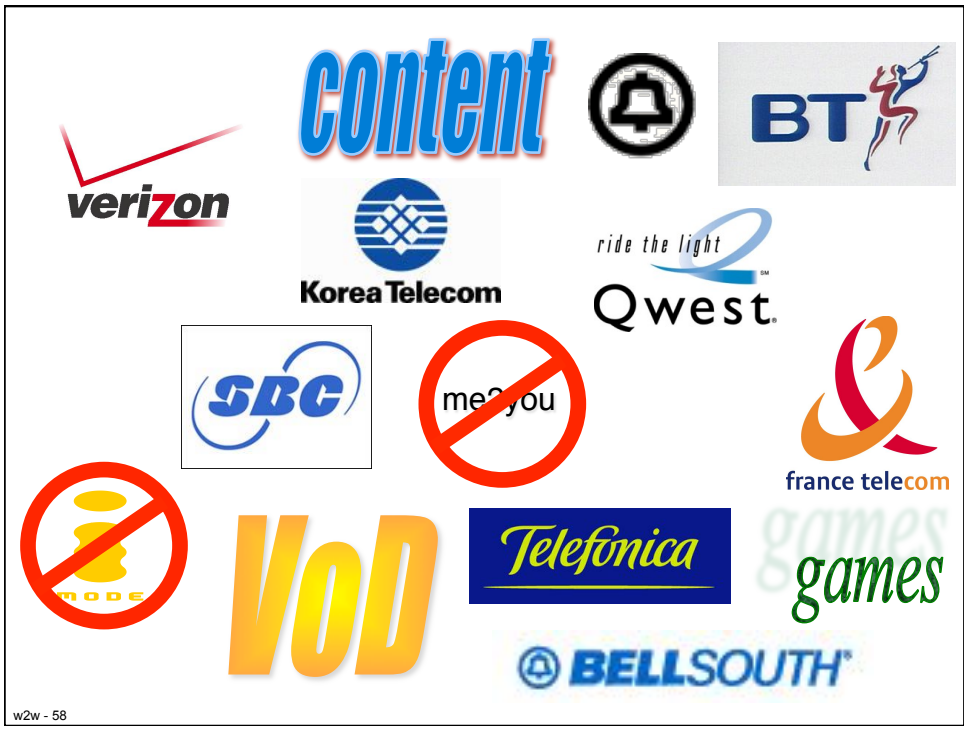
content
verizon
BT
Korea Telecom
ride the light
Qwest
SBC
me2you
france telecom
VoD
Telefónica
games
BELLSOUTH
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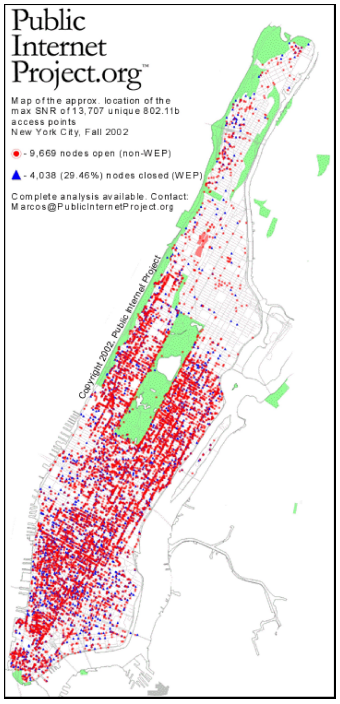

+ community nets?

back to the future?

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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

10 decisions that made a difference

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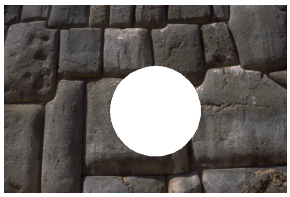
Current Decisions

path openness
standards?
security
privacy
ISP business model
regulations



or

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Key Open Questions

Who says who makes the rules?

Who says who pays for what?

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it is **NOW**

(and it is us)

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I'm pessimistically optimistic

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