

“It” will be called “The Internet”  
but ...

Scott Bradner  
NANOG On the Road  
April 21, 2015



- So Scott, what is on your mind these days?

**“That doesn’t make any sense at all!”**

Political science student said to me when told how the DNS roots are run.

**“That doesn’t make any sense at all!”**

Political science student said to me when told how the DNS roots are run.

**‘That doesn’t make any sense at all!’**

Government of Iraq when told that the .iq ccTLD was tied up in a Texas Bankruptcy court .

**‘That doesn’t make any sense at all!’**

Traditional telecommunications SDOs when they realized that governments have no formal role in IETF technical standards.

**‘That doesn’t make any sense at all!’**

Law enforcement (and spy) agencies when told that end-to-end-encryption should be the default on the Internet.

**‘That doesn’t make any sense at all!’**

Telephone carrier when told it should treat its customers fairly.

**‘That doesn’t make any sense at all!’**

Telstra when it was told it had to cover the cost of connecting to the Internet.

...

Come to think of it, the Internet as we know it, does  
not make sense to lots of people

It never did.  
(And that protected it.)

How did we get here?

(For reference, I have been doom-whining  
about this since the mid 1990s.)

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A biased history, starting PB  
(Before Packets)

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## Telecommunications in the 1950s



Nation-state-based telephone companies

One service: voice (+ some “wires”)

One quality: ‘toll-quality voice’

Very highly regulated – much revenue for countries

Interconnection via ITU rules

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## ITU rules, 1<sup>st</sup> set – ITC (1865)

International Telegraph Conference decisions made by country representatives

Set pattern for future telephone rules

tariffs & settlements

technical standards

complaint process

protect state & morality

*be able to stop messages that “may appear dangerous to the safety of the State or which would be contrary to the laws of the country, public order or morality”*

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# Communications Governance V1

Governance by governments

Enforced by country regulators

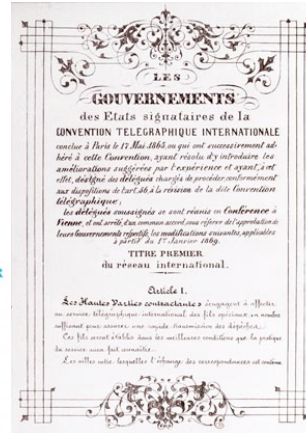
More than just technology

Also protect state, money & morality

Westphalian ideal?



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Circuits: the golden measure of perfection

Pre-defined quality

Enforced by busy signals

If the call gets through, it WILL be the right quality

Minutes: the golden measure of quantity

Exclusive use of resources for duration of call

Caller pays (other than special cases)

Settlements paid to the carriers that terminate calls

In the 1980s, the largest company in the world was a telephone carrier



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## Packets peering over the horizon

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Global data networks dream (1962):

J.C.R Licklider: *Galactic Network*

First mention of the concept (1962)

Paul Baran: *On Distributed Communications Networks*

“short message blocks”

Expanded on in 11 volume 1964 RAND series

Term “Packet” from Donald Davies (1966)



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## Packets:

Dest Addr	Src Addr	payload
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Split data stream into short message blocks

Blocks include destination addresses

Blocks treated independently when forwarded through network

Destination node responsible for reassembling blocks into data stream

## Network:

Forwards packets based on destination addresses

Provides no sequence or reliability functions or guarantees

Does not 'see' what is being carried in packets

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## So

No quality

No reliability

No control by carrier

## Also

Applications/services in end nodes not in the network

*Who is going to make money on that?*



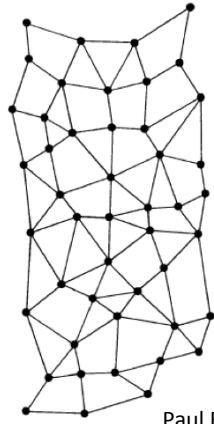
John McQuillan



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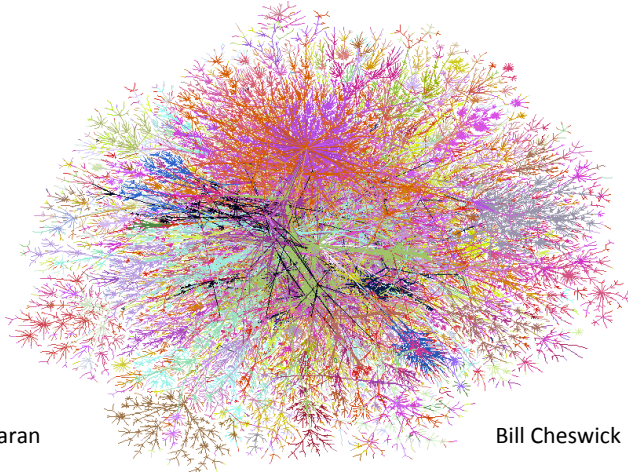
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### Capricious network architecture



Paul Baran

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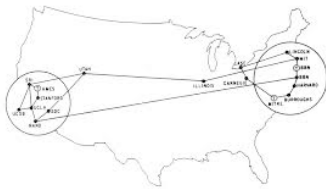


Bill Cheswick

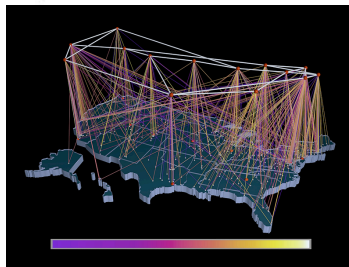
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### Proofs of concept



SEP 4 September 1971



NCSA



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## A rider not a builder

The ARPANET, and the follow on Internet, rode on the telephone network

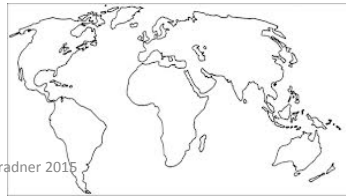
But were not services offered by the telephone companies

Internet service providers (ISPs) bought “wires” from telephone companies

ISP routers interconnected these wires

ISPs not limited to a single telephone carrier or to a single country

From inside the net you could not see political boundaries



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## But, what did they prove (by 1990s)?

That wide-area packet networks “work”

If you can define what “work means”

That worms and viruses also “work”

That hacking “works”

That ISPs could (reliably) go bankrupt



Not sure if the Internet was “of this world”

Technical relevance or politically

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## Inconceivable relevance

Existing telecommunications world did not believe

E.g., IBM no-bid ARPANET router  
no future in packet-based networks

Conventional wisdom: best effort useless

Guaranteed QoS required

Most connections low speed (dial-up)

No threat seen to telephone companies

Thus, totally ignored by regulators  
including the FCC & the ITU



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## 1990s

1991: WWW

Permissionless innovation

Growing connectivity

Hosts: 1991: 376 K, 1999: 56 M

Countries: 1990: 31, 1997: 171

Users: 2000: 260 M

“Always on” growing

Still mostly ignored by regulators as “useless”

The US did try to regulate Internet speech

The Computer Decency Act of 1996

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## The importance of occasional chaos

*“What achieved success was the very chaos that the Internet is. The strength of the Internet is that chaos. It's the ability to have the forum to innovate” S.*

Bradner, witness, CDA trial, 3/'96

*“Just as the strength of the Internet is chaos, so the strength of our liberty depends upon the chaos and cacophony of the unfettered speech the First Amendment protects.” Judge Dalzell, 6/'97*

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## The Internet in the 1990s

Doubling annually

Exploding in mindshare

But still no meaningful regulation

FCC explicitly declined to regulate

From inside the net you could still not see national borders

i.e., it was **cyberspace**, and looked like it was not of this world

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## “Shine perishing republic”

The brief reign of the republic of cyberspace

*A Declaration of the Independence of Cyberspace –*

John Perry Barlow – 1996

*“Your legal concepts of property,  
expression, identity, movement,  
and context do not apply to us.  
They are all based on matter,  
and there is no matter here..”*



*'the Internet will get rid of countries'* – participant,  
*International Forum on the White Paper (IFWP) –*  
1998

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## Cautionary Vignette

NET '97 - Kuala Lumpur

ISOC Developing Country Workshop



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## Managing cyberspace in the 1990s

Internet technology did not require centralized management

Bilateral agreements between ISPs defined connectivity & architecture

Services rode on top of Internet

Like the Internet rode on top of telephone networks

Two exceptions: IP addresses & domain names

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## IP Addresses

Blocks of addresses assigned to independent regional Internet registries (RIRs) by IANA

Internet assigned numbers authority

i.e. Jon Postel



RIRs independently developed assignment policies

Community-based policy development process

IETF approved global policies



No government involvement

I E T F



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## Domain Names

IANA, under US government contract, delegated operation of top level domains (TLDs)

E.g., .com, .net, .us, .jp

Commercial TLD delegations directed by US

Country code delegations done by IANA alone

Generally first come, first got

IANA also managed “root zone”

List of TLD delegations in a US government-run root zone server (“the A root”)

12 other Root name servers retrieve zone from the A root

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## The beginning of the end

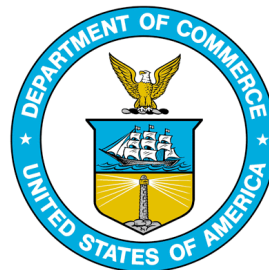
Jan 1998 – Jon Postel “redirected the root”

Asked the root server operators to retrieve zone from his server (instead of the government run one) - and 10 did



“The Internet”

VS.



VS.

“The Government”

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## Aftermath

Ira Magaziner threatened to send in the Marines  
Jon relented after a short while (*‘it was an experiment’*) & ICANN was formed soon after

With strong “guidance” from the US Government



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Everyone woke up – “the Internet” is important  
Replacing all telecommunications infrastructure  
Trashing traditional businesses



Helping to topple governments



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## A real, but not new, threat to order

*“The invention of the [...] is the greatest event in history. It is the mother of revolution.”*

*“In its [...] form, thought is more imperishable than ever; it is volatile, irresistible, indestructible. It is mingled with the air. ... Now it converts itself into a flock of birds, scatters itself to the four winds, and occupies all points of air and space at once.”*

*“A [...] is so soon made, costs so little, and can go so far! How can it surprise us that all human thought flows in this channel?”*

Who said this about what?

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## Victor Hugo: Hunchback

*“The invention of the **printing press** is the greatest event in history. **It is the mother of revolution.**”*

*“In its **printed** form, thought is more imperishable than ever; it is volatile, irresistible, indestructible. It is mingled with the air. ... Now it converts itself into a flock of birds, scatters itself to the four winds, and occupies all points of air and space at once.”*

*“A **book** is so soon made, costs so little, and can go so far! How can it surprise us that all human thought flows in this channel?”*

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# Privacy? Ha!

Google  
IS WATCHING  
YOU



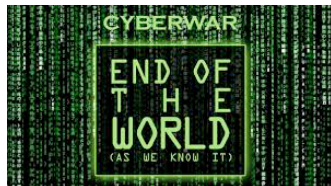
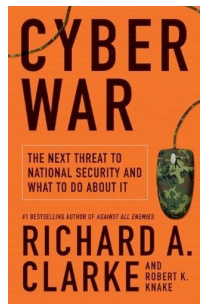
soxfirst.com

eff

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And then there is



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Just ask



**SONY**



Estonia

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The Internet is now far too important to leave it to  
the people that know how it actually works

Because what is there now 'does not make any  
sense' (at least to governments, carriers, politicians)

But now what?

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## The elephant in the background

It is a Post Snowden World

US no longer has moral authority to “run the Internet”

Embolden ITU

Countries filter or disconnect



The Guardian

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## Current picture - international

U.S. offered to relinquish control of ICANN

Conditionally: alternative must be multistakeholder model, maintain stability of DNS, meet needs of IANA customers & maintain open Internet

Should be of little interest

Just the technical coordination of 3 functions  
But seen as U.S. “running Internet”



Proposals being considered by NTIA/IANA  
Stewardship Transition Coordination Group  
Meanwhile – Congress is trying to say “no”

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## Current picture – international, contd.

Many countries want ITU-T to take over standards & regulations of the Internet

A dance that has been going on for many years

Latest round (ITU Plenipotentiary Conference – Oct/ Nov 2014) – kept status quo



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## Current picture – U.S.

FCC has been trying to enforce (sort of) network neutrality

Overtaken in court – lack of statutory authority

Changed ISP classification to be covered by “title II”

Title II is heavy handed telecom regulation

FCC will “forebear” most regulations

Congress trying to limit FCC controls

An ISP association has sued.



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## Going dark

The FBI says they want regulations to require back doors in all Internet applications – so they can see in “dark places”

e.g., to counter Apple’s iOS and iMessage locks

Now using All Writs Act (1798) to force compliance

So they can wiretap or get at contents

Never mind that they can not show any example where this would have made a difference

“a child will die”

Note: the real bad guys already have their own tools and are incented to hide

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The Internet is:

A destroyer of businesses

A confuser of citizens

A toppler of governments

An enabler of terrorists, pornographers & child molesters

A forum for hate

Unpredictable & uncontrollable

A bypasser of taxes

...

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The Internet also is:

The most important communications facilitator the world has ever known (other than the spoken & written word)

The parent revolution (in business, politics, science, society, ...)

And it does not make any sense at all

So Scott, what will the Internet look like in 2020?

I have no idea

It could look like the telegraph network of the 1890s

It could look like a copyright industry-run TiVo

It could look like Big Brother from 1984

It could look like the Internet we have today

which is a combination of all of the above

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But, it will be called

# The Internet

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