

Governance in a Cyber World

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Agenda

- How we got here: telecom history & governance
- This Internet thing
- Futures

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Visions

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1949: George Orwell

The telescreen received and transmitted simultaneously. Any sound that Winston made, above the level of a very low whisper, would be picked up by it, moreover, so long as he remained within the field of vision which the metal plaque commanded, he could be seen as well as heard. There was of course no way of knowing whether you were being watched at any given moment. How often, or on what system, the Thought Police plugged in on any individual wire was guesswork. It was even conceivable that they watched everybody all the time. But at any rate they could plug in your wire whenever they wanted to. You had to live -- did live, from habit that became instinct -- in the assumption that every sound you made was overheard, and, except in darkness, every movement scrutinized.

1984

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1968: Walt Disney



<http://hight3ch.com/post/internet-predicted-in-1968/>

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1975: John Brunner

I don't want to know the details," Sandy interrupted. "I'm just assuming that you have the biggest-ever worm loose in the net, and it automatically sabotages any attempt to monitor a call to the ten nines. If I'd had to tackle the job, back when they first tied the home-phone service into the net, I'd have written the worm as an explosive scrambler, probably about half a million bits long, with a backup virus facility and a last-ditch infinitely replicating tail. It should just about been possible to hang that sort of tail on a worm by 2005

The Shockwave Rider

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1981: Neil Ardley

People still collect books as valuable antiques or for a hobby, but you get virtually all the information you need from the view-screen of your home computer system. The computer is linked to a library – not a library of books but an electronic library where information on every subject is stored in computer memory banks. You simply ask



Instead of going out to the shops and stores in your town or city, you contact them through your videophone computer. You'll need to see what you're buying, even if you can't handle it, so the viewscreen of the videophone computer shows you the goods available. You then instruct the computer to order the goods you want and have them delivered to your house.

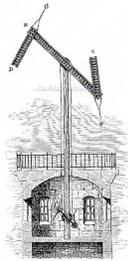
World of Tomorrow

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History Telecom & Telecom Governance

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Long Distance Communication – P1



1793

WHAT HATH GOD WROUGHT



1844



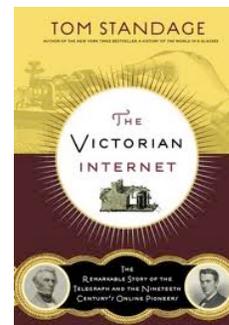
1858

1875 – 650,000 miles

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Telegraph System Architecture

- State-owned or state-licensed providers confined to a state
- Approved services
- Revenue source for state
- Bilateral interconnect agreements



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Telegraph Regulations



- 1865: 20 European *governments* gathered in Paris International Telegraph Conference -> International Telegraph Convention (ITC) -> International Telegraph Union (ITU)

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ITC 1865

- Tariffs & settlements
- Technical standards
- Retention requirement
- Complaint process
- . . .
- Aims included protecting state & morality
Requirement to 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

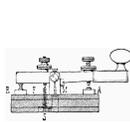
- Governance by governments
Empowered state regulators
- More than just technology
Also protect state, money & morality
- Westphalian ideal?



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ITU

- International Telegraph Union ->
International Telecommunication Union



1865



1885



1906



1934



1949

because ITU “covered all forms of wireline and wireless communication”

A treaty organization

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Telephone System Architecture

- State-owned or state-licensed providers
Confined to a state
- Approved services
- Significant revenue source for states
- Decade long planning cycles
- Circuit-based “intelligent network”
- QoS & security “guaranteed”
- Interconnection under ITU rules

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Telco (in U.S.)



- all connections outside the residence or enterprise were via **the** telephone company
- rent not sell
long term return
slow change



1892



1963 – 1990's

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Telco, contd.

- dumb instrument
- closed system
until Hush-A-Phone &
Carterphone
- regulated as common carrier
not responsible for customer actions
sell same service to everyone



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Telco Features

- circuit switched
defined quality & call state
- end system to switch signaling
operator
dial (1st 1904, deployed 1919)
touch tone (1st 1941, deployed 1968)
accidental end-to-end signaling
- switch to switch signaling
in-band tones, out-of-band SS7 (1980)
- one application: voice



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Telco Business

- started with per call billing
 - flat rate expanding
- long distance
 - intra country, inter country
 - different fees
- settlements
 - calling party compensates receiving telco
- regulators
 - dictate quality, features, tariffs, coverage ...



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Telco Security

- dumb end stations secure
 - changing with smartphones
- hackable signaling
 - tones - “phone phreaks”
 - SS7 - no built-in security & gateways
- hackable switches (i.e., computers)
 - e.g., Mitnick & Greek telco
- caller ID spoofing

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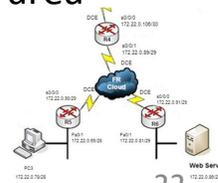
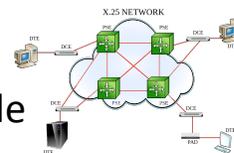
Telco Circuits

- Pre-setup paths through a network
e.g., for a phone or data call
- Predetermined capacity
- Setup as part of calling process
- Torn down (removed) when call done
and capacity released
- Cannot establish new circuits if not enough
capacity
get “fast busy” signal in phone system if circuits full

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Telco Data

- Voice was primary service
- Point-to-point leased lines available
- X.25 – packet switched wide area network
Fully defined in 1976
Reliable data delivery via pre-configured paths
- Frame Relay - packet switched wide area network
Fully defined in 1991
Optional guaranteed quality of service



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Telco: Summary

- **The** Phone Network
- circuit-based
- statically predictable calling patterns
- predictable growth rates
- assumed absolute requirement for QoS
- assumption of being carrier-provided
- a regulated monopoly
- the largest corporation in the world
most of the \$ from communications



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The Internet

- Self contained packets
- Multiple unrelated efforts:
 - Packet switching theory: (Kleinrock) 1961
 - Showed packet switching to be a more efficient switching method than circuits
 - Day dreaming: (Licklider's Galactic Network) 1962
 - Survivable infrastructure for voice and data: (Baron) 1964
 - Make use of remote expensive computers: (Roberts) 1964
- But Roberts had the money

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The Money

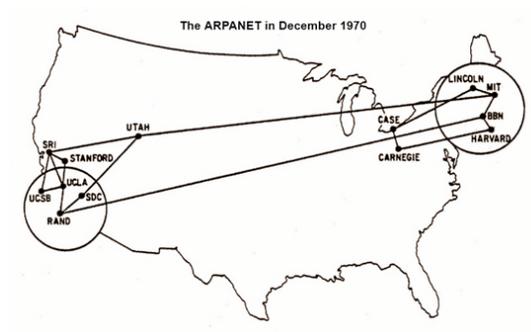
- The money came from the U.S. Department of Defense
This will be important later



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The ARPANET

- A network to share computing resources
Funded by ARPA (U.S. DoD)
- First nodes deployed in October 1969



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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



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The ARPANET Architecture(s)

- The early ARPANET connected a computer at a site to a computer at another site
- Bob Kahn & Vint Cerf developed TCP/IP in the mid 1970s.
Transmission Control Protocol/Internet Protocol
- ARPANET switched to TCP/IP in January 1983
- TCP/IP enabled the Internet (a “network of networks”)



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TCP/IP not IPTCP

- Originally Kahn & Cerf designed a reliable data delivery protocol
- Then they decided that the end systems should be able to decide the level of reliability wanted and split off the Internet Protocol
- So, no reliability requirement & QoS guarantees
 - Also no network-based security

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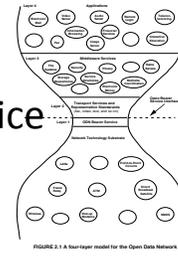
Packets!

- Self contained chunk of data 
- Handled independently of preceding or following packets
- Contains destination and source internetwork addresses
- May contain processing hints
 - e.g. QoS tag
- No delivery guarantees
 - Net may drop, duplicate, & deliver out of order
 - Reliability (where needed) must be done by ends

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Common Bearer Service

- Use existing networks
 - Not have to build new infrastructure
 - Not tied to one network technology
- Thus, required a Common Bearer Service (IP) & treat networks as generic
- IP very simple
 - Just transport packet to destination
- Ends are responsible for security & reliability



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The Rise of the Stupid Network

- Phone network technology: *Intelligent Network*
 - Many network-based services
 - Admission control, number translation, ...
- Isenberg's *Rise of the Stupid Network*
 - Isenberg's basic messages:
 - Network-based services slow to change
 - Voice is not all there is
 - Carrier gets in the way
 - Just "deliver the bits" works



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End-to-End Argument

- 1981 paper by Saltzer, Reed, & Clark
- end systems know what they can do
e.g., performance
- end systems know what they are doing
e.g., what application
- end systems know they want
e.g., reliability, security, etc.
- network cannot reliably know
some networks try by using deep packet inspection



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Internet Services

- End-to-end
Packets & best effort “stupid network”
- Services at the edges
Services ride over network
- Agnostic core
- Net supports multiple services
- No required link between carrier and services
Permission not required
- But must play by the same technical rules
- Unrestrained innovation

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Telephone Services

- self named “Intelligent Network”
- services ‘in the network’
 - mostly voice related services
 - e.g., time of day dialing, *69,
 - (lots of) usage accounting
- thus, new services required permission & economic decision by carrier
- central resource control
- Touch Tone (1963) was an aberration
 - allowed end-to-end signaling
 - enabled non-carrier services



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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 ITU

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Internet Regulation

- What Internet regulation?
- In the U.S., the FCC refrained
- Telephone companies ignored the Internet
- Overlay, not new, network

“Experts”: does not/cannot work



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But the Internet Grew

- Doubling annually
- Exploding in mindshare
- But still no meaningful regulation
- FCC explicitly declined to regulate
- From inside the net you could not see national borders
- i.e., it was cyberspace, and looked like it was not of this world

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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 Internet rode on top of telephone networks
- Exceptions: protocol parameters, IP addresses & domain names

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IANA

- Internet Assigned Numbers Authority
- Coordinates & assigns Internet-related unique values
 - Protocol parameters
 - IP addresses
 - Top-level domains and DNS server addresses
- Originally funded by ARPA (DARPA)



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Protocol Parameters

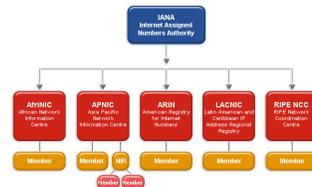
- Used to differentiate between options and payloads in protocols
e.g., port 25 = email, port 22 = secure remote login
- IANA maintains a registry of protocol parameters for the Internet Engineering Task Force (IETF)



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IP Addresses

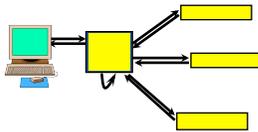
- IPv4: 32-bits
4,294,967,296 addresses
- IPv6: 128-bits
340,282,366,920,938,463,463,374,607,431,768,211,456 addr.
- Allocated by IANA to regional IP registries (RIRs)
- Allocated by RIRs to ISPs
- Allocated by ISPs to customers
- RIR contract specifies that IP addresses are loaned not owned



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Domain Names

- Translate human-friendly alphanumeric names into IP addresses
- Uses distributed set of database servers (DNS servers) run by different organizations
(I run my own, Harvard runs its own)
- Top level domains (TLDs) assigned by IANA
IANA maintains map between TLDs and server addresses



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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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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 (literally)
- Jon relented after a short while & ICANN was formed soon after
 With strong “guidance” from the US Government
- ITU redoubled efforts to gain control



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Illusionary interregnum

- Cyberspacers were filling a regulatory vacuum with imaginary structures
- There are still cyberspacers out there
- But so are the ITU, national regulators & the copyright industry
- And users, money, the Arab Spring, “confused citizens” and the NSA



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ICANN

- Internet Corporation for Assigned Names and Numbers
 - Setup by US government in 1998
- Has contract for the IANA function from U.S. DoC
 - Current contract expires Sept. 30, 2015
- Remit includes
 - protocol identifiers (for IETF)
 - IP Address pool
 - DNS TLDs & server map
 - DNS root name servers



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ICANN Role

- Formally, ICANN just coordinates IANA functions
- But, also has expanded top level domain space
Thousands of new TLDs
- Also, seen as top of the pyramid of Internet functions
Even though it does not have any such authority

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Internet: The Mother of Revolution

- The revolution that enables revolutions
 - Telecommunications
 - News
 - Social interaction
 - Content industry
 - Business
 - Society
 - Memory



but no international regulation!

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Some Example Issues

- Peering relationships
 - Telephone: peering requirements defined in regulations
 - Internet: big ISPs refuse to peer with small ISPs
 - Local peering points are voluntary - no mandate
- International settlements
 - Telephone: caller pays terminating carrier
 - Internet: customer pays local ISP
- Quality of service
 - Telephone: service must meet specific quality
 - Internet: best effort service

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Biggest Issue

- Society disruption



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Current State

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

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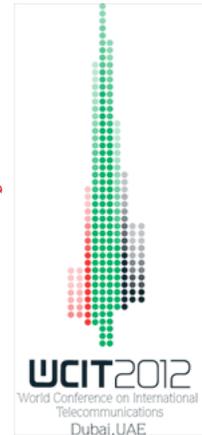
Internet Governance

- What is the court for the Internet?
A state court in Kentucky?
- No one in charge
Internationally or domestically in many countries
- U.S. has some control through ICANN
ICANN does technical coordination protocol values, DNS & addresses
- Power vacuum? - some governments think so
- They want the ITU to fill the perceived vacuum
Government-based decision process



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ITU Wakes Up



**note: there will be no ITU relevance
without an Internet involvement**

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U.S. moral authority

- U.S. has “run” the Internet since the start
Currently controls DNS & address roots through ICANN
- Other countries have “gone along”
US fended off alternative management – e.g. ITU
- Snowden revelations have changed the picture
Reduced the moral authority of the U.S.



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Meanwhile

- NETmundial was held in April 2014
“Global Multistakeholder Meeting on the Future of Internet Governance”
- General discussion on getting the Internet out of U.S. “control”



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DoC Says “Maybe”

- In March the U.S. Department of Commerce announced the intent to transition out of a contract for the IANA functions
- Solution must have “broad community support and address the following four principles:
Support and enhance the multistakeholder model;
Maintain the security, stability, and resiliency of the Internet DNS;
Meet the needs and expectation of the global customers and partners of the IANA services; and,
Maintain the openness of the Internet.”

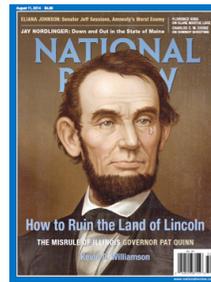
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Give Away the Internet?!

- Some in the U.S. Congress went nuts
How can you give away the Internet!
Remember that we (DARPA) created it!
- As did some others



Marco Rubio



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NISTCG

- NTIA/IANA Stewardship Transition
Coordination Group created to develop
transition proposal
- 30 members from the Internet community
IETF, IAB, ISOC, IP registries, root server operators,
ICANN security group, ICC, gTLD and ccTLD groups,
& ICANN government advisory group
- Proposal due before IANA contract expires
But DoC could extend contract if it wanted to

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Coming Soon

- ITU Plenipotentiary Conference 2014
*The **Plenipotentiary Conference** is the key event at which ITU Member States decide on the future role of the organization, thereby determining the organization's ability to influence and affect the development of information and communication technologies (ICTs) worldwide.*
- Where the ITU what it thinks its future role is



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ITU Proposals

- Proposals come from “member states”
- Many of which want the ITU to take over the governance of the Internet
 Policy, settlements, technical standards, regulations
- Expect proposals to implement a takeover
- Recall that the ITU is government controlled

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ITU's Authority

- The ITU assumes that if the member states agree to something then the ITU has the authority
 - Derived from the governments
- E.g., at one point they thought they could require the IETF to submit its standards to the ITU for ratification
 - Note the IETF is a private group

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Summary

- Yes, there is no cyberworld Governance
- But there is a lot of activity that could lead to some
 - And the result may not be all that pretty
 - Or all that positive for the Internet that got us to where we are now

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Questions?

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