The Internet: The anti-network

Scott Bradner

Context: National

- AT&T agreed to become a regulated monopoly 1913
- Federal Communications Commission (FCC)
  - Established by Communications Act of 1934
    - Act amended by Telecommunications Act of 1996
- AT&T broken up 1984
- FCC in charge of regulating inter-state telephone
- Title II of amended act: Common Carrier
  - A common carrier must provide services fairly
  - FCC has adopted many (>200) regulations on how telephone companies must operate
    - E.g., call quality, 911, wiretapping, interconnection, settlements, services and the prices for them are regulated

Context: International

- International Telecommunications Union (ITU)
  - Established 1865 (telegraph -> telephone & radio)
  - UN agency since 1947
  - Member States (governments) approve standards
- Scope
  - Technical & process standards - over 4K "recommendations"
    - Technology
    - Service definition (including quality of service)
    - International settlements
    - Interconnection policy
    - Regulations covering "telecommunication matters"
- ITU: governance of traditional telecommunications
  - Mostly intergovernmental & pervasive

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The Internet

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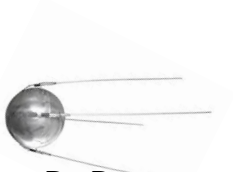
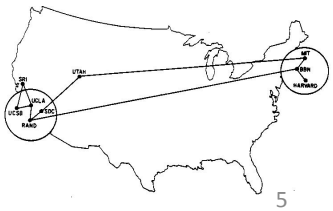
The Pre-Beginning



- 1957: Sputnik
- 1958: Advanced Research Project Agency - DoD
- 1960: Paul Baran: packet networks/redundant links and forwarding devices (routers)
  Publicize (To prevent a nuclear first strike)

- 1966: ARPA allocates $1M to build ARPANET
  To enable remote access to ARPA-funded computers
- 1969: 1st 4 hosts
- 1970: 9 hosts (including Harvard)
- 1980: 200 hosts (international)



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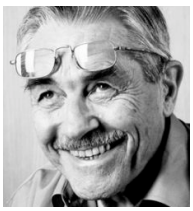
The Beginning

- 1972: Louis Pouzin designed the CYCLADES network
  Pure datagram (packet), no delivery assumptions
  Reliability the responsibility of the end nodes – "e2e"
- 1974: Vint Cerf & Bob Kahn: 1st version of TCP/IP
  Benefited from Pouzin's concepts
- 1983: ARPANET switches to TCP/IP
  Actual start of the Internet (network of networks)



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Internet Architecture

- Interconnected independent networks
- Pair-wise interconnection decisions
  - No central planning or interconnection regulations
- No central control & little coordination are required
  - Protocol parameters
    - Fields in protocols that need to be in sync – value unimportant
  - Bulk IP address assignments
    - Actual assignments & assignment policy done regionally
  - Maintain DNS root zone file
    - Set of pointers to servers for TLDs (e.g. .com, .company, .fr)

- Above functions done by IANA
  - Internet Assigned Numbers Authority

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The Technology

- Packets (vs circuits)
- Run over existing networks (vs purpose-built network)
- No QoS guarantees (vs per-call dedicated capacity)
- No assumptions of underlying network quality (vs 5-9s service reliability)
  - Packets can be reordered, duplicated or dropped
  - End systems responsible for reliability & security, if wanted
- End-to-end model (e2e)
  - network is "stupid"- application agnostic
  - Vs. "Intelligent Network" – applications are in the network
    - Exception: touch tone, which can be e2e

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Can not possibly be of any use

- No guarantees
- No quality of service
- No security
- No carrier model (where the carrier provides connections and applications)
  - So no business model
- IBM, AT&T etc., said that the Internet would not fly
- So they, and the regulators, ignored it

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Internet Services

- Anyone can talk with anyone
- Anyone can offer any service
  - As long as it runs over the Internet Protocol
  - As long as the standard Internet service is “good enough”
- No permissions required
  - Might have local firewall issues, but the ‘Net will transport
- No application-specific payments to carriers

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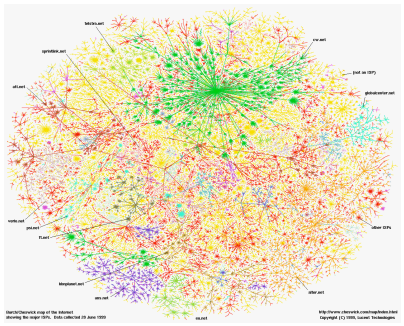
Internet: The Anti-Network

- Everything that the telephone network was not
  - Flexible
  - Innovative
  - Enabling
  - Generative
  - Distributed authority
  - (mostly) internationally seamless
  - (mostly) unregulated/ungoverned
    - Exceptions in some countries – e.g. China, England, …



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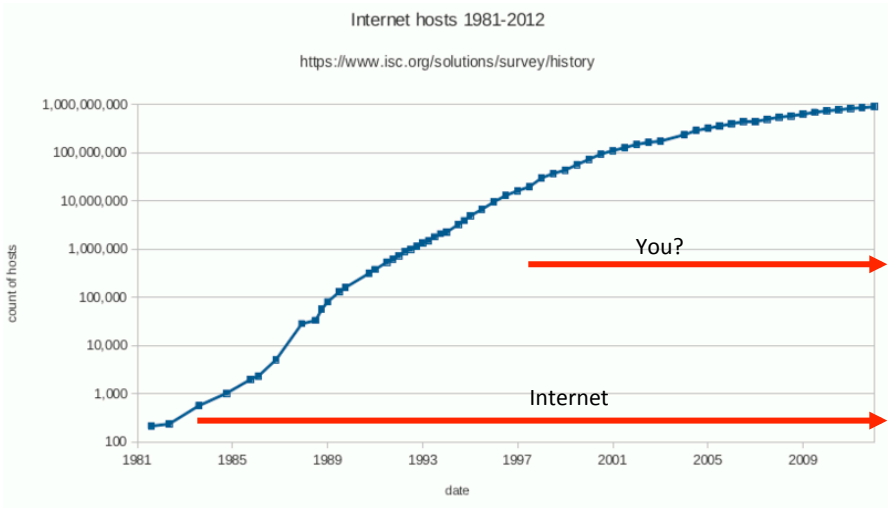
Someone Thinks it Works



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oops

- Starting in late 1990s some regulators began to see some handwriting on the wall
- U.S. FCC said they would not regulate (even though they said they had the authority)
- Some in ITU tried to get the ITU to be anointed Internet standards source & Internet regulator
  - Every 4 year member state gathering (Plenipot)
  - Internet has been on the agenda since 1998
  - Proposals defeated, mostly by the U.S. exercising its "moral authority"
    - 'everything is fine, nothing to see here, move along'

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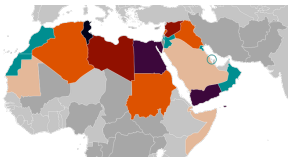
First change impetus

- Too much disruption, too much money
  - Business disruption – e.g., publishing, music, telecom
  - Social disruption – e.g., Arab Spring
  - $trillions business over the internet
- Too much consolidation
  - ISPs taken over by traditional telecom carriers
  - Carriers with the mindset that they owned the customers and deserved a piece of the action
- Too little money
  - International telecom revenue all but disappeared
  - Tax money disappeared



amazon.com

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Second change impetus

- Eliminate U.S. moral authority

Edward Snowden

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National Attempts at Regulation

- China knows how
- Most other countries have some regulations
- But conflict between physical borders and borderless Internet
  - China an exception
- US tried & failed with Communications Decency Act
  - US courts ruled it unconstitutional
  - Same with records in a Microsoft data center in Ireland
- Headline: *Zuckerberg and Facebook face German probe over racist posts*
  - Only deleted 46% of "unlawful" posts they were alerted to

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Giving Away the Internet

- IANA function has been run by ICANN, a private multistakeholder organization under a contract with the U.S. government since 1998
  - Just the three technical coordination functions – nothing more
- U.S. Government announced in Mach 2014 that it was ready to let the contract expire and let ICANN go it alone if the Internet community would support the idea
- Some in Congress saw this as 'giving away the Internet' with a potential to 'destroy our First Amendment rights on the Internet'

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What this Points Out

- There is no one and no organization that runs the Internet
- There is no "Internet governance" as a thing
- The Internet is the result of millions of cooperating people and organizations
  - E.g. the IANA edits the root zone, which points to the .edu nameserver, EDUCAUSE runs the .edu nameservers which points to to the Harvard nameservers, which provide information about computers at Harvard and to subdoman nameserves, e.g., dfci.harvard.edu which provide information on computers at Dana-Farber Cancer Institute
- All that binds these entities together are technical standards

iana EDUCAUSE DANA-FARBER CANCER INSTITUTE

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Internet Technical Standards

- All important Internet technical standards come from the IETF or W3C
  - Internet Engineering Task Force
  - World Wide Web Consortium
- Open voluntary standards organizations that produce open voluntary standards
- Participants driven to 'do what's right'
- ITU, on the other hand, does what its member states think is right
  - Many in the ITU still think the Internet does not work, or at least, can not continue to look like it works, & want to fix it

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Internet Governance near in the U.S.?

- Tussle in Washington for the past decade
- Deregulationists vs Openists
  - Deregulationists want to free the carriers to do whatever they want since its "their" network
    - E.g. record your every Internet activity and sell it to advertisers or to governments
  - Openists think the network should be e2e and the carrier should just deliver the bits since they are being paid by the customer to do that
- The debate has been referred to as "network neutrality"
- Same issue in many other countries

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FCC Four Principles

- FCC has been trying to require ISPs follow 4 principles through multiple rulemakings over many years
  1. consumers are entitled to access the lawful Internet content of their choice
  2. consumers are entitled to run applications and use services of their choice, subject to the needs of law enforcement
  3. consumers are entitled to connect their choice of legal devices that do not harm the network
  4. consumers are entitled to competition among network providers, application and service providers, and content providers
- Blocked by the courts each time

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ISPs Under Title II

- In February 2015 the FCC reclassified ISPs as being subject to Title II
- But said that they would forbear (not enforce) most of the Title II rules that govern telephone service – just enforcing those that would ensure a neutral network
- The carriers sued but this time the FCC won
- Many in congress did not like it – they claimed that regulations would destroy the Internet

  But they were only looking at the carriers not the $trillions of business & innovation over the 'Net

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Where from here?

- On the International front things have not changed when many of us thought they would
  - The ITU is in a planning meeting as we speak, so things might change
- In the U.S.
  - The FCC is starting to add additional rules for ISPs
    - E.g., ISP privacy requirements
  - A change in administrations could undo the Title II designation
  - A future FCC could be much more activist in regulations
  - The courts could force the FCC to add regulations since it has the power

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Today

- There is no "Internet governance" at the International level
  - Though many countries would like to see lots
- There is no "Internet governance" at the U.S. level
  - Other than the FCC rules that ISPs have to be fair
- The Internet exists by cooperation not control
- A bit of utopia? -- can it last?
  - The lack of Internet governance has lasted since the 1980's and it is what created the Internet of today
- But that could all change tomorrow (literally)

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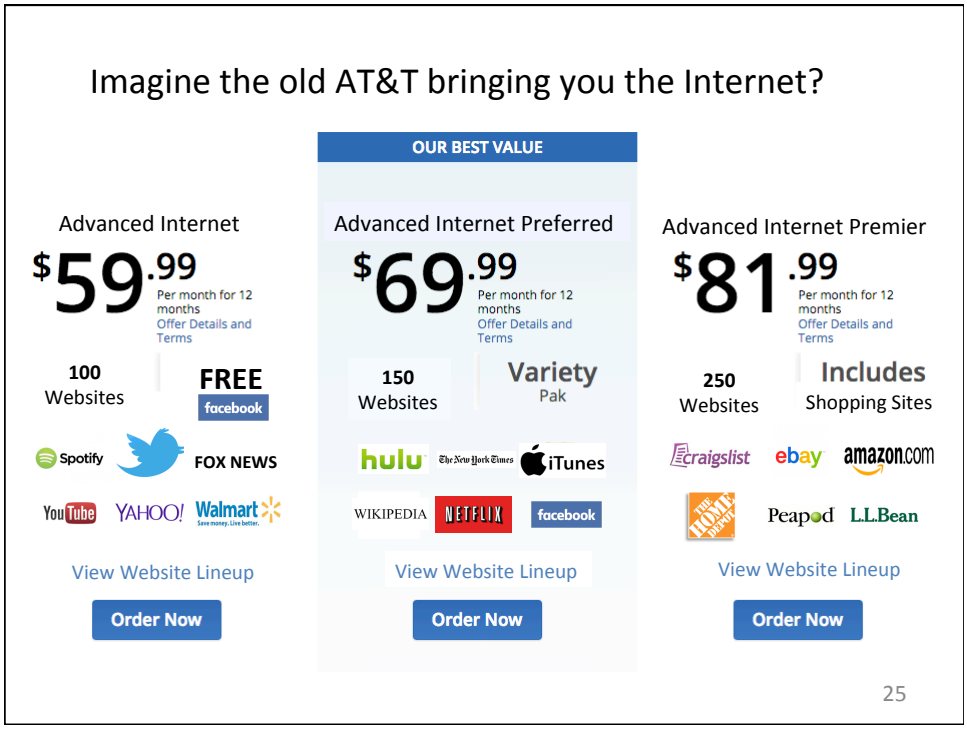
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