CSCI 1800 Cybersecurity and International Relations

Internet Governance I

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Outline

• What is Internet governance?
• Internet layers and issues
• History of Internet governance.
• Can and should the Internet be governed?
• Governance issues at the infrastructure, logic and content layers of the Internet.
Short History of the Internet

• Internet officially released in US and UK on 1/83.
• By 1994 was available to public and in 1995 the private, USG-sponsored backbone was replaced by interconnected commercial backbones.
• In 1991 Tim Berners-Lee* introduced text-only browser based on hypertext (HTML and HTTP).

* Announced on 4/4/17 that he is the new Turing Prize winner!
More History of the Technology

• The 1990s were an exciting time.
• In ‘93 Mosaic*, first graphical browser appeared
• Suddenly useful web-based content emerged.
• Many new high-tech companies formed and fortunes made.
• The dot-com boom followed by bust in March 2000 – reality set in.

* Marc Andreessen, co-author of Mosaic, is founder of Netscape and VC firm Andreessen Horowitz
What is Internet Governance (IG)?

• The word governance derives from the Latin word “gubernare,” to steer a ship.

• IG is concerned with technology, social norms, decision-making procedures, and design of institutions to “steer” the Internet.

• IG participants are individuals, corporations, and nation states.

• Internet governance is being hotly debated.

Source: Internet Governance: A Primer, Akash Kapur, UN Development Programme, 2005
Early History of Internet Governance

• 1960s – DARPA develops/runs ARPANET, distributed network for military use.
• 1970s – ARPANET use expands to universities, res. labs.
• 1983 – Internet launch, governance shifts to it.
• 1986 – NSFNET emerges; Internet goes global.
• 1986 – Internet Engineering Task Force (IETF) created
  – Manages technical standards.
  • Request for Comments* (RFCs) – now binding conditions
  – Introduces technical governance to Internet.
  – Operates in an open and consultative fashion.

More History of Internet Governance

• Mid 1980s – Domain Name System (DNS)
  – DNS is managed by Internet Assigned Numbers Authority (IANA) starts at USC under USG contract.
  – Root zone file – Maps top-level domains (e.g. .com, .cn) to name servers – distributed to 13 root name servers.

• 1994 – USG outsources DNS to Network Solutions
  – Many concerned that Internet would be commercialized.
  – After much conflict/deliberation, given to ICANN.

• 1998 – Non-profit Internet Corporation for Assigned Names and Numbers (ICANN) created.
  – ICANN manages IANA functions.
ICANN’s Functions

• The IANA functions
  – Authorizes changes to the root zone file
  – Assigns AS numbers and protocol numbers
  – Allocates generic Top Level Domain Names (gTLD’s) through formal process to qualified organizations
  – Assigns blocks of IP addresses to Regional Internet Registries (RIRs) that provide them to Autonomous Systems (ASes).
## Authoritative Root Name Servers

<table>
<thead>
<tr>
<th>Hostname</th>
<th>IP Addresses</th>
<th>Manager</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.root-servers.net</td>
<td>198.41.0.4 2001:503:ba3e::2:30 (IPv4 address) (IPv6 address)</td>
<td>VeriSign, Inc. (USA)</td>
</tr>
<tr>
<td>b.root-servers.net</td>
<td>192.228.79.201</td>
<td>University of Southern California (ISI) (USA)</td>
</tr>
<tr>
<td>c.root-servers.net</td>
<td>192.33.4.12</td>
<td>Cogent Communications (USA)</td>
</tr>
<tr>
<td>d.root-servers.net</td>
<td>199.7.91.13 2001:500:2d::d</td>
<td>University of Maryland (USA)</td>
</tr>
<tr>
<td>e.root-servers.net</td>
<td>192.203.230.10</td>
<td>NASA (Ames Research Center) (USA)</td>
</tr>
<tr>
<td>f.root-servers.net</td>
<td>192.5.5.241 2001:500:2f::f</td>
<td>Internet Systems Consortium, Inc. (USA)</td>
</tr>
<tr>
<td>g.root-servers.net</td>
<td>192.112.36.4</td>
<td>US Department of Defense (NIC) (USA)</td>
</tr>
<tr>
<td>h.root-servers.net</td>
<td>128.63.2.53 2001:500:1::803f:235</td>
<td>US Army (Research Lab) (USA)</td>
</tr>
<tr>
<td>i.root-servers.net</td>
<td>192.36.148.17 2001:7fe::53</td>
<td>Netnod (Sweden)</td>
</tr>
<tr>
<td>j.root-servers.net</td>
<td>192.58.128.30 2001:503:c27::2:30</td>
<td>VeriSign, Inc. (USA)</td>
</tr>
<tr>
<td>k.root-servers.net</td>
<td>193.0.14.129 2001:7fd::1</td>
<td>RIPE NCC (Europe)</td>
</tr>
<tr>
<td>l.root-servers.net</td>
<td>199.7.83.42 2001:500:3::42</td>
<td>ICANN (USA)</td>
</tr>
<tr>
<td>m.root-servers.net</td>
<td>202.12.27.33 2001:dc3::35</td>
<td>WIDE Project (Japan)</td>
</tr>
</tbody>
</table>
Recursive DNS Resolution

Domain Name Space

- Root Zone
- Top Level Domain (e.g. generic, country code TLDs)
- Sub Domains

- NS RR ("resource record")
  - names the nameserver authoritative for delegated subzone

- "delegated subzone"
  - When a system administrator wants to let another administrator manage a part of a zone, the first administrator's nameserver delegates part of the zone to another nameserver.

- resource records
  - associated with name

- zone of authority,
  - managed by a name server

See also: RFC 1034 4.2: How the database is divided into zones.
IG Layers & Issues

• Governance practiced by many organizations at many levels

• **Infrastructure Level**
  – Interconnections – telecoms, companies (e.g. Comcast, Google)

• **Logical Level**
  – Domain Name System – ICANN including IANA
  – IP Allocation & Numbers – Regional Internet Registries, Registrars
  – Standards – many orgs. produce protocols, e.g. IETF, W3C, etc.

• **Content Level**
  – Pollution control – spam
  – Cybercrime – e.g. Budapest Convention, Shanghai Cooperation Org.
  – Intellectual Property Rights – WIPO, WTO
  – Control of Internet – many bodies involved, e.g. UN, ISOC, ICANN

• **IG is multi-layered and multi-faceted!**
Historical Debate on IG

• Should IG focus only on technical matters?
  – Some say yes, others say it must include social, legal and economic consequences of technical decisions.

• What is the role of governments?
  – Some want it to retain its current form or increased
  – Others want it decreased or eliminated.

• Should governance be allowed to evolve?
  – Some say yes, others say it must be replaced.
Multi-Stakeholder Model (MSM) - Wiki

• Vague notion in 2003. Now widely accepted in IG
• MSM is a framework for engagement
  – Stakeholder is a person, group, organization or government with an interest in a matter.
  – All stakeholders participate on equal footing
  – Open, transparent, accountable process
  – Tries to use consensus-based decision making
  – It motivates stakeholders to take responsibility!
• Now widely used on Internet, in civil society, UN
MSM – ICANN Definition

• Involvement of stakeholders in the learning process
• Stakeholders work towards common goals
• Work involves different sectors and scale
• It is focused on effectuating change
• Agreements are created based on cooperation
• Stakeholders deal with power & conflict consciously
• Bottom-up and top-down strategies are integrated in governance and policy making
Application of MSMs

• By ICANN, the Internet Engineering Task Force (IETF)
  – ICANN does consensus-based policy development
  – Approach based on global stakeholder input and codified in the White Paper* (USG, 1998, proposed by Magaziner ‘69)
  – ICANN implements MSM via board meetings, supporting organizations and advisory committees
  – The Tao of IETF: A Novice’s Guide to the IETF**

• “all public policies pertaining to the Internet should be developed in a multi-stakeholder framework.” – Markus Kummer, Internet Society.

* See http://icannwiki.com/index.php/White_Paper
** See https://www.ietf.org/tao.html
Congress Endorses the MSM

• Both houses of Congress voted unanimously in support of MSM in 2012:

“That it is the sense of Congress that the Secretary of State, in consultation with the Secretary of Commerce, should continue working to implement the position of the United States on Internet governance that clearly articulates the consistent and unequivocal policy of the United States to promote a global Internet free from government control and preserve and advance the successful multistakeholder model that governs the Internet today.”
A Skeptical View of MSMs

• “Multistakeholderism is a coup d’etat against democracy by those who would merely be lobbyists in a democratic system.” P. R. Lehto, J.D.
International Discussions in 2000s

• UN World Summit on the Information Society (WSIS) in 2003 & 2005 addressed global digital divide – expand Internet to the developing world.

• WSIS created the Working Group on Internet Governance (WGIG) that produced this definition:
  – Internet governance is the development and application by governments, the private sector and civil society, in their respective roles, of shared principles, norms, rules, decision-making procedures, and programs that shape the evolution and use of the Internet.

• This definition is not binding on governments!
IG Players & Function

• Actors include governments, private sector, and civil society (i.e. outside family, state, market).
• Internet governance is more than DNS, BGP and technical decisions.
• Working Group on IG (WGIG) in 2005 says IG “also includes other significant public policy issues, such as critical Internet resources, the security and safety of the Internet and developmental aspects and issues.”
Why is IG Challenging?

• Internet operation lacks central authority or mechanism.
  – Control distributed among autonomous systems.
• The network is “dumb”.
  – Most of the intelligence is at the edges.
• Open standards encourage innovation but also make the Internet hard to manage.
  – Consensus is needed to change standards.
• On the other hand, all nations realize need to control bad content and bad behavior.
• **Caution:** We must not compromise the core architecture as we fix Internet problems.
ICANN and Governance

• Creation of ICANN initiated rounds of debate on governance.
• Although, ICANN initially had technical mandate (DNS, IP addresses, handling protocols), it quickly became embroiled in controversies.
• Critics said it lacked transparency and democracy, was too close to USG, excluded developing world.
• The informal, consensual, trust-based model of Internet governance called into question.
• New methods of governance were then explored.
Alternative Governance Models

• 2002 – **UN General Assembly calls for** a World Summit on the Information Society* (WSIS).

• 2003 & 2005 WSIS summits held in Geneva, Tunis
  – Calls for creation of the Internet Governance Forum (IGF)
  – Subsequent WSIS forums held every few years.
  – ITU, based in Geneva, runs WSIS meetings.

• 2006 – IGF** is a UN multi-stakeholder forum for policy discussions of IG. Meetings held annually.

* See [http://www.itu.int/wsis/index.html](http://www.itu.int/wsis/index.html)
** See [http://www.intgovforum.org/cms/](http://www.intgovforum.org/cms/)
WSIS 2005 on IG (Tunis Agenda*)

• **34.** A working definition of **Internet governance** is the development and application by governments, the private sector and civil society, in their respective roles, of shared principles, norms, rules, decision-making procedures, and programmes that shape the evolution and use of the Internet.

* See http://www.itu.int/net/wsis/docs2/tunis/off/6rev1.html
WSIS 2005 on IG (Tunis Agenda*)

35. ... In this respect it is recognized that:

• Policy authority for Internet-related public policy issues is the sovereign right of States. ....

• The private sector has ... an important role in the development of the Internet, both in the technical and economic fields.

• Civil society has also played an important role on Internet matters, ... and should continue to play such a role.

• Intergovernmental organizations ... should continue to have, a facilitating role in the coordination of Internet-related public policy issues.

• International organizations ... should continue to have an important role in the development of Internet-related technical standards and relevant policies.

* See http://www.itu.int/net/wsis/docs2/tunis/off/6rev1.html
Must the Internet be Governed?

• Many believe governance should be minimized.
• Internet does depend on its free, open culture.
• However, absences of rules can be bad.
  – Anarchy can stifle innovation (e.g. lack of patents)
  – What norms might be developed and for whom?
• Better to ask what is right form of governance?
  – Balance needed between rules and freedom, control and anarchy, process and innovation.
Internet Governance Layers & Issues

• Content Layer
  – Pollution Control
  – Cybercrime
  – Intellectual Property Rights

• Logical Layer
  – Standards
  – Domain Name System
  – IP Allocation and Numbering

• Infrastructure Layer
  – Interconnection
  – Universal Access
  – Next-Generation Pathways
Infrastructure Layer Issues

• Because interconnections not regulated, larger Internet Service Providers can dictate terms to smaller ones.
  – Particularly problematic for developing countries.
  – Is net neutrality needed?

• Lack of content within developing countries results in their going outside for it.
  – Is this a “reverse subsidy” of $Billions to US providers?

• Universal access to Internet is desired by some.
  – Is close access point OK, how about phone access, etc?
  – ITU-D sector helps developing countries with access.

• Will developing countries not be able to keep up?
Some Logic Layer Issues

• Standards are essential to functioning of Internet.
  – E.g. TCP/IP, IPSEC, DNS, DNSSEC, HTML, HTTP, XML

• Standards are a form of de facto governance.
  – Attempt made in 2001 to introduce standards based on patents for which royalties required. The community got upset and they were withdrawn.

• As standards change, governance must adjust

• Standards bodies at Logic Layer:
More Logic Layer Issues

• Management of the Domain Name System
  – Until 2000 top-level domains (TLDs) were .arpa, .com, .net, .org, .int, .edu, .gov, and .mil
  – There are now more than 1,000 generic TLDs:
    • E.g. .academy, .coffee, .tokyo,
  – DNS also has country code TLDs (ccTLDs), e.g. .fr, .au
  – Internationalized domain names in non-Latin alphabet
• ICANN management of DNS was controversial.
  – Now independent of USG but under US legal jurisdiction
More Logic Layer Issues

• ICANN handling of ccTLDs has been contentious
  – National sovereignty and digital divide are issues.
  – Who should handle ccTLDs?
  – Today they are in the hands of countries.

• IP Allocation and Numbering
  – All IPv4 addresses have been allocated
  – IPv6 allocations now available.
    • What allocation policies should be used?
    • Allocate prefixes to countries?
    • Have countries distribute sub-prefixes?
Issues at the Content Layer

• Internet Pollution: spam, malware, DDoS
  – See SPAMHAUS

• Cybercrime
  – Council of Europe Convention on Cybercrime has guidelines to create domestic legislation that make illegal: access to computers without legal approval, computer-based forgery or fraud, child pornography, infringement on copyrights, etc.
World Conference on International Telecommunications (WCIT)

- Held by the International Telecommunications Union (ITU) in Dubai from December 3-14, 2012.
- Congress endorsed MSM in anticipation.
- International Telecommunications Regulations (ITRs) revised to include references to Internet
  - Previously ITRs applied only to public switched telephone networks* (PSTNs)
- A direct challenge by a UN entity to the existing system for running the Internet.
- **1,600 diplomats from 151 countries attended!**

The WCIT Crisis

• Only nations can introduce topics and vote at ITU
• Autocratic nations wanted ITU take over Internet
  – The conference ended badly.
  – US, EU, Canada, India, etc. did not ratify treaty
  – 89 nations did ratify, 55 did not
• Difficult to alter Internet governance
  – WCIT 2012 clearly signals that some nations will try.
• ITU 2014 Plenipotentiary in Busan ended well.
  – Same players, similar issues, but more congenial.
Issues to Ponder For Next Class

• How should the Internet be governed?
• Are multi-stakeholder alliances working?
• What role should governments have in Internet governance?
• What roles can we define for Internet service providers (ISPs)?
Review

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• Governance issues at the infrastructure, logic and content layers of the Internet.

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