

Signposts in Cyberspace:

The Domain Name System and Internet Navigation

Committee on Internet Navigation and the Domain Name System,
Computer Science and Telecommunications Board of
the National Research Council

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Objectives of Study

- In light of the range of controversies concerning the DNS and its relationship to Internet navigation, the committee undertook a careful analysis of each
 - Domain Name System (DNS)
 - Described history and current state and assessed its performance
 - Analyzed technology prospects and institutional issues
 - Internet Navigation (IN)
 - Described history and current state and assessed its performance
 - Analyzed technology prospects and institutional issues
 - Concluded and recommended where possible; otherwise, characterized alternative views
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Domain Name System

DNS Assessment

- ❑ Overall, despite the very rapid and largely unexpected growth in the amount of Internet traffic that it has had to accommodate, the DNS' technical system and institutional framework have performed reliably and effectively during the two decades of the DNS' existence
 - ❑ However, the continued success of the DNS is not assured
 - ❑ Many forces are challenging the DNS' future
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DNS Challenges

Governance

- What is relation to Internet governance?
- Who will be the steward?
- How does ICANN achieve legitimacy?

Management

- Root name server system
- Generic top-level domains
- Country code top-level domains

Security

- Denial of service and message alteration attacks
- Physical vulnerability and performance monitoring

Operations

- Commercial forces
 - UDRP
 - Internationalized domain names
 - Whois data
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Internet Governance

- Internet governance is of broad concern and is currently the subject of the UN-sponsored World Summit on the Information Society and the multiple preparatory meetings for it
 - Internet governance issues include:
 - Regulation of e-commerce
 - Control of spam
 - Use of the Internet for fraud, gambling, child pornography
 - Disparities in usage between rich and poor
 - Protection of privacy and freedom of expression
 - Protection of intellectual property
 - The DNS is not an effective tool for addressing these issues
 - DNS governance is only a part of Internet governance
 - Efforts to employ the DNS governance structure as a vehicle for broader Internet governance are likely to be ineffective and could be detrimental to the DNS
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DNS Governance

- Governance of the DNS is not an appropriate venue for national political interests
 - DNS has been relatively free from pressures arising from competing national interests
 - International disputes have been largely kept out
 - National governments only one of multiple stakeholders in DNS
 - DNS needs non-governmental and multi-stakeholder governance
 - **Recommendation: The DNS should not be put directly under the control of governments or intergovernmental agencies**
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DNS Governance Today

- Steward: Department of Commerce
 - Authorization of the manager
 - Oversight of manager
 - Approval of management recommendations
 - Management: ICANN
 - Recommendations to steward (i.e. root zone file)
 - Day-to-day administration of top level domains, IP addresses, and other key parameters of Internet
 - Agreements with *some* key players –TLD registries
 - Development of institutional framework: UDRP, registrars, Whois data policies
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Transfer of Stewardship

- If ICANN fulfills agreed set of tasks, Commerce intends to transfer stewardship to ICANN by 2006
 - Free-standing ICANN:
 - Will lack oversight by Commerce
 - Will lack “protection” afforded by Commerce
 - **Recommendation: Before completing the transfer of stewardship, Commerce should seek other ways to provide protection and oversight of ICANN**
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Legitimacy of ICANN

- Principal Issue: ICANN must gain acceptance as legitimate authority for key DNS decisions
 - ICANN is work in progress, rich in controversy and accomplishment
 - Great number of constituencies, with often conflicting interests
 - Specific issues: Scope, structure, and processes
 - ICANN more likely to improve legitimacy by narrowing scope and improving processes than by seeking ideally representative composition of Board
 - No matter how constituted, ICANN is unlikely to satisfy all its constituency groups
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Critical DNS Elements

In the DNS area, ICANN must achieve effective modus operandi with three critical sets of participants:

- Root Name Server Operators
 - Generic Top-Level Domain Registries
 - Country Code Top-Level Domain Registries
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Root Name Server Operators

- **Recommendation: No greater oversight of the operators is necessary**
 - So long as they continue to operate effectively and reliably and to improve the system's security, stability, and capability
 - **Recommendation: Independent funding arrangements should continue**
 - Multiplicity of sources contributes to resilience, autonomy, and diversity of the root
 - **Other recommendations:**
 - More formal coordination by ICANN in the longer term
 - A formal process for replacing operators who withdraw or fail: ICANN to decide based on operators' recommendations
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Generic Top-Level Domains

- Addition of new gTLDs
 - Technically and operationally: the addition of tens per year for several years poses minimal risk to the stability of the root
 - User needs and economic benefits: the arguments are inconclusive
 - **Recommendation: If new gTLDs are added, ICANN should:**
 - **Establish a regular schedule that sets the maximum number that could be added each time and the interval between additions**
 - **Establish a regular evaluation process and a mechanism to suspend additions in the event of severe technical or operational problems**
 - **Consider alternate processes, less reliant on expert, staff, or Board judgments, in addition to comparative hearing or expert evaluation**
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Country Code Top-Level Domains - 1

- The ccTLDs – 243 of the 258 TLDs - operate under a wide range of oversight arrangements: national governments, local Internet communities, autonomy, commercial contracts
 - Resolution of ICANN's role vis-à-vis the ccTLDs is one of ICANN's critical challenges
 - ICANN has formal agreements with only a small fraction of the 243 ccTLDs, but has critical authority for delegations and redelegations
 - Relations with ICANN have been difficult since the beginning
 - Budget – contributions more than benefits
 - Delegations and redelegations – resented ICANN authority
 - Absence of ccTLD Supporting Organization
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Country Code Top-level Domains - 2

- ❑ ICANN has established a Country Code Names Supporting Organization (ccNSO) to draw ccTLDs more actively into its operations and build stronger basis for their support
 - ❑ ICANN is making other efforts to respond to ccTLD concerns
 - ❑ If ICANN's current efforts do not succeed, it may find itself under pressure to limit its role to gTLD management and root zone file recordkeeping and to turn ccTLD delegation over to some other organization
 - Regional ccTLD organizations or
 - International Telecommunication Union
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DNS Security

- **Recommendation: Anycast server deployment should be expanded**
 - Root name servers have added “anycast” servers and redundant connectivity
 - **Recommendation: DNSSEC should be widely deployed among name servers, in particular for the root zone and top-level domains**
 - DNSSEC has been developed to prevent alteration of messages being transmitted among name servers
 - **Recommendation: The need for further diversification of the location of root name server facilities and personnel should be carefully analyzed in the light of possible dangers, both natural and human in origin**
 - Concentrations of base root name servers in Washington and Los Angeles areas
 - **Recommendation: More should be done to monitor continuously the performance and traffic flows of the DNS infrastructure so as to detect and respond rapidly to attacks or outages**
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Internet Navigation

Internet Navigation Aids & Services

Aids

- Domain name: known or guessed
- Hyperlink
- Bookmark
- Keyword
- Metadata

Services

- Directory
 - Search Engine
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Internet Navigation Assessment

- Wide range of Internet navigation aids and services now permit large segments of the public Internet, especially the Web, to be traversed rapidly and efficiently
 - Seekers of content and services, no matter where located, have convenient access to much human knowledge and experience
 - Providers of content and services, no matter where located, can reach a global audience
 - Surveys indicate high level of satisfaction with Internet navigation aids and services at present by general users in the U.S.
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Internet Navigation Challenges

□ Technological

- **Persistence of Internet resources**
- Using context in search
- Understanding user behavior

□ Institutional

- **Preserving neutrality of results of searches**
 - Consolidation of navigation providers
 - Continuation of innovation
 - Trademarks as keywords
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Persistence of Resources

- Internet resources lack persistence – though located once at an address, they may not be found there again – because they are, among other possibilities:
 - Dynamic – such as a weather forecast
 - Revised – such as versions of a report
 - Moved – from one computer location to another
 - Removed – when computer replaced or service ended
 - Unreadable – when format is no longer read
 - Owners of valuable Internet resources should establish policies to ensure their persistence
 - Scholarly and legal reasons for resources to persist
 - Preservation – saving Internet resources, though not at the same address – is being undertaken by public (e.g. national libraries and archives) and private organizations (The Internet Archive)
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Neutrality of Results

(commercial navigation services)

- Possible abuses could erode neutrality of basic results
 - pay for placement high in neutral ranking
 - failure to effectively distinguish paid from neutral listings
 - **Recommendation: Regulatory agencies should pay careful and continuing attention to the result ranking and display practices of search services and their advertisers to assure free flow of information and full disclosure of ranking practices**
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DNS and Internet Navigation

Role of the DNS

- The preservation of a stable, reliable and effective Domain Name System will remain central to
 - the operation of the Internet,
 - most Internet applications, and
 - most means of Internet Navigation
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Protecting the DNS and IN

- The demonstrated success of the DNS and navigation aids and services in meeting the basic needs of all Internet users should not be jeopardized by efforts
 - to constrain or direct their evolution outside of the open architecture of the Internet or
 - to use them to enable control of the free flow of information across the Internet
 - The governance and administration of the DNS should not become a vehicle for addressing political, legal, or economic issues beyond those of the DNS itself
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Signposts in Cyberspace

The Report of the Committee on
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Name System of the Computer
Science and Telecommunications
Board of the National Research
Council

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http://www7.nationalacademies.org/cstb/pub_dns.html