Internet Designers as Policy-Makers: Lessons for Emerging Media

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The Question

- What can those working with new media today learn from the history of the Internet design process?

Today

- **Overview of the study**
  - list of publications from which drawn at close of powerpoint + URLs where can find full texts
- **Introduction to the RFCs**
- **Take-aways from research findings for those working with new media**
  - design criteria as policy principles
  - conceptualizations of uses & users
  - addressing diversity
  - issue nuance & multi-dimensionality
  - coping with instability

The Study

- Inductive discourse analysis of Internet RFCs 1969-2009
  - comprehensive 1969-1979
  - topical 1980-2009
  - NSF funded 2008-2012
  - 8 publications so far, more on the way
- Launch question: how did those responsible for designing the Internet think about policy?
  - other issues of interest appeared along the way

- What the study is not
  - in-depth analysis of decision-making on specific technical issues
- What the study is
  - policy analysis
  - recuperation of history
  - sociotechnical boundary work
  - theory-building re large-scale sociotechnical infrastructure

- Methodological challenges
  - reading Martian upside down in a mirror
  - every document & every sentence matters
  - size & complexity of project
  - level of expertise required for policy analysis
  - constant change in subject, terminology, extent of formalization

- Automated analysis useless
  - ex: locating privacy issues
    - automated search: ~ 12% but many spurious
    - inductive reading: ~18%
  - constant change in subject & terminology
  - natural language processing approach would result in Borges map of the world = the world

- Comprehensive *inductive* reading
  - coding for about 70 variables *within* texts
  - classification *of* texts by genre & sub-genre, institutional type, year, country
- Implications of doing secondary analysis of technical documents as policy documents
  - ex: policy implications may be in author, not text
  - ex: technical problems turn into social issues when discussing alternatives

The Internet Requests for Comments

- Medium for Internet design decision-making + historical record of that decision-making

- hosted by IETF & publicly accessible online

- Today 8093 docs; ~ 5700 through close of 2009

- **Authors employed by > 1300 entities of 14 institutional types from 44 countries through 2009**

- Genres
  - formal: range from informational through formal publication of protocols
  - informal (coded): range from discussions of technical standards through user guides & jokes
- Functions, especially early, ranged from protocol development to community formation

An Anycast Prefix for 6to4 Relay Routers

Status of this Memo

Copyright Notice

Abstract

   This memo introduces a "6to4 anycast address" in order to simplify
   the configuration of 6to4 routers. It also defines how this address
   will be used by 6to4 relay routers, how the corresponding "6to4
   anycast prefix" will be advertised in the IGP and in the EGP. The
   memo documents the reservation by IANA (Internet Assigned Numbers
   Authority) of the "6to4 relay anycast prefix."

Policy Issues Show up Early

- 1970 - security
- 1971 - privacy, <u>commercialization of the network</u>, malware, <u>access to network in rural areas</u>, internationalization
- 1972 - <u>energy issues</u>
- 1973 - need for user authentication, spam
- 1975 - <u>high school students hack network</u>
- 1977 - voice

Policy-Making Processes

- Defining the policy subject
- Developing decision-making procedures & entities
  - IAB, IETF, ICANN evolve out of discussions & decisions
- Implementation programs, guides, behavioral norms
- Venue for conflicts & conflict resolution

Technical vs Legal Thinking

- RFCs offer support for critics
  - little on disability (only 2 RFCs), elderly (0)
- RFCs also offer evidence that counters critics
  - active discussion of language issues begins early, just lots of technical problems to solve
- Implicit policy analysis very rich
  - eg, viewing privacy as contextual and boundary definitional appears in RFCs long before shows up in social science or legal literatures

Policy-Making

- Announce positions
  - eg, no wiretapping, defining online telephony
- Address general legal issues
  - eg, antitrust, fraud
- Address Internet-specific legal issues
  - eg, spam, phishing
- Respond to US law
  - eg, compliance, technical inadequacies of law
- Respond to laws of other countries
  - eg, Canadian emphasis on rural access

Policy Analysis

- Explicit
  - provides technical background
    - eg, RFCs on fair queuing & quality of service key to understanding technical side of network neutrality
  - critique of statutory law
  - explanations of technical contradictions in laws & regulations
- Implicit
  - technical analysis of dimensions of policy issues not yet apparent in legal discussions

Political Thought

- Free speech value of network
  - comes up first in a joke but becomes serious
- Jurisdictional issues
  - geopolitical
  - geopolitical vs network political
  - effort to be "agnostic" re "what is a country" in DNS

- Uses of law in technical environment
  - US constitutional principles justify alterations to IETF processes
  - how can compliance be effectively -- & appropriately -- achieved?
  - what is "legality" anyhow?

Design Criteria as Policy Principles

- RFCs present "constitutional principles" for the Internet

- Logistical policy principles
  - just as US Constitution includes basic elements of government structure, some of these principles are logistical
    - sustaining the process
    - content reliability
    - network reliability
    - compatibility

Design Criteria: Social Policy Principles

- User democracy
  - design for all types of users & uses
- Technological democracy
  - design simultaneously for most sophisticated innovations & for least sophisticated, lowest capacity equipment
- Telepresent distributed computing
  - experience computing at a distance as if it were local
- Balance between flexibility & network resilience
  - user control & flexibility vs. need for network standardization

- Stimulate innovation qua innovation
- Interoperability
  - compatibility (backward & forward)
  - extensibility (innovation + scale)
- Other social goals
  - get the network running fast
  - promote social interaction among users
  - provide user support

Uses & Users

- Conceptualizations of uses & users were extremely broad & rich

- Driven by
  - network imaginaries from diverse sources
  - designer ambitions
  - input from users
  - surprises driven by network affordances (eg, email)

Uses

- RFC 1: "stimulate early and wide use by a wide class of users"
- Commercial use foreseen by 1971
  - banks & warehouse user needs (RFC 144)
  - profit-making time-sharing cos (RFC 164)
  - General Motors first corporation to join meetings as user (RFC 316, 1972)
  - health care industry (RFC 144)
  - users not supported by ARPA

– government uses foreseen in first decade (by 1979)

- military needs in *author* or *assumptions*, not text
- air traffic control (RFC 659)
- criminal justice (RFC 144)
- education (RFC 313)
- weather service (RFC 420)
- libraries (RFC 286)
- *e-government* (RFC 371, 1972)

Users

- *Human users vs. daemon users*
- Benign vs. malicious users
- Programmers vs. non-programmers
  - Internet insiders vs. other computer scientists
- Recognition that must learn from users
  - but rely upon designers themselves for naive social science input
- Assumption: human users highly heterogeneous

Addressing Diversity

- The most prevalent discussions of diversity involved internationalization
- Techniques during 1st decade included
  - authorship & participation in conversation
  - influence of international organizations
  - extension of network beyond US
  - **issues**
  - conceptual & operational definitions
  - design criteria (policy principles)

International Issues

- Social implications & political valence
- Cultural impact on naming practices
- Users from around world will seek different information from databases (eg, weather)
- International collaboration to build network
- Technological mix necessary (satellites & packet radio)

- Tariffs
- Dual use
- Vulnerabilities introduced by geographic extensions (eg, London - only 1 link)
- Need synchronicity - and thus a shared clock - to internationalize
- Language issues
  - first raised in 1971, received most attention of all international issues in first decade

Issue Nuance & Multi-dimensionality

- Attention to issues such as access during design processes often treat as singular in nature
  - issue-sensitive design processes often incorporate only 1 or a few approaches to problem resolution
  - but in reality social issues are complex, highly nuanced, multi-dimensional
  - sensitivity to these evident during Internet design process

Exemplar: Privacy

- ~ 18% of documents deal with privacy
  - most frequently discussed policy issue
- Just during the first decade, techniques discussed dealt with
  - humans
  - network
  - data

- Privacy protections: Human
  - logging in
    - username, password, account #, additional IDs at other levels of data or files
    - network "birthplace" concept
  - masking input
  - offline arrangements

- Privacy protections: Network
  - private networking
    - concept of "intranet" by 1979
    - off-line storage, snail mail
  - termination of activity
    - stopping processes
    - flushing input/output info
    - destroying files

- message design
  - packetizing
  - header design
  - humans vs. daemons
- connection identity
  - privacy for socket numbers
- Privacy protections: Data
  - information architecture
    - file names & path names
    - metadata
  - encryption

Coping with Instability

- The Internet epitomizes digital instabilities
- Hortatory value re lessons **not** learned
  - insistence on backward compatibility in 1970s
  - but IPv6 not backward compatible
- Internet RFCs have become model for large-scale sociotechnical infrastructure decision-making processes

The Difficulties

- Began by thinking all decisions would have to be permanent
  - paralyzing, unrealistic
- There must be experts somewhere
- Pervasive variability
  - everything susceptible to change
    - programming languages, software, hardware, network levels, users & user practices
  - division & multiplication

The Techniques

- Definitional labor
- Conceptual labor
- Network agency
- Rhetorical tools
- Process manipulations
- Deference to community
- Living with paradox

Definitional & Conceptual Labor

- Design subject
  - what are communication processes?
  - what is the network?
  - what are network elements?
    - RFCs defined the "byte"
- Experimentation vs protocol change
- Idiosyncrasy vs error
- Glocalization

Rhetorical Tools

- Design assumptions, constraints, recommendations articulated
- What is not articulated does not exist
  - precision a requirement
- Models shape perceptions of problems & possible solutions
- Texts are problem-solving provocations
  - but text ≠ implementation
- Skins (design wraps) are affordances

Process Manipulations

- Delay
- Incomplete specification
  - cf incomplete theorization in the law
- Experimentation as acculturation
- Personal force
  - ex: grad student Postel: I'm naming czar
- Ongoing network measurement
- Details on need to know basis
- RFCs as process tool

Deference to Community

- Strong normative pressures
- Siting of design solutions, community preferences, & compliance interact
- But limits
  - ex: "community" said no property rights in domain names, but law said yes
  - ex: want user input, but differentiate between those with & without technical knowledge

Living with Paradox

- Expect instability in commands, identities
  - BUT assume everything works
- Document everything
  - BUT assume lag between changes & documentation
- Never use imprecise words in protocols
  - BUT describe things symbolically (foobar)
- *Use of paradoxes as canniness*

In Sum . . . .

"Network topology is a complicated political and economic question ...." (RFC 613, p. 1)

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for more information ….

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    - RFC-related pieces: http://people.tamu.edu/~braman/html/topicinternetdesign.html