
Integrating Network Engineering into the Policy Debate



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A Welcome Addition to the Policy Debate

- An appreciation basic principles of network engineering is missing from the policy debate
 - TCP's origins in CYCLADES
 - Congestion management (Jacobson's AIMD)
 - Mentioned only tangentially: longstanding efforts to implement Quality of Service (QoS)
- Paper shows the flaws with simplistic visions of end-to-end and the importance of preserving room for experimentation

Engineering as an Exercise in Tradeoffs

- Reinforces that engineering is inherently pragmatic
 - Solutions rarely framed in terms of theory and absolutes
 - Solutions vary with the context and the nature of the problem to be solved
 - Optimal solutions should vary across time
- Underscores the importance of providing a structure that permits experimentation rather than finding the “right” answer

Examples of Changes in Context: Congestion Management

- Jacobson's solution regards nonrival of an acknowledgement as evidence of congestion
 - Irrelevant for UDP (no acknowledgements)
 - Incorrect inference for wireless networks
 - Acknowledged as insufficient to allocate streams fairly
- Problems led to Random Early Detection (RED)
 - Does not solve biases based on burstiness, packet size, roundtrip time, phase problems, etc.
 - Does not solve TCP-noncompliance or aggressiveness

Explicit Prioritization in the Network's Core

- BGP supports explicit routing policies
 - Driven in part by multihoming
 - Load balancing
 - Cost minimization
 - Quality of service
 - Examples of other policies
 - Never put Iraq on a route starting at the Pentagon
 - Do not transit the U.S. to get from British Columbia to Ontario
 - Only transit Albania if there is no alternative to the destination
 - Traffic starting or ending at IBM should not transit Microsoft

The Broader Economic Context

- As what people want becomes increasingly varied, the optimal level of standardization changes
- The nature of competition changes as markets mature
 - Look for market niches/delivering more value
 - Look for lower costs/specialized production functions
- The network is moving away from strict hierarchy
 - Private peering, multihoming
 - Secondary peering, caches, content delivery networks

Potential Barriers to Experimentation

- Network economic effects (lock in)
- Technological paradigms
- Regulation
 - Three possible approaches
 - Ex ante prescriptive
 - Ex post case-by-case
 - None
 - The danger that regulation will prove the most durable