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Differentiated Services over the Internet: An Impossible Dream?

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Managed/Differentiated Services Controversy

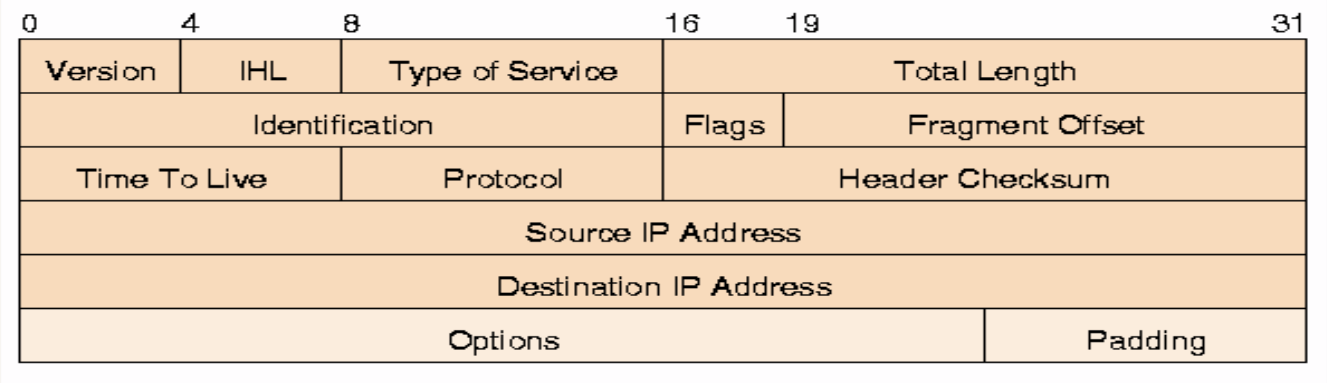
- Basis of “Anti-Discrimination” Rules
  - Markey and Snowe-Dorgan fee ban
  - Berners-Lee nuance
  - Isenberg/Crawford “All Packets are Equal” rule
- An Old Argument in Network Engineering
  - Bandwidth vs. Control battles in logic-scarcity era
  - Largely settled in modern engineering: need both!
- Agency fears of last-mile monopoly
  - How difficult is it to switch carriers?
  - Could do it packet-by-packet in wireless

Internet Diversity

- A Network of Networks
- Originally built to interconnect:
  - ARPANET
  - S. F. Bay Area Packet Radio Network
  - Atlantic Packet Satellite Network
  - AUTODIN II
- Currently Interconnects:
  - MPLS over Optical Ethernet core
  - DSL, ATM, FTTH, DOCSIS wireline edge
  - 3G, 4G, Wi-Fi, Wi-Max wireless edge

Classical Internet Interconnect Dynamics

- Original Internet Sought Highest Common Factor
- *RFC 795 - Service mappings* allowed high-priority exchanges between ARPANET and PRNET



- *RFC 1633 Integrated Services in the Internet Architecture*
- *RFC 2283 Multiprotocol Extensions for BGP-4*
- *RFC 2475 An Architecture for Differentiated Services*
- Ongoing work with Re-ECN, P2P.

Commercial Internet Interconnect Dynamics

- Privatization of Internet forced quick migration to BGP
  - First Priority was support for Web
  - Web is a Best-Efforts System
- All Packet Exchanges are Subject to Negotiation
  - Current Operational Norms are Trade Secret
- Gap Between Theory and Practice
  - Differentiated in Theory
  - Best Efforts in Practice
  - Some BGP Exchanges actually do preserve “Priority”

Why Differentiate?

- Better Support for Heterogeneous Applications
  - *Service differentiation is desired to accommodate heterogeneous application requirements and user expectations, and to permit differentiated pricing of Internet service.* – RFC 2475
- Provide End-User Control over MPLS
  - Internet's unknown core protocol
  - Designed for Traffic Engineering
- Support Voice as well as Data on Mobile Nets

Why Forbid Differentiation?

- Prevent Temptation
  - Don’t allow ISPs to think about extracting monopoly rents
- Preserve the Internet as it has “always been” (since 1995)
  - Web-centric Internet Should Dominate
- Simplify Provisioning and Operation
  - Complicated Decisions about Service Tiers
- Focus investment on raw bandwidth
  - Either/Or of management vs. bandwidth
  - No longer necessary to make that choice

Angels and Devils

- *If my devils are to leave me, I am afraid my angels will take flight as well.* - Rainer Maria Rilke
- Angels:
  - Four times as many phone calls per Wi-Fi segment
  - Practical use of TelePresence over the Internet
  - Mobile 911 and a Public Safety Network that really works
  - Freedom from bill shock and bandwidth caps
- Devils:
  - Arbitrary Lock-ins and Lock-outs
  - Costs of Launching New Services
  - Mangement inconvenience

Classical Network Diversity

- Two Applications
  - Interactive
  - File Transfer
- Two Delivery Requirements
  - Low Delay
  - High Reliability

Enriching the Internet

- Internet is a consensus system
- Internet is not uniform
  - Diverse Applications
  - Diverse technologies
  - Diverse speeds and capacities
- Advanced Applications Stress the System
  - TelePresence Began with Private Wire
  - Moving to Virtual Private Wire and Private Switching
  - Will Migrate to Differentiated Internet
  - Will Mature on Generic Internet