IPv6: Addressing the Future

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The IP Hourglass

- email, WWW, phone...
- SMTP, HTTP, RTP...
- TCP, UDP...
- IP
- ethernet, PPP...
- CSMA, async, sonet...
- copper, fiber, radio...
Why the Hourglass Architecture?

⌛ Why an internet layer?
- make a bigger network
- global addressing
- virtualize network to isolate end-to-end protocols from network details/changes

⌛ Why a single internet protocol?
- maximize interoperability
- minimize number of service interfaces

⌛ Why a narrow internet protocol?
- assumes least common network functionality to maximize number of usable networks
Putting on Weight

- requires more functionality from underlying networks
Mid-Life Crisis

- doubles number of service interfaces
- requires changes above & below
- creates interoperability problems
Oops! An Accident

- NATs & ALGs used to glue the broken pieces
- lots of kinds of new glue being invented—ruins predictability
- some apps remain broken, since repairs are incomplete
More Fattening Temptations

- TCP “helpers”
- reliable multicast assists
- packet-intercepting caches
- “content-based routing”
- active networking
Lost Features of the Internet

- transparency
- robustness through “fate sharing”
- dynamic routing
- unique addresses
- stable addresses
- connectionless service
- always-on service
- peer-to-peer communication model
- application independence
Below-the-Waist Bulge

mostly reinventing, badly, what IP already does (or could do):

- VLANs
- layer 2 tunneling protocols
- MPLS, PPPoE,… (“layer 2.5”)

lower layers mostly seem to just make IP’s job harder

- cells, circuits, QoS, multicast, large clouds, opaque clouds
What to Do?

First, acknowledge that this is the normal entropy / decay that besets all large, engineered systems over time.

So, shall we just let nature take its course?

Or, shall we make the effort to get back into shape?
A Fitness Goal

- perhaps we can trim down from an hourglass to a wineglass
- promising signs: IP-over-SONET, IP-over-WDM
- IPv6 to restore simplicity and functionality
Potential Impact of IPv6 on the Next-Generation Internet?

1. restore capabilities of the previous generation Internet!
2. add capabilities for new environments, new devices, and new applications
3. allow those capabilities to reach everyone, everywhere, all the time
Only Time Will Tell…