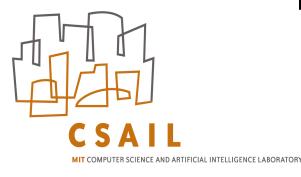
Video-over-IP as a Specialized Service

William Lehr

WIE2015

UCSD December 16-17, 2015





An observation and a question

Internet Video is the major driver of infrastructure investment

- Cisco VNI: by 2019, video will be 80% of Internet traffic
- Most of this is linear entertainment, aka "TV/Movies"
- Most of this will be handled by CDNs
- (Above is a forecast...)

Question: What if Video-over-IP were not Internet??

- Does this traffic *belong* on the Internet?
 - Do we want an Internet optimized for TV?
 - If so, is that still essential infrastructure?
- How might Internet differ if video-over-IP is NOT part of Internet?
 - Benefits/costs of separate networks? Tech, Biz, policy implications?
 - How might we get there from here (if we wanted to...)?

Video-over-IP as a Specialized Service

Video traffic is a lot of things... but a lot of it is TV

- Linear TV: Netflix, Hulu, Xfinity, HBOGo, etc.
- YouTube, New Media, Gaming
- Surveillance/monitoring cameras
- Video conferencing

Linear TV has well defined, distinctive characteristics

- Cacheable, delay tolerant
- One-way, asymmetric traffic (HD video)
- (inherently) multicast
- Bundled content+conduit: Subscription, PPV, and advertising supported ("free")
- (Copyright protection an issues of special concern?)

Internet: heterogeneous, adaptive, anything-over-anything

- Ubiquitous Connectivity (anywhere to anywhere)
- Two-way, symmetric (and everything else)
- Inherently end-to-end (content under end-user control)
- Conduit only: Subscription, MB usage tiered, content/application agnostic

Policy Convergence: legacy → future; silos → ?

Broadcast/media regulation : content (editorial)

- Content regulation: domestic content, porno, public programming
- Must-carry & retransmission consent
- Media Concentration
- Program access, etc.
- MVPD copyright rules (STELA)
- First Amendment

Telecom (PSTN) regulation : conduit

- Universal service: everyone has affordable access to telephone
- Interconnection: ubiquitous connectivity, including international (ITU)
- Advanced Services (S706)
- CALEA, e911, etc.

Broadband: Open Internet Order (OIO)

- BIAS : open, neutral Internet access
- Non-BIAS (aka, Specialized Services): ?? Unregulated ??

Benefits of separate Internet & Video-over-IP networks?

- Technical: separate networks share resources when efficient
 - Internet: lower average data rate, higher peak/average
 - Layer 3 isolation easier (agnostic about PHY/application layers)
 - Separate networks: multi-homing, end-user autonomy, resiliency, ...
- Business Model: integrators bundle silos at retail
 - Today's triple play: separate networks for Internet, VoIP, IPTV
- Regulatory: regulating "silos" focuses scope of regulation
 - Universal service: subsidize basic infrastructure, not entertainment
 - Interconnection: IP Video interconnection regulation (if needed) better than general Internet interconnection regulation.
 - Advanced services: Optimize Internet for IoT future smart healthcare, energy, eGovernment, not more ways to enjoy toys...

Some research questions...

How might we get there from here?

- How does this impact OIO? OVD review? PSTN transition?
- Is it desirable and feasible to define Title II IPTV service?

Implications for measurement?

- How does performance measurement differ when Video is part of Internet traffic v. when Video is separate network (that may share resources)?
- Implications on Video performance measurement?

One or multiple networks better?

- How does separate network for specialized services impact value of <u>Differentiated Services for Internet (v. Best effort)?</u>
- (For whom? Which is easier to evolve?)

Lots more....

Other stuff...

OIO Concerns about specialized services

- Reachability (¶47): BIAS is about general reachability. A service that is for special application not BIAS.
- Capacity Isolation (¶ 112): Protect BIAS from "dirt road"
- Pricing & Payment (¶114): Attempts to hide BIAS as non-BIAS
- MVPD Review: FCC NPRM (December 2014)
 - OVD reclassification? (Aereo...)