



# QoS in the home

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# Agenda

- The problem
- What applications need QoS?
- Current state of in-home QoS
- Further out



# The problem

- How does QoS/prioritization by an ISP interact with QoS/prioritization within the home?
- Let's answer this question in these steps:
  - Why do users want QoS in the home?
  - What does QoS in the home look like?
  - How would this interact with provider QoS?



# What home traffic needs QoS?

## ■ VoIP

- SP-provided (Comcast),  
Over  
-the-top managed (Vonage), OTT ad-hoc (Skype)
- User cares about quality, SP may or may not
- Small BW requirement, easy solutions apply

## ■ Videoconferencing

- Low-end (Skype) has no real quality requirements
- High-end needs something better



# What home traffic needs QoS?

- Streaming video in home
  - In home (NAS/PC to Digital Media Adapter), OTT managed/ad-hoc (Apple TV, Netflix/Roku)
  - User cares about quality, SP doesn't
- Streaming video from service provider
  - Converged access link and/or home network for TV and data
  - SP cares about quality



# Flow categorization

## ■ In-home

- Source & sink in home network
- e.g. video playout from NAS/PC to DMA

## ■ External, incoming

- Source outside the home, sink inside
- e.g. VoD (either SP-run or Vudu/Netflix)

## ■ External, in+out

- Bidirectional flow in & out of home
- E.g. videoconferencing or VoIP



# Access link upstream QoS

- Diffserv for outgoing traffic on the router
- Prioritize voice over data
  - Linksys/Vonage PAP2 or WRT54G-P2
  - Plug-and-play, but only for that application
- Sophisticated bandwidth management
  - Queueing/shaping on Residential Gateway (RG)
    - Handles multiple applications
    - Needs configuration



# Access link upstream QoS

- Problem: RG must know upstream bandwidth
  - Bandwidth a property of Access Network Terminating device
  - Hard to determine exactly *a priori*
    - DSL: line can retrain
    - Cable: upstream bandwidth shared with other customers
  - What to do if bandwidth changes? ☹️
  - Solution: Integrated router/access device
    - Who administrates QoS policy on this device?
  - Solution: Export bandwidth from ANT to RG (and anybody else)
    - What protocol? DSL modems use TR-69, others?
- Other issues
  - *Unprovisioned* local QoS can give *fairness* to applications
  - *Provisioned* QoS can be hard to manage
  - *Auto-provisioning* QoS (e.g. via signalling proxies) very complex





# In-home QoS

- In the home today: no real QoS
- Options at Layer 3
  - Diffserv via queueing/shaping
- Options at Layer 2
  - Wired Ethernet (100Mb/s or 1 Gb/s)
  - MoCA (coax cable)
  - HPNA (powerline)
  - WiFi (802.11b/g/n)
- WiFi is the real bear!!
  - Convenient, so people want to use it
  - Complicated to get good QoS
- Must be idiot-proof



# Standards efforts – UPnP QoS

- UPnP QoS specified by UPnP Forum
  - Support QoS requests using XML/SOAP
  - V2.0: Prioritized QoS
  - V3.0 (currently draft): Parameterized QoS
- Source/sink devices (control points) request QoS services for flows
- QoS Manager (QM) services requests for QoS by
  - Determining the topology of the network
  - Identifying the nodes between the source and sink devices
  - Issuing QoS requests to each of the devices
- QoS Policy Holder (QPH) advises QM on relative priority of request and traffic
  - Indicates relative reservation priority, and marking for endpoint to use
- Home network devices export QoS Device profile
  - Implements QoS requests by prioritizing traffic with signalled marking



# Standards efforts - other

- Digital Living Network Alliance (DLNA)
  - Certification program for manufacturers
  - Built around UPnP QoS 2.0
  - Describes a more specific, “conformable” standard
- CableLabs Reserved Service Domain (RSD)
  - Built around UPnP QoS 3.0
  - Specific guidelines & rules for implementation
  - Supports QoS 2.0-style “Prioritized Service Domain”
- Digital Video Broadcasting project (DVB)
  - Home Networking (DVB-HN) QoS
  - Based around DLNA guidelines, prioritized QoS



# Other in-home QoS efforts

## ■ Windows Rally

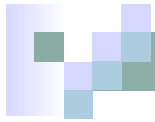
- Microsoft's "successor" to UPnP
- Built around Web Services model
- Proposed to OASIS for standardization

## ■ Vendor QoS solutions

- e.g. Linksys/Cisco Entertainment Grade Home Network (EGHN)
- UPnP QoS 2.0 + enhancements

## ■ Provisioning software

- e.g. "Network Magic" from Pure Networks/Cisco
  - Cisco Home Network Administration Protocol (HNAP), built around XML+SOAP services
- Device administration/configuration
- Bandwidth monitoring



# Access link downstream QoS

- Interesting for SP video delivery
- DiffServ for packet marking
- Admission control?
  - In-home: clients co-operate and divide up fixed bandwidth pool
  - Sender-driven: Admission control within the provider network, including the access link
  - Receiver-driven: In-home device signals access link bandwidth/flow requirement to network



# Summary

- In-home QoS is coming!
- Benefits:
  - It enables some useful applications
    - Converged home network for data, voice, video
    - Interesting user video applications
  - WiFi especially is interesting here
  - It has value for service providers too
- Challenges
  - Figuring out what to build!
    - Getting heterogeneous equipment to interoperate
    - Making sophisticated features *easy to use*
    - Building these into lightweight equipment
  - Figuring out how to do QoS across WiFi sensibly