AV Bridge Summary: an early view
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Michael Johas Teener

Mikejt@broadcom.com

Preface and warnings

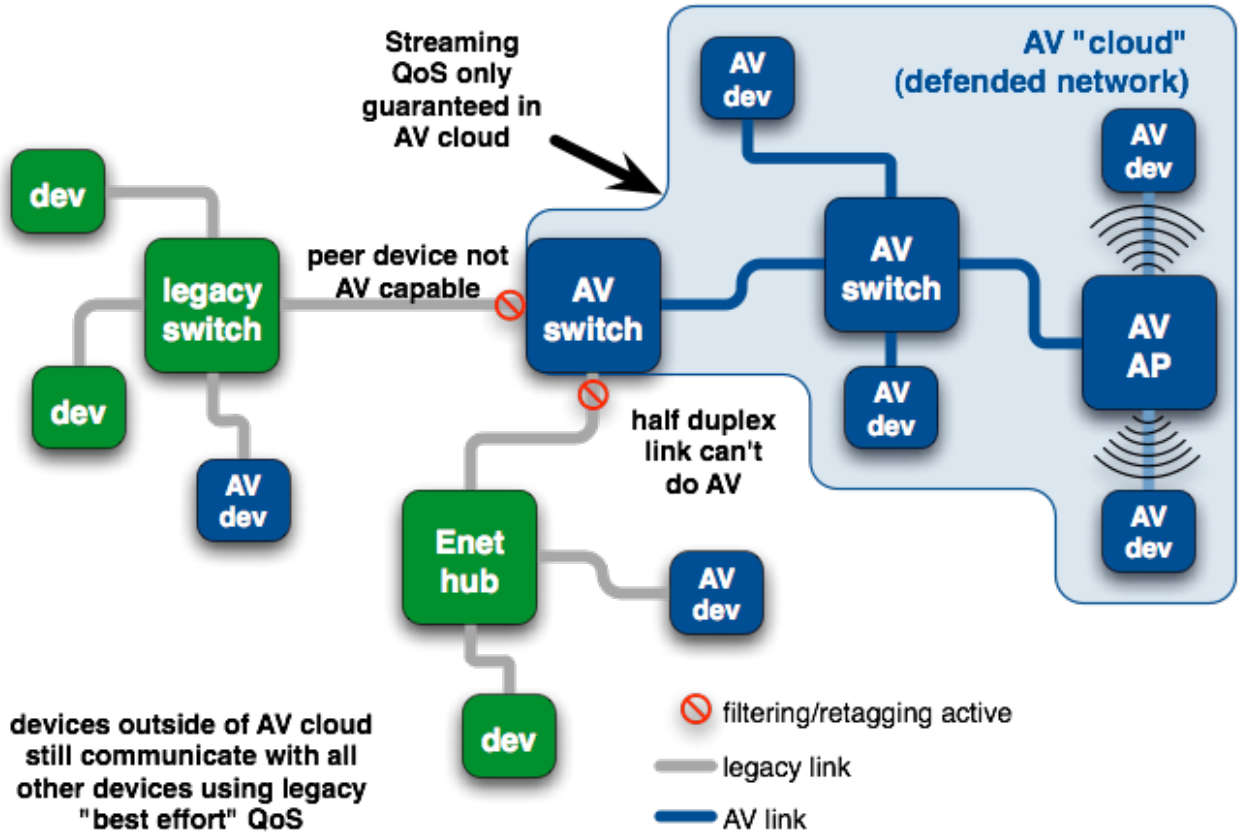
- Outline of bridge (and DTE) operation
  - To be used as the very start of a “Ethernet AV” recommended practice
    - (there needs to be an “802 AV” recommended practice that includes .11/.15/.16/.etc … but that is later work)
- Personal point of view
  - No one else has reviewed this
- Very preliminary!

Contents

- Structure of an 802 AV network
- 802-only time synchronization
- Reservation protocol
  - What is being reserved?
- AV stream frames
- Setting up a defended network
- Traffic shaping

Structure of an 802 AV network

- Directly connected participating devices … any intervening non-participating device defines a boundary to AV QoS



802-only time synchronization

- Assume something between a 1588 profile (preferred) and a timing domain that appears to be a 1588 subdomain
  - Time synchronization between 1588 and 802.1 is very simple
- Bridges (and 802.1 layer of endpoints) have “pretty good” idea of time, and very accurate measurement of delay to attached peers
  - “pretty good” means within a microsecond or so
- Specification TBD, but all current proposals have adequate performance
  - Cost/complexity/interoperability/robustness will be metrics used to choose a method
  - Assume unique Ethertype with subtype to uniquely identify packets that must have accurately measured launch/receive times
  - Measurement granularity of launch/receive times ≤ 40ns
- Separate PAR (P802.1as) for stand-alone document

Reservation protocol

- Will be based on “SRP” as described by Felix Feng
  - MRP (P802.1ak) application to register a multicast address along a path and to associate a traffic class with that address
- Reserves bandwidth at a defined class of service for a specific stream
  - Bandwidth is defined as “bytes per class interval”
  - Class of service is “highly interactive” (with 125us class interval) or “normal interactive” (with 1ms class interval)
  - Stream is identified by destination address (multicast)
- Will be amendment to IEE Std 802.1Q-2005
  - perhaps P802.1at?

AV stream frames

- 802.1Q tagged frames with PCP 5 for highly interactive and PCP 4 for normal interactive
- How is multicast address chosen?
  - Should this be an 802 problem?
    - UPnP has some mechanisms for this
  - If so, default 802 operation could be same as “auto IP”: pick an address from an 802-owned multicast set, probe using it to see if anyone responds … repeat for “n” times

Setting up a defended network

- Need to prevent interference from non-participating traffic
- If all bridges were managed ones (participated in spanning tree), we could do this with existing protocols like LLDP
  - Oops … unmanaged bridges are *the most likely* type to find in the home
- So … since we require time synch on AV networks, we can use that to determine if an unmanaged bridge is attached to a port
  - If cable delay between peers is “unreasonable” (>> 100 m), we can assume that the link cannot be used for AV streaming
  - Time synch granularity is ≤ 40ns, so cable length uncertainty on the order of ±8m
- If cable delay is OK, and peer responds to enhanced link discovery with correct attributes, then peer can be assumed to be a part of the AV cloud

Traffic shaping

- Source device must do traffic shaping to match reservation (launch no more than x bytes per class interval)
  - Right? No arguments?
- Advantages for shaping traffic at bridges
  - Allows better best-effort performance
    - Nothing to be gained if stream data arrives early … all streaming applications are built around worst case latency and provide appropriate buffering
    - Delaying “early” stream data allows best effort traffic to use unneeded transmission opportunities … best effort QoS is typically improved with reduced latency
  - Network scalability
    - Buffers within bridges and endpoints can have fixed “small” size regardless of network topology and never drop packets with streaming QoS

SRP-assisted traffic shaping

- SRP allows a bridge the maximum streaming traffic that is expected to be transmitted and received on each port at any point in time
- Time synch protocol guarantees that bridges agree on common time reference (+/- some small delta … e.g., 1us)
- These two pieces of information allow a bridge to make a good guess whether a particular frame should be transmitted during a particular class interval
  - Use a kind of dynamically adjusted WRR queue draining algoritm
- Delivery jitter greatly reduced, but bounds increase with number of hops

Misc. services

- Will provide other services for higher layers
  - Localization (content protection methods frequently require that devices that share protected content must be “close” to each other
    - AVB can provide a good estimate of the cable distance between two devices … on the order of ±8m per cable hop
  - Device authentication/link security
    - AVB can use 802.1 security services to validate endpoints and bridges, and provide link-level encryption