

Audio Video Bridging (AVB) Assumptions

IEEE 802.1 AVB Interim

June 6, 2007 – AVB Call

Green Text = Agreed to on Various AVB Calls/Meetings

Black Text = Not Decided

Changes Marked with Red from last version

Don Pannell

Marvell

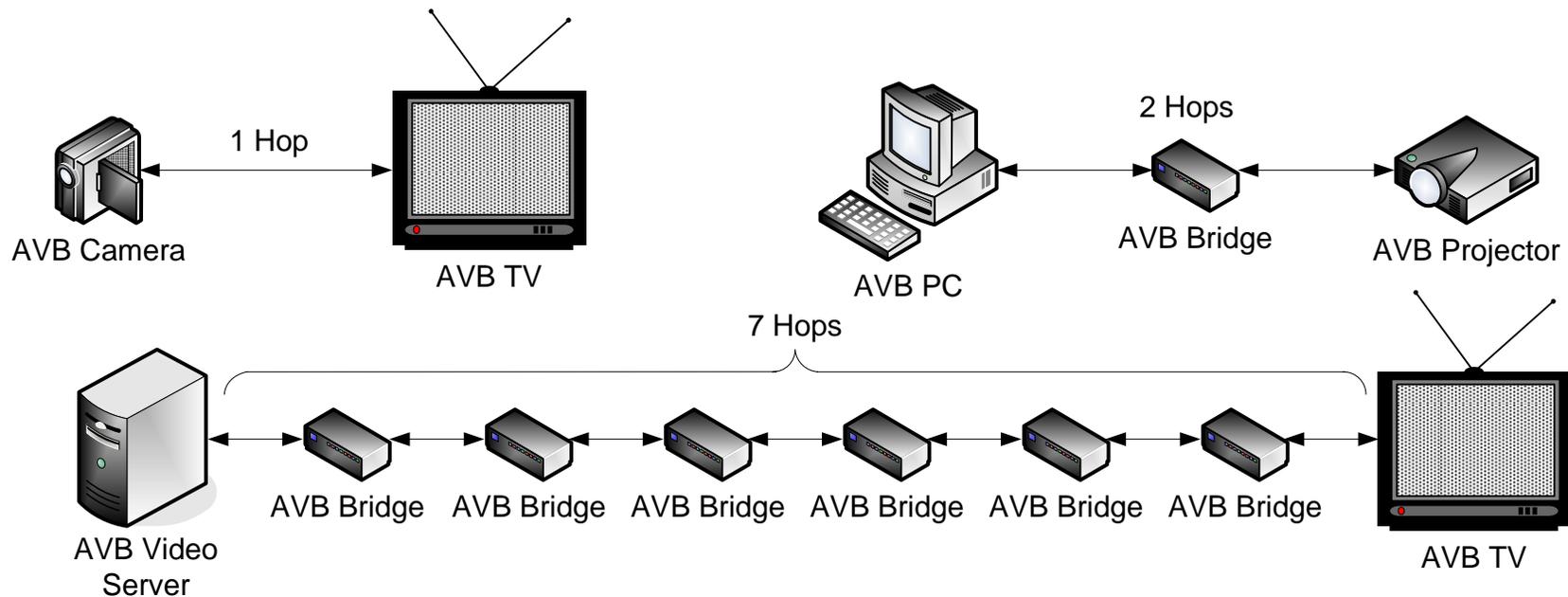
dpannell@marvell.com

Revision History

- Avb-pannell-assumptions-0607-v6: After Geneva Interim & after 5/23/07 call
- Avb-pannell-assumptions-0507-v5: After many calls
- Avb-pannell-assumptions-0407-v4: After 4/11/07 call
- Avb-pannell-assumptions-0407-v3: After 4/04/07 call
- Avb-pannell-assumptions-0307-v2: After 3/28/07 call
- Avb-pannell-assumptions-0307-v1: Before 3/28/07 call

Performance Goals

- Max Latency (802.1Qav – MAC to MAC, not analog source to sync eg., microphone to speaker or hard drive to display)
 - 802.3: AVB Class 5: Less than 2 mSec over 7 Hops
 - 802.3: AVB Class 4: Less than 8 or 16 mSec over 7 Hops?
 - Prefer binary numbers
 - 802.11: ??
- Hops are defined in 802.1 terms, i.e., 1 LAN = 1 Hop



Performance Goals / Names

- Latency Variation (Jitter)
 - 802.3: Need to discuss objectives – effects shaper
- Class Observation Interval
 - AVB Class 5 is 125 uSec
 - AVB Class 4 is 1-5 mSec?
- AVB Class 5 together with AVB Class 4 cannot use more than 75% of a link's bandwidth
 - The Remaining 25% (or more) is used for Legacy (non-AVB) flows
- Functional Device Type Names
 - AVB will use Talkers, Listeners & Bridges
 - Talker is the source of a Stream, Listener is a receiver of a Stream
 - A Bridge is an 802.1 Bridge
 - Any physical device could be any combination of these

802.3 Link Requirements

- Link Speed
 - 802.3: 100 Mbit/sec or faster (i.e., no 10 Mbit support)
- Link Duplex
 - 802.3: Full Duplex only (i.e., no half duplex support)
- Maximum Frame Size
 - Defined as Layer 2 bytes – or start of DA through end of CRC
 - 802.3: 1088 bytes for AVB Class 5? 1522 bytes? Or 2000 bytes? (i.e., no Jumbo frame support)
- Flow Control
 - 802.3x is not supported and cannot be used on AVB links

AVB Frame Format

- 802.1 Q Tagging
 - All AVB Streams will be Q Tagged
 - All PTP frames (for 802.1AS) will NOT be Q Tagged
 - All SRP frames (for 802.1Qat) will be Q Tagged
- VLANs
 - The VID is a VLAN and not a Stream Identifier
 - Stream Identifiers must be unique per VID
- Ether types
 - The Ether type of a frame is not a Stream Identifier
- Priorities
 - AVB Class 5 Streams will use a Q Tag priority of 5 (PCP)
 - AVB Class 4 Streams will use a Q Tag priority of 4 (PCP)
 - PTP Frame priority? (Residency time concerns – Slide 12)

Stream Identification - SRP

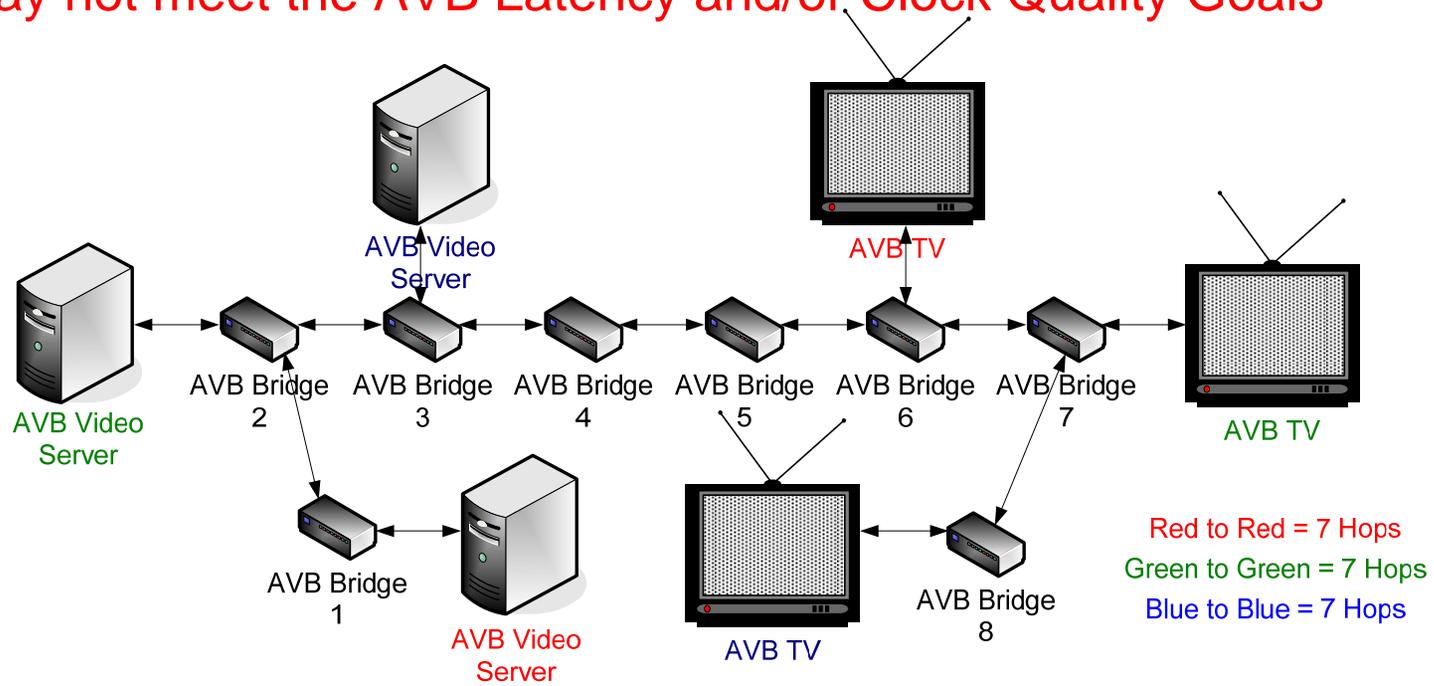
- Stream Identification (Ref 1)
 - An AVB Stream Frame is Any Frame with a Q Tag priority 4 or 5 entering an AVB port using an SRP Reserved DA
 - An AVB Port is a port mode bit used to differentiate the port from being a Legacy port (AVB ports are part of the AVB Cloud, Legacy ports are at the edge of the AVB Cloud, not connected to an AVB aware device)
 - SRP DA's are differentiated from MMRP DA's in the Address Database by a new SRP indicator in the MAC entry
 - SRP DA's are 'Reserved' when entered into the Address Database with the entry's SRP indicator set
- Stream Policy (Ref 1)
 - Only those frames that meet the Stream Identification (above) can be placed into the AVB Egress Queues
 - Need to decide about PTP and other Management frames (Slide 12)
 - All other frames are placed into the Legacy Egress Queues
 - Frames that contain an SRP 'Reserved' DA with a Q Tag priority 4 or 5 entering a non-AVB port (i.e., a Legacy port) must have their Q Tag priority re-mapped to 2 or 3, respectively (i.e., PRI 4 goes to 2, PRI 5 goes to 3) - May change to SRP OUI w/Discard action

SRP Assumptions

- Stream Identifier Addresses
 - All bridges must be aware of all Stream MAC addresses in use even if the stream will not pass through this bridge. This is required so that all Legacy ports can correctly re-mark all incoming frames with an SRP stream ID and an AVB Class PRI (see previous slide)?
 - This causes a need for larger Filtering Databases (increased cost)
 - Or the switch can use an AVB Multicast OUI range check?
 - Current Preference – But this only works for multicast addresses
 - Unicast addresses, if supported, would need the above method
 - Or we just don't care about this case as its not very likely?
 - This approach will probably not be acceptable in a Provider space as it's a potential DoS attack
- SRP will currently allocate a Static bandwidth for a flow (i.e., Dynamic support is dependent on contributions from those that need it and may need to become part of a separate PAR)

SRP Assumptions

- Is this a valid AVB Cloud?
- If so: SRP Needs to Count Hops and/or report the Max Latency or Port Speed reported from all the Hops
 - So a Listener can determine if it wants to listen to the stream as it may not meet the AVB Latency and/or Clock Quality Goals



SRP Questions

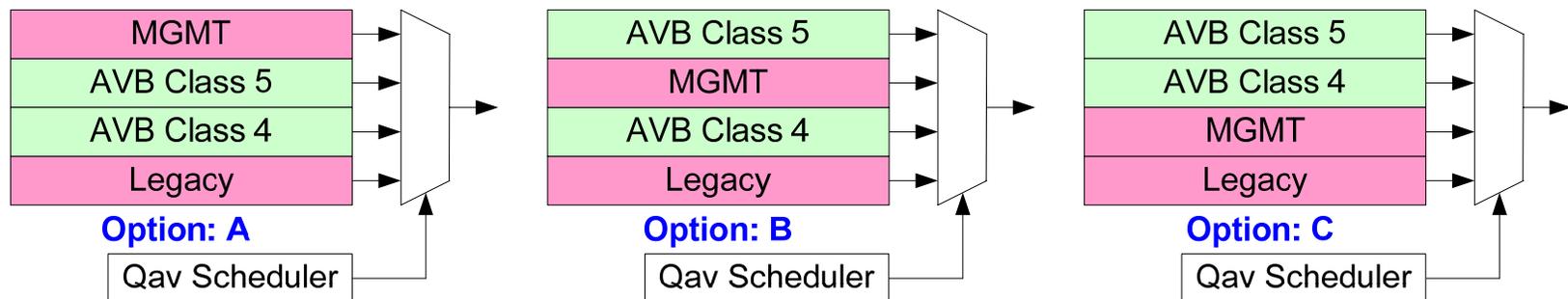
- How do we handle the case where a Bridge or Listener(?) is out of Address Resources?
 - Or it can't handle the current address but it can support others
- How are Stream Addresses going to be Allocated?

PTP Assumptions

- PTP Clock Quality (802.1AS clock, Ref 2)
 - +/- 100ppm or better from a free running ≥ 25 MHz clock
 - Less than 4 ppm per Second drift
 - End point time synchronization accuracy for steady-state (up to 7 Hops) ≤ 1 uSec (i.e., any 2 PTP clocks separated by at most 7 Hops differ by no more than 1 uSec)
- Media Sample Clock Quality (P1722 AVB-TP clock)
 - Jitter/Wander: per MTIE in Ref 3
 - Endpoint media output synchronization accuracy ≤ 1 uSec
 - Startup/Settling time (includes change in Grand Master): 2 Sec?
- 802.3 PHY Latency Jitter/Wander (Ref 2)
 - No more than 86 ns per Hop or 43 ns per PHY (i.e., portion that is not known and corrected for)

PTP/Qav Priority

- Priority Models (do we need to spec this or just spec the latency)?
 - Concern is where to put PTP and/or Management (BPDU type) frames
 - Assume PTP is a MGMT (Management) frame & all MGMT are given **the same scheduling priority**?
 - The figure below shows how frames are MUX'ed onto the wire with the higher lines having a higher priority.



Qav Assumptions

- Bridges do per class shaping
- Talkers do per stream shaping?
- Policing, if done, is mainly for DoS attacks, and is therefore much less accurate than Shaping since you don't want to discard any approved flows
 - This is because the Observation Interval between devices is not synchronized

Qav Questions

- Minimum size frame issues on reservations for low bandwidth streams?
- Observation intervals name – token bucket solutions... What are we really doing here?

802.11 Requirements

- Link Speed
 - 802.11: 100 Mbits or faster
- Link Duplex
 - 802.11: Half Duplex (no choice)
- Maximum Frame Size (Layer 2 bytes – DA through CRC)
 - 802.11: 1088 bytes for AVB Class 5? 1522 bytes? Or 2000 bytes? (i.e., no Jumbo frame support)
- Flow Control
 - 802.11: Won't be allowed

Other Issues

- 802.1AE Environments
 - Any AVB Streams and PTP & SRP frames can be AE Tagged
 - Need to understand implications of MacSEC on PTP Timestamping
 - Will Need Help with 802.3 on this
- PONs are currently not specifically supported?
 - i.e., PON support is dependent on contributions from those that need it and may need to become part of a separate PAR
- Provider Networks are currently not specifically supported?
 - i.e., Provider Network support is dependent on contributions from those that need it and may need to become part of a separate PAR
- Other Assumptions ...
 - (this is a growing work in process)

References

- Ref 1: at-pannell-policy-0607-v3
 - Title: 802.1 Qat Policy Proposals
- Ref 2: as-garner-assumptions-for-error-sources-time-synch-0507-v03
 - Title: Assumptions for Sources of Time Synchronization Error in IEEE 802.1AS
- Ref 3: avb-garner-requirements-summary-r4-060217
 - Title: Summary of AVB Bridging Network Requirements