Audio Video Bridging (AVB) Assumptions

IEEE 802.1 AVB Plenary

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Green Text = Agreed to on Various AVB Calls/Meetings

Black Text = Not Decided

Changes Marked with Red from last version

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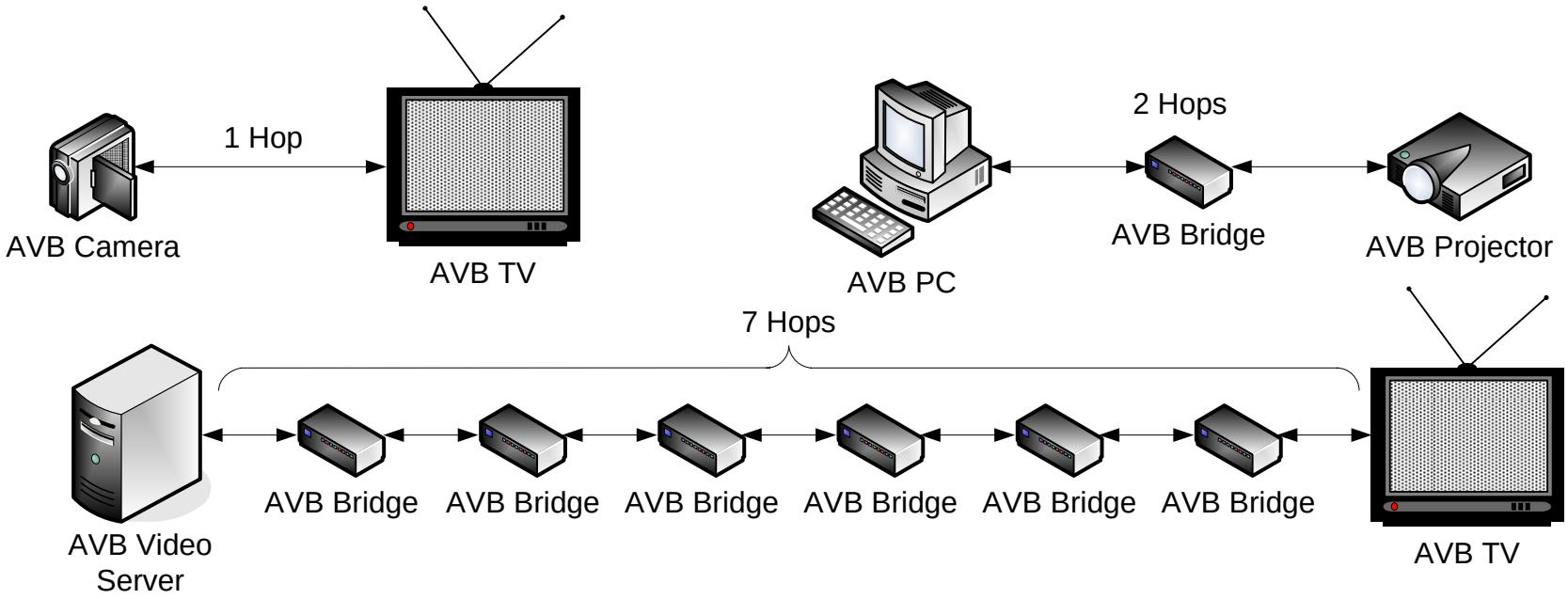
Revision History

- Avb-pannell-assumptions-1107-v9: After many calls – 11/13/07 Atlanta
- Avb-pannell-assumptions-0907-v8: After many calls – 9/04/07 Stockholm
- Avb-pannell-assumptions-0707-v7: After many calls – 7/17/07 San Francisco
- 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 A: Less than 2 mSec over 7 Hops
  - 802.3: AVB Class B: 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: See shaper defined in 802.1Qav Drafts
- There is no longer a Class Observation Interval
  - The shaping of AVB data is defined in 802.1Qav Drafts
- AVB Class A together with AVB Class B cannot use more than 75% of a link's bandwidth (i.e., not to exceed 75%)
  - The Remaining 25% (or more) is used for Legacy (non-AVB) streams
- 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)
  - Energy Efficient Ethernet issues need to be considered
- Link Duplex
  - 802.3: Full Duplex only (i.e., no half duplex support)
  - Works with clause 43 Link Aggregation (data and PTP)
- Maximum Frame Size
  - Defined as Layer 2 bytes – or start of DA through end of CRC
  - 802.3: 1088 bytes for AVB Class A for 100 Mbit links?
    1522 bytes? Or 2000 bytes for Legacy frames?
    (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 A Streams will use a default Q Tag priority of 5 (PCP)
  - AVB Class B Streams will use a default Q Tag priority of 4 (PCP)
    - These Q Tag PRI defaults may change – voice your wish!

Stream Identification - SRP

- Stream Identification (for Queue Usage in Bridges – Ref 1)
  - An AVB Stream Frame is Any Frame with an AVB Reserved priority entering an AVB port
  - An AVB Port is a port mode 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)
- Stream Policy (for Queue Usage in Bridges – Ref 1)
  - Only those frames that meet the Stream Identification (above) can be placed into the AVB Egress Queues
  - All other frames are placed into the Legacy Egress Queues
  - Frames that contain an AVB Reserved priority entering a non-AVB port (i.e., a Legacy port) must have their Q Tag priority re-mapped

SRP Assumptions

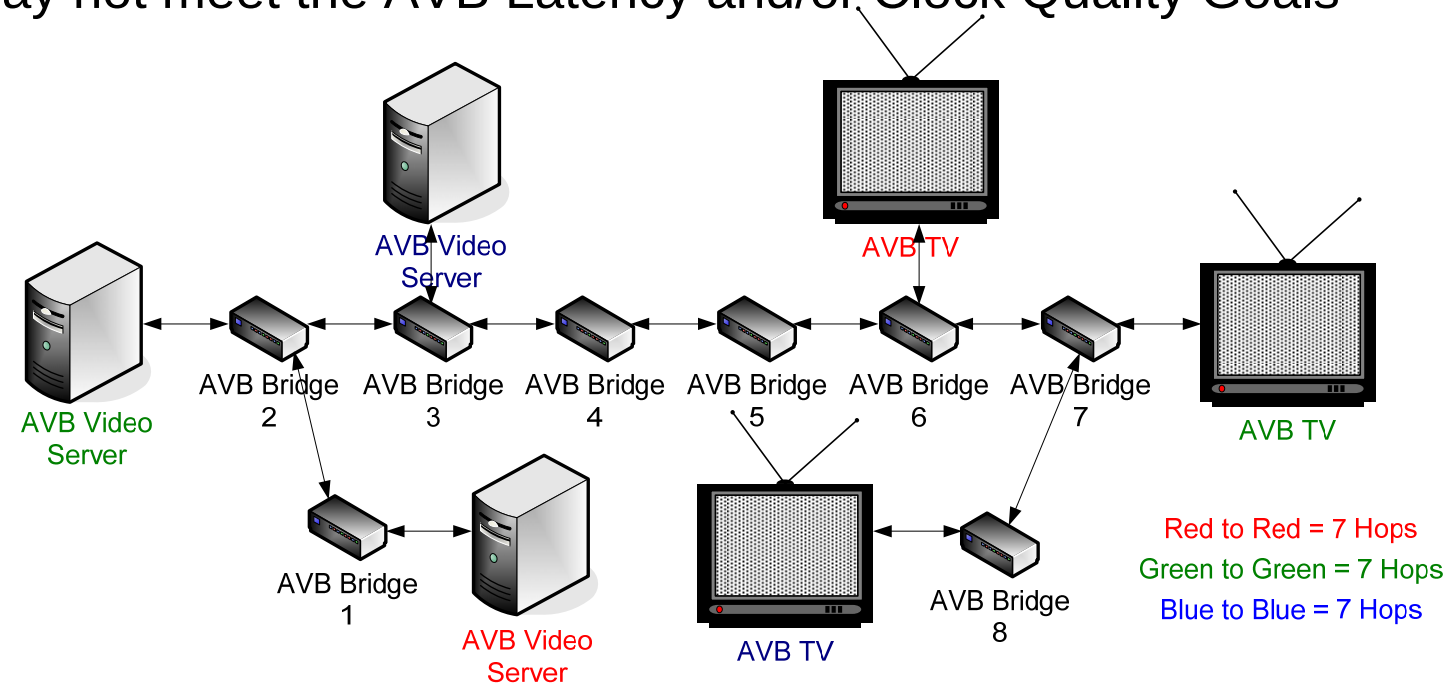
- Stream Identification (for Filtering in Bridges)
  - Different Multicast Streams must use Unique Multicast Addresses (within the same VLAN)
  - The standard will support Unicast (Individual) & Multicast (Group) DA for AVB streams
- Each stream can use only one priority
- A Reservation (i.e., a DA MAC Address) is for one stream only
- SRP will currently allocate a Static bandwidth for a stream (i.e., Dynamic, sometimes called Variable Bit Rate, support is dependent on contributions from those that need it and may need to become part of a separate PAR)
- Variable Bit Rate streams need to reserve the peak bandwidth that they need
- Reconfiguration of a stream's bandwidth is allowed

SRP Assumptions

- AVB Frame Priorities are changeable
  - These are changeable for ‘engineered’ networks
  - For Home networks the set of specified defaults simply must work!
- Hook up to existing higher layer protocols without imposing any new requirements on the higher layer protocols

SRP Assumptions

- The figure below is a valid AVB Cloud
- Therefore, 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?
- How will SRP Respond to changes in the network topology (eg., Spanning Tree change) and/or usable bandwidth (eg., wireless and/or Energy Efficient Ethernet)?
- How will SRP Respond to changes in bandwidth request based on user requests (eg., when the user requests an increase in bandwidth)?
- Need to specify a sublayer interface in Qav to respond to T-Spec requests (e.g., is 802.1AE enabled,…)?

SRP Questions

- What is the Stream identification for the Reservation protocol for Talkers and Listeners?
- What is the Stream identification for the Reservation protocol for Bridges?
- Are Changed AVB Priorities (those being used in Tagged frames) communicated through out the AVB Cloud and if so, how?
- What is an SRP domain & its forwarding rules?
  - Is 802.1AS required if timing is not needed?
  - In the default/non-engineered case 802.1AS is needed to detect 'transparent bridges' however
- What is an AVB domain?
  - Assume it to be a subset of an 802.1AS domain
- What is an 802.1AS domain?

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)
- Recovered Media Sample Clock Quality
  - Jitter/Wander: per MTIE in Ref 3
  - Endpoint media output synchronization accuracy <= 1 uSec
  - Media clock quality maintained during PTP clock discontinuity (e.g. change in Grandmaster)?
  - Network Startup settling time: < 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)
- Spanning Tree (or equivalent) will eliminate routing loops in an AVB cloud for PTP?

PTP Assumptions

- PTP Clock Discontinuities
  - Slave clocks will see discontinuities in Global Time (i.e. step changes in epoch) during media streaming operation
  - Discontinuities may originate from selection of new Grandmaster, or may occur within a clock while it is acting as Grandmaster
  - A step change in epoch may be any value (usec to years)
  - The 802.1AS clock service will inform its client upon change in Grandmaster selection
  - The clock service should inform its client of other clock discontinuities
- An AVB cloud must be contained inside an 802.1AS domain
  - Don't want an AVB Cloud using different time services
- Can't modify 802.1AS frames on-the-fly (i.e., in the egress path)
  - i.e., Implementations must use some subsequent message

PTP Assumptions

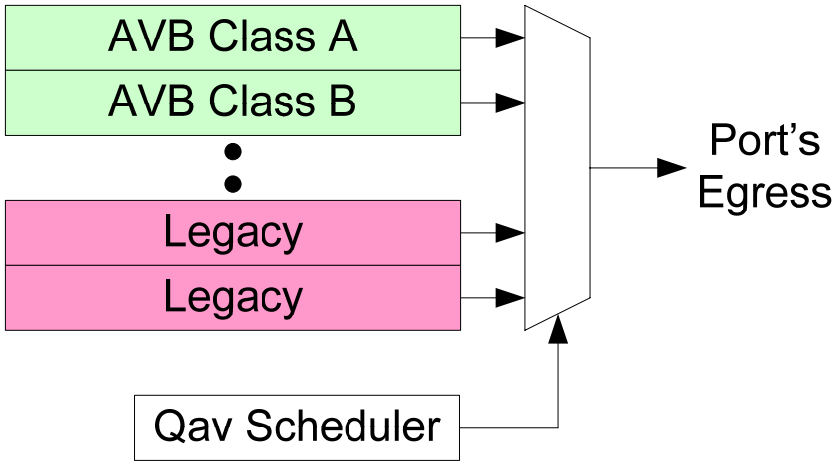
- An 802.1AS domain is a contiguous set of bridges/end-stations that meet the 802.1AS requirements
  - 802.1AS domain may be larger than an AVB (SRP) Cloud
- The 802.1AS protocol packets are not propagated beyond the 802.1AS domain, except possibly for determining the edge of the 802.1AS domain

PTP Assumptions

- The end-station clock components associated with a single-port (end-station) and multi-port (bridge-station) are the same.
- The end-station clock components can include a clockTarget, traceable clockSource, or clockSource & clockTarget components.
- The functional distinction between traceable and nontraceable sources is the behavior when not currently the grandMaster:
  - A traceable ClockSource behavior does not change.
  - A nontraceable ClockSource sync's to network-supplied time.
- A nontraceable ClockSource-only device is disallowed, because it introduces possible time discontinuities when the GM changes.

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?
    - At what point do MGMT frames get MUX'ed to the Port's Egress?



PTP Questions

Qav Assumptions

- Bridges do per class shaping
- Talkers do per stream shaping?
- Policing at ingress is not required and will not be specified
- In the absence of congestion (i.e., interfering traffic), Talkers will not burst AVB stream frames (i.e., they will transmit 1 frame then an extended IFG to even out the frame spacing)
- Talkers are required to follow the shaping algorithm that is specified for Bridges (i.e., that which is defined in the 802.1Qav drafts)

Qav Questions

- How will Qav work with Qaz (i.e., pacing for congestion management)? Do we need to worry?

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 A (depending on the speed of the link)?
    1522 bytes? Or 2000 bytes for Legacy frames?
    (i.e., no Jumbo frame support)
- Link Level Flow Control
  - 802.11: Won't be allowed

Other Issues

- How will MSTP select an SRP path over a CM (Congestion Management) path or a non-SRP/non-CM path using ‘out of the box’ defaults?
- How is the edge of the ‘stream’ cloud determined (i.e., the cloud that uses Qat and Qav)?
- Use 802.1AS to detect ‘transparent bridges’ and then indicate that the port it is connected to is not ‘AVB Capable’?
  - Where does this fit into the building of STP?

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-policies-0707-v04
  - Title: 802.1 Qat Policies 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