AV Bridge Summary: an early view

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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 and a timing domain that appears to be a 1588 subdomain
  – Bridging between 1588-2002 and 802.1(time-synch) 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 may be best ways to choose a method
  – Assume unique Ethertype with packet type to uniquely identify packets that must have timestamps saved
• Separate PAR (perhaps 802.1at?)
Reservation protocol

• Assume something similar to “SRP” as described by Felix Feng
• 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)
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?
  – If so, default 802 operation could be same as “auto IP”: pick an address, 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
  - 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
- 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
• Two methods: transparent and explicit
Transparent traffic shaping

- SRP results in bridges knowing the maximum traffic that can be transmitted and received on each port.
- 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.
- Done “transparently” … i.e., bridges do not communicate class interval boundary information.
  - Implementation/specification a bit subtle … algorithm correctness TBD
  - Delivery jitter greatly reduced, but bounds increase with number of hops.
Explicit traffic shaping

• Each device transmits a “start of interval” frame between all frames sent within a particular class interval
• Receiving bridge internally labels frames with class interval and uses for scheduling transmission in a following class interval
• Implementation/specification is very simple … algorithm correctness easy to prove, but rather unusual behavior for a bridge
• Delivery jitter bounded to no more that 2x class interval regardless of network topology