



# Linux Network Enabling Requirements for Audio/Video Bridging (AVB)

Linux Plumbers 2012

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# Agenda

Audio Video Bridging (AVB) Overview

AVB on Linux

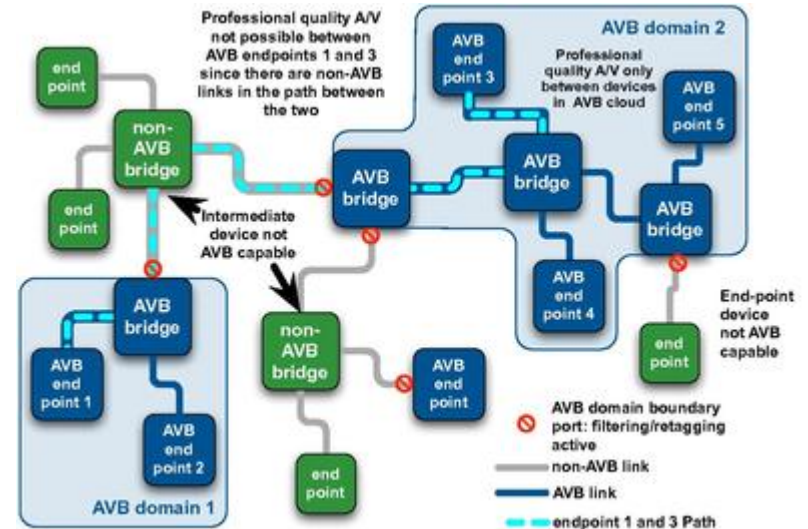
Questions



# Why AVB?

People have been sending audio & video over networks for decades now ... so what is new about AVB?

- Buffering data to hide packet loss and bandwidth issues causes presentation lag (the echo cancellation in your ear tolerates up to 10 msec)
- Sending audio to multiple devices requires synchronization of the presentation-time (e.g. lip-sync of video to audio, warbling in 7.1 audio systems) ,
- Auto companies want to use AVB to reduce cost.



# What is "AVB"?

for this discussion at least ...\*

AVB := 802.1Qat + 802.1Qav + 802.1AS

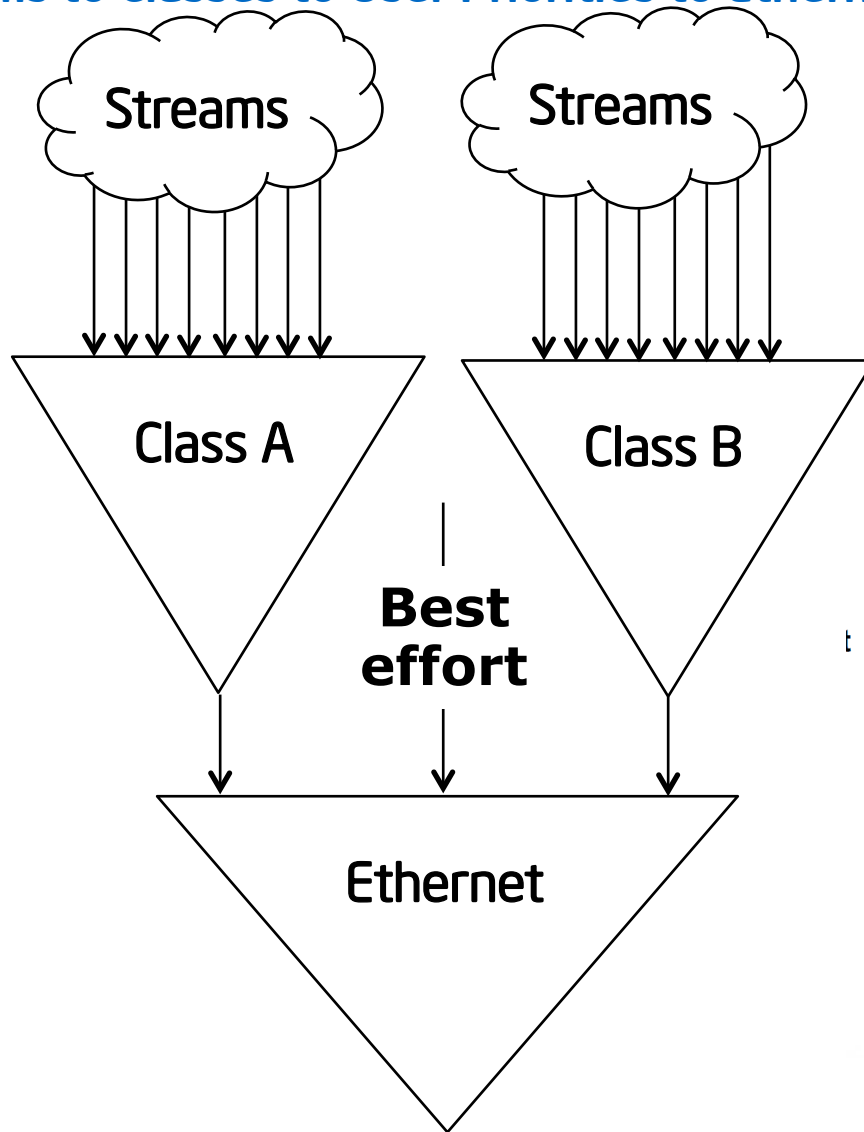
- 802.1Qat := MMRP + MVRP + MSRP = "Stream Reservation"
- 802.1Qav := "Hardware-based traffic shapers"
- 802.1AS := "Time Synchronization"

\* There are a number of additional user-mode protocols layered on top to handle AVB device discovery & control, as well as media framing:

- L2-based IEEE 1722, 1722.1
- L3-based 1733 & RTP
- I also don't talk about the receiving end of these streams - as they only really need to support 802.1AS and MRP - no need for traffic shaping.

# Functional Overview

## Streams to Classes to User Priorities to Ethernet

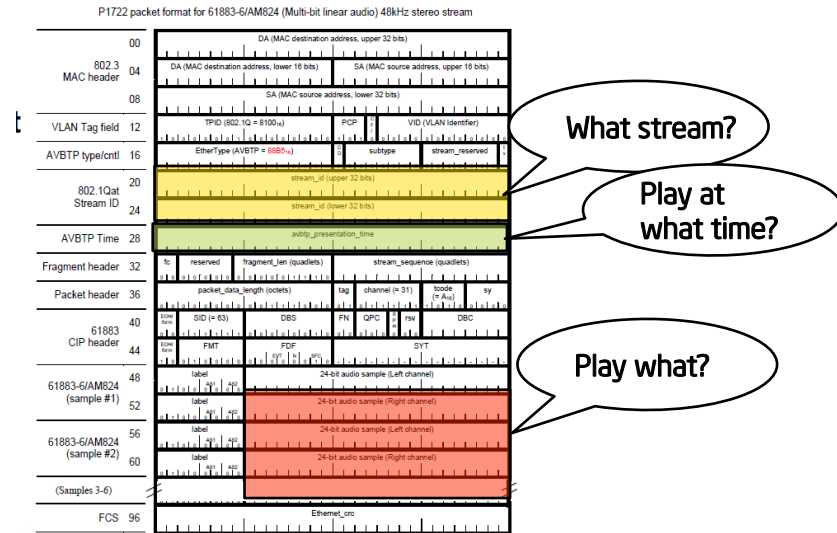


### Notes

Each stream contains zero (0) or more media channels.

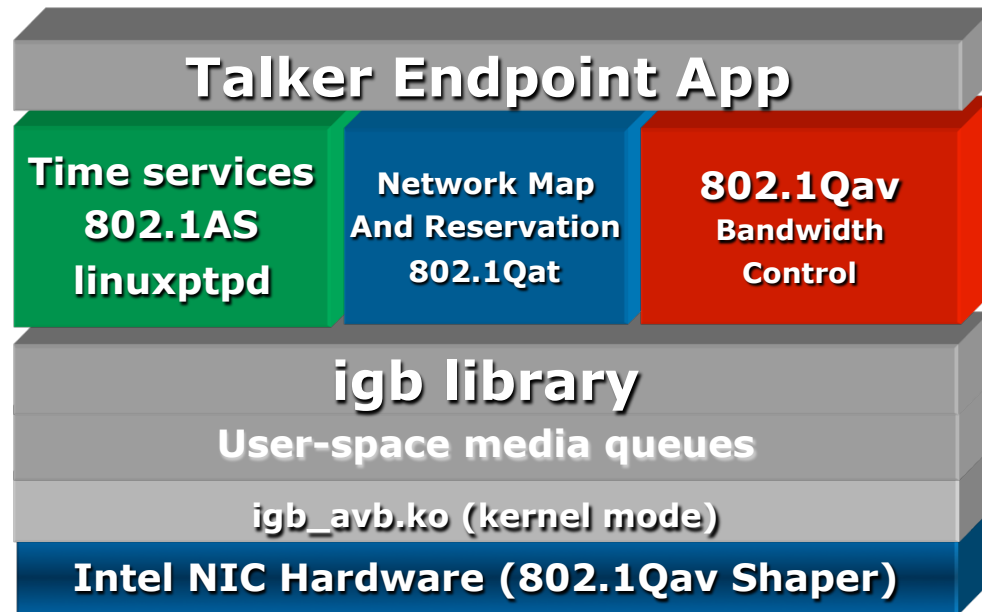
As streams are added/removed to a class, bandwidth of the class is adjusted.

Discovery of UserPrio and VLAN made during Qat (the "DOMAIN" msg).



# Proof of Concept Linux Stack [DEMO]

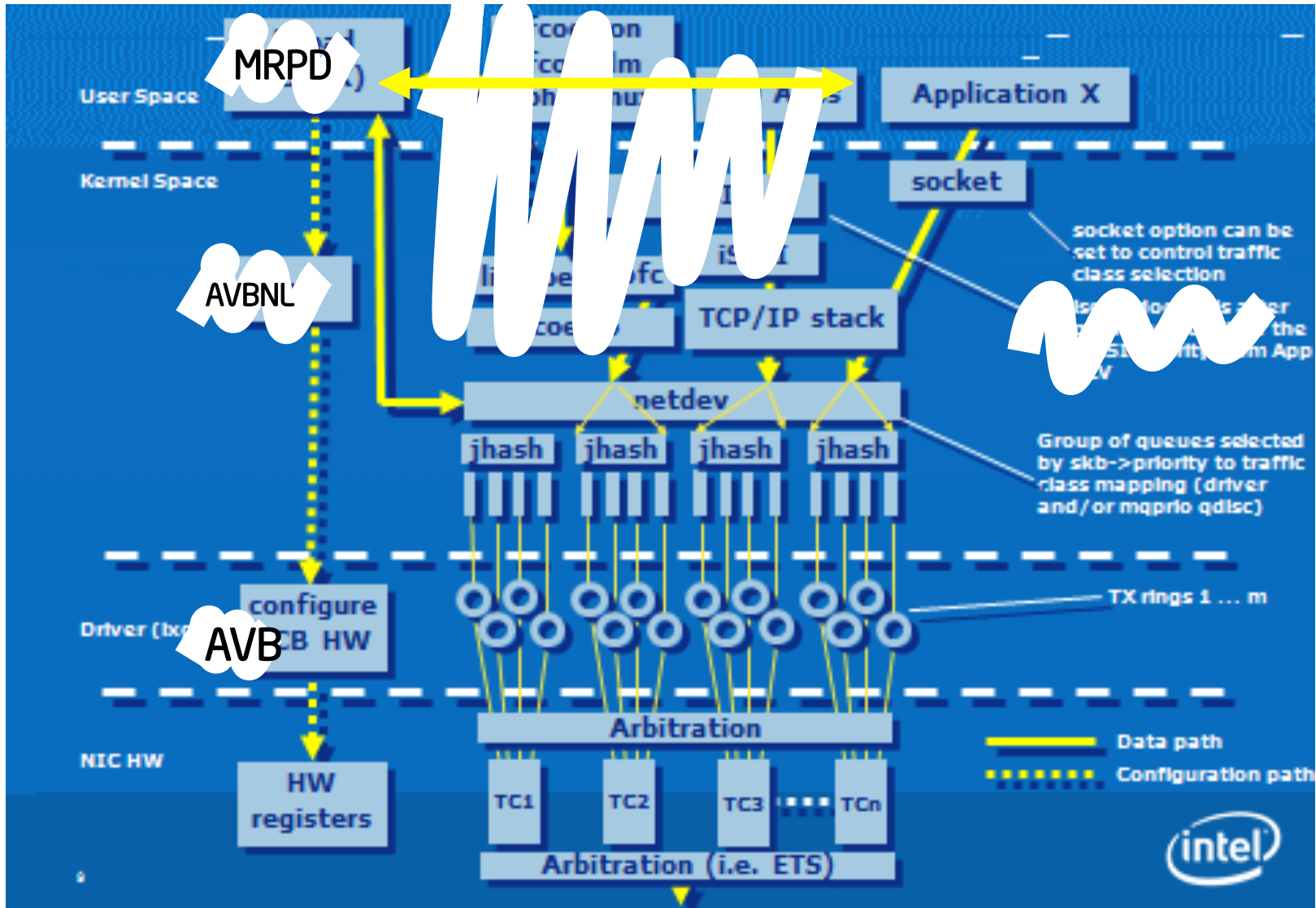
[e1000.sourceforge.net /linux\\_igb\\_avb](http://e1000.sourceforge.net/linux_igb_avb)



## Notes

In the current design, one of the queues is kept by the in-kernel igb module for best-effort traffic. Media queues are mapped to user-space.

# Remember DCB/FCoE? AVB drops right in ...





# Gap 1 - Timed Transmission

- Prior patches enabled passing timestamp information to applications on receive, and returning tx timestamps on the ERRMSG queue ...
- Need to extend timestamps to control actual packet transmit time ...
  - As the class shaper is adjusted, the class shaper may momentarily send more or less data on existing streams with traffic outstanding on a class. This can cause over-runs or under-runs on receivers.
  - Helps with sequencing of streams onto the same Class shaper (e.g. multiple apps write onto streams and expects the class shaper to pace out the traffic fairly ...) ← can workaround with driver-based knowledge of individual streams (not desirable).
  - This works with L2 or message-based protocols (like UDP) – not stream based like TCP however.

# CMSG PROPOSAL for Timed Tx

New CMSG type to indicating timed transmission (as well as corresponding transmission time).

- Transmission time is relative to the physical interface.
- User-mode application will need to perform translation if required from the global "AS" time to the physical interface relative time.

```
cmsg->cmsg_level = SOL_RAW; /* UDP too? */
cmsg->cmsg_type = TIMED_TX;
cmsg->cmsg_len = CMSG_LEN(8); /* seconds.nsec format */
/* Initialize the payload: */
tx_time = (u_int64_t*) CMSG_DATA(cmsg);
*tx_time = tx_seconds << 32 | tx_nsec;
```

## Gap (2) – ethtool support

Would be desirable to dynamically configure “AVB” functionality (enable/disable) via ethtool.

- Based on our experience, requires device reset.
- New option to display as well as change “AV” state of adapter interface.



## For More Information & Planned Future Steps

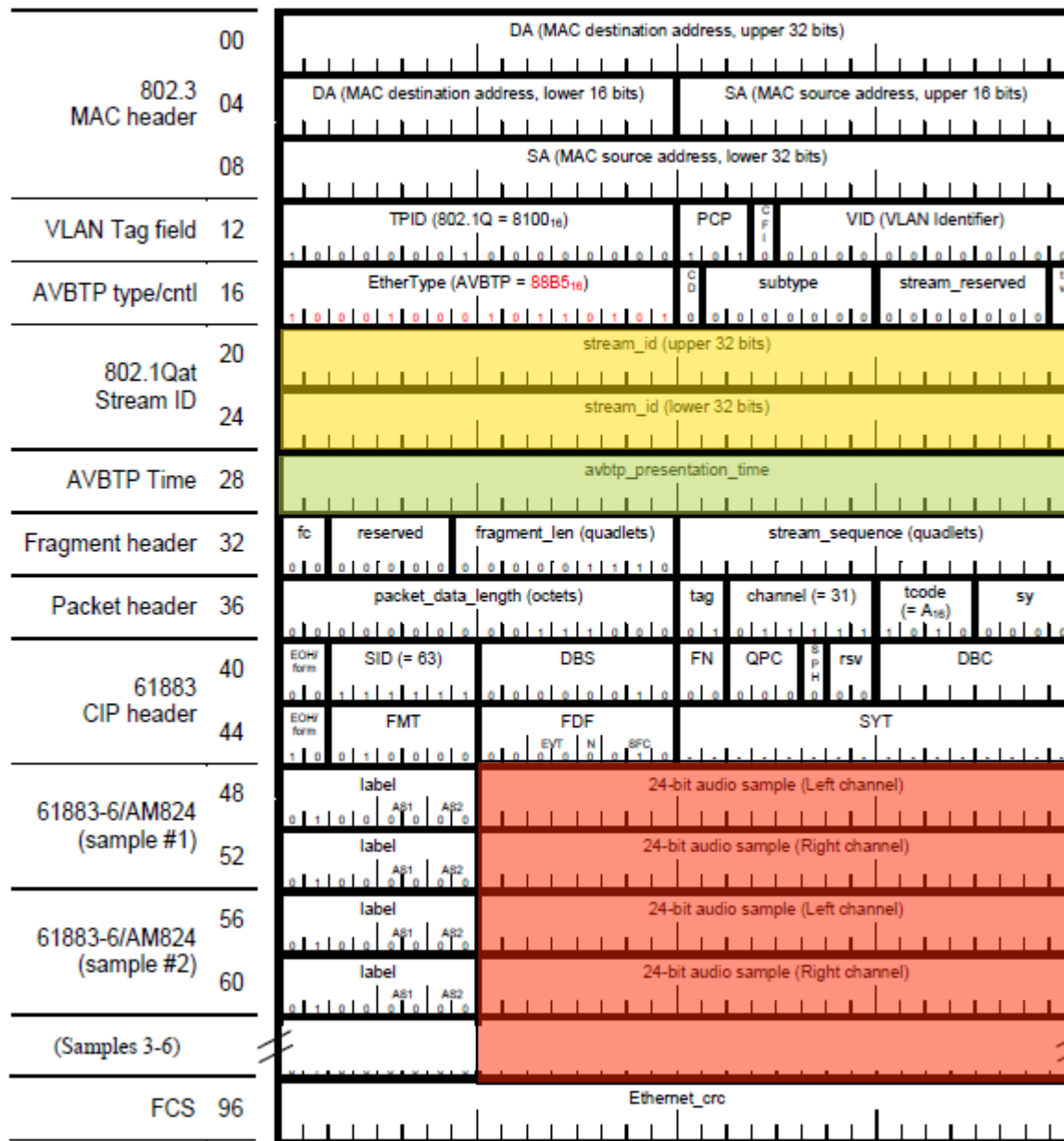
- “linux\_igb\_avb” tarballs of this code are posted to Intel’s existing e1000.sourceforge.net project.
- In process of establishing a github repos\* for open source collaboration and contribution \*project name pending Intel Legal approval
- Enhancements to example applications.



# Q & A?



P1722 packet format for 61883-6/AM824 (Multi-bit linear audio) 48kHz stereo stream



P1722 packet format for 61883-8, Source Packet Type=0 (video data)

