Overview:
SAE AS6802 in Ethernet Service Landscape Context

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“Ethernet is a family of frame-based computer networking technologies for local area networks (LANs). The name came from the physical concept of the ether. It defines a number of wiring and signaling standards for the Physical Layer of the OSI networking model as well as a common addressing format and Media Access Control at the Data Link Layer.” [wikipedia]
Switched Ethernet

Originally designed for a physical bus topology, Ethernet specifies a Collision Detection Multiple Access (CDMA) algorithm.

- Frames may physically collide on the physical bus.
- Collisions are identified (hopefully).
- A jamming signal is sent to the bus.
- After random back-off times the nodes try to re-send their frames.

Switched Ethernet moves to star and tree topologies.

- Physical collisions are avoided.
- New problem of buffer overflows in the Ethernet switches arises.
ARINC 664-p7 improves switched Ethernet towards end-to-end delivery guarantees.

- Multicast Ethernet frames are used.
  - Multicast = 1 Sender, n Receivers
- Frame generation rate is bounded in the senders and controlled and enforced (!) in the ARINC 664-p7 switches.
  - Buffer utilization in switches can be bound.
  - Network Calculus gives a formal basis to calculate end-to-end delays.
802.1Q (IEEE Standard for Local and Metropolitan Area Networks – Virtual Bridged Local Area Networks):

- This standard builds upon the 802.1D standard.
- Upon others, it also defines “Virtual LANs (VLANs)”.
- A VLAN is identified by a VLAN identifier (VID) and characterizes a group of end stations.
- One end station can be member of several VLANs.
- Standard Ethernet messages can be VLAN-tagged, via a four byte field before the Ethertype field.
- The VLAN-tag holds a priority and the VLAN ID (VID).
  - This priority is used to derive the outgoing queue (and hence the traffic class) used for forwarding the frame.
IEEE is a master-slave synchronization protocol with leader-election.

**Master-Slave:**
- Grandmaster provides clock synchronization messages.
- Boundary Clock Mechanism
- Transparent Clock Mechanism

**Leader Election:**
- PTP
Audio Video Bridging

AVB specifies a clock synchronization protocol (based on IEEE 1588) and Amendments to the Virtual LAN (VLAN) standard (IEEE 802.1Q) to enable Quality of Service for Audio and Video datastreams

- "P802.1AS: IEEE Standard for Local and Metropolitan Area Networks - Timing and Synchronization for Time-Sensitive Applications in Bridged Local Area Networks"

- "P802.1Qat: IEEE Standard for Local and Metropolitan Area Networks---Virtual Bridged Local Area Networks - Amendment: 11: Stream Reservation Protocol (SRP)" (note: the “at” identifies the Amendment 11"

- "P802.1Qav: IEEE Standard for Local and Metropolitan Area Networks---Virtual Bridged Local Area Networks - Amendment 12: Forwarding and Queuing Enhancements for Time-Sensitive Streams" (note: the “av” identifies the Amendment 12")
Data Center Bridging

SAE AS6802 TTEthernet: Synchronous Communication Service with Global Timebase in the Context of 802.1Qbb
Priority Based Flow Control (PFC)

Transmit Queues | Ethernet Link | Receive Buffers
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One | | One
Two | | Two
Three | | Three
Four | | Four
Five | | Five
Six | STOP | Six
Seven | PAUSE | Seven
Eight | | Eight

IEEE DCB DCE/CEE Asynchronous, priority based Ethernet communication

TDM-style Synchronized Communication
Comparing with DCE, CEE and IEEE DCB

Dynamic Bandwidth Release By Time-Triggered Traffic in 802.1Qaz (ETS) Context

Offered Traffic

Realized Bandwidth Use

- TT
- HPC
- SAN
- LAN

t1 t2 t3 t4