ITPANDA E-AVB Implementation in the Car

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Ethernet AVB ?

As a Abbreviation of Ethernet Audio Video Bridging,
This technology can transfer the audio and video streaming data guaranteed with time sync. in LAN (Local Area Network) .
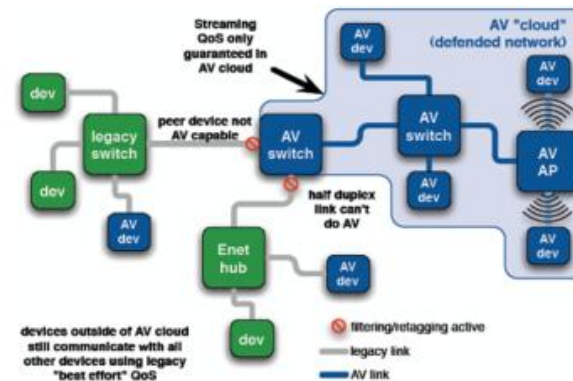
Current Ethernet scheme is based on the frame transfer and packet switching. This does not guarantee the reliable streaming service

In order to overcome this limitation, synchronize the clock with devices connected in the same bridge and provide the synchronized traffic transferring

E-AVB vs. MOST

- Scalable, Versatile Topologies

|	Ethernet AVB	MOST
Applications	Automotive, Consumer, Professional Audio	Automotive
Standards	Open (IEEE)	Proprietary
Topology	Star, Ring, Bus, Tree or hybrid	Ring
Speed	10M to 10Gbps & interoperable	25M to 150Mbps & not interoperable
Bandwidth	Full bandwidth per node	Share between devices on ring
Suppliers	Multiple vendors	SMSC
Software/Equipment Costs	Low – legacy TCP/IP tools & s/w, open sources	High – expensive tools & s/w for MOST
Silicon Costs	Low	Higher
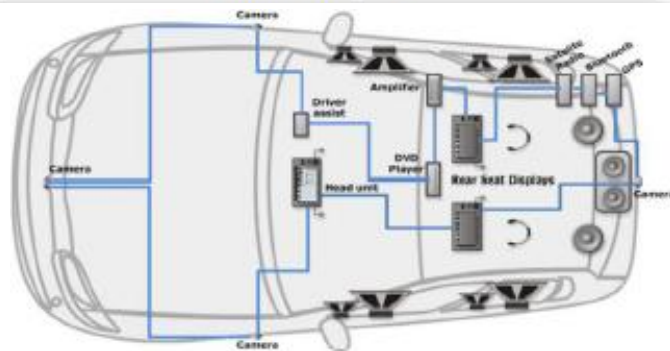
Figure 1. Example of MOST ring topology. All devices see entire network traffic from every other devices
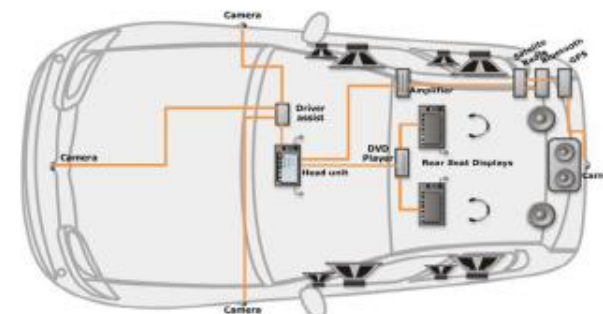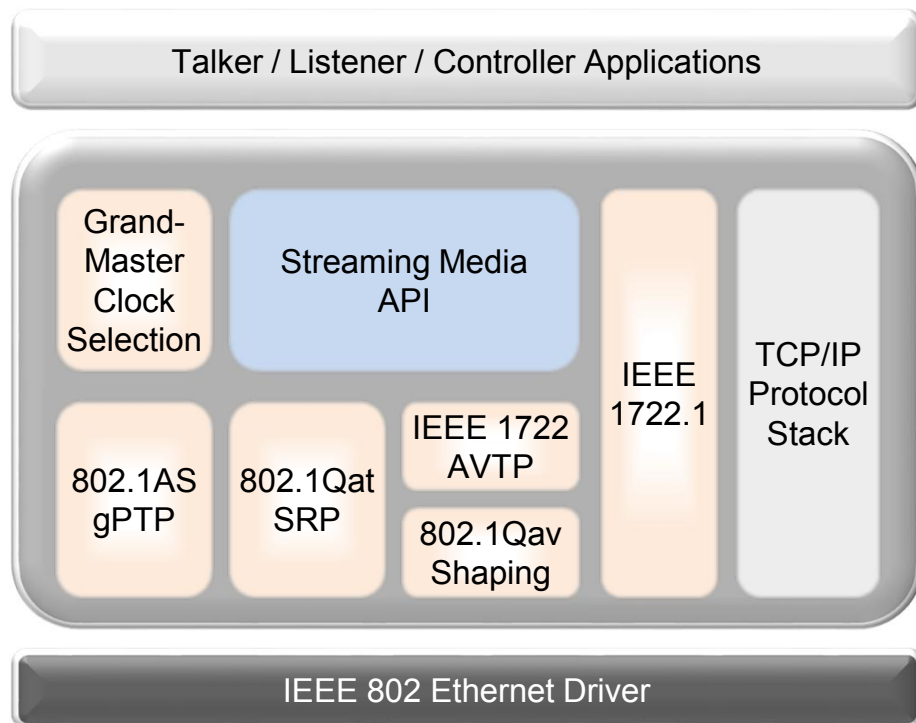
Figure 2. Possible AVB architecture. In this example, the camera signals from the front of the car only pass to the drives assistance module.
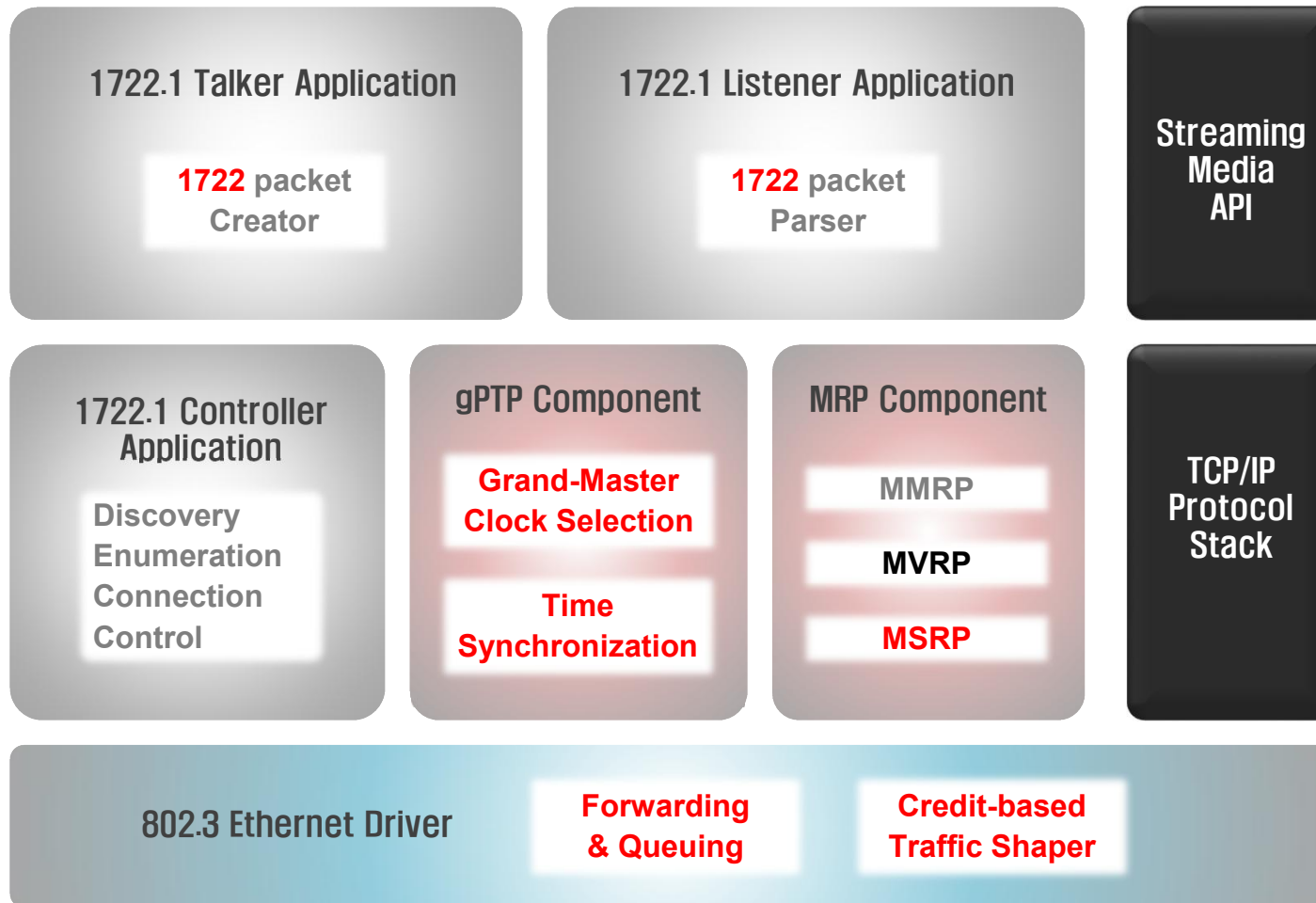
IEEE Standards for E-AVB

Talker / Listener / Controller Applications

Grand-Master Clock Selection	Streaming Media API		IEEE 1722.1	TCP/IP Protocol Stack
802.1AS gPTP	802.1Qat SRP	IEEE 1722 AVTP		
		802.1Qav Shaping		

IEEE 802 Ethernet Driver

IEEE 802.1BA
(Audio Video Bridging (AVB) Systems)
- Requirement which Ethernet AVB Bridge and End station should provide

IEEE 802.1AS
(Timing and Synchronization for Time-Sensitive Applications in Bridged LAN)
- time synchronization between AV devices

IEEE 802.1Qav & 802.1Qat
Forwarding & Queuing algorithm and Traffic Shaper for AV frame transfer
- Stream Reservation Protocol

IEEE 1722
(Audio Video Transport Protocol)
- encapsulation of AV stream transfer

IEEE 1722.1
(Audio Video Discovery, Enumeration, Connection management, and Control)
- Talker and Listener connection and management

E-AVB Stack Architecture on Linux Platform

1722.1 Talker Application

1722 packet Creator

1722.1 Listener Application

1722 packet Parser

Streaming Media API

1722.1 Controller Application

Discovery
Enumeration
Connection
Control

gPTP Component

Grand-Master Clock Selection

Time Synchronization

MRP Component

MMRP

MVRP

MSRP

TCP/IP Protocol Stack

802.3 Ethernet Driver

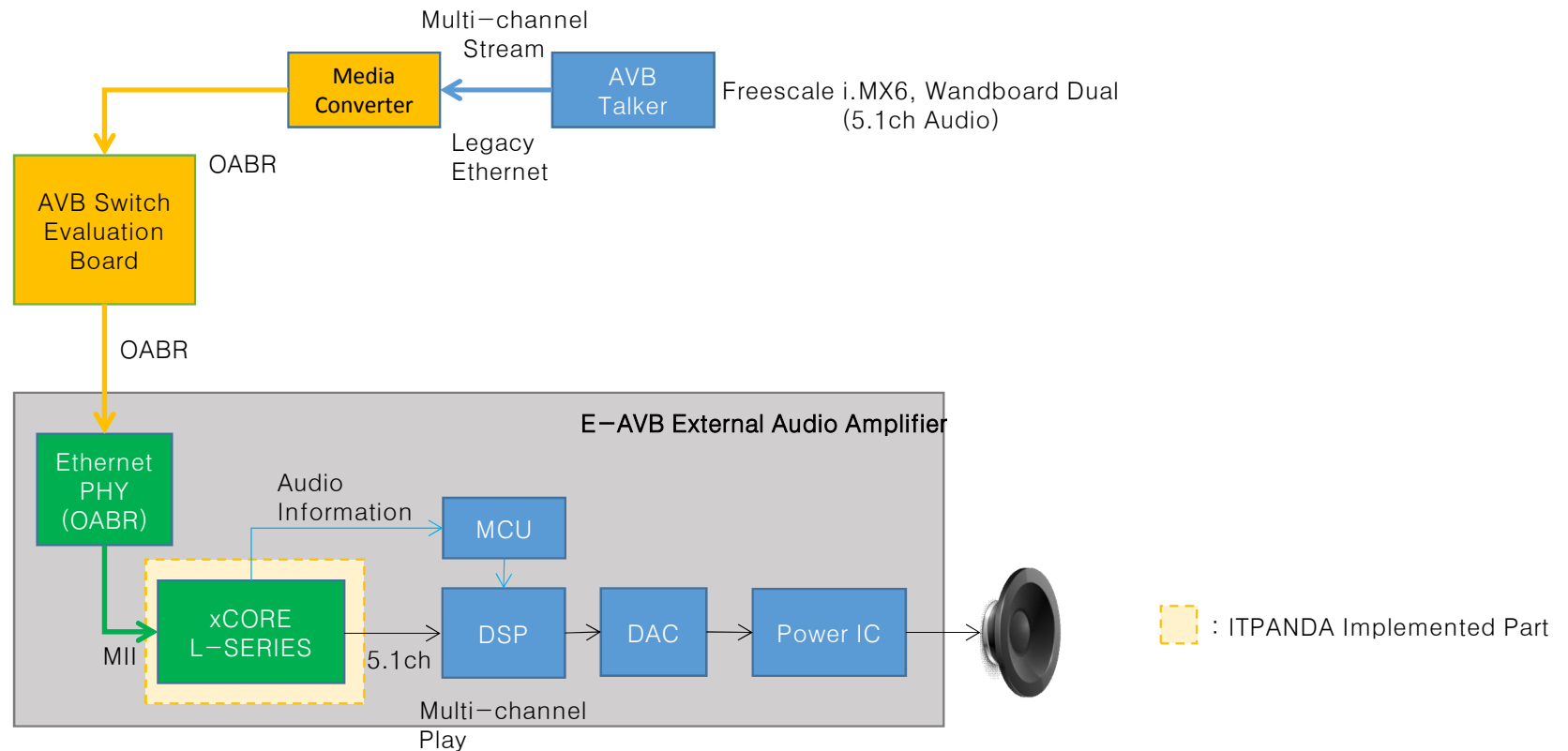**Forwarding & Queuing**

Credit-based Traffic Shaper

Simple Structure of Implementation

- E-AVB External Audio Amplifier – A/B Mixing Case
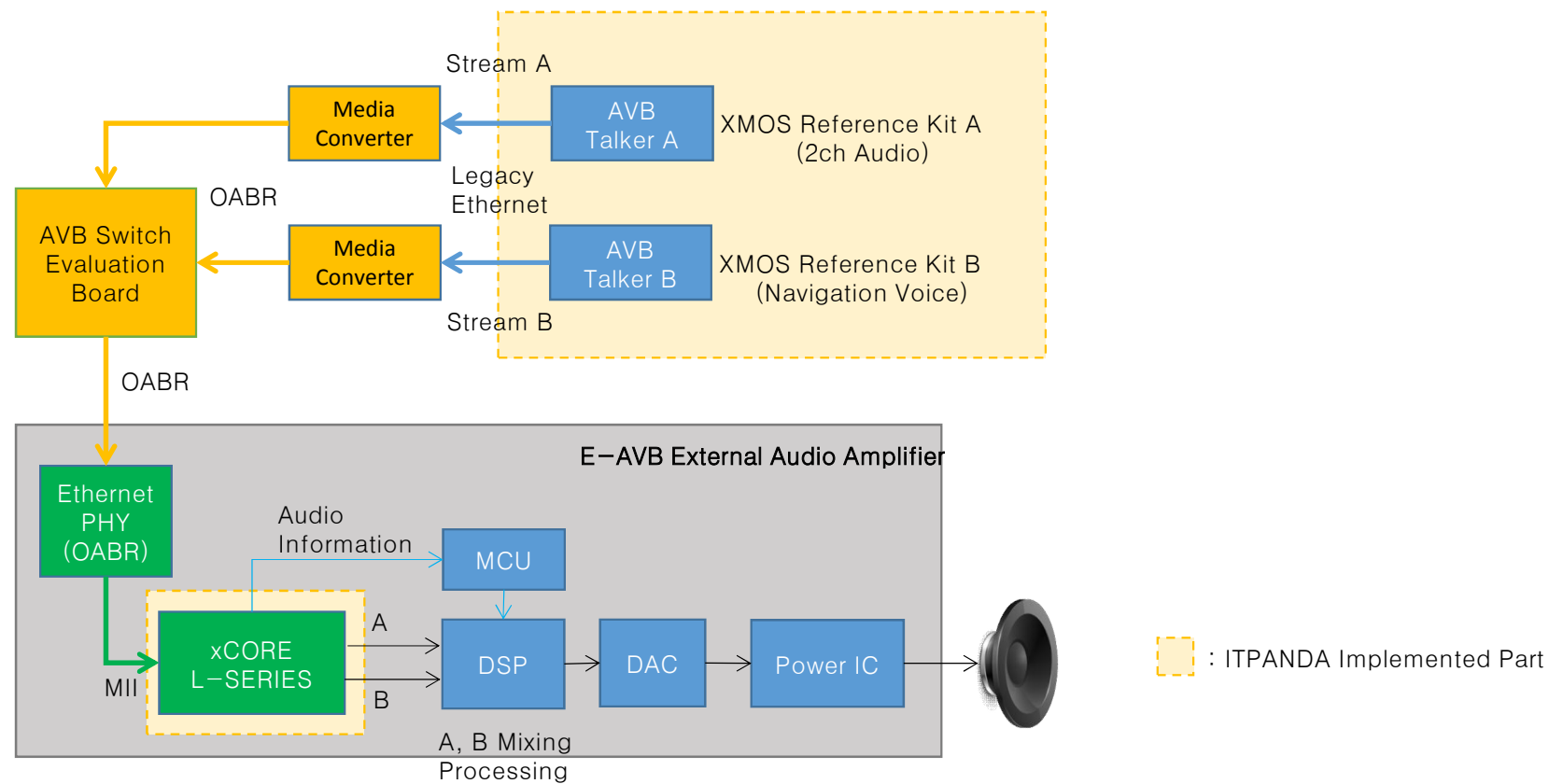
Simple Structure of Implementation

- E-AVB External Audio Amplifier – 5.1-channel Multi-stream Audio Output Case

Lessons Learned from Real Implementation

#	Issues	Lessons
1	For the case of 5.1-channel audio streaming Talker, Freescale i.MX6 Board supporting only IEEE 802.1AS was used - Because FQTSS(IEEE 802.1Qav) is not operated by H/W, we did some workarounds such as, RT patch, priority compromise, etc. - So the construction of 5.1-channel high bandwidth audio stream and the Ethernet synchronized streaming was performed by S/W - This occasionally induces sound disconnection due to momentarily high system performance	To prevent performance issue of system construction and operation, H/W supporting Queue(FTQSS) has to be used for media streaming, because Talker MUST transmit the media stream having Media Clock.
2	Until the development of stable H/W for queueing support, considerable amount of computational burden to S/W will exist. This will require the priority negotiation effort between engineers of each component module.	There has to exist the master control tower for E-AVB resource management, especially for priority and bandwidth.

ITPANDA E-AVB Demo System
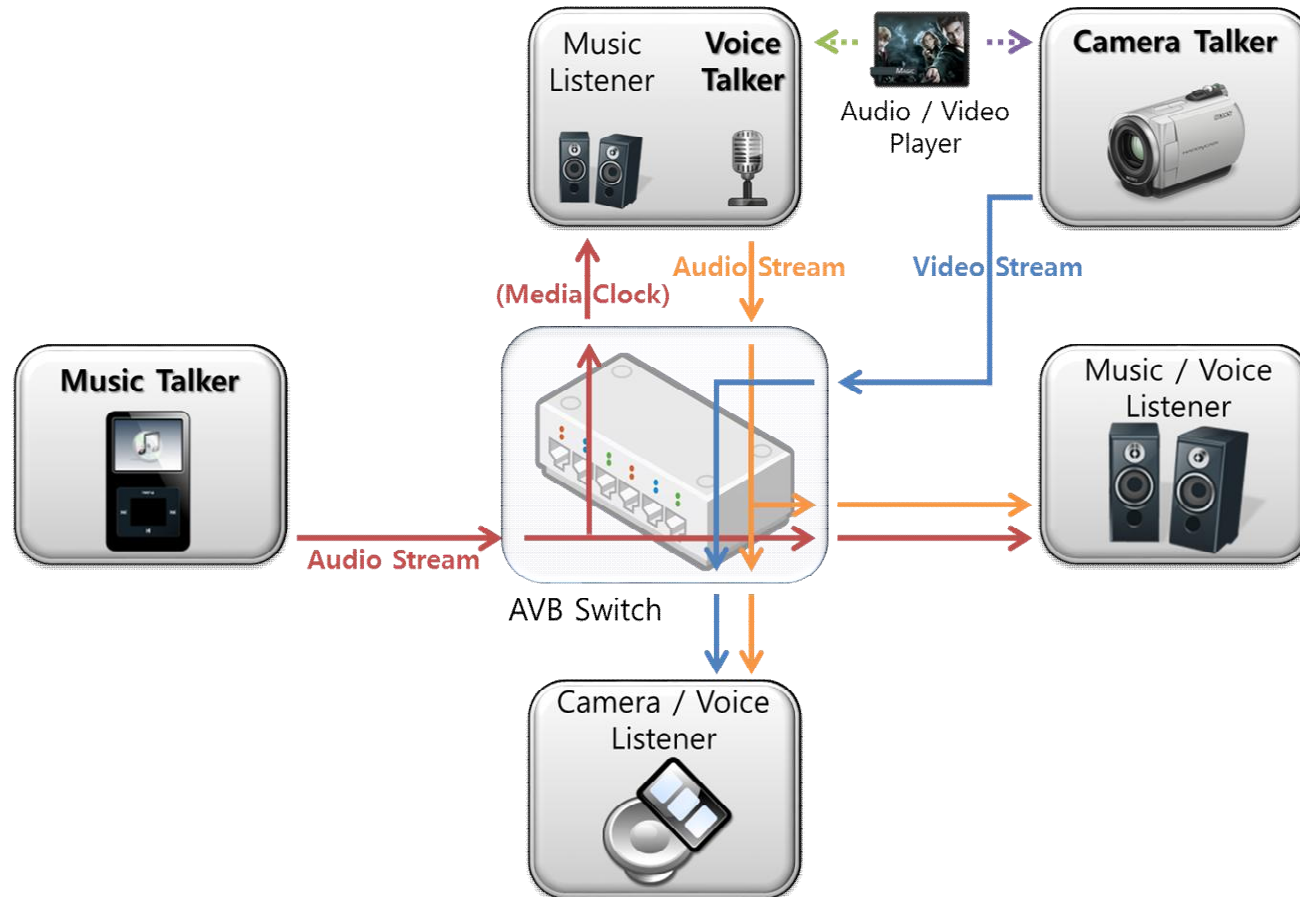
Discussions

- Is E-AVB the only and the best solution for the car networking going more and more complex?

- Is E-AVB the best solution for timely critical application?

    – Ex. Camera room mirror vs. rear camera for reverse gear

- Can E-AVB put all existing car network methods together, including CAN?

- Can car OEM support the negotiation or the compromise between car components for E-AVB resource management?

Future Plan

- Defining the interface API and packaging the stack with document

  – Easy to use by application layer

- Provide the standard environment to validate the E-AVB device

  – Performance measurement whether to meet E-AVB requirement

- Developing the test suite to simulate the E-AVB devices

  – It is highly required to provide the simulation tool in the development period

Thank you

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