THE NEXT 10 YEARS

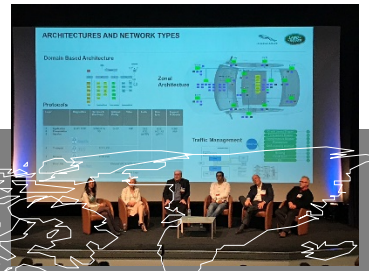
VOICES OF PREVIOUS HOSTS

EE-322, 3.11.2021
Kirsten Matheus

BMW GROUP THE NEXT 100 YEARS

Rolls-Royce Motor Cars Limited

LOCATIONS OF THE ETHERNET & IP @ AUTOMOTIVE TECHNOLOGY DAY. FROM 2011 TO 2021.



★10. virtual

8. London

4. Detroit

6. Paris

9. Detroit

7. San Jose

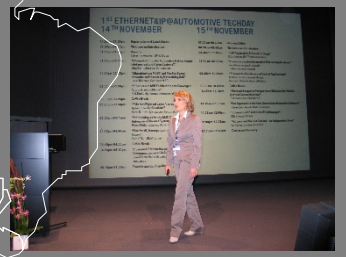
3. Leinfelden

5. Yokohama

2. Regensburg

1. Munich

11. Munich



QUESTIONS TO THE PREVIOUS HOSTS.

- Where and when was “your” event?
- What was the most important challenge for Automotive Ethernet at the time?
- What is the most important development between then and today, in respect to Automotive Ethernet?
- What, in your opinion, are the most important challenges to address in the next 10 years?

REPRESENTATIVES OF THE PREVIOUS EVENT HOSTS PARTICIPATING TODAY.

1. 2011 Munich (host: BMW) → Kirsten Matheus
2. 2012 Regensburg (host: Continental/Harman) → Daniel Hopf
3. 2013 Stuttgart (host: BOSCH) → Thomas Hogenmüller
4. 2014 Detroit (host: GM)
5. 2015 Yokohama (host: Jaspar)
6. 2016 Paris (host: Renault) → Jose Villanueva
7. 2017 San Jose (host: US-Car/GM)
8. 2018 London (host: JLR)
9. 2019 Detroit (host: Ford) → Haysam Kadry
10. 2020 virtual (host: BMW) → Kirsten Matheus
11. 2021 Munich/virtual (host: BMW) → Kirsten Matheus

WHAT WAS THE MOST IMPORTANT CHALLENGE FOR AUTOMOTIVE ETHERNET IN THE YEAR OF THE EVENT?

BMW: Ethernet as an IVN technology was new. It was important to initiate knowhow build-up and exchange in the industy

Conti: At that time, we still had a very proprietary, “closed” market situation: Mostly single-source. There were no standards yet, much was hidden, which made debugging & diagnostics very hard.

BOSCH: Possible fragmentation of market by competing proprietary 100 Mb/s solutions.

GM: Moving towards a mature and pervasive automotive network, from infotainment to autonomous driving, how Ethernet is uniquely qualified to transform the vehicle.

Jaspar: Standardization for international standard(IEEE/ISO) of 1Gbps optical communication.

Renault: At the time of the event, few OEMs had Ethernet cars on the street. Standardization was on track, thanks to OPEN Alliance and IEEE. The majority of OEMS had already decided when & why they were going to introduce Ethernet, and they were facing the first developments with TIER-1s. Ethernet was seen more like a high speed technology to cover use cases in between legacy CAN buses@2Mbps and LVDS@2.5Gbps.

UScar/GM: Achieving a robust, deterministic, fault tolerant, and high-speed network suitable for more challenging applications like autonomous driving and IoT connectivity. Safety and security concerns for vehicle connectivity and autonomous driving. Support for multi Gbps speeds.

Ford: Making the move from engineered networks with fixed messages to dynamic networks that can send information.

BMW: Leveraging the full potential of Ethernet while there is an increasing number of competing non-Ethernet IVN technologies.

WHAT IS THE MOST IMPORTANT DEVELOPMENT BETWEEN THEN AND TODAY, IN RESPECT TO AUTOMOTIVE ETHERNET?

BMW: All major car manufacturers have introduced Automotive Ethernet solutions and are looking to extend their networks. Multi-vendor, multi-speed market.

Conti: Today we have a multi-vendor, multi-speed, (mostly) standardized networking technology which no one in the industry doubts.

Bosch: Complete Eco System from 10Mb/s up to 10 Gb/s (and 25-100 in prep), TSN and 1722. Multi Vendor.

GM: Better introduction of Ethernet in production vehicles across multiple domain applications and multiple OEMs.

Jaspar: In Japanese OEMs, cars equipped with in-vehicle Ethernet are mass-produced by Toyota, Nissan and Honda.

Renault: A clear roadmap on PHY technology. In 2016, 1000BASE-T1 was on track, but Multigigabit and 10BASE-T1s plans were still not made public. The same happened with the evolution of L2 AVB technology, TSN group was just about to be created. The clear commitment of the industry has permitted to considered Ethernet as a mature technology, ready to FACE challenges of next decade. UNECE cyber security regulations have also impacted the way IVN networks are managed.

UScar/GM: New TSN protocols were finalized for addressing the need for the coexistence of deterministic and best effort traffic.

Ford: The original 100Mb speed was fast but was limited as to how much video it could transfer. Today's 10Gb speeds can not only handle compressed video but can also handle processor resource sharing.

WHAT, IN YOUR OPINION, ARE THE MOST IMPORTANT CHALLENGES TO ADDRESS IN THE NEXT 10 YEARS?

BMW: Making Ethernet pervasive (fewer non-Ethernet technologies/no gateways, use of Ethernet also for safety critical traffic, secure and performant).

Conti: Full ASIL-D compliant autonomous operation with Ethernet over vehicle lifetime. Realization of MultiGig Ethernet speeds in the vehicle: Creating standards for those is one thing, having them in operation within the EMC limits under all conditions the other.

Bosch: Use Case Definition for MultiGig/ Consolidation of outdated technical solutions (FlexRay, SerDes)/ understanding and usage of performant 1722 Eco-System

Jaspar: Establishing TSN, SDN and 10Gbps technology.

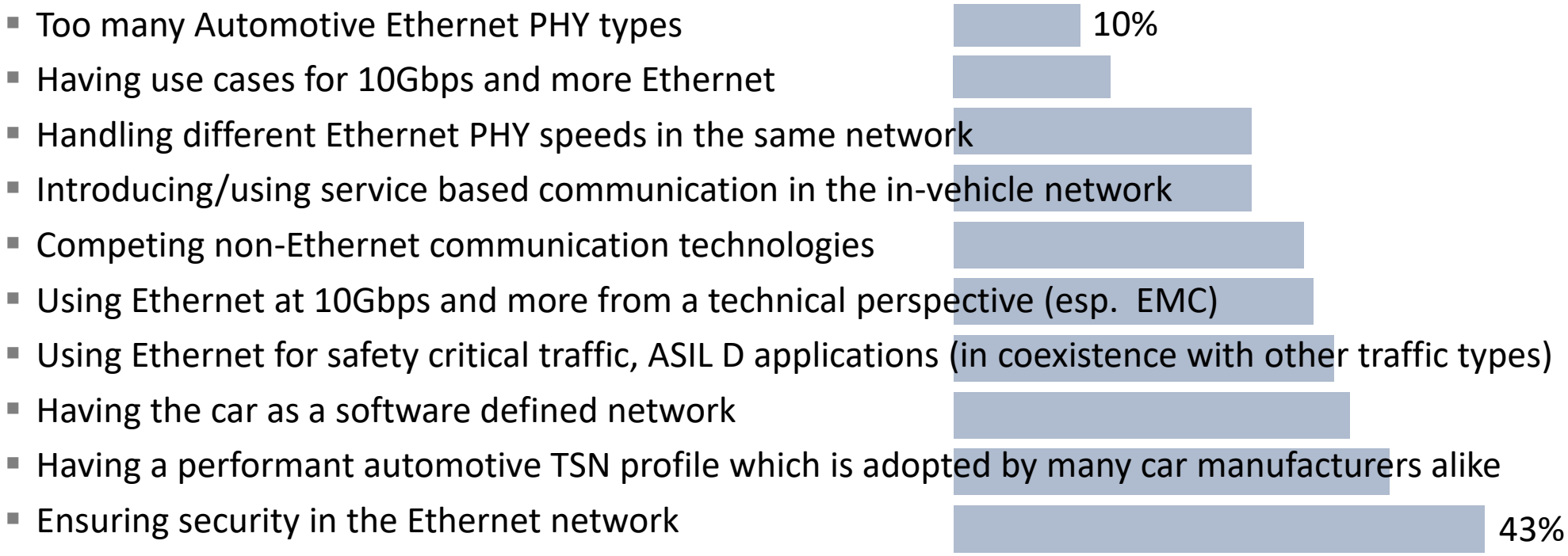
Renault: Using Ethernet as backbone of central & zonal Architectures with the right level of QoS & security, introducing Service Oriented Architecture as communication paradigm, to increase EE/architecture scalability. Standardization the Ethernet switch model to ease the configuration toolchain (AUTOSAR, YANG model…). Creation of TSN profiles for gatewaying with legacy technologies.

Ford: Keeping ahead of the hackers and the serviceability of increasingly complex vehicles.

VOTING: WHERE DO YOU SEE THE LARGEST CHALLENGES FOR AUTOMOTIVE ETHERNET IN THE FUTURE? (MULTIPLE ANSWERS POSSIBLE)

1. Competing non-Ethernet communication technologies
2. Too many Automotive Ethernet PHY types
3. Handling different Ethernet PHY speeds in the same network
4. Using Ethernet for safety critical traffic, ASIL D applications (in coexistence with other traffic types)
5. Using Ethernet at 10Gbps and more from a technical perspective (esp. EMC)
6. Having use cases for 10Gbps and more Ethernet
7. Introducing/using service based communication in the in-vehicle network
8. Having the car as a software defined network
9. Ensuring security in the Ethernet network
10. Having a performant automotive TSN profile which is adopted by many car manufacturers alike

RESULTS: WHERE DO YOU SEE THE LARGEST CHALLENGES FOR AUTOMOTIVE ETHERNET IN THE FUTURE? (MULTIPLE ANSWERS POSSIBLE)



Q&A

THANK YOU FOR YOUR ATTENTION.

VOICES OF PREVIOUS HOSTS

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