How the ever increasing amount of software influences in-vehicle network architectures

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For a long time, the E/E network architectures have become larger and more heterogeneous with every new car generation. Can, LIN, MOST, FlexRay, Ethernet. Each newly introduced bus technology was not replacing any of its predecessors; it complemented them and added missing features. LIN is cheaper than CAN, MOST is faster than CAN, FlexRay offers time synchronization, and Ethernet …? Ethernet is not cheaper than CAN, not faster than MOST and has (in its plain form) no time-determinism like FlexRay. Nevertheless, there is little doubt that Ethernet will be the dominant in-vehicle networking technology for the next decade, at least. Why is this?

Ethernet was introduced not only because it brings some really new and urgently needed networking feature into the vehicle. Ethernet was chosen largely because it is so simple to connect it to any type of software on any type of microcontroller, and then use almost consumer-class products to build the network topology. And there exist a number of specific variants and higher-level protocols that add features such as time synchronization, bandwidth reservation and traffic shaping (important for real-time communication), etc. Some say that Ethernet is about to become the all-in-one baseline networking technology for all future vehicles with the capability to really replace CAN, MOST, and FlexRay and maybe even LIN (which is difficult because LIN is so cheap).

What does that mean to future E/E network architectures? Will network designers lose their jobs because we do not need them anymore? Which networking competences will they need in the future and why? To what extend will the continuing software growth influence the E/E architectural design further? Which general trends can we expect? Which of the typical network development tasks will survive (and even get worse or more complex)?

We have asked E/E network responsibles at leading German OEMs to share their visions and answers with us. In some aspects they share the same vision: Ethernet is set as a future backbone network technology. Fully automated driving will largely increase the system-level complexity of software, safety and real-time requirements. Safety and security are slightly moving into network design responsibility. In other aspects they differ, for instance in the specific software strategies that impact the evolution of the networks. Centralized computing with service-oriented software calls for other topologies than decentralized networks with domain-oriented controllers. Such differences also reflect the different strategies and positioning of each OEMs. Volume or premium? Small or large model range? At the conference, we will summarize the results of this study and elaborate on the trends that we expect.