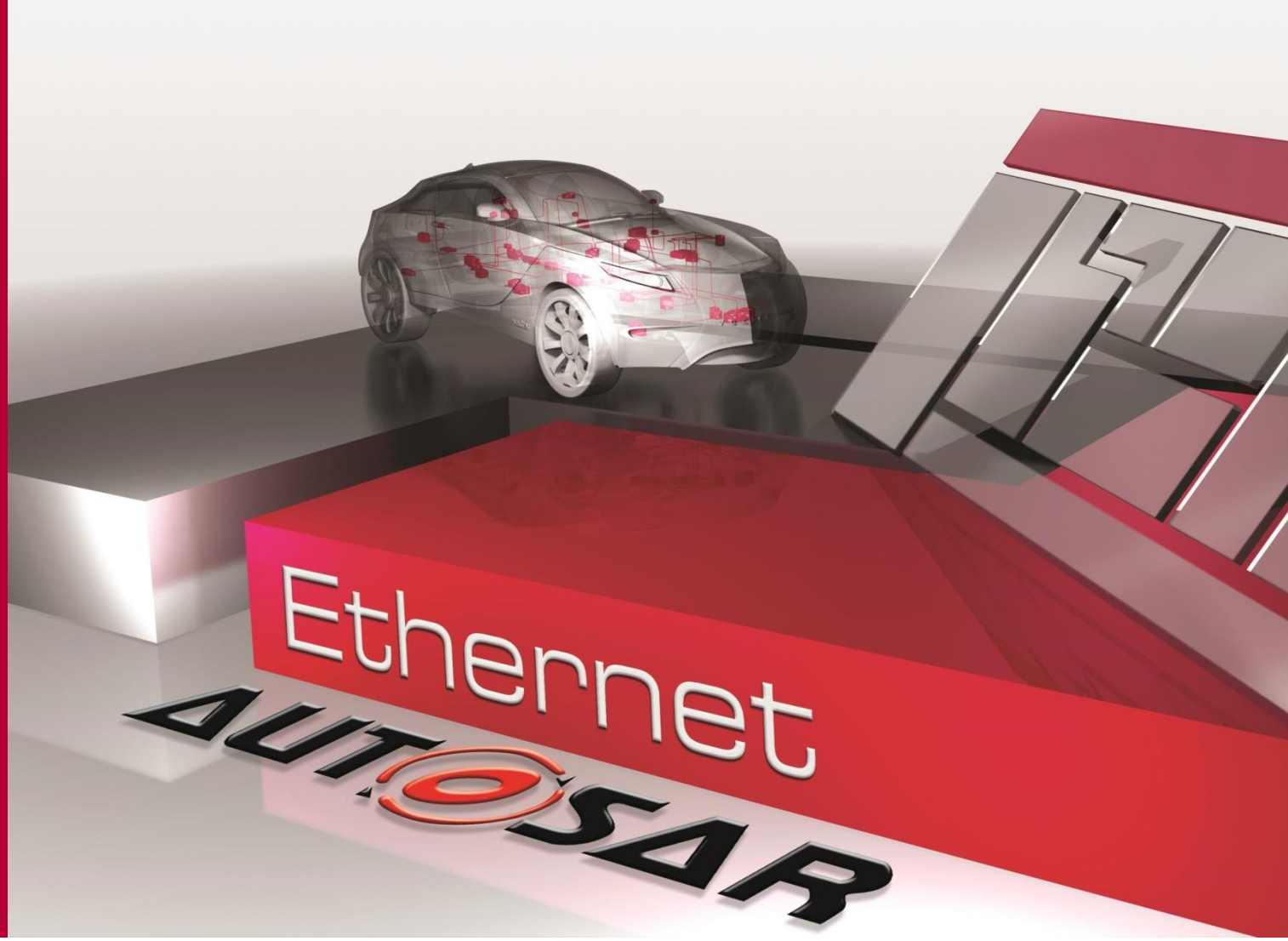


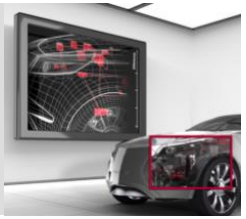
Automotive Ethernet in AUTOSAR and beyond

Vector UK Conference 2014

Agenda – Automotive Ethernet Use-Cases

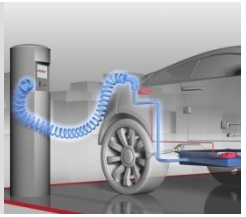
Diagnostics, Measurement and Calibration

- AUTOSAR (R4.x) and Extensions



Vehicle-to-Grid

- Non-AUTOSAR

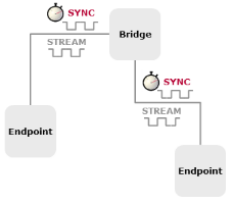


In-Vehicle Ethernet Communication

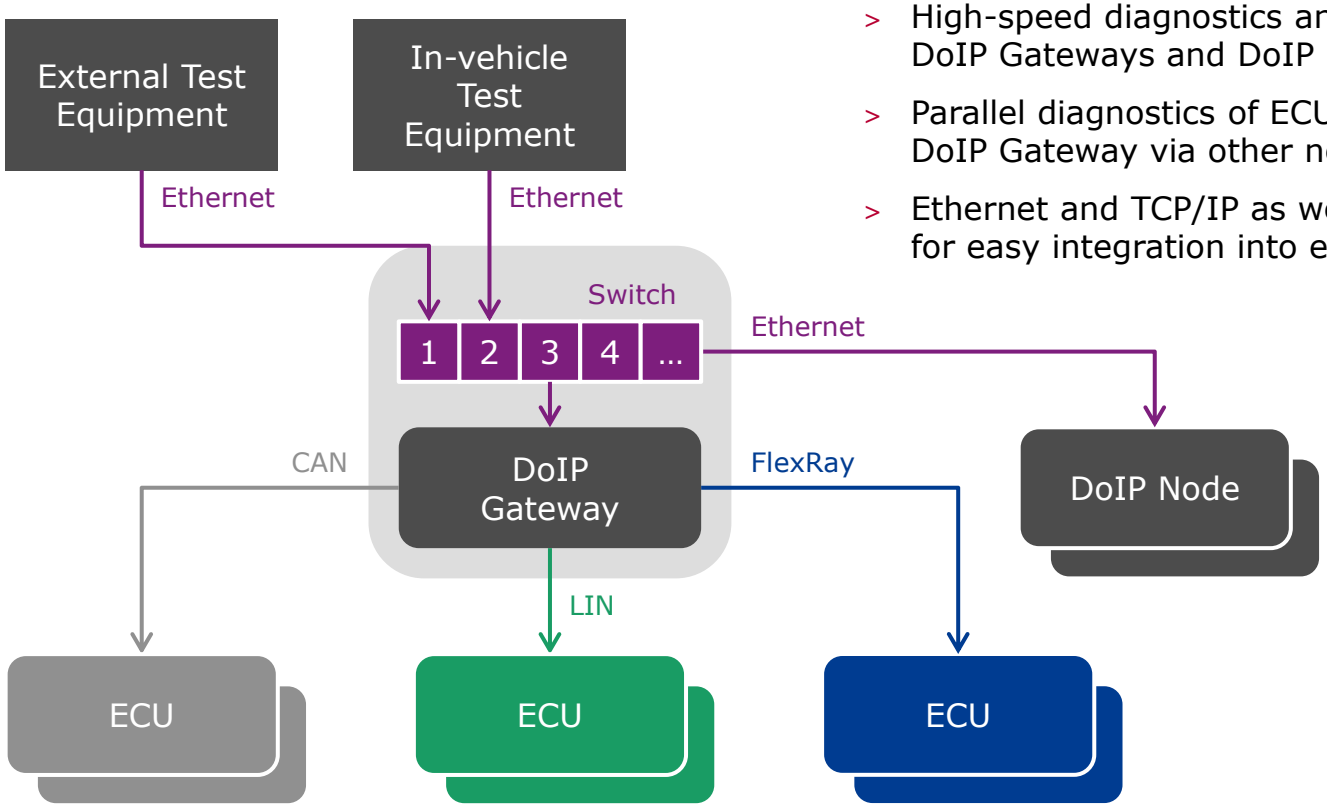
- AUTOSAR (R4.1/R4.2)

Audio/Video Bridging

- Partly AUTOSAR (R4.2)

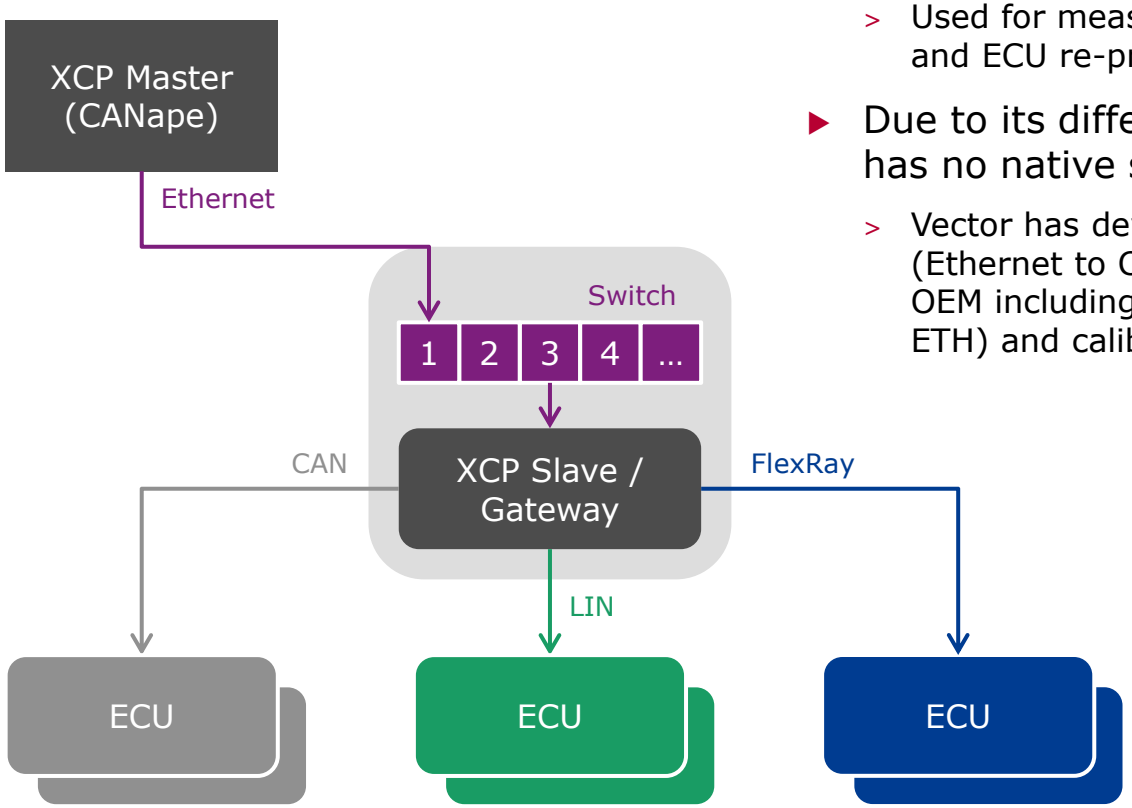


Diagnostics over Internet Protocol (DoIP)



- ISO 13400
  - High-speed diagnostics and re-programming of DoIP Gateways and DoIP Nodes
  - Parallel diagnostics of ECUs connected to the DoIP Gateway via other networks
  - Ethernet and TCP/IP as well-known technologies for easy integration into existing infrastructure

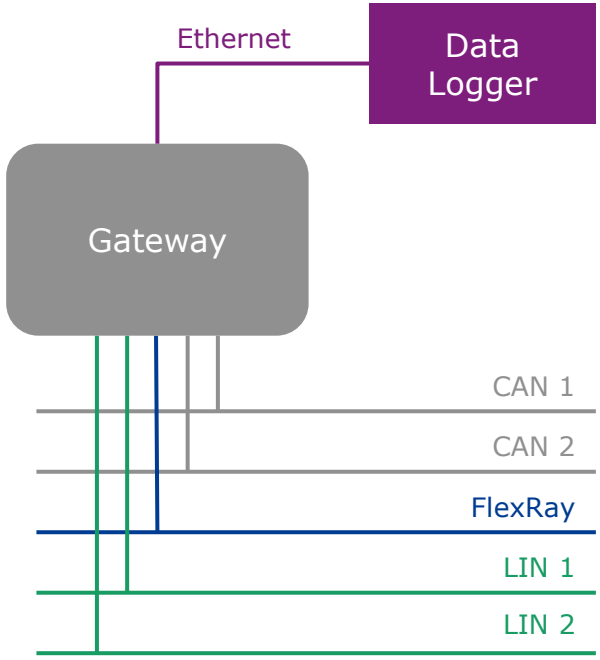
Universal (X) Measurement and Calibration Protocol (XCP)

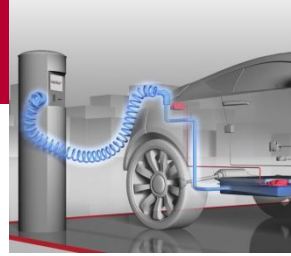


- ASAM AE MCD-1 XCP
  - Used for measurement, calibration, bypassing and ECU re-programming
- Due to its different transport layers, XCP has no native support for routing
  - Vector has developed a solution for XCP routing (Ethernet to CAN/LIN/FlexRay) together with an OEM including embedded software (MICROSAR ETH) and calibration tool (CANape)

Mirroring

- How can vehicle internal bus traffic be logged and analyzed if Ethernet is the only access point to the vehicle and without additional logging equipment?
- Solution: Mirroring of CAN/LIN/FlexRay bus traffic to Ethernet
  - Mirroring of complete communication
  - Simultaneous mirroring of all connected busses possible
  - Multiple CAN/LIN/FlexRay messages are packed in one Ethernet packet
  - Additional information is added to the mirrored messages
  - Mirror functionality can be switched on/off e.g. by a diagnostic command
- On-/Offline analysis of mirrored data e.g. in CANoe

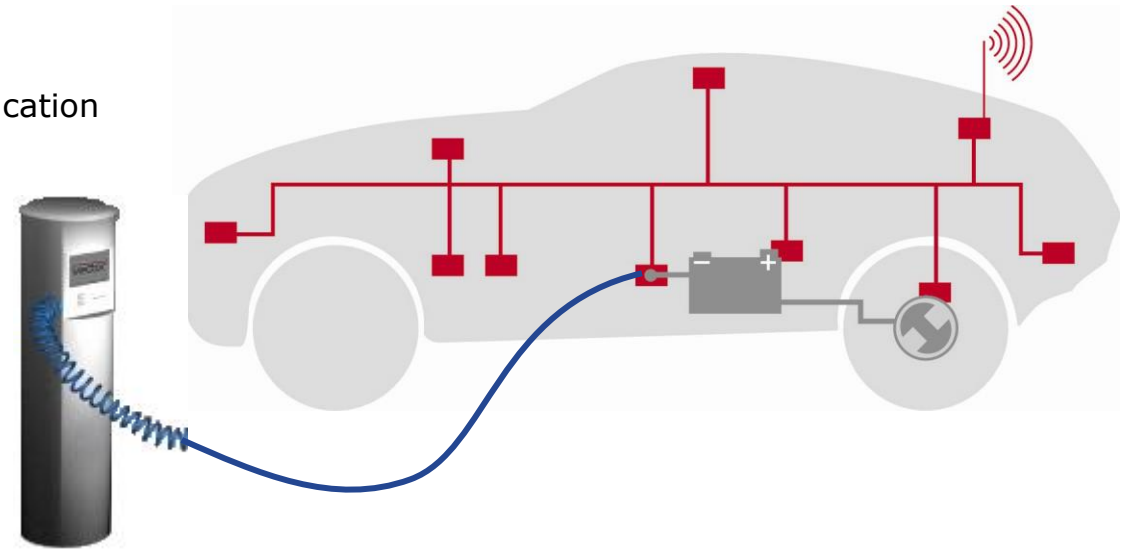




Smart Charge Communication (SCC)

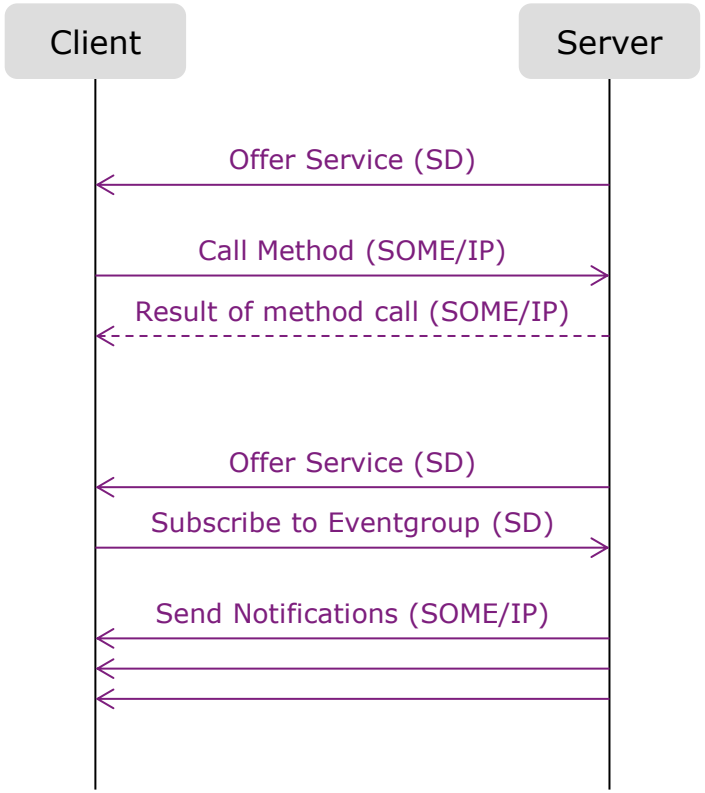
- AC and DC charging of electric and hybrid vehicles
  - Profile: Plug and Charge (PnC) – charging in a public environment with billing
  - Profile: External Identification Means (EIM) – "simple" charging
  - ISO 15118
  - DIN 70121 (DC charging with EIM only)

- Customer specific functions
  - E.g. based on HTTP communication



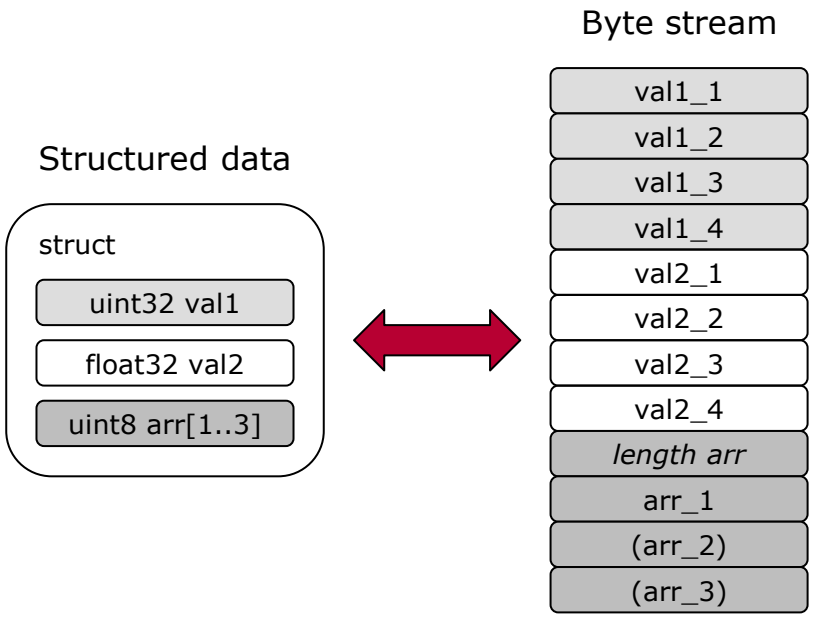
Service Discovery (SD)

- Service-oriented communication scheme instead of a classical signal-oriented approach
- What is a "service"?
  - A service can contain "methods" which can be called by other ECUs (Remote Procedure Call)
  - A service can contain "events" to which other ECUs can subscribe to be informed about changes or updates
  - There are service providers (servers) and service consumers (clients)
- Advantages
  - Save bandwidth (on other communication paths) and reduce CPU load
    - Unicast instead of multi- and broadcast messages (use the advantages of a switched network)
    - Do not send and receive invalid signals or signals the ECU is not interested in
  - Dynamic relocation of services possible



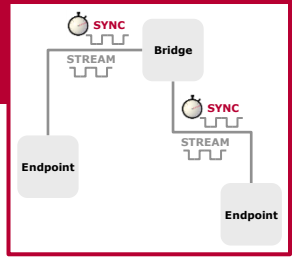
Scalable Service-Oriented Middleware over IP (SOME/IP)

- SOME/IP is an automotive remote procedure call and serialization protocol
  - Definition of a header format which supports remote procedure calls (RPC), i.e. calling a method on a remote server ECU like it would be executed on the own ECU
  - Definition how application data shall be serialized to the on-the-wire payload
    - Support of basic data types, complex data types (e.g. C-struct), static and dynamic array data types
    - Independent on endianess
  - Designed for AUTOSAR and non-AUTOSAR ECUs



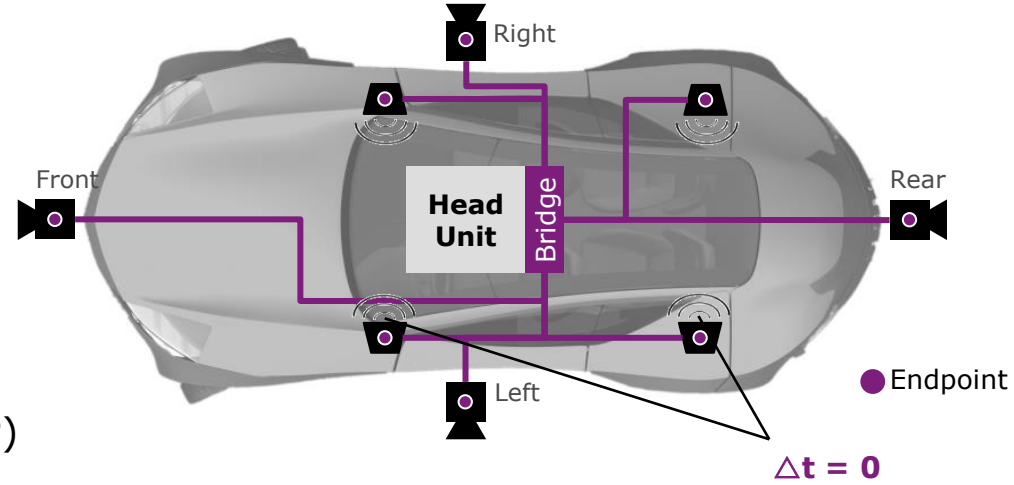
UDP Network Management (UDPNM)

- Coordination of the transition between normal operation and bus-sleep mode of an Ethernet network
  - Periodic broadcast messages are sent by nodes which want to keep the NM-cluster awake
  - No master node
  - Further features
    - Node detection (detect all present nodes in a network)
    - Ready sleep detection (detect if all nodes in a network are ready for bus-sleep mode)
    - Partial Networking
  - Similar to network management on CAN
- No wake-up based on NM messages possible
  - Additional bus connection or wake-up line necessary
  - Transceiver support missing
    - Power consumption in sleep mode is too high
    - New transceivers are currently under development



Bridging & Management

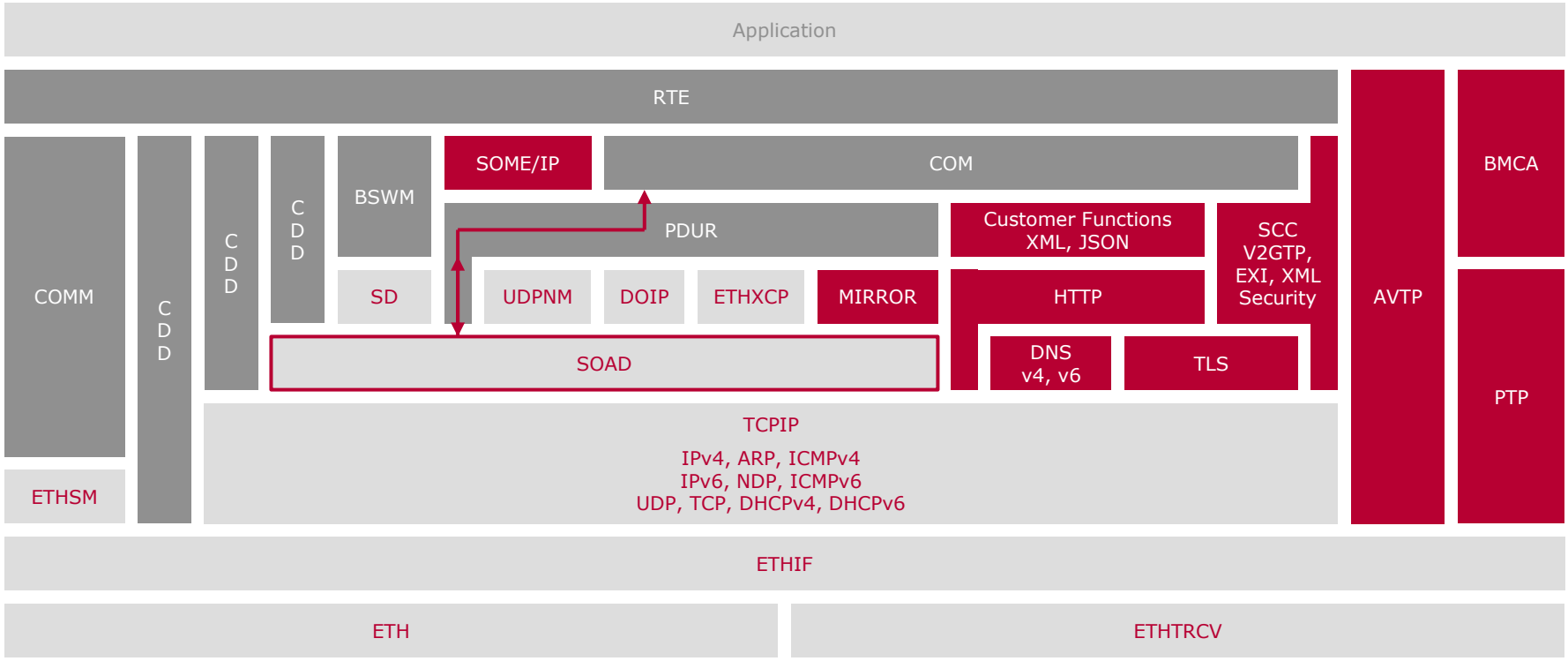
- Introduction and overview
  - IEEE 802.1BA
- Precision Time Protocol (PTP) and Best Master Clock Algorithm (BMCA)
  - IEEE 802.1AS
- Stream Reservation Protocol (SRP)
  - IEEE 802.1Qat
- Forwarding and Queuing Enhancements for Time-Sensitive Streams (FQTSS)
  - IEEE 802.1Qav



Audio/Video data transmission and reception

- Audio/Video Transport Protocol (AVTP)
  - IEEE 1722(a) – (a) == Automotive version in draft status

AUTOSAR Ethernet Stack plus Extensions



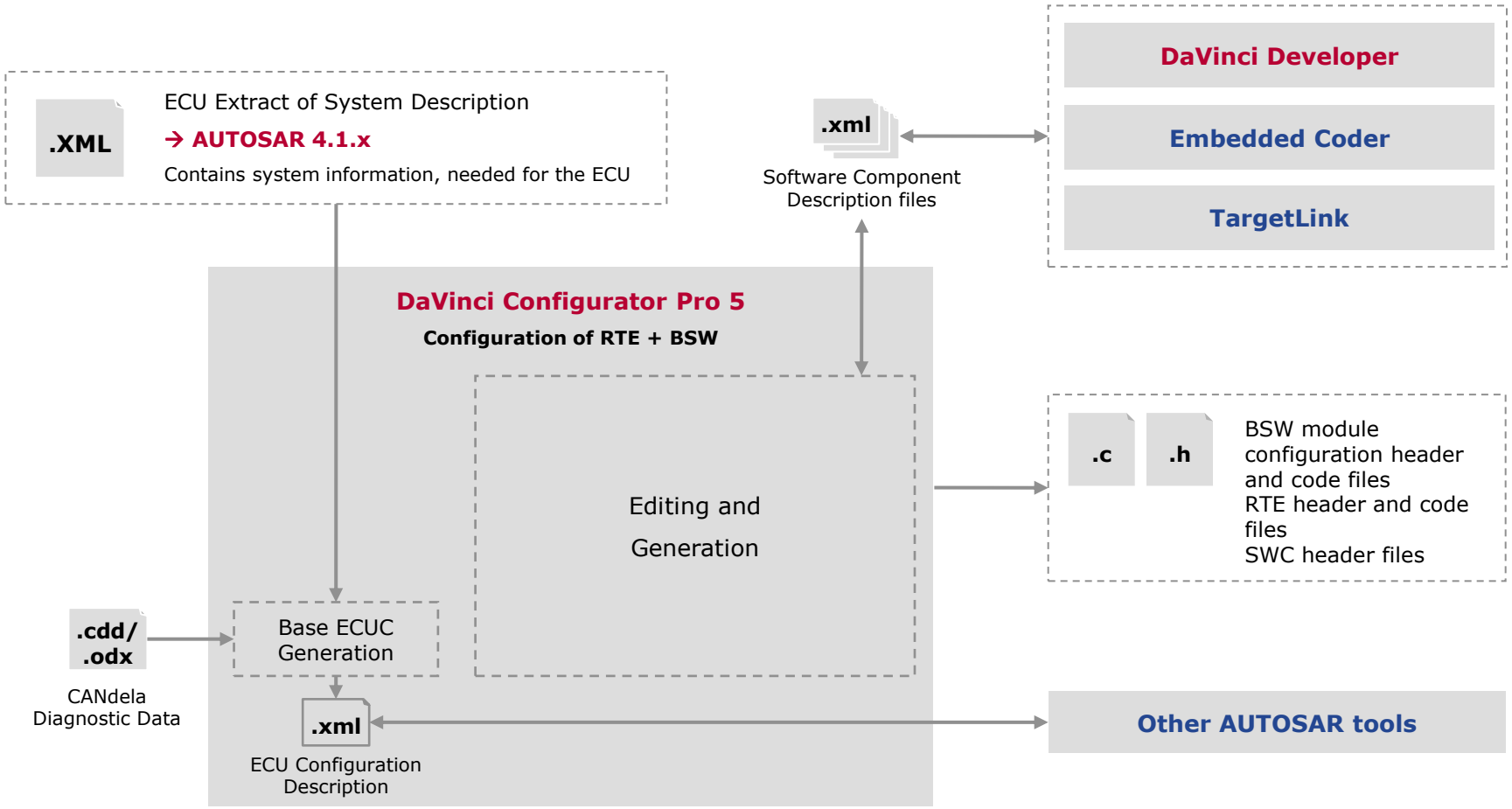
<Module> AUTOSAR Common Module

<Module> AUTOSAR Ethernet Stack Module

<Module> AUTOSAR Ethernet Stack Module with Extensions

<Module> Non-AUTOSAR Module

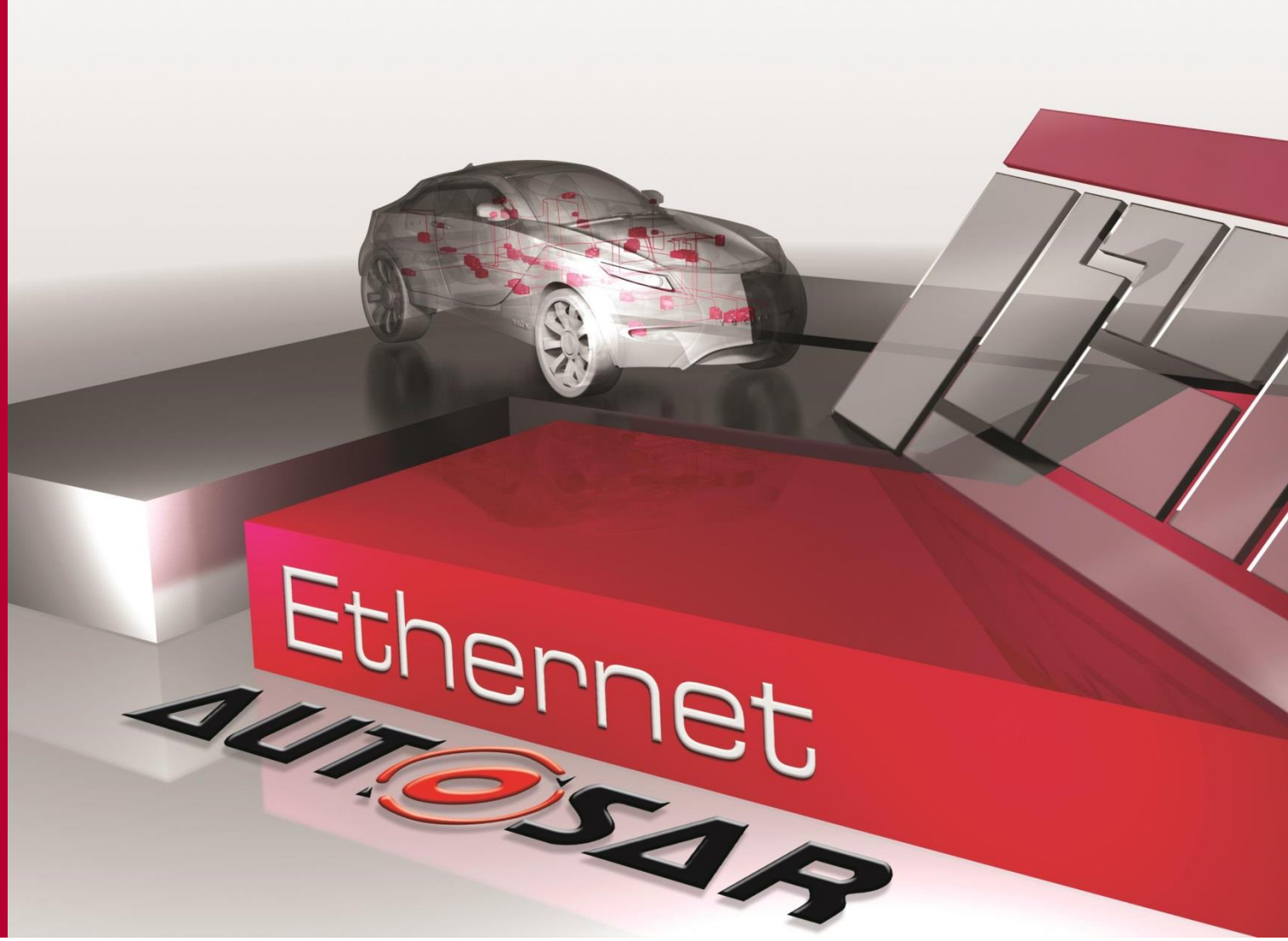
ECU Configuration Flow



There is more to come …

AUTOSAR Concepts for R4.2.1

- CONC_600_SwitchConfiguration
  - Configuration of an Ethernet switch by AUTOSAR basic software
  - In-vehicle DHCP server
- CONC_601_SenderReceiverSerialization
  - RTE transformer (SOME/IP, COM-based, E2E, …)
- CONC_603_EfficientCOMforLargeData
  - Second COM module without complex PDU triggering mechanisms and without buffer handling
- CONC_605_GlobalTimeSynchronization
  - Synchronization of the system time over different bus systems and networks
  - Refers to PTP in case of Ethernet



Questions?

Thank you for your attention.

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