Ethernet & Adaptive AUTOSAR
Key elements of the new Volkswagen E/E architecture

Dr. Marcel Wille, Dr. Olaf Krieger
Volkswagen AG
Agenda

1. Motivation for a new E/E architecture
2. Basic approach
3. Service-oriented architecture with Adaptive AUTOSAR
4. Service-oriented communication with Ethernet/ IP protocol stack
5. Conclusion
Digital. Connected.

Current way of thinking: Vehicle separated from customers’ daily digital experience

New way of thinking: Vehicle integrated in customer digital experience
The smart vehicle consistently increases its performance via updates and upgrades after sales.

A new approach is required to enable continuous innovation.

„Digital World“ stands for innovation and being up to date → The Vehicle becomes an integral part of this digital world.
Basic approach – Assumptions and Challenges

Key Parameters
- Power Train
  - Chassis
  - Body
  - ADAS
  - Infotainment
  - ...  
- Chassis
- Body
- ADAS
- Infotainment
- Auto. Driving
- Digitalization
  - ...  

Criteria
- E/E-Architecture
  - Distributed Functional Architecture
  - not appropriate for update- and upgradability

E/E-Architecture
- Centralized Functional Architecture
  - Application Server with Basic System Services
A new approach to enable updatability & upgradability

- Centralized functional architecture with decoupling of application software and I/O functions
  - Reduce overall system complexity and dependencies between applications
- Efficient & fast development of customer functions
  - Provide basic services required by several customer functions
  - Make use of service-oriented communication

In-Car Application-Server (ICAS)
Service-oriented architecture as key to digitalization

- Service-oriented communication
- Dynamic binding using service discovery and publish/subscribe
- Data representation primarily based on REST (Representational State Transfer) → uniform interfaces, stateless, separation of concerns, …
- Forward- and backward-compatibility of interfaces

Enables Volkswagen to easily **Plug & Play** new functions by improve updateability, upgradeability, reusability and portability
A common SW-Framework enables:

- Customer functions/basic services to be developed independently of ICAS and operating system
- Common methodology and exchange formats
- Common update and communication protocols
ICAS architecture will be derived from SW Reference Architecture.
Service-oriented communication with Ethernet- and IP-based protocol stack

- Service oriented communication via Ethernet enables high bandwidth and more flexibility
- Use of standards as far as possible through the whole stack
Service oriented communication

Volkswagen Infotainment Web Interface (viwi)
- RESTful* micro services architecture
- Using JSON, HTTP, TLS
- Flexible protocol for distributed Services in different ECUs and off board
- Apps running in node.js or other web service container or HTML5 based HMI elements
- All services are multi client capable and stateless
- Specification is part of W3C Automotive Working Group

SOME/IP
- Cyclic communication for control services

* representation state transfer
### Digitalization as driver for new Protocols?

<table>
<thead>
<tr>
<th>HTTP</th>
<th>???</th>
<th>Some/ IP</th>
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<tbody>
<tr>
<td>HMI, Internet, CE-Devices</td>
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<td>Vehicle control</td>
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<td>Internet Standard (Cloud)</td>
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<td>Vehicle oriented</td>
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<td>Established protocol environment e.g. TLS, OAuth</td>
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<td>Closed Environment</td>
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<td>Text-based</td>
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<td>Binary</td>
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<td>Data centric approach (RESTful)</td>
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<td>RPC approach</td>
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**Is something new required if the vehicle becomes an integral part of the digital world?**
Using TLS and SecOC to increase Security

Transport Layer Security (TLS) and Datagram Transport Layer Security (DTLS)

**Authentic communication**
- Authentication of client and Server
- Data integrity

**Encrypted communication**
- For confidential information

SecOC for authentic signal based communication
VLAN and packet Filter Firewall

- Network with different security zones realized by VLANs
- Secure routing to communicate between security domains using Packet filter

External Accessible Network e.g. LTE, WiFi, Bluetooth, OBD
Low security requirements

Internal Network medium security and availability requirements

Internal Network high security and availability requirements
Conclusion

Volkswagen is going to introduce a centralized architecture with focus on updatability and upgradability of customer functions.

In-Car Application Servers (ICAS) are using Adaptive AUTO SAR as standardized SW-Framework.

In-Car Application Servers (ICAS) are using standardized Ethernet/IP protocols for service-oriented communication.

Volkswagen & Vector will jointly promote Adaptive AUTO SAR and automotive Ethernet to be used in new Volkswagen E/E architecture.
Thank you very much for your attention.