AUTOSAR Introduction

Part 1 – The AUTOSAR Partnership and Standardization

BOSCH Continental Ford gm STELLANTIS TOYOTA VOLKSWAGEN GROUP

Agenda

Part 1

- The AUTOSAR Partnership
  - Organization
  - Basic Principles
- The AUTOSAR Standardization

Part 2

- Architecture and Features
- Smart Solutions Based on AUTOSAR
- Processes and Quality

AUTomotive Open System ARchitecture

AUTOSAR Mission

AUTOSAR is a global partnership of leading companies in the automotive and software industry to develop and establish the s**tandardized software framework** and **open E/E system architecture** for intelligent mobility.

AUTOSAR Vision

AUTOSAR will be the **global established standard** for **software** and **methodology** enabling **open E/E system architectures** for future intelligent mobility supporting high levels of dependability, especially safety and security.

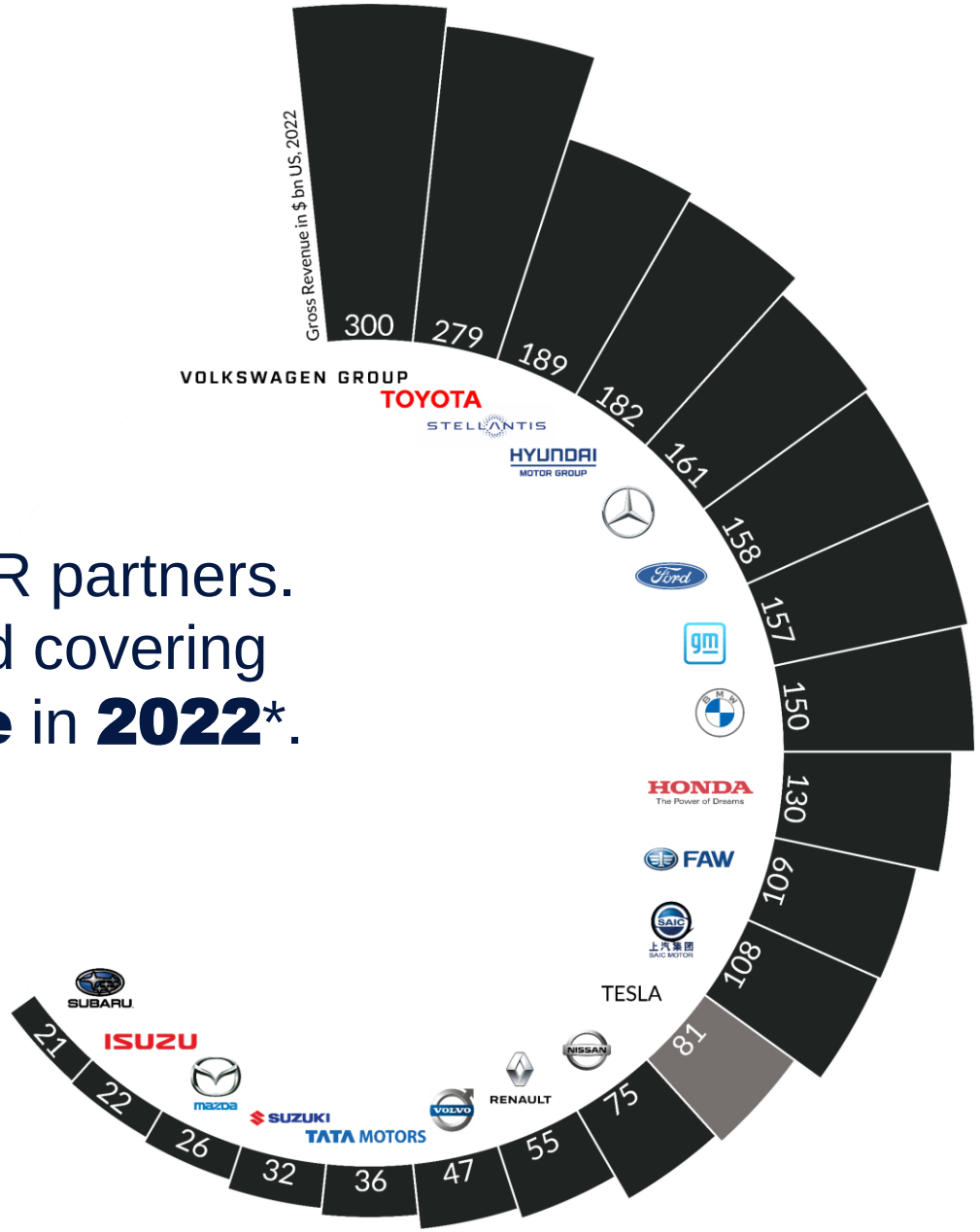
AUTOSAR Parnership

Collaboration model with proven track record

AUTOSAR has succeeded **in bringing together main players** in automotive E/E system development **to form a powerful standard** that is successfully used all **around the world**.

AUTOSAR Partnership

The advantage of a strong community



31 international automotive OEM are AUTOSAR partners. **19** are **under the 20 top-selling OEM** and covering **around 80%** of the **total market revenue** in **2022***.

Together with other OEM, Tier1 and Suppliers, our partners are collaborating to shape Future Intelligent Mobility.

*ref. to G2: 51 Automotive Industry Statistics to Highlight Latest Trends

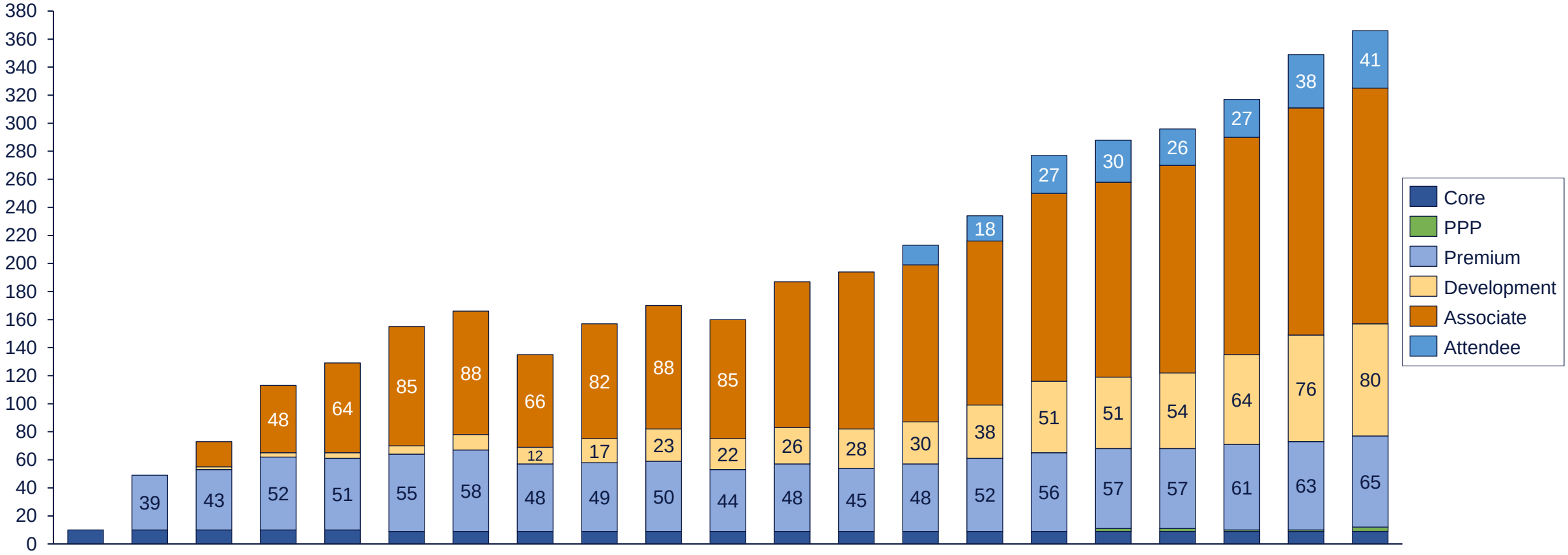
AUTOSAR Partnership

Types of partnership

	 **Premium Plus**	 **Premium**	 **Development**	 **Associate**	 **Attendee**	 **Subscriber**
Motivation	Leading innovations and project development in AUTOSAR standards	Development and exploitation of AUTOSAR standards (size >100)	Development and exploitation of AUTOSAR standards (size < 100)	Exploitation of AUTOSAR standards	Development of AUTOSAR standards	Openness of AUTOSAR standards to eligible public
Annual Fee	90,000 Euro	31,000 Euro	10,000 Euro	21,000 Euro	Free	3,000 Euro
Annual Contribution	5 FTE + 1 FTE (Project Leader)	1.5 FTE	0.5 FTE	None	Individual agreement	None

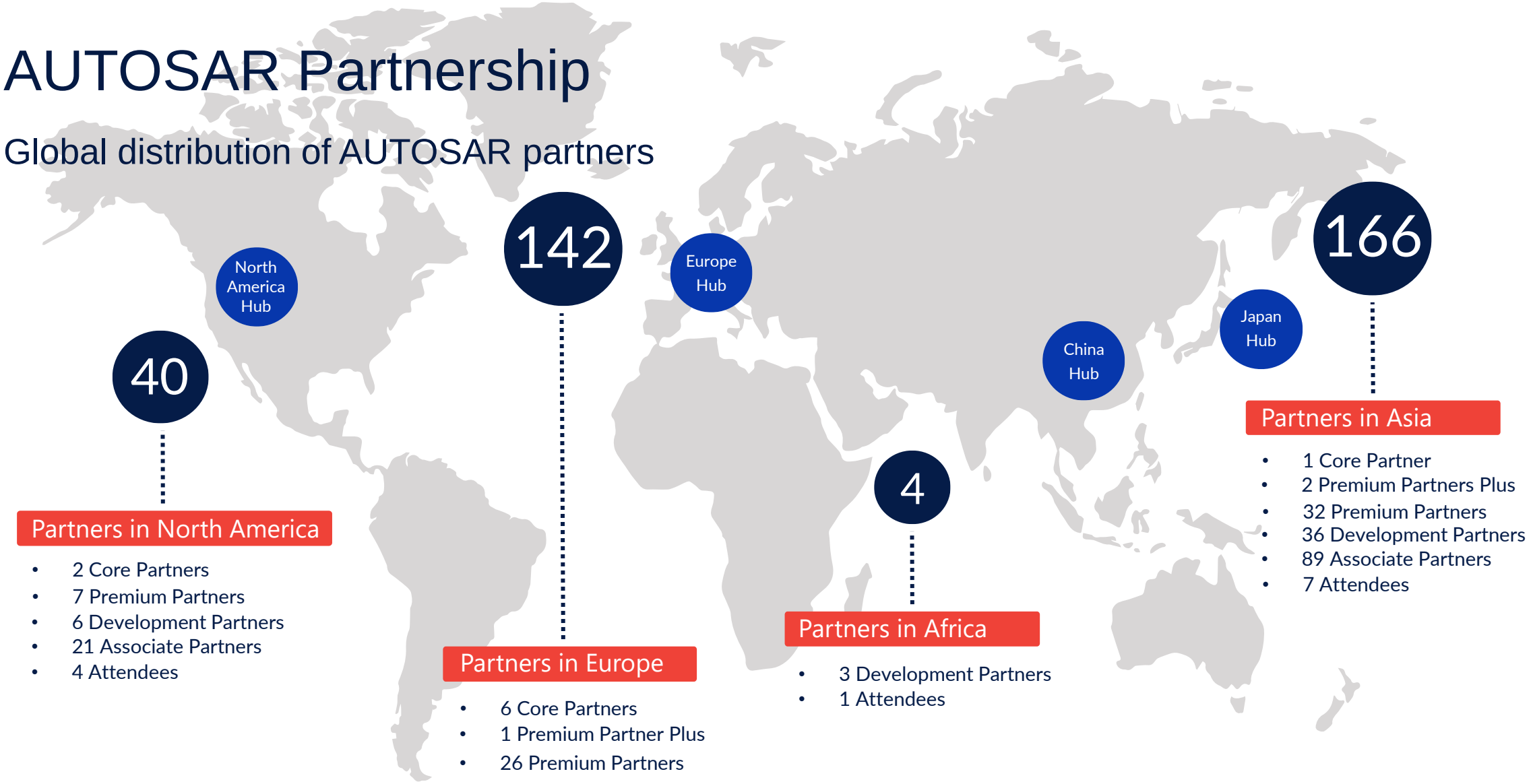
AUTOSAR Partnership

Partner Development since 2003



AUTOSAR Partnership

Global distribution of AUTOSAR partners



Partners in North America

- 2 Core Partners
- 7 Premium Partners
- 6 Development Partners
- 21 Associate Partners
- 4 Attendees

Partners in Europe

- 6 Core Partners
- 1 Premium Partner Plus
- 26 Premium Partners

Partners in Africa

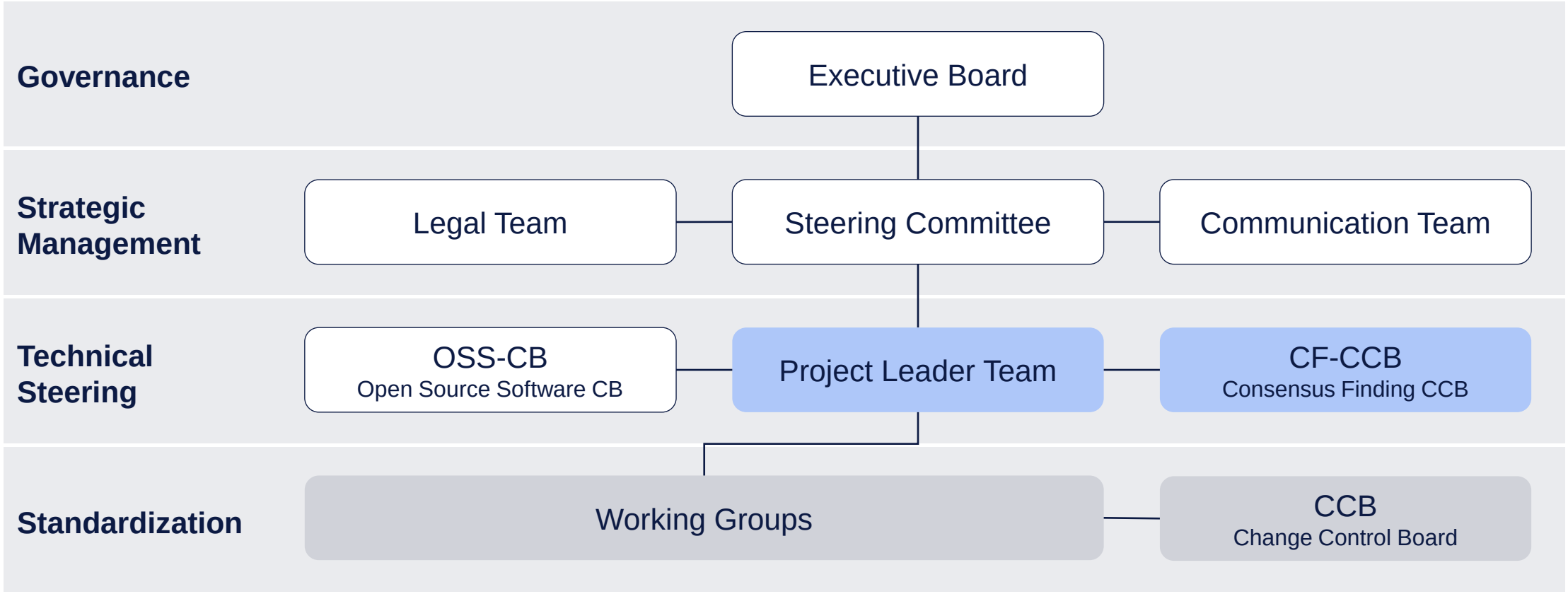
- 3 Development Partners
- 1 Attendees

Partners in Asia

- 1 Core Partner
- 2 Premium Partners Plus
- 32 Premium Partners
- 36 Development Partners
- 89 Associate Partners
- 7 Attendees

AUTOSAR Organization

Official Roles



AUTOSAR Organization

Support Fuctions

AUTOSAR Internal Affairs Office (IAO), Spokesperson and Regional Spokespersons

Business Administration

- Partner and User Management
- Finance
- Meeting Management

Communication Support

- Marketing

Technical Management

- Standards
- Software Development Engineering and Integration

Deliverable Management

- Change Management
- Quality Assurance
- Release Management

Legal Support

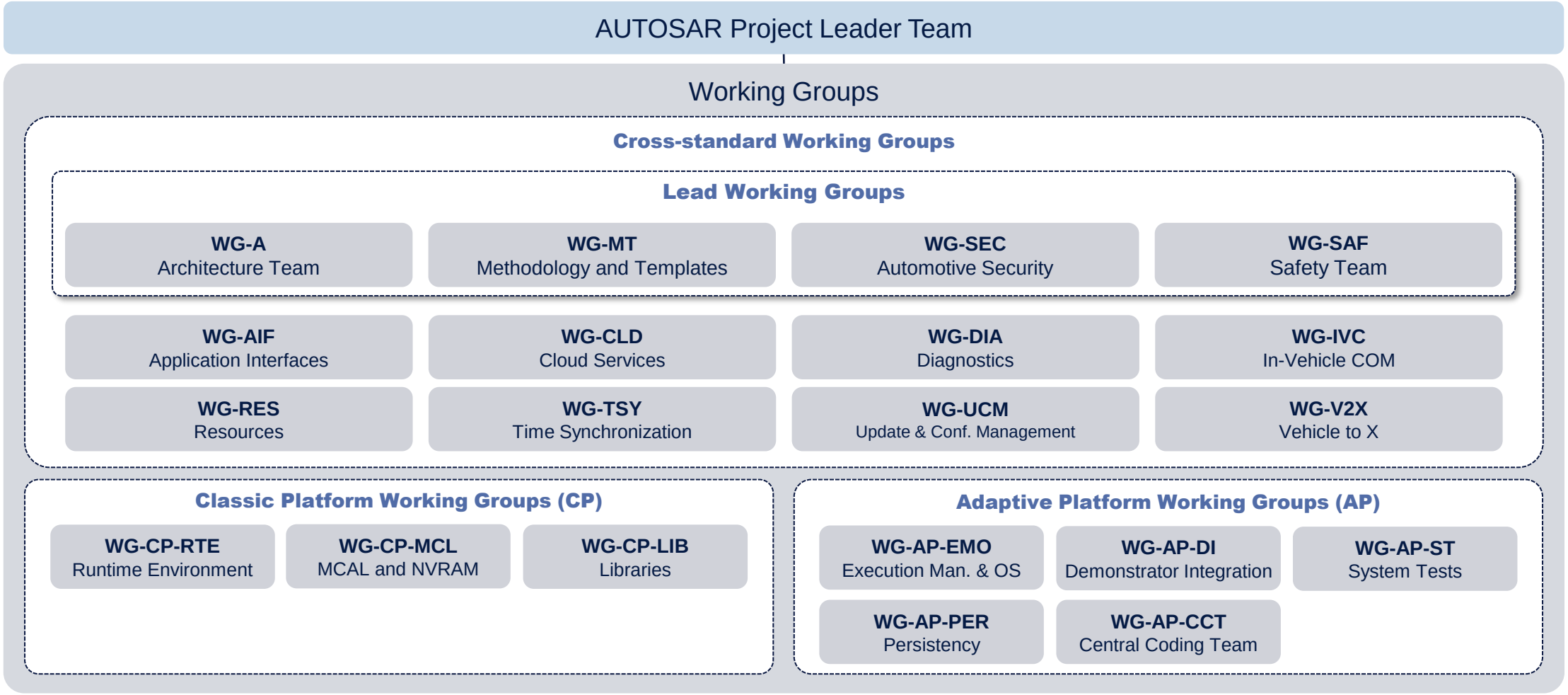
Requirements Management

Quality and Process Management

Technical Office and IT Infrastructure

AUTOSAR Organization

Overview of Working Groups



AUTOSAR Organization

User Groups Structure

Steering Committee / Project Leader Team

AUTOSAR User Groups

Regional User Groups

UG-CN
China

UG-NA
North America

UG-IN
India

Exploitation User Groups

UG-IE
Improved Exploitation

UG-ET
Education & Training

3rd Party Organizations

first 3rd Party

3rd Party User Groups

AUTOSAR Group*
…

…

other 3rd Party

3rd Party User Groups

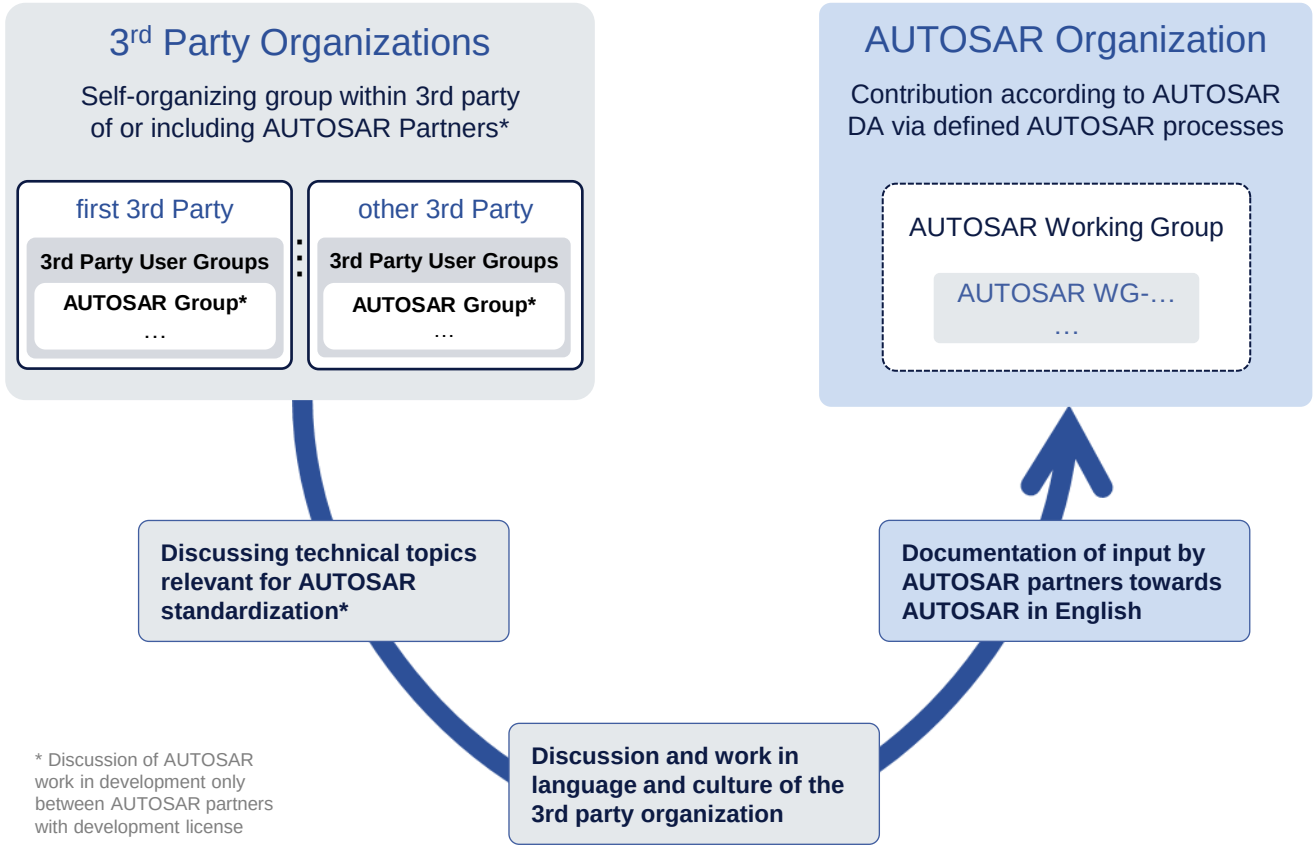
AUTOSAR Group*
…

* Self-organizing group within 3rd party of or including AUTOSAR Partners.

AUTOSAR Organization

3rd Party Group – Contribution of 3rd Party Technical Interests

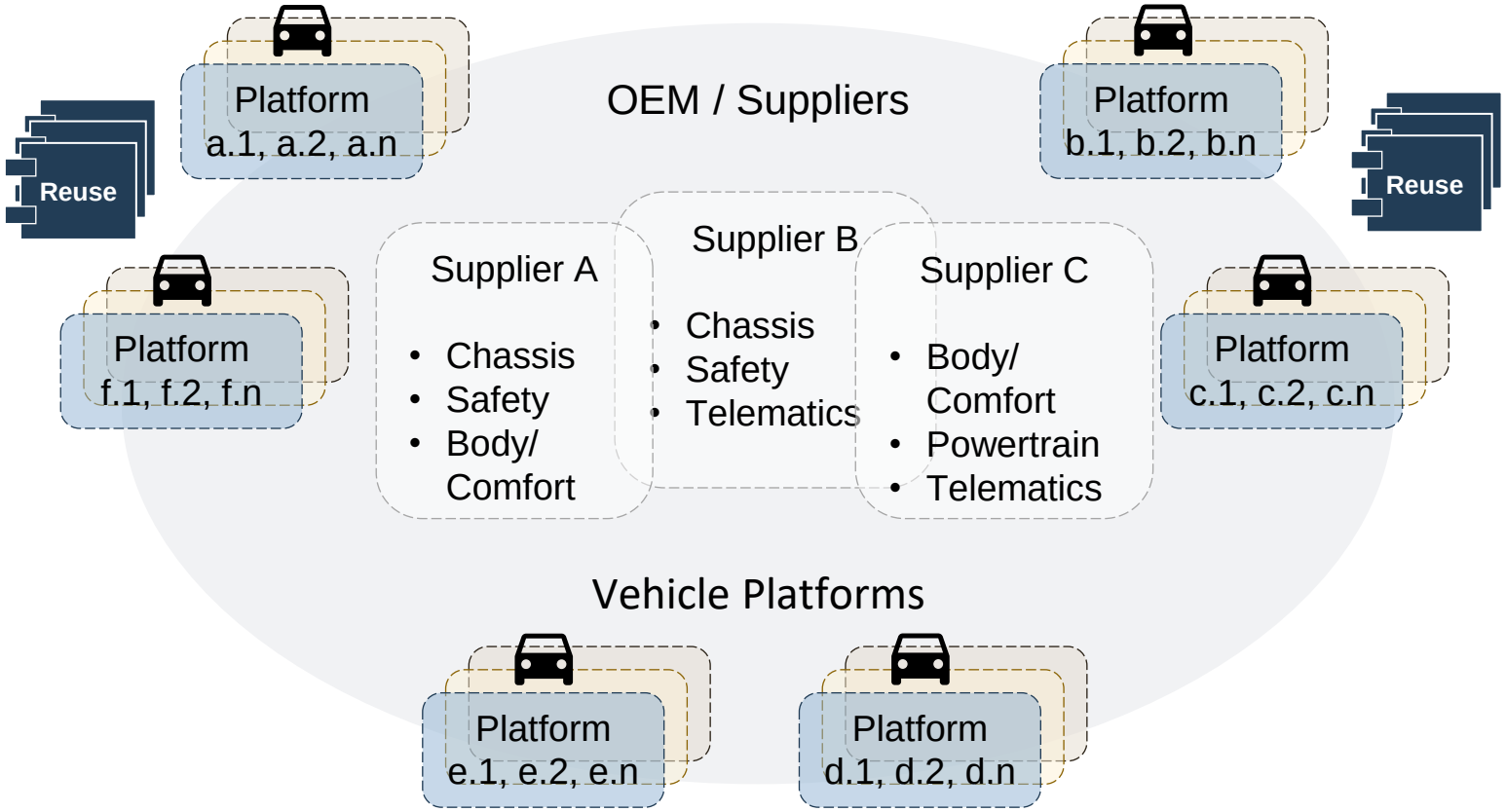
- Example Collaboration Model:
- 3rd parties technical interests are elaborated in 3rd party organizations
- Interested 3rd party organizations establish internal groups to interface to AUTOSAR.



AUTOSAR Basic Principles

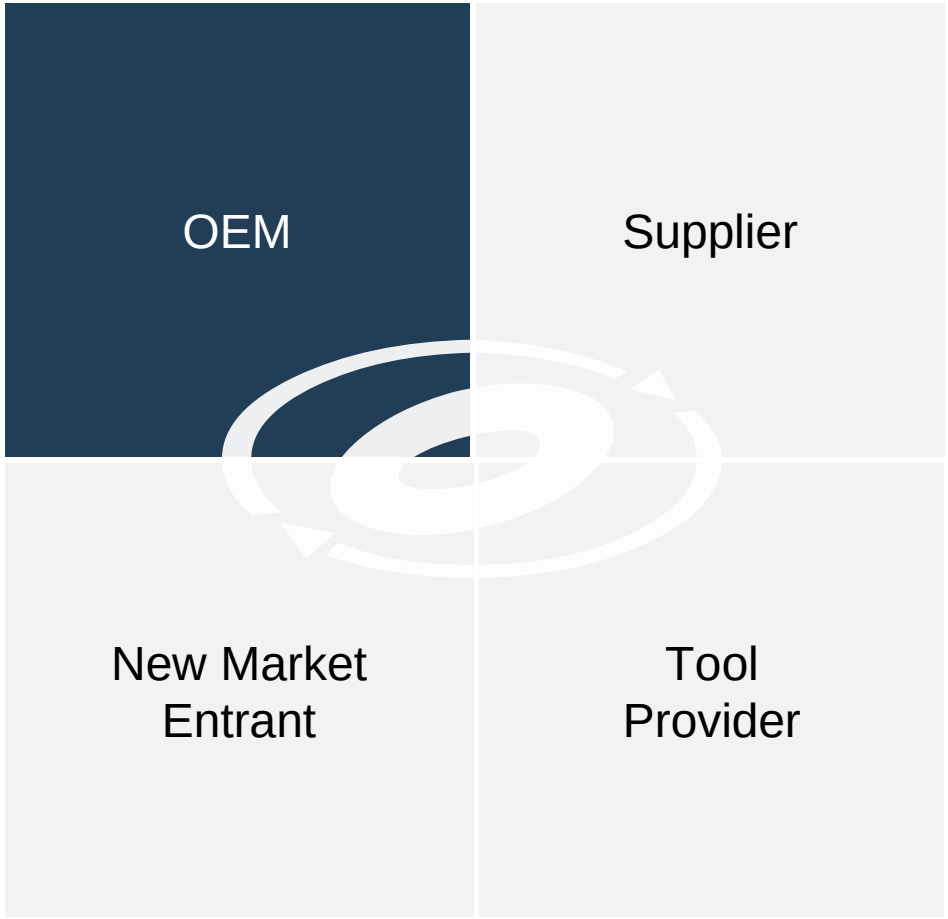
Benefits of a Software Framework

The standardized AUTOSAR software framework ensures an advanced complexity management for integrated E/E architectures through increased **reuse** and **exchangeability of software modules** within and between OEMs and suppliers.



AUTOSAR Basic Principles

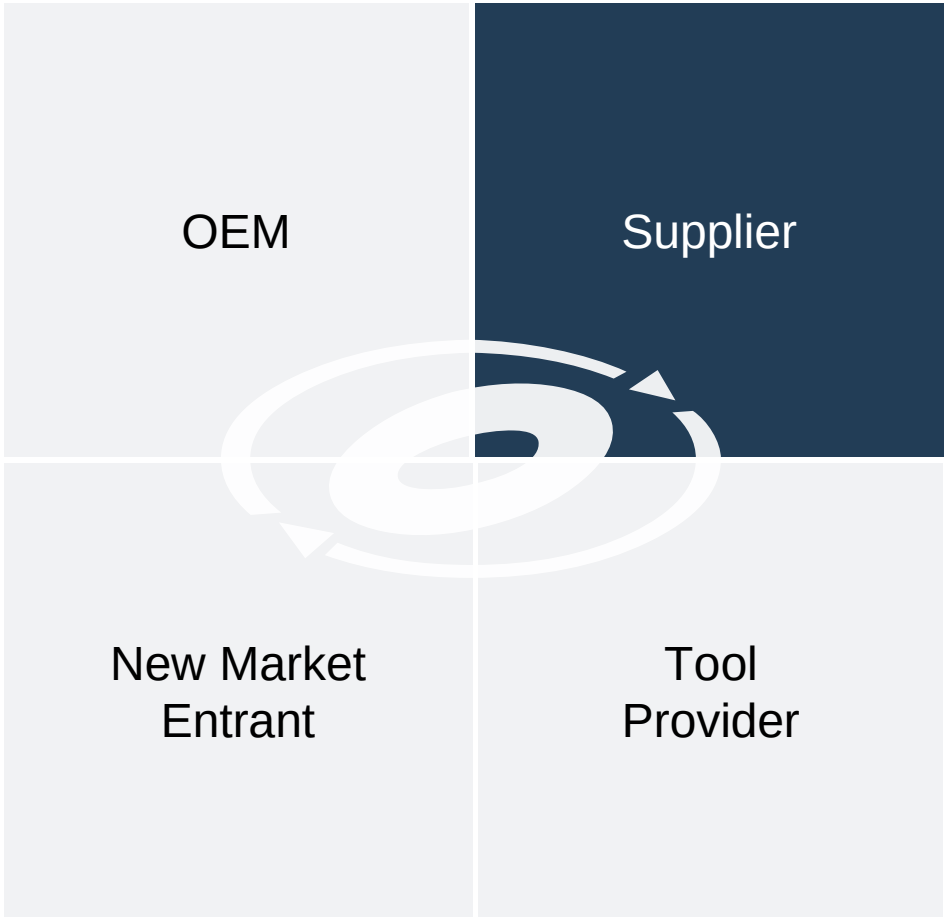
Benefits of Applying the AUTOSAR SW Framework (1)



- Supports **distributed development** among suppliers
- Standardizes **non-competitive SW**
- Allows competition on innovation with increased **design flexibility**
- **Simplifies** software and system **integration**
- **Reduces** overall software **costs**
- Supports **SW update and upgrades over the air**

AUTOSAR Basic Principles

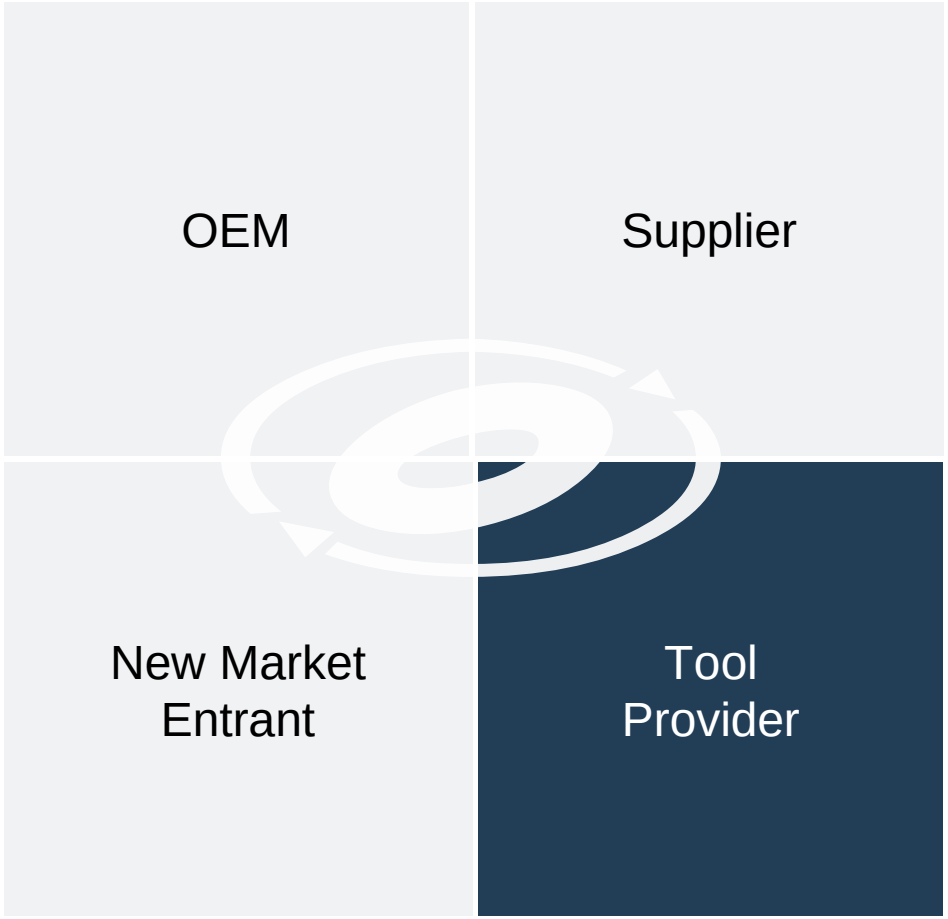
Benefits of Applying the AUTOSAR SW Framework (2)



- Enhances efficient **variant handling**
- **Reuses software** modules across OEMs
- Increases efficiency of **application development**

AUTOSAR Basic Principles

Benefits if Applying the AUTOSAR SW Framework (3)



- Supports a clearly **structured development process** based on a metamodel with templates and virtualization
- Can support **modern development processes**
- **Embeds tools** into an overall tool environment

AUTOSAR Basic Principles

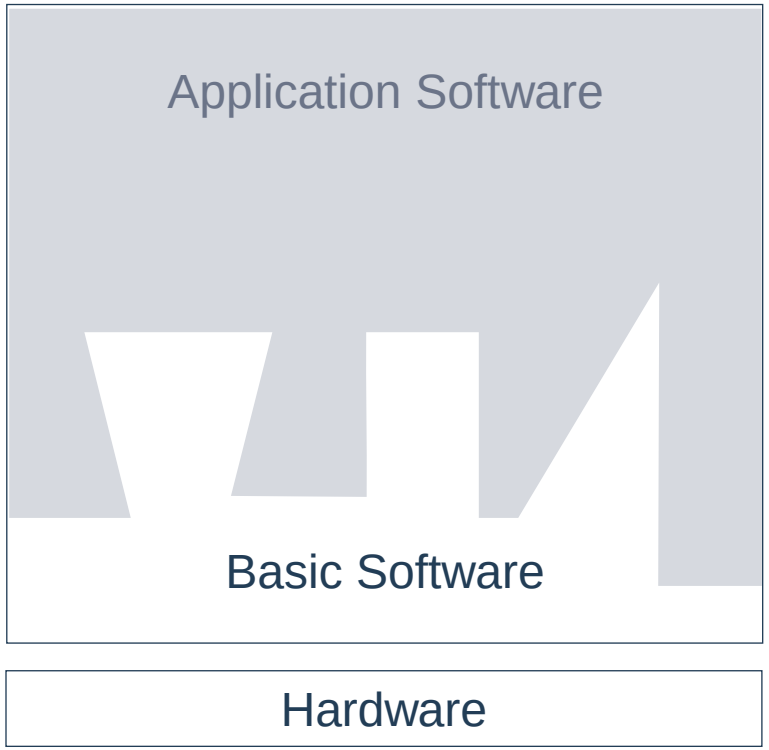
Benefits of Applying the AUTOSAR SW Framework (4)

- Enables **exploitation models** through standardized interfaces
- **Could become vendor** for SW stacks
- Has access to **comprehensive documentation** of specs and methodology
- **Can contribute to market** for training courses and engineering support
- Has access to **training material**

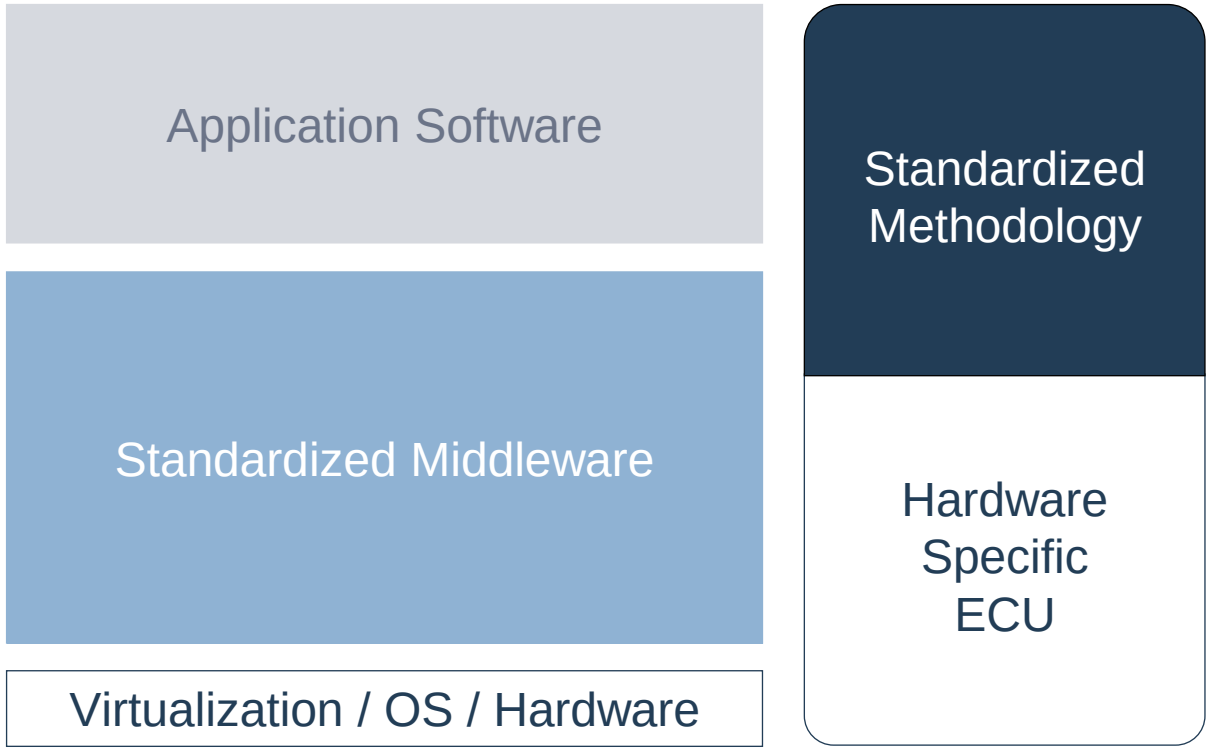
AUTOSAR Basic Principles

Proprietary vs. AUTOSAR Middleware Approach

Proprietary Solution



AUTOSAR™

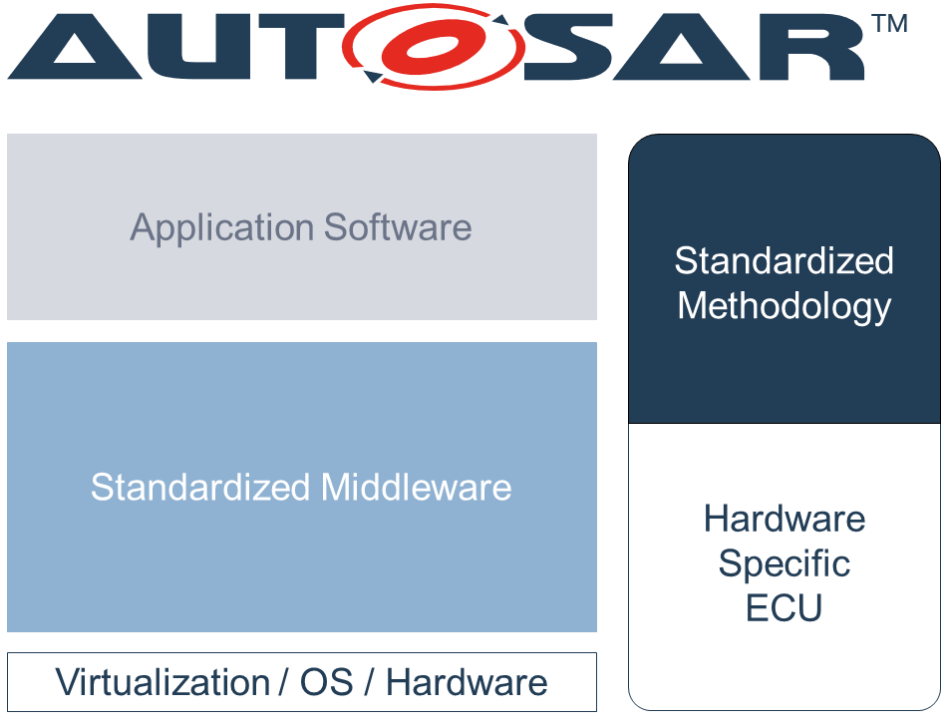


AUTOSAR Basic Principles

Benefits of the AUTOSAR Middleware Approach

AUTOSAR provides a holistic ecosystem for innovative electronic systems with high **performance, safety and security** requirements.

- **Hardware** and **software** widely **independent** of each other
- **Distributed, parallel development** (by abstraction) through horizontal layers; therefore, **reduced** development **time** and **costs**
- **Enhanced quality** and **efficiency** through software reuse



Agenda

Part 1

- The AUTOSAR Partnership
- The AUTOSAR Standardization
  - Challenges in the Mobility Sector
  - The Software Framework

Part 2

- Architecture and Features
- Smart Solutions Based on AUTOSAR
- Processes and Quality

Challenges in the Mobility Sector

Select Main Drivers for Software Defined Vehicles

Connected, **A**utomated, **S**hared, and **E**lectrified driving

Highly Automated Driving with Dependability

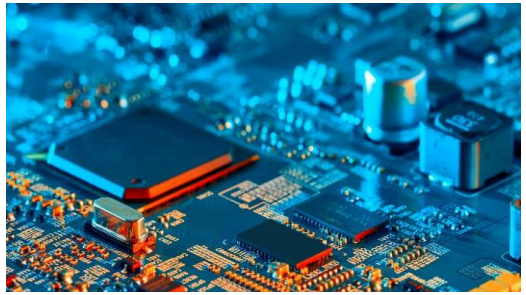
- Safety
- Security
- Reliability, Availability and Maintainability

V2X, Internet of Things, Cloud-Based Services

- Security
- QoS
- Over the Air (OTA) Update/Upgrade

Increasing Data Rates and Volume

- Automotive Ethernet
- 5G



New Automotive Processor Technologies

- Centralized multi-core processors

Challenges in the Mobility Sector

Highly Automated Driving - It‘s all About Trust!

High dependability will require

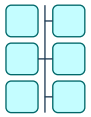
- a balance between **safety** and **availability** through redundancy and degradation concepts.
- **protection against** common cause or common mode **failures** through physical and software diversity.
- comprehensive system **monitoring** and **diagnosis**.
- high **system reliability**.
- Over The Air (**OTA**) serviceability.
- **certifiable** development processes.

Challenges in the Mobility Sector

Driving Innovations in E/E Architectures

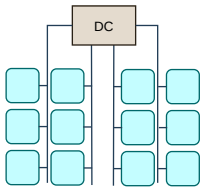
- Domain/Vehicle Controller
- Deeply Embedded ECUs
- Obsolete ECUs
- Part of Software Defined Vehicle eco-system
- Integration Process
- Intelligent Actuators/Sensors

Distributed ECUs



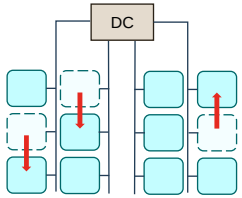
1970
Mechanics

Centralization

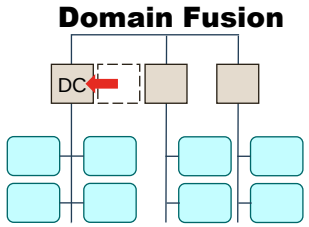


1980
Electric Support

Integration



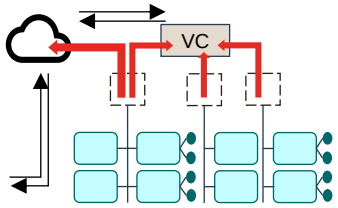
1990
Info-tainment



2000
Linked Networks

2010
90% of All E/E-Driven Innovations

Vehicle Computer

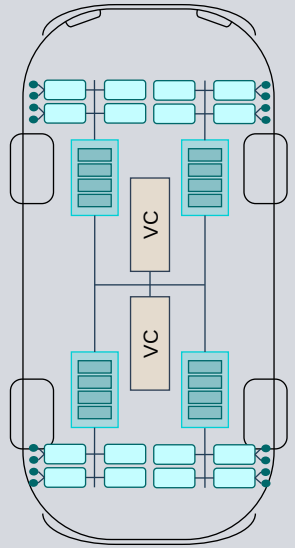


2020
Major E/E-driven Innovations

Vehicle-Backend Connection
Service-oriented Architectures

Zone Architecture

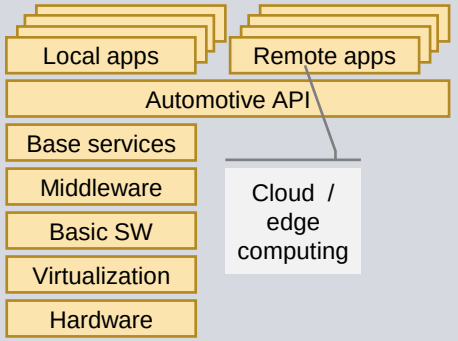
2025



Zone Architecture
Time-Sensitive Networking

Software-Defined Vehicle

2030



Vehicle-Backend Integration
Vehicle OS
Automotive API
Big Data
Central HPC

Complexity increase

The AUTOSAR Opening Strategy

A Set of Measures to Meet the Challenges

- ✓ Regional Representations
- ✓ 3rd Party Collaboration
- ✓ Premium Partner Plus
- ✓ Derived Applications
- ✓ Easier Access to a limited scope of AUTOSAR Work
- Automotive API
- AUTOSAR Open Framework

Derived Applications

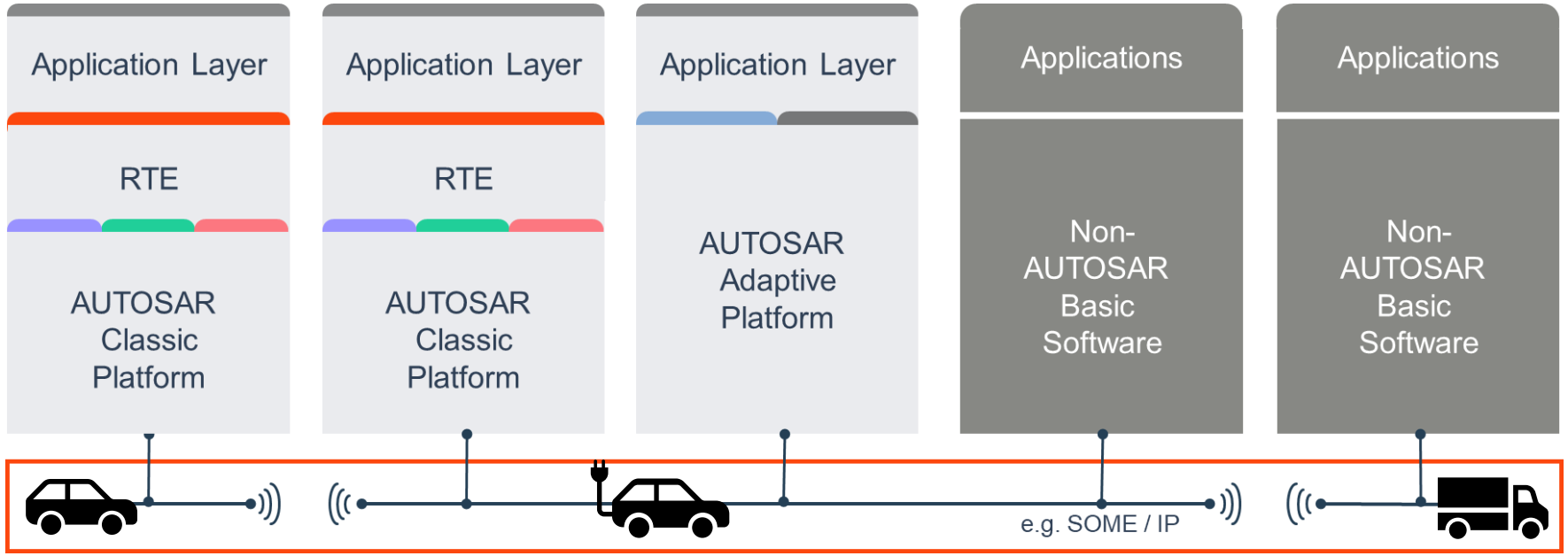
- Mobility infrastructure
- Agricultural machinery
- Maritime Shipping
- Railway
- Urban Mobility
- Industrial Automation
- Building Automation
- Household appliance
- Medical technology

The AUTOSAR Opening Strategy

Easier Access to Provide AUTOSAR Compatible Components or Products

The new “Associate Partner” variant “Light”

- For free.
- Exploitation rights for very limited scope of AUTOSAR standards.



The AUTOSAR Opening Strategy

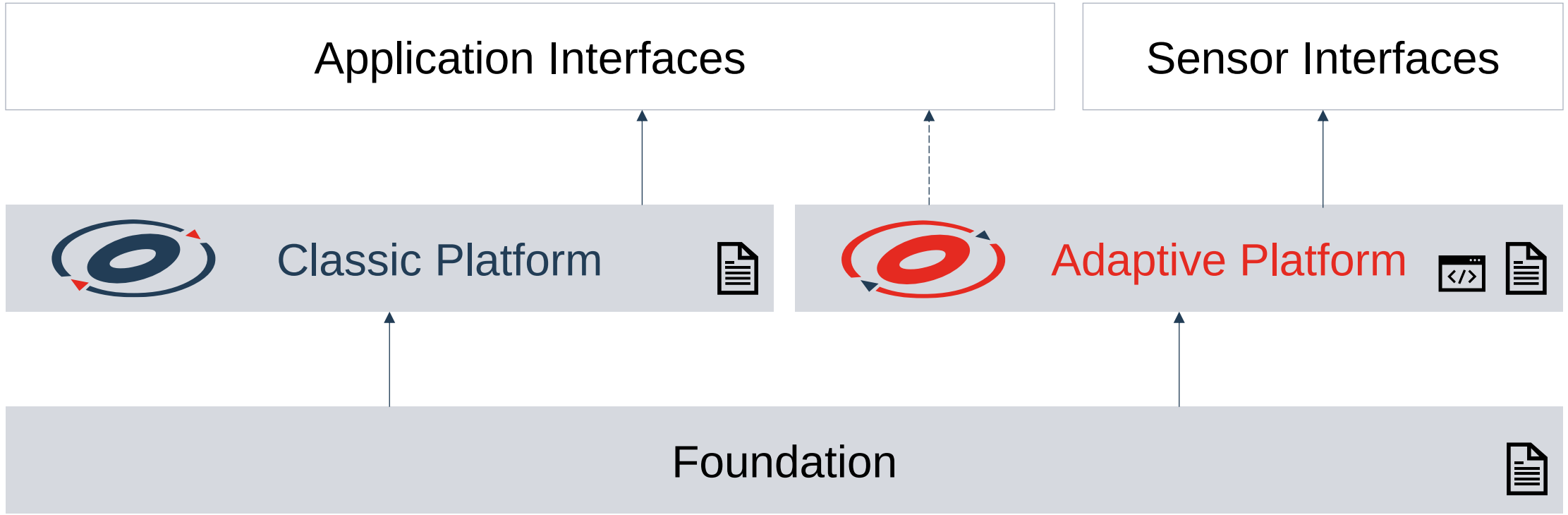
Foster Collaboration for Software Defined Vehicles (SDV)

The planned AUTOSAR Open Framework (AOF)

- to enable open collaboration in the SDV ecosystem **considering the overarching purpose of AUTOSAR**.
- to **foster an ecosystem** of complementary standards, software implementations, and capabilities
- to allow new activities **beyond the limits** of the AUTOSAR Development Cooperation.
- is **open for interested parties** from the automotive and related industries to develop joint solutions.

The AUTOSAR Software Framework

Deliverables



The AUTOSAR Software Framework

Deliverables

	Classic Platform	Adaptive Platform	Non-AUTOSAR Platforms e.g. Infotainment
			GENIVI, Android, Linux, Automotive Grade Linux, Microsoft Windows, Robot Operating System (ROS)
Real Time Requirements	**High**, in the range of micro-seconds	**Mid**, in the range of milli-seconds	**Low**, in the range of seconds
Safety Criticality	**High**, up to ASIL-D	**High**, at least ASIL-B	**Low**, QM
Computing Power	**Low**, ~ 1000 DMIPs	**High**, > 20.000 DMIPs	**High**, ~ 10.000 DMIPs

AUTOSAR Adaptive Platform

Three Pillars for ADAS Applications

1. Safe and Secure

2. Connected

3. Dynamic and Updateable

The mixed-critical automotive extension to POSIX

- Standard automotive connectivity
- Automotive-specific functional add-ons
- Functional Safety and Cyber Security
- E/E Architecture development
  - Top-down workflow for distributed development
  - Formal exchange formats

AUTOSAR Adaptive Platform

Three Pillars for ADAS Applications (1)

1. Safe and Secure

2. Connected

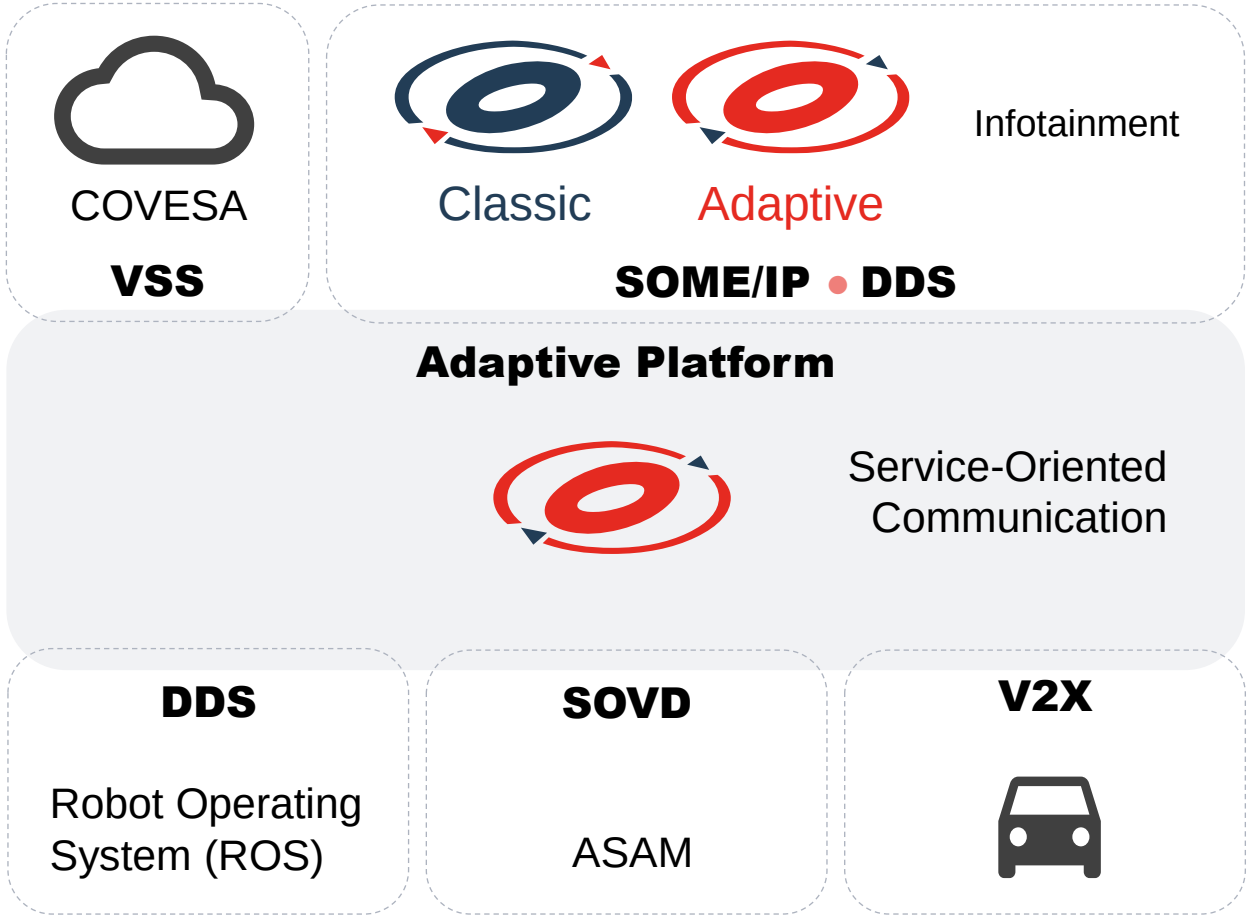
3. Dynamic and Updateable

- External Communication:
  TLS • DTLS • IPsec
- In-Vehicle Communication:
  SecOC • IPsec • MACsec
- Platform
  Safe Data Storage • Supervision • Failure Handling • Resource Budgeting • E2E for SOA • Exceptionless APIs • Identity Access Management • Crypto • Firewall • Intrusion Detection System Management

AUTOSAR Adaptive Platform

Three Pillars for ADAS Applications (2)

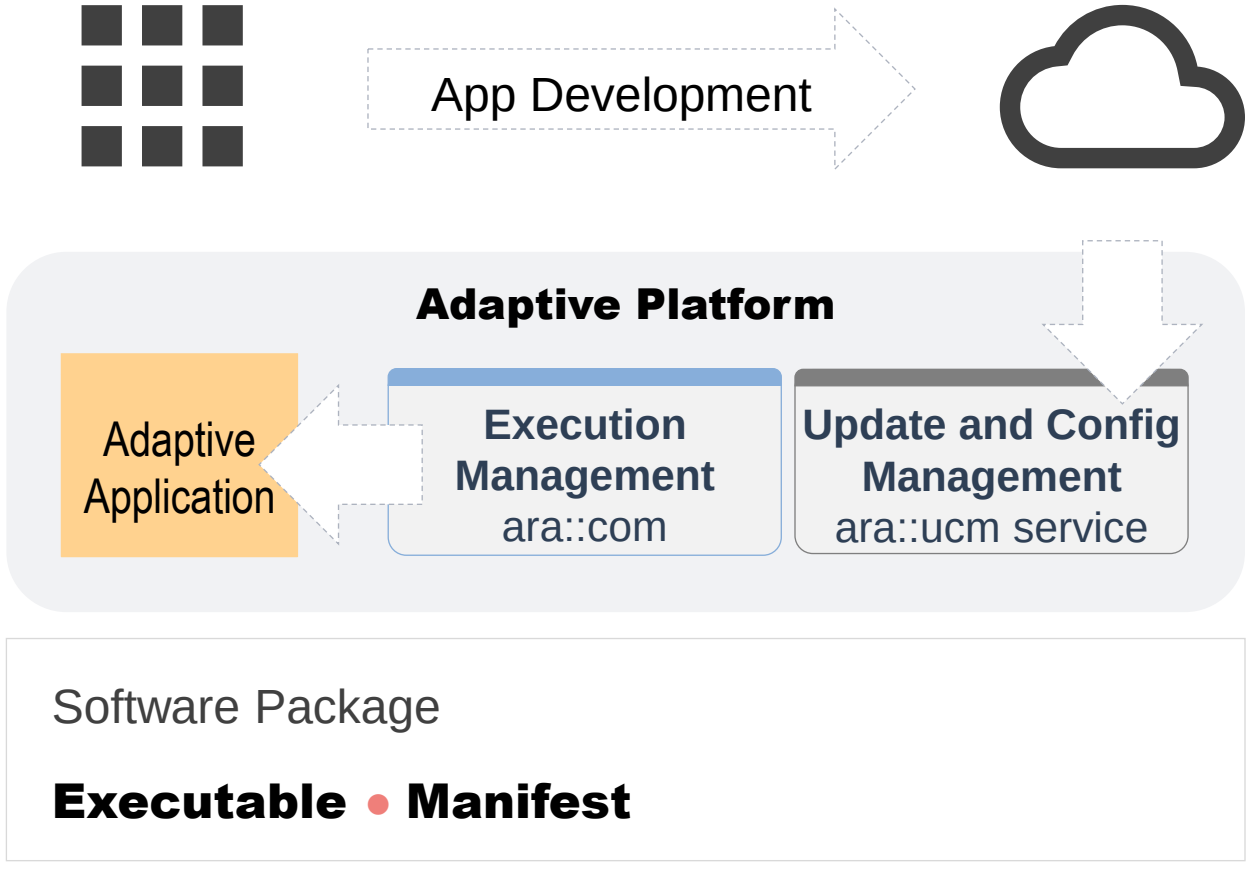
1. Safe and Secure
2. Connected
3. Dynamic and Updateable



AUTOSAR Adaptive Platform

Three Pillars for ADAS Applications (3)

1. Safe and Secure
2. Connected
3. Dynamic and Updateable



AUTOSAR Classic Platform

Four Pillars Form the Standard Solution for Today´s Automobiles

1. Functional Safety

2. Efficiency

3. Field Proven

4. Performance

AUTOSAR Classic Platform

Four Pillars Form the Standard Solution for Today´s Automobiles (1)

1. Functional Safety

2. Efficiency

3. Field Proven

4. Performance

- Mature safety features (e.g. watchdog, E2E communication protection, etc.)
- Scalable from QM up to ASIL D

AUTOSAR Classic Platform

Four Pillars Form the Standard Solution for Today´s Automobiles (2)

1. Functional Safety

2. Efficiency

3. Field Proven

4. Performance

- AUTOSAR stacks from different vendors
- Cost effective by supporting a wide range of µControllers
- Flexible due to CDD

AUTOSAR Classic Platform

Four Pillars Form the Standard Solution for Today´s Automobiles (3)

1. Functional Safety

2. Efficiency

3. Field Proven

4. Performance

- Mature by many years of application
- High quality due to widespread implementations
- Established distributed development processes with standardized methods and templates

AUTOSAR Classic Platform

Four Pillars Form the Standard Solution for Today´s Automobiles (4)

1. Functional Safety

2. Efficiency

3. Field Proven

4. Performance

- Hard real time capabilities
- Event triggered applications
- Flexible through supporting a wide range of protocols and networks
- Scalable by configuration


AUTOSAR
Thank you
for your attention
BMW
BOSCH
Continental
Ford
gm
STELLANTIS
TOYOTA
VOLKSWAGEN GROUP