ETAS AUTOSAR Toolchain Overview

Agenda

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1	Introduction to AUTOSAR
2	ETAS AR Toolchain
3	ETAS AR Starter Kit
4	Real Use Case: SK Porting to MPC5777C
5	Q&A

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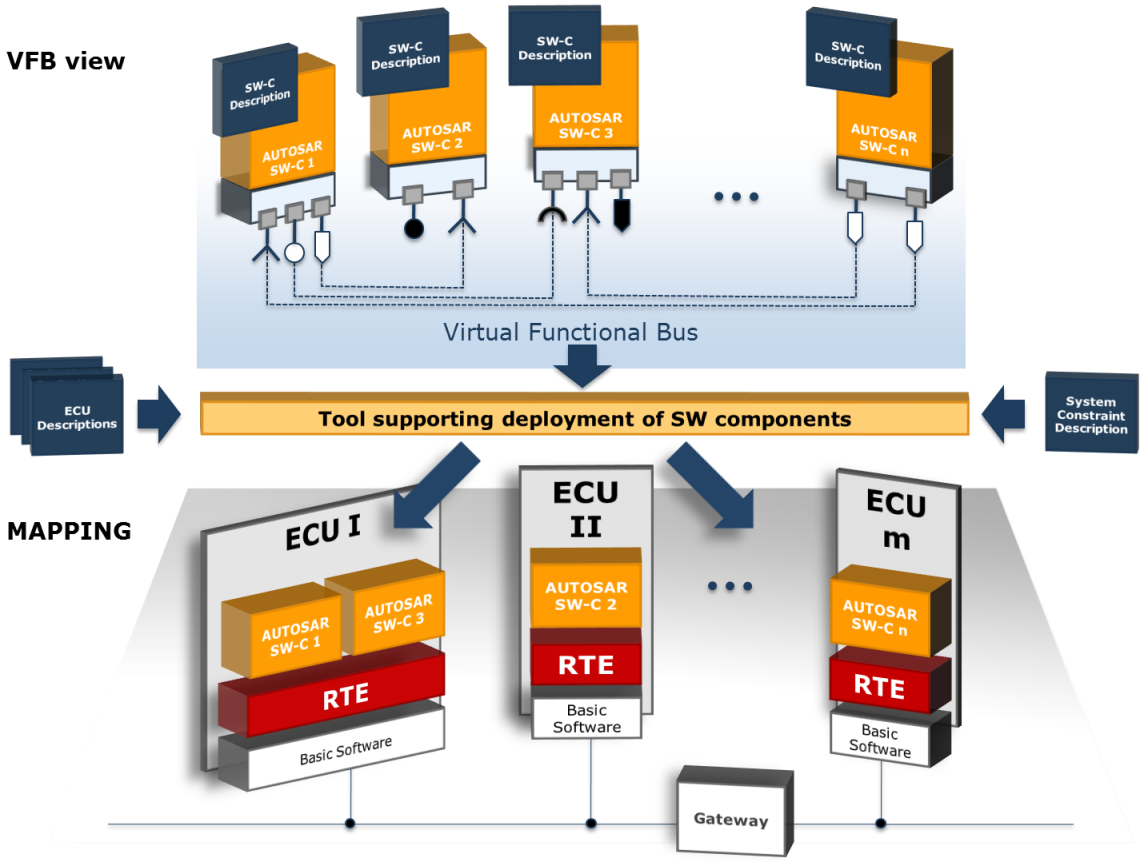
"The standardized software framework for intelligent mobility"

AUTOSAR (AUTomotive Open System Architecture – more commonly "AR") is an open and standardized automotive software architecture, jointly developed by automobile manufacturers, suppliers and tool developers.

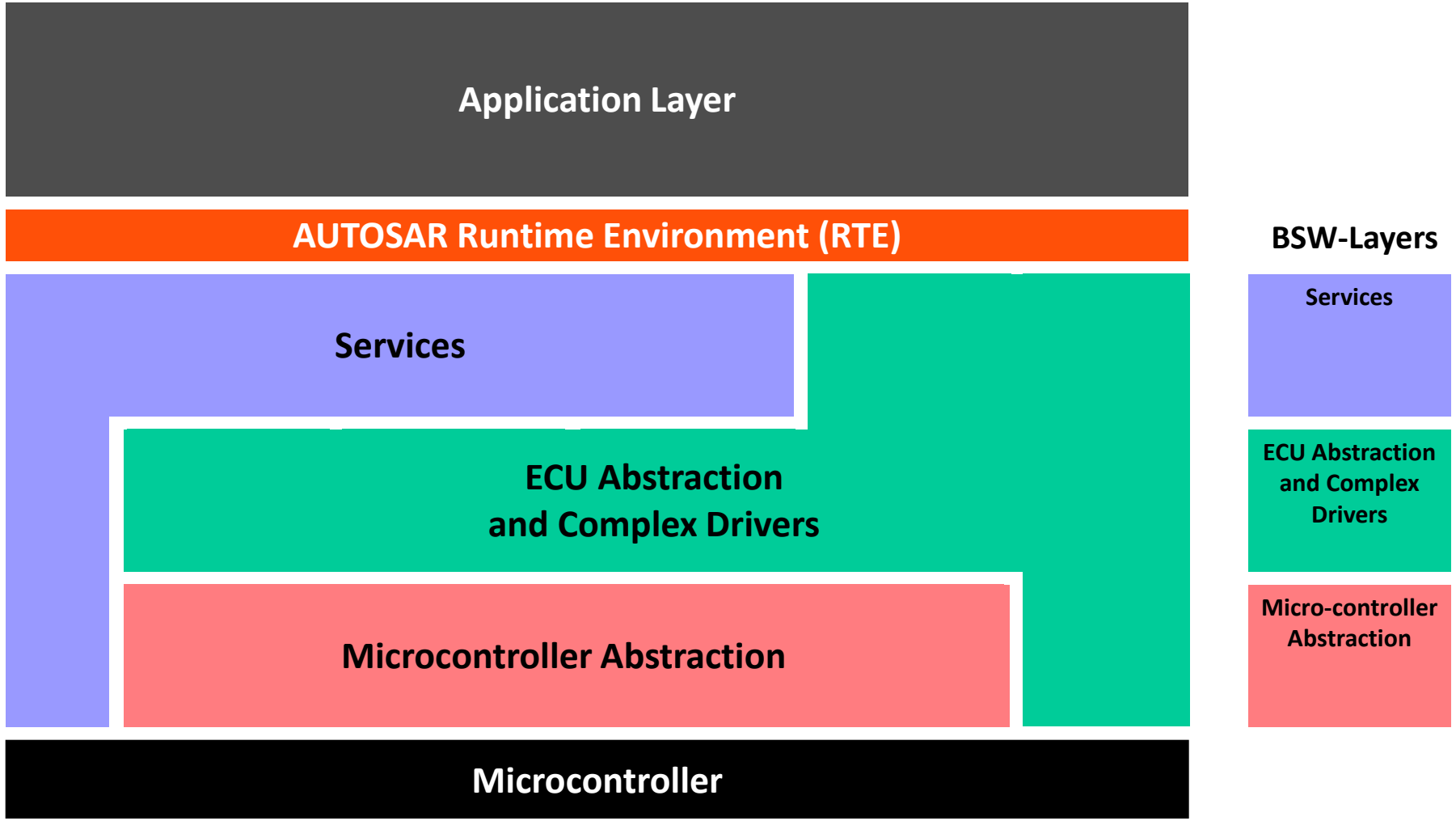
AUTOSAR aims to improve complexity management of highly integrated E/E architectures through an increased reuse and exchangeability of SW modules between OEMs and suppliers.

Virtual Functional Bus (VFB)

- It is one of the essential concepts in AR, and decouples the applications from the infrastructure.
- SW Components (SWC), on an abstract level, communicates only via this virtualized bus through communication ports.
- The VFB handles communication both within the individual ECU and between ECUs. From an application point of view, no detailed knowledge of lower-level technologies or dependencies is required.
- **This supports hardware-independent development and usage of application software.**



Software Architecture



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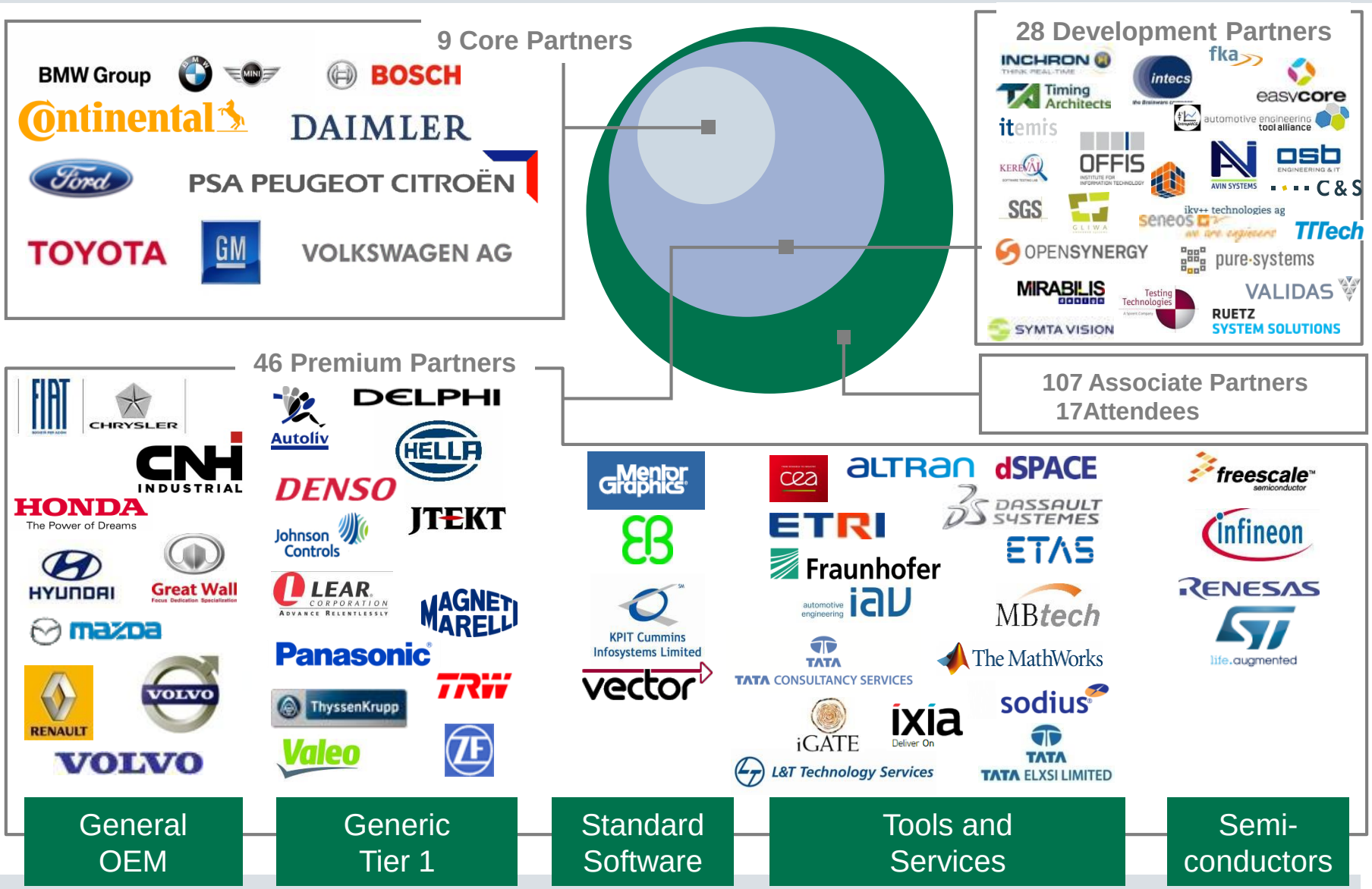
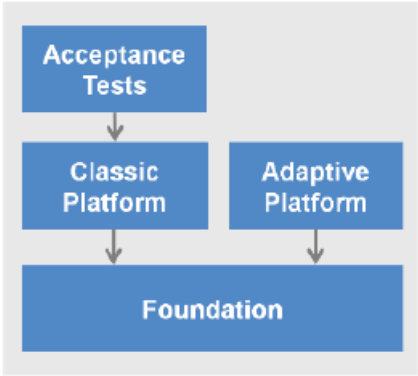
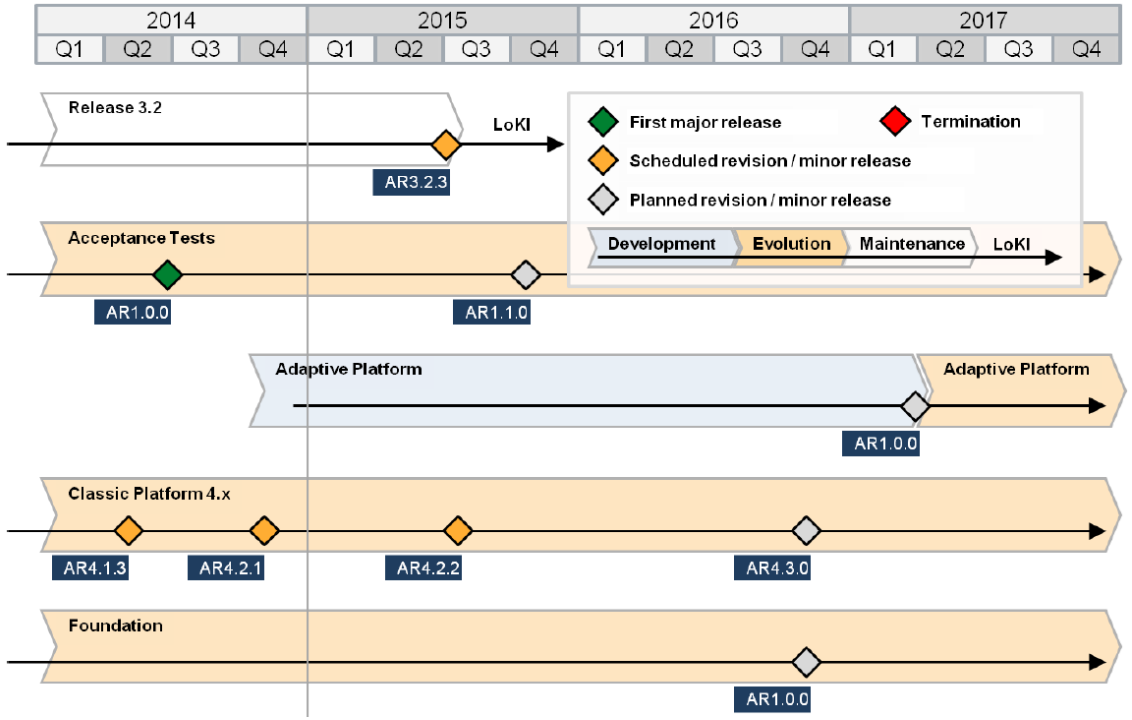
Partnerships



AUTOSAR Products



- AUTOSAR Classic Platform (CP)
- AUTOSAR Acceptance Tests (TC)
- AUTOSAR Foundation (AF)
- AUTOSAR Adaptive Platform (AP)

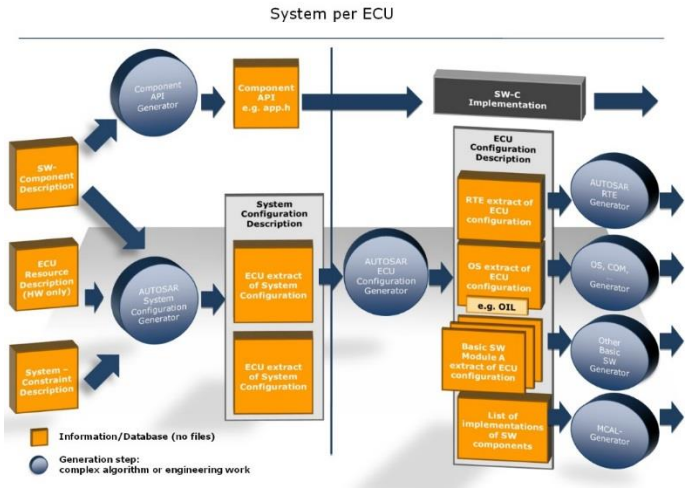


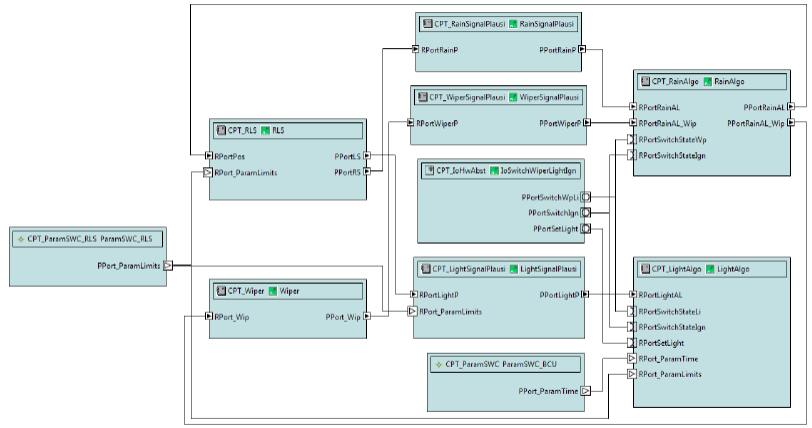
COMPARISON OF TECHNICAL CHARACTERISTICS OF

CLASSIC PLATFORM	ADAPTIVE PLATFORM
Operating system based on OSEK	Operating system based on POSIX (PSE51 with optional extensions)
Execution of code directly from ROM	Application is loaded from persistent memory into RAM
Same address space for all applications	Each application has its own virtual address space
Optimized for signal-based communication	Designed for service-oriented communication
Fixed task configuration	Support of multiple dynamic scheduling strategies

Benefits of AR Methodology

- There are many benefits that can derive to the migration to the AR Methodology:
  - Application SWCs can we developed **without dependencies to physical ECUs** (and so SWCs can be moved from one ECU to another without impacts),
  - **Modularity** and **Stratification** of BSW allows for replacement of modules or entire stacks with minimal impacts (most of the cases on integration code),
  - **Standardization** of SW specification increase reliability of BSW modules and reduce bugs or deviations at SW level.





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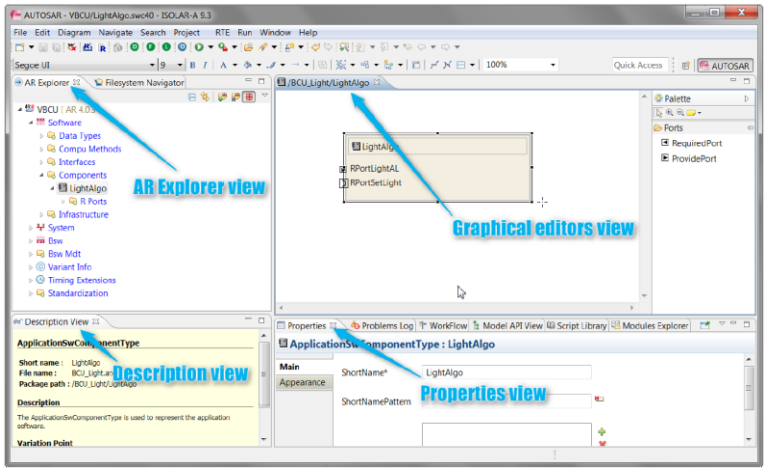
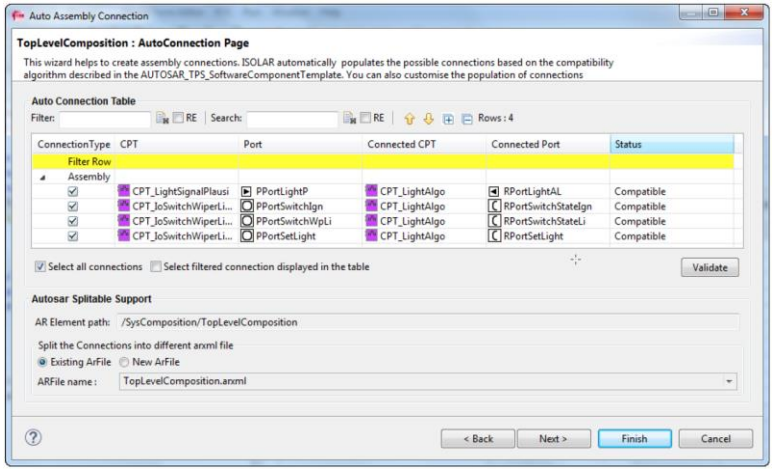
AUTOSAR Tooling

- The Methodology and exchange format (so called ARXML files) is quite complex to manage
- The standardization of ECU-dependent SW levels (RTE and BSW) requires the use of SW generators.

- A typical AR toolchain comprises:
  - An Authoring tool (editor for arxml files),
  - RTE Generator,
  - BSW Generator,
  - OS Generator.

- The use of the AR methodology is more prone (compared to the past) to the use of Virtual Validation tools.





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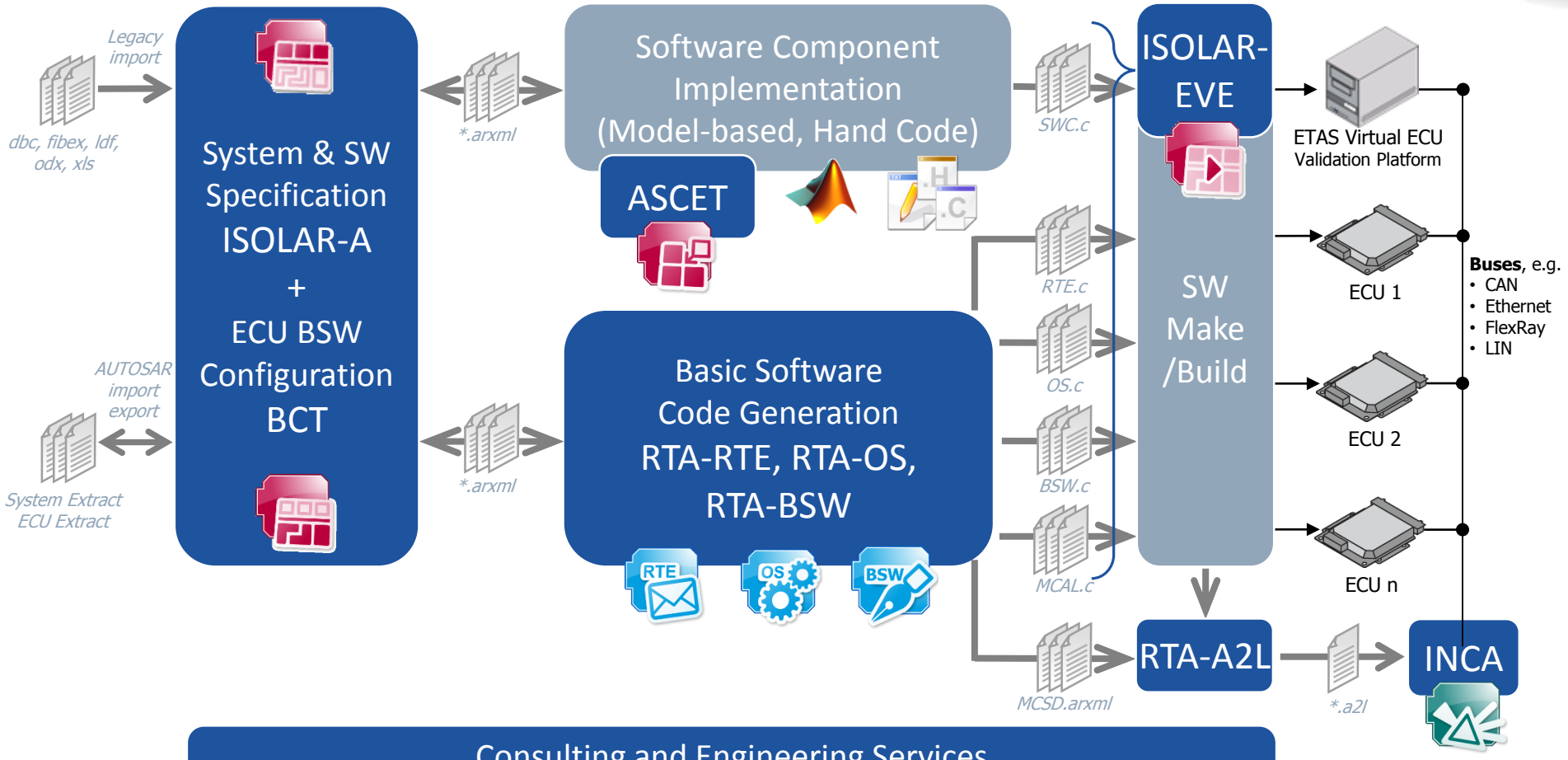
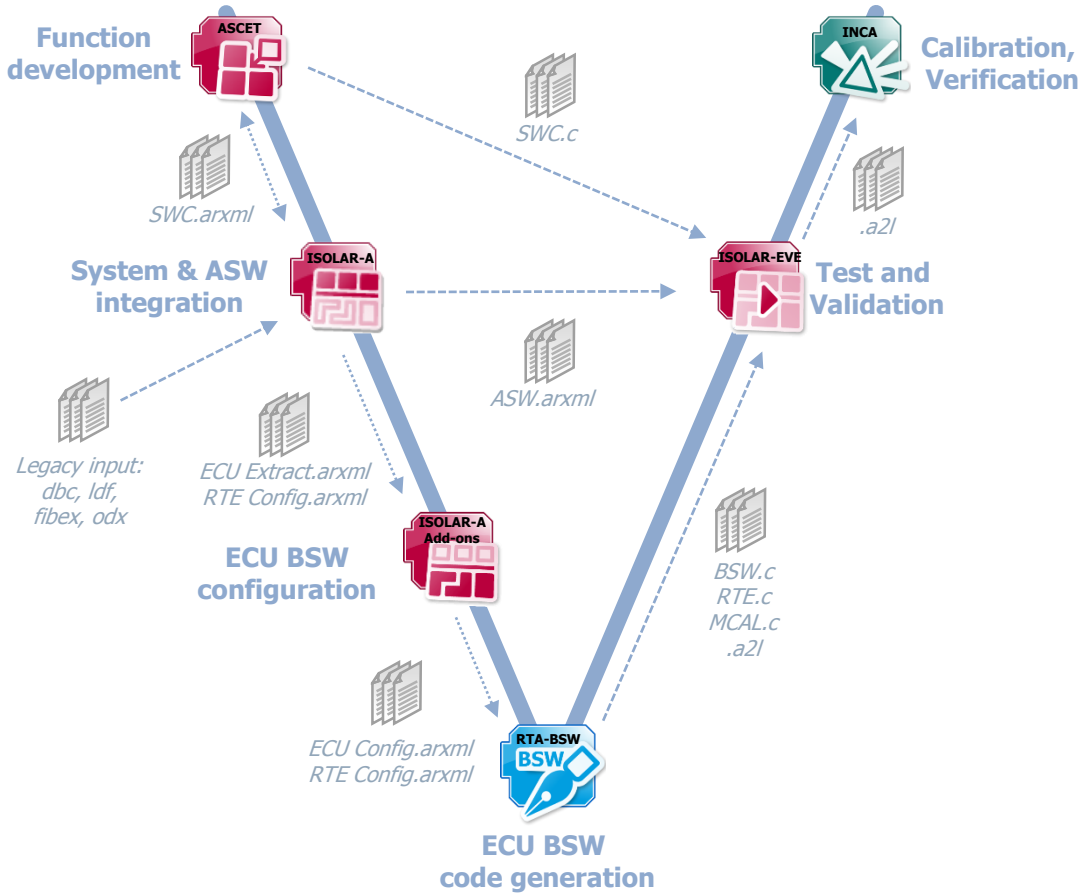
ETAS AUTOSAR Offer



RTA-BSW AUTOSAR 4.x Basic software modules developed and provided by ETAS and third-parties.

ETAS AUTOSAR Portfolio and the V-Cycle Engineering Model

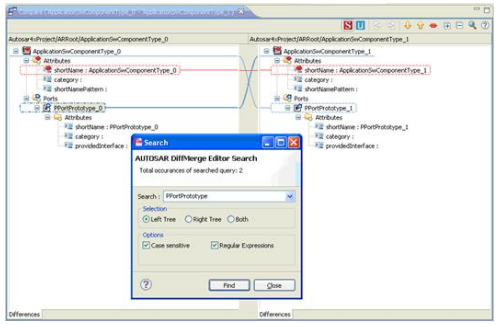


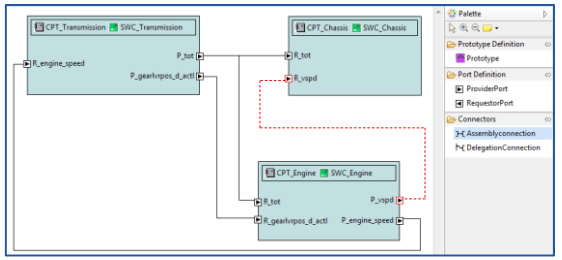
Advanced and Extensible Support for AUTOSAR Authoring

AUTOSAR captures all system design details in its rich meta-model. This requires advanced tool support to provide efficient usability.

AUTOSAR Authoring

- ISOLAR-A supports the AUTOSAR methodology for describing AUTOSAR Systems, ECU instances, software components and compositions
- ISOLAR-A supports the BSW configuration
- ISOLAR-A natively speaks AUTOSAR XML (.arxml) allowing for easy integration with other tools
- ISOLAR-A supports importing information from legacy formats such as DBC, Fibex and LDF
- ISOLAR-A is based on open-source and open standards through Eclipse and ARTOP to allow for simple extension and integration





Complete AUTOSAR Basic Software Components

AUTOSAR basic software components provide the foundation for efficient application development, they need to "just work"!

Proven in Use BSW Components

- RTA-OS is the smallest and fastest AUTOSAR OS implementation, RTA-RTE was the first implementation of the AUTOSAR RTE specification
- ETAS software components now deployed in over 1 Billion ECUs world wide
- Support for multicore ECU and advanced protection/safety features.
- Access to complete AUTOSAR BSW stack developed to support ISO26262 ASIL-D deployments

RTA-OS: The smallest AUTOSAR OS in the world, so small it fits here:


CERTIFICATE
No. Z10 13 08 34489 004
Holder of Certificate: ETAS GmbH
Factory(ies):
Certification Mark:
Product: Software Tool for Safety Related Development
Model(s): RTA-RTE, RTA-OS
Parameters:
Tested according to:
Test report no.:
Date, 2013-09-16
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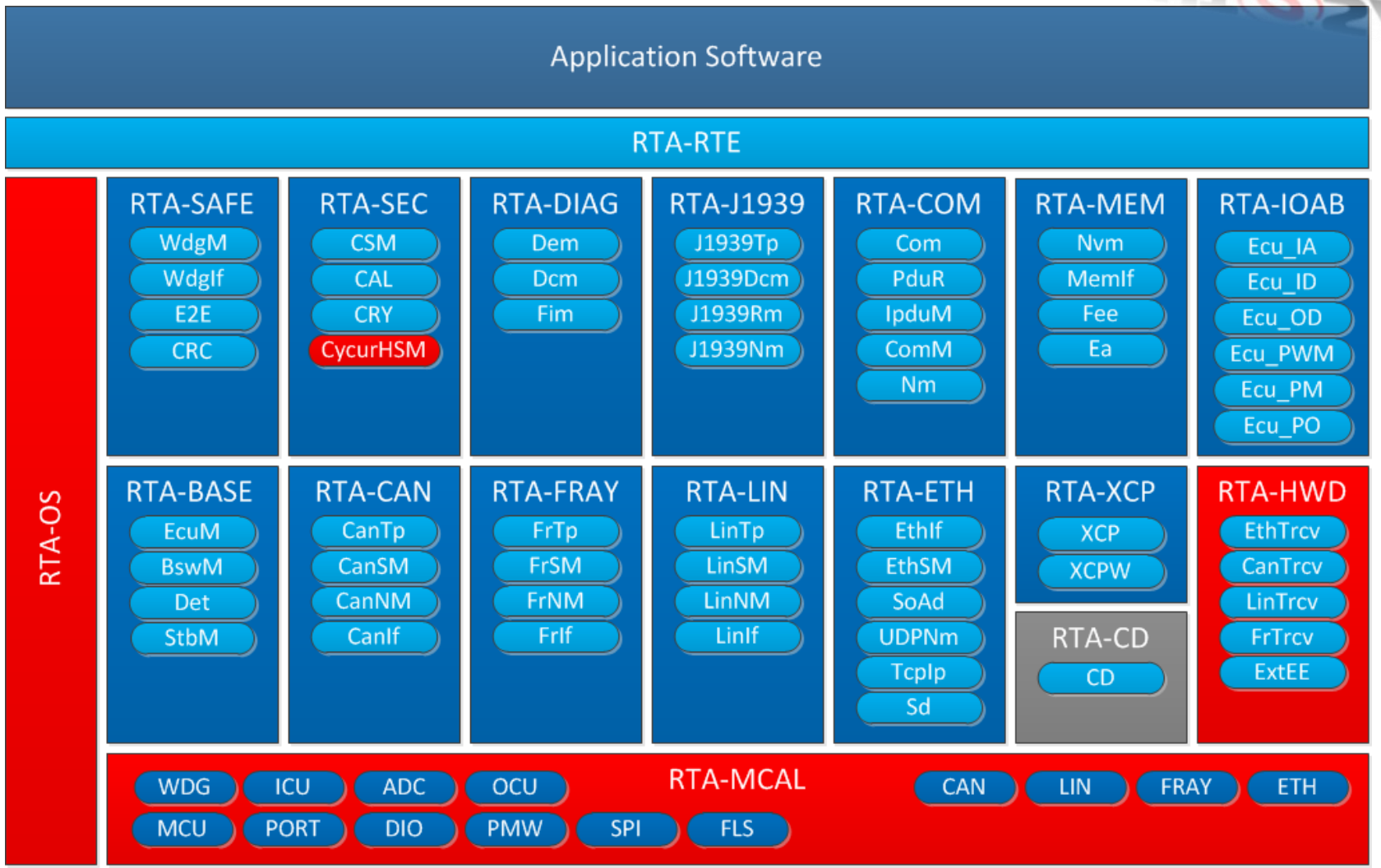
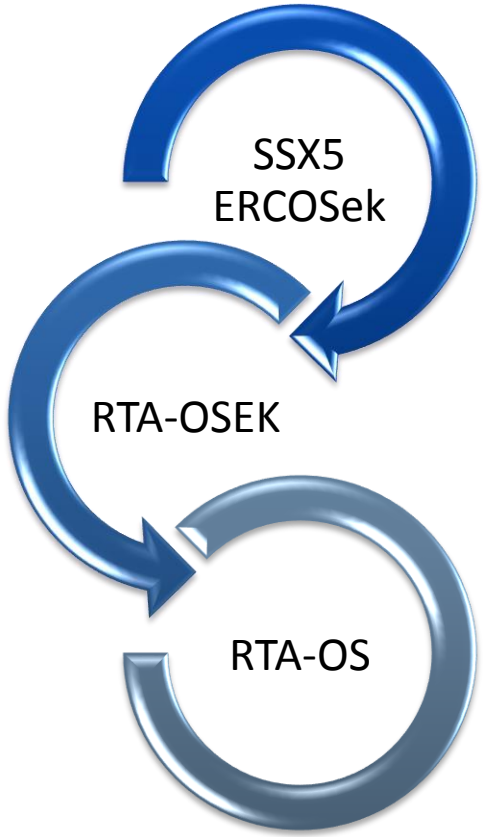
RTA-BSW: Modules and Packages



*) AUTOSAR 4.x Basic software modules developed and provided by ETAS and third-parties.
**) Red blocks are hardware dependent components, available today for a wide range of microcontroller/compiler combinations with further ports available on request.

RTA-OS is a…

- Third generation of automotive OS from ETAS
  - SSX5, ERCOSek – non-OSEK OSs
  - RTA-OSEK – class-leading OSEK OS
  - RTA-OS – AUTOSAR OS
- RTA-OSEK and ERCOSEK are used in more than 800 million ECUs
- Proven history of small, fast, portable OS products
- RTA-OS continues the tradition of improving performance and features while supporting on-going automotive standards



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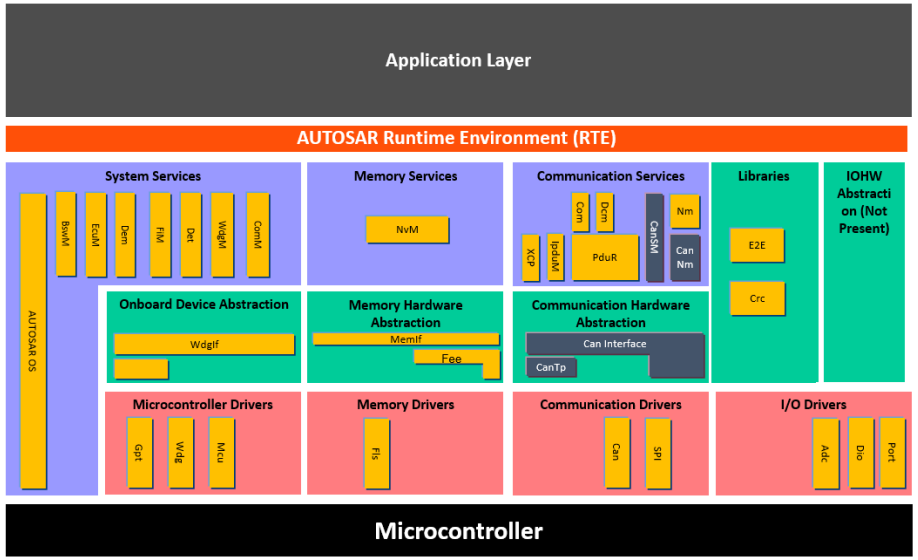
RTA-BSW Starter Kit

- Provides a complete, integrated example of RTA-BSW:
  - Shows how to integrate application software and full AUTOSAR stack
    - Including ASW, RTE, OS, BSW and MCAL
  - Runs on representative hardware or virtual environment

- The example application (included) demonstrates:
  - CAN communication
    - Including the UDS diagnostic protocol
  - Diagnostic event management
  - Non-volatile memory management
  - Mode management
  - Watchdog management
  - E2E (end-to-end communication protection)
  - Calibration via XCP
  - Calibration via external tools like INCA (supported by A2L)



Execution environment

- Targeted for:
  - Specified Development board *or*
  - Virtual ECU
- **Training**
  - On-site training for up to 6 engineers

RTA Starter Kit – Package Contents

RTA-BSW Package	Scope of configuration
RTA-RTE	Sample ASW with SWCs using BSW services
RTA-OS	Single-core operating system configuration
RTA-A2L	Generate A2L file for measurement and calibration.
RTA-BASE	Standard start-up/shutdown process configuration (no wake-up/sleep)
RTA-COM	Com stack configuration includes 43 signals, NM supported, CanTP supported
RTA-CAN	
RTA-MEM	10 blocks configured
RTA-DIAG	Sample UDS and DTC configuration (3 DTCs configured)
RTA-SAFE	Wdg: alive supervision configuration E2E: sample configuration, 1 protected signal
RTA-XCP	Sample configuration for measurement and calibration
MCAL	MCAL integration and testing. Configuration limited to MCU, PORT, DIO, CAN, FLS, WDG

RTA Starter Kit on Specific microcontroller

RTA Starter Kit on ISOLAR-EVE Virtual ECU

- Include
  - Six month evaluation license
  - Full source BSW configuration files
  - Full source code for all BSW modules (excluding OS)
  - Full source code for example application
  - Product documentation
  - On-site training for up to six engineers
  - Product support
- **Note**: Software is for evaluation purposes only. It can not be used for production projects.

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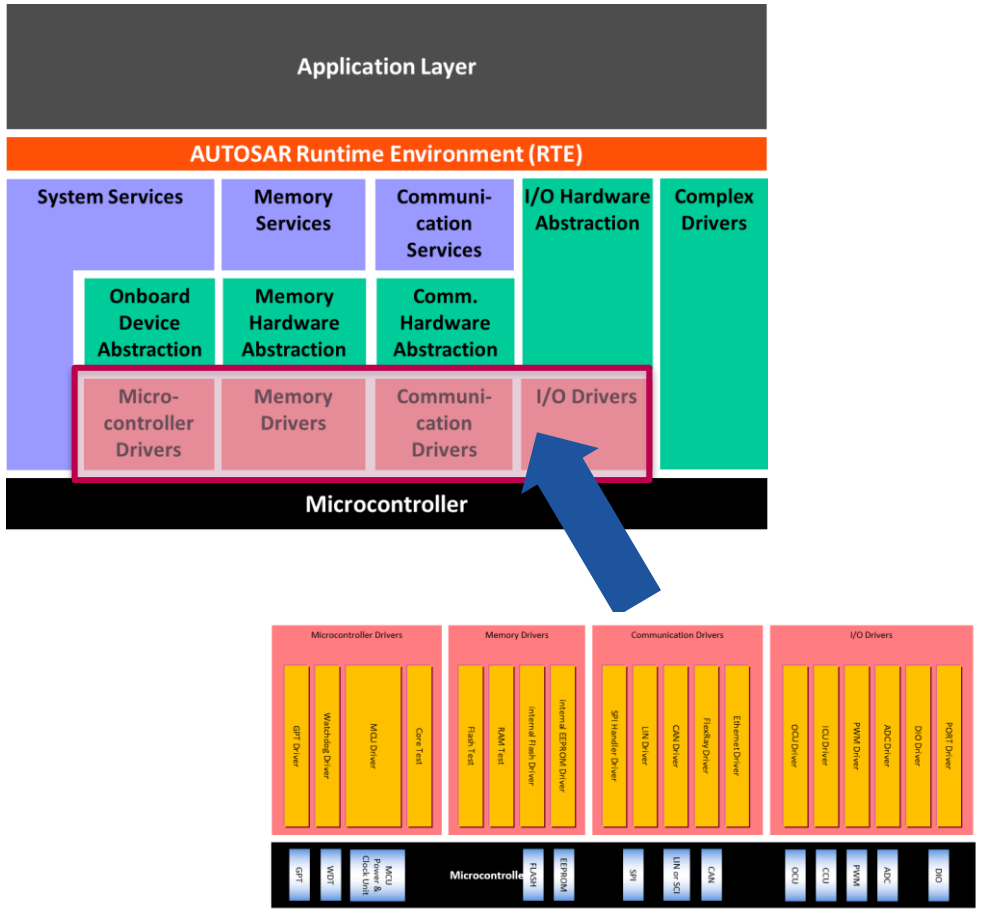
SK porting across different architecture

- Exploiting the AR methodology an existing SW implementation can be easily moved to a different HW architecture by simply replacing the MCAL (which incapsulates the HW dependencies).

- Porting of original SK to MPC5777c, minimal Workflow:
  - New MCAL configuration (Target dependent),
  - Integration,
  - Final Testing.



List of BSW/MCAL Modules

Function Name	Description
OS	Operating system integration and configuration
RTA-BASE	BSW base components for managing overall ECU and BSW modes (EcuM, BswM, Stbm, DLT, Det)
RTA-CAN	BSW CAN communication modules (CanIf, CanSM, CanNM, CanTP)
RTA-COM	BSW network communication modules (PduR, Com, ComM, IpduM, Nm)
RTA-DIAG	BSW diagnostic modules (Dem, Dcm, Fim)
RTA-MEM	BSW memory stack modules (NvM, MemIf, Fee)
RTA-SAFE	BSW safety related modules (WdgIf, WdgM, Crc, E2E)
RTA-XCP	BSW XCP protocole module (XCP over CAN)
MCAL	MCAL integration and configuration (Can, Gpt, Dio, Irq, Mcu, Port, Fls, Wdg)
RTE	Run-Time Environment
SWC test	Implementation and integration of test SWC

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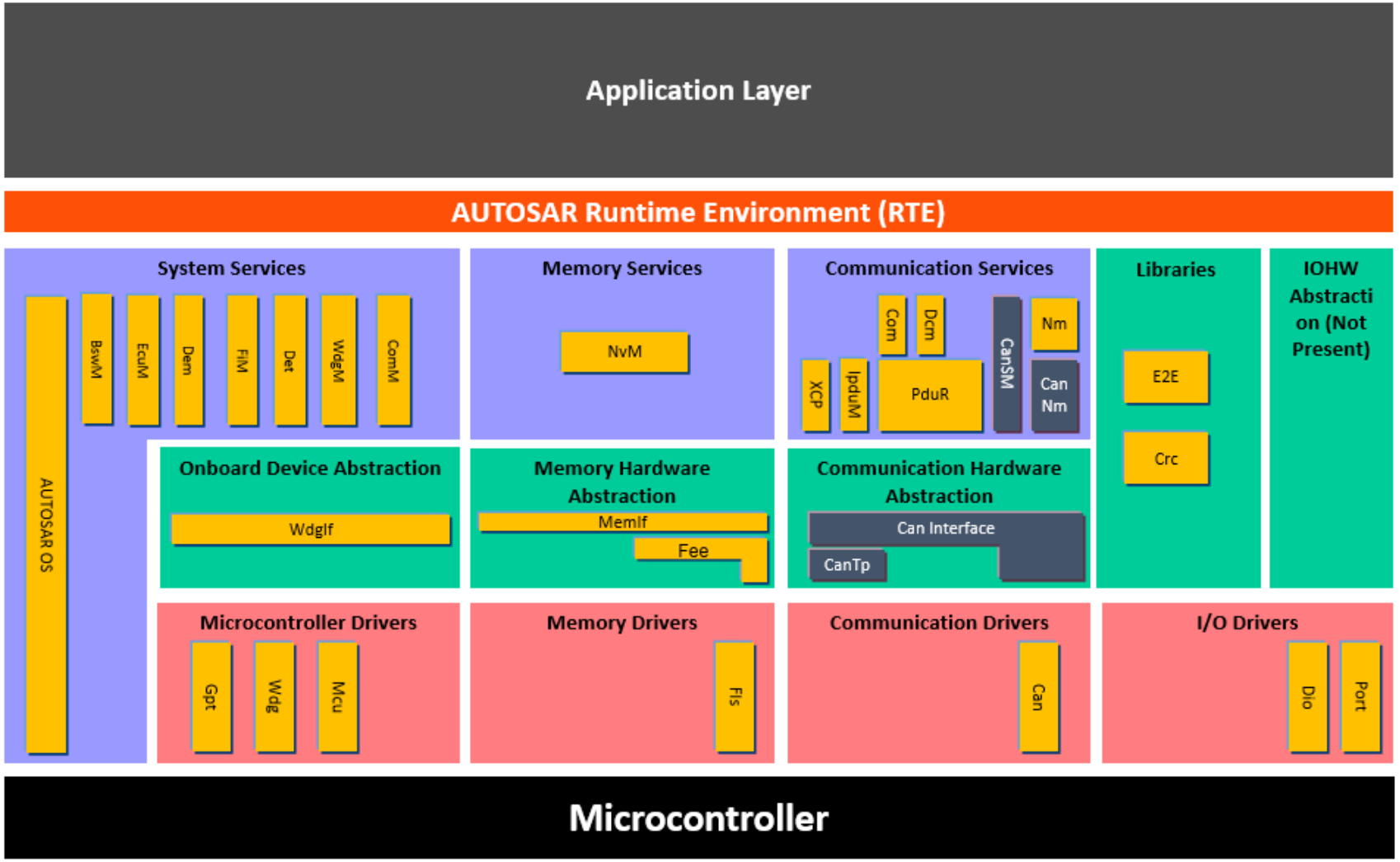
Real Use Case: Porting of AR SK to MPC5777C



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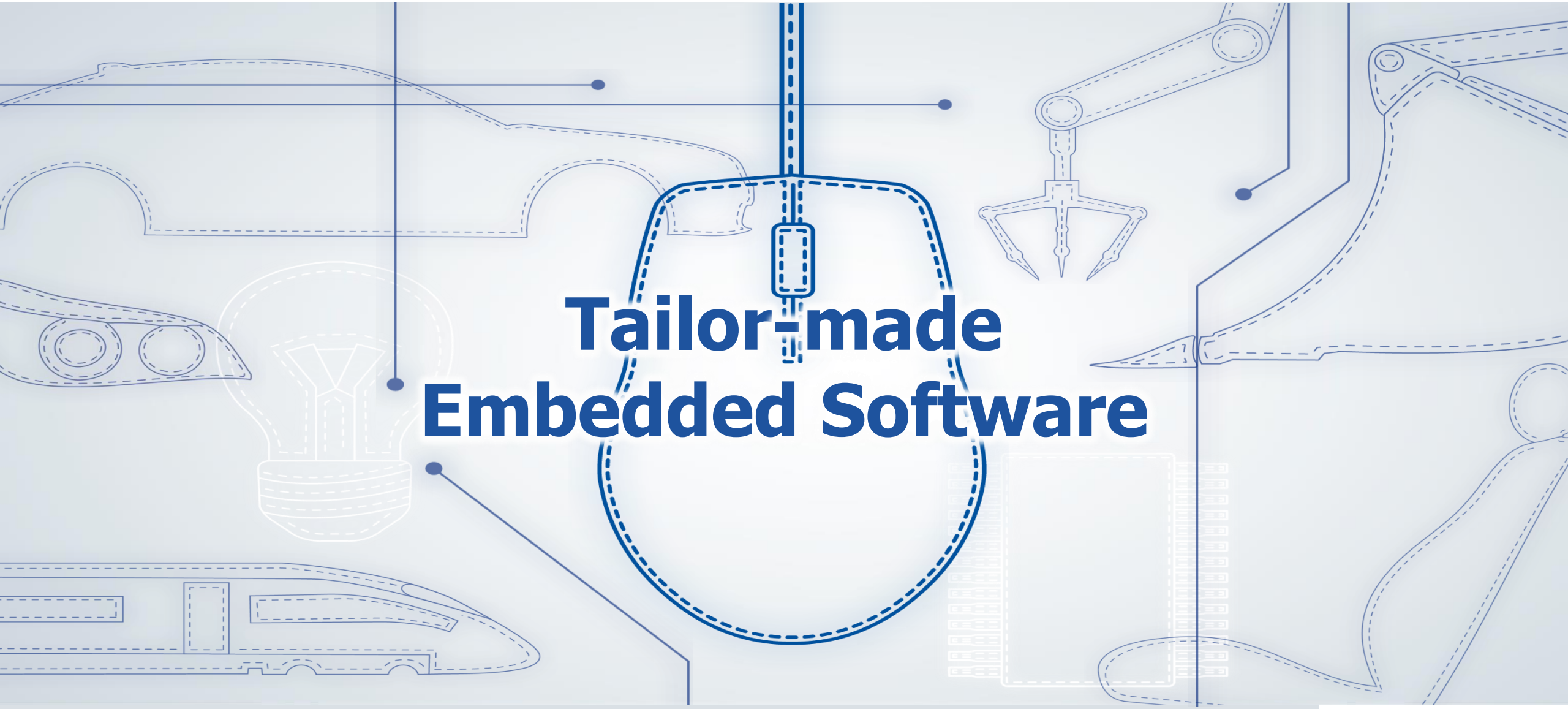
Questions?



Tailor-made Embedded Software