AUTOSAR Standard Developments and NXP AUTOSAR Software

Vlad Sterian

AUTOSAR MCAL Team Lead

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NXP

SECURE CONNECTIONS
FOR A SMARTER WORLD

Agenda

- What is AUTOSAR

- AUTOSAR Architecture

- NXP MCAL Components

- AUTOSAR Versions and Differences

- Getting Started with AUTOSAR MCAL
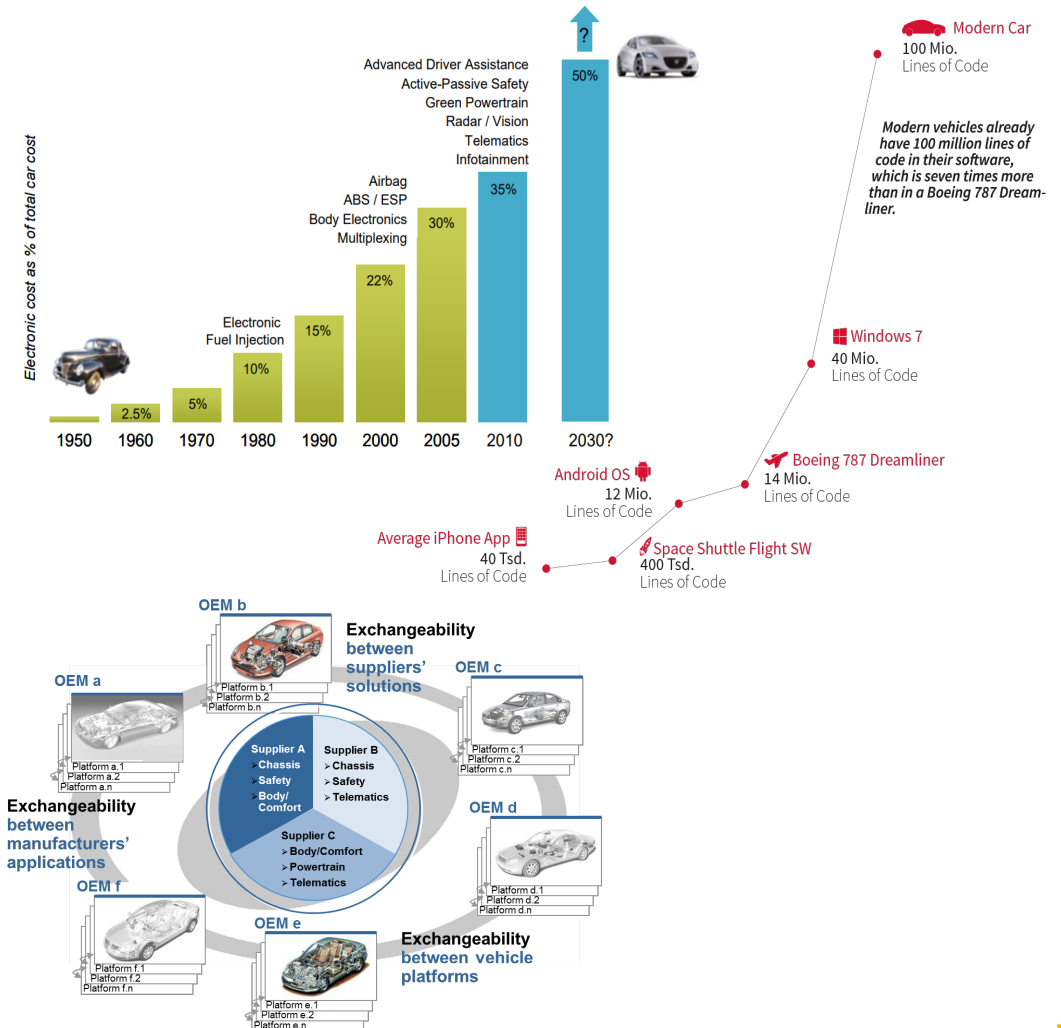
What is AUTOSAR

AUTOSAR Overview

The challenges:

- **Complexity** of automotive E/E systems is growing

- Amount of **software** in cars grows **exponentially**

- Number of **HW platforms** and interdependencies **increased**

- Development **processes** and **data formats** are not **harmonized**
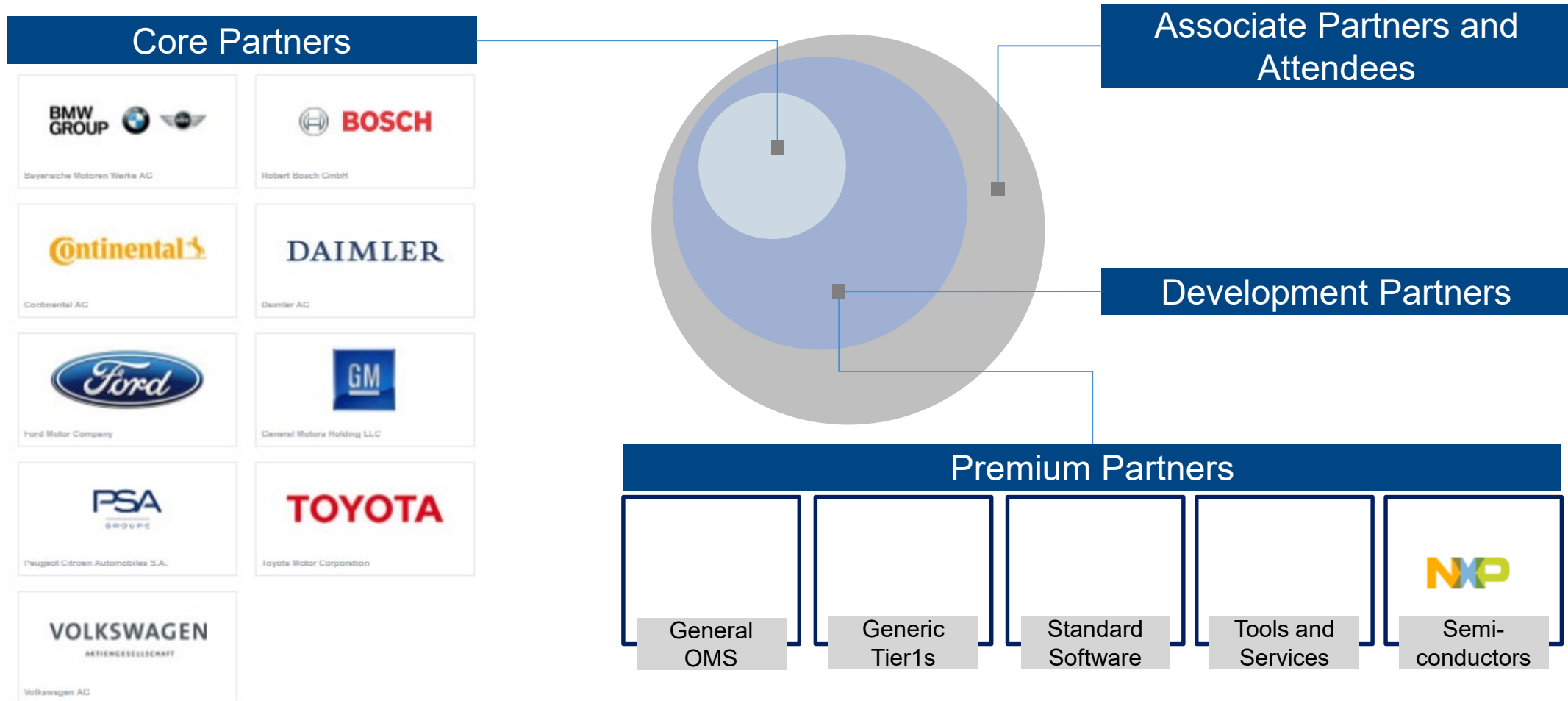
The main objective of AUTOSAR:

Master the ECUs growing complexity by enhancing SW quality and re-usability

- Functionalities are exchangeable and reusable between OEM and supplier

- The development methods and tools are re-used

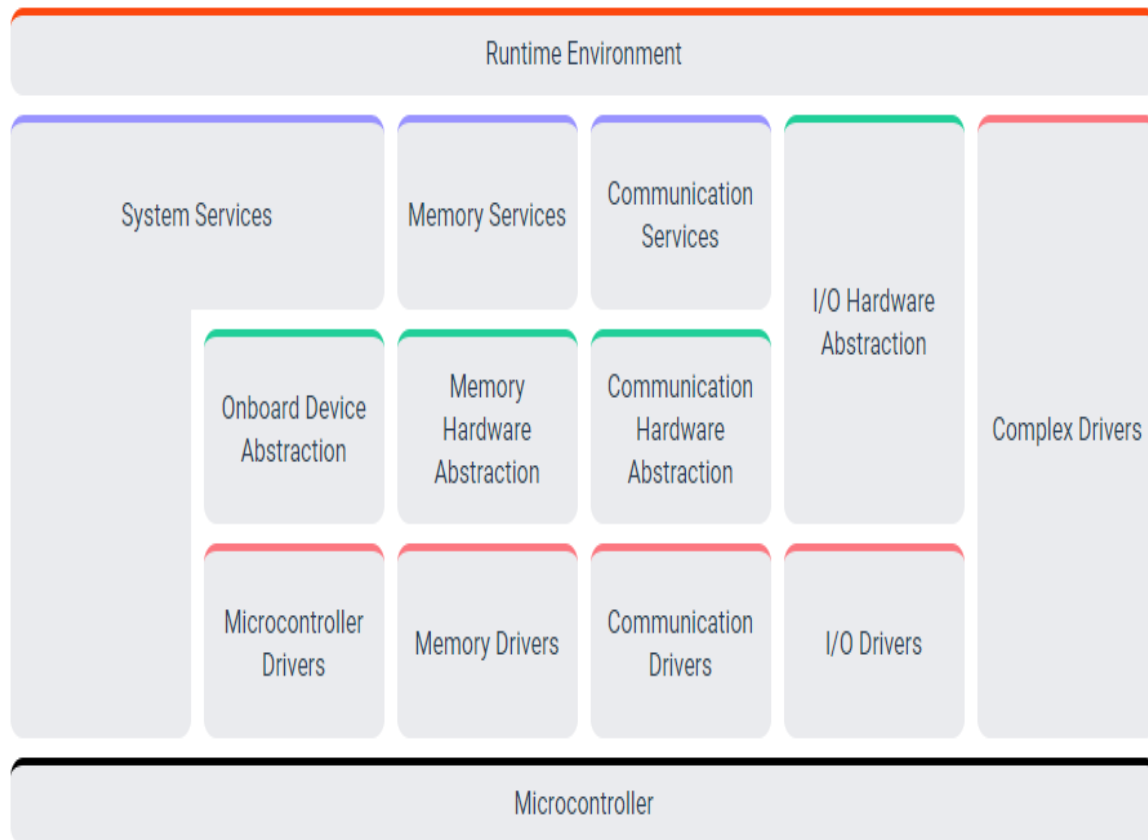- common basic software, concentrating on functions with competitive value

AUTOSAR Overview – Worldwide Partnership

AUTOSAR (**AUT**omotive **O**pen **S**ystem **AR**chitecture)

Core Partners
- BMW GROUP — Bayerische Motoren Werke AG
- BOSCH — Robert Bosch GmbH
- Continental — Continental AG
- DAIMLER — Daimler AG
- Ford — Ford Motor Company
- GM — General Motors Holding LLC
- PSA GROUPE — Peugeot Citroen Automobiles S.A.
- TOYOTA — Toyota Motor Corporation
- VOLKSWAGEN AKTIENGESELLSCHAFT — Volkswagen AG

Associate Partners and Attendees

Development Partners

Premium Partners
- General OMS
- Generic Tier1s
- Standard Software
- Tools and Services
- Semi-conductors (NXP)

AUTOSAR Overview – Classic vs Adaptive

AUTOSAR Overview – Classic vs Adaptive

	AUTOSAR Classical Platform	**AUTOSAR** Adaptive Platforms
Operating System	OSEK OS	POSIX specification
Communication Protocols	Signal-based Communication (CAN, FlexRay, Most)	Service Oriented Communication (SOME/IP)
Scheduling Mechanisms	Fixed task configuration	Dynamic scheduling strategies
Memory Management	Same address space for applications (MPU)	Visual address space for each app (MMU)

AUTOSAR Architecture

COMPANY PUBLIC | 7

AUTOSAR Layer Architecture

- The **AUTOSAR Basic Software** is divided in three major layers and Complex Drivers: Services, ECU Abstraction and **Microcontroller Abstraction**.
- The Basic Software Layers are further divided into **functional groups**.
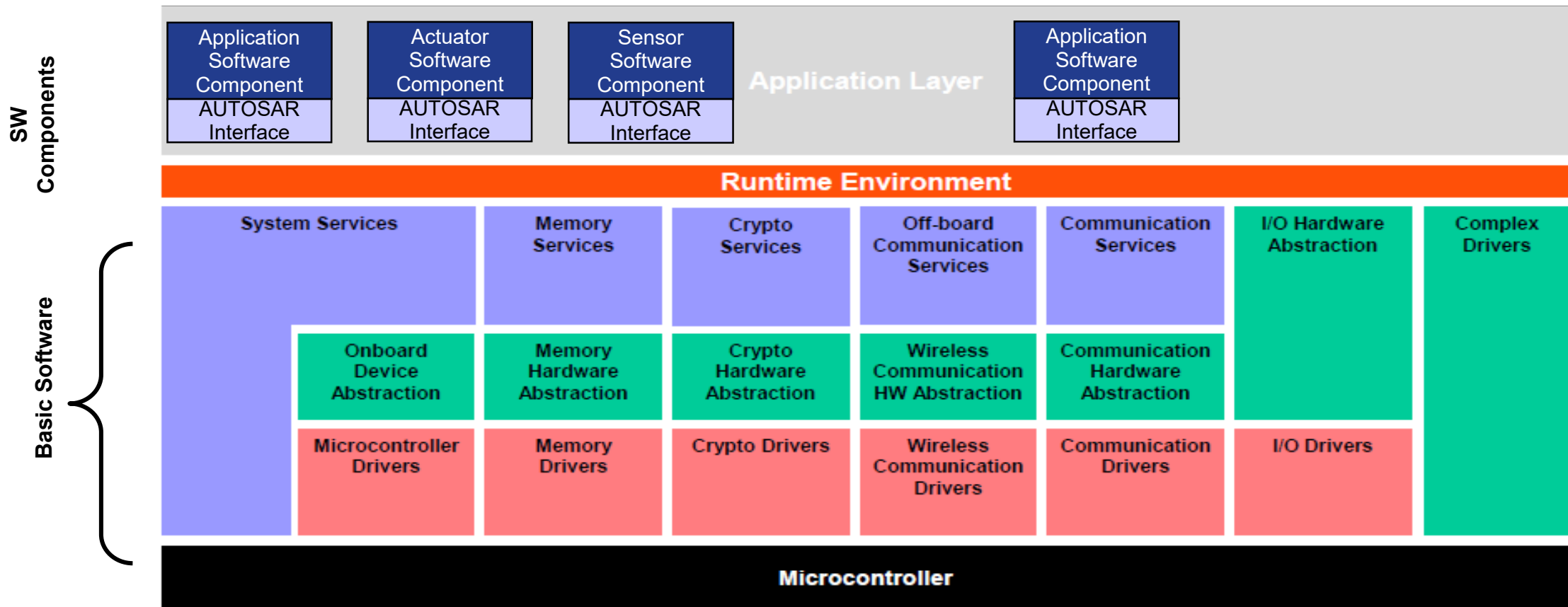
AUTOSAR Layer Architecture (ASR4.3 and Above)

NXP Basic AUTOSAR Software

- **NXP Standard Products** – MCAL (source code), OS (source code) and Configuration Tool (executable) for MCAL and OS

- **Partner Products** (Elektrobit, Vector, KPIT, etc.) – The rest of AUTOSAR basic software as needed & Integration Services (NXP IP + Partner IP + Customer IP)

- **Complex Drivers** – custom software offered by NXP Consulting & Professional Engineering Services

SW Application Component	SW Application Component	SW Application Component	SW Application Component	SW Application Component	SW Application Component

AUTOSAR Runtime Environment (RTE)

Operating System (OS)

System Services	Memory Services	Crypto Services	Communication Services	I/O Hardware Abstraction
Onboard Device Abstraction	Memory Hardware Abstraction	Crypto Hardware Abstraction	Communication Hardware Abstraction	

Microcontroller Abstraction Layer (MCAL)

Microcontroller Drivers	Memory Drivers	Crypto Drivers	Communication Drivers	I/O Drivers

AUTOSAR Basic Software

Microcontroller

NXP MCAL Components

NXP MCAL Components
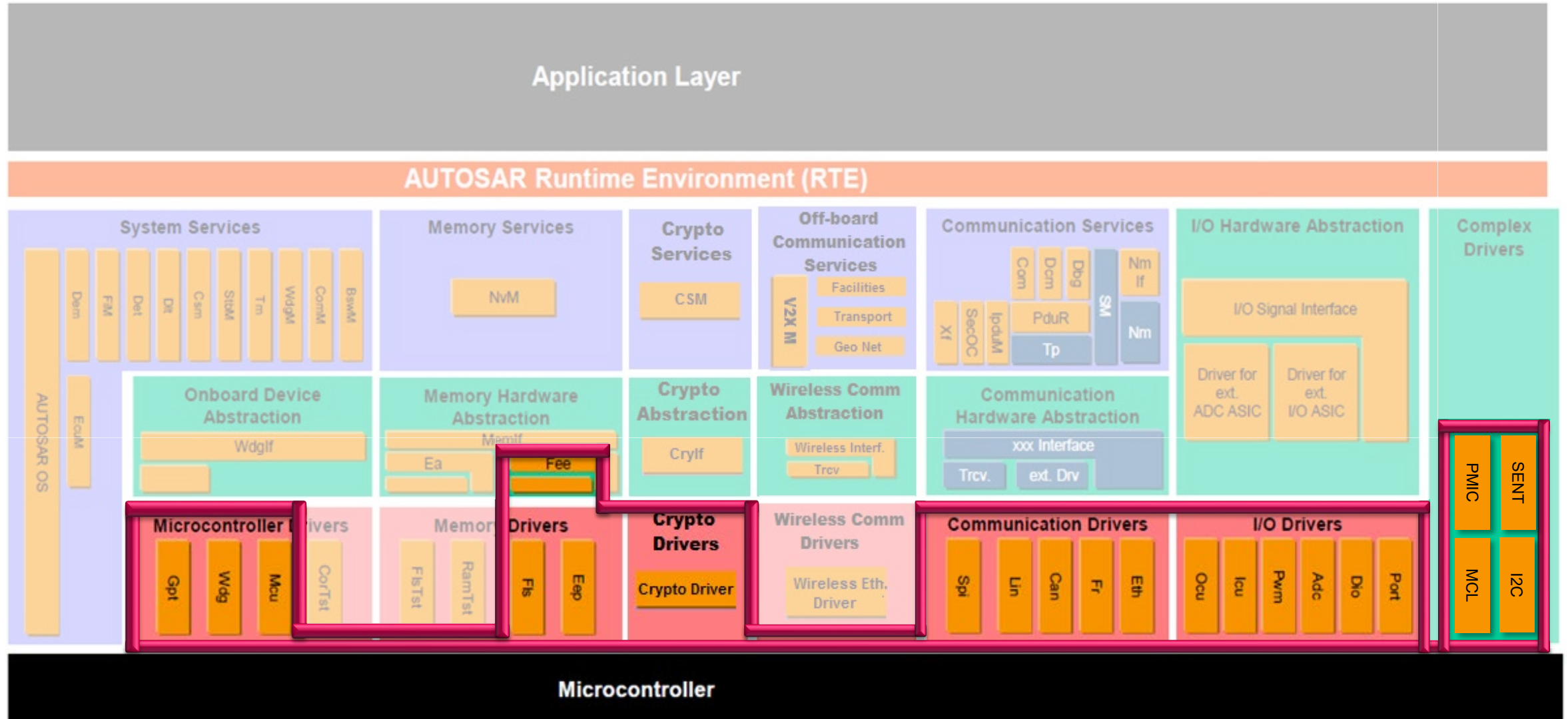
NXP MCAL Product

Collection of low-level drivers abstracting the hardware peripherals to a standard interface

Target application – real-time part for all automotive domains (ADAS, VDS, GPIS,

C&S, Infotainment)

- Production quality releases covering versions 4.4, 4.3, 4.2, 4.0, 3.2, 3.0 or 2.1
- of the AUTOSAR standard
- Developed using SPICE Level 3 compliant process.
- Safety Element out of Context (SEooC) integrable within ASIL-D products.
- Supports most NXP automotive µcontrollers and processors - 40+ different
- platforms from 16bit to 32bit PowerPC and ARM up to 64bit ARM
- NXP MCAL maintained as a single SW codebase (per AUTOSAR version)
- Compatible with LLCE communication drivers (CAN_LLCE/LIN_LLCE/FR_LLCE).
- Integrates multiple software features as extensions to AUTOSAR standard (to expose specialized hardware features).
  - 18 standard drivers (MCU, PORT, DIO, ADC, GPT, PWM, ICU, WDG, FLS, EEP, FEE, SPI, LIN, CAN, OCU, FlexRay, Crypto, Ethernet)
  - Multiple complex drivers extending AutoSAR on various platforms:
    - MCL – centralized DMA and DMAMux configuration and functionality, common timer code
    - I2C – Inter-Integrated Circuit driver
    - PMIC – Power management integrated Circuits
    - SENT – Single Edge Nibble transmission
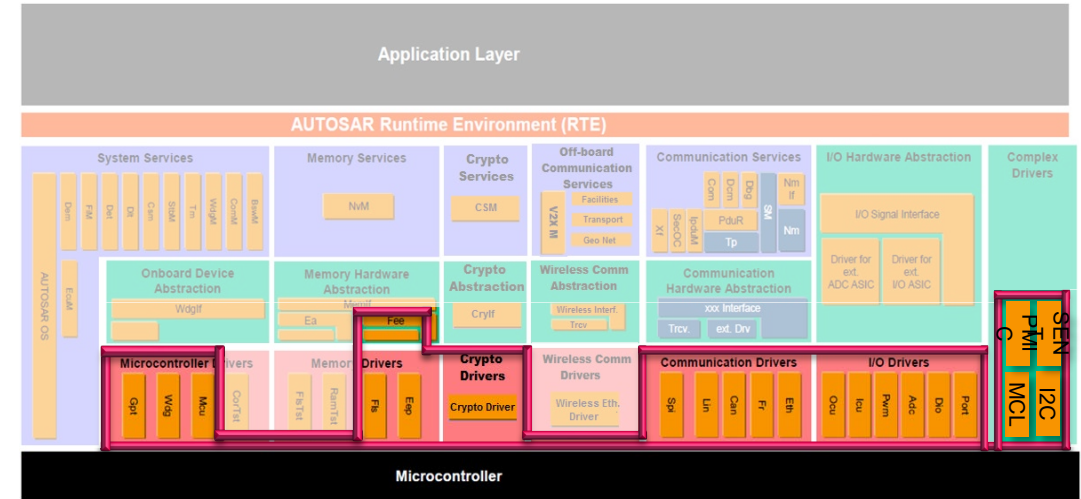
NXP MCAL Product – Content of the package

- Software Package - containing drivers as eclipse plugins for Elektrobit Tresos
  - For each driver:
    - Source code + configuration templates
    - Driver User Manual
    - Driver Integration Manual
  - For entire package:
    - MCAL sample application
    - MCAL Release Note
- Quality Package - delivered to customers for RTM releases (only on request for Beta)
  - For each driver:
    - Driver Test Specification
    - Driver Test Summary Report
    - Driver MISRA Summary Report
    - Driver Code Coverage Summary Report
    - Driver Traceability Matrix
    - Driver VSMD Report
    - Driver Profiling Report
    - Driver Code size, Stack size, RAM size Reports
    - Driver Static analysis Report (added only on customer request)
  - For entire MCAL package:
    - MCAL Test Summary Report
    - MCAL Quality Matrix
    - List of changes

- Safety Package - delivered to customers for IS RTM releases
  - For each driver:
    - Driver FMEA
  - For entire MCAL package:
    - MCAL Safety Manual
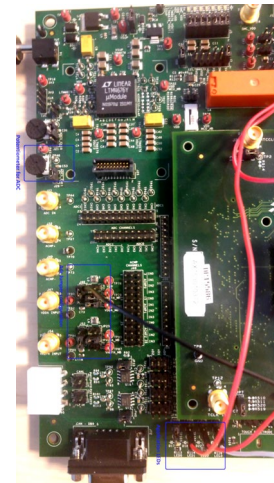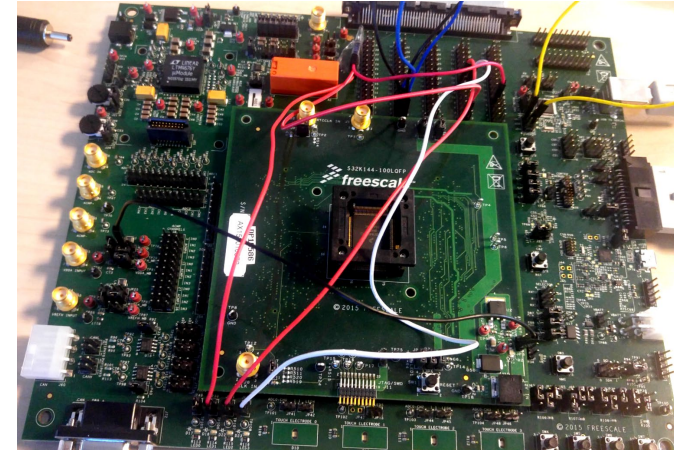
NXP MCAL Product – Configurator and generator

Source: Elektrobit
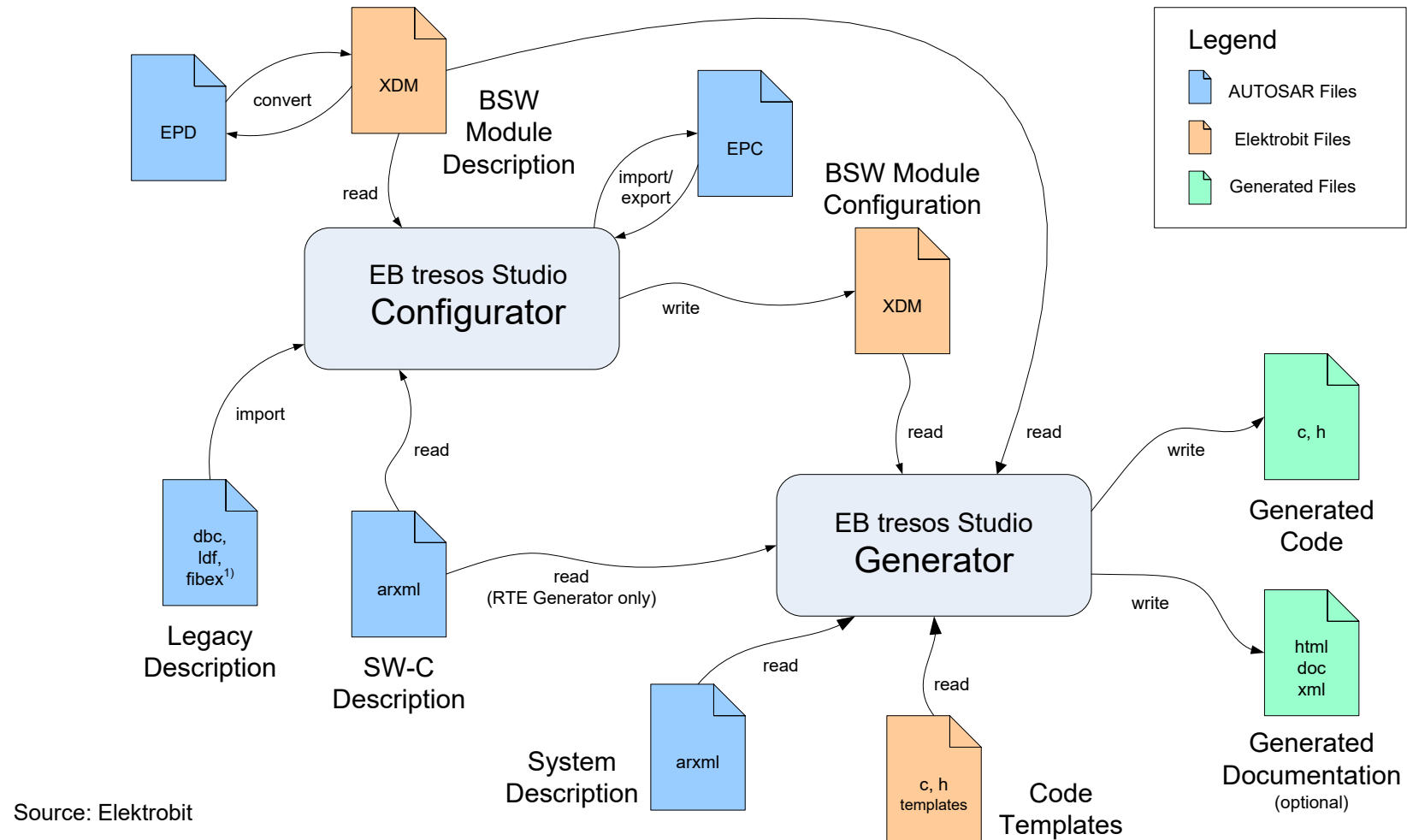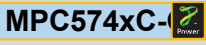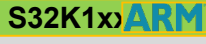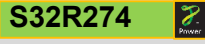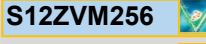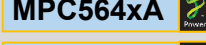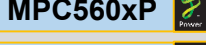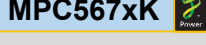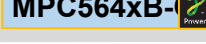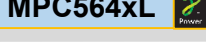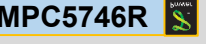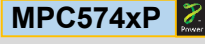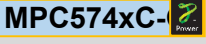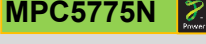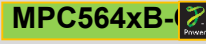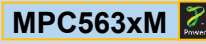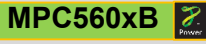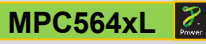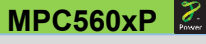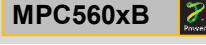
NXP MCAL Product – Configurator and Generator
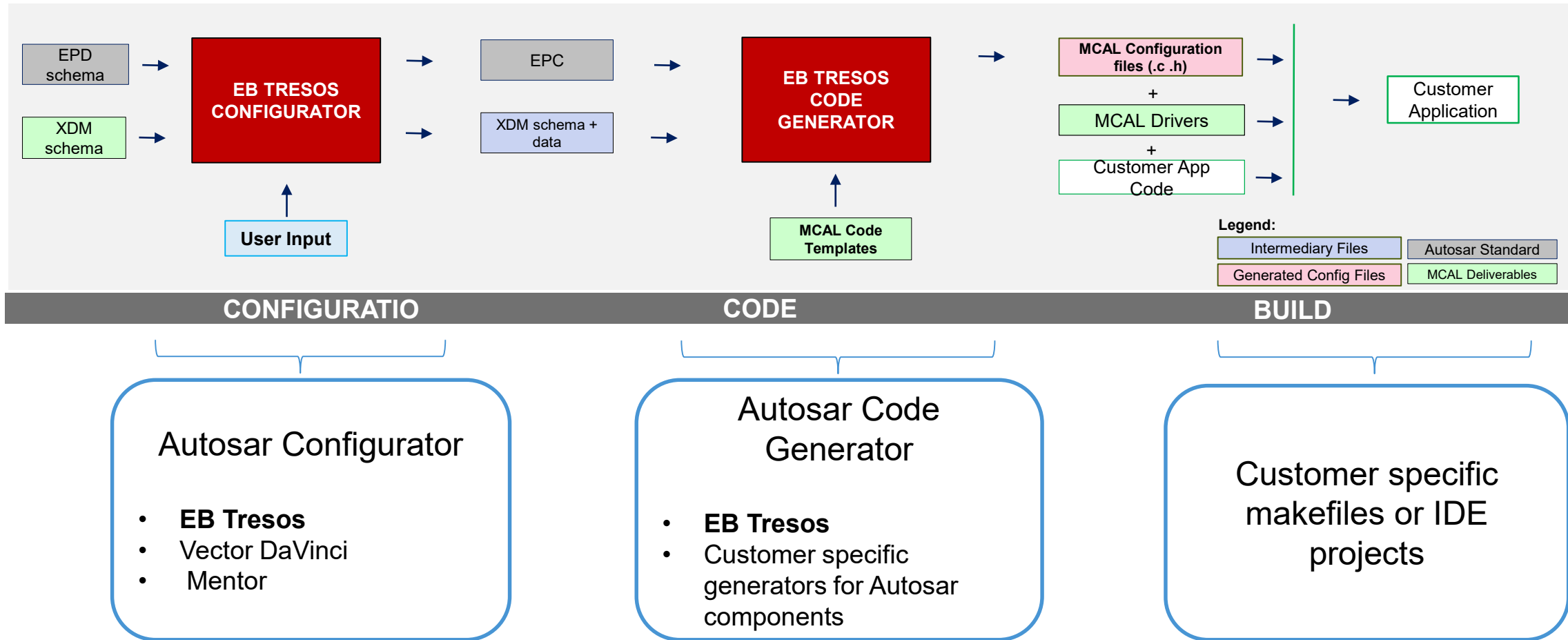
NXP AUTOSAR MCAL – Availability Matrix

	QM			ISO26262 ASIL			
ASR 4.4				ARM	ARM		
				ARM	ARM		
ASR 4.3		MPC574xC-(Power)	S32K1x ARM	S32K2x ARM	MPC574xC-(Power)	MPC5777C (Power)	S32K1x ARM
ASR 4.2	MPC574xC-(Power)			S32R274 (Power)	S32V234 ARM	S32K2x ARM	
			S32K1x ARM	S32R372 (Power)	MPC574xC-(Power)	S32K1x ARM	MPC567xF (Power)
ASR 4.0.3	MPC574xP (Power)	MPC574xC-(Power)	S32K1x ARM	MPC5777C (Power)	MPC5777M (Power)	MPC5746R (Power)	MPC5775K (Power)
	S12ZVM256	S12ZVC	MAC57D5 ARM	SAC58R ARM	MPC574xP (Power)	MPC574xC-(Power)	S32K1x ARM	MPC5775N (Power)
	MPC560xB (Power)	MPC564xA (Power)	MPC560xP (Power)	MPC567xK (Power)			
	MPC564xB-(Power)	MPC567xR (Power)	MPC564xL (Power)				
ASR 3.2	MPC560xB (Power)	MPC564xB-(Power)					
ASR 3.0	MPC564xB-(Power)	MPC563xM (Power)	MPC560xB (Power)	MPC564xL (Power)			
	MPC5668G (Power)	MPC564xA (Power)	MPC567xK (Power)	S12			
	MPC560xS (Power)	MPC567xF (Power)	MPC560xP (Power)				
	MPC551x (Power)	MPC560xB (Power)	MPC564xB-(Power)				

Legend:
- 🟩 available
- 🟨 development
- ⬜ retired
- 🟦 not supported /free

AUTOSAR Versions and Differences

AUTOSAR Versions and Differences – 4.4 vs 4.2

- AUTOSAR 4.4 introduces the Multicore concept
- Bus Mirroring present in the latest standard version
- ASR 4.2 has LIN Master, ASR4.4 has Master and Slave
- Security: TLS (Transport Layer Security), Key manager, SEM (Security Event Memory)
- Crypto Stack
- New MISRA standard
- Added DET transient errors
- Updates on ETH, CAN, FR, FLS, PWM, ICU drivers
- OS – ARTI (AUTOSAR Run-Time Interface)
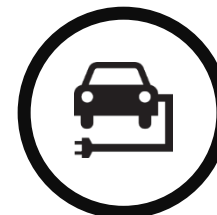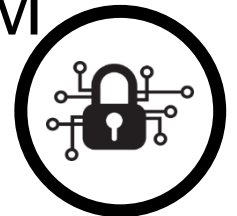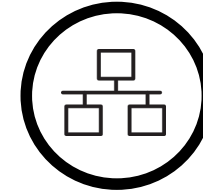
Getting Started with AUTOSAR MCAL

Get AUTOSAR Installation SW from Web to Your Account

Go to nxp.com Click on desired product*.
    Example: MPC5748G:

1. Click on Products
2. Click on Power Arch…
3. Click on MPC55xx/5xxx MCUs

*Note The ISO26262 MCAL version is developed according the SEooC requirements of ISO26262. NXP supplies a FMEA and a Safety Manual for this MCAL. The Safety Manual will state the MCAL's ASIL level.

NXP Products App

Arm® Processors
i.MX Applications Processors
Layerscape Communication Processors
S32 Automotive Platform

Arm® MCUs
General Purpose MCUs
i.MX RT Crossover Processors

Power Architecture® Processors

All Processors and MCUs

Processors and Microcontrollers
Arm Processors
Arm Microcontrollers
Power Architecture®
MPC55xx/5xxx MCUs

Get AUTOSAR Installation SW from Web to Your Account

4. Click on MPC57xx

PRODUCTS

MPC57xx

Powertrain, Body Control, ADAS

Single to multicore Functional Safety compliance to standards such as ISO 26262.

mobileGT MCUs (51xx/52xx)

5. Scroll down and select MPC574xB-C-G

MPC57xx Products

Product	Description
MPC574xB-C-G	Ultra-Reliable MCUs for Automotive & Industrial Control and Gateway
MPC5746R	Automotive & Industrial Engine Management MCU
MPC574xP	Ultra-Reliable MPC574xP MCU for Automotive & Industrial Safety Applications

Get AUTOSAR Installation SW from Web to Your Account

6. Click on Tools & Software

MPC574xB-C-G: Ultra-Reliable MCUs for Automotive & Industrial Control and Gateway

OVERVIEW	DOCUMENTATION	TOOLS & SOFTWARE	BUY/PARAMETRICS	PACKAGE/QUALITY

7. Scroll down to AUTOSAR and select the proper product

AUTOSAR

AUTOSAR 4.3 MCAL (QM) for MPC574xB-C-G

AUTOSAR (Classic) v4.3 rev 1 microcontroller abstraction layer drivers for ADC, CAN, CRYPTO, DIO, ETH, FLS, FR, GPT, ICU, LIN, MCU, OCU, PORT, PWM, SPI, WD...show more

2018-08-13 12:47:00   EXE   1 KB   SW574XG-MCAL431E

Download

AUTOSAR 4.3 MCAL (ISO 26262) for MPC574xB-C-G

AUTOSAR (Classic) v4.3 rev1 microcontroller abstraction layer drivers for ADC, CAN, CRYPTO, DIO, ETH, FLS, FR, GPT, ICU, LIN, MCU, OCU, PORT, PWM, SPI, WDG...show more

Download

Standard Services for SW Products (for direct customer only)

Standard Services

FBRs and CCTs are orderable as required by the customer at code freeze date.

FBR and CCT orders require a production license and a valid DISM license.

Frozen Branch Release (FBR)

- NXP integrates required bug fixes in any RTMC version (latest or previous ones) as specified by the customer and delivers an updated release package

- NXP executes test of the software with the customer specified compiler version settings and delivers test report to customer

- Requires all remaining open issues to be agreed by the customer in the request document as non-relevant or acceptable for the Customer Target Project

- Does not include or mean an obligation for NXP to use the specified compiler version and settings in future general releases of the Software

Custom Compiler Test (CCT)

- NXP executes test of the software (RTMC versions) with the customer specified compiler version settings and delivers test report to customer

- Requires all open issues to be agreed by the customer in the request document as non-relevant or acceptable for the Customer Target Project

- Does not include or mean an obligation for NXP to use the specified compiler version and settings in future general releases of the Software

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