



# **AUTOSAR Overview**

#### > AUTOSAR Overview

**AUTOSAR Solution** 

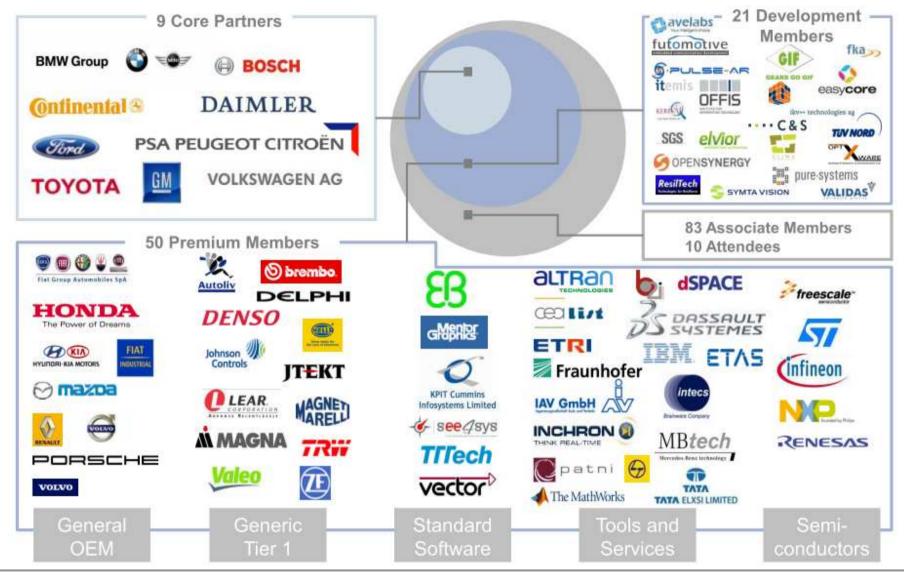
AUTOSAR on the way





# **Overview and Objectives**

#### AUTOSAR Partnership



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### **Development of Functionality**

#### >80% of automotive innovations are based on software

		Daseu	UII SUITWAIE
Electronic fuel injection Cruise control	Gearbox control         Anti lock brakes         Electronic fuel injectior         Cruise control	Airbags Flectronic stability control Adaptive gearbox control Adaptive gearbox control Emergency call Gearbox control Traction control Anti lock brakes Electronic fuel injection Cruise control	Active body control
1975	1985	1995	2005 2015



#### Why AUTOSAR?

The challenge:

- E/E complexity is growing fast
- Quantity of **software** is exploding
- Many different hardware platforms are used
- Development processes and data formats are not harmonized

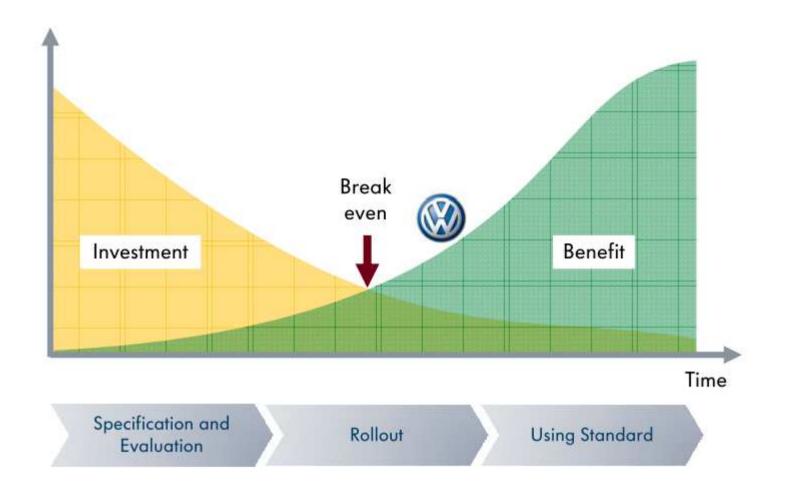
The main objective of **AUT OSAR** 

#### → Improve software quality and reduce costs by re-use

- Re-use of functions across carlines and across OEM boundaries
- Re-use of basic software
- Re-use of development methods and tools



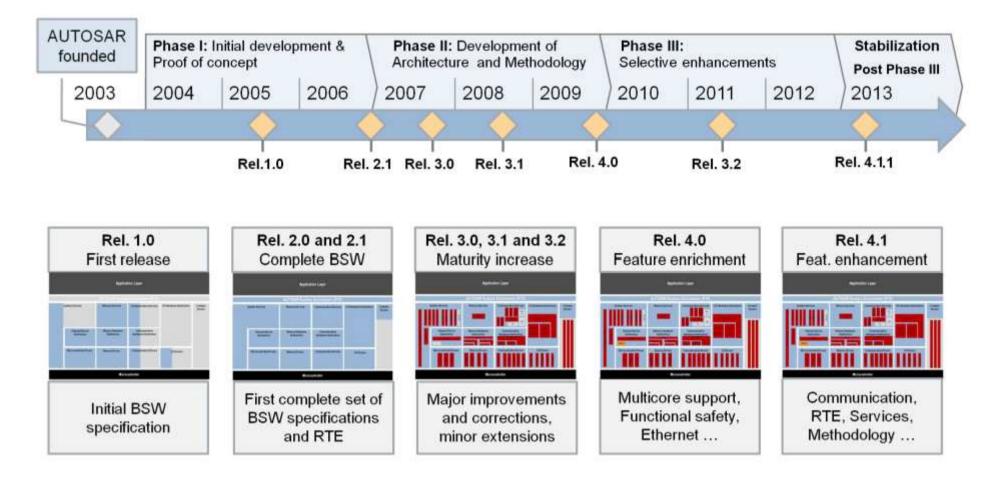
# Why AUTOSAR???



Source: Explore AUTOSAR Conference in Pune 2012



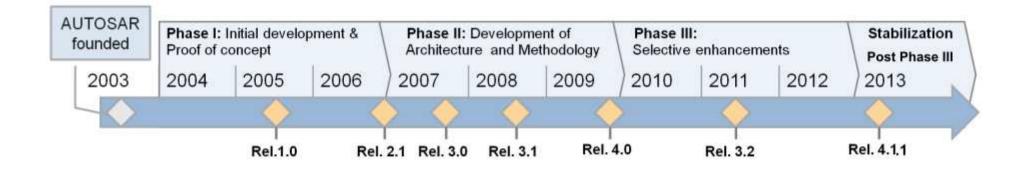
### 10 Years

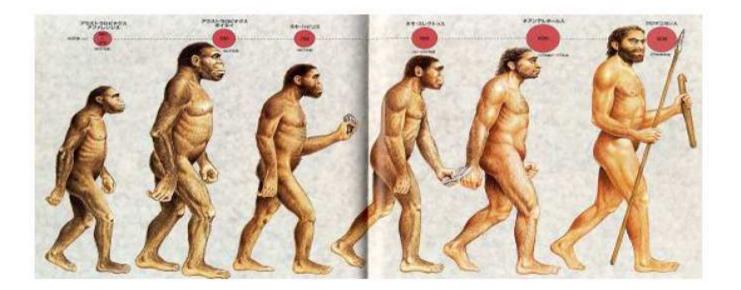


Source: 6th AUTOSAR Open Conference



### 10 Years





Source: 6th AUTOSAR Open Conference



#### Introduction to AUTOSAR AUTOSAR Status

AUTOSAR is a broadly used standard in Europe

#### AUTOSAR 3.x:

- ▶ First specification: 2007
- ➔ Mature solution used for series production 2010ff
- → Adaptations necessary → OEM-specific extensions

#### AUTOSAR 4.x:

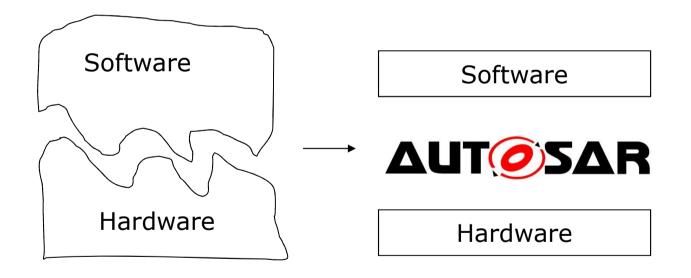
- ► First specification: 2009
- → First mature specification: 2012 (4.0.3)
- $\rightarrow$  4.0.3 is the right version for development start in 2012
- → New functions: safety, Ethernet/IP, multicore, ...



Overview and Objectives AUTOSAR Slogan

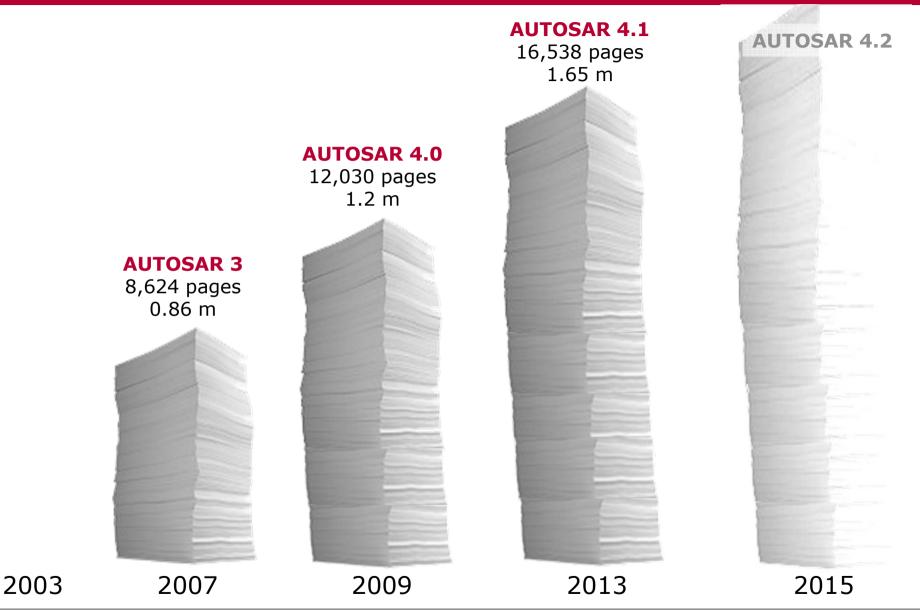
Two different AUTOSAR statements:

"Cooperate on standards – compete on implementation"





### AUTOSAR Specification – "In the beginning was the word"





#### AUTOSAR Accomplishments

**Standardization** of methods and data exchange formats

Standardization of application software interfaces

Standardization of basic software and network behavior

- > Network Management
- > Partial Networking
- > ECU State Management
- > Transport Protocols
- > Non-Volatile Memory

> ...

E2E Protection Wrapper	on Application									
SCHM					RTE					
<u>os</u> os	SYS BSWM COMM CSM (CRY) DET ECUM STBM WDGIF WDGM	DIAG DCM DEM FIM AMD DBG DLT RTM <sup>1</sup>	MEM EA FEE MEMIF NVM	COM COM J193 CAN CAN CAN CAN	39TP XCP TP NM SM	PDUM N	M PI	ETH ETHXCP SOAD/DOIP TCPIP <sup>1</sup> ETHSM ETHIF	JO IOHWAB V2G <sup>1</sup> DNS EXI HTTP SCC TLS XML Security AVB <sup>3</sup> AVTP BMCA PTP	LIBS CAL (CPL) CRC E2E E2E
	MCAL ADCDRV CANDRV CORTST	DIODRV EEPDRV ETHDRV	FLSDRV FLSTST FRDRV	GPTDRV ICUDRV IICDRV <sup>1</sup>	LINDRV MCUDRV PORTDRV Microcont		SPIDRV WDGDRV	EXT CANTRCV DRVEXT <sup>2</sup> ETHTRCV	FRTRCV LINTRCV	
Vector Standar	d Software	3rd Party So	oftware						extensions for AU EXTADC, EEPEXT, FL	

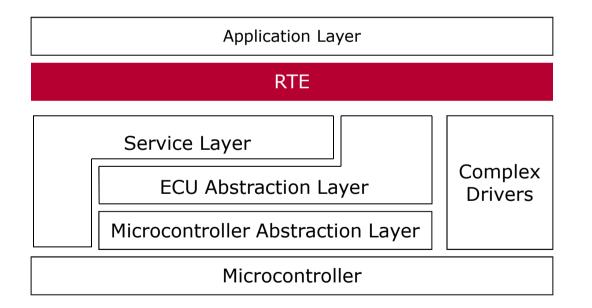


Application								
AUTOSAR Runtime Environment (RTE)								
Syste Servio				I/O Signal				
	Onboard Device Abstraction	Memory Hardware Abstraction	Comm. Hardware Abstraction	If	Complex Device Drivers			
	Micro- contoller Drivers	Memory Drivers	Comm. Drivers	I/O Drivers				
Microcontroller								
	Microcontroller ECU Abstraction Service Abstraction Layer Layer							

### AUTOSAR RTE Architecture

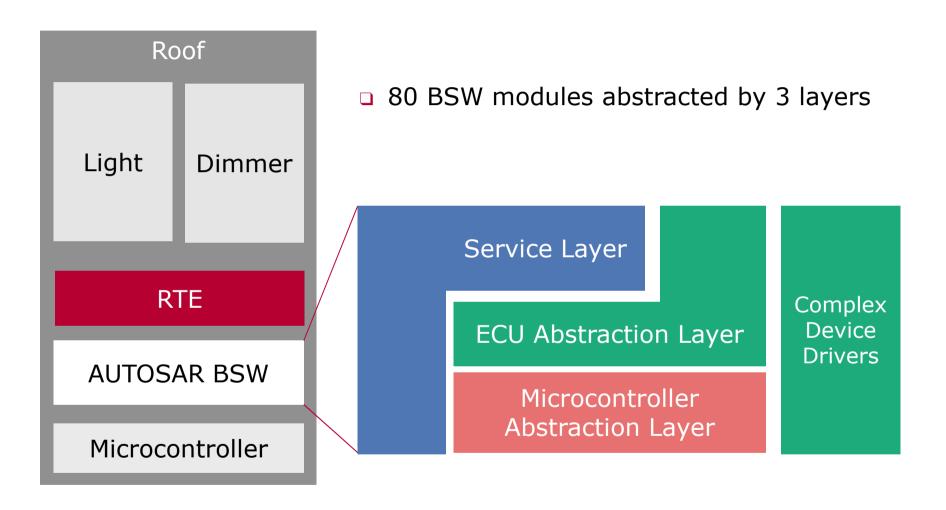
Task

- Components independent of ECU mapping
- Functionality
  - Middleware providing communication services (intra / inter ECU)





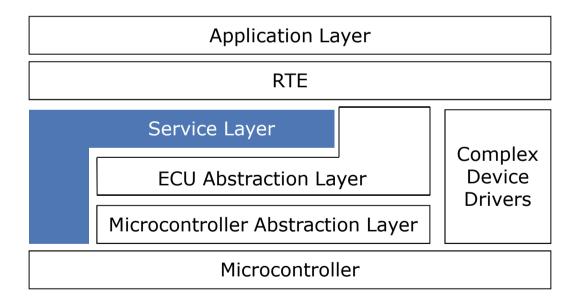
Layered View: Simplified





Service Layer

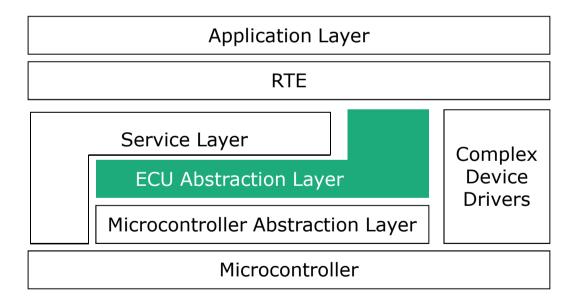
- Task
  - Services for application
- Functionality
  - Diagnostics, NVRAM Management, OS, Communication
  - Memory and ECU management





ECU Abstraction Layer

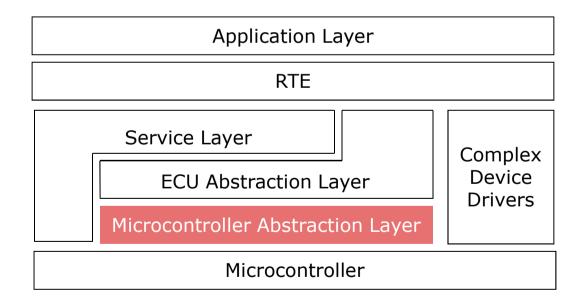
- Task
  - Make higher levels independent of ECU hardware
- Functionality
  - Driver for external devices
  - Interface for internal and external periphery (IO)





Microcontroller Abstraction Layer

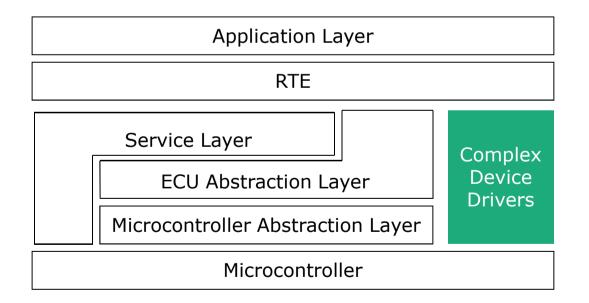
- Task
  - Make higher layers independent of microcontroller
- Functionality
  - Drivers with direct access to internal periphery of μC
  - Memory-mapped devices external to µC





Complex Device Drivers

- Task
  - Offer functionality for complex sensors and actuators
- Functionality
  - Direct access to resources for critical applications
  - Examples: Injection control, tire pressure monitoring





# Agenda

AUTOSAR Overview

#### > AUTOSAR Solution

AUTOSAR on the way

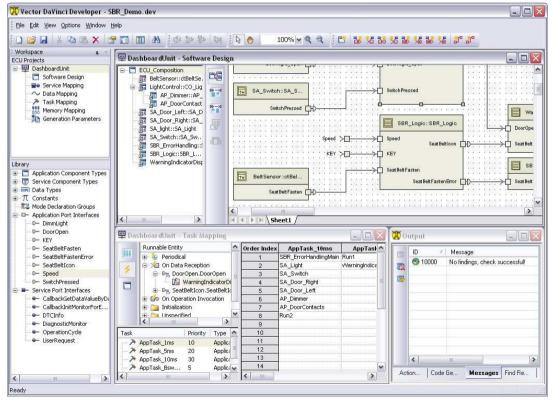




# **Designing AUTOSAR SWCs**

DaVinci Developer: SWC Design

- Define application architecture of AUTOSAR ECUs
- Integrate the SWC with the ECU basic SW
- Configure the AUTOSAR RTE





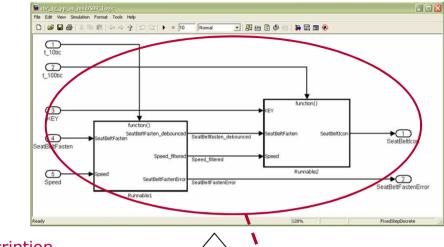


### Designing AUTOSAR SWCs

DaVinci Developer: Interaction with model-based development tools

Simulink/EmbedderCoder or TargetLink

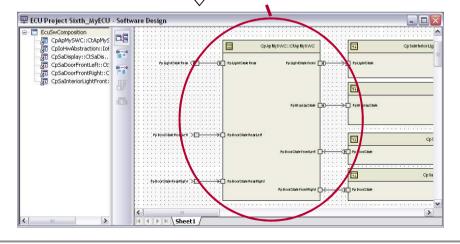
- Develop the behavior model
- Generate SWC implementation code



SWC description (e.g. ports, runnables) is exchanged via AUTOSAR XML

#### DaVinci Developer

- Define SWC structure
- Integrate the SWC into the ECU application architecture
- ► Configure the RTE

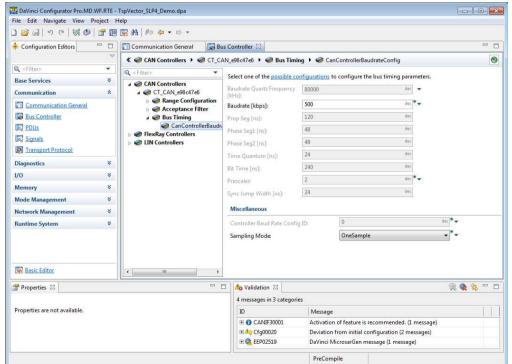




# DaVinci Configurator Pro

Configuring Basic Software

- One tool for configuration of complete BSW and RTE
- Comfort Editors and Assistants to support specific use cases
- Basic Editors (GCE) for native ECU-C view
- Easy navigation between editors





## Vector Embedded AUTOSAR Software

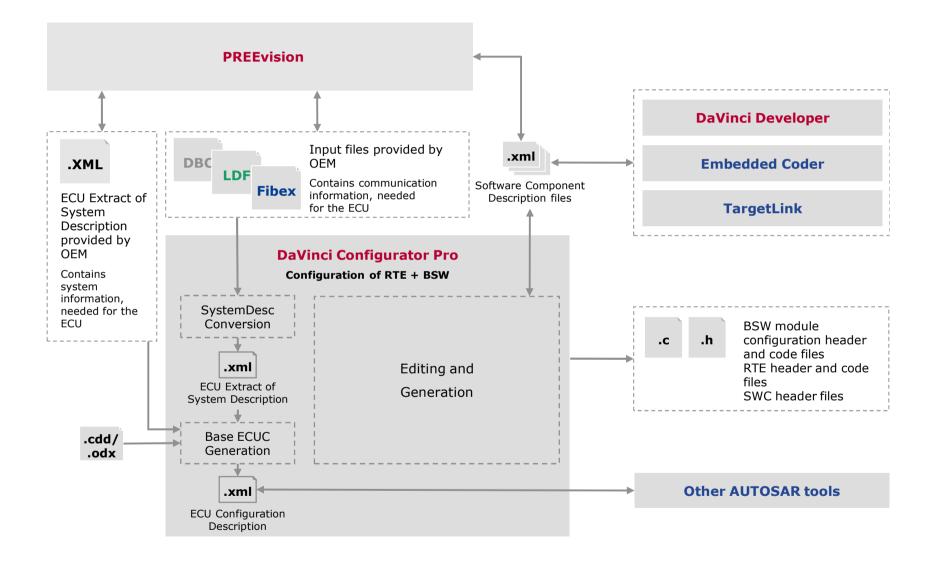
#### MICROSAR

E2E Protection Wrapper	Application Application									
SCHM	RTE									
0S 0S	SYS BSWM COMM CSM (CRY) DET ECUM STBM TM WDGIF WDGM	DIAG DCM DEM FIM J1939DCM DBG DLT RTM <sup>1</sup>	MEM EA FEE MEMIF NVM	COM COM J1939TP J1939NM J1939RM CANXCP CANTP CANNM CANSM CANIF	IPDUM	NM PDL	R ETH ETHXCP UDPNM SOME/IP <sup>1</sup> SD DOIP SOAD TCPIP ETHSM ETHIF	IO IOHWAB V2G <sup>1</sup> DNS EXI HTTP SCC TLS XML Security AVB <sup>1</sup> AVTP BMCA PTP	LIBS CAL (CPL) CRC E2E	
	MCAL ADCDRV CANDRV CORTST	EEPDRV FL	STST IC	PTDRV LINDRV UDRV MCUDR CDRV <sup>1</sup> OCUDRV Microco	V PWMDRV	SHEDRV <sup>1</sup> SPIDRV WDGDRV	EXT CANTRCV DRVEXT <sup>2</sup> ETHTRCV	FRTRCV LINTRCV		
Vector Standard	l Software	3rd Party Softwa	re					e extensions for AUT EXTADC, EEPEXT, FL		





### Workflow AUTOSAR 4.x

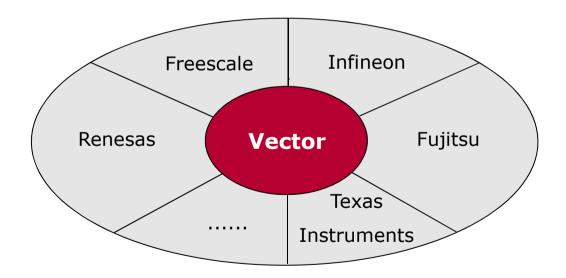




#### MICROSAR – Vector AUTOSAR Basic Software

#### Large variety of platforms supported

- Vector cooperates with microcontroller manufacturers to integrate the MCAL (Microcontroller Abstraction Layer) which are provided by them
- An individual solution for your favored microcontroller is possible at any time







# Agenda

AUTOSAR Overview

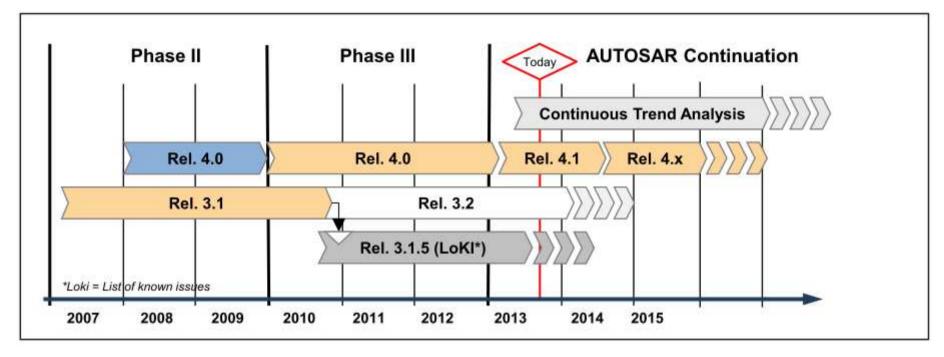
AUTOSAR Solution

#### > AUTOSAR on the way





### AUTOSAR Releases



- ► AUTOSAR is stabilizing with R3.2 and 4.x
- AUTOSAR is worldwide in massive series roll-out
- High acceptance in the market is achieved
- Existing releases will be used over long period of time in many applications
  Source: 6th AUTOSAR Open Conference



### **AUTOSAR - Exploitations**

**SOP of a complete AUTOSAR solution** (BSW + RTE)

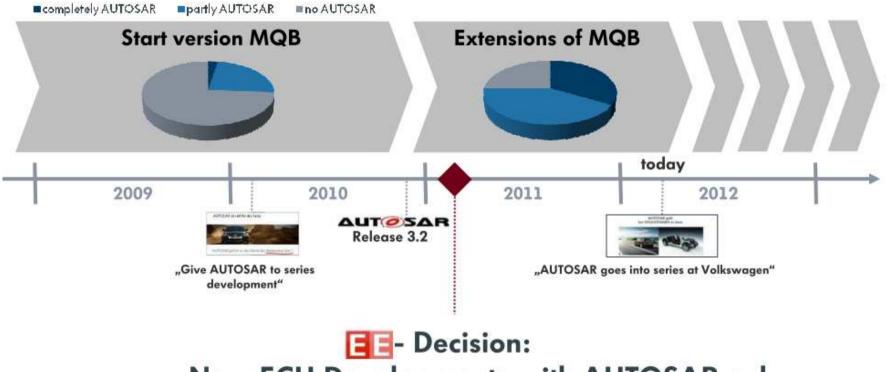
	2010	2011	2012	2013	2014	2015	2016	
AUTOSAR 3.x								
AUTOSAR 4.x								

- **AUTOSAR 3.x** is used in serial production projects by:
  - Audi / Volkswagen / Porsche
  - Daimler
  - ► Fiat / Chrysler
  - Volvo Trucks (incl. Construction Machines)
- **AUTOSAR 4.x** is used in serial production projects by:
  - BMW
  - ► GM
  - Toyota
  - Volvo Cars
- AUTOSAR 4.x is generally announced by
  - Ford
  - PSA
  - **>** ...





#### AUTOSAR in VW



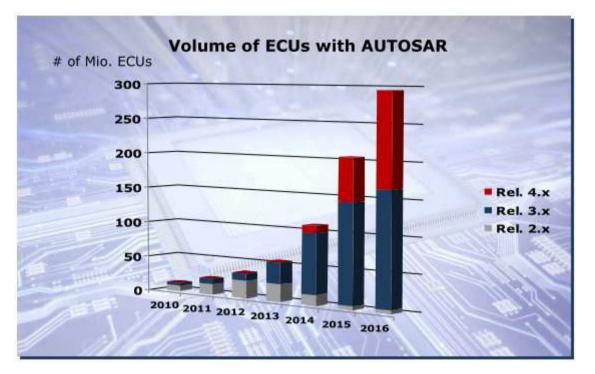
New ECU Developments with AUTOSAR only

Source: Explore AUTOSAR Conference in Pune 2012

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At least 25% of the total number of ECUs produced in 2016 will have AUTOSAR inside (based on planning of AUTOSAR OEM Core Partner only)

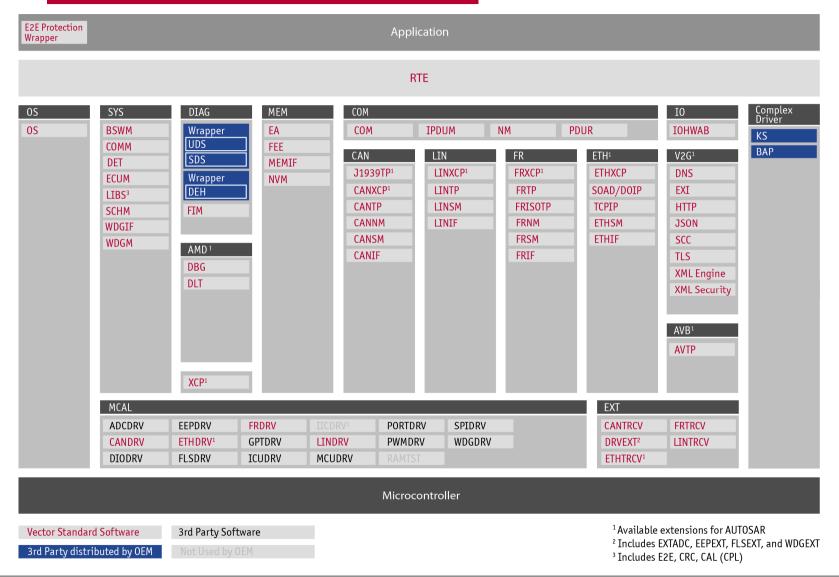


Source: Explore AUTOSAR Conference in Pune 2012



# MICROSAR 3 for VW Group

#### MQB (technical identical to MLBevo)

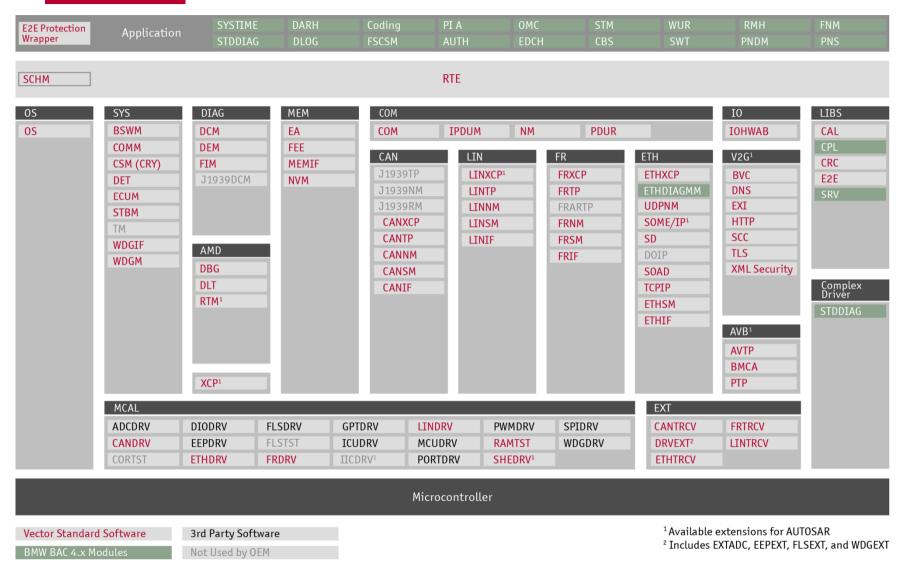


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### BAC 4.0 MICROSAR Basic-Software for BMW

#### Overview



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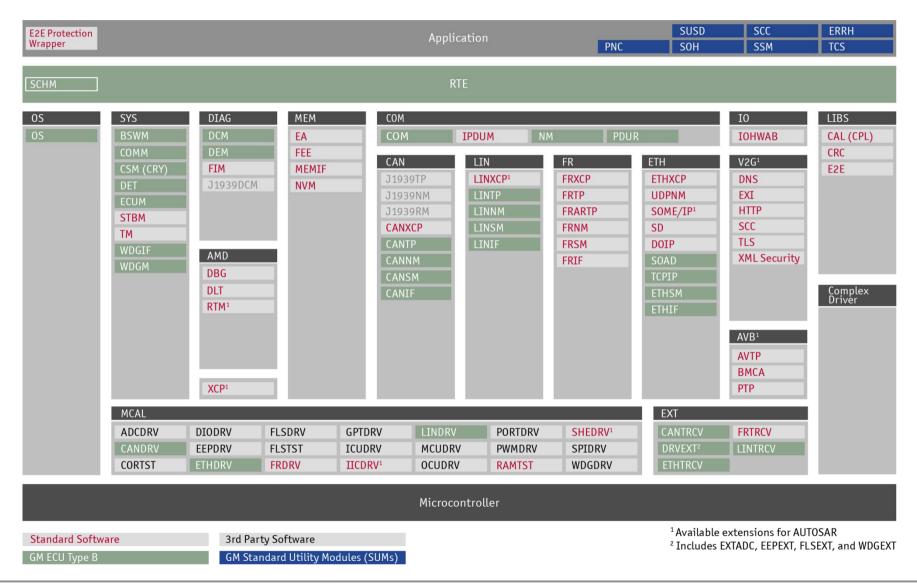
### MICROSAR 3 for Daimler SLP10

FBL	E2E Protection Wrapper										
Flash Boot Loader			RTE								
	<u>05</u> 05	SYS BSWM COMM DET ECUM LIBS <sup>3</sup> SCHM WDGIF WDGM	DIAG DCM DEM FIM FIM DBG DLT RTM <sup>1</sup>	MEM EA FEE MEMIF NVM	COM COM J1939TP <sup>1</sup> CANXCP <sup>1</sup> CANXCP <sup>1</sup> CANNM CANSM CANIF	IPDUM LIN LINXCP <sup>1</sup> LINTP LINSM LINIF	NM P FR FRXCP <sup>1</sup> FRTP FRISOTP FRNM FRSM FRIF	DUR ETH <sup>1</sup> ETHXCP SOAD/DOIP TCPIP ETHSM ETHIF	IO IOHWAB V2G <sup>1</sup> DNS EXI HTTP JSON RCS SCC TLS XML Engine XML Security	<u>Complex</u> Driver	
		MCAL ADCDRV CANDRV DIODRV	EEPDRV ETHDRV <sup>1</sup> FLSDRV	FRDRV GPTDRV ICUDRV	IICDRV <sup>1</sup> PORTI LINDRV PWMD MCUDRV RAMT	RV WDGDRV		EXT CANTRCV DRVEXT <sup>2</sup> ETHTRCV <sup>1</sup>	FRTRCV LINTRCV		
					Microo	ontroller					
Vector Standard Daimler SLP 10		<b>3rd Party Softw</b> Not Used	are					<sup>2</sup> Includes	extensions for AUT EXTADC, EEPEXT, FL E2E, CRC, CAL (CPL)	SEXT, and WDGEXT	

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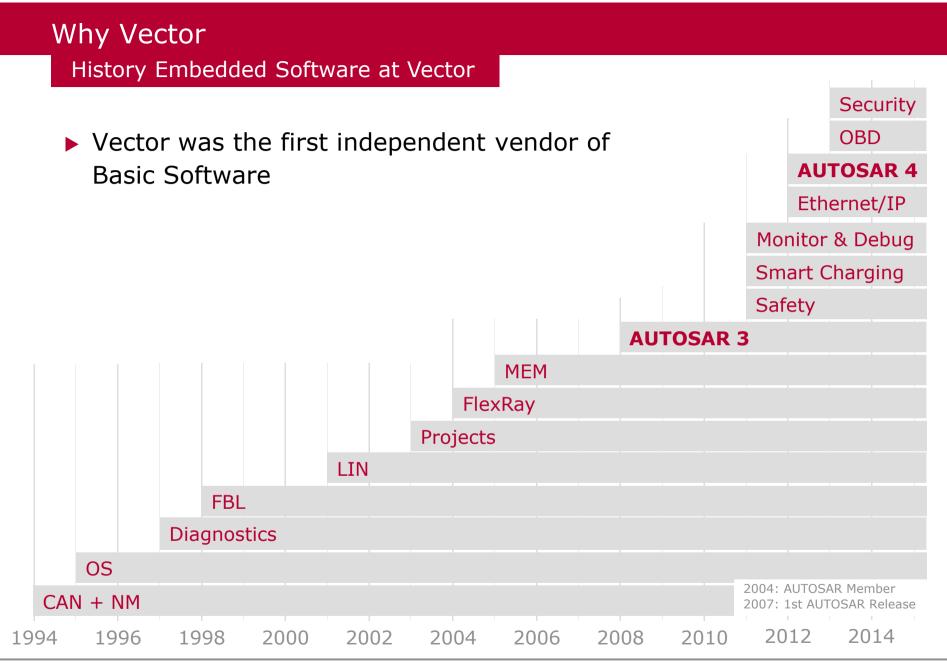


### MICROSAR for General Motors (GM)



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#### AUTOSAR in China

- Cooperation with Chinese customers from 2009
- ▶ FAW, ChangAn, Foton, PATAC, DFM...



# **Case Study**

Developing a driver library for engine controllers with AUTOSAR Complex Device Drivers (CDD)





Thank you for your attention.

For detailed information about Vector and our products please have a look at: <u>www.vector.com</u>

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