



Specifics of Embedded Software for FlexRay

Agenda

> AUTOSAR

FlexRay BSWs

XCP

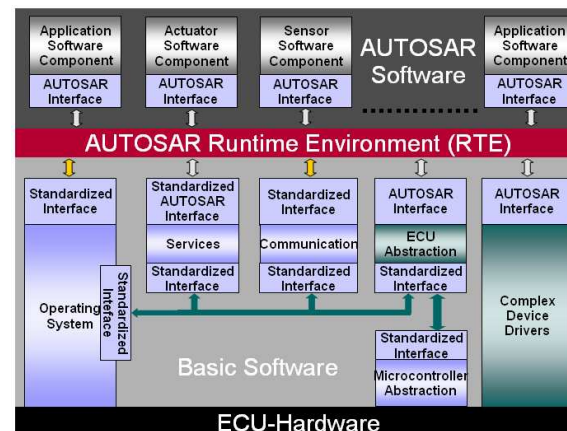
Flashbootloader FlexRay

AUTOSAR

AUTOmotive Open System ARchitecture

□ Standardization of

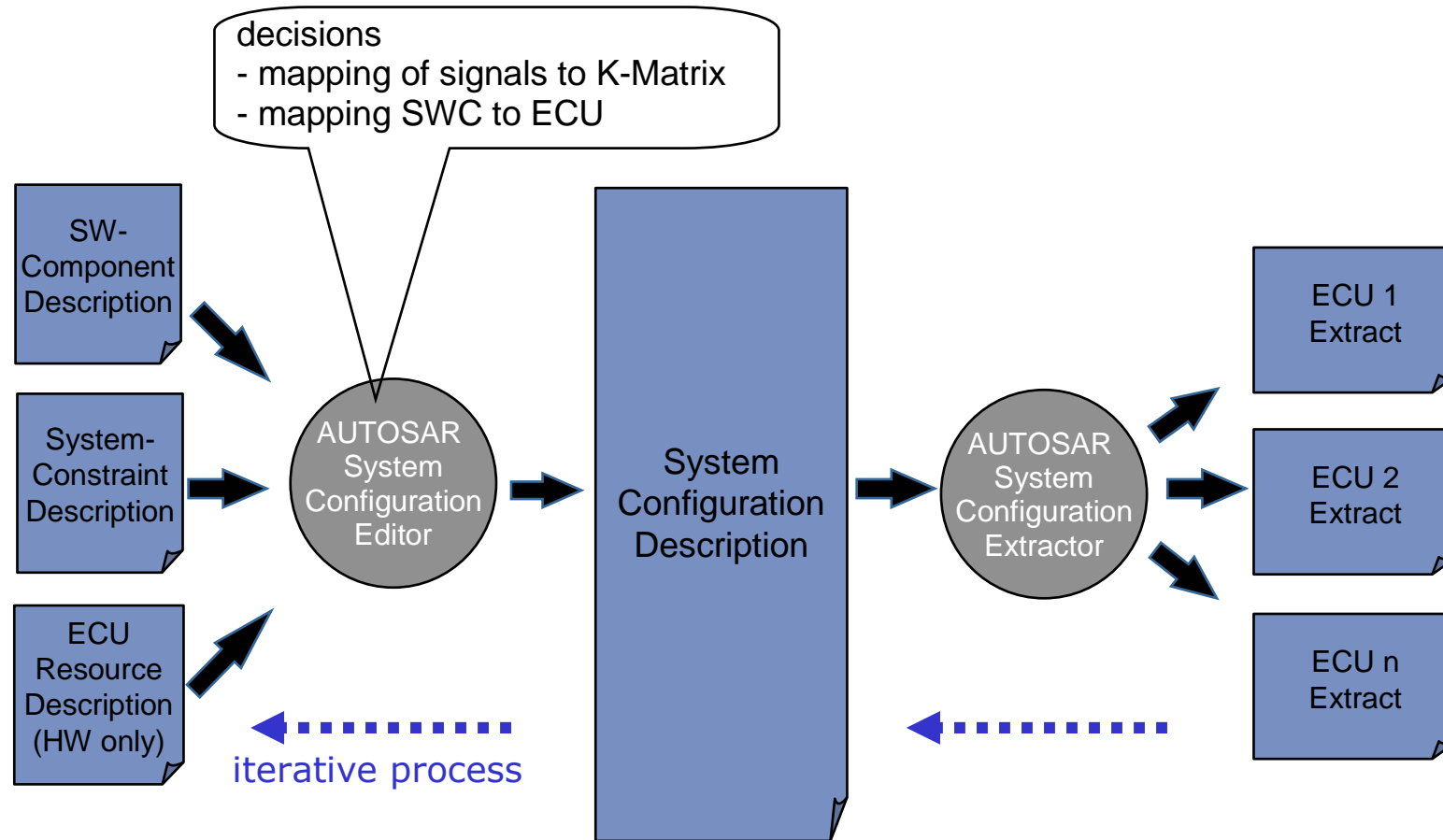
- Interfaces
- Exchange formats
- Methodology



- Standardization and implementation of basic system functions as OEM independent „Standard Stack“
- Integration of software components of various sources
- Scalability to different vehicle- and platform-variant

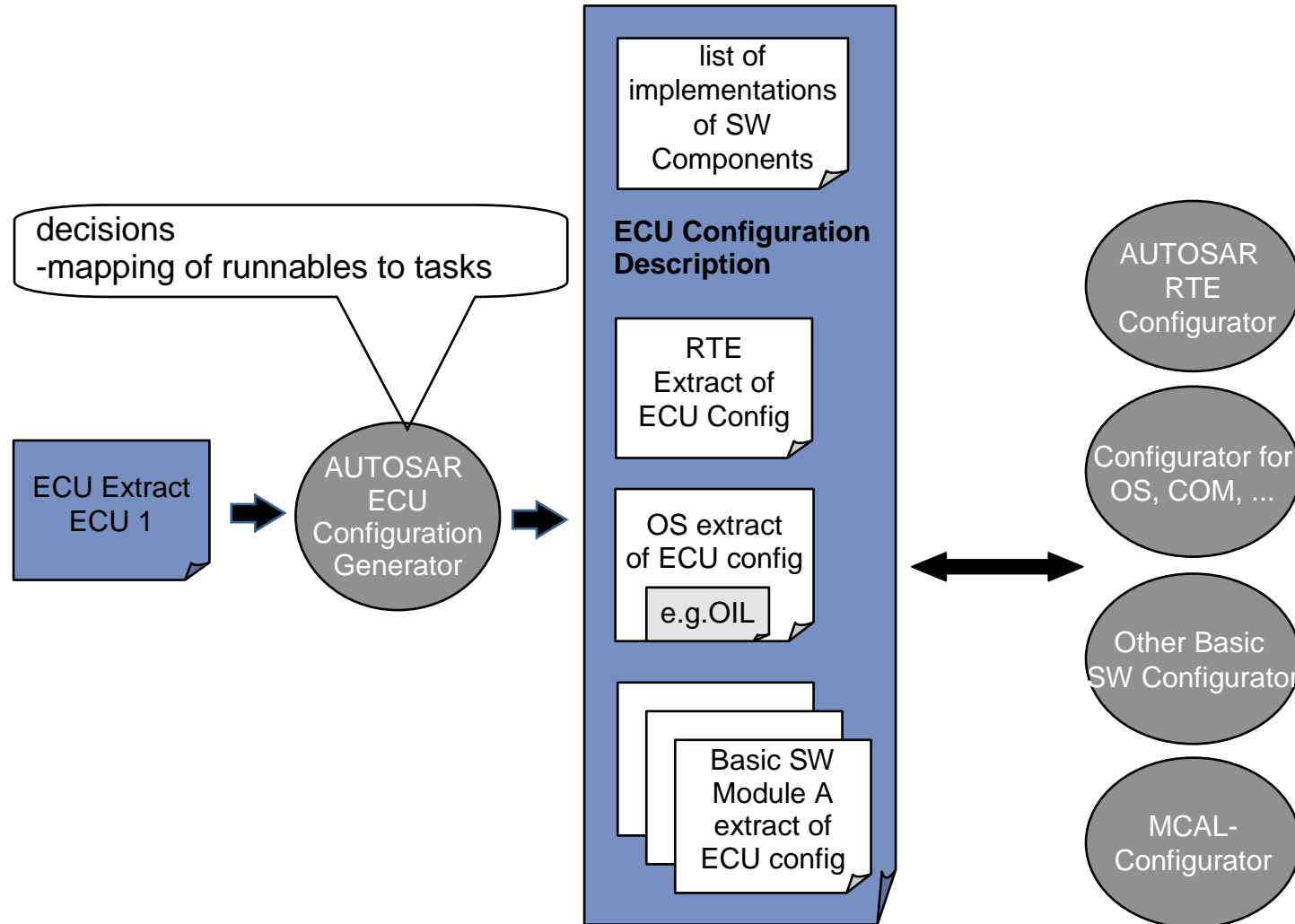
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Methodology - System Configuration



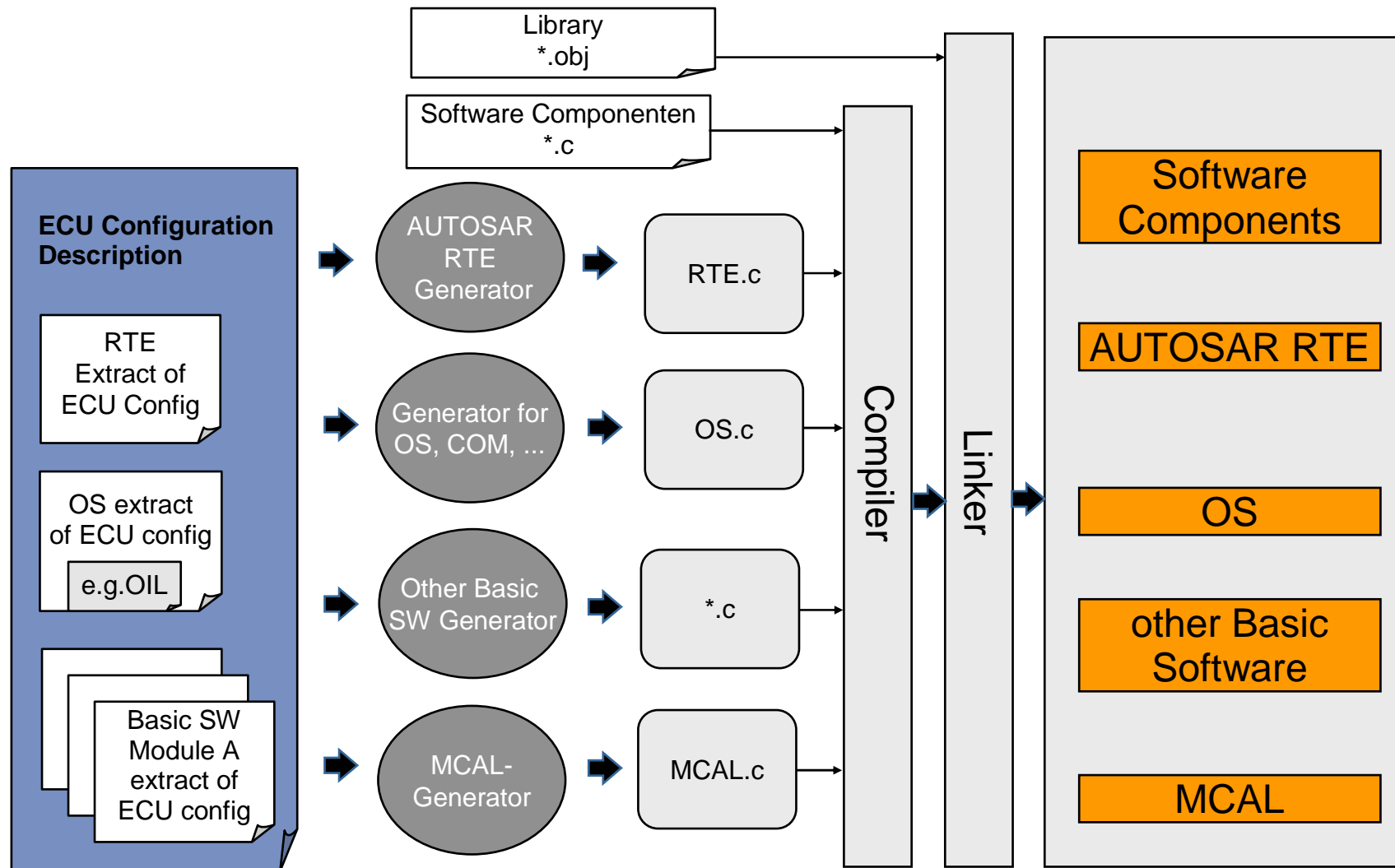
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Methodology - ECU Configuration



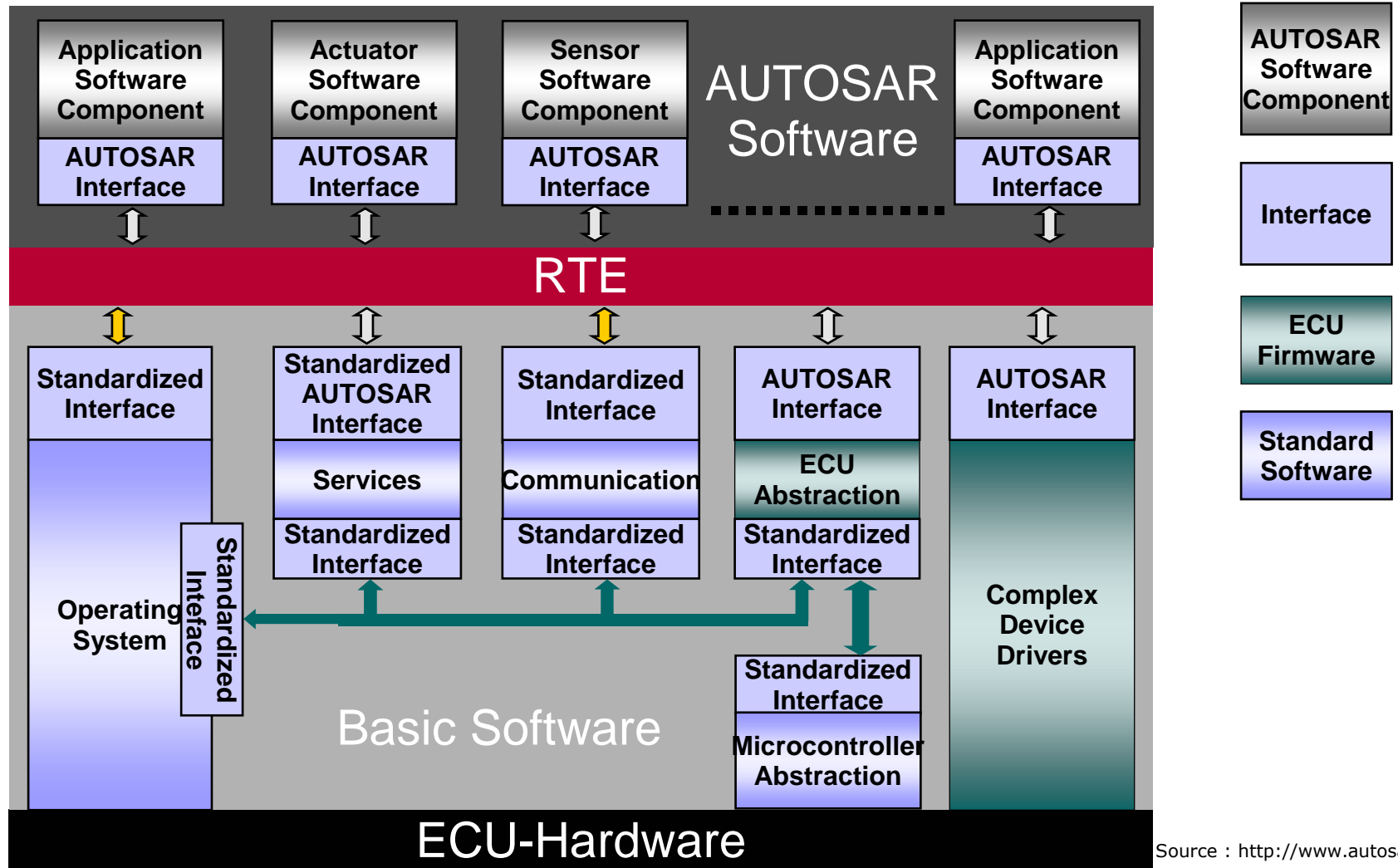
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Methodology - Executable ECU



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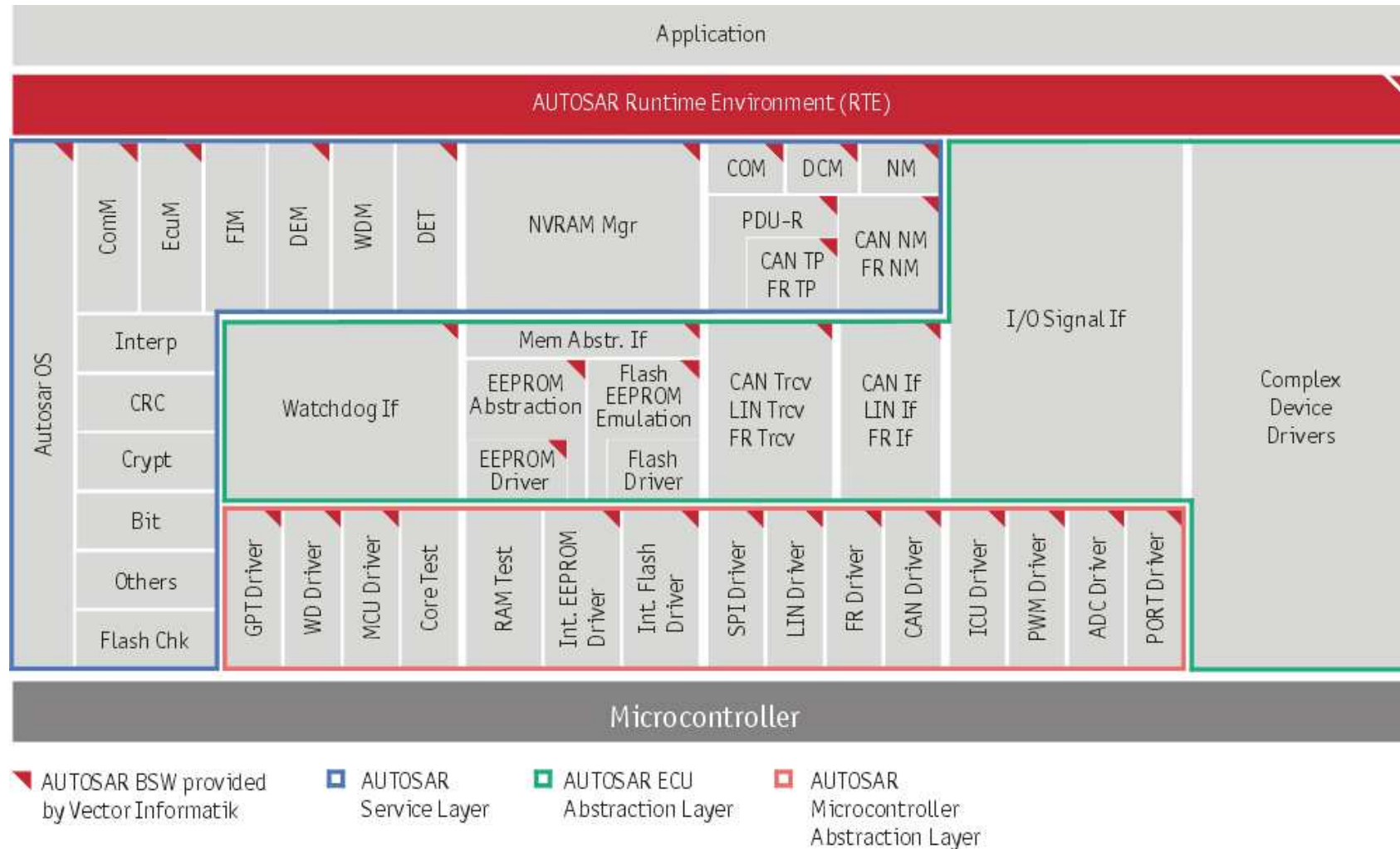
ECU Architecture



Source : <http://www.autosar.org>

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ECU BSW Architecture



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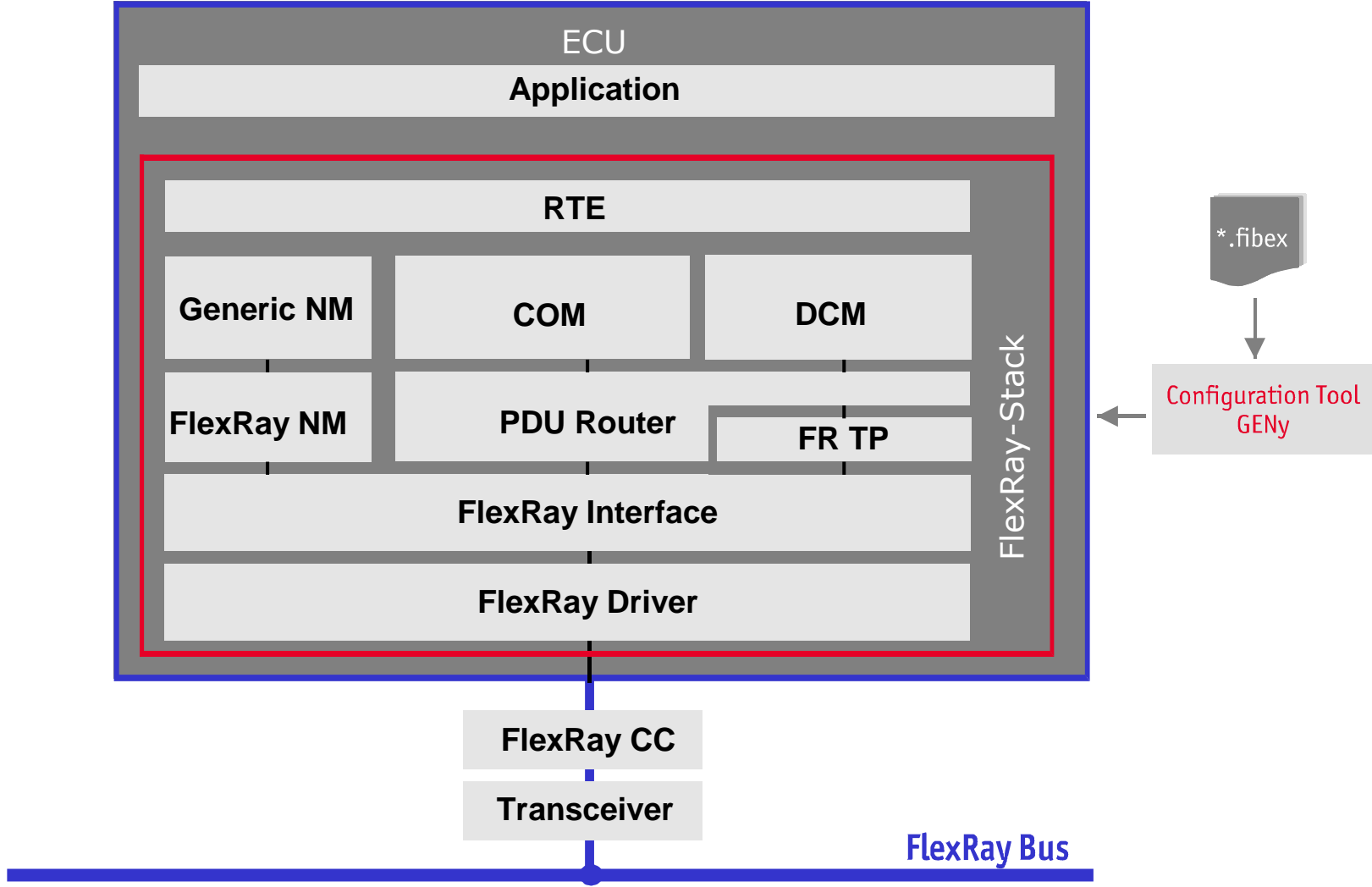
> **FlexRay BSWs**

XCP

Flashbootloader FlexRay

FlexRay BSWs

Overview



FlexRay BSWs

Duties

- ❑ FlexRay Driver:
 - ❑ Initialize the FR Controller
 - ❑ Send and Receive Frames
 - ❑ Detection of FR Controller Errors

- ❑ FlexRay Interface
 - ❑ Assemble PDUs to Frames and vice versa
 - ❑ Handling of PDU Update Bits
 - ❑ Indication/Confirmation

- ❑ FlexRay TP
 - ❑ Handling of segmented and (un)segmented PDUs
 - ❑ ISO Format
 - ❑ Extended Formats

- ❑ Network Management:
 - ❑ Indication of the local communication needs to others

FlexRay BSWs

Vector FlexRay-Stack

- ❑ BSW modules according to AUTOSAR 2.0
- ❑ Based on demo application (16 Frames, 16 PDUs, 1 TP channel)
- ❑ No compiler optimization

Target platform: Freescale S12X	DET disabled		DET enabled	
	ROM (+Cfg)	RAM (+Cfg)	ROM (+Cfg)	RAM (+Cfg)
FlexRay-Driver	3471 (+519)	2 (+768)	4211 (+519)	2 (+768)
FlexRay-Interface	4557 (+653)	7 (+264)	7413 (+653)	7 (+264)
FlexRay-TP	13037(+160)	0 (+175)	14020(+162)	0 (+175)
Generic NM (no DET)	819 (+13)	13	819 (+13)	13
FlexRay-NM	505 (+21)	23	1361 (+21)	24
FlexRay-Trcv	702 (+8)	4	1232 (+8)	4

FlexRay BSWs

Vector FlexRay-Stack

- ❑ BSW modules according to AUTOSAR 2.0
- ❑ Based on demo application (16 Frames, 16 PDUs, 1 TP channel)
- ❑ No compiler optimization

Target platform: NEC V850	DET disabled		DET enabled	
	ROM (+Cfg)	RAM (+Cfg)	ROM (+Cfg)	RAM (+Cfg)
FlexRay-Driver	5350 (+620)	4	6404 (+620)	4
FlexRay-Interface	9606 (+696)	12 (+264)	14186(+696)	12 (+264)
FlexRay-TP	21528(+228)	0 (+222)	23388(+228)	0 (+222)
Generic NM (no DET)	1924 (+14)	36	1924 (+14)	36
FlexRay-NM	826 (+24)	24	2420 (+24)	24
FlexRay-Trcv	1452(+8)	4	2376(+8)	4

Agenda

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FlexRay BSWs

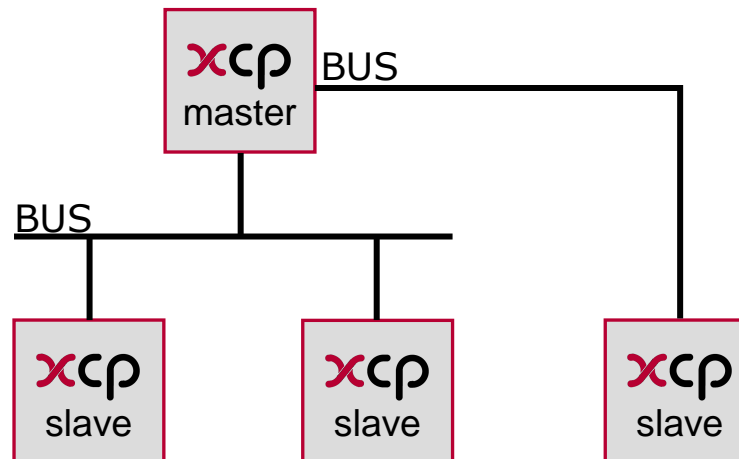
> **XCP**

Flashbootloader FlexRay

XCP

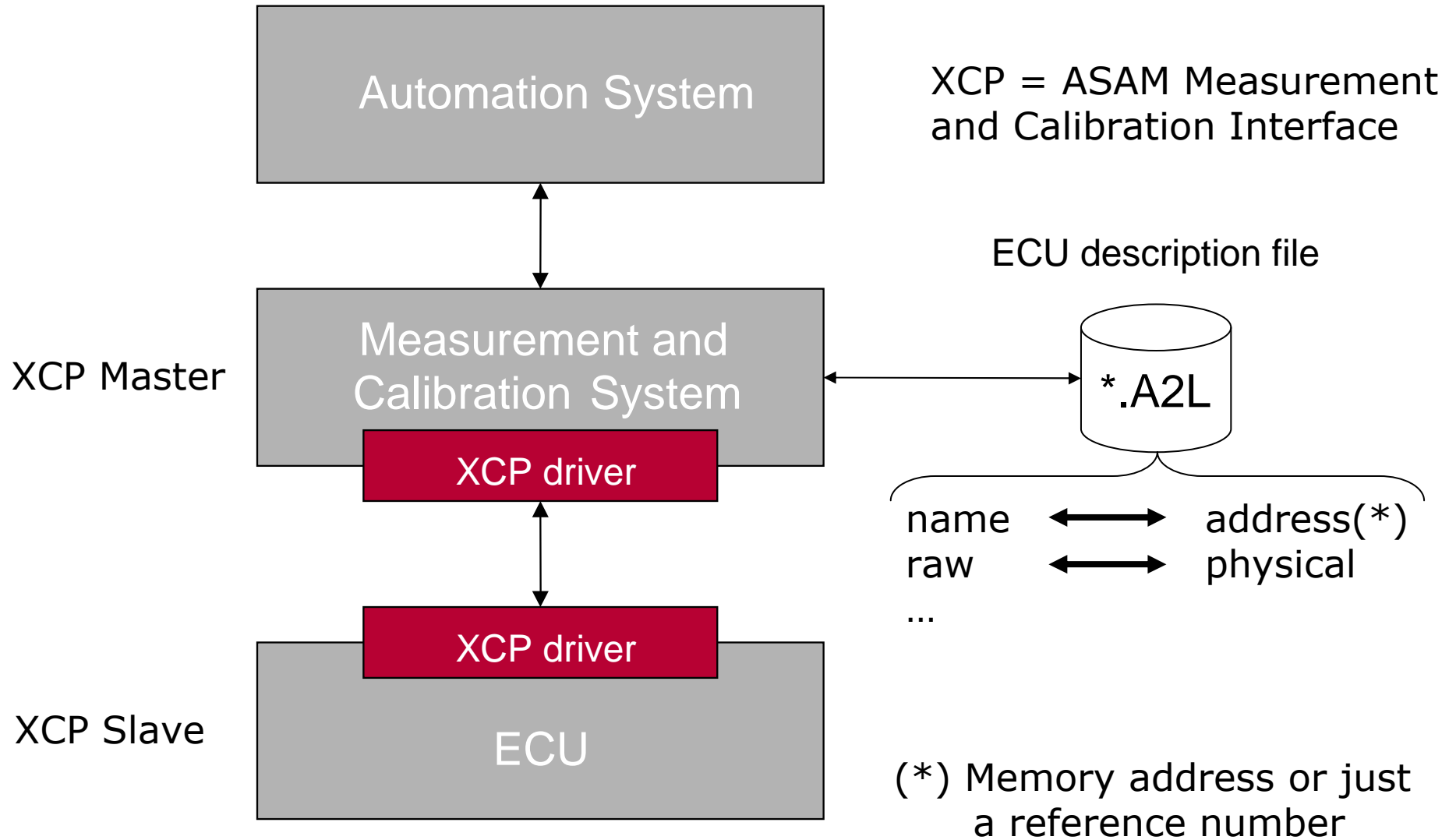
Overview

- ❑ XCP is the successor of CCP (CAN Calibration Protocol)
- ❑ XCP stands for Universal Calibration Protocol
- ❑ The “X” generalizes the “various” transportation layers used by the members of the protocol family e.g. “XCP on CAN”, “XCP on Ethernet”, “XCP on UART/SPI”, “XCP on LIN”, etc.
- ❑ ASAM Measurement and Calibration Interface, standard since 2003
- ❑ Single Master, Multi Slave concept



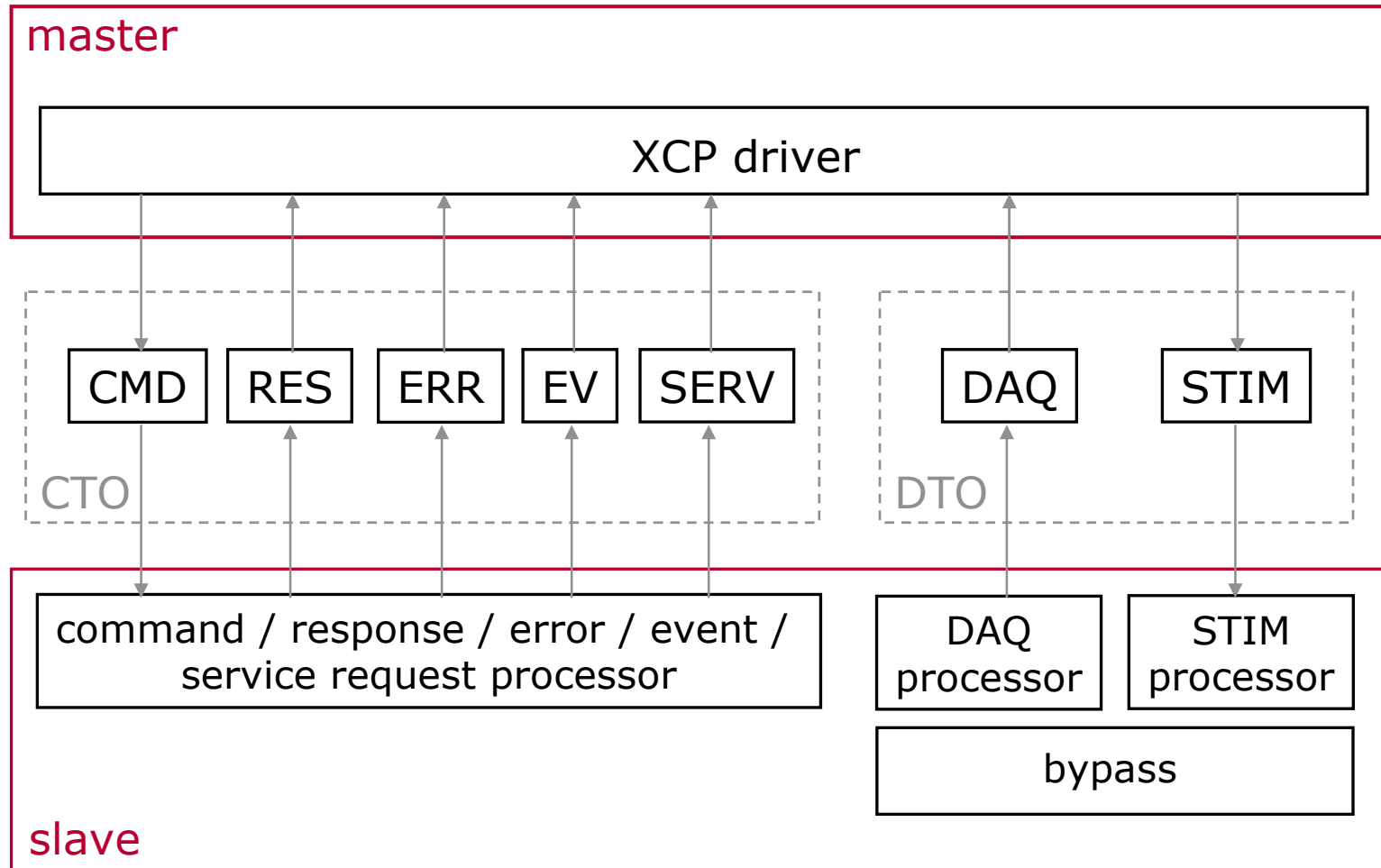
XCP

Association for **S**tandardization of **A**utomation and **M**easuring Systems



XCP

Communication between Master and Slave

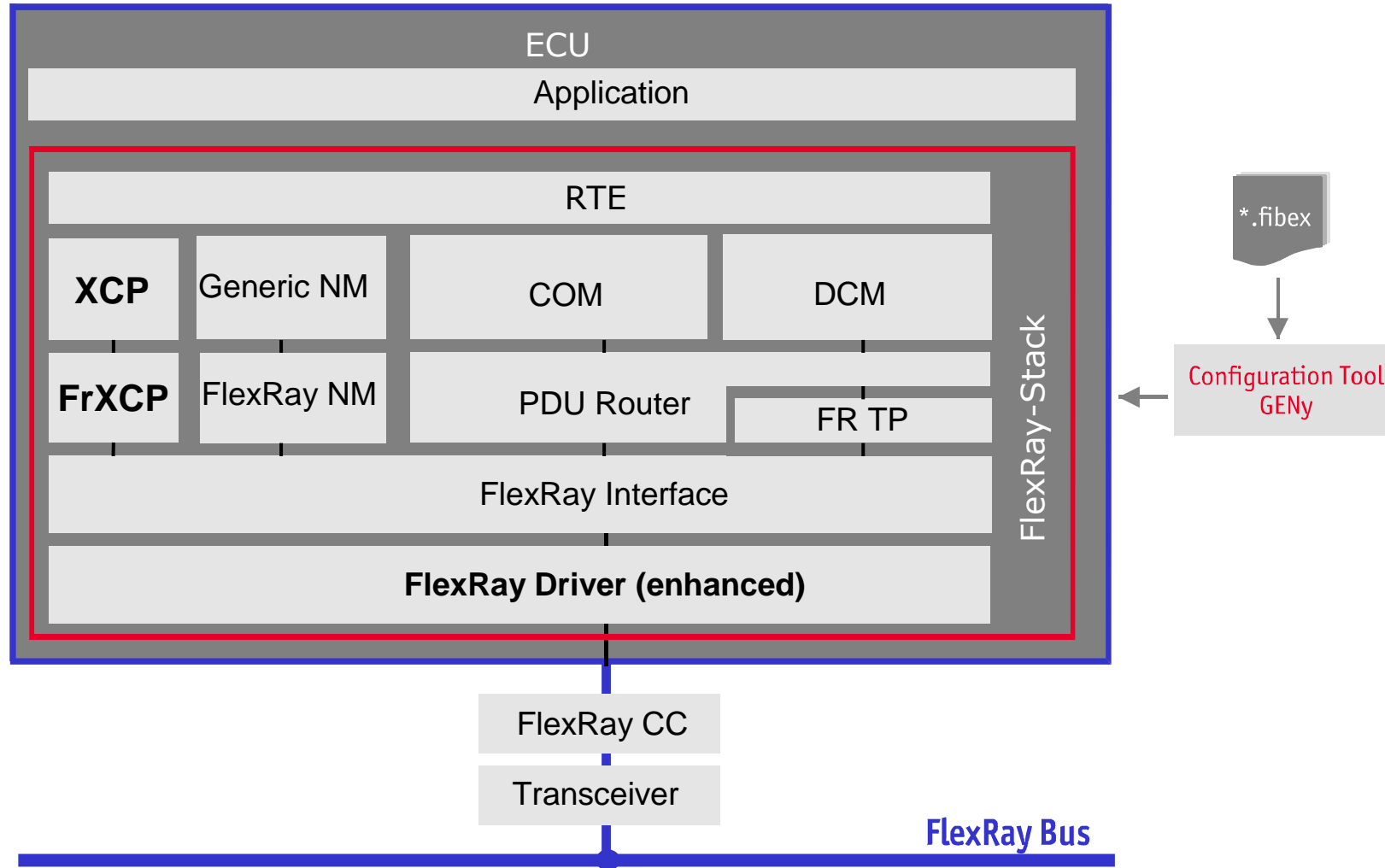


CTO: Command Transfer Object

DTO: Data Transfer Object

XCP

XCP on FlexRay - Architecture



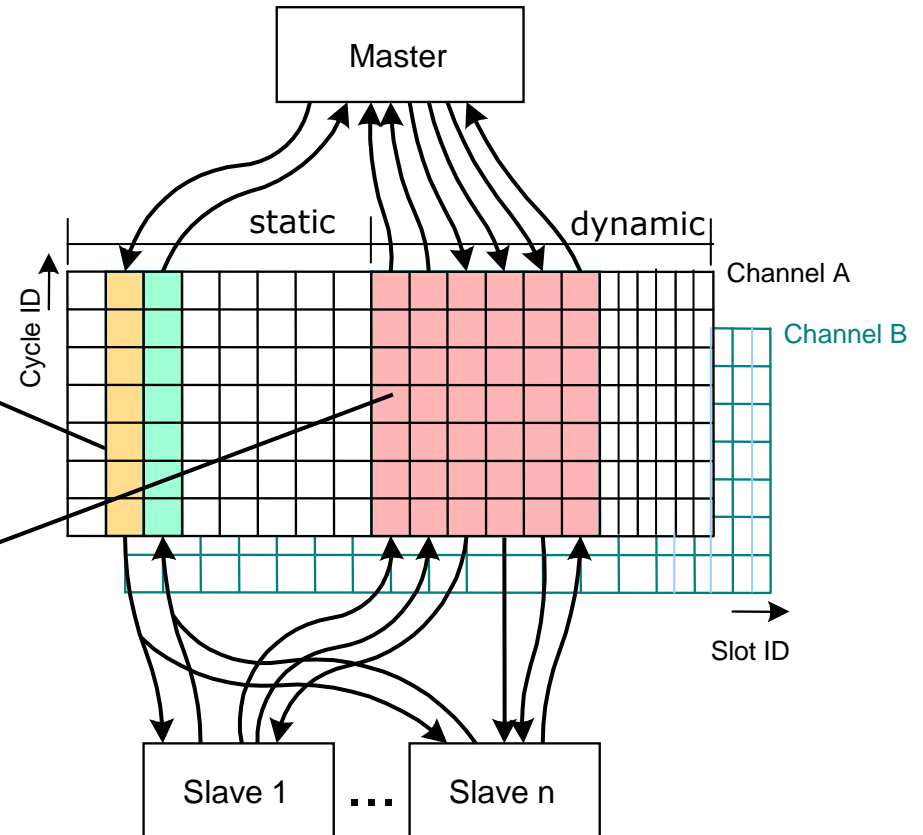
- ❑ Static Part
 - ❑ only XCP_PRE_CONFIGURED
 - Exclusive L-PDUs for each Slave
 - Not reconfigurable
 - Unique assignment Master-Slave, no slot-multiplexing

- ❑ Dynamic Part
 - ❑ XCP_PRE_CONFIGURED
 - Pre-configured L-PDUs
 - Exclusive or per Slot-Multiplexing
 - ❑ XCP_RUNTIME_CONFIGURED
 - Run-time configurable L-PDUs
 - Initialization by the Master

XCP

XCP on FlexRay - Example

- ❑ Arbitration by the XCP-Master via mutually used CMD and RES channels in order to avoid collisions
- ❑ Measured values are transmitted via L-PDUs dynamically assigned at run-time



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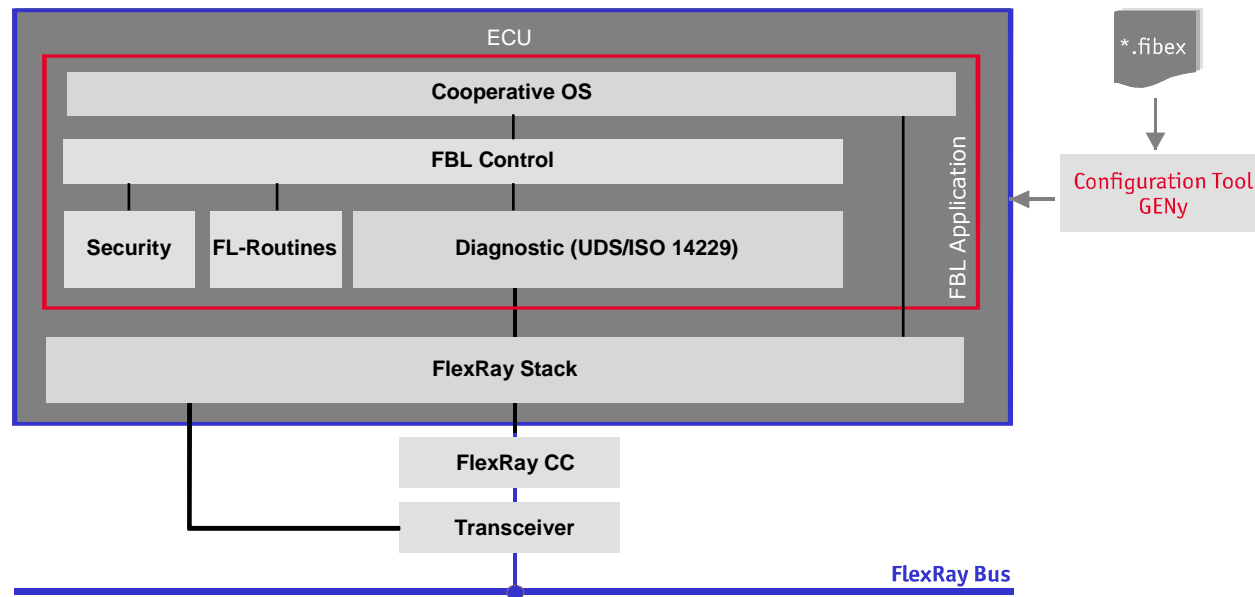
> **Flashbootloader FlexRay**

Flashbootloader FlexRay

Architecture

FlashBootLoader Application

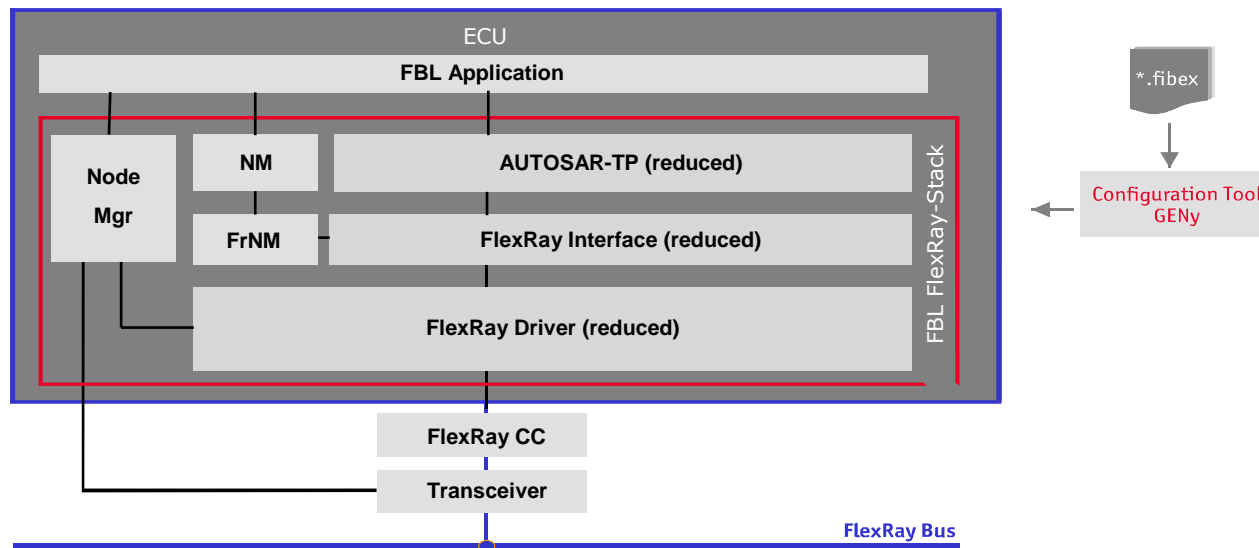
- ❑ Diagnostic (UDS/ISO 14229)
- ❑ FlashBootLoader Control
- ❑ Security
- ❑ Flash Routines



Flashbootloader FlexRay

Architecture

- ❑ Optimized FlexRay-Stack
 - ❑ AUTOSAR FlexRay Driver (reduced)
 - ❑ AUTOSAR FlexRay Interface (reduced)
 - ❑ AUTOSAR TP (reduced, single configuration)
 - ❑ Network Management (optional)
 - ❑ Node Manager for start-up



Flashbootloader FlexRay

Example

- ❑ Data throughput depends on
 - ❑ FlexRay Schedule
 - ❑ Same schedule as for regular communication
 - ❑ Different schedule, specifically tailored for flashing
 - ❑ TP-Configuration
 - ❑ How many PDUs are assigned to the TP-channel
 - ❑ What size are these PDUs



Thank you for your attention.

For detailed information about Vector
and our products please have a look at:
www.vector-informatik.com

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