

Performance of AUTOSAR Basic Software modules in a chassis ECU

- 1st AUTOSAR Open Conference & 8th AUTOSAR Premium Member Conference -

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by
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&
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Content

- I. Introduction
- II. Architecture and Tooling Architecture
- III. Performance Expected
- IV. Performance Parameters of BSW
- V. Overall Performance compared to non AUTOSAR System

Introduction – Project Overview

◆ Project Purpose

- ◆ Feasibility of AUTOSAR basic S/W in terms of performance and resource usage in vehicle test.
- ◆ Application S/W development independent of Basic S/W and basic S/W development independent of H/W

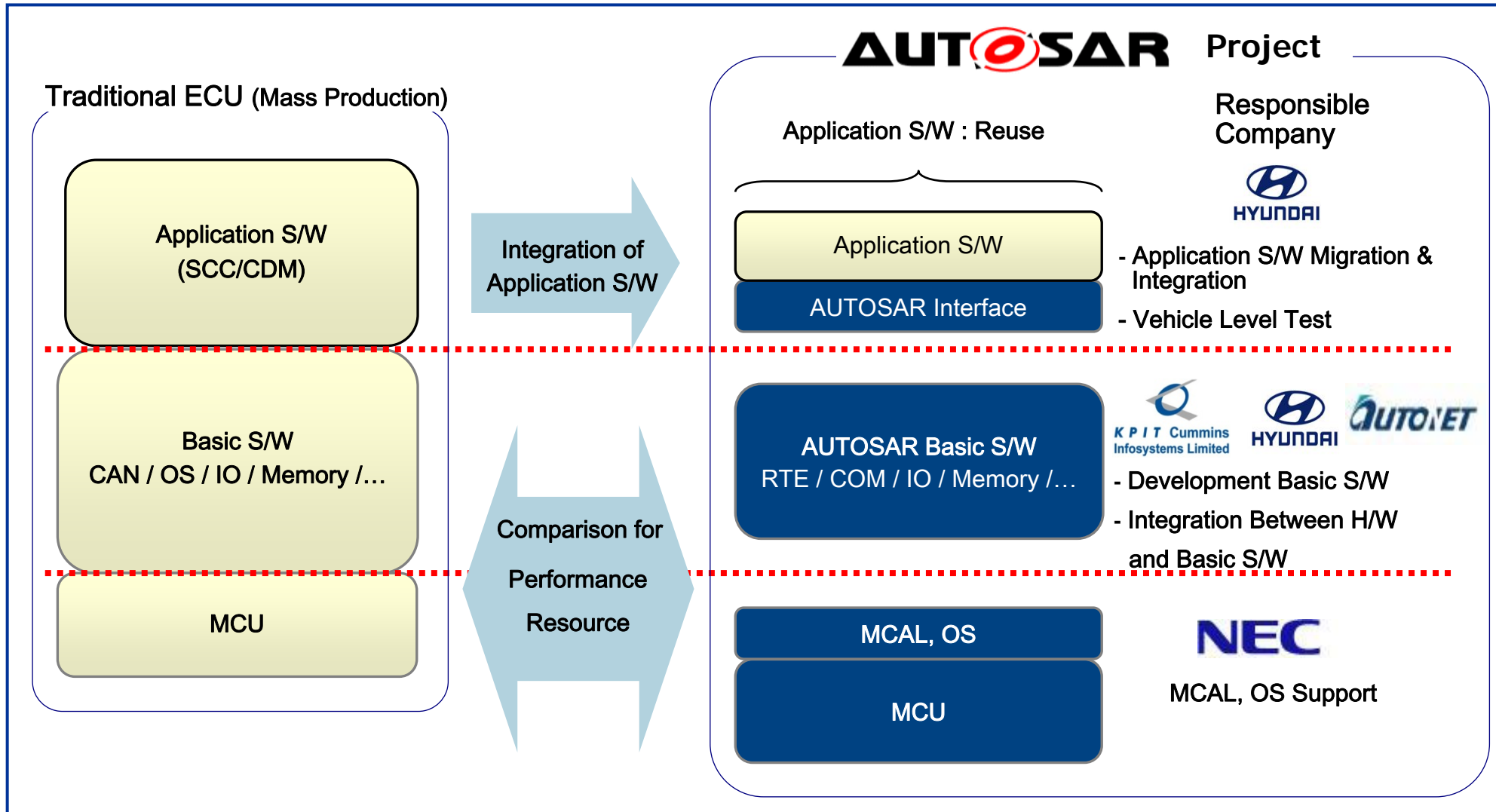
◆ Participants

- ◆ Hyundai Motor Company, Hyundai Autonet Co., Ltd.
- ◆ KPIT Cummins
- ◆ NECEL

◆ Target Application

- ◆ Smart Cruise Control (SCC)
- ◆ Collision Damage Mitigation (CDM)

Introduction – Project Scope

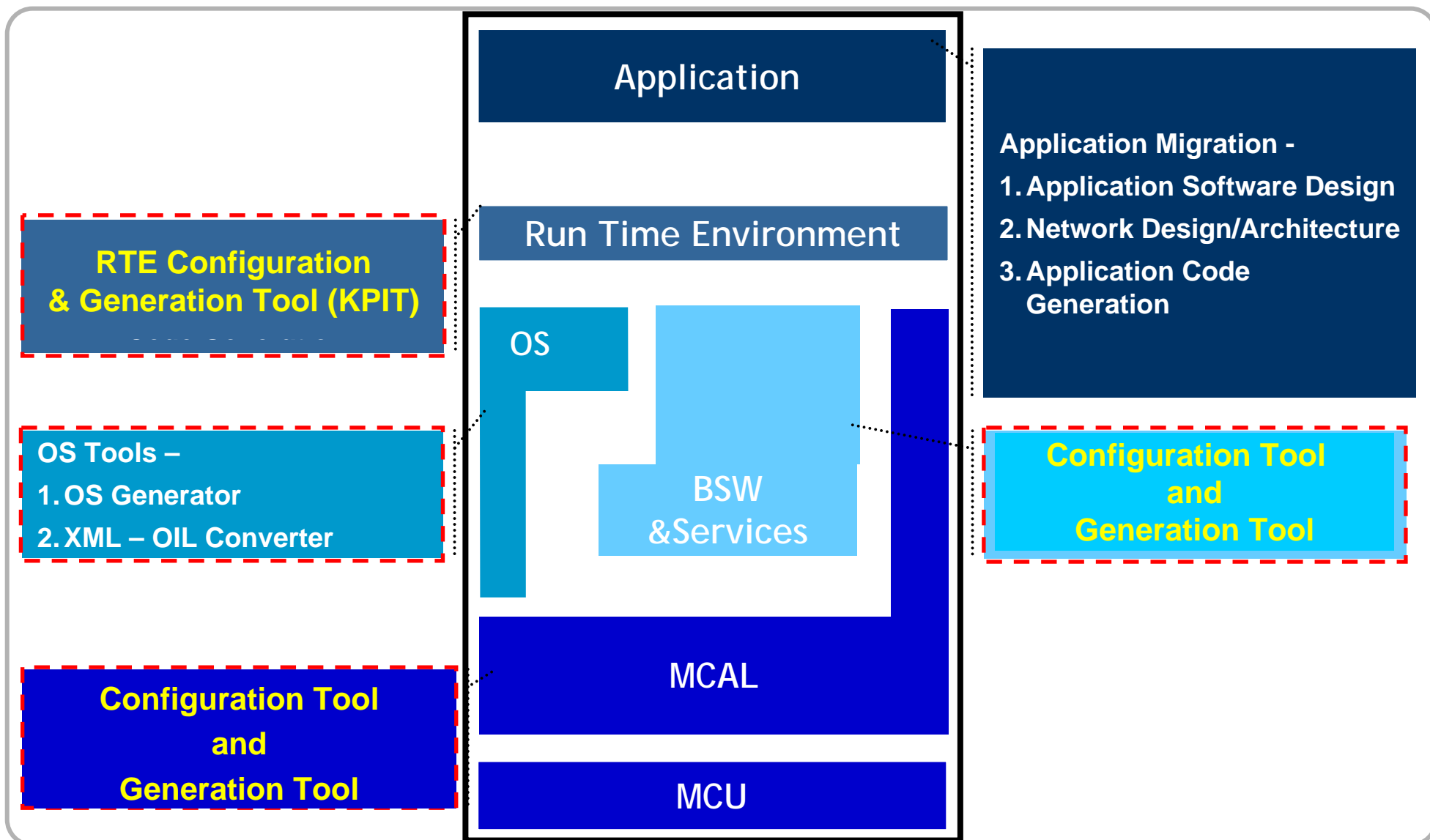




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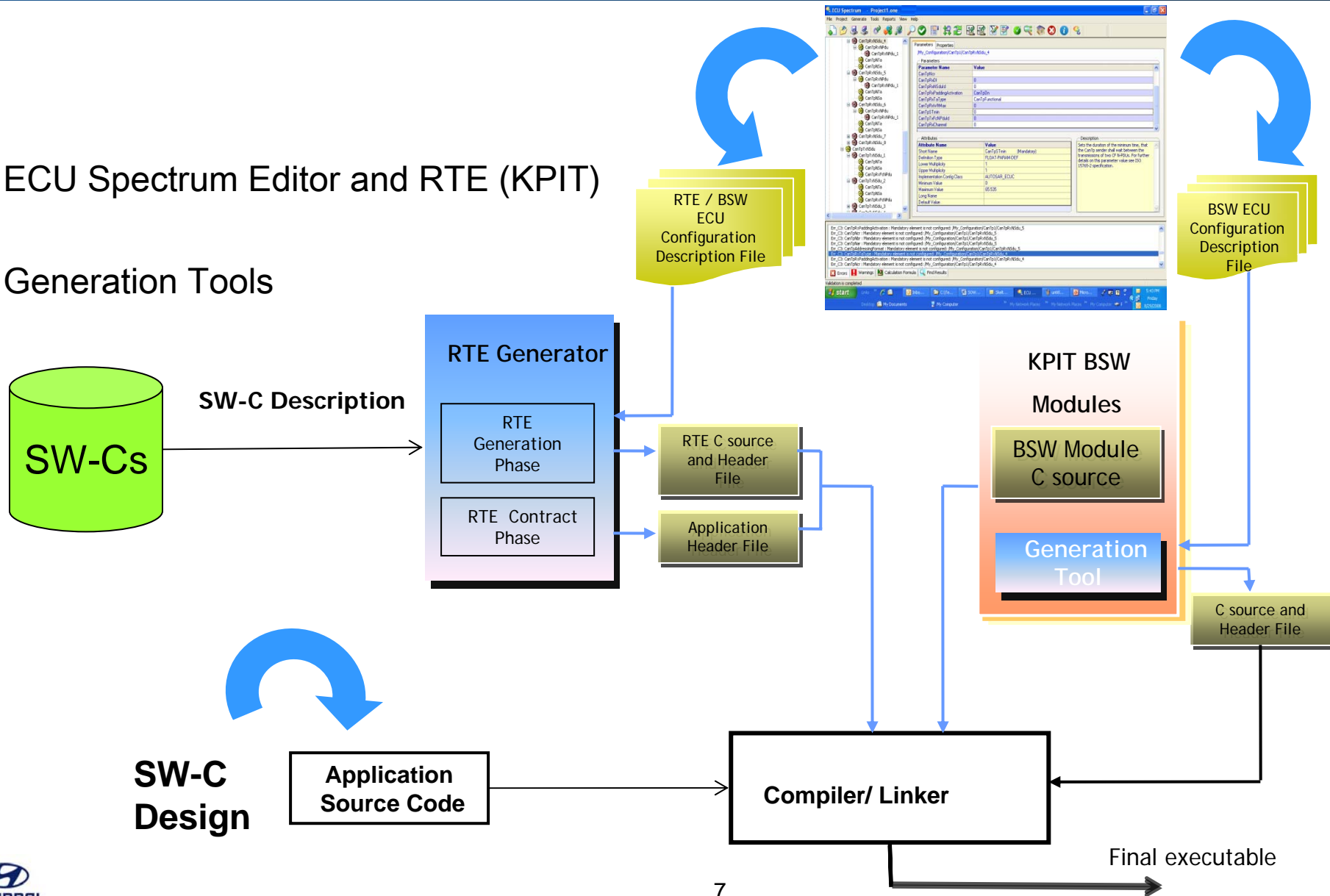
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Architecture



Tooling Architecture

- ◇ ECU Spectrum Editor and RTE (KPIT)
- ◇ Generation Tools





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Performance Expected

◇ Targeted Performance (HMC)

- ◇ All vehicle test cases in the proving ground must be satisfied.

◇ Targeted Performance

- ◇ Throughput efficiency must meet the existing application timing requirements
- ◇ Code memory shall be within 45% increase for AUTOSAR solution



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Performance Parameters of BSW

◆ Parameters Critical for SCC/CDM

- ◆ Throughput Efficiency
- ◆ Memory Consumption

◆ Configuration parameters used for the communication stack

- ◆ Processor Used: NEC V850 ES/FJ3 with 48 MHz Clock

Configuration Parameters	No. of Signal/IPDUs
CanIfNumOfCanRxPduls	23
CanIfNumOfTxPduls	40
ComIPduGroup Configuration(Tx)	4
ComIPduGroup Configuration(Rx)	4
ComIPdu Configuration(Tx)	40
ComIPdu Configuration(Rx)	23
ComSignal Configuration(Tx)	311
ComSignal Configuration(Rx)	193
ComSignalGroup Configuration (Tx)	40
ComSignalGroup Configuration (Rx)	23

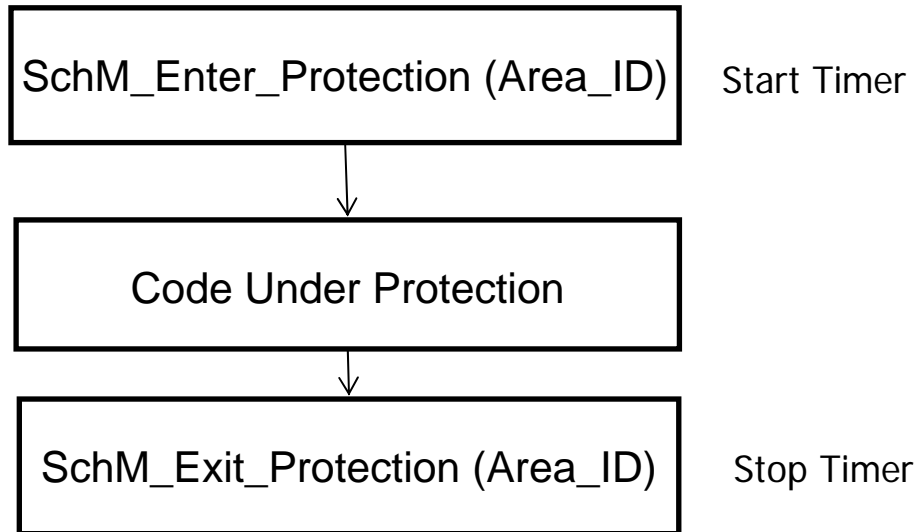
Performance Parameters of BSW

- ◆ Throughput Efficiency for Communication Stack
 - ◆ Maximum Interrupt Suppression Time
 - ◆ Send Message Time
 - ◆ Receive Message Time
 - ◆ Interrupt Process Time

Performance Parameters of BSW

◆ Maximum Interrupt Suppression Time

- ◆ To measure the maximum interrupt suppression time, when interrupt is suppressed by Com, PduR and CanIf, Can modules.



◆ Result

- ◆ Maximum Interrupt Suppression Time
 - ◆ SCC/CDM Configuration- 56 micro seconds

Performance Parameters of BSW

◆ Send Message Time

- ◆ To measure the time that a CAN signal takes to pass through the communication stack (Com, PduR, CanIf, Can).

◆ Evaluation Description

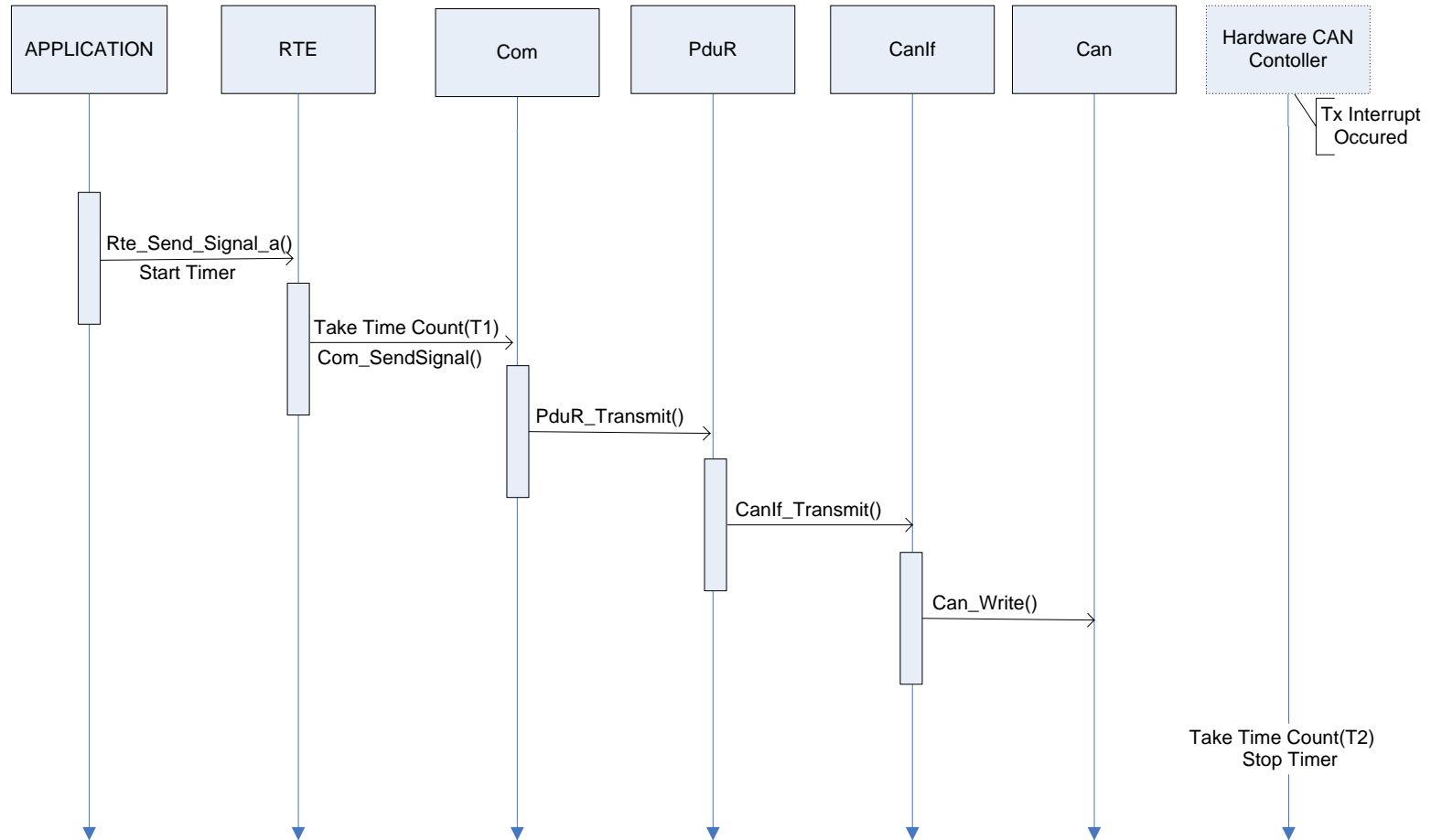
- ◆ Application (RTE) provides the data for transmission.
- ◆ While the transmission of the data is completed and transmit interrupt exits.
- ◆ The transmit time is calculated as transmission time multiplied by the timer scale.

◆ Result

- ◆ Send Message Time within Communication stack
 - ◆ SCC/CDM Configuration - 271 micro seconds

Performance Parameters of BSW

SEND MESSAGE TIME



Performance Parameters of BSW

◆ Receive Message Time

- ◆ To measure the time that a CAN receive indication takes to pass through the communication stack (Com, PduR, CanIf, Can).

◆ Evaluation Description

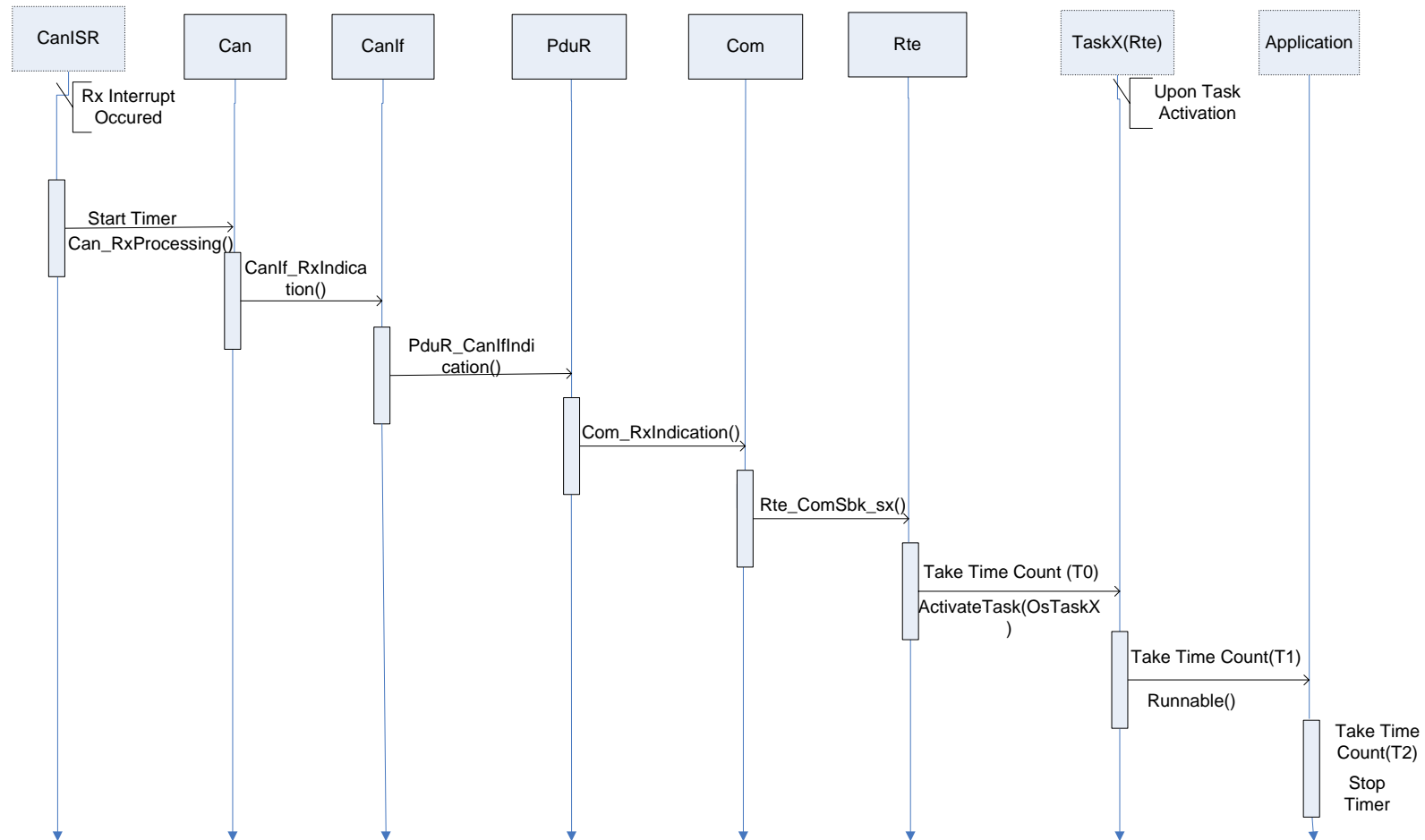
- ◆ When CAN frame is received, the interrupt is invoked and timer is started.
- ◆ While the reception of data is completed, the timer value is read.
- ◆ The reception time is calculated as timer value multiplied by the timer scale.

◆ Result

- ◆ Receive Processing Time within Com Stack
 - ◆ SCC/CDM Configuration - 64 micro seconds

Performance Parameters of BSW

◆ RECEIVE MESSAGE TIME



Performance Parameters of BSW

◆ Interrupt Process Time

- ◆ To measure the time duration of interrupt process.

◆ Evaluation Description

- ◆ When CAN frame is received, Rx Indication interrupt function is invoked and timer started.
- ◆ Before returning from this interrupt function, timer value is measured.
- ◆ Receive Interrupt Processing Time is calculated as timer value multiplied by timer scale.

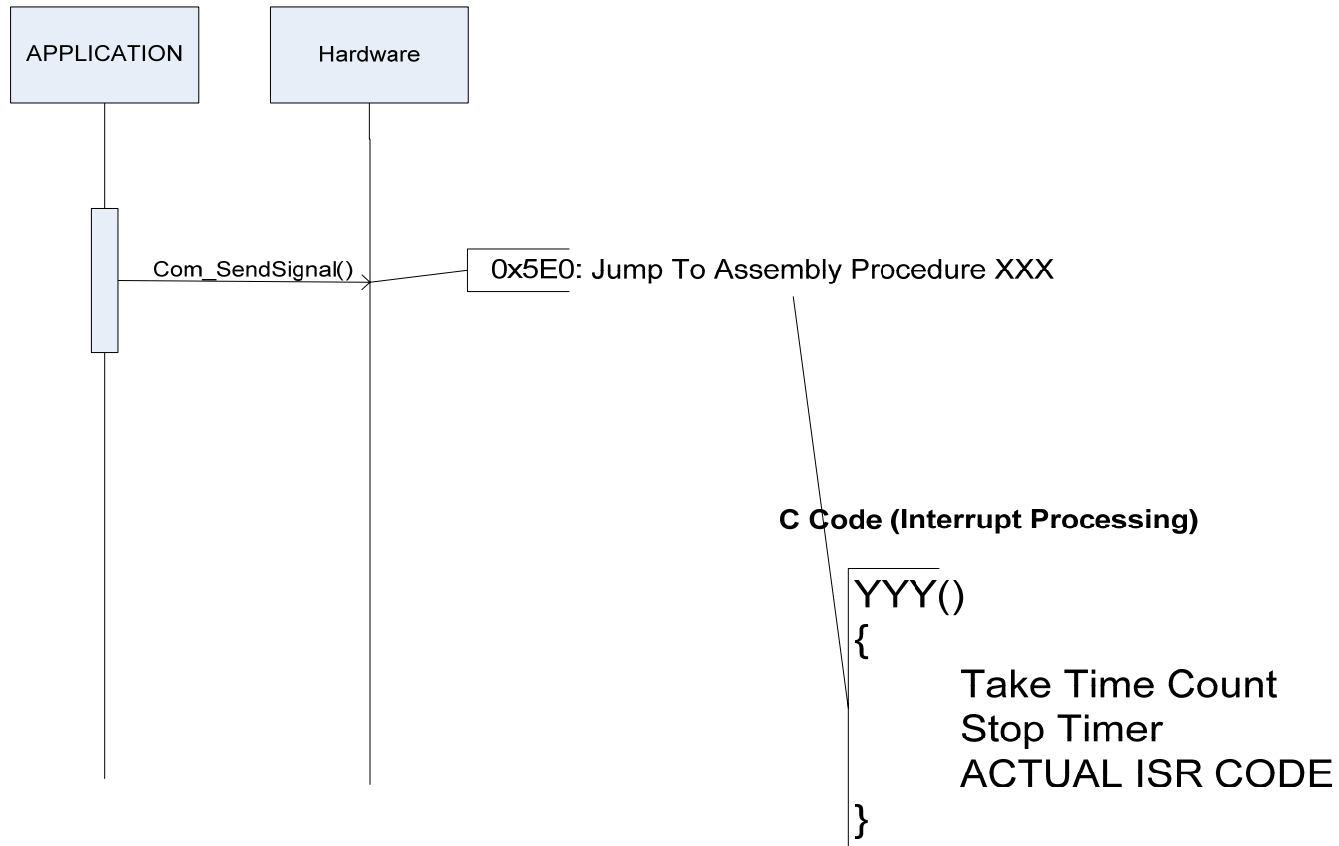
The same procedure is used for Interrupt Process Time for Send

◆ Result

- ◆ CAN Interrupt Process Time for Send/Receive - micro seconds
 - ◆ SCC/CDM Configuration - 8/ 24 micro seconds

Performance Parameters of BSW

◆ INTERRUPT PROCESS TIME



Performance Parameters of BSW

◆ Other Components Configured

- ◆ Memory stack comprising of NvM, MemIf, Fee, Micro specific flash library
- ◆ Watchdog stack comprising of WdgM, WdgIf and Wdg
- ◆ IOHWAbs module configured for the application
- ◆ Diagnostic modules comprising of Dcm, Dem, CanTp
- ◆ MCU and IO modules comprising of Mcu, Gpt, Adc, Pwm, Dio, Port



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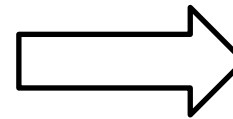
Performance Achieved in HMC

◆ Throughput Efficiency - Meets the application requirements

◆ Memory Consumption

◆ Application ROM Size : Increased about 40%

◆ BSW ROM Size : Increased about 80%



Total increase in code size : 66%

◆ Despite of increased memory, SCC/CDM system was tested in a car and passed all test cases. However, still there are possibilities for optimization.

	Non-AUTOSAR		AUTOSAR	
	ROM	RAM	ROM	RAM
Application (SCC/CDM)	41 K Bytes	4 K Bytes	57K Bytes	0.36 K Bytes
BSW (Including MCAL)	75 K Bytes	6 K Bytes	136 K Bytes	1.9 K Bytes

Thank You

