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AUTOMOTIVE
CONFERENCE 2024
Korea

Development of Vehicle Platform Controller Application Software for Hybrid Vehicles using MATLAB and Simulink

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Contents

Overview

Transition to Software Defined Vehicle

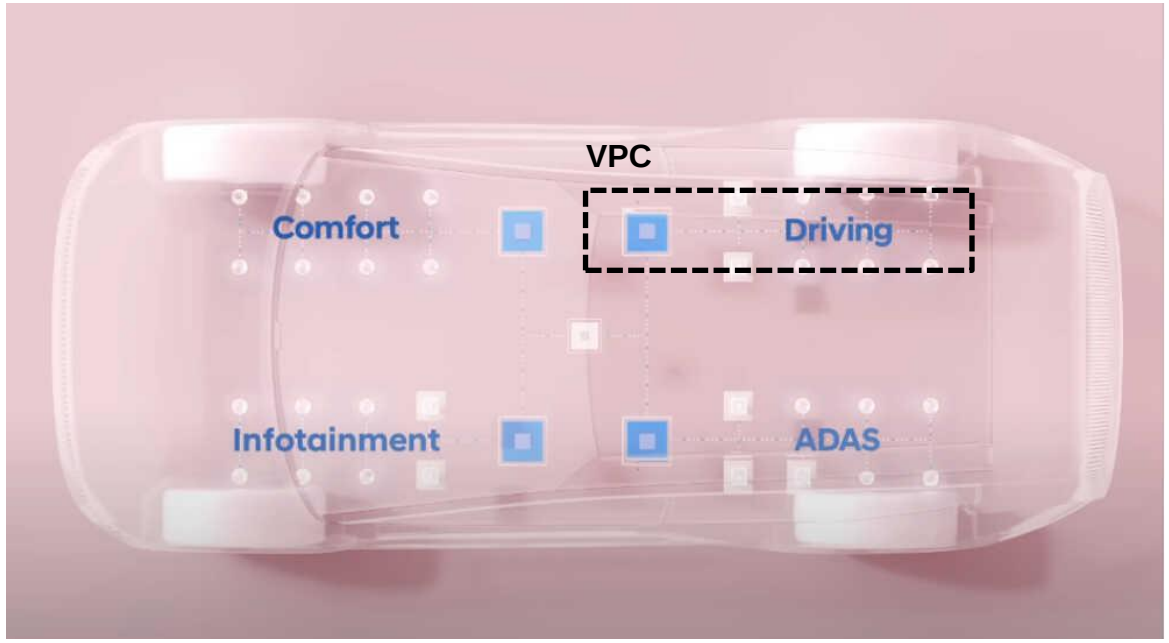
- Providing new services and continuously updating vehicle performance through OTA (Over-The-Air)
- Equipped with high-load technology utilizing the cloud
- Providing various connectivity services

https://www.hyundai.co.kr/search/searchDetail?searchContents=sdv

Overview

VPC(Vehicle Platform Controller)

- Domain Centralized Architecture
- Reduction of SW development complexity through vehicle-level function integration
- Expanding Model-Based Development



https://www.hyundai.co.kr/story/CONT0000000000094656

Overview

Major changes for VPC

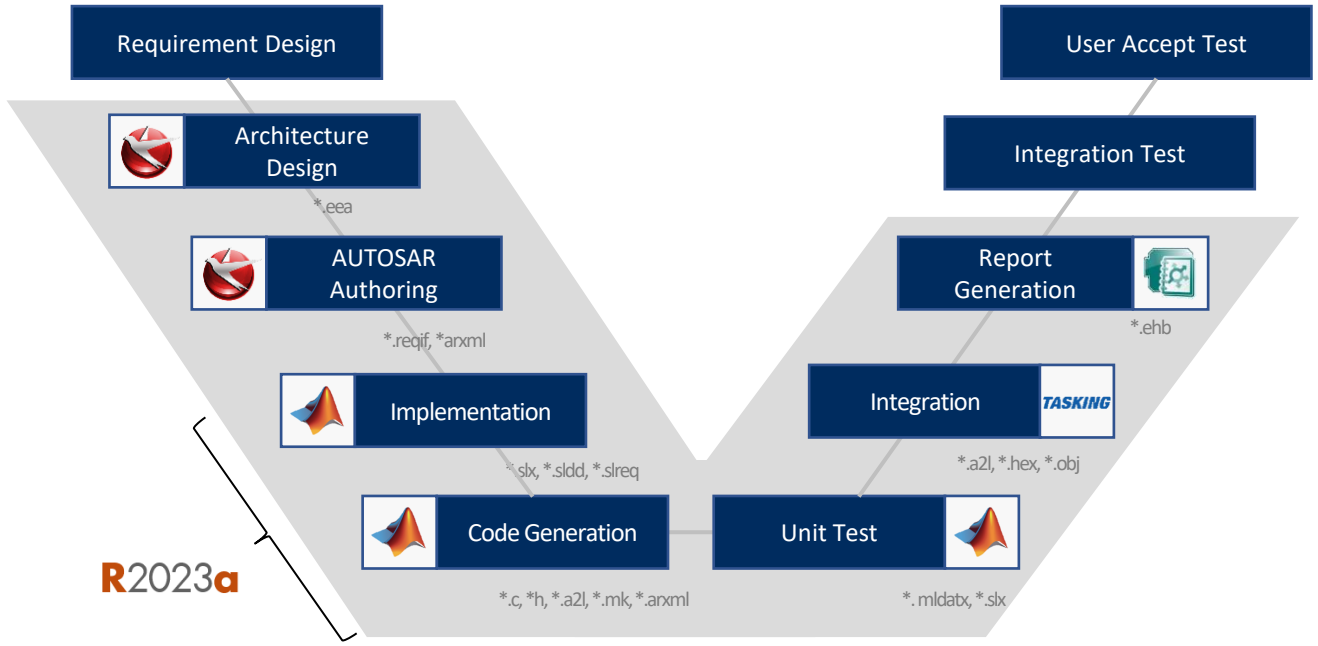
- Integration of vehicle controllers
- AUTOSAR platform
- Feature based software architecture
- VPC LINK

Overview

Major changes for VPC

- Integration of vehicle controllers
  - Using Common tool-chain
    - MATLAB R2023a
  - Converting naming convention
  - Converting block properties

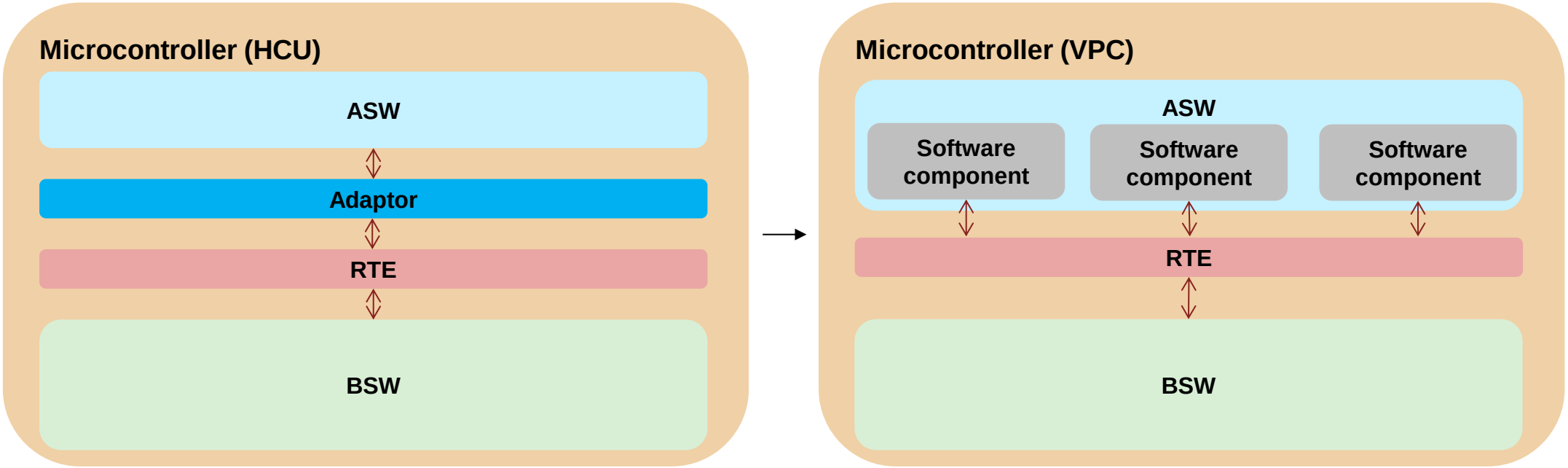
VPC Tool-chain



Overview

Major changes for VPC

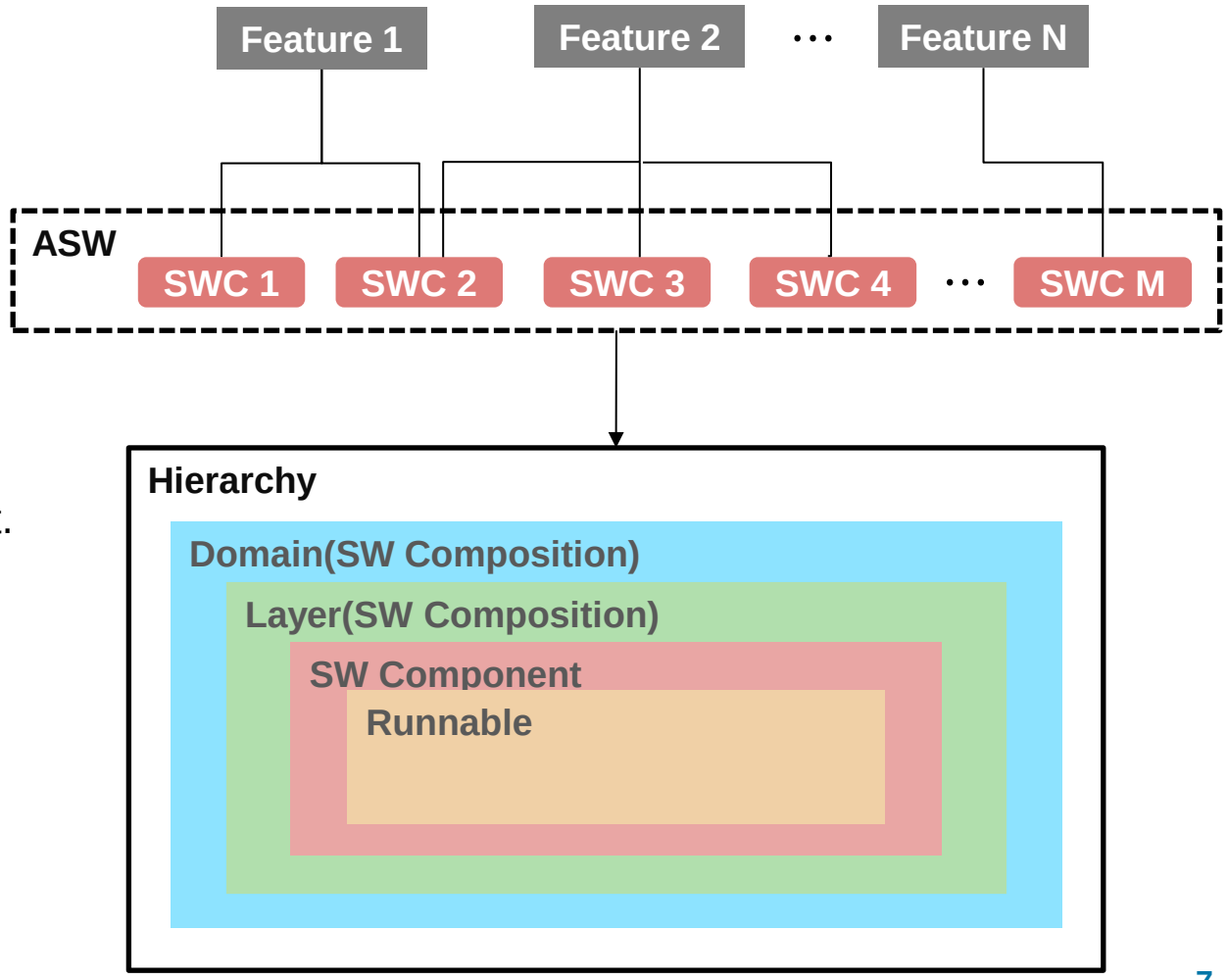
- AUTOSAR platform



Overview

Major changes for VPC

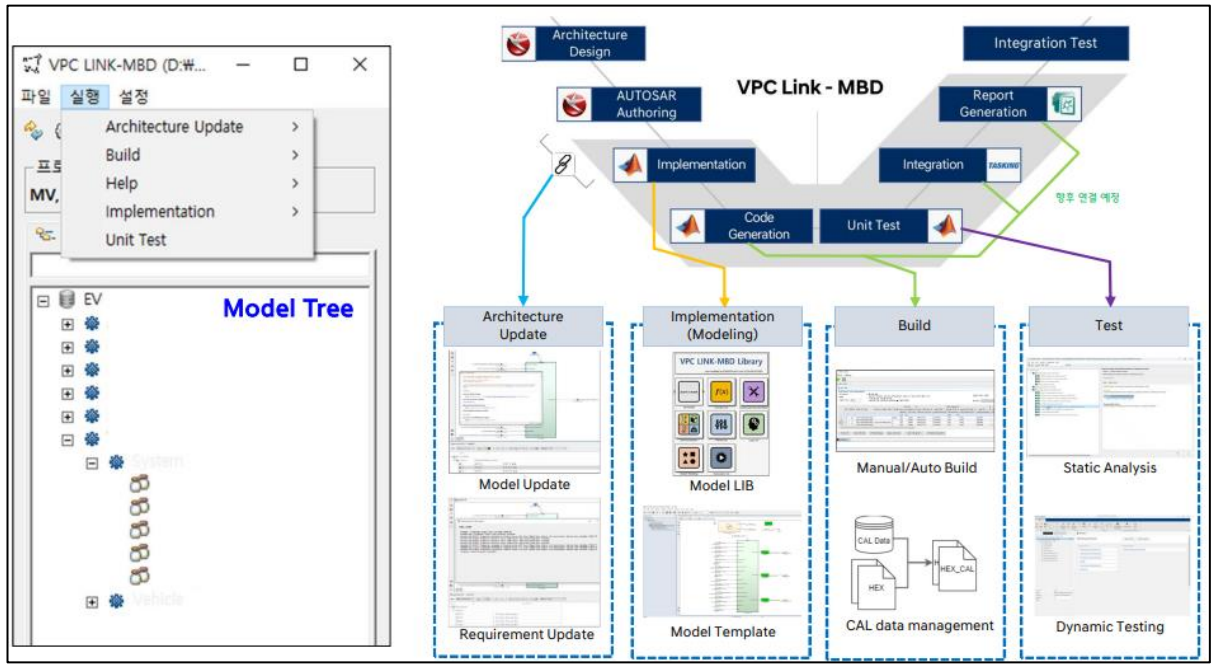
- Feature based software architecture
  - Classification of application software by feature
  - Software composition grouping
    - Domains are classified by functional purpose.
    - Domain is divided into layers as control target.



Overview

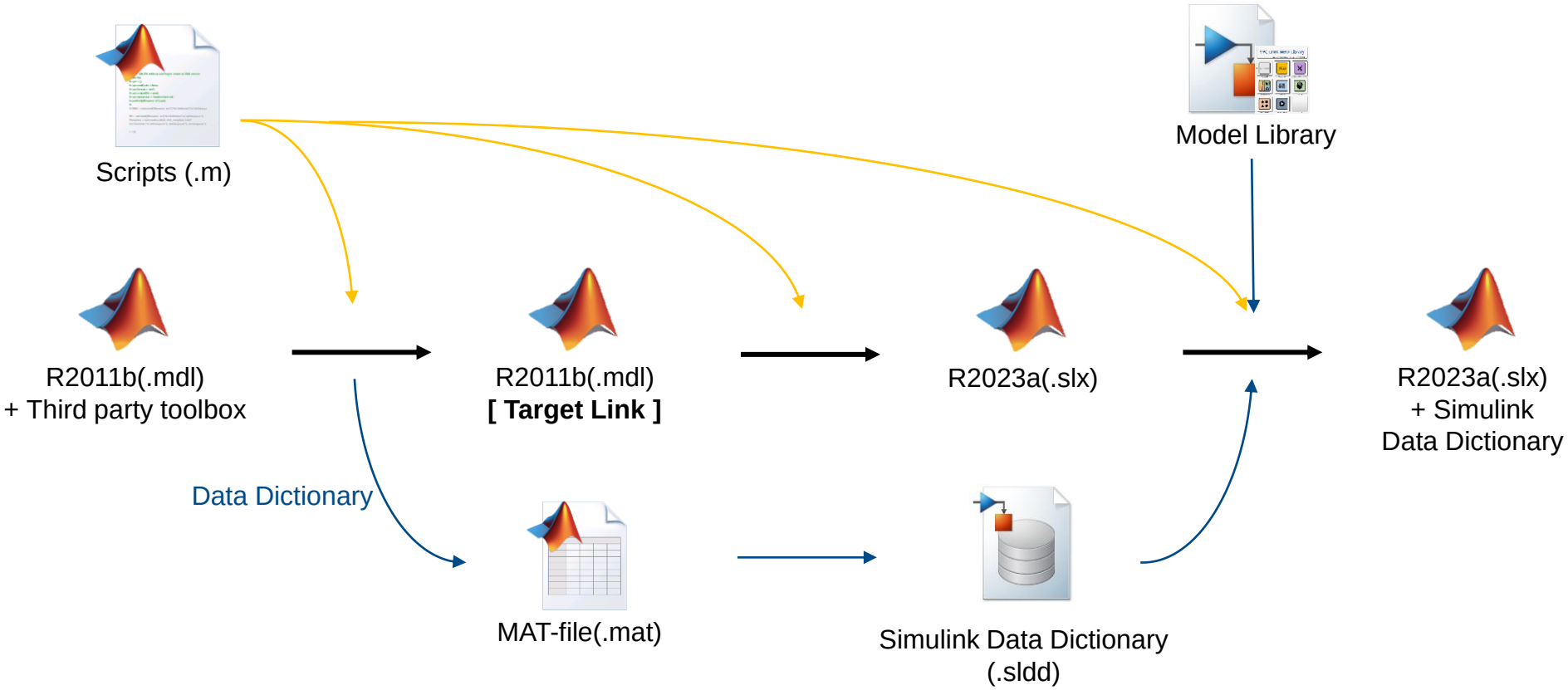
Major changes for VPC

- VPC LINK - MBD
  - Shorten SW development time
  - Seamless SW development environment
  - Functions
    - Architecture Update
    - Model Library & Template
    - Code gen. & Build
    - Test (Static & Dynamic)



Development of Application Software

Update MATLAB R2011b to R2023a

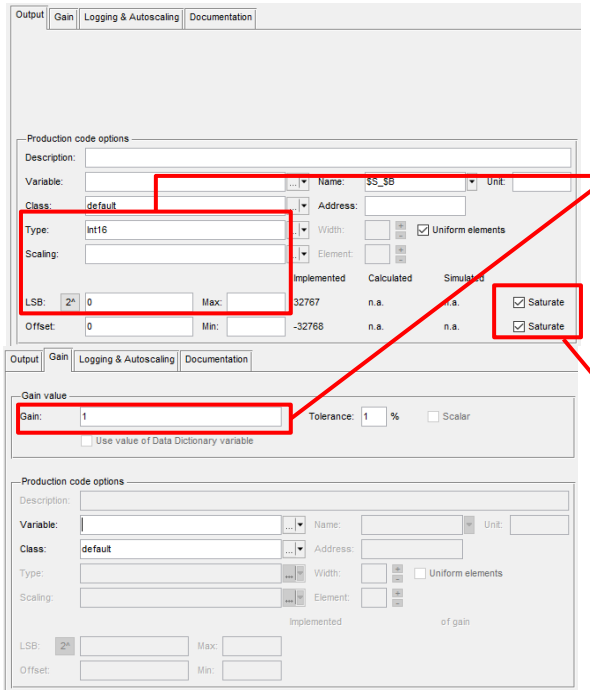


Development of Application Software

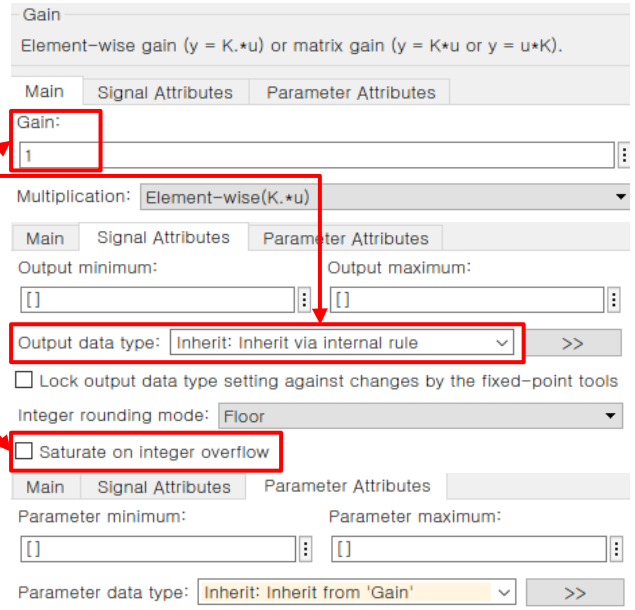
Update MATLAB R2011b to R2023a

- Change Simulink blocks

Gain block (**Target Link**)



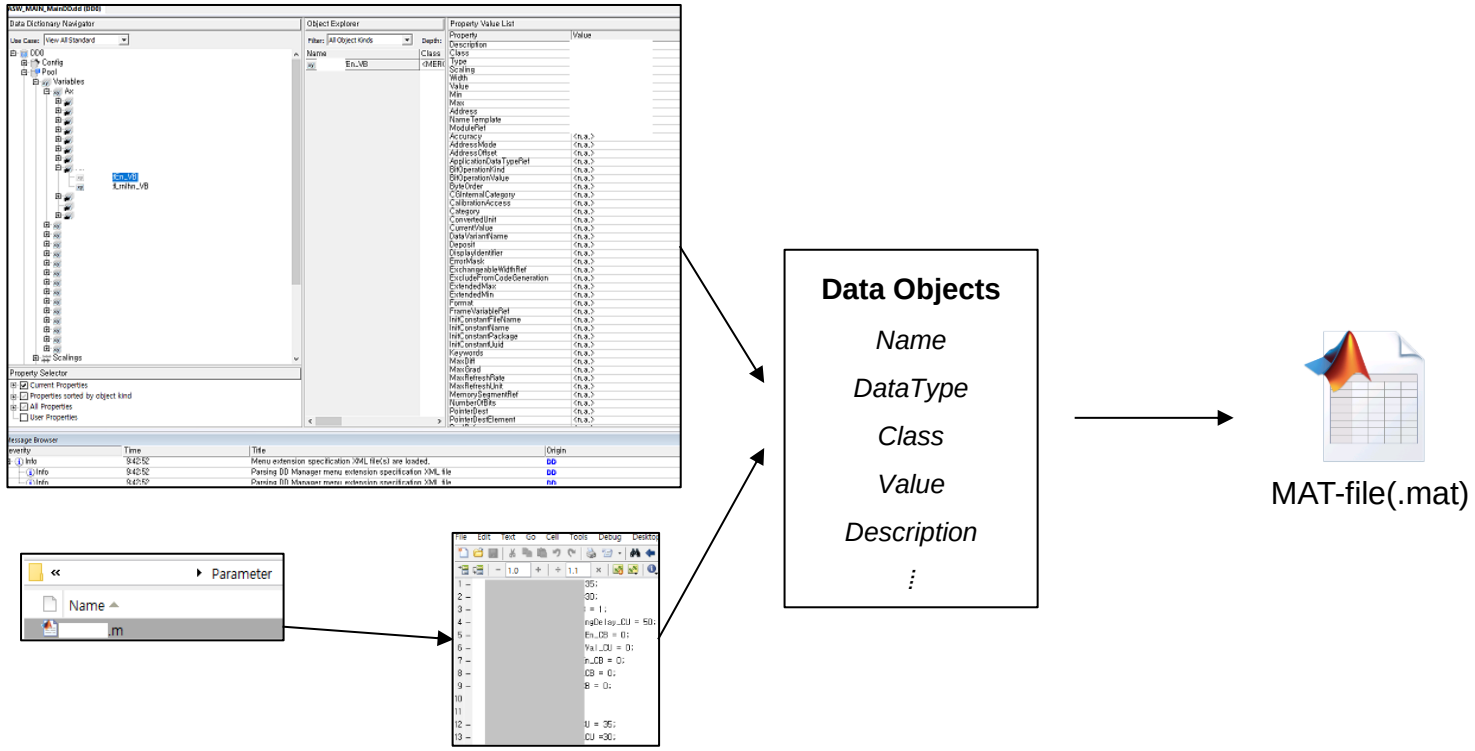
Gain block (**Embedded Coder**)



Development of Application Software

Update MATLAB R2011b to R2023a

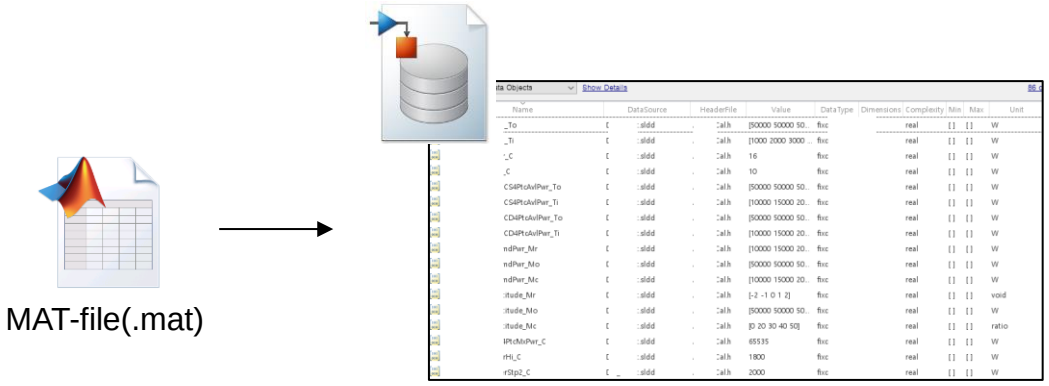
- Extract data dictionary to mat-file

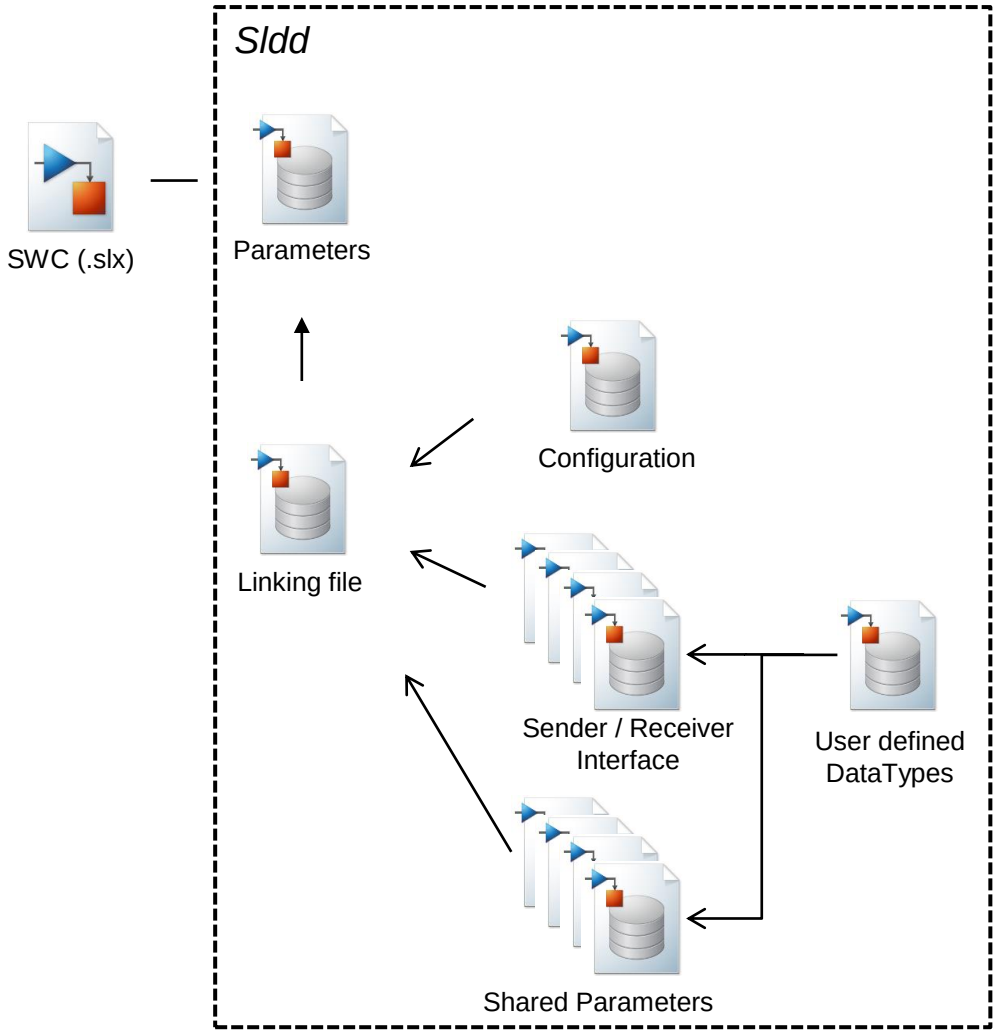


Development of Application Software

Update MATLAB R2011b to R2023a

- Create Simulink Data Dictionary

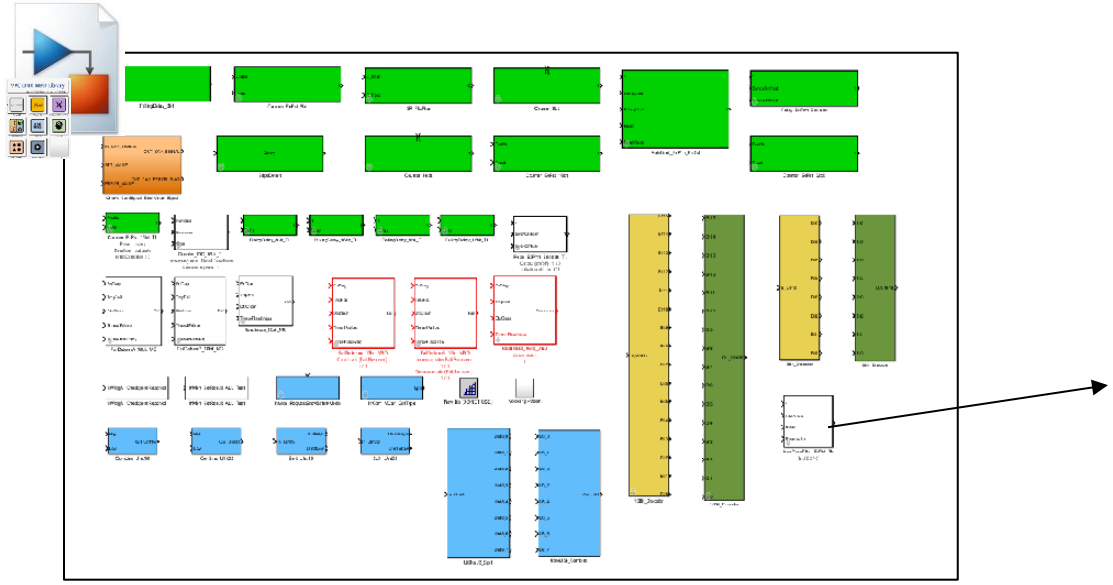


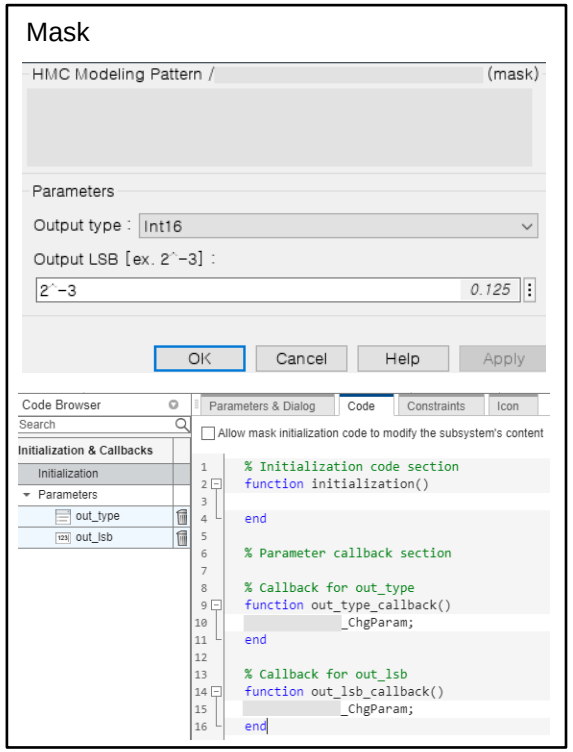


Development of Application Software

Update MATLAB R2011b to R2023a

- Apply VPC model library

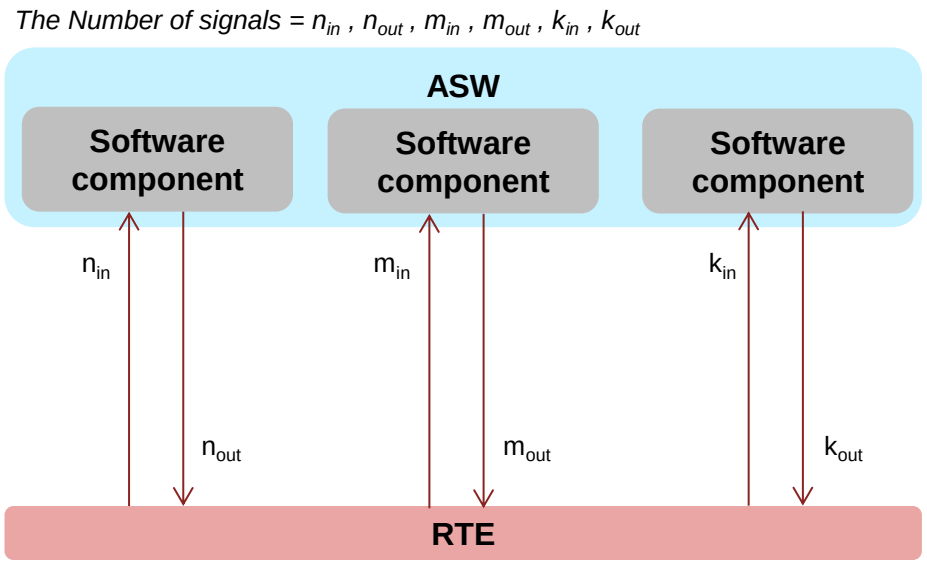




Development of Application Software

AUTOSAR Blockset

- Sender/Receiver Ports
  - The more RTE calls there are, the higher the CPU load
  - To reduce the number of RTE calls, the In/Out signals between SWCs are create as structures

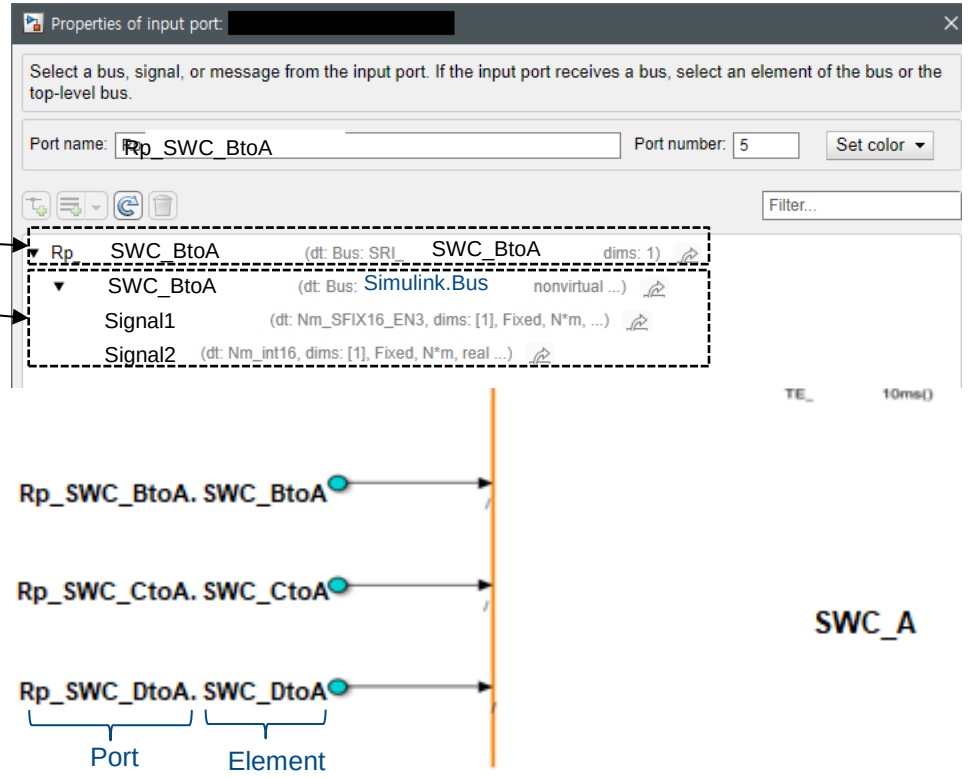


Development of Application Software

AUTOSAR Blockset

- Sender/Receiver Ports

AUTOSAR	Simulink
Sender / Receiver ports	In/Out Bus element
Port	Port Name : SWC B to A
Data Element	Name : SWC B to A (Datatype : Simulink.Bus)



Development of Application Software

AUTOSAR Blockset

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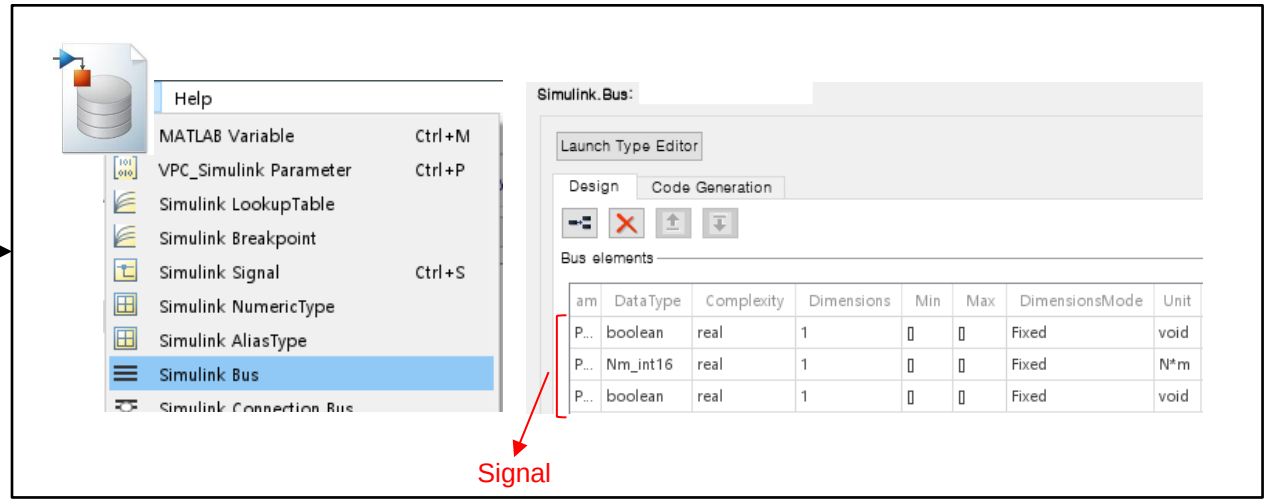
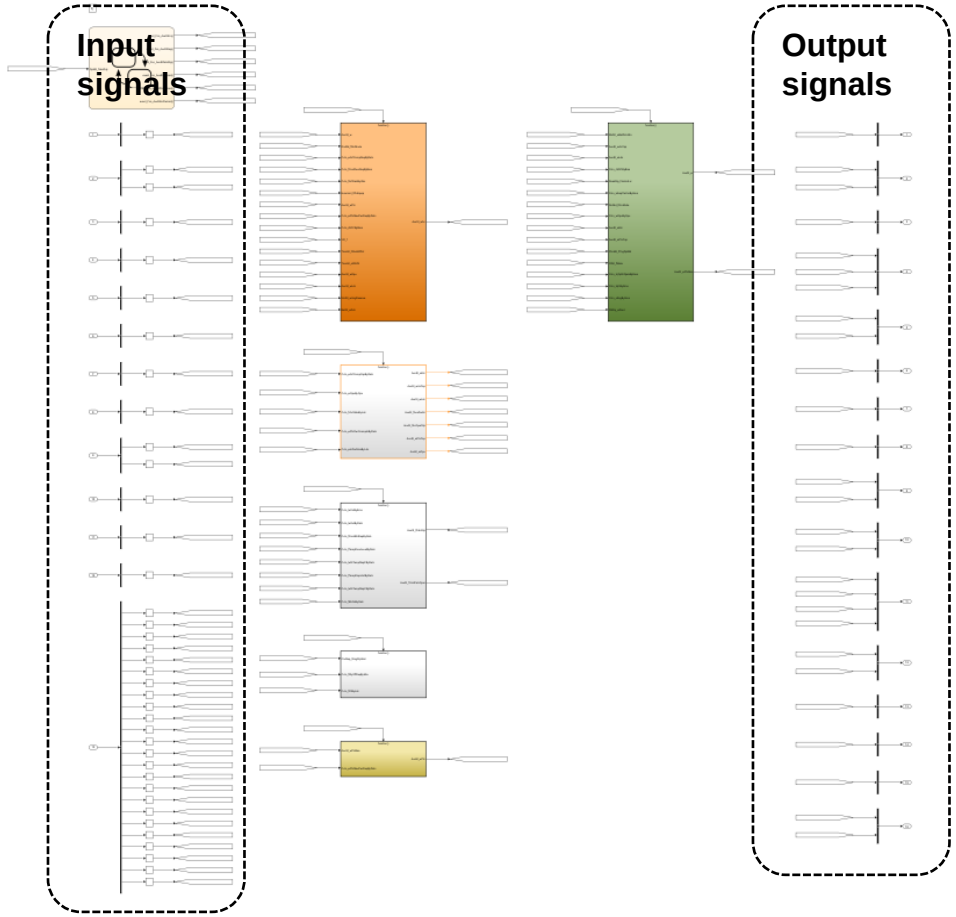


Development of Application Software

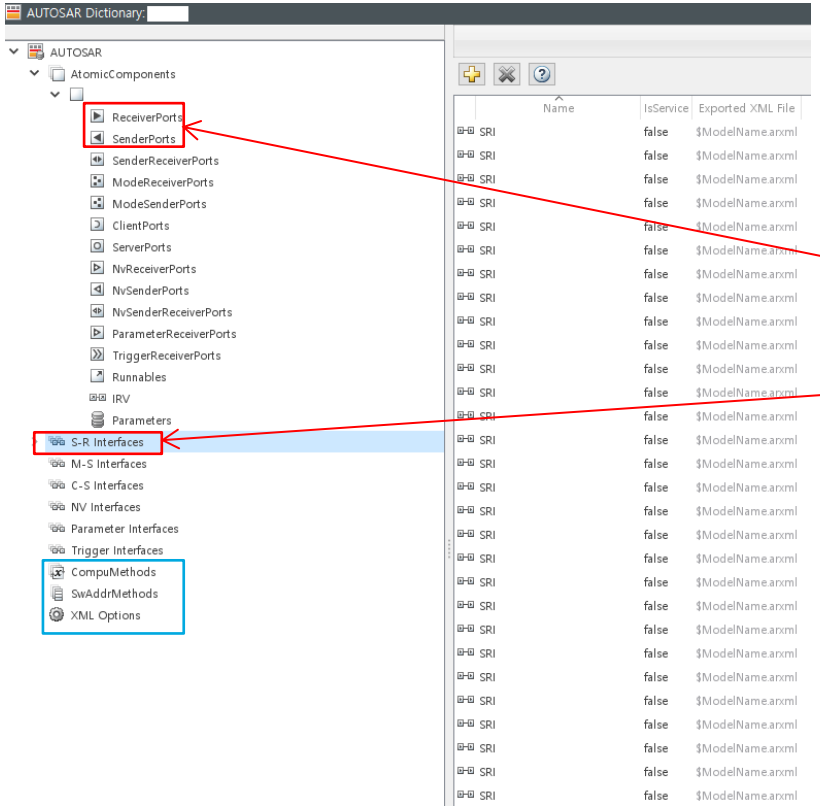
AUTOSAR Blockset

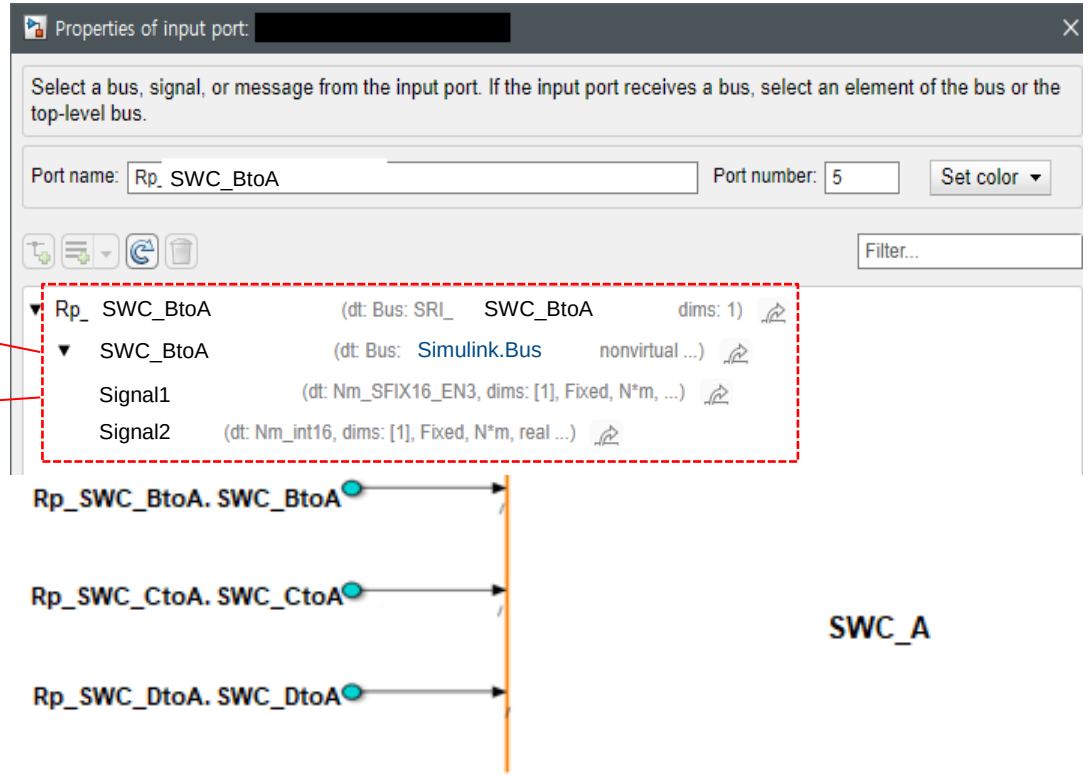


Development of Application Software

AUTOSAR Blockset

- AUTOSAR Dictionary

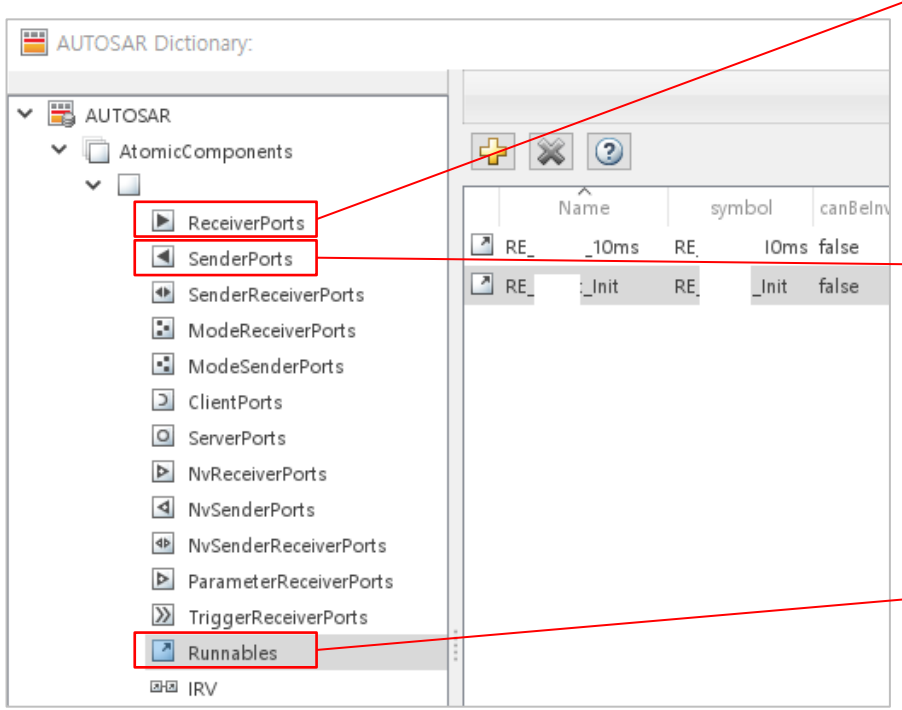


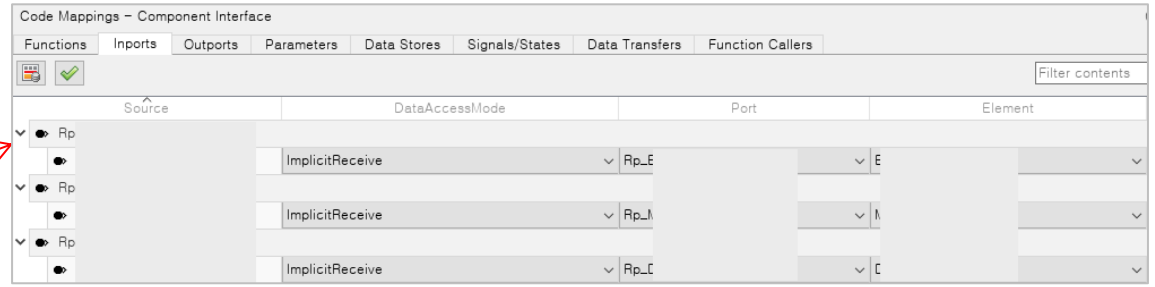


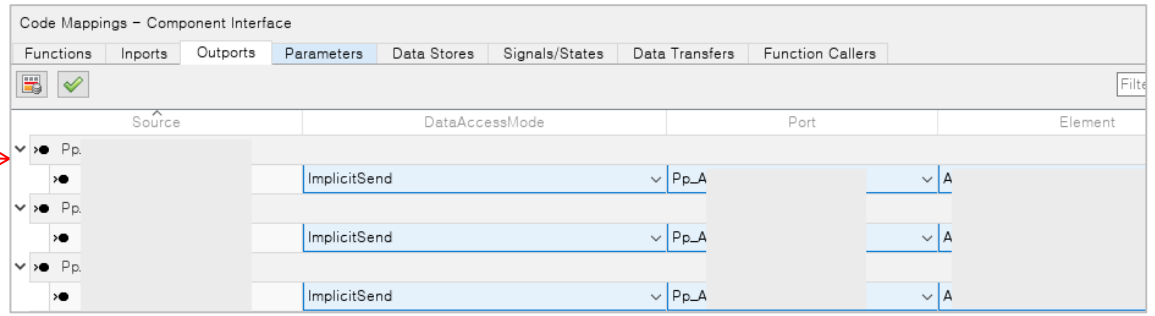
Development of Application Software

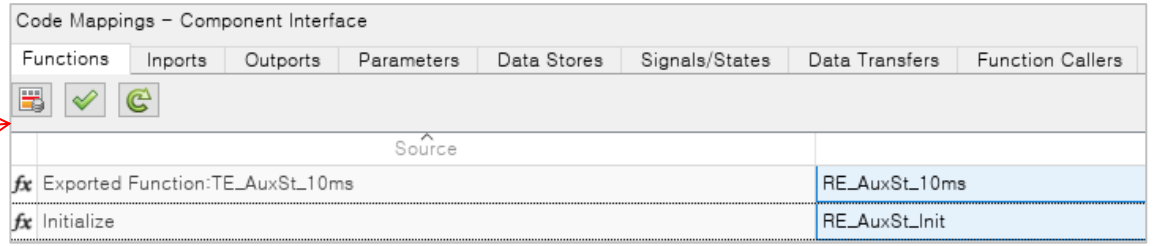
AUTOSAR Blockset

- Code Mappings





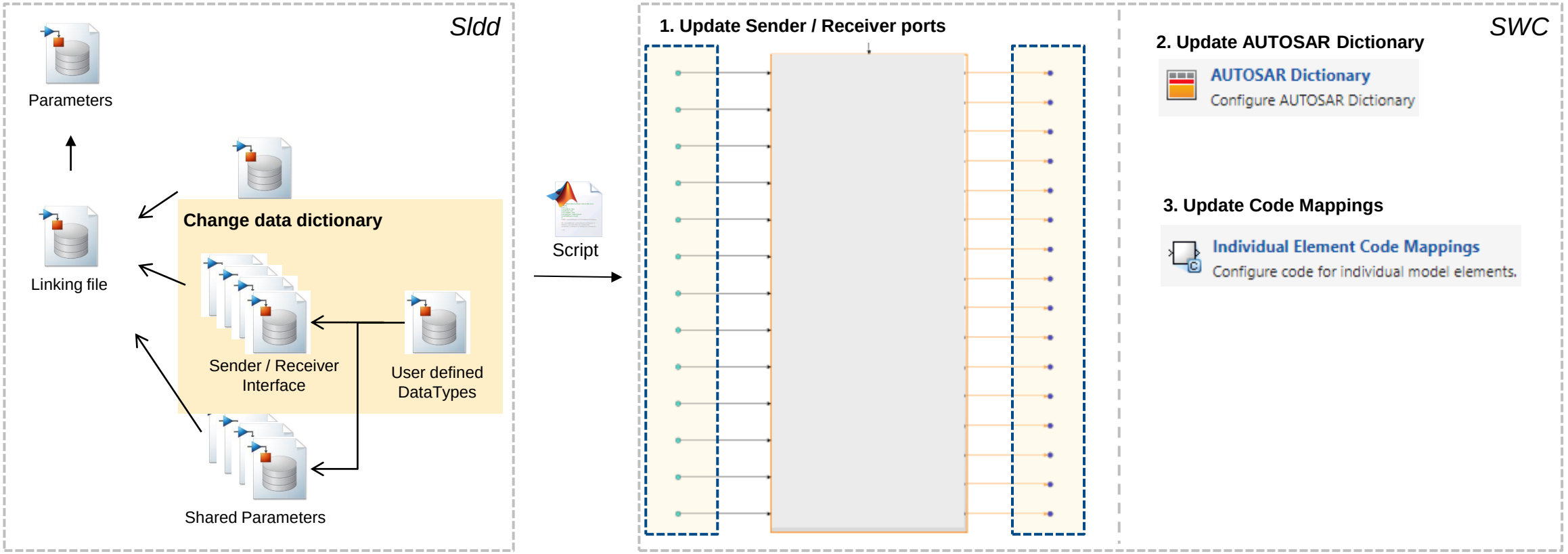




Development of Application Software

AUTOSAR Blockset

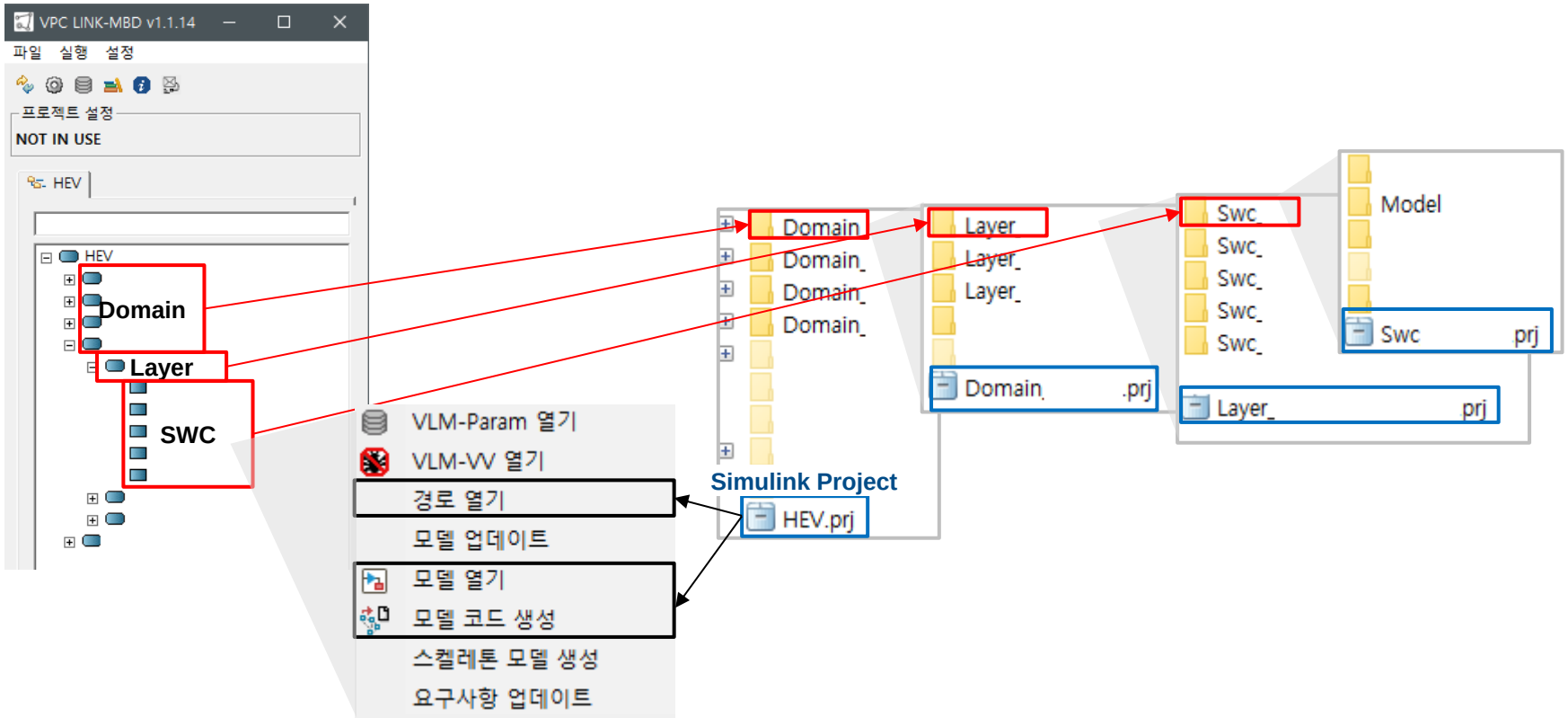
- Automation script for AUTOSAR Interface



Development of Application Software

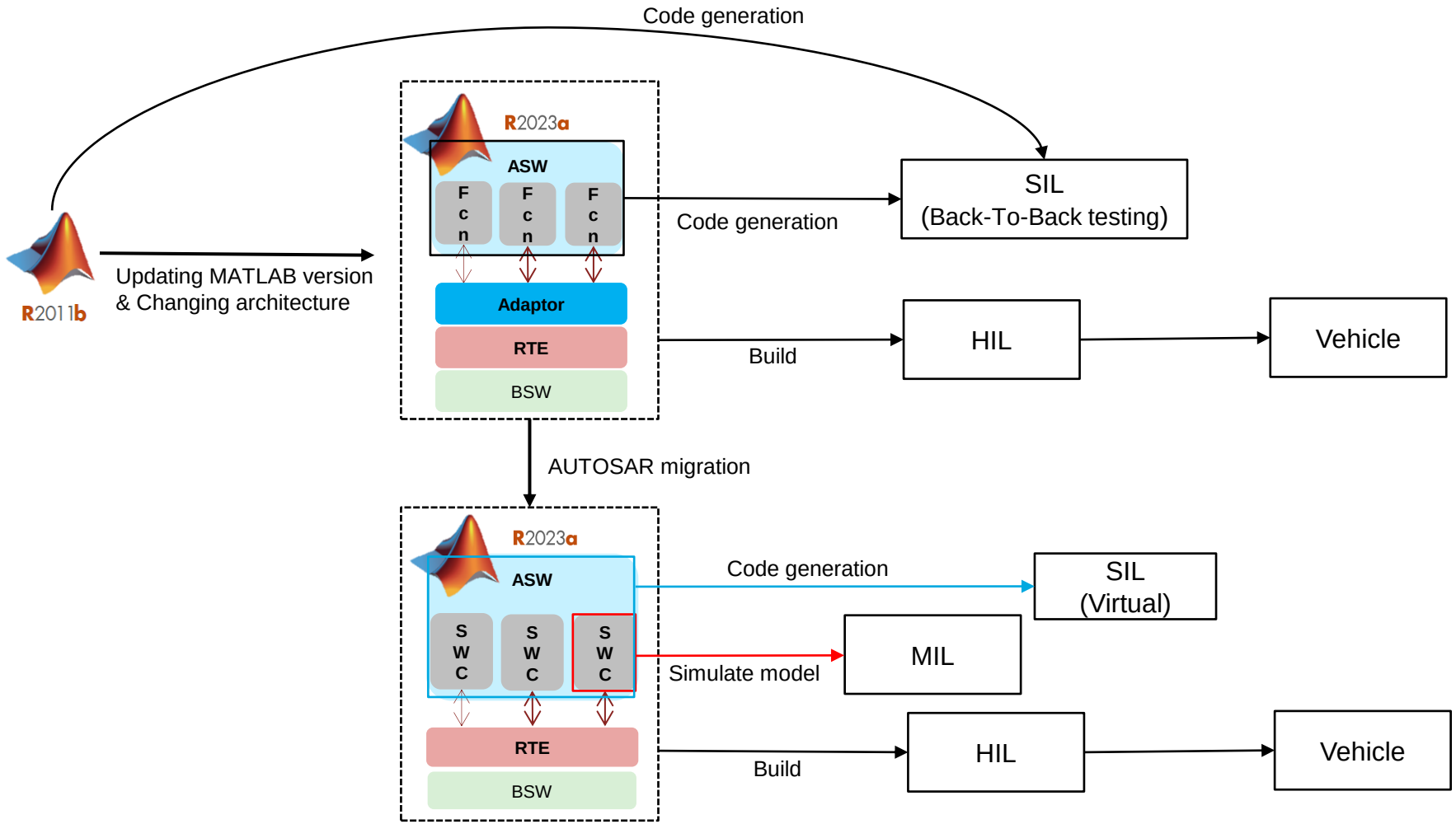
VPC LINK - MBD

- Creating a Simulink Project for linking VPC LINK



Verification of Application Software

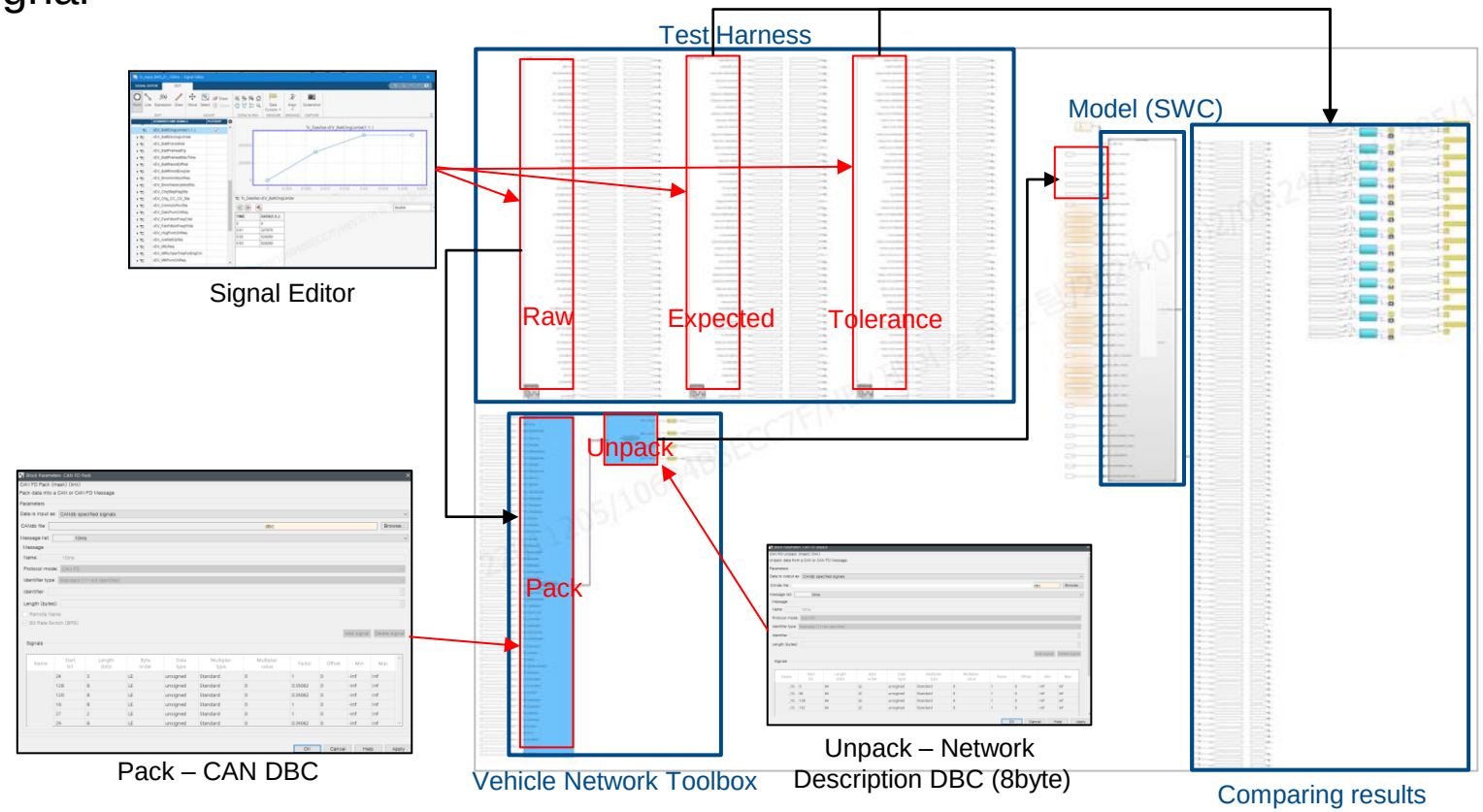
Verification Process



Verification of Application Software

Model In the Loop (MIL)

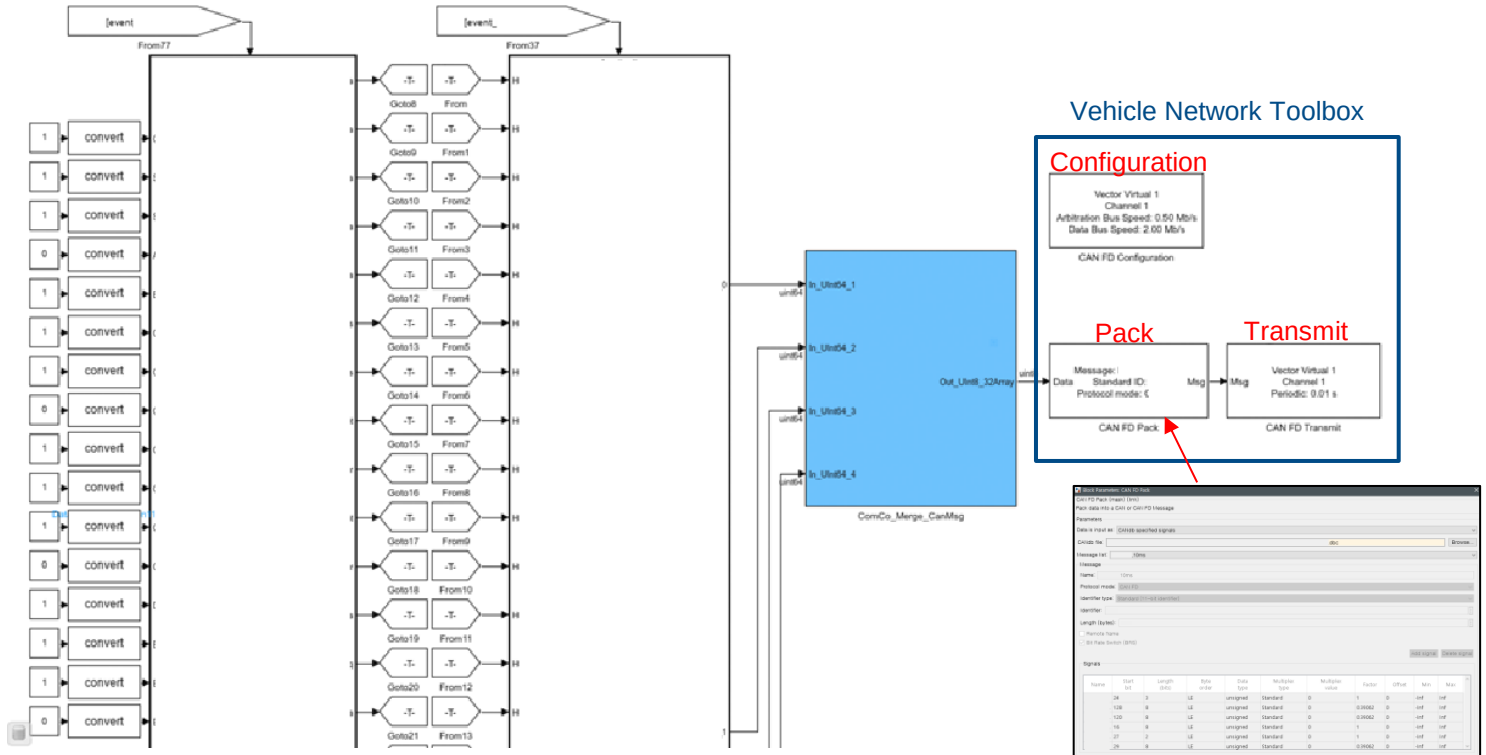
- CAN Input signal



Verification of Application Software

Model In the Loop (MIL)

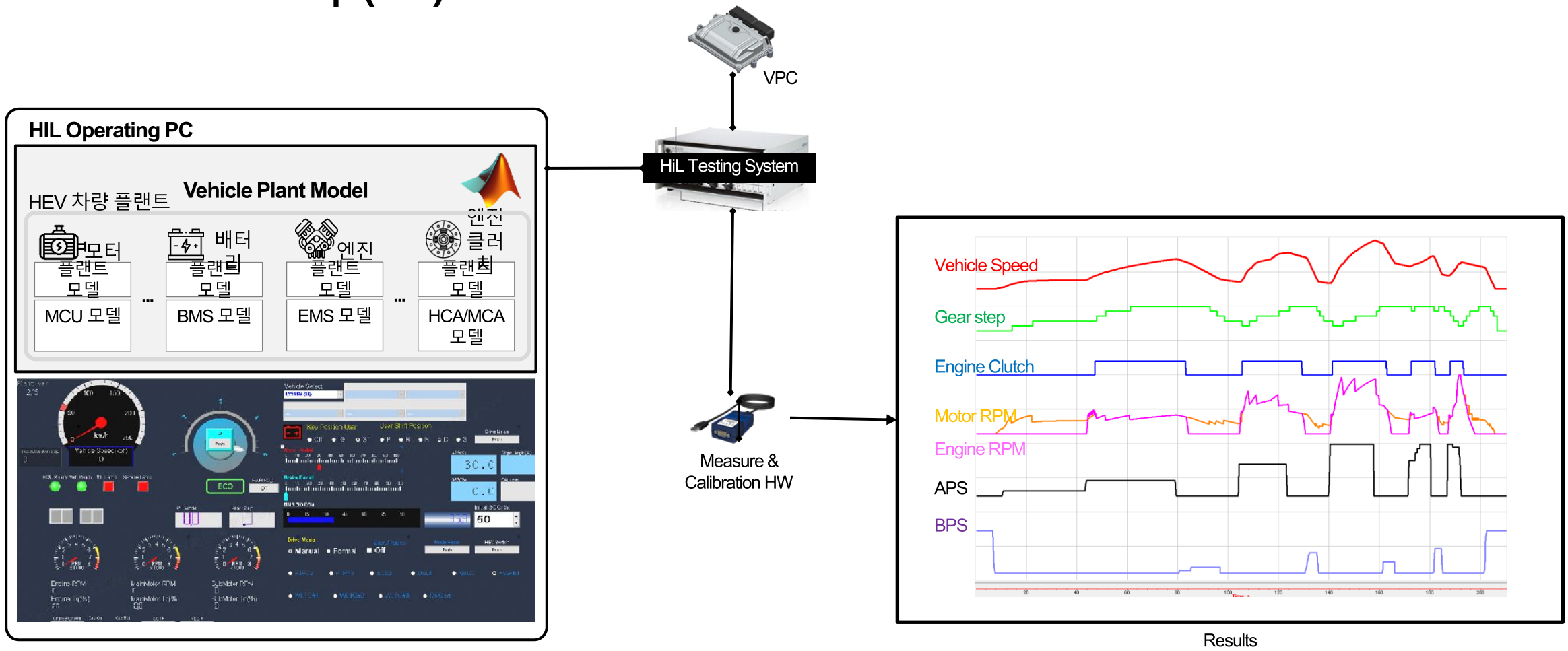
- CAN Output signal



Pack – CAN DBC

Verification of Application Software

Hardware in the Loop (HIL)



Summary & Future plans

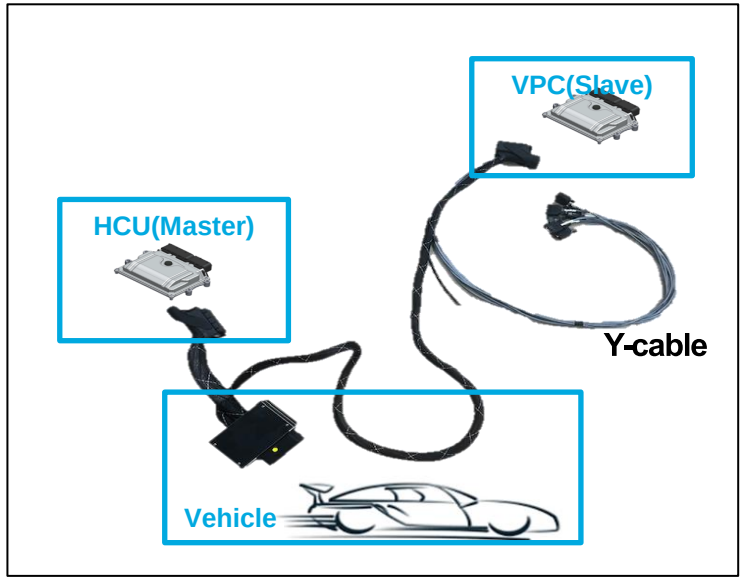
Summary

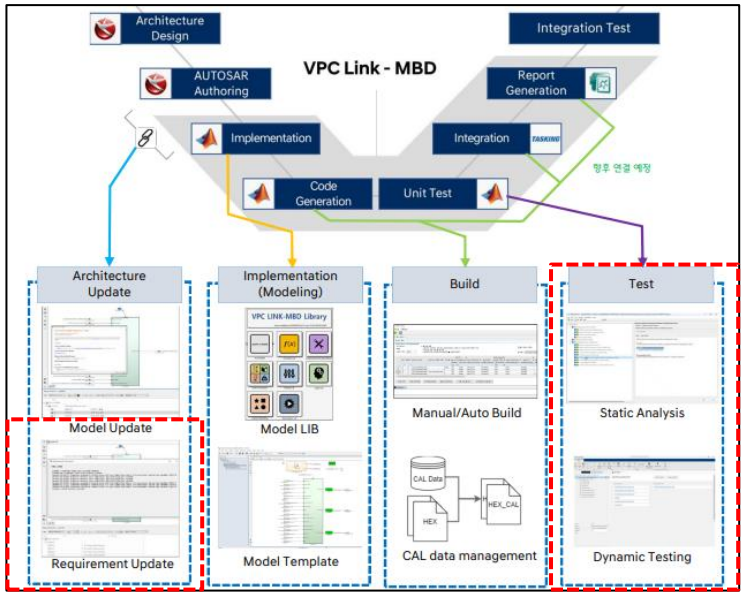
- Project goal is development of Vehicle Platform Controller(VPC)
- Updated MATLAB from 2011b to 2023a to use the tool-chain for VPC development.
- Using AUTOSAR Blockset for applying AUTOSAR platform to ASW
- Test harness and Vehicle network toolbox are used to verify CAN Interface
- Perform VPC SW verification using HILS

Summary & Future plans

Future plans

- Vehicle Test using y-cable
  - Drive the vehicle using HCU controller as the master controller
  - Use the VPC controller as a slave to perform only calculations within the controller
  - ASW verification by comparing the output of controllers connected to Master and Slave
- Applying Simulink Requirement Toolbox and Simulink Test using VPC LINK - MBD





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Thank you

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