MATLAB EXPO

양산형 Safety/자율주행 솔루션 개발을 위한 프로세스 전 단계에서의 Matlab/Simulink 활용 노하우

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MathWorks

INDEX

- ADUS?
- Project Introduction
- Development Process with Matlab Tools

  A. Design : Traceability Managemnet

  B. Implementation : Matlab/Simulink Tips

  C. Validation : System/SW Validation

  D. Production

What is ADUS?

Autonomy, Safety, Service

Technologies for Human

ADUS

Autonomous Driving for US

Who is ADUS?

Innovation in Various Industries

▼ By Expanding Autonomous
Driving Technology.

Developing Safety Solution

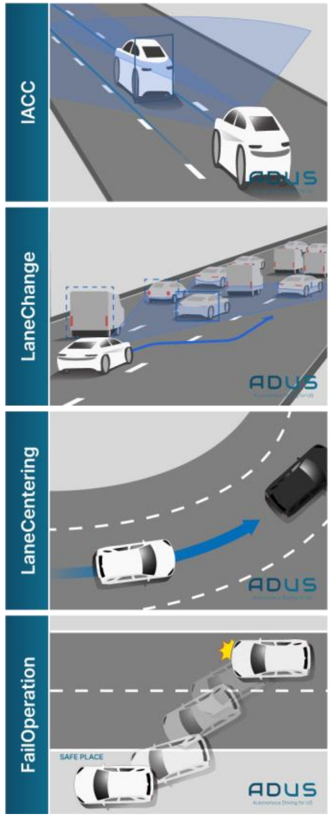
▼ To Meet the Global Standards
of Commercial Vehicles.

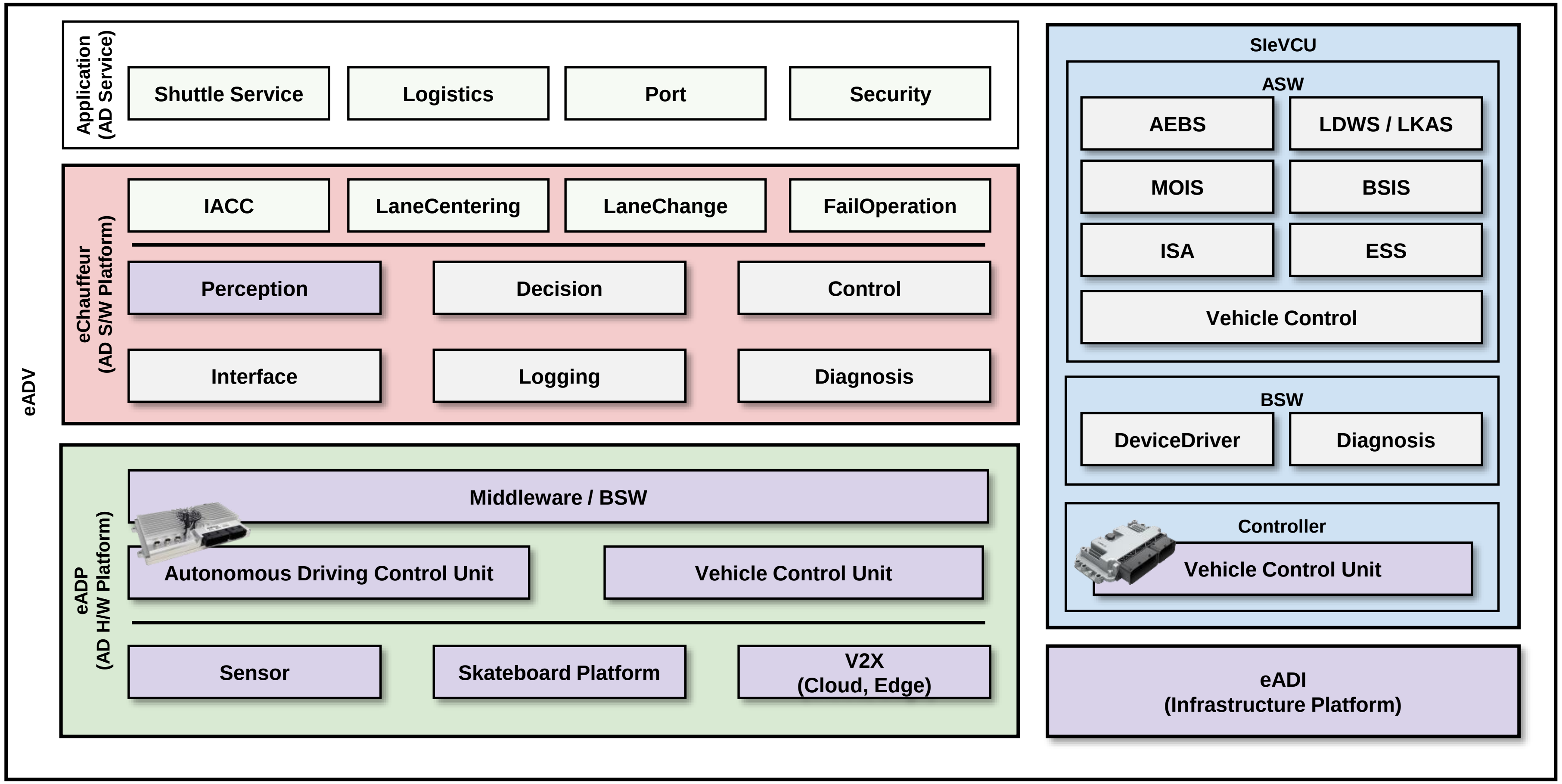
The Best Experts

▼ in Autonomous Driving
& Automotive Part Industry.

ADUS Solutions Architecture

Cooperation with Partners





eADV

Application (AD Service)

Shuttle Service | Logistics | Port | Security

eChauffeur (AD S/W Platform)

IACC | LaneCentering | LaneChange | FailOperation

Perception | Decision | Control

Interface | Logging | Diagnosis

eADP (AD H/W Platform)

Middleware / BSW

Autonomous Driving Control Unit | Vehicle Control Unit

Sensor | Skateboard Platform | V2X (Cloud, Edge)

SIeVCU

ASW

AEBS | LDWS / LKAS

MOIS | BSIS

ISA | ESS

Vehicle Control

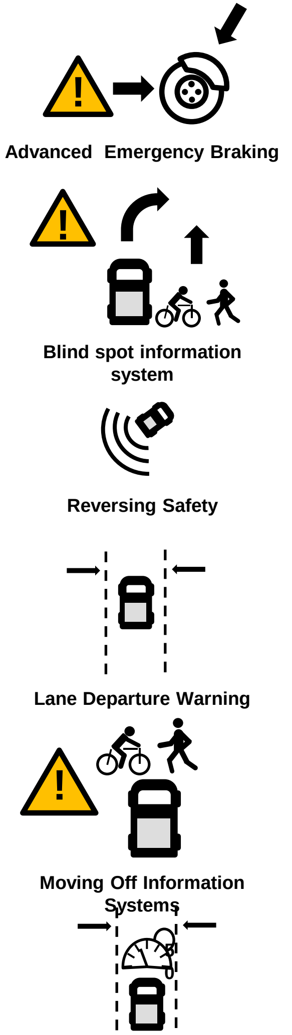
BSW

DeviceDriver | Diagnosis

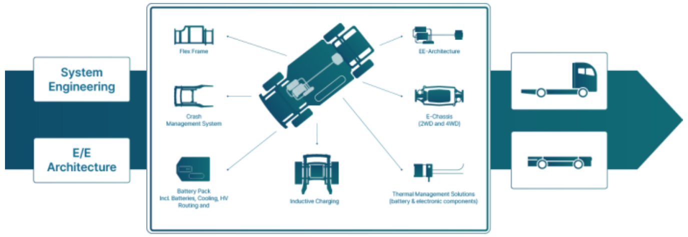
Controller

Vehicle Control Unit

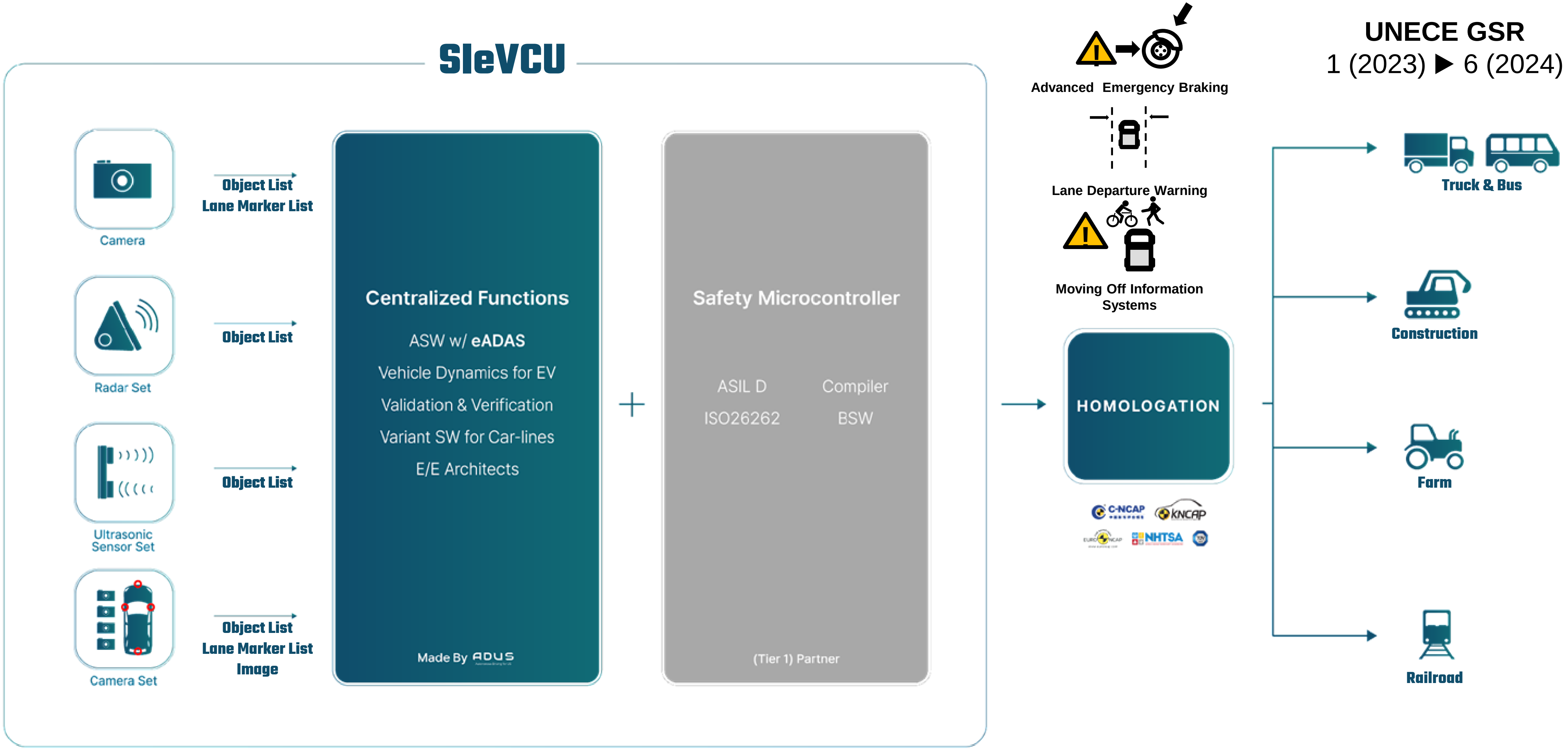
eADI (Infrastructure Platform)


Advanced Emergency Braking
Blind spot information system
Reversing Safety
Lane Departure Warning
Moving Off Information Systems
Emergency Safety Stop

IACC : Intelligent Adaptive Cruise Control
AEBS : Automatic Emergency Braking System
LDWS : Lane Departure Warning System
LKAS : Lane Keeping Assist System
MOIS : Moving Off Information System
BSIS : Blind Spot Information System
ISA : Intelligent Speed Assist
ESS : Emergency Safe Stop
eADV : expandable Autonomous Driving Vehicle
eADP : expandable Autonomous Driving Platform
eADI : expandable Autonomous Driving Infrastructure
SIeVCU : Safety Integrated Vehicle Control Unit



Project Introduction : Safety Solution for CV OEM



SIeVCU

Camera — Object List, Lane Marker List

Radar Set — Object List

Ultrasonic Sensor Set — Object List

Camera Set — Object List, Lane Marker List, Image

Centralized Functions

ASW w/ **eADAS**

Vehicle Dynamics for EV

Validation & Verification

Variant SW for Car-lines

E/E Architects

Made By ADUS

+

Safety Microcontroller

ASIL D

Compiler

ISO26262

BSW

(Tier 1) Partner

Advanced Emergency Braking

Lane Departure Warning

Moving Off Information Systems

HOMOLOGATION

C-NCAP KNCAP NHTSA

UNECE GSR

1 (2023) ▶ 6 (2024)

Truck & Bus

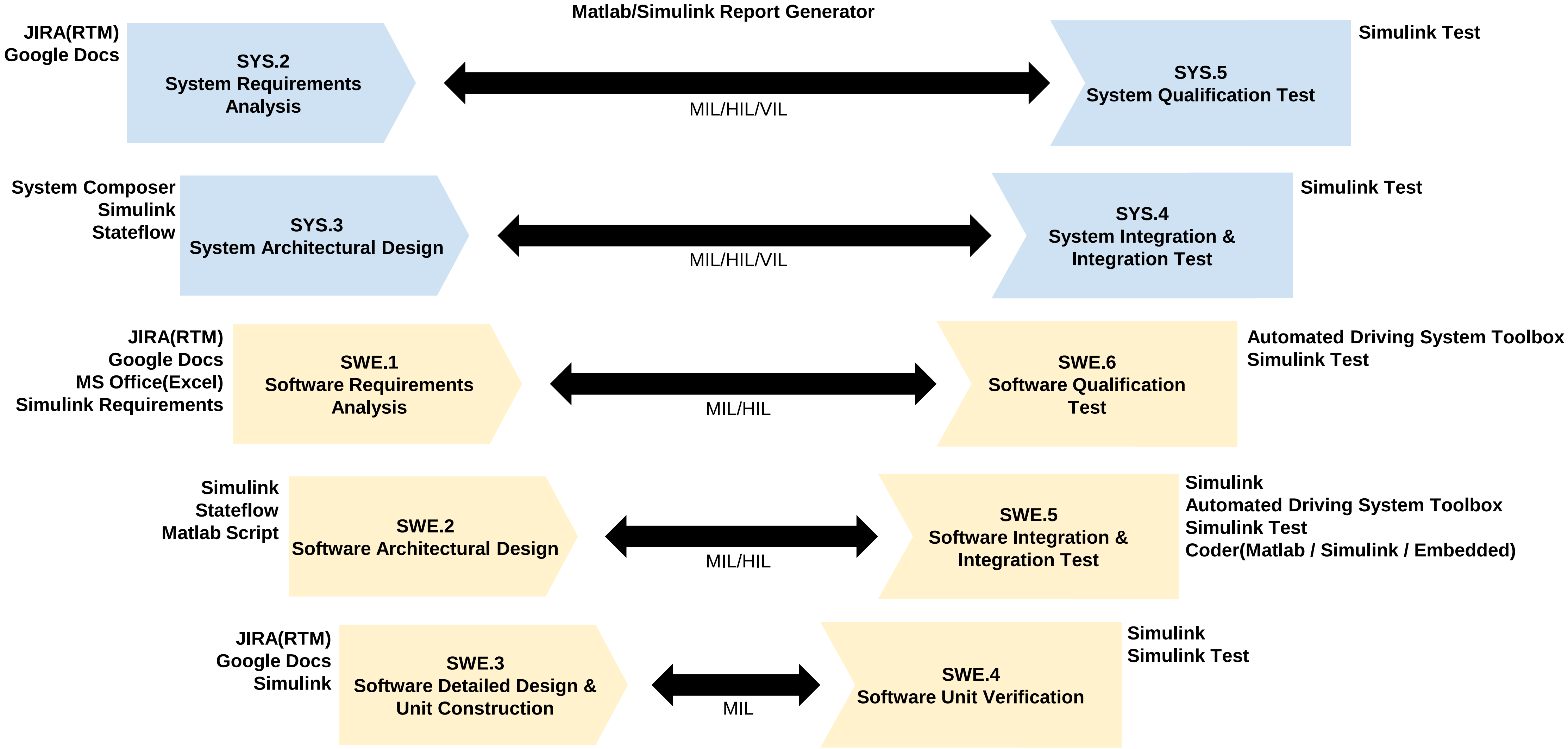
Construction

Farm

Railroad

SIeVCU^{TM} (Safety Integrated expandable Vehicle Control Unit) Gen2

Development Process with Matlab Tools



Matlab/Simulink Report Generator

JIRA(RTM)
Google Docs

SYS.2
System Requirements Analysis

MIL/HIL/VIL

SYS.5
System Qualification Test

Simulink Test

System Composer
Simulink
Stateflow

SYS.3
System Architectural Design

MIL/HIL/VIL

SYS.4
System Integration & Integration Test

Simulink Test

JIRA(RTM)
Google Docs
MS Office(Excel)
Simulink Requirements

SWE.1
Software Requirements Analysis

MIL/HIL

SWE.6
Software Qualification Test

Automated Driving System Toolbox
Simulink Test

Simulink
Stateflow
Matlab Script

SWE.2
Software Architectural Design

MIL/HIL

SWE.5
Software Integration & Integration Test

Simulink
Automated Driving System Toolbox
Simulink Test
Coder(Matlab / Simulink / Embedded)

JIRA(RTM)
Google Docs
Simulink

SWE.3
Software Detailed Design & Unit Construction

MIL

SWE.4
Software Unit Verification

Simulink
Simulink Test

Development Process with Matlab Tools

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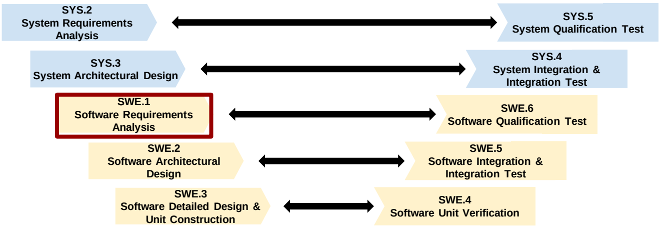
Design : Traceability Management

Google Docs -> Excel -> Simulink Requirements <-> Simulink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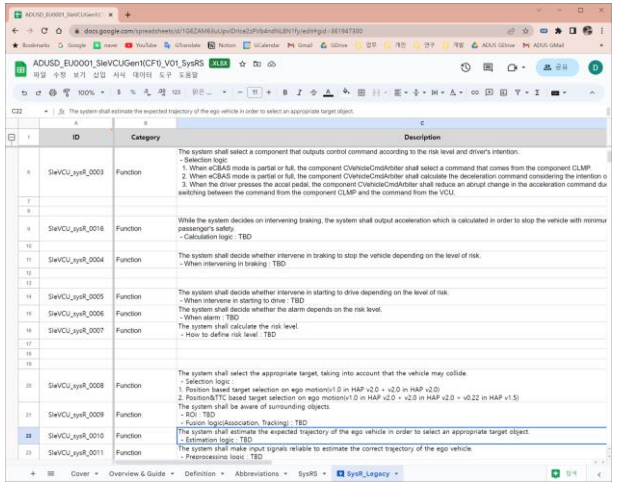
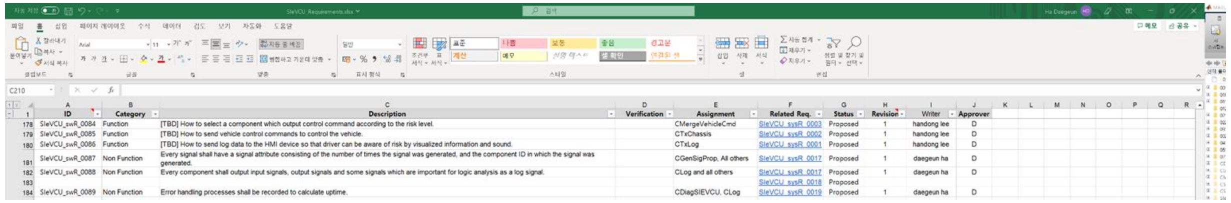
SWE.4
Software Unit Verification

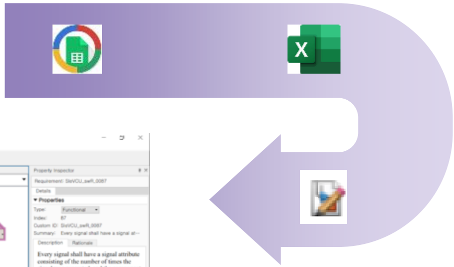

ADUSD_EU0001_SleVCUGen1(CF1)_V01_SysRS
XLSX
파일 수정 보기 삽입 서식 데이터 도구 도움말
공유
Cover
Overview & Guide
Definition
Abbreviations
SysRS
SysR_Legacy

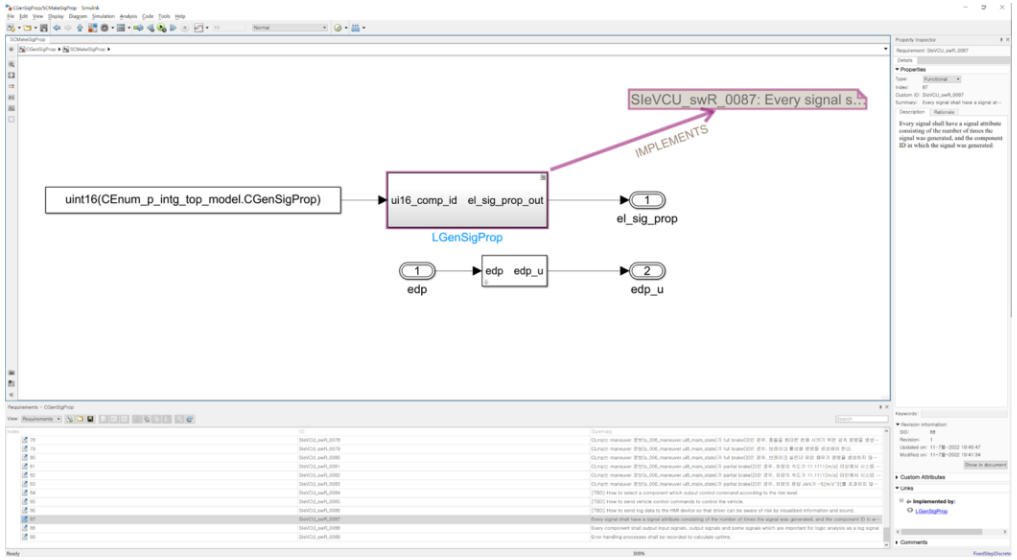
C22 The system shall estimate the expected trajectory of the ego vehicle in order to select an appropriate target object.

	ID	Category	Description
6	SleVCU_sysR_0003	Function	The system shall select a component that outputs control command according to the risk level and driver's intention. - Selection logic 1. When eCBAS mode is partial or full, the component CVehicleCmdArbiter shall select a command that comes from the component CLMP. 2. When eCBAS mode is partial or full, the component CVehicleCmdArbiter shall calculate the deceleration command considering the intention o 3. When the driver presses the accel pedal, the component CVehicleCmdArbiter shall reduce an abrupt change in the acceleration command du switching between the command from the component CLMP and the command from the VCU.
7			
8			
9	SleVCU_sysR_0016	Function	While the system decides on intervening braking, the system shall output acceleration which is calculated in order to stop the vehicle with minimur passenger's safety. - Calculation logic : TBD
10			
11	SleVCU_sysR_0004	Function	The system shall decide whether intervene in braking to stop the vehicle depending on the level of risk. - When intervening in braking : TBD
12			
13			
14	SleVCU_sysR_0005	Function	The system shall decide whether intervene in starting to drive depending on the level of risk. - When intervene in starting to drive : TBD
15	SleVCU_sysR_0006	Function	The system shall decide whether the alarm depends on the risk level. - When alarm : TBD
16	SleVCU_sysR_0007	Function	The system shall calculate the risk level. - How to define risk level : TBD
17			
18			
19			
20	SleVCU_sysR_0008	Function	The system shall select the appropriate target, taking into account that the vehicle may collide. - Selection logic : 1. Position based target selection on ego motion(v1.0 in HAP v2.0 + v2.0 in HAP v2.0) 2. Position&TTC based target selection on ego motion(v1.0 in HAP v2.0 + v2.0 in HAP v2.0 + v0.22 in HAP v1.5)
21	SleVCU_sysR_0009	Function	The system shall be aware of surrounding objects. - ROI : TBD - Fusion logic(Association, Tracking) : TBD
22	SleVCU_sysR_0010	Function	The system shall estimate the expected trajectory of the ego vehicle in order to select an appropriate target object. - Estimation logic : TBD
23	SleVCU_sysR_0011	Function	The system shall make input signals reliable to estimate the correct trajectory of the ego vehicle. - Preprocessing logic : TBD

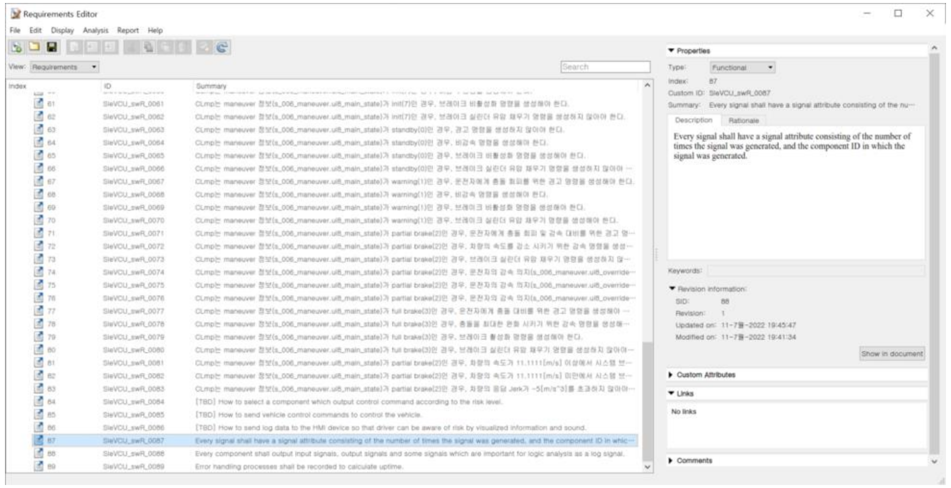


	ID	Category	Description	Verification	Assignment	Related Req.	Status	Revision	Writer	Approver
178	SleVCU_swR_0084	Function	[TBD] How to select a component which output control command according to the risk level.		CMergeVehicleCmd	SleVCU_sysR_0003	Proposed	1	handong lee	D
179	SleVCU_swR_0085	Function	[TBD] How to send vehicle control commands to control the vehicle.		CTxChassis	SleVCU_sysR_0002	Proposed	1	handong lee	D
180	SleVCU_swR_0086	Function	[TBD] How to send log data to the HMI device so that driver can be aware of risk by visualized information and sound.		CTxLog	SleVCU_sysR_0001	Proposed	1	handong lee	D
181	SleVCU_swR_0087	Non Function	Every signal shall have a signal attribute consisting of the number of times the signal was generated, and the component ID in which the signal was generated.		CGenSigProp, All others	SleVCU_sysR_0017	Proposed	1	daegeun ha	D
182	SleVCU_swR_0088	Non Function	Every component shall output input signals, output signals and some signals which are important for logic analysis as a log signal.		CLog and all others	SleVCU_sysR_0017	Proposed	1	daegeun ha	D
183						SleVCU_sysR_0018	Proposed			
184	SleVCU_swR_0089	Non Function	Error handling processes shall be recorded to calculate uptime.		CDiagSlEVCU, CLog	SleVCU_sysR_0019	Proposed	1	daegeun ha	D




CGenSigProp/SCMakeSigProp - Simulink
File Edit View Display Diagram Simulation Analysis Code Tools Help
Normal
SCMakeSigProp
CGenSigProp ▸ SCMakeSigProp ▸
Property Inspector
SleVCU_swR_0087: Every signal s...
IMPLEMENTS
uint16(CEnum_p_intg_top_model.CGenSigProp)
ui16_comp_id
el_sig_prop_out
LGenSigProp
1
el_sig_prop
1
edp
edp
edp_u
2
edp_u
Implemented by:
LGenSigProp

Every signal shall have a signal attribute consisting of the number of times the signal was generated, and the component ID in which the signal was generated.



Index	ID	Summary
61	SleVCU_swR_0061	CLmp는 maneuver 정보(s_006_maneuver.ui8_main_state)가 init(7)인 경우, 브레이크 비활성화 명령을 생성해야 한다.
62	SleVCU_swR_0062	CLmp는 maneuver 정보(s_006_maneuver.ui8_main_state)가 init(7)인 경우, 브레이크 실린더 유압 채우기 명령을 생성하지 않아야 한다.
63	SleVCU_swR_0063	CLmp는 maneuver 정보(s_006_maneuver.ui8_main_state)가 standby(0)인 경우, 경고 명령을 생성하지 않아야 한다.
64	SleVCU_swR_0064	CLmp는 maneuver 정보(s_006_maneuver.ui8_main_state)가 standby(0)인 경우, 비감속 명령을 생성해야 한다.
65	SleVCU_swR_0065	CLmp는 maneuver 정보(s_006_maneuver.ui8_main_state)가 standby(0)인 경우, 브레이크 비활성화 명령을 생성해야 한다.
66	SleVCU_swR_0066	CLmp는 maneuver 정보(s_006_maneuver.ui8_main_state)가 standby(0)인 경우, 브레이크 실린더 유압 채우기 명령을 생성하지 않아야 …
67	SleVCU_swR_0067	CLmp는 maneuver 정보(s_006_maneuver.ui8_main_state)가 warning(1)인 경우, 운전자에게 충돌 회피를 위한 경고 명령을 생성해야 한다.
68	SleVCU_swR_0068	CLmp는 maneuver 정보(s_006_maneuver.ui8_main_state)가 warning(1)인 경우, 비감속 명령을 생성해야 한다.
69	SleVCU_swR_0069	CLmp는 maneuver 정보(s_006_maneuver.ui8_main_state)가 warning(1)인 경우, 브레이크 비활성화 명령을 생성해야 한다.
70	SleVCU_swR_0070	CLmp는 maneuver 정보(s_006_maneuver.ui8_main_state)가 warning(1)인 경우, 브레이크 실린더 유압 채우기 명령을 생성해야 한다.
71	SleVCU_swR_0071	CLmp는 maneuver 정보(s_006_maneuver.ui8_main_state)가 partial brake(2)인 경우, 운전자에게 충돌 회피 및 감속 대비를 위한 경고 명…
72	SleVCU_swR_0072	CLmp는 maneuver 정보(s_006_maneuver.ui8_main_state)가 partial brake(2)인 경우, 차량의 속도를 감소 시키기 위한 감속 명령을 생성…
73	SleVCU_swR_0073	CLmp는 maneuver 정보(s_006_maneuver.ui8_main_state)가 partial brake(2)인 경우, 브레이크 실린더 유압 채우기 명령을 생성하지 않…
74	SleVCU_swR_0074	CLmp는 maneuver 정보(s_006_maneuver.ui8_main_state)가 partial brake(2)인 경우, 운전자의 감속 의지(s_006_maneuver.ui8_override…
75	SleVCU_swR_0075	CLmp는 maneuver 정보(s_006_maneuver.ui8_main_state)가 partial brake(2)인 경우, 운전자의 감속 의지(s_006_maneuver.ui8_override…
76	SleVCU_swR_0076	CLmp는 maneuver 정보(s_006_maneuver.ui8_main_state)가 partial brake(2)인 경우, 운전자의 감속 의지(s_006_maneuver.ui8_override…
77	SleVCU_swR_0077	CLmp는 maneuver 정보(s_006_maneuver.ui8_main_state)가 full brake(3)인 경우, 운전자에게 충돌 대비를 위한 경고 명령을 생성해야 …
78	SleVCU_swR_0078	CLmp는 maneuver 정보(s_006_maneuver.ui8_main_state)가 full brake(3)인 경우, 충돌을 최대한 완화 시키기 위한 감속 명령을 생성해…
79	SleVCU_swR_0079	CLmp는 maneuver 정보(s_006_maneuver.ui8_main_state)가 full brake(3)인 경우, 브레이크 활성화 명령을 생성해야 한다.
80	SleVCU_swR_0080	CLmp는 maneuver 정보(s_006_maneuver.ui8_main_state)가 full brake(3)인 경우, 브레이크 실린더 유압 채우기 명령을 생성하지 않아야…
81	SleVCU_swR_0081	CLmp는 maneuver 정보(s_006_maneuver.ui8_main_state)가 partial brake(2)인 경우, 차량의 속도가 11.1111[m/s] 이상에서 시스템 브…
82	SleVCU_swR_0082	CLmp는 maneuver 정보(s_006_maneuver.ui8_main_state)가 partial brake(2)인 경우, 차량의 속도가 11.1111[m/s] 미만에서 시스템 브…
83	SleVCU_swR_0083	CLmp는 maneuver 정보(s_006_maneuver.ui8_main_state)가 partial brake(2)인 경우, 차량의 응답 Jerk가 -5[m/s^3]를 초과하지 않아야…
84	SleVCU_swR_0084	[TBD] How to select a component which output control command according to the risk level.
85	SleVCU_swR_0085	[TBD] How to send vehicle control commands to control the vehicle.
86	SleVCU_swR_0086	[TBD] How to send log data to the HMI device so that driver can be aware of risk by visualized information and sound.
87	SleVCU_swR_0087	Every signal shall have a signal attribute consisting of the number of times the signal was generated, and the component ID in whic…
88	SleVCU_swR_0088	Every component shall output input signals, output signals and some signals which are important for logic analysis as a log signal.
89	SleVCU_swR_0089	Error handling processes shall be recorded to calculate uptime.

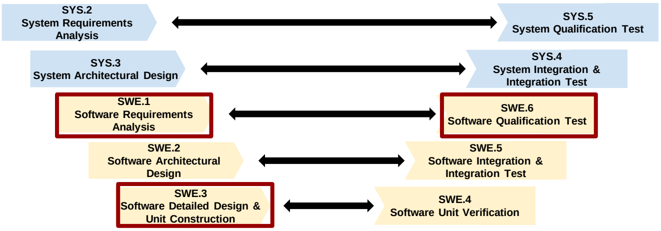
Type: Functional
Index: 87
Custom ID: SleVCU_swR_0087
Summary: Every signal shall have a signal attribute consisting of the nu…

Description: Every signal shall have a signal attribute consisting of the number of times the signal was generated, and the component ID in which the signal was generated.

Revision information:
SID: 88
Revision: 1
Updated on: 11-7월-2022 19:45:47
Modified on: 11-7월-2022 19:41:34

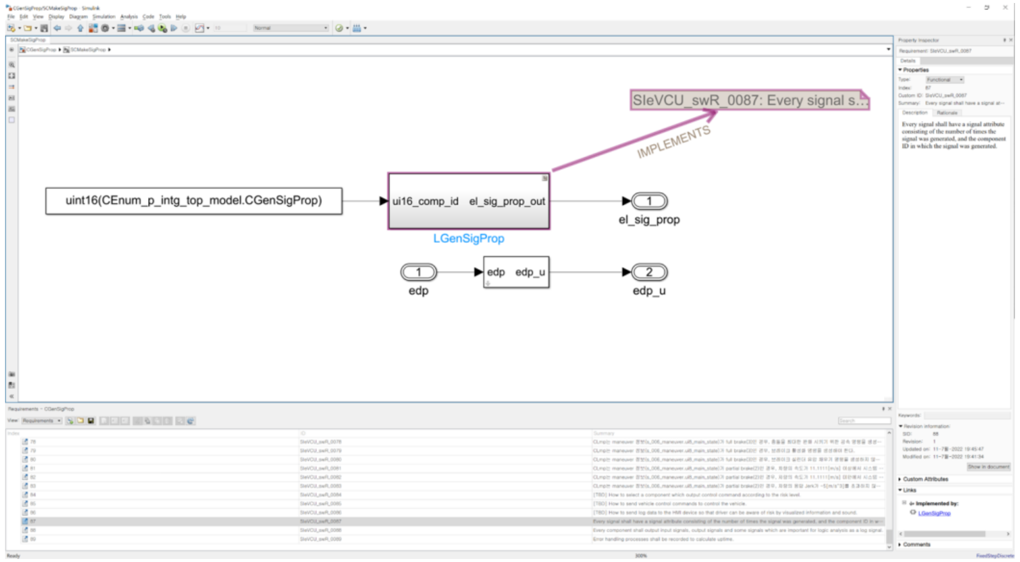
Links: No links

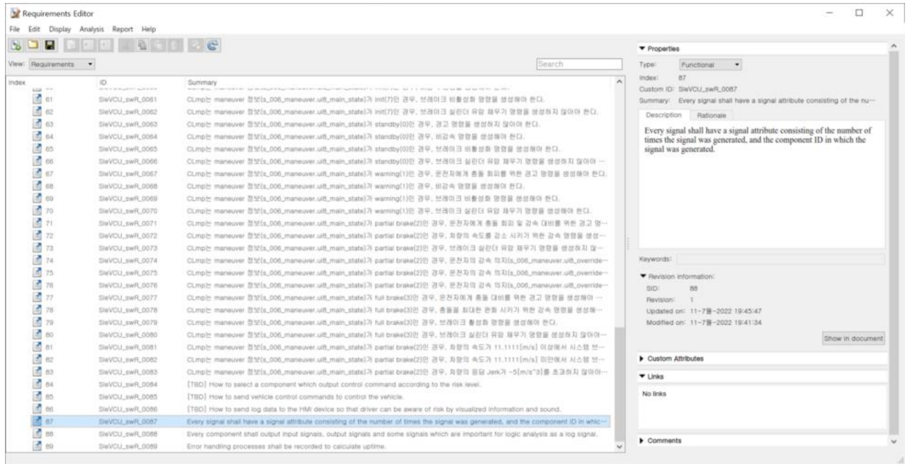
Design : Traceability Management



- SYS.2 System Requirements Analysis ⟷ SYS.5 System Qualification Test
- SYS.3 System Architectural Design ⟷ SYS.4 System Integration & Integration Test
- SWE.1 Software Requirements Analysis ⟷ SWE.6 Software Qualification Test
- SWE.2 Software Architectural Design ⟷ SWE.5 Software Integration & Integration Test
- SWE.3 Software Detailed Design & Unit Construction ⟷ SWE.4 Software Unit Verification

Traceability (Simulink <-> SW Req.)





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67	SIeVCU_swR_0067	CLmp는 maneuver 정보(s_006_maneuver.ui8_main_state)가 warning(1)인 경우, 운전자에게 충돌 회피를 위한 경고 명령을 생성해야 한다.
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71	SIeVCU_swR_0071	CLmp는 maneuver 정보(s_006_maneuver.ui8_main_state)가 partial brake(2)인 경우, 운전자에게 충돌 회피 및 감속 대비를 위한 경고 명···
72	SIeVCU_swR_0072	CLmp는 maneuver 정보(s_006_maneuver.ui8_main_state)가 partial brake(2)인 경우, 차량의 속도를 감소 시키기 위한 감속 명령을 생성···
73	SIeVCU_swR_0073	CLmp는 maneuver 정보(s_006_maneuver.ui8_main_state)가 partial brake(2)인 경우, 브레이크 실린더 유압 채우기 명령을 생성하지 않···
74	SIeVCU_swR_0074	CLmp는 maneuver 정보(s_006_maneuver.ui8_main_state)가 partial brake(2)인 경우, 운전자의 감속 의지(s_006_maneuver.ui8_override···
75	SIeVCU_swR_0075	CLmp는 maneuver 정보(s_006_maneuver.ui8_main_state)가 partial brake(2)인 경우, 운전자의 감속 의지(s_006_maneuver.ui8_override···
76	SIeVCU_swR_0076	CLmp는 maneuver 정보(s_006_maneuver.ui8_main_state)가 partial brake(2)인 경우, 운전자의 감속 의지(s_006_maneuver.ui8_override···
77	SIeVCU_swR_0077	CLmp는 maneuver 정보(s_006_maneuver.ui8_main_state)가 full brake(3)인 경우, 운전자에게 충돌 대비를 위한 경고 명령을 생성해야 ···
78	SIeVCU_swR_0078	CLmp는 maneuver 정보(s_006_maneuver.ui8_main_state)가 full brake(3)인 경우, 충돌을 최대한 완화 시키기 위한 감속 명령을 생성해···
79	SIeVCU_swR_0079	CLmp는 maneuver 정보(s_006_maneuver.ui8_main_state)가 full brake(3)인 경우, 브레이크 활성화 명령을 생성해야 한다.
80	SIeVCU_swR_0080	CLmp는 maneuver 정보(s_006_maneuver.ui8_main_state)가 full brake(3)인 경우, 브레이크 실린더 유압 채우기 명령을 생성하지 않아야···
81	SIeVCU_swR_0081	CLmp는 maneuver 정보(s_006_maneuver.ui8_main_state)가 partial brake(2)인 경우, 차량의 속도가 11.1111[m/s] 이상에서 시스템 브···
82	SIeVCU_swR_0082	CLmp는 maneuver 정보(s_006_maneuver.ui8_main_state)가 partial brake(2)인 경우, 차량의 속도가 11.1111[m/s] 미만에서 시스템 브···
83	SIeVCU_swR_0083	CLmp는 maneuver 정보(s_006_maneuver.ui8_main_state)가 partial brake(2)인 경우, 차량의 종방 Jerk가 -5[m/s^3]를 초과하지 않아야···
84	SIeVCU_swR_0084	[TBD] How to select a component which output control command according to the risk level.
85	SIeVCU_swR_0085	[TBD] How to send vehicle control commands to control the vehicle.
86	SIeVCU_swR_0086	[TBD] How to send log data to the HMI device so that driver can be aware of risk by visualized information and sound.
87	SIeVCU_swR_0087	Every signal shall have a signal attribute consisting of the number of times the signal was generated, and the component ID in whic···
88	SIeVCU_swR_0088	Every component shall output input signals, output signals and some signals which are important for logic analysis as a log signal.
89	SIeVCU_swR_0089	Error handling processes shall be recorded to calculate uptime.

Properties

Type: Functional

Index: 87

Custom ID: SIeVCU_swR_0087

Summary: Every signal shall have a signal attribute consisting of the nu···

Description | Rationale

Every signal shall have a signal attribute consisting of the number of times the signal was generated, and the component ID in which the signal was generated.

Keywords:

Revision information:

SID: 88

Revision: 1

Updated on: 11-7월-2022 19:45:47

Modified on: 11-7월-2022 19:41:34

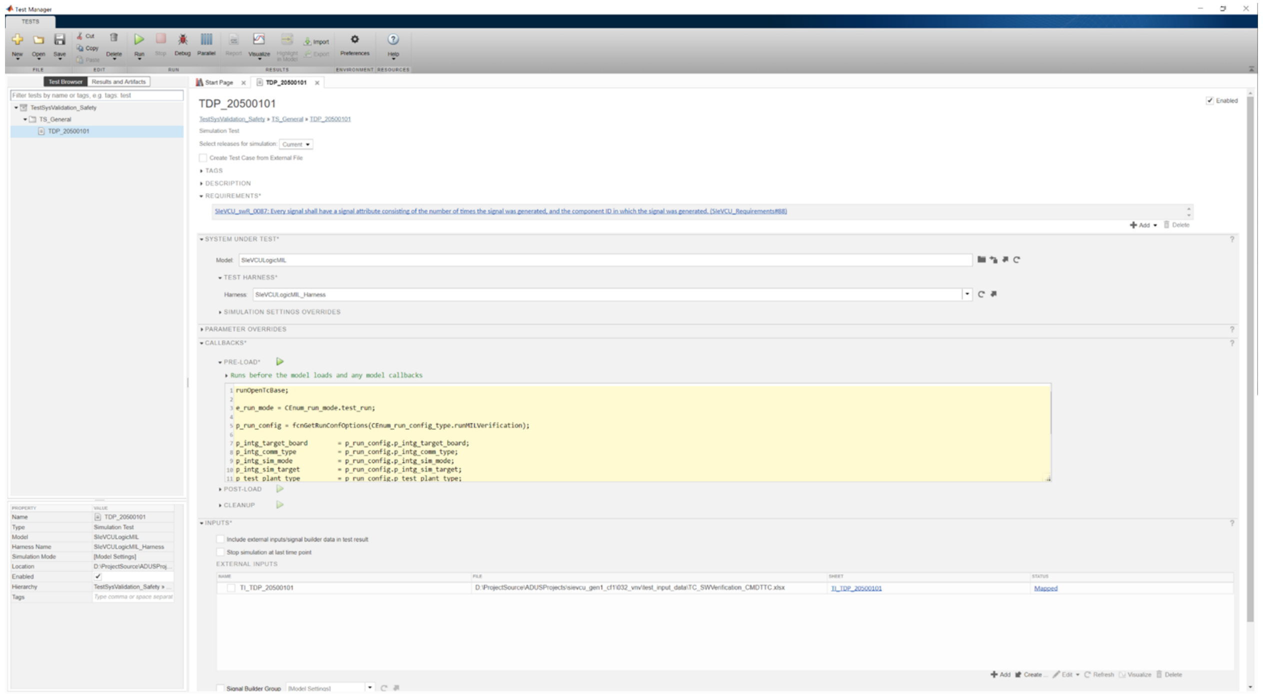
Show in document

Custom Attributes

Links

No links

Comments



TDP_20500101

TestSysValidation_Safety » TS_General » TDP_20500101

Simulation Test

Select releases for simulation: Current

☑ Enabled

□ Create Test Case from External File

TAGS

DESCRIPTION

REQUIREMENTS*

SIeVCU_swR_0087: Every signal shall have a signal attribute consisting of the number of times the signal was generated, and the component ID in which the signal was generated. (SIeVCU_Requirements#88)

SYSTEM UNDER TEST*

Model: SIeVCULogicMIL

TEST HARNESS*

Harness: SIeVCULogicMIL_Harness

SIMULATION SETTINGS OVERRIDES

PARAMETER OVERRIDES

CALLBACKS*

PRE-LOAD*

Runs before the model loads and any model callbacks

```
runOpenTcBase;

e_run_mode = CEnum_run_mode.test_run;

p_run_config = fcnGetRunConfOptions(CEnum_run_config_type.runMILVerification);

p_intg_target_board        = p_run_config.p_intg_target_board;
p_intg_comm_type           = p_run_config.p_intg_comm_type;
p_intg_sim_mode            = p_run_config.p_intg_sim_mode;
p_intg_sim_target          = p_run_config.p_intg_sim_target;
p_test_plant_type          = p_run_config.p_test_plant_type;
```

POST-LOAD

CLEANUP

INPUTS*

□ Include external inputs/signal builder data in test result

□ Stop simulation at last time point

EXTERNAL INPUTS

NAME	FILE	SHEET	STATUS
TI_TDP_20500101	D:\ProjectSource\ADUSProjects\sievcu_gen1_cf1\032_vnv\test_input_data\TC_SWVerification_CMDTTC.xlsx	TI_TDP_20500101	Mapped

Signal Builder Group: [Model Settings]

PROPERTY	VALUE
Name	TDP_20500101
Type	Simulation Test
Model	SIeVCULogicMIL
Harness Name	SIeVCULogicMIL_Harness
Simulation Mode	[Model Settings]
Location	D:\ProjectSource\ADUSProj...
Enabled	✓
Hierarchy	TestSysValidation_Safety » ...
Tags	Type comma or space separat

- ADUS?
- Project Introduction
- Development Process with Matlab Tools

  A. Design : Traceability Managemnet

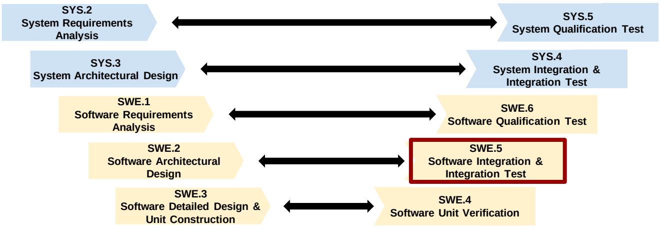
  B. Implementation : Matlab/Simulink Tips

  C. Validation : System/SW Validation

  D. Production

Development Process with Matlab Tools

Implementation : Matlab/Simulink Tips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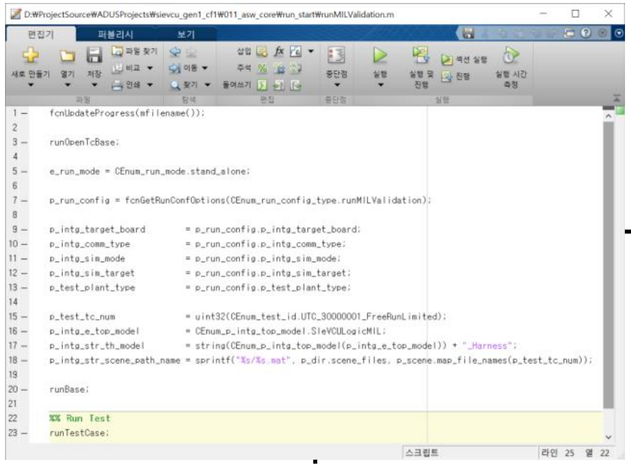
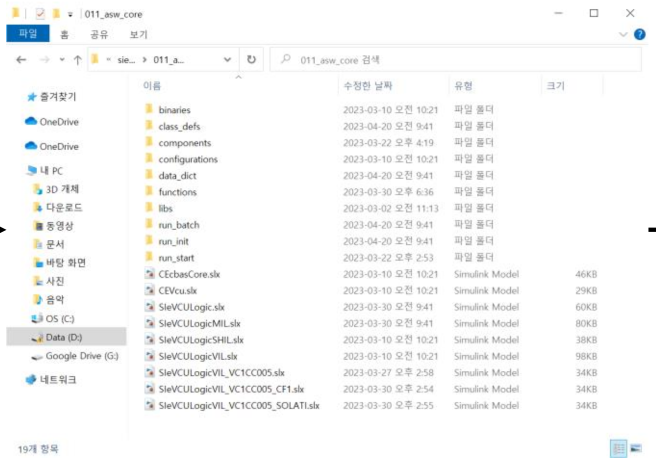
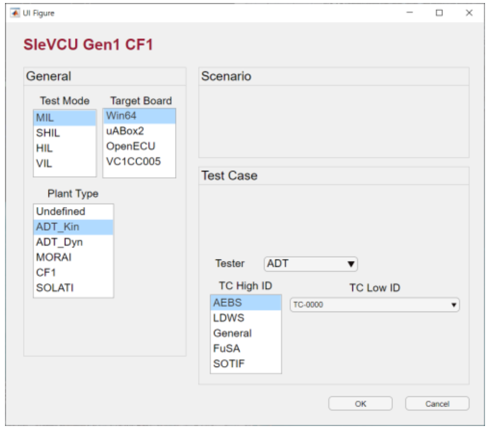
Variant Management



```
fcnUpdateProgress(mfilename());

runOpenTcBase;

e_run_mode = CEnum_run_mode.stand_alone;

p_run_config = fcnGetRunConfOptions(CEnum_run_config_type.runMILValidation);

p_intg_target_board       = p_run_config.p_intg_target_board;
p_intg_comm_type          = p_run_config.p_intg_comm_type;
p_intg_sim_mode           = p_run_config.p_intg_sim_mode;
p_intg_sim_target         = p_run_config.p_intg_sim_target;
p_test_plant_type         = p_run_config.p_test_plant_type;

p_test_tc_num             = uint32(CEnum_test_id.UTC_30000001_FreeRunLimited);
p_intg_e_top_model        = CEnum_p_intg_top_model.SleVCULogicMIL;
p_intg_str_th_model       = string(CEnum_p_intg_top_model(p_intg_e_top_model)) + "_Harness";
p_intg_str_scene_path_name = sprintf("%s/%s.mat", p_dir.scene_files, p_scene.map_file_names(p_test_tc_num));

runBase;

%% Run Test
runTestCase;
```



이름	수정한 날짜	유형	크기
binaries	2023-03-10 오전 10:21	파일 폴더	
class_defs	2023-04-20 오전 9:41	파일 폴더	
components	2023-03-22 오후 4:19	파일 폴더	
configurations	2023-03-10 오전 10:21	파일 폴더	
data_dict	2023-04-20 오전 9:41	파일 폴더	
functions	2023-03-30 오후 6:36	파일 폴더	
libs	2023-03-02 오전 11:13	파일 폴더	
run_batch	2023-04-20 오전 9:41	파일 폴더	
run_init	2023-04-20 오전 9:41	파일 폴더	
run_start	2023-03-22 오후 2:53	파일 폴더	
CEcbasCore.slx	2023-03-10 오전 10:21	Simulink Model	46KB
CEVcu.slx	2023-03-10 오전 10:21	Simulink Model	29KB
SleVCULogic.slx	2023-03-30 오전 9:41	Simulink Model	60KB
SleVCULogicMIL.slx	2023-03-30 오전 9:41	Simulink Model	80KB
SleVCULogicSHIL.slx	2023-03-10 오전 10:21	Simulink Model	38KB
SleVCULogicVIL.slx	2023-03-10 오전 10:21	Simulink Model	98KB
SleVCULogicVIL_VC1CC005.slx	2023-03-27 오후 2:58	Simulink Model	34KB
SleVCULogicVIL_VC1CC005_CF1.slx	2023-03-30 오후 2:54	Simulink Model	34KB
SleVCULogicVIL_VC1CC005_SOLATI.slx	2023-03-30 오후 2:55	Simulink Model	34KB



SleVCU Gen1 CF1

General

Test Mode	Target Board
MIL	Win64
SHIL	uABox2
HIL	OpenECU
VIL	VC1CC005

Plant Type: Undefined, ADT_Kin, ADT_Dyn, MORAI, CF1, SOLATI

Scenario

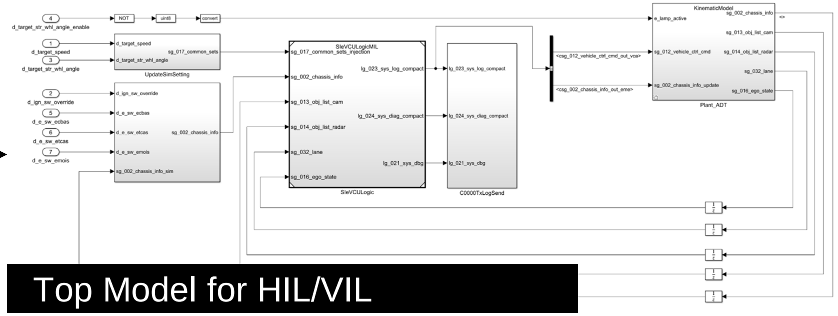
Test Case

Tester: ADT

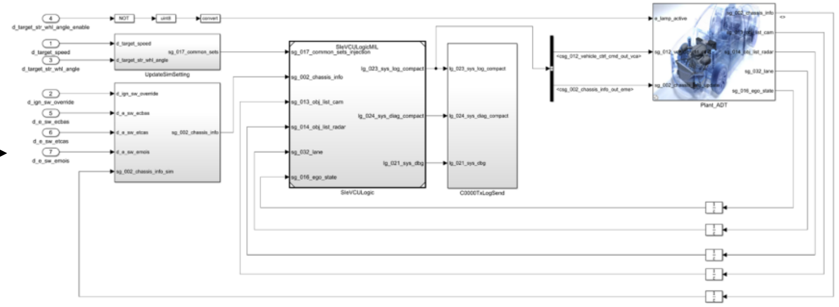
TC High ID: AEBS, LDWS, General, FuSA, SOTIF

TC Low ID: TC-0000

Test Mode (Controller)	Target Vehicle		
	Virtual Plant (ADT)	**Actual Vehicle** Target1	**Actual Vehicle** Target2
MIL Windows/Linux	@	#	*
VIL Target Controller (VCU)	!	+	&

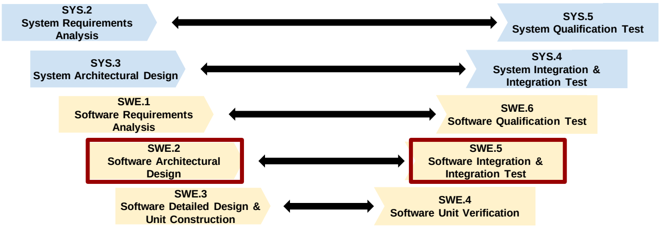


Top Model for HIL/VIL



Top Model for MIL(Test Harness)

Implementation : Matlab/Simulink Tips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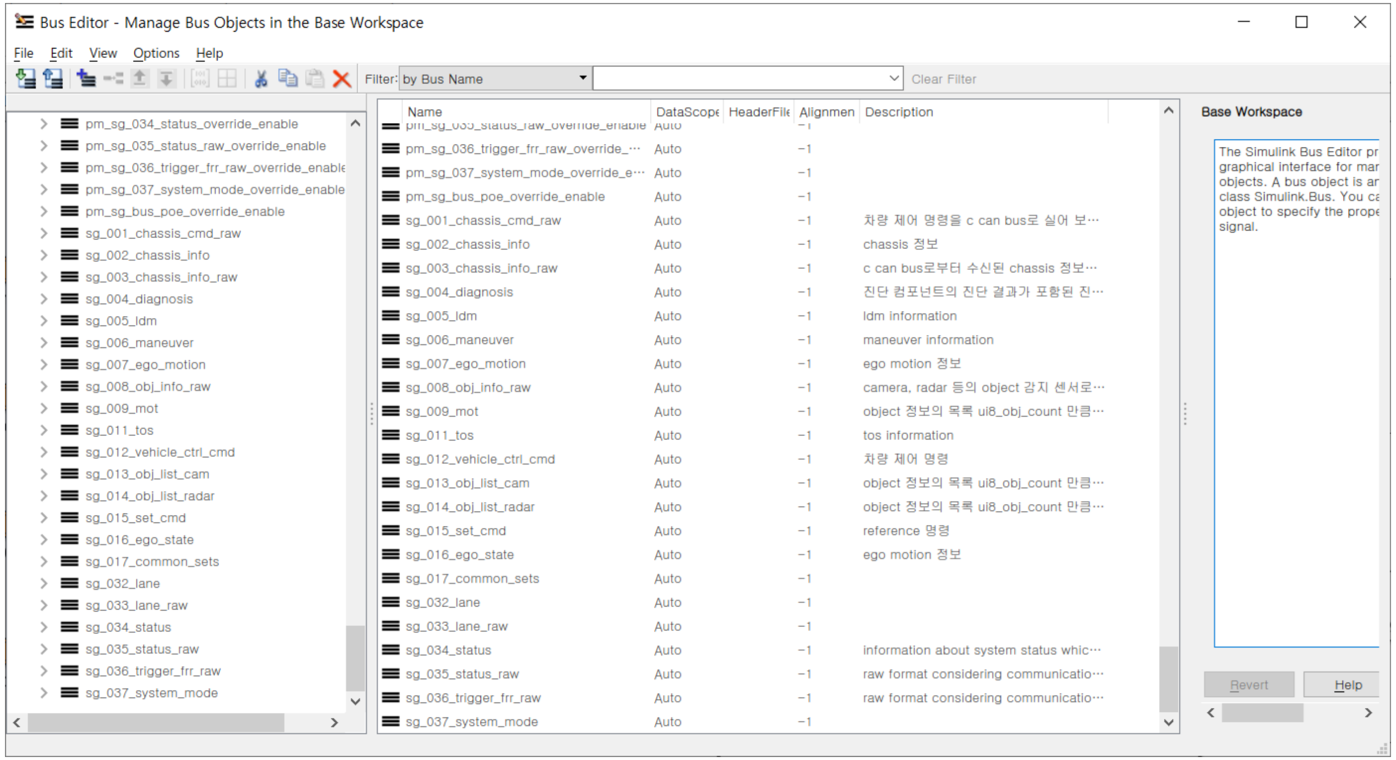
Signal Definition by Simulink Bus

Naming Convention

1. 신호/변수
    1. 형식 : [DataType] [Dimension]_[ID]_[성격]_[세부 성격] ex) s_000_chassis_info
    2. 항목
        1. Type
            1. struct : sg(variable), pm(parameter), di(diagnosis), el(element), lg(log), db(debug), st(status)
            2. (1 byte) char : i8
            3. (1 byte) unsigned char : u8
            4. (2 bytes) short : i16
            5. (2 bytes) unsigned short : u16
            6. (4 bytes) integer : i32
            7. (4 bytes) unsigned integer : u32
            8. single, float : f
            9. double : d
            10. string : str
            11. enumeration : e
            12. child struct
                1. child의 data type 앞에 'c_'를 prefix로 사용한다. (ex. cs_001_~, cl_001_~)
                2. log 신호의 경우 예외로 입력은 'in_', 출력은 'out_', 진단은 'diag_' prefix를 사용한다.
        2. Dimension
            1. 배열일 경우 row, column 수로 표현
            2. 크기가 1인 경우 생략 가능
            3. Simulink에서 Dimension만 설정한 경우 r값을 설정한 것임.
            4. ex) i8r2_num, i8c2_index, fr2c3_ldm
        3. ID : struct일 경우에만 생성 순서로 일련번호를 부여한다. structure, parameter, diagnosis, element 각각의 일련번호는 별도로 관리한다.
        4. 성격 : 변수의 의미를 표현하는 단어
        5. 세부 성격(optional) : 0개 이상의 세부 성격을 '_'를 사용하여 연결



pm_sg_034_status_override_enable
pm_sg_035_status_raw_override_enable
pm_sg_036_trigger_frr_raw_override_enable
pm_sg_037_system_mode_override_enable
pm_sg_bus_poe_override_enable
sg_001_chassis_cmd_raw
sg_002_chassis_info
sg_003_chassis_info_raw
sg_004_diagnosis
sg_005_ldm
sg_006_maneuver
sg_007_ego_motion
sg_008_obj_info_raw
sg_009_mot
sg_011_tos
sg_012_vehicle_ctrl_cmd
sg_013_obj_list_cam
sg_014_obj_list_radar
sg_015_set_cmd
sg_016_ego_state
sg_017_common_sets
sg_032_lane
sg_033_lane_raw
sg_034_status
sg_035_status_raw
sg_036_trigger_frr_raw
sg_037_system_mode

Name	DataScope	HeaderFile	Alignmen	Description
pm_sg_035_status_raw_override_enable	Auto		-1	
pm_sg_036_trigger_frr_raw_override_…	Auto		-1	
pm_sg_037_system_mode_override_e…	Auto		-1	
pm_sg_bus_poe_override_enable	Auto		-1	
sg_001_chassis_cmd_raw	Auto		-1	차량 제어 명령을 c can bus로 실어 보…
sg_002_chassis_info	Auto		-1	chassis 정보
sg_003_chassis_info_raw	Auto		-1	c can bus로부터 수신된 chassis 정보…
sg_004_diagnosis	Auto		-1	진단 컴포넌트의 진단 결과가 포함된 진…
sg_005_ldm	Auto		-1	ldm information
sg_006_maneuver	Auto		-1	maneuver information
sg_007_ego_motion	Auto		-1	ego motion 정보
sg_008_obj_info_raw	Auto		-1	camera, radar 등의 object 감지 센서로…
sg_009_mot	Auto		-1	object 정보의 목록 ui8_obj_count 만큼…
sg_011_tos	Auto		-1	tos information
sg_012_vehicle_ctrl_cmd	Auto		-1	차량 제어 명령
sg_013_obj_list_cam	Auto		-1	object 정보의 목록 ui8_obj_count 만큼…
sg_014_obj_list_radar	Auto		-1	object 정보의 목록 ui8_obj_count 만큼…
sg_015_set_cmd	Auto		-1	reference 명령
sg_016_ego_state	Auto		-1	ego motion 정보
sg_017_common_sets	Auto		-1	
sg_032_lane	Auto		-1	
sg_033_lane_raw	Auto		-1	
sg_034_status	Auto		-1	information about system status whic…
sg_035_status_raw	Auto		-1	raw format considering communicatio…
sg_036_trigger_frr_raw	Auto		-1	raw format considering communicatio…
sg_037_system_mode	Auto		-1	

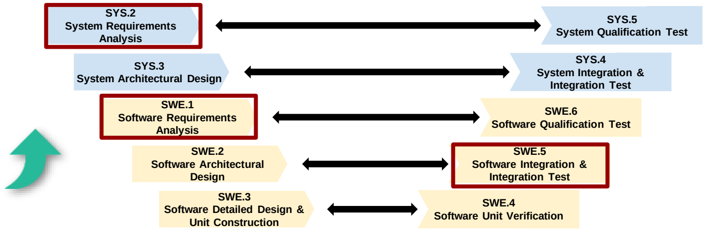
The Simulink Bus Editor pr
graphical interface for mar
objects. A bus object is ar
class Simulink.Bus. You ca
object to specify the prope
signal.

Implementation : Matlab/Simulink Tips

Parameter, Description(SRS)

Automation!

Maintenance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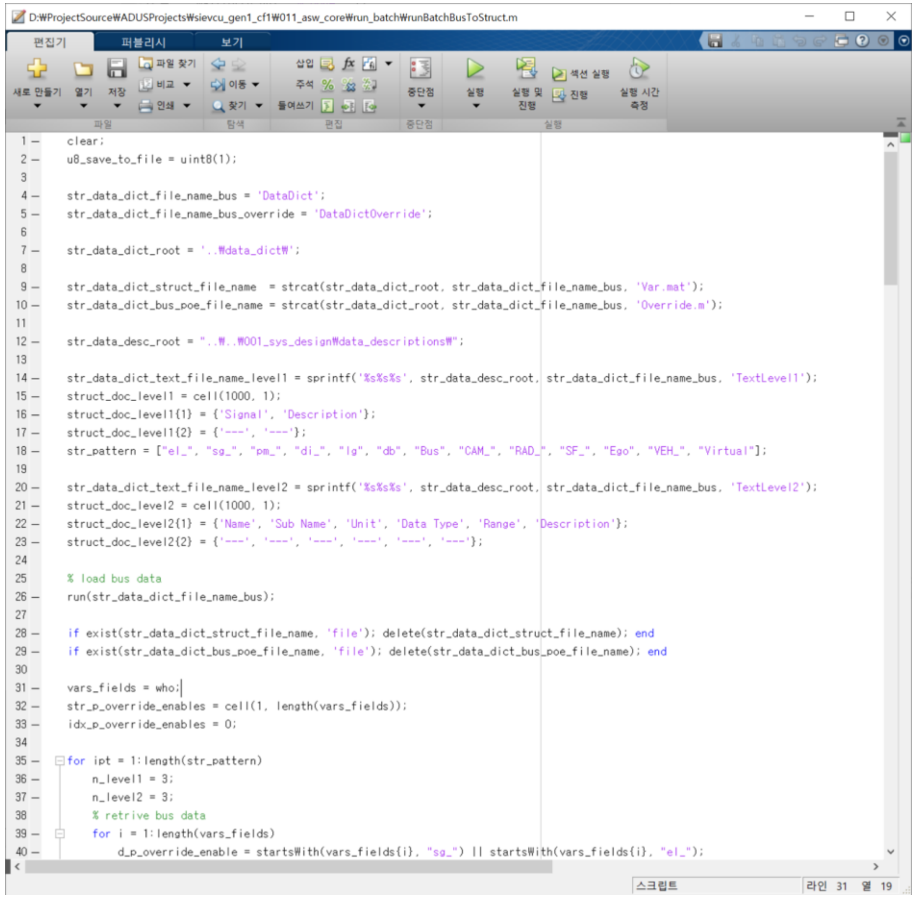
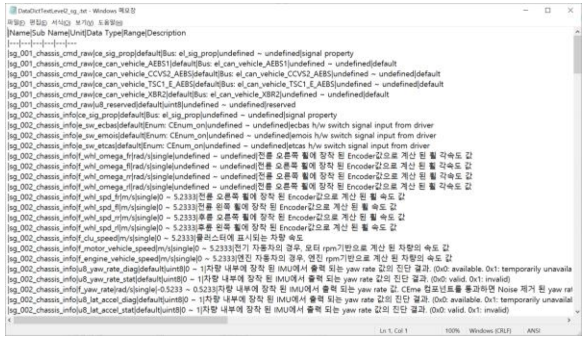
Script for creation parameter



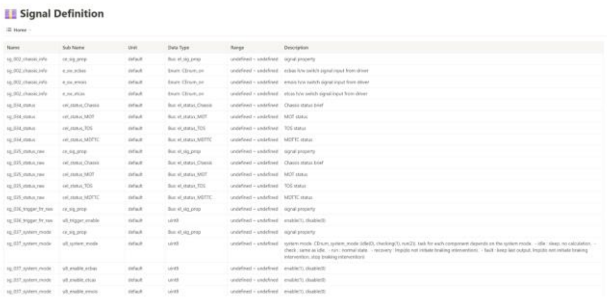
```matlab
clear;
u8_save_to_file = uint8(1);

str_data_dict_file_name_bus = 'DataDict';
str_data_dict_file_name_bus_override = 'DataDictOverride';

str_data_dict_root = '..₩data_dict₩';

str_data_dict_struct_file_name  = strcat(str_data_dict_root, str_data_dict_file_name_bus, 'Var.mat');
str_data_dict_bus_poe_file_name = strcat(str_data_dict_root, str_data_dict_file_name_bus, 'Override.m');

str_data_desc_root = "..₩..₩001_sys_design₩data_descriptions₩";

str_data_dict_text_file_name_level1 = sprintf('%s%s%s', str_data_desc_root, str_data_dict_file_name_bus, 'TextLevel1');
struct_doc_level1 = cell(1000, 1);
struct_doc_level1{1} = {'Signal', 'Description'};
struct_doc_level1{2} = {'---', '---'};
str_pattern = ["el_", "sg_", "pm_", "di_", "lg", "db", "Bus", "CAM_", "RAD_", "SF_", "Ego", "VEH_", "Virtual"];

str_data_dict_text_file_name_level2 = sprintf('%s%s%s', str_data_desc_root, str_data_dict_file_name_bus, 'TextLevel2');
struct_doc_level2 = cell(1000, 1);
struct_doc_level2{1} = {'Name', 'Sub Name', 'Unit', 'Data Type', 'Range', 'Description'};
struct_doc_level2{2} = {'---', '---', '---', '---', '---', '---'};

% load bus data
run(str_data_dict_file_name_bus);

if exist(str_data_dict_struct_file_name, 'file'); delete(str_data_dict_struct_file_name); end
if exist(str_data_dict_bus_poe_file_name, 'file'); delete(str_data_dict_bus_poe_file_name); end

vars_fields = who;
str_p_override_enables = cell(1, length(vars_fields));
idx_p_override_enables = 0;

for ipt = 1:length(str_pattern)
    n_level1 = 3;
    n_level2 = 3;
    % retrive bus data
    for i = 1:length(vars_fields)
        d_p_override_enable = startsWith(vars_fields{i}, "sg_") || startsWith(vars_fields{i}, "el_");
```

Markup Text


DataDictTextLevel2_sg_.txt - Windows 메모장
파일(F) 편집(E) 서식(O) 보기(V) 도움말(H)
Ln 1, Col 1
100%
Windows (CRLF)
ANSI

```
|Name|Sub Name|Unit|Data Type|Range|Description
|---|---|---|---|---|---
|sg_001_chassis_cmd_raw|ce_sig_prop|default|Bus: el_sig_prop|undefined ~ undefined|signal property
|sg_001_chassis_cmd_raw|ce_can_vehicle_AEBS1|default|Bus: el_can_vehicle_AEBS1|undefined ~ undefined|default
|sg_001_chassis_cmd_raw|ce_can_vehicle_CCVS2_AEBS|default|Bus: el_can_vehicle_CCVS2_AEBS|undefined ~ undefined|default
|sg_001_chassis_cmd_raw|ce_can_vehicle_TSC1_E_AEBS|default|Bus: el_can_vehicle_TSC1_E_AEBS|undefined ~ undefined|default
|sg_001_chassis_cmd_raw|ce_can_vehicle_XBR2|default|Bus: el_can_vehicle_XBR2|undefined ~ undefined|default
|sg_001_chassis_cmd_raw|u8_reserved|default|uint8|undefined ~ undefined|reserved
|sg_002_chassis_info|ce_sig_prop|default|Bus: el_sig_prop|undefined ~ undefined|signal property
|sg_002_chassis_info|e_sw_ecbas|default|Enum: CEnum_on|undefined ~ undefined|ecbas h/w switch signal input from driver
|sg_002_chassis_info|e_sw_emois|default|Enum: CEnum_on|undefined ~ undefined|emois h/w switch signal input from driver
|sg_002_chassis_info|e_sw_etcas|default|Enum: CEnum_on|undefined ~ undefined|etcas h/w switch signal input from driver
|sg_002_chassis_info|f_whl_omega_fr|rad/s|single|undefined ~ undefined|전륜 오른쪽 휠에 장착 된 Encoder값으로 계산 된 휠 각속도 값
|sg_002_chassis_info|f_whl_omega_fl|rad/s|single|undefined ~ undefined|전륜 오른쪽 휠에 장착 된 Encoder값으로 계산 된 휠 각속도 값
|sg_002_chassis_info|f_whl_omega_rr|rad/s|single|undefined ~ undefined|전륜 오른쪽 휠에 장착 된 Encoder값으로 계산 된 휠 각속도 값
|sg_002_chassis_info|f_whl_omega_rl|rad/s|single|undefined ~ undefined|전륜 오른쪽 휠에 장착 된 Encoder값으로 계산 된 휠 각속도 값
|sg_002_chassis_info|f_whl_spd_fr|m/s|single|0 ~ 5.2333|전륜 오른쪽 휠에 장착 된 Encoder값으로 계산 된 휠 속도 값
|sg_002_chassis_info|f_whl_spd_fl|m/s|single|0 ~ 5.2333|전륜 왼쪽 휠에 장착 된 Encoder값으로 계산 된 휠 속도 값
|sg_002_chassis_info|f_whl_spd_rr|m/s|single|0 ~ 5.2333|후륜 오른쪽 휠에 장착 된 Encoder값으로 계산 된 휠 속도 값
|sg_002_chassis_info|f_whl_spd_rl|m/s|single|0 ~ 5.2333|후륜 왼쪽 휠에 장착 된 Encoder값으로 계산 된 휠 속도 값
|sg_002_chassis_info|f_clu_speed|m/s|single|0 ~ 5.2333|클러스터에 표시되는 차량 속도
|sg_002_chassis_info|f_motor_vehicle_speed|m/s|single|0 ~ 5.2333|전기 자동차의 경우, 모터 rpm기반으로 계산 된 차량의 속도 값
|sg_002_chassis_info|f_engine_vehicle_speed|m/s|single|0 ~ 5.2333|엔진 자동차의 경우, 엔진 rpm기반으로 계산 된 차량의 속도 값
|sg_002_chassis_info|u8_yaw_rate_diag|default|uint8|0 ~ 1|차량 내부에 장착 된 IMU에서 출력 되는 yaw rate 값의 진단 결과. (0x0: available. 0x1: temporarily unavaila
|sg_002_chassis_info|u8_yaw_rate_stat|default|uint8|0 ~ 1|차량 내부에 장착 된 IMU에서 출력 되는 yaw rate 값의 진단 결과. (0x0: valid. 0x1: invalid)
|sg_002_chassis_info|f_yaw_rate|rad/s|single|-0.5233 ~ 0.5233|차량 내부에 장착 된 IMU에서 출력 되는 yaw rate 값. CEme 컴포넌트를 통과하면 Noise 제거 된 yaw ra
|sg_002_chassis_info|u8_lat_accel_diag|default|uint8|0 ~ 1|차량 내부에 장착 된 IMU에서 출력 되는 yaw rate 값의 진단 결과. (0x0: available. 0x1: temporarily unavailal
|sg_002_chassis_info|u8_lat_accel_stat|default|uint8|0 ~ 1|차량 내부에 장착 된 IMU에서 출력 되는 yaw rate 값의 진단 결과. (0x0: valid. 0x1: invalid)
```

Markup Display(JIRA, Notion, Etc…)

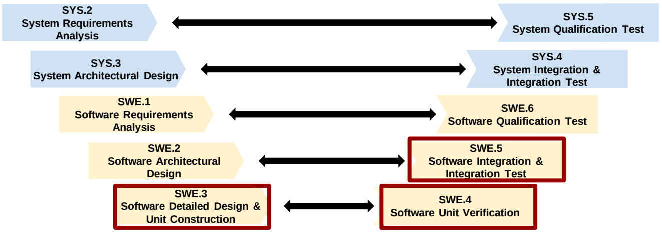


Signal Definition

Name	Sub Name	Unit	Data Type	Range	Description
sg_002_chassis_info	ce_sig_prop	default	Bus: el_sig_prop	undefined ~ undefined	signal property
sg_002_chassis_info	e_sw_ecbas	default	Enum: CEnum_on	undefined ~ undefined	ecbas h/w switch signal input from driver
sg_002_chassis_info	e_sw_emois	default	Enum: CEnum_on	undefined ~ undefined	emois h/w switch signal input from driver
sg_002_chassis_info	e_sw_etcas	default	Enum: CEnum_on	undefined ~ undefined	etcas h/w switch signal input from driver
sg_034_status	cel_status_Chassis	default	Bus: el_status_Chassis	undefined ~ undefined	Chassis status brief
sg_034_status	cel_status_MOT	default	Bus: el_status_MOT	undefined ~ undefined	MOT status
sg_034_status	cel_status_TOS	default	Bus: el_status_TOS	undefined ~ undefined	TOS status
sg_034_status	cel_status_MDTTC	default	Bus: el_status_MDTTC	undefined ~ undefined	MDTTC status
sg_035_status_raw	ce_sig_prop	default	Bus: el_sig_prop	undefined ~ undefined	signal property
sg_035_status_raw	cel_status_Chassis	default	Bus: el_status_Chassis	undefined ~ undefined	Chassis status brief
sg_035_status_raw	cel_status_MOT	default	Bus: el_status_MOT	undefined ~ undefined	MOT status
sg_035_status_raw	cel_status_TOS	default	Bus: el_status_TOS	undefined ~ undefined	TOS status
sg_035_status_raw	cel_status_MDTTC	default	Bus: el_status_MDTTC	undefined ~ undefined	MDTTC status
sg_036_trigger_fr_raw	ce_sig_prop	default	Bus: el_sig_prop	undefined ~ undefined	signal property
sg_036_trigger_fr_raw	u8_trigger_enable	default	uint8	undefined ~ undefined	enable(1), disable(0)
sg_037_system_mode	ce_sig_prop	default	Bus: el_sig_prop	undefined ~ undefined	signal property
sg_037_system_mode	u8_system_mode	default	uint8	undefined ~ undefined	system mode. CEnum_system_mode (idle(0), checking(1), run(2)). task for each component depends on the system mode. - idle : sleep, no calculation. - check : same as idle. - run : normal state. - recovery : [illegible] - fault : keep last output. [illegible]
sg_037_system_mode	u8_enable_ecbas	default	uint8	undefined ~ undefined	enable(1), disable(0)
sg_037_system_mode	u8_enable_etcas	default	uint8	undefined ~ undefined	enable(1), disable(0)
sg_037_system_mode	u8_enable_emois	default	uint8	undefined ~ undefined	enable(1), disable(0)

Implementation : Matlab/Simulink Tips

Determined Interface with MBD



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SWE.6 Software Qualification Test
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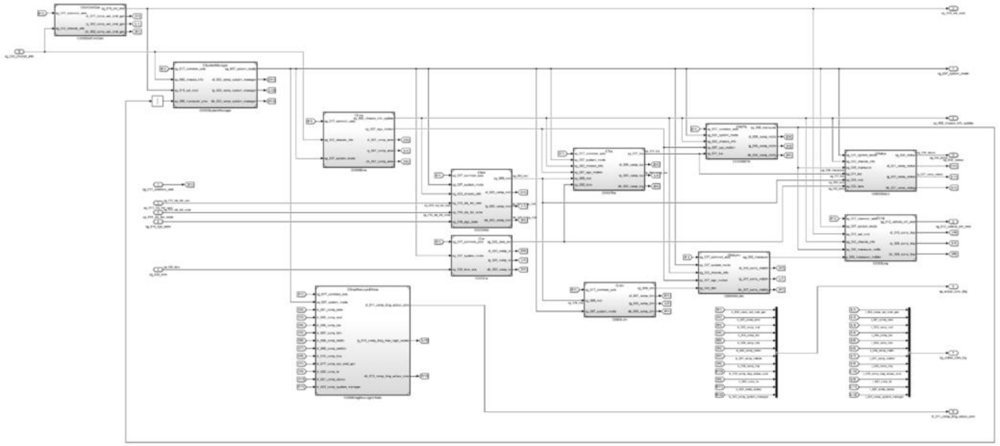
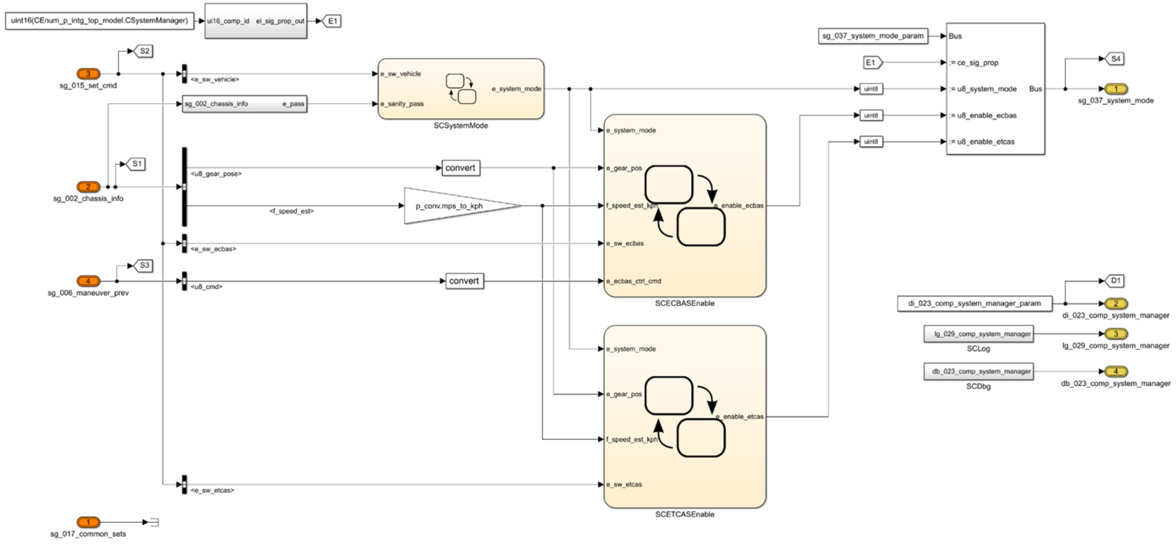
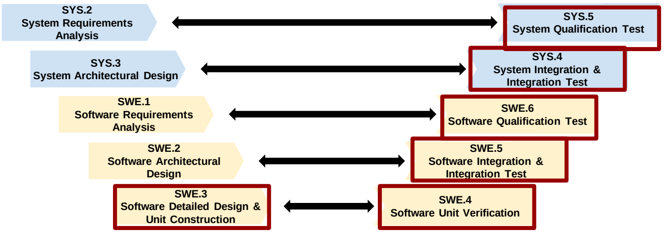
SWE.3 Software Detailed Design & Unit Construction
SWE.4 Software Unit Verification





Signal Type	Description
Output	output of the component
Diagnosis	diagnostics result(RC, PFC, PC)
Log	properties of the input signal (Count, TimeStamp, Source ID) Output signal data Internal variables
Debugging	variables for debugging

Implementation : Matlab/Simulink Tips



SYS.2 System Requirements Analysis ↔ SYS.5 System Qualification Test

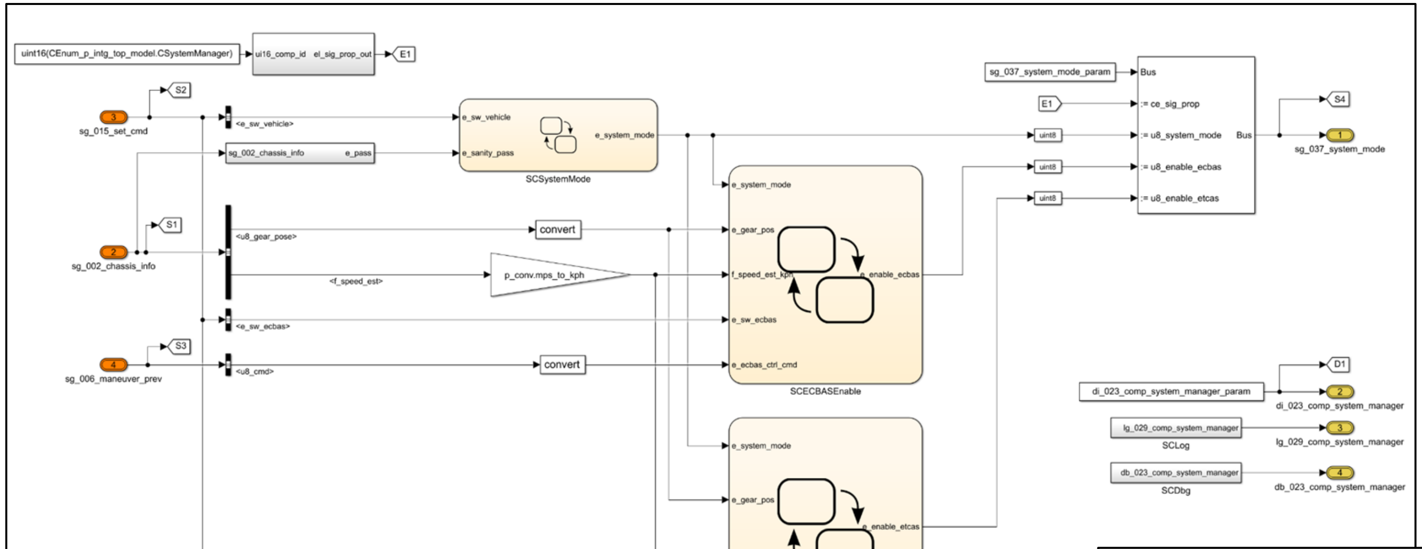
SYS.3 System Architectural Design ↔ SYS.4 System Integration & Integration Test

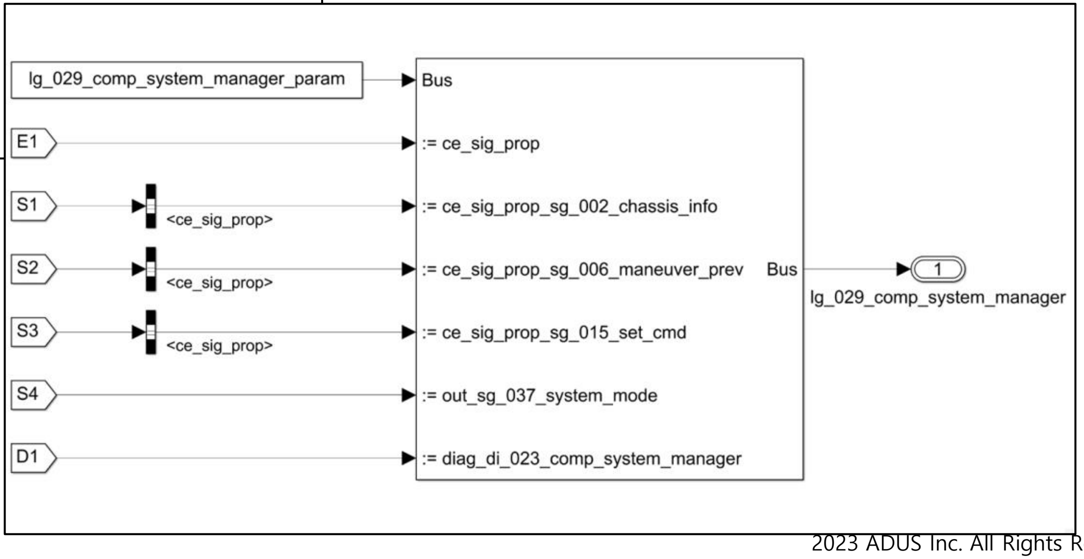
SWE.1 Software Requirements Analysis ↔ SWE.6 Software Qualification Test

SWE.2 Software Architectural Design ↔ SWE.5 Software Integration & Integration Test

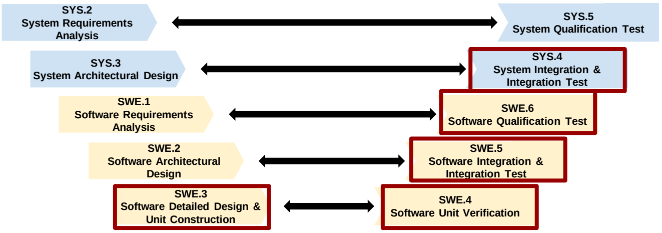
SWE.3 Software Detailed Design & Unit Construction ↔ SWE.4 Software Unit Verification

Data Logging for effective debugging




lg_029_comp_system_manager_param
Bus
E1
:= ce_sig_prop
S1
<ce_sig_prop>
:= ce_sig_prop_sg_002_chassis_info
S2
<ce_sig_prop>
:= ce_sig_prop_sg_006_maneuver_prev
Bus
1
lg_029_comp_system_manager
S3
<ce_sig_prop>
:= ce_sig_prop_sg_015_set_cmd
S4
:= out_sg_037_system_mode
D1
:= diag_di_023_comp_system_manager

Implementation : Matlab/Simulink Tips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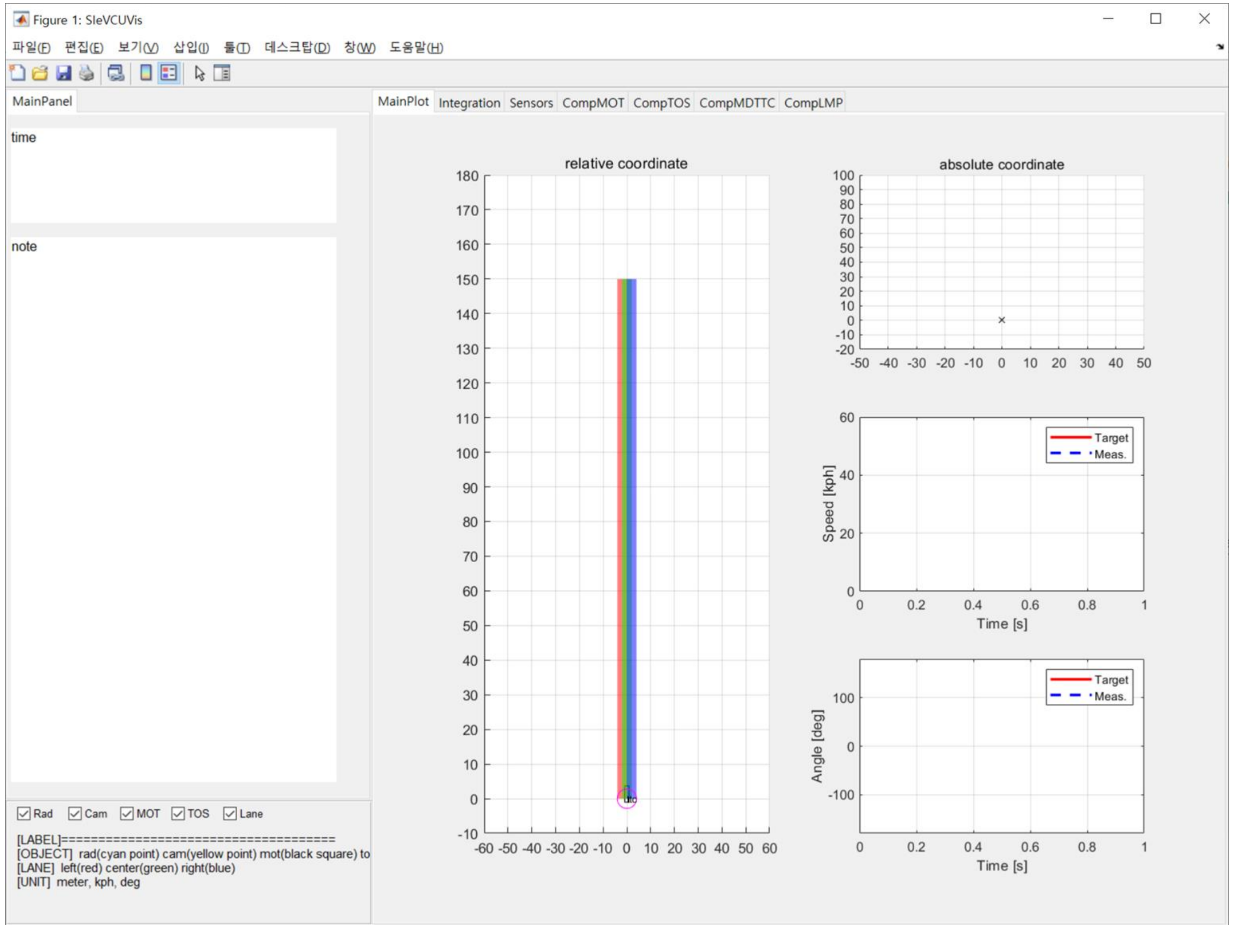
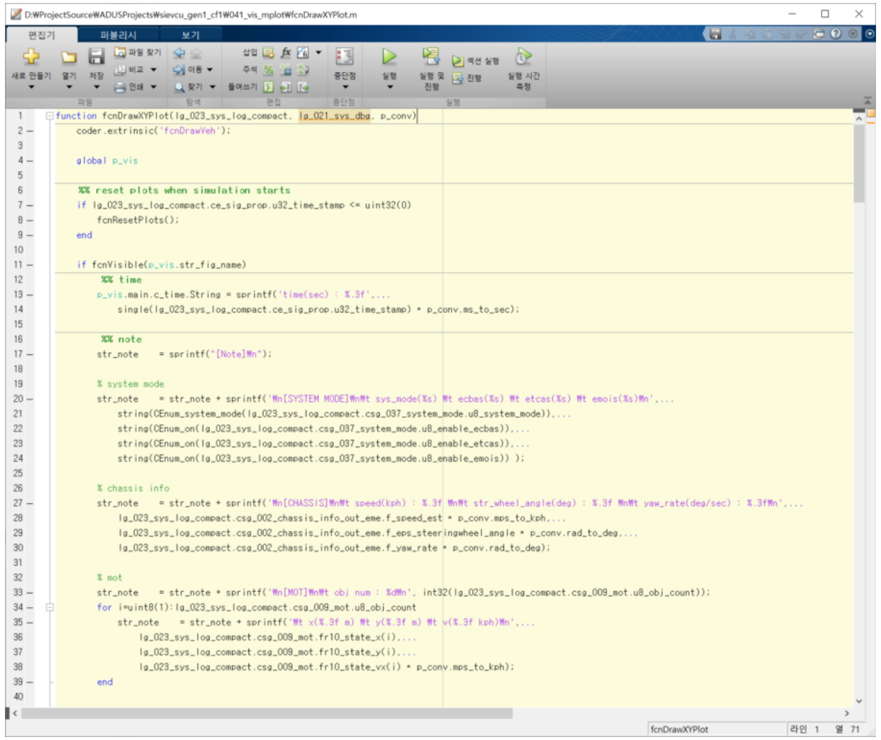
Visualization for debugging

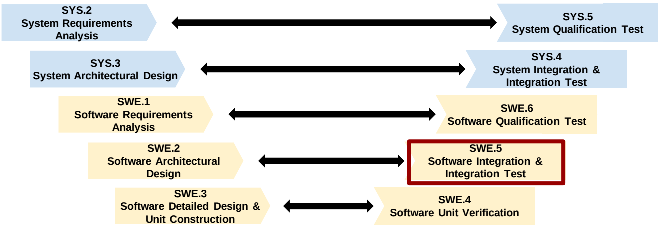


[LABEL]====================================
[OBJECT] rad(cyan point) cam(yellow point) mot(black square) to
[LANE] left(red) center(green) right(blue)
[UNIT] meter, kph, deg



```
function fcnDrawXYPlot(lg_023_sys_log_compact, lg_021_sys_dbg, p_conv)
    coder.extrinsic('fcnDrawVeh');

    global p_vis

    %% reset plots when simulation starts
    if lg_023_sys_log_compact.ce_sig_prop.u32_time_stamp <= uint32(0)
        fcnResetPlots();
    end

    if fcnVisible(p_vis.str_fig_name)
        %% time
        p_vis.main.c_time.String = sprintf('time(sec) : %.3f',...
            single(lg_023_sys_log_compact.ce_sig_prop.u32_time_stamp) * p_conv.ms_to_sec);

        %% note
        str_note    = sprintf("[Note]₩n");

        % system mode
        str_note    = str_note + sprintf('₩n[SYSTEM MODE]₩n₩t sys_mode(%s) ₩t ecbas(%s) ₩t etcas(%s) ₩t emois(%s)₩n',...
            string(CEnum_system_mode(lg_023_sys_log_compact.csg_037_system_mode.u8_system_mode)),...
            string(CEnum_on(lg_023_sys_log_compact.csg_037_system_mode.u8_enable_ecbas)),...
            string(CEnum_on(lg_023_sys_log_compact.csg_037_system_mode.u8_enable_etcas)),...
            string(CEnum_on(lg_023_sys_log_compact.csg_037_system_mode.u8_enable_emois)) );

        % chassis info
        str_note    = str_note + sprintf('₩n[CHASSIS]₩n₩t speed(kph) : %.3f ₩n₩t str_wheel_angle(deg) : %.3f ₩n₩t yaw_rate(deg/sec) : %.3f₩n',...
            lg_023_sys_log_compact.csg_002_chassis_info_out_eme.f_speed_est * p_conv.mps_to_kph,...
            lg_023_sys_log_compact.csg_002_chassis_info_out_eme.f_eps_steeringwheel_angle * p_conv.rad_to_deg,...
            lg_023_sys_log_compact.csg_002_chassis_info_out_eme.f_yaw_rate * p_conv.rad_to_deg);

        % mot
        str_note    = str_note + sprintf('₩n[MOT]₩n₩t obj num : %d₩n', int32(lg_023_sys_log_compact.csg_009_mot.u8_obj_count));
        for i=uint8(1):lg_023_sys_log_compact.csg_009_mot.u8_obj_count
            str_note    = str_note + sprintf('₩t x(%.3f m) ₩t y(%.3f m) ₩t v(%.3f kph)₩n',...
                lg_023_sys_log_compact.csg_009_mot.fr10_state_x(i),...
                lg_023_sys_log_compact.csg_009_mot.fr10_state_y(i),...
                lg_023_sys_log_compact.csg_009_mot.fr10_state_vx(i) * p_conv.mps_to_kph);
        end

```

Implementation : Matlab/Simulink Tips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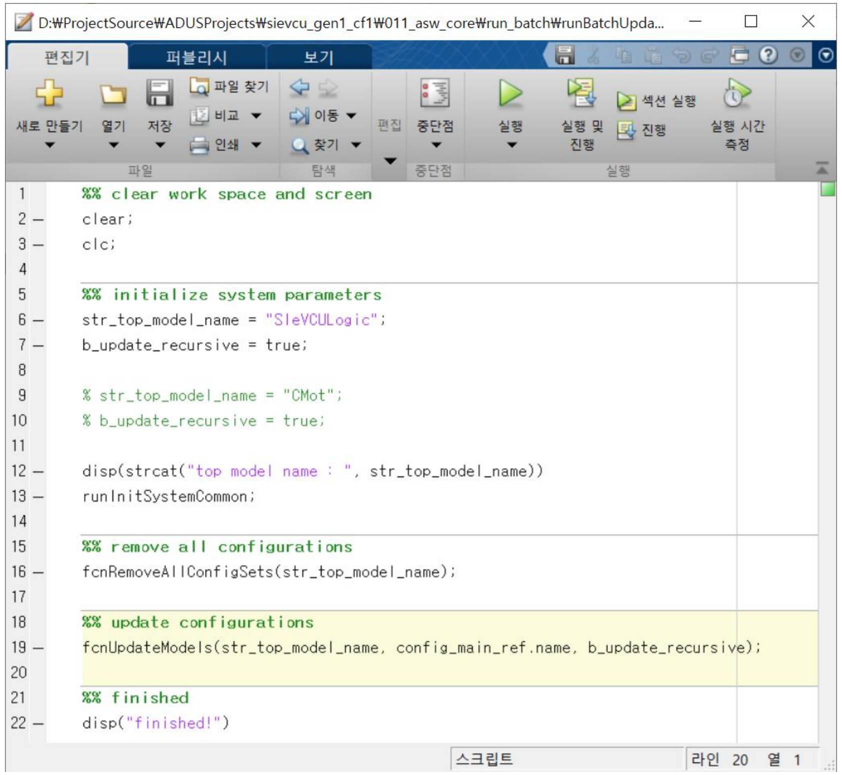
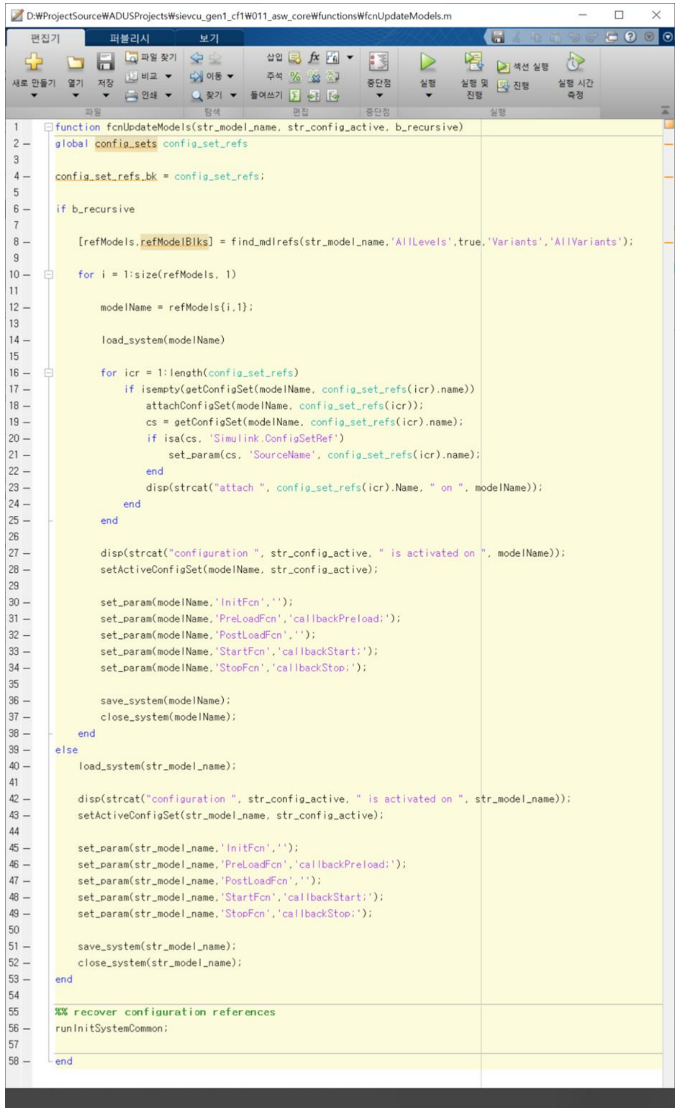
Automation for properties of the reference model



```
%% clear work space and screen
clear;
clc;

%% initialize system parameters
str_top_model_name = "SIeVCULogic";
b_update_recursive = true;

% str_top_model_name = "CMot";
% b_update_recursive = true;

disp(strcat("top model name : ", str_top_model_name))
runInitSystemCommon;

%% remove all configurations
fcnRemoveAllConfigSets(str_top_model_name);

%% update configurations
fcnUpdateModels(str_top_model_name, config_main_ref.name, b_update_recursive);

%% finished
disp("finished!")
```



```
function fcnUpdateModels(str_model_name, str_config_active, b_recursive)
global config_sets config_set_refs

config_set_refs_bk = config_set_refs;

if b_recursive

    [refModels,refModelBlks] = find_mdlrefs(str_model_name,'AllLevels',true,'Variants','AllVariants');

    for i = 1:size(refModels, 1)

        modelName = refModels{i,1};

        load_system(modelName)

        for icr = 1:length(config_set_refs)
            if isempty(getConfigSet(modelName, config_set_refs(icr).name))
                attachConfigSet(modelName, config_set_refs(icr));
                cs = getConfigSet(modelName, config_set_refs(icr).name);
                if isa(cs, 'Simulink.ConfigSetRef')
                    set_param(cs, 'SourceName', config_set_refs(icr).name);
                end
                disp(strcat("attach ", config_set_refs(icr).Name, " on ", modelName));
            end
        end

        disp(strcat("configuration ", str_config_active, " is activated on ", modelName));
        setActiveConfigSet(modelName, str_config_active);

        set_param(modelName,'InitFcn','');
        set_param(modelName,'PreLoadFcn','callbackPreload;');
        set_param(modelName,'PostLoadFcn','');
        set_param(modelName,'StartFcn','callbackStart;');
        set_param(modelName,'StopFcn','callbackStop;');

        save_system(modelName);
        close_system(modelName);
    end
else
    load_system(str_model_name);

    disp(strcat("configuration ", str_config_active, " is activated on ", str_model_name));
    setActiveConfigSet(str_model_name, str_config_active);

    set_param(str_model_name,'InitFcn','');
    set_param(str_model_name,'PreLoadFcn','callbackPreload;');
    set_param(str_model_name,'PostLoadFcn','');
    set_param(str_model_name,'StartFcn','callbackStart;');
    set_param(str_model_name,'StopFcn','callbackStop;');

    save_system(str_model_name);
    close_system(str_model_name);
end

%% recover configuration references
runInitSystemCommon;

end
```

Automation!

Maintenance

Development Process with Matlab Tools

- ADUS?
- Project Introduction
- Development Process with Matlab Tools

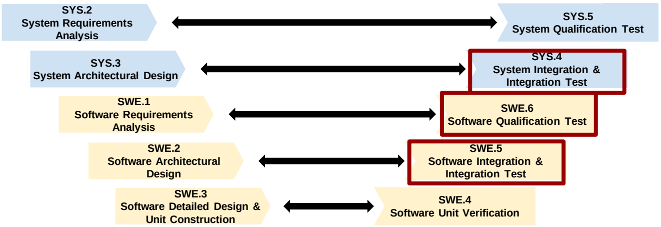
  A. Design : Traceability Managemnet

  B. Implementation : Matlab/Simulink Tips

  C. Validation : System/SW Validation

  D. Production

Validation : System/SW Validation



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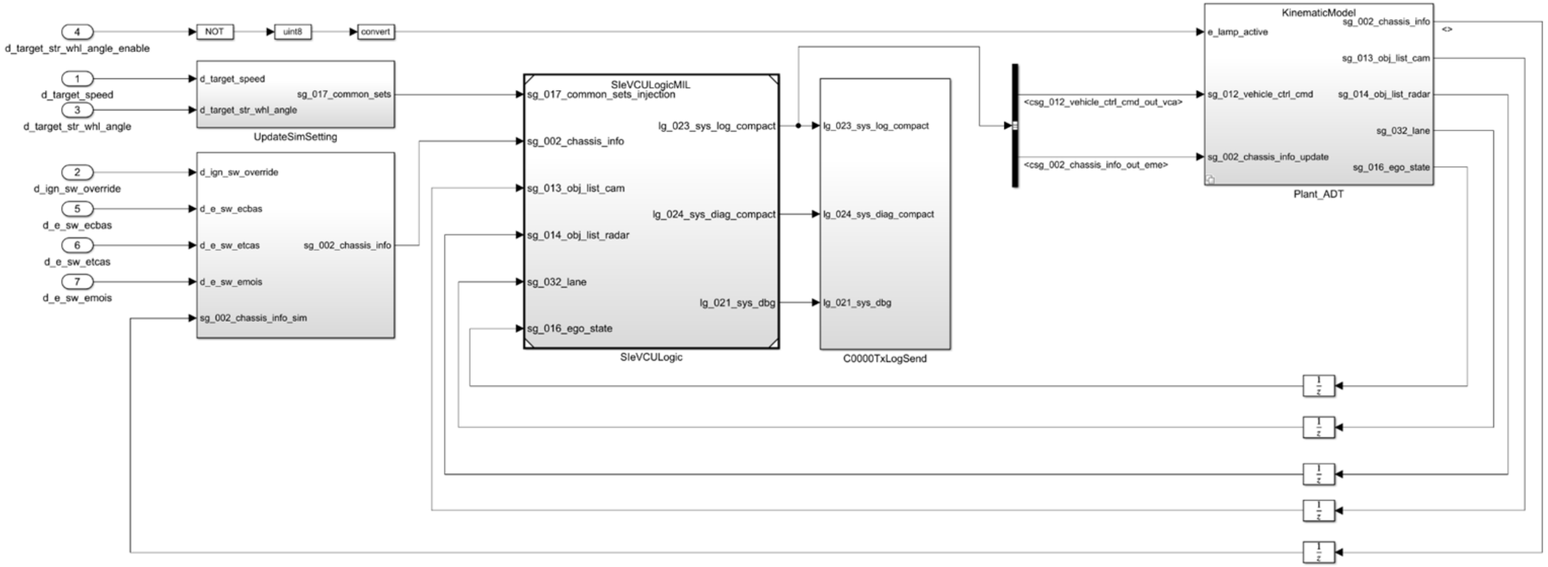
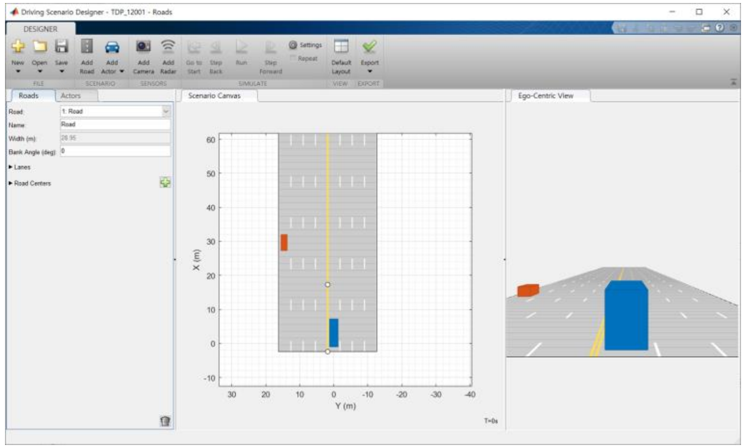
SWE.4 Software Unit Verification

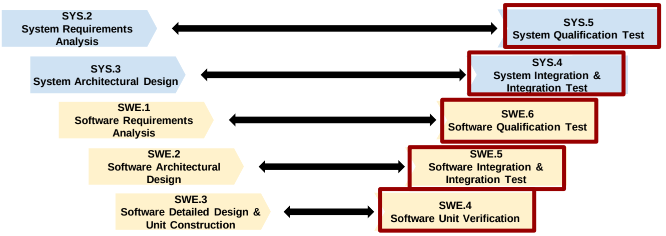
MIL Test Environment : ADT(Vehicle Model, Environment/Sensor Model) + Test Harness





ADT : Automated Driving System Toolbox

Validation : System/SW Validation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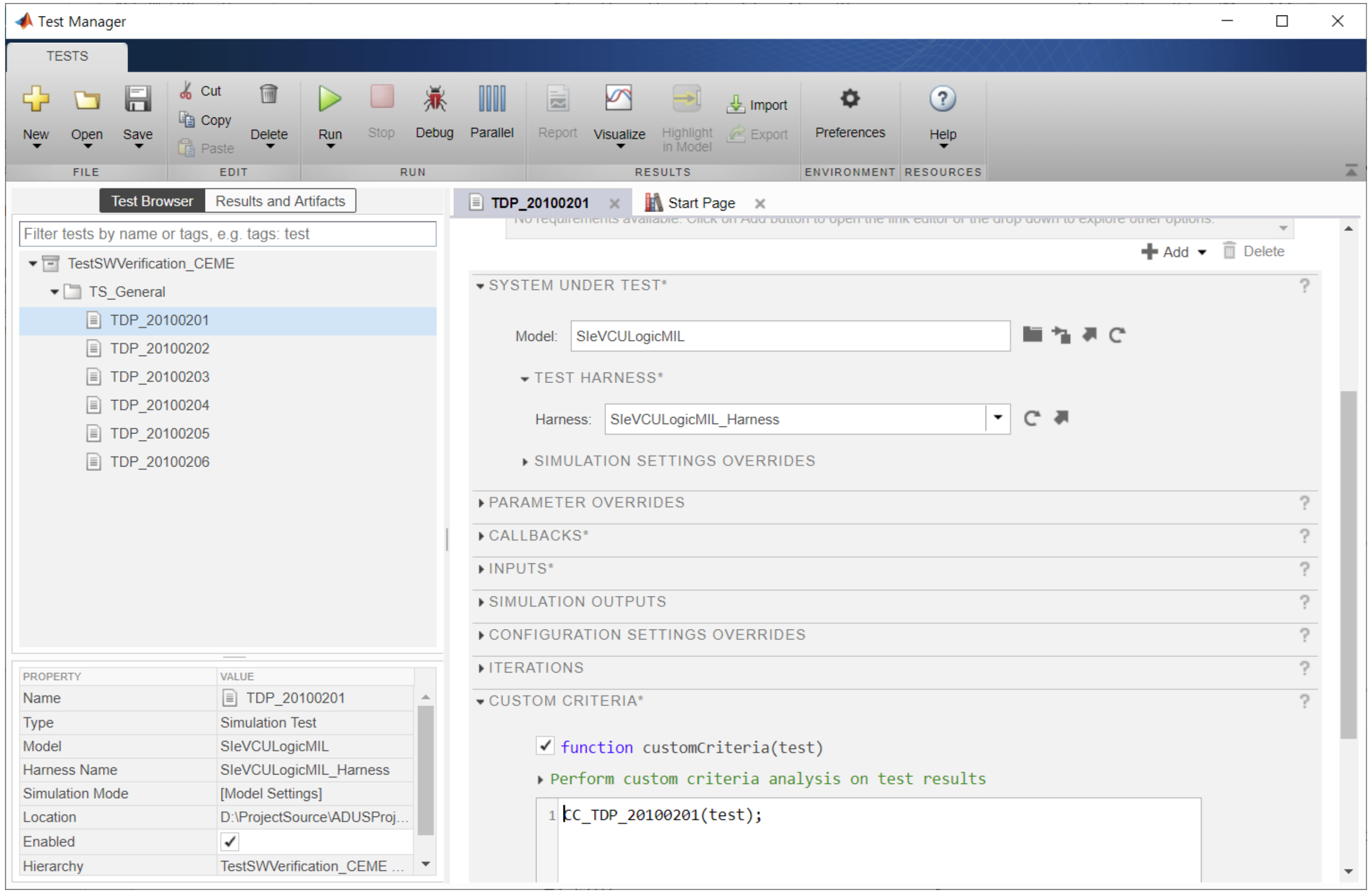
Test Case Management



- TestSWVerification_CEME
  - TS_General
    - TDP_20100201
    - TDP_20100202
    - TDP_20100203
    - TDP_20100204
    - TDP_20100205
    - TDP_20100206

PROPERTY	VALUE
Name	TDP_20100201
Type	Simulation Test
Model	SleVCULogicMIL
Harness Name	SleVCULogicMIL_Harness
Simulation Mode	[Model Settings]
Location	D:\ProjectSource\ADUSProj...
Enabled	✓
Hierarchy	TestSWVerification_CEME ...

SYSTEM UNDER TEST*

Model: SleVCULogicMIL

TEST HARNESS*

Harness: SleVCULogicMIL_Harness

SIMULATION SETTINGS OVERRIDES

PARAMETER OVERRIDES

CALLBACKS*

INPUTS*

SIMULATION OUTPUTS

CONFIGURATION SETTINGS OVERRIDES

ITERATIONS

CUSTOM CRITERIA*

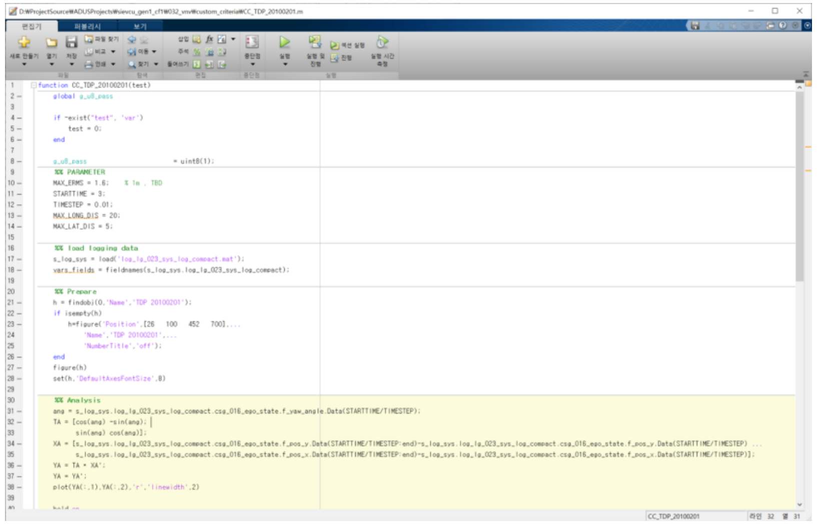
☑ function customCriteria(test)

Perform custom criteria analysis on test results

```
CC_TDP_20100201(test);
```

Automation!

Maintenance



```
function CC_TDP_20100201(test)
    global g_u8_pass

    if ~exist("test", 'var')
        test = 0;
    end

    g_u8_pass                          = uint8(1);
    %% PARAMETER
    MAX_ERMS = 1.6;    % 1m , TBD
    STARTTIME = 3;
    TIMESTEP = 0.01;
    MAX_LONG_DIS = 20;
    MAX_LAT_DIS = 5;

    %% load logging data
    s_log_sys = load('log_lg_023_sys_log_compact.mat');
    vars_fields = fieldnames(s_log_sys.log_lg_023_sys_log_compact);

    %% Prepare
    h = findobj(0,'Name','TDP 20100201');
    if isempty(h)
        h=figure('Position',[26   100   452   700],...
            'Name','TDP 20100201',...
            'NumberTitle','off');
    end
    figure(h)
    set(h,'DefaultAxesFontSize',8)

    %% Analysis
    ang = s_log_sys.log_lg_023_sys_log_compact.csg_016_ego_state.f_yaw_angle.Data(STARTTIME/TIMESTEP);
    TA = [cos(ang) -sin(ang);
          sin(ang) cos(ang)];
    XA = [s_log_sys.log_lg_023_sys_log_compact.csg_016_ego_state.f_pos_y.Data(STARTTIME/TIMESTEP:end)-s_log_sys.log_lg_023_sys_log_compact.csg_016_ego_state.f_pos_y.Data(STARTTIME/TIMESTEP) ...
          s_log_sys.log_lg_023_sys_log_compact.csg_016_ego_state.f_pos_x.Data(STARTTIME/TIMESTEP:end)-s_log_sys.log_lg_023_sys_log_compact.csg_016_ego_state.f_pos_x.Data(STARTTIME/TIMESTEP)];
    YA = TA * XA';
    YA = YA';
    plot(YA(:,1),YA(:,2),'r','linewidth',2)

    hold on
```

- ADUS?
- Project Introduction
- Development Process with Matlab Tools

A. Design : Traceability Managemnet

B. Implementation : Matlab/Simulink Tips

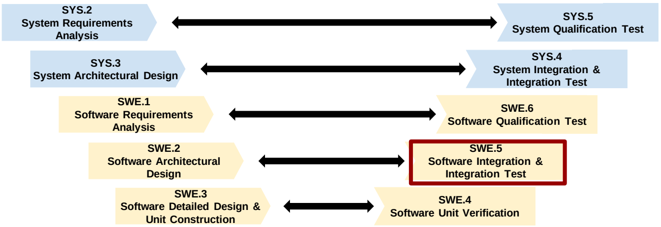
C. Validation : System/SW Validation

D. Production

Development Process with Matlab Tools

Production

Configuration 관리 방법

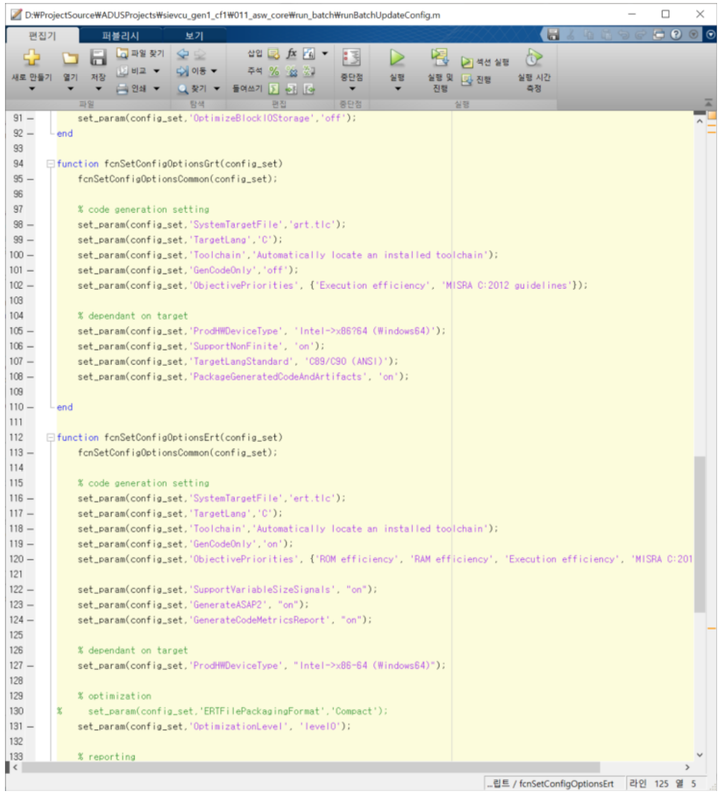

SYS.2 System Requirements Analysis ↔ SYS.5 System Qualification Test

SYS.3 System Architectural Design ↔ SYS.4 System Integration & Integration Test

SWE.1 Software Requirements Analysis ↔ SWE.6 Software Qualification Test

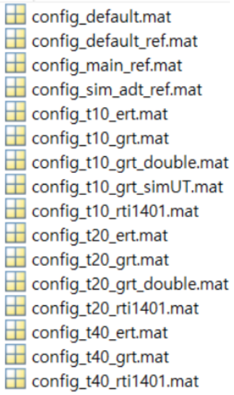
SWE.2 Software Architectural Design ↔ SWE.5 Software Integration & Integration Test

SWE.3 Software Detailed Design & Unit Construction ↔ SWE.4 Software Unit Verification


D:₩ProjectSource₩ADUSProjects₩sievcu_gen1_cf1₩011_asw_core₩run_batch₩runBatchUpdateConfig.m

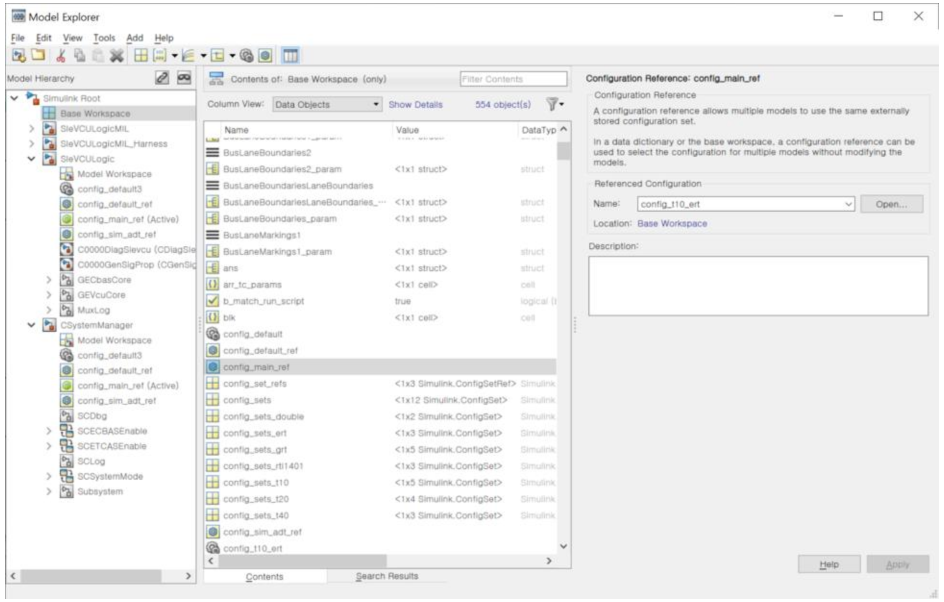
```
    set_param(config_set,'OptimizeBlockIOStorage','off');
end

function fcnSetConfigOptionsGrt(config_set)
    fcnSetConfigOptionsCommon(config_set);

    % code generation setting
    set_param(config_set,'SystemTargetFile','grt.tlc');
    set_param(config_set,'TargetLang','C');
    set_param(config_set,'Toolchain','Automatically locate an installed toolchain');
    set_param(config_set,'GenCodeOnly','off');
    set_param(config_set,'ObjectivePriorities', {'Execution efficiency', 'MISRA C:2012 guidelines'});

    % dependant on target
    set_param(config_set,'ProdHWDeviceType', 'Intel->x86?64 (Windows64)');
    set_param(config_set,'SupportNonFinite', 'on');
    set_param(config_set,'TargetLangStandard', 'C89/C90 (ANSI)');
    set_param(config_set,'PackageGeneratedCodeAndArtifacts', 'on');

end

function fcnSetConfigOptionsErt(config_set)
    fcnSetConfigOptionsCommon(config_set);

    % code generation setting
    set_param(config_set,'SystemTargetFile','ert.tlc');
    set_param(config_set,'TargetLang','C');
    set_param(config_set,'Toolchain','Automatically locate an installed toolchain');
    set_param(config_set,'GenCodeOnly','on');
    set_param(config_set,'ObjectivePriorities', {'ROM efficiency', 'RAM efficiency', 'Execution efficiency', 'MISRA C:201

    set_param(config_set,'SupportVariableSizeSignals', "on");
    set_param(config_set,'GenerateASAP2', "on");
    set_param(config_set,'GenerateCodeMetricsReport', "on");

    % dependant on target
    set_param(config_set,'ProdHWDeviceType', "Intel->x86-64 (Windows64)");

    % optimization
%     set_param(config_set,'ERTFilePackagingFormat','Compact');
    set_param(config_set,'OptimizationLevel', 'level0');

    % reporting
```

…립트 / fcnSetConfigOptionsErt | 라인 125 열 5


- config_default.mat
- config_default_ref.mat
- config_main_ref.mat
- config_sim_adt_ref.mat
- config_t10_ert.mat
- config_t10_grt.mat
- config_t10_grt_double.mat
- config_t10_grt_simUT.mat
- config_t10_rti1401.mat
- config_t20_ert.mat
- config_t20_grt.mat
- config_t20_grt_double.mat
- config_t20_rti1401.mat
- config_t40_ert.mat
- config_t40_grt.mat
- config_t40_rti1401.mat

Automation!

Maintenance



- Simulink Root
  - Base Workspace
  - SIeVCULogicMIL
  - SIeVCULogicMIL_Harness
  - SIeVCULogic
    - Model Workspace
    - config_default3
    - config_default_ref
    - config_main_ref (Active)
    - config_sim_adt_ref
    - C0000DiagSievcu (CDiagSie
    - C0000GenSigProp (CGenSig
    - GECbasCore
    - GEVcuCore
    - MuxLog
  - CSystemManager
    - Model Workspace
    - config_default3
    - config_default_ref
    - config_main_ref (Active)
    - config_sim_adt_ref
    - SCDbg
    - SCECBASEnable
    - SCETCASEnable
    - SCLog
    - SCSystemMode
    - Subsystem

Name	Value	DataTyp
BusLaneBoundaries2		
BusLaneBoundaries2_param	<1x1 struct>	struct
BusLaneBoundariesLaneBoundaries		
BusLaneBoundariesLaneBoundaries_···	<1x1 struct>	struct
BusLaneBoundaries_param	<1x1 struct>	struct
BusLaneMarkings1		
BusLaneMarkings1_param	<1x1 struct>	struct
ans	<1x1 struct>	struct
arr_tc_params	<1x1 cell>	cell
b_match_run_script	true	logical (l
blk	<1x1 cell>	cell
config_default		
config_default_ref		
config_main_ref		
config_set_refs	<1x3 Simulink.ConfigSetRef>	Simulink
config_sets	<1x12 Simulink.ConfigSet>	Simulink
config_sets_double	<1x2 Simulink.ConfigSet>	Simulink
config_sets_ert	<1x3 Simulink.ConfigSet>	Simulink
config_sets_grt	<1x5 Simulink.ConfigSet>	Simulink
config_sets_rti1401	<1x3 Simulink.ConfigSet>	Simulink
config_sets_t10	<1x5 Simulink.ConfigSet>	Simulink
config_sets_t20	<1x4 Simulink.ConfigSet>	Simulink
config_sets_t40	<1x3 Simulink.ConfigSet>	Simulink
config_sim_adt_ref		
config_t10_ert		

Configuration Reference: config_main_ref

Configuration Reference

A configuration reference allows multiple models to use the same externally stored configuration set.

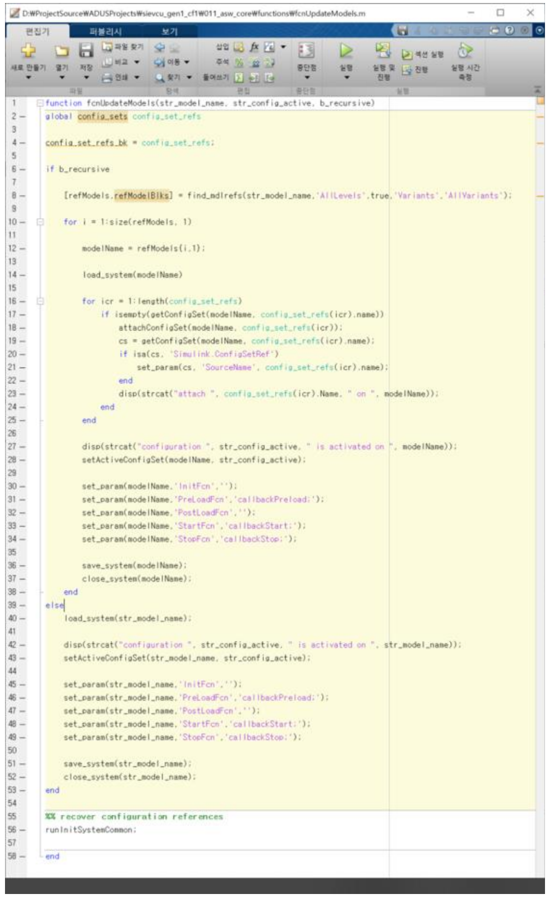
In a data dictionary or the base workspace, a configuration reference can be used to select the configuration for multiple models without modifying the models.

Referenced Configuration

Name: config_t10_ert

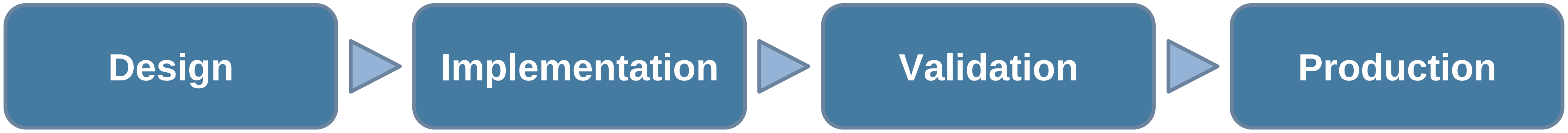
Location: Base Workspace

Description:


D:₩ProjectSource₩ADUSProjects₩sievcu_gen1_cf1₩011_asw_core₩functions₩fcnUpdateModels.m

```
function fcnUpdateModels(str_model_name, str_config_active, b_recursive)
global config_sets config_set_refs

config_set_refs_bk = config_set_refs;

if b_recursive

    [refModels,refModelBlks] = find_mdlrefs(str_model_name,'AllLevels',true,'Variants','AllVariants');

    for i = 1:size(refModels, 1)

        modelName = refModels{i,1};

        load_system(modelName)

        for icr = 1:length(config_set_refs)
            if isempty(getConfigSet(modelName, config_set_refs(icr).name))
                attachConfigSet(modelName, config_set_refs(icr));
                cs = getConfigSet(modelName, config_set_refs(icr).name);
                if isa(cs, 'Simulink.ConfigSetRef')
                    set_param(cs, 'SourceName', config_set_refs(icr).name);
                end
                disp(strcat("attach ", config_set_refs(icr).Name, " on ", modelName));
            end
        end

        disp(strcat("configuration ", str_config_active, " is activated on ", modelName));
        setActiveConfigSet(modelName, str_config_active);

        set_param(modelName,'InitFcn','');
        set_param(modelName,'PreLoadFcn','callbackPreload;');
        set_param(modelName,'PostLoadFcn','');
        set_param(modelName,'StartFcn','callbackStart;');
        set_param(modelName,'StopFcn','callbackStop;');

        save_system(modelName);
        close_system(modelName);
    end
else
    load_system(str_model_name);

    disp(strcat("configuration ", str_config_active, " is activated on ", str_model_name));
    setActiveConfigSet(str_model_name, str_config_active);

    set_param(str_model_name,'InitFcn','');
    set_param(str_model_name,'PreLoadFcn','callbackPreload;');
    set_param(str_model_name,'PostLoadFcn','');
    set_param(str_model_name,'StartFcn','callbackStart;');
    set_param(str_model_name,'StopFcn','callbackStop;');

    save_system(str_model_name);
    close_system(str_model_name);
end

%% recover configuration references
runInitSystemCommon;

end
```

Summary



Design ▶ Implementation ▶ Validation ▶ Production

Design

- **Traceability**
  ▼ Between Requirements & Implementation

Implementation

- **Variant Management**
  ▼ Test Mode, Target Vehicle, Target H/W
- **Data Definition**
  ▼ Bus
- **Interface Based Cooperation**
- **Logging Data Port**
- **Properties for Reference Models**

Validation

- **MIL Test Environment**
- **Test Management**

Production

- **Configuration Management**

MATLAB EXPO

Thank you

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