3V-SG(vECU-MBD Working group) with ASAM

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ASAM Association for Standardization of Automation and Measuring Systems

Agenda

1	vECU-MBD Working Group
2	3V-SG (Virtual Verification & Validation using vECU Study Group)
3	Collaboration on ASAM XCP
4	Summary

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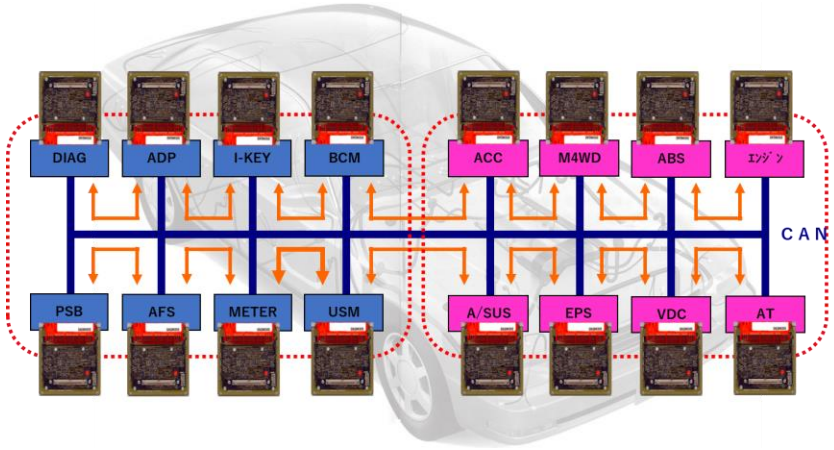
Background (1/2)

Issues in automotive ECU development

- Demand for automotive causes ever-increasing complexity of automotive software
- On the other hands shorten TAT (turn-around time), decreasing cost and keep high level of safety are required for development of the software.

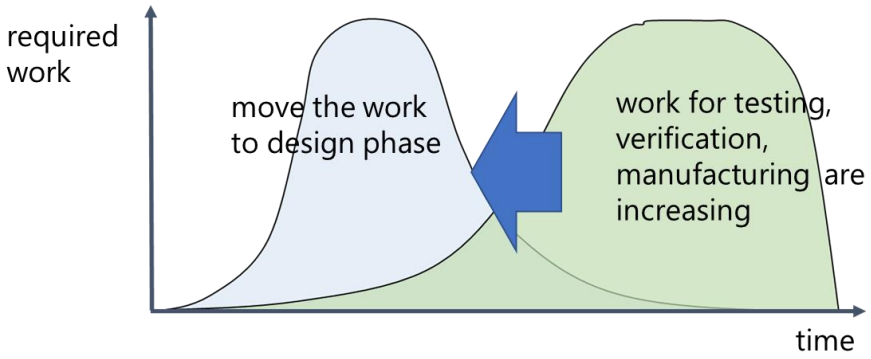


Solutions are required to develop ever-increasing automotive software.

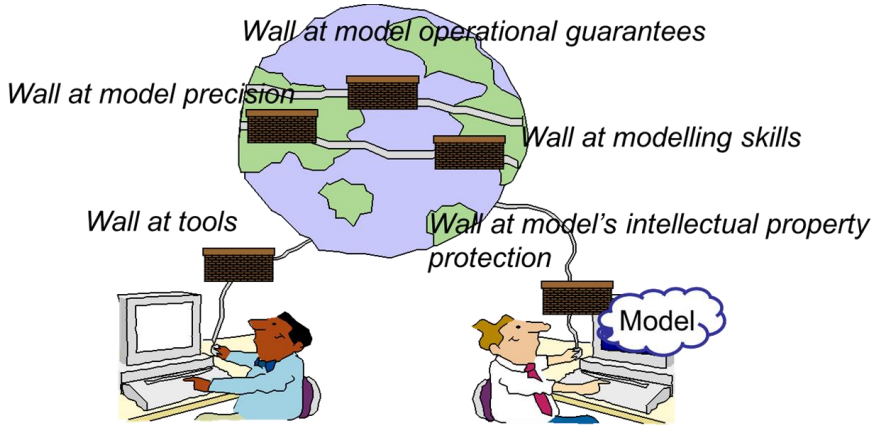
Background (2/2)

Challenges in applying MBD

One of the solutions is applying model-based development (MBD) for the development of the ECUs.
It is expected improve productivity, shorten TAT, and keep quality.



However, there were many challenges to apply MBD for ECUs development.

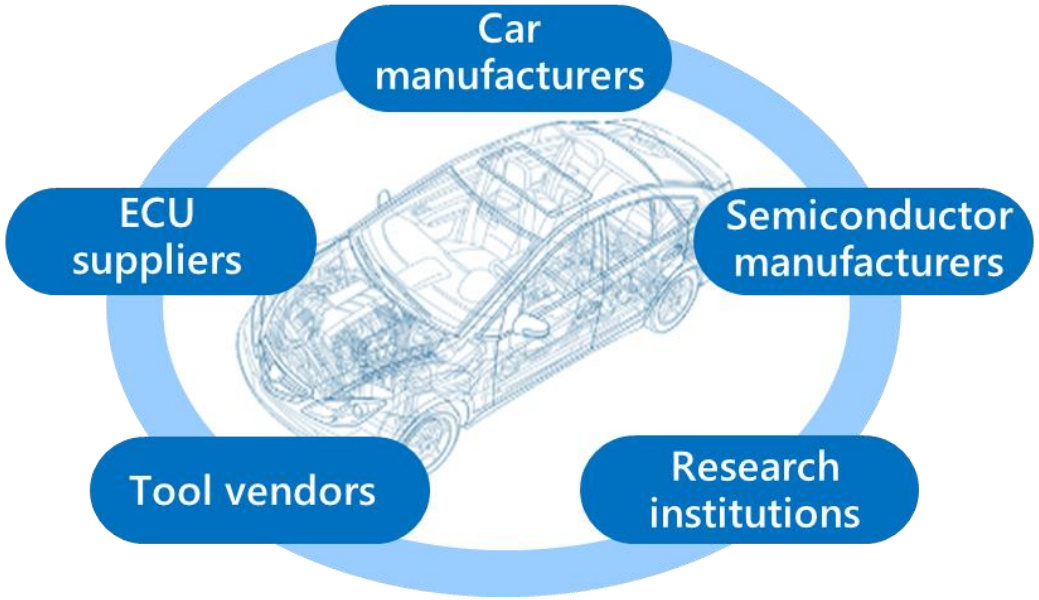


To tackle the issues, we started collaboration between, OEM, suppliers, semiconductor companies, and tool companies who relating to developing ECUs.

vECU-MBD Working Group

Overview

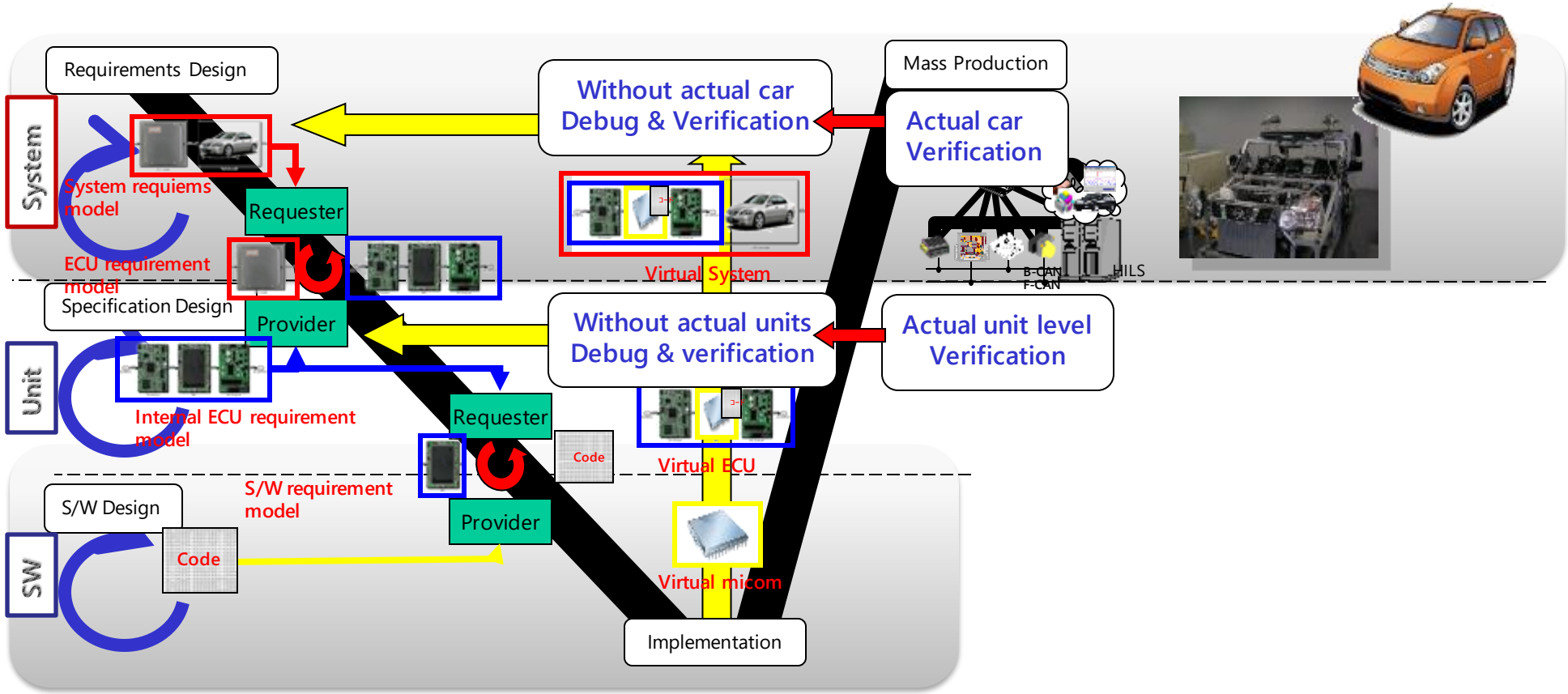
- **Objective**
  Promote MBD using virtual ECU*
- **Working group members**
  Collaboration of cross domain industries regarding to automotive ECU. Engineers and researchers from organizations related to the ECU.
- **Started**
  From April/2010
- **Home page**
  http://www.vecu-mbd.org/en/
- **Activities**
  - Publishing guideline documents to apply MBD
  - Developing proof of concept models



*) ECU: electronic control unit

Objective of the WG

Efficient development of the ECU using MBD



Utilizing virtual ECUs at each design levels ⇒ Decreasing TAT & Cost

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3	Collaboration on ASAM XCP
4	Summary

From vECU-MBD WG to 3V-SG

- The technology related to automotive and the demands from society are changed rapidly.
- Automotive electronic systems are becoming more important to meet these demands, and then the scale and complexity are accelerating.

- While the targets of verification and evaluation such as autonomous driving and connectivity, are expanding dramatically, we decided to advance our activities to widely research virtual verification methods as one of the verification means.

- We start 3V-SG (**V**irtual **V**erification & **V**alidation using vECU **S**tudy **G**roup).

vECU-MBD WG

3V-SG (Virtual Verification & Validation using vECU Study Group)

2010～2021

- Primary focuses on ISS* and its application, and enlightenment in the industry.
- Acquisition of public projects

2021～

- Study group to widely study virtual verification methods as one of the verification methods.
- With a view to advocating standardization for methodologies from research results.

*) ISS: Instruction Set Simulation

3V-SG

- **Objective**
  Widely research "virtual verification methods" as a means of verification and evaluation. And provide and widely disseminate proposals on technologies and development methods for realizing the development and efficiency of mobility systems.

- **How**
  General meeting, Steering committee, and Task forces that carries out specific activities.

- **Web**
  https://www.3v-sg.org (in preparation)
  http://www.vecu-mbd.org

PoC activities in 3V-SG

- **Collaboration on ASAM XCP**
  Feasibility study for using ASAM XCP at co-simulation of different users in the cloud (Co-MBD). A proposal in the ASAM XCP to be used in the virtual environment.

- **METI-SPILS**
  Study of design methods to streamline the use of SPILS, study of SPILS applications such as fault injection by using the vehicle model from METI[*1].

- **FMI Collaboration**
  Study of the FMI[*2] and its applications.

And more activities are under discussion.

*1) METI: Ministry of Economy, Trade and Industry
*2) FMI: Functional Mock-up Interface

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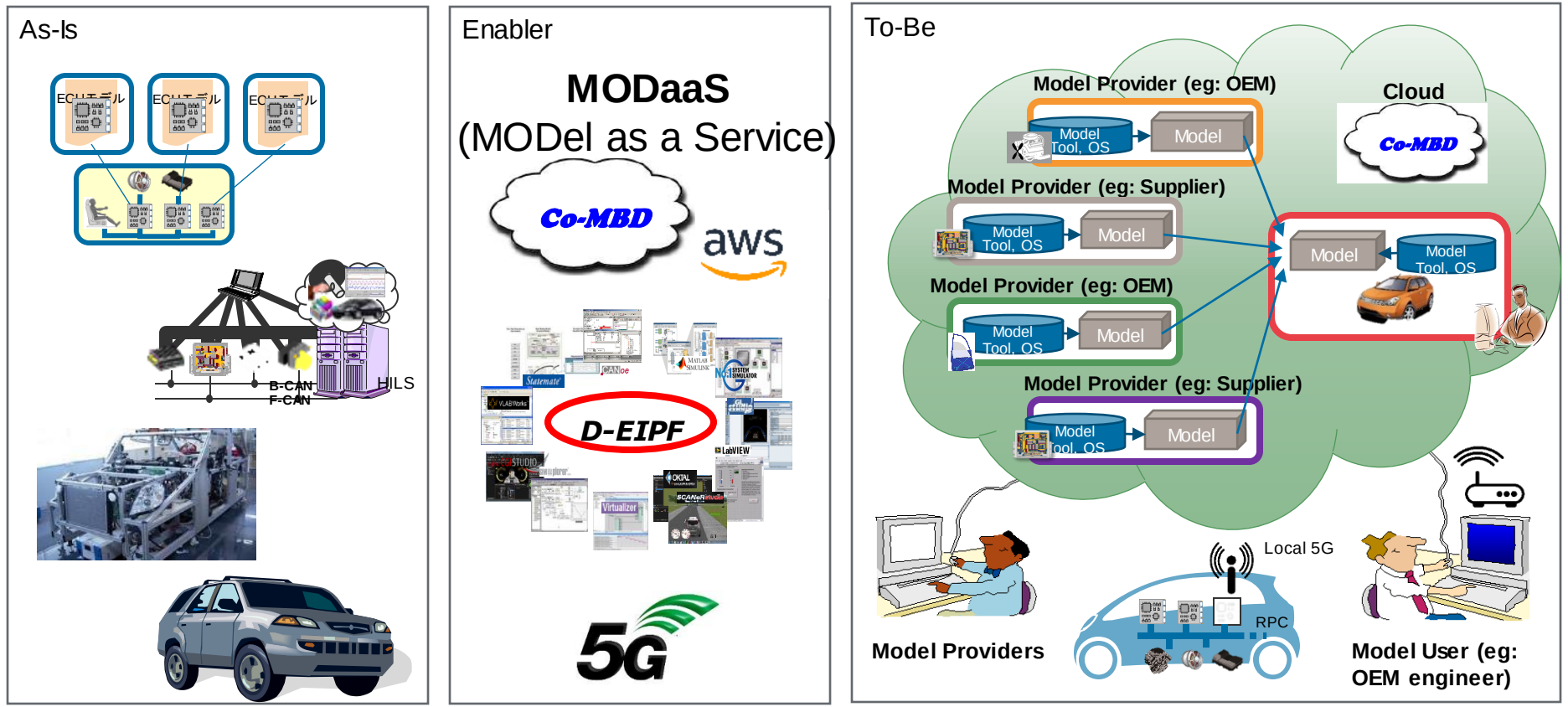
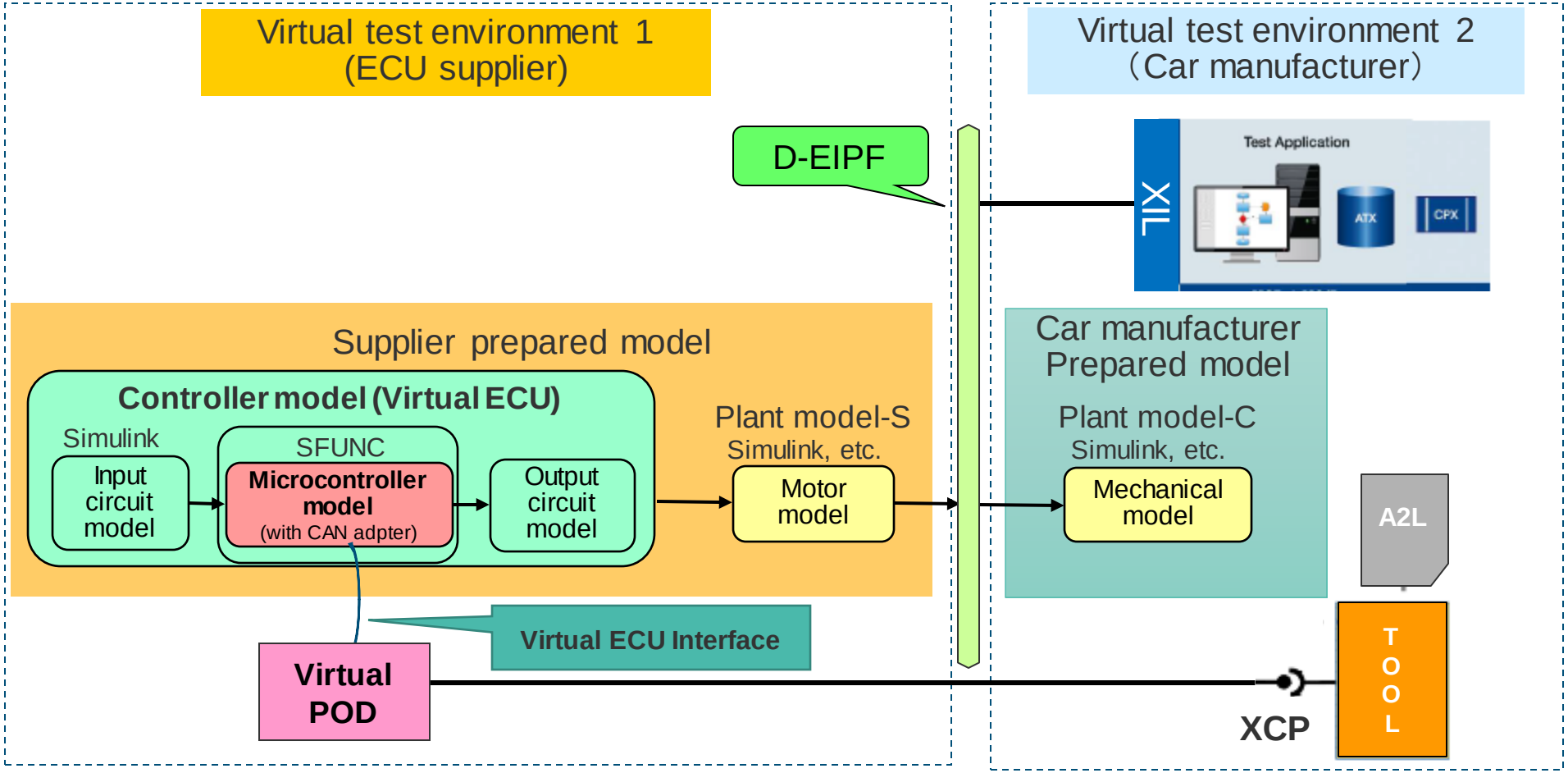
Collaboration on ASAM XCP

Co-MBD using virtual-HILS on Cloud



ASAM XCP and Co-MBD

Feasibility study for using ASAM at co-simulation of different users on cloud (Co-MBD)



ASAM XIL : an API standard for the communication between test automation tools and test benches
ASAM MCD-1 XCP : a bus-independent, master-slave communication protocol to connect ECUs with calibration systems
POD : Plug-On Device

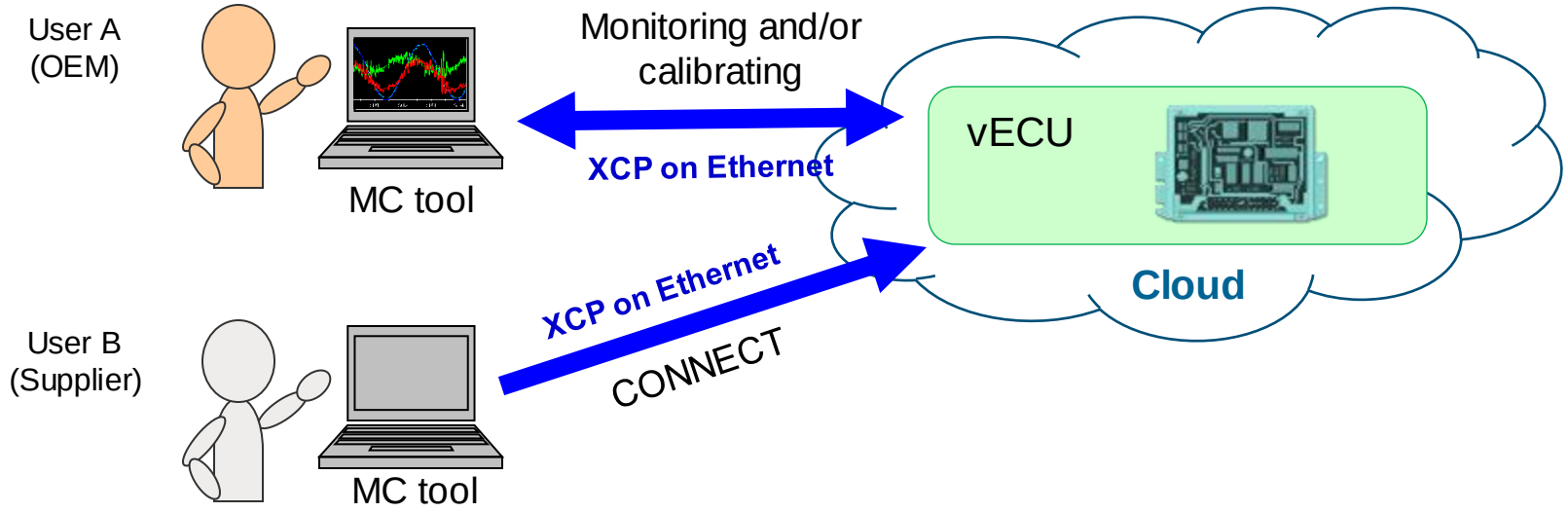
Concerns and Issues to realize MC on virtual environment

Will add when we face any concerns/issues.

No	Item	Description	Countermeasure	Note
1	Startup sequence	If startup sequence is different among vECUs, there is a concern that synchronous measurement is not possible. (e.g. MC tool should be start first, or simulator started first...) Startup sequence of vECU should be flexible and not depend on the specific order.	To be confirmed in future.	
2	Restriction by security mechanism on execution environment	Due to security mechanism on PC which MC tool or vECU is set on, not possible to change configuration of network and firewall. For this MC tool PC and vECU PC cannot be connected.	Use PCs on which the configuration of NW and firewall can be changed.	In the case that device license is needed to install vECU, should be careful for security mechanism of PC.
3	Multi-master connection in cloud environment	ASAM MCD-1 XCP does not allow multi-master topology. On cloud environment there is a possibility that multiple masters connect to a vECU. Ex. During a user is monitoring or calibrating a vECU on cloud, another user may connect to the same vECU.	Implement any exclusive control to vECU. or, Feedback to ASAM if there is use case multi-master connection is necessary.	
4	Seed & Key support	vECU. Is it possible to support Seed & Key mechanism to vECU? (or already supported?)	To be confirmed in future.	
5	Disconnection control between MC tool and vECU	A mechanism to forcibly disconnect XCP communication is needed. (ex. In the case that no one notices that keep MC tool connecting to vECU)	To be confirmed in future.	
6	MC tool on cloud	Restrictions on MC tool: Is it possible to use MC tool on cloud? What kind of restriction will be? (ex. Any restriction of license)	To be confirmed in future.	
7		Multiuser access to MC tool: If MC tool is put on cloud, there is a case multi users will use at the same time. The number of user will be limited?	To be confirmed in future.	
8		Location of A2L file: If MC tool is put on cloud, where should A2L file be put? (Cloud server where MC tool is installed, or user's local PC?)	To be confirmed in future.	
9	Timeout setting in A2L	For vECU the timeout value for command-response defined in A2L is different from real ECU.	To change the value in A2L or setting of MC tool.	

Concern about multi-master connection in cloud environment

Ex. During user A (OEM) is monitoring and/or calibrating of vECU, user B (supplier) connects.



From ASAM Office;

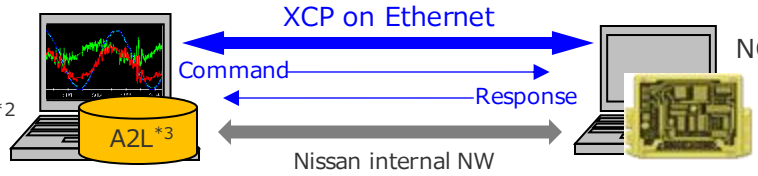
- MCD-1 XCP does not define a behavioral specification of multi-master connection.
- When multiple masters send CONNECT command with the same IP address and port, slave (vECU) cannot identify the user for each commands.
- Slave will respond to CONNECT commands even if multiple times. However, measurement may stop by command sequence error dependent on what command will be sent from users.
- Need to implement exclusive control mechanism to vECU.
- Any way we will plan to include this case to verification scenario,
- and study to give feedback to ASAM if there is use case multi-master connection is necessary

Ex. There might be a case that OEM user would like to share with supplier in real time the transition of variables associated with calibration.

Concern No.9: Timeout setting

Environment

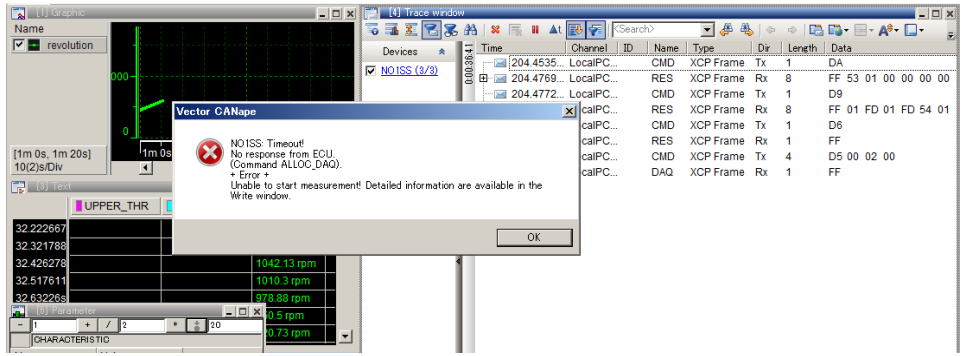
MC tool
- INCA V7.2.5*1
- CANape V16.0 SP5*2



*1: ETAS
*2: Vector
*3: GAIO

Timeout error occurred.

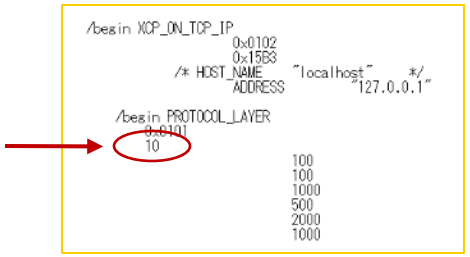
- XCP communication between MC tool and simulator was disconnected.
- Timeout error was displayed on the screen of MC tool.
- Timing of disconnection was indefinite.



Findings

Issue was avoidable by changing the command–response timeout to the larger.

- When setting to 10ms, 100ms : Timeout error occurred.
- **When setting to 1000ms : No error**



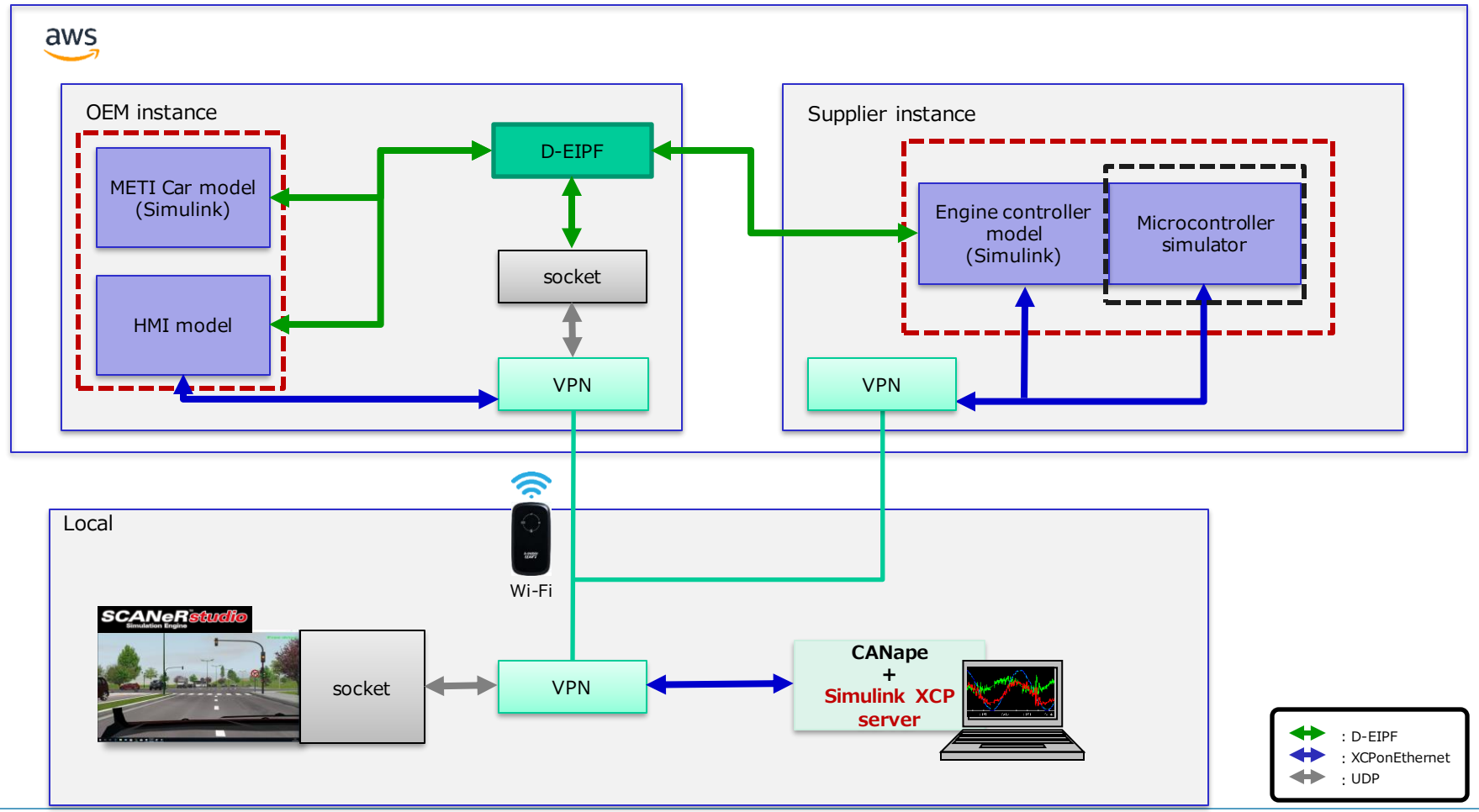
PoC participants (~ 2021.03)

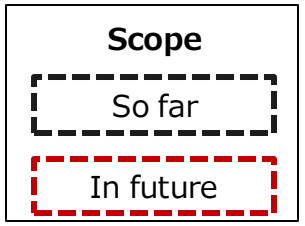
- Australian Semiconductor Technology Company K.K.
- ETAS K.K.
- GAIO TECHNOLOGY Co., Ltd.
- Nihon Synopsys G.K.
- Nissan Motor Co., Ltd.

Currently recruiting members again for the activity in future.

A goal image at step 5

Scope of PoC is expanded (not only SPILS but also **MILS**).
We will study the use case for MILS and verify whether we can use MC tool in the same way as real ECU or SPILS environment.





In the future

We would like to give feedback about findings gotten through vECU-WG to ASAM standards.

Relevant standards

- MCD-1POD
- MCD-1XCP
- MCD-2MC

4. Summary

- Engineers and researchers in the industry involved in model-based development of in-vehicle electronic systems collaborate to solve problems in utilizing model-based development. Create / publish, demonstrate, propose, and raise awareness of guides that guide the use of model-based development.

- From vECU-MBD WG to 3V-SG.
  Widely research "virtual verification methods" as a means of verification and evaluation. And provide and widely disseminate proposals on technologies and development methods for realizing the development and efficiency of mobility systems.

- **We are looking forward to advance virtual verification methods by collaborating with ASAM.**

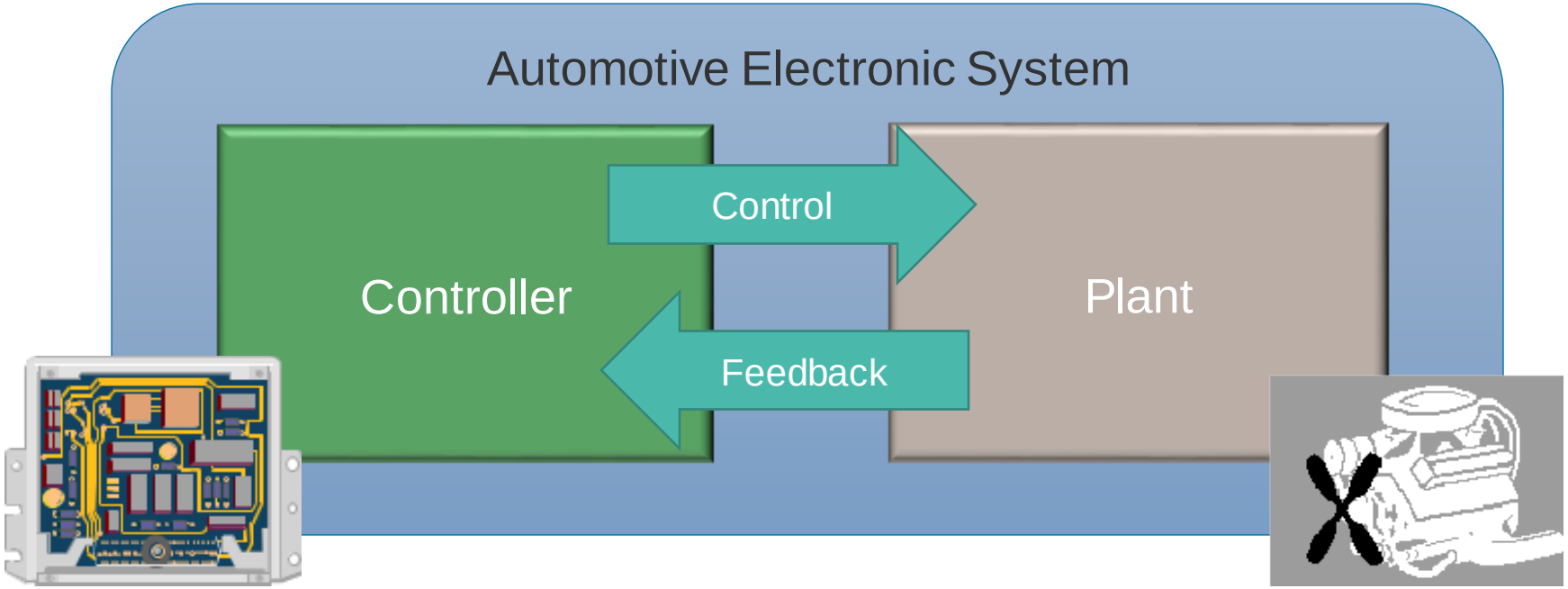
ASAM

3V-SG
Virtual Verification & Validation using vECU Study Group

Backup Slide

Focused Area (1/2)

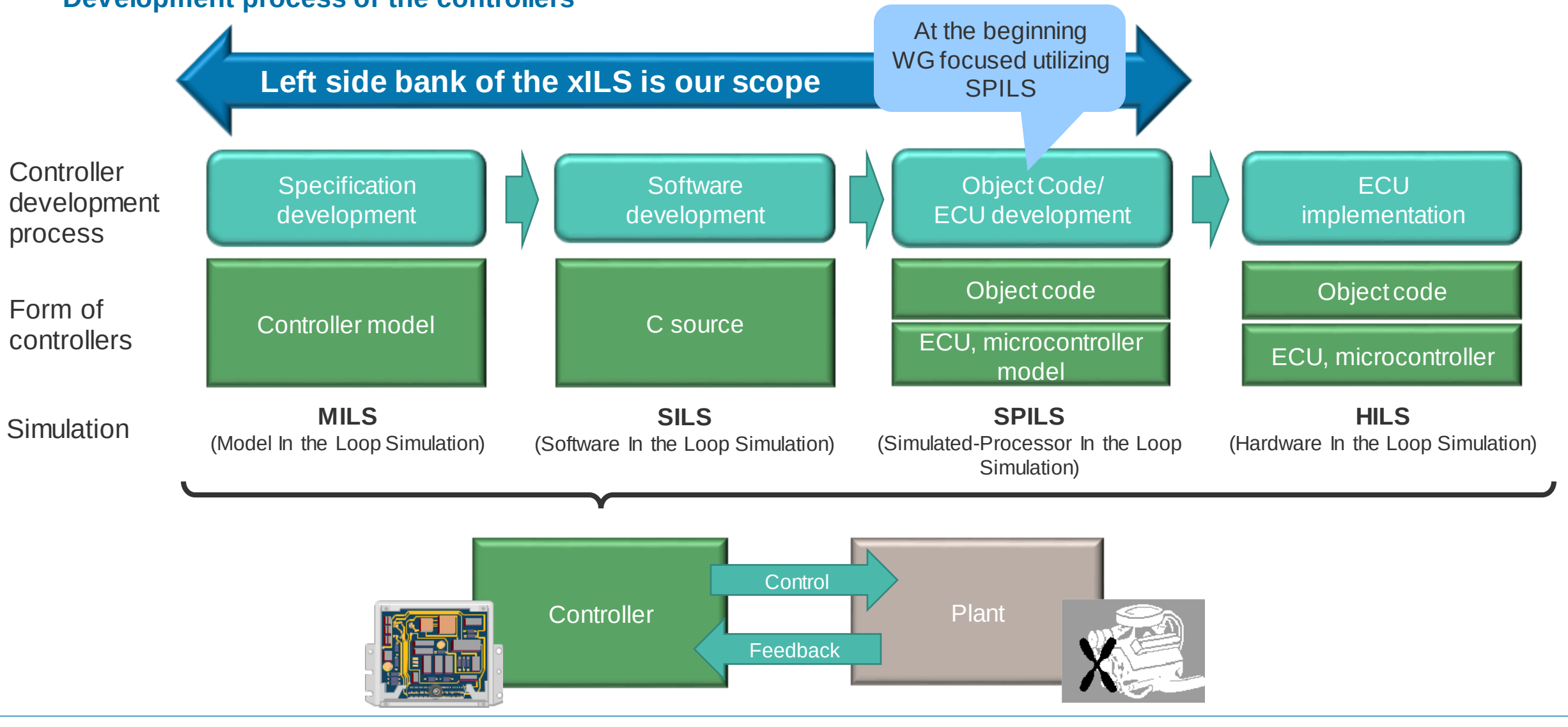
Automotive Electronic System



Focus on functional aspects of the electronics controllers

Focused Area (2/2)

Development process of the controllers

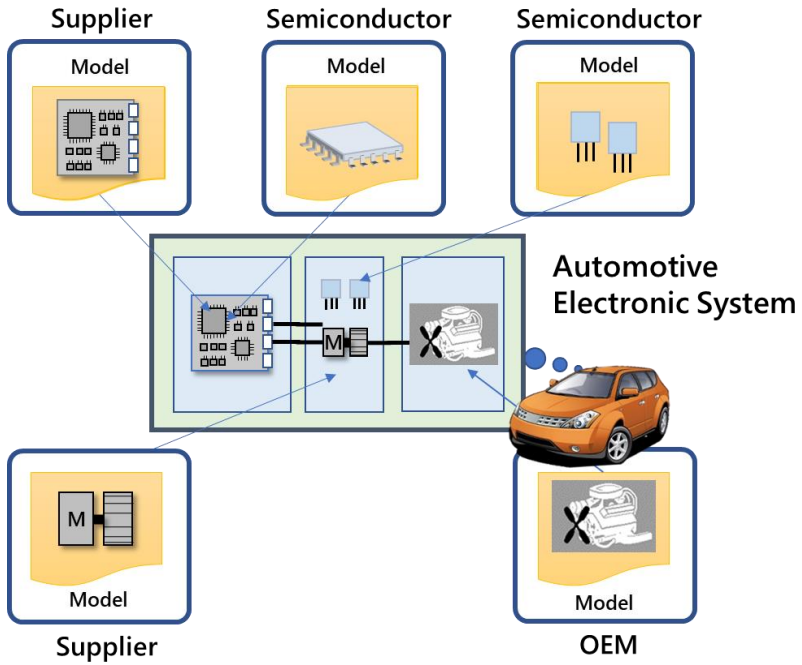


Co-MBD (Collaborative MBD)

Background

Issues in sharing models

It is required to gather all of the models when we use MBD. Models are often provided other companies such as other OEMs, suppliers, semiconductor companies.



Issue 1: Intellectual property right issue

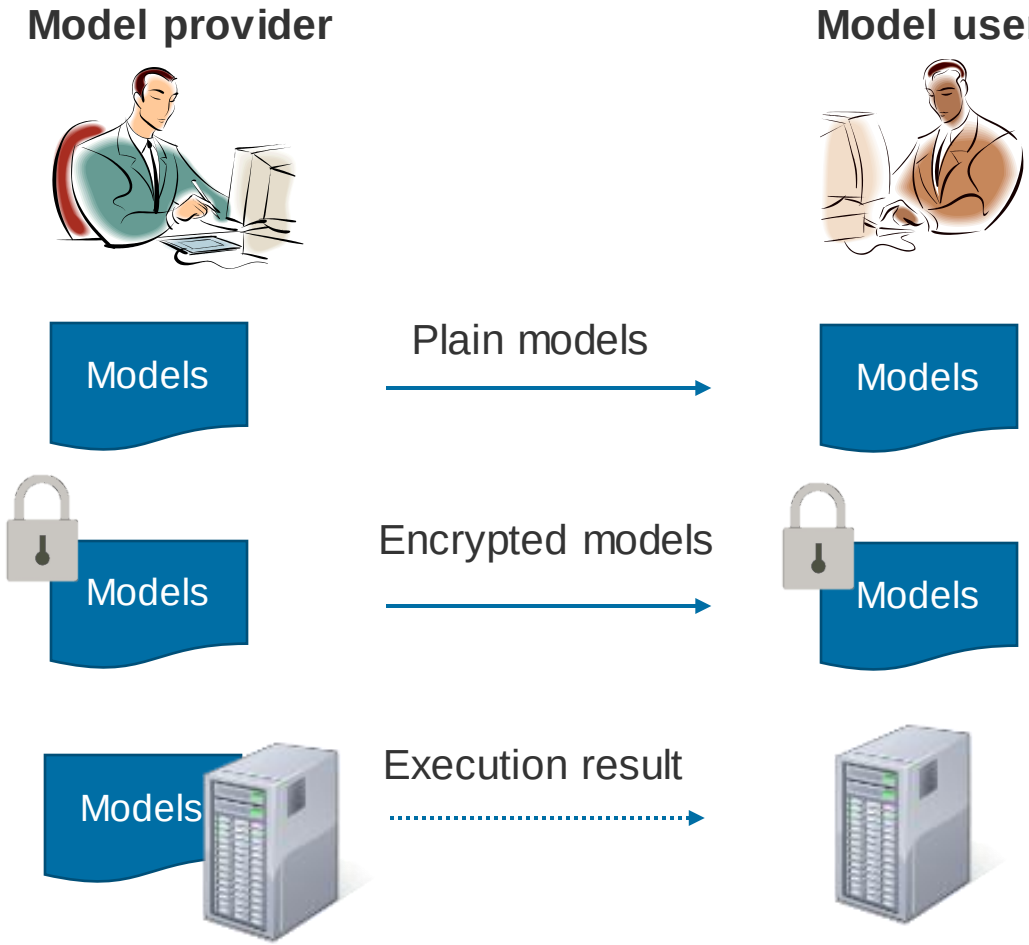
How to protect model-provider's know-hows in the model while sharing the model with other companies ?

Issue 2: Model maintenance issue

How to keep update the models ?

Co-MBD (Collaborative MBD)

Model as a Service (MDaaS)



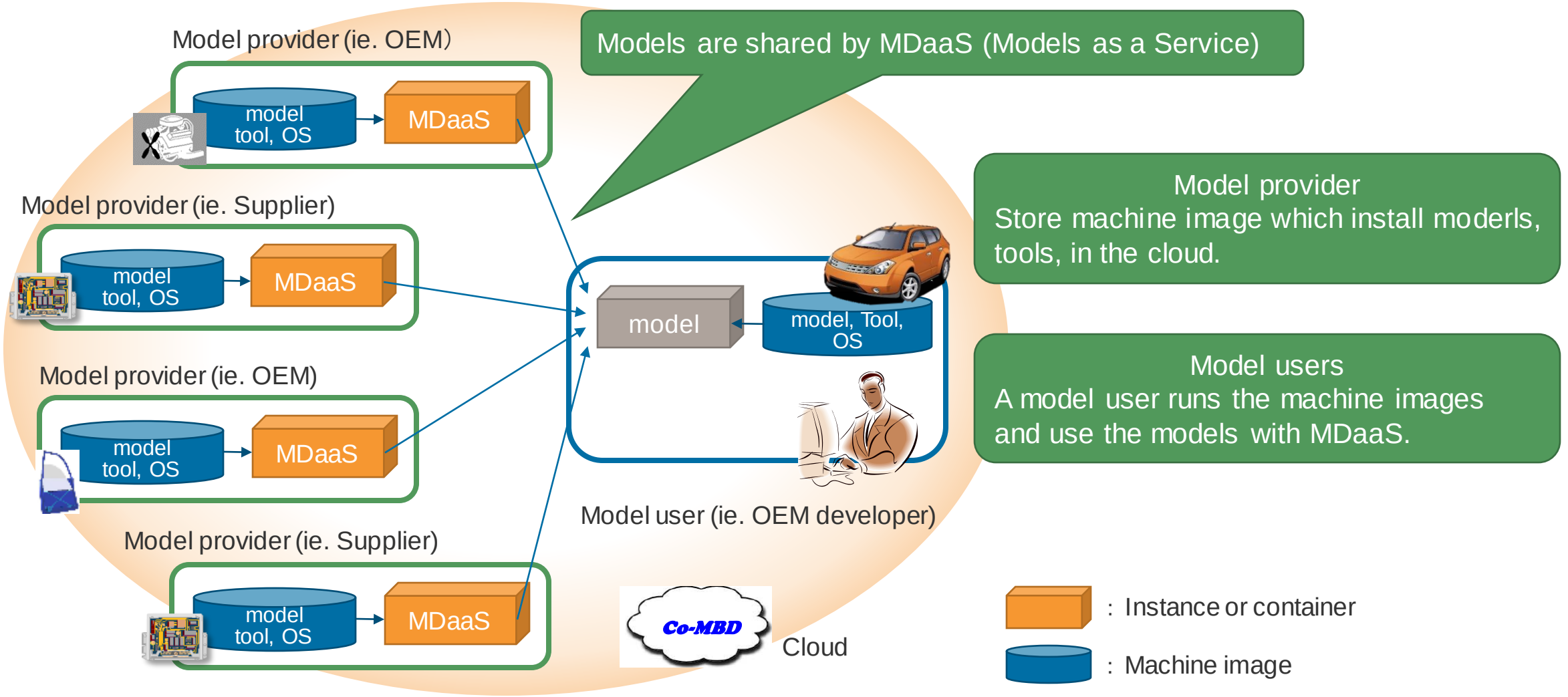
How to share models	Model location	Model disclosure	Model maintenance
Share plain model	✗ User side	✗ Disclose	✗ User (+provider)
Share encrypted model	✗ User side	○ Not disclose	✗ Provider (+User)
Pass execution result	○ Provider side	○ Not disclose	○ Provider side

Models as a Service (MDaaS)

○: preferable, ✗: not preferable

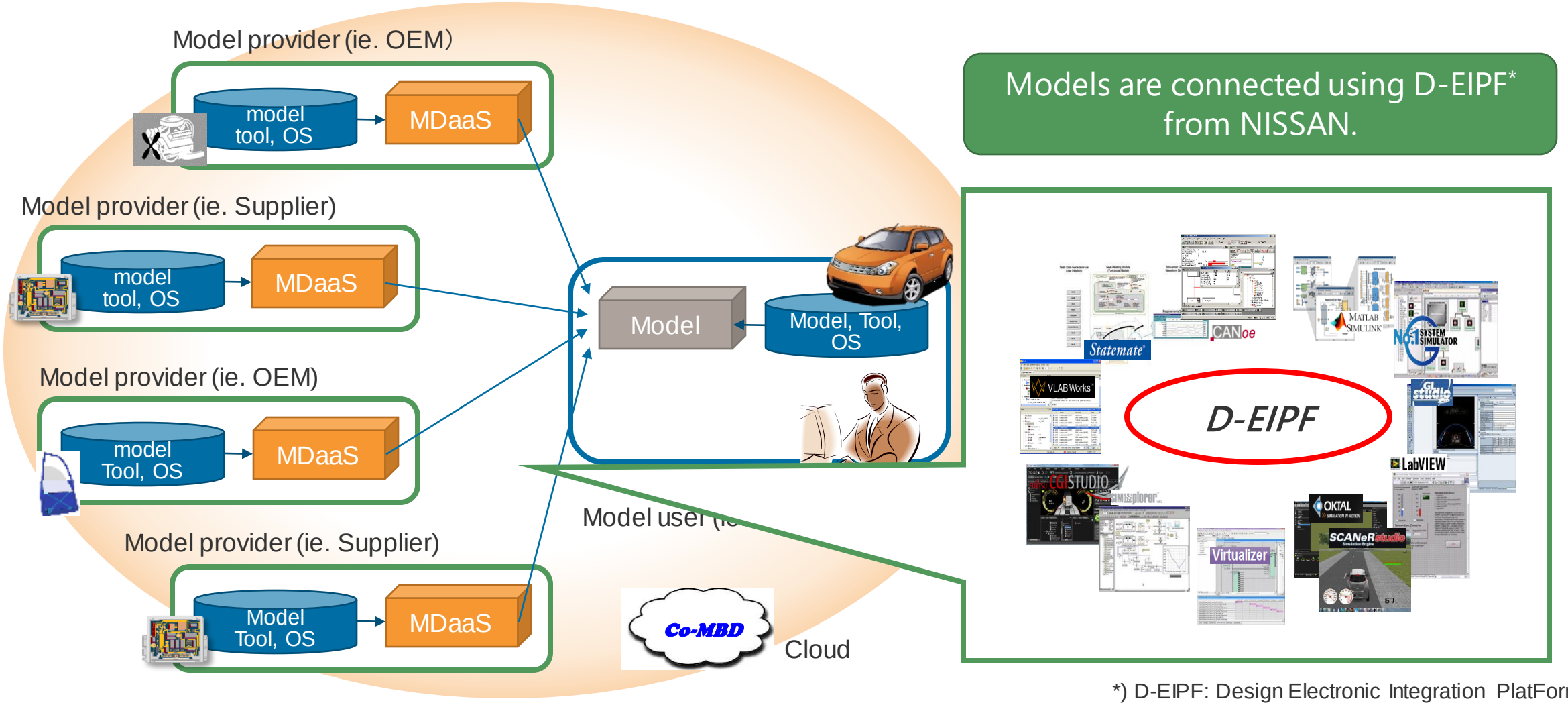
Co-MBD in the cloud

concept



Co-MBD in the cloud

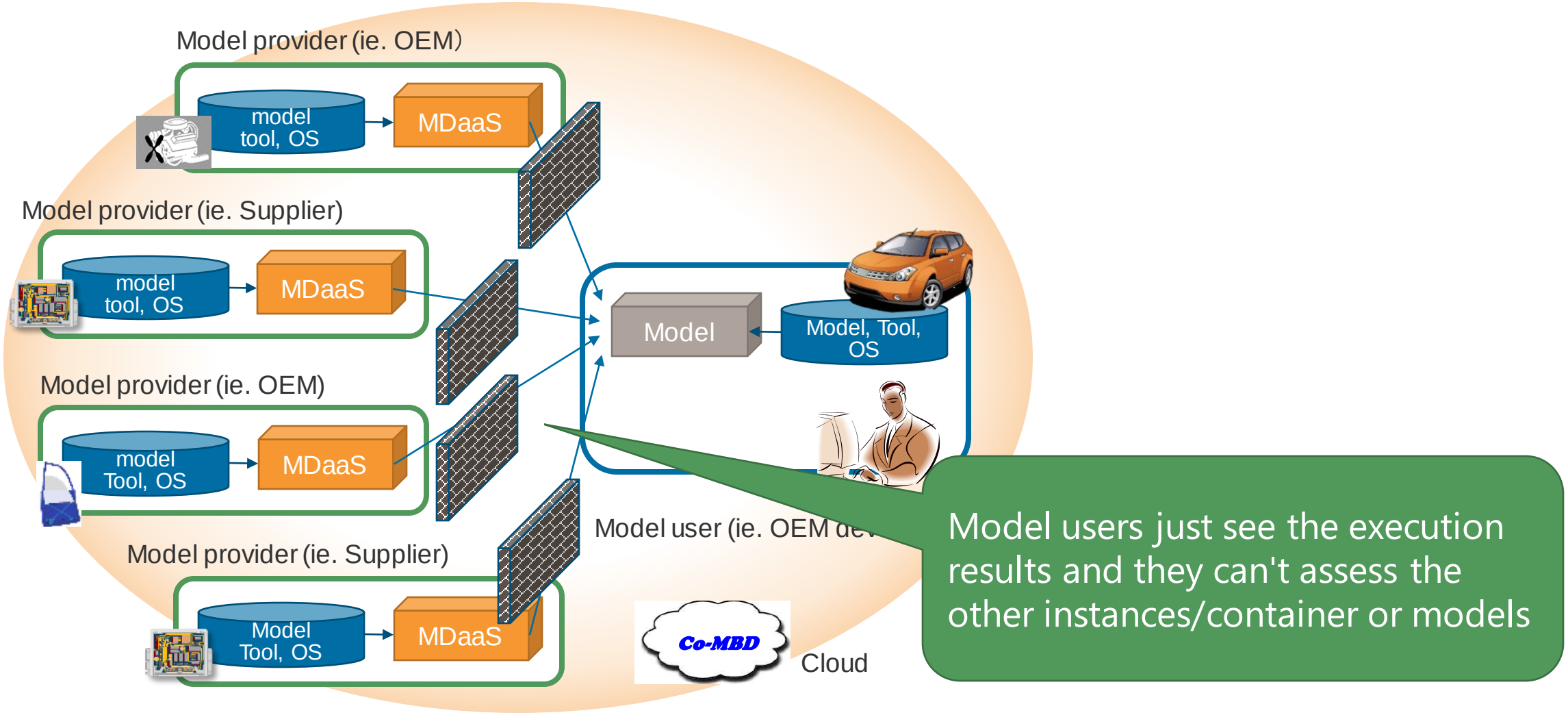
Interface between models



*) D-EIPF: Design Electronic Integration PlatForm

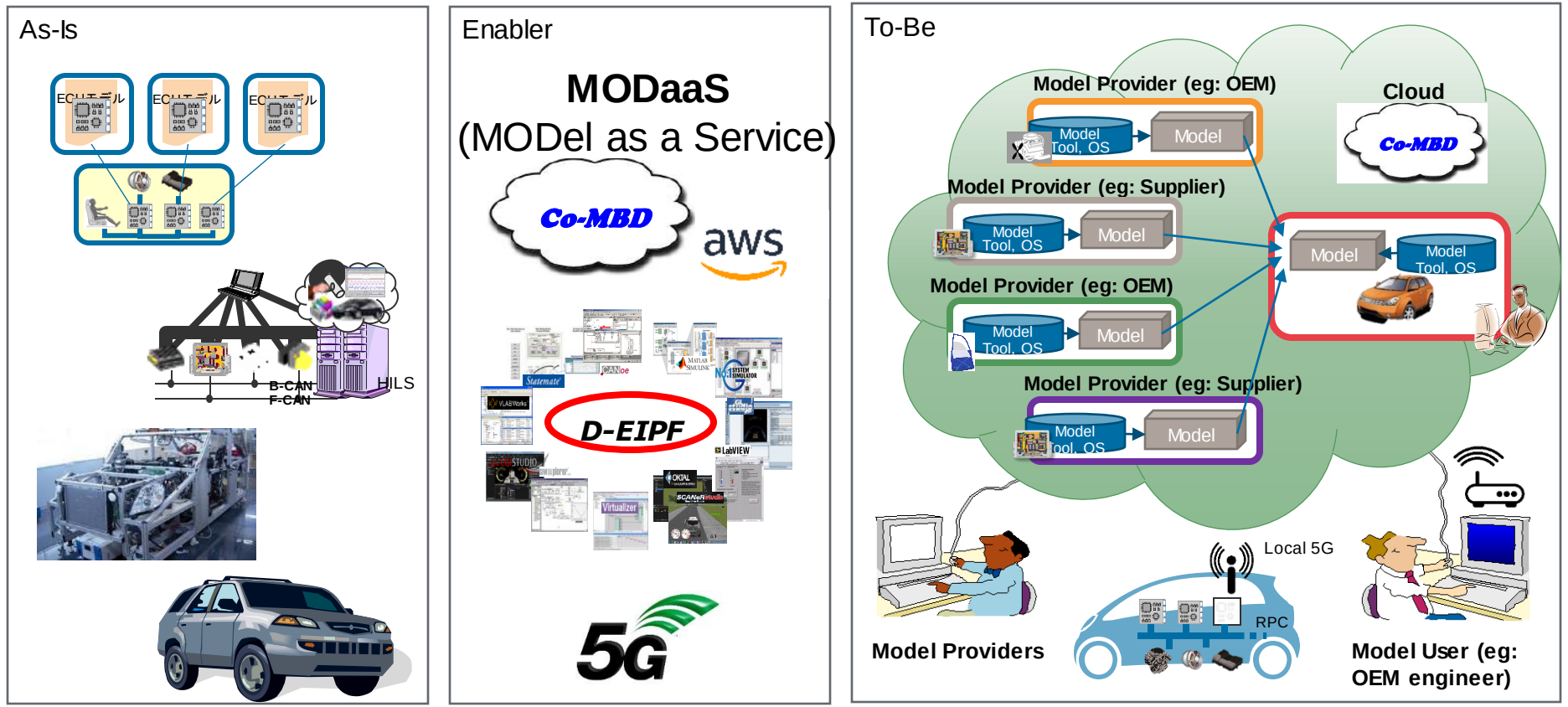
Co-MBD in the cloud

Protects models' intellectual property

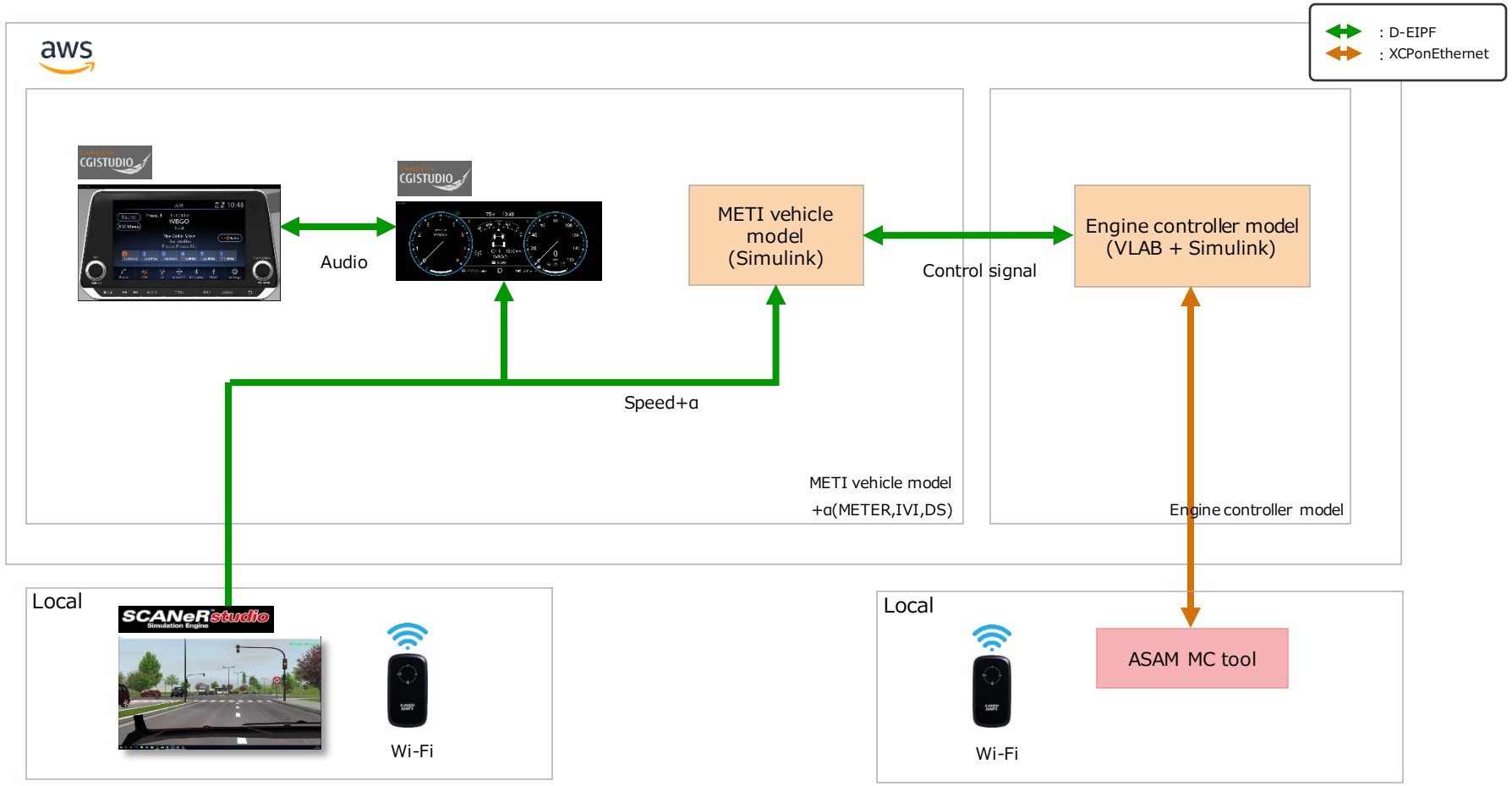


Collaboration on ASAM XCP

Co-MBD using virtual-HILS on Cloud



A goal image at step 5



Concern about multi-master [illegible]tion in cloud environment

Under study the activity plan and road map

Evaluation plan

Eva. Steps	Evaluation	Number of ECUs		Sim. tool of ECUs		MC Tool Environment		Virt. ECU Environment		Plant model		Remarks
		Single	Multi.	same	diff.	Local*	Cloud	Local*	Cloud	No	Yes	
step0	MC tool can be used for a virtual ECU.	✗		✗		✗		✗		✗		
step0.5	MC tool can be used for multiple virtual ECUs. The virtual ECUs use the same simulation tool.		✗	✗		✗		✗		✗		Environment of MC tool and Virtual ECU: on-premise
step1	MC tool can be used for multiple virtual ECUs. The virtual ECUs use different simulation tools.		✗		✗	✗		✗		✗		
step2	MC tool can be used with the step1 configuration in the cloud environment.		✗		✗	✗	✗		✗	✗		Environment of MC tool and Virtual ECU: cloud
step3,4	MC tool can be used with step2 configuration, and the virtual ECU also runs in the cloud.		✗		✗	✗	✗		✗		✗	Evaluation model: power window system
step5	A simple vehicle model is used.		✗		✗	✗	✗		✗		✗	Evaluation model: METI model

black text：done. red text：not done yet.

✗：setup used in the evaluation（blue: evaluation item at this step）

*) local : means on-premis