ASAM Regional Meeting Japan 2019

vECU-MBD WG / Co-MBD Application TF Cooperation with ASAM

June 27, 2019
NISSAN MOTOR CO., LTD.
Akira Watanabe

Contents

[Notes]
ECU: Electronic Control Unit
vECU: Virtual ECU
MBD: Model Based Development
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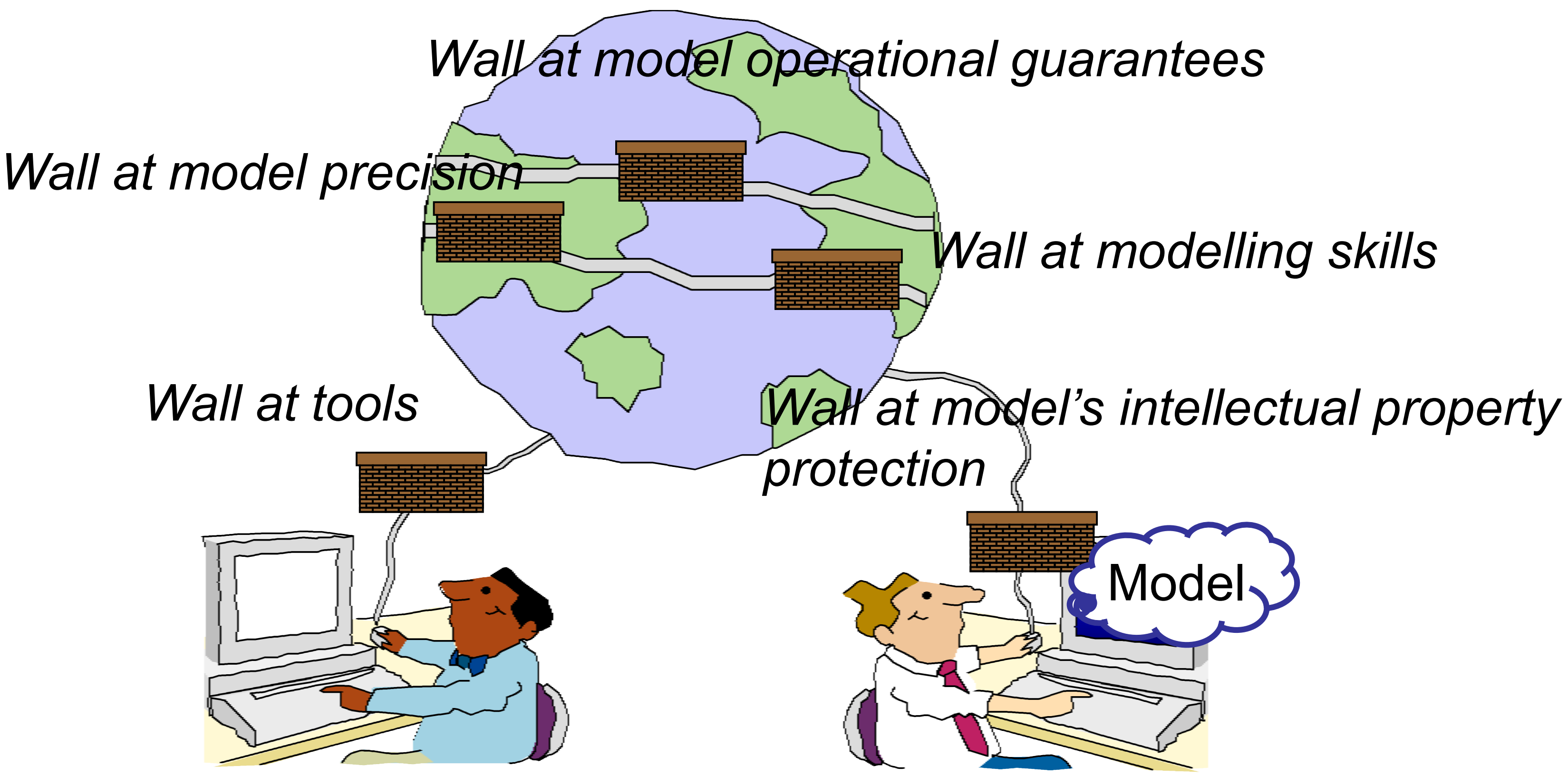
Challenges for utilization of virtual ECUs

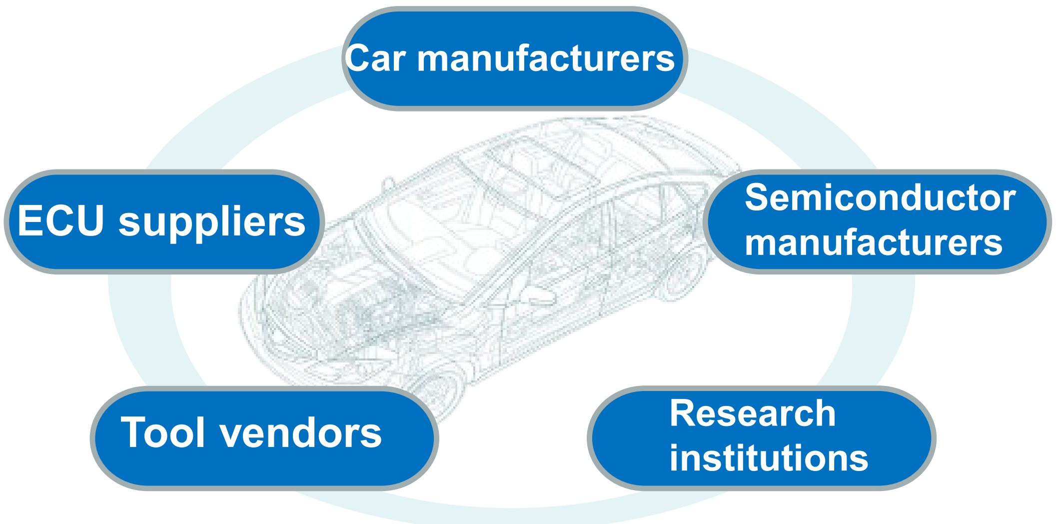


A cross domain organization involves car manufacturers, supplier, semiconductor companies, tool companies is required.

vECU-MBD Working Group

- **Objective:** Promote use of MBD using virtual ECUs
- **Feature:** Collaborative activities cross domain industries those relate to automotive ECUs
- **Activity started:** from 2010/April
- **Home page:** http://www.vecu-mbd.org/en/
- **Working group members:** 31 organizations (as of 2019/June)

Aisin Seiki Co., Ltd., ETAS K.K., InterBuddy Inc., VITS INC., Australian Semiconductor Technology Company K.K., OMRON Automotive Electronics Co., GAIO TECHNOLOGY Co., Ltd., Calsonic Kansei Corporation, Institute of Systems, Information Technologies and Nanotechnologies（ISIT）, Cypress Innovates Ltd., Sumitomo Wiring Systems, Ltd., Zerosoft Assist Technology Co., Ltd., Team AIBOD Ltd., dSPACE Japan K.K., TOSHIBA CORPORATION, Toyota Technical Development Corporation, Nissan Motor Co., Ltd., Cadence Design Systems, Japan, Nihon Synopsys G.K., NSK corporation, Japan Automobile Research Institute（JARI）, Hitachi Automotive Systems, Ltd., Hitachi Industry & Control Solutions, Ltd., Hitachi, Ltd., Denso Ten Ltd., Bosch Corporation, Board Planning Co., Ltd., Honda R&D Co., Ltd., Mazda Motor Corporation, Mitsubishi Electric Corporation, Renesas Electronics Corporation [in no particular order]



- **Main achievements of the activities**
  - Publication of guide document, "*User support guide to consider introduction of virtual ECU*" and "*Model procurement / integration guide*“.
  - Publication of the specification of CAN bus model to be used in MBD.
  - Proof-of-concept experiment for typical use cases of the virtual ECU.
    Major activity themes:
    (1) Multiple ECUs, (2) Fault injection test, (3) Co-simulation of different users in the cloud

Roadmap of the Working Group

By considering importance and difficulties, 4 phases of activities have been planned.

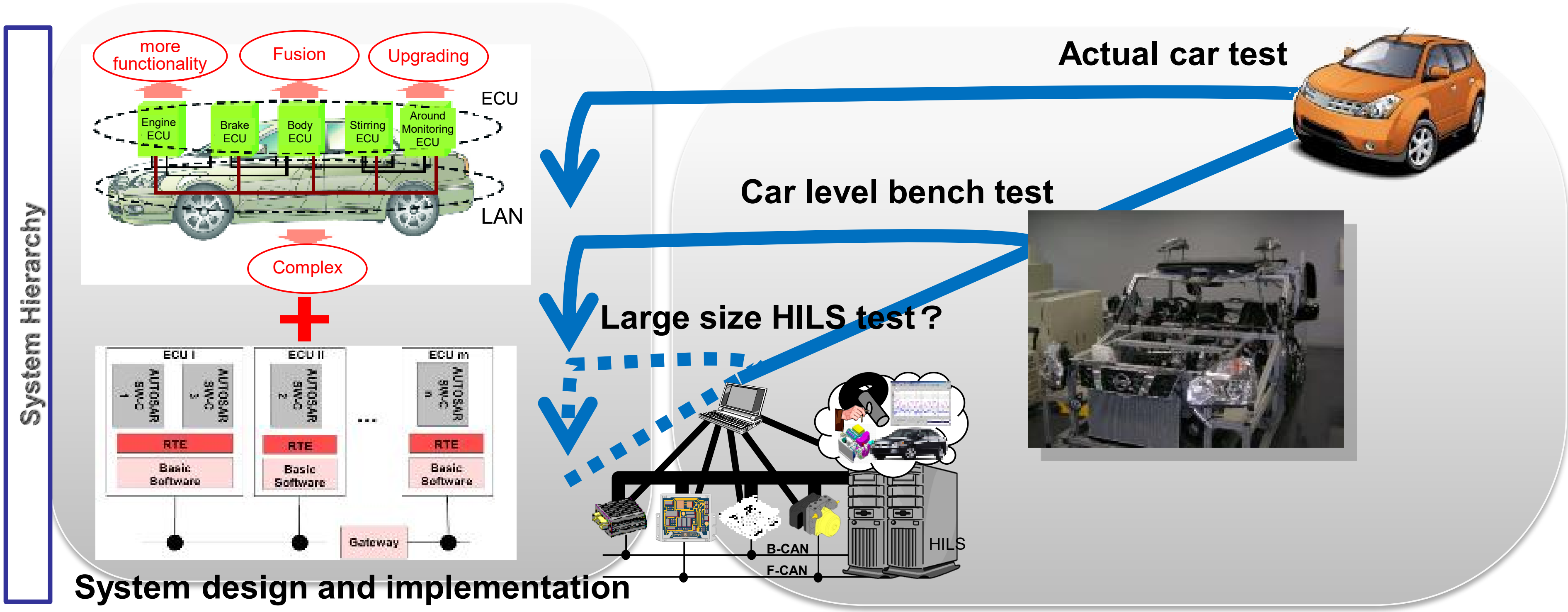
Phase 1 2011FY -	Phase 2 2013FY -	Phase 3 2016FY -	Phase 4 2019FY -
Basic Technology for Virtual ECU	**Integration of MBD Environment**	**Large Scale Cooperation through industries**	**Apply MBD for development use cases**
• ECU model development for experiment • Definition of development process and model supply chain business process	• Fault injection • Interface model connecting multiple ECUs, Co-simulation of multiple ECUs	• Co-simulation of different users in the cloud • METI model	• **ASAM XCP** • **Fault injection using industry proposed common methodologies** • **other plans are under discussion**

Organized Task Forces (TF)

- *Model marketplace TF* (Phase 1)
- *Virtual HILS TF* (Phase 2 – Phase 3)
- *Co-MBD Application TF* (Phase 4)
- *Microcontroller Model TF* (Phase 1 – Phase 2)

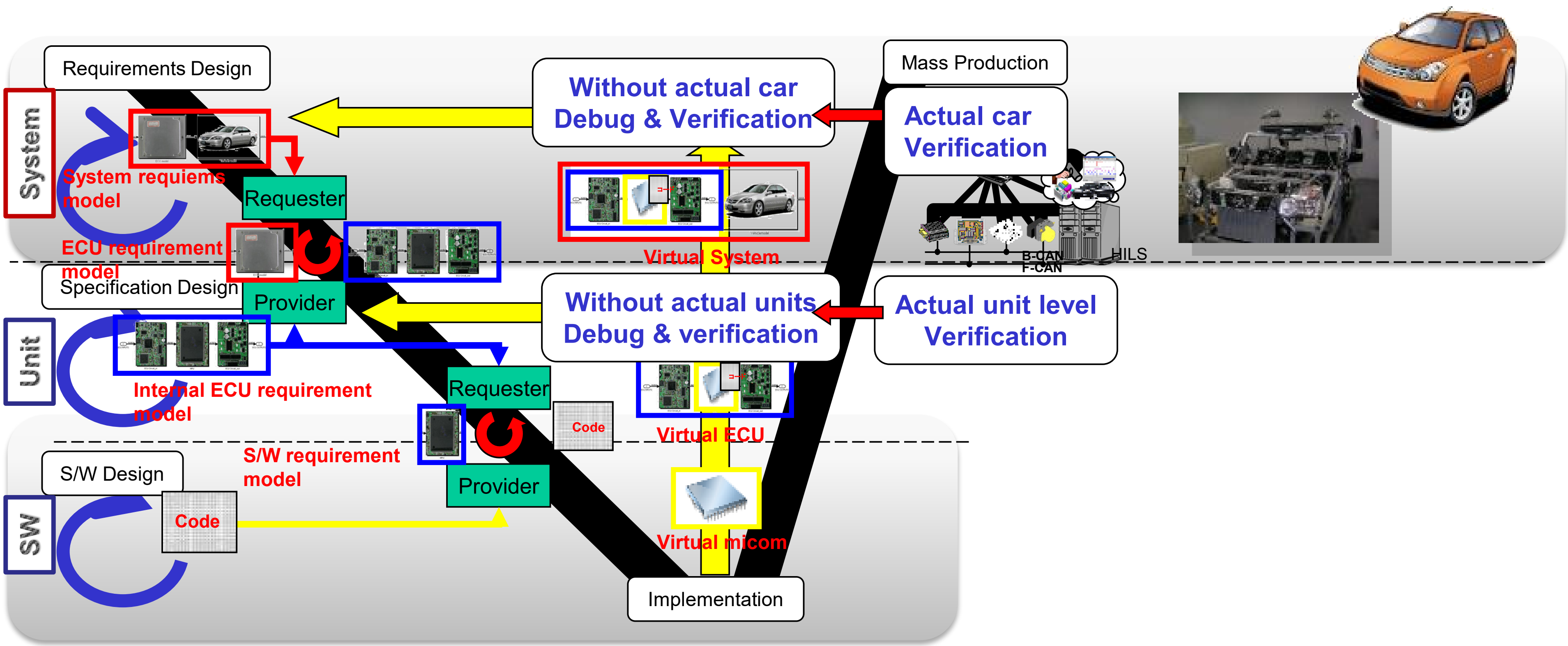
Subject of the WG：Test of distributed complex systems

Tests of ‘Application S/W’ + ‘Platform S/W’ + ‘Network’ are performed after actual units are fabricated. And problems are found in the post-process !



Aim of the WG：Efficient development of the ECU using MBD

Utilize virtual ECU at each design level ⇒ Decrease TAT & Cost



Proof-of-concept experiments done by WG

1. Multiple ECU system using SPILS (Simulated-Processor In the Loop Simulation).
   - Binary-code of the micro-controllers of multiple ECUs are executed using Simulink and microcontroller-simulator co-simulation.

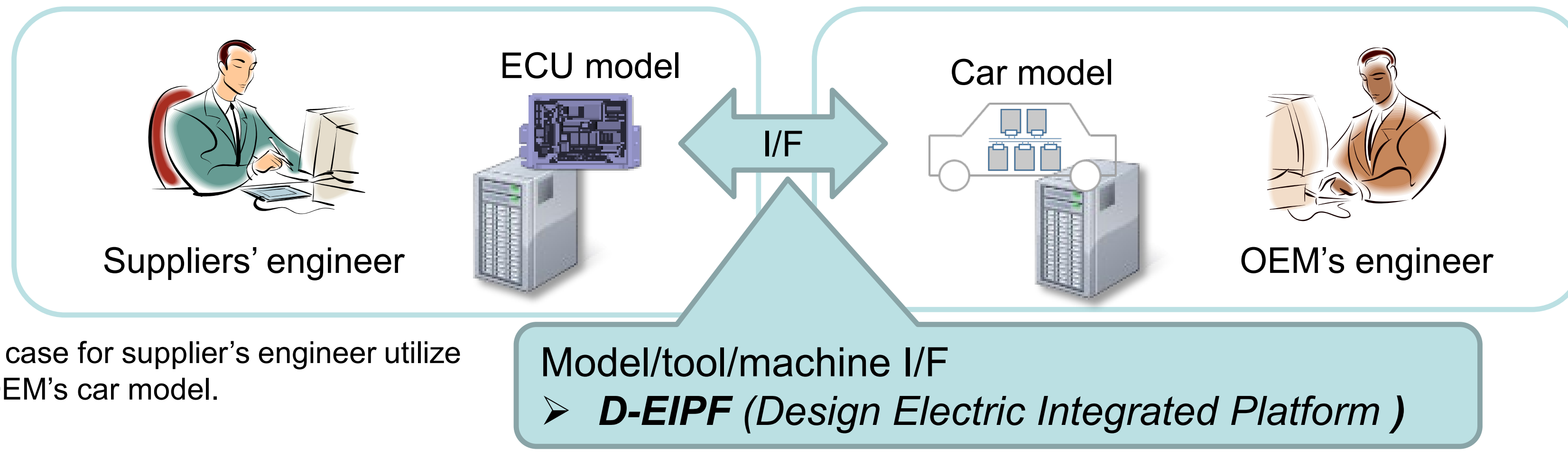
2. Fault injection using SPILS
   - Behaviors of binary level of S/W are verified under H/W or memory fault cases.
   - Proposal of a fault injection methodology.

3. Co-simulation by different users in the cloud.
   - Use case for different users (ie, OEM's engineer and supplier's engineer) work cooperatively using each others' models without passing model itsself.
   - Proposal of a development methodology called Co-MBD (Collaborative MBD).

Only major PoC experiments are shown

Co-MBD (Collaborative MBD)

Co-MBD:
A proposed development methodology to achieve collaborative development without passing models each other. Engineers can use other company's models as a service in the cloud.



A case for supplier's engineer utilize OEM's car model.

How to provide models

- Models are provided as a service. Models are executed in providers' machine and only result are passed to model users.
- Files of the models are kept in models' providers.

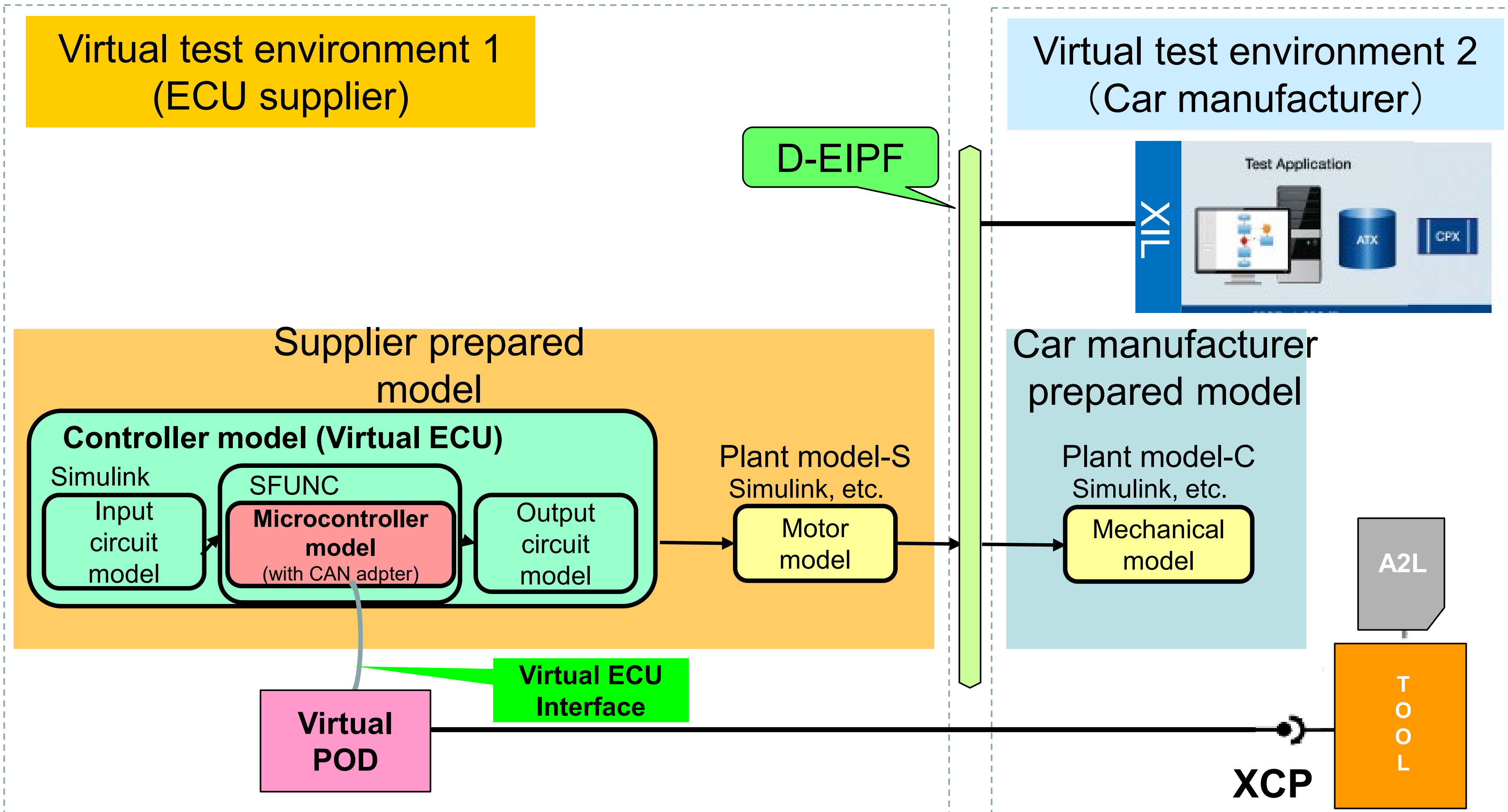
Merit

➢ For model providers :
- Can keep model's Confidentiality or IP.

➢ For model users :
- Do not have to do model's maintenance.
- Can utilize computing resource from cloud.

ASAM 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

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Participants

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

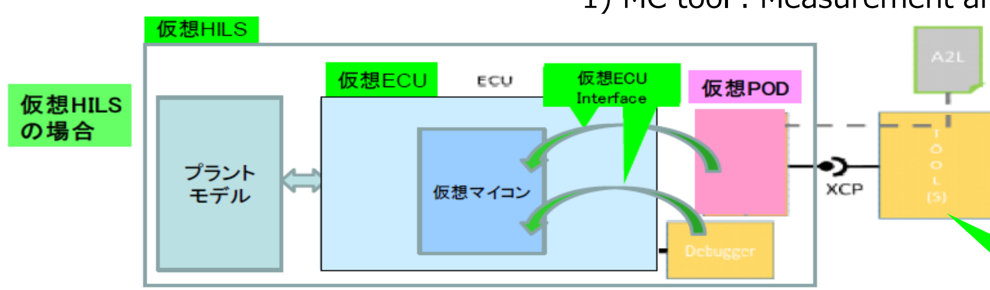
* alphabetical sequence

Proposal for ASAM-Cooperation activity

Reminder: ASAM Japan OEM Meeting / March 05, 2019
Update: June 27, 2019

- **Purpose**
  To use ASAM MCD-1 XCP under virtual HILS environment, and perform demonstration verification of monitoring and calibration.
- **Goal**
  To understand the merit and issue to apply ASAM MCD-1 XCP to the virtual HILS environment.
- **Proposal**
  Background: A standard protocol for ECU monitoring and calibration between ECU and MC tool is ASAM MCD-1 XCP. OEMs use MC tool which supports XCP.
  By using existing MC tools for monitoring and calibration of virtual ECU, we can expect to reduce the costs for tool investment, maintenance, education and so on. Therefore we propose to use XCP under the virtual HILS environment and try out the monitoring and calibration of virtual ECU.

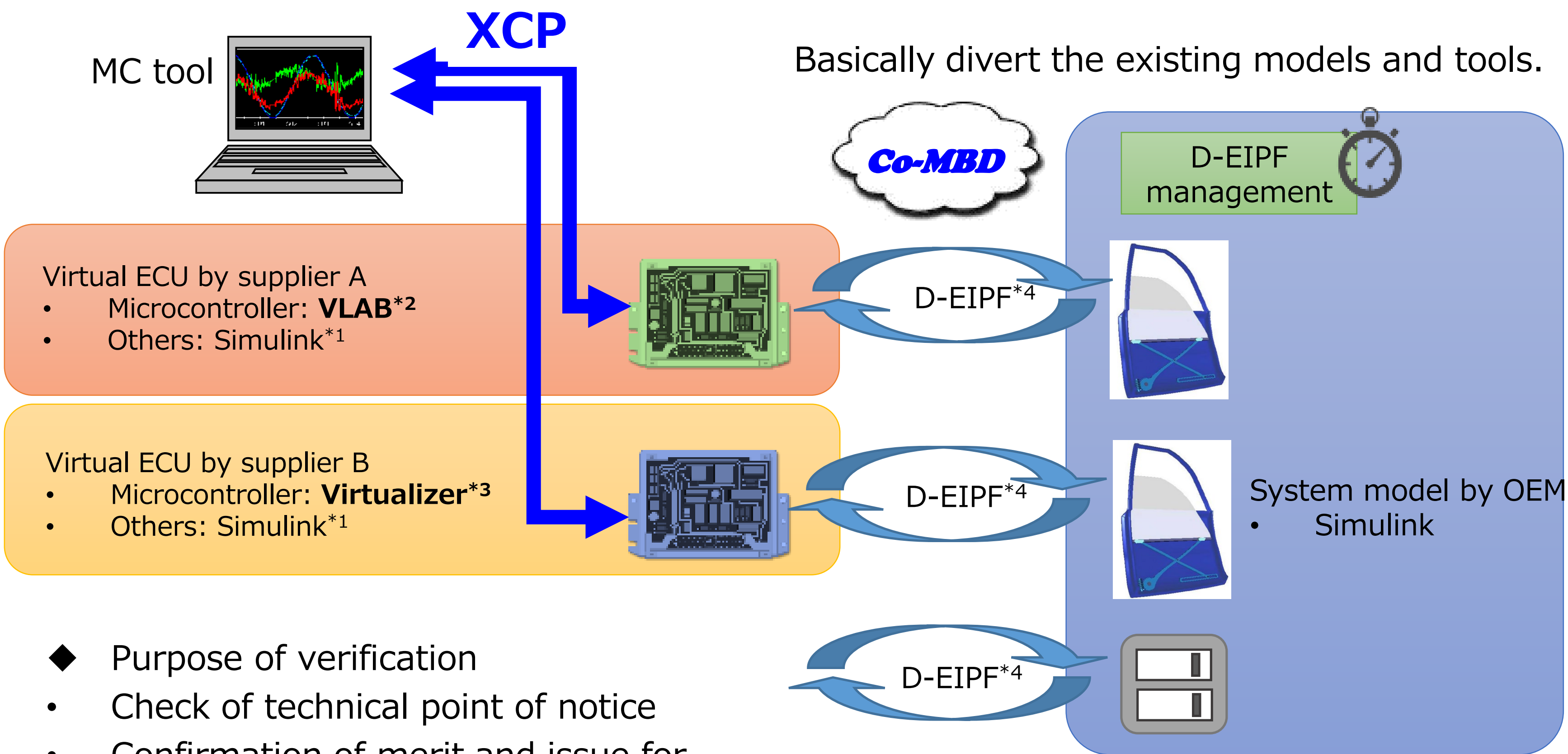
*1) MC tool : Measurement and Calibration tool



Real MC tool used for HILS

Source: ASAM and Virtual HILS by Miyazaki (Hitachi Automotive Systems, Ltd.), 2017.06.23 @ vECU-MBD WG

Image of demonstration verification



◆ Purpose of verification

- Check of technical point of notice
- Confirmation of merit and issue for operation
- Feedback to ASAM

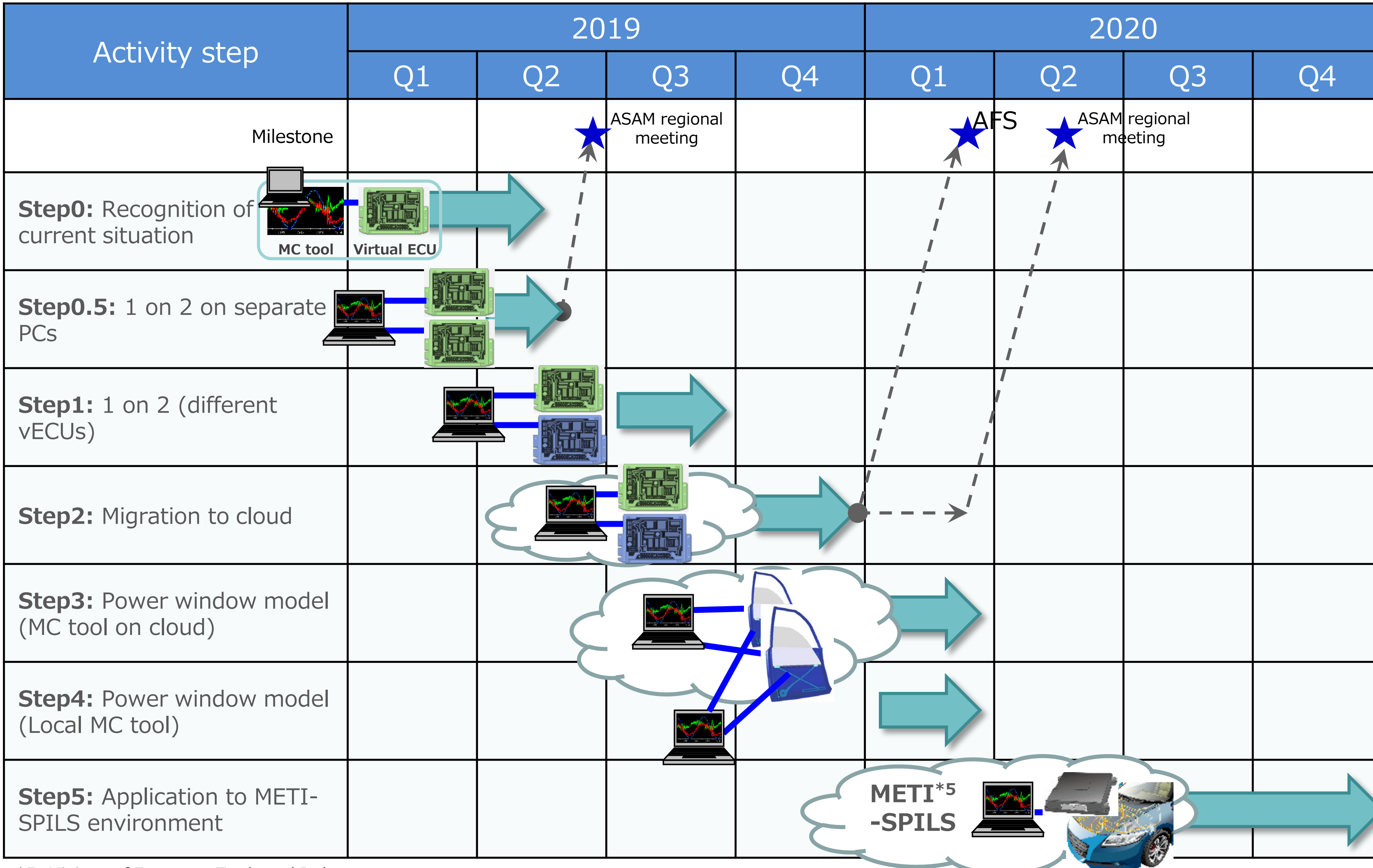
◆ Step of verification

Planning from Step0 to Step5.

→ For details please refer next slide.

*1: MathWorks
*2: ASTC
*3: Synopsys
*4: Nissan

Schedule



*5: Ministry of Economy, Trade and Industry
Ref) https://www.meti.go.jp/press/2016/03/20170331010/20170331010.html

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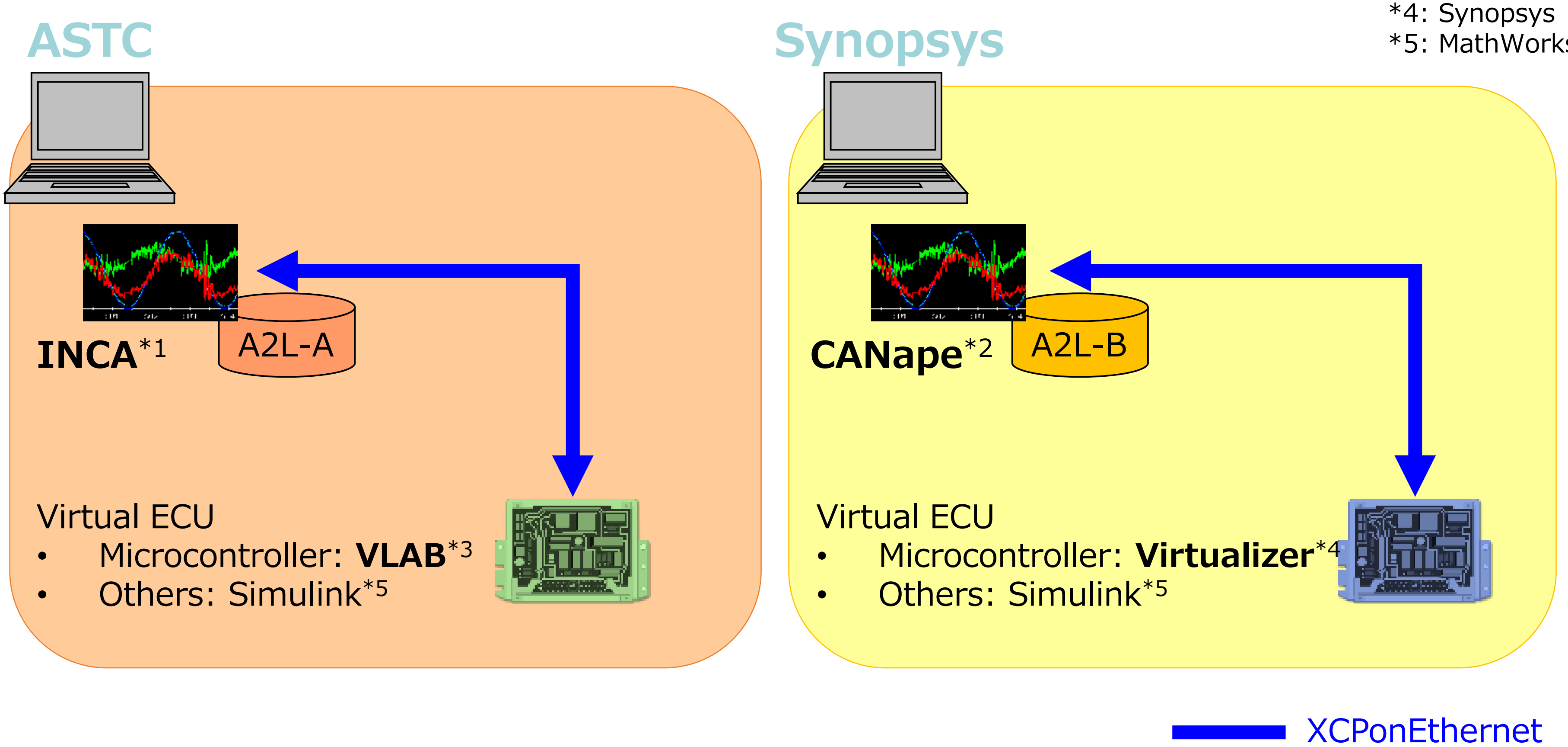
Image of Step0

- MC tool and vECU on the same PC.

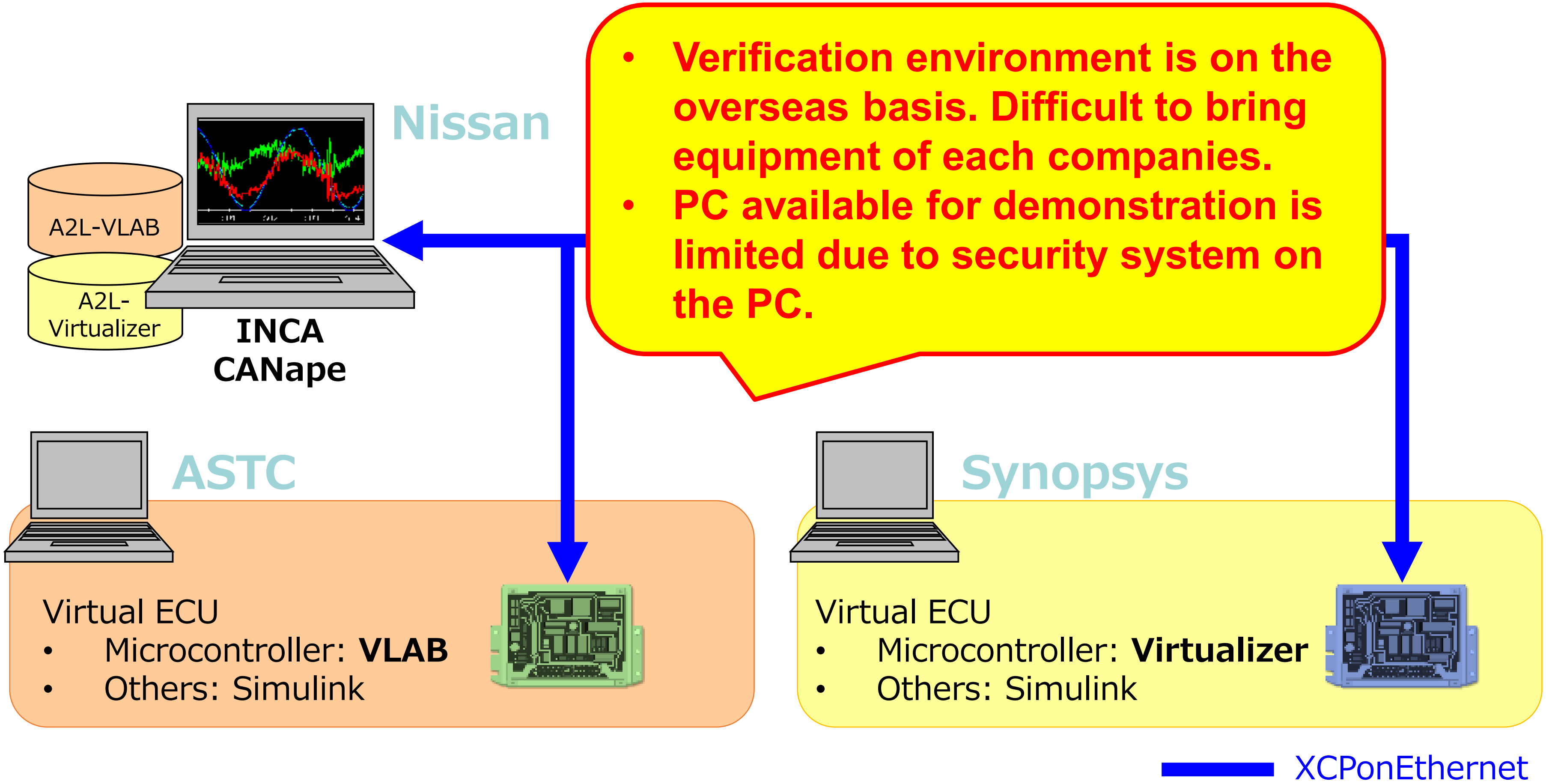
*1: ETAS
*2: Vector
*3: ASTC
*4: Synopsys
*5: MathWorks



➢ Software of virtual ECU can be any simple or existing one.
➢ Two virtual ECUs do not have to synchronize.

Image of Step1

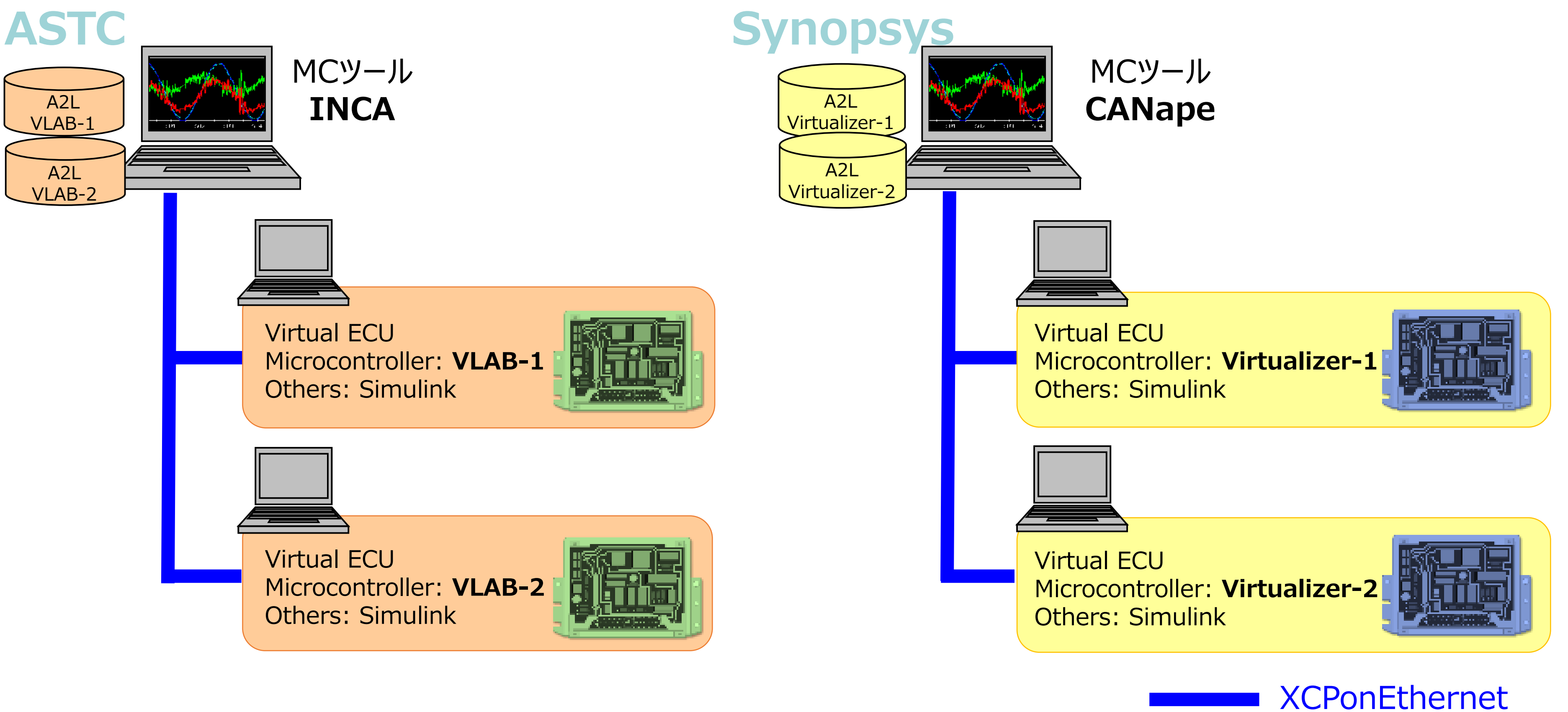
- MC tool and vECU on separate PCs.
- “1 on 2” connection (Synchronous measurement of VLAB and Virtualizer).



- ➢ Software of virtual ECU can be any simple or existing one.
- ➢ Two virtual ECUs do not have to synchronize.

Image of Step0.5

- Because Step1 is not easy to perform due to some restrictions, we set one step as **Step0.5** before Step1.
- vECU vendors prepare two ECU models (software was copy) and set up "1 on 2" connection.



➢ Software of virtual ECU can be any simple or existing one.
➢ Two virtual ECUs do not have to synchronize.

Image of demonstration today (ASTC)

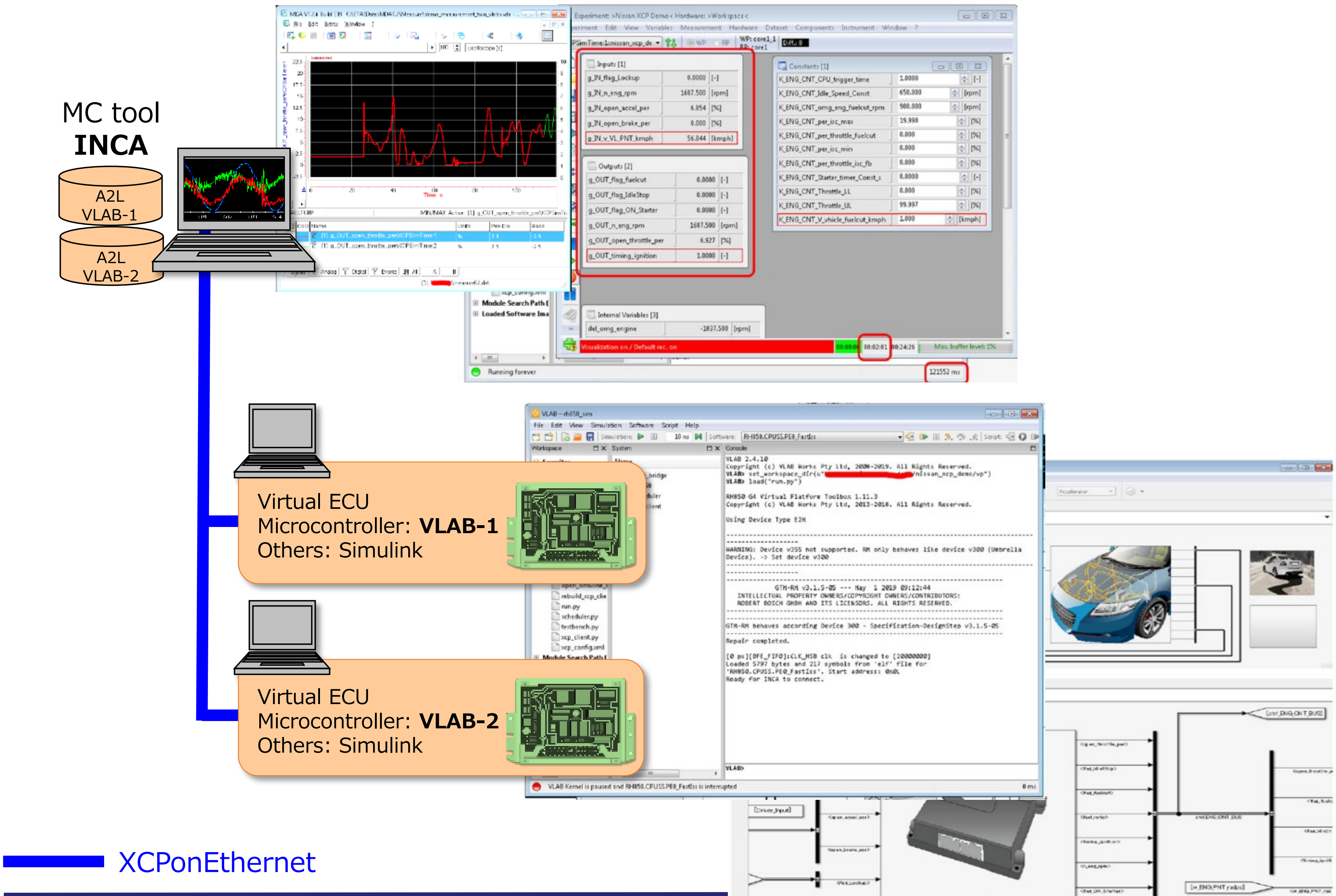
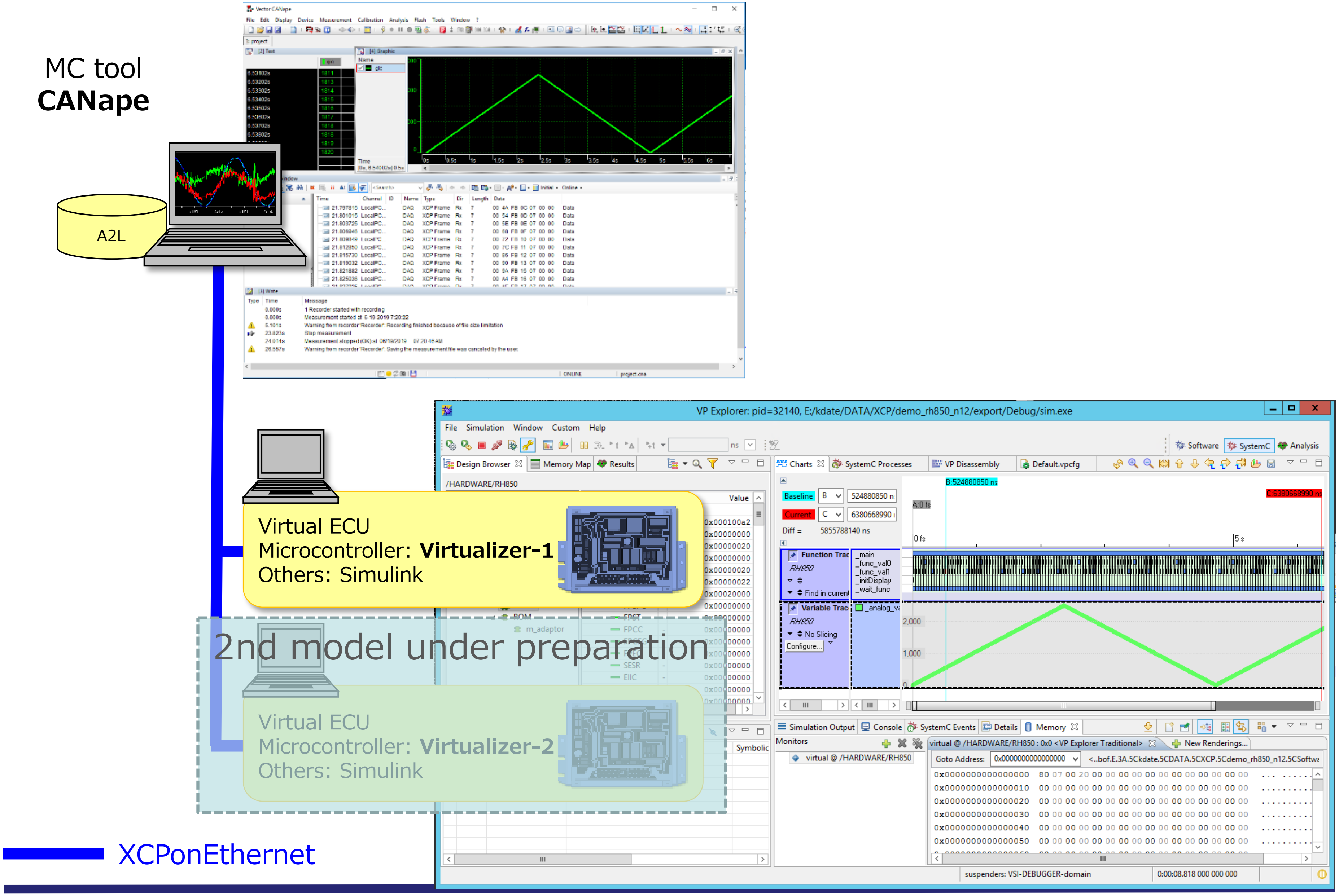


Image of demonstration today (Synopsys)



Concerns and Issues to realize MC on virtual environment

Will add when we face any concerns/issues.

No.	Concerns/Issues	Countermeasure	Remarks
1	<u>Startup sequence</u> 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	<u>Restriction by security mechanism on execution environment</u> 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.

In future

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

Relevant standards

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

Thank you for your attention.

Appendix

Activity plan

Step		Step 0	Step 0.5	Step 1	Step 2	Step 3	Step 4	Step 5	備考
日程案		2019 1月~6月	2019 5月～6月	2019 7月～9月	2019 9月~12月	2020 1月～3月	2020 1月～3月	2020 4月～	
目的		現状認識	仮想ECU・MCツール 別PC (1対N※)	仮想ECU・MCツール 別PC (1対N) VLAB、Virtualizerの同期測定。	仮想ECU・MCツールのクラウド移行、接続確認	クラウド＆パワーウィンドウシステムでの検証(MCツールもクラウド上)	クラウド＆パワーウィンドウシステムでの検証(MCツールはローカル)	METI-SPILS 環境での実証検証	
担当 (アルファベット順)		ASTC, ETAS, Nissan, Synopsys	ASTC, ETAS, Nissan, Synopsys	ASTC, ETAS, Nissan, Synopsys	ASTC, dSPACE, ETAS, Synopsys	ASTC, dSPACE, ETAS, Nissan, Synopsys	ASTC, dSPACE, ETAS, Nissan, Synopsys	ASTC, dSPACE, ETAS, Nissan, Synopsys	
仮想ECU x MCツール組合せ	**ASTC (VLAB)**	INCA	INCA	INCA	INCA/ControlDesk	INCA/ControlDesk ※パワーウィンドウシステム対応が必要	INCA/ControlDesk ※パワーウィンドウシステム対応が必要	INCA/ControlDesk	
	Synopsys (Virtualizer)	CANape	CANape	CANape	INCA/ControlDesk	INCA/ControlDesk	INCA/ControlDesk	INCA/ControlDesk	
取組み課題	**仮想ECUとMCツール 同一PC or 別PC**	同一PC	別PC	別PC	同一PC※1	同一PC※1	別PC	同一PC※2	※1 クラウド環境の構成による ※2 METI-SPILS環境の構成による
	クラウド移行	-	-	-	仮想ECU＆MCツール	仮想ECU＆MCツール	仮想ECUのみ (MCツールはローカル)	METI-SPILS環境の構成による。	
	実証例題	簡易モデル (有りもの)	簡易モデル (有りもの)	簡易モデル (有りもの)	簡易モデル / パワーウィンドウシステム	パワーウィンドウシステム	パワーウィンドウシステム	METI-SPILS	
実施方法		WG前日ないし当日にワークショップ形式で実施。			WG前日ないし当日にワークショップ形式で実施 /個社でオフラインで実施し結果をWGで共有				
備考		実環境。今できることを有りもので実演して頂く。	※VLAB2台、Virtualizer2台の構成を各仮想ECUベンダーに用意頂く。		事前に、VLAB – ControlDesk、Virtualizer – INCA/ControlDesk の接続検証が必要。	パワーウィンドウシステムへのXCPドライバ組込みが容易であれば実施を検討する。	パワーウィンドウシステムへのXCPドライバ組込みが容易であれば実施を検討する。		