

# System Architecture Design Environment for Highly Complicated Mission-Critical Systems

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# System Architecture Design Environment for Highly Complicated Mission-Critical Systems

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# Issues to Develop Mission-Critical Systems

## Market Requirement

- **More and more functionality & Higher Reliability** to meet consumer's expectations
- **Releasing products early** to respond market



## Difficulties of development

- **Need to verify complicated and large size of system**
  - Software verification
    - Actual HW is not ready (under development)
  - Shorten development time

It is getting difficult to keep high reliability.  
How to develop mission-critical systems we can rely on ?

# For Example, Automotive ...

## Power Train Control

- Gasoline Engines
- Diesel Engines
- Hybrid Engines
- Transmissions
- ...

## Safety Control

- Anti-lock brake systems
- Brake assist systems
- ...

## Body Control

- Lights
- Door open/close
- Power windows
- Wipers
- Air conditioners
- Audio systems
- Dashboards
- Air bag systems
- ...



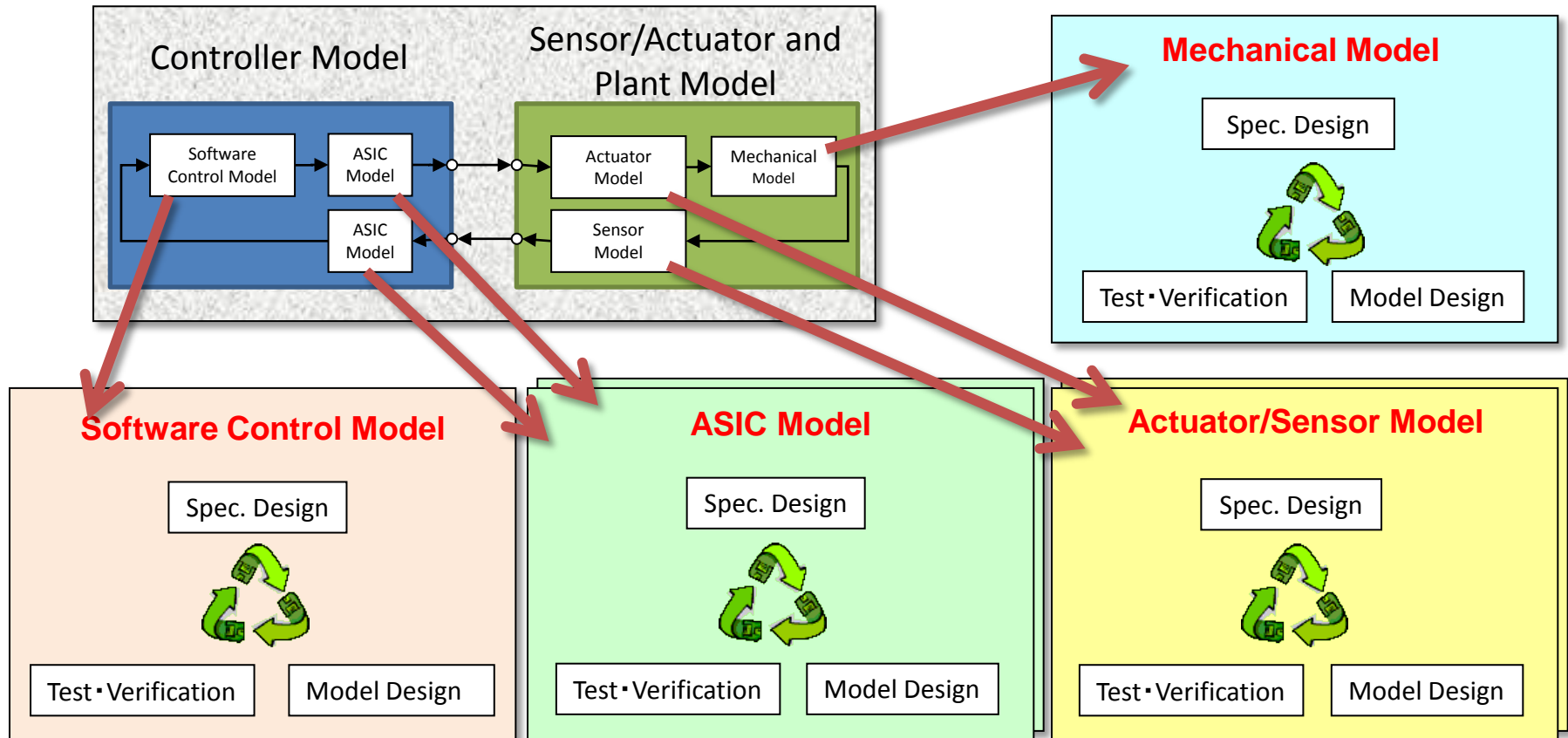
## Multi-media

- Car navigation systems
- Lane Keeping Assist Systems
- Parking Support Systems
- Pre-crash safety systems
- Forward distance warning Systems
- ...

40 -100 ECUs(Electric Control Units) are in one car

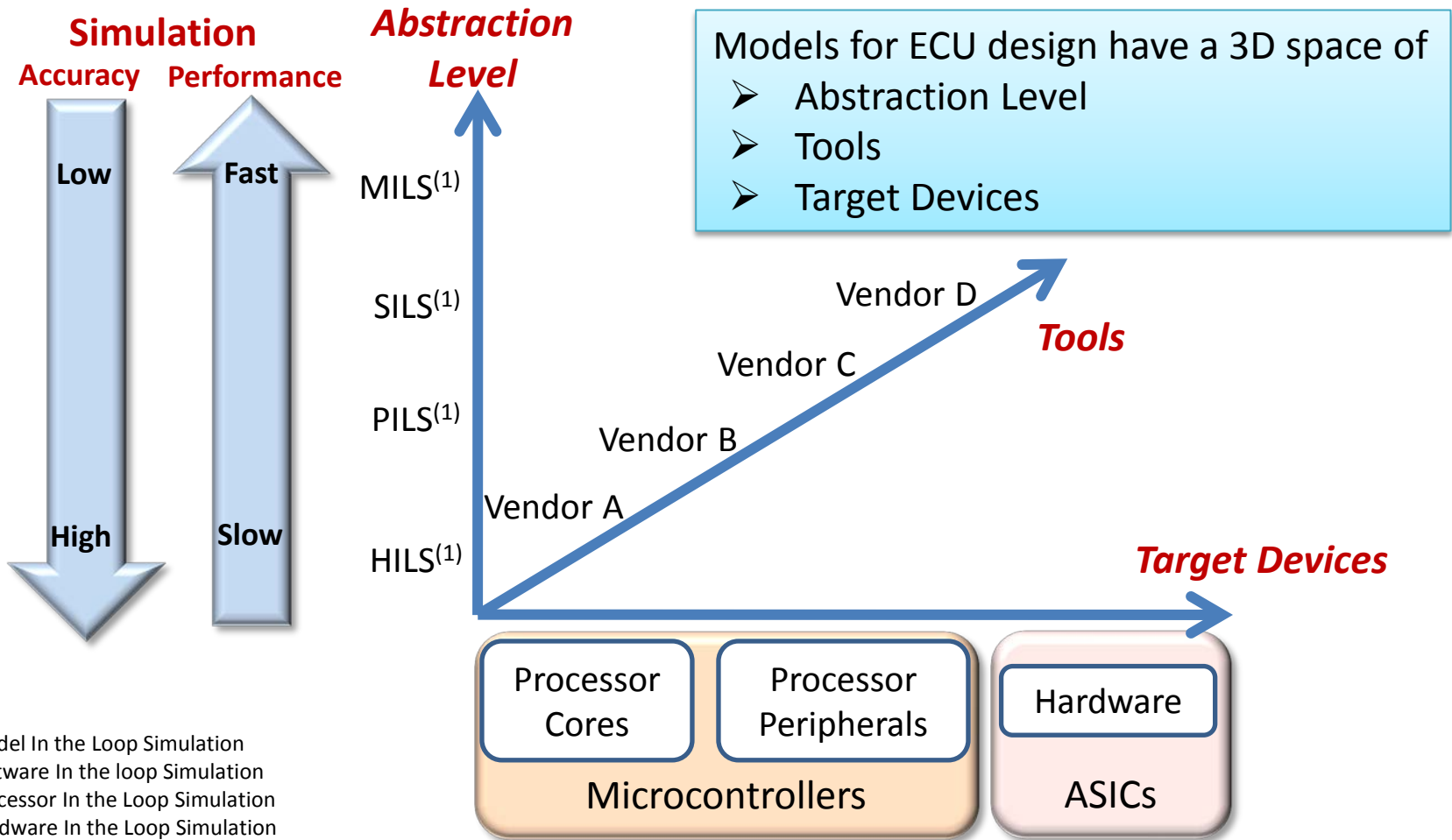
# Model-Based Development (MBD) for ECU Design

## System Model



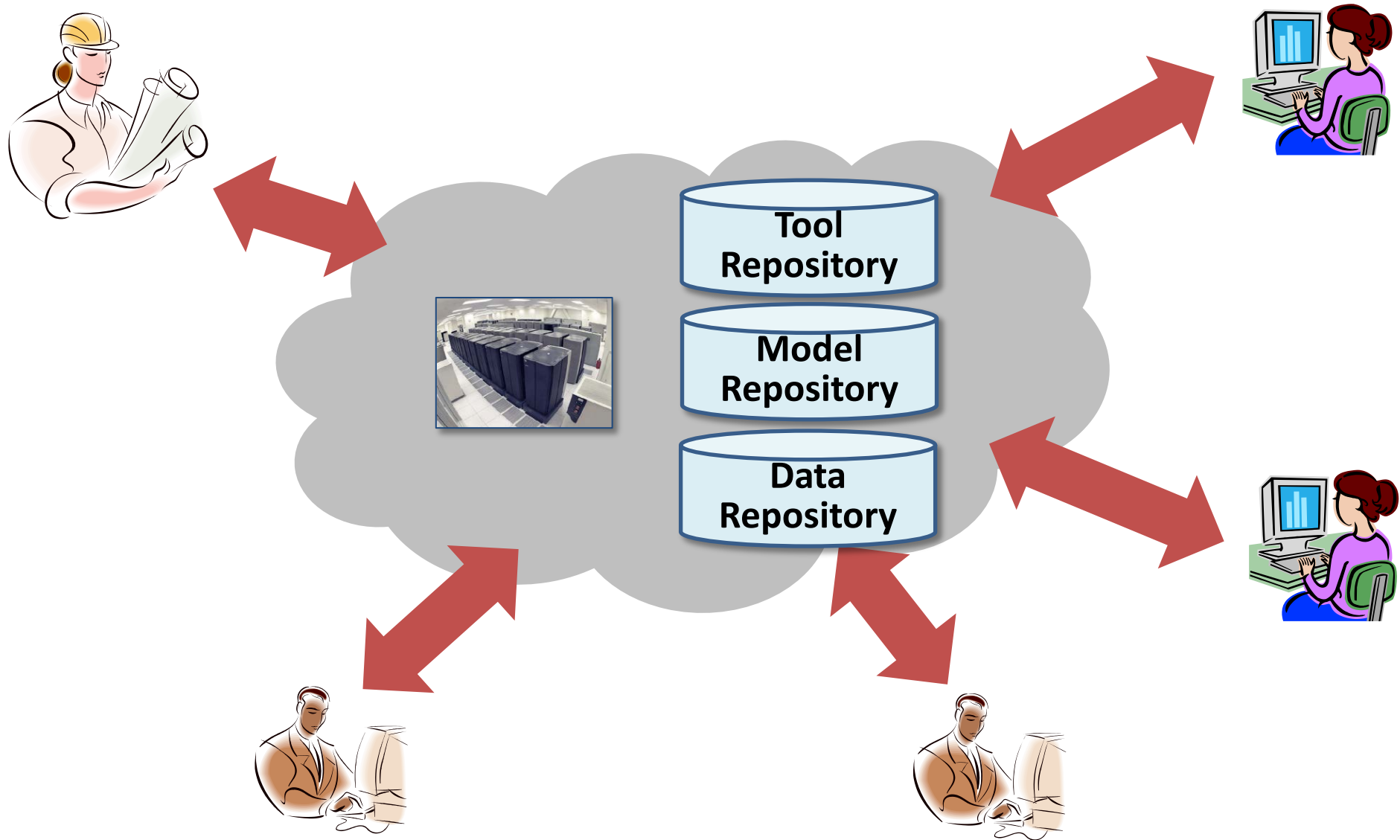
**Tools**, and availability of the *models and data* is crucial to adopt MBD for ECU development in the automotive related companies.

# It Is NOT Easy to Improve the Availability of Models for MBD

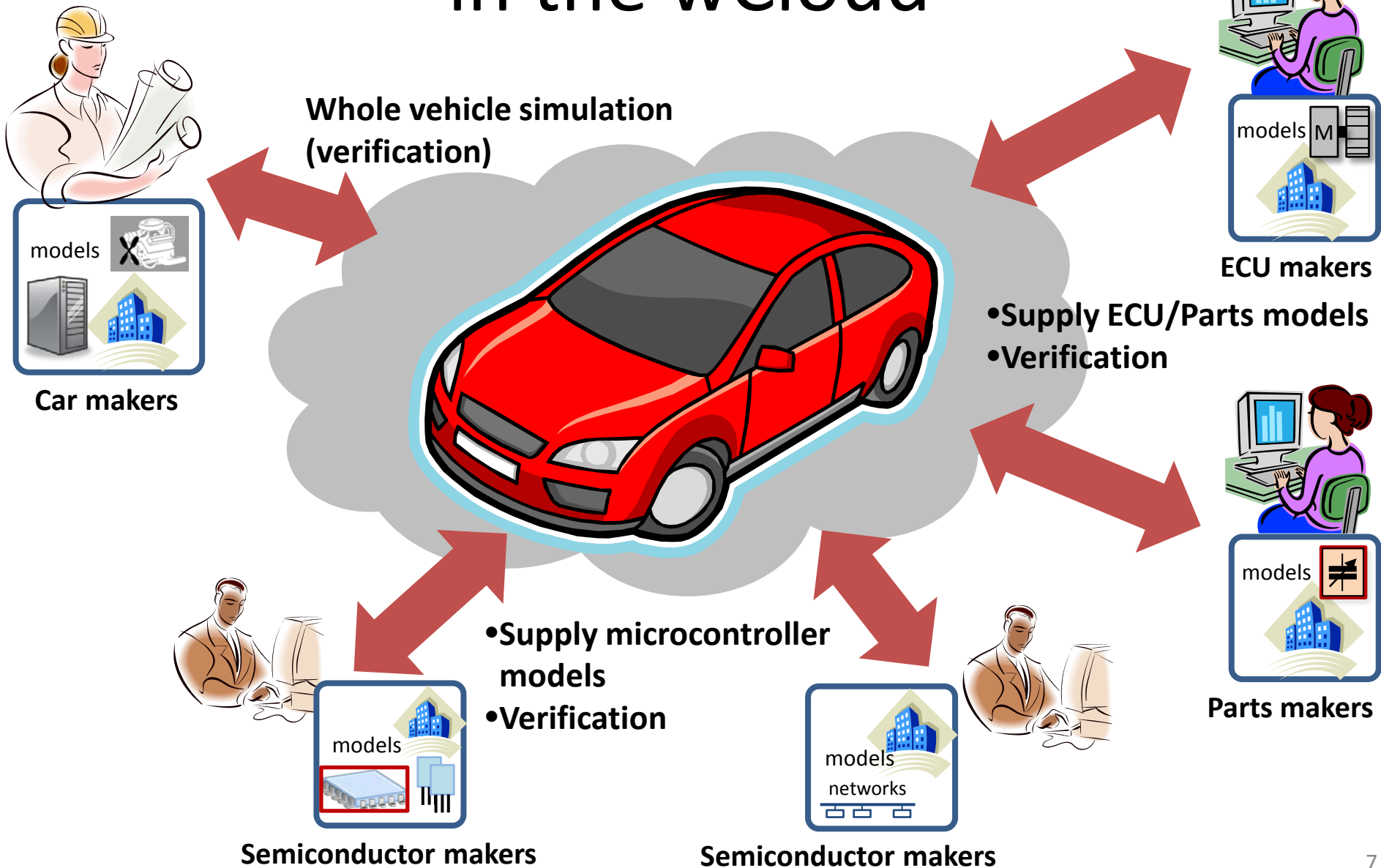


There are many variations of models required for ECU design, and development of models takes time and cost .

# wCloud (Workshop Cloud)



# “A Whole Vehicle (in Virtual)” in the wCloud





# What is wCloud?

## wCloud (workshop cloud) :

Aiming efficient, low cost, shorter development and transfer of knowledge of design/manufacturing by creating a workshop for design/manufacturing technologies in the cloud including following features.

- **Cloud's IaaS (Infrastructure as a Service) function**

Achieving **decrease of TCO**(Total Cost of Ownership) and **shorter TAT**(Turn around time) .  
Developers use necessary resources only when they are required (without owning them).

- **TaaS (Tool as a Service) function**

Achieving **decrease of TCO** and **shorter TAT**.  
Developers use necessary CAD/CAE tools only when they are required (without owning them).

- **Repository function**

Achieving **efficient development**, **decrease of TCO**, and **shorter TAT**.  
Store design data (models) and Input/output data those are required by CAD/CAE tool execution. And developers share the data.

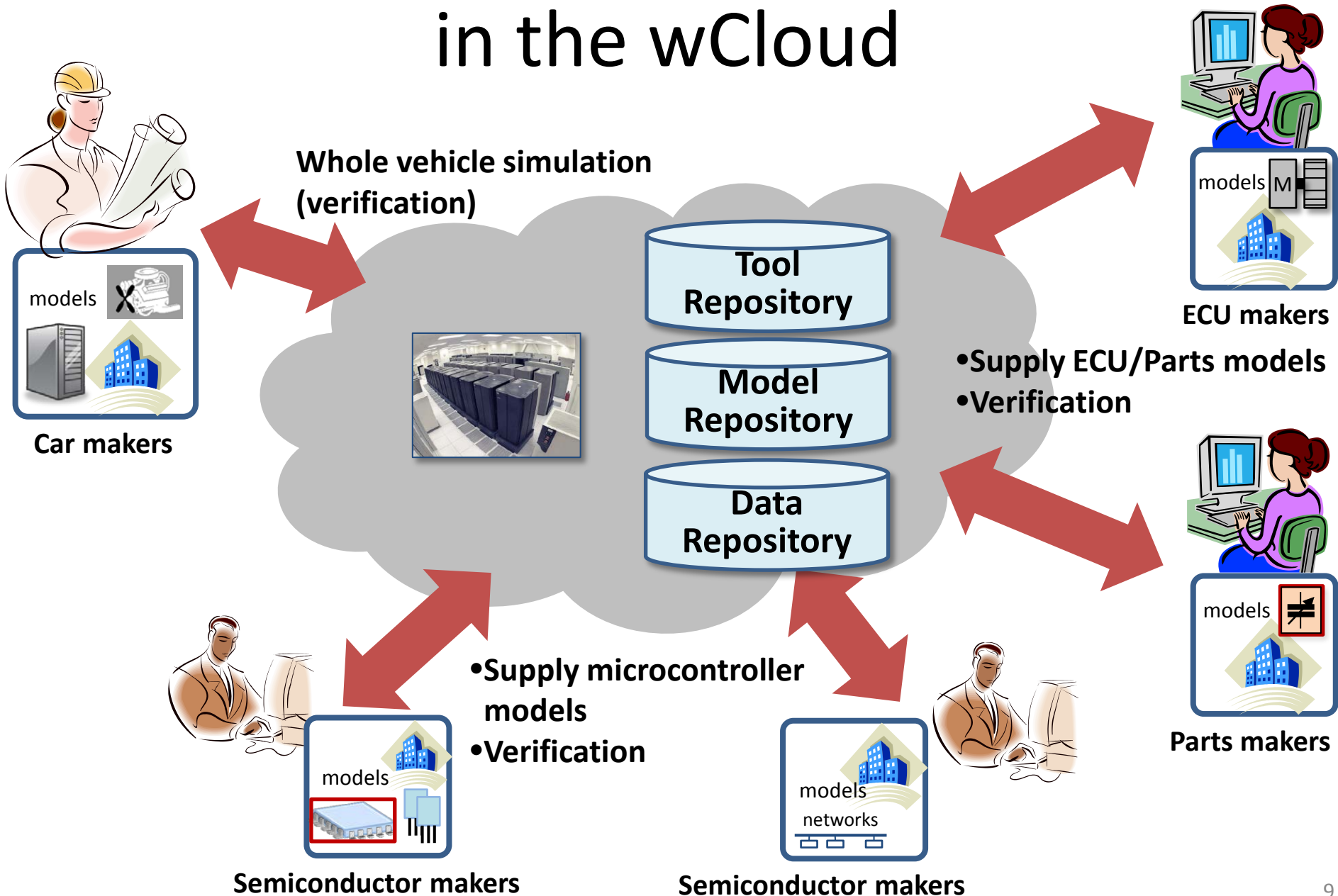
- **Marketplace function :**

Achieving **efficient development** by easily access for necessary tool/model/data.  
By Improve availability of tool/model/data which is attained by promoting developers of tool/model/data to provide them.

- **wCloud works with SNS (Social Network Service) function :**

Achieving **transfer knowledge of design/manufacturing** by promoting communication inside communities for each application/tool/model.

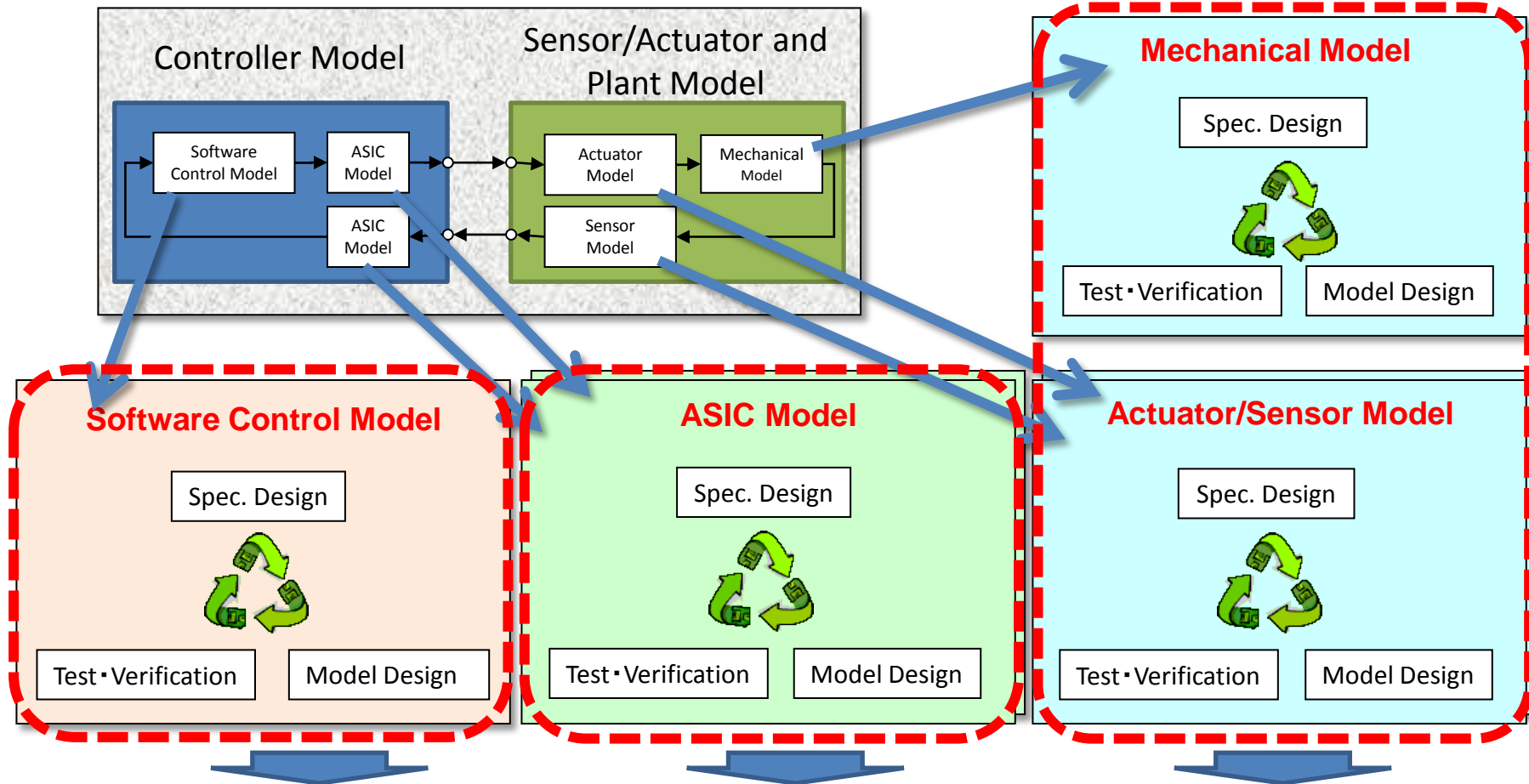
# “A Whole Vehicle (in Virtual)” in the wCloud





# Tool Federation

## System Model



Target	Processor	H/W	Mechanical parts
Simulator	Transactional simulator	Circuit simulator	Physical simulator

System model simulation may consist of different kinds of simulator

# Tool Federation

## - Example: Power Window System (demo) -

### Plant model (and H/W)

- H/W
- Motor, Mechanical Parts

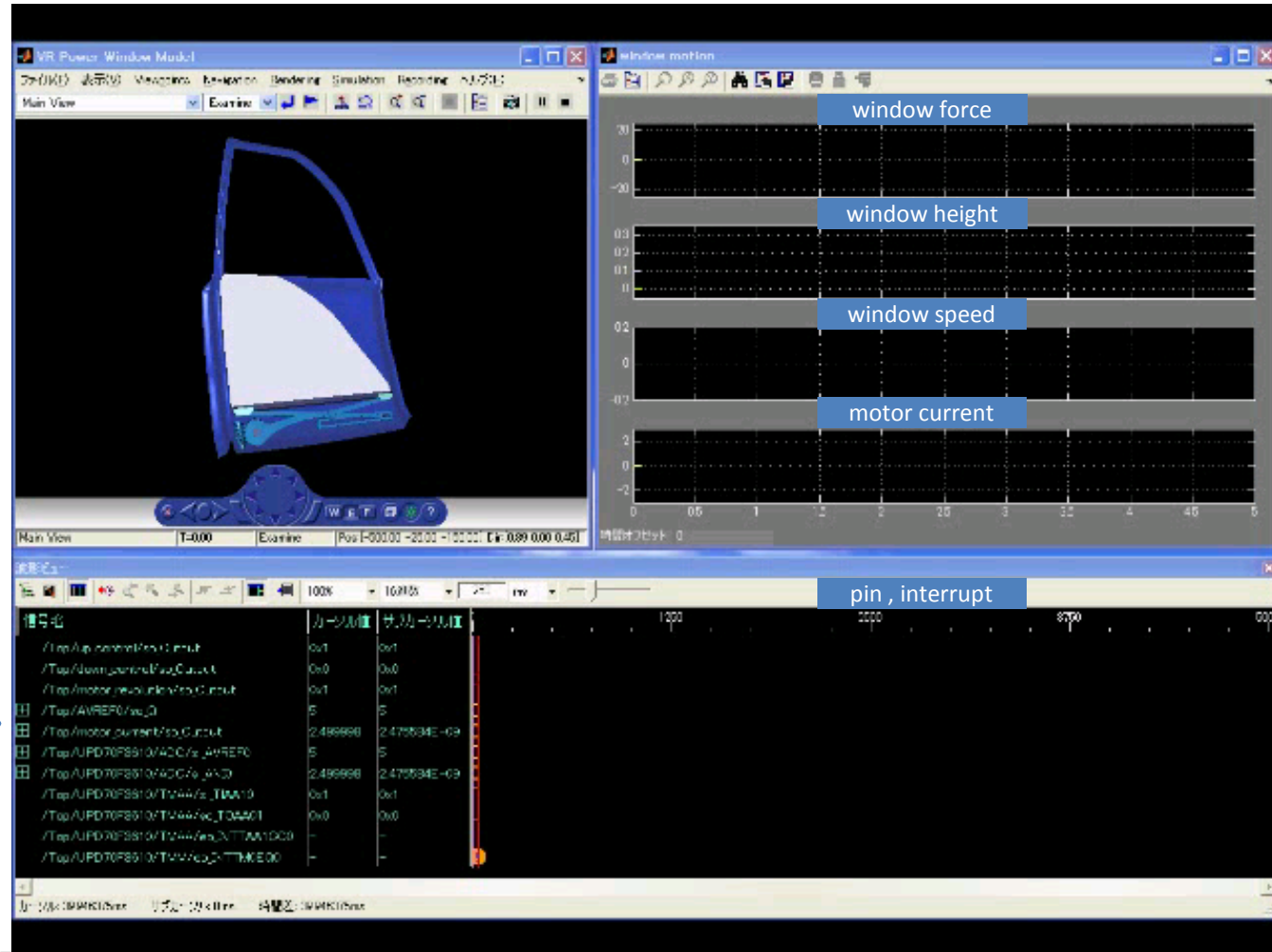
Matlab/Simulink

Tools are interfaced at the microcontroller's pin.

### Controller model

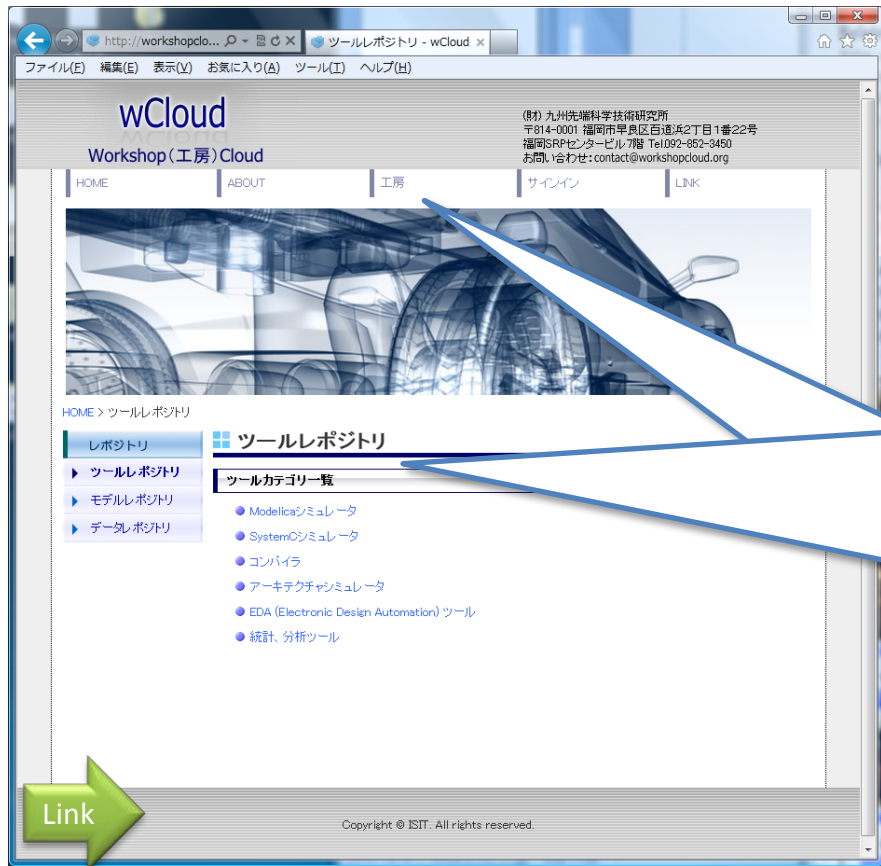
- Microcontroller (V850 (Renesas electronics)) runs object code.

Microcontroller simulator



Demo is sped up by 30 times from the actual simulation speed.

# workshopcloud.org



- The web site was opened by ISIT in September 2012.
- The workshopcloud is in trial phase (available for internal users only).
- Working on to open to the public in 2013.

## ● Workshops

### ➤ Repositories

- Tool repository
  - Model repository
  - Data repository

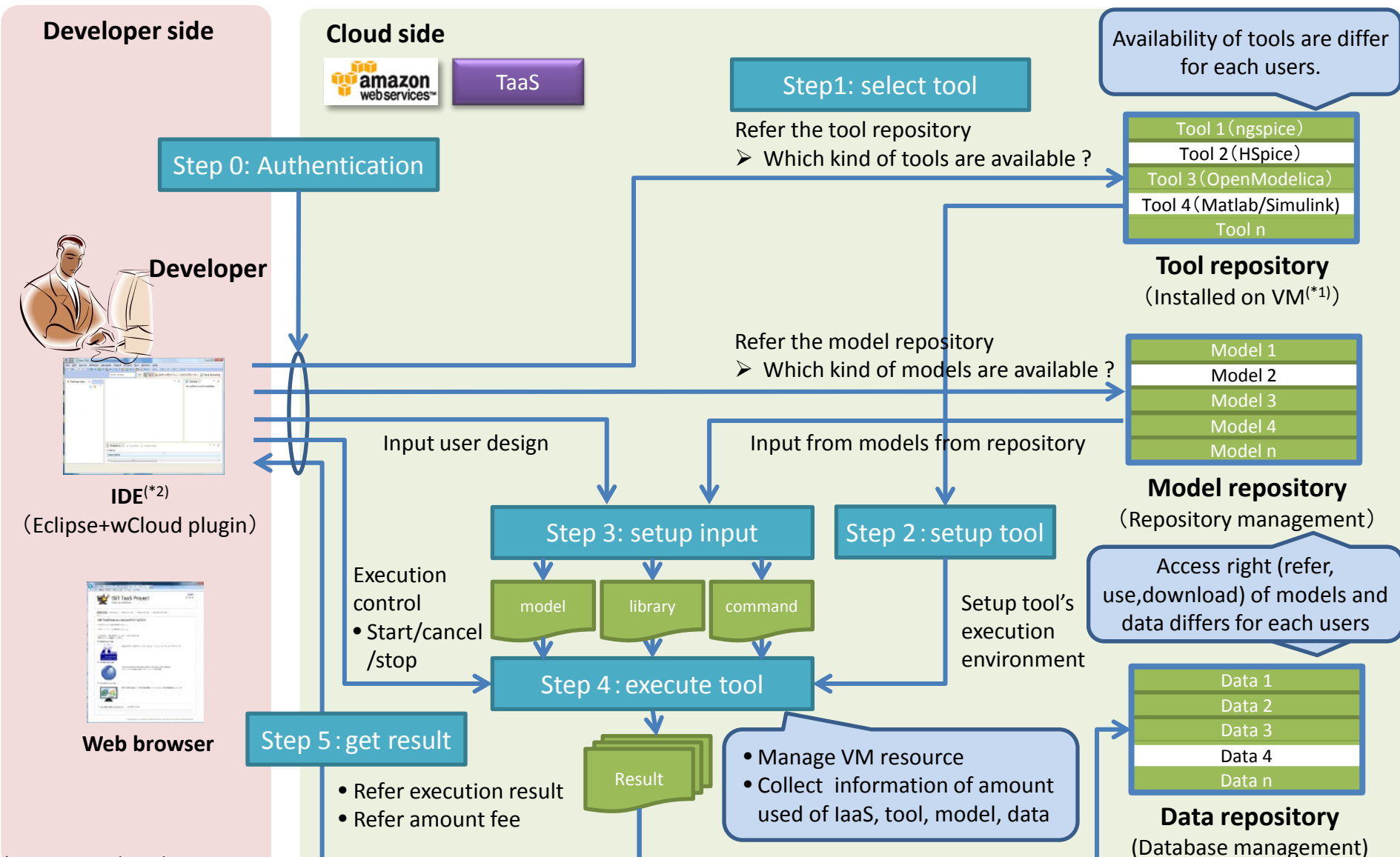
Begin with from tools

### ➤ Application Templates

- Automotive
- HPC

Begin with templates  
I.e. Power window

# A Flow to Use Tools/Models/Data in the wCloud



\*1: VM: Virtual Machine

\*2: IDE: Integrated Development Environment

# Tools for the wCloud

- Tools from OSS (Open Source Software) and tools from academia.

Category	Tool	Note
Modelica Simulators	OpenModelica	Modelica simulators. (Modelica is a language to model physical systems)
	Jmodelica	
SystemC simulators	OSCI SystemC	A transaction level simulator.
Architecture Simulators	Redefis	C Compiler, Simulator, debugger, and profiler for dynamic reconfigurable processors developed by ISIT.
	SFQ-LSRDP	A simulator for Large scale reconfigurable datapath processors developed by Kyushu univ.
Compilers	(TBA)	
EDA tools	ngspice	A circuit level simulator.
	3D EDA tool	A Place & Routing tool for 3D IC developed by Honda research and Kyushu univ.
Analysis tools	R	A statistical analysis tool.



# wCloud Enables Virtual Design Environment for Highly Complicated Mission Critical Systems

