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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ISIT

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

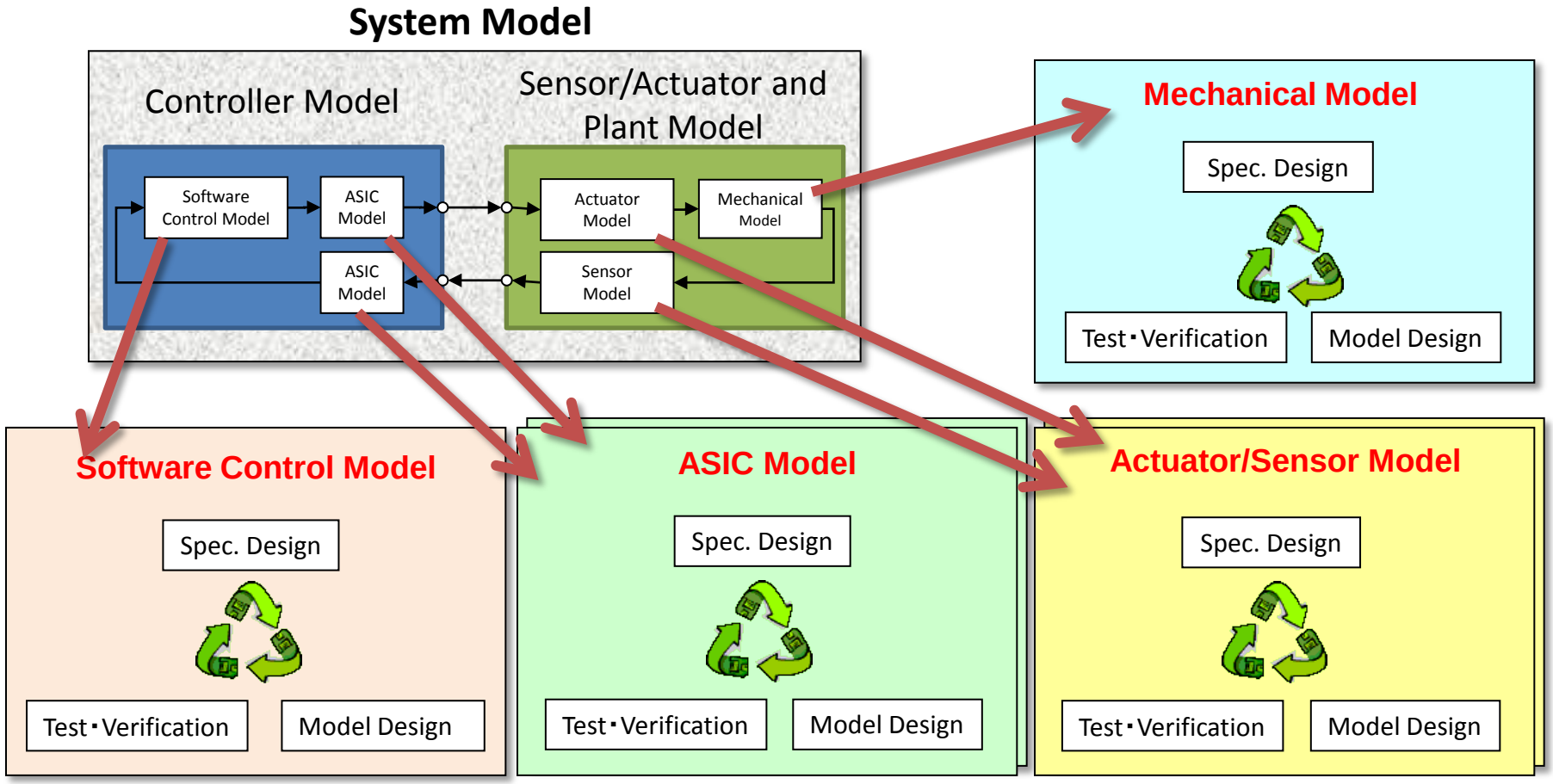
- Lights
- Door open/close
- Power windows
- Wipers
- Air conditioners
- Audio systems
- Dashboards
- Air bag systems
- …

Multi-media

- Car navigation systems
- Lane Keeping Assist Systems
- Parking Support Systems
- Pre-crash safty systems
- Forward distance warning Systems
- …

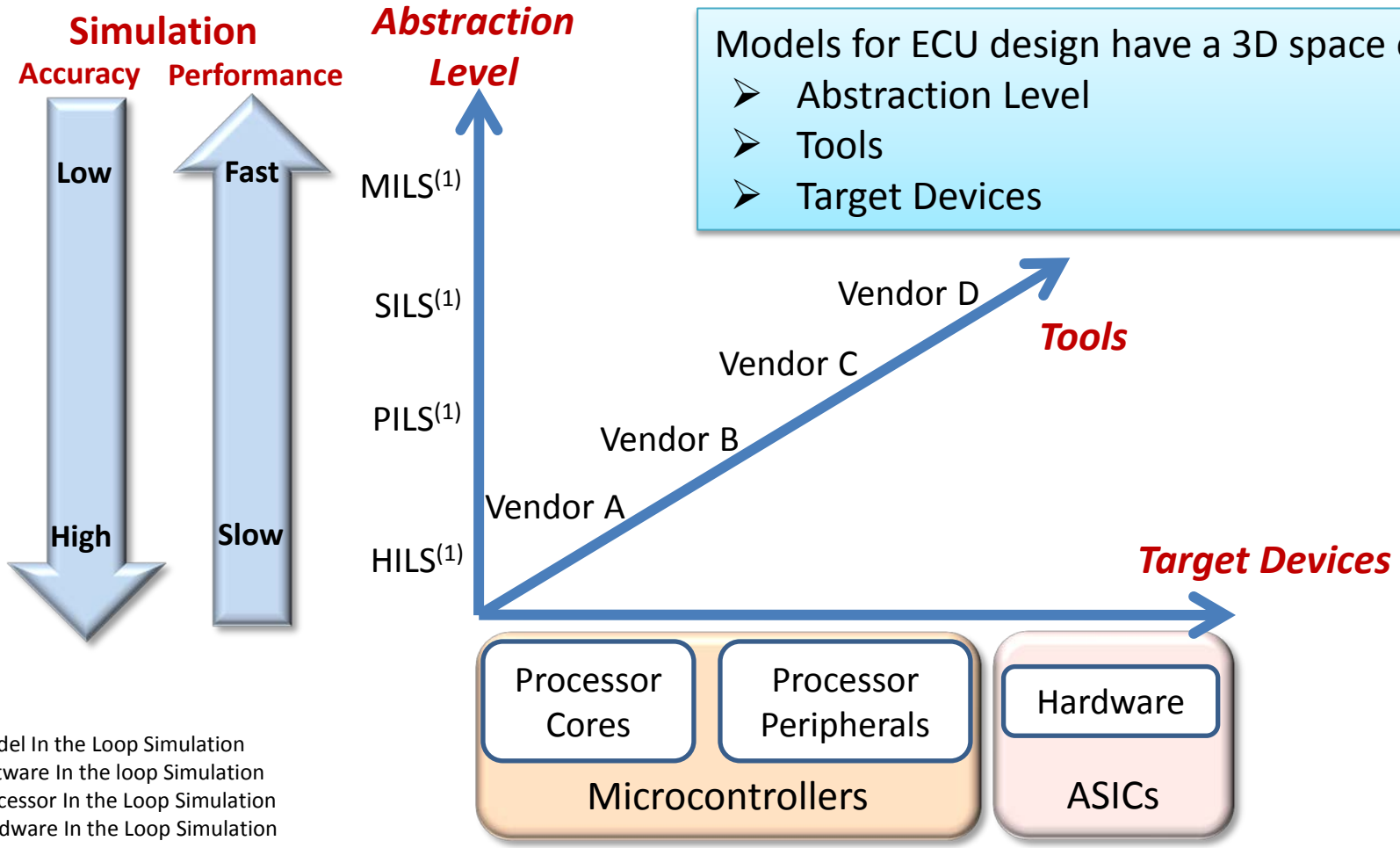
40 -100 ECUs(Electric Control Units) are in one car

Model-Based Development (MBD) for ECU Design



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



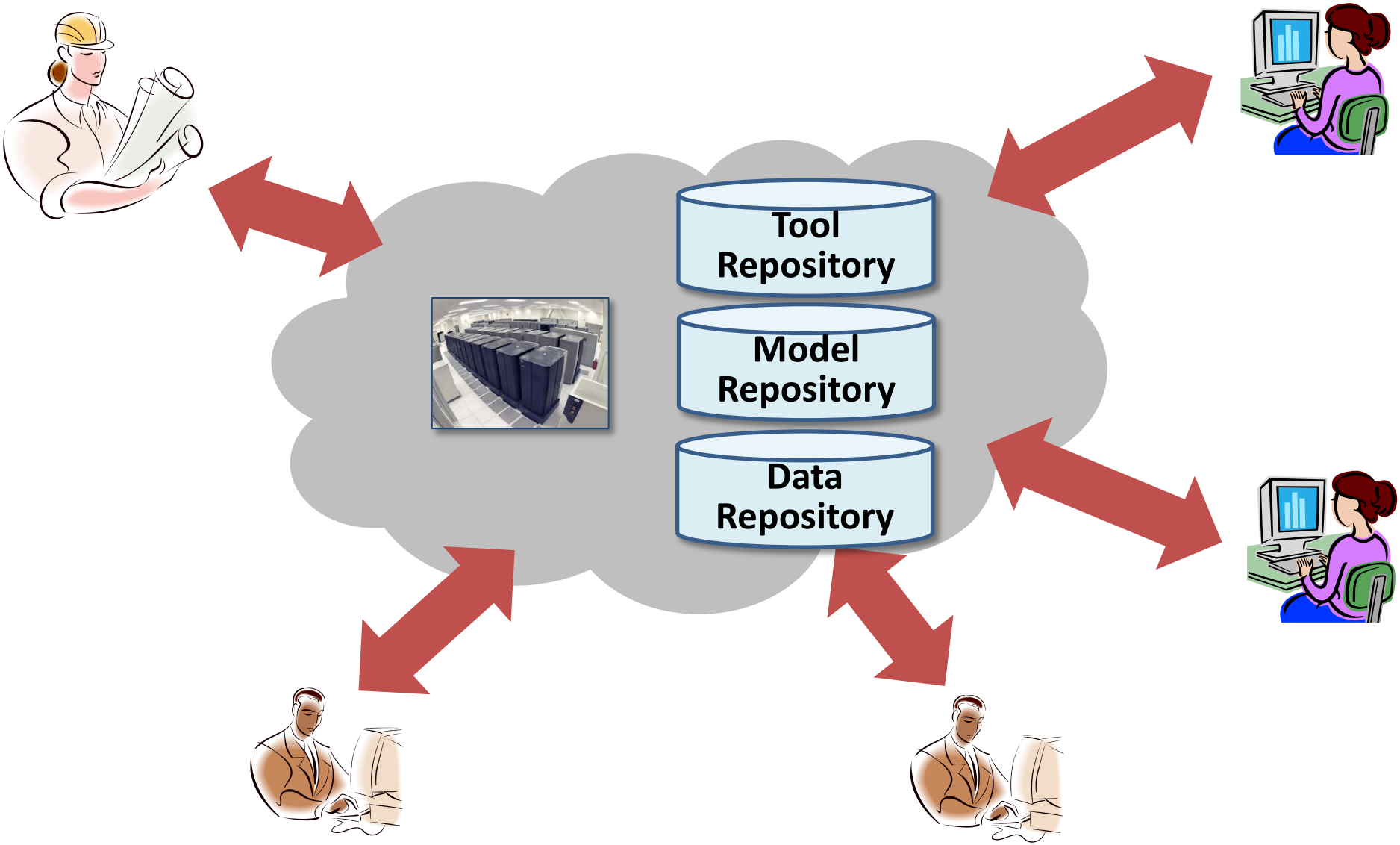
Models for ECU design have a 3D space of

- Abstraction Level
- Tools
- Target Devices

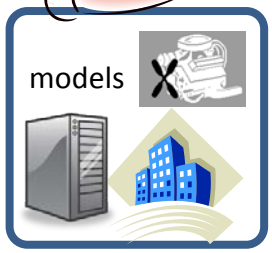
(1)
MILS : Model In the Loop Simulation
SILS : Software In the loop Simulation
PILS : Processor In the Loop Simulation
HILS : Hardware In the Loop Simulation

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

wCloud（Workshop Cloud）

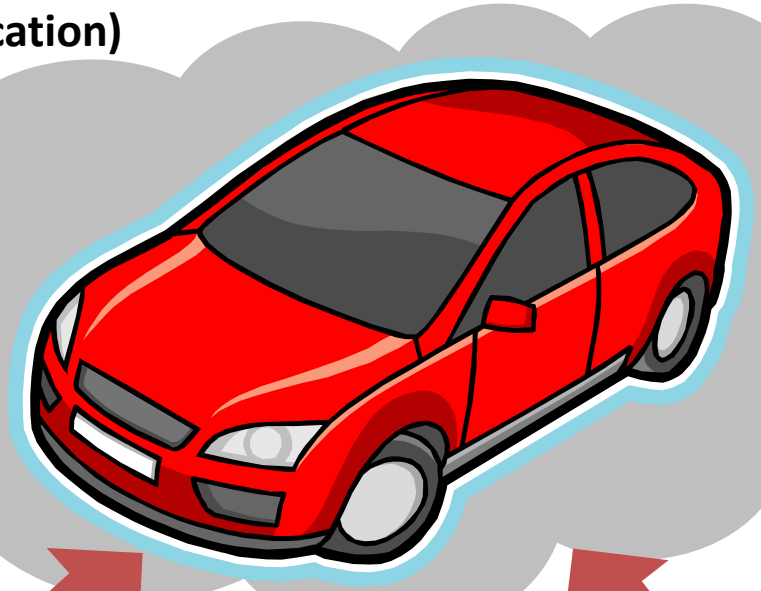


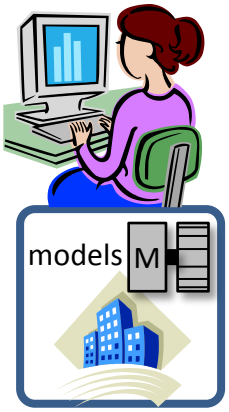
“A Whole Vehicle (in Virtual)” in the wCloud



Car makers

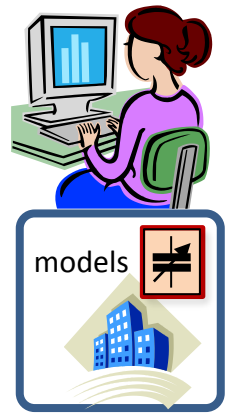
Whole vehicle simulation (verification)



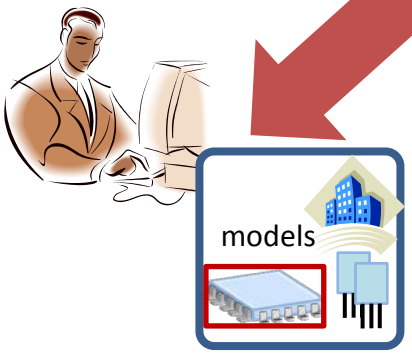


ECU makers

•Supply ECU/Parts models
•Verification

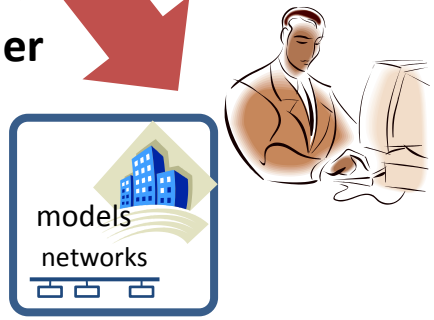


Parts makers



Semiconductor makers

•Supply microcontroller models
•Verification



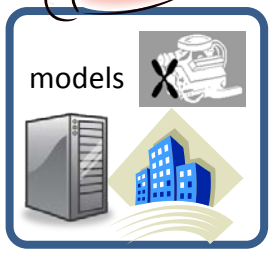
Semiconductor makers

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



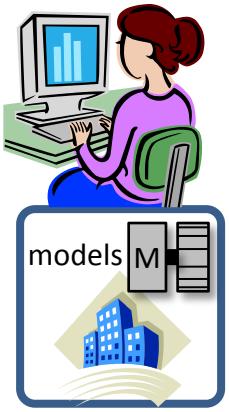
Car makers

Whole vehicle simulation (verification)

Tool Repository

Model Repository

Data Repository



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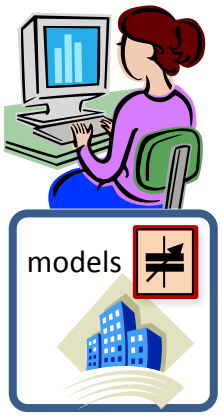
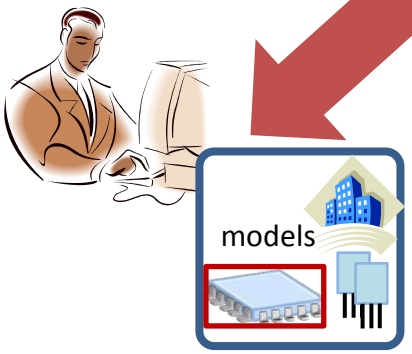


Parts makers



Semiconductor makers

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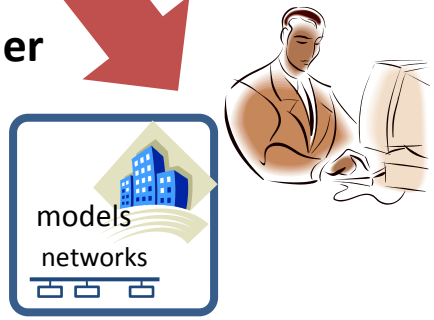


Semiconductor makers

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

Car makers

Whole vehicle simu
(verification)

TaaS(*2)

IaaS(*1) service

Tools
- OSS Tools
- Commercial Tools

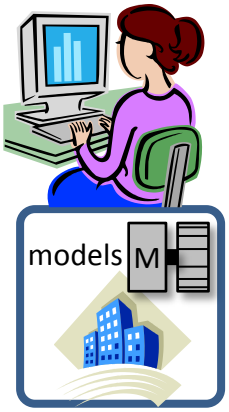
Tool repository management
- SW package management tools

Models
- Microcontrollers, Sensor/accumulators, plant models

Model repository management
- User authorization, access control
- Data repository, version control

Data
- Simulation input data and output data

Data repository management
- User authorization, access control
- Data repository



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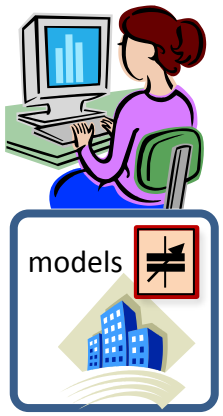
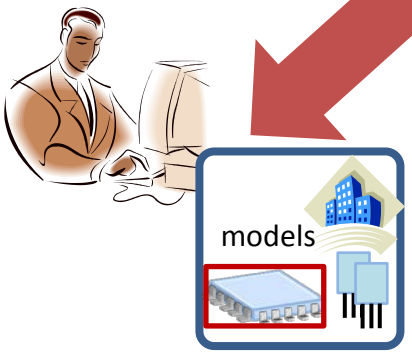


Parts makers



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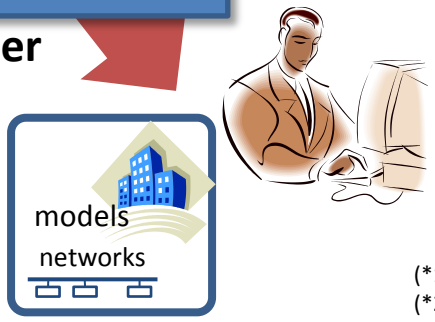
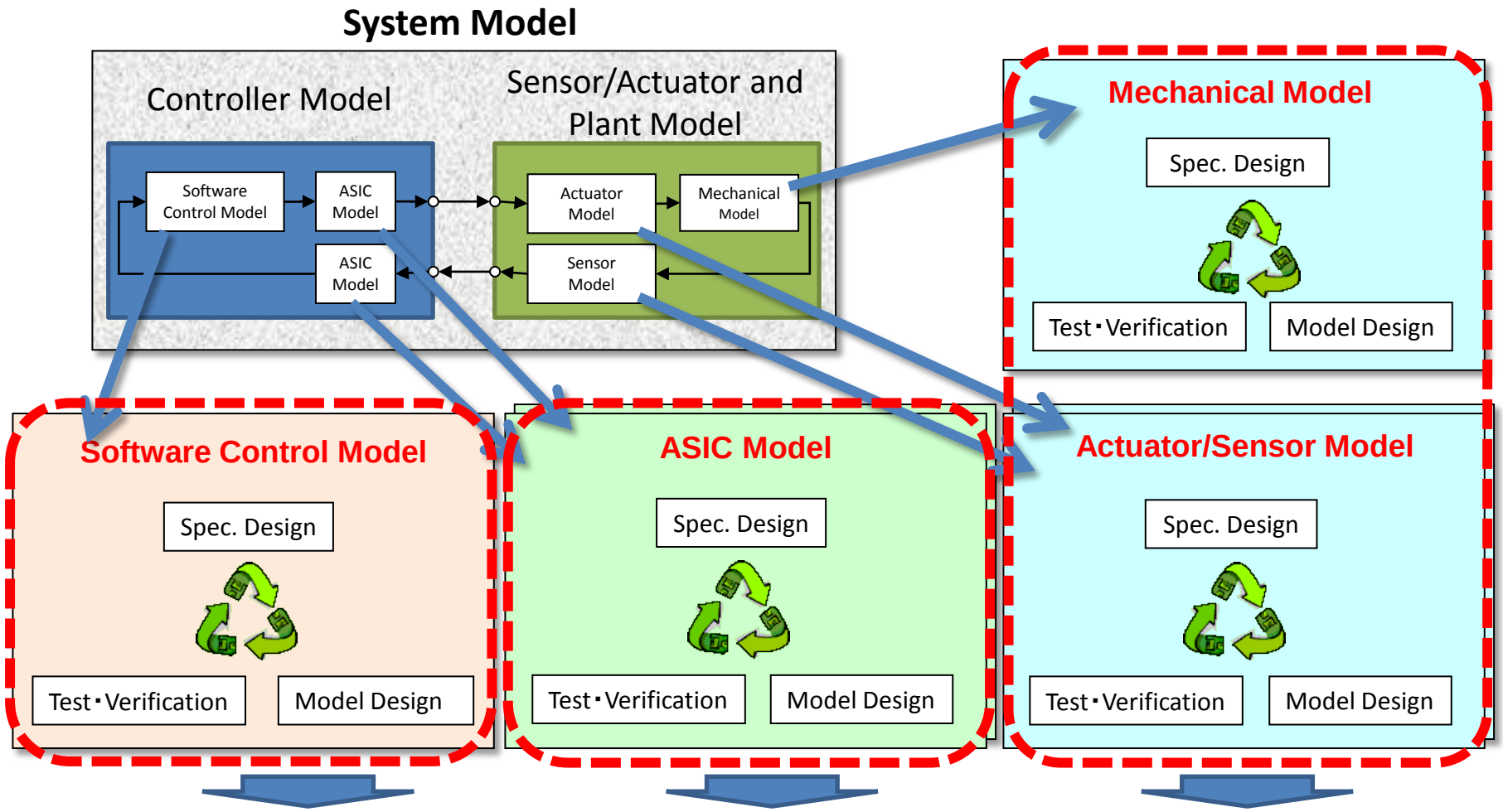


Semiconductor makers

(*1): IaaS: Infrastructure As A Service
(*2): TaaS: Tool As A Service

Tool Federation



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) -

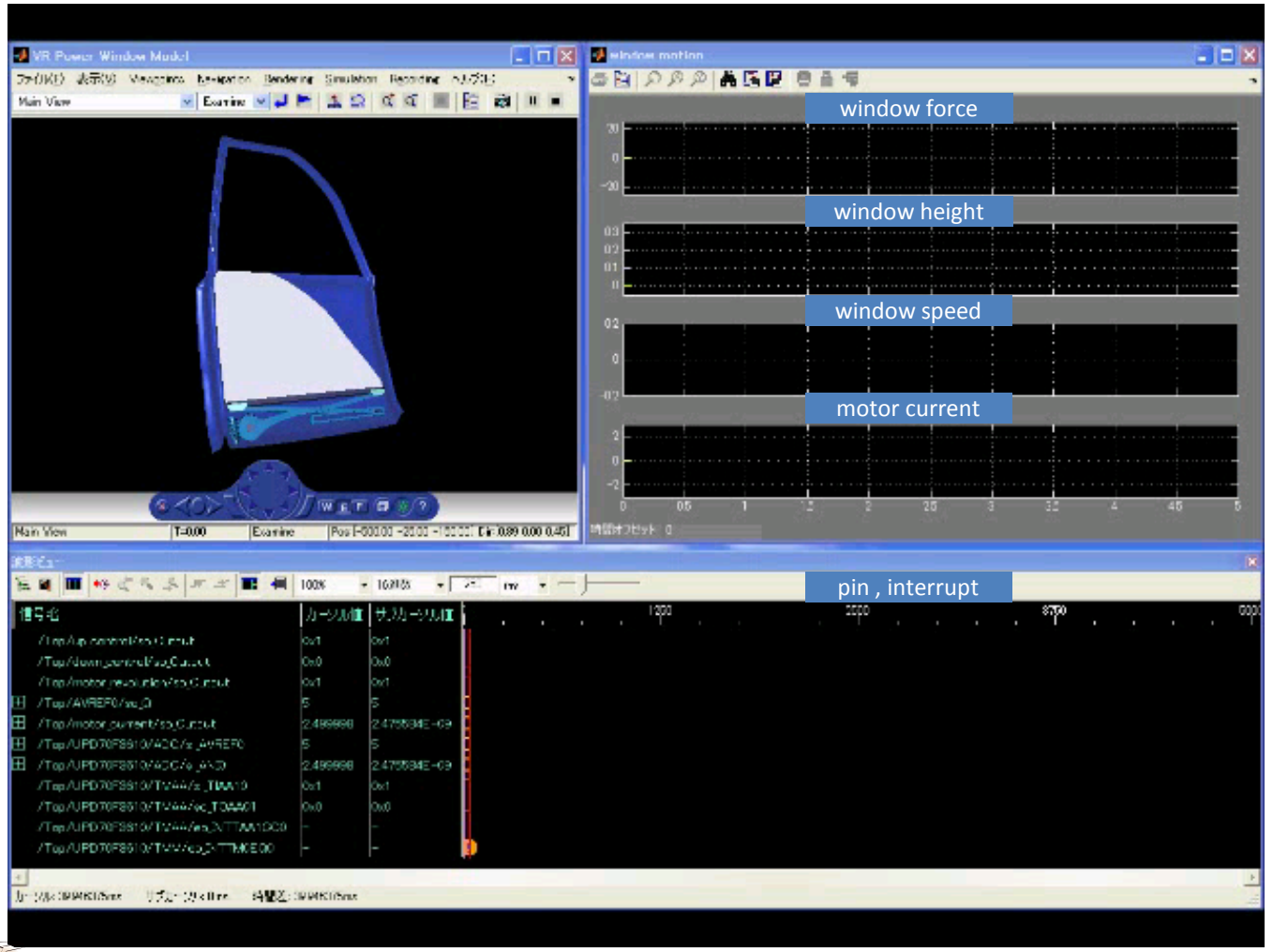
Plant model (and H/W)
- H/W
- Motor, Mechanical Parts

Matlab/Simulink

Tools are interfaced at the microcontroller's pin.

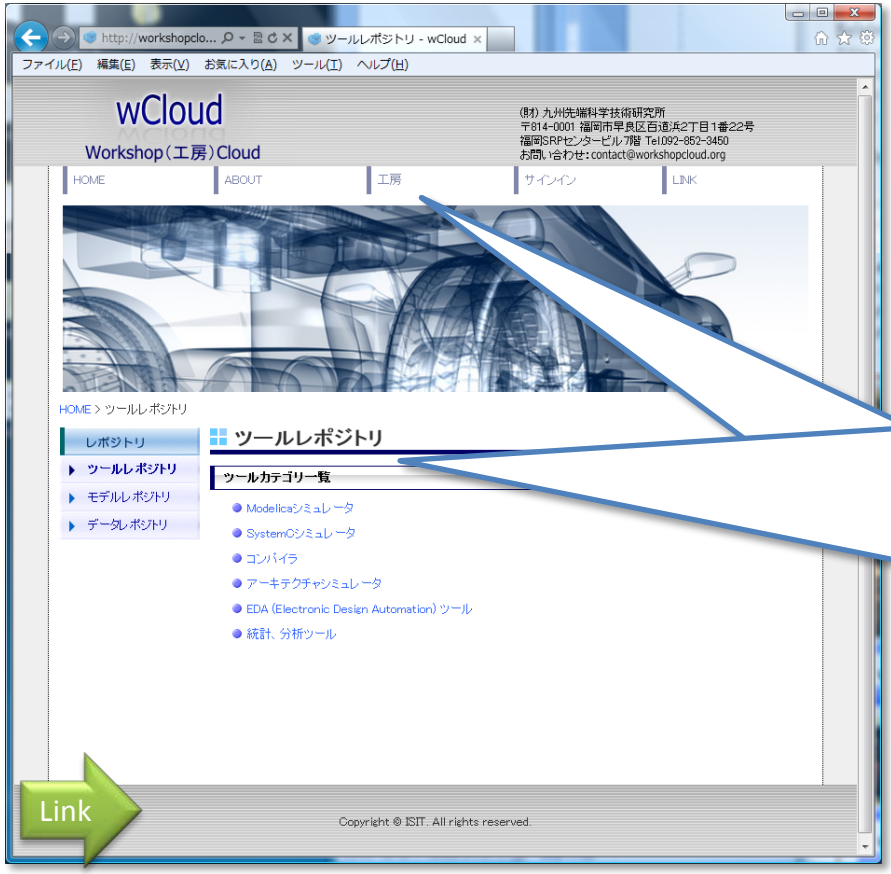
Controller model
- Microcontroller (V850 (Renesas electronics)) runs object code.

Microcontroller simulator



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

workshopcloud.org



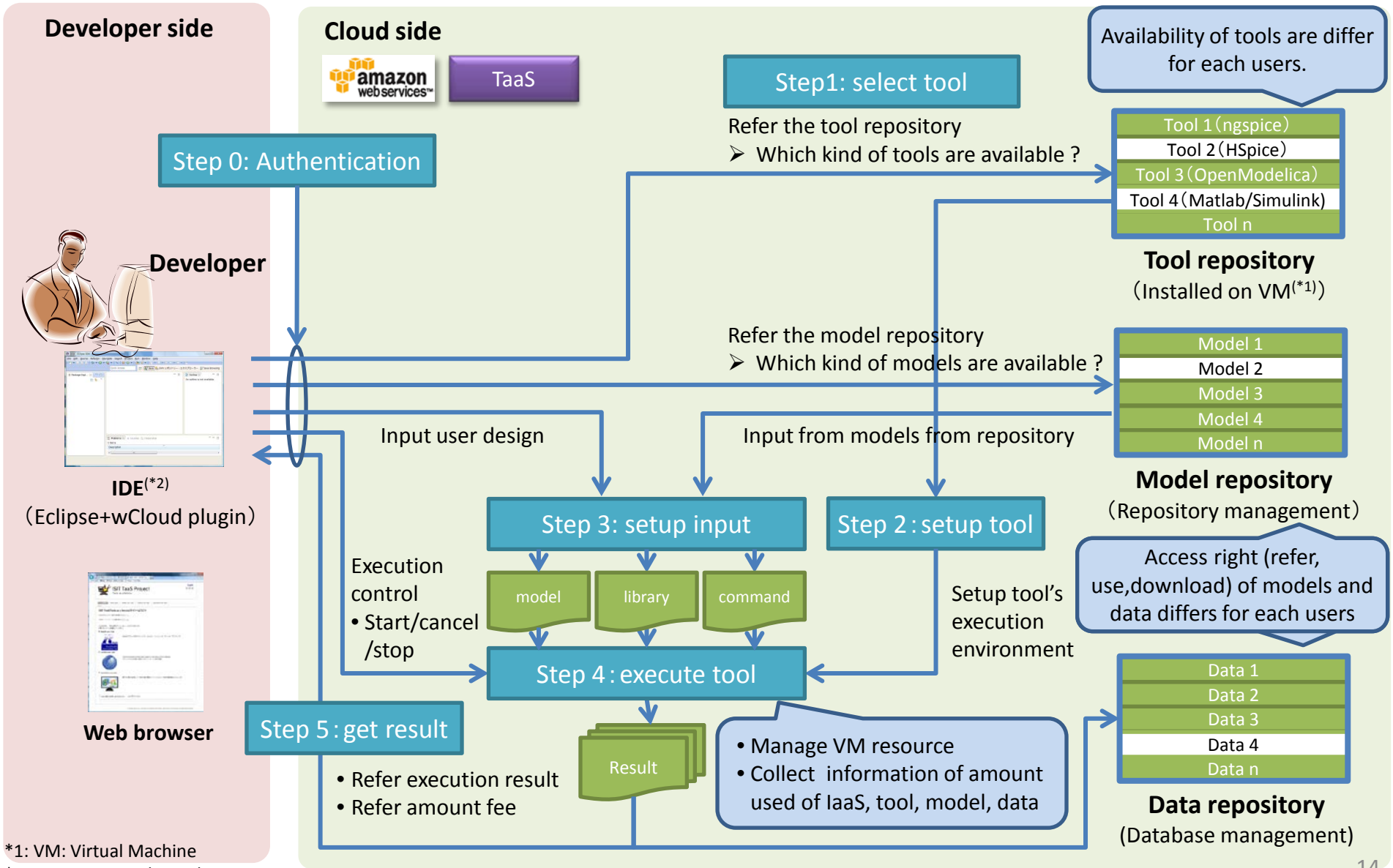
- The web site was opened by ISIT in September 2012.
- The workshopcloud is in trial phase (available for internal users only).
- Working on to open to the public in 2013.

- Workshops
- **Repositories**
  - Tool repository
    - Model repository
    - Data repository
- **Application Templates**
  - Automotive
  - HPC

Begin with from tools

Begin with templates
Ie. 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