



Development of an Open Software Platform for Robotic Services(OPRoS) in Korea

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- I** Introduction
- II** Component
- III** Framework
- IV** IDE
- V** Testing
- VI** Server

I. Introduction

Low cost of
development and
maintenance



Support of
various robot
application
programs



Robot S/W developer



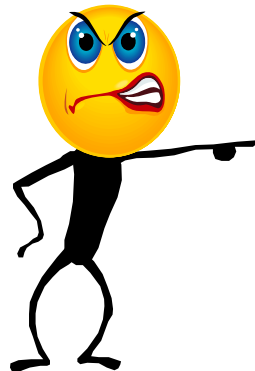
Reuse of existing
robot algorithms



Portability
Extensibility
of robot S/W
contents



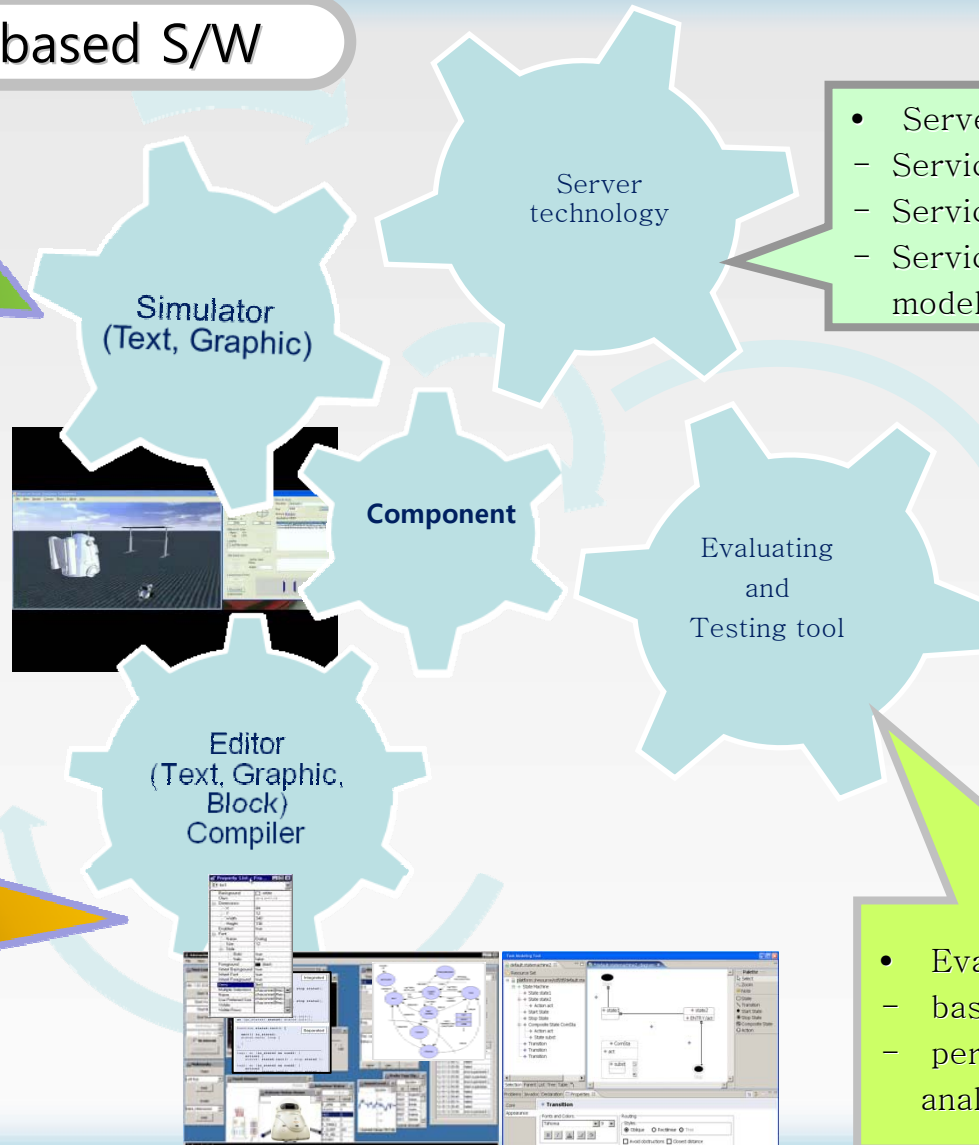
Our final objective is to
provide state-of-the-art robot platform
software that has efficiency, portability,
extensibility, and so on.



I. Introduction

Component based S/W

- Various robot modeler and environment modeler
- Stage generator
- Rendering
- Linking to programs and environment maps.



- Server technology
 - Service provider/binder
 - Service Description
 - Service implementation model

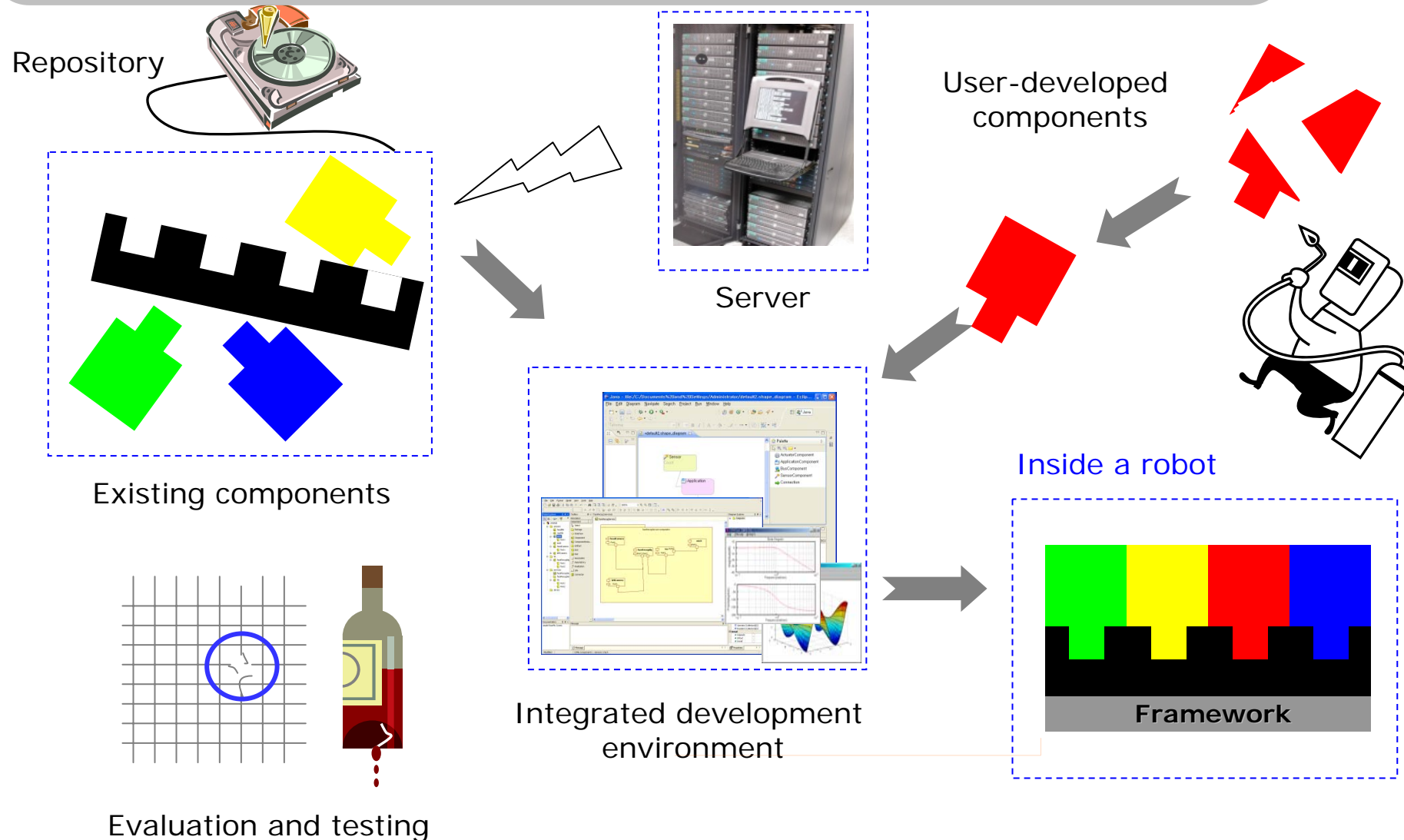


- Contents composing tool
 - Time Line
 - Task scripts
- Component composing tool
 - Component composer
 - Block language

- Evaluation/Testing technology
 - based on web/program
 - performance measurement and analysis

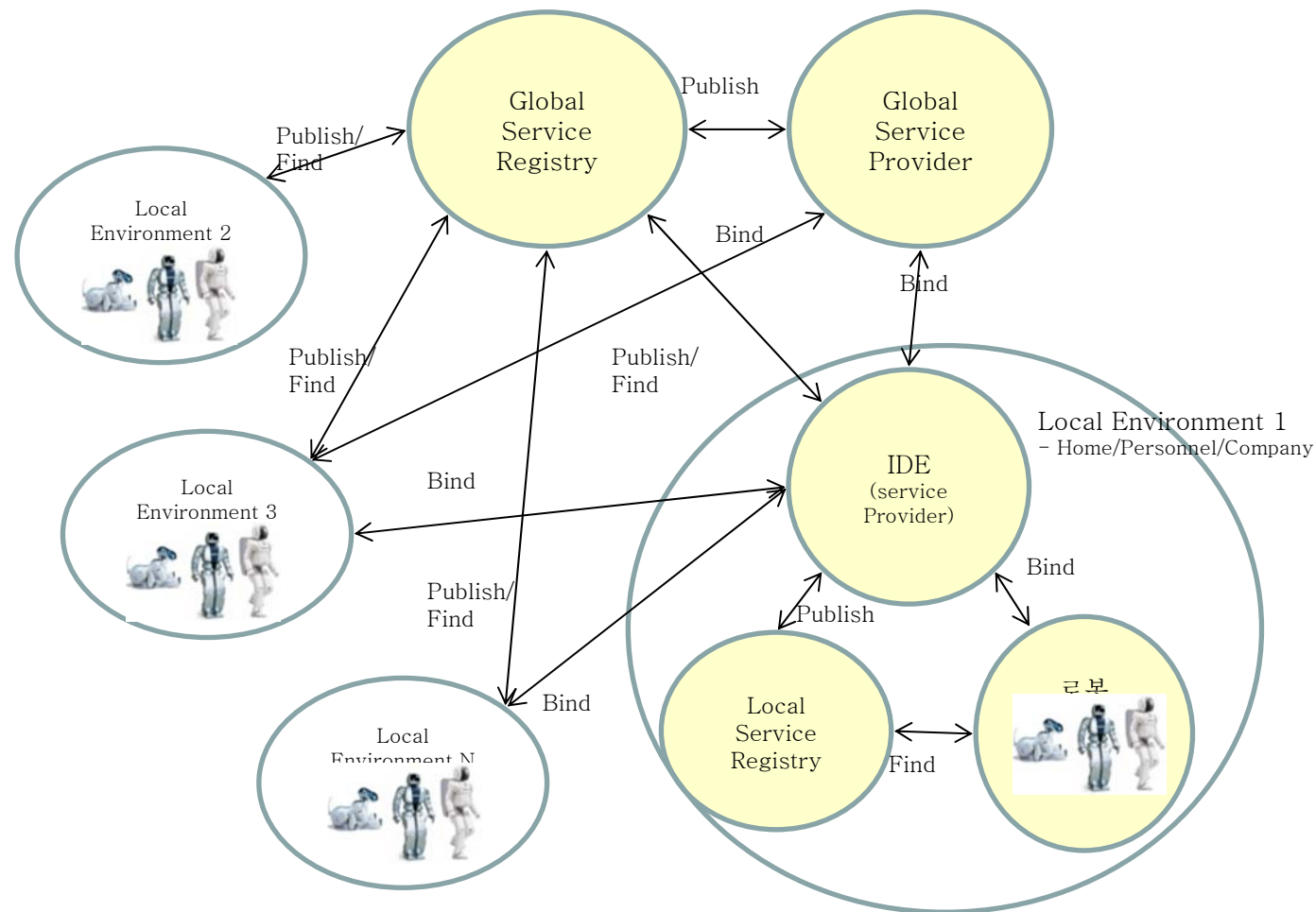
I. Introduction

Overview of Open Software Platform for Robotic Services (OPRoS)

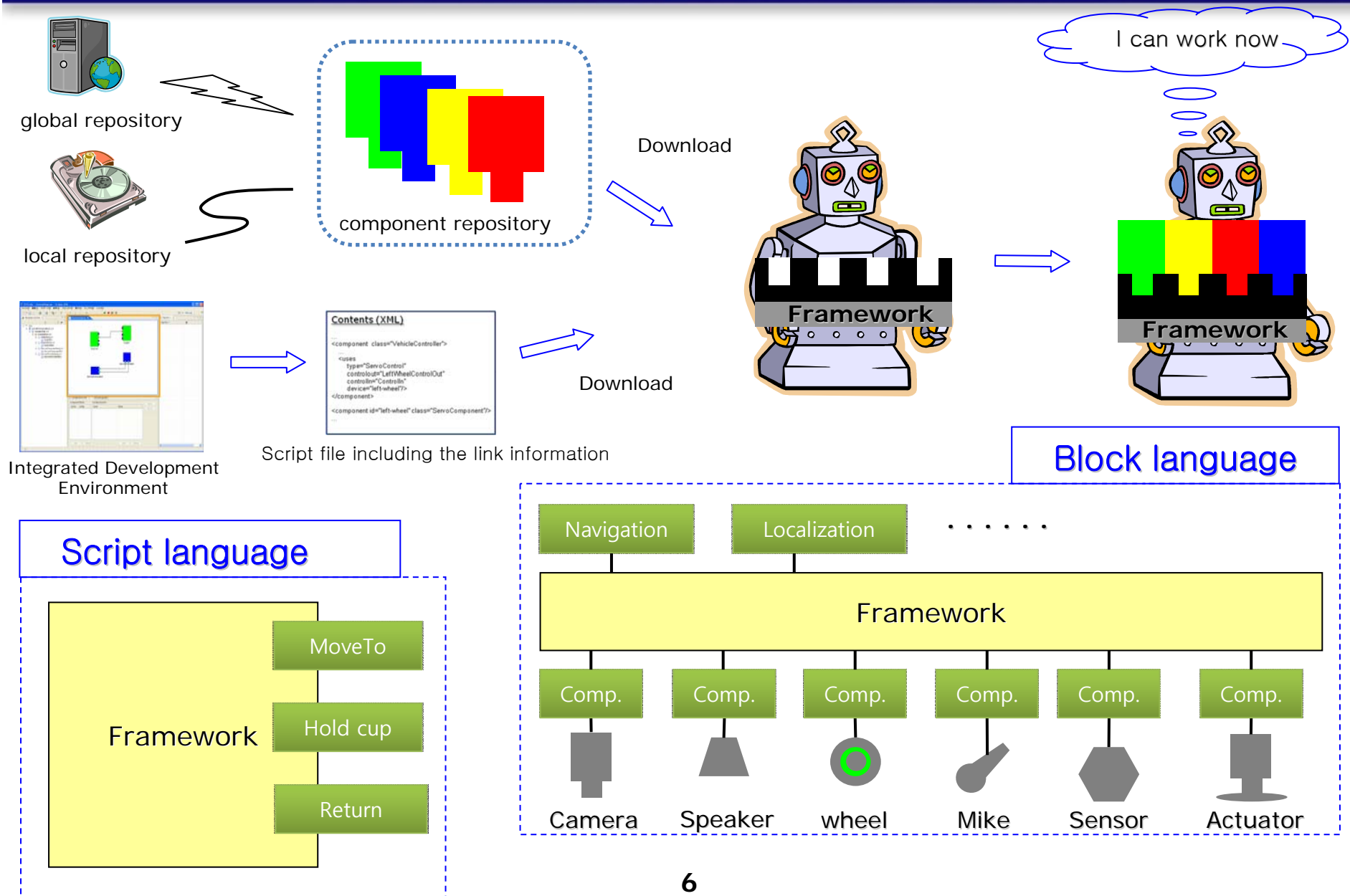


I. Introduction

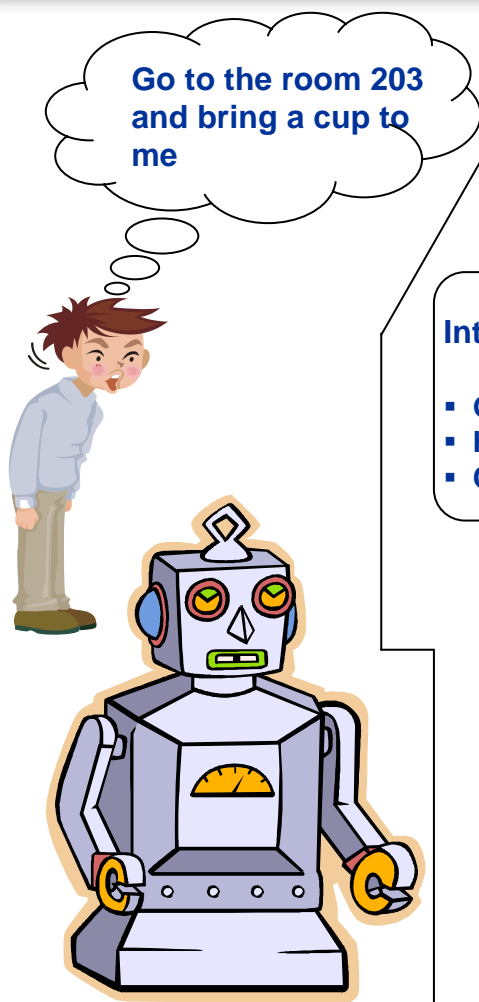
Overall Architecture of OPRoS System



I. Introduction



I. Introduction



Two kinds of languages

Script language

Interpretation of task

- Go to the room
- Hold a cup
- Come back



Task script execution engine

- Setting path to the room 203 and driving motors for moving
- Executing the program of arm-controlling for holding a cup
- Setting path and driving motors for coming back



Control component

Actuator component

Sensor component

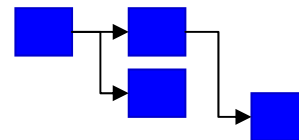
Navigation component

Necessary programs

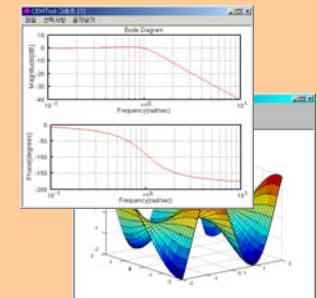
- Navigation
- Controls
- Vision
- Voice recognition



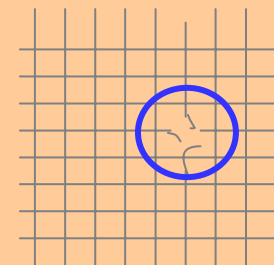
Component manager



Monitoring & Data acquisition



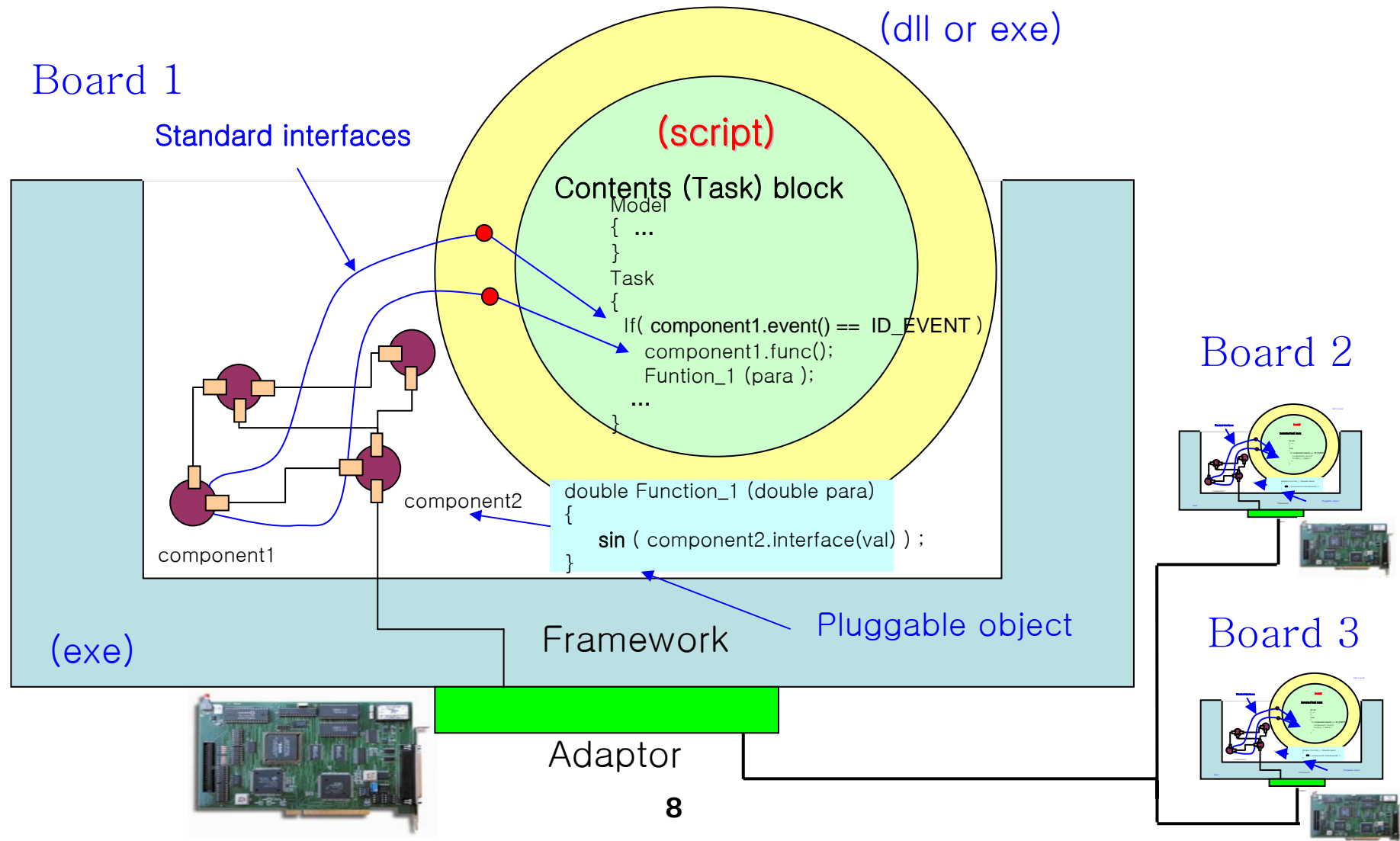
Testing S/W



Block language

I. Introduction

Conceptual view of Robot Framework



I. Introduction

An overview of our project

- Period : Dec., 2007. ~ Sep., 2012.
- Objective
 - To establish standards of components,
 - Innovate the core technology for frameworks, development environments, and evaluation and testing,
 - Employ user-friendly web based technologies
 - Open source and license-free as possible
- Contents
 - Development of components for robot S/W applications
 - ◉ Definition and implementation of the internal logical models for components
 - ◉ Development of application components and template code such as sensing/vision/navigation/control/network
 - Development of frameworks for robot S/W
 - ◉ QoS manager dealing with execution context, scheduling, and so on
 - ◉ Component/contents/service manager carrying out management of those files and loading/unloading of them
 - ◉ Event manager and fault manager
 - ◉ Testing and evaluation manager
 - ◉ Development of connectors for OPRoS components such as direct connector among components and indirect connector via UPnP and CORBA
 - ◉ Development of UPnP/CORBA middleware connectors for the support of dynamic distributed environments

I. Introduction

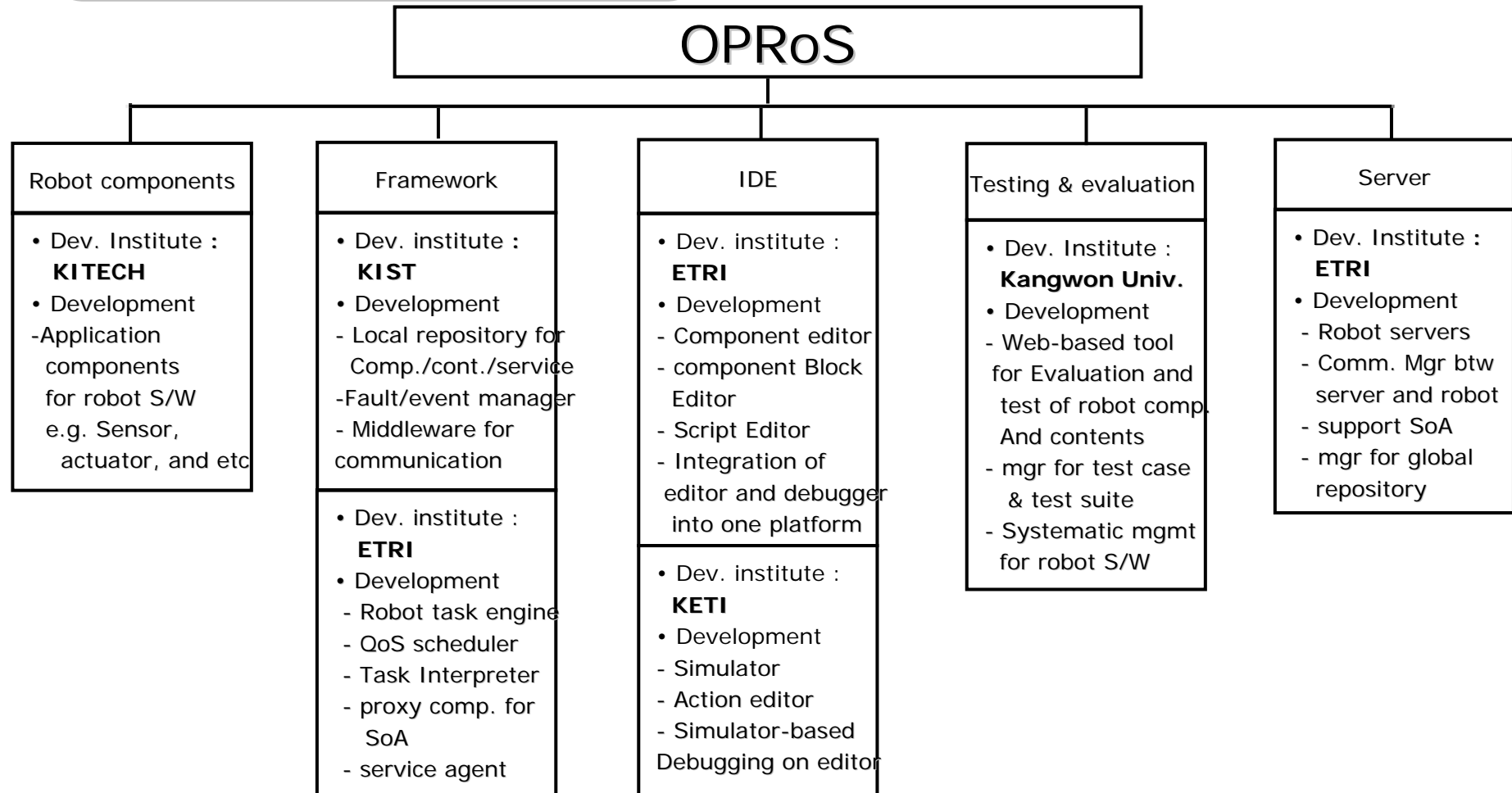
An overview of our project

- Contents

- Develop the core technologies for a robot IDE and robot simulation for multi degree-of-freedom robots
 - ◉ Component editor based on template code
 - ◉ Component block editor, action editors, script editor, and control block editor based on visual programming languages
 - ◉ Editor is linking with debugging function using simulation.
- Development of core technologies for automatic evaluation testing the performance and the functions of robot modules
 - ◉ Development of automation technologies for the performance evaluation and technologies for functional and model test suite.
 - ◉ Tests and evaluation of robot framework, integrated development environment, and components.
 - ◉ Development of test engines and an integrated development tool for S/W management tools.
- Development of Server technologies for SoA and component Repository
 - ◉ Development of SoA(Service-Oriented Architecture) for computation of Services and downloading services
 - ◉ Development of global repository for components, contents, and services

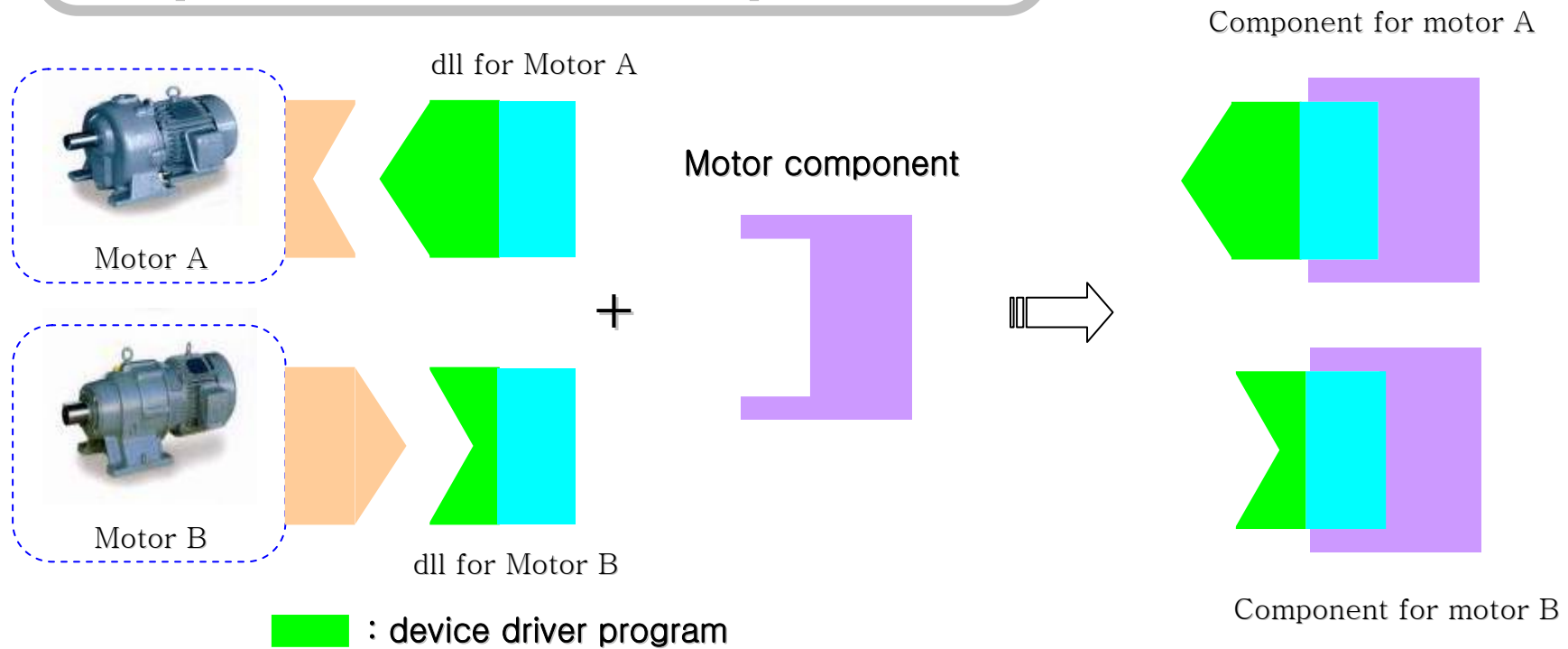
I. Introduction

Organization of our project



II. Component

Component : ex) Motor component

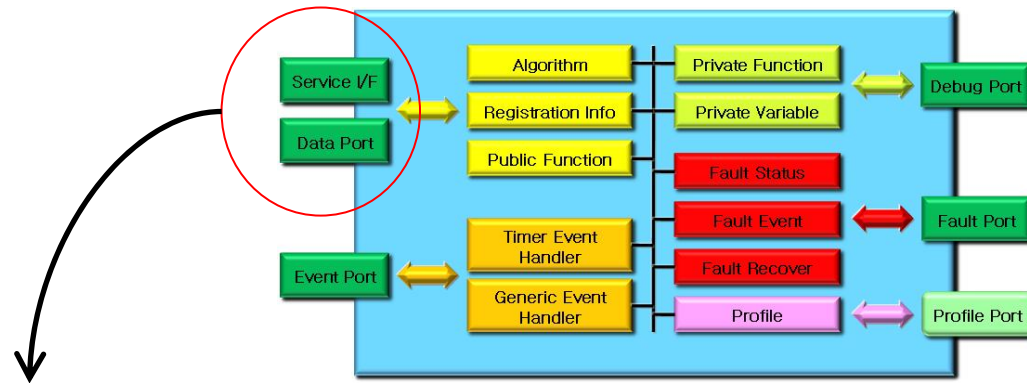


Reuse of component

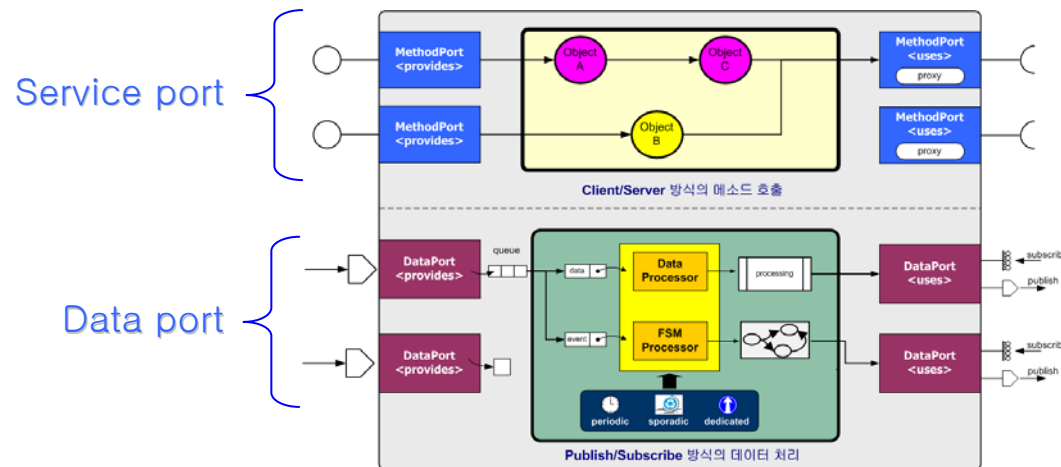


II. Component

OPRoS Component



- Internal view of Data port & service port



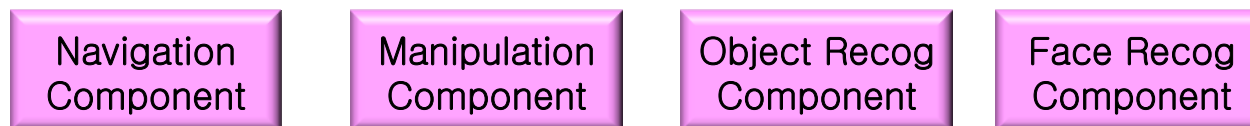
II. Component

Several OPRoS Component

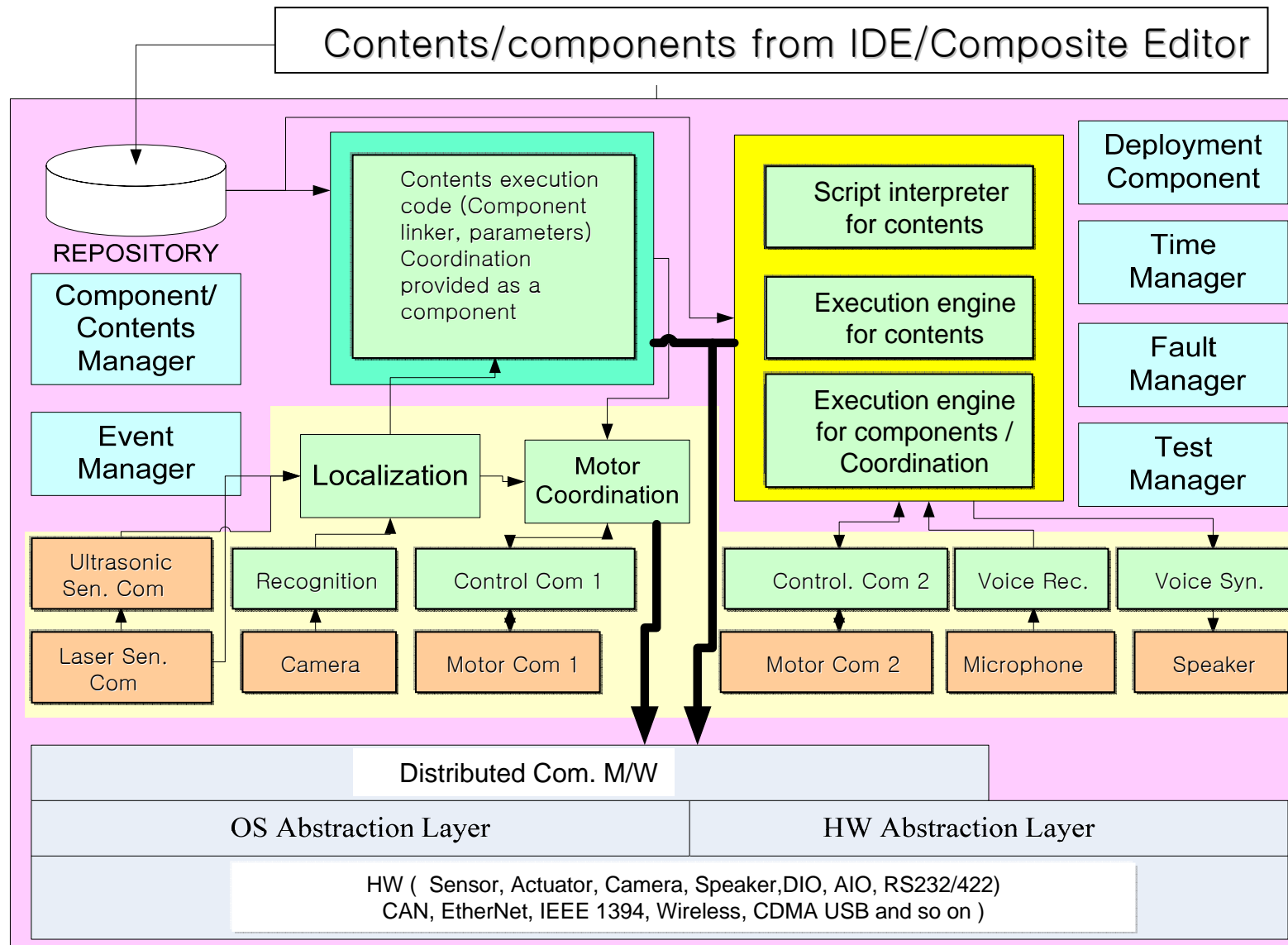
- Basic components & Applied components
- Basic components
 - ▶ Implementation of all devices without respect to HAL(Hardware Abstract Layer)
 - ▶ Implementation of basic algorithms such as filters
 - ▶ Bus, Actuator, Sensor, IO, Camera, etc...



- Applied Components
 - ▶ Navigation, Manipulation, Recognition, etc...

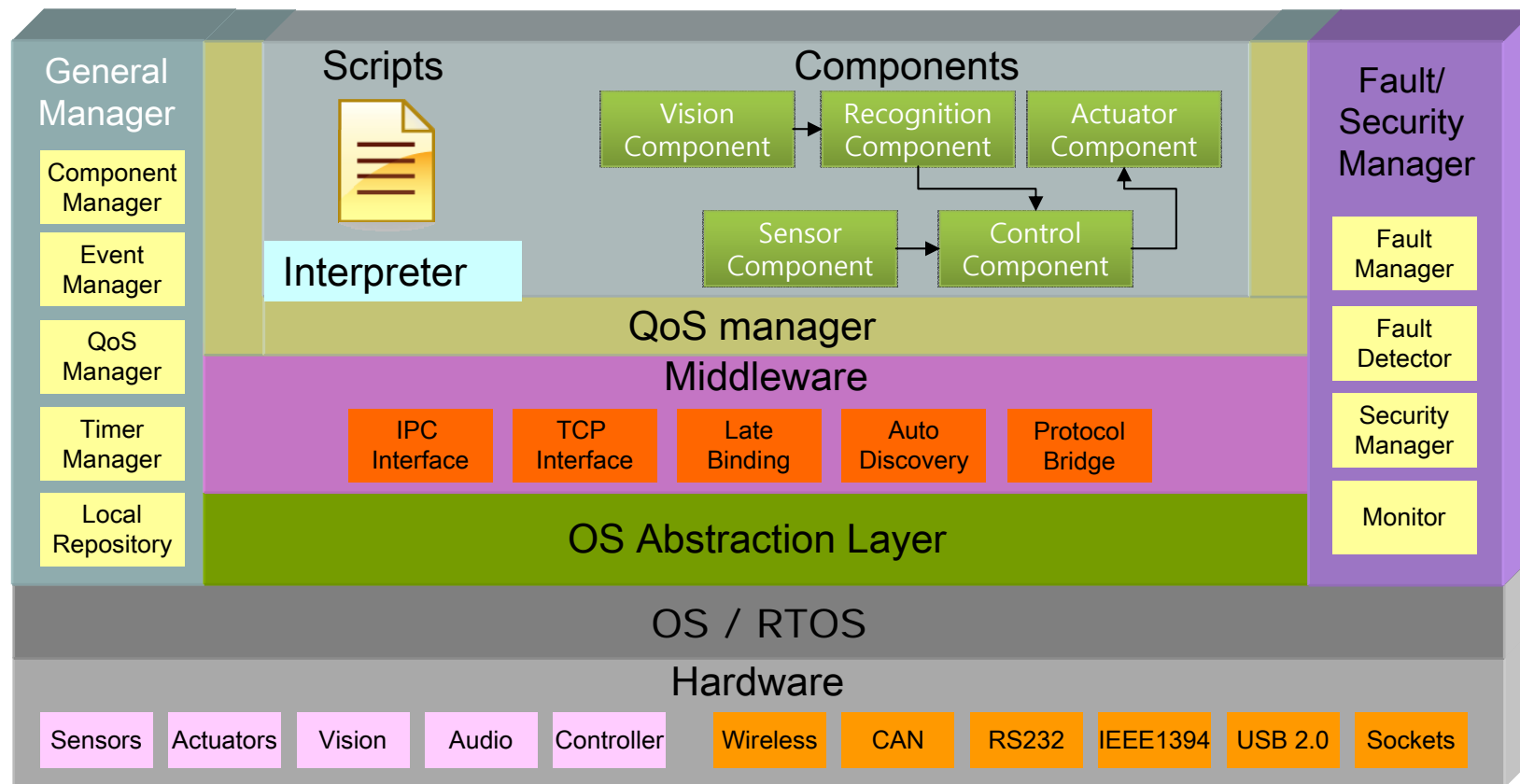


III. Framework



III. Framework

The structure of framework

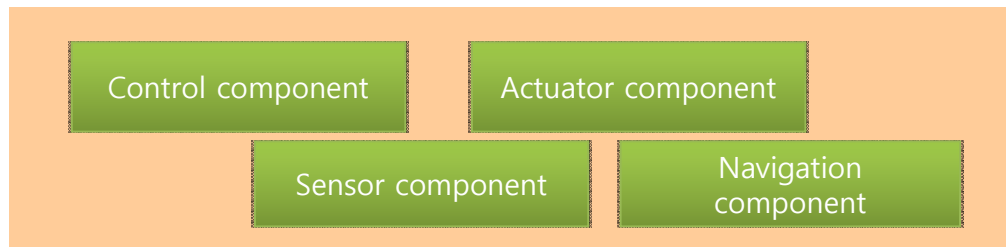


III. Framework

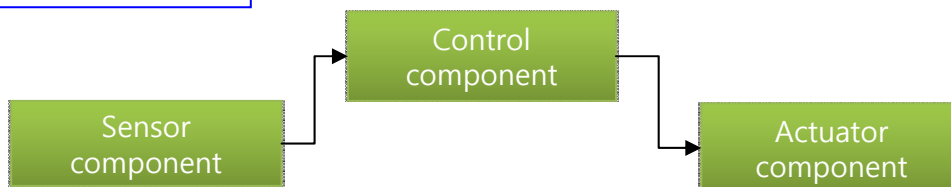
Two kinds of languages

Script language

Control(...)
Acuator(...)
Sensor(...)



Block language

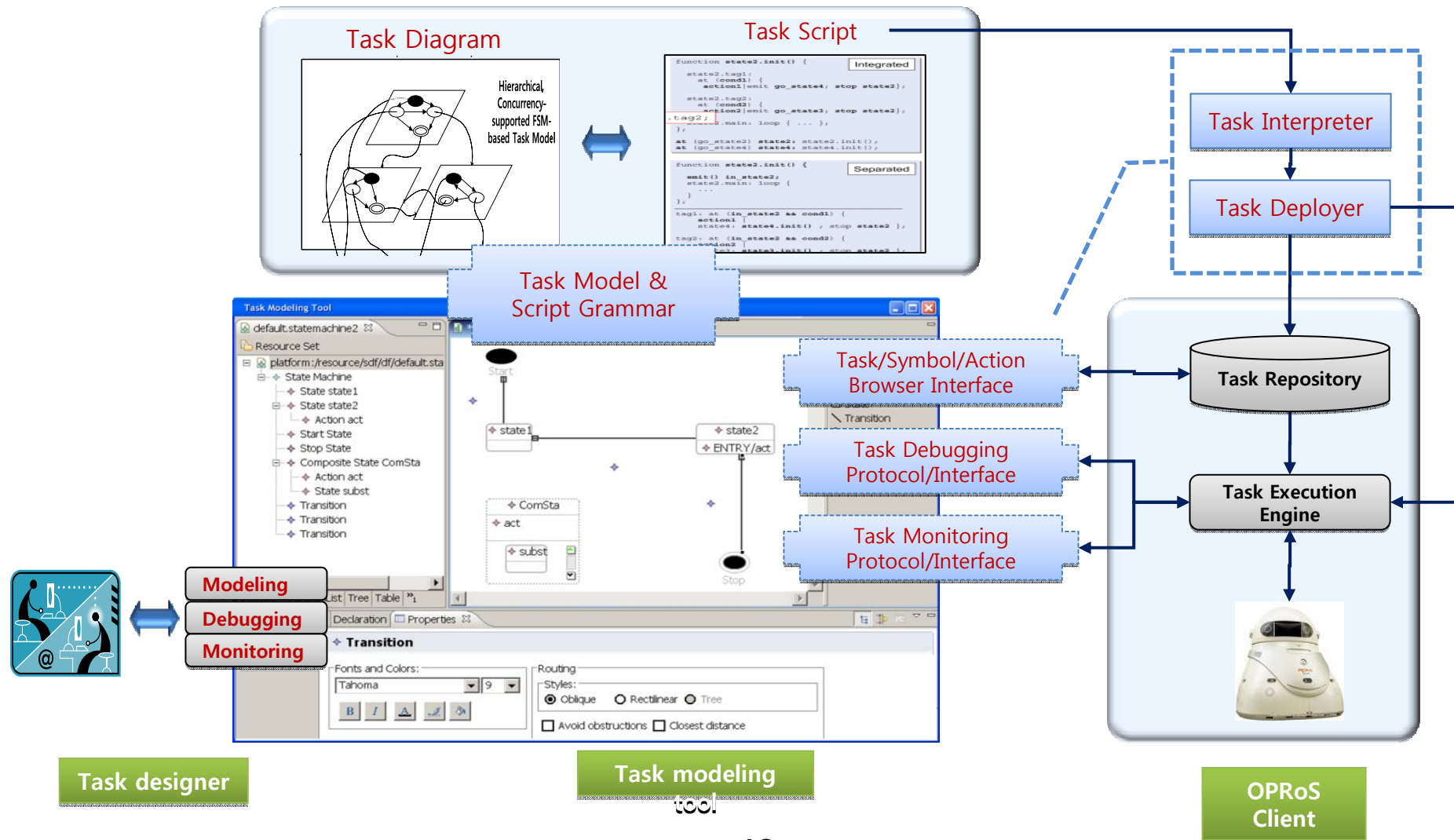


Umm... We need
framework to support
components



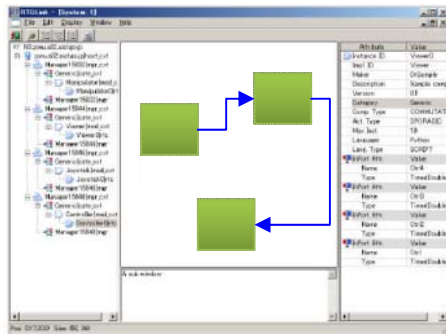
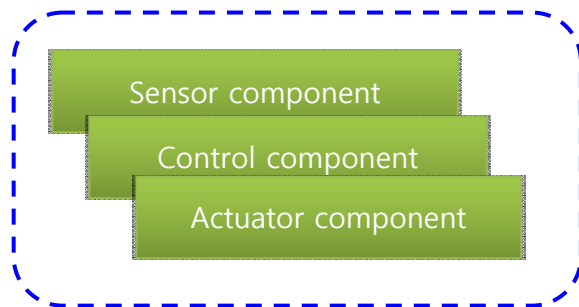
IV. Integrated Development Environment

Contents development environment for script language



IV. Integrated Development Environment

Component composition : generate a link script file from IDE



```
<xsd:complexType name="components">
<xsd:sequence>
  <xsd:element name="InstanceName" type="xsd:string"/>
  <xsd:element name="uuid" type="xsd:anyURI"/>
  <xsd:element name="Ports" type="PortType"/>
  <xsd:element name="StateOf" type="ModeState"/>
<xsd:element name="Connect" type="ComponentProfile"/>
</xsd:sequence>
</xsd:complexType>
```

Name of Component
Unique code of component
Port of Component
State of Component
Information on Component

```
<xsd:complexType name="ComponentProfile">
<xsd:sequence>
  <xsd:element name="Cname" type="xsd:string"/>
  <xsd:element name="connectorID" type="xsd:string"/>
  <xsd:element name="Version" type="xsd:string"/>
  <xsd:element name="Vendor" type="xsd:anyURI"/>
  <xsd:element name="Category" type="xsd:string"/>
</xsd:sequence>
</xsd:complexType>
```

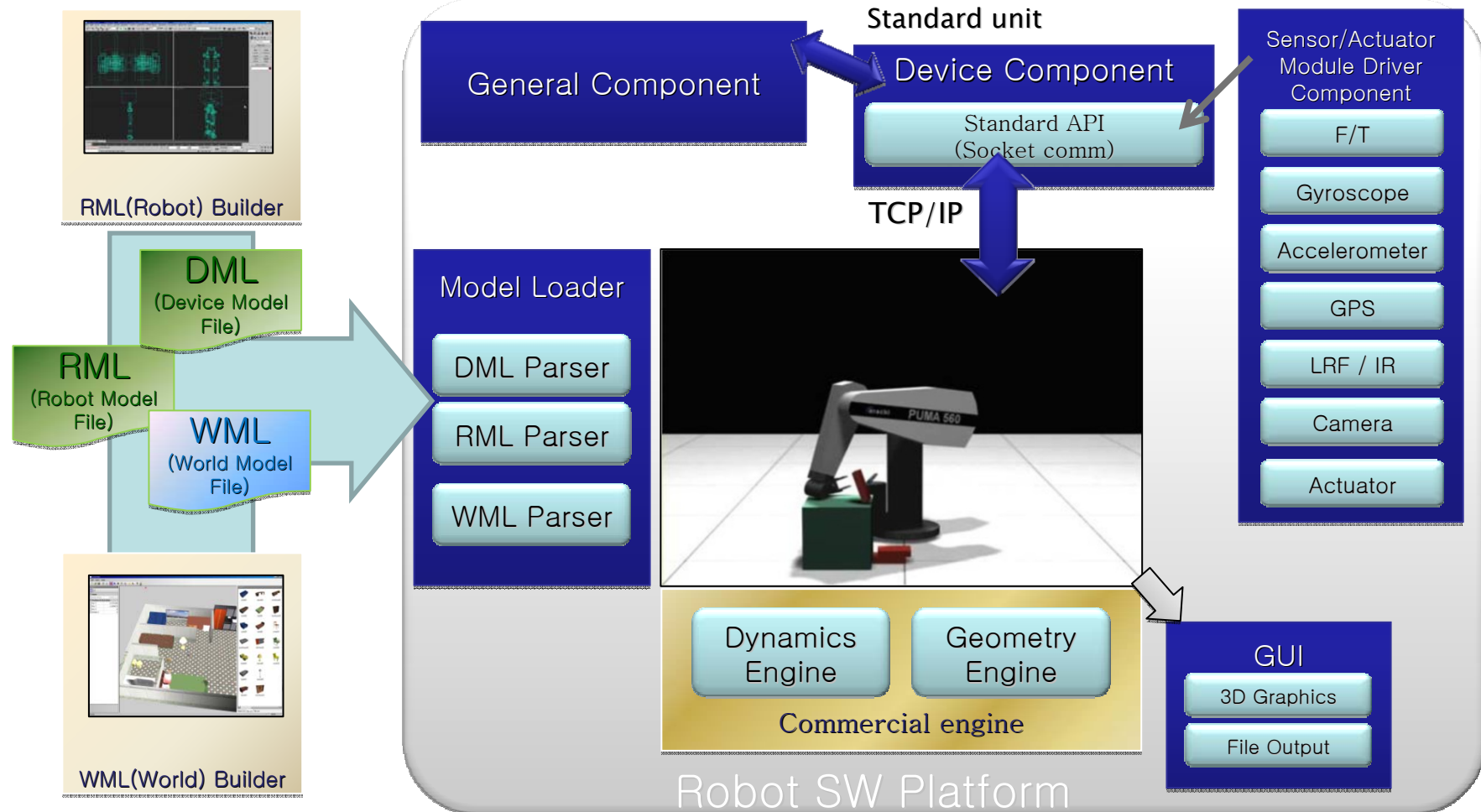
sourceLinkers/targetLinkers
Unique ID of connector
Version of component
Vendor of component
Category of component

```
<xsd:simpleType name="PortType">
<xsd:sequence>
  <xsd:element name="sourceLinkers" type="xsd:IDREF"/>
  <xsd:element name="targetLinkers" type="xsd:IDREF"/>
  <xsd:element name="PortDirection" type="Portflow"/>
</xsd:sequence>
</xsd:complexType>
```

Information on
Output, Inport,
in/out

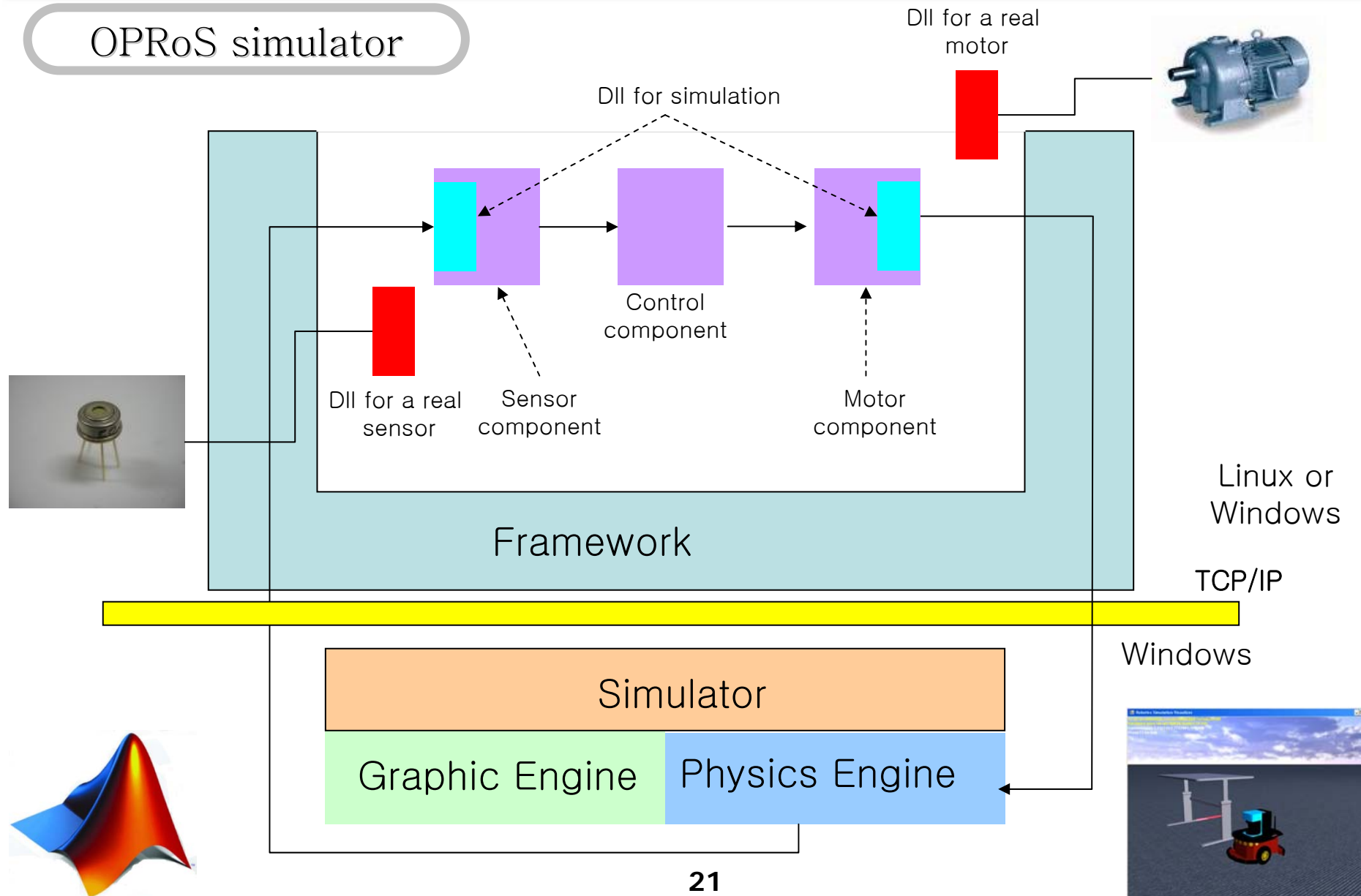
IV. Integrated Development Environment

OPRoS simulator



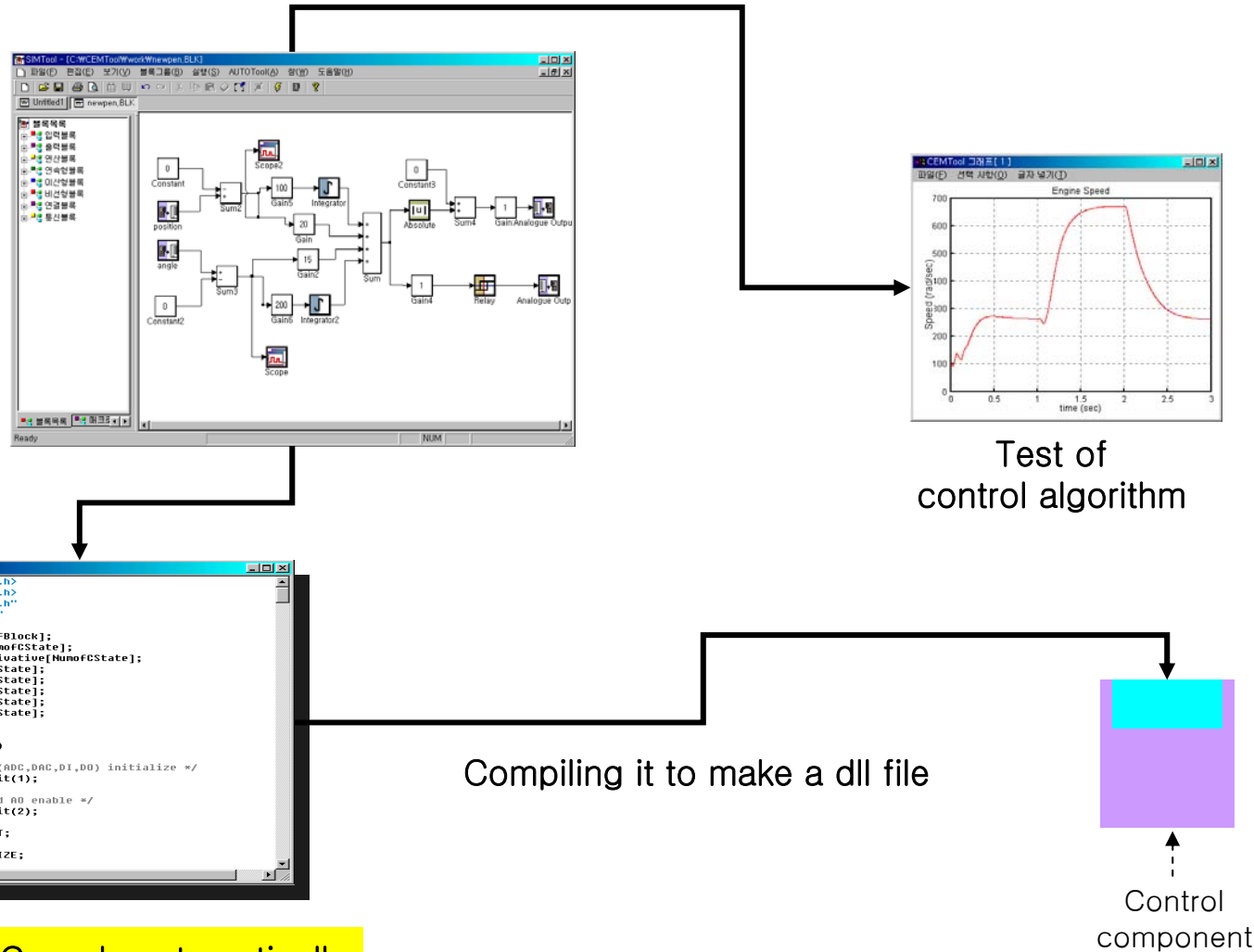
IV. Integrated Development Environment

OPRoS simulator



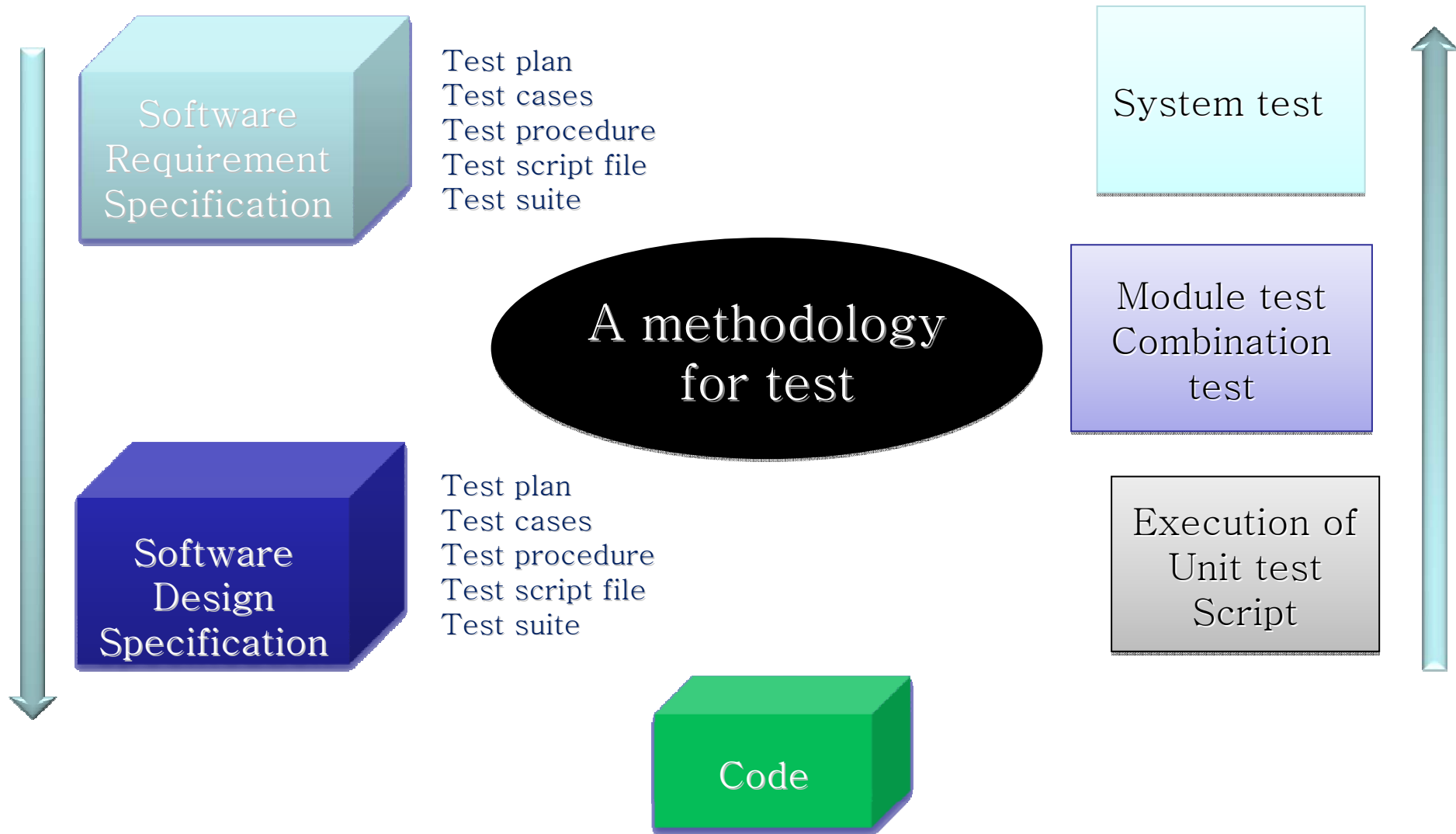
IV. Integrated Development Environment

OPRoS simulator : control design



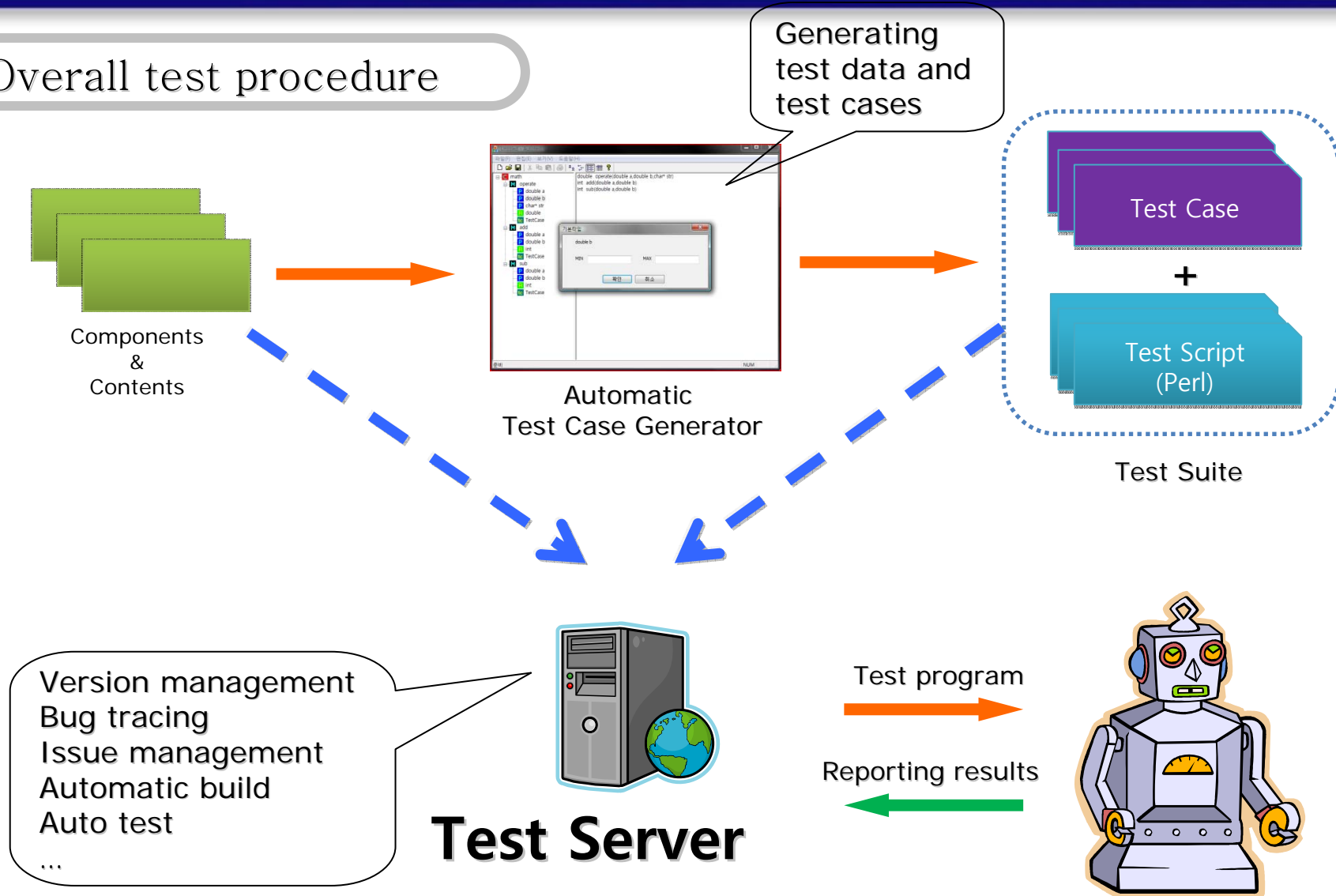
Generating C-code automatically

V. Testing



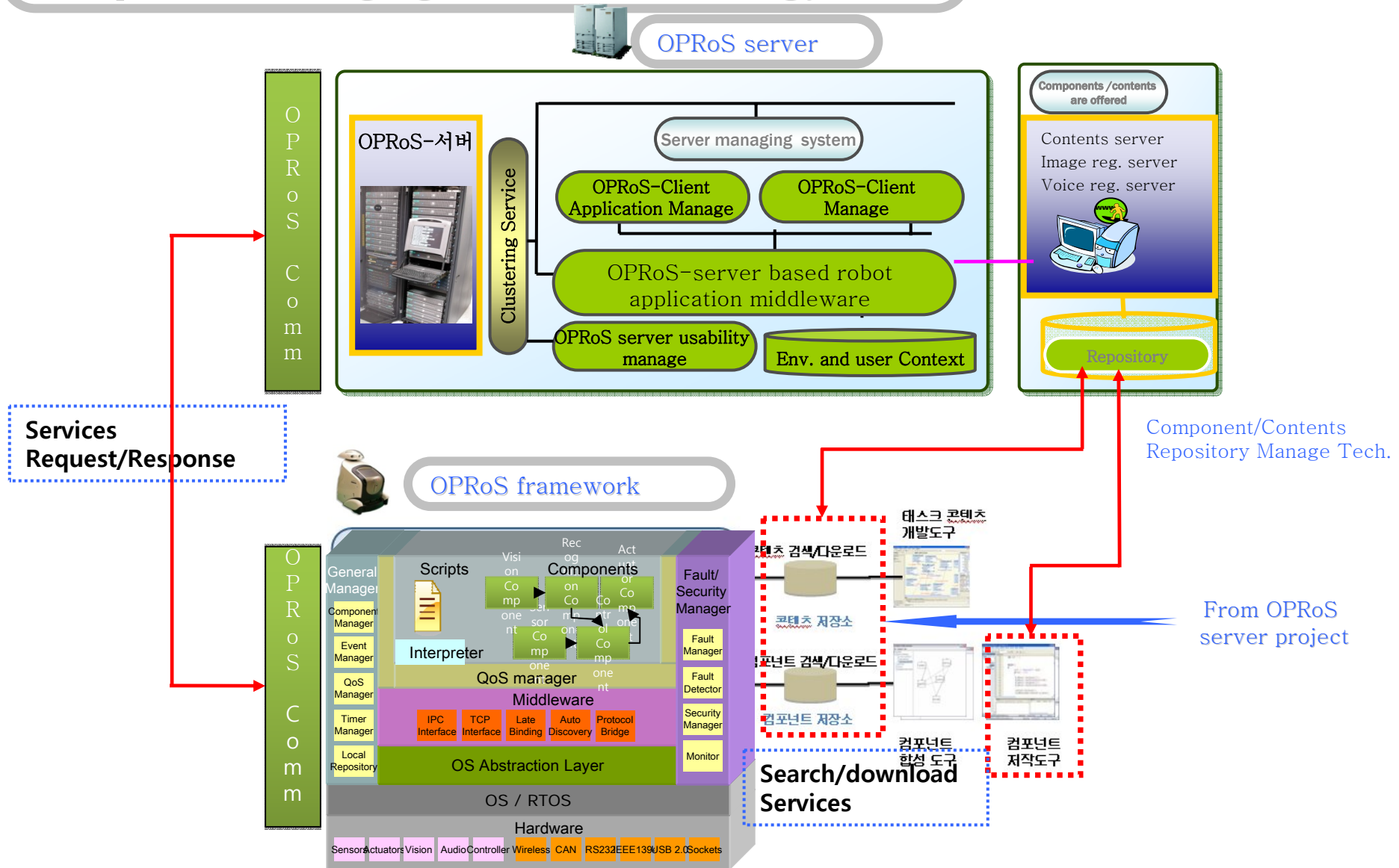
V. Testing

Overall test procedure




VI. Server

Component managing (server) technology



VII. Summary

- The Project consists of 5 parts to support users from developers to general users and activate the robot market including SW:
 - Component Technology,
 - Framework Technology
 - IDE and Simulation Technology
 - Test and Evaluation Technology
 - Server Technology
- In the Project
 - Source code will be open on about Aug. 2009
 - license will be free as possible
but license policy has not been decided on.



Thank you for
listening attentively