Robotics Domain Task Force Final Agenda ver.1.0.3 robotics/2011-12-01

OMG Technical Meeting - Santa Clara, CA, USA -- December 12-16, 2011

http://robotics.omg.org/

		TF/SIG Host	Joint (Invited	Agenda Item	Purpose	Room
Sunday: WG activites(pm)						
13:00	17:00			Robotics DDC4RTC submitters meeting	Arrangement	Napa1, Lobby Lvl
Monday: WG activity and Robotics-DTF Plenary(am)						
9:00	12:00			**DDC4RTC** (Robotic Infrastructure) WG(3h) - Noriaki Ando (AIST) and Seung-Woog Jung (ETRI)	discussion	Exec Suite 1118
				RoIS (Robotic Functional Services) WG(3h): - Su-Young Chi, Hyunsoo Kim and Toshio Hori	discussion	Exec Suite 1132
12:00	13:00			**LUNCH**		Magnolia, Lobby Lvl
13:00	18:00			Architecture Board Plenary		Winchester, 2nd FL
13:00	18:00			**DDC4RTC** (Robotic Infrastructure) WG(5h) - Noriaki Ando (AIST) and Seung-Woog Jung (ETRI)	discussion	Exec Suite 1118
				RoIS (Robotic Functional Services) WG(5h): - Su-Young Chi (ETRI), Miki Sato (JARA/ATR) and Toshio Hori (AIST)	discussion	Exec Suite 1132
Tuesday: WG activity(am) and Robotics-DTF Plenary(pm)						
9:00	11:00			**DDC4RTC** (Robotic Infrastructure) WG(2h) - Noriaki Ando (AIST) and Seung-Woog Jung (ETRI)	discussion	Exec Suite 1118
				RoIS (Robotic Functional Services) WG(2h): - Su-Young Chi (ETRI), Miki Sato (JARA/ATR) and Toshio Hori (AIST)	discussion	Exec Suite 1132
11:00	12:00	Robotics		**Special Talk: the legal aspects of autonomous cars** - Bryant Walker Smith (Stanford Univ.)	Robotics plenary closing	Bayshore East, 2nd FL
12:00	13:00			**LUNCH**		Magnolia, Lobby Lvl
13:00	13:45	Robotics		**Special Talk: Proteus Robotics Ontology** - Laurent Rioux (THARES)	presentation and discussion	Bayshore East, 2nd FL
13:45	**14:30**	Robotics		**Domestic Standardization Activity for Standardizing Voice Interface for Service Robots in Japan** - Yosuke Matsusaka	presentation and discussion	
				Break (30min)		
15:00	15:40	Robotics		WG Reports and Discussion (Service WG, Infrastructure WG, Models in Robotics WG)	presentation and discussion	
15:40	16:00	Robotics		Contact Reports: - Makoto Mizukawa(Shibaura-IT), and Young-Jo Cho(ETRI)	Information Exchange	
16:00	16:30	Robotics		Robotics-DTF Plenary Wrap-up Session (**DTF Co-Chair Election**, Roadmap and Next meeting Agenda)	Robotics plenary closing	
16:30				Adjourn joint plenary meeting		
16:30	17:00			Robotics WG Co-chairs Planning Session (Preliminary Agenda for next TM, Draft report for Friday)	planning for next meeting	
Wednesday: WG activitiy						
9:00	12:00			**DDC4RTC** (Robotic Infrastructure) WG(3h) - Noriaki Ando and Seung-Woog Jung	discussion	Exec Suite 1118
				RoIS (Robotic Functional Services) WG(3h): - Su-Young Chi, Miki Sato and Toshio Hori	discussion	Exec Suite 1132
12:00	14:00			**LUNCH and OMG Plenary**		Magnolia, Lobby Lvl
14:00	18:00			**DDC4RTC** (Robotic Infrastructure) WG(4h) - Noriaki Ando and Seung-Woog Jung	discussion	Exec Suite 1118
18:00	20:00			**OMG Reception**		Mezzanine, 2nd Lvl
Thursday: WG activitiy						
10:40	**11:00**	MARS		Joint Plenary with MARS (**Voting** to postpone the dead line of the reserved submission for DDC4RTC RFP)	Joint with **MARS**	Steavens Creek, 2nd FL
9:00	12:00			Robotics WG activity follow-up	discussion	Exec Suite 1132
12:00	13:00			**LUNCH**		Magnolia, Lobby Lvl
13:00	18:00			Architecture Board Plenary		Winchester, 2nd FL
13:00	18:00			Robotics WG activity follow-up	discussion	Exec Suite 1132
Friday						
8:30	12:00			AB, DTC, PTC		Magnolia, Lobby Lvl
12:00	13:00			**LUNCH**		Bayshore, 2nd FL
Other Meetings of Interest						
Monday						
8:00	8:45	OMG		New Attendee Orientation		Bayshore West, 2nd FL
9:00	12:00	OMG		Tutorial - Introduction to OMG Specifications		Bayshore West, 2nd FL
8:30	17:30	OMG		Cloud Standards Customer Council Meeting		Camino Real, 2nd FL
Tuesday						
7:30	9:00	OMG		Liaison ABSC		Napa 1, Lobby Lvl
17:00	18:00	OMG		RTF-FTF Chair's Workshop		Napa 3, Lobby Lvl
Wednesday						
9:00	17:00	Helthcare		Semantics and SOA Service Information Day		Winchester, 2nd Lvl
9:00	17:00	BMI		Value Delivery Information Day		Laurence, 2nd Lvl
9:00	17:00	SysA		System Assurance PTF		Napa 1, Lobby Lvl
Thursday						
9:00	12:00	OMG		Introduction to OMG's System Modeling Language (SysML) Tutorial		Camino Real, 2nd FL
9:00	17:00	SysA		System Assurance PTF		Napa 2, Lobby Lvl

Please get the up-to-date version from http://staff.aist.go.jp/t.kotoku/omg/RoboticsAgenda.pdf

Minutes of the Robotics DTF Meeting
June 20-24, 2011
Salt Lake City, UT, USA
(robotics/2011-12-02)

Meeting Highlights

- Revised submission of the Robotic Interaction Service (RoIS) Framework RFP was accepted and the Finalization Task Force (RoIS-FTF) was chartered.
- The final report of Robotic Localization Services (RLS-1.1) was accepted to issue.
- Three presentations;
  - "OPRoS: Open Platform for Robotic Services", Hong Seong Park, Kangwon National University [robotics/2011-06-09]
  - "Conformance Testing Method for Robotic Software Components", Mi-Sook Kim, Kangwon National University [robotics/2011-06-10]
  - "Robotics Technology Applied to Great East Japan Earthquake", Miwako DOi, Toshiba [robotics/2011-06-11]

List of Generated Documents

robotics/2011-06-01 Final Agenda (Tetsuo Kotoku)
robotics/2011-06-02 Washington DC Meeting Minutes [approved] (Geoffrey Biggs and Seung-woog Jung)
robotics/2011-06-03 Draft: Revised submission ver.2 to the RoIS Framework RFP (Miki Sato)
robotics/2011-06-04 Draft: Revised submission ver.2 to the RoIS Framework RFP with Change bar (Miki Sato)
robotics/2011-06-05 Draft: Errata for ver.2 from 4weeks before original version (robotics/2011-05-01) (Miki Sato)
robotics/2011-06-06 Presentation: Revised Submission to Robotic Interaction Service (RoIS) Framework (Toshio Hori, Miki Sato, and Su-Young Chi)
robotics/2011-06-07 Event Management Model for DDC4RTC (Seung-Woog Jung)
robotics/2011-06-08 Repository & Directory Managers for DDC4RTC (Seung-Woog Jung)
robotics/2011-06-09 OPRoS: Open Platform for Robotic Services (Hong Seong Park)
robotics/2011-06-10 Conformance Testing Method for Robotic Software Components (Mi-sook Kim)
robotics/2011-06-11 Robotics Technology Applied to Great East Japan Earthquake (Miwako Doi)
robotics/2011-06-12 Infrastructure WG Progress Report (Noriaki Ando)
robotics/2011-06-13 Robotic Functional Services WG Report (Toshio Hori)
robotics/2011-06-14 Contact Report: Standardization of RTC-CANopen (Makoto Mizukawa)
robotics/2011-06-15 Contac Report: ISO/TC184/SC2/WG1 (Tetsuo Kotoku)
robotics/2011-06-16 Charter RoIS-FTF (Miki Sata)
robotics/2011-06-17 Contact Report: IEEE SA (Standardization Activities)
robotics/2011-06-18 Opening Presentation (Tetsuo Kotoku)
robotics/2011-06-19 Roadmap for Robotics Activities (Tetsuo Kotoku)
robotics/2011-06-20 Wrap-up Presentation (Tetsuo Kotoku)
robotics/2011-06-21 Kissimmee Meeting Preliminary Agenda - DRAFT (Tetsuo Kotoku)
robotics/2011-06-22 Santa Clara Meeting Preliminary Agenda - DRAFT (Tetsuo Kotoku)
robotics/2011-06-23 DTC Report Presentation (Su-Young Chi)
robotics/2011-06-24 Salt Lake City Meeting Minutes - DRAFT (Miki Sato and Seung-woog Jung)
robotics/2011-06-25 OPRoS Catalog (Hong Seong Park)

Minutes

Monday, June 20, 2011, Sun Valley, 2nd FL
Robotics DTF Plenary Meeting
AIST, ATR, ETRI, JARA, KAR, KNU, Sibaura-IT, Toshiba, UEC, Univ. of Tokyo, Univ. of Tsukuba

10:55-11:00 Robotics DTF Opening Session, Chair: Dr. Kotoku (AIST)
- Minutes takers: Miki Sato (ATR) and Seung-Woog Jung (ETRI)

11:00-12:00 Revised Submission Presentation for RoIS Framework RFP, Sun Valley, 2nd FL
- Presented by Dr. Hori, AIST, Japan.
- Review of the revised RoIS framework and discussion.
- Vote to Vote for the RoIS Framework revised submission [robotics/11-06-03].
  Approved: Shibaura IT(motion), AIST(second), ETRI(white ballot)
- Vote for the RoIS Framework revised submission [robotics/11-06-03].
  Approved: JARA(motion), ETRI(second), Shibaura IT(white ballot)
- AB review schedule
  RLS: Mon. 13:40-14:00 at Arizona, Main Level.
  RoIS Framework: Mon. 16:20-16:40 at Arizona, Main Level.

Tuesday, June 21, 2011, Sun Valley, 2nd FL
Robotics DTF Plenary Meeting
AIST, ATR, ETRI, JARA, KAR, KNU, Sibaura-IT, Toshiba, UEC, Univ. of Tokyo, Univ. of Tsukuba

13:00-14:00 Special Talk: Prof. Hong Seong Park (Kangwon National Univ.)
- Design Tools for Robot Software: OPRoS (Open Platform for Robotic Service)
- Introduction of OPRoS framework, its functions and tools.
- Several demonstrations using OPRoS.

14:00-14:30 Special Talk: Prof. Mi-Sook Kim (Kangwon National Univ.)
- Testing Methods for Robot Software Component
- Introduction of OpRoS Test System.
- Introduction of 3 types of SW component testing, methods, states and ports.

15:00-15:30 Special Talk: Dr. Miwako Doi (Toshiba)
- Robotics Technology Applied to Tohoku Earthquake and Tsunami
- Introduction of robots working at the nuclear plant in Fukushima.
- Introduction of Toshiba crawler robots with a Gamma Camera.

15:30-15:35 Wrap-up Session, Chair: Dr. Kotoku (AIST)
Quorums: 3
AIST, ETRI, JARA, KAR, Shibaura-IT, UEC, Univ. of Tsukuba
- Washington meeting minute review
  Approved: AIST(motion), Univ. of Tsukuba(second), Shibaura-IT(white ballot)

15:35-15:45 WG report: Infrastructure WG, Dr. Ando
- Reviewing and merging homeworks of each others..
- Merging two initial submissions: Component Data Model, Event Management, Reposity Manager, Directory Manager, Application Supervisor.
- Review and discussion about PIM and UML diagrams.

15:45-15:55 WG report: Functional Service WG, Dr. Hori (AIST)
- Presentation and voting for the revised submission to the RoIS.
- Presentation at the AB and passed with condition.
- Drafting a charter of RoIS FTF.

15:55-16:10 Contact Report, Prof. Makoto Mizukawa (Shibaura IT)
- Introduction of RTC-CANopen standardization in CiA.

16:10-16:25, Demonstration of Prototype of RoIS Framework, Dr. Sato (JARA/ATR)
- Demonstrate the prototype of RoIS Framework libraries.

16:25-16:35 Contact Report, Dr. Kotoku (AIST)
- Introduction of ISO/CD9787 Coordinate system and motion
- Introduction of ISO/DIS8373 Vocabulary

16:35-16:45 Contact Report, Dr. Miwako Doi (Toshiba)
- IEEE standardization meeting at ICRA2011

16:45-17:00 Wrap-up Session, Chair: Dr. Kotoku (AIST)
- Call for volunteer Co-Chair of Robotics-DTF: No volunteers, postponed one meeting.
- Roadmap for Robotics Activities
  RTC-RTF Report deadline postponed to Santa Clara meeting, Dec. 2011
- Schedule for next meeting: skip the next Kissimmee OMG meeting.

ATTENDEE (17 Participants)
- Andrew Watson (OMG)
- Noriaki Ando (AIST)
- Geoffrey Biggs (AIST)
- Su-Young Chi (ETRI)
- Miwako Doi (Toshiba/Univ of Tokyo)
- Toshio Hori (AIST)
- Chul-Jong Hwang (KAR)
- Seung-Woog Jung (ETRI)
- Koji Kamei (JARA/ATR)
- Mi-Sook Kim (Kangwan National Univ.)
- Tetsuo Kotoku (AIST)
- Makoto Mizukawa (Shibaura IT)
- Yoshihiro Nakabo (AIST)
- Hong-Seong Park (Kangwan National Univ.)
- Miki Sato (JARA/ATR)
- Seiichi Shin (UEC)
- Takashi Tsubouchi (Univ. of Tsukuba)

Prepared and submitted by Seung-Woog Jung (ETRI) and Miki Sato (JARA/ATR).

Robotics-DTF Plenary Meeting
Opening Session

December 13, 2011

Santa Clara, CA, USA

Hyatt Regency Santa Clara

Approval of Minutes

Meeting Quorum : 4

AIST, ETRI, JARA, UEC, Univ. of Tokyo, Univ. of Tsukuba,

Minutes taker(s):

- **Koji Kamei**
- **Seung-Woog Jung**

Minutes review

Salt Lake City Meeting Summary

Revised Submission to Robotic Interaction Service (RoIS) Framework [robotics/2011-05-01,02,03,04,05]

Robotics Plenary: (17 participants)

–3 Talks

- "OPRoS: Open Platform for Robotic Services", Hong Seong Park, Kangwon National University [robotics/2011-06-09]
- "Conformance Testing Method for Robotic Software Components", Mi-Sook Kim, Kangwon National University [robotics/2011-06-10]
- "Robotics Technology Applied to Great East Japan Earthquake", Miwako DOi, Toshiba [robotics/2011-06-11]

–2 WG Reports

- Robotic Infrastructure WG [robotics/2011-06-12]
- Robotic Functional Services WG [robotics/2011-06-13]

Kissimmee Meeting Summary

No Plenary Meeting:

Robotic Functional Services WG :

(4 participants)

-

Platform for RObotic modeling and Transformations for End-Users and Scientific communities

An ontology for experimental validation of solutions to robotic problems

N. du Lac[1], J.L. Farges[2], M. Hemaissia-Jeannin[3], J. Lahera-Perez[4], S. Millet[5], B. Patin[5], L. Rioux[3] (speaker), S. Stinckwich[6]

[1]INTEMPORA, [2]ONERA, [3]TRT, [4]INRIA, [5]DASSAULT-AVIATION, [6]GREYC

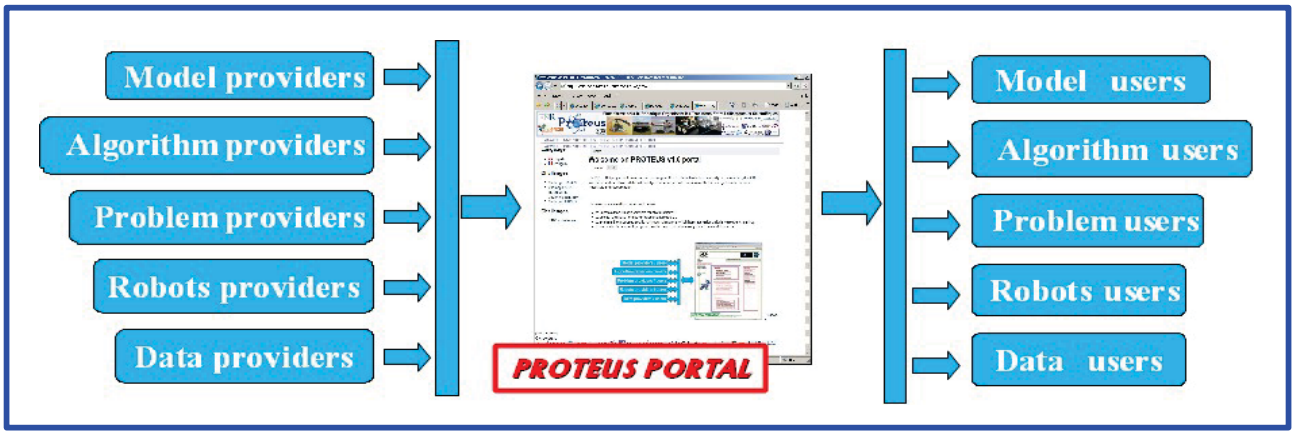
OMG technical meeting, Santa Clara
December 12-16 2011

Outline

Intellectual Property Rights are governed by PROTEUS Contract and PROTEUS consortium agreements. Before using, reproducing, modifying or disclosing the information contained in that document, it is under the user responsibility to check its rights and if mandatory ask to the Intellectual Property Owner the authorisation to use, reproduce, modify or disclose the information.

Introduction

PROTEUS is a Platform for organizing exchanges between industry and academics in the robotic domain



Use of a common language
Development of a theory grounding the vocabulary

Specification of the theory with an ontology*

**** Ontology : formal representation of knowledge describing a domain***

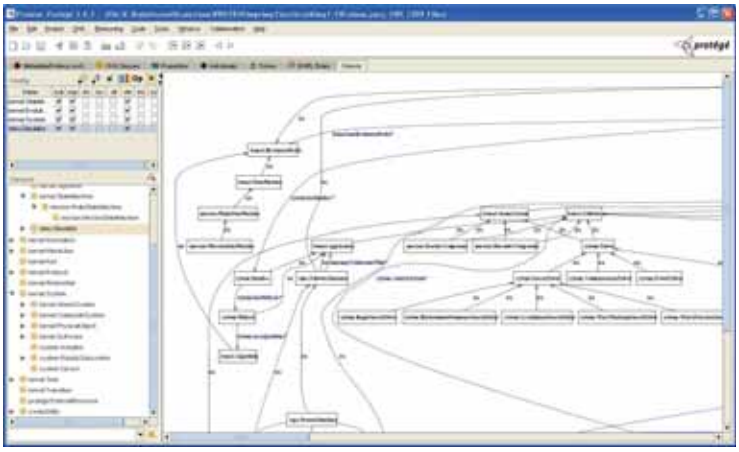
State of the art* of ontologies for the robotic domain

Gives Ontology	← *(Objective*	*and Scope)*
MLCOF	To help object recognition by robot	Robot context
OMRKF	To organize robot knowledge	Robot context
OCOA	To develop a control architecture	Control architecture of a model with components
Deplanques	To assess decisional autonomy	Robotics and environment
Schlenoff and Messina	To support development, test and certification of robotic technologies	Urban search and rescue missions
RoSta	To standardize	Mobile, handling and service robotics
PROTEUS	***To support exchanges***	***Mobile Robotics***

**** not exhaustive, see for example***
http://lists.w3.org/Archives/Public/public-xg-ssn/2009Aug/att-0037/SSN-XG_StateOfArt.pdf&usg=AFQjCNGMxI0CHy4FJuxquXVneXfJF6k2tg

Methodology and PROTEUS ontologies structure

- Language used: Web Ontology Language (OWL), provides
  - Namespaces
  - Classes
  - Properties
  - Rules
- Tooling used: Protégé (mainly 3.4.4 version)



Offers consistency checking using Pellet

PROTEUS ontologies structure – core elements

These ontologies can be "found" in the "R1.1.4.3-S11.17-ProteusCoreOntology" software package provided

PROTEUS (proteus)
Link to PROTEUS core ontologies

EXPERIMENT (exp)
It describes the PROTEUS process
... Problem, Solution, Assessment, ...

ROBOT (robot)
It describes robots
... GroundVehicle, AirVehicle, Building, Floor, ...

SIMULATION (simu)
It describes how system can live inside software, hardware, etc
... Simulation, Probe, providesLifeTo, ...

MISSION (mission)
It describes a mission that can be used by the robot performing it or for performance assessment
... MissionObjective, MissionType, ...

SYSTEM (system)
what are the specific components of a robot
...
DeviceSystem, ActuatorSystem, SensorSystem, PowerSystem, ...

ENVIRONMENT (env)
It describes were the robots evolve and defines the interactions propagation
... Atmosphere, LandSurface, Building, Floor, ...

INFORMATION (information)
It describe the data pieces that will necessarily exist
... data, Abstraction, ...

KERNEL (kernel)
Main elements to describe a robotic scenario:
... PhysicalObject, Interaction, System, EvolutionModel, ...

Use of the platform expe:Problem

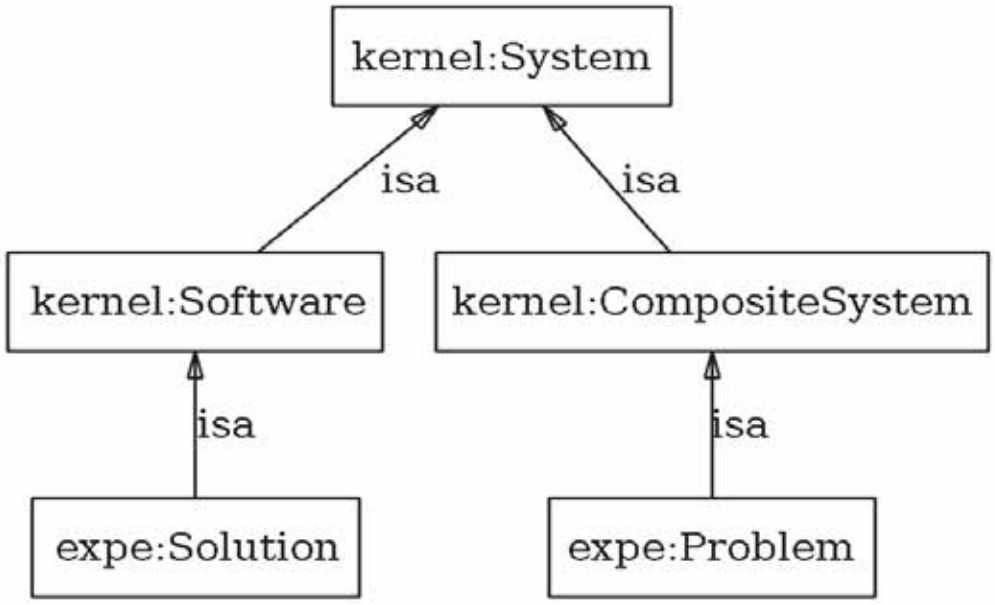
- Is a : kernel:CompositeSystem
- Own properties
  - expe:hasConfiguration expe:Configuration
  - expe:IsASubSetOf expe:Scenario
  - kernel:aggregates some kernel:Environement
  - kernel:aggregates some expe:Solution
  - kernel:aggregates some robot:Robot
- Inherited properties
  - kernel:aggregates kernel:System
  - expe:canBeDeployedIn expe:ProteusSimulator
  - expe:withDeployementBecomes simu:SimulatedSystem
  - kernel:hasEvolutionModel kernel:EvolutionModel
  - kernel:hasPort kernel:Port
  - kernel:hasState kernel:State
  - kernel:triggers kernel:Interaction

Use of the platform expe:Solution

- Is a : kernel:Software
- Own properties
  - expe:hasConfiguration expe:Configuration
  - expe:IsPartOf system:RoboticFunctionalSystem
- Inherited properties
  - kernel:triggers some system:ApplicationInteraction
  - kernel:triggers kernel:Interaction
  - expe:canBeDeployedIn expe:ProteusSimulator
  - expe:withDeployementBecomes simu:SimulatedSystem
  - kernel:hasEvolutionModel kernel:EvolutionModel
  - kernel:executesOn kernel:Hardware
  - kernel:hasPort kernel:Port
  - kernel:hasState kernel:State

Use of the platform

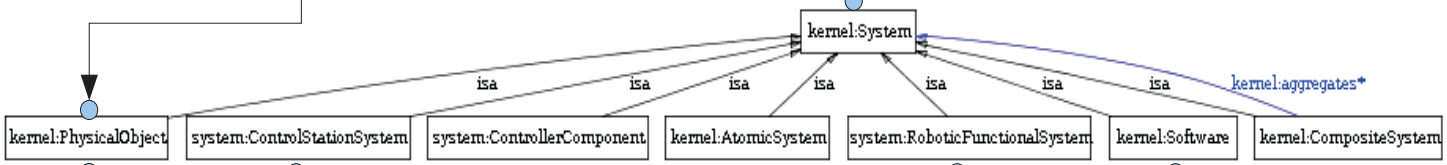
Indirectly expe:Problem and expe:Solution are kernel:System



Kernel classes kernel:System

env:hasSurface
information:has3DRepresentation
information:hasPhysicalCharacteristic
kernel:definesAReferential
kernel:evolvesIn
kernel:isPositionnedIn

expe:canBeDeployedIn
expe:withDeployementBecomes
kernel:hasEvolutionModel
kernel:hasPort
kernel:hasState
kernel:triggers



expe:isHostedBy
system:MapsOnto

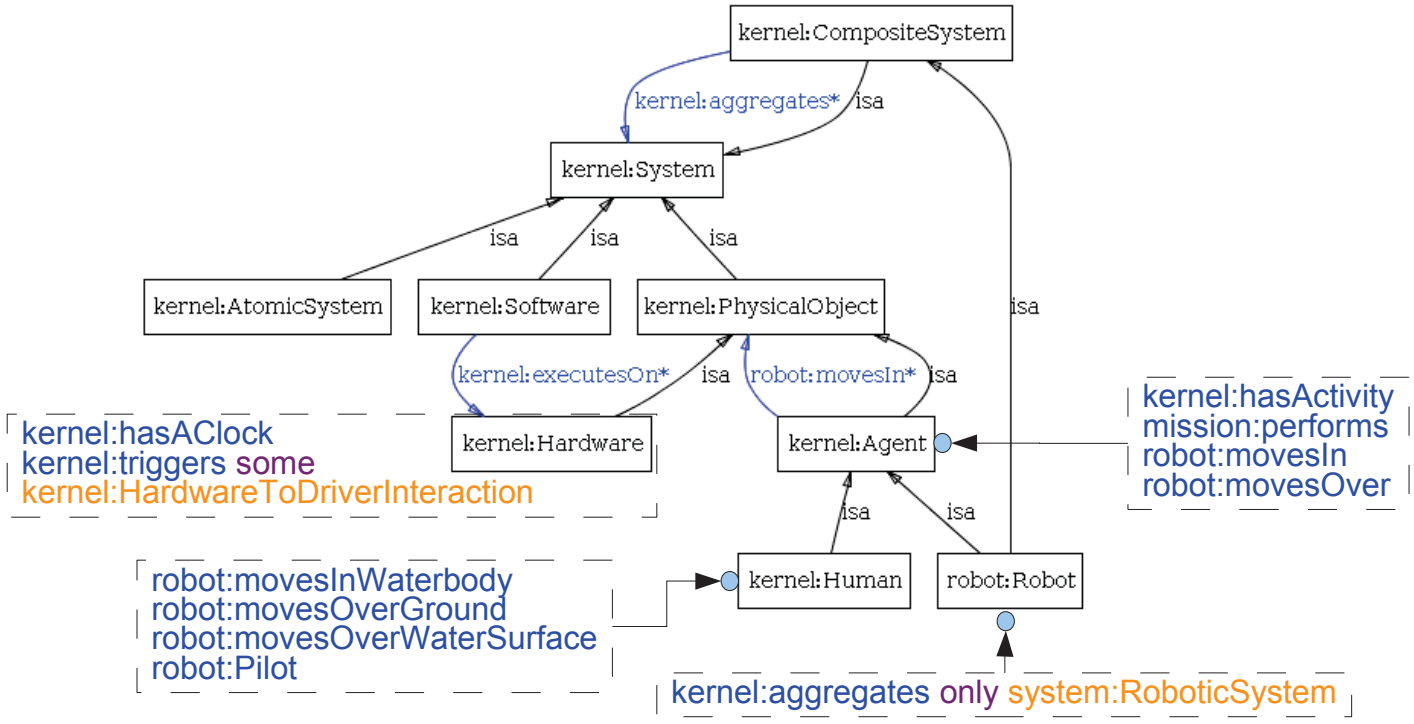
kernel:triggers some system:ControlAndCommand

kernel:executesOn
kernel:triggers some system:ApplicationInteraction

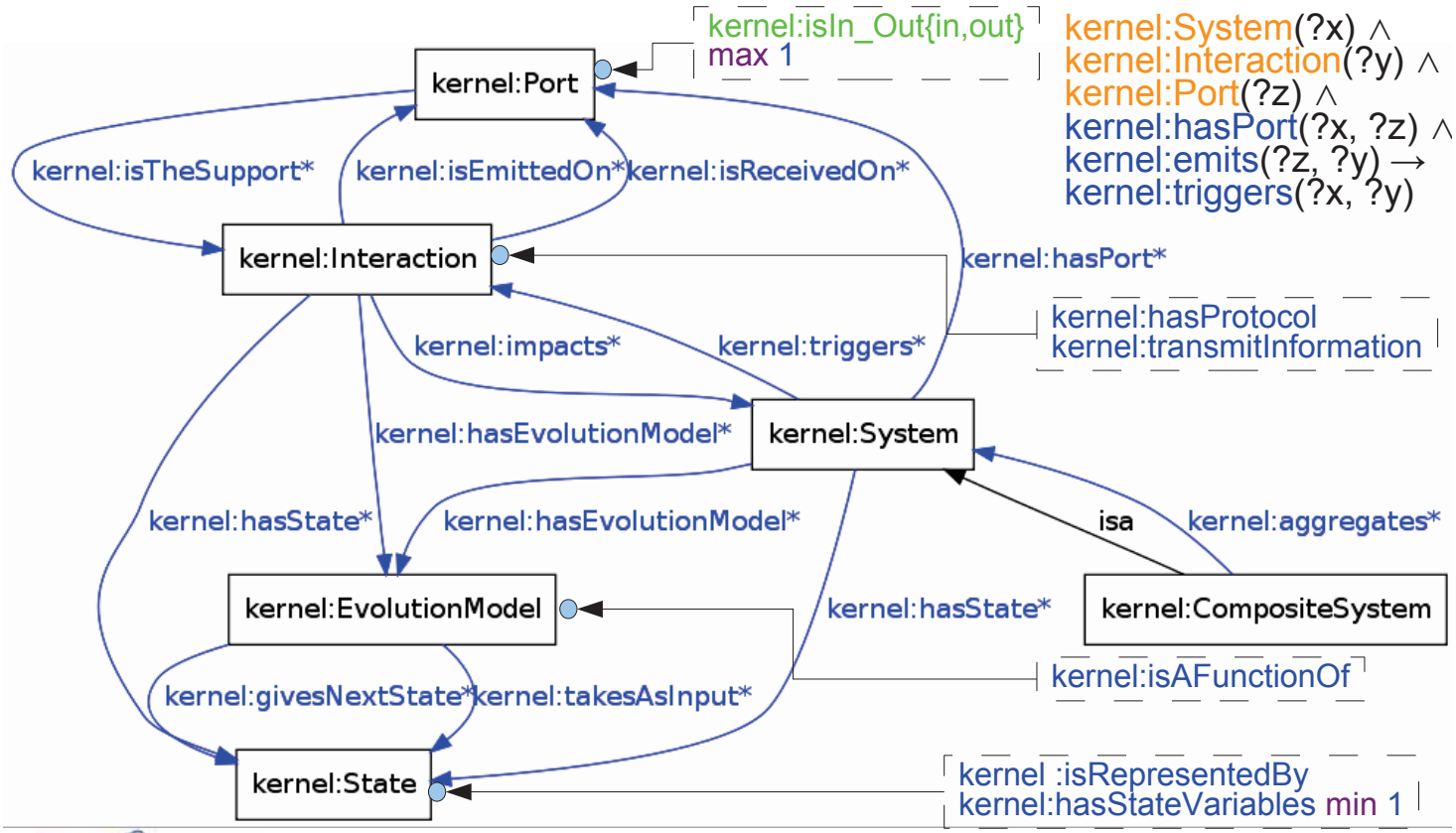
Disjoints

Kernel classes kernel:System

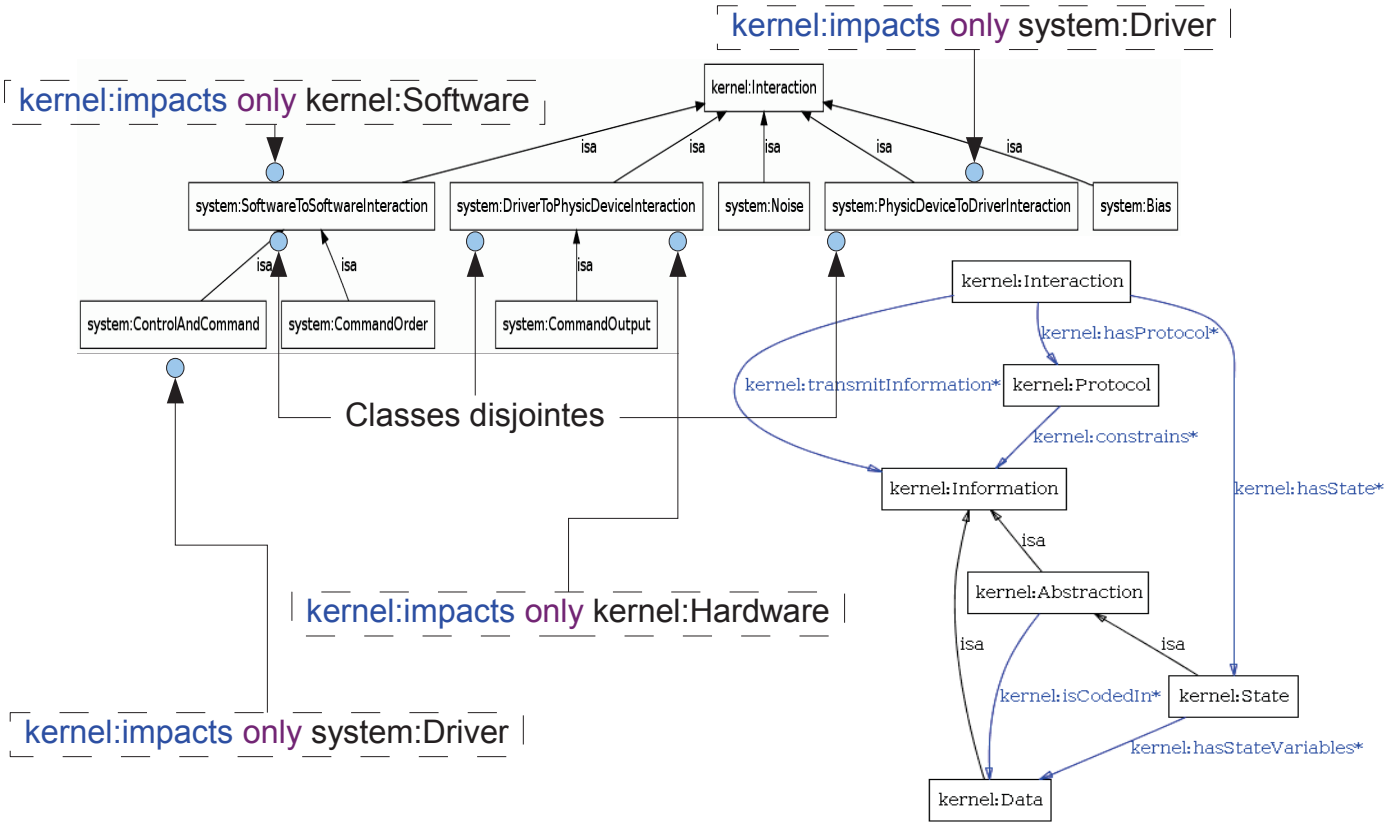
- Almost everything is system



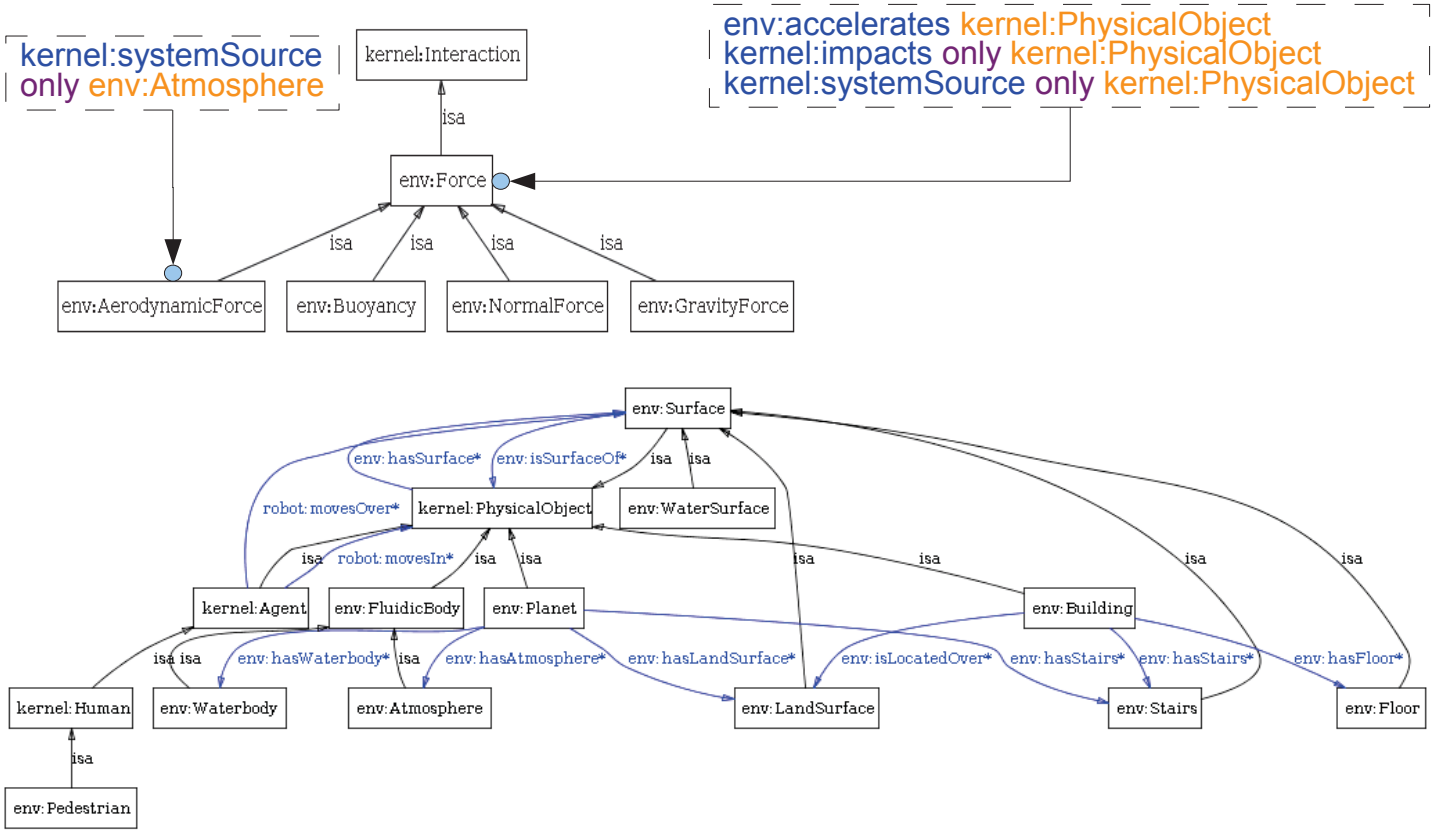
Kernel classes kernel and system



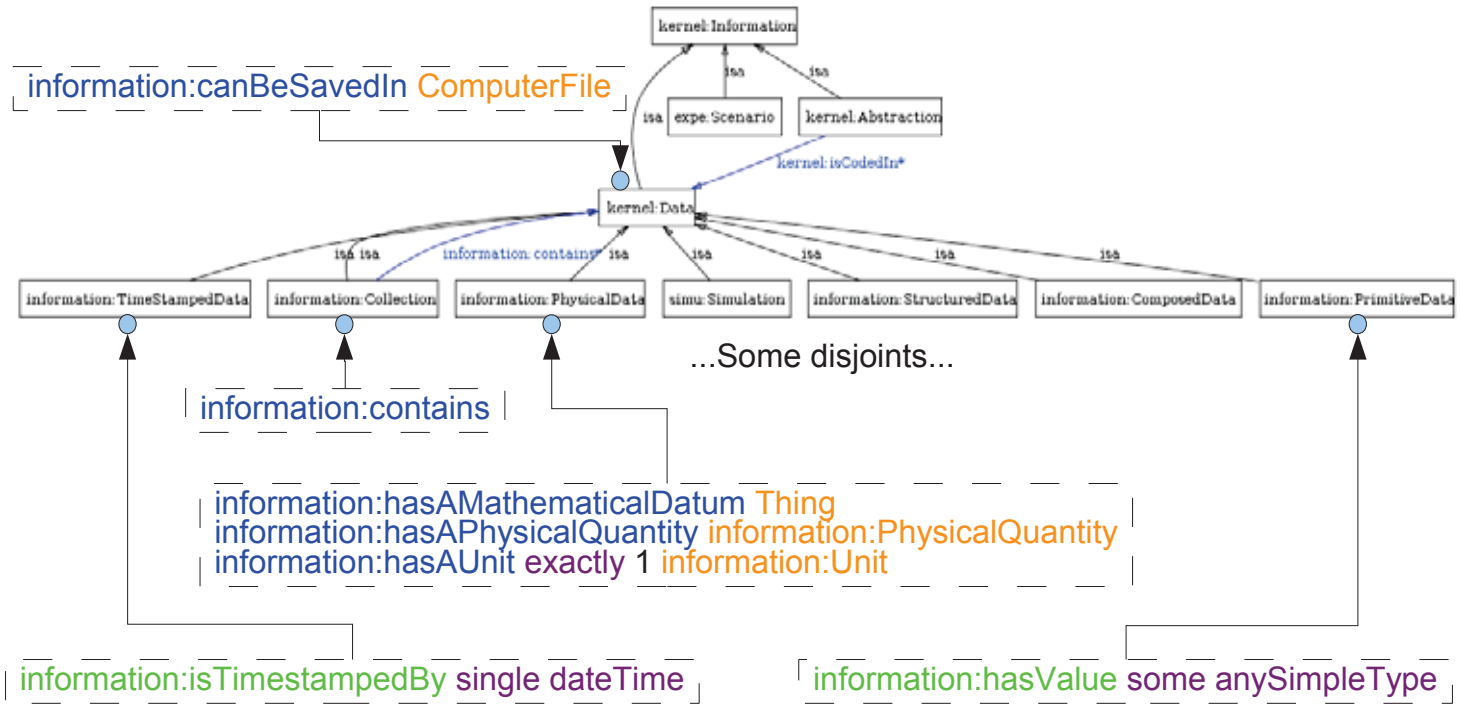
Kernel classes kernel:Interaction



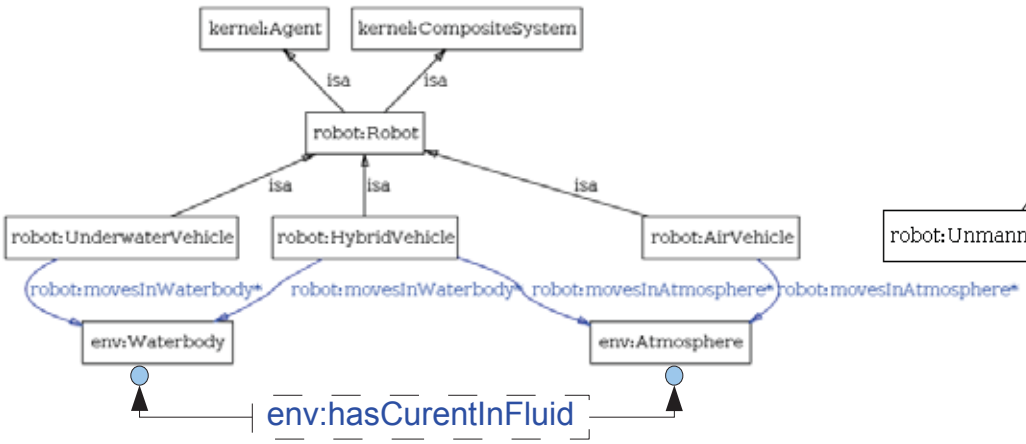
Environment

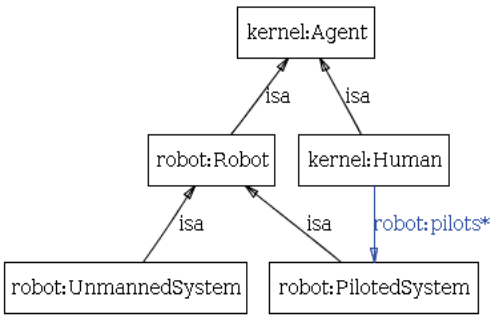


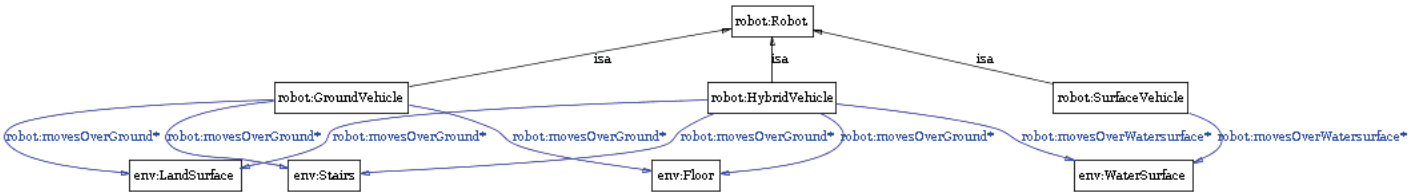
Information



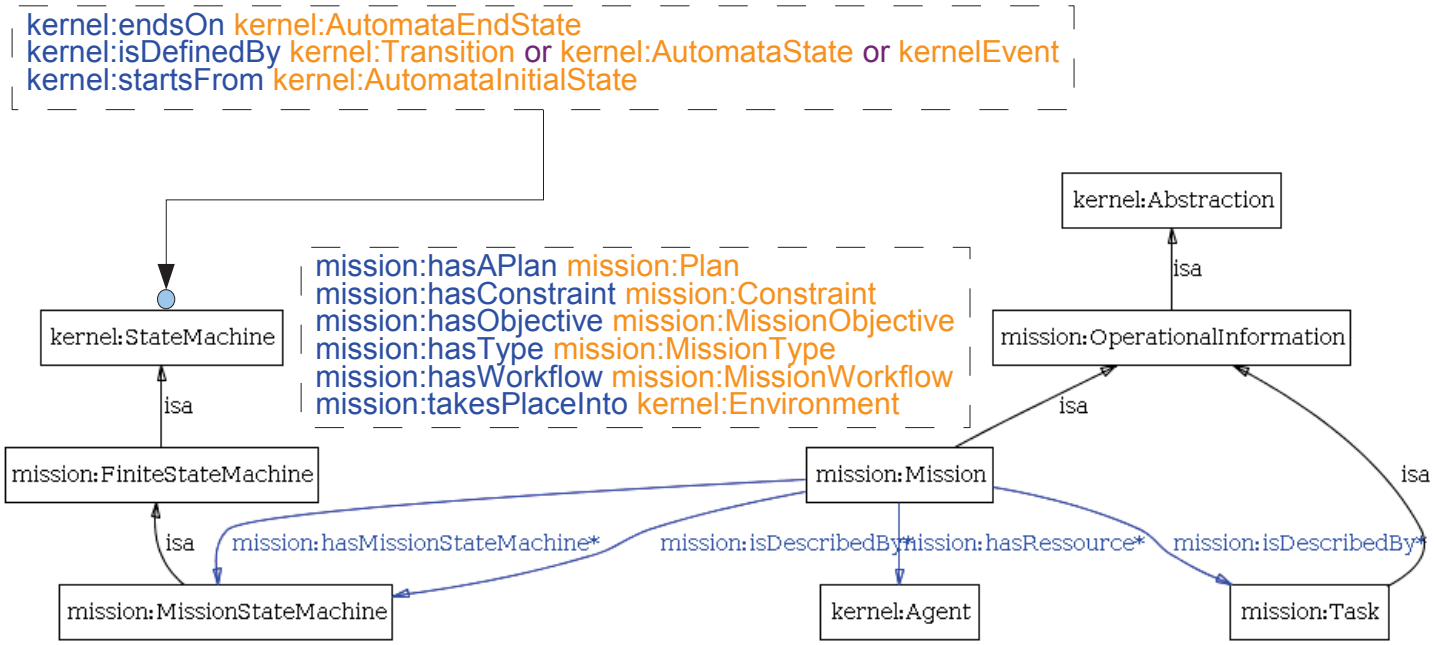
Robots and their components



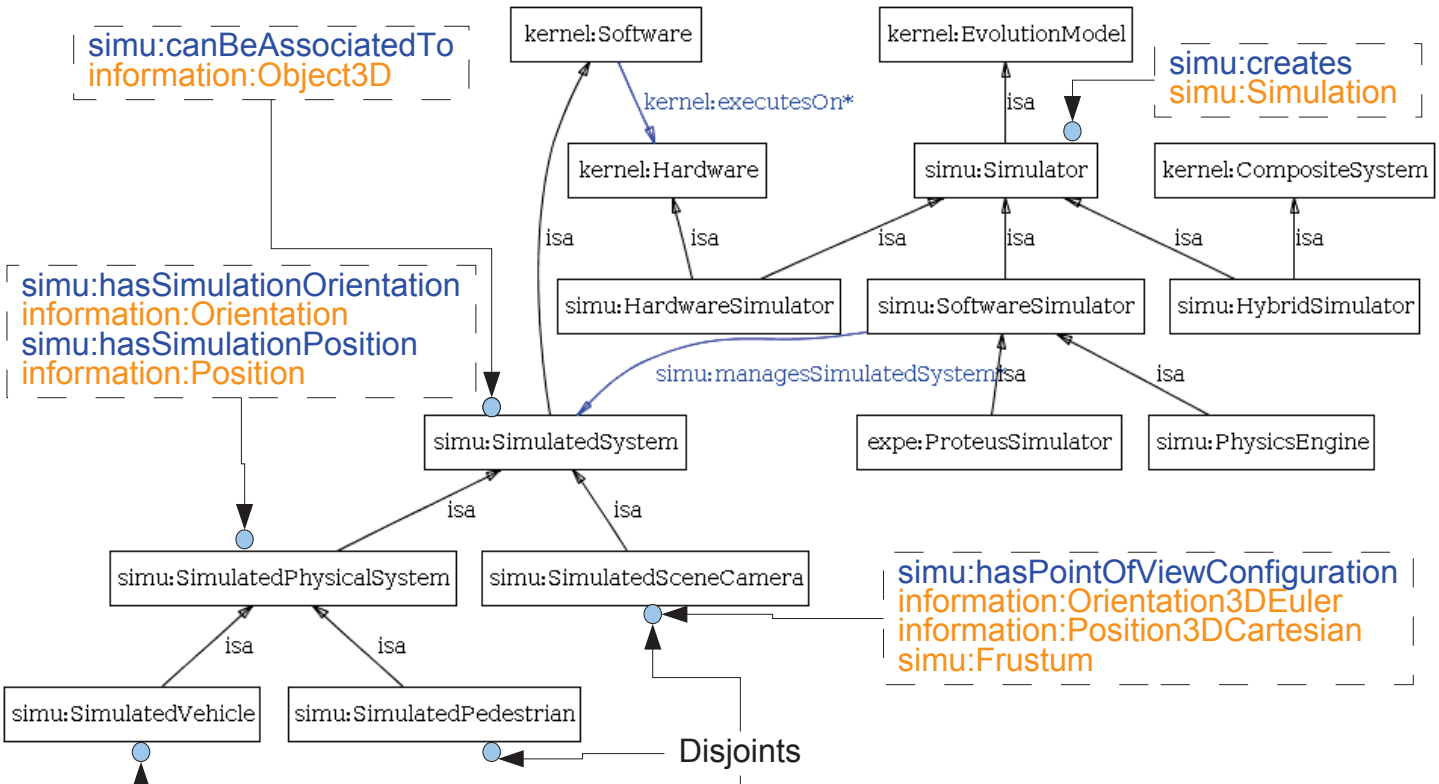




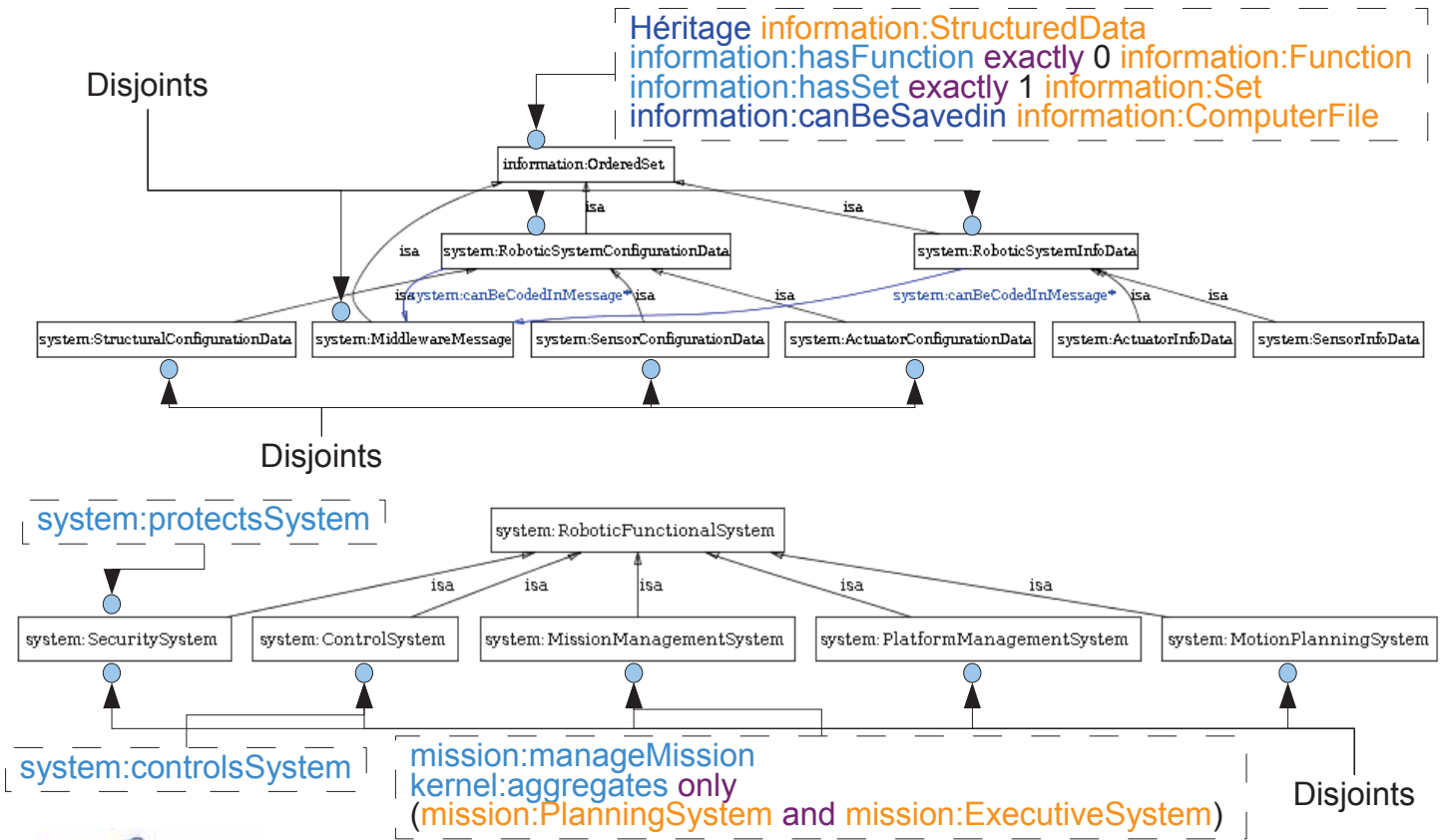
Missions



Simulation



Systems



Validation

- Consistency check using:
  - ”Pellet”
  - Protégé “OWL/Run ontology tests...”
- Description of scenarios associated to challenges for PROTEUS validation
  - Urban: robot taxi service
    - Not segregated mode
    - Challenge on Pavin site in Clermont-Ferrand (France)
  - Air-ground: area surveillance
    - Search and track of intruders
    - Challenge in Caylus (France) military camp
  - Landmark search
    - Problem based learning for teaching robotics
    - Challenge on DGA site in Bourges (France)

Validation – Urban scenario

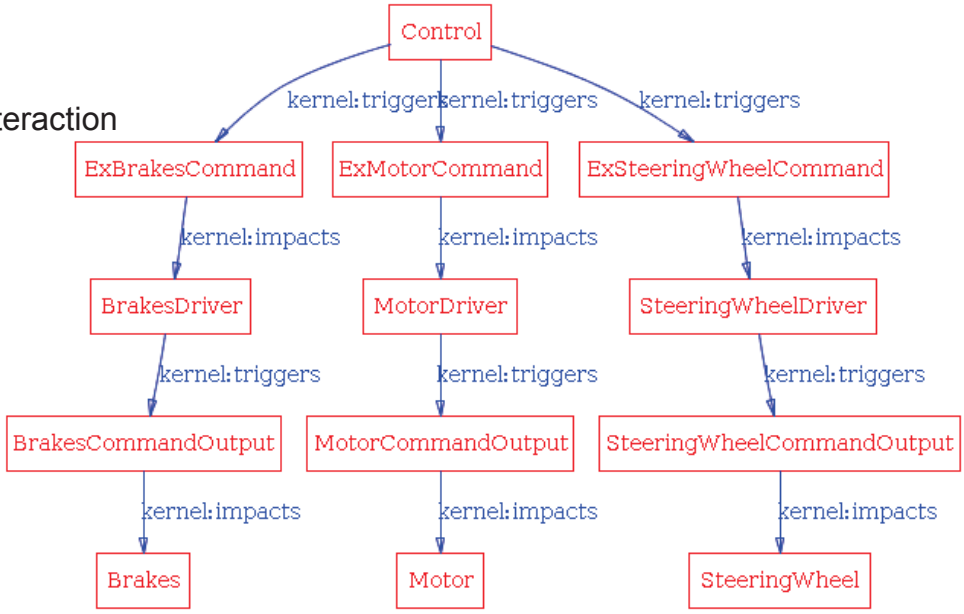
system:ControlSystem and kernel:Software

system:SoftwareToSoftwareInteraction

system:MotorizationDriver

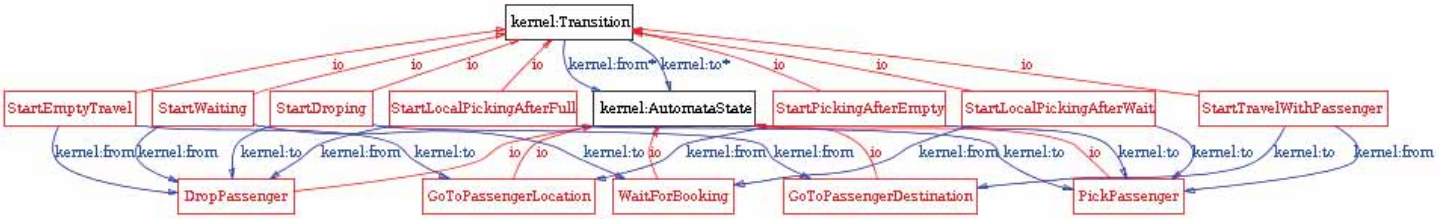
system:CommandOutput

system:MotorizationHardware



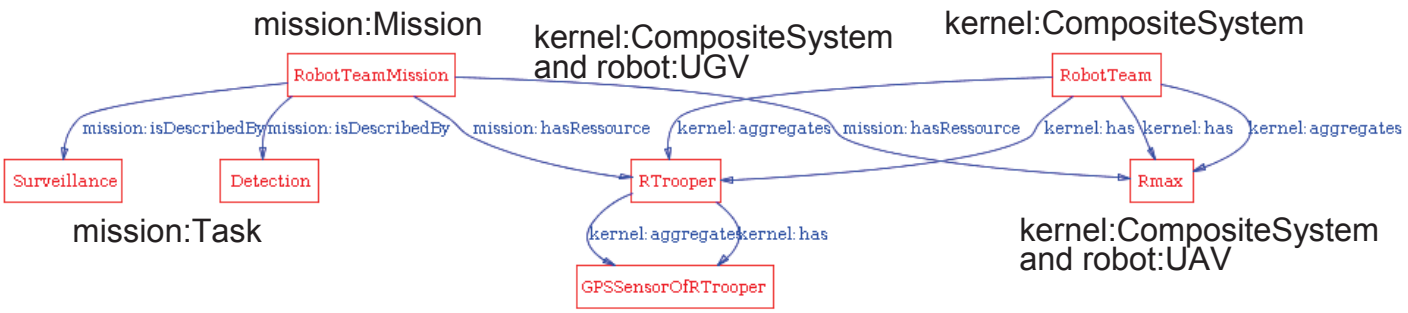
Validation – Urban scenario

- Description of mission evolution by a mission:MissionStateMachine
- The mission management system kernel:hasEvolutionModel this state machine
- mission:MissionStateMachine kernel:isDefinedBy :



Intellectual Property Rights are governed by PROTEUS Contract and PROTEUS consortium agreements. Before using, reproducing, modifying or disclosing the information contained in that document, it is under the user responsibility to check its rights and if mandatory ask to the Intellectual Property Owner the authorisation to use, reproduce, modify or disclose the information.

Validation – Air-ground scenario



Validation – Landmark search scenario

- Software Architecture

Ex... : system:SoftwareToSoftwareInteraction

system:SecuritySystem and kernel:Software

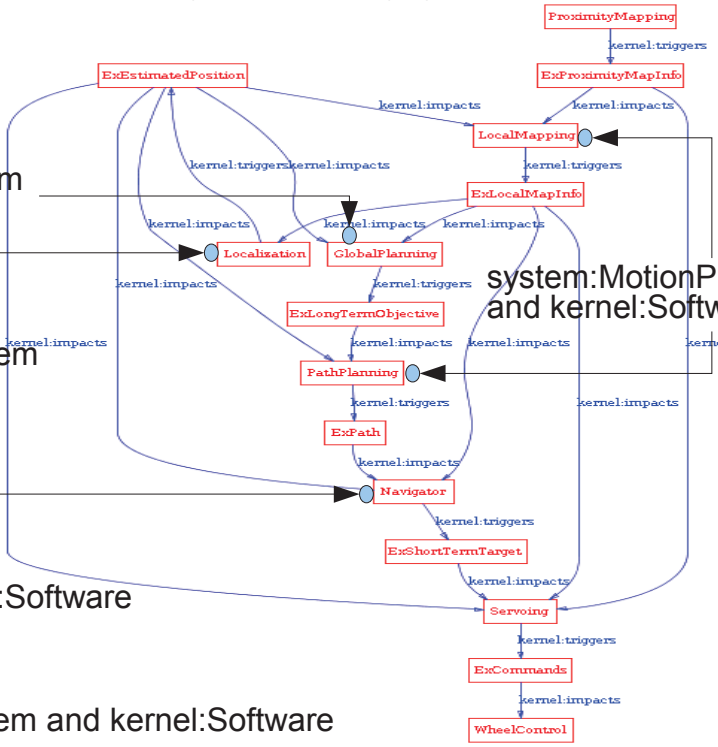
system:MissionManagementSystem and kernel:Software

system:PlatformManagementSystem and kernel:Software

system:MotionPlanningSystem and kernel:Software

system:ControlSystem and kernel:Software

system:Closed-Loop_ControlSystem and kernel:Software



Conclusion

- The ontology includes :
  - 364 classes
  - 185 properties
  - 31 data types
- Nothing actually new, but common frame:
  - Able to describe some scenarios
  - Sharable by robotic community
  - Able to ground a Domain Specific Language (DSL) for robotics
    - Automatic simulation assembly
    - Robotic middleware projection
    - G. Lortal, S. Dhouib and S. Gérard (2011) Integrating Ontological Domain Knowlege into a Robotic DSL, Models in Software Engineering, Lecture Notes in Computer Science, Volume 6627, 401-414
- Endless work because of expected feedback from:
  - Language developers
  - Challenge providers and challengers

National Institute of Advanced Industrial Science and Technology AIST

Domestic Standardization Activity for Standardizing Voice Interface for Service Robots in Japan

Yosuke Matsusaka

National Institute of Advanced Industrial Science and Technology (AIST)

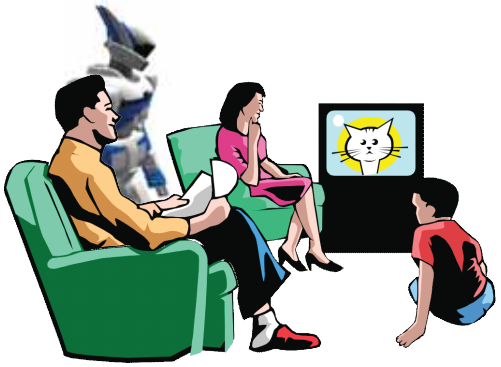
Robotics DTF

OMG Technical Meeting 2011/12/13

National Institute of Advanced Industrial Science and Technology AIST

Background

- Industrial Robot
  - Expert Operator
  - Specified Action
- Personal/Service Robot
  - Naïve User＝Operator
  - Various Situations and Tasks



- "Communication" is the key function.

National Institute of Advanced Industrial Science and Technology AIST

Why Voice is Useful: Interface Constraint

Similar condition occur for car navigation, logistics, etc.

National Institute of Advanced Industrial Science and Technology AIST

Why Development of Communication Function is Difficult?

Reason: Requires Wide Range of Knowledge

- -Audio Signal Processing
- -Lexical Analysis
- -Speech Recognition / Synthesis
- -Dialogue Management, etc…

As a result…:

High development effort.

(When we develop from scratch…)

Low learning curve.

(Because we are not the professional in developing communication systems…)

National Institute of Advanced Industrial Science and Technology
AIST

Middleware!

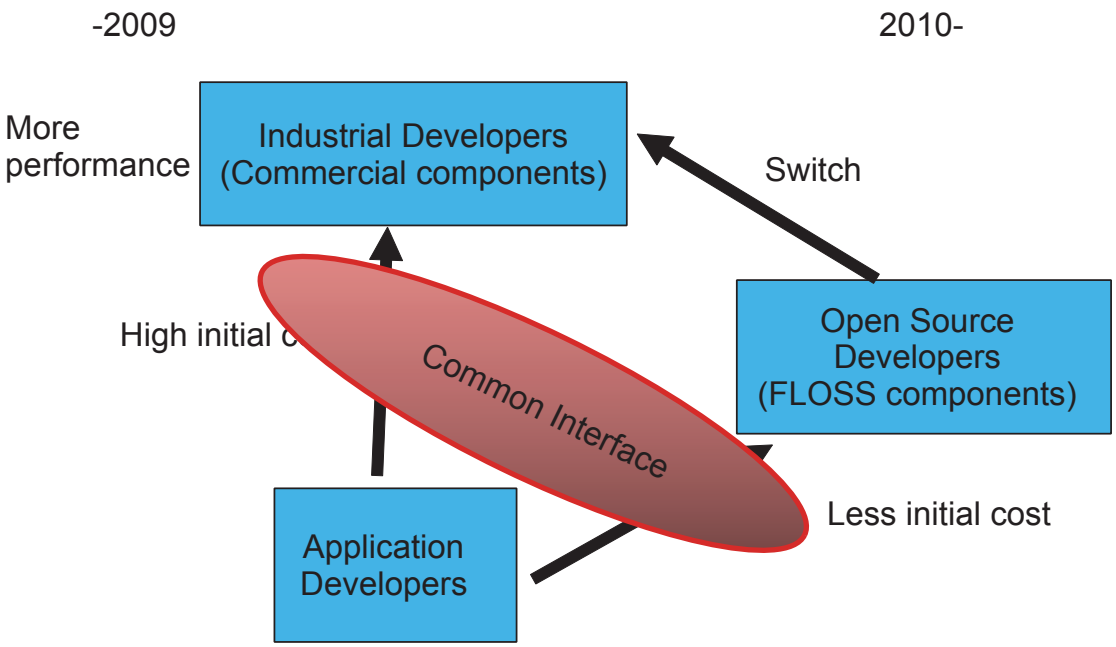
National Institute of Advanced Industrial Science and Technology
AIST

NEDO-IRTS (2008-2012)

- NEDO Intelligent Robot Technology Software Project (NEDO-IRTS).
- National project to develop middleware for robotic applications (RT).
- Members from both industry and academia.
- Widely spreaded issues from motor control to human robot communication.

National Institute of Advanced Industrial Science and Technology AIST

Needs for Common I/F (Case of NEDO-IRTS)



National Institute of Advanced Industrial Science and Technology AIST

Common I/F Definition Policy

Maximize the reusability.

Respect to the other standards.

Be more practical (less cutting edge).

We share OMG spirit.

Related Voice Standards and Uniqueness of Robotic Application

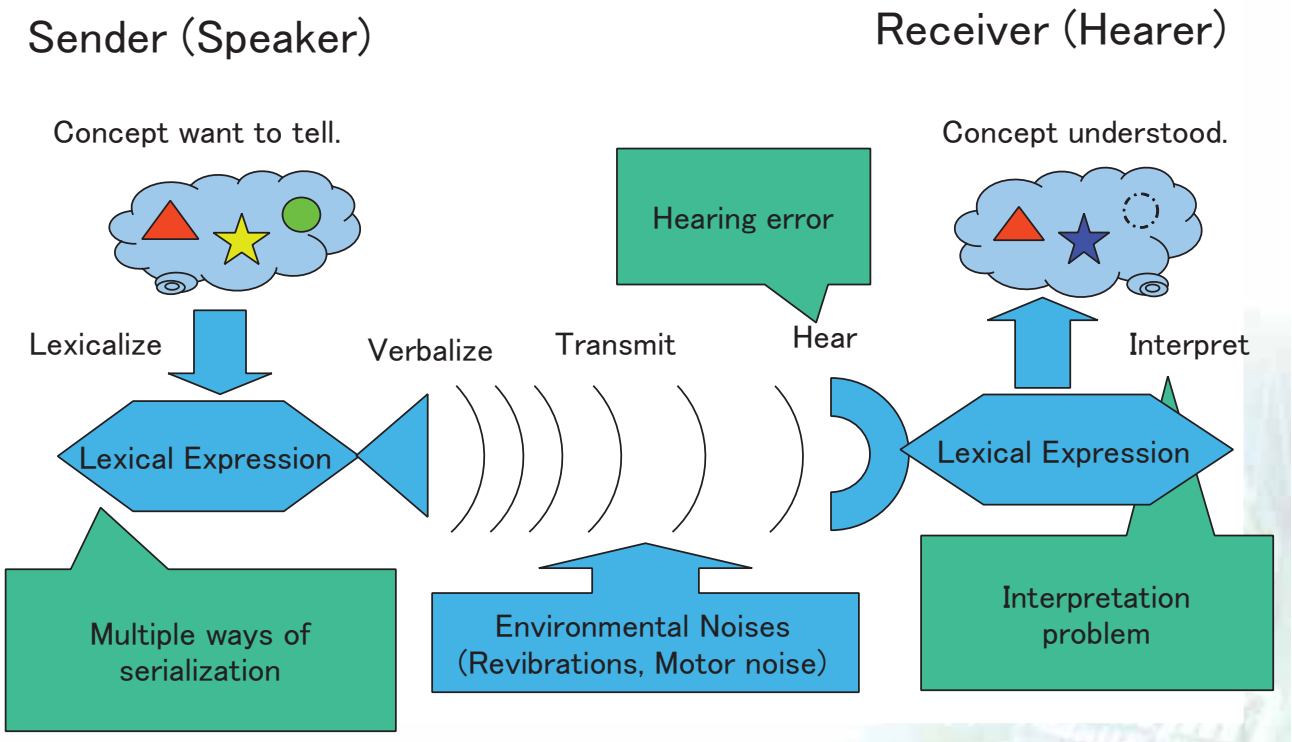
W3C "Voice Browser" specifications

- VoiceXML(Voice/DTMF Interaction)
- SRGS(Speech Recognition Grammar)
- SSML(Speech Synthesis Markup)

What is missing:

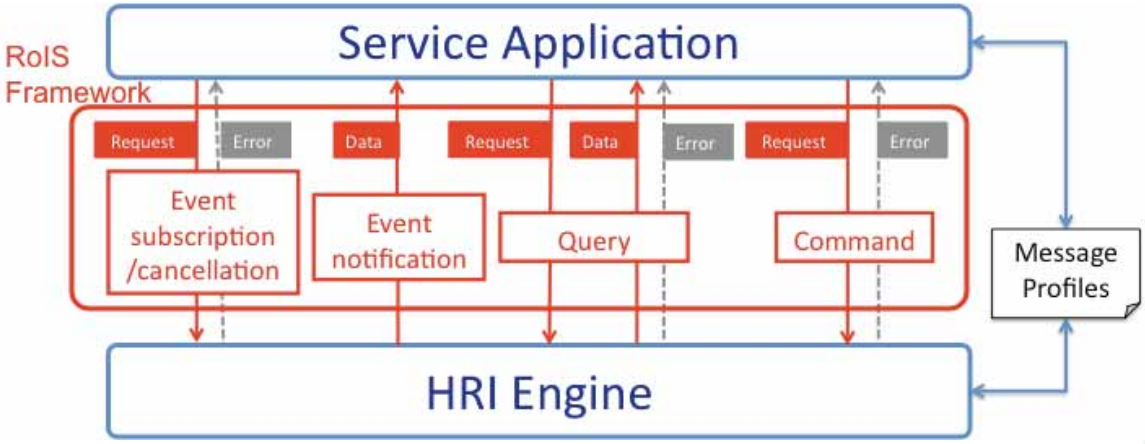
- Cope with **auditory** problems.
- **Component specification** to enhance the reusability.

Unique Problems for Robots



Related OMG Activity: RoIS Specification

RoIS: Robotic Interaction Service Framework



Current state:

-Focused on providing application framework.

-Not yet for component specifications.

Related OMG Activity: RT-Component Specification

RT-Component specification:

•Strict definition of execution cycles.

=> Good support for real-time system.

•Strict definition of interface types.

=> Ensure communication between components developed in different organizations.

•XML based format to describe abstract design of the component and the system.

=> Enable MDSD (Model Driven Software Development).

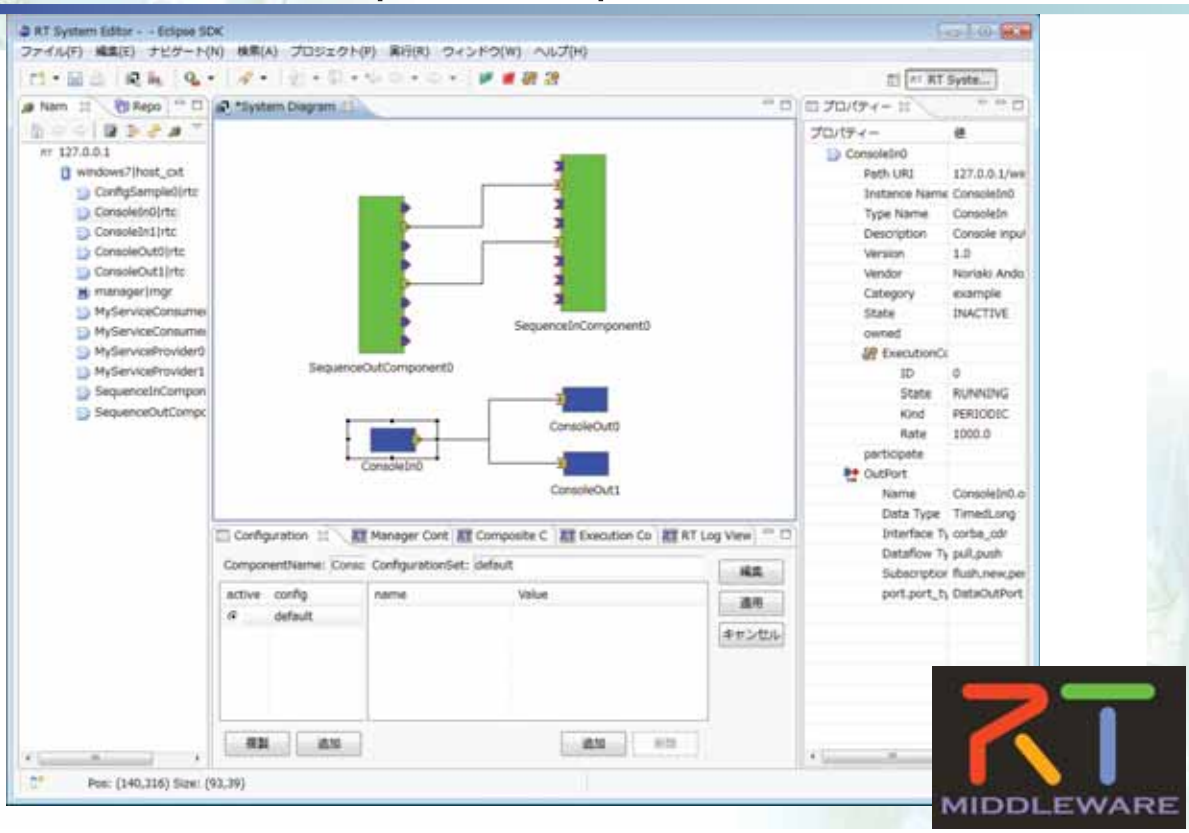
OpenRTM-aist:

-An implementation of RTM specification with eclipse based tool-chain.

National Institute of Advanced Industrial Science and Technology AIST

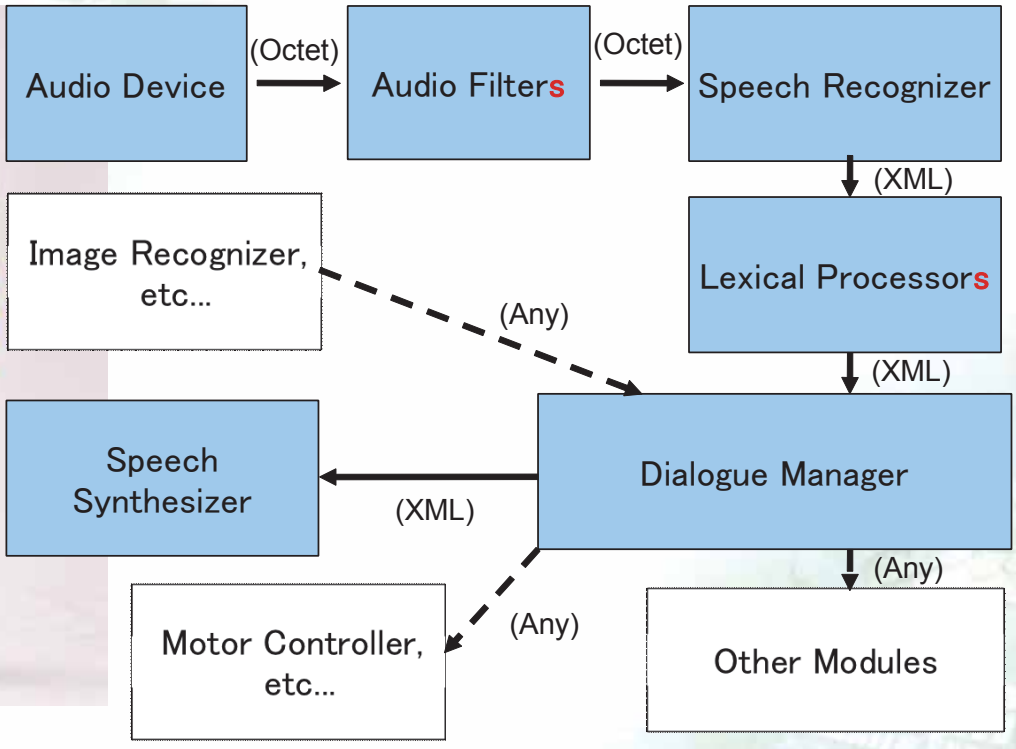
Related OMG Activity: RT-Component Specification

OMG WE SET THE STANDARD®



National Institute of Advanced Industrial Science and Technology AIST

The NEDO-IRTS Common I/F Specification



National Institute of Advanced Industrial Science and Technology AIST

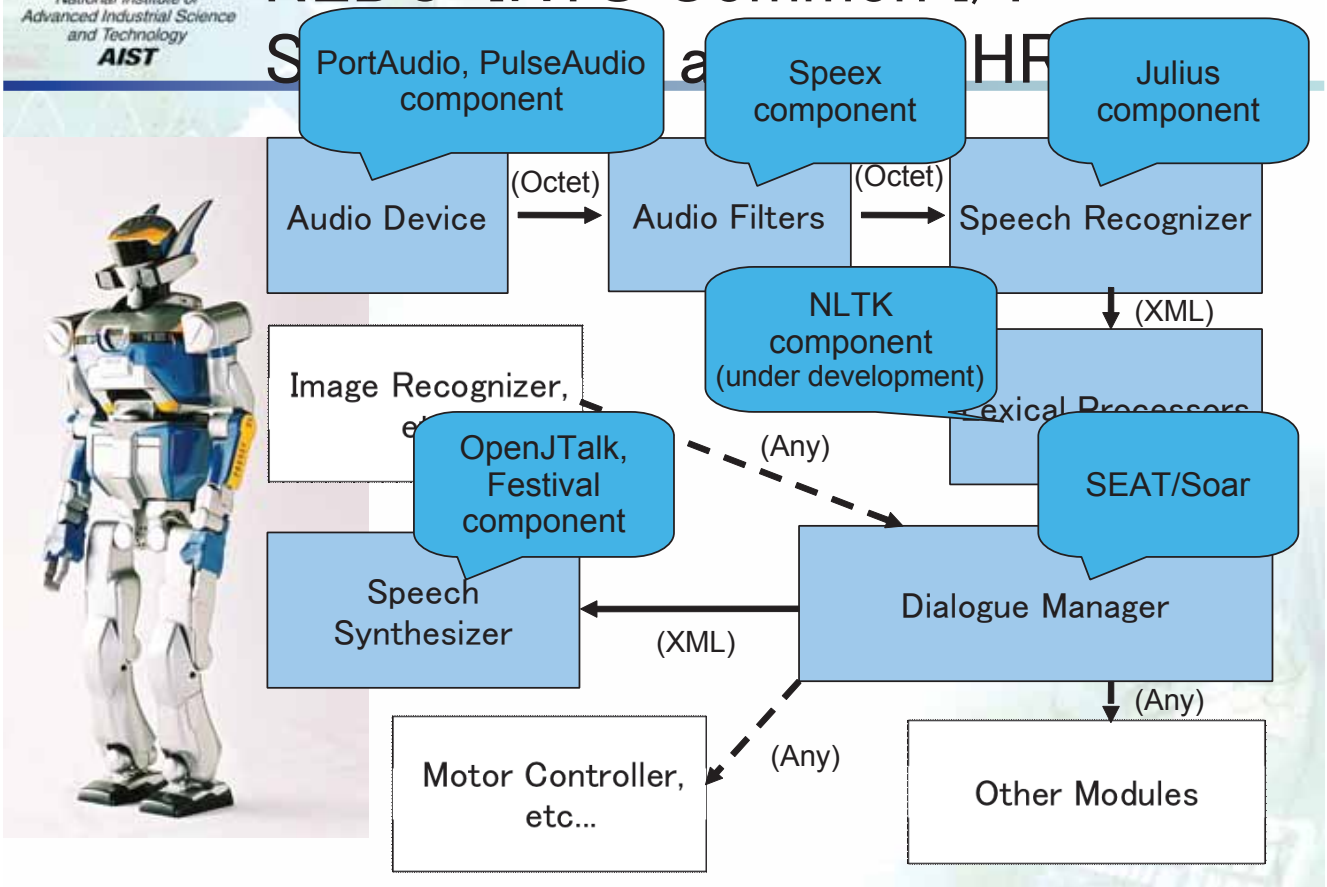
OpenHRI

- Reference implementation of common interface specification defined in NEDO-IRTS.
- Integrate wide range of open source software based on RT-Component specification.
- Easy to install package for Windows and Linux.

http://openhri.net/

National Institute of Advanced Industrial Science and Technology AIST

NEDO-IRTS Common I/F



National Institute of Advanced Industrial Science and Technology
AIST

Demo

List of Issues for RoIS Framework

OMG Santa Clara MTG
Robotic Functional Service WG
2011.12.12
Miki Sato & Koji Kamei (JARA/ATR),
Toshio Hori (AIST),
Su-Young Chi (ETRI)

issues (1)

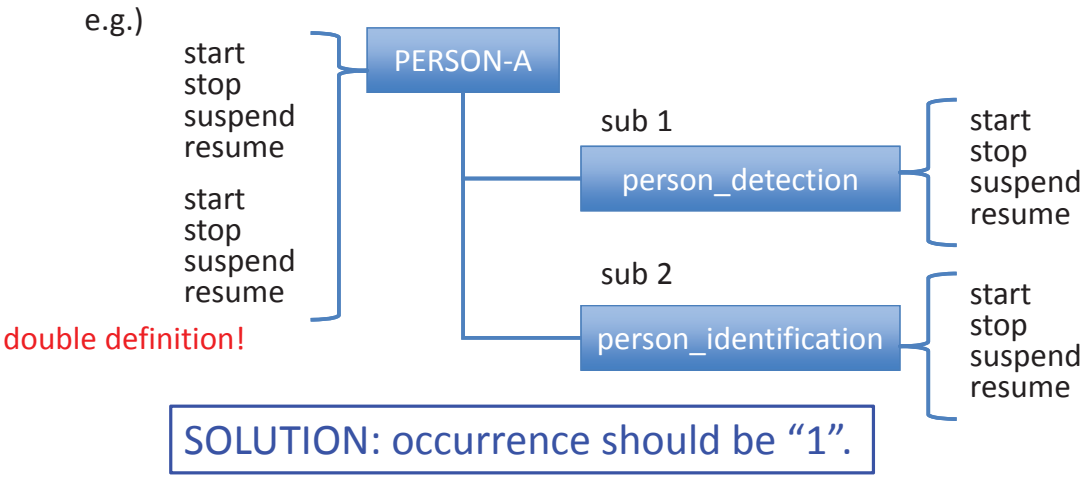
* How to submit new issues?

1. ~~What version is correct for XMI model on EA?~~
   ~~(EA ver. 9.0 includes "OMG UML", but ver. 9.1 does not include the model.)~~
   ~~SOLUTION: USE UML2.3~~
2. Clarify relationship with ROS, RTC.
   →Add description of UNR-PF architecture and wrapping ROS & RTC.
3. Verify the ETRI's implementation.
4. "condition" is not defined in detail.
   → Add some examples in Appendix. Need more discussion.
5. In ~~7.5.2 "Command_Message_Profile",~~ Table 7.26 "Command_Message_Profile" in 7.5.3 "Message Profile", there is no profile for the result parameters related with 7.4.3.2 "Command Result Message".
6. In 7.4.3 "Message Data", there is no definition of "Error Message" for "get_error_detail" method, and there is no profile for the result parameters for this message in ~~7.5.2~~ 7.5.3.

issues (2)

7. In Table ~~29~~ 7.29 “Component Profile”, occurrence of sub_component is N.

   For example, if the each sub component include “RoIS_Common” as their sub_component, what will happen?



SOLUTION: occurrence should be “1”.

issues (3)

8. In Table ~~30~~ 7.30“HRI_Engine_Profile”, parameters of HRI engine is defined in this profile. However, these parameter should be defined in the Component Profile of “System Information Component” for this Engine.

   →Need more discussions.

9. In Figure 17, “RoIS_Common” should be deleted.
10. In Table ~~34~~ 7.34 “System Information”, “robot ref(List<RoIS_Identifier>)” is required for “robot_position” and “position_data” should be List<Data>.

issues (4)

11. In Table ~~36~~ 7.36 “person_localization”(and other localization components), parameters of sensing-cycle and/or resolution (minimum position difference which sensor can distinguish) are required. These parameters should be added for (optional) get_parameter. Detection-cycle (multiple of sensing-cycle) and Detection-difference (larger than resolution) may be set by set_parameter.

issues (5)

12. In Table ~~44~~ 7.44“speech synthesis”, data type of the argument and result parameter of “character” should be “RoIS_Identifier”.
13. In ~~4.1.~~ 3.1 “Normative References”, ISO19143 should be added in the list.
14. In Table ~~7~~ 7.7“Error Type”, “PROFILE_CHANGED(tentative name)” should be added in the enumeration.
15. P.23 line 3, “each type of error” -> “each error”.
16. condition of “get_error_detail (Table 7.2),” “get_command_result (Table 7.3),” “get_event_detail (Table 7.5)” can be omitted. Need more discussions.

condition

1. get_profile / search / bind_any

   →"condition" is mainly used for selecting Engine/Component. engine_name, engine_ref, System Information(position, status(only for get_profile), operable time), component_name, component_ref can be used as "common condition". Other conditions may be treated as "component specific condition".

2. get_error_detail / command_result / event_detail

   →ID for each message is enough for this purpose. "condition" can be omitted.

3. query

   →same as 1.

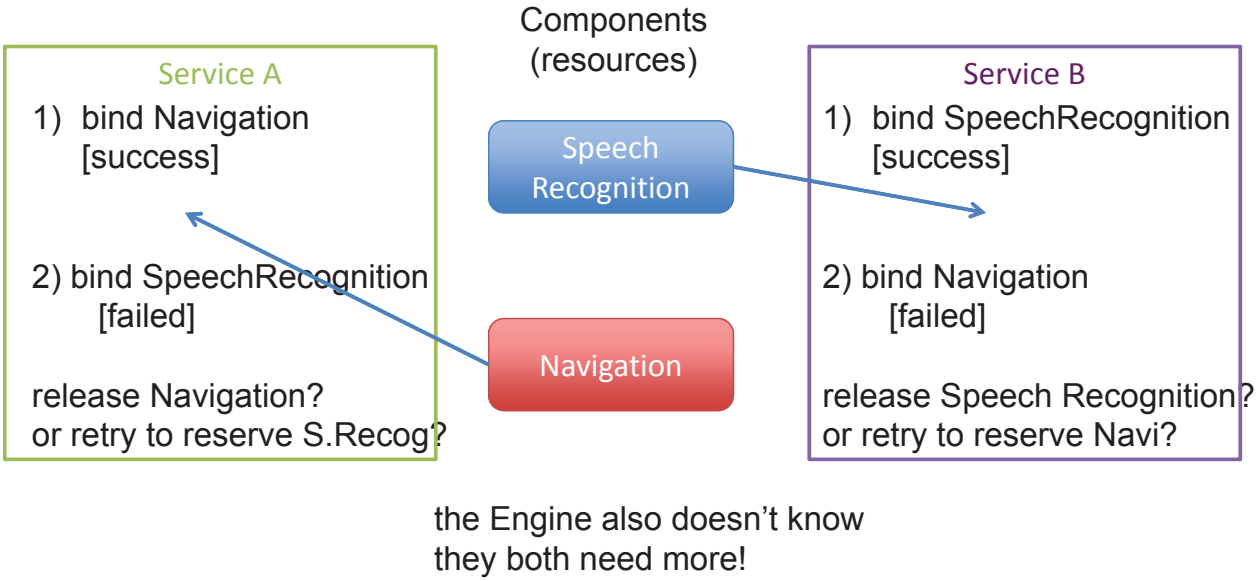
4. subscribe

   → There are two types, i.e., condition for selecting engine/component and condition for event occurrence. Need more discussions

Issues (2011/12/12) -1

17. Title of Table 7.7 "ErrorType enumeration" is not appropriate because it contains not only errors but "PROFILE_CHANGED." [Hori]
18. Definition of HRI Engine is ambiguous in Section 4. [Chi]
19. Order of HRI Engine and Service Application should be changed in Section 4. [Chi]
20. A method for atomic allocation of multiple HRI Components is required to avoid race condition. (See next slide) [Kamei]

Dynamic allocation / Dynamic re-configuration



the Engine also doesn't know
they both need more!

Needs "Convention" to cancel (partial) reservation.

1) atomic allocation function (forced to cancel in allocation function).
2)

Issues (2011/12/12) -2

21. Dependencies (Requisite conditions) among HRI Components should be defined in HRI Profile. [Kamei]
22. Methods "search," "bind" and "bind_any" may be extended for allocating multiple components at once. [Sato]

Issues & Resolutions (1) -revised

1. Command Result Message definitions: In 7.5.3, there is no profile for the result parameters related with 7.4.3.2
2. Relationship with RTC and ROS: Relationship with ROS, RTC should be clarified.
3. Parameter definitions for Error Message: In 7.4.3 “Message Data”, there is no definition of “Error Message” for “get_error_detail” method, and there is no profile for the result parameters for this message in 7.5.3.
4. Occurrence of sub component for Component Profile: In Table 7.29 “Component Profile”, occurrence of sub_component is N to avoid double definition. For example, if the each sub component include “RoIS_Common”, the main component may include the two same common messages defined in RoIS_Common. Therefore, the occurence should be "1".
   ⇨ Occurence should be "1".

Items in RED : not resolved yet.
Items in BLACK: resolved

Issues & Resolutions (2)

5. Parameter in HRI Engine Profile: In Table 7.30 “HRI_Engine_Profile”, parameters of HRI engine is defined in this profile. However, these parameter should be defined in the Component Profile of “System Information Component” for this Engine. Therefore, "parameter" definitions in HRI engine profile should be removed.
   ⇨ RESOLVED: “Parameter" definitions in HRI engine profile should be removed.
6. RoIS_Common in System Information component: In Figure 17, “RoIS_Common” should be removed because System Information component does not include RoIS_Common messages.
   ⇨ RESOLVED: Should be removed.
7. Parameters for System Information component: In Table 7.34 “System Information”, “robot ref(List<RoIS_Identifier>)” is required for “robot_position”, same as person position data in "Person localization" In addition, “position_data” should be List<Data>.
   ⇨ RESOLVED: robot ref (List<RoIS_Identifier>) should be added. Position_data is changed to List<Data>.

Issues & Resolutions (3)

8. Parameters for Localization component: In Table 7.36 “person_localization”(and other localization components), parameters of sensing-cycle and/or resolution (minimum position difference which sensor can distinguish) are required. These parameters should be added for (optional) get_parameter. In addition, Detection-cycle (multiple of sensing-cycle) and Detection-difference (larger than resolution) may be set by set_parameter.
9. Parameters for Speech Synthesis component: In Table 7.44 “speech synthesis”, data type of the argument and result parameter of “character” should be “RoIS_Identifier”.
   8. RESOLVED: Data type of the argument and result parameter of “character” are changed as “RoIS_Identifier”.
10. Additional Normative References: In 3.1 “Normative References”, ISO19143 (Geographic information - Filter encoding) should be added in the list. This reference is referred for QueryExpression.
    8. RESOLVED: Should be added.

Issues & Resolutions (4)

11. Notification of Profile change: It is required to consider methods about notification when the engine or component profile changed. "receive_error" method is usable for this purpose. “PROFILE_CHANGED(tentative name)” should be added in the enumeration of "Error Type" (Table 7.7). However, this status is not an error, so "receive_error" and "Error Type" should be renamed.
12. Wrong Expression: P.23 line 3, “each type of error” should be corrected to “each error”.
    ⇨ RESOLVED: Should be corrected
13. Condition for identifying message: Condition of “get_error_detail (Table 7.2),” “get_command_result (Table 7.3),” and “get_event_detail (Table 7.5)” can be omitted because these method can identify their message by message_id (such as command_id, event_id and error_id).
14. Definition of HRI Engine is ambiguous in Section 4.
    ⇨ RESOLVED: An object that manages HRI Components. It mediates Human-Robot Interaction functions of the HRI Components to Service Application(s).

Issues & Resolutions (5)

15. Order of HRI Engine and Service Application should be changed in Section 4.
    ⇨ RESOLVED: should be changed
16. A method for atomic allocation of multiple HRI Components is required to avoid race condition.
17. Dependencies (Requisite conditions) among HRI Components should be defined in HRI Profile.
18. Methods “search,” “bind” and ”bind_any” may be extended for allocating multiple components at once.

Robotic Functional Service WG
WG Report

WG Co-Chairs: SuYoung Chi, Miki Sato, Toshio Hori
2011/12/13

robotics/2011-12-07

WG activities before this meeting

- At Kissimmee Meeting (2011/09)
  - Discussed issues for RoIS Framework
    - Attendants: Doi (Toshiba), Sato (ATR) and Hori (AIST)
    - Sam (Sparx Systems) partly attended to verify UML models.
  - 15 issues were raised and discussed.
    - Some of them were resolved.
- At Tokyo private meeting (2011/11)
  - Issues raised at Kissimmee meeting was introduced and discussed.

WG activities during this meeting

- Monday & Tuesday morning
  - Issues raised at Kissimmee meeting were introduced along with some resolutions.
  - New issues were raised.
    - No. of issues are currently 22, including 15 from the Kissimmee meeting.
  - Discussed their resolutions.
  - We discuss unresolved items tomorrow morning.

robotics/2011-12-07

Schedule after this meeting (tentative)

- Issues shall be posted to OMG before the deadline (Feb. 20th, 2012).
- All the issues submitted may be resolved by email discussion and/or (private) meeting.

- Deadlines (indicated in the charter):
  - ~~Beta Specification Publication: 31st July, 2011~~
    - Document No. of Beta 1 Spec.: dtc/11-08-06
  - Comments Due: 20th February, 2012
  - Report Due Date: 21st May, 2012
  - Report Deadline: 29th June, 2012

List of Issues for RoIS Framework

OMG Santa Clara MTG
Robotic Functional Service WG
2011.12.13
Miki Sato & Koji Kamei (JARA/ATR),
Toshio Hori (AIST),
Su-Young Chi (ETRI)

Issues & Resolutions (1)

1. Command Result Message definitions:
   In 7.5.3, there is no profile for the result parameters related with 7.4.3.2
2. Relationship with RTC and ROS:
   Relationship with ROS, RTC should be clarified.
3. Parameter definitions for Error Message:
   In 7.4.3 “Message Data”, there is no definition of “Error Message” for “get_error_detail” method, and there is no profile for the result parameters for this message in 7.5.3.
4. Occurrence of sub component for Component Profile:
   In Table 7.29 “Component Profile”, occurrence of sub_component is N to avoid double definition. For example, if the each sub component include “RoIS_Common”, the main component may include the two same common messages defined in RoIS_Common. Therefore, the occurence should be "1".
   ⇨ Occurence should be "1".

Items in RED : not resolved yet.
Items in BLUE: several possibilities. Need more discussions.
Items in BLACK: resolved

Issues & Resolutions (2)

5. Parameter in HRI Engine Profile:

   In Table 7.30 “HRI_Engine_Profile”, parameters of HRI engine is defined in this profile. However, these parameter should be defined in the Component Profile of “System Information Component” for this Engine. Therefore, "parameter" definitions in HRI engine profile should be removed.

   ⇨ RESOLVED: “Parameter" definitions in HRI engine profile should be removed.

6. RoIS_Common in System Information component:

   In Figure 17, “RoIS_Common” should be removed because System Information component does not include RoIS_Common messages.

   ⇨ RESOLVED: Should be removed.

7. Parameters for System Information component:

   In Table 7.34 “System Information”, “robot ref(List<RoIS_Identifier>)” is required for “robot_position”, same as person position data in "Person localization"
   In addition, “position_data” should be List<Data>.

   ⇨ RESOLVED: robot ref (List<RoIS_Identifier>) should be added. Position_data be changed to List<Data>.

Issues & Resolutions (3)

8. Parameters for Localization component:

   In Table 7.36 “person_localization”(and other localization components), parameters of sensing-cycle and/or resolution (minimum position difference which sensor can distinguish) are required. These parameters should be added for (optional) get_parameter. In addition, Detection-cycle (multiple of sensing-cycle) and Detection-difference (larger than resolution) may be set by set_parameter.

9. Parameters for Speech Synthesis component:

   In Table 7.44 “speech synthesis”, data type of the argument and result parameter of “character” should be “RoIS_Identifier”.

   ⇨ RESOLVED: Data type of the argument and result parameter of “character” are changed as “RoIS_Identifier”.

10. Additional Normative References:

    In 3.1 “Normative References”, ISO19143 (Geographic information - Filter encoding) should be added in the list. This reference is referred for QueryExpression.

    ⇨ RESOLVED: Should be added.

Issues & Resolutions (4)

11. Notification of Profile change:

    It is required to consider methods about notification when the engine or component profile changed.
    "receive_error" method is usable for this purpose.
    “PROFILE_CHANGED (tentative name)” should be added in the enumeration of "Error Type" (Table 7.7). However, this status is not an error, so "receive_error" and "Error Type" should be renamed.

12. Wrong Expression:

    P.23 line 3, “each type of error” should be corrected to “each error”.

    ⇨ RESOLVED: Should be corrected

13. Condition for identifying message:

    Condition of “get_error_detail (Table 7.2),” “get_command_result (Table 7.3),” and “get_event_detail (Table 7.5)” can be omitted because these method can identify their message by message_id (such as command_id, event_id and error_id).

    ⇨ NEED MORE DISCUSSIONS: Remove / Make them optional

Issues & Resolutions (5)

14. Definition of HRI Engine is ambiguous in Section 4.

    ⇨ RESOLVED: New definition is “An object that manages HRI Components. It mediates Human-Robot Interaction functions of the HRI Components to Service Application(s).”

15. Order of HRI Engine and Service Application should be changed in Section 4.

    ⇨ RESOLVED: should be changed

16. A method for atomic allocation of multiple HRI Components is required to avoid race condition.

17. Dependencies (Requisite conditions) among HRI Components should be defined in HRI Profile.

18. Methods “search,” “bind” and ”bind_any” may be extended for allocating multiple components at once.

19. Misspelling:

    In Table 7.2 (P.31) The word “Enghien” should be “Engine” (in the “connect” row) [Hori]

    ⇨ RESOLVED

Issues & Resolutions (6)

20. Unifying Notation of Terms:

    "HRI Engine," "HRI Components," and other terms defined in Section 4 should be unified as in the definition table. [Hori]

21. Complex "Command Unit List":

    Implementing "Command Unit List" is very difficult. It should be simplified.

22. "Condition" is ambiguous:

    "Condition" is used in many interfaces and methods, but it is difficult to implement without examples.

Please consult the 2011/12/12 version document, too, for further information.

Infrastructure WG Progress Report

(Santa Clara meeting)

Noriaki Ando (AIST)

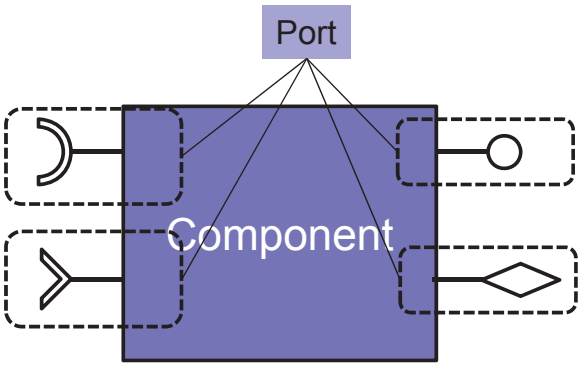
robotics/2011-12-09

Topics of This Meeting

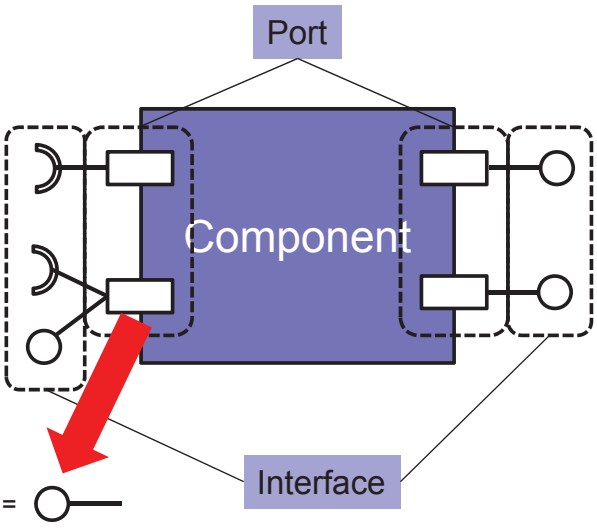
- Merged submission has been postponed
  - Next March (Washington) meeting
- Reviewed implementation by Shibaura-IT
  - CanOpen-based RTC D&C platform
- Reviewed merged submission
  - Component Data Model
  - Some diagrams are created and updated from the discussion
  - Sequence diagrams will be added for readers' convenience

Port in DEPL and RTC

Port and Component in DEPL

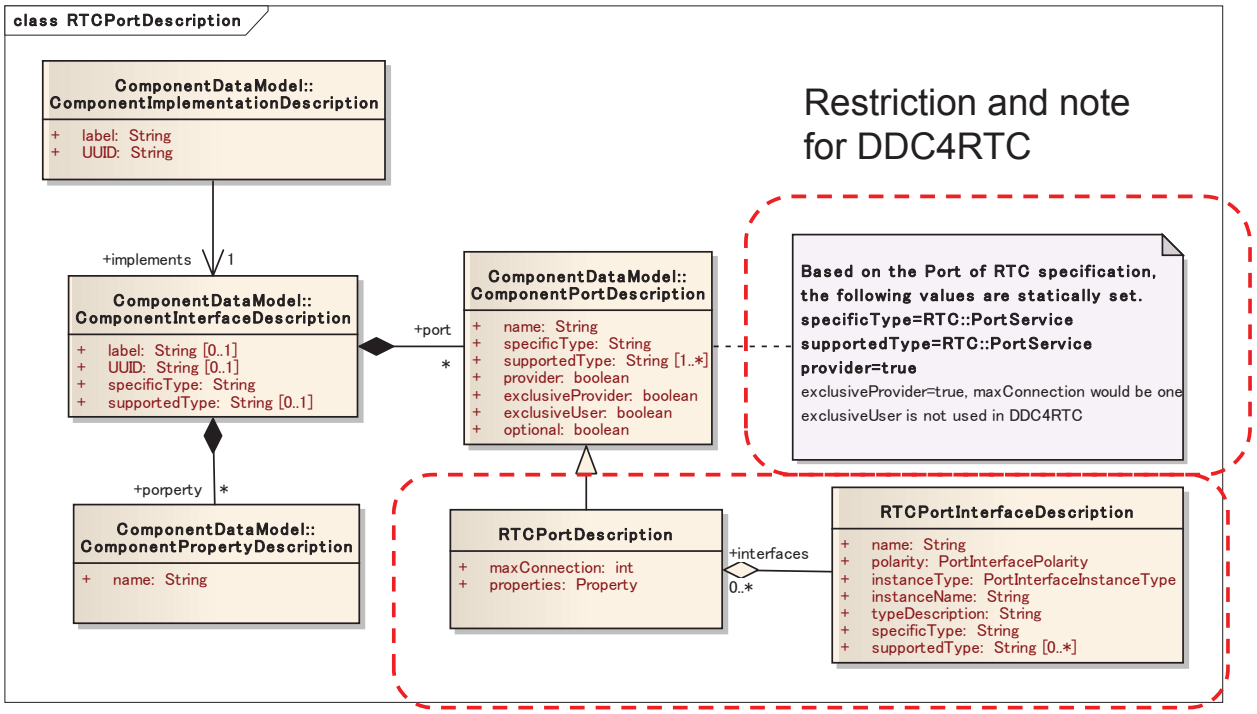


Port and Component in RTC

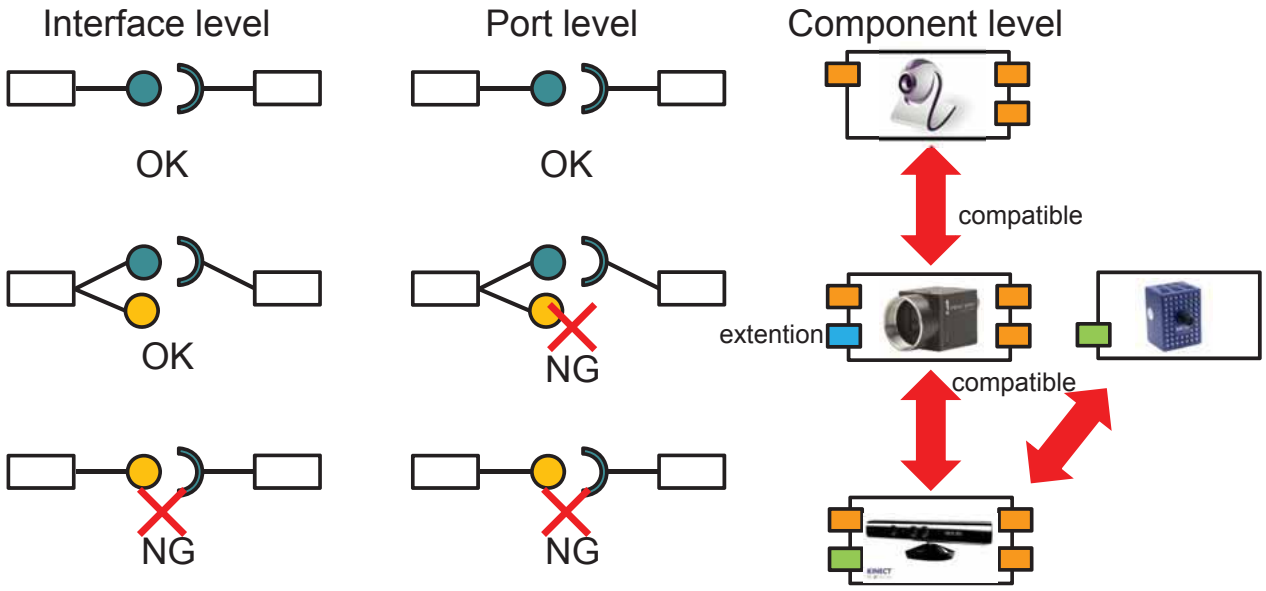


Port itself is a service (RTC::PortService)

DDC4RTC Port description



Compatibility of Components



DEPL: Component interface and ports
RTC: Port and it service interfaces

TOC of the Specification

Next

- Continues merging process
- Complete a draft merged specification before the next meeting.

RTC RTF 1.1

- Comments received from 3 sources.
- 8 resolved issues, 9 deferred issues, 1 duplicate
- 4 of 7 members voted.
- Resolved changes were correcting the specification
  - Diagram fixes
  - Grammatical corrections
- Minor comments received from AB review
  - Missing #pragmas in IDL, XMI bugs

AIST

RTC RTF 1.1

- Deferred issues were all linked in one change
  - Remove the strong relationship between execution contexts and components.
- Rationale: allow a wider range of configurations of execution contexts and components.
- Deferred because it is API-breaking.
  - Should be handled in the next major version.

ISO TC184/SC24 Contact Report

Su-Young Chi **Ph.D.**
ETRI
2011-12-13

ISO TC184/SC2
Venue: DIN, Burggrafenstraße 6, 10787 Berlin, Germany

ISO/TC 184: Automation systems and integration
ISO/TC184/SC 2: Robots and robotic devices

2011.09.26 ~ 28	DIN building, Berlin ISO TC 184/SC 2/WG 7(Personal care safety)
2011.09.29	DIN building, Berlin ISO TC 184/SC 2/WG 1(Vocabulary and characteristics)
2011.09.30	DIN building, Berlin ISO TC 184/SC 2/WG 8(Service robots)

Dates of next meetings
Mtg #17: Feb. 10 (Fri), in Orlando, USA.
Mtg #18: July 13 (Fri), in Milano, Italy

IEEE/RAS Standardisation

- IEEE/RAS is attempting standardisation in two areas, led by Raj Madhavan
  - Robot map data representation (P1873)
  - Ontology
- Working groups were accepted by the IEEE Standardisation Association in October.
- Map data co-chairs
  - Wonpil Yu
  - Geoffrey Biggs
- Ontology chair: Craig Schlenoff
- Study group meeting at IROS 2011 had good participation from industry, who are very keen for map standards.

Robotics-DTF Plenary Meeting
Wrap-up Session

December 13, 2011

Santa Clara, CA, USA

Hyatt Regency Santa Clara

Document Number

robotics/2011-12-01 Final Agenda (Tetsuo Kotoku)
robotics/2011-12-02 Salt Lake City Meeting Minutes [approved] (Seung-woog Jung and Miki Sato)
robotics/2011-12-03 Opening Presentation (Tetsuo Kotoku)
robotics/2011-12-04 Proteus: An ontology for experimental validation of solutions to robotic problems (Laurent Rioux)
robotics/2011-12-05 Domestic Standardization Activity for Standardizing Voice Interface for Service Robots in Japan (Yosuke Matsusaka)
robotics/2011-12-06 List of Issues for RoIS Framework [Mon. version] （Toshio Hori)
robotics/2011-12-07 Robotic Functional Services WG Report (Toshio Hori)
robotics/2011-12-08 List of Issues for RoIS Framework [Tue. version] (Toshio Hori)
robotics/2011-12-09 Infrastructure WG Progress Report (Noriaki Ando)
robotics/2011-12-10 RTC1.1-RTF Report (Geoffrey Biggs)
robotics/2011-12-11 ISO/TC184/SC2 Contact Report (Su-Young Chi)
robotics/2011-12-12 IEEE/RAS Standardisation (Geoffrey Biggs)

Document Number (cont.)

robotics/2011-12-13 Wrap-up Presentation (Tetsuo Kotoku)
robotics/2011-12-14 Roadmap for Robotics Activities (Tetsuo Kotoku)
robotics/2011-12-15 Next Meeting Preliminary Agenda - DRAFT (Tetsuo Kotoku)
robotics/2011-12-16 Event, Repository, Directory Manager for DDC4RTC (Seungwoog Jung)
robotics/2011-12-17 Component Management Model and Target Data Model (Seungwoog Jung)
robotics/2011-12-18 List of Issues for RoIS Framework [Wed. version] (Toshio Hori)
robotics/2011-12-19 DDC4RTC Progress Report [mars2011-12-08] (Tetsuo Kotoku)
robotics/2011-12-20 DTC Report Presentation (Tetsuo Kotoku)
robotics/2011-12-21 Santa Clara Meeting Minutes - DRAFT (Koji Kamei and Seung-woog Jung)

AIST

Call for volunteer

- Robotics-DTF Co-Chair

  => Postpone voting one more meeting

- Robotic Services WG Co-Chair

  Miki Sato => Koji Kamei

NATIONAL INSTITUTE OF ADVANCED INDUSTRIAL SCIENCE AND TECHNOLOGY (AIST)

Organization (from Dec. 16th, 2011)

Robotics-DTF

Tetsuo Kotoku (AIST, Japan)
Young-Jo Cho (ETRI, Korea)

- **Publicity Committee** — Abheek Bose (ADA Software, India)
- **Contacts Committee** — Makoto Mizukawa (Shibaura-IT, Japan); Young-Jo Cho (ETRI, Korea); Yun Koo Chung (ETRI, Korea)

Technical WGs

- **Infrastructure WG** — Noriaki Ando（AIST, Japan); Seung-Woog Jung (ETRI)
- **Robotic Functional Services WG** — Su-Young *Chi* (ETRI, Korea); Koji Kamei (ATR, Japan); Toshio Hori (AIST, Japan)
- **Modelling for Robotics WG** — Takeshi Sakamoto (Technologic Arts); Toby McClean (Zeligsoft)
- **Robotic Interaction Service Framework 1.0 WG** — Su-Young *Chi* (ETRI, Korea); Koji Kamei (ATR, Japan); Toshio Hori (AIST, Japan)

Reston Meeting Agenda

March 19-23 (Reston, VA, USA)

Monday:

DDC4RTC revised submission review, vote-to-vote, voting (am)
WG activity (pm)

Tuesday:

WG activity (am)
Robotics-DTF Plenary Meeting (pm)
- •Guest and Member Presentation
- •Contact reports

Wednesday:

WG activity follow-up

Thursday:

WG activity follow-up [if necessary]

Plenary Attendee (18 participants)

- Bryant Walker Smith (Stanford)
- Geoffrey Biggs (AIST)
- In-Cheol Jeong (ETRI)
- Jolien Deantoni (INRIA)
- Koji Kamei (JARA/ATR)
- Laurent Rioux (Thales)
- Miki Sato (JARA/ATR)
- Miwako Doi (Toshiba)
- Noriaki Ando (AIST)
- Seung-Woog Jung (ETRI)
- Shuichi Nishio (JARA/ATR)
- Su-Young Chi (ETRI)
- Takashi Suehiro (UEC)
- Takashi Tsubouchi (Univ. of Tsukuba)
- Tetsuo Kotoku (AIST)
- Toshio Hori (AIST)
- Yosuke Matsusaka (ATR)
- Young-Jo Cho (ETRI)

Roadmap for Robotics Activities

robotics/2011-12-14

Item	Status	Kissimmee FL Sep-2011	Santa Clara CA Dec-2011	Reston VA Mar-2012	Cambridge MA Jun-2012	Jacksonville FL Sep-2012	Burlingame CA Dec-2012	POC / Comment
Flyer of Robotics-DTF [Publicity Sub-Committee]	Suspended							
Robot Interaction Service (RoIS) Framework RFP [Robotic Functional Services WG]	In Process				FTF Report			
Dynamic Deployment and Configuration for RTC (DDC4RTC) RFP [Robotic Infrastructure WG] in MARS	In Process			Revised Submittion & Voting				Sponsor: MARS
Robotic Map Services RFP [Robotic Functional Services WG]	Planned							IEEE R&A?
etc…	Future							
Robotics Information Day [Technology Showcase]	Future							
RoIS Finalization Task Force	In Process				FTF Report			
RTC 1.1 Revision Task Force	Done Dec-2011	Comments Due: ?	RTF Report					
RTC 1.2 or 2.0 Revision Task Force	Planned							
RLS 1.2 or 2.0 Revision Task Force	Planned							will go to ISO/TC211
Related Events		Chu-suk (Special Holidays in Korea)						

Robotics Domain Task Force Preliminary Agenda ver.0.0.1 robotics/2011-12-15

OMG Technical Meeting - Reston, VA, USA -- March 19-23, 2012

http://robotics.omg.org/

		TF/SIG				
		Host	Joint (Invited	Agenda Item	Purpose	Room
Sunday: WG activites(pm)						
13:00	17:00			Robotics DDC4RTC submitters meeting	Arrangement	
Monday: WG activity and Robotics-DTF Plenary(am)						
9:00	11:00			Robotics DDC4RTC submitters meeting	Arrangement	
?	?	MARS	Robotics	**Revised Submission for DDC4RTC RFP Review, Vote-to-Vote, and Voting** - Noriaki Ando (AIST) and Seung-Woog Jung (ETRI)	Joint with **MARS**	
12:00	13:00			**LUNCH**		
13:00	18:00			Architecture Board Plenary		
13:00	18:00			**DDC4RTC** (Robotic Infrastructure) WG(5h) - Noriaki Ando (AIST) and Seung-Woog Jung (ETRI)	discussion	
				RoIS (Robotic Functional Services) WG(5h): - Su-Young Chi (ETRI), Koji Kamei (JARA/ATR) and Toshio Hori (AIST)	discussion	
Tuesday: WG activity(am) and Robotics-DTF Plenary(pm)						
9:00	12:00			**DDC4RTC** (Robotic Infrastructure) WG(3h) - Noriaki Ando (AIST) and Seung-Woog Jung (ETRI)	discussion	
				RoIS (Robotic Functional Services) WG(3h): - Su-Young Chi (ETRI), Koji Kamei (JARA/ATR) and Toshio Hori (AIST)	discussion	
12:00	13:00			**LUNCH**		
13:00	13:45	Robotics		Talk: (45min) - TBA	presentation and discussion	
13:45	14:30	Robotics		Talk: (45min) - TBA	presentation and discussion	
				Break (30min)		
15:00	15:30	Robotics		Talk: (30min) - TBA	presentation and discussion	
15:30	16:10	Robotics		WG Reports and Discussion (Service WG, Infrastructure WG, Models in Robotics WG)	presentation and discussion	
16:10	16:30	Robotics		Contact Reports: - Makoto Mizukawa(Shibaura-IT), and Young-Jo Cho(ETRI)	Information Exchange	
16:30	17:00	Robotics		Robotics-DTF Plenary Wrap-up Session (**DTF Co-Chair Election**, Roadmap and Next meeting Agenda)	Robotics plenary closing	
17:00				Adjourn joint plenary meeting		
17:00	17:30			Robotics WG Co-chairs Planning Session (Preliminary Agenda for next TM, Draft report for Friday)	planning for next meeting	
Wednesday: WG activitiy						
9:00	12:00			**DDC4RTC** (Robotic Infrastructure) WG(3h) - Noriaki Ando and Seung-Woog Jung	discussion	
				RoIS (Robotic Functional Services) WG(3h): - Su-Young Chi, Koji Kamei and Toshio Hori	discussion	
12:00	14:00			**LUNCH and OMG Plenary**		
14:00	18:00			**DDC4RTC** (Robotic Infrastructure) WG(4h) - Noriaki Ando and Seung-Woog Jung	discussion	
				RoIS (Robotic Functional Services) WG(4h): - Su-Young Chi, Koji Kamei and Toshio Hori	discussion	
18:00	20:00			**OMG Reception**		
Thursday: WG activitiy						
?	?	MARS		Joint Plenary with MARS (tentative) (reserved for DDC4RTC RFP Re-Review and Voting)	Joint with **MARS**	
9:00	12:00			Robotics WG activity follow-up	discussion	
12:00	13:00			**LUNCH**		
13:00	18:00			Architecture Board Plenary		
13:00	18:00			Robotics WG activity follow-up	discussion	
Friday						
8:30	12:00			AB, DTC, PTC		
12:00	13:00			**LUNCH**		
Other Meetings of Interest						
Monday						
8:00	8:45	OMG		New Attendee Orientation		
Tuesday						
7:30	9:00	OMG		Liaison ABSC		

Please get the up-to-date version from http://staff.aist.go.jp/t.kotoku/omg/RoboticsAgenda.pdf

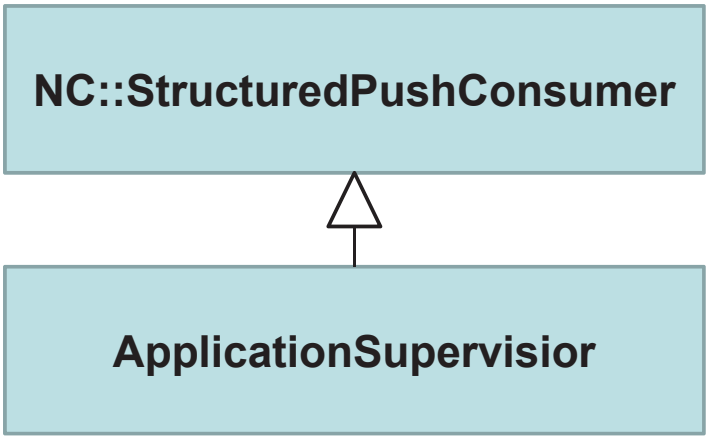
Event, Repository, Directory Managers for DDC4RTC

OMG Meeting Dec 12-16, 2011 Santa Clara

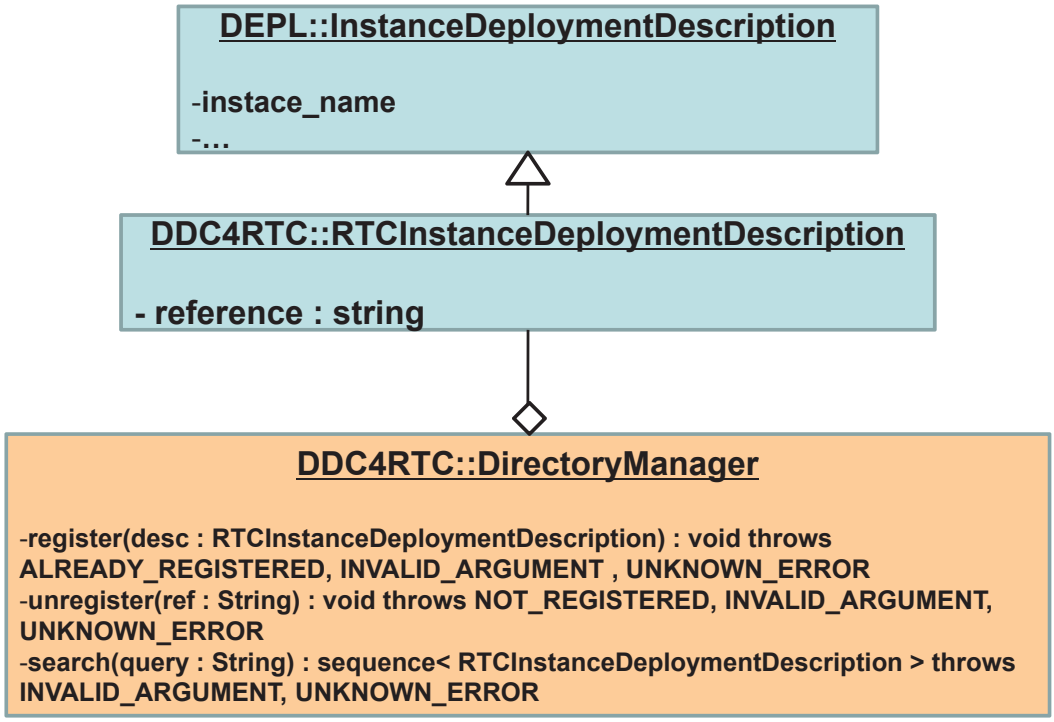
Seungwoog Jung
Infrastructure WG, Robotics DTF
ETRI, KOREA

Event Management Model

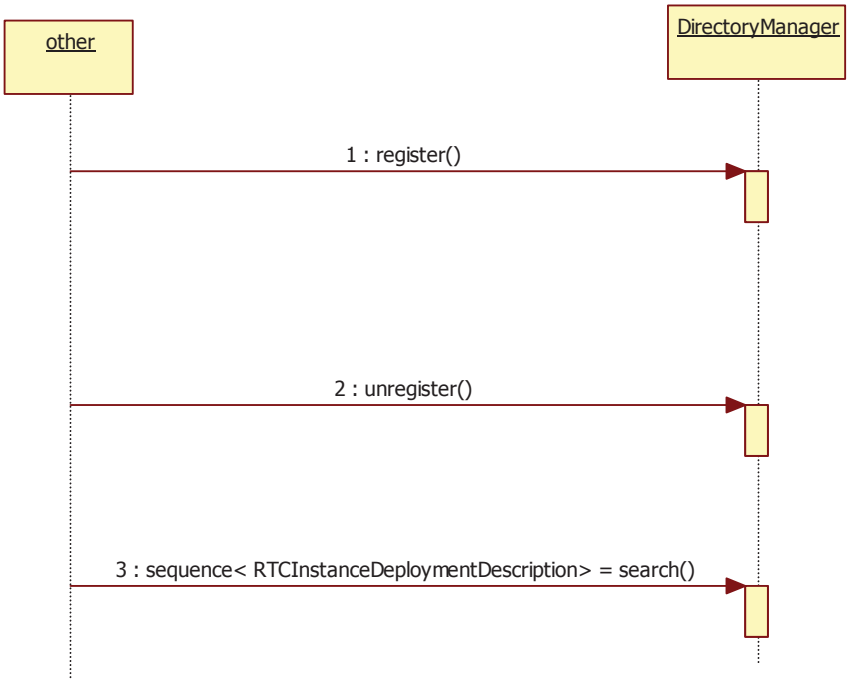
- We don't have to define additional event system for DDC4RTC
- We can use OMG notification service specification



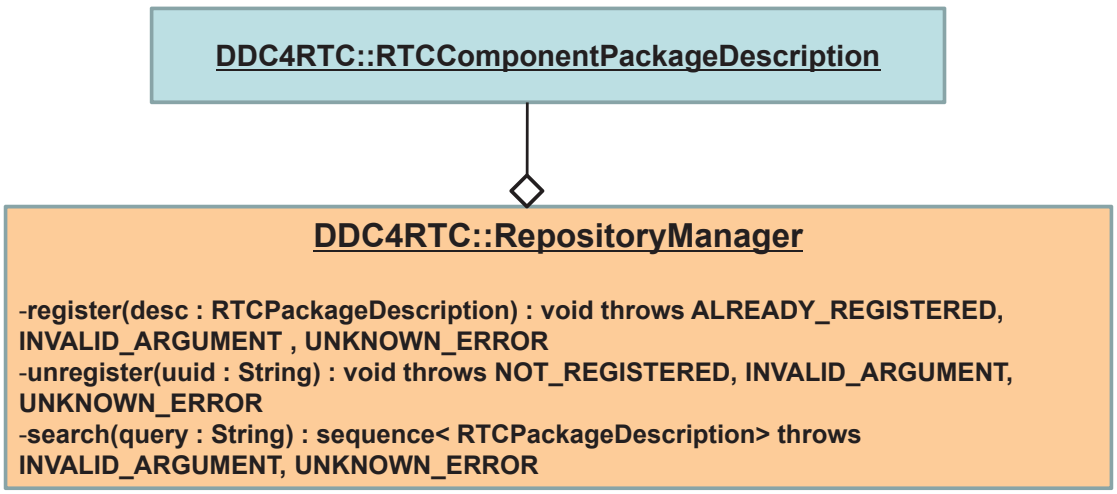
Class diagram of Directory Manager



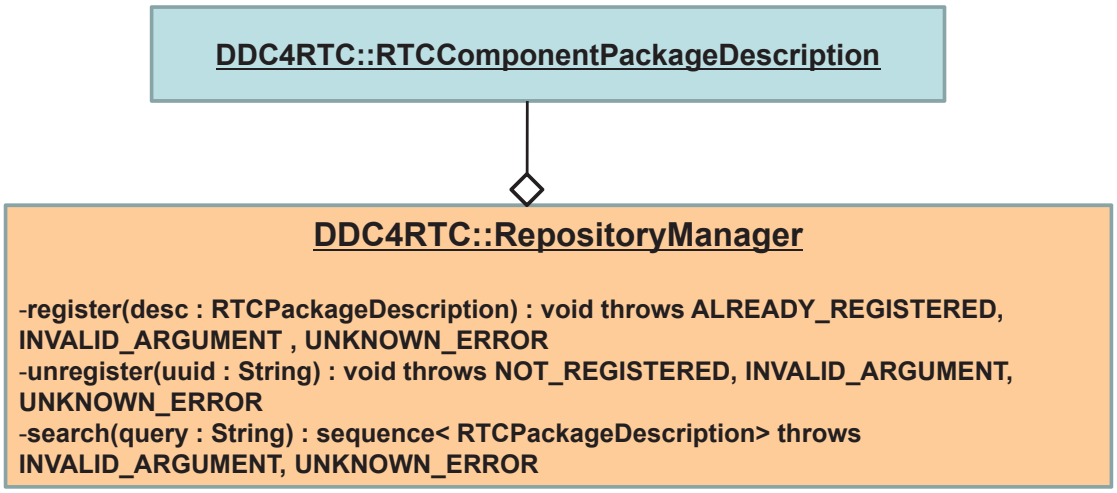
Class Diagram of Directory Manager



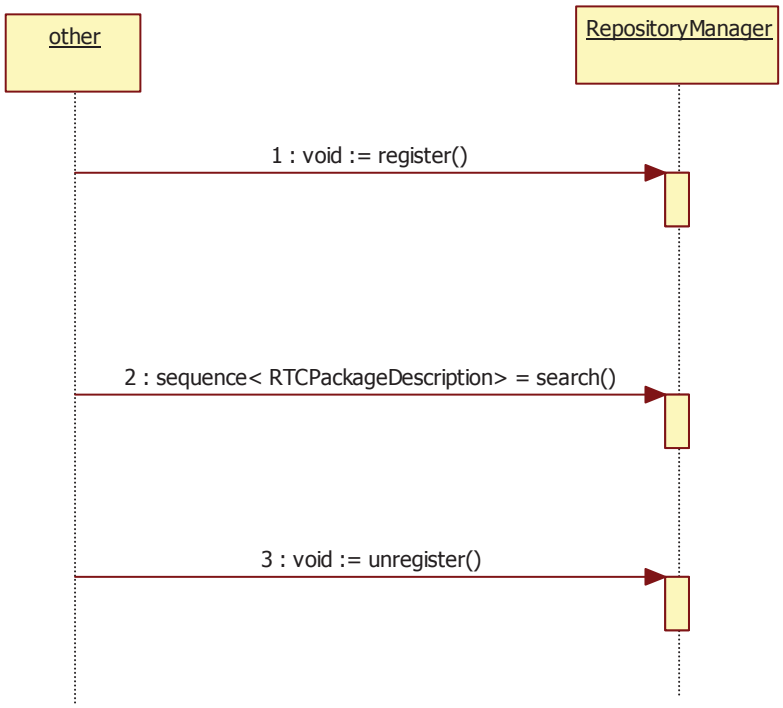
Repository Manager



Repository Manager



Sequence diagram of Repository Manager



4 Component Management Model

4.1 RepositoryManager

4.1.1 Description

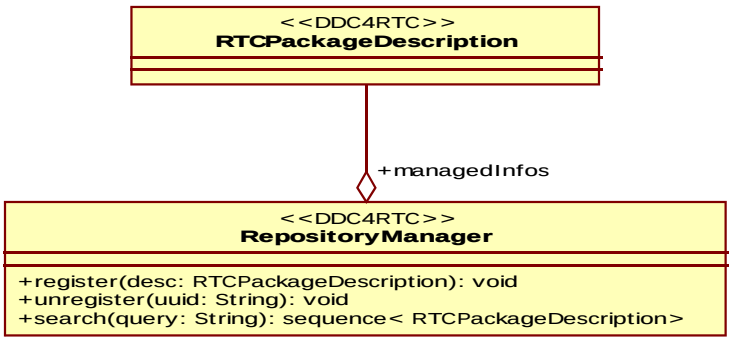


Figure 4.1 - Class diagram of RepositoryManger

The RepositoryManager provides the interfaces for storing, searching, and retrieving RTCs, and the data model for the component profile description. The RepositoryManager also provides the interfaces for storing, searching, and retrieving RTC-based systems and the data model for the RTC-based system profile description.

4.1.1.1 Attributes

No attributes.

4.1.1.2 Operations

- register(desc : RTCPackageDescription) : void throws ALREADY_REGISTERED, INVALID_ARGUMENT , UNKNOWN_ERROR

  This function registers a package to the repository under the given package information. It throws ALREADY_REGISTERED when the package is already registered, INVALID_ ARGUMENT when the package description is not correct, and UNKNOWN_ERROR when there is some error occurred.

- unregister(uuid : String) : void throws NOT_REGISTERED, INVALID_ARGUMENT, UNKNOWN_ERROR

  This function deletes a package from the repository. It throws NOT_REGISTERED when the package is not registered, INVALID_ ARGUMENT when the uuid is not correct, and UNKNOWN_ERROR when there is some error occurred.

- search(query : String) : sequence< RTCPackageDescription> throws INVALID_ARGUMENT, UNKNOWN_ERROR

This function searches a set of packages which meet the given condition and returns a sequence of RTCPackageDescription. The condition is given by the query which is described by the ISO/TC211 Graphic Information-filter encoding(ISO reference number : 19143). It throws INVALID_ ARGUMENT when the query is not correct, and UNKNOWN_ERROR when there is some error occurred.

4.1.1.3 Associations

- managedInfos: RTCPackageDescription[0..*]

  The RepositoryManager manages a set of RTCPackageDescriptions.

4.1.1.4 Constraints

No constraints.

4.1.1.5 Semantics

No semantics.

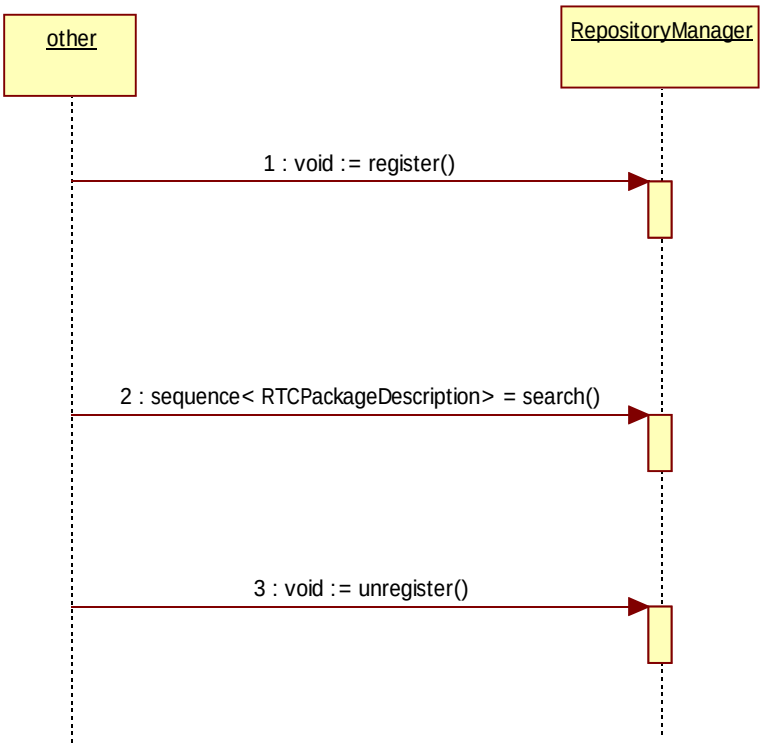


Figure 4.2 - Sequence diagram of RepositoryManger

5 Target Data Model

7 Target Data Model

7.1 Event Management Model

The Event Management Model of DDC4RTC provides certain functionality such as notifying environmental changes to RTC based applications or filtering such events based on previously registered condition. The model uses the OMG Notification Service Specification. The ApplicationSupervisor of DDC4RTC inherits the StructuredPushConsumer defined in the Notification Service Specification.

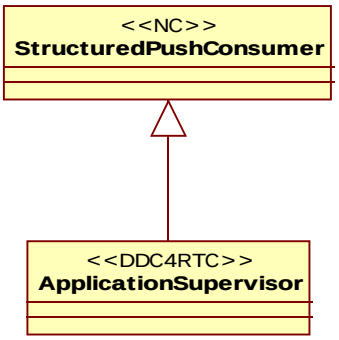


Figure 7.1 - Class diagram of Event Management Model

7.2 DirectoryManager

7.2.1 Description

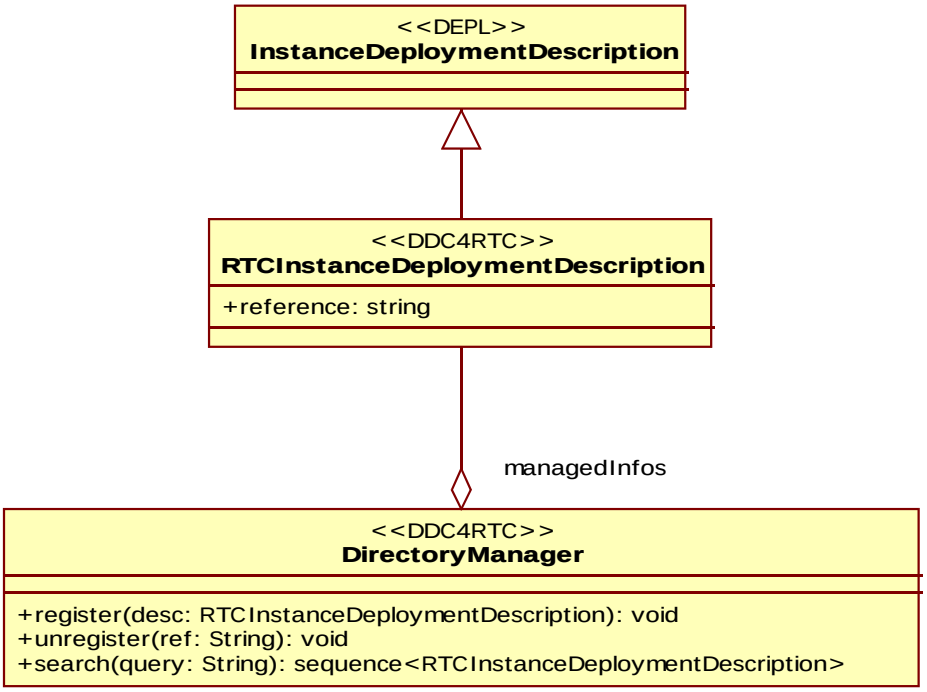


Figure 7.2 - Class diagram of DirectoryManager

The DirectoryManager provides the interfaces for RTC instance discovery and the data model which describes the RTC instance.

7.2.1.1 Attributes

No attributes.

7.2.1.2 Operations

- register(desc : RTCInstanceDeploymentDescription) : void throws ALREADY_REGISTERED, INVALID_ARGUMENT , UNKNOWN_ERROR

  This function registers the information of an RTC instance to the directory under the given information of the RTC instance. It throws ALREADY_REGISTERED when the RTC instance is already registered, INVALID_ ARGUMENT when the given information of the RTC instance is not correct, and UNKNOWN_ERROR when there is some error occurred.

- unregister(ref : String) : void throws NOT_REGISTERED, INVALID_ARGUMENT, UNKNOWN_ERROR

This function deletes the information of an RTC instance from the directory. It throws NOT_REGISTERED when the RTC instance is not registered, INVALID_ ARGUMENT when the ref is not correct, and UNKNOWN_ERROR when there is some error occurred.

- search(query : String) : sequence< RTCInstanceDeploymentDescription> throws INVALID_ARGUMENT, UNKNOWN_ERROR

  This function searches a set of RTC instances which meet the given condition and returns a sequence of RTCInstanceDeploymentDescription. The condition is given by the query which is described by the ISO/TC211 Graphic Information-filter encoding(ISO reference number : 19143). It throws INVALID_ ARGUMENT when the query is not correct, and UNKNOWN_ERROR when there is some error occurred.

7.2.1.3 Associations

- managedInfos: RTCInstanceDeploymentDescription[0..*]

  The DirectoryManager manages a set of RTCInstanceDeploymentDescription.

7.2.1.4 Constraints

No constraints.

7.2.1.5 Semantics

No semantics.

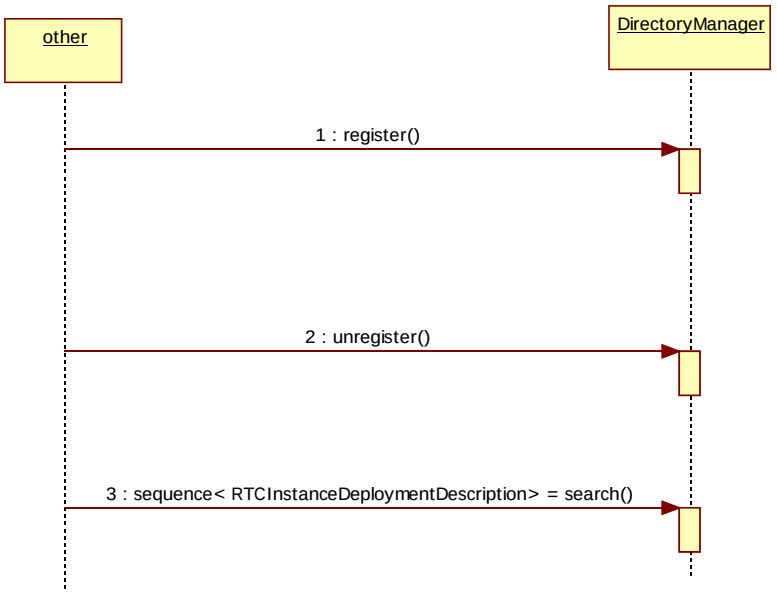


Figure 7.3 – Sequence diagram of DirectoryManager

List of Issues for RoIS Framework

OMG Santa Clara MTG
Robotic Functional Service WG
2011.12.14
Miki Sato & Koji Kamei (JARA/ATR),
Toshio Hori (AIST),
Su-Young Chi (ETRI)

Issues & Resolutions (1)

1. Command Result Message definitions:
   In 7.5.3, there is no profile for the result parameters related with 7.4.3.2
   ⇨ Related to Issue. 3 & 11
2. Relationship with RTC and ROS:
   Relationship with ROS, RTC should be clarified.
3. Parameter definitions for Error Message:
   In 7.4.3 “Message Data”, there is no definition of “Error Message” for “get_error_detail” method, and there is no profile for the result parameters for this message in 7.5.3.
   ⇨ Related to Issue. 1 & 11
4. Occurrence of sub component for Component Profile:
   In Table 7.29 “Component Profile”, occurrence of sub_component is N to avoid double definition. For example, if the each sub component include “RoIS_Common”, the main component may include the two same common messages defined in RoIS_Common. Therefore, the occurence should be "1".
   ⇨ Occurence should be "1".

Items in RED : not resolved yet.
Items in BLUE: several possibilities. Need more discussions.
Items in BLACK: resolved

Issues & Resolutions (2)

5. Parameter in HRI Engine Profile:

   In Table 7.30 “HRI_Engine_Profile”, parameters of HRI engine is defined in this profile. However, these parameter should be defined in the Component Profile of “System Information Component” for this Engine. Therefore, "parameter" definitions in HRI engine profile should be removed.

   ⇨ RESOLVED: “Parameter" definitions in HRI engine profile should be removed.

6. RoIS_Common in System Information component:

   In Figure 17, “RoIS_Common” should be removed because System Information component does not include RoIS_Common messages.

   ⇨ RESOLVED: Should be removed.

7. Parameters for System Information component:

   In Table 7.34 “System Information”, “robot ref(List<RoIS_Identifier>)” is required for “robot_position”, same as person position data in "Person localization"
   In addition, “position_data” should be List<Data>.

   ⇨ RESOLVED: robot ref (List<RoIS_Identifier>) should be added. Position_data be changed to List<Data>.

Issues & Resolutions (3)

8. Parameters for Localization component:

   In Table 7.36 “person_localization”(and other localization components), parameters of sensing-cycle and/or resolution (minimum position difference which sensor can distinguish) are required. These parameters should be added for (optional) get_parameter. In addition, Detection-cycle (multiple of sensing-cycle) and Detection-difference (larger than resolution) may be set by set_parameter.

   ⇨ RESOLVED: Refer to the RLS specification.

9. Parameters for Speech Synthesis component:

   In Table 7.44 “speech synthesis”, data type of the argument and result parameter of “character” should be “RoIS_Identifier”.

   ⇨ RESOLVED: Data type of the argument and result parameter of “character” are changed as “RoIS_Identifier”.

10. Additional Normative References:

    In 3.1 “Normative References”, ISO19143 (Geographic information - Filter encoding) should be added in the list. This reference is referred for QueryExpression.

    ⇨ RESOLVED: Should be added.

Issues & Resolutions (4)

11. Notification of Profile change:

    It is required to consider methods about notification when the engine or component profile changed.
    "receive_error" method is usable for this purpose.
    “PROFILE_CHANGED (tentative name)” should be added in the enumeration of "Error Type" (Table 7.7). However, this status is not an error, so "receive_error" and "Error Type" should be renamed.

    ⇨ HOMEWORK: Including restructuring all the message classes.

12. Wrong Expression:

    P.23 line 3, “each type of error” should be corrected to “each error”.

    ⇨ RESOLVED: Should be corrected

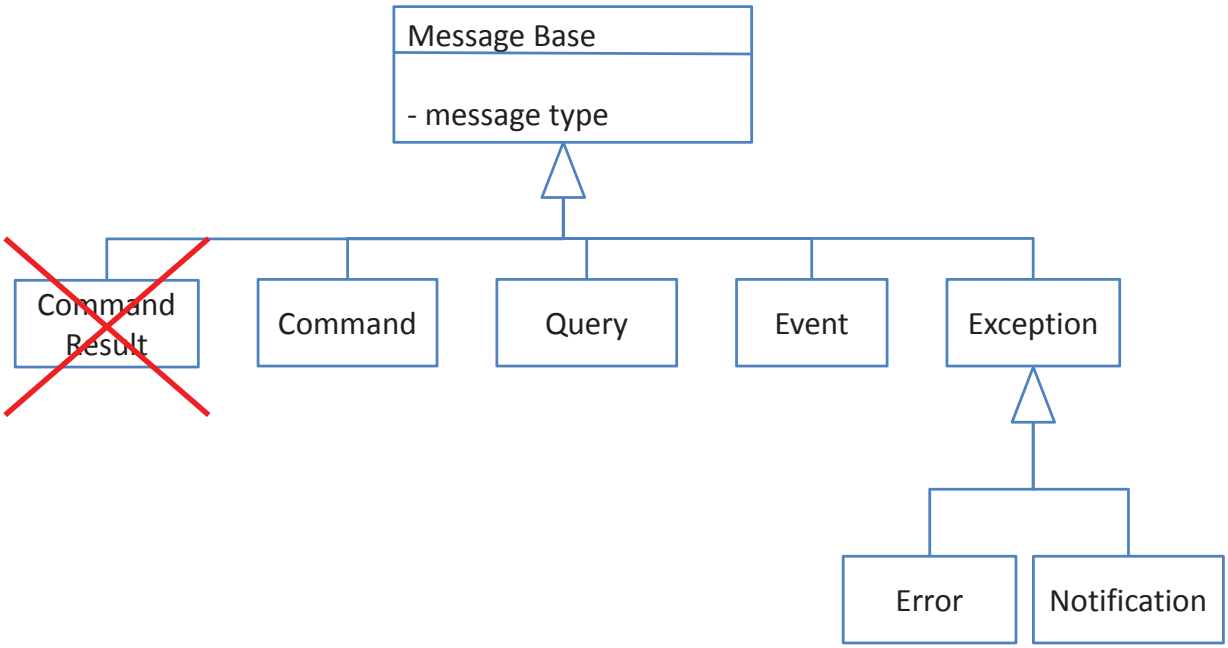
13. Condition for identifying message:

    Condition of “get_error_detail (Table 7.2),” “get_command_result (Table 7.3),” and “get_event_detail (Table 7.5)” can be omitted because these method can identify their message by message_id (such as command_id, event_id and error_id).

    ⇨ NEED MORE DISCUSSIONS: Remove / Make them optional

    ⇨ Related to 22.

Message structure



Issues & Resolutions (5)

14. Definition of HRI Engine is ambiguous in Section 4.

    ⇨ RESOLVED: New definition is "An object that manages HRI Components. It mediates Human-Robot Interaction functions of the HRI Components to Service Application(s)."

15. Order of HRI Engine and Service Application should be changed in Section 4.

    ⇨ RESOLVED: should be changed

16. A method for atomic allocation of multiple HRI Components is required to avoid race condition.

17. Dependencies (Requisite conditions) among HRI Components should be defined in HRI Profile.

18. Methods "search," "bind" and "bind_any" may be extended for allocating multiple components at once.

19. Misspelling:

    In Table 7.2 (P.31) The word "Enghien" should be "Engine" (in the "connect" row) [Hori]

    ⇨ RESOLVED

Issues & Resolutions (6)

20. Unifying Notation of Terms:

    "HRI Engine," "HRI Components," and other terms defined in Section 4 should be unified as in the definition table. [Hori]

21. Complex "Command Unit List":

    Implementing "Command Unit List" is very difficult. It should be simplified.

22. "Condition" is ambiguous:

    "Condition" is used in many interfaces and methods, but it is difficult to implement without examples.

23. General System Message Class should be defined:

    ⇨ Related to Issue 1, 3 & 11.

Please consult the 2011/12/12 version document, too, for further information.

Condition (1)

1. get_profile / search / bind_any

   →"condition" is mainly used for selecting Engine/Component. engine_name, engine_ref, System Information(position, status(only for get_profile), operable time), component_name, component_ref can be used as "common condition". Other conditions may be treated as "component specific condition".

2. get_error_detail / command_result / event_detail

   →ID for each message is enough for this purpose. "condition" can be omitted.

3. query

   →same as 1.

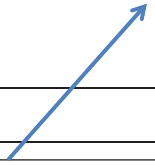
4. subscribe

   → There are two types, i.e., condition for selecting engine/component and condition for event occurrence. Need more discussions

Condition (2)

```
<condition>
  <param name="engine_name">Robot_A</param>
  <param name="status">READY</param>
</condition>
```

Operations	List of candidates supplied to condition parameter
get_profile search bind / bind_any query	- engine_name - engine_ref - System Information (position, status, operable time) - component_name - component_ref - …
subscribe	- position (RLS::Data? Simple Feature Access (ISO19125: Part 1)?) …
get_event_detail	???



ISO19125: Part 1 = OGC 06-103r4

Homework assignment

Chair	Issue No. (*)
Hori	1, 3, 11, 21, 23
Kamei (Sato)	2, 16, 17, 18, 22
Chi	1, 3, 11, 22, 23

(*) Issue numbers are based on the list (pp.2–8) in this document, NOT the numbers assigned by OMG (http://www.omg.org/issues/rois-ftf.open.html).

Private meeting in Korea (tentative)

- Date: Feb. 3(Fri.) & 4(Sat.) full day, 2012. (tentative)
- Place: Incheon, Korea (tentative)
- Purpose: To discuss unresolved issues.

- Organizers: ETRI & KAR

DDC4RTC Progress Report

(Santa Clara meeting)

Noriaki Ando(AIST), Seung-Woog Jung(ETRI)
and Tetsuo Kotoku(AIST)

mars/2011-12-08

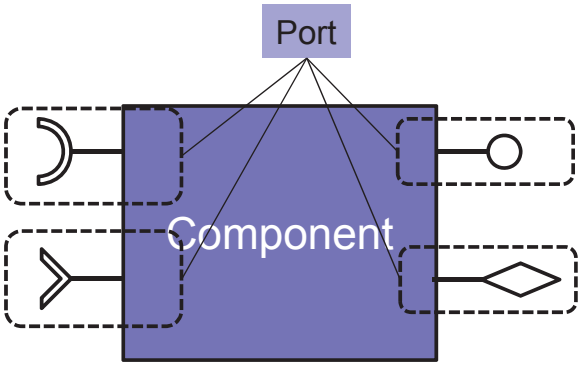
TOC of the Specification

Topics of This Meeting

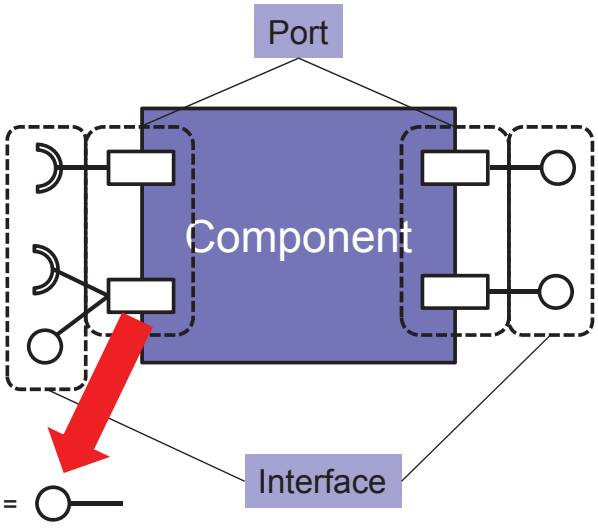
- Merged submission has been postponed
  - Next March (Washington) meeting
- Reviewed implementation by Shibaura-IT
  - CanOpen-based RTC D&C platform
- Reviewed merged submission
  - Component Data Model
  - Some diagrams are created and updated from the discussion
  - Sequence diagrams will be added for readers' convenience

Port in DEPL and RTC

Port and Component in DEPL

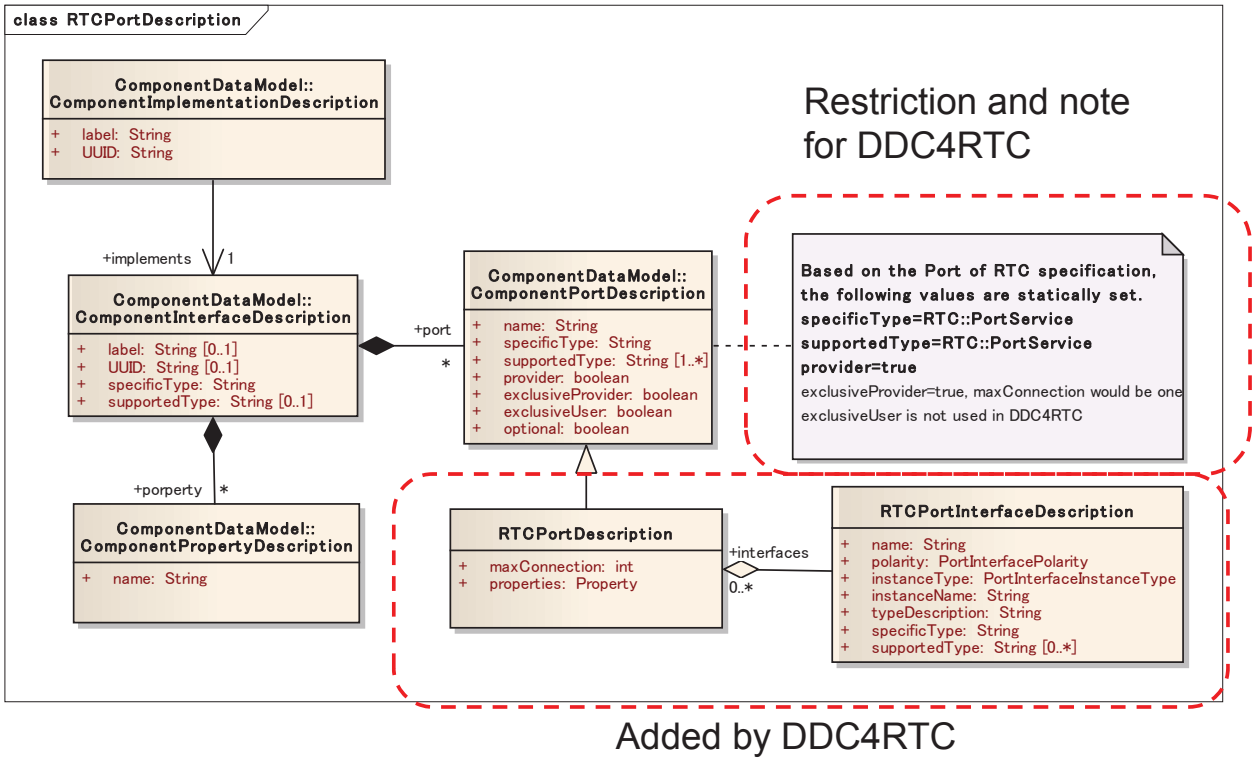


Port and Component in RTC

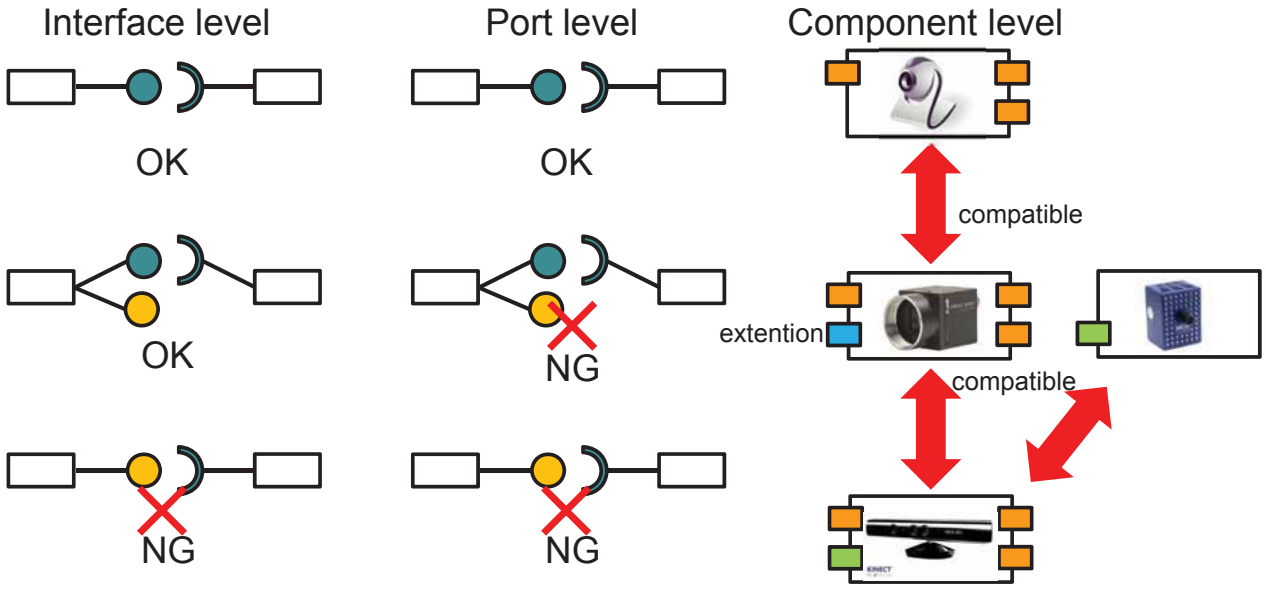


Port itself is a service (RTC::PortService)

DDC4RTC Port description



Compatibility of Components



DEPL: Component interface and ports
RTC: Port and it service interfaces

Proposal

- We would like to make a motion to extend the revised submission deadline for Dynamic Deployment and Configuration for RTC (DDC4RTC) [mars/2010-06-16] to February 20th, 2012, 4 weeks before the March meeting in Reston.

Robotics-DTF

Date: Friday, 16th December, 2011
Chair:, T. Kotoku and Y. –J. Cho
URL: http://robotics.omg.org/
email: robotics@omg.org

➢Highlights from this Meeting:

Extend the revised submission to Robotic Interaction Service for RTC (DDC4RTC) [mars/2011-12-08]

Robotics Plenary: (18 participants)

- **3 Talks**
  - **"The Legal Aspects of Autonomous cars", Bryant Walker Smith (Stanford Univ.)**
  - **"Proteus: An ontology for experimental validation of solutions to robotic problems" , Laurent Rioux (THARES) [robotics/2011-12-04]**
  - **"Domestic Standardization Activity for Standardizing Voice Interface for Service Robots in Japan", Yosuke Matsusaka(AIST) [robotics/2011-12-05]**
- **2 WG Reports**
  - **Robotic Infrastructure WG [robotics/2011-12-09]**
  - **Robotic Functional Services WG [robotics/2011-12-07]**

Robotics-DTF

Date: Friday, 16th December, 2011
Chair:, T. Kotoku and Y. –J. Cho
URL: http://robotics.omg.org/
email: robotics@omg.org

➢Future deliverables (In-Process):

- **Dynamic Deployment and Configuration for RTC (DDC4RTC) revised submission**

➢Next Meeting (Raston):

- **Election of a Robotics-DTF Co-Chair**
- **Review of the revised submission of DDC4RTC**
- **Guest presentation**
- **Contact reports**
- **Roadmap discussion**

Minutes of the Robotics DTF Meeting -- DRAFT
December 12-16, 2011
Santa Clara, CA, USA
(robotics/2011-12-21)

Meeting Highlights

- The deadline of the DDC4RTC revised submission was extended to the upcoming Reston Meeting.
- The final report of Robotic Technology Component (RTC-1.1) was accepted to issue.
- Three presentations;
  - "The Legal Aspects of Autonomous cars", Bryant Walker Smith (Stanford Univ.)
  - "Proteus: An ontology for experimental validation of solutions to robotic problems" , Laurent Rioux (THARES) [robotics/2011-12-04]
  - "Domestic Standardization Activity for Standardizing Voice Interface for Service Robots in Japan", Yosuke Matsusaka(AIST) [robotics/2011-12-05]

List of Generated Documents

robotics/2011-12-01 Final Agenda (Tetsuo Kotoku)
robotics/2011-12-02 Salt Lake City Meeting Minutes [approved] (Seung-woog Jung and Miki Sato)
robotics/2011-12-03 Opening Presentation (Tetsuo Kotoku)
robotics/2011-12-04 Proteus: An ontology for experimental validation of solutions to robotic problems (Laurent Rioux)
robotics/2011-12-05 Domestic Standardization Activity for Standardizing Voice Interface for Service Robots in Japan (Yosuke Matsusaka)
robotics/2011-12-06 List of Issues for RoIS Framework [Mon. version] （Toshio Hori)
robotics/2011-12-07 Robotic Functional Services WG Report (Toshio Hori)
robotics/2011-12-08 List of Issues for RoIS Framework [Tue. version] (Toshio Hori)
robotics/2011-12-09 Infrastructure WG Progress Report (Noriaki Ando)
robotics/2011-12-10 RTC1.1-RTF Report (Geoffrey Biggs)
robotics/2011-12-11 ISO/TC184/SC2 Contact Report (Su-Young Chi)
robotics/2011-12-12 IEEE/RAS Standardisation (Geoffrey Biggs)
robotics/2011-12-13 Wrap-up Presentation (Tetsuo Kotoku)
robotics/2011-12-14 Roadmap for Robotics Activities (Tetsuo Kotoku)
robotics/2011-12-15 Next Meeting Preliminary Agenda - DRAFT (Tetsuo Kotoku)
robotics/2011-12-16 Event, Repository, Directory Manager for DDC4RTC (Seung-woog Jung)
robotics/2011-12-17 Component Management Model and Target Data Model (Seung-woog Jung)
robotics/2011-12-18 List of Issues for RoIS Framework [Wed. version] (Toshio Hori)
robotics/2011-12-19 DDC4RTC Progress Report [mars2011-12-08] (Tetsuo Kotoku)
robotics/2011-12-20 DTC Report Presentation (Tetsuo Kotoku)
robotics/2011-12-21 Santa Clara Meeting Minutes - DRAFT (Miki Sato and Seung-woog Jung)

Robotic Technology Component RTF report	dtc/11-11-02
Specification with change bars	dtc/11-12-03
Specification without change bars	dtc/11-12-02
C++ header file	dtc/11-11-05
IDL file	dtc/11-12-04
XMI file	ptc/11-12-03
EAP files	ptc/11-12-04
Inventory	ptc/11-12-02

Minutes

Tuesday, 13 Dec, 2011, Bayshore East, 2nd Fl.
Robotics DTF Plenary Meeting
AIST, ETRI, JARA, UEC, Univ. of Tokyo, Univ. of Tsukuba (Quorums: 4)
18 attendees

10:55 - 11:00 Robotics DTF Opening Session, Chair: Dr. Kotoku
- Minutes takers: Seung-Woog Jung (ETRI) and Koji KAMEI (ATR)
- Salt Lake City Meeting minutes review
  approved : Univ. of Tokyo (motion), ETRI (second), Univ. of Tsukuba (white ballot)

11:00 - 12:00 Special Talk: Bryant Walker Smith (Stanford Univ.)
The legal aspects of autonomous cars

13:00 - 13:45 Special Talk: Laurent Rioux (THARES)
An ontology for experimental validation of solutions to robotics problems

13:45 - 14:30 Special Talk: Yosuke Matsusaka (AIST)
Domestic Standardization Activity for Standardizing Voice Interface for Service Robots in Japan

15:00 - 15:40 WG Reports
- Functional Service WG, Toshio Hori (AIST)
  . Review of issues & resolutions
    * 22 issues arising (15 from Kissimmee, then discussed in Tokyo)
  . Future schedule
    * Comments Due : 20th Feb, 2012
    * Report Due : 21st May, 2012
    * Report Deadline : 29th June, 2012
- Infrastructure WG, Noriaki Ando (AIST)
  . Merged submission has been postponed : Next March (Washington) meeting
  . Reviewed implementation by Shibaura-IT
    * CAN-open based RTC D&C platform
  . Reviewed merged submission
    * Component Data Model
    * Some diagrams are created and updated from this discussion
    * Sequence diagram will be added for readers' convenience
  . Port in DEPL and RTC is different
    * DEPL component model is based on CCM
    * RTC component model is based on UML component model
    * add additional features to DEPL for DDC4RTC
  . Compatibility of Components
    * interface level
    * port level
    * component level
  . ISO 19143 for describing query and constraints
- RTC 1.1 RTF, Geoffrey Biggs (AIST)
  . Comments from 3 sources
  . 8 resolved issues, 9 deferred issues, 1 duplicate

. AB comment : XMI exportable
- Deferred because it is API-breaking.
* should be handled in the next major version.

15:40 - 16:00 Contact reports

- ISO TC184/SC2 (Robots and robotic devices), Su-Young Chi (ETRI)
  . Berlin meeting (2011/09)
    * ISO/TC184/SC2/WG7 : Personal care safety
    * ISO/TC184/SC2/WG1 : Vocabulary and characteristics
    * ISO/TC184/SC2/WG8 : Service Robots
  . Dates of next meetings
    * Mtg #17 : Feb. 10(Fri), Orlando, USA
    * Mtg #18 : July 13(Fri), Milano, Italy
- IEEE/RAS Standardization, Geoffrey Biggs (AIST)
  . two areas (led by Raj Madhaven)
    * Robot map data representation (P1873)
    * Ontology
  . Working Group accepted by the IEEE Standardization Association
    * October, 2011
    * Map data co-chairs : Wonpil Yu (ETRI), Geoffrey Biggs (AIST)
    * Ontology chair : Craig Schlenoff
  - Study group meeting at IROS 2011

16:00 - 16:30 Robotics DTF Wrap-up Session, Chair: Dr. Kotoku

- Robotics-DTF Co-Chair : postpone voting one more meeting
- Robotic Services WG Co-Chair
  . Miki Sato (JARA/ATR) -> Koji Kamei (JARA/ATR)
  . JARA (motion), AIST (second), ETRI (white ballot)
- Changing RoIS FTF chair requires vote (will be on Friday)
- Schedule for next meeting
  - DDC4RTC revised submission

ATTENDEE (18attendees):

- Noriaki Ando (AIST)
- Geoffrey Biggs (AIST)
- Su-Young Chi (ETRI)
- Young-Jo Cho (ETRI)
- Julien Deantoni (INRIA)
- Miwako Doi (Univ. of Tokyo / Toshiba)
- Toshio Hori (AIST)
- InCheol Jeong (ETRI)
- Seung-Woog Jung (ETRI)
- Koji Kamei (JARA/ATR)
- Tetsuo Kotoku (AIST)
- Laurent Rioux (THARES)
- Yosuke Matsusaka (AIST)
- Shuichi Nishio (JARA/ATR)
- Takashi Suehiro (UEC)
- Takashi Tsubouchi (Univ. of Tsukuba)
- Miki Sato (JARA/ATR)
- Bryant Walker Smith (Stanford Univ.)

Prepared and submitted by Seung-Woog Jung (ETRI) and Koji Kamei (JARA/AATR)