### Schedules:

<table>
<thead>
<tr>
<th>Time</th>
<th>TF/SIG</th>
<th>Host</th>
<th>Agenda Item</th>
<th>Purpose</th>
<th>Room</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td><strong>Architecture Board Plenary</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><strong>LUNCH</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><strong>Break</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><strong>Robotics Activity Charter Discussion</strong></td>
<td>Discussion for the future robots related activity and its authorization</td>
<td>Jefferson, Lobby Lv1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><strong>Robotics Activity Roadmap Discussion</strong></td>
<td>Discussion for the future robots related activity and its authorization</td>
<td>Jefferson, Lobby Lv1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><strong>SDO Activity Report in Washington Meeting</strong></td>
<td></td>
<td>GB Salon E, 1st FL</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><strong>Architecture Board Plenary</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Other Meetings of Interest to SDO

<table>
<thead>
<tr>
<th>Time</th>
<th>TF/SIG</th>
<th>Host</th>
<th>Agenda Item</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td><strong>New Attendee Orientation</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><strong>Tutorial - Software Radio Components Specification</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><strong>C4I Coalition Day</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><strong>Tutorial - Introduction to UML 2.0</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><strong>New Attendee Reception (by invitation only)</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><strong>Tutorial - Survey of OMG Specifications</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><strong>Meeting for Robotics Showcase (Nicole and</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><strong>RTC MARS Vanderbilt presentations</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><strong>RTC Coordination</strong></td>
<td></td>
</tr>
</tbody>
</table>
Preceding Activities

- **Presentation**  (by Prof. Makoto Mizukawa)
  April 26, 2004 (St. Louis TM)
  mars/2004-04-10

- **Robotics Information Forum**  
  August 24, 2005  (Montreal TM)
  Kick-off
  http://www.is.aist.go.jp/rt/events/20040824OMG.html
  mantis/2004-08-06 .. -10

Mailing List:
robotics@omg.org
Research on Task Intelligence and Robot Middleware

Takashi Suehiro
Task Intelligence Research Group
Intelligent Systems Research Institute
AIST

Robot Technology Middleware Project

• Supported by NEDO (New Energy and Industrial Technology Development Organization)
• about 100 million yen/year
• from 2002 to 2005

• RT means Robot Technology
Our Research Area
(Task Intelligence)

- Intelligent Manipulator Control
- Manipulation Skill
- Dexterous Hand and Gripper
- Man-Robot Interface
- Vision
- Task Modeling
- System Integration

Research Activities

- Projects
  - RT (Robot Technology) Middleware Project (2002-2005)

- Basic Researches
  - Fabric Handling Robot
  - Personal Manipulation Robot
  - Robot arm with tactile sensors
  - etc.
Manipulator Control

- Base of our research,
- not directly related with Robot Middleware.

- We found a limitation of system, which led us to Robot Middleware.

Servo Control of Direct Drive Manipulators

- We have developed sophisticated DD manipulator servo,
- position/force hybrid control in task space,
- implemented on MIPRCOC 16, 16bit high performance micro computer(4 mips).
- ETA2(1983), ETA3(1985)
ETA2

- 1983

Face Fitting Skill by ETA3

- 1988
Limitation of the Control System

- We wanted to apply more sophisticated control method. But, there were limitations of the control system.
  - CPU power
  - program structure

- We developed new control system on transputer network.
Multi-Agent Control System

- Distributed robot control system,
- We developed CORBA like system by ourselves, routing system, definition of typical agent structures and data structure, automatic generation of stubs and skeletons, and data marshalling library.
- This is conceptual base of our Robot Middleware.

Takumi: Intelligent Manipulator Control System

- Start from 1993

Stamping skill
Multi-Agent Control System on Transputer Network

- 1994

View of Takumi Control System

- 1995
Seal Stamping

• 1995

Skill on Multi-Agent System

• 1996
Parallel Execution of Touch Skills

Sequential execution

Parallel execution

Figure 3 Move-to-touch

Figure 7 Parallel execution of two move-to-touch skills

1. a → b: Parallel execution of move-to-touch skills
2. b → c: Execution of the remaining skill

Move to touch
Spreading Multi-Agent Concept

- We would like to develop all of our robot system as multi-agent system.
- But ...
Sensor Based Control System

- 2000

Robot Middleware

- Multi-agent system is conceptually good,
- but it is difficult to spread without specification of architecture and software support.

- Robot Middleware
What we have learned about system integration

- Robot systems are integration of many robotic technologies.
- Modularize structure is important.
- Behaviors of modules have typical patterns, which are characterized by flows of commands and data.
- We need specification of architecture.

General Framework of Robot Component

- Basic Structure of RT Component
Current State of AIST-RTM

Version: RTM-0.1.0 (pre-α)

- Base
  - IDL of RtComponent, InPort, OutPort
  - Implementation of them
    - CORBA: omniORB
    - OS: Linux, Windows
    - Language: C++, python

- samples
  - Provide sample programs(motor, sensor, controller) as templates of components.

- services
  - Supply a sample of connection and activity management GUI.

Resolved Motion Rate Control of Manipulator
Force Control of Manipulator

Robotic Space Application (MEW)
Placement of RT Components

1. Mobility: autonomous mobile robot
2. Visual Function:
   - Image Input: Active camera on mobile robot, camera in intercom
   - Image Output: Display in living room
3. User Interface: PDA(menu selection, speech recognition)
4. Other household appliances: Lights(Living, Dining, Kitchen rooms), Door of refrigerator, automatic door, electric door lock, intercom

Example of Service Scenario
Specification of Robot Middleware

- Discussion in JARA WG
- In OMG
  - specification of Robot Component Framework based on PIM of SDO(Super Distributed Object).
  - expansion of the framework and preparation of common services for robotic application areas.

END
Discussion of Charter on Robotics Activities

November 2, 2004
Arlington, VA

Charter on Robotics Activities (draft version)

- We focus on adaptations and extensions of OMG technologies that apply specific domain of the robot systems, which include interactions with physical entities like conventional manufacturing systems, remote operation systems for hazardous environments, entertainment robots, intelligent transportation systems, and various pervasive intelligent systems with sensor(s) and/or actuator(s). We anticipate daily life support systems will become one of the emerging markets in near future. Examples include systems that have one or more of the following characteristics: Interaction with real world, Interaction with human, and Interaction with virtual world.
- We promote mutual understanding between robot community and OMG community.
- We endeavor to collaborate with other organization for standardization, such as the one of home information appliance, and make an open effort to increase interoperability in the field of robotics.
- We extend specifications for Platform Independent Models (PIMs), the Unified Modeling Language (UML), the Common Object Request Broker Architecture (CORBA) / Common Object Services (COS), the Model Driven Architecture (MDA) and other standards that fall into the OMG purview. We develop new standards for specialized systems where no current baseline specifications exists such as MDA for Robotics. This means that the object technology is not limited to software but is extended to real object. This effort promotes the use of OMG technologies in various markets.
- For technology areas that overlap with other OMG Task Forces, we coordinate with the appropriate OMG subgroups and the Architecture Board to determine where the work will be accomplished.
Comments and Suggestions

• The draft charter is too long.
  4th paragraph: no enumerate all the OMG tech.
  1st paragraph: not need to say in so much detail

• Simple is better

Charter for Robotics Activities in SDO (revised version)

The purpose of the Robotics activities is to foster the integration of robotics systems from modular components through the adoption of OMG standards. To realize this purpose, we will:

• Adapt and extend OMG technologies that apply to the specific domain of robotics systems where no current baseline specifications exist, such as MDA for Robotics. The object technology is not solely limited to software but is extended to real objects. This effort promotes the use of OMG technologies in various markets.
• Promote mutual understanding between the robotics community and the OMG community.
• Endeavor to collaborate with other organizations for standardization, such as the one for home information appliances, and make an open effort to increase interoperability in the field of robotics.
• Coordinate with the appropriate OMG subgroups and the Architecture Board, for technology areas that overlap with other OMG Task Forces, to determine where the work will be accomplished.
## Roadmap for Robotics Activities

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Charter on Robotics Activities</td>
<td>In Process</td>
<td></td>
<td>issued</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Kotoku(AIST), Mizukawa(Shibaura-IT)</td>
</tr>
<tr>
<td>SDO model for Robotics Domain</td>
<td>Planned</td>
<td>discussion</td>
<td>draft RFP</td>
<td>RFP</td>
<td></td>
<td></td>
<td></td>
<td>Revised? Submittion</td>
<td>Kotoku(AIST), Suehiro(AIST), Lemaire(JARA), Sameshima(Hitachi)</td>
</tr>
<tr>
<td>Robotics Information Day [Technology Showcase]</td>
<td>Planned</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Yokomachi(NEDO), Kotoku(AIST)</td>
</tr>
<tr>
<td>Robotics: Initial Survey [Clarification of Target Item]</td>
<td>Planned</td>
<td>discussion</td>
<td>draft RFI</td>
<td>RFI</td>
<td>RFI due Presentation</td>
<td>review RFI response</td>
<td>review RFI response</td>
<td></td>
<td>(JARA), et al.</td>
</tr>
<tr>
<td>(Robot Middleware for Controller)</td>
<td>Future</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>to be discussed</td>
</tr>
<tr>
<td>(Robot Middleware for Specific Applications)</td>
<td>Future</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>to be discussed</td>
</tr>
<tr>
<td>(Robot Middleware Common Services)</td>
<td>Future</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>to be discussed</td>
</tr>
<tr>
<td>(Robot Middleware for Common Data Structures)</td>
<td>Future</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>to be discussed</td>
</tr>
</tbody>
</table>
Charter for Robotics Activities in SDO (revised version)

The purpose of the Robotics activities is to foster the integration of robotics systems from modular components through the adoption of OMG standards. To realize this purpose, we will:

- Adapt and extend OMG technologies that apply to the specific domain of robotics systems where no current baseline specifications exist, such as MDA for Robotics. The object technology is not solely limited to software but is extended to real objects. This effort promotes the use of OMG technologies in various markets.
- Promote mutual understanding between the robotics community and the OMG community.
- Endeavor to collaborate with other organizations for standardization, such as the one for home information appliances, and make an open effort to increase interoperability in the field of robotics.
- Coordinate with the appropriate OMG subgroups and the Architecture Board, for technology areas that overlap with other OMG Task Forces, to determine where the work will be accomplished.
## Roadmap for Robotics Activities

<table>
<thead>
<tr>
<th>Item</th>
<th>Status</th>
<th>DC</th>
<th>Burlingame</th>
<th>European</th>
<th>Boston</th>
<th>USA</th>
<th>TBD</th>
<th>TBD</th>
<th>POC / Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>SDO model for Robotics Domain</td>
<td>Revised</td>
<td>Initial Submission</td>
<td>Revised Submission</td>
<td>Mizukawa(Shibaura-IT), Suehiro(AIST), Lemaire(JARA), Sameshima(Hitachi)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Robotics Information Day (Technology Showcase)</td>
<td>Finalized</td>
<td>Initial Submission</td>
<td>Revised Submission</td>
<td>Mizukawa(Shibaura-IT), Suehiro(AIST), Lemaire(JARA), Sameshima(Hitachi)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Robotics: Initial Survey (Clarification of Target Item)</td>
<td>Revised</td>
<td>Initial Submission</td>
<td>Revised Submission</td>
<td>Mizukawa(Shibaura-IT), Suehiro(AIST), Lemaire(JARA), Sameshima(Hitachi)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Robot Middleware for Controller)</td>
<td>Future</td>
<td>Future</td>
<td>Future</td>
<td>Future</td>
<td>Future</td>
<td>Future</td>
<td>Future</td>
<td>Future</td>
<td>to be discussed</td>
</tr>
<tr>
<td>(Robot Middleware for Specific Applications)</td>
<td>Future</td>
<td>Future</td>
<td>Future</td>
<td>Future</td>
<td>Future</td>
<td>Future</td>
<td>Future</td>
<td>Future</td>
<td>to be discussed</td>
</tr>
<tr>
<td>(Robot Middleware Common Services)</td>
<td>Future</td>
<td>Future</td>
<td>Future</td>
<td>Future</td>
<td>Future</td>
<td>Future</td>
<td>Future</td>
<td>Future</td>
<td>to be discussed</td>
</tr>
<tr>
<td>(Robot Middleware for Common Data Structures)</td>
<td>Future</td>
<td>Future</td>
<td>Future</td>
<td>Future</td>
<td>Future</td>
<td>Future</td>
<td>Future</td>
<td>Future</td>
<td>to be discussed</td>
</tr>
</tbody>
</table>

---

**Next Meeting (Burlingame, CA):**

- **Robotics Technology Information Day (Mon.)**
  - Recruit new member

- **SDO Meeting (Sun.)**
  - SDO model for Robotics Domain, (discussion of RFP contents)
  - Robotics Technology: initial survey (discussion of RFI contents)
  - Robotics Activities motion proposal (new SIG / rename SIG)
  - Tactics for recruiting new participants (discussion)
OMG Documents Generated
sdo/04-11-01 SDO Final Agenda for Washington DC Meeting (Tetsuo Kotoku)
sdo/04-11-02 Introduction: Preceding Activities (Tetsuo Kotoku)
sdo/04-11-03 Invited Talk “Research on Task Intelligence and Robot Middleware” (Takashi Suehiro)
sdo/04-11-04 Charter Discussion (Tetsuo Kotoku)
sdo/04-11-05 SDO Roadmap (Tetsuo Kotoku)
sdo/04-11-06 PTC Report (Tetsuo Kotoku)
sdo/04-11-07 Minutes of Washington DC Meeting (Tetsuo Kotoku)

Agenda
09:20-09:30 Welcome and Review SDO Agenda
09:30-10:15 Presentation by Takashi Suehiro, AIST
10:30-11:00 Robotics Activity Charter Discussion
11:00-12:00 Robotics Activity Roadmap Discussion
13:00-14:00 SDO Model for Robotics Domain Discussion
14:00-14:30 Next Meeting Agenda Discussion

Minutes

2 November, Tuesday

Tetsuo KOTOKU, presiding co-chair
Meeting Week – Kick-off
- Called meeting to order at 09:20
- Tetsuo Kotoku introduced preceding activities.
  ✓ sdo/04-11-02 Preceding Activities
- Tetsuo Kotoku reviewed the Agenda.
  ✓ sdo/04-11-01 SDO Final Agenda for Washington DC

Invited Talk “Research on Task Intelligence and Robot Middleware”
- Takashi Suehiro (AIST) presented his research activities on intelligent manipulation, manipulation skill, dexterous hand, man-robot interface and vision system by using interesting video clips.
  ✓ sdo/04-11-03 Invited Talk “Research on Task Intelligence and Robot Middleware”

Robotics Activity Charter Discussion
- Tetsuo Kotoku presented the Draft Carter posted on the mailing-list and its revised one.
- Claude R. Baudoin (Schlumberger-Doll Research) explained his mailed comments, and helped to edit the revised version.
- Motion to issue the charter for the robotics working group in SDO SIG. Motion adopted by unanimous consent.
  ✓ sdo/04-11-04 Charter Discussion

Robotics Activity Roadmap Discussion
- Tetsuo Kotoku presented the Draft Roadmap.
- Claude R. Baudoin and Anthony Tarlano(NTT docomo) gave us their valuable comments and revised our roadmap.
- Olivier Lemaire(Matsushita Electric Works) made a query about the SDO roadmap except robotics.
- Seiichi Shin(The Univ. of Tokyo) answered the question. -No special activities now.
  ✓ sdo/04-11-05 SDO Roadmap
SDO Model for Robotics Domain Discussion
• Free discussion on SDO model for robotics. No specific action was taken.

We discussed the charter and the roadmap again.
• Andrew Watson (OMG) suggested renaming SDO-SIG or setting up new Robotics-SIG.
• Andrew Watson suggested that we had better to prepare a document explaining the objectives of the RFP and the RFI in our roadmap.

Meeting Wrap-up, Plan for Burlingame
• Tetsuo Kotoku presented the Draft Agenda for the next Burlingame meeting.
• Olivier Lemaire suggested adding the item “Robotics Domain SIG motion proposal.”
• Claude R. Bordin suggested adding the item “Tactics for recruiting new members” and to invite OMG staffs for Business Developing and Marketing.
  ✓ sdo/04-11-06 PTC Report

ADJOURNED @ 14:30 pm

Prepared and submitted by Tetsuo Kotoku (AIST)