

Robot Service Network Protocol Developed by Robot Service initiative

5th Japan – Korea Service Robot Workshop

November 26, 2009

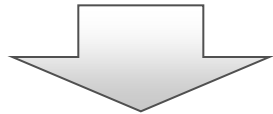
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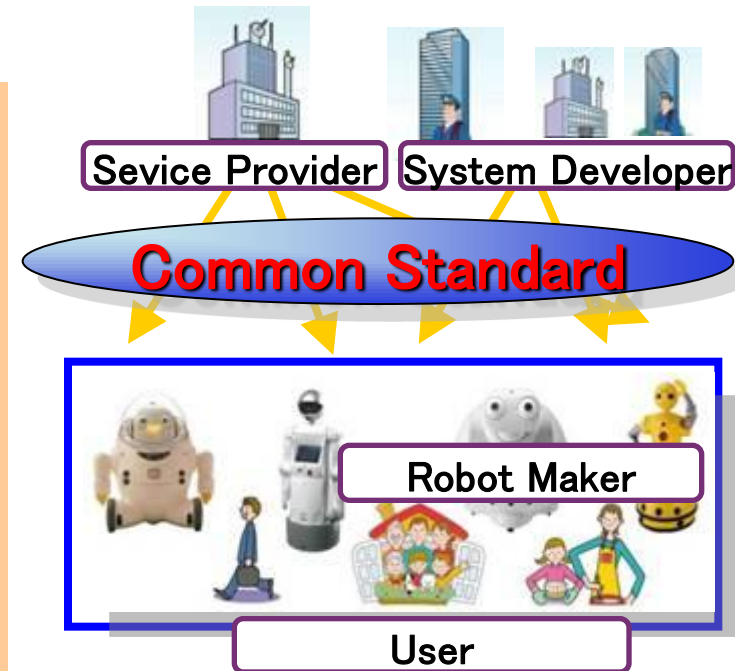
Need for Standardization

- Protocol for receiving information via network
 - Robots need “content.”
 - Weather information, traffic information, news, etc.
 - Standardization enables effective collaboration with various service venders.



Robot Service initiative (RSi)

- Various robots can use the same contents.
- Data from various robots can be uploaded onto the Internet to standardize services.
- Specifications can be created as a Robot Service Network Protocol (RSNP).



What is RSi?

■ Objectives

- To investigate the services that can be supported by network-connected robots
- To promote the use of these robot services so they contribute to the robot industry

■ Established on May 17, 2004

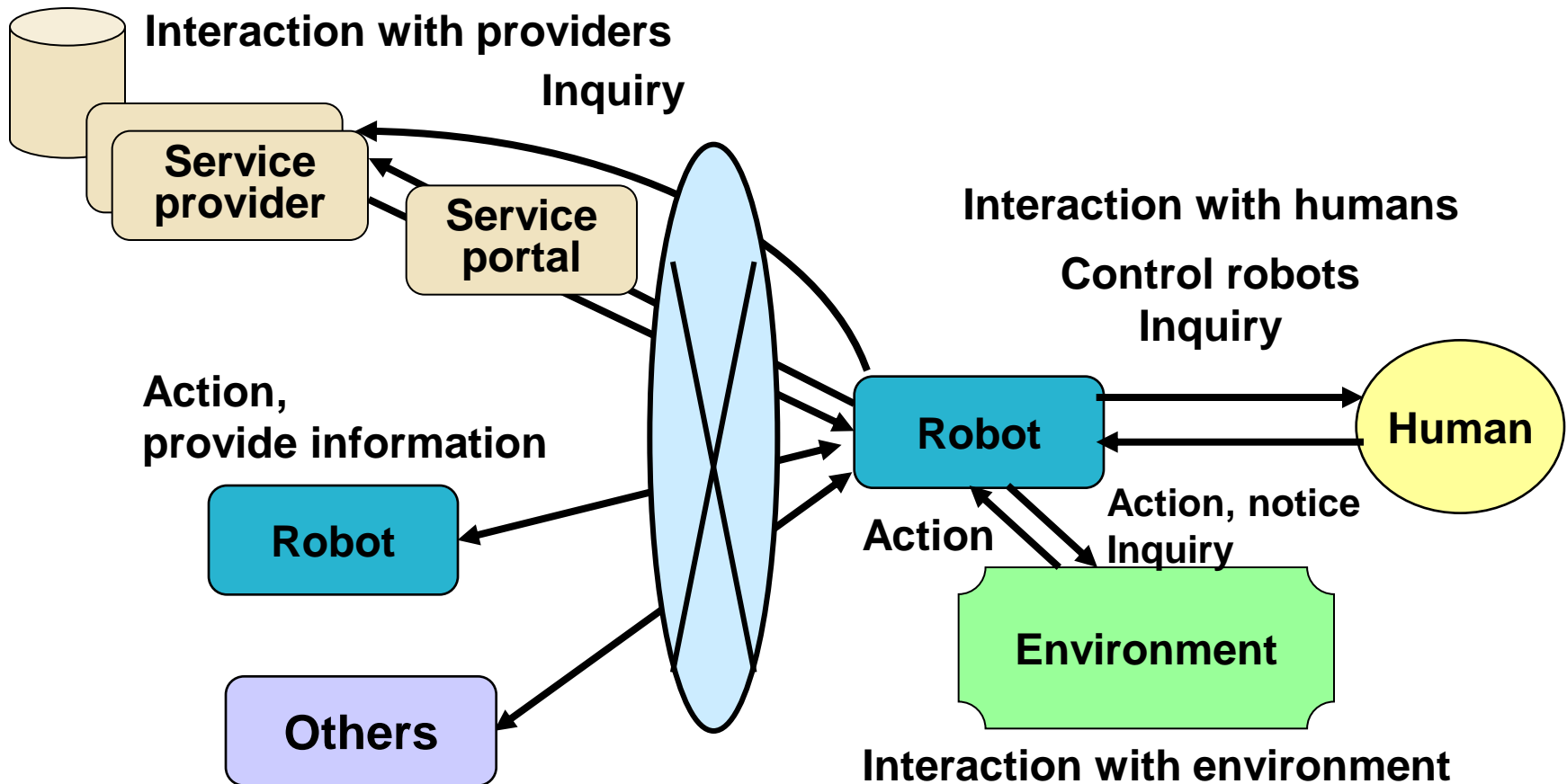
by Fujitsu, Mitsubishi Heavy Industries (MHI), and Sony

■ Eleven members as of November 2009

MHI, Fujitsu, Fujitsu Laboratories, Toshiba, Business Design Laboratory, Japan Weather Association, SEC, Lightware, NEC Communication Systems, Advanced Institute of Industrial Technology, Future University-Hakodate

Concept of RSNP

Open protocol for communication among robots and network services

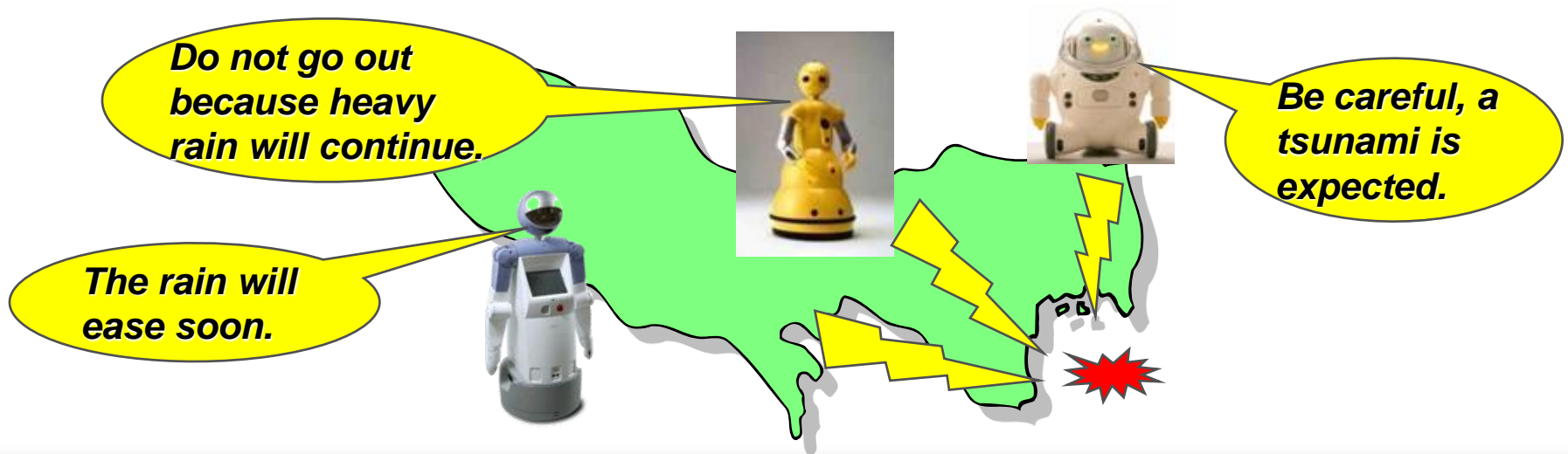


Service Examples of RSNP

- a. Disaster Information Service
- b. Monitoring Service
- c. Sales Promotion Service
- d. Robot Map

a. Disaster Information Service

- Disaster information from Japan Weather Association is analyzed and then distributed as disaster information comments
 - The following six types of information are provided: rainfall, lightning, earthquake, tsunami, volcano information, other warnings
 - Once a new piece of disaster information arrives at the server, it is distributed to the robot
 - Selects necessary information according to the region where the robot has been deployed to notify the people around



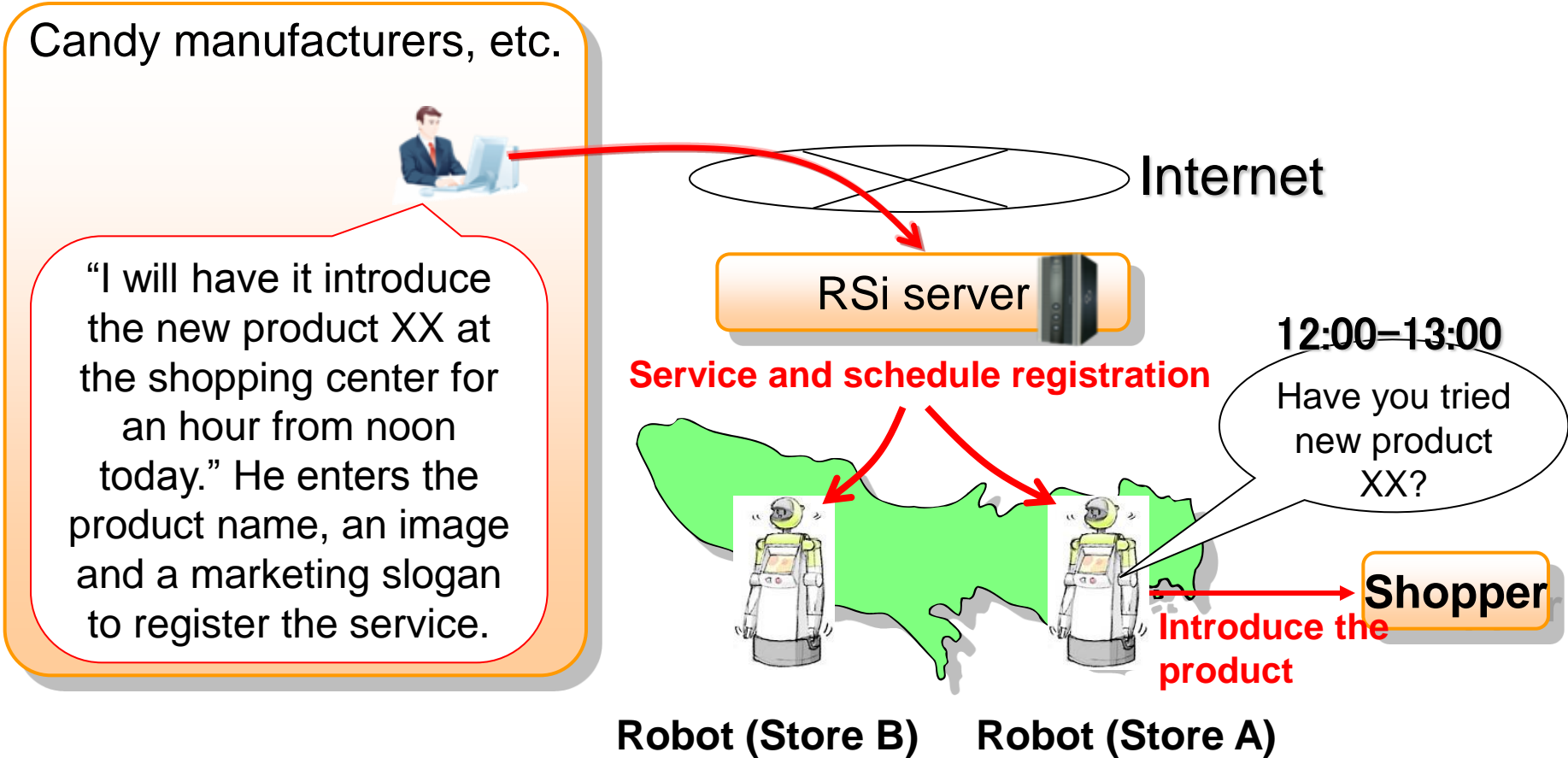
b. Monitoring Service

- Images from the robot camera are continually acquired
- Operation of the robot camera
- Multiple units are simultaneously monitoring
- Monitoring service can be used for House-sit monitoring, Home medical care and Inpatient monitoring service



c. Sales Promotion Service

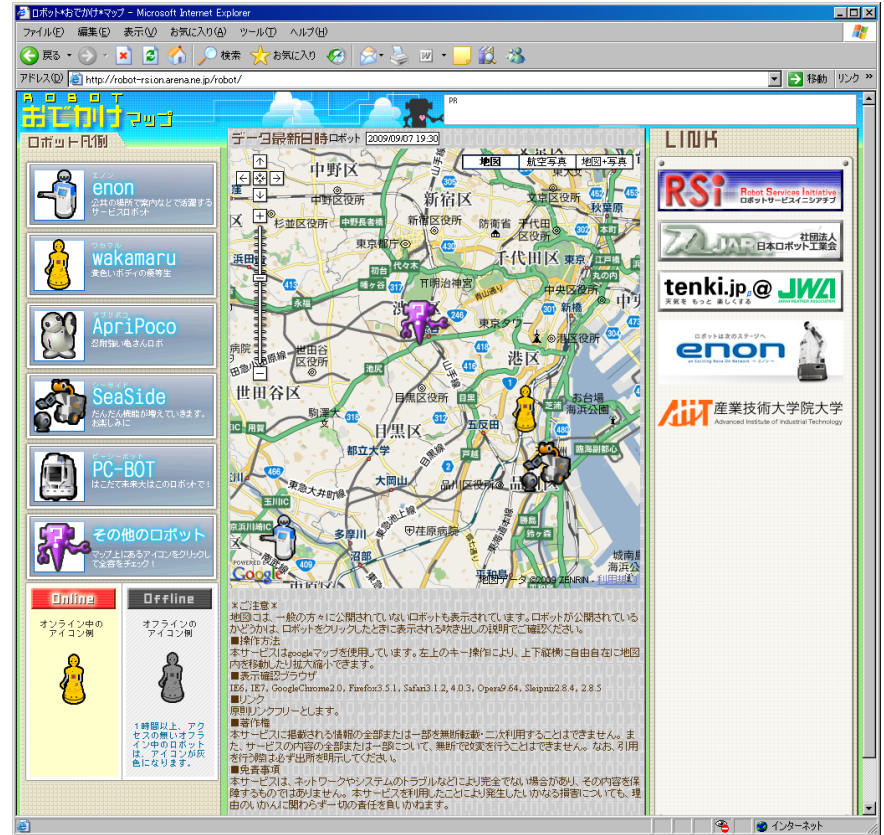
- Food manufacturers and others can use a robot located at a shopping center by the hour



d. Robot Map

- Service trial infrastructure -

- Robot Map
Shows that robots in various places are connected
- Can be used by general consumers as well
Possible topic of conversation
- Economic value
Improve the robot's ability to attract customers



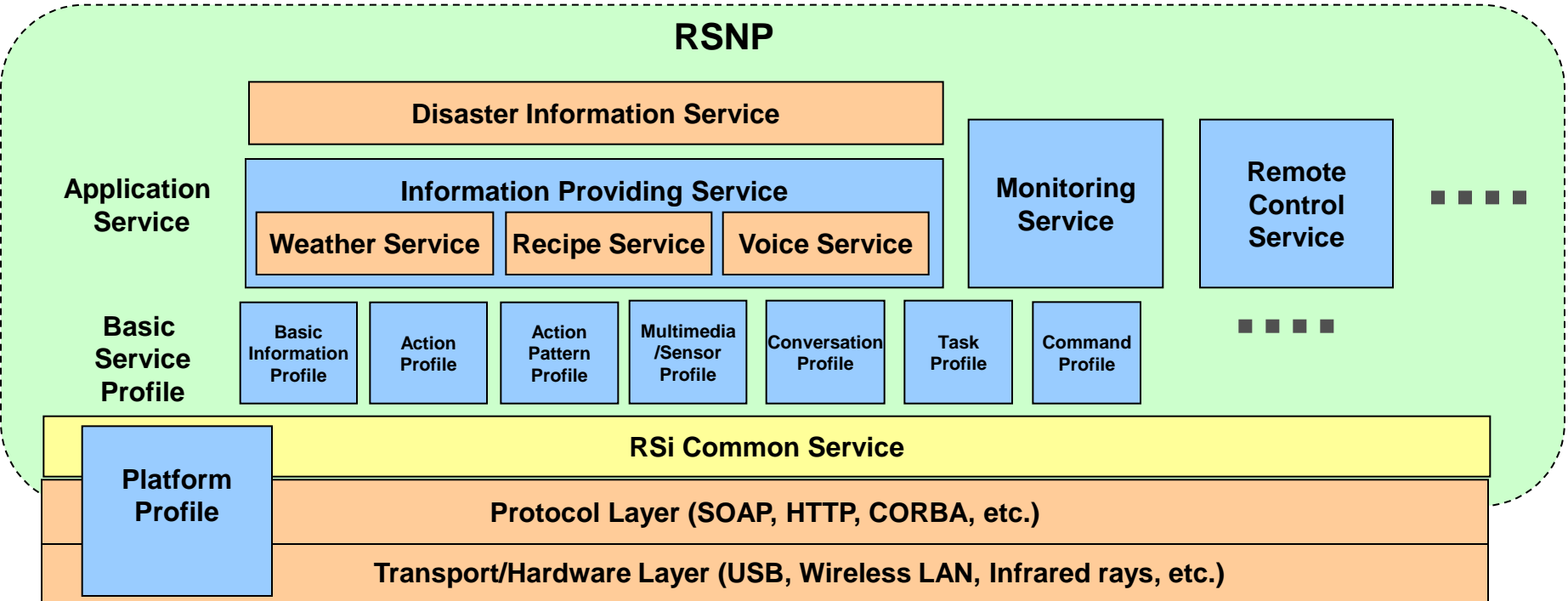
Approach on RSNP

- Create specifications for information services such as weather and disaster information
→ RSNP1.0 (2006)
- Create specifications for bidirectional (PUSH) communication, services associated with movements, sensor information upload, authentication, etc.
→ RSNP2.0 (2008)
- Create specifications for common behaviors and movements of robots as well as combinations of those behaviors and movements
→ RSNP2.1 (2009)

RSNP Architecture

- Specifies necessary functions to provide robot services
- RSNP = RSi Common Service + Profiles
- Common Service

Pull, Push, Asynchronous/Synchronous Communication



Profiles

- Application service profiles

Information services, such as disaster and weather information services, and remote control and monitoring services

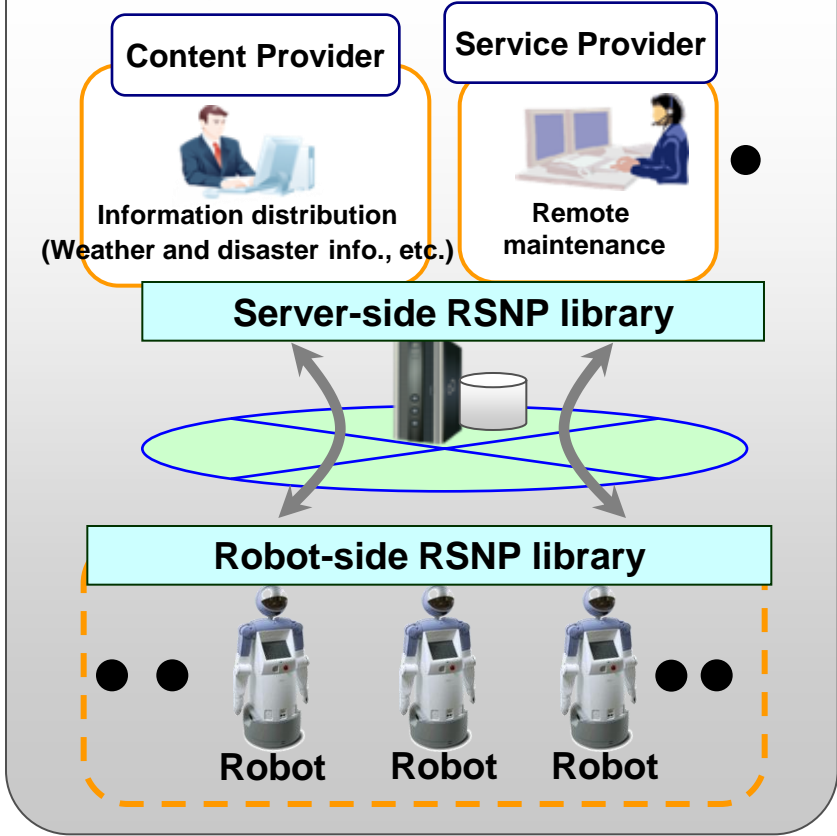
- Basic service profiles

Multimedia and sensor support, behavioral patterns and movements

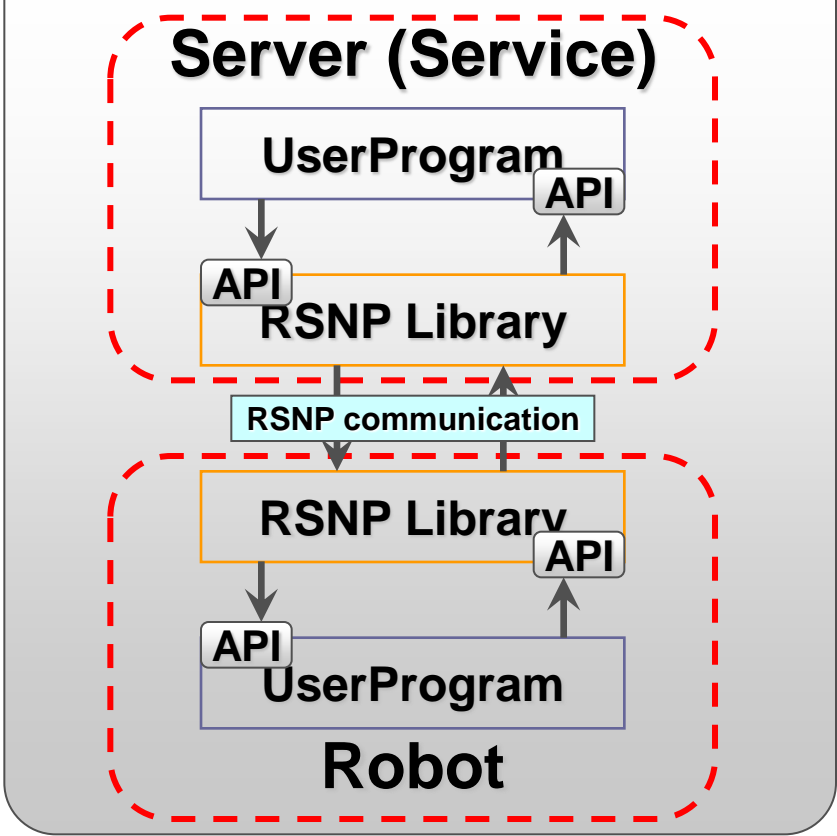
→ Service and robot features are provided as modules, and RSi is applicable to various different services and a number of robots having various functions

Structure of RSNP

Service provision image by RSNP



Configuration chart



Connecting the robot and the server via RSNP communication

The user program of the robot providing services connects the robot to the server via RSNP communication just by calling a library API, and the user program of the corresponding server performs processing (and vice versa)

Feature of RSNP

a. PUSH

Mechanism that necessary information is distributed to robots when necessary

b. Task Profile

Framework to change various robot services

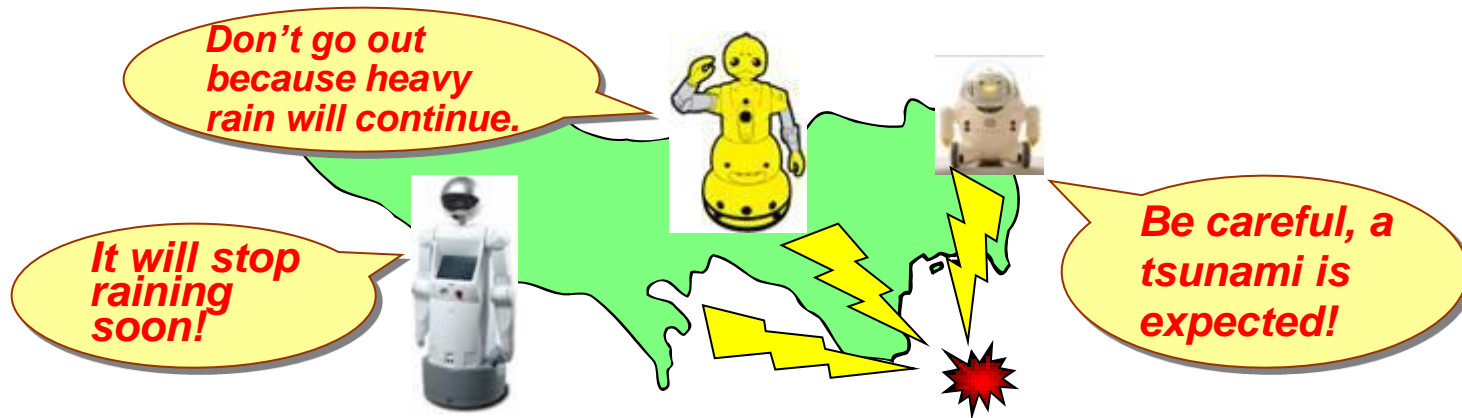
c. Command Profile

Framework to handle combinations of simple behaviors and movements common to robots for remote operation

d. RSi and RT Middleware

a. PUSH

Disaster information distribution service



Necessary information is distributed to robots when necessary
→ **PUSH-type transmission to robots is necessary**

- ◆ Conditions for resolving the issues of PUSH-type transmission to robots
 - Information must be able to go through firewalls
 - It is not necessary to have robots fitted with a server
 - IT standard specifications should be used as much as possible

b. Task Profile

Robot service Ensure robots can recognize the situation and have them perform various compound behaviors and movements based on that recognition

Examples of services: Giving guidance at facilities and exhibitions, introducing products, and going on patrol.

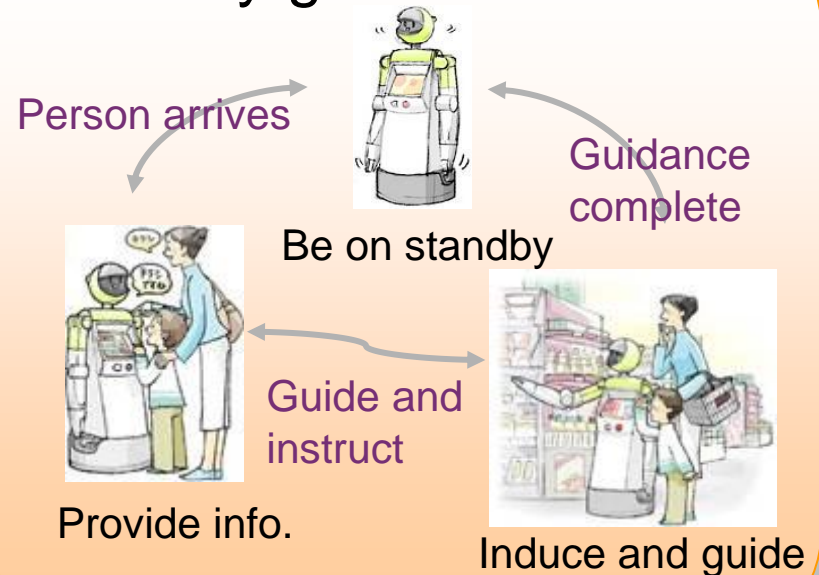


Task profile

Framework to handle various robot services

- Describe services (Describe service scenarios)
- Customize contents (Words and movements)
- Instruct when to execute (schedule), etc.

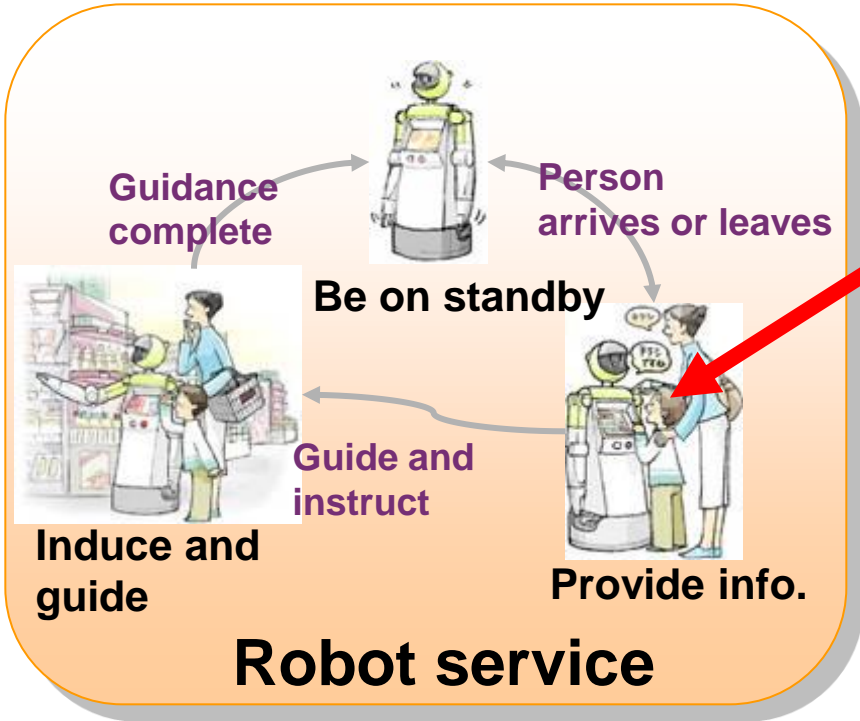
Facility guidance service



c. Command Profile

A remote operator instructs behaviors and movements while the robot carries out services

- Simple combined behaviors and movements such as gestures and utterances
- Common format to various robots



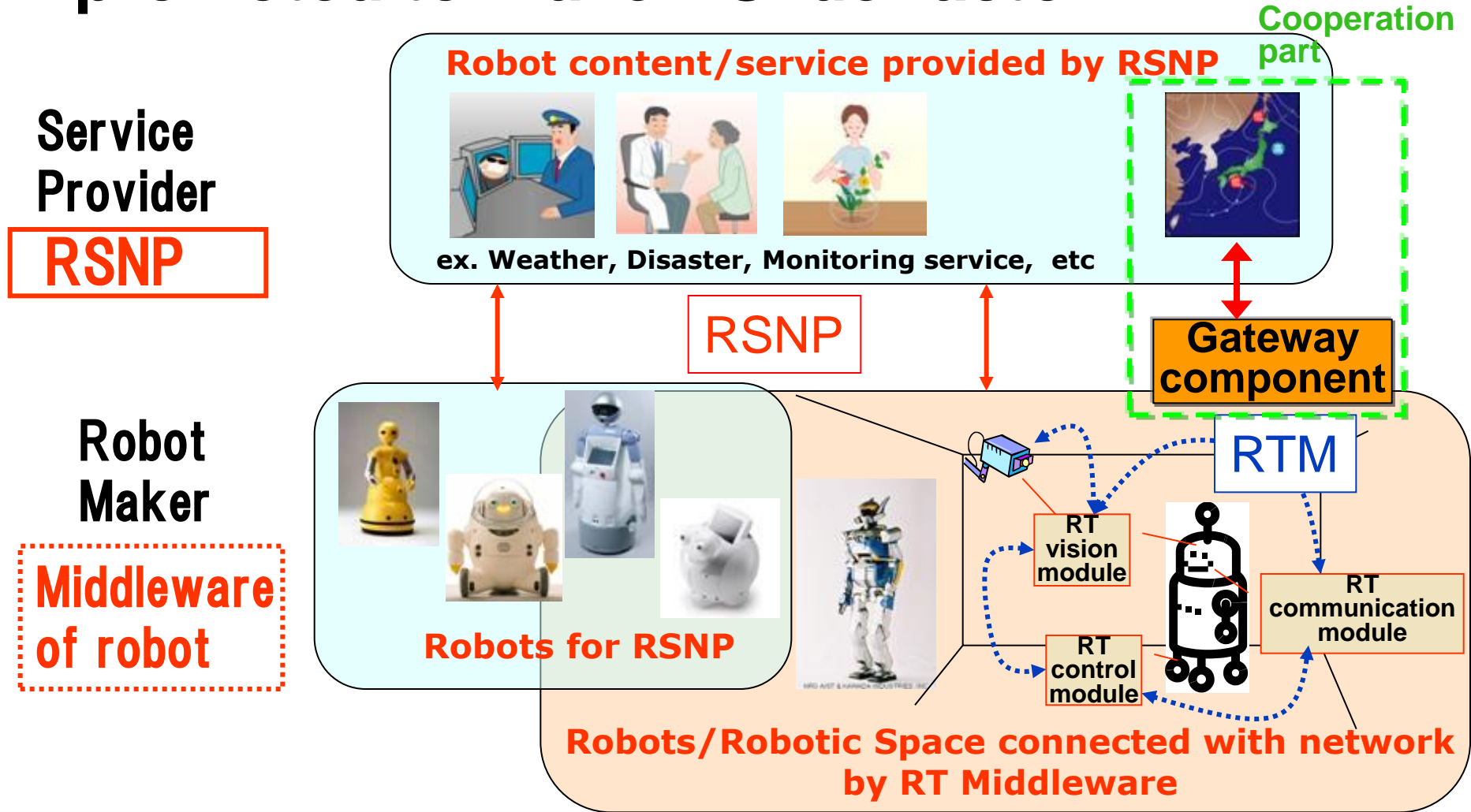
A time-limited sales bargain has just begun!

- Insert movements and utterances different from usual only at that time
- Check operations and recover the situation when a problem occurs

Command profile

d. RSi and RT Middleware

- RSi cooperates with RT middleware and promoted to make RSi de-facto



RSNP Library

- The library is provided as an SDK supporting RSNP
 - Integrated development environment: Eclipse
 - Required middleware: JavaSE, Tomcat, Axis2
 - SDK for robots and SDK for services
- Provided for RSi members free of charge
- Future plans
 - SDK for robots
 - It is possible to operate with a low-end CPU

Expression using Robot Map

The screenshot shows the Robot Map interface with several callouts:

- Various robots:** A list of robot types on the left side, including Enon (public service), Wakamaru (yellow robot), ApriPoco (tortoise robot), SeaSide (service robot), PC-BOT (train robot), and other robots.
- Locational Information:** A map of the Tokyo area showing the location of various robots, with a purple robot icon highlighted in the center.
- Advertisements:** A vertical banner on the right side containing advertisements for RSI (Robot Services Initiative), JARA (Japan Robot Association), tenki.jp@JWA (Japan Weather Association), enon (an existing save on network), and AIT (Advanced Institute of Industrial Technology).
- Real-time operation status:** A section at the bottom left showing the status of robots, with a yellow robot icon indicating online status and a grey robot icon indicating offline status.

Expansibility of the Robot Map

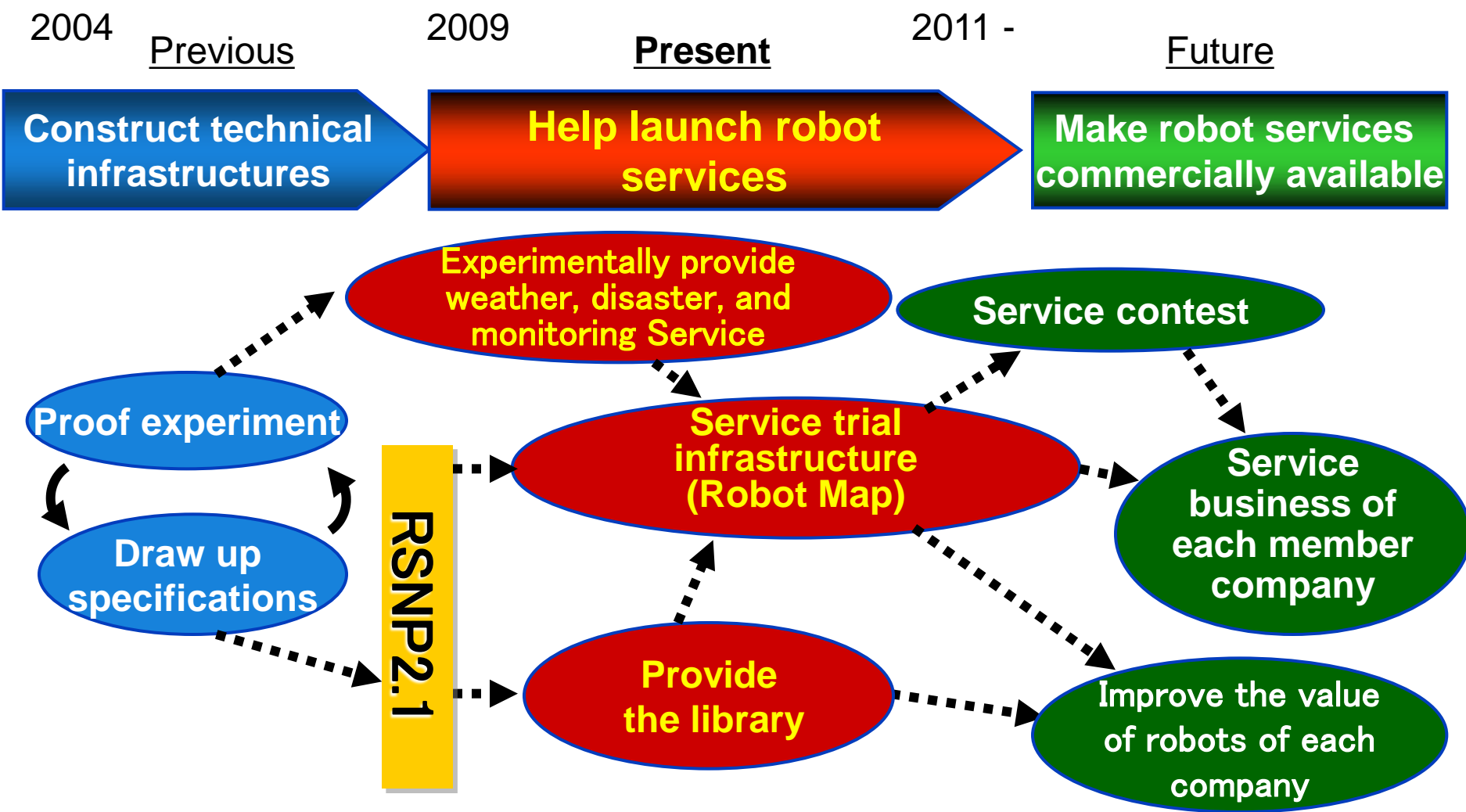
- The robot map can be used for the following image displays:
 - Images from the robot's camera
 - Photographs of the installation location
 - Display of detailed information on the robot
 - Advertisements
- Link to other services
 - Monitoring function
 - Distribution of messages and advertisements
 - Remote operation
 - Maintenance



Operation of the Robot Map



Roadmap



Conclusion

- We were able to establish RSNP as a technical infrastructure to provide robot services

From now on, we will:

- Maintain a development environment and other environments to make it easier to use
- Have many researchers and students use the library to create and expand new robot services
- Utilize the robot map to widely appeal to the general public
- Appeal to content providers for participation by increasing the number of those who use the robot