



Proposal for Japan-US collaboration for a sustainable robot platform development strategy

Institute of Intelligent Systems, AIST
Manufacturing Industries Bureau, METI
Infrastructure WG, Robotics DTF, OMG



Outline

- Problems with open source robotic software
 - How to commercialize software platform
- What we have learned from the past ten years
 - Standardization and open specifications
 - 3rd party implementations
- Proposals from AIST
- How to collaborate between the OSRF and AIST (and METI)

Problems with robotic open-source software

- Sustainability
 - Difficult to maintain the resources necessary for development, maintenance and user support
- Reliability
 - Difficult to guarantee the reliability of the software for commercial usage when using agile software development
- Lack of desired level of product adoption
 - Difficult to be used in a commercial product due to the above problems

What we have learned from the past ten years

- Open specifications and standards
 - Standards make software easy to fork
 - 3rd party implementers can easily join the community
- Companies as users and providers
 - User companies want to pay for software (and get support)
 - Provider companies want to perform quality management, documentation, and user support to drive sales.

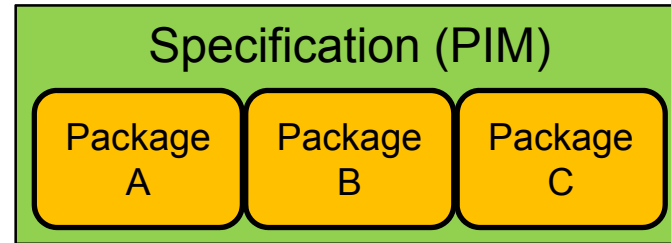
OMG RTC Family

| Name | Vender | Fatures | Interoperability |
|----------------------|-------------------|---|------------------|
| OpenRTM-aist | AIST | C++, Python, Java | --- |
| H-RTM | Honda R&D | OpenRTM-aist compat. FSM component support | ⊙ |
| OpenRTM.NET | SEC | .NET (C#,VB,C++/CLI, F#, etc..) | ⊙ |
| RTM on Android | SEC | Android support | ⊙ |
| RTC-Lite | AIST | An implementation for PIC, dsPIC | ○ (bridge) |
| miniRTC, microRTC | SEC | Implementations for CAN and ZigBee devices | ○ (bridge) |
| RTMSafety | SEC/AIST | Functional safety (IEC61508) capable implementation | ○ (bridge) |
| RTC CANOpen | SIT, CiA | A mapping between CANOpen and RTC (CiA standard) | ○ (bridge) |
| PALRO | Fuji soft | C++ PSM implementation for small humanoid robot | × |
| OPRoS | ETRI | Korean national project | × |
| GostaiRTC | GOSTAI, THALES | A C++ PSM implementation for robot language URBI | × |

Variety of implementations based on a standard

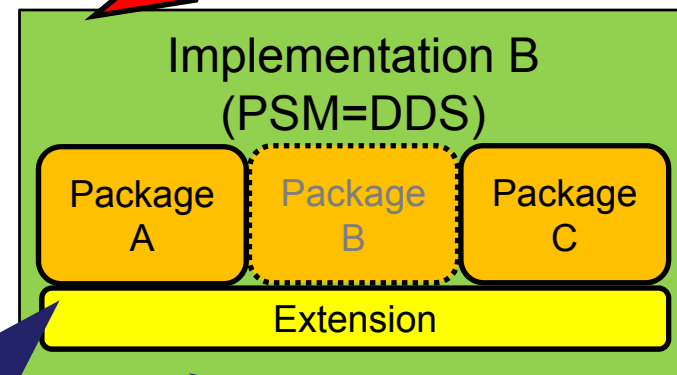
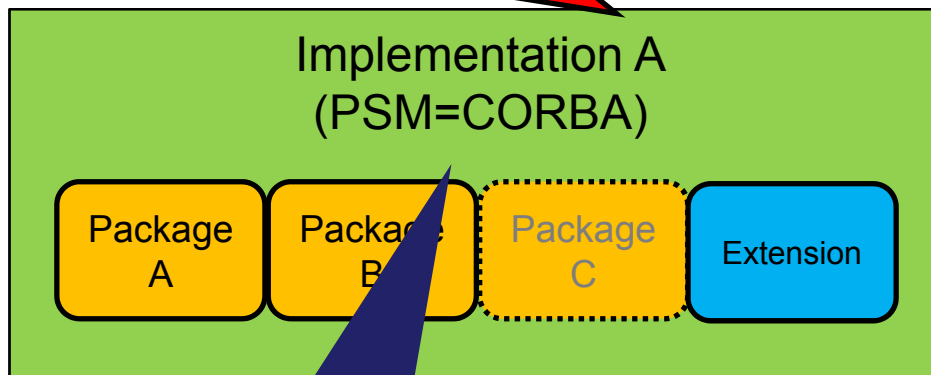
- Guarantees continuity of products
- Makes it easy to bridge between implementations

Use of a Standard Specification



Modular standard specification

(OMG) Standards often consist of modular specification packages



Implementer chooses one specific platform (PIM->PSM mapping is usually defined)

Implementer can chose some packages from the full specification. Only the conformance points have to be adopted.

Implementer usually adds some extensions to the implementation to add additional value to their products.

Evolution of Software and Standards

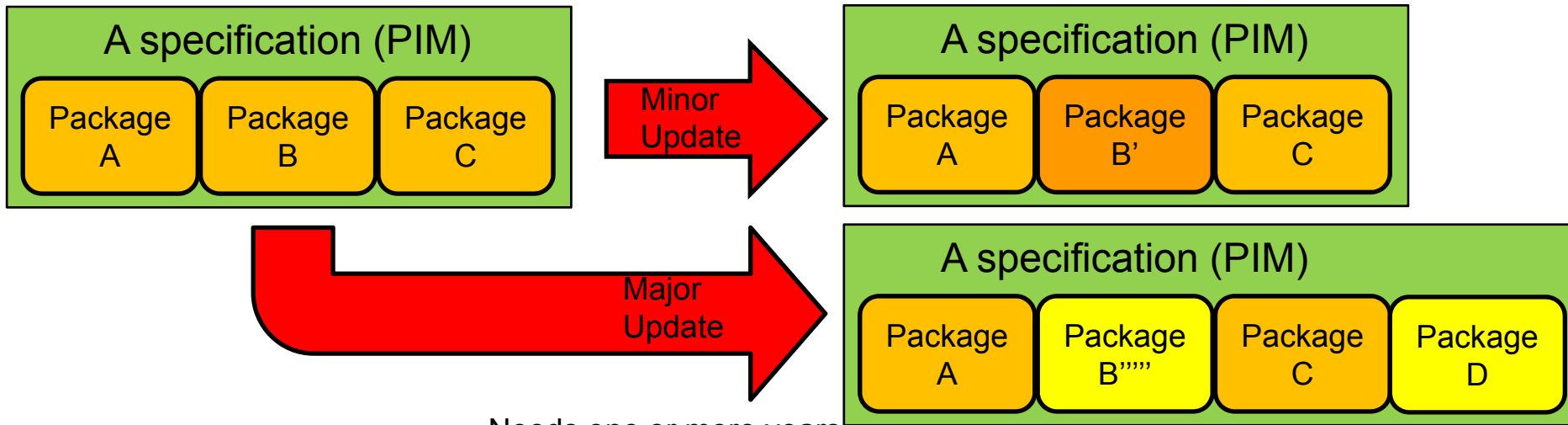
Most of standards define
"Interface"
and/or "Data Types"

Easy to extend
the old interface
by inheriting it



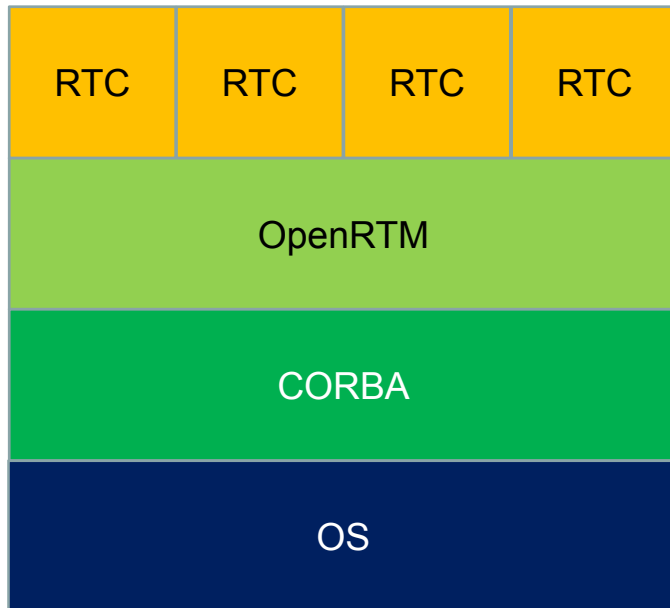
Interface standard
never disturbs the
evolution of software

Only requires half a year



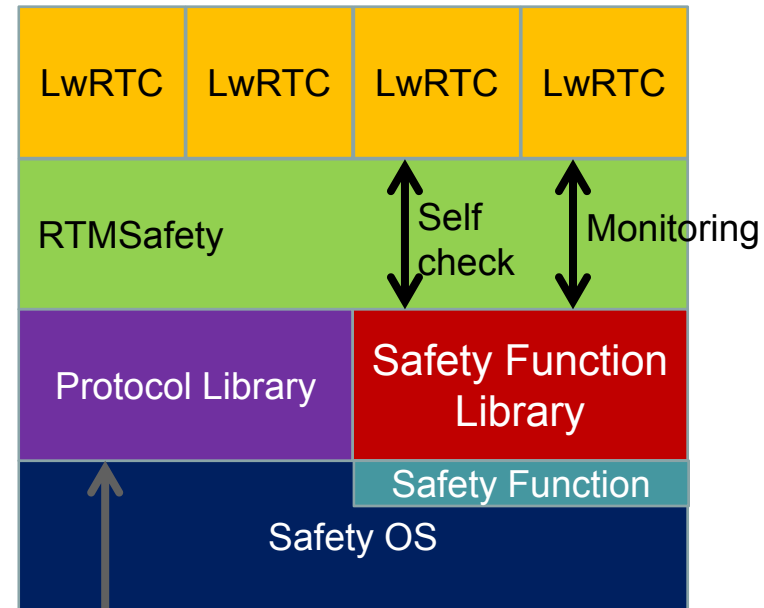
Needs one or more years

OpenRTM and RTMSafety



(a) Conventional RT-Middleware

Open-source software by AIST

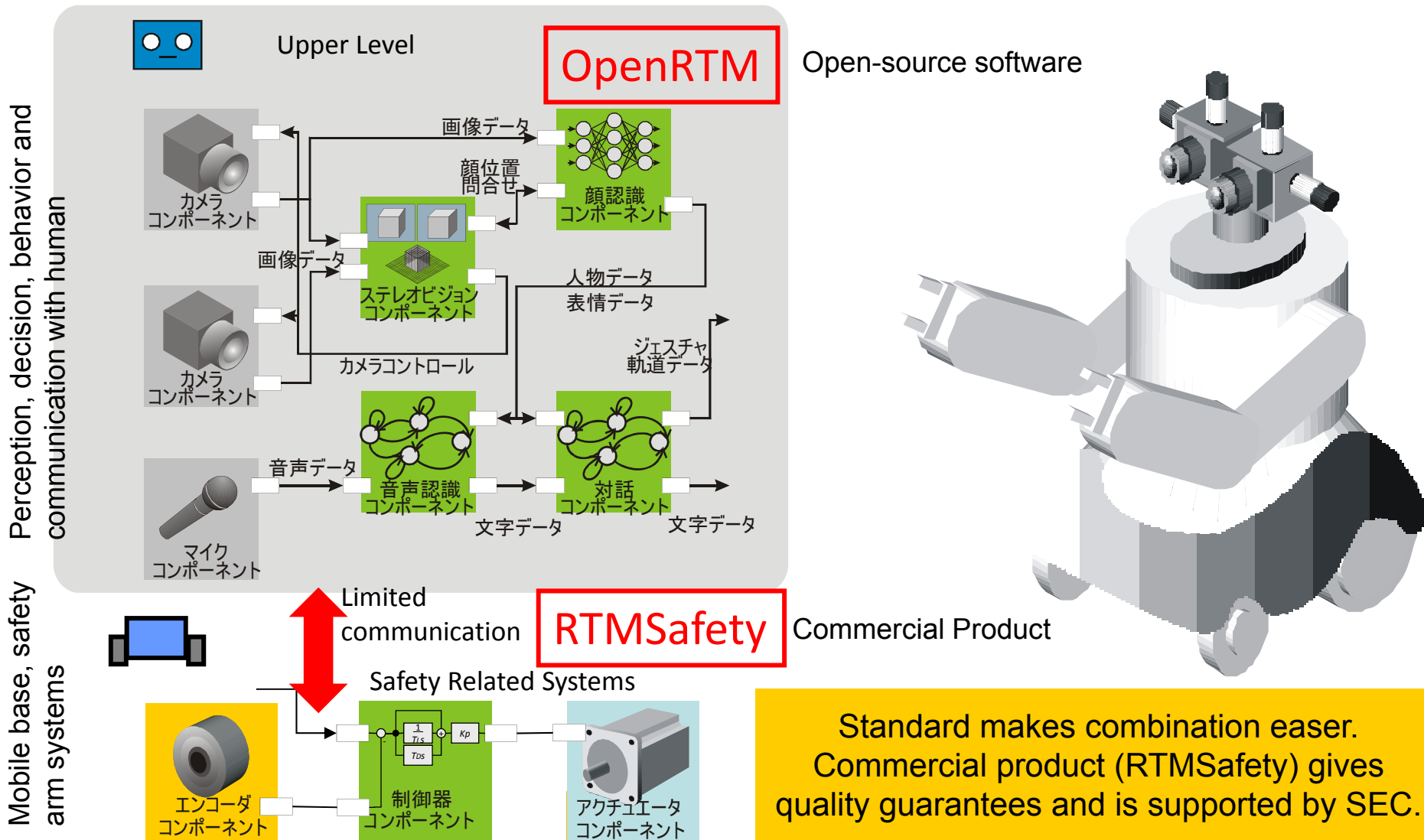


(b) RTMSafety

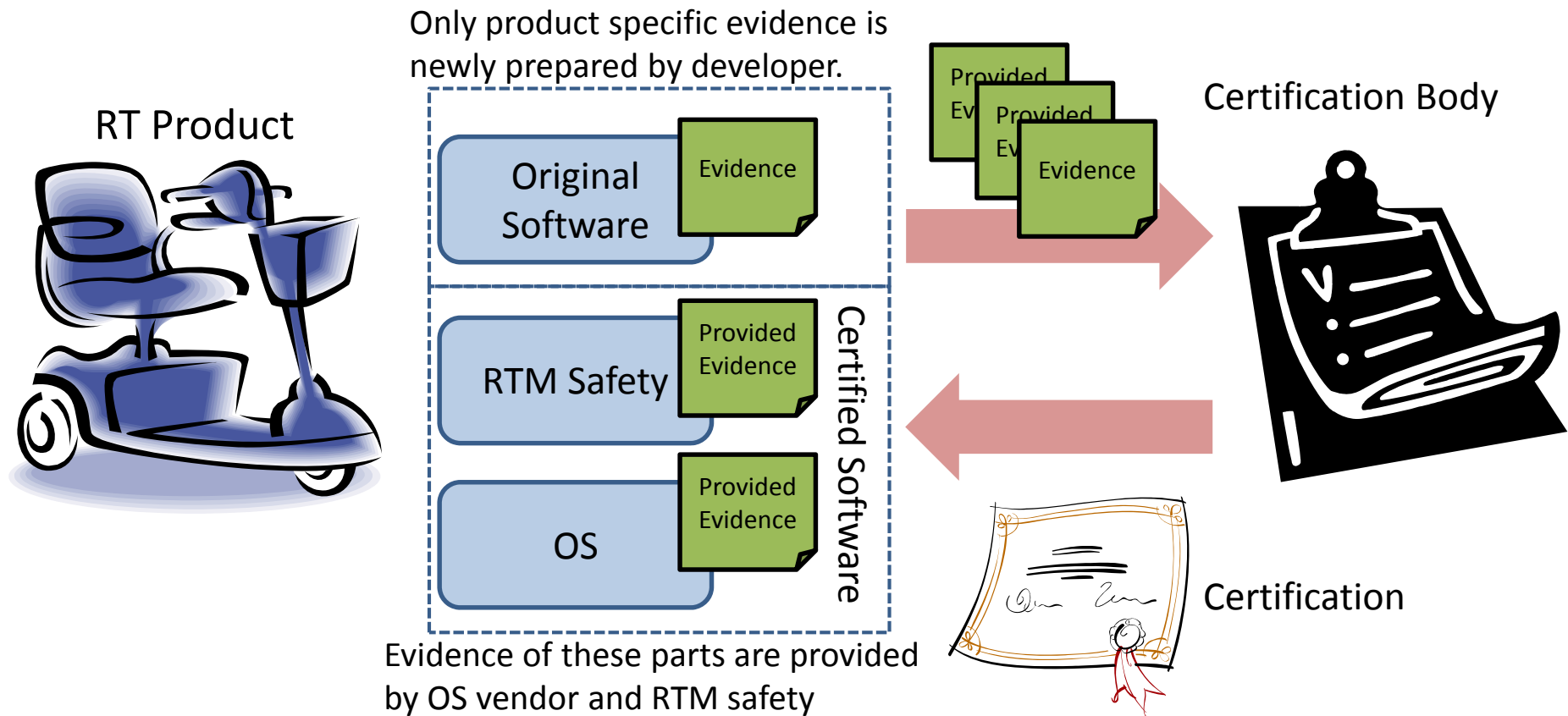
Commercial Product sold by SEC Co. Ltd.

RTMSafety utilises safety functionality provided by a safety-critical OS. User land components are implicitly cared by safety functions.

SRS (Safety Related Systems) and non-SRS in Robotic Systems



Certification process using d-RTM



Our Proposals

- Unified software specifications
 - Define a set of unified robotics software specifications from parts of ROS and RTM
 - Propose the specifications to the OMG
- Software implementation
 - AIST will make its best effort to provide resources for a commercial-grade implementation of the specifications
 - And distribute it as an open source software

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UCM (Unified Component Model)

- A new component standard is being developed
- MARS and Robotics TF started discussion UCM last year
- UCM RFP issued Dec. 2014
- Initial submissions were presented in the June, 2014 meeting (Boston)

In UCM RFP

As UCM targets DRTE systems, this RFP should be considered in relation to the existing OMG component standard for Robotics, namely :

- Robotic Technology Component, v1.1 [RTC] – formal/12-09-02

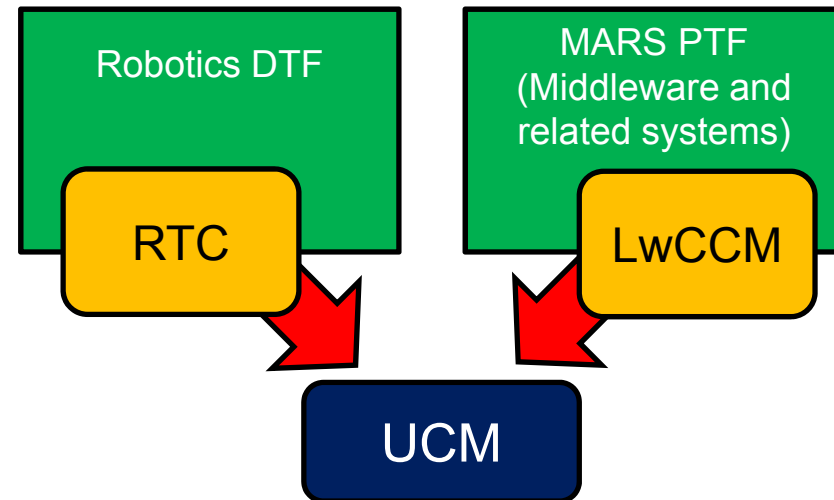
HONDA



PRISMTECH
Performance Critical Middleware



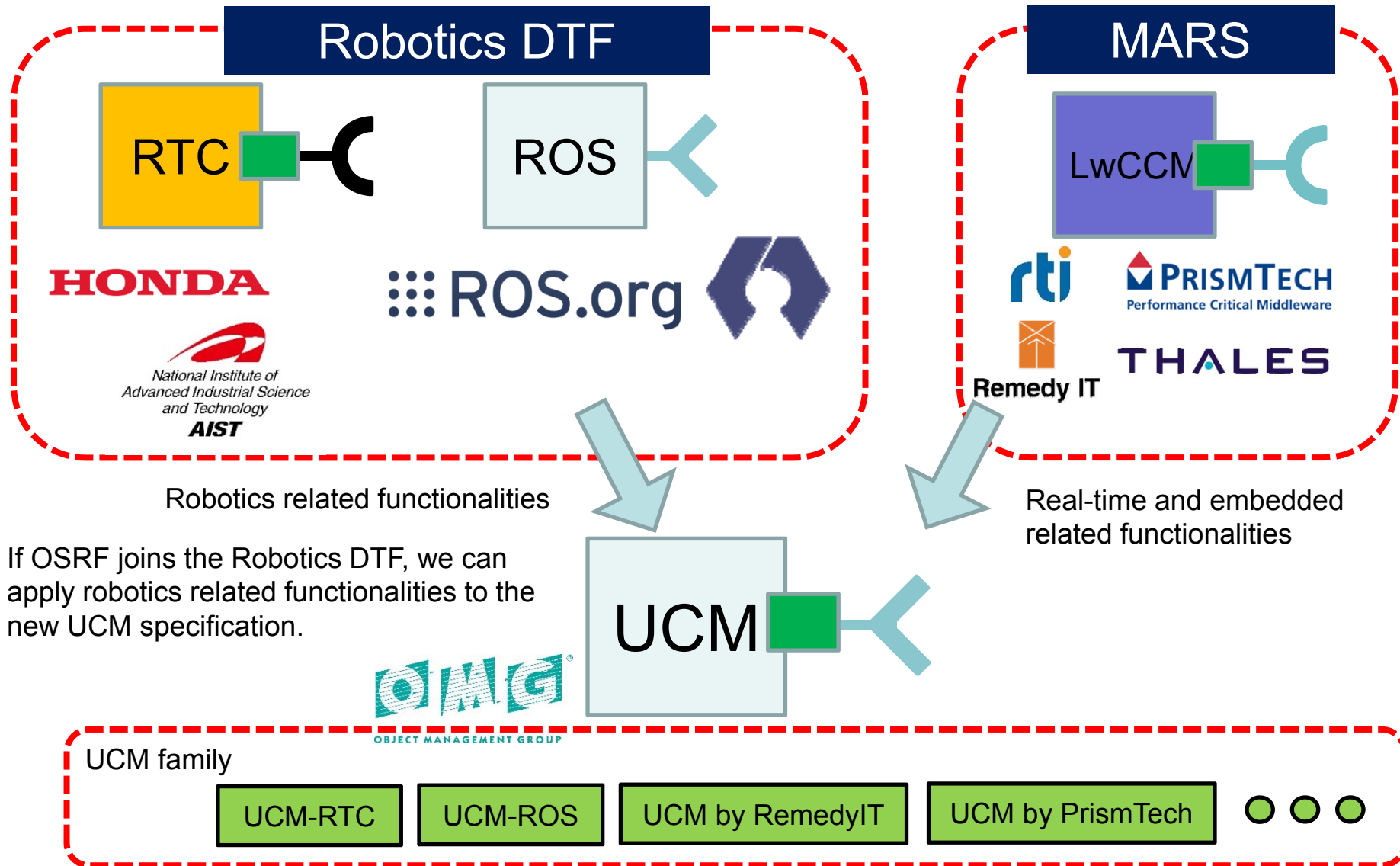
Remedy IT **THALES**



UCM is for “Distributed”, “Real-time” and “Embedded” systems.

Please join our activities!!

Utilising the OMG and UCM Standardization Process



Implementing Commercial ROS

- We can implement a commercial version (safety-critical version) of ROS using AIST or government budget
 - Need to be compliant with some standards (RTC, UCM, etc.)
 - ROS joins the RT/UCM family, and RTC joins the ROS family
 - If a commercial ROS product is required, we can provide it
- If ROS/RTM/UCM become a standard-compliant implementation, the Japanese government will adopt them as the standard robot platform.

Application Developments



Nextage (Kawada Industries)



Baxter (Rethink)

- Hardware platforms
 - Upper torso humanoid robots for industrial uses
 - The academic version of the robots already use ROS.
- Application developments
 - Developing application software with potential users of the robots

Summary

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