

# Open-source software in the RT-Middleware project

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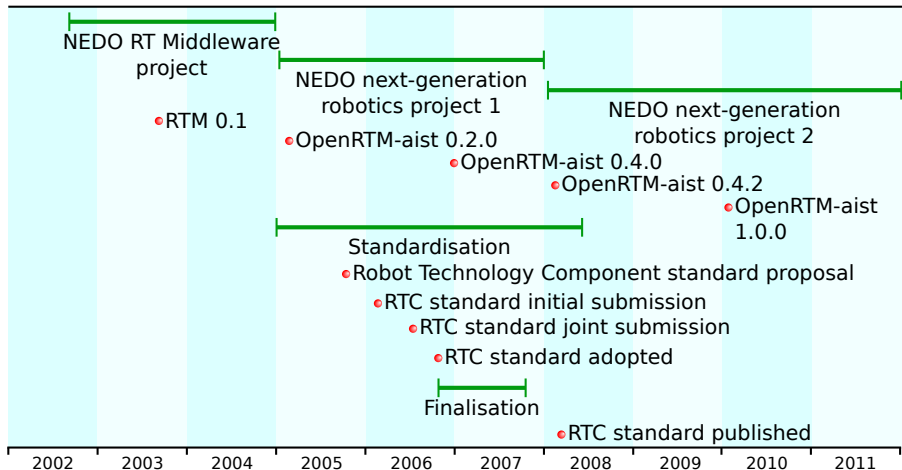
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# Introduction: What is RT-Middleware?

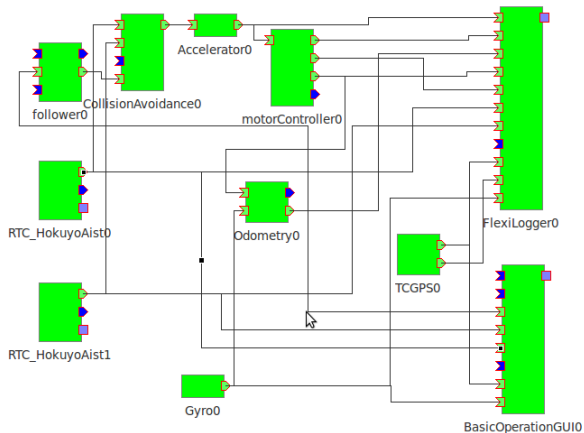
- Japanese project to develop a complete development and run-time environment for robots.
- Middleware + Tools = Platform
- Middleware for distributed intelligent systems.
  - Component-based with a standardised component model.
- Tool chain to work with the middleware.
  - Develop components
  - Develop systems
  - Manage systems *dynamically* at run-time



# History

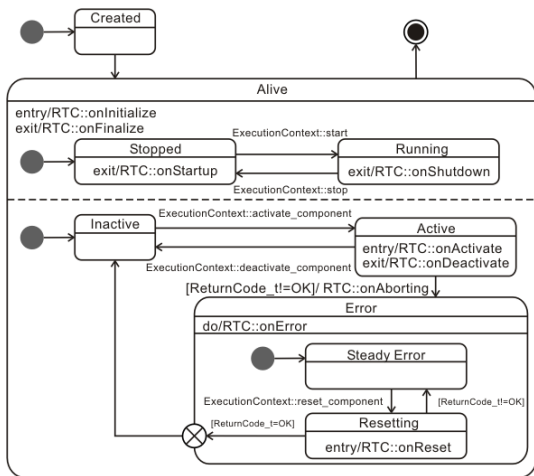


- Component-based middleware for distributed intelligent systems.



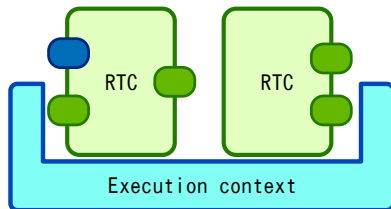
# RT Component model

- Component model defines the life cycle of components.

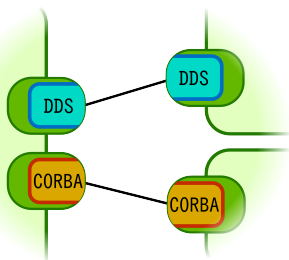


# Execution contexts

- Provide execution time based on a configuration provided by the developer.
- Execution container concept moves control over execution from component developer to system developer.
- OpenRTM-aist provides commonly-used ECs:
  - Periodic execution context
  - Real-time periodic execution contexts using ART Linux and RT-Preempt
  - Composite periodic execution context
- Additional ECs provided by 3rd parties
  - e.g. Synchronised execution context (OpenHRP)



- Defined by the RTC standard as points of communication between components.
  - RTC standard makes no attempt to define methods of communication.
  - Standard defines the interfaces to inform ports of connections.
- OpenRTM-aist provides several transports for its ports:
  - CORBA-based data flow
  - CORBA-based remote procedure call
  - TCP data flow
  - Data Distribution Service (DDS)



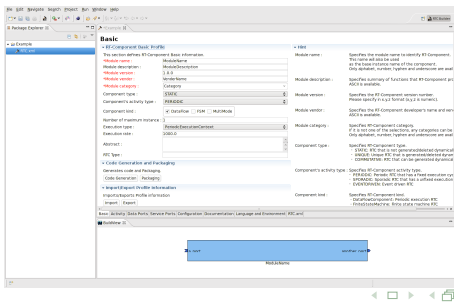
# Standardisation

- Robot Technology Component specification at the Object Management Group.
- Defines the *external* interfaces for introspection and control of RT Components, Execution Contexts and Ports.
  - Note: *not* the interfaces for communication between components.
- Open standard (<http://www.omg.org/spec/RTC/>) published in 2008.
- Many implementations in use or development (not all are open source).
  - OpenRTM-aist
  - OpenRTM.NET
  - OPRoS
  - Gostai RTC
  - RTC-CANopen
  - microRTCs-Zigbee
  - RTM on Android
  - ...

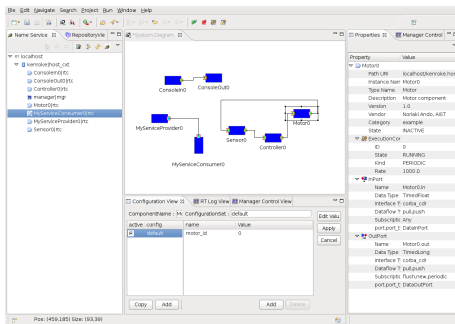


- A middleware is only part of a complete platform.
- The RT-Middleware includes numerous tools, many of which are open source.
- Many tools are developed as Eclipse plugins to form a complete IDE.
- Tools developed at AIST:
  - RTCBuilder
  - RTSystemEditor
  - RTShell
  - rtctree
  - rtsprofile

- Graphical tool for designing RT-Component specifications.
- Developers provide component information including:
  - Meta-data (version, description, documentation, etc.)
  - Port layout
  - Configuration parameters
- Tool generates source code template implementing the specification in the developer's chosen language.
- Can merge changes to the specification into existing source code.



- Graphical tool for designing RT-Systems.
- Combine existing components into component networks.
- Introspect running systems.
- On-line and off-line modes.
- Designed systems can be saved as RTSPProfile models for use with other tools.

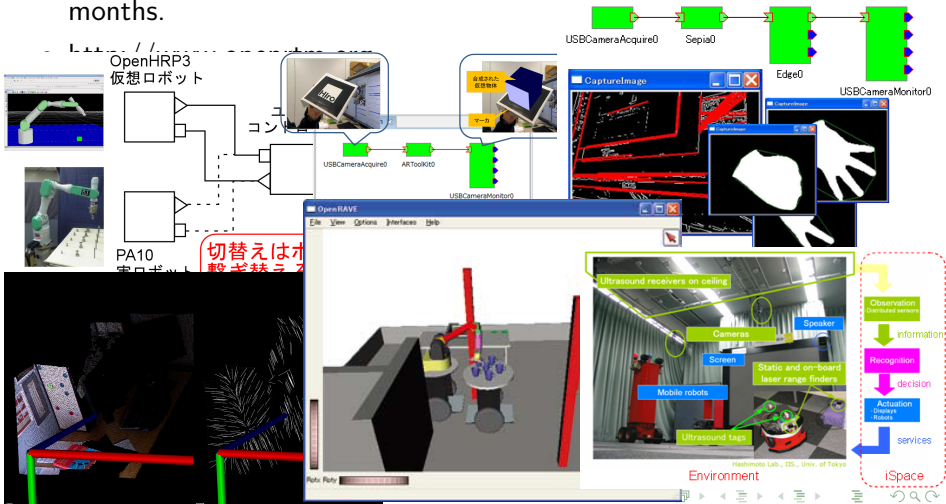


- Command-line equivalent (and more) to RTSystemEditor.
- Useful where GUIs cannot be used:
  - Resource-constrained systems
  - Automation via scripting
- Can also perform functions not available in RTSystemEditor, e.g.:
  - Component debugging
  - Logging

- rtctree
  - Python library for introspection of running components.
  - RTShell uses this library to access components.
- rtsprofile
  - Library providing an execution-time model of RT-Systems.
  - Uses the RTSPProfile model, allowing inter-operation with RTSystemEditor.
  - Combine with rtctree to manage with RT-Systems at run-time.

# Projects

- RT-Middleware website provides space to register projects.
- Over 100 components, component-groups and tools registered in two months.



# Summary

- RT-Middleware is developing a complete platform for robot development.
- OpenRTM-aist provides the open-source middleware at the centre of the platform.
- Several tools available for developing and working with the middleware and software running on it.
- Project pages provide a place for the free exchange of RT-Components and tools.
- <http://www.openrtm.org>