

EPROSIMA

The
Middleware
Experts

Micro-ROS

Industrial ROS Conference

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eProsima in one shot

- Experts on middleware, focused on DDS.
 - DDS is the middleware powering **ROS2**.
 - eProsima Fast RTPS is one of the supported implementations
 - Currently the default implementation.
- **OMG Members – Standard Contributors:**
 - RPC over DDS, Web Enabled DDS,
 - DDS Security (Supporter), OPC-UA DDS (Supporter)
 - XRCE DDS (DDS for eXtremely Resource Constrained Environments)



Some Customers

GENERAL DYNAMICS
Santa Bárbara Sistemas



Robotic Success Cases

- OSRF (ROS2)
- Dronecode (PX4)



Open Source
Robotics Foundation

- Many Robotics companies:

- 3D Robotics
- Intelligent Robots
- Near Earth Autonomy
- ...



Dronecode



FIWARE Chapter Leader: Robotics and middleware

- FIWARE:
 - Big EU Project
 - Open Source component framework
 - More than 300M Eur of investment
- Role of eProsimas:
 - Robotics and middleware chapter leader
 - Fast RTPS
 - Robotics Success Histories.



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Micro-ROS

Upcoming ROS2 Feature

Micro-ROS motivation

- Robots today are networks of microcontroller based sensors and actuators connected to general purpose computers.
- ROS2/DDS does not fit well in small embedded devices (microcontrollers):
 - Low computational power and memory
 - May be also:
 - Battery powered
 - Communicated thorough Constrained networks (LoWPANs)
- There are some “micro/tiny” DDS implementations but they cut the API and the protocol:
 - No standard yet, XRCE DDS is coming.
 - Lack of features.



Micro-ROS

- Micro-ROS is a common Project from
 - eProsima (Coordinator)
 - Bosch
 - Acutronics (Erle, HROS)
 - FIWARE Foundation
 - PIAP
 - Industrial Research Institute for Automation and Measurements (Poland)
- It will extend ROS2 to allow its use in microcontrollers.
- Funded by EU,
 - Letter of support: OSRF, ROS-I, FIWARE, Mobile Industrial Robots, Deepfield Robotics and Bosch powertools
- Starting Jan,2018



Micro-ROS



Micro-RTPS & Micro-ROS

- Micro-ROS will use micro-RTPS as the core middleware.
 - Micro-RTPS is an implementation of XRCE DDS (DDS for eXtreme Resource Constrained Environments), an upcoming standard of the OMG.
 - RTI, Twin Oaks and eProsima have already a joint submission.
 - It adapts RTPS/DDS to these scenarios.
 - Micro-RTPS first prototype already adopted by Dronecode
 - **Already an Alpha available!** 😊

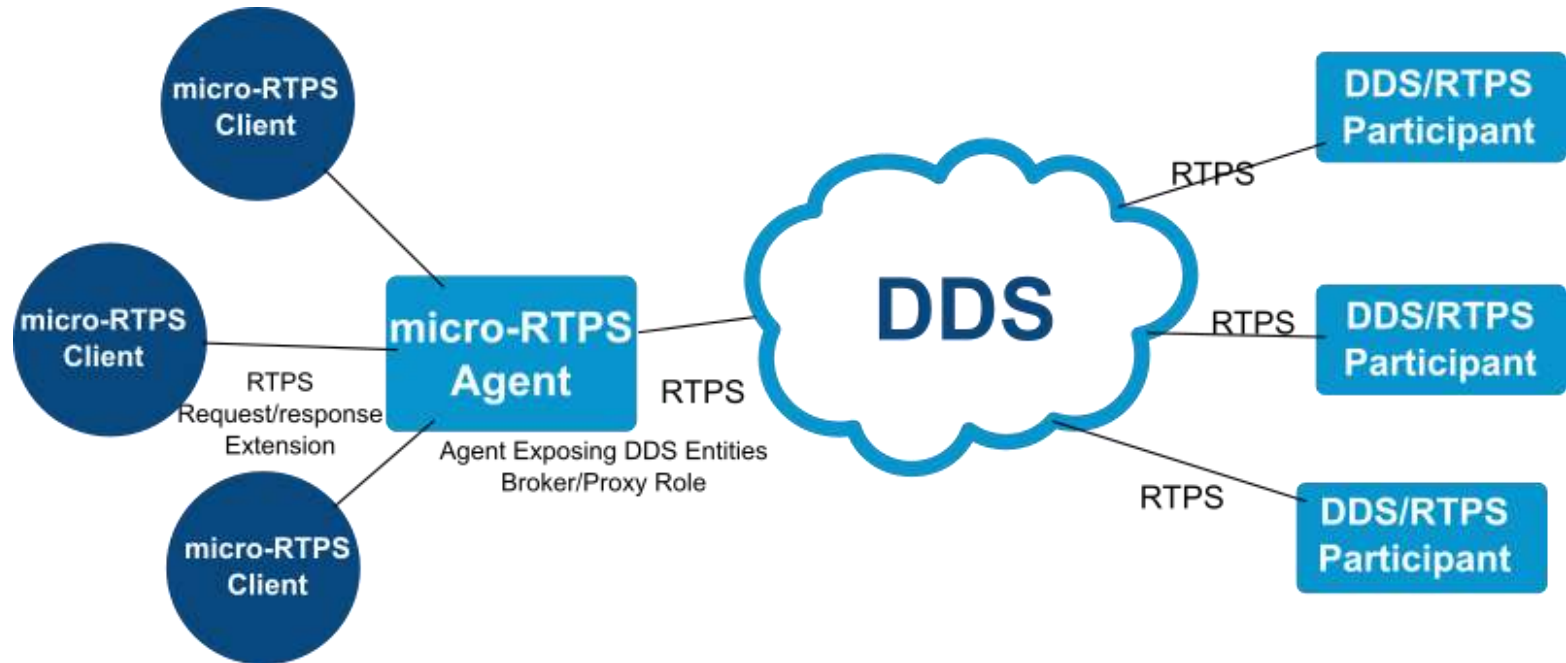


Micro-RTPS links

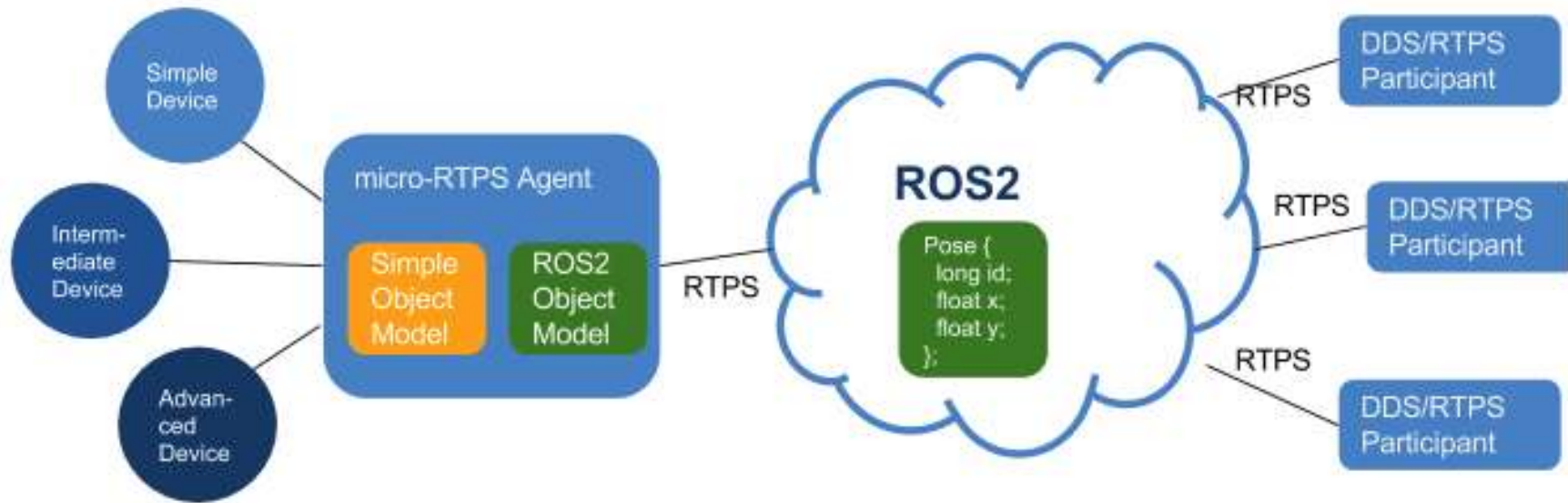
- Github Repo:
<https://github.com/eProxima/micro-RTPS>
- Readthedocs:
 - <http://micro-rtps.readthedocs.io>
- Quick start video:
 - <https://youtu.be/XT-Y1CfOGJM>



Micro-RTPS Architecture



Micro-ROS Architecture



Hardware and Firmware

- Micro-ROS will select a reference platform to test and run the framework:
 - OS: NuttX
 - Hardware:
 - STM32L1: Low profile microcontroller
 - STM32F4: Medium performance microcontrollers
 - ARM Cortex-R: For certified apps.
 - Ethernet, Serial, and 6LowPan
- Creation of a reference Hardware Bridge between micro-ROS and ROS2



Comms and interoperability

- Enhanced micro-RTPS
 - Including Peer to Peer comms for selected cases.
 - Security integrated with DDS/ROS2 security.
- Interoperability
 - ROS1, ROS2, HROS, FIWARE Components



Enhanced API

- Predictable scheduling and executing
 - Based on the concept of executors introduced in ROS 2, we will introduce a core library for predictable scheduling and executing, allowing finegrained control of the mapping of callbacks to tasks of the RTOS.
- Lifecycle and system modes
 - Starting from the node lifecycle concept proposed for ROS 2, we will design and implement advanced mechanisms for the runtime management of single application components, subsystems of multiple components and the overall system.
- Embedded transform (TF) library
 - a highly efficient transform library shall be developed, that integrates microROS components into the ROS TF tree in an efficient way



Full Benchmarking and Test bed

- Multiple measures:
 - Latency, throughput, CPU use, memory...
- Reference platform benchmarking:
 - Hardware + OS
- Micro-ROS Framework benchmarking
- User benchmarking tools



Use Cases

- 1.- Drones (eProxima):
 - PX4 Autopilot Example
- 2.- Micro-ROS sensors (Acutronics)
 - H-ROS
- 3.- Domestic outdoor robots (Bosch)
 - Indego
- 4.- Smart warehouse (PIAP)
 - PIAP SCOUT robot
- FIWARE Integration of 1-4
 - Orion Context Broker



Communication, Dissemination, Collaboration, Standardization and Exploitation

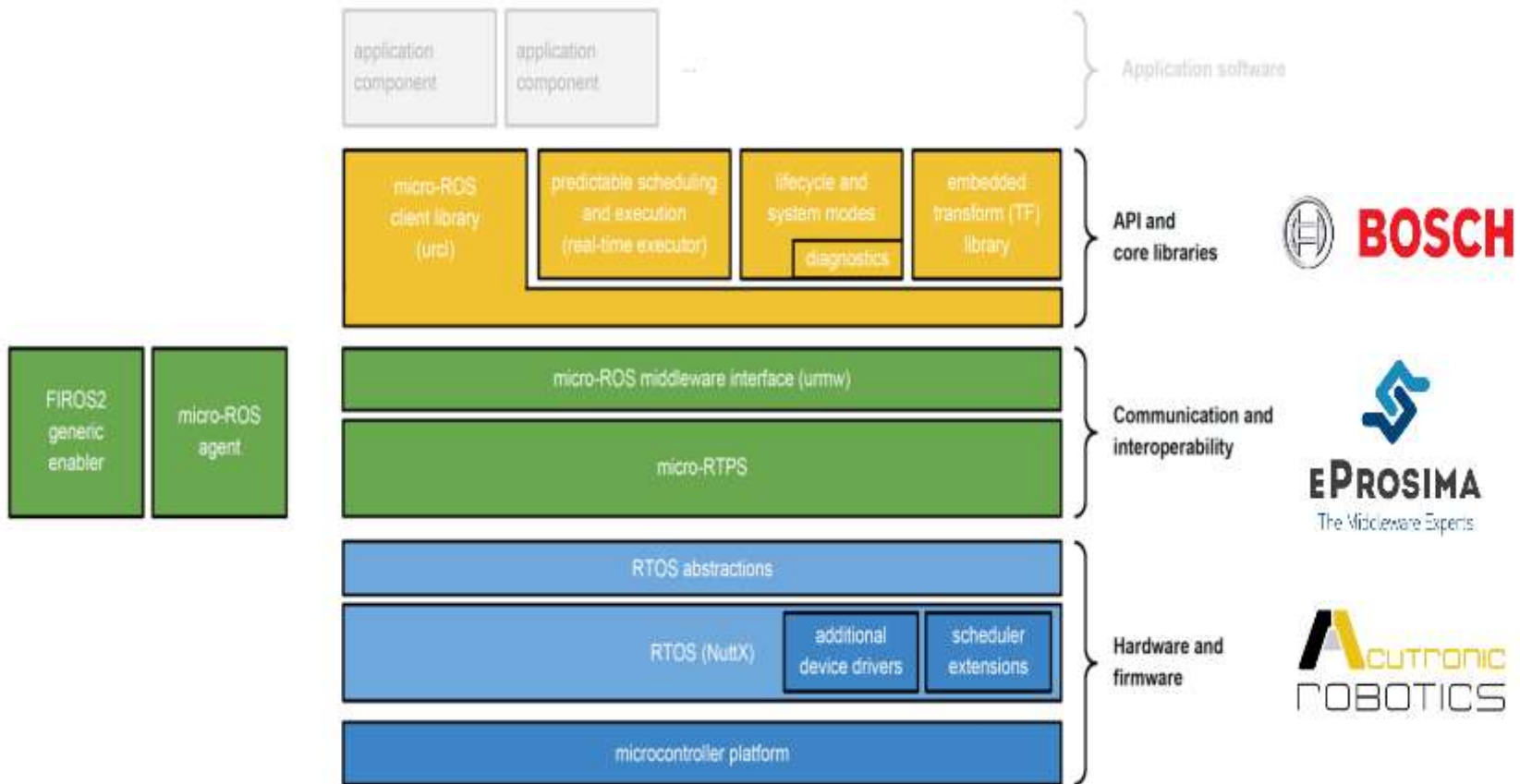
- Key points:
 - OMG standardization
 - Truly Open Source
 - ROS & ROS-I Community collaboration
 - EU Projects Collaboration:
 - ROSIN, RobMoSys
 - FIWARE



Micro-ROS Building Blocks



Benchmarking and tools



Want to know more?

- www.eProsima.com
- Youtube:
<https://www.youtube.com/user/eprosima>
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Thank you!

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