D3.16

Micro XRCE-DDS for ROS Software Release Y4

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Abstract	This document provides links to the released software and documentation for deliverable D3.16 *Micro XRCE-DDS for ROS Software Release Y4* of the Task 3.1 *micro-RTPS Additional Features*.

Contents

1 Summary

eProsima Micro XRCE-DDS is a software solution which allows to communicate eXtremely Resource Constrained Environments (XRCEs) with an existing DDS network. This implementation complies with the specification proposal, "eXtremely Resource Constrained Environments DDS (DDS-XRCE)" submitted to the Object Management Group (OMG) consortium.

Micro XRCE-DDS implements a client-server protocol that enables resource-constrained devices (clients) to take part in DDS communications. The Micro XRCE-DDS Agent (server) makes possible this communication by acting on behalf of the Micro XRCE-DDS Clients and enabling them to take part as DDS publishers and/or subscribers in the DDS Global Data Space. Micro XRCE-DDS provides both a plug and play Micro XRCE-DDS Agent and an API layer that allows implementing your Micro XRCE-DDS Clients.

2 Acronyms and keywords

Acronym	Explanation
CDR	Common Data Representation
DDS	Data Distribution Service
DDS-XRCE	DDS For Extremely Resource Constrained Environments
GA	Grant Agreement
OFERA	Open Framework for Embedded Robotic Applications
OMG	Object Management Group
ROS	The Robot Operating System
RTPS	Real Time Publish Subscribe

3 Overview to Results

This document provides links to the released software and documentation for deliverable D3.16 *Micro XRCE-DDS for ROS Software Release Y4* of Task 3.1 *micro-RTPS Additional Features*.

As exposed in D3.3, a minor deviation from the OFERA Grant Agreement is the name of this deliverable. micro-RTPS is no more called micro-RTPS. With its first official release, eProsima changed its name to Micro XRCE-DDS as it is a more accurate name for referring the protocol implemented.

The work associated to the task 3.1 is to improve and adapt the previous versions of Micro XRCE-DDS to the needs of micro-ROS. In this direction this year's added features are:

- Multithreading support
- Custom transport APIs
- Ping support
- Continuos fragment mode
- FreeRTOS+TCP support

- Zephyr RTOS support
- RTEMS RTOS support
- Bug fixing and performance improvements

The annex of this document includes a copy of the official product information page. A documentation annex has been omitted due to its extension. However, links have been provided.

4 Links to Software Repositories

Micro XRCE-DDS is distributed as an open source software. The full suite is composed by multiple repositories:

Micro XRCE-DDS Client:

- Git repository: https://github.com/eProsima/Micro-XRCE-DDS-Client

Branch	Latest commit	ROS 2 version
ros2	e81b10a	rolling
ros2	e81b10a	galactic
ros2	e81b10a	foxy
v1.2.1	46ee5bc	dashing/eloquent

Micro XRCE-DDS Agent:

- Git repository: https://github.com/eProsima/Micro-XRCE-DDS-Agent

Branch	Latest commit	ROS 2 version
ros2	34bc3ba	rolling
ros2	34bc3ba	galactic
ros2	34bc3ba	foxy
v1.3.0	cb1d053	dashing/eloquent

a central repository, Micro XRCE-DDS:

- Git repository: https://github.com/eProsima/Micro-XRCE-DDS

and a readthedocs documentation:

- Documentation: https://micro-xrce-dds.readthedocs.io/en/latest/

5 Annex 1: eProsima Micro XRCE-DDS

Content of product description web from eProsima from 24th Nov 2021.

5.1 Open source solution

eProsima Micro XRCE-DDS is an open source wire protocol that implements the OMG DDS for eXtremly Resource Constrained Environment standard (DDS-XRCE). The aim of the DDS-XRCE protocol is to provide access to the DDS Global-Data-Space from resource-constrained devices. This is achieved as a result of a client-server architecture, where low resource devices, called XRCE Clients, are connected to a server, called XRCE Agent, which acts on behalf of its clients in the DDS Global-Data-Space.

Micro XRCE-DDS is composed by two main elements:

- Micro XRCE-DDS Agent: a CPP 11 out-of-the-box application which implements the XRCE Agent functionality.
- Micro XRCE-DDS Client: a C99 library which implements the XRCE Client-side functionality.

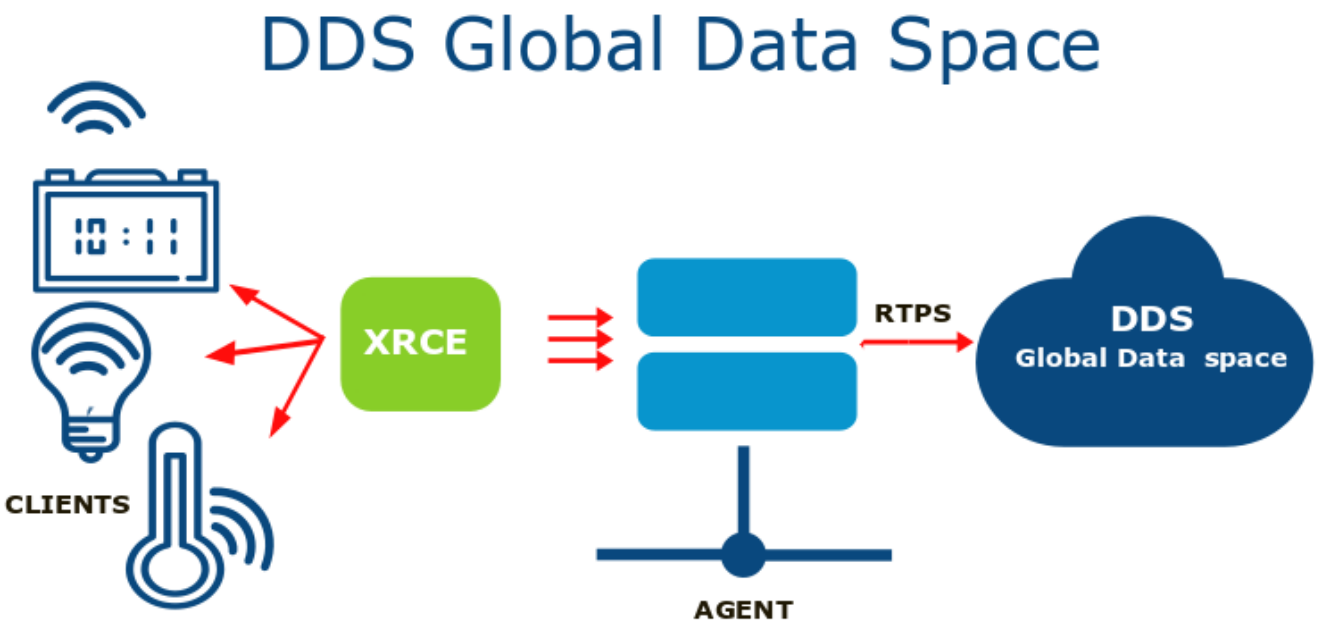

Figure 1:

Apart from the ones mentioned above, Micro XRCE-DDS uses two additional components:

- Micro CDR: a de/serialization engine used in the Client library.
- Micro XRCE-DDS Gen: a code generator tool creating Micro CDR de/serialization functions and Client apps examples from IDL sources.

5.1.1 Main features:

Low Resource Consumption

- The design and implementation of this middleware consider the memory restriction of the devices.
- Micro XRCE-DDS Client is completely dynamic memory free, allocating all the memory at start-up.
- From the point of view of memory footprint, the latest version of this library has a memory consumption of around **80 KB of Flash memory** and **3 KB of RAM** for a complete publisher and subscriber application.

Multi-Transport Support

- Contrary to other IoT middleware such as MQTT and CoaP which work over only a particular transport layer, XRCE supports multiple transport protocol natively. In particular, the latest version of Micro XRCE-DDS supports **UDP**, **TCP**, and a custom **Serial** transport protocol.
- eProsima Micro XRCE-DDS has a transport interface for both Agent and Client which simplifies a transport custom design. This gives the user the possibility of implementing easily the port of Micro XRCE-DDS to different platforms and the addition of new transports.

Multi-Platform Support

- eProsima Micro XRCE-DDS Client supports **Windows**, **Linux**, and **NuttX** as embedded RTOS.
- eProsima Micro XRCE-DDS Agent supports **Windows** and **Linux** platform.

5.1.2 Last release features:

- Peer-to-peer communication.
- Message fragmentation support.
- Programmable Agent through modern CPP API.
- FreeRTOS support.
- Application configuration.

5.1.3 Available documentation:

- Manual
- Shapesdemo video

5.1.4 Application:

Micro XRCE-DDS is focused on microcontroller applications which require a publisher/subscriber architecture. Some examples of this kind of applications are found in a sensor network, IoT or robotics.

Some important companies such as Renesas and ROBOTIS are using already Micro XRCE-DDS as their middleware solution. Furthermore, the micro-ROS project, an extension of ROS2 (The Robot Operating System) for microcontrollers, has adopted Micro XRCE-DDS as its middleware layer, easing the adoption of Micro XRCE-DDS by a big community of developers with thousands of robotic and IoT active projects. MORE INFORMATION ABOUT EPROSIMA MICRO XRCE-DDS:

For any questions please contact info@eprosima.com