eProsima Fast RTPS:
The most complete open source DDS for #ROS2

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Fast RTPS Release for Eloquent

- Features
  - What is new? Fast RTPS release for eloquent.
  - Current Set of features

- Performance
  - Faster: Low latency and high throughput.

- Roadmap

- Adoption

- Team
Features: What is new?

- Real-Time Behaviour
  - Static allocations
    - No dynamic memory allocations
  - Non-blocking calls
  - Sync and Async publishing
    - Regular and large data.
- Intra-process communication
  - Replace the udp loopback.
- Discovery Server.
Total Allocation Calls

Total allocation calls

- Crystal
- Dashing
- Eloquent

<table>
<thead>
<tr>
<th>Method</th>
<th>Crystal</th>
<th>Dashing</th>
<th>Eloquent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Best effort, volatile</td>
<td>800</td>
<td>700</td>
<td></td>
</tr>
<tr>
<td>Best effort, transient</td>
<td>800</td>
<td>700</td>
<td></td>
</tr>
<tr>
<td>Reliable, volatile</td>
<td>1200</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reliable, transient</td>
<td>1400</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Discovery Server

ROS 2 DEFAULT DISCOVERY

FIRST STAGE: NODE DISCOVERY (PDP)

MULTICAST

SECOND STAGE TOPIC DISCOVERY (EDP)

UNICAST

DISCOVERY SERVER

NODE & TOPIC DISCOVERY (PDP, EDP)

DISCOVERY SERVER(S)

NODE 1

NODE 2

NODE 3

NODE 4
What was there already? I

- **Dynamic Types** (DDS X-Types)
  - Base of ROS2 Integration Service FTP & SOSS
- **Extended ROS2 QoS Support**
  - deadline, lifespan, liveliness
- **WAN Support**
  - TCP Transport.
- **Multi-Platform:**
  - Linux, Windows, MacOS, QNX, VxWorks, Android, iOS
  - NuttX, FreeRTOS (Micro-ROS)
What was there already? II

- **DDS Security** Implementation
  - Open source implementation **SROS**
  - OMG Security Interoperability tests.

- **Micro-ROS** Integration - Support for eloquent.
  - eProsima Micro XRCE-DDS ships Fast RTPS 1.9.3
  - The only Open Source implementation of XRCE-DDS Standard.

- **Complete documentation** and examples:
  - Readthedocs, shapesdemo, multiple examples
## DDS ROS2 Features Matrix comparison

<table>
<thead>
<tr>
<th>Feature</th>
<th>eProsima Fast RTPS</th>
<th>OpenSpliceDDS Community</th>
<th>CycloneDDS</th>
</tr>
</thead>
<tbody>
<tr>
<td>DDS Security</td>
<td>YES</td>
<td>NO</td>
<td>NO</td>
</tr>
<tr>
<td>Micro-ROS Support</td>
<td>YES</td>
<td>NO</td>
<td>NO</td>
</tr>
<tr>
<td>Dynamic Types &amp; Integration Srv</td>
<td>YES</td>
<td>NO</td>
<td>NO</td>
</tr>
<tr>
<td>Real-Time Behavior (Static Alloc)</td>
<td>YES</td>
<td>NO</td>
<td>NO</td>
</tr>
<tr>
<td>Server Based Discovery</td>
<td>YES</td>
<td>NO</td>
<td>NO</td>
</tr>
<tr>
<td>ROS2 Extended QoS</td>
<td>YES</td>
<td>YES</td>
<td>NO</td>
</tr>
<tr>
<td>WAN Support</td>
<td>YES</td>
<td>YES</td>
<td>NO</td>
</tr>
</tbody>
</table>
Performance
iROBOT Case

- Very Complex Topology
- Single Process
- Many DDS Participants
- First Experiment (Defaults):
  - Async Publishing
  - Defensive Static Alloc.
- Bad results.
iRobot Case: Fast RTPS - Sync Pub

- Synchronous Publishing + Intraprocess
- Min Memory Profile + Whitelist
iRobot Case: Single Participant

- Same as before, plus:
- 1-to-1 mapping ROS Node to DDS participant
Resources: iRobot Perf. Framework

- ROSJect to reproduce the results: [http://www.rosject.io/l/f196e4b/](http://www.rosject.io/l/f196e4b/)
- iRobot Latest experiments: [https://discourse.ros.org/t/ros-2-for-consumer-robotics/11860](https://discourse.ros.org/t/ros-2-for-consumer-robotics/11860)
- RMW docs: [https://github.com/ros2/rmw_fastrtps](https://github.com/ros2/rmw_fastrtps)
DDS Benchmarking: Latency
DDS Benchmarking: Throughput
Resources: DDS Benchmarking

Web: www.eprosima.com/benchmarking

Github REPO: https://github.com/eProsima/benchmarking

ROSJect: benchmarking: http://www.rosject.io/l/eff5d61/
Roadmap
Ongoing ROSIN FTPs

- **ROS2 Integration Service**
  - SOSS. Already Available

- **ROS2 Shared Memory**
  - Also Sony Partnership
  - First release Available on Feb, 2020

- **ROS2 BenchMarking**
  - Performance, Performance, Performance
  - One team just for performance.
micro-ROS 2020.

- ROS 2 Foxy support.
- Client configuration API.
- Extended ROS 2 concepts and APIs:
  - Services implementation.
  - Parameters implementation.
  - Graph introspection.
Fast RTPS Ongoing features

- Multiple performance enhancements.
- Modern C++ DDS API.
- Low Bandwidth Support
  - Compression, Header Reduction
  - Static Discovery (already available)
  - NACK based Reliability (already available)
Adoption
Fast RTPS ROS2 Success Cases

- OpenRobotics: ROS2 and SROS Default DDS
  - Fast RTPS Repo: Over 15,000 clones per month
- Dronecode:
  - PX4-ROS2 Bridge
- FIWARE:
  - Iot & Robotics middleware. ROS2 Bridge.
Some ROS2 Customers/partners

- APEX.AI: Real-Time Behaviour
- Clearpath: Large Scale Fleets
- Auterion: PX4 - ROS2 Bridge
- Micro-ROS: ROS2 for Microcontrollers
  - Bosch, PIAP, FIWARE Foundation
- Sony: ROS2 Shared Memory
- Many others, including non-ROS customers
  - defense, aerospace, automotive, industrial automation.
Our Team: ROS2 Focus
eProsima Team: and yes, we are hiring ;)}
Thank you