WiP Abstract: Preliminary Evaluation of ROS2

Yuya Maruyama
School of Engineering Science
Osaka University

Shinpei Kato
Graduate School of
Information Science
Nagoya University

Takuya Azumi
Graduate School of
Engineering Science
Osaka University

Cyber-Physical Systems (CPS) represent the next generation of distributed and embedded systems. CPS applications have become increasingly complicated and diverse to monitor and control complex real-time phenomena. The Robot Operating System (ROS), an open-source middleware for robotics development, has been widely used for CPS applications (e.g., autonomous cars). ROS provides publish/subscribe transport, multiple libraries (e.g., Point Cloud Library), and tools to help software developers create CPS applications.

However, ROS does not meet real-time run requirements and only runs on a few types of OSs. Therefore, ROS is not suitable for real-time, embedded systems. To address this problem, ROS will undergo a significant upgrade and will be known as ROS2 [1]. ROS2 considers the following use cases: real-time systems, non-ideal networks, small embedded systems, and cross-platform.

The existing version of ROS (hereinafter referred to as ROS1) will be reconstructed with improving user interface APIs and utilize new technologies (e.g., Data Distribution Service (DDS) [2]). The ROS1 transport system will be replaced by DDS, an industry-standard real-time communication system and end-to-end middleware that can provides reliable publish/subscribe transport.

The next-generation communication system of ROS2, DDS, is suitable for CPS due to its various transport configurations, such as DEADLINE, RELIABILITY, and DURABILITY. It has multiple implementations, including small/embedded solutions to reduce library sizes and memory footprints. Developed by different DDS vendors, several implementations have been used in mission-critical environments and have been verified by NASA. Therefore, ROS2, by using DDS, is reliable and flexible.

ICCPS'16, April 11-14, 2016, Vienna, Austria.

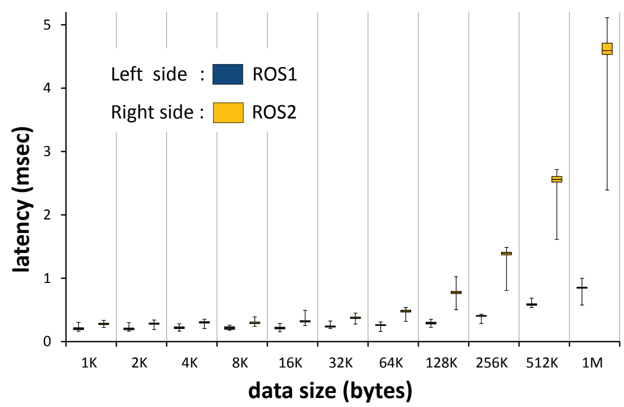

Figure 1: Comparison of the transport latency variation versus data size for ROS1 and ROS2.

Figure 1 shows the data communication time between nodes using ROS1 and ROS2. Using DDS, ROS2 has various transport configurations available that cause a certain amount of overhead. ROS2 needs to convert data for DDS and abstract DDS from ROS2 users. The overhead contains these transactions in addition to the difference between the ROS1 communication system and DDS. These influences vary depending on the transport situation, data size, and DDS vendor.

In this study, we clarify the performance characteristics of currently available data transport between nodes for ROS1 and ROS2 in various situations. Showcasing the present capability of ROS2, depending on DDS vendors and configurations, we explore and evaluate the constraints facing ROS2 and its potential. The advantages and disadvantages of ROS2 are clarified along with problems in the case where ROS1 and ROS2 coexist. To the best of our knowledge, this evaluation is the first to explore the ROS2's performance.

1. REFERENCES

[1] Open Source Robotics Foundation (OSRF). ROS2. https://github.com/ros2.

[2] G. Pardo-Castellote. OMG Data-Distribution Service: Architectural Overview. In *Proc. of IEEE International Conference on Distributed Computing Systems Workshops*, pages 200–206, 2003.