Proposal of ROS-compliant FPGA Component for Low-Power Robotic Systems

－case study on image processing application－

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Introduction

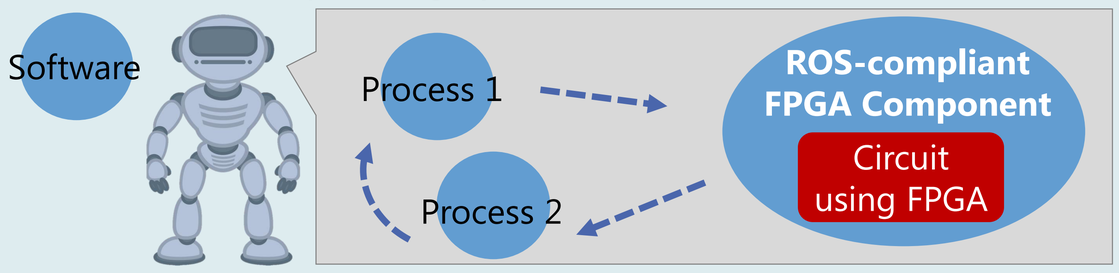
Background

- Robotic systems require sophisticated processing
- FPGA processing can achieve high-performance under low-power requirement
- Requirement of short term development of robots.

Objective

- To propose an **FPGA component technology** for easy integration of an FPGA into robots
- **The FPGA component** is complied with and can be used in **ROS** system

*ROS : Robot Operating System



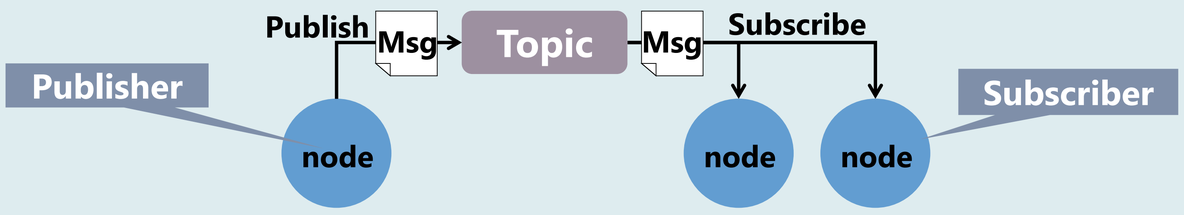
What's ROS ?

ROS (Robot Operating System)

- A software platform which provides a framework of communication for robotic components and a build system for robotic software.
- Officially Supported Platform: Ubuntu Linux

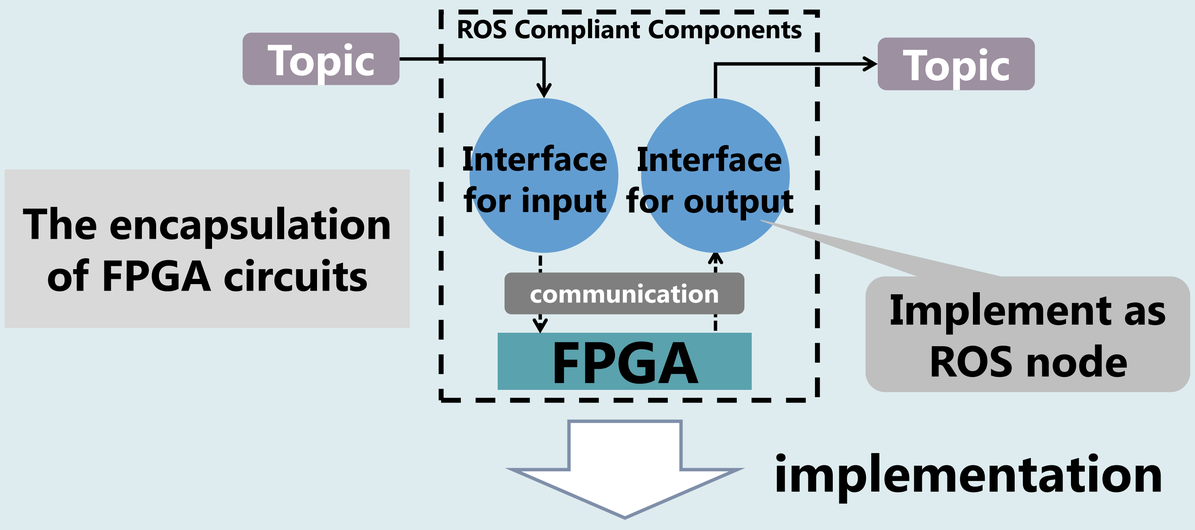
Publish / Subscribe messaging

Topic	classification of message
Publisher	publishes a message to a topic
Subscriber	subscribed to the topic



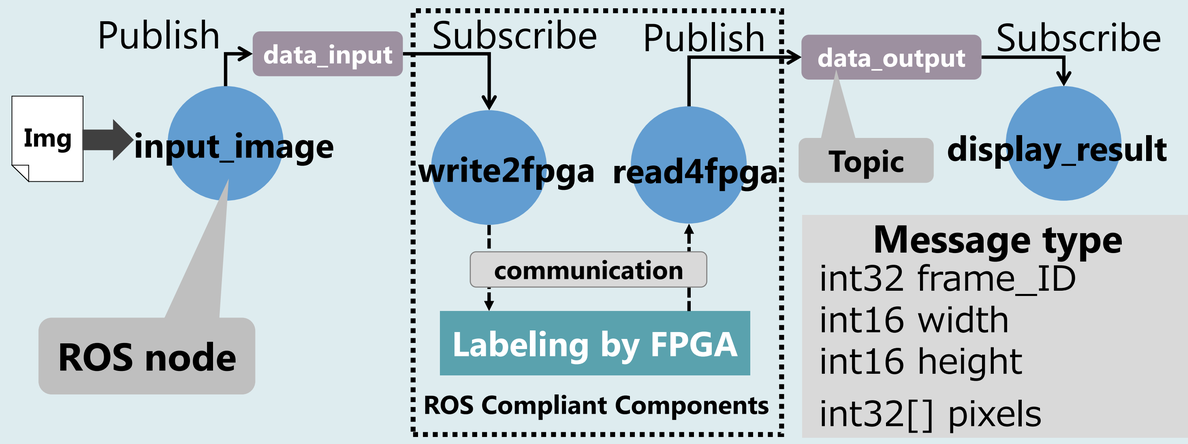
ROS can dynamically configure network structure.

ROS-compliant FPGA component



Developers can improve the system performance by using FPGA as a ROS component while keeping productivity

Case Study : Labeling

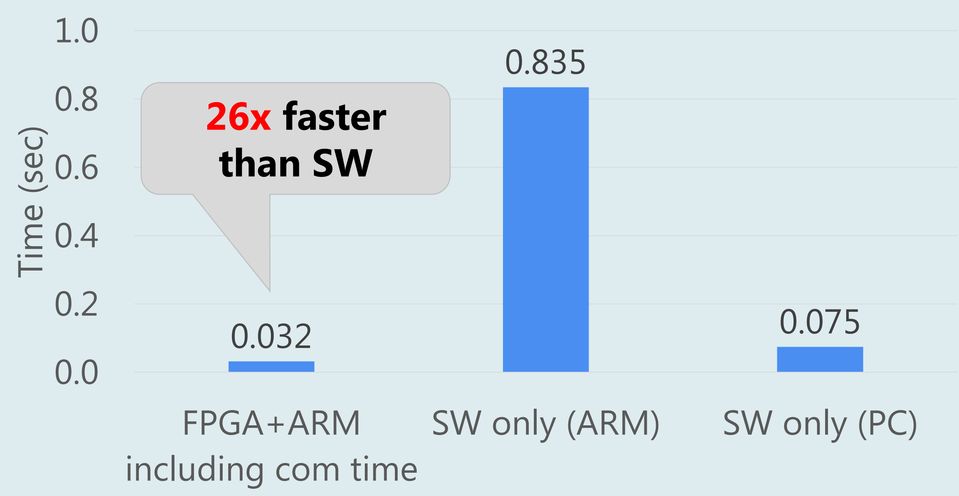


What's labeling ?

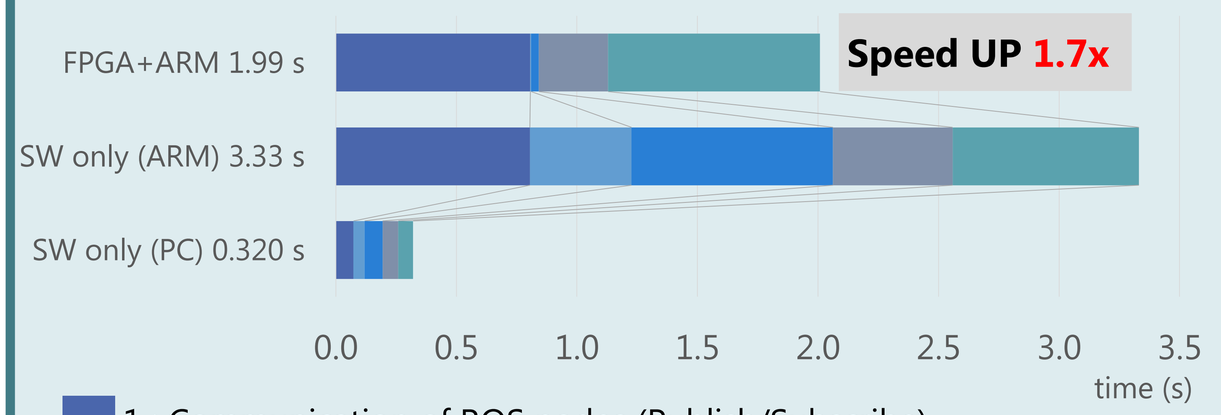
Processing of image labeling that it puts label number each group of white pixels in binary image

Performance evaluation

Measured processing time of labeling



Total latency of the ROS compliant FPGA component



Resolution：1920 x 1080
Zedboard (Zynq-7020)
ARM(PS): Cortex-A9 666MHz
FPGA(PL): 100MHz
PC: Core i7 870 2.93GHz

Conclusion

- The ROS-compliant FPGA component achieves performance improvement while maintaining high development productivity
- There is necessary for the reduction of ROS node's communication latency

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