1. Background

Requirements for an Intelligent Robot System
- Distributed processing in Edge-to-Cloud locations
- Processing: High-performance, ex) Image recognition,
- Mobility: Low Power due to battery operation

The expectation by introducing FPGA into robots
- High-performance processing at low power

Problem: difficult development of FPGA
- Necessity of reducing the cost

Key technology for Edge-to-Cloud System:

2. FPGA component

ROS (Robot Operating System)
- Component-oriented development platform
- Publish/Subscribe communication among components

- Component: FPGA

(1) ROS-Compliant FPGA component
(2) Hardwired ROS-Compliant FPGA
using Programmable SoC (ARM+FPGA, component)
using hardwired TCP/IP stack on FPGA

3. Edge-to-Cloud Location Transparent FPGA Component

Target system
(An example system model of an Intelligent Robot)

Processing allocation #1

Processing allocation #2

4. Demo System

C++ description of Image_filter()

Tools Flow using High Level Synthesis (HLS)

5. Conclusion and Future works

Conclusion
A component-based design method using inter/intra-FPGA component technology is proposed.

The inter/intra-FPGA component technology is inspired by the ROS (Robot Operating System) and the Publish/Subscribe communication model, which improves the component reusability.

Future Work To Do!
Design the proposed development framework in detail.
Evaluate the design productivity of the proposed framework to develop intelligent robots.

Acknowledgement: This research and development work were supported by the JSPS Kakenhi grant (17K00072).
The authors also thank Xilinx University Program and Intel University Program.

Mar. 9-13, 2020 – DATE20@ALPEXPO, Grenoble, France

Okawa Lab., Tokai Univ.