

ICRA 2024 Tutorial

Connected Robotics Platform for ROS Deployment in Real-world Network Settings

2024 IEEE International Conference on Robotics and Automation
Yokohama, Japan 13th May 2024 from 13:00-17:30PM (JST GMT+9)



Learn more:



Project Partners:



ICRA 2024 Tutorial

Connected Robotics Platform for ROS Deployment in Real-world Network Settings

2024 IEEE International Conference on Robotics and Automation
Yokohama, Japan 13th May 2024 from 13:00-17:30PM (JST GMT+9)

Agenda

Time	Session
13:00-13:15	Registration and environment setup
13:15-13:30	Opening and introduction
13:30-14:50	Demonstration of the Connected Robotics
14:50-15:40	Hands-on experience of ROS under the Connected Robotics
15:40-16:00	Break
16:00-17:20	Building your own ROS applications for the Connected Robotics
17:20-17:30	Closing remarks

Speakers:



Renxi Qiu
Associate Professor
University of Bedfordshire, UK



Michal Kapinus
Researcher
Brno University of Technology



Lanfranco Zanzi
Senior Researcher
NEC Laboratories Europe



Bartosz Bratus
Software Engineer
University of Bedfordshire



Guillem Gari
R&D cloud architect
Robotnik Automation S.L.



Sandra Moreno Olivares
R&D Engineer
Robotnik Automation S.L.



Adrian Lendinez Ibañez
PhD Researcher
University of Bedfordshire



Vladimir Guroma
Software Engineer
University of Bedfordshire



Jan Kubálek
CTO
BringAuto



Kandarp Amin
Senior Project Leader, Thermal Processing Technologies
TWI Ltd



Darren Williams
Professor in Practice
TWI Ltd



Sebastian Andraos
CEO
HAL Robotics



Radu Popescu
Cloud-native Software/DevOps Engineer
University of Bedfordshire



Paul McHard
Senior Software Engineer
HAL Robotics



Angelos Stathis
Robotics Solution Engineer
Wings ICT Solutions SA



Georgia Pantelide
Senior R&D Project Manager
Ebos Technologies Ltd

Moderator:



This project has received funding from the European Union's Horizon 2020 research and innovation programme under the Grant Agreement No 101016681.

Project Partners:



ICRA 2024 Tutorial

Connected Robotics Platform for ROS Deployment in Real-world Network Settings

2024 IEEE International Conference on Robotics and Automation
Yokohama, Japan 13th May 2024 from 13:00-17:30PM (JST GMT+9)

Full Agenda

- 13:00-13:15** Registration and environment setup
- 13:15-13:30** Opening and introduction
Connected Robotics Platform (CROP) – Network softwarization and virtualization for robotics - *Prof Renxi Qiu (University of Bedfordshire, UK)*
- 13:30-14:50** **Demonstration of the Connected Robotics**
Scenario: Network-based SLAM in unstructured real-world network using CROP
- Offloading SLAM to remote Cloud and local Edge – *Dr Michal Kapinus (Brno University of Technology, Czechia)*
 - Quality-aware robot operations, robot selecting optimal resource based on quality signals – *Dr Lanfranco Zanzi (NECLab, Germany)*
 - Resilient and robust service by autonomous Edge switch over – *Mr. Bartosz Bratus (University of Bedfordshire, UK)*
- Integrated demonstration (hybrid):
- Remote demonstration: Summit XL connected to AWS Cloud for PPDR surveillance tasks – *Mr. Guillem Garí and Ms. Sandra Moreno Olivares (RobotNik Automation SLL, Spain), Mr. Adrian Lendínez (Telefonica, Spain) and Mr. Vladimir Guroma (University of Bedfordshire, UK)*
- Presentations:
- Applications of Connected Robotics in Transportation – *Mr. Jan Kubálek (BringAuto, Czechia)*
 - Applications of Connected Robotics in Manufacturing – *Mr. Kandarp Amin and Prof Darren Williams (TWI, UK)*
- 14:50-15:40** **Hands-on experience of ROS under the Connected Robotics**
Scenario: Breaking the barrier of ROS2 DDS into real-world networks
- Limitation of ROS2 and DDS (BUT) and Hand on experience of remote object detection in unstructured networks – *Dr Michal Kapinus (Brno University of Technology, Czechia)*
 - Hand on experience of obstacle avoidance in unstructured networks – *Dr Michal Kapinus (Brno University of Technology, Czechia)*
 - Demonstration: Behind scene story, fully orchestrated infrastructure automation – *Mr. Bartosz Bratus and Mr. Radu Popescu (University of Bedfordshire, UK)*
- 15:40-16:00** Break
- 16:00-17:20** **Building your own ROS applications for the Connected Robotics**
Scenario: Accelerated ROS application development
- Demonstration: Relay in connected robotics – *Dr Michal Kapinus (Brno University of Technology, Czechia)*
 - Demonstration: How to build a tele-operation app in unstructured network – *Mr. Angelos Stathis (WINGS ICT Solution, Greece), Dr Michal Kapinus (Brno University of Technology, Czechia)*
 - Demonstration: How to build a containerised portable region detector for industrial Robots - *Mr Sebastian Andraos and Mr Paul McHard (HAL Robotics)*
 - Demonstration: Onboarding and deploying the newly created network applications with orchestration – *Mr Bartosz Bratus and Mr. Radu Popescu (University of Bedfordshire, UK)*
 - Hand on experience to the newly created ROS applications for connected robotics - *Users, assisted by all*
- 17:20-17:30** Closing remarks

ICRA 2024 Tutorial

Connected Robotics Platform for ROS Deployment in Real-world Network Settings

2024 IEEE International Conference on Robotics and Automation
Yokohama, Japan 13th May 2024 from 13:00-17:30PM (JST GMT+9)

Potential Users	Potential Users	Technical Challenge	CROP Solution
ROS developers	I want my ROS application to be deployed in the cloud and interact with my local robots. Problem: Although the ROS code works fine in the LAN, it does not work anymore through the Internet.	The Internet has multiple domains and multi-administrations. Various security requirements and package inspection kill my existing ROS application.	CROP integrates network function virtualisation into robot deployment. It generates a static virtual LAN for ROS applications, at the same time dynamically adapting the network resources for the virtual network on demand.
ROS developers	I want to give the best possible slice and compute to my mobile robots. Problem: This is cumbersome and completely out of my knowledge. At the end, I just use VPN and hard code everything to the robot.	Network topology for mobile robots is dynamic. Knowledge gap between robotics and DevOps.	Virtualized and portable robot operational environments with dynamic edge switch over and slice switch over on-demand.
System administrators	I want a secured communication between robot and ROS application offloaded in the cloud. Problem: I have no idea what is running in the robot.	Scalability and maintainability of robot applications.	CROP utilises cloud native design to separate vertical logic from horizontal deployment.
Network Applications Developers	I want my network application to be roaming on multiple edges (available in multiple locations)	Synchronisation of data. Maintain stateless and stateful transactions in operation. Integrating robot specific domain knowledge into the resource provision	CROP enables dynamic resource provision through software-defined and portable interfaces. It reduces the developers' burden by orchestrating robot specific operations together with network resources for the best quality of experience.



This project has received funding from the European Union's Horizon 2020 research and innovation programme under the Grant Agreement No 101016681.

Project Partners

