

Evaluation of DDS-TSN with Götting KATE AGV

Project topic adaptable for Oberseminar, Student Thesis, Bachelor, or Master/Diploma-Thesis



Image credits: GÖTTING KG, <https://www.goetting.de/en/applications-solutions/kate>

Objective of Work

Automated Guided Vehicles (AGVs) are used in various ways in the industry such as production, manufacturing, and other domains. Typically, an AGV is controlled via a fleet management system that localizes an AGV with markings using sensors from an AGV. Another way is to remotely control an AGV from a terminal through direct user input. Depending on the implementation, the requirements for the communication channel between control unit and AGV can be more or less demanding. Commonly, closed loop control systems require almost deterministic communication behavior. Time-sensitive Networking (TSN) is a set of IEEE standards that aims to make wired Ethernet communication deterministic.

More and more robots rely on the Robot Operating System (ROS). "ROS is a set of software libraries and tools that helps to build robot applications." [ros.org] In the latest version, ROS2, the Data Distribution Service (DDS) is used as a middleware communication protocol for exchanging messages in a publish and subscribe transport architecture.

Due to the nature of AGVs, mobility creates a new challenge. Real-time control and safety require a guaranteed transmission and arrival of network packets. Various technologies have been proposed in the past to address the problems, e.g., industrial WiFi, 5G(-TSN), or DECT-NR+.

Focus of Work

In the thesis, the following tasks should be addressed:

- literature study
- implementation of a canbus-compatible ROS interface for the Götting KATE AGV
- development of testbed to evaluate DDS-TSN control channel with AGV including definition of appropriate test cases with an emphasis on reproducible results
- analyze and compare standard DDS communication in ROS with DDS-TSN integration to determine whether TSN provides significant performance advantages that justify its added complexity
- measurement and optimization of the DDS-TSN communication channel
- analysis and discussion of the results
- documentation of the work in a scientific way
- presentation of the results in a scientific way

In the thesis, the following tasks can be addressed if time allows:

- optional: comparison of wired TSN with at least one wireless technology
- optional: identify gaps in the DDS-TSN description & propose a solution

Material for Further Reading

- https://design.ros2.org/articles/ros_on_dds.html
- <https://www.omg.org/spec/DDS-TSN/1.0/Beta1/About-DDS-TSN>

Keywords

ROS, DDS, TSN, AGV

Contact Details

- Supervisor: Stefan Senk (stefan.senk@tu-dresden.de)
- Language: English or German