Proof of concept for integrating TORCS within a DDS environment

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Contents

1 Project data

- Project supervisor(s): Prof. Vittorio Zaccaria
- Describe in this table the group that is delivering this project:

Last and first name	Person code	Email address
Marco Apollonio	10764083	marco2.apollonio@mail.polimi.it
Giacomo Bossi	10766073	giacomo3.bossi@mail.polimi.it

- Describe here how development tasks have been subdivided among members of the group, e.g.:
  - Bossi configured the Docker environment to simplify the development process.
  - Apollonio worked on the integration of the OpenDDS library within the TORCS simulator.
  - ...
- Links to the project source code; Put here, if available, links to public repos hosting your project

2 Project description

2 pages max please

- What is your project about?
- Why it is important for the AOS course?

2.1 Introduction

The project aims to integrate the TORCS simulator within a DDS environment, in order to test the real time communication between a ECU, being it a real one or a simulated one, and the TORCS simulator.

The project is divided in two Proof of Concepts, each one with a specific goal to achieve:

- The first Proof of Concept aims to send the steering commands from the ECU to the TORCS simulator using The Vehicle Signal Specification (VSS) standard. One modification done to the VSS standard is the usage of the steering wheel as an actuator instead of being a sensor.
- The second Proof of Concept aims to create a torque vectoring algorithm on the ECU so that it receives as an input the yaw rate and the lateral acceleration of the car from the simulator and the angle of the steering wheel from the steering wheel. The ECU will then calculate the torque to be applied to each wheel and send it to the simulator. All this communication will be done using the DDS environment, without the usage of the VSS standard.

2.2 Design and implementation

For each proof of concept we developed a specific bot that need to be selected in the TORCS simulator. The bot will have the Publisher and Subscriber functionalities to communicate with the DDS environment based on the requirement needed to verify the proof of concept.

2.2.1 Design of First Proof of Concept

For the first Proof Of Concept we decided to create two topics in the DDS environment, using the VSS standard for the steering commands:

- SteeringInformation: it's used to send the steering commands to the TORCS simulator.
- WheelInformation: it's used to send the wheels rotation information from the TORCS simulator to the ECU.

The ECU will have a Publisher for the SteeringInformation topic and a Subscriber for the WheelInformation topic. The TORCS simulator will have a Subscriber for the SteeringInformation topic and a Publisher for the WheelInformation topic.

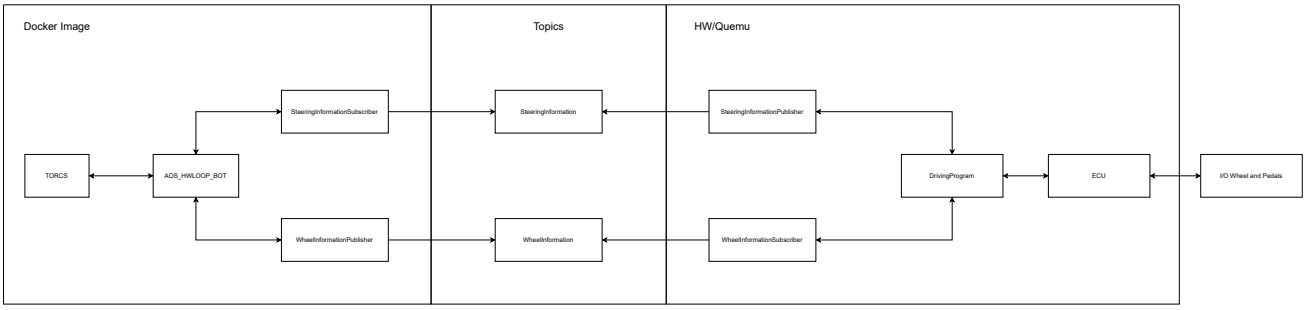

Figure 1: Schematization of the first proof of concept

2.2.2 Design of Second Proof of Concept

3 Project outcomes

3.1 Concrete outcomes

Describe the artifacts you've produced, if possible by linking to repo commits. For those who choose to work on an open source project, please put here the **URL to your final pull request**.

Those that have chosen to present a paper can include a link to the slides.

3.2 Learning outcomes

What was the most important thing all the members have learned while developing this part of the project, what questions remained unanswered, how you will use what you've learned in your everyday life? Please also indicate which tools you learned to use.

Examples:

- Foo learned to write multithreaded applications, he's probably going to create his own startup with what she has learned. She also learned how to debug with gdb.
- Bar learned how to interact with the open source community, politely answering to code reviews and issuing pull requests through Git.

3.3 Existing knowledge

What courses you have followed (not only AOS) did help you in doing this project and why? Do you have any suggestions on improving the AOS course with topics that would have made it easier for you?

3.4 Problems encountered

What were the most important problems and issues you encountered? Did you ever encountered them before?

- Foo encountered a problem with some critical sections. He ended up rewriting existing lock implementation.

4 Honor Pledge

(**This part cannot be modified and it is mandatory to sign it**)

I/We pledge that this work was fully and wholly completed within the criteria established for academic integrity by Politecnico di Milano (Code of Ethics and Conduct) and represents my/our original production, unless otherwise cited.

I/We also understand that this project, if successfully graded, will fulfill part B requirement of the Advanced Operating System course and that it will be considered valid up until the AOS exam of Sept. 2022.

Group Students' signatures