Warehouse Package Handling Workflow

A collaborative robotics process for automated package handling using ROS2 and Unity Hub

MSc in Computer Science – UNICAM

Module: Autonomous & Collaborative Robotics

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CONTENT

Introduction to the Project

Overall Scope

- Create an automated warehouse package handling system.
- Use **ROS2** for robot communication and **Unity Hub** for realistic simulation.
- Integrate collaborative robots: Bring-and-Drop Robot and Shelf Robot.

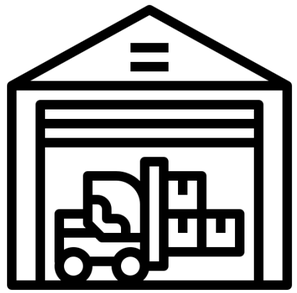
Goals

- Simulate a realistic and efficient warehouse automation scenario.
- Enhance task coordination and reliability through robotics and advanced simulation tools.

Scenario – Key Components (1/3)

Counter

- Acts as the central command centre for the entire process.
- Responsible for receiving external package handling requests, including package ID, pickup, and drop-off locations.
- Validates package information and assigns tasks to robots.
- Monitors the progress of tasks to ensure successful completion.



Scenario – Key Components (2/3)

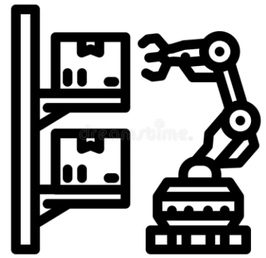
Bring-and-Drop Robot (MoverBot)

- Key tasks include navigating to the package location, picking it up, and delivering it to the designated drop-off point.
- Collaborates with the Shelf Robot to ensure packages are aligned and ready for transport.
- Ensures efficient operations through seamless coordination

Scenario – Key Components (3/3)

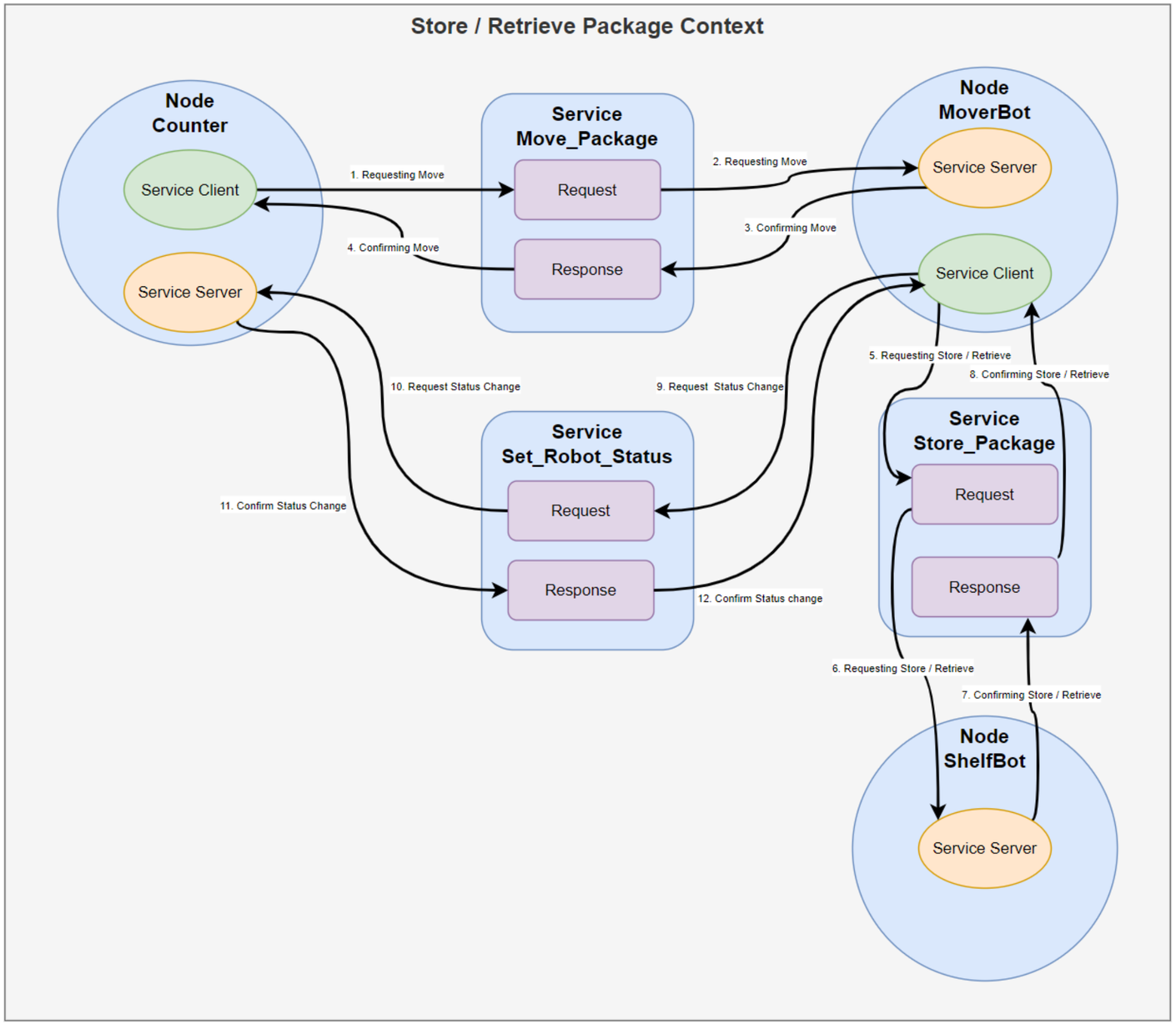
Shelf Robot (ShelfBot)

- Key tasks include scanning shelves to locate the package and aligning it for easy pickup by the Bring-and-Drop Robot.
- Ensures seamless coordination with the Bring-and-Drop Robot.
- Enhances operational efficiency through precise alignment

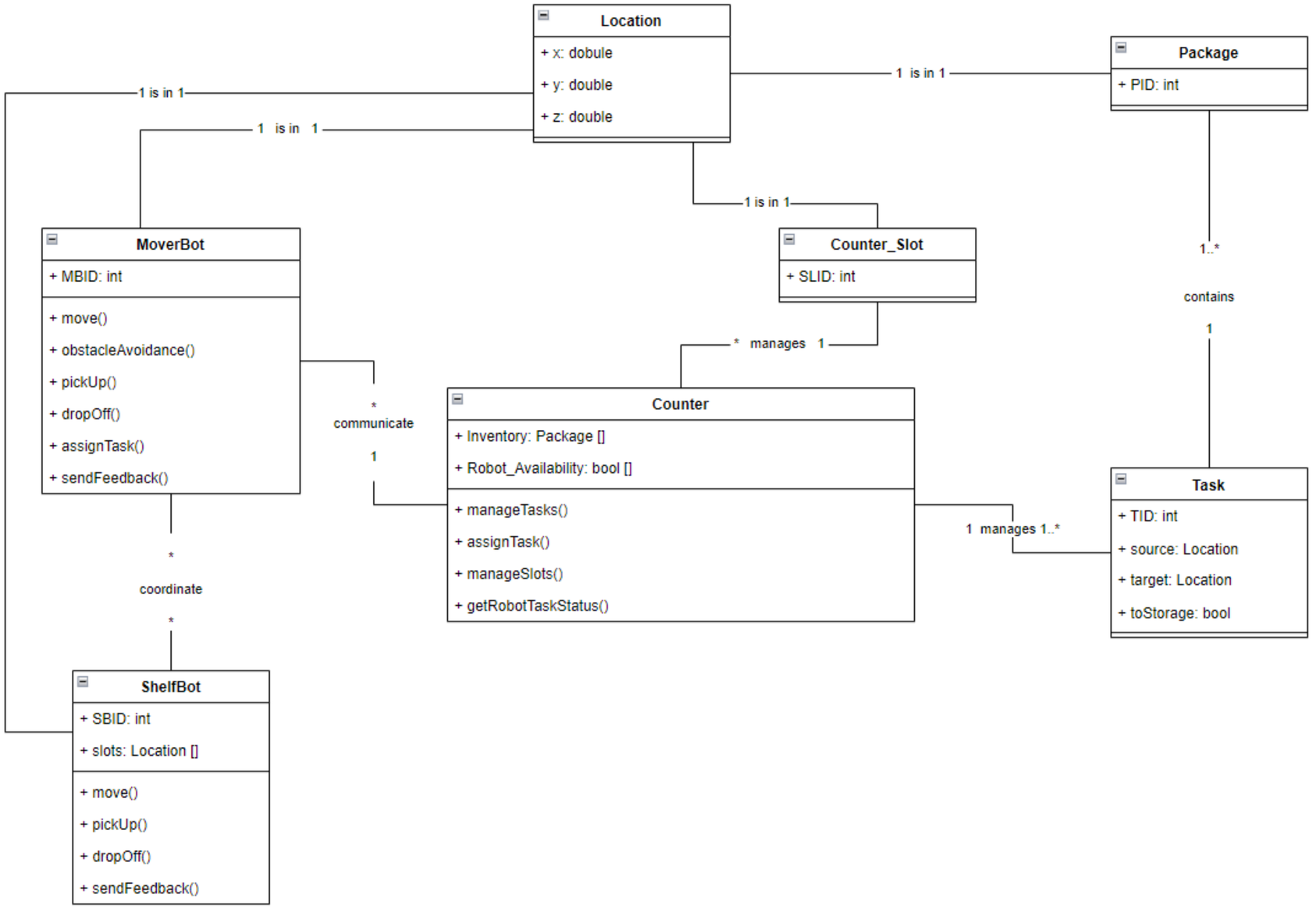


Architecture Design

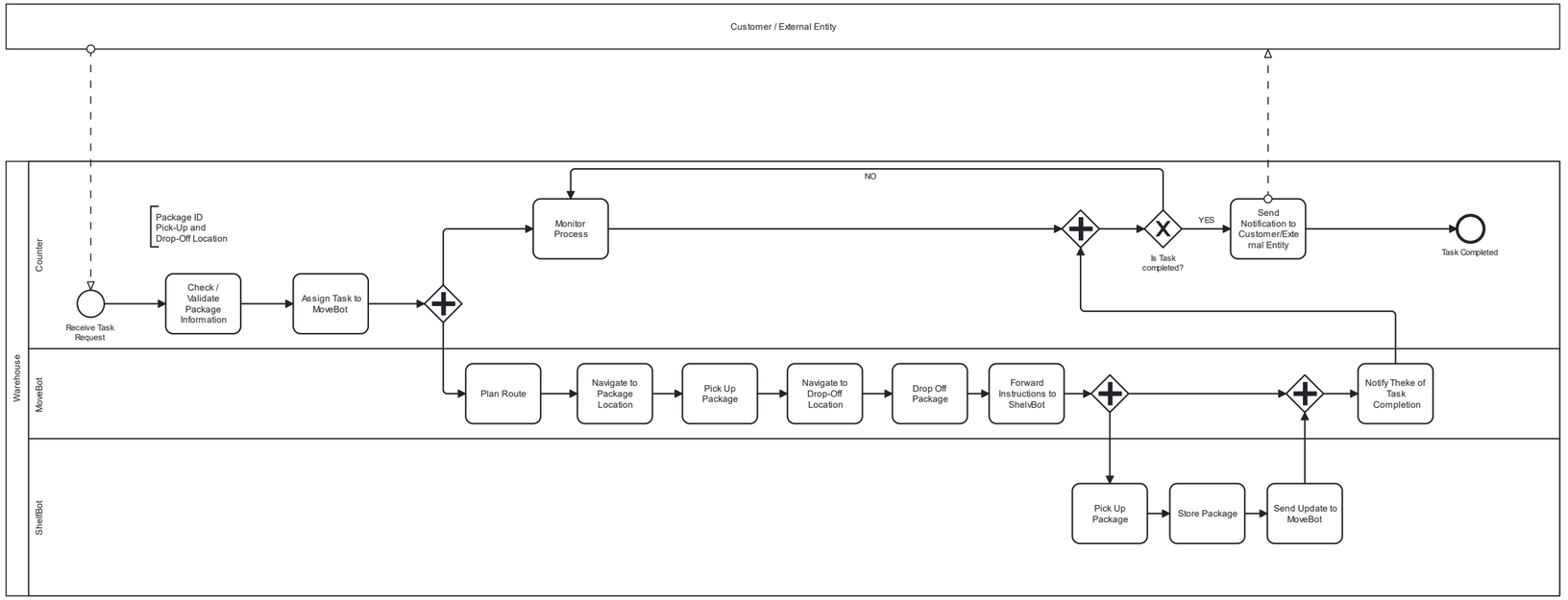
Architecture – ROS Nodes & Services

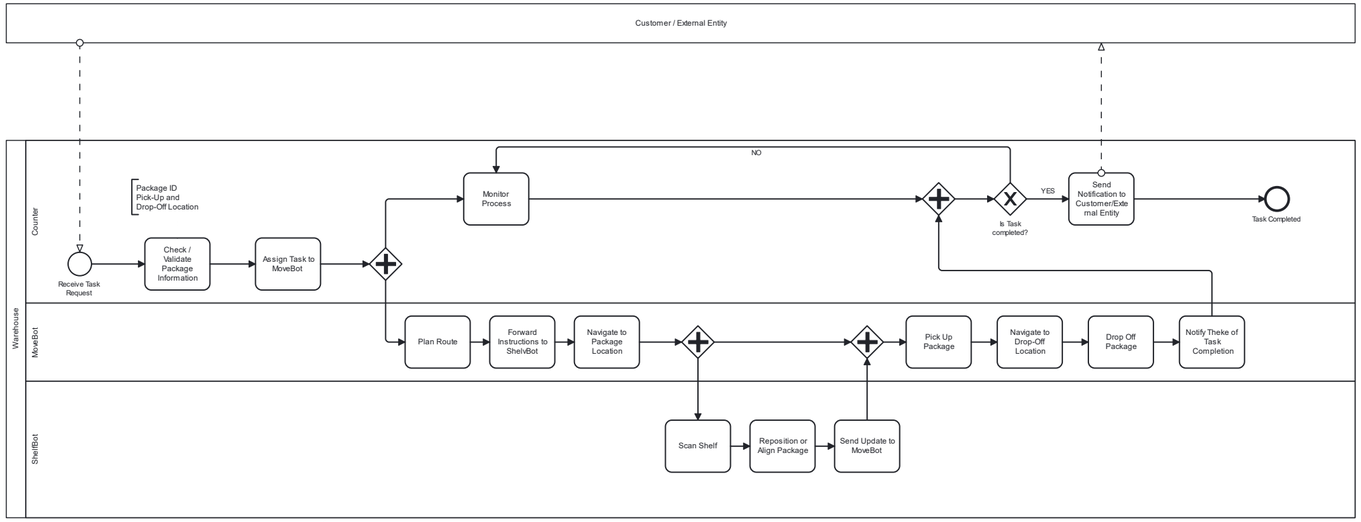


Architecture – UML Class Diagram

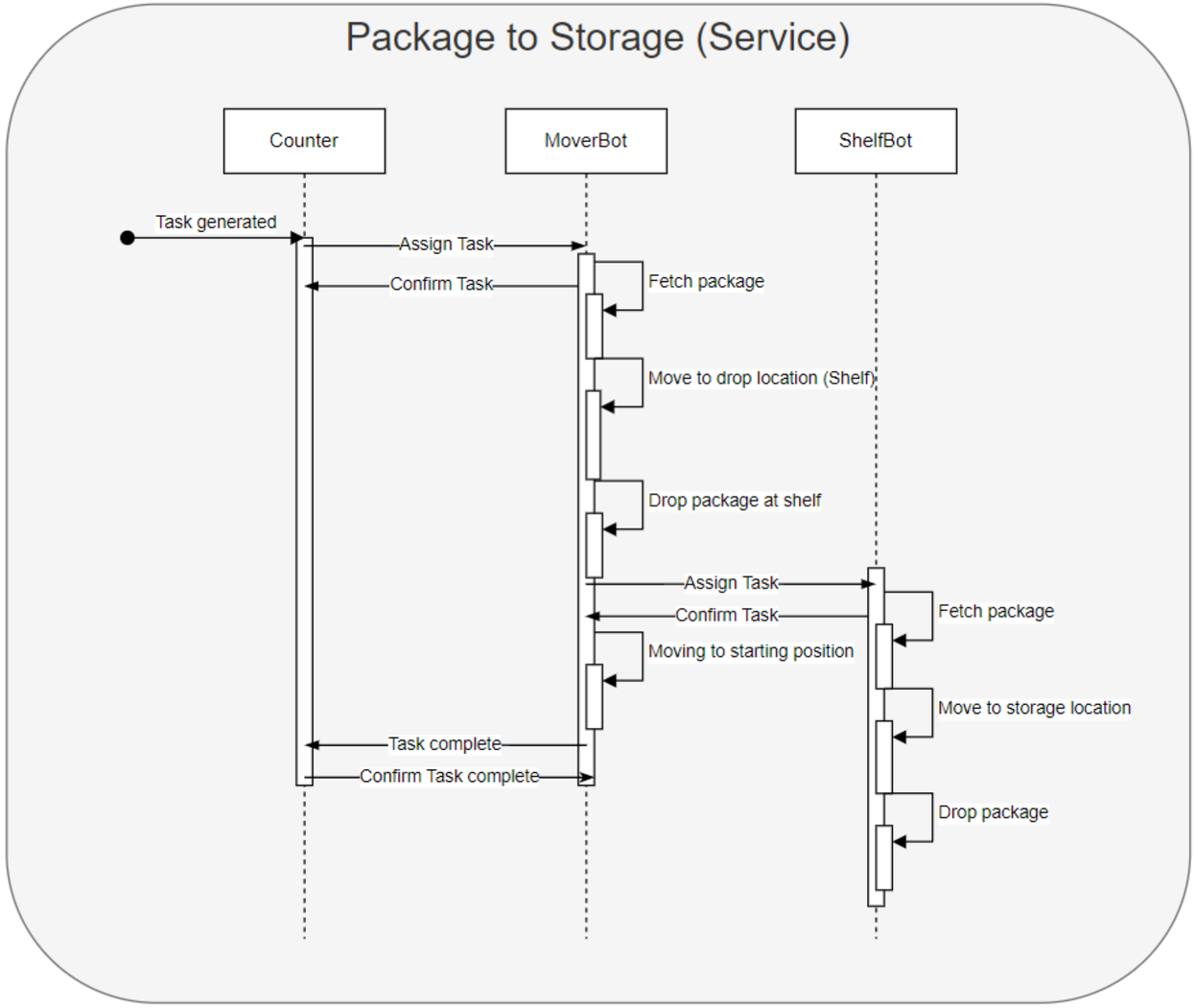


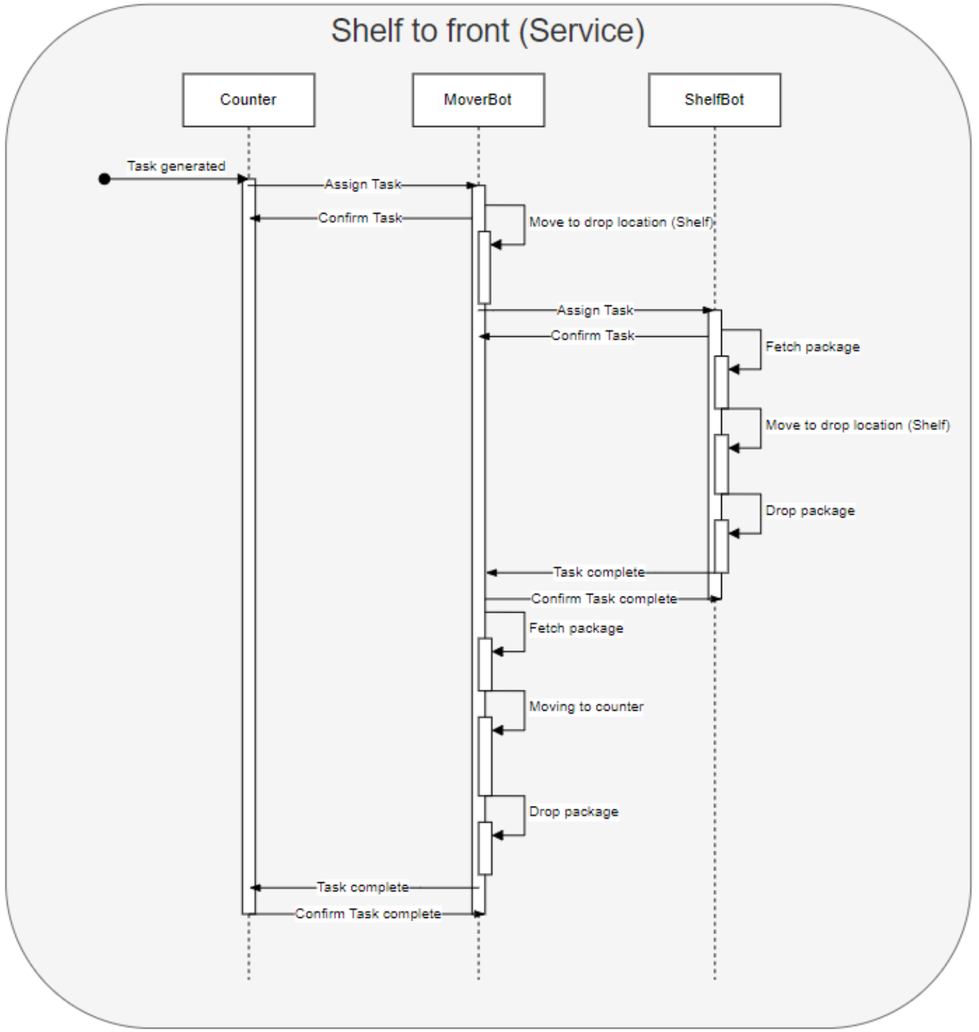
Workflow – BPMN





Workflow – Communication Flow





Live Demo

Conclusion and Future Improvements

Conclusion

- Automated warehouse package handling system was implemented
- Solution Simulates a fairly realistic, collaborative Multi Robot System with Unity Hub and ROS2 integration
- Minor adjustments would be needed to transfer the solution into the physical space

Future Improvements

- Improvements on collision detection & avoidance
- Dynamic instead of road based movement
- Varying package sizes
- Smarter Inventory Management
- Specific adaptions per case (more, adapted, or different robots)

Questions?

THANK YOU

FOR YOUR ATTENTION