MOTIUS

WE R&D.

Omniverse for Automation Simulation

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December 23, 2025 11:07 (0536ec2)

Omniverse for Automation Simulation

Automotive | Robotics | Synthetic Data

Our automotive customer needed to automate the movement of cars coming off the production line to various stations in the factory.

Differential Drive	Omnidirectional Drive	Ackermann Steering
		

Various robots and even tele-operation solutions exist, but exploring them all with pilot projects would have taken too long, been too costly and it would have disrupted the production line.

Simpler scenario calculations did not answer the really important questions:

1. **How many robots** do we need to cover all shifts and all stations?
2. How do the robots behave in a realistic environment, including **limited space**, limited battery life, and other traffic?
3. How can we **adapt our factory layout** to optimize the flow of robots and cars? How does this change the number and type of robots we need?

Approach

We built a simulation environment in NVIDIA's Isaac Sim to answer these questions, and to simulate the behavior of different types of autonomous mobile robots (AMRs) in a factory setting.

Using the library of open source robot models for ROS and synthetic data generation capabilities of Omniverse, the Motius team put together realistic simulations of each robot type, and the factory environment.

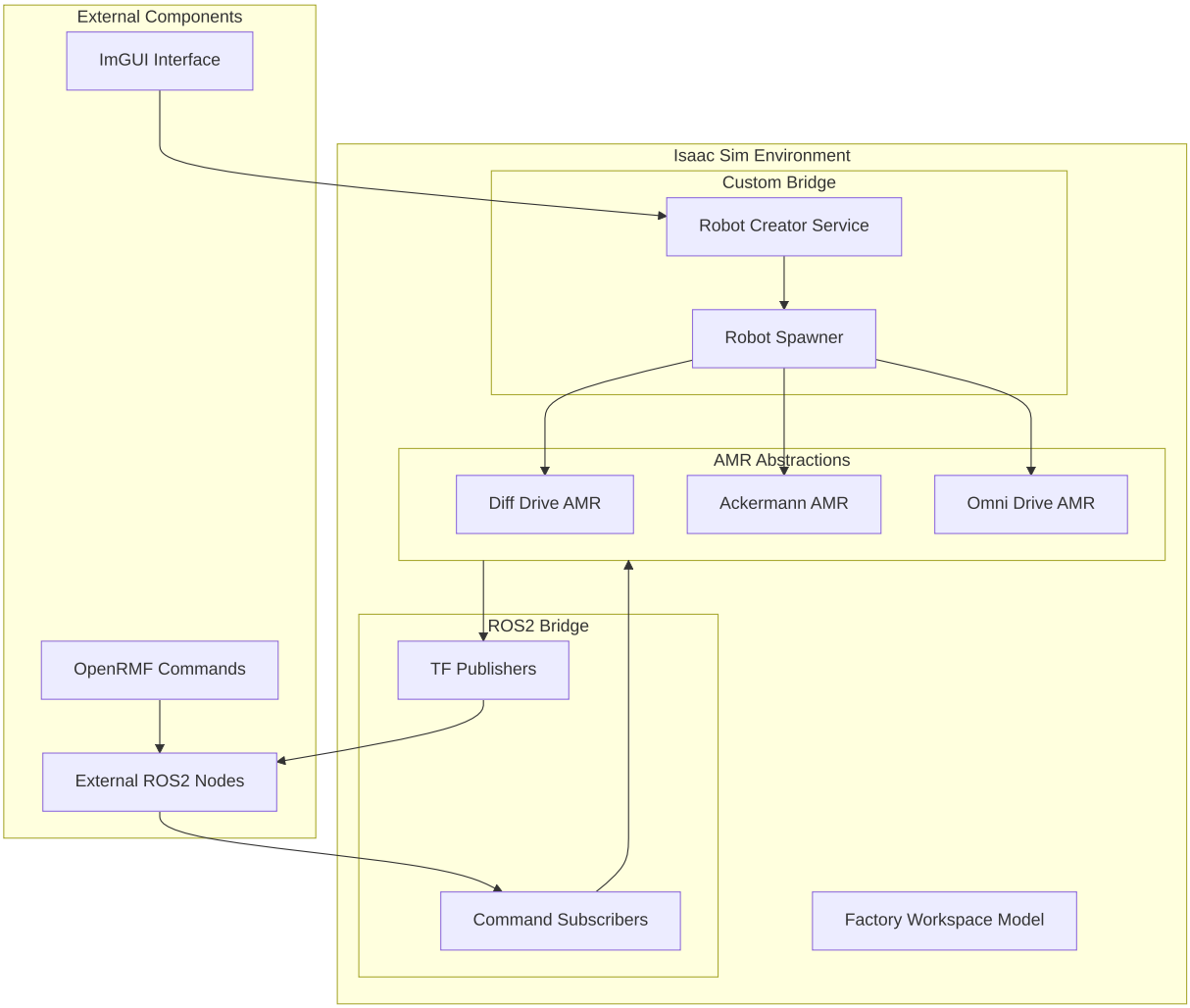
Isaac Sim Environment

The simulation environment is built using NVIDIA's Isaac Sim, which provides a realistic physics engine and rendering capabilities for simulating autonomous mobile robots (AMRs) in a factory setting.

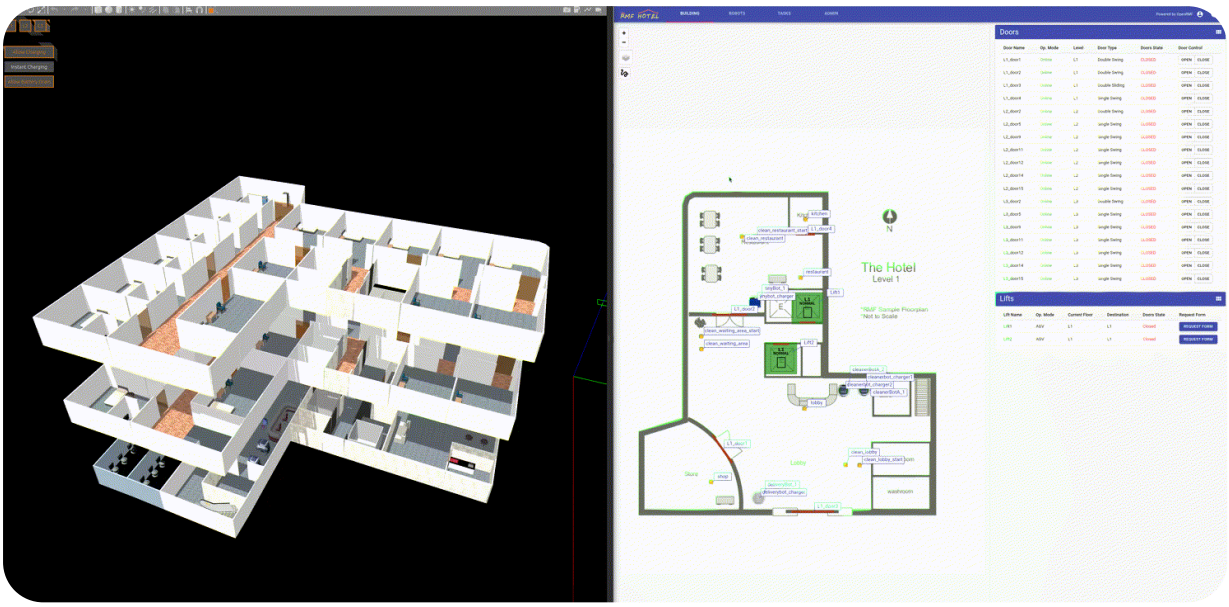
Integration Points

OpenRMF integrates with the simulation environment to send commands, create robots dynamically, and provide real-time feedback on robot poses.

Finally, results of the simulation (robot types, number, performance, etc.) needed to be logged and analyzed.



OpenRMF

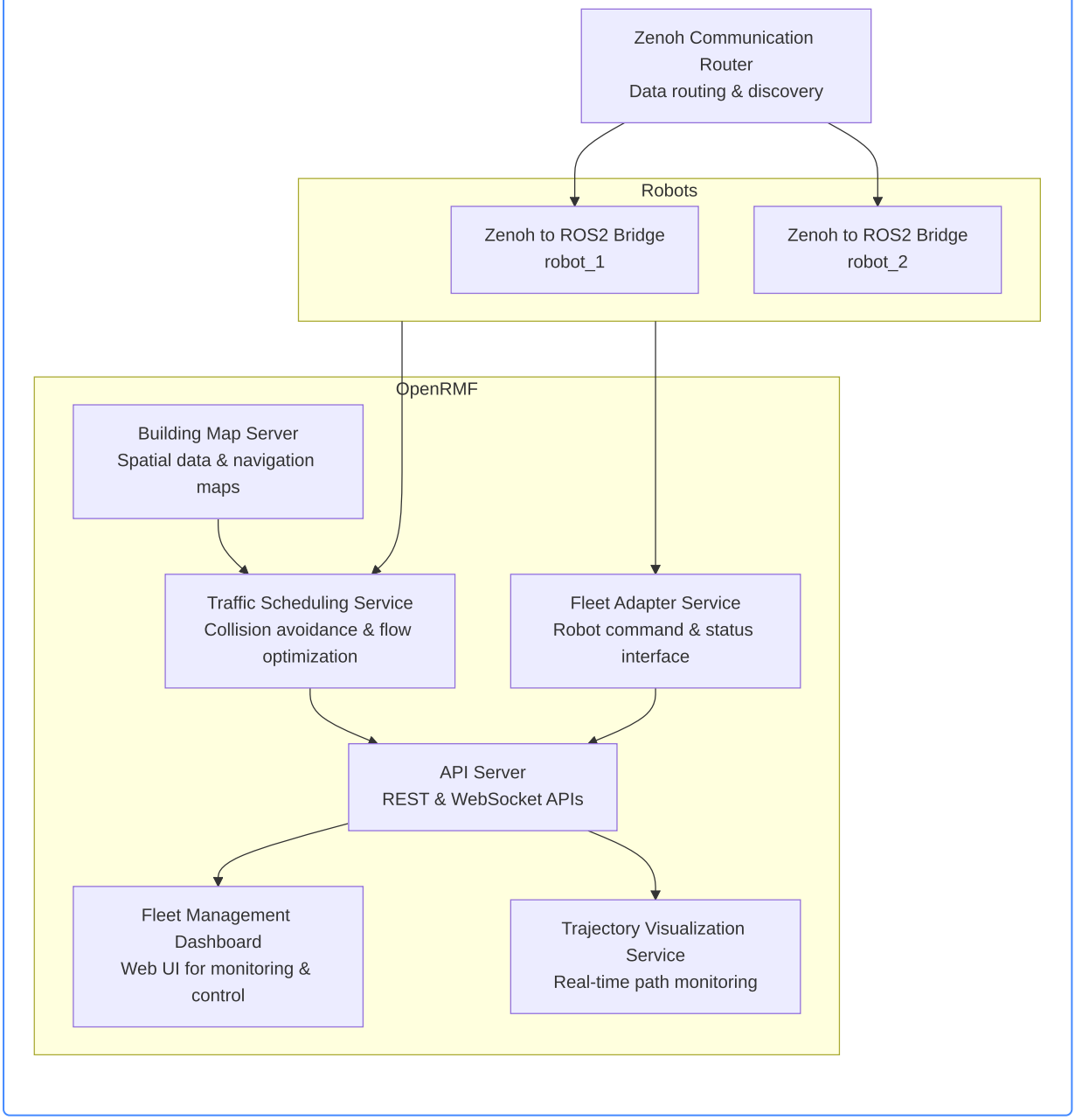


Demo video of Open RMF in a multi-story office building

OpenRMF is used as a fleet management system and central map server:

- [x] Each robot gets its own Zenoh bridge for isolated control
- [x] Traffic Management prevents AMRs from crashing into each other using the building map and tracks where each robot is going
- [x] Web dashboard lets operators the status of the robot and task execution
- [x] We built tools to import maps and define zones of interest

OpenRMF Architecture

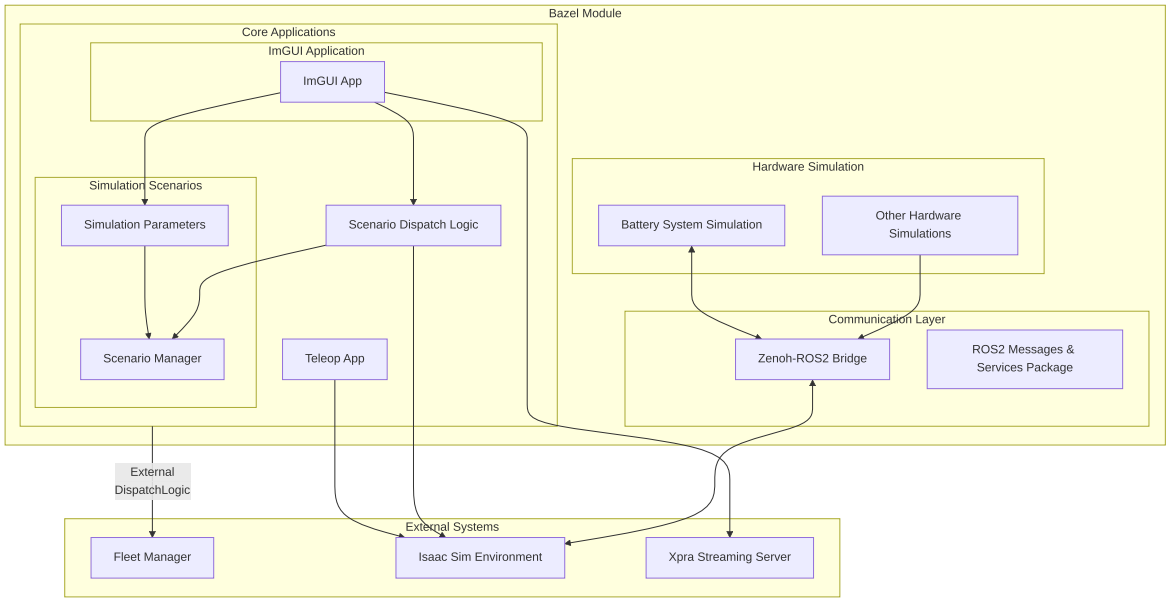


Development Workflow

Our simulation runs in a **Kubernetes** cluster, allowing us to develop and test scenarios locally or in the cloud.

Bazel is used to manage dependencies and build the simulation environment, ensuring a consistent and reproducible development workflow.

Structure in Bazel



Deployment

Our simulation runs in Kubernetes, both locally for engineering, and in a cloud environment for executing long-running scenarios.

The cloud deployment comes with external systems that allow remote access, tracking KPIs of the scenarios, and tracing simulation execution.

Application at SEW-Eurodrive

Using the Omniverse simulation environment, SEW-Eurodrive can now:

- [x] Simulate automation scenarios with mobile & stationary robots, at 80% accuracy in only 20% of the time it would take to pilot them
- [x] Test real software components in a physics-based simulation environment
- [x] Easily give your IT & OT engineers access to this environment to verify their own changes