Continuous Software Engineering for Designing and Operating an Autonomous Ocean Observation System

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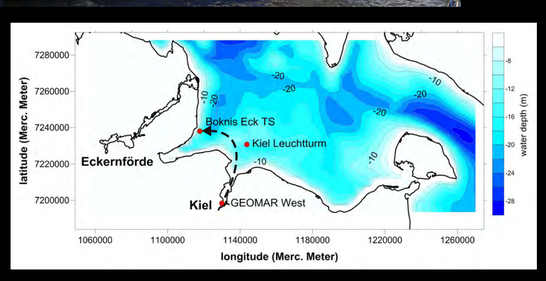
Helmholtz Future Project ARCHES (Autonomous Robotic Networks to Help Modern Societies)

Demo Mission 2020



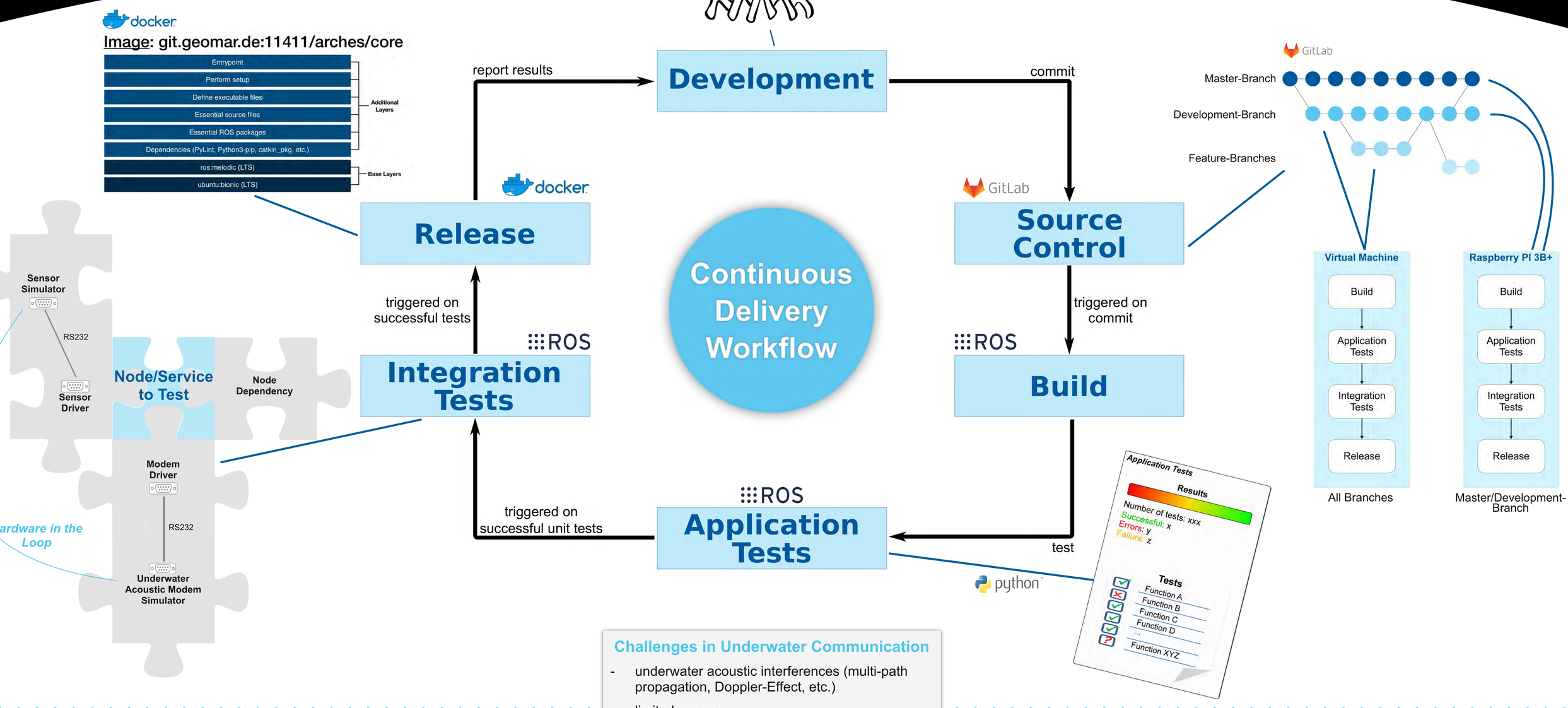
Abstract

The ocean is the largest ecosystem on earth, facing dramatic changes like deoxygenation, warming, acidification, and contamination by industrial pollution to name a few. To resolve major changes of the marine realm in space and time a highly cooperating network of robotic and synchronized autonomous multiple sensor systems is needed. In 2018 the Helmholtz Centres DLR, AWI, KIT, and GEOMAR formed a research alliance to investigate how robotic networks can be build to autonomously explore these environments.

The vision of this Helmholtz Future Project ARCHES, is a network of heterogeneous, autonomous and interconnected robotic systems. To operate the network we develop an underwater communication framework. The centrepiece of our framework is the middleware Robot Operating System (ROS). ROS provides us interfaces and services to develop a microservice architecture with loosely coupled nodes. This project is designed using a continuous delivery workflow with automatic testing and releasing of software. We containerize the entire framework using Docker. Hence, we easily control all dependencies of our nodes, and by running the nodes in separate sandboxes, they cannot crash the entire robotic system upon failure of a single system component.

Used Tools

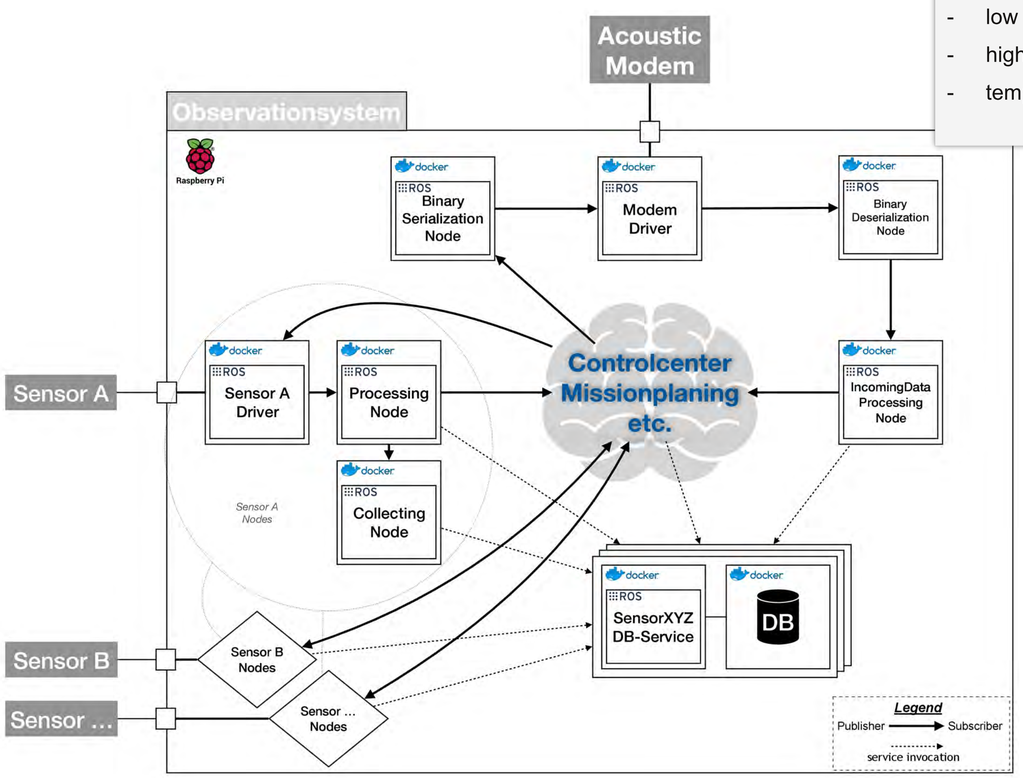
GitLab, ROS, python, C++, docker



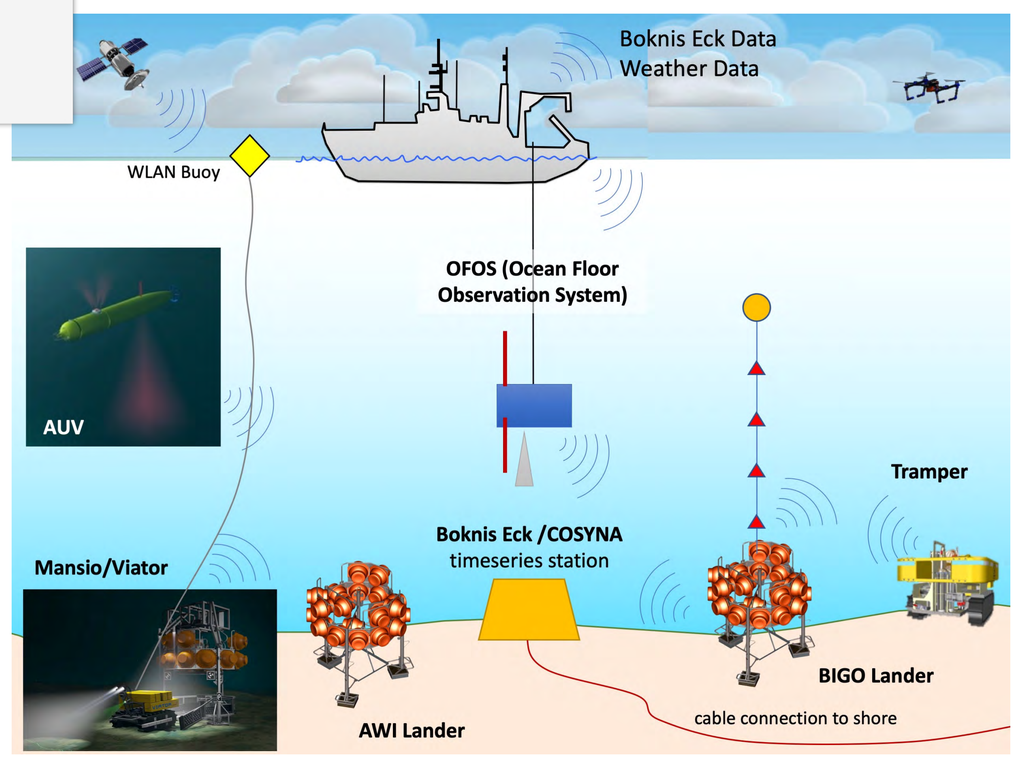
Challenges in Underwater Communication

- underwater acoustic interferences (multi-path propagation, Doppler-Effect, etc.)
- limited energy
- limited computational power
- slow transmission speed (1500 m/s)
- low bandwidth for data transmission
- high bit error rates
- temporarily losses of connection

Envisioned Microservice Architecture



Envisioned Demo Mission Setup



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