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Software Development Processes for Optimizing Academic Research Software Through CI/CD and Web Applications

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Background:

Research associates at our institute frequently develop methods for investigating building systems and indoor climate technology. While these researchers excel in their domains and create valuable computational methods, they often lack formal software development training. This leads to challenges in code maintainability and accessibility, particularly when sharing research outputs with stakeholders outside academia or attempting cross-institutional collaboration.

Challenges:

Two primary challenges emerge: First, the complexity of research code makes it difficult for decision-makers and practitioners to utilize the developed methods directly. Here, web-based frontends are a promising option to let users understand the research in an interactive manner. Second, the varying programming expertise among researchers often results in code that doesn't meet the quality standards required for open-source development and collaboration with other institutes. To address this, CI/CD pipelines are helpful.

Approach:

Our institute's software development team addresses these challenges through a dual approach. They develop web applications to make research methodologies and results accessible to the public while simultaneously reviewing and improving researchers' code bases. This includes implementing better development practices and establishing proper software engineering processes.

Implementation:

To streamline collaboration between software developers and researchers, we developed a requirements web application that helps researchers define technical specifications at project inception. This tool bridges the knowledge gap between domain experts and software developers, reducing iterative cycles in application development. Additionally, once researchers start developing their methods, we support this development with extensive CI/CD pipelines. Herein, we established a Kubernetes cluster hosting a scalable GitLab runner, providing centralized continuous integration capabilities for all software projects.

Results:

This structured approach has significantly improved both the accessibility of research outputs and the quality of research software. The requirements web application has streamlined the development process, while our CI/CD infrastructure ensures consistent code quality across projects. This framework enables effective collaboration between researchers and software developers, despite their different technical backgrounds.

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