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DevOps: A Paradigm Shift in Scientific Research

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DevOps, the set of practices and tools that combines software development and information technology operations, is beginning to transform the scientific research process from study design to publication of results. The similarities between the phases of the scientific method and the DevOps lifecycle are apparent. The scientific method has several stages and the DevOps lifecycle has several similar stages: plan, create, verify, and release. Shifting the approach of science to follow the DevOps lifecycle is transformational - increased transparency, collaboration, reproducibility, speed to results, and data integrity.

In this transformation, the first stages of the scientific method, equates to the DevOps plan stage. Hypotheses and research tasks can be managed and documented in issue tracking systems. Issue progress can be tracked with milestones and labels. No information is lost in separate email threads or local documents. Assigning issues to users along with approver and reviewer features can make the research process highly efficient between collaborators.

Data collected during the testing stage are stored in a central repository where source control management (SCM) keeps them safe and accessible. Git technology allows all changes to be controlled, tagged, versioned, and peer-reviewed through merge requests. Analysis scripts are also stored in SCM as well and run using continuous integration (CI) (the verify stage). Containerization is used to replicate computing environments and ensures reproducible results.

DevOps platforms are able to transform scientific research because the whole research lifecycle can be documented with a single source of truth in a repository, shared, and accessed. Where currently, only final results are reviewed and published in the form of papers, leaving the rest of the process opaque to reviewers and the public, the DevOps workflow allows access to and collaboration on all stages of the scientific lifecycle. As this one repository hosts all stages of the scientific process, metrics can be generated on all contributions. Researchers around the world can use the exact same workflows on their own data ensuring reproducible science.

References

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