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Conquaire: Continuous quality control for research data to ensure reproducibility

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https://conquaire.uni-bielefeld.de

About

We present progress in Conquaire, a DFG project to foster the analytical reproducibility of research results at Bielefeld University, Germany, conducted by CITEC (Center of Excellence in Cognitive Information Technology), Bielefeld University Library and 9 research groups from 2016 to 2019. DFG grant number: 277747081.

Motivation

Reproducibility of research results enables peer validation. However, reproducing research results is a major challenge:

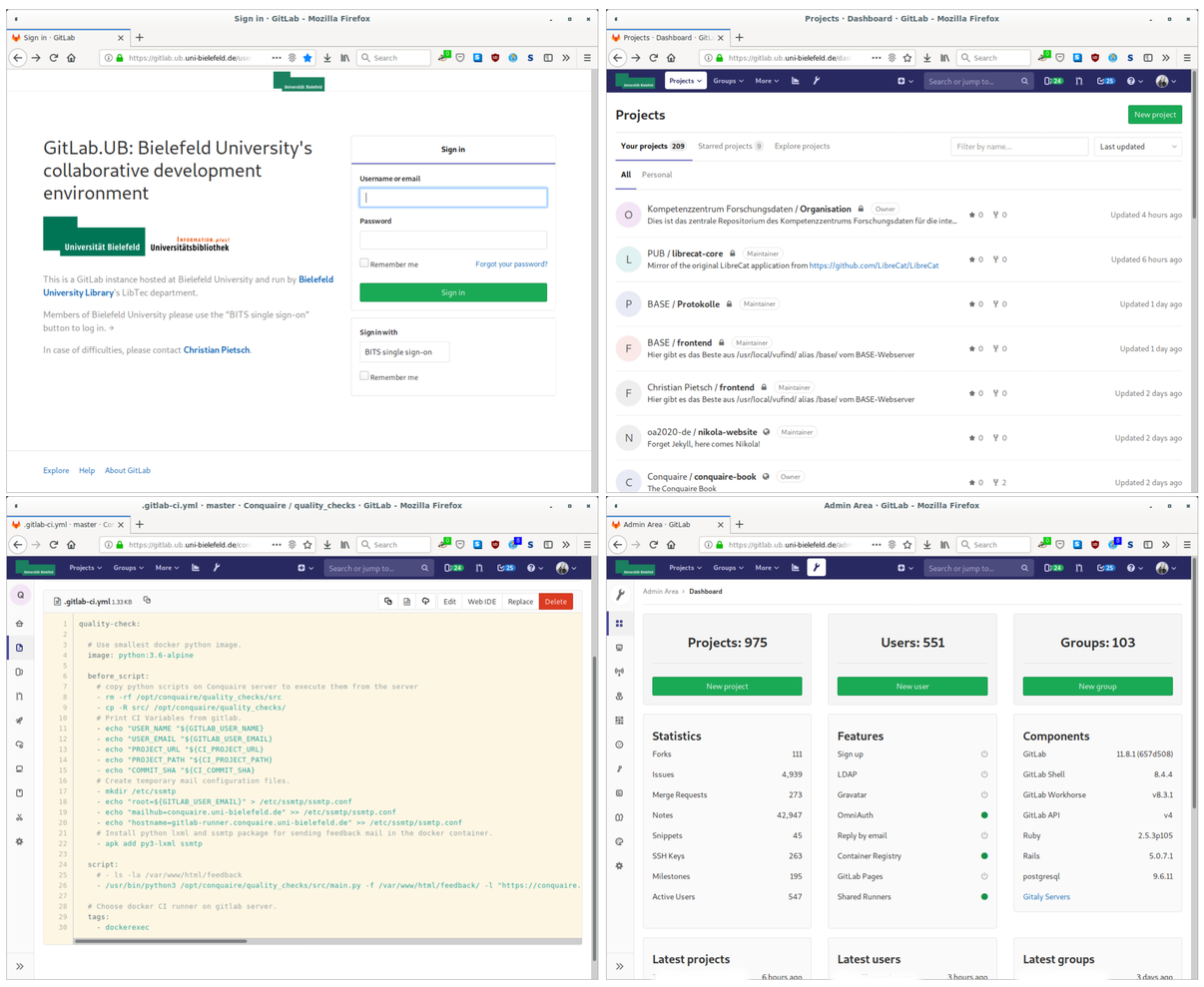
- Nature survey (1576 scientists): 50–70 % reproducibility failures
- Reproducibility Project: 61 % failure rate in Psychology
- pharmaceutical clinical drug trials: 82 % failure rate

Conquaire approach to improve data quality

Prime directive: Do not to create any extra effort for researchers, and not to stand in their way. Instead, we try to tap into their existing workflows in 4 easy steps:

1. offer an institutional GitLab instance with Large File Storage
2. offer training in Git and GitLab as well as for PUB (see below)
3. offer data quality checks implemented in GitLab CI (see below)
4. connect GitLab to our institutional publication repository PUB for instant data publishing incl. DOI minting, linking, and archiving

1. GitLab.UB



2. Training

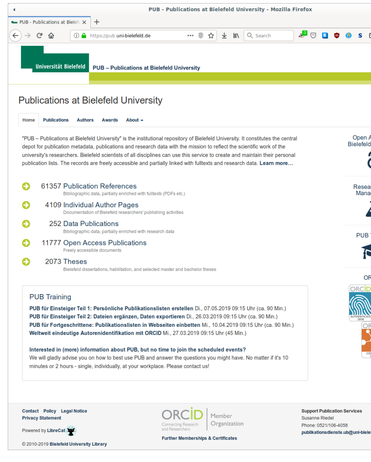
- In 2016, delegates from 8 research groups (project partners) attended several hands-on Git training sessions based on the Software Carpentry course https://swcarpentry.github.io/git-novice/.
- Once in each semester since summer 2018, we have offered a Git and GitLab training session to Bielefeld University staff. They were almost fully booked.

3. Continuous data quality checks

Inspired by successful software development practices such as versioning and continuous integration (CI), we apply these ideas to research data management (RDM).

The GitLab component GitLab CI can automatically run arbitrary programs whenever files are added or changed. These programs run on a separate server within a temporary Docker container. We provide a `.gitlab-ci.yml` file that runs them.

It checks for basic FAIR data principles compliance and tries to validate the most popular data file types.



4. Publishing datasets

Bielefeld University's institutional publication repository PUB is the place where researchers enter their publications, including data publications. PUB is an in-house development based on the free and open-source LibreCat software.

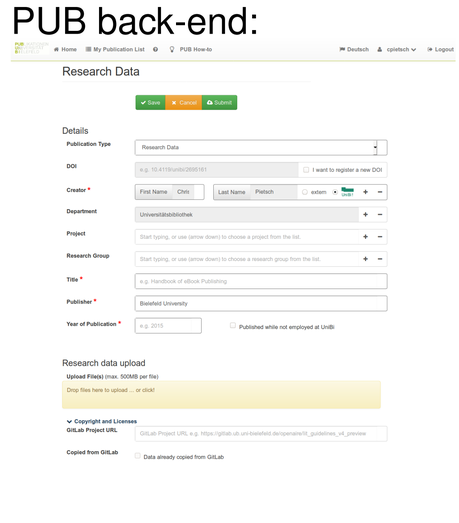
As an alternative to the existing upload button, researchers can now select one of their GitLab.UB projects to publish any version and get a DOI for it. PUB talks to the GitLab API.

Data publications can be linked to conventional publications. Metadata can be re-used in the Linked Open Data spirit via an open API in formats such as MODS and DataCite XML.

Soon, PUB will display a badge indicating the overall result of the data quality checks from step 3.

PUB front-end:

PUB back-end:



Related work

This project was initiated by Najko Jahn's observation that researchers started to use GitHub for tasks other than software development (see the project proposal on the Conquaire website for quantitative details).

Later, GitHub started to co-operate with Zenodo to offer a data publication service not unlike the one we provide for Bielefeld University but without pre-configured quality checks.

More recently, GitLab added a feature called Auto DevOps that provides pre-configured quality and security checks for software development.

Ongoing work

How to display the badge?