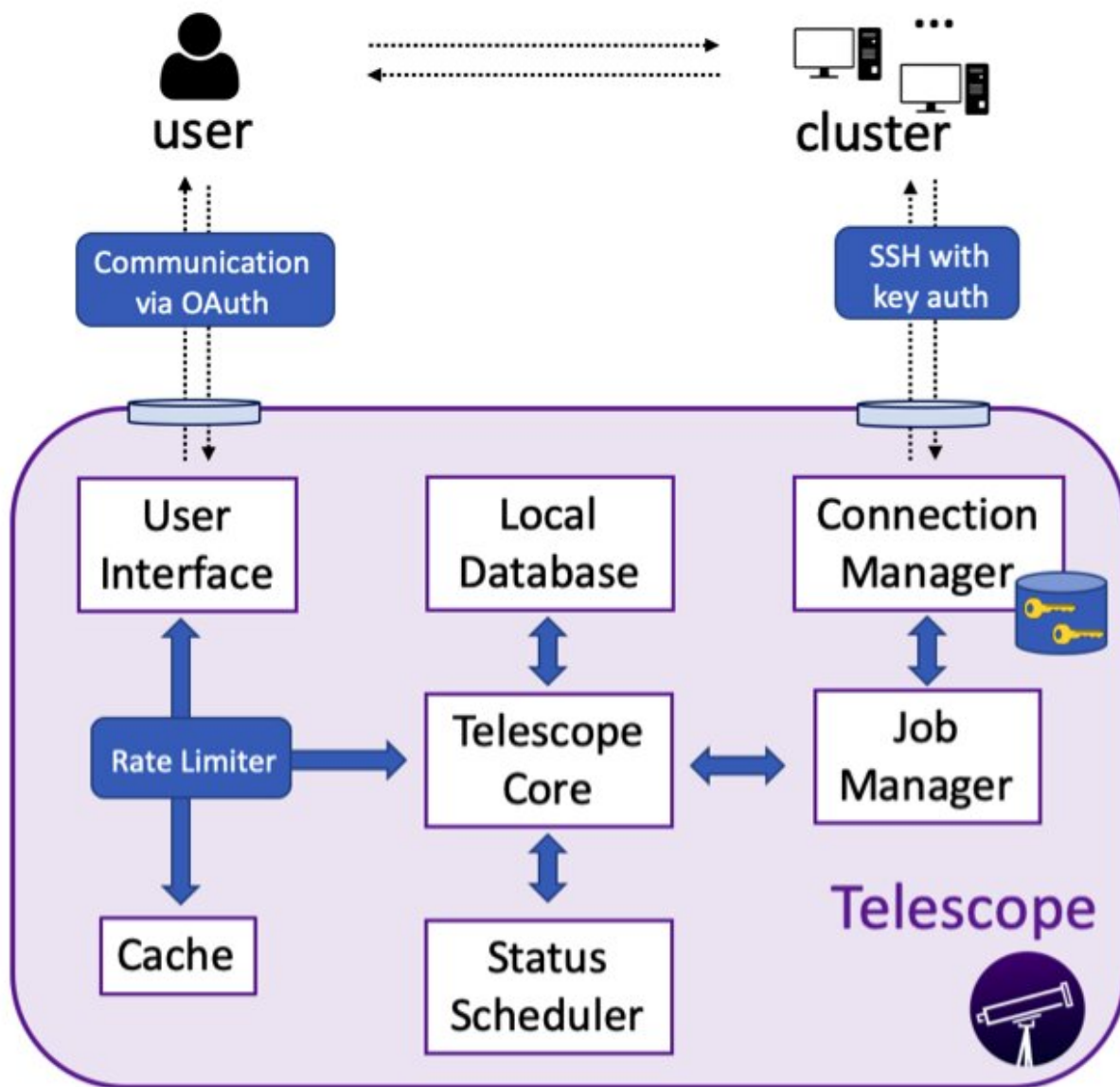# Telescope: a tool to manage bioinformatics analyses on mobile devices

October 18 2019, by Ingrid Fadelli

Telescope architecture: the job manager gathers job information by connecting

to the target cluster via its connection manager. Telescope's local database keeps records of this information, which is rendered by the user interface into a (mobile-friendly) web page. Credit: Brito et al.

A team of researchers at UCLA, the University of São Paulo, the Federal University of São Carlos and the University of Southern California has recently developed an interactive tool for managing large-scale bioinformatic analyses in real-time and from portable devices. This new tool, called Telescope, was first presented in a paper pre-published on *arXiv*.

The team who developed Telescope includes postdoctoral fellows from UCLA Collaboratory, a research lab at the university's Institute for Quantitative and Computational Biosciences. Working at UCLA Collaboratory allows these researchers to interact with other students and faculty members at the university who have varying levels of expertise in computational biology. These interactions are what ultimately inspired the team to develop a user-friendly tool for managing large-scale bioinformatics analyses.

"Most life sciences and biomedical studies today target effects so subtle and hard to detect that large amounts of data and computational power have become the new status quo," the researchers told TechXplore via email. "Often, however, researchers describe the excessive dependence on command-line tools as cumbersome and highly unintuitive for those who lack formal computational training."

Specialized training initiatives and workshops have been found to be particularly effective in encouraging researchers to start using powerful methods for large-scale bioinformatics analyses. However, most techniques to access these methods on computational facilities are not

very well integrated with wet lab environments, where most biology experiments are carried out. With this in mind, the researchers set out to develop a tool that would enable better integration between bioinformatics tools and wet lab research.

"Telescope was proposed to nurture integration and closer collaboration between wet lab research and bioinformatics, reducing the learning curve traditionally required to run complex bioinformatics analyses in computational facilities," the team told TechXplore. "The challenge, however, was guaranteeing that the final solution would indeed address the gaps and be intuitive to most researchers."

In order to present their solution to both tech-savvy researchers and those with limited computational skills, the researchers decided to introduce Telescope during the II Hackathon event at the beginning of 2018. Hackathon brings together researchers with IT and coding skills, offering them the opportunity to learn IT skills as a group, for instance, exploring how to build scripts and apply bioinformatics tools to datasets.

"Our idea attracted both newbies wanting to get their hands dirty working directly with data as quickly as possible and tech-savvies who just wanted an easier way to check their work from their phones," the researchers explained. "Telescope was thus designed from and for the community."

Most researchers who carry out experiments in wet lab environments need to meet substantial time demands. Telescope is designed to help them manage their workload better, supervising and adjusting bioinformatics analyses in real-time.
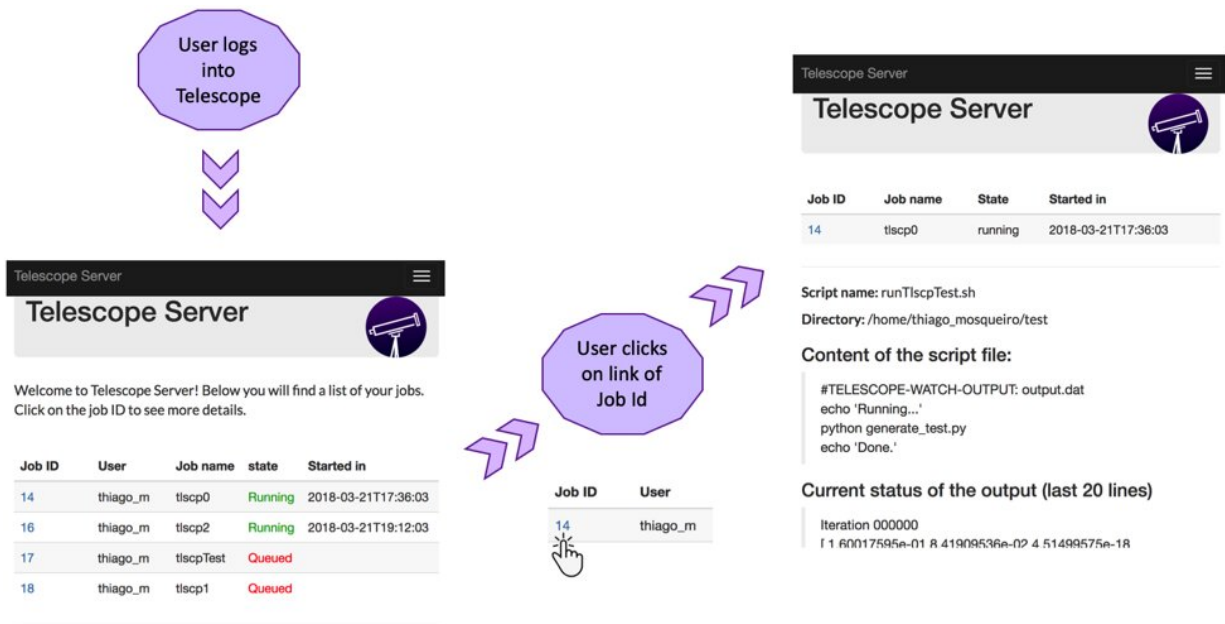
Telescope user interface: The first screen displays the status of the jobs on the cluster. The next screen shows detailed information about the first listed job: source directory, name and content of the script file, and last lines of current task output. Credit: Brito et al.

Essentially, Telescope strengthens the relationship between wet lab experiments and tools for analysing large amounts of biological data. It does this by providing a secure and user-friendly platform on which users can kickstart their research and manage tasks relevant to bioinformatics jobs running in high-performance clusters.

"Telescope leverages common web frameworks such as Twitter's Bootstrap to provide an eye-candy user experience and support an extensible interface," the researchers said. "Intending to support both new and experienced users, Telescope's core manages and stores user access keys using industry standards."

The access keys stored by Telescope are used to connect high-performance computational clusters through a secure shell in order to receive the latest job status updates and issue new commands whenever needed (e.g., deleting old tasks etc.). Telescope allows wet-lab scientists to track the status of their work and easily access preliminary results of their bioinformatics analyses directly on their mobile phones. This means that they can also identify potential issues with their analyses early on and cancel them without having to use a computer.

"Compared to the usual approach of using command lines at Linux terminals, Telescope is a more intuitive and interactive tool," the researchers explained. "For instance, sharing analysis results is as easy as sharing a link, as you would on Twitter or Facebook. Nonetheless, we feel that our most meaningful achievement was the engagement with the traditionally non-computational life sciences community at the beginning of the development."

This new tool for managing bioinformatics analyses took the needs of biology researchers into close consideration. In fact, the team took advantage of the Hackathon event to collect input and feedback from biology experts with varying degrees of IT competency and experience using computational analysis tools.

"We gathered input from novice computational users, as we wanted to create a tool that tackles the most challenging points of using unintuitive command lines," the researchers said. "We then developed a simple and minimal web interface that can run on various devices, including mobile phones, with zero setup. The challenge was to trade off simplicity with security, and we achieved a good balance by employing industry-standard protocols, such as storing keys using PBDKS."

The tool developed by this group of researchers, which is now available on GitHub, can assist biology experts in their work, helping them to

manage their bioinformatics analyses in a simpler and more intuitive way. In addition to allowing biomedical researchers to access the power of large computational facilities from their portable devices, Telescope is a customizable and extensible software. This means that users can add new features to it or can help to develop it further.

"Our project will now be maintained by the Mangul Lab at USC as open-source software," the researchers said. "We are also planning to integrate Telescope into most of our lab's analyses pipelines in order to evaluate user experience further. As the next step, these tests will be expanded to a poll of beta testers from a broader community. Our overarching goal is to roll out Telescope for the users of USC's high-performance cluster in the future. Throughout this process, the Mangul lab will thrive to engage with the community to drive adoption and ensure that Telescope remains relevant."

More information: Telescope: an interactive tool for managing large scale analysis from mobile devices. arXiv:1909.12469 [cs.DC]. arxiv.org/abs/1909.12469