Best Practices for a Future Open Code Policy for NASA Space Science
Response to a call for White Papers

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Abstract

Open source code is better code, as it can use the many free tools and services now available to the open source community. Access to these tools helps teams easily follow best practices for creating, testing, and distributing scientific software.

In recent years the popularity of open source software and the infrastructure to support it has grown phenomenally. Companies now provide services for free to open source code-bases. These services enable teams to follow best practices for software development with a minimal investment in time, money, and other resources. This brief white paper will enumerate a selection of these services and describe how they can benefit scientific software development. Each tool is free to use for open source projects and teams. While many of the practices described are achievable with closed source solutions, none of them are as cheap, fast and low-maintenance as their open source alternatives. Some can especially benefit code written in academic environments. Even those with NASA funding often lack the resources that NASA internal teams have access to. If our goal is safer, better, faster, cheaper then open source science code is the way to achieve it.

Github

Github[1] is a service that enables developers to save, organize, and share open source code for free online. It is a website interface to the popular git version control system and enables the following:

- Source code can be easily shared among teams without the need to set up and maintain an expensive web server. This enables free and easy collaboration.
- Published results can reference a tag of the code at a specific state, which will never change. Other researchers can replicate past findings using that tag, while the development team makes further changes.
- Users of the code can contribute to future development by providing their own changes, while the owner of the code-base retains ultimate control over what is included.
- Owners retain full control over official code-bases and can migrate to government, academic, or private alternatives to Github freely and easily.

Codecov

Testing code is crucial to producing reliable software packages, but testing is tedious and often difficult. It can be hard to know whether tests cover every part of the code-base, or if some parts remain untested. Codecov[2] is a service that analyzes open source projects for free and reports which parts of the code base is covered by the given tests.

TravisCI

Running tests is its own challenge, especially when the code must be tested on many operating systems. By lowering the barriers to effective testing, teams can catch more bugs and security vulnerabilities before releasing code. TravisCI[3] is one of many cloud testing tools helping developers write safer, more correct and reliable code.

- Tests are run automatically when a change is seen on Github.
- Tests are run in the cloud on multiple operating systems with no human interaction needed. Teams can test on some systems they otherwise cannot access.
- Success and failure reports are generated automatically in an easy to read format.

Conda

Installing software of any kind on a user's machine can be a difficult task. Different operating systems have different requirements, and all software packages depend on other packages to run. For example, graphing code depends upon a graphing library to display results. Conda[4] is a free package manager for open source packages. Many other package managers exist with differing strengths and weaknesses. Teams can reasonably distribute open source software through more than one package manager.

- User installation is as easy as typing `conda install` into a terminal.
- Developers tell Conda which other packages their code depends on. Conda installs these dependencies before installing the developer's package.
- Conda supports all programming languages unlike other managers which focus on a single language.
- Conda supports Linux, Mac, and Windows unlike other managers which focus on a single Operating system.

NASA teams and academic collaborators alike have real opportunities to benefit if we shift to a policy that permits and encourages open source development. Saving money and reducing overhead will empower teams of all sizes and funding levels to write better code more reliably; code that is easier to share, use, and improve.

References

[1] https://github.com.

[2] https://codecov.io.

[3] https://travis-ci.com.

[4] https://conda.io/docs/.