R & R

Jacob Oursland & Elijah Grimshaw

February 14, 2017

Introduction

Source code repository visualization techniques have greatly improved over the last few years, providing great insight into how the software we use was created. This is inspiration for seeing what else may be understood from examining information hidden away within a code repository. We investigate the R source code as a source for data which will then be analyzed with the R programming language.

Data Collection

Data collection is a straightforward process of downloading a GitHub mirror of the R source code.[1] After this we converted metadata of the source code commits to JSON, recording the author, date, paths modified, and lines added and removed. This process was performed by a script that converts the output of **git log** to JSON.

Example **git log** entry:

```
commit 4c3f25fd118abb2c7092cfa27c67f5e2485860ab
Author: ripley <ripley@00db46b3-68df-0310-9c12-caf00c1e9a41>
Date:   Sun Feb 12 11:53:57 2017 +0000

updates, especially about append mode

git-svn-id: https://svn.r-project.org/R/trunk@7215800db46b3-68df-0310-9c12-caf00c1e9a41

 src/library/utils/man/download.file.Rd | 6 +++---
 1 file changed, 3 insertions(+), 3 deletions(-)
```

Resulting JSON entry:

```
{
  "commit": "4c3f25fd118abb2c7092cfa27c67f5e2485860ab",
  "author": "ripley <ripley@00db46b3-68df-0310-9c12-caf00c1e9a41>",
  "date": "2017-02-12 11:53:57 +0000",
  "message": "updates-especially-about-append-mode",
  "paths": [
    {
      "insertions": "3",
      "deletions": "3",
      "path":
      "src/library/utils/man/download.file.Rd"
```

[1] https://github.com/wch/r-source

```
    }
  ]
},
```

The resulting JSON files were processed using a custom C++ program to compute a total lines added and removed (instead of a per-file lines added and removed) and clean up the author name.

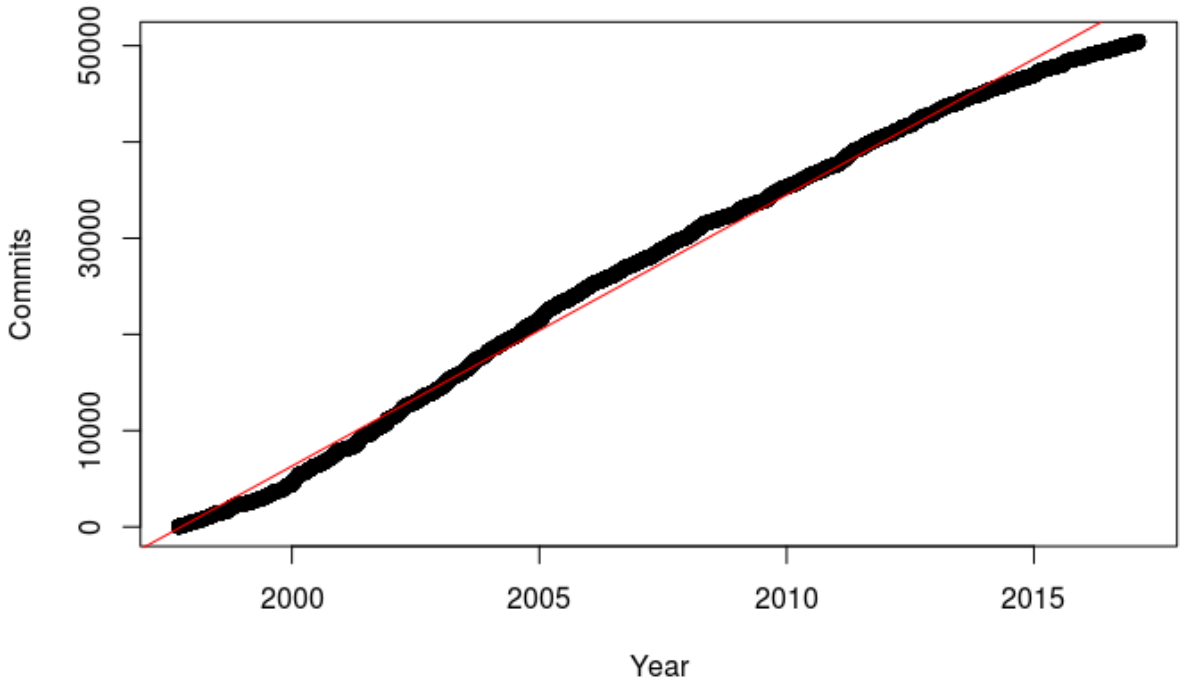
The source to the conversion and processing programs are available on GitHub.[2]

Data Analysis

Using the JSON dataset, we investigated the total number of commits, each author's contributions, and the sizes of contributions each author made.

Rate of Commits

We began investigating the rate of commits, expecting to see a rapid increase as more contributors joined the team and better tooling reduced the efforts in testing and submitting changes. Instead we found that over the last 20 years, commit rates had held fairly linear with a drop off in recent time. This could be attributed to the project being mature with new features being added as R packages and not language changes.



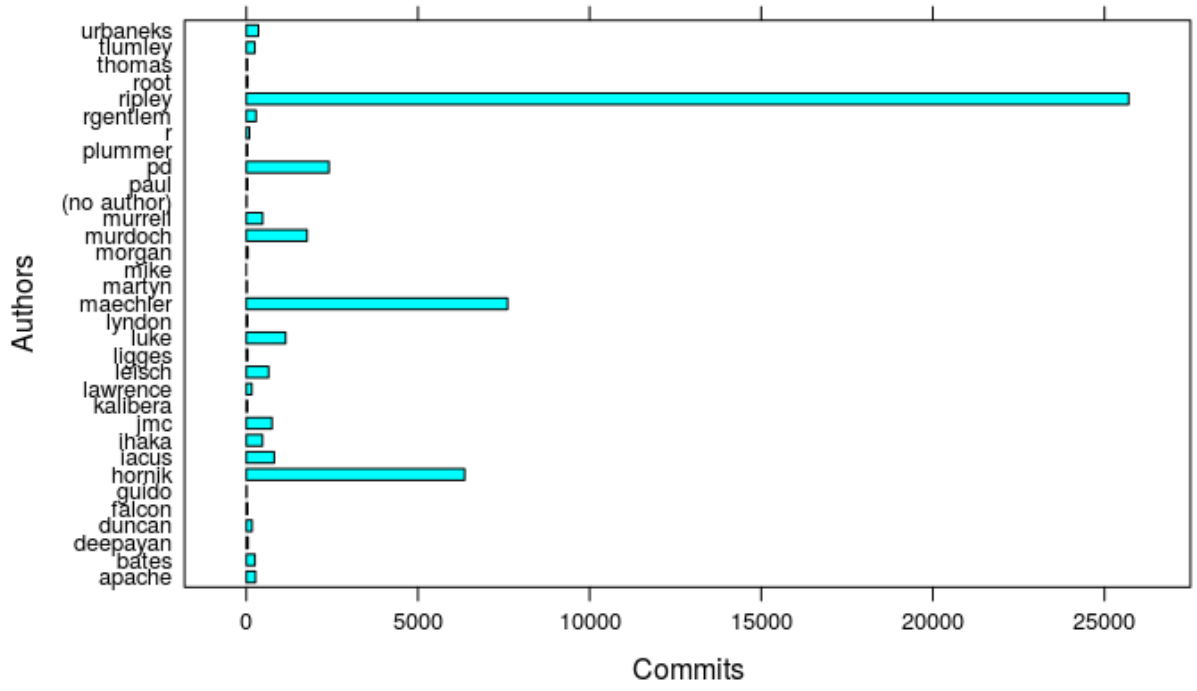
[2] https://github.com/oursland/r-commits

Author's Contributions

We looked at the contributions of each author to see if we could identify who were the major committers, and if they could be divided between feature developers and bugfix developers.

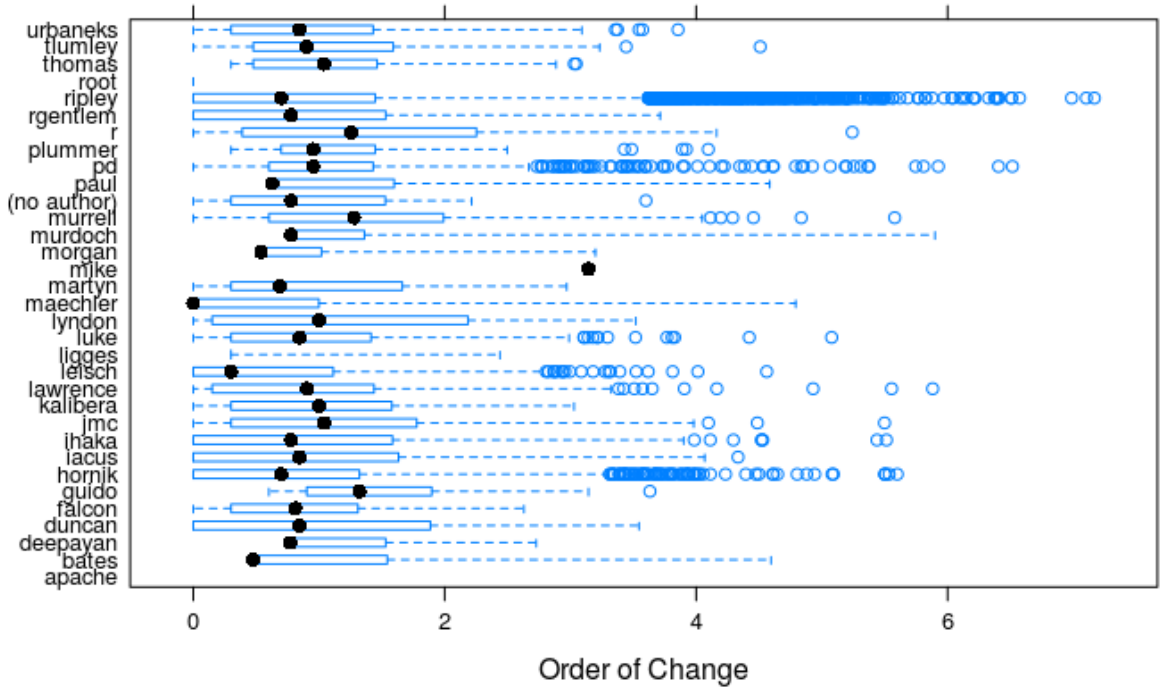
Number of Commits

As demonstrated by Figure 3, the vast majority of changes to R are committed by only a few developers. Most commits are small, implying that they are likely to be bugfixes or small changes to existing functionality, not new features.



Commit Sizes

Figure 4 shows that the same developers who commit the most tend to make the largest commits. This implies that the regular developers are also the developers who have implemented the major language features.



Conclusion

The R programming language is developed by only a handful of programmers. Of this group, only about 4 developers are very active and they produce both the major features and the bug fixes.