Code Churn

Yegor Bugayenko

Lecture #13 out of 24
80 minutes

History of Version Control Systems (VCS)

- The Librarian by ADR: created in 1969
- Panvalet by Computer Associates: 1969
- SCCS by Bell Labs: 1973
- RCS by GNU: 1982
- CVS: 1986
- ClearCase by IBM: 1992
- Apache Subversion: 2000
- Mercurial: 2005
- Git: 2005

"We can measure the increase or decrease in system complexity as measured by a selected metric, code delta, or we can measure the total amount of change the system has undergone between builds, code churn."

— *Code Churn: A Measure for Estimating the Impact of Code Change*, Sebastian G. Elbaum and John C. Munson, Proceedings of the International Conference on Software Maintenance (ICSM), 1998

Motivating Example

Commit #1:

0

```
class Book
  private final int id;
  public Book(int it)
    this.id = i;
```

Commit #2:

+5

```
class Book
  private int id;
  public Book(int it)
    this.id = i;
  public int getId()
    return this.id;
  private int setId(int i)
    this.id = i;
```

Commit #3:

+2 / -2

```
final class Book
  private final int id;
  public Book(int it)
    this.id = i;
  public int getId()
    return this.id;
```

Delta: +3 / 0, Churn: +7 / -2

Code Delta vs. Code Churn

BUILD	RCM	DELTA	CHURN
1	184643.38	5.72	7.12
2	184648.81	5.43	16.78
3	185702.10	1053.28	1547.93
4	185857.61	155.50	187.11
5	186236.58	378.97	429.30
6	186261.81	25.23	294.18
7	186083.21	-178.60	791.87
8	186726.70	643.50	836.71
9	187072.37	345.65	426.24
10	187157.08	84.71	86.74
11	189945.91	2788.85	2804.02
12	190000.81	54.89	59.28
13	190007.10	6.29	6.38
14	190012.49	5.39	5.48
15	190069.36	56.87	75.08
16	190066.48	-2.88	3.86
17	190067.65	1.17	1.17
18	190067.81	0.16	0.21

Table 2: Evolution Data for QTB

"A limitation of measuring code deltas is that it doesn't give an indicator as to how much change the system has undergone. If several software modules are removed and are replaced by modules of roughly equivalent complexity, the code delta for the system will be close to zero."

Source: *Code Churn: A Measure for Estimating the Impact of Code Change*, Sebastian G. Elbaum et al., ICSM, 1998

“Our case study provides strong support for the following conclusion: increase in relative code churn measures is accompanied by an increase in system defect density.”

— *Use of Relative Code Churn Measures to Predict System Defect Density*, Nachiappan Nagappan and Thomas Ball, Proceedings of the International Conference on Software Engineering (ICSE), 2005

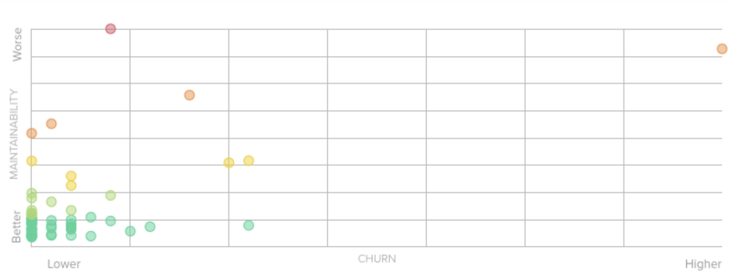
"We can conclude that committing files with higher cumulative code churn values (i.e. those of longer change history) is more likely to result in negative maintainability change."

— *Cumulative Code Churn: Impact on Maintainability*, Csaba Faragó, Péter Hegedűs, Rudolf Ferenc, Proceedings of the International Working Conference on Source Code Analysis and Manipulation (SCAM), 2015

“Non-normal code churn can be a tangible and measurable effect of architectural violations in source code. However, more research is needed to better understand this connection, e.g., if violations are the cause, the size of the effect, the cost of refactoring, and whether it is generalizable to other system.”

— *The Relationship of Code Churn and Architectural Violations in the Open Source Software JabRef*, Tobias Olsson, Morgan Ericsson, Anna Wingkvist, Proceedings of the 11th European Conference on Software Architecture: Companion Proceedings, 2017

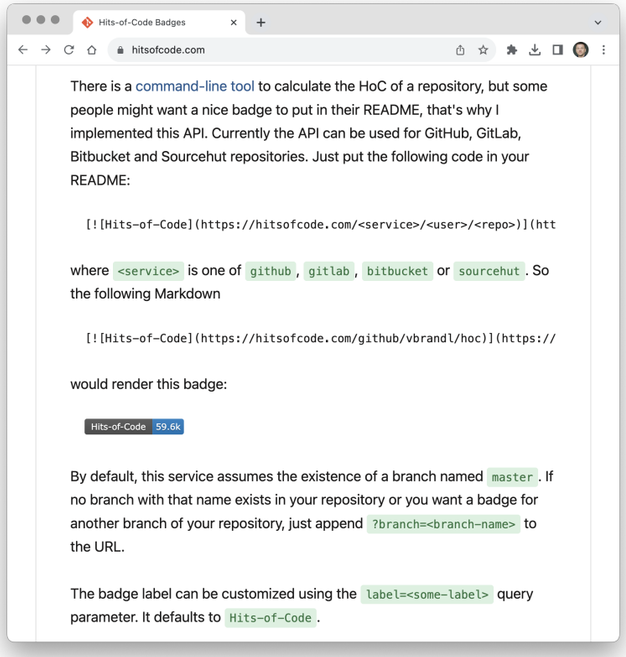
CodeClimate.com Interpretation of Code Churn



"When we have finished analyzing your default branch, you will see churn metrics for the files in your repository. This churn metric is approximately the number of times a file has changed in the last 90 days, calculated by counting the number of distinct versions of that file across commits from that time."

Source: their blog

HitsOfCode.com



Created by Valentin Brandl (@vbrandl) and inspired by the blog post of mine: Hits-of-Code Instead of SLoC (2014)

Read this:

Code Churn: A Measure for Estimating the Impact of Code Change, Sebastian G. Elbaum and John C. Munson, Proceedings of the International Conference on Software Maintenance (ICSM), 1998

Hits-of-Code Instead of SLoC (2014)