

# Dead Code

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Lecture #12 out of 24

80 minutes

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## Motivating Example

Before (**wrong**):

```
1 class Book
2     private int id;
3     public Book(int it)
4         this.id = i;
5     public int getId()
6         return this.id;
7
8     private int setId(int i)
9         this.id = i;
```

After (**better**):

```
1 class Book
2     private final int id;
3     public Book(int it)
4         this.id = i;
5     public int getId()
6         return this.id;
```



MIKA MÄNTYLÄ

“Dead code is code that has been used in the past, but is currently never executed. Dead code hinders code comprehension and makes the current program structure less obvious.”

— M. Mantyla, J. Vanhanen, and C. Lassenius. A Taxonomy and an Initial Empirical Study of Bad Smells in Code. In *Proceedings of the International Conference on Software Maintenance*, 2003. doi:[10.1109/icsm.2003.1235447](https://doi.org/10.1109/icsm.2003.1235447)

## Dead Code Elimination (Compiler Optimization)

Dead code is here:

```
1 void main(int x) {  
2     int a = 42;  
3     if (x > 0) {  
4         a = 256;  
5     }  
6     a = 7;  
7     print(a);  
8 }
```

“Dead code refers to computations whose results are never used. Code that is dead can be eliminated without affecting the behavior of the program.”

Source: *Compiler Techniques for Code Compaction*,  
Saumya K. Debray, William Evans, Robert Muth,  
Bjorn De Sutter, ACM Transactions on Programming  
languages and Systems (TOPLAS), 22(2), 2000



SIMONE ROMANO

“Although there is some consensus on the fact that dead code is a common phenomenon, it could be harmful, and it seems to matter to software professionals; surprisingly, dead code has received very little empirical attention from the software engineering research community.”

— Simone Romano, Christopher Vendome, Giuseppe Scanniello, and Denys Poshyvanyk. A Multi-Study Investigation into Dead Code. *IEEE Transactions on Software Engineering*, 2018. doi:[10.1109/tse.2018.2842781](https://doi.org/10.1109/tse.2018.2842781)

## Unreachable/Dead Methods in Java

| Table 1: Dataset Information |        |        |        |        |                          |
|------------------------------|--------|--------|--------|--------|--------------------------|
| Software                     |        | LOCs   | #Types | #Meth. | #Un. Meth.    %Un. Meth. |
| ArtOfIllusion                | 2.4.1  | 79,383 | 600    | 5,426  | 545    10%               |
| LaTeXDraw                    | 2.0.8  | 65,334 | 252    | 3,130  | 212    7%                |
| aTunes                       | 1.10.1 | 42,357 | 778    | 4,067  | 240    6%                |
| MediaPesata                  | 1.0    | 1,580  | 31     | 162    | 8    5%                  |

Source: *A Graph-based Approach to Detect Unreachable Methods in Java Software*, Simone Romano, Giuseppe Scanniello, Carlo Sartiani, Michele Risi, Proceedings of the 31st Annual ACM Symposium on Applied Computing, 2016



SEBASTIAN EDER

“We conducted the study on the level of methods in the sense of object oriented programming. The systems contains 25,390 methods. We found that 25% of all methods were never used during the complete period.”

— Sebastian Eder, Maximilian Junker, Elmar Jurgens, Benedikt Hauptmann, Rudolf Vaas, and Karl-Heinz Prommer. How Much Does Unused Code Matter for Maintenance? In *Proceedings of the 34th International Conference on Software Engineering (ICSE)*, 2012. doi:[10.1109/icse.2012.6227109](https://doi.org/10.1109/icse.2012.6227109)

## Volatility Metric



“The variance  $Var(g)$  is the **Volatility** of the source code. The smaller the Volatility the more *cohesive* is the repository and the smaller the amount of the abandoned code inside it.”

Then, the mean  $\mu$  is calculated as:

$$\mu = \frac{1}{Z} \sum_{j=1}^Z g_j \quad (5)$$

Finally, the variance is calculated as:

$$Var(g) = \frac{1}{Z} \sum_{j=1}^Z |g_j - \mu|^2 \quad (6)$$

The variance  $Var(g)$  is the Volatility of the source code.



## Volatility vs. Number of Files in a Repo



## Monolithic Repositories

**Centralization** The codebase is contained in a single repo encompassing multiple projects.

**Visibility** Code is viewable and searchable by all engineers in the organization.

**Synchronization:** The development process is trunk-based; engineers commit to the head of the repo.

**Completeness** Any project in the repo can be built only from dependencies also checked into the repo. Dependencies are unversioned; projects must use whatever version of their dependency is at the repo head.

**Standardization** A shared set of tooling governs how engineers interact with the code, including building, testing, browsing, and reviewing code.

Source: *Advantages and Disadvantages of a Monolithic Repository: A case study at Google*, Ciera Jaspan et al., ICSE, 2018



CIERA JASPÁN

“Our survey results show that engineers at Google strongly prefer our monolithic repo, and that visibility of the codebase and simple dependency management were the primary factors for this preference.”

— Ciera Jaspán, Matthew Jorde, Andrea Knight, Caitlin Sadowski, Edward K. Smith, Collin Winter, and Emerson Murphy-Hill. Advantages and Disadvantages of a Monolithic Repository: A Case Study at Google. In *Proceedings of the 40th International Conference on Software Engineering: Software Engineering in Practice*, 2018. doi:[10.1145/3183519.3183550](https://doi.org/10.1145/3183519.3183550)



RACHEL POTVIN

“The Google codebase includes approximately one billion files and has a history of approximately 35 million commits spanning Google’s entire 18-year existence. The repository contains 86TBa of data, including approximately two billion lines of code in nine million unique source files.”

— Rachel Potvin and Josh Levenberg. Why Google Stores Billions of Lines of Code in a Single Repository. *Communications of the ACM*, 2016.  
[doi:10.1145/2854146](https://doi.org/10.1145/2854146)



DURHAM GOODE

“Facebook’s main source repository is enormous—many times larger than even the Linux kernel, which checked in at 17 million lines of code and 44,000 files in 2013.”

— Rain Durham Goode. Scaling Mercurial at Facebook.  
<https://engineering.fb.com/2014/01/07/core-infra/scaling-mercurial-at-facebook/>, 2014. [Online; accessed 15-03-2024]



TOMAS VOTRUBA

“Before monorepo, I had to upgrade every package manually, which resulted in dissonance: one package used Symfony\Console 3.2, but other only 2.8 and it got messy for no reason.”

— Tomas Votruba. How Monolithic Repository in Open Source Saved My Laziness. <https://tomasvotruba.com/blog/2017/01/31/how-monolithic-repository-in-open-source-saved-my-laziness>, 2017. [Online; accessed 15-03-2024]

## Benefits of “Manyrepo” Approach

**Encapsulation** Each repo encapsulates and hides its details from everybody else.

**Fast Builds** When a repo is small, the time its automated build takes is small.

**Accurate Metrics** Calculating LoC for a large repository doesn't make any sense.

**Homogeneous Tasks** It's easier to make tasks similar in size and complexity.

**Single Coding Standard** Smaller repositories look more beautiful.

**Short Names** Smaller namespaces mean better maintainability.

**Simple Tests** More dependencies are difficult to mock and test.

Source: [Monolithic Repos Are Evil](#) (2018)

Read this:

Monolithic Repos Are Evil (2018)



# References

Rain Durham Goode. Scaling Mercurial at Facebook.  
https:

//engineering.fb.com/2014/01/07/core-  
infra/scaling-mercurial-at-facebook/,  
2014. [Online; accessed 15-03-2024].

Sebastian Eder, Maximilian Junker, Elmar Jurgens,  
Benedikt Hauptmann, Rudolf Vaas, and  
Karl-Heinz Prommer. How Much Does Unused  
Code Matter for Maintenance? In *Proceedings of  
the 34th International Conference on Software  
Engineering (ICSE)*, 2012.  
doi:[10.1109/icse.2012.6227109](https://doi.org/10.1109/icse.2012.6227109).

Ciera Jaspan, Matthew Jorde, Andrea Knight, Caitlin  
Sadowski, Edward K. Smith, Collin Winter, and  
Emerson Murphy-Hill. Advantages and  
Disadvantages of a Monolithic Repository: A  
Case Study at Google. In *Proceedings of the 40th  
International Conference on Software Engineering:  
Software Engineering in Practice*, 2018.

doi:[10.1145/3183519.3183550](https://doi.org/10.1145/3183519.3183550).

M. Mantyla, J. Vanhanen, and C. Lassenius. A  
Taxonomy and an Initial Empirical Study of Bad  
Smells in Code. In *Proceedings of the International  
Conference on Software Maintenance*, 2003.  
doi:[10.1109/icsm.2003.1235447](https://doi.org/10.1109/icsm.2003.1235447).

Rachel Potvin and Josh Levenberg. Why Google  
Stores Billions of Lines of Code in a Single  
Repository. *Communications of the ACM*, 2016.  
doi:[10.1145/2854146](https://doi.org/10.1145/2854146).

Simone Romano, Christopher Vendome, Giuseppe  
Scanniello, and Denys Poshyvanyk. A  
Multi-Study Investigation into Dead Code. *IEEE  
Transactions on Software Engineering*, 2018.  
doi:[10.1109/tse.2018.2842781](https://doi.org/10.1109/tse.2018.2842781).

Tomas Votruba. How Monolithic Repository in Open  
Source Saved My Laziness.  
[https://tomasvotruba.com/blog/2017/01/  
31/how-monolithic-repository-in-open-  
source-saved-my-laziness](https://tomasvotruba.com/blog/2017/01/31/how-monolithic-repository-in-open-source-saved-my-laziness), 2017. [Online;  
accessed 15-03-2024].