Typesafe

Fighting Bit rot

With your mind

Viktor Klang

Director of Engineering

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Bit rot

> The term "bit rot" is often used to refer to dormant code rot, i.e. **the fact that dormant (unused or little-used) code gradually decays in correctness** as a result of interface changes in active code that is called from the dormant code.
>
> - http://en.wikipedia.org/wiki/Bit_rot

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... or how to create maintainable software

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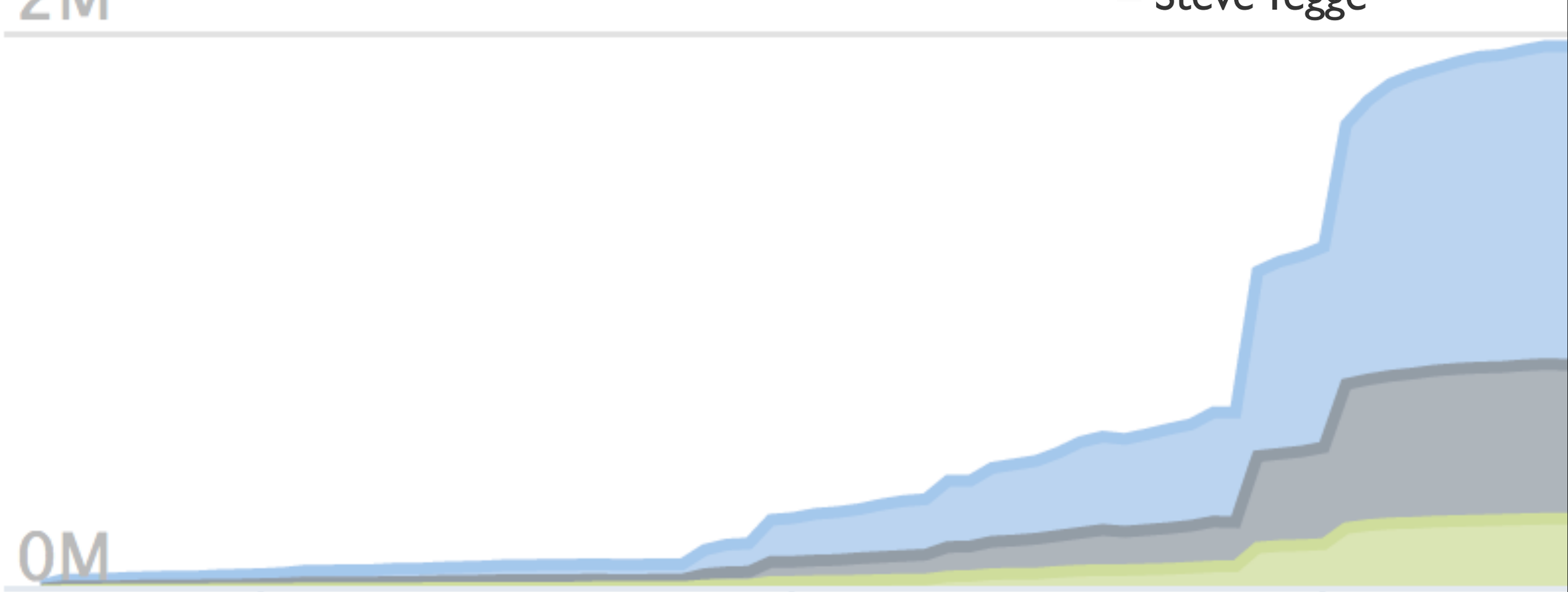
Lines of Code

> I happen to hold a hard-won minority opinion about code bases. In particular I believe, quite staunchly I might add, that **the worst thing that can happen to a code base is size.**
>
> – Steve Yegge



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Outline

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Outline

- Example: Akka

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Outline

- Example: Akka
- Code & Maintenance

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- Example: Akka
- Code & Maintenance
- How our minds fight bit rot

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- Example: Akka
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- Tools

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Outline

- Example: Akka
- Code & Maintenance
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- Tools
- Pro tips

Outline

- Example: Akka
- Code & Maintenance
- How our minds fight bit rot
- Tools
- Pro tips
- Summary

“

Build powerful,
concurrent & distributed
applications more easily.

”

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Akka stats

Akka stats

- Number of modules: **19**

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Akka stats

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- First Commit: Feb 2009

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Akka stats

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- Est. effort: 36 years (COCOMO)

Akka stats

- Number of modules: **19**
- First Commit: Feb 2009
- Total Commits: **13,450**
- Total contributors: 135
- Est. effort: 36 years (COCOMO)
- Mostly written in **Scala**

http://www.ohloh.net/p/akka

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Akka stats

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Akka stats

- Total lines: 203,515

Akka stats

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- Code lines: **142,894**

Akka stats

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#1 top Github pull award

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#1 AWARd gH TDP PILLS

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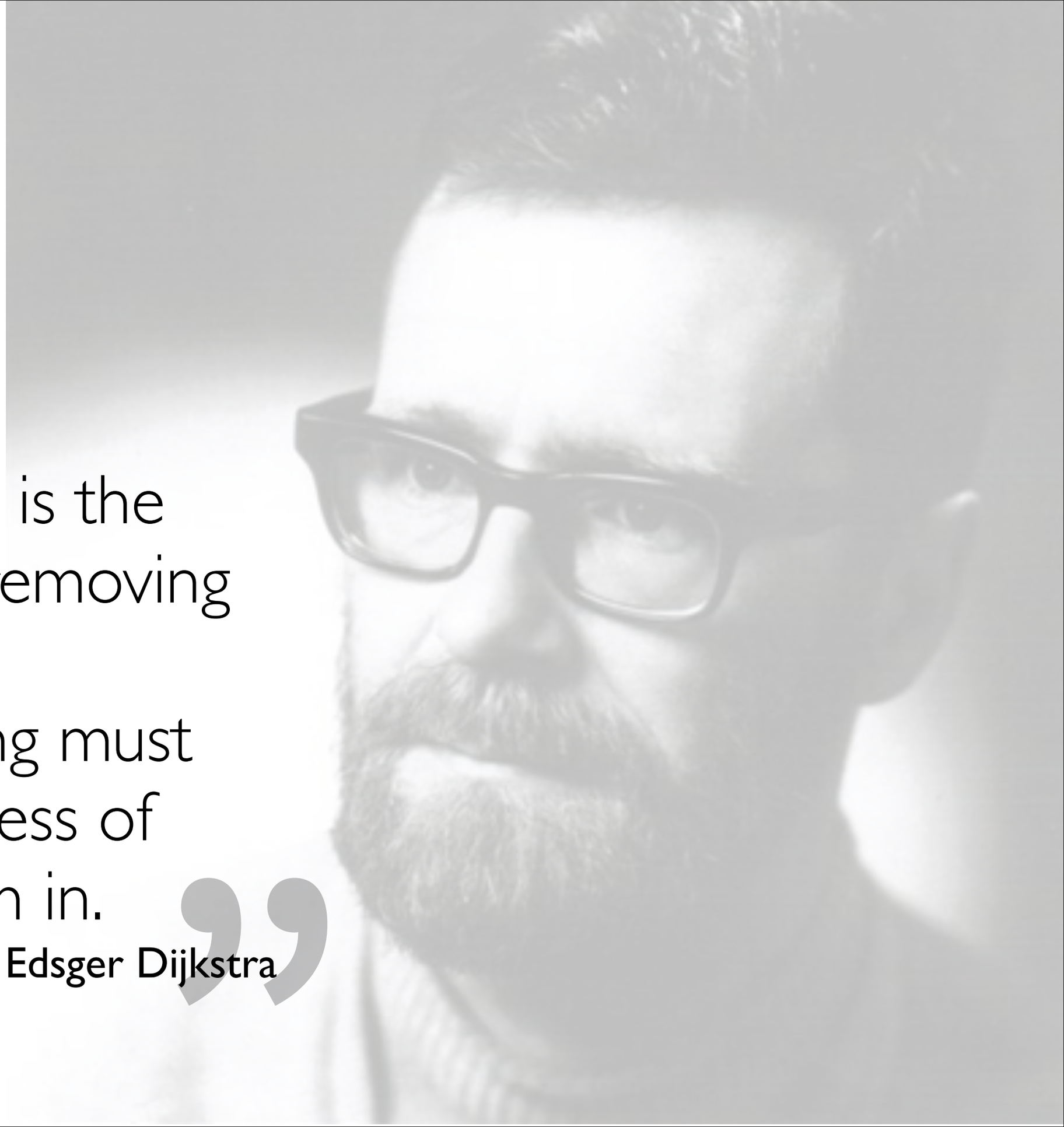

> If debugging is the process of removing bugs, then programming must be the process of putting them in.
>
> – Edsger Dijkstra

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Maintenance

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Maintenance

- Adaptive – evolve with new surroundings

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Maintenance

- Adaptive – evolve with new surroundings
- Perfective – evolve to meet new needs

Typesafe

Maintenance

- Adaptive – evolve with new surroundings
- Perfective – evolve to meet new needs
- Corrective – diagnose and fix defects

Typesafe

Maintenance

- Adaptive – evolve with new surroundings
- Perfective – evolve to meet new needs
- Corrective – diagnose and fix defects
- Preventive – refactor etc

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Maintenance

- Adaptive – evolve with new surroundings
- Perfective – evolve to meet new needs
  - Corrective
  - Preventive

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[…] a good programmer can reasonably maintain about **20,000** lines of code.

[…] language doesn't matter. It's still 20,000 lines.

If your language requires fewer lines to express the same ideas, you can spend more time on stuff that otherwise would go beyond those 20,000 lines.

– Guido van Rossum
Creator of the Python Programming Language

So ... how do you fight bit rot with your mind?

http://en.wikipedia.org/wiki/Broken_windows_theory

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Zero Known Defects

Policy

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My point today is that, **if we wish to count lines of code, we should not regard them as "lines produced" but as "lines spent"**:

the current conventional wisdom is so foolish as to book that count on the wrong side of the ledger.

– Edsger Dijkstra

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Lines of Code Spent

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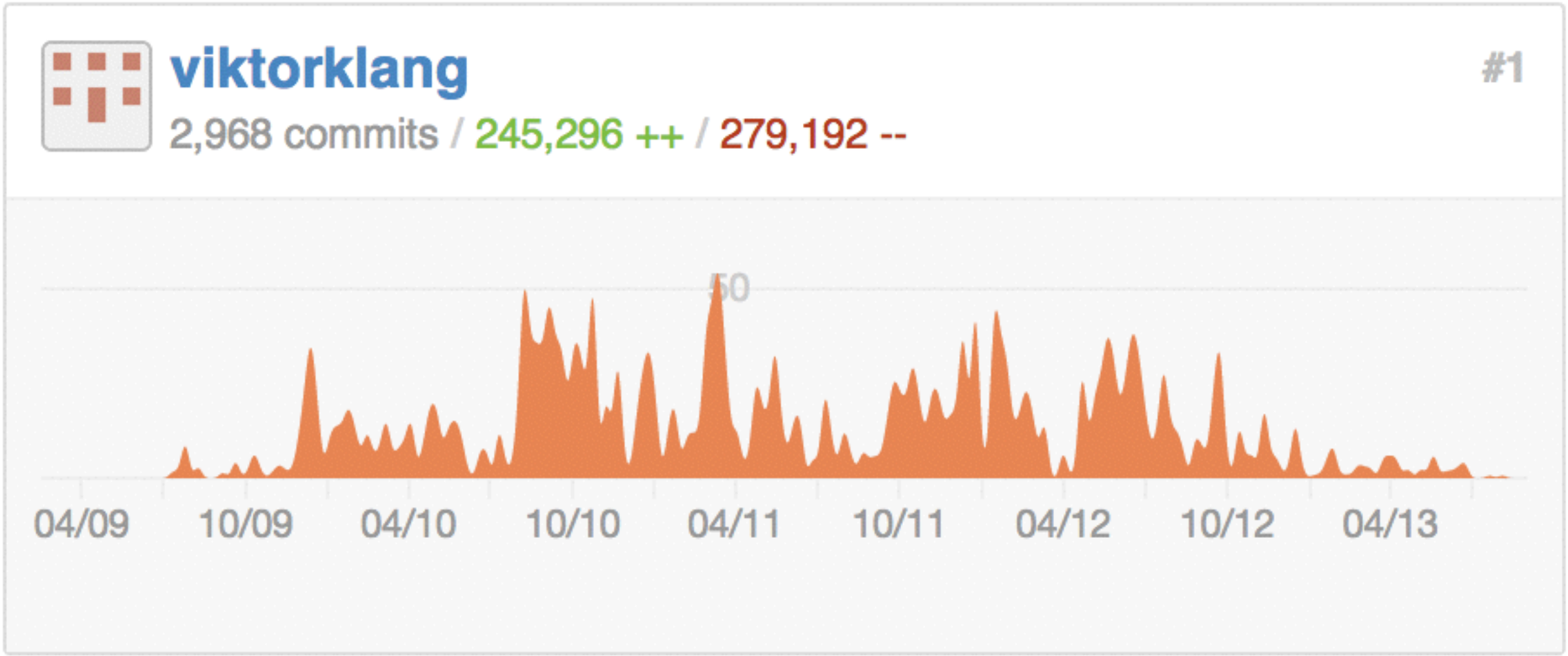
Less is more!



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(My) Test philosophy

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(My) Test philosophy

- Feature – **must have**

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(My) Test philosophy

- Feature – **must have**
- Integration – **should have**

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(My) Test philosophy

- Feature – **must have**
- Integration – **should have**
- Unit – **may have**

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Laws

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Laws

- DRY

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Laws

- DRY
- Boy Scout Rule

Laws

- DRY
- Boy Scout Rule
- Test

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Laws

- DRY
- Boy Scout Rule
- Test
- Document

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Everyone code reviews

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Everyone code reviews

- Collective Ownership

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- Collective Ownership
- Harmonization

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- Harmonization
- Education

Typesafe

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Typesafe

Everyone code reviews

- Collective Ownership
- Harmonization
- Education
- Documentation
- Test Coverage

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Documentation

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Documentation

- Reference documentation

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Documentation

- Reference documentation
- API documentation

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Documentation

- Reference documentation
- API documentation
- Put "Whys" in the code

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Solve everything at least twice

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git ~~blame~~ / praise

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Rules

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Rules

- Code formatting

Rules

- Code formatting
- Tabs vs spaces

Rules

- Code formatting
- Tabs vs spaces
- Features

Typesafe

Rules

- Code formatting
- Tabs vs spaces
- Features
- Commits

Typesafe

Rules

- Code formatting
- Tabs vs spaces
- Features
- Commits
  - Description

Typesafe

Rules

- Code formatting
- Tabs vs spaces
- Features
- Commits
  - Description
  - Message

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Auto-enforce

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Auto-enforce

- Reformat on save / compile

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Auto-enforce

- Reformat on save / compile
- Post-commit hooks

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Features

- What features do we use when and why?

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Common Dev Tools

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Common Dev Tools

- Issue tracker

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- Issue tracker
- Code reviewer

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- Issue tracker
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- Continuous Integration

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- Issue tracker
- Code reviewer
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- Build tool

Typesafe

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- Issue tracker
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- Continuous Integration
- Build tool
- Source Control

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Common Dev Tools

- Issue tracker
- Code reviewer
- Continuous Integration
- Build tool
- Source Control
- Documentation Generator

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Issue tracking

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Issue tracking

- Absolute priority ordering

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Issue tracking

- Absolute priority ordering
- Break down into half-day size

Typesafe

Issue tracking

- Absolute priority ordering
- Break down into half-day size
- Follow motivation when choosing

Typesafe

Source Related

Typesafe

Source Related

- Code review tool

Typesafe

Source Related

- Code review tool
  - Use the one that works best

Source Related

- Code review tool
  - Use the one that works best
- Continuous Integration tool

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Typesafe

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  - Use the one that works best
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- Build tool
  - Use the one that works best
- Source Control

Typesafe

Source Related

- Code review tool
  - Use the one that works best
- Continuous Integration tool
  - Use the one that works best
- Build tool
  - Use the one that works best
- Source Control
  - Use Git and be done with it!

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Continuous Integration

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Continuous Integration

- Run CI on Pull Requests before merge

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Continuous Integration

- Run CI on Pull Requests before merge
- Run CI continuously on main branches

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Documentation Generator

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Documentation Generator

- All code samples should be tests that are compiled and run and automagically lifted in

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Documentation Generator

- All code samples should be tests that are compiled and run and automagically lifted in
- Documentation generation should be a part of CI so if it fails, it fails the build

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Documentation Generator

- All code samples should be tests that are compiled and run and automagically lifted in
- Documentation generation should be a part of CI so if it fails, it fails the build
- Generate at least HTML + PDF

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Individual Tools

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Editors/IDEs

- Build tool will enforce code style so use the editor you are most productive in!

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HW Interfaces

HW Interfaces

- Don't change keyboards/layouts to write faster

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HW Interfaces

- Don't change keyboards/layouts to write faster
  - Do it to avoid strain on your fingers and wrists

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10: Pain leads to shortcuts

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20: Shortcuts lead to bugs

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HW Interfaces

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10: Pain leads to shortcuts

20: Shortcuts lead to bugs

30: Bugfixing means typing

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HW Interfaces

- Don't change keyboards/layouts to write faster
  - Do it to avoid strain on your fingers and wrists
    - 10: Pain leads to shortcuts
    - 20: Shortcuts lead to bugs
    - 30: Bugfixing means typing
    - 40: **goto** 10

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#define Protips

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Dependencies

Dependencies

- Have a cost associated with using them

Dependencies

- Have a cost associated with using them
  - License management

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Dependencies

- Have a cost associated with using them
  - License management
  - Repository and / or package size

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- Have a cost associated with using them
  - License management
  - Repository and / or package size
  - Transitive dependencies

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  - License management
  - Repository and / or package size
  - Transitive dependencies
    - Version conflicts

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- Have a cost associated with using them
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    - Version conflicts
- You cannot abstract away understanding

Typesafe

Dependencies

- Have a cost associated with using them
  - License management
  - Repository and / or package size
  - Transitive dependencies
    - Version conflicts
- You cannot abstract away understanding

— only delegate responsibility

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Planned interfaces

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Planned interfaces

- Design and document your public API

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- Don't make things **API by accident**

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- Good API design takes a lot of effort

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Planned interfaces

- Design and document your public API
- Don't make things **API by accident**
- Public API needs to have proper documentation
- Good API design takes a lot of effort
  - **But is worth it!**

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Avoid defaults in code

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Avoid defaults in code

- Put defaults in external configuration

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- Possible to change without recompiling

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- Makes structure of the code cleaner

Typesafe

Avoid defaults in code

- Put defaults in external configuration
- Possible to change without recompiling
- Makes structure of the code cleaner
- Avoids scattering same "default" in multiple places (DRY)

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Avoid shared mutable state

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Avoid shared mutable state

- Consequences of shared mutable state:

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Avoid shared mutable state

- Consequences of shared mutable state:
  - Interactions are hard to calculate

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Avoid shared mutable state

- Consequences of shared mutable state:
  - Interactions are hard to calculate
  - Almost always assumes single-threaded execution

Avoid shared mutable state

- Consequences of shared mutable state:
  - Interactions are hard to calculate
  - Almost always assumes single-threaded execution
  - Hard to reason and verify impact of changes

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All the possibilities!

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All the possibilities!

```
public int mutable() {
  int x = 1;
  int y = 2;
  int z = 3;
  ...
  return x + y + z;
}
```

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All the possibilities!

```
public int mutable() {
  int x = 1;
  int y = 2;
  int z = 3;
  ...
  return x + y + z;
}
```

```
public int immutable() {
  final int x = 1;
  final int y = 2;
  final int z = 3;
  ...
  return x + y + z;
}
```

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Immutable

Immutable

- Things that do not change frees the mind from calculating the interactions

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Immutable

- Things that do not change frees the mind from calculating the interactions
- Use **const** / **final** whenever possible

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Immutable

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- Favor immutability in collections and data

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Immutable

- Things that do not change frees the mind from calculating the interactions
- Use **const** / **final** whenever possible
- Favor immutability in collections and data
  - Persistent collections can be very efficient

Expressions > Statements

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- Statements do not "**return**" anything

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- Statements do not "**return**" anything
  - They can only produce results by writing to shared memory

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- Statements do not "**return**" anything
  - They can only produce results by writing to shared memory
  - This leads to having a lot of variables

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Expressions > Statements

- Statements do not "**return**" anything
  - They can only produce results by writing to shared memory
  - This leads to having a lot of variables
  - Remember what we said about immutability

Expressions > Statements

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Expressions > Statements

```
public int foo() {
  int x;
  if (smth) {
    x = 5;
  } else {
    x = 10;
  }
  ...
  return result;
}
```

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Expressions > Statements

```
public
  int
  if
    x = 5;
  }
    x = 10;
  }
  …
  return
}
```

```
public int foo() {
  int x;
  if (smth) x = 5;
  else x = 10;
  …
  return result;
}
```

Typesafe

Expressions > Statements

```
public
  int
  if
    x = 5;
  }
    x = 10;
  }
  ...
  return
}
```

```
public
  int
  if
  else
  ...
  return
}
```

```
public int foo() {
  final int x =
    smth ? 5 : 10;
  ...
  return result;
}
```

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Versioning

v1 . . . v5

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Versioning

v1 . . . v5

- Very few enjoy designing versioning

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Versioning

v1 . . . v5

- Very few enjoy designing versioning
- Very few enjoy evolving an unversioned system

Typesafe

Versioning

v1 . . . v5

- Very few enjoy designing versioning
- Very few enjoy evolving an unversioned system
- Guess which one of these usually lasts longer

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Bad comments

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Bad comments

- Comments also rot

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Bad comments

- Comments also rot
- Never commit commented out code.

If it isn't worth compiling, it's not worth maintaining.

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Don't Copy Paste

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Don't Copy Paste

- Copy-paste violates DRY

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Don't Copy Paste

- Copy-paste violates DRY
- Use Cut-paste

Typesafe

Don't Copy Paste

- Copy-paste violates DRY
- Use Cut-paste
- If you Cut-paste-paste-*

Typesafe

Don't Copy Paste

- Copy-paste violates DRY
- Use Cut-paste
- If you Cut-paste-paste-*
  - **Stop it**

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Failures will occur

Failures will occur

- Fault tolerance impacts system design

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Failures will occur

- Fault tolerance impacts system design
  - Think about failures up front

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Failures will occur

- Fault tolerance impacts system design
- Think about failures up front
- Avoid mixing concerns in code

Failures will occur

- Fault tolerance impacts system design
  - Think about failures up front
  - Avoid mixing concerns in code
- Overload is a type of failure

Failures will occur

- Fault tolerance impacts system design
  - Think about failures up front
  - Avoid mixing concerns in code
- Overload is a type of failure
  - How should the system behave?

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Pride in work

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∑-ary

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∑-ary

- Creating successful "bit rot" resistant software boils down to:

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Σ-ary

- Creating successful "bit rot" resistant software boils down to:
  - Culture

Typesafe

Σ-ary

- Creating successful "bit rot" resistant software boils down to:
  - Culture
  - Process

Σ-ary

- Creating successful "bit rot" resistant software boils down to:
  - Culture
  - Process
  - Practices

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Σ-ary

- Creating successful "bit rot" resistant software boils down to:
  - Culture
  - Process
  - Practices
- And last but not least:

Σ-ary

- Creating successful "bit rot" resistant software boils down to:
  - Culture
  - Process
  - Practices
- And last but not least:
  - **Continuously improving them**

“Time is the fire
in which we burn
– Delmore Schwarz
”

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EOF