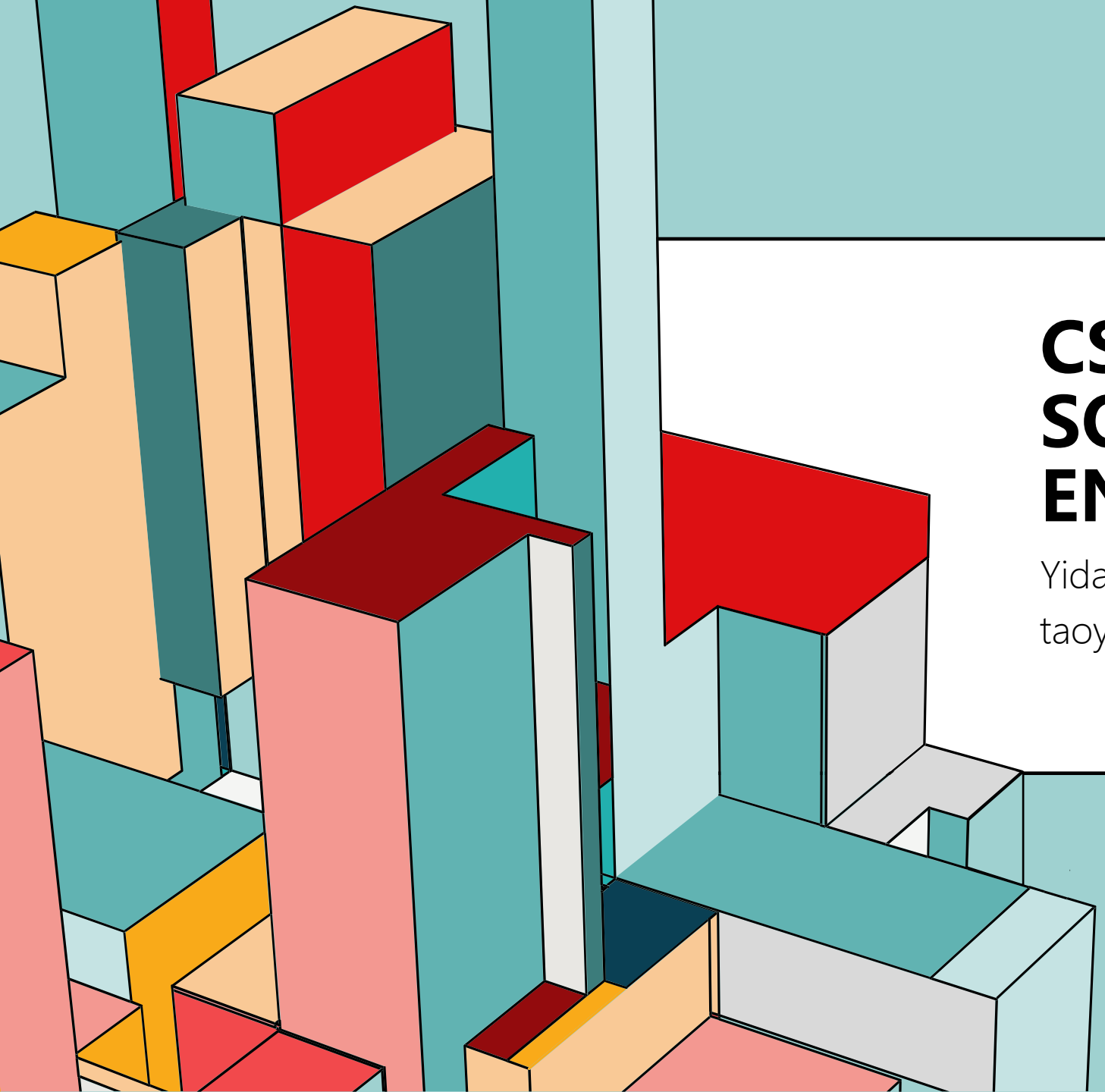

# CS304 SOFTWARE ENGINEERING

Yida Tao

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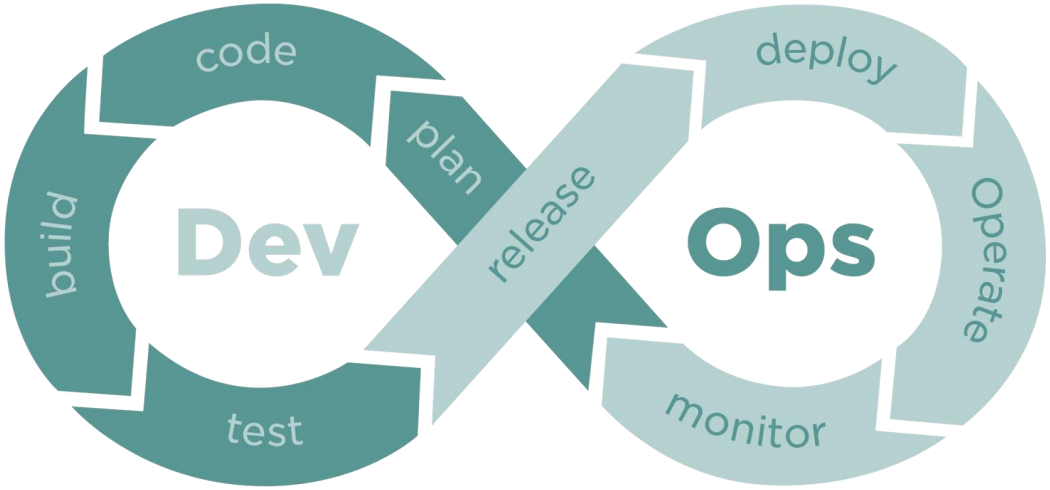
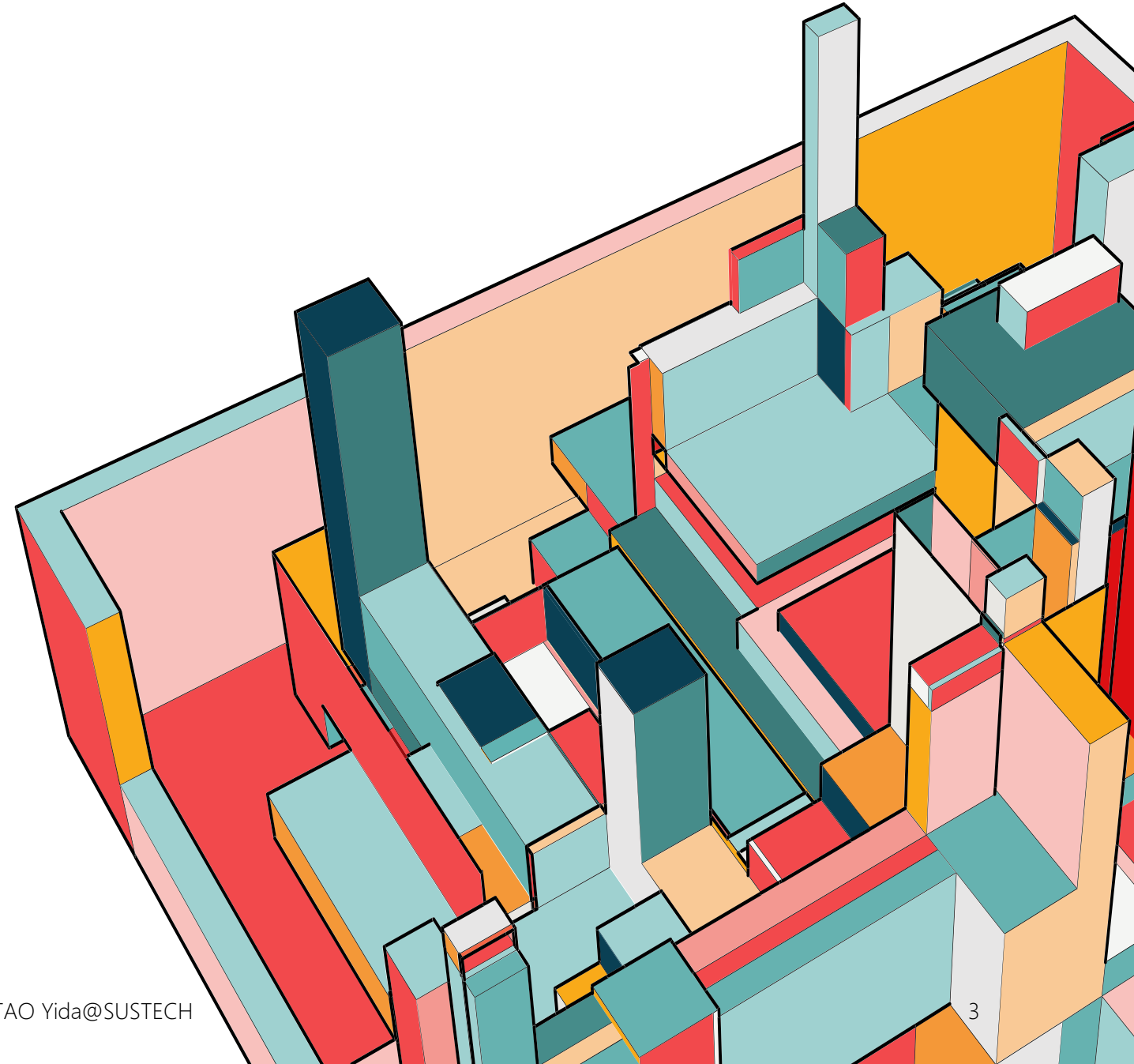
# WHERE ARE WE NOW?




**One missing piece before release……**

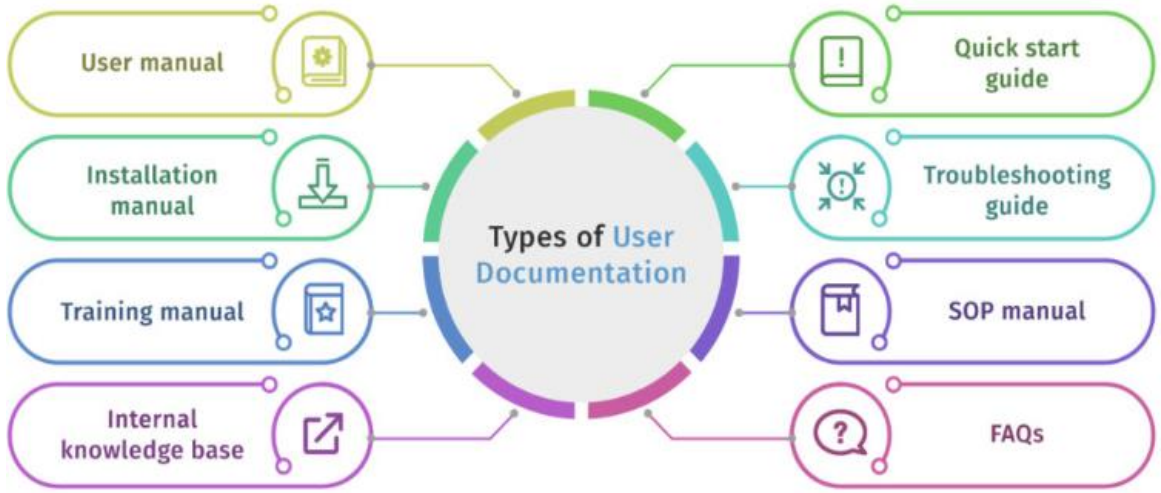
# LECTURE 10

- Software documentation
  - Types
  - Good Practices
  - Tools
- Documentation as Code

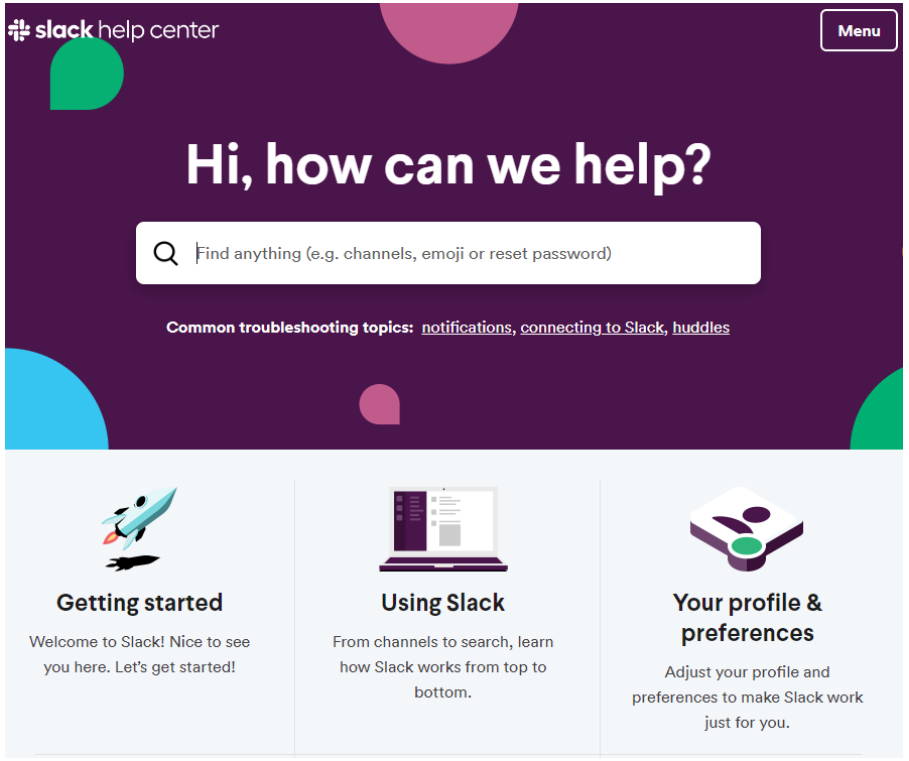


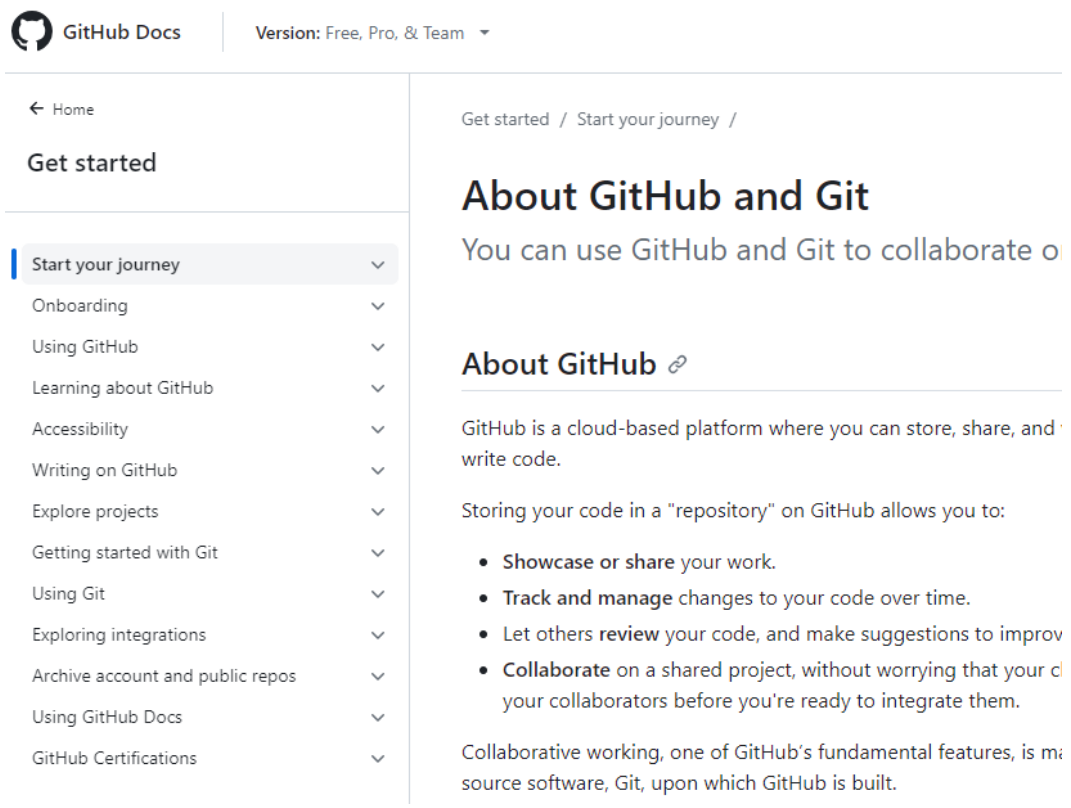
# EXTERNAL SOFTWARE DOCUMENTATION

- **End-user documentation**: gives end users basic instructions on how to use, install and troubleshoot the software (e.g., user guides, tutorials).
- **Enterprise user documentation**: used for IT staff who deploy the software across the enterprise.
- **Just-in-time documentation**: provides end users with support documentation at the exact time they will need it (e.g., FAQ pages, how-to documents)



# EXTERNAL SOFTWARE DOCUMENTATION



# INTERNAL SOFTWARE DOCUMENTATION

- **Administrative documentation**: the high-level administrative guidelines, roadmaps and product requirements for the software development team and project managers working on the software (e.g., status reports, meeting notes).

- **Developer documentation**: provides instructions to developers for building & extending the software and guides them through the development process.
  - Requirements documentation
  - Architecture & design documentation
  - Code Comments
  - API documentation
  - Readme, release notes, etc.

# INTERNAL SOFTWARE DOCUMENTATION

```java
/**
 * Creates a new String using the character sequence represented by
 * the StringBuffer. Subsequent changes to buf do not affect the String.
 *
 * @param buffer StringBuffer to copy
 * @throws NullPointerException if buffer is null
 */
public String(StringBuffer buffer)
{
  synchronized (buffer)
    {
      offset = 0;
      count = buffer.count;
      // Share unless buffer is 3/4 empty.
      if ((count << 2) < buffer.value.length)
        {
          value = new char[count];
          VMSystem.arraycopy(buffer.value, 0, value, 0, count);
        }
      else
        {
          buffer.shared = true;
          value = buffer.value;
        }
    }
}
```

java.io.String

## How to build Teedy from the sources

Prerequisites: JDK 11, Maven 3, NPM, Grunt, Tesseract 4

Teedy is organized in several Maven modules:

- docs-core
- docs-web
- docs-web-common

First off, clone the repository: `git clone https://github.com/sustech-cs304/Teedy`

### Launch the build

From the root directory:

```
mvn clean -DskipTests install
```

### Run a stand-alone version

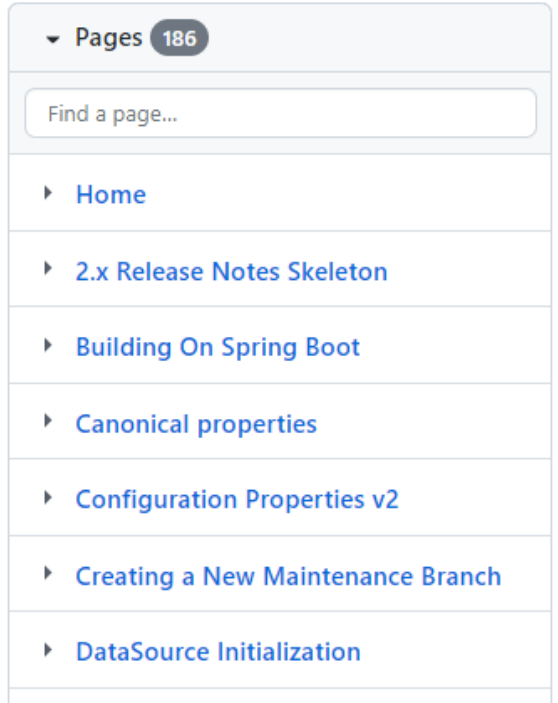
From the `docs-web` directory:

```
mvn jetty:run
```

Teedy readme

# INTERNAL SOFTWARE DOCUMENTATION

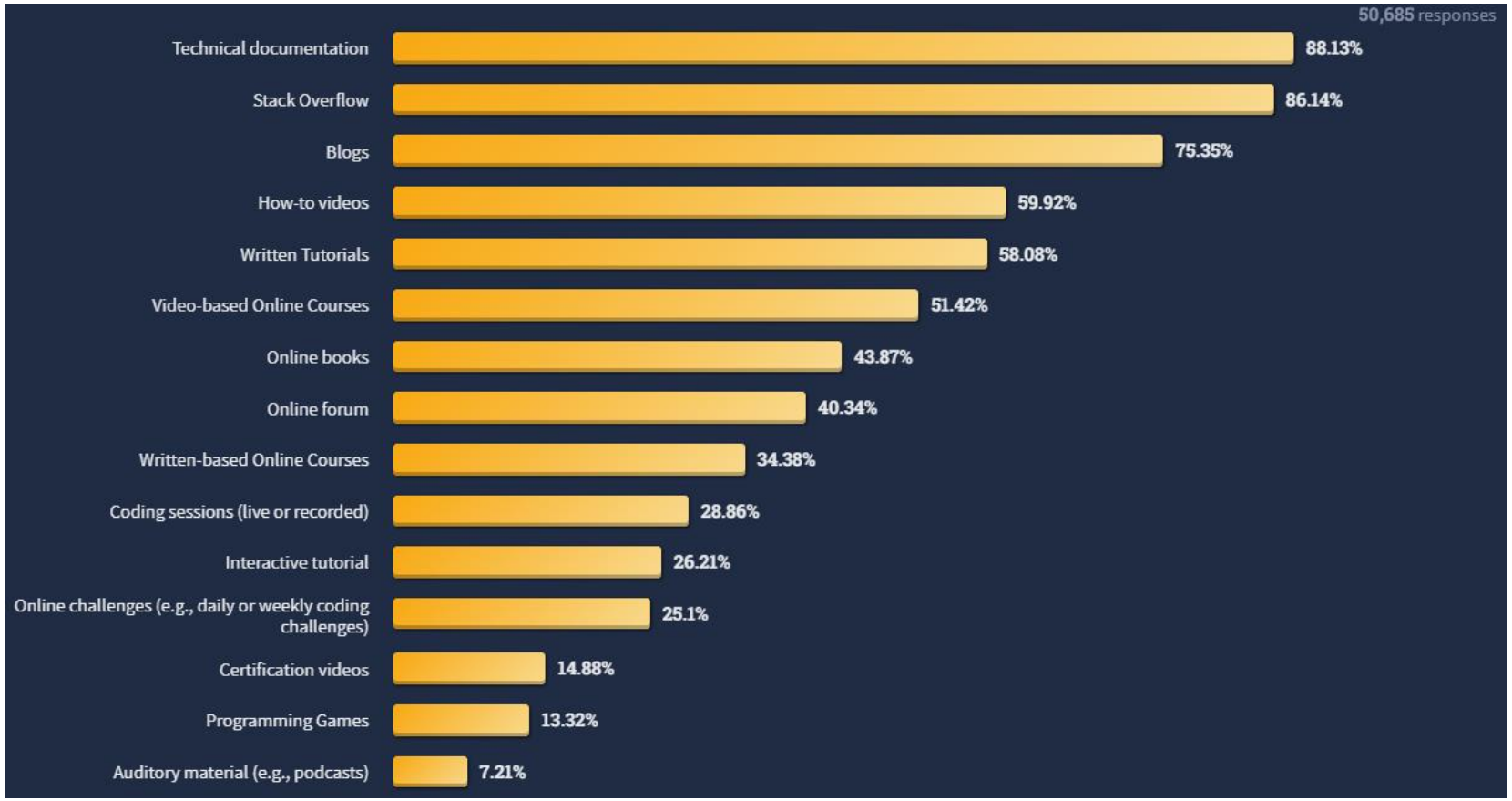

百度paddle paddle文档：https://www.paddlepaddle.org.cn/documentation/docs/zh/api/index_cn.html




https://github.com/spring-projects/spring-boot/wiki

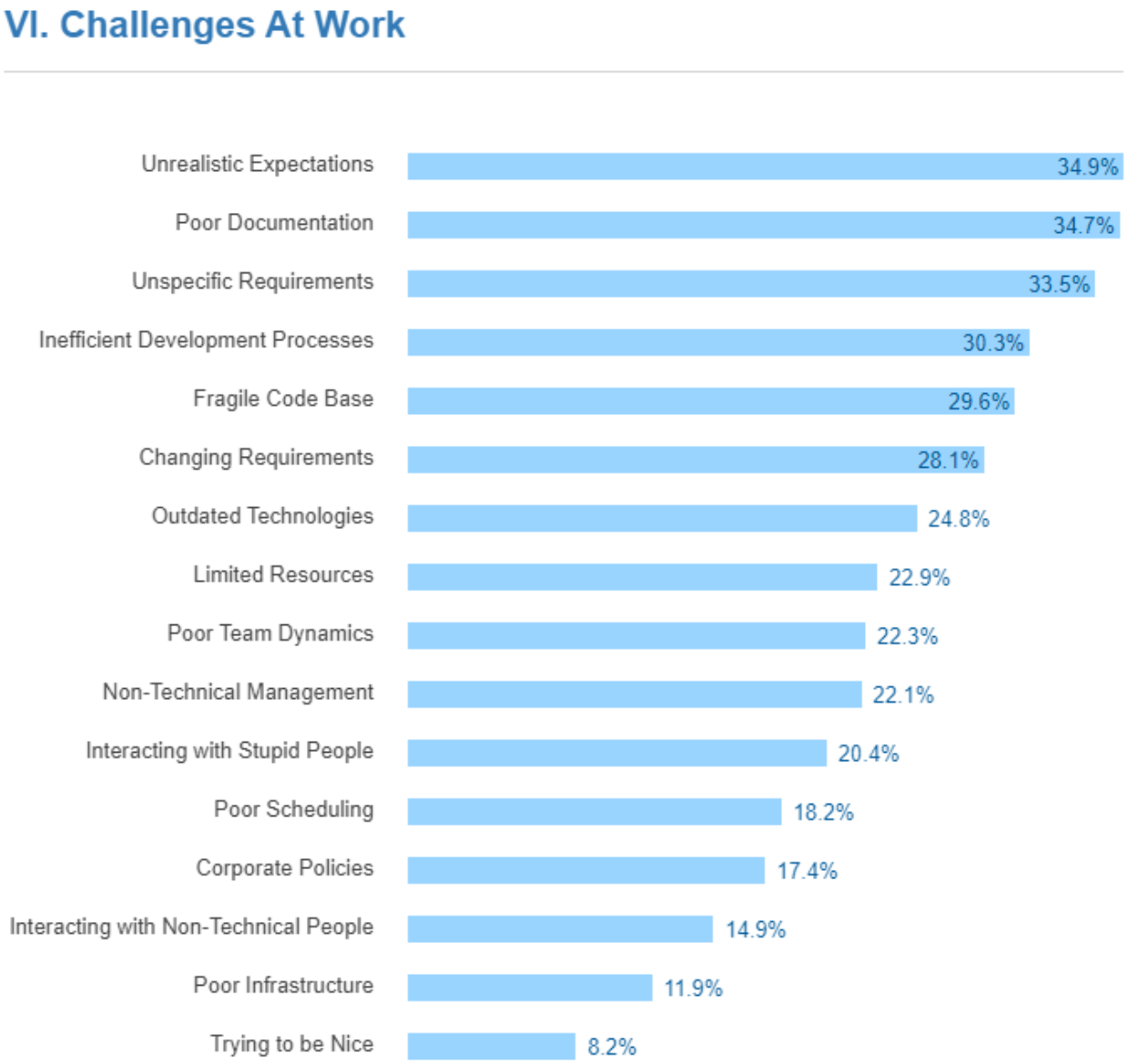
# IMPORTANCE OF DOCUMENTATION

What online resources do you use to learn to code?

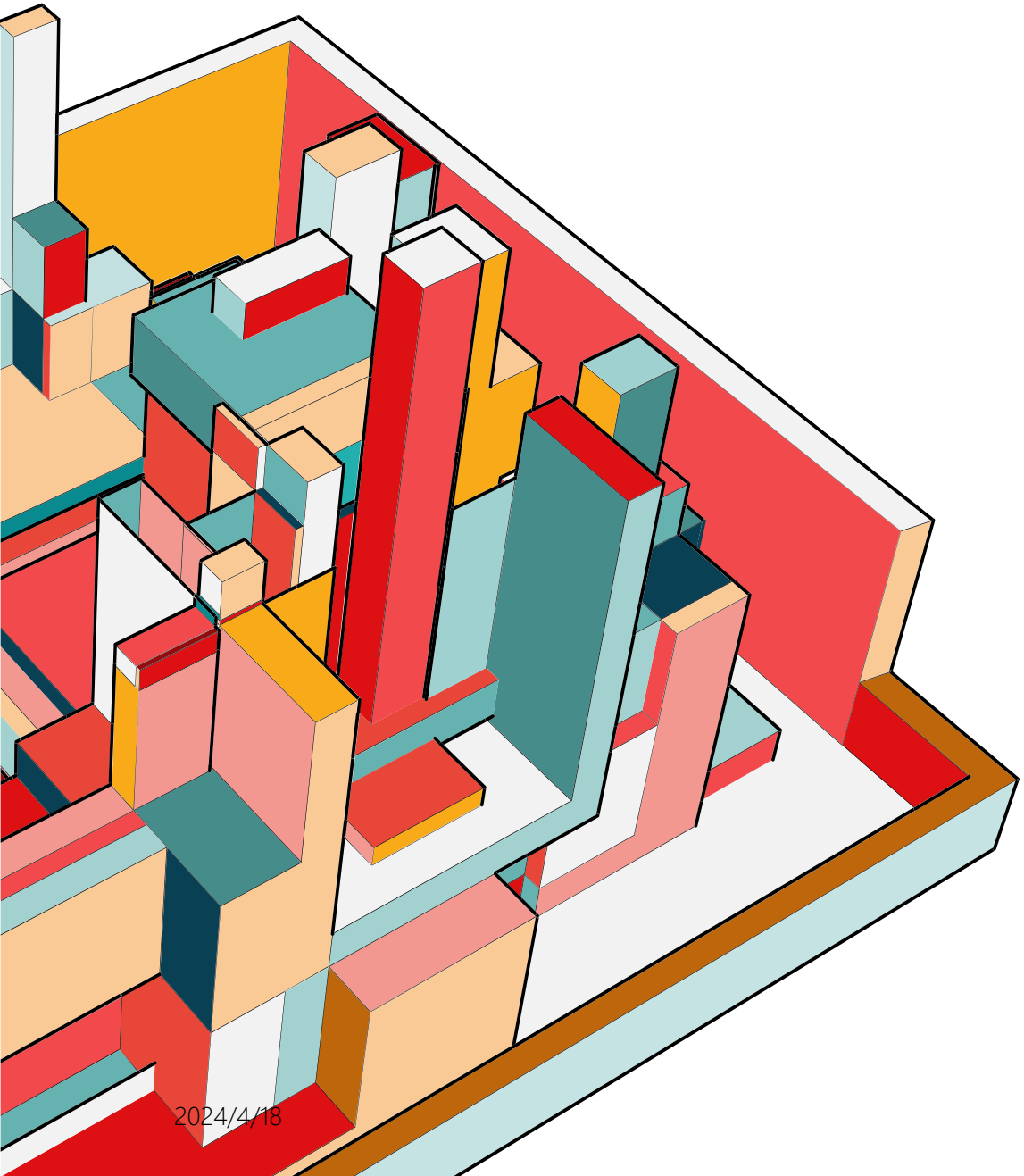



Stack Overflow Developer Survey 2022

# POOR DOCUMENTATION IS EVERYWHERE




Source: Stack Overflow Developer Survey 2016



# WRITING GOOD DOCUMENTATION

## GOOD PRACTICES

# SELF-DOCUMENTING CODE

- Self-documenting (or self-describing) code follow naming conventions and structured programming conventions that enable use and understanding of the system without prior specific knowledge
  - Meaningful directory structure
  - Meaningful file/class/method/variable names

- Main goal: allowing developers to understand code at a glance

# SELF-DOCUMENTING CODE

```
float a, b, c; a=9.81; b=5; c= .5*a*(b^2);
```

**vs**

```
const float gravitationalForce = 9.81;
float timeInSeconds = 5;
float displacement = (1 / 2) * gravitationalForce * (timeInSeconds ^ 2);
```

Good code doesn’t need documentation. It’s self-explaining

https://stackoverflow.com/questions/209015/what-is-self-documenting-code-and-can-it-replace-well-documented-code

# CODE COMMENTS （注释）

- Sometimes when the code alone can’t provide context or clarify intent, the developer may write extra descriptions, i.e., code comments.
- Code comments enhance readability. They facilitate code reviews, refactoring, and maintenance.
- Code comments are ignored by compilers and interpreters when producing the final executable. Thus, they incur no runtime performance overhead. However, too many or unnecessary comments reduce readability.

# WRITING GOOD COMMENTS

- Comments should be used only to explain the **intent** behind code that cannot be refactored to explain itself
- Mostly used for providing **additional context**, instead of simply repeating the code
- Should answer **WHY**, instead of WHAT

```
const float a = 9.81; //gravitational force
float b = 5; //time in seconds
float c = (1/2)*a*(b^2) //multiply the time and gravity together to get displacement.
```

**vs**

```
/* compute displacement with Newton's equation x = v₀t + ½at² */
const float gravitationalForce = 9.81;
float timeInSeconds = 5;
float displacement = (1 / 2) * gravitationalForce * (timeInSeconds ^ 2);
```

https://stackoverflow.com/questions/209015/what-is-self-documenting-code-and-can-it-replace-well-documented-code

# WRITING GOOD COMMENTS

```
1           while (! finished) {
2               try {
3                   Thread.sleep(10); // so that program gets time to handle xxx logics
4               }
5               catch (InterruptedException e) {
…                   ……
…               }
…           }
```

Meaningful code comment complements / explains the intention of the code

# WRITING GOOD COMMENTS

```
1   //WARNING: This test case requires ~15 minutes to execute, don't run it during
    daily integration.
2   @Ignore
3   @Test
4   public void testHighThroughput() {
5   //模拟十万个线程同时进行访问
6   }
```

Meaningful code comment gives necessary warnings

# WRITING GOOD COMMENTS

```
1    //Notice：should be read from external config files
2    String driver = "com.mysql.jdbc.Driver";
3    String url = "jdbc:mysql://localhost:3306/sqltestdb";
4    String user = "root";
5    String password = "123456";
6    Class.forName(driver);
7    con = DriverManager.getConnection(url,user,password);
```

Meaningful code comment reminds about self-admitted technical debt (自承认技术债): developers consciously perform the hack (suboptimal solution) due to time constraints or technical limitations

# WRITING GOOD COMMENTS

```
1  public int[] sortNumbers() {
2      //TODO: the sorting code here
3      return new int[]{1,2,3,4,5};
4  }
```

Meaningful code comment helps developers locate incomplete/unfinished implementations (//TODO cannot exist in delivered code)

# COMMENTS - EXAMPLES

```
// make sure the port is greater or equal to 1024
if (port < 1024) {
  throw new InvalidPortError(port);
}
```

Bad
- No additional information
- WHAT

```
// port numbers below 1024 (the privileged or "well-known ports")
// require root access, which we don't have
if (port < 1024) {
  throw new InvalidPortError(port);
}
```

Okay
- Additional information
- WHY

Examples from https://www.youtube.com/watch?v=uPMxUnBjGG8

# COMMENTS - EXAMPLES

```
if (!hasRootPrivileges(port)) {
  throw new InvalidPortError(port);
}

private boolean hasRootPrivileges(int port) {
  // port numbers below 1024 (the privileged or "well-known ports")
  // require root access on unix systems
  return port < 1024;
}
```

Better

- Refactored with meaningful name (`hasRootPrivileges`)

```
final static const HIGHEST_PRIVILEDGED_PORT = 1023;

private boolean hasRootPrivileges(int port) {
  // The privileged or "well-known ports" require root access on unix systems
  return port <= HIGHEST_PRIVILEDGED_PORT;
}
```

Even better

- Turn **magic number** into a constant with meaningful name
- Comment might no longer be needed

Examples from https://www.youtube.com/watch?v=uPMxUnBjGG8

# COMMENTS - DESCRIBING WHY

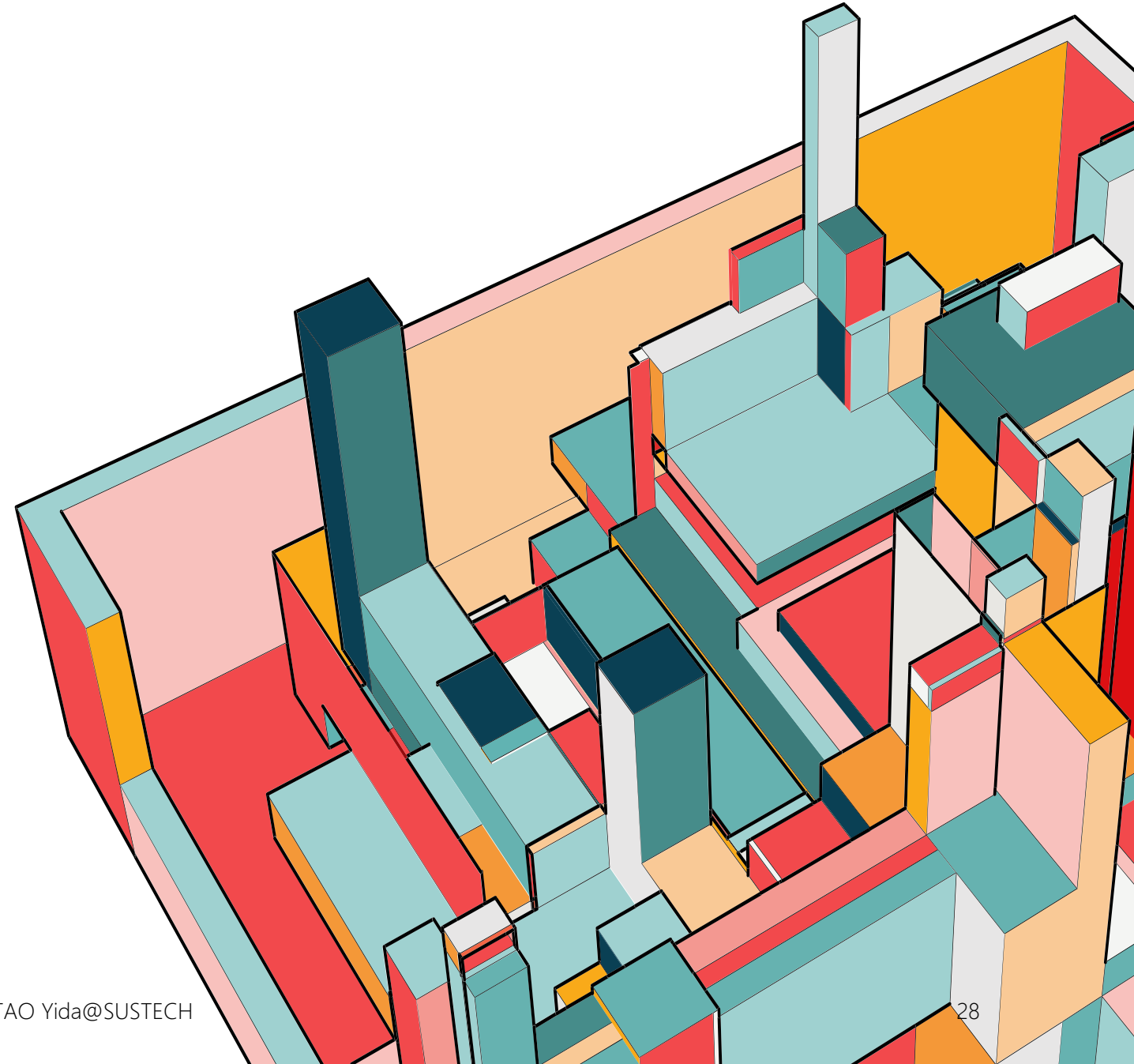
- Describe the design decisions to a class
- Describe the limitations of an implementation
- Describe usage assumptions of APIs
- Describe the purpose and intents of each file

# COMMENTING PRINCIPLES

- The best documentation is the code itself
- Make the code self-explainable and self-documenting
- Do not document bad code, refactor or rewrite it!
- WHY (rationales), not WHAT (implementations)

# JAVADOC

Javadoc (included in JDK) automatically generates API documentation from comments present in the Java source code.



# JAVADOC COMMENT SYNTAX

- Javadoc comments structure look very similar to a regular multi-line comment, but the key difference is the extra asterisk at the beginning
- Javadoc style comments may contain HTML tags as well.

```
// This is a single line comment

/*
 * This is a regular multi-line comment
 */

/**
 * This is a Javadoc
 */
```

https://www.baeldung.com/javadoc

# JAVADOC COMMENT SYNTAX

- Javadoc comments may be placed above any class, method, or field which we want to document.

- These comments are commonly made up of two sections:
  - The description of what we're commenting on
  - The standalone block tags (marked with the “@” symbol) which describe specific meta-data

https://www.baeldung.com/javadoc

# JAVADOC TAGS

| | |
|---|---|
| @author | A person who made significant contribution to the code. Applied only at the class, package, or overview level. Not included in Javadoc output. It's not recommended to include this tag since authorship changes often. |
| @param | A parameter that the method or constructor accepts. Write the description like this: @param count Sets the number of widgets you want included. |
| @deprecated | Lets users know the class or method is no longer used. This tag will be positioned in a prominent way in the Javadoc. Accompany it with a @see or {@link} tag as well. |
| @return | What the method returns. |
| @see | Creates a see also list. Use {@link} for the content to be linked. |
| {@link} | Used to create links to other classes or methods. Example: {@link Foo#bar} links to the method `bar` that belongs to the class `Foo`. To link to the method in the same class, just include #bar. |
| @since 2.0 | The version since the feature was added. |
| @throws | The kind of exception the method throws. Note that your code must indicate an exception thrown in order for this tag to validate. Otherwise Javadoc will produce an error. @exception is an alternative tag. |
| @Override | performs a check to see if the method is an override. used with interfaces and abstract classes. |

https://idratherbewriting.com/java-javadoc-tags/

# JAVADOC AT CLASS LEVEL

```java
/**
* Hero is the main entity we'll be using to . . .
*
* Please see the {@link com.baeldung.javadoc.Person} class for true identity
* @author Captain America
*
*/
public class SuperHero extends Person {
    // fields and methods
}
```

https://www.baeldung.com/javadoc

# JAVADOC AT METHOD LEVEL

```
/**
 * Returns the element at the specified position in this list.
 *
 * @param  index index of element to return.
 * @return the element at the specified position in this list.
 * @throws    IndexOutOfBoundsException if index is out of range <tt>(index
 *            &lt; 0 || index &gt;= size())</tt>.
 */
public E get(int index) {
    RangeCheck(index);

    return elementData[index];
}
```

java.util.ArrayList

# JAVADOC GENERATION

```
C:> javadoc -d C:\home\html -sourcepath C:\home\src java.my.package
```

```
/**
 * Returns the element at the specified position in this list.
 *
 * @param  index index of element to return.
 * @return the element at the specified position in this list.
 * @throws    IndexOutOfBoundsException if index is out of range <tt>(index
 *            &lt; 0 || index &gt;= size())</tt>.
 */
public E get(int index) {
    RangeCheck(index);

    return elementData[index];
}
```

**get**

```
public abstract E get(int index)
```

Returns the element at the specified position in this list.

**Specified by:**

`get` in interface `List<E>`

**Parameters:**

`index` - index of the element to return

**Returns:**

the element at the specified position in this list

**Throws:**

`IndexOutOfBoundsException` - if the index is out of range (index < 0 || index >= size())

# DOCUMENTATION TOOLS & FRAMEWORKS

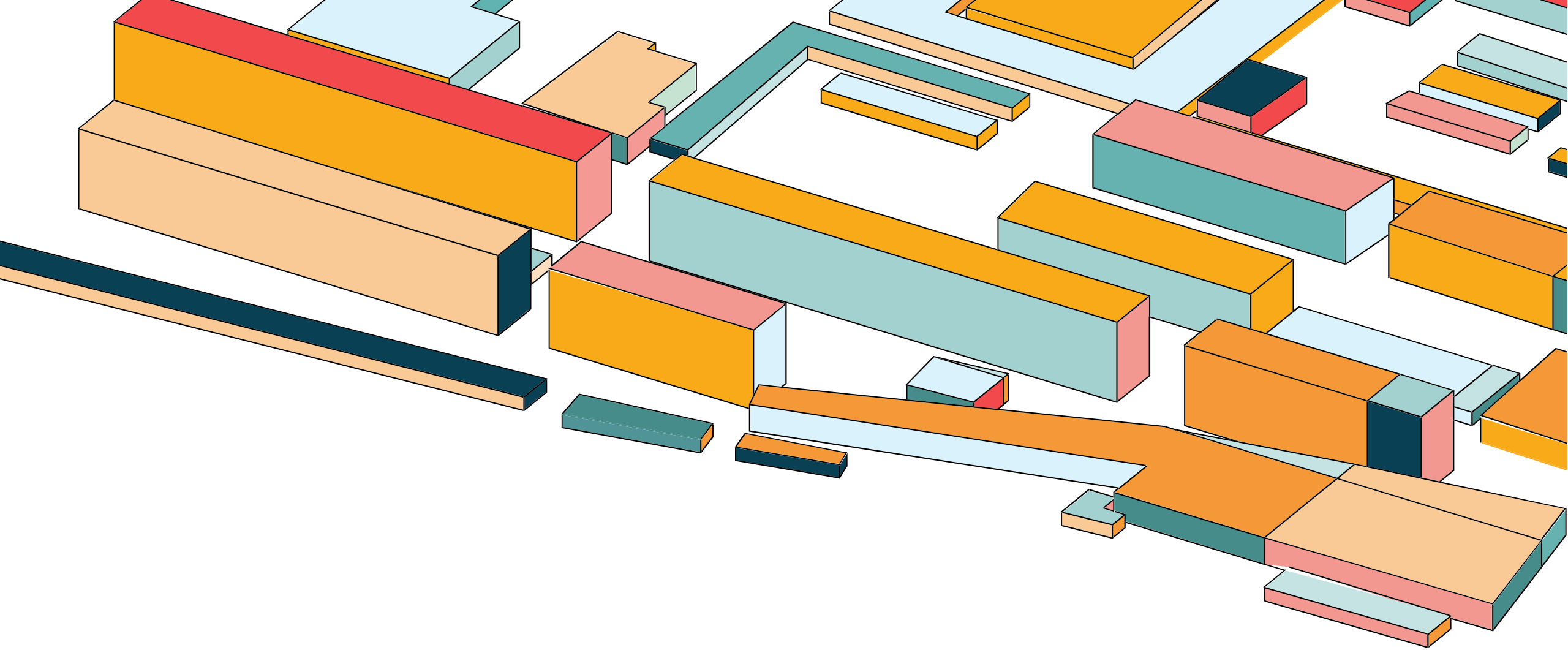
- Python: Python has its built-in documentation tool called PyDoc, which generates HTML documentation from Python code.
- JavaScript: JSDoc is an open source API documentation generator for Javascript. It allows developers to document their code through comments.

https://www.baeldung.com/javadoc

# DOCUMENTATION TOOLS & FRAMEWORKS

- Sphinx: a documentation generator. https://www.sphinx-doc.org/en/master/
- Swagger: a popular framework for documenting REST APIs. https://swagger.io/docs/
- GitBook: a modern documentation platform where teams can document everything from products to internal knowledge bases and APIs. https://www.gitbook.com/

https://www.baeldung.com/javadoc



# LESS RECOGNIZED DOCUMENTATION

# TESTS

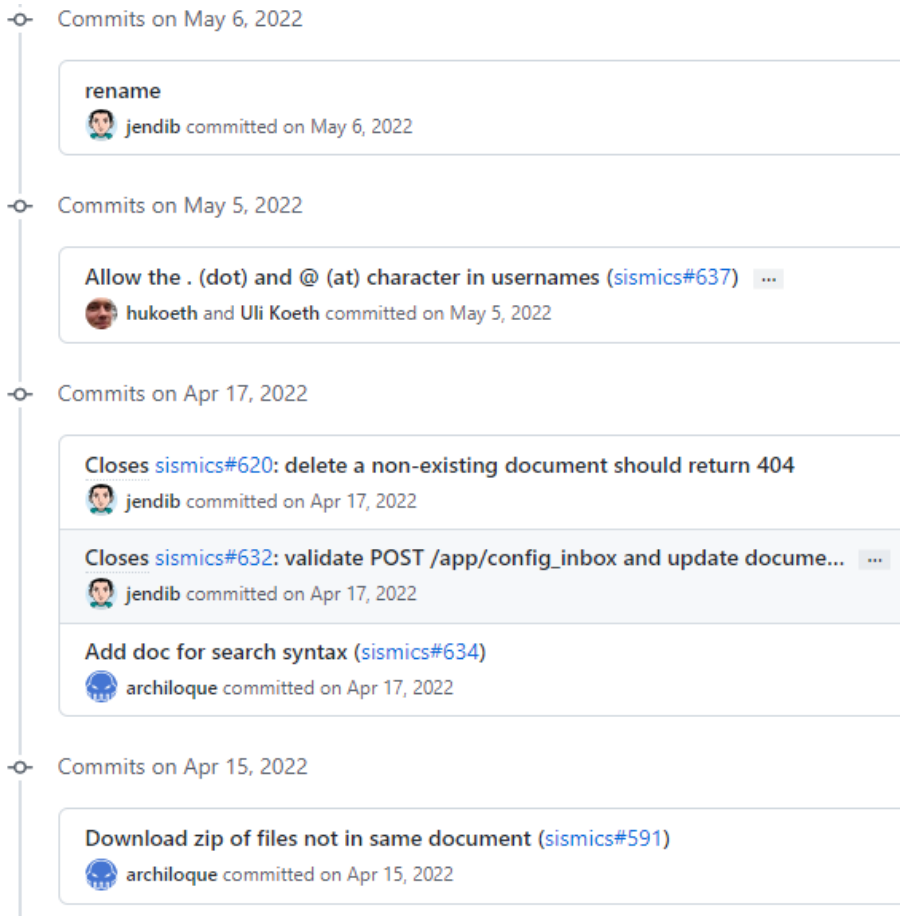
- Tests could be used to “document” how the code should behave
- Tests provide examples of how to use an API, with assertions
- Tests also give examples of edge case scenarios

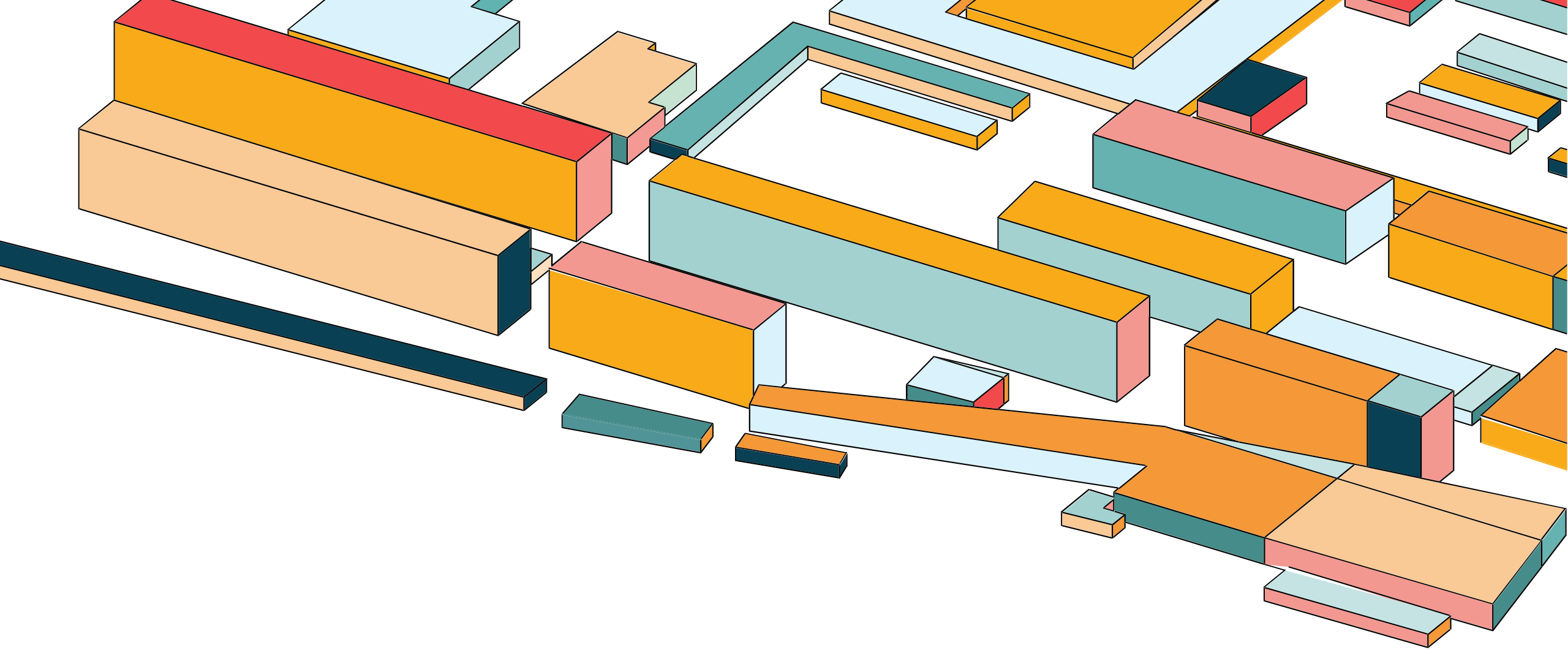
```
void shouldRetrieveValuesInOrderTheyAreAdded()
void shouldThrowExceptionIfStackIsEmpty()
void shouldThrowExceptionIfMaxThresholdIsReached()
```

Sample tests for Stack

# GIT COMMIT MESSAGES

- Gives context of the change
- Explain “why this change is needed?” kinds of questions
- Commit messages live with the code with no clutter
- Always up-to-date w.r.t. the code changes



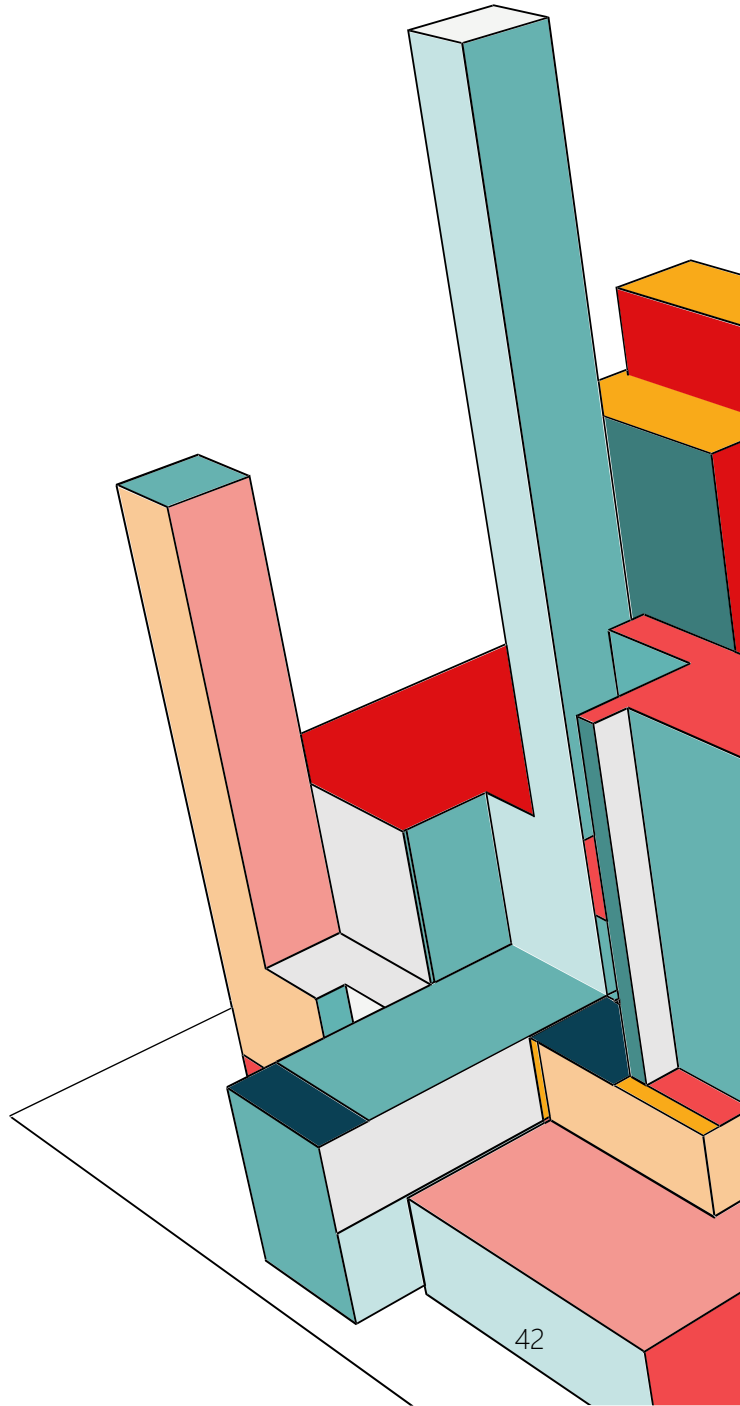


# DOCUMENTATION AS CODE

# ONCE UPON A TIME ...

48%

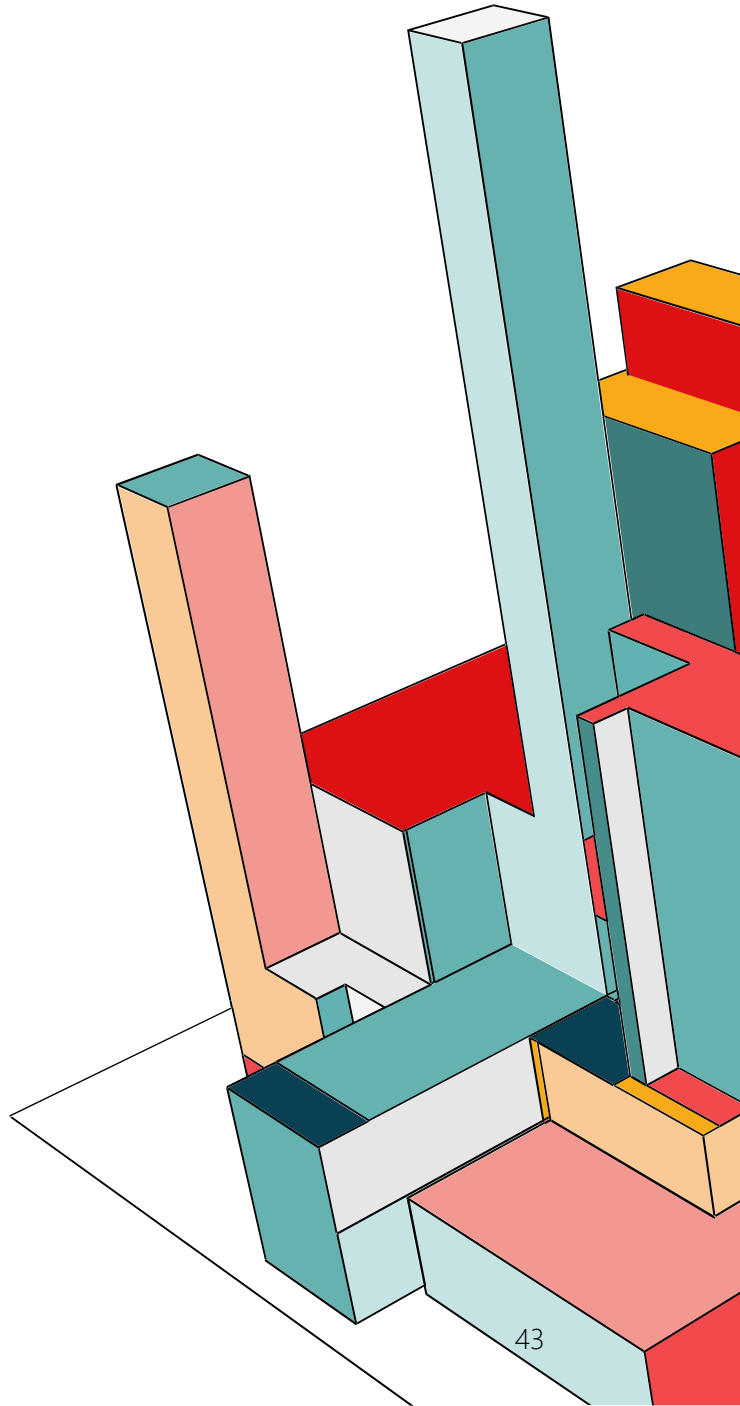
Google engineers citing documentations as productivity issue (Googlegeist 2014)



# ONCE UPON A TIME ...

50%+

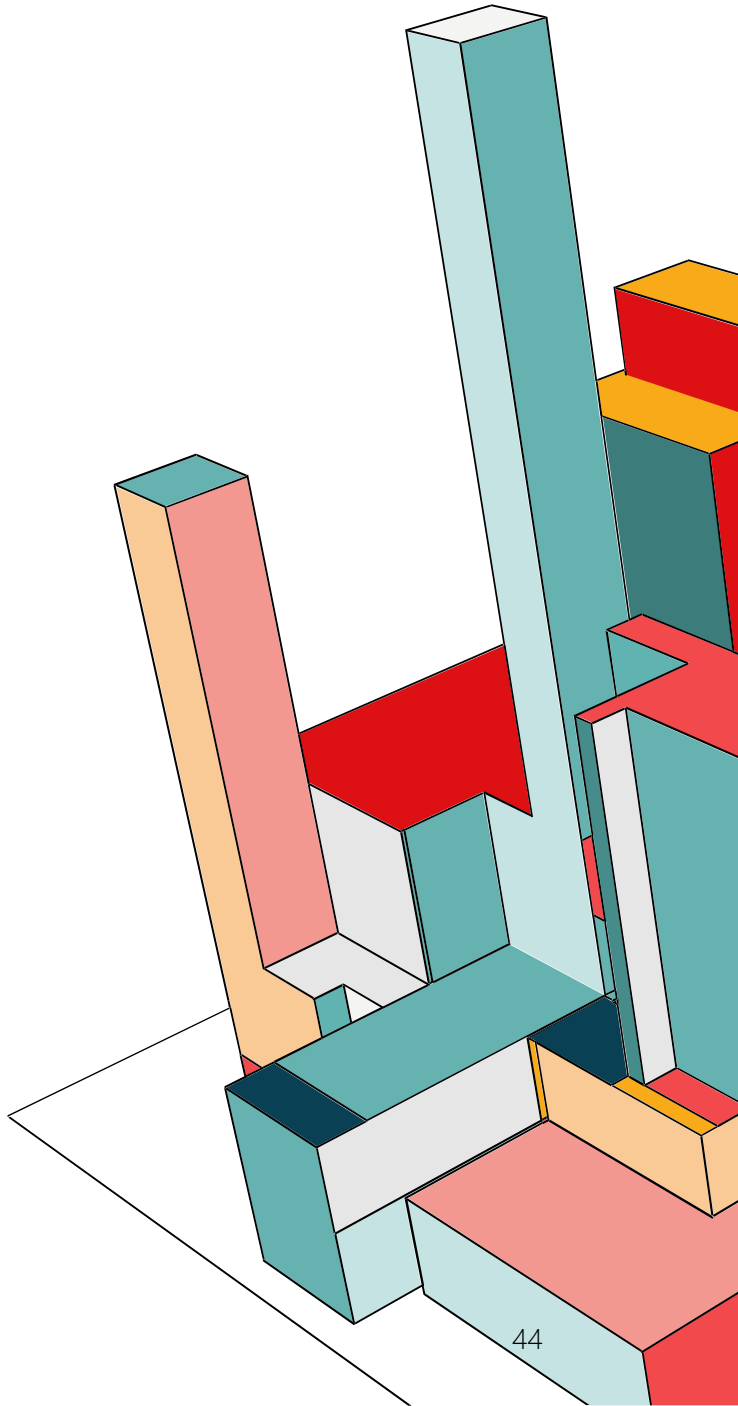
Google SRE issues cited problems with documentation (Googlegeist 2014)



# ONCE UPON A TIME . . .

Troubles with docs

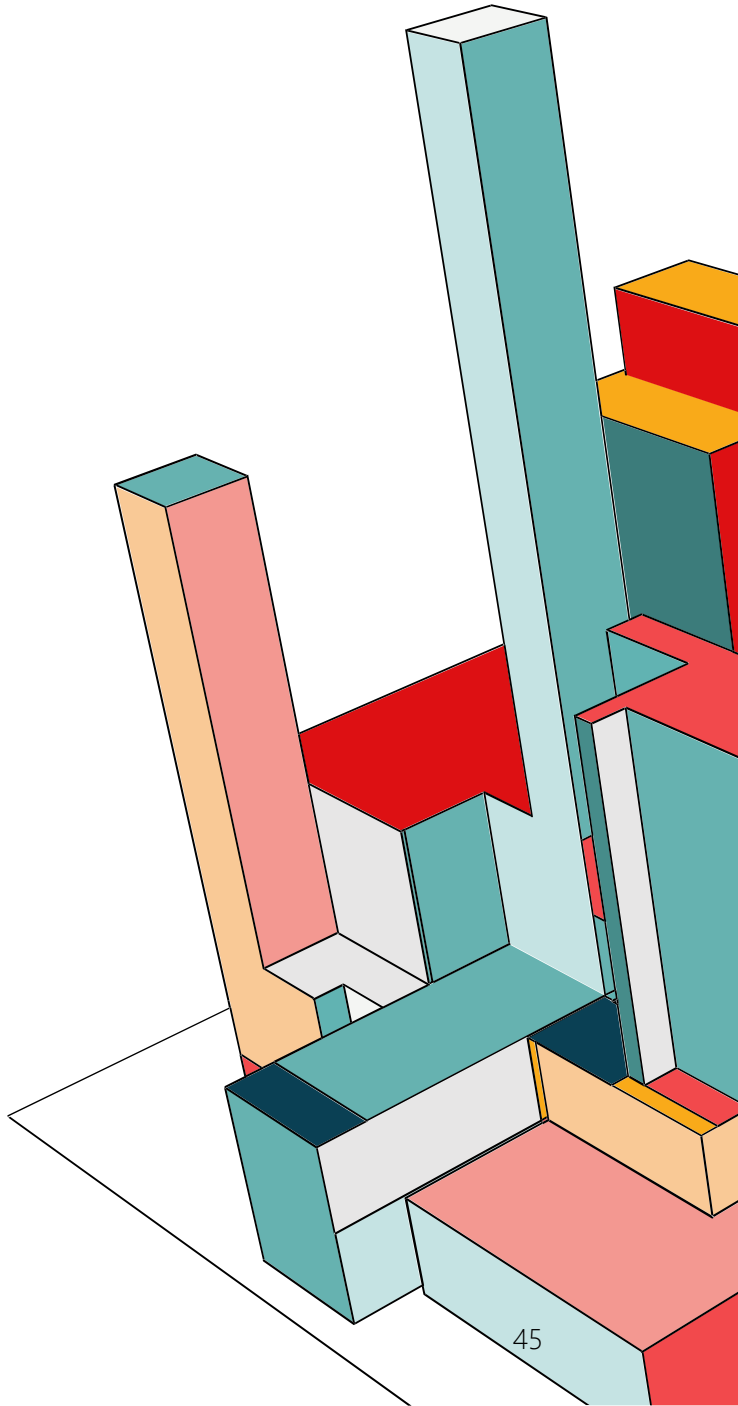
- They “don’t exist”
- They are “impossible to find”
- They are “wrong”



# ONCE UPON A TIME . . .

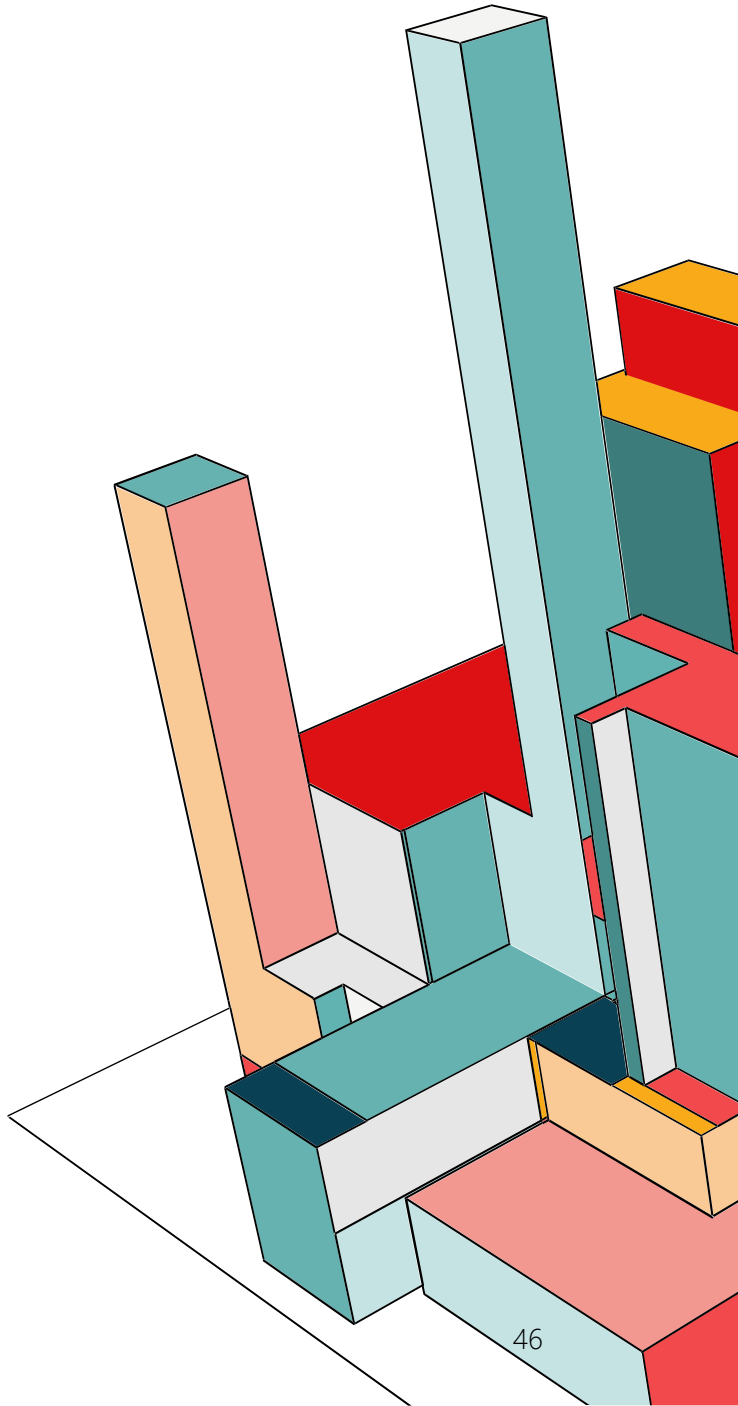
Troubles with writing docs

- “No time”
- “No incentive”



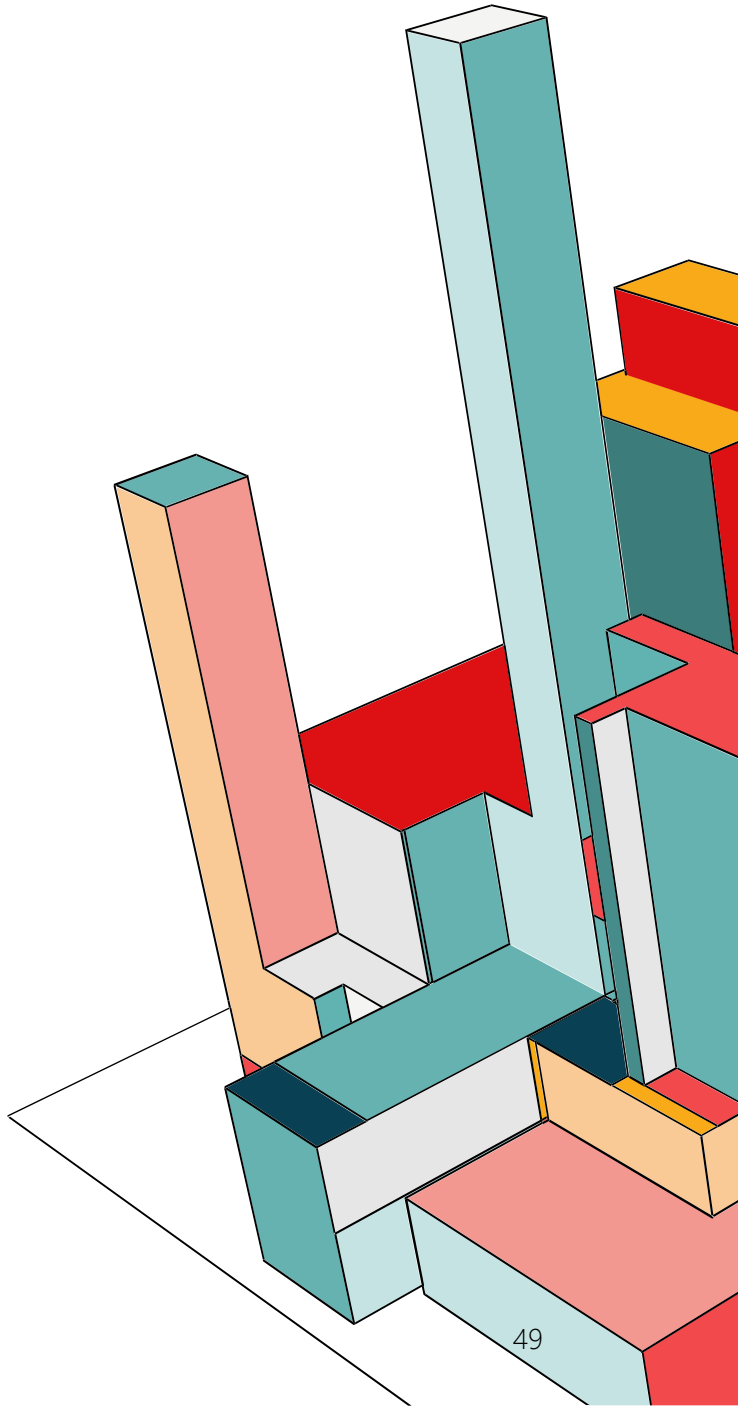
# NO DOC CULTURE

Docs: Everybody’s problem, nobody’s jobs



# LESSONS LEARNED

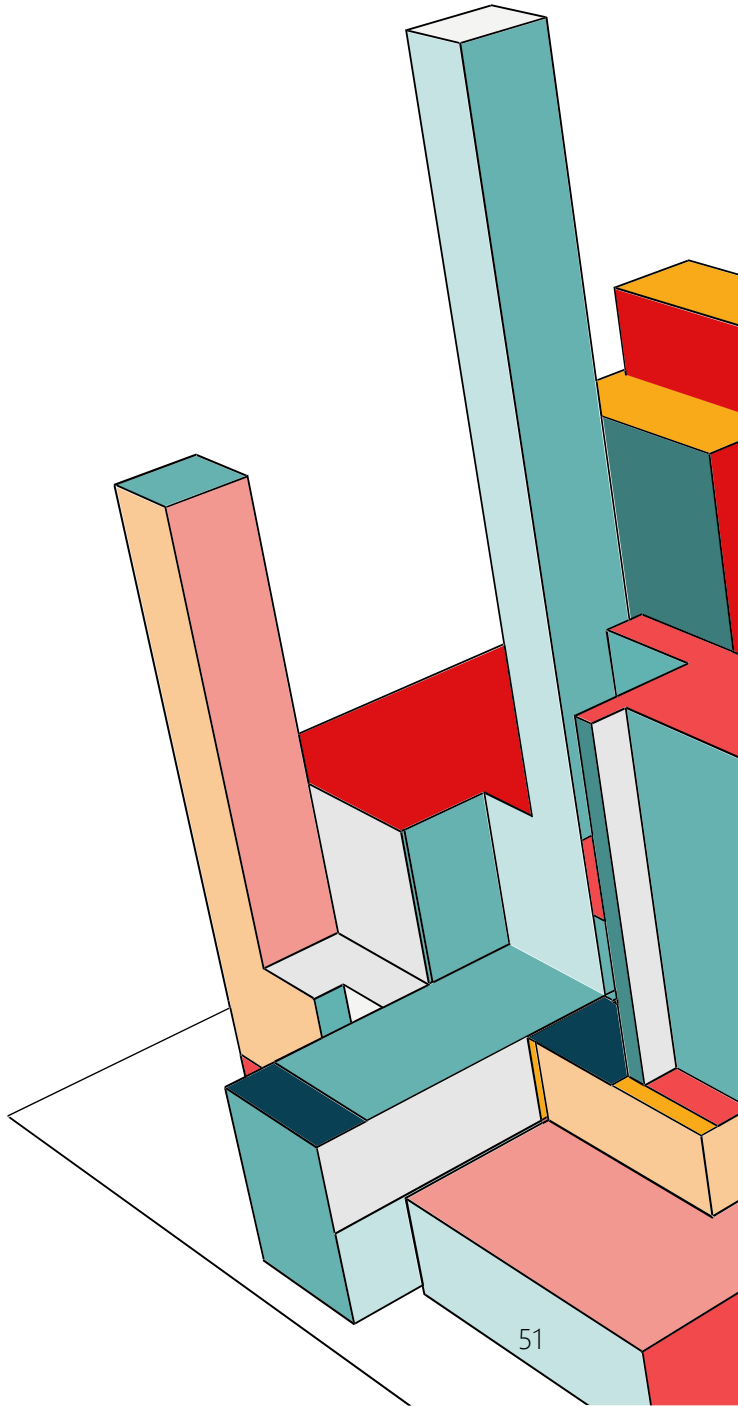
Documentation will never be part of the engineering culture until it is integrated into the codebase and workflow



# g3doc

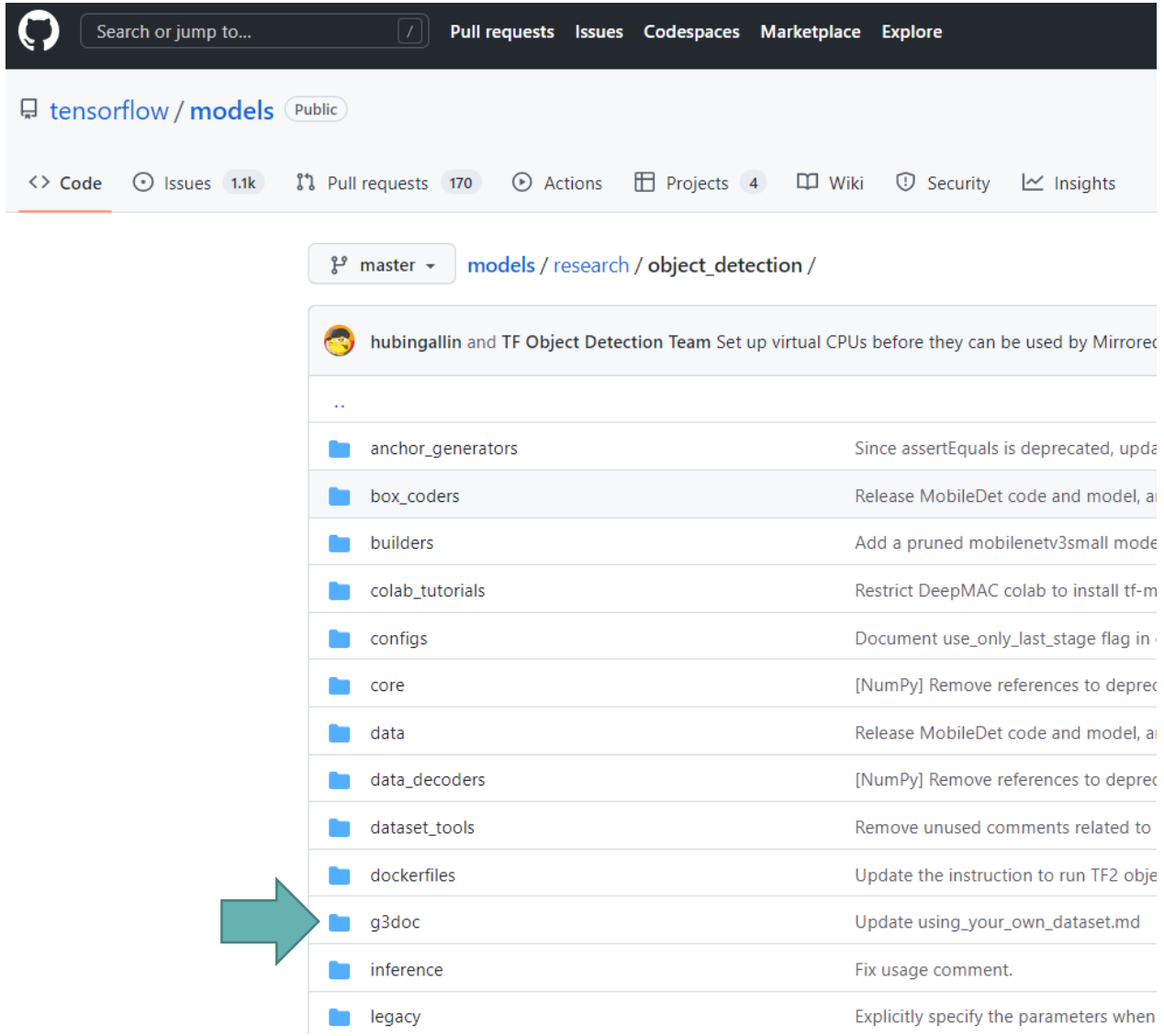
Engineers find, create, and maintain docs using their regular workflow and developers tools

Documentation is treated as code



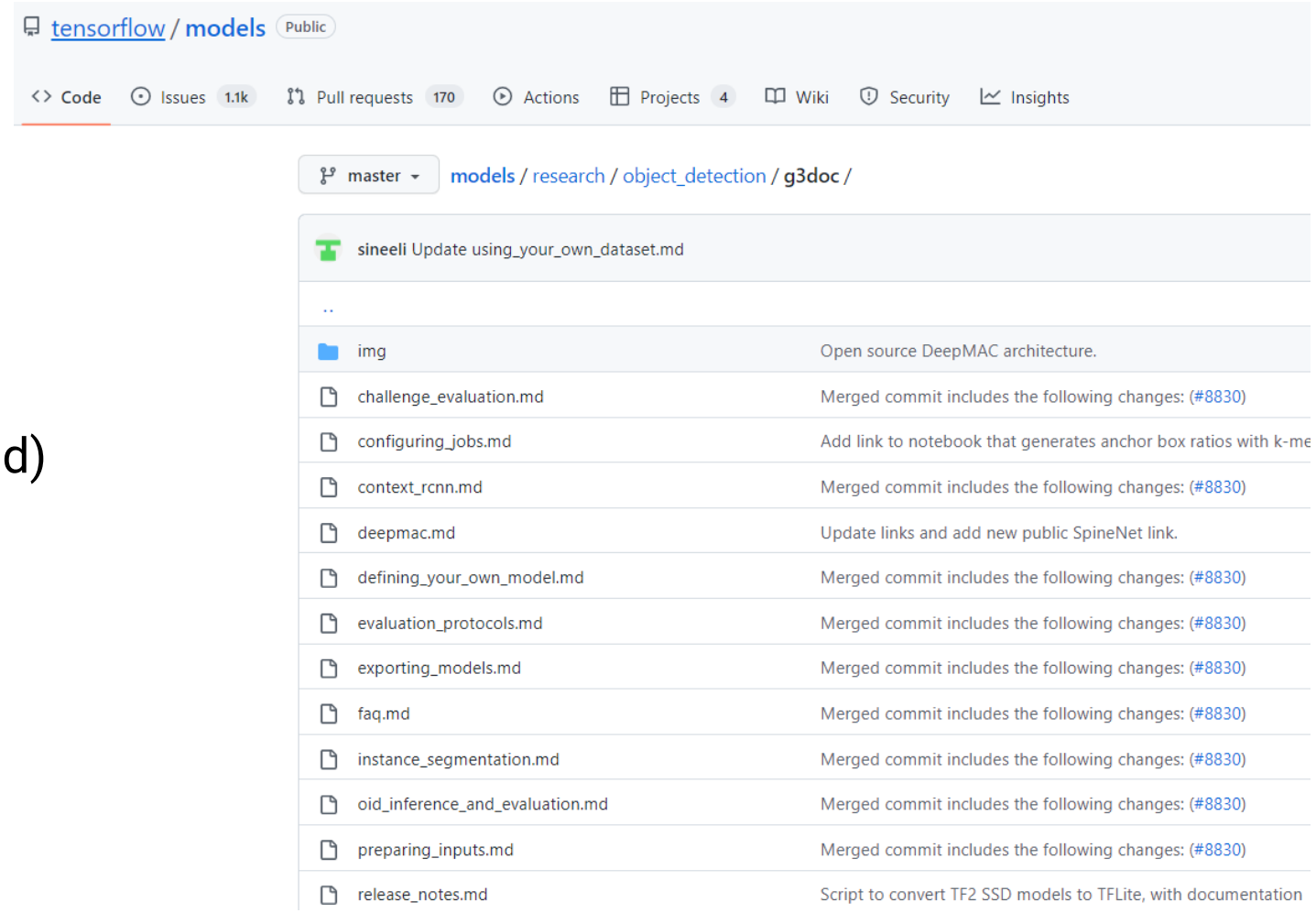
# DESIGN 1: DOCS LIVES WITH CODE

Docs are stored side-by-side with the source code in the codebase



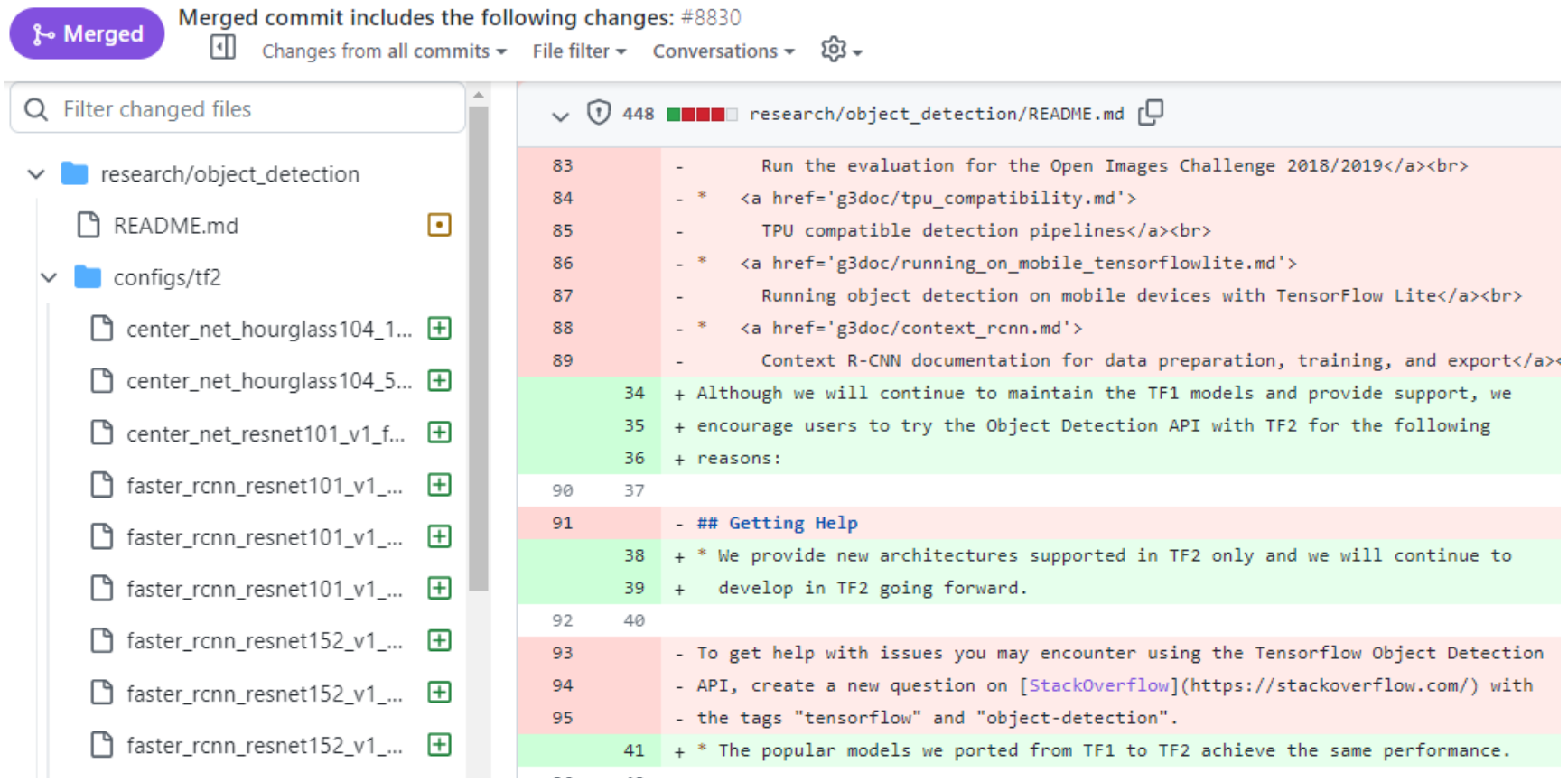
# DESIGN 2: USE MARKDOWN

Docs are written in markdown format (.md)



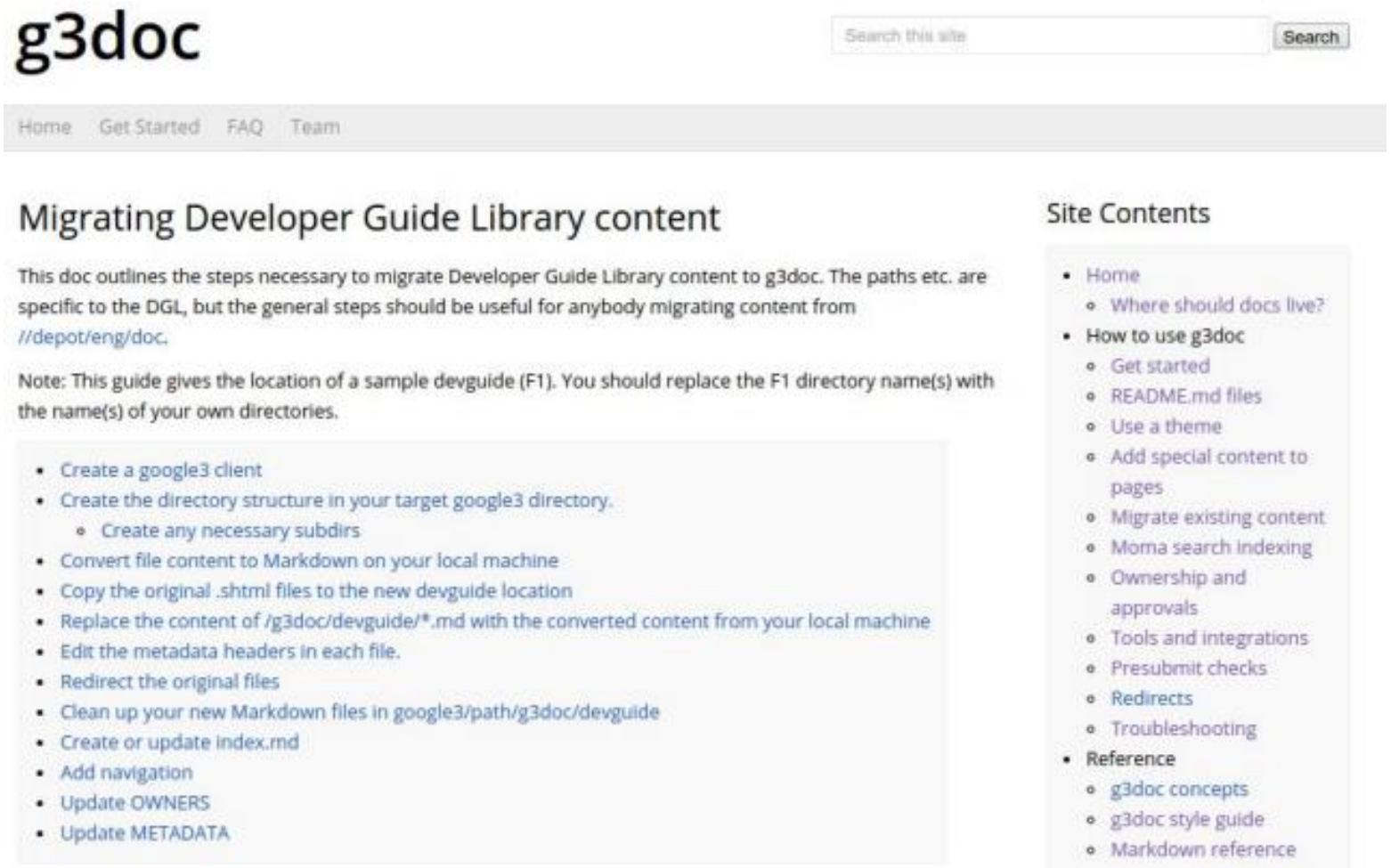
# BENEFITS

- Docs are under version control like code
- Allow code review, diff, blame, fixes, and issue tracking



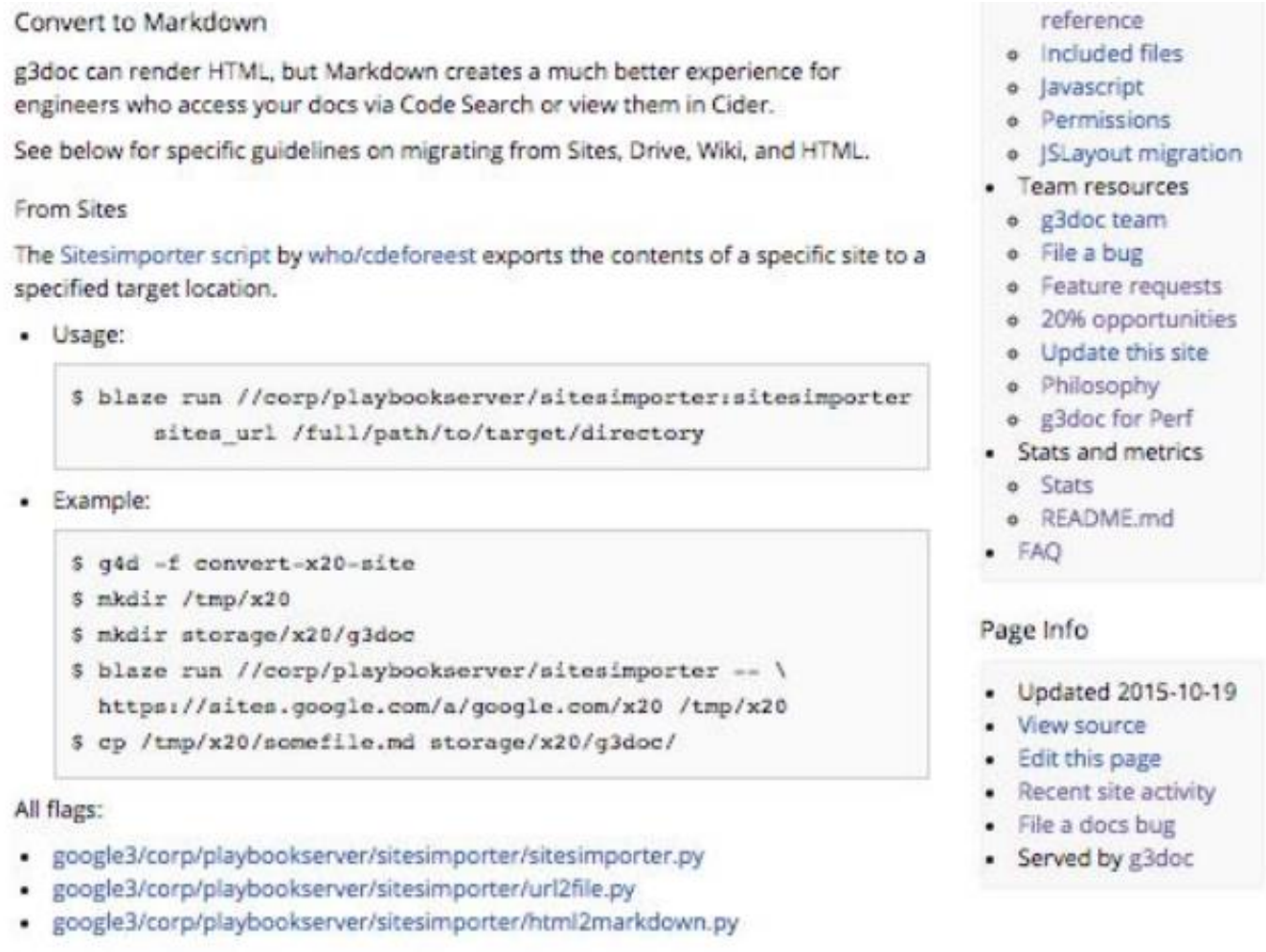
# BENEFITS

- g3doc renders beautiful html based on .md files
- Developers focus on the contents, instead of the presentation



# BENEFITS

- Docs have rich links to source code
- Easy for code search



Convert to Markdown

g3doc can render HTML, but Markdown creates a much better experience for engineers who access your docs via Code Search or view them in Cider.

See below for specific guidelines on migrating from Sites, Drive, Wiki, and HTML.

From Sites

The Sitesimporter script by who/cdeforeest exports the contents of a specific site to a specified target location.

- Usage:

```
$ blaze run //corp/playbookserver/sitesimporter:sitesimporter
      sites_url /full/path/to/target/directory
```

- Example:

```
$ g4d -f convert-x20-site
$ mkdir /tmp/x20
$ mkdir storage/x20/g3doc
$ blaze run //corp/playbookserver/sitesimporter -- \
  https://sites.google.com/a/google.com/x20 /tmp/x20
$ cp /tmp/x20/somefile.md storage/x20/g3doc/
```

All flags:

- google3/corp/playbookserver/sitesimporter/sitesimporter.py
- google3/corp/playbookserver/sitesimporter/url2file.py
- google3/corp/playbookserver/sitesimporter/html2markdown.py

reference
- Included files
- Javascript
- Permissions
- JSLayout migration

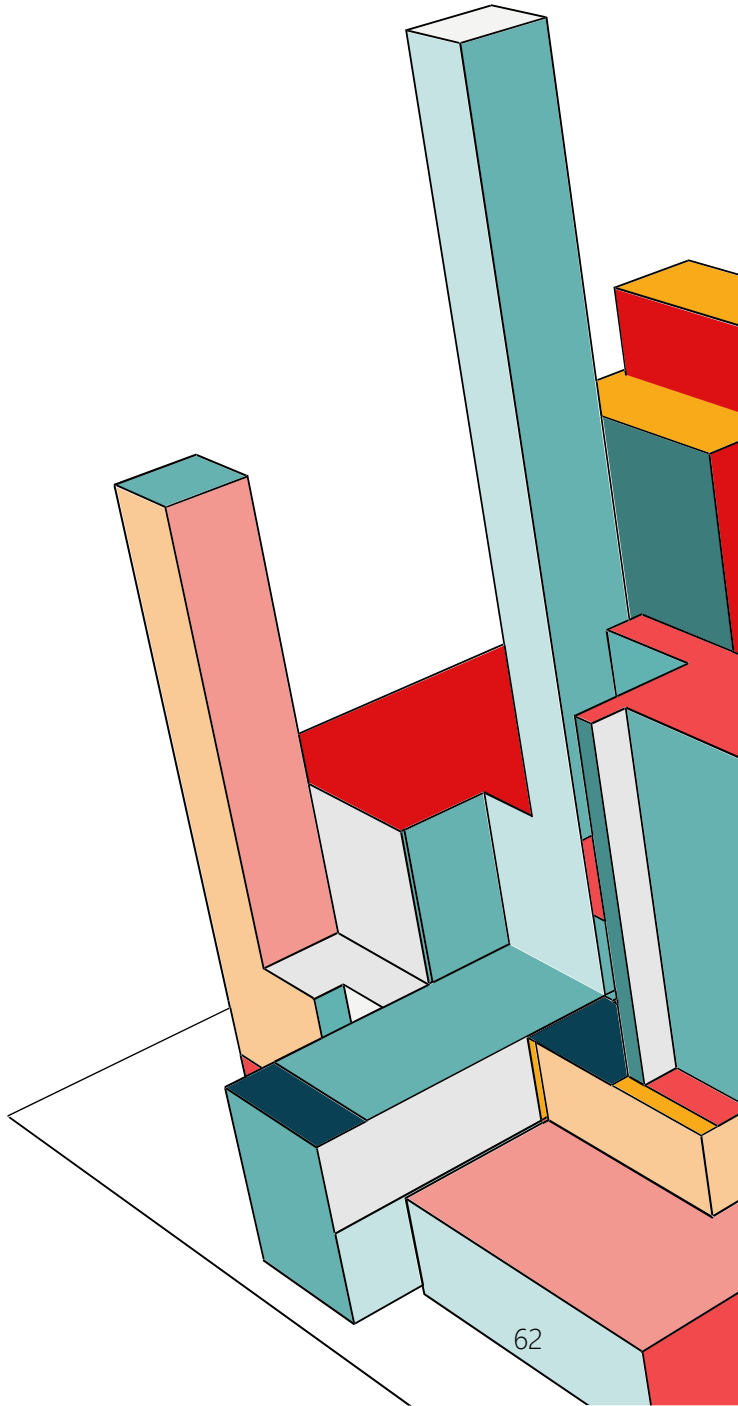
- Team resources
  - g3doc team
  - File a bug
  - Feature requests
  - 20% opportunities
  - Update this site
  - Philosophy
  - g3doc for Perf
- Stats and metrics
  - Stats
  - README.md
- FAQ

Page Info

- Updated 2015-10-19
- View source
- Edit this page
- Recent site activity
- File a docs bug
- Served by g3doc

# READINGS

- Chapter 10. Documentation. Software Engineering at Google by Titus Winters, et al.
- 第4.2章 代码风格. 现代软件工程基础 by 彭鑫 et al.



# NEXT

- Continuous Integration