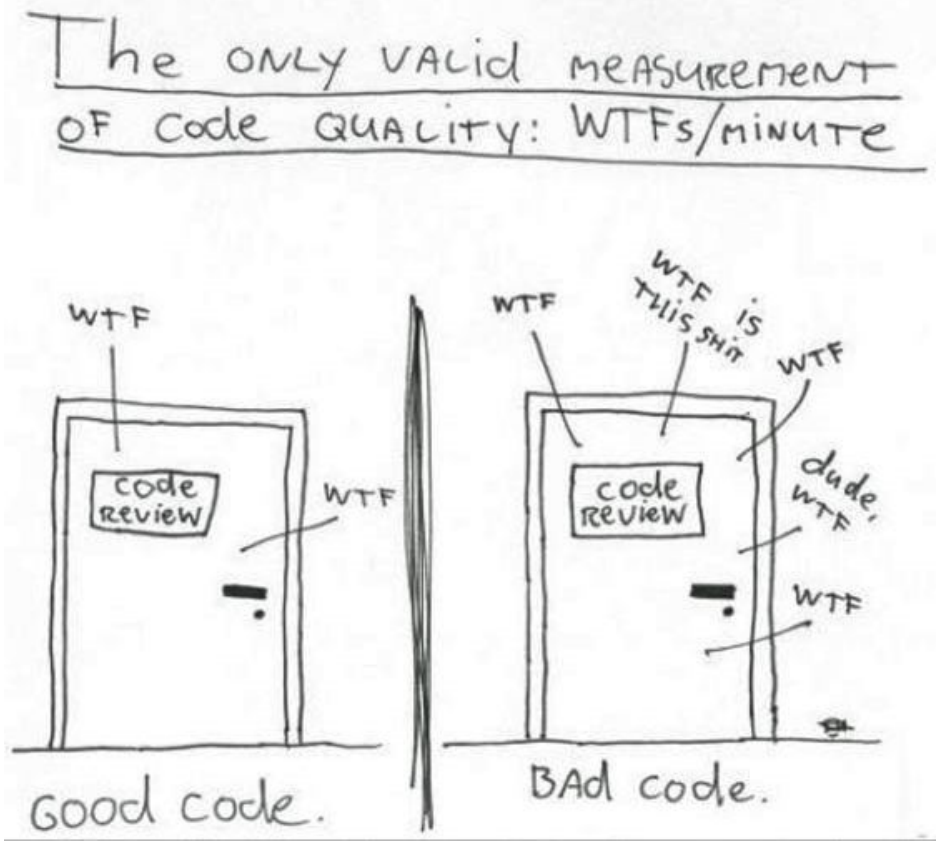
STATIC CODE ANALYSIS and MANUAL CODE REVIEW

Jakub Papcun
Jan Svoboda

HELLO!

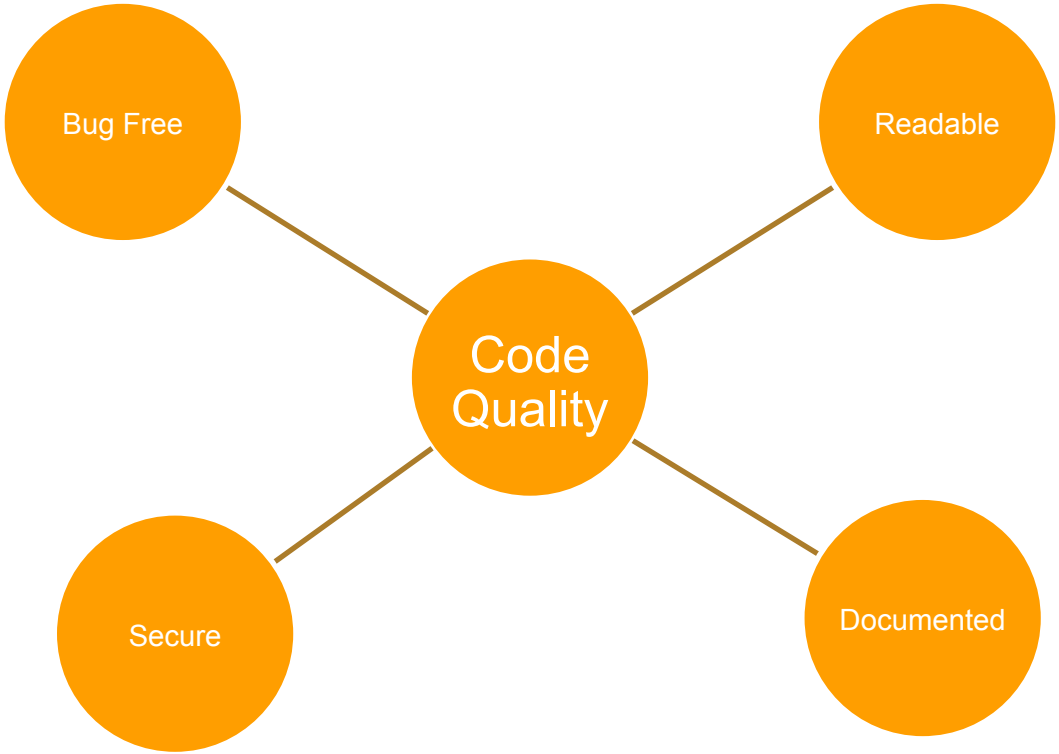
Jakub Papcun, Jan Svoboda

- FI MUNI graduates
- Java Developers since 2011
- Scrum Masters



How Developers See Quality

CODE QUALITY



THERE IS NO PERFECT CODE

Analysis of computer software performed without executing the software.

- No program execution
- Automated process
- Possible to run as part of Continuous Integration

1

C++

NetBeans

C#

Visual Studio

TYPES OF STATIC CODE ANALYSIS

Type Checking	• correct assignment of types of objects
Style Checking	• style of the code and its formatting
Program Understanding	• helps user make sense of large codebase and may include refactoring capabilities
Security review	• uses dataflow analysis for detection of possible code injection
Bug Finding	• looks for places in the code where program may behave in a different way from the way intended by developer

IT ALL BEGINS WITH THE FIRST LINE

WHY USE STATIC CODE ANALYSIS

Higher Code Quality

Cheaper defect fixing

Repeatibility

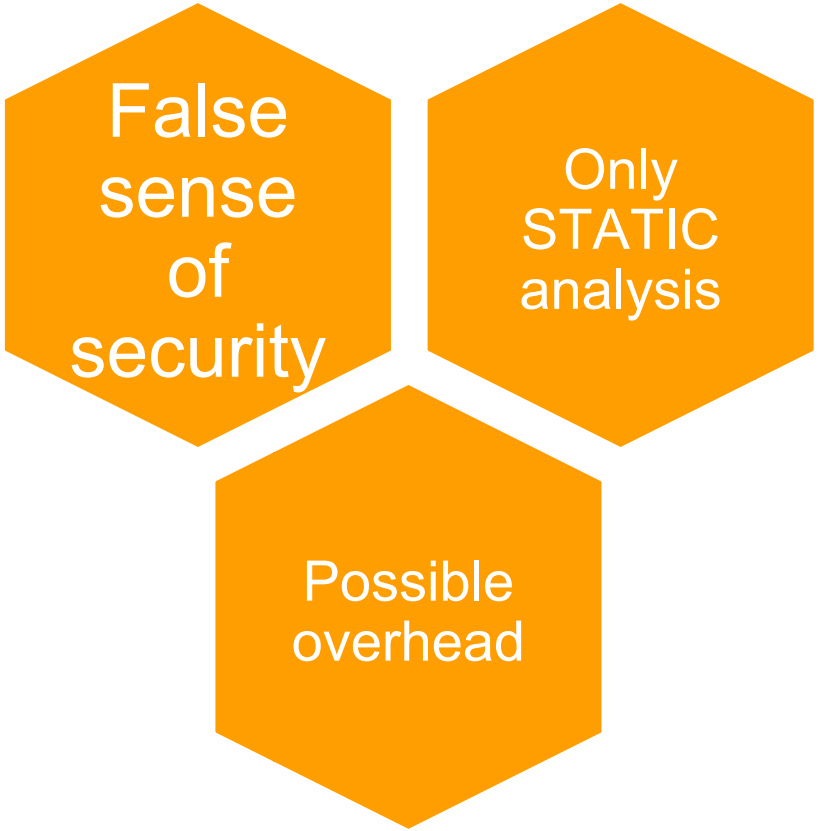
Readibility

No Input

Education

Coding Guidelines Compliance

DRAWBACKS


False sense of security
Only STATIC analysis
Possible overhead

PITFALLS OF STATIC CODE ANALYSIS

	Is a problem	Is NOT a problem
Was found	**True Positive**	**False Positive**
Was NOT found	**False Negative**	

```
public static Pair<Long, String> parseConfigurationString(String configurationStr) {
        Long linkTypeId = null;
        String direction = null;
        int sepPos = 1 configurationStr != null ? configurationStr.indexOf('|') : -1;
        if (sepPos >= 0) {
                String linkTypeIdStr = 2 configurationStr.substring(0, sepPos);
```

A "NullPointerException" could be thrown; "configurationStr" is nullable here. ... 2 months ago ▾ L181

Bug Major Resolved (False Positive) ▾ Not assigned 10min effort Comment cert, cwe

JP Jakub Papcun sepPos is -1 if configurationStr is null ... the the next IF checks if sepPos is 0 or higher thus by transition checking if configurationStr is null or not. 2 months ago

HELLO WORLD

```
1  public class HelloWorld {
```

Add a private constructor to hide the implicit public one. ...
2 months ago ▾ L1
Code Smell | Major | Open | Not assigned | 30min effort
design

```
2
3      public static void main(String[] args) {
4          // Prints "Hello, World" to the terminal window.
5          System.out.println("Hello, World");
```

Replace this usage of System.out or System.err by a logger. ...
2 months ago ▾ L5
Code Smell | Major | Open | Not assigned | 10min effort
bad-practice, cert

```
6      }
7
8  }
```

LEARN ABOUT YOURSELF

- Lines of Code (LOC)
- Comments Quality
- Code Duplication
- Technical Debt
- Cyclomatic Complexity
- Cognitive Complexity
- Dependency Cycle Detection

RULES

A checker defining possible issues in the code

Unused local variable
Memory leaks
SQL injection
Call of function on null

- Reliability issues
- May crash at runtime
- May cause extremely unpredictable behavior

- Null pointer dereference
- Memory leaks
- Buffer overflow

```
1  static void printPoint(Point p) {
2    if (p == null) {
3      System.err.println("p is null");
4    }
5    if (p.x < 0 || p.y < 0) {
6      System.out.println("Invalid point");
7      return;
8    }
9    System.out.println(p);
10 }
```

- Security issues
- Crash or corrupt the system
- Open space for attack

- Harcoding credentials
- Data/SQL Injection
- Not securing “cookies”

```
1  public static void main(String[] args) throws Exception {
2    Properties info = new Properties();
3    info.setProperty("user", "root");
4    info.setProperty("password", "^6nR$%_");
5    Connection connection = DriverManager.getConnection("jdbc:mysql://localhost:3307", info);
6    try {
7      //...
8    } finally {
9      connection.close();
10   }
11 }
```

- Maintainability issues
- Decrease readibility, architecture quality etc.

- Unused private method
- Possible error in bit operations
- Incorrect allocation size

```
1 static void printErrorMessage(String message) {
2   System.out.err("An error occured");
3 }
```

```
1 Proffesional john = new Proffesional("John", 25, "miner");
2 public boolean checkJohn(Person p) {
3   return p == john;
4 }
```

```
private Map<String, String> paths = new HashMap<String, String>();

public void addPath(String name, String path) {
    paths.put(name, path);
}

private String getNormalizedPath(String name) throws IOException {
    return paths.get(name).toLowerCase();
}
```

Can return `null`

A NullPointerException is thrown in case of an attempt to dereference a `null` value.

```
private static void foo(){
    int i = 0;
    String s = null;

    if(i > 0){
        s = "positive";
    }

    if(s.contains("pos")){
        System.out.println(s);
    }
}
```

Statement always `false`

`s` is always `null`

1. Statement is always false and never enters the block
2. s variable is always null and NullPointerException may be thrown

```
private static void foo(int arr[]){
    if(arr != null & arr.length != 0){
        foo2();
    }
    return;
}
```

& or &&

Questionable use of bit operation ‘&’ in expression. Did you mean ‘&&’?

```
private static void foo(int j){
    Integer k;
    switch(k){
      case 1: System.out.println("k lower than 2."); break;
      case 2: System.out.println("k equals 2."); break;
      case 3: System.out.println("k bigger than 2."); break;
      default: System.out.println("K = " + k);
    }
    return;
}
```

`j` is never used

`k` not initialized

1. j variable is never used and thus redundant
2. k variable is never initialized and thus unusable

```
public void foo(){
  Item item = new Item();
  if(item.getInfo() != null){
    String info = item.getInfo().trim();
  }
}
```

may return `null`

```
class Item{
  public String getInfo(){
    // Making REST Request
  }
}
```

REST may fail and return null

HOW DO I EVEN START?

STOP WITH REGRESSION

PERFECTION IS IMPOSSIBLE

DO IT “ON-THE-FLY”

klocwork®

a Rogue Wave Company

sonarqube

Pmd

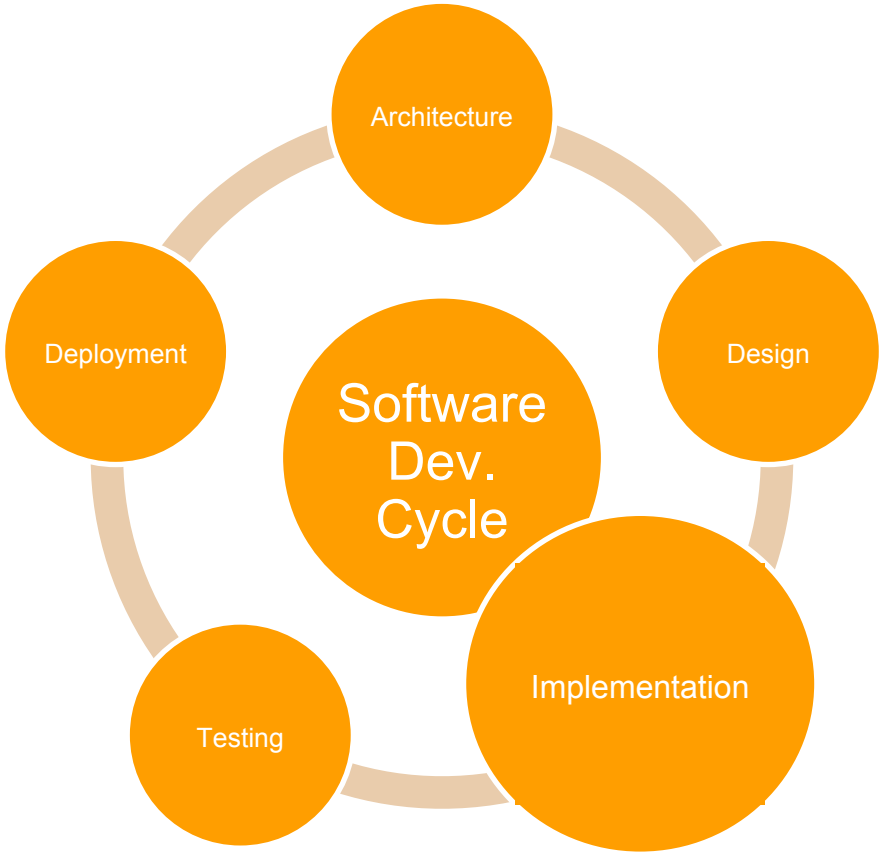
THANKS!

Any questions?

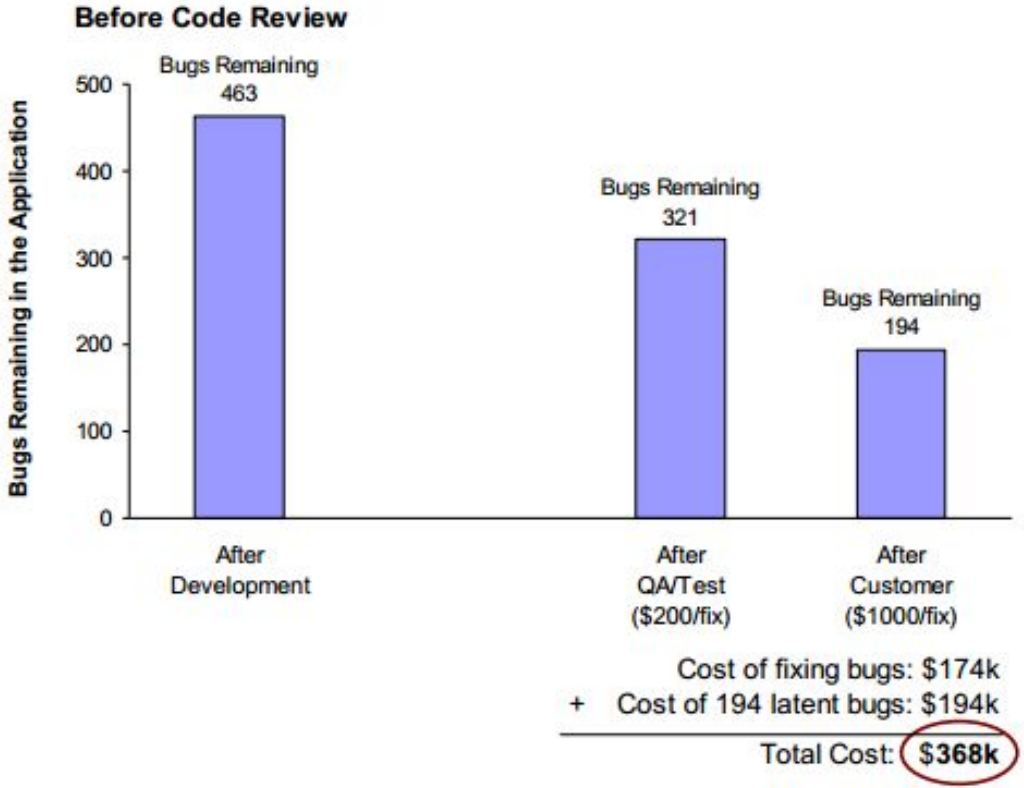
Systematic examination of the source code

Early Defect Detection

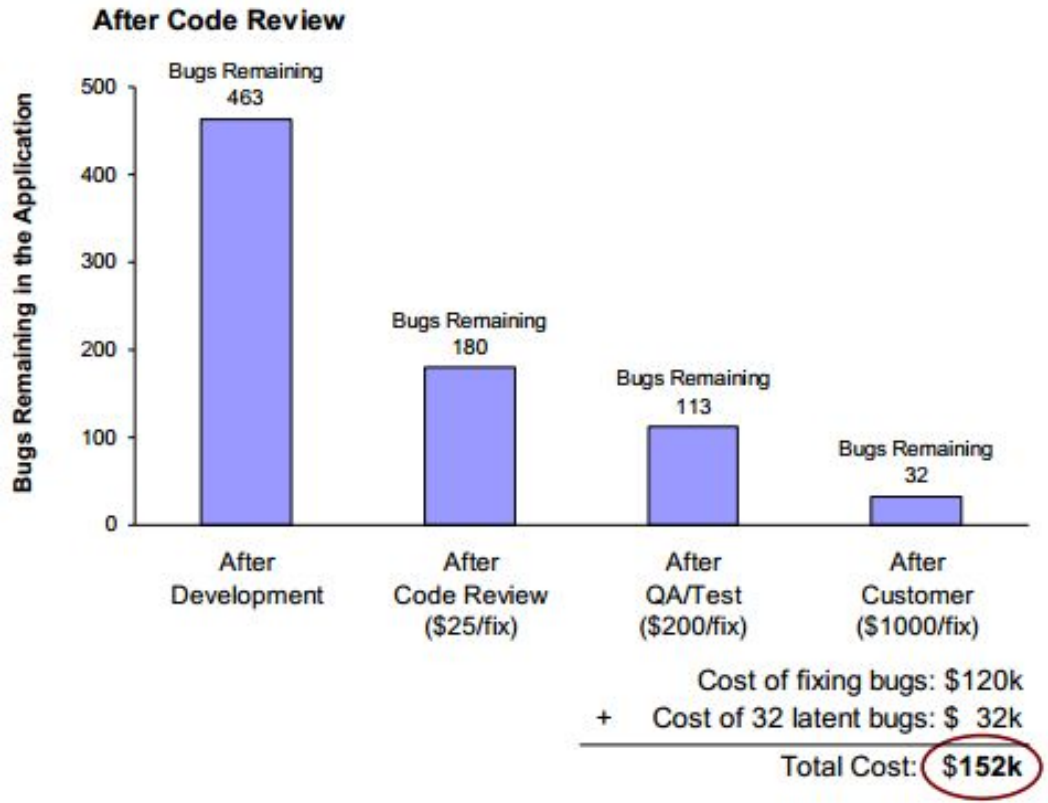
MCR IN DEVELOPMENT CYCLE



COST OF DEFECT FIX



COST OF DEFECT FIX



- Different point of view
- Product evolution awareness
- Education

WHAT MAKES GOOD CODE REVIEW?

- Goal
- People
- Technical knowledge

TYPES OF MCR

- Formal
- Informal
- Tool-assisted

- Typically face-to-face meeting
- Roles (moderator, observer, reviewer)
- Participants go through the source code to fulfill goal of review

Pros	• Well documented • Process oriented
Cons	• Time consuming • Effort required does not correspond to value gained • Human Factor

- Typically two developers (author and reviewer) conducting ad-hoc review
- Over-the-shoulder review
- Extreme programming

Pros

- Simple
- Most effective type of MCR

Cons

- Not documented
- Not process oriented
- Consumes time of two developers

- A tool is used for the review
- Designed to mitigate drawbacks of other approaches

Pros

- Documented
- Enforcing process
- Time efficient
- Reviewer has all the time required

Cons

- Cost of the tool
- It is easier for reviewer to cheat

- Automated File Gathering
- Automated Metrics Collection
- Combined Display
- Process Enforcement


sonarqube

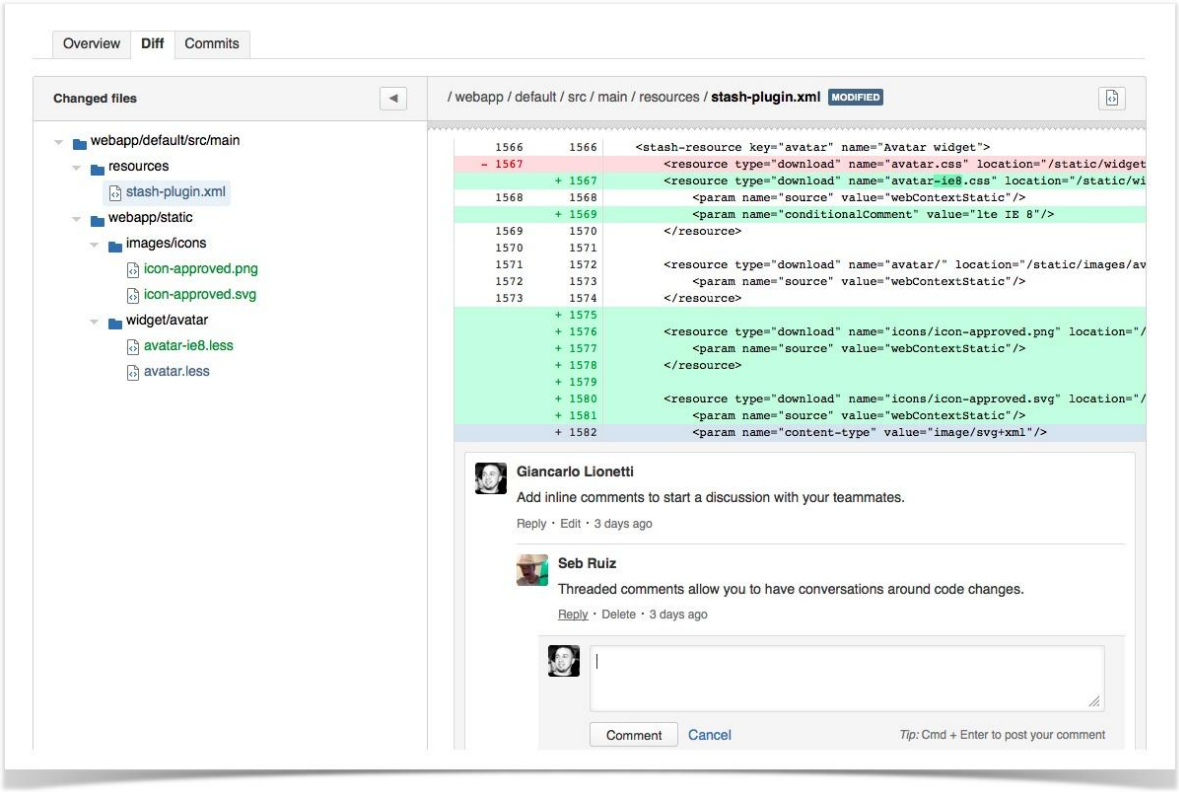

Atlassian
Bitbucket


Atlassian
Crucible

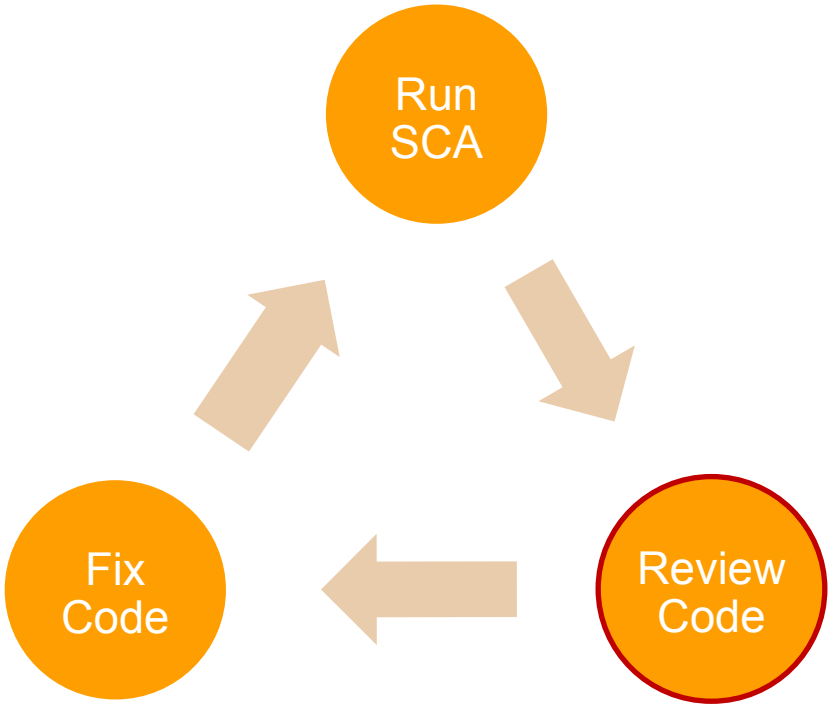
Make Code review natural part of development process

GIT WORKFLOW

ATLASSIAN BITBUCKET



RELATION TO STATIC CODE ANALYSIS?



HUMAN FACTOR

The only factor that ruins manual code review

Effective Code Review

- Do it
- Don‘t be affraid to have face-to-face
- Be honest
- Use proper and polite language
- Never be personal

THANKS!

Any questions?