

NULL

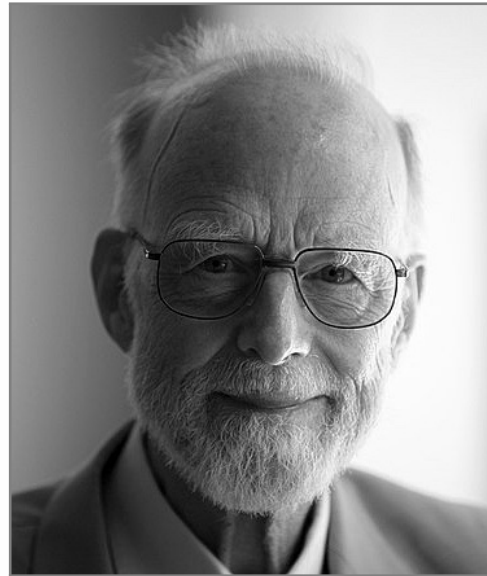
YEGOR BUGAYENKO

Lecture #6 out of 8

80 minutes

The slidedeck was presented by the author in this [YouTube Video](#)

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“I was designing the first comprehensive type system for references in an OO language (ALGOL W). My goal was to ensure that all use of references should be absolutely safe. But I couldn’t resist the temptation to put in a null reference, simply because it was so easy to implement. This has led to innumerable errors, vulnerabilities, and system crashes, which have probably caused a billion dollars of pain and damage in the last forty years.”

— Tony Hoare. Null References: The Billion Dollar Mistake.

[https://www.infoq.com/presentations/](https://www.infoq.com/presentations/Null-References-The-Billion-Dollar-Mistake-Tony-Hoare/)

[Null-References-The-Billion-Dollar-Mistake-Tony-Hoare/](https://www.infoq.com/presentations/Null-References-The-Billion-Dollar-Mistake-Tony-Hoare/), aug 2009.

[Online; accessed 22-09-2024]

Fail Fast vs Fail Safe

Alternatives to Returning NULL

Alternatives to Checking for NULL

Alternatives to Storing NULL

Object Thinking

Spring Boot

Chapter #1:

Fail Fast vs Fail Safe



“Over time, more and more errors will fail fast, and you’ll see the cost of debugging decrease and the quality of your system improve.”

— James Shore. Fail Fast. *IEEE Software*, 1, 2004. doi:[10.1109/MS.2004.1331296](https://doi.org/10.1109/MS.2004.1331296)

Defaults

Fail Safe:

```
1 int size(File file) {
2     if (!file.exists()) {
3         return 0;
4     }
5     return file.length();
6 }
```

Fail Fast:

```
1 int size(File file) {
2     if (!file.exists()) {
3         throw new IllegalArgumentException(
4             "The file is absent :("
5         );
6     }
7     return file.length();
8 }
```

The right snippet is more fragile, leading to more errors in runtime, but eventually ... leading to less bugs [Bugayenko, 2015a].

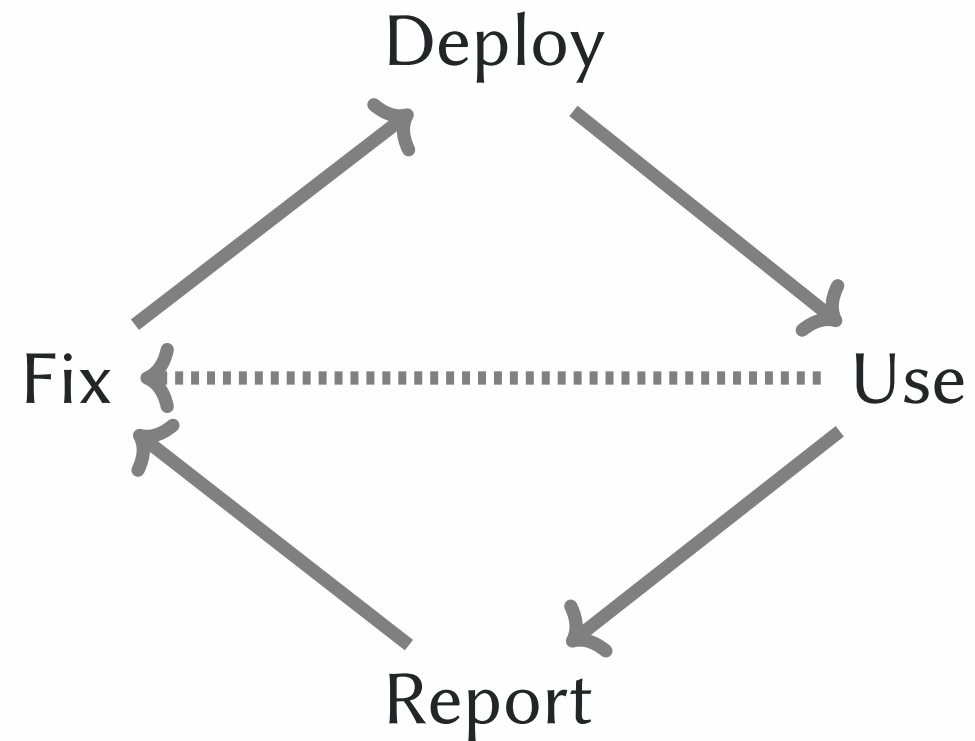
Exception swallowing

```
1 String read(File file) {
2   try {
3     return new String(
4       Files.readBytes(file)
5     );
6   } catch (IOException e) {
7     e.printStackTrace();
8     return ""; // default
9   }
10 }
```

```
1 String read(File file) {
2   try {
3     return new String(
4       Files.readBytes(file));
5   } catch (IOException e) {
6     throw new IllegalStateException(
7       String.format(
8         "Can't read file %s", e.name()),
9     e);
10  }
11 }
```

The right snippet is escalating, while the left one is swallowing.

Software Development Lifecycle



Watch this video from DEVit'2016 conference:
[Need It Robust? Make It Fragile!](#)

Chapter #2:

Alternatives to Returning NULL

Returning NULL or raising an error?

```
1 String nameOfEmployee(int id) {  
2     if (!em.existsInDb(id)) {  
3         return null;  
4     }  
5     return em.readFromDb(id);  
6 }
```

```
1 String nameOfEmployee(int id) {  
2     if (em.existsInDb(id)) {  
3         throw new EmployeeNotFound(id);  
4     }  
5     return em.readFromDb(id);  
6 }
```

The right snippet is “Fail Fast,” that’s why more preferable [Bugayenko, 2014, 2015b].



Returning a List or a NULL?

```
1 String nameOfEmployee(int id) {  
2     if (!em.existsInDb(id)) {  
3         return null;  
4     }  
5     return em.readFromDb(id);  
6 }
```

```
1 List<String> nameOfEmployee(int id) {  
2     List<String> names =  
3         new ArrayList<>(0);  
4     if (em.existsInDb(id)) {  
5         names.add(em.readFromDb(id));  
6     }  
7     return names;  
8 }
```

There are no elegant alternatives in most languages, like `Optional` in Java 8+ [Bugayenko, 2018].

[Return [List](#) Fake]

 **Yegor Bugayenko** 
@yegor256 ...

Say, you are designing a method `findUserByName()`, which has to find a user in the database. What would you return if nothing is found?
[#elegantobjects](#)

NULL	26.2%
Throw an exception	22.2%
A fake user	8.1%
An empty list	43.5%

865 votes · Final results

8:17 AM · Apr 29, 2018

Returning a Fake Entity

```
1 Employee employee(int id) {
2     if (!em.existsInDb(id)) {
3         return null;
4     }
5     return new PgEmployee(id);
6 }
7
8 e = employee(42);
9 print(e.id());
10 print(e.salary());
```

```
1 Employee employee(int id) {
2     if (!em.existsInDb(id)) {
3         return FakeEmployee(id);
4     }
5     return new PgEmployee(id);
6 }
7
8 e = employee(42);
9 print(e.id());
10
11 print(e.salary());
```

Chapter #3:

Alternatives to Checking for NULL

null-coalescing operator in C#

```
1 int? sizeOf(File f) {
2     if (!f.exists()) {
3         return null;
4     }
5     return f.size();
6 }
7
8 int? s = sizeOf(f);
9 if (s == null) {
10     s = 0;
11 }
```

```
1 int? sizeOf(File f) {
2     if (!f.exists()) {
3         return null;
4     }
5     return f.size();
6 }
7
8 int s = sizeOf(f) ?? 0;
```

Both snippets are bad design, though. They are workarounds.

[??-operator [Ruby](#) Kotlin]

&. operator in Ruby

```
1 def employee(id)
2   unless db.exists?(id)
3     return nil
4   end
5   return db.get(id)
6 end
7
8 e = employee(42)
9 puts e.name unless e.nil?
```

```
1 def employee(id)
2   unless db.exists?(id)
3     return nil
4   end
5   return db.get(id)
6 end
7
8 puts employee(42)&.name
```

Actually, the snippets produce different output when the employee is not found. How are they different?

NULL-awareness in Kotlin

```
1 var a: String = "abc"
2 a = null // compilation error
3
4 var b: String? = "abc"
5 b = null // no error here
6
7 println(b?.length) // prints what?
8 println(b?.length ?: -1) // Elvis operator
```



Chapter #4:

Alternatives to Storing NULL

[Immutability]

Immutable objects

```
1 class Employee {
2     private String name = null;
3     void setName(String n) {
4         this.name = n;
5     }
6 }
7
8 e = new Employee();
9 e.setName("Jeff");
```

```
1 class Employee {
2     private final String name;
3     Employee(String n) {
4         this.name = n;
5     }
6     Employee withName(String n) {
7         return new Employee(n);
8     }
9 }
10
11 e1 = new Employee();
12 e2 = e1.withName("Jeff");
```

Chapter #5:

Object Thinking

Pay respect to your objects!

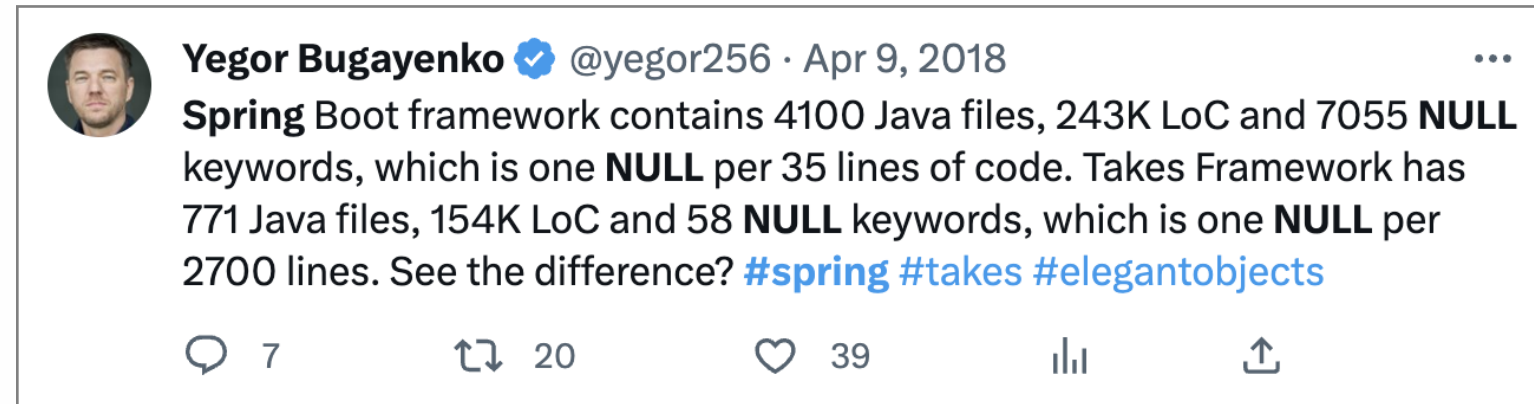
```
1 d = getDepartment(42);  
2 e = d.getEmployee("Jeff");  
3 if (e != null) {  
4     printf("Hello, %s", e.name());  
5 }
```

```
1 - Hello, is it the department no.42?  
2 - Yes.  
3 - Let me talk to your employee "Jeff".  
4 - Hold the line please...  
5 - Hello.  
6 - Are you NULL?
```



Chapter #6:

Spring Boot



You can do your own analysis of existing Java open source GitHub repositories to see how often their developers use |null| keyword.

The Takes framework is here: [yegor256/takes](https://github.com/yegor256/takes).

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James Shore. Fail Fast. *IEEE Software*, 1, 2004.

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