

# 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://jttu.net/hoare2009null>, 8 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, 21(5), 2004.  
doi:10.1109/MS.2004.1331296

[ [Defaults](#) Swallowing SDLC ]

## 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].

[ Defaults [Swallowing](#) SDLC ]

## 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.

[ Defaults Swallowing [SDLC](#) ]

## Software Development Lifecycle



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



Chapter #2:

## Alternatives to Returning NULL

[ [Return](#) List Fake ]

## 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].

[ Return [List](#) Fake ]

## 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%
<b>An empty list</b>	<b>43.5%</b>

865 votes · Final results

8:17 AM · Apr 29, 2018

[ Return List [Fake](#) ]

## 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

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

## 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?



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

## 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).

## References

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