CAMC and NHD

Yegor Bugayenko

Lecture #9 out of 24
80 minutes

The slidedeck was presented by the author in this YouTube Video

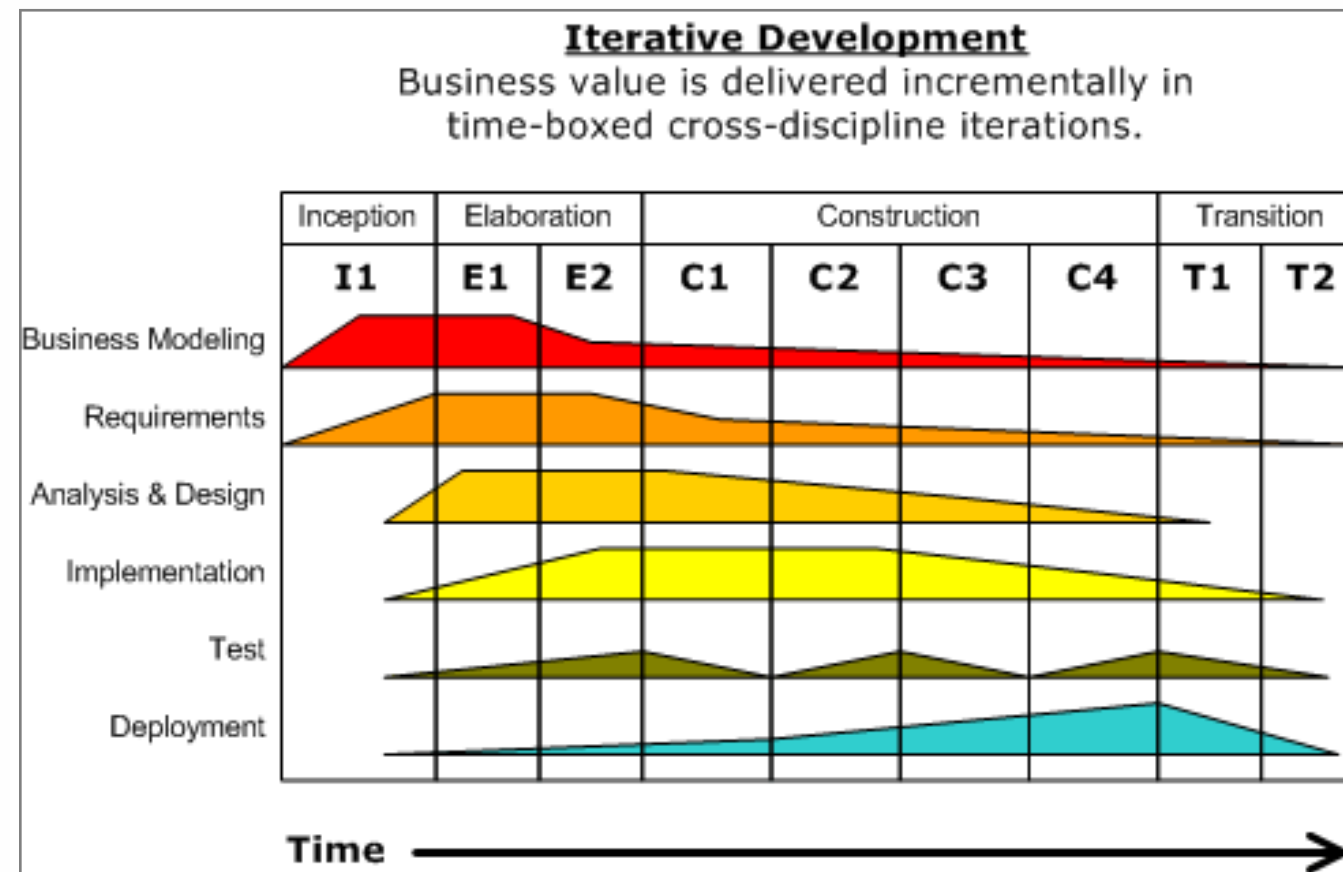"Without a well-defined process, your development team will develop in an *ad hoc* manner, with success relying on the heroic efforts of a few dedicated individual contributors. This is not a sustainable condition."
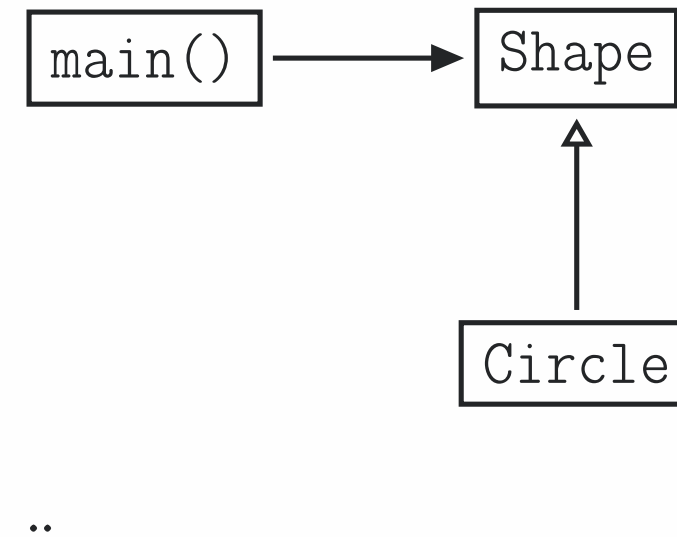
— Philippe Kruchten. *The Rational Unified Process: An Introduction.* Addison-Wesley Professional, 2004. doi:10.5555/518604

Rational Unified Process (RUP)

Decoupling via Interfaces (in Java)

```java
interface Shape
  double area();

class Circle implements Shape
  int r;
  @Override
  double area()
    return r * r * 3.14d;

void main(Shape s)
  double a = s.area();
```

Jagdish Bansiya

"**CAMC**: Cohesion Among Methods of Classes (CAMC) evaluates the relatedness of methods in the interface of a class using the parameter lists defined for the methods. It can be applied earlier in the development than can traditional cohesiveness metrics because it relies only on method prototypes declared in a class."

— Jagdish Bansiya. Class Cohesion Metric for Object Oriented Designs. *Journal of Object-Oriented Programming*, 11(8):47–52, 1999

```
Alert(AlertType, byte, *text = 0, Bitmap *bm = 0);
~Alert();
VObject *DoCreateDialog();
int Show(char *fmt);
int ShowV(char *fmt, va_list ap);
class Menu *GetMenu();
void InspectorId(char *buf, int sz);
```

O	AlertType	byte	Bitmap	char	va_list	int
Alert	1	1	1	0	0	0
~Alert	0	0	0	0	0	0
DoCreateDialog	0	0	0	0	0	0
Show	0	0	0	1	0	0
ShowV	0	0	0	1	1	0
GetMenu	0	0	0	0	0	0
InspectorId	0	0	0	1	0	1

(b) The parameter occurrence matrix.

Source: Jagdish Bansiya. Class Cohesion Metric for Object Oriented Designs. *Journal of Object-Oriented Programming*, 11(8):47–52, 1999

k — total number of methods

l — total number of types

$$\text{CAMC} = \frac{1}{k \times l} \times \sum_{i=1}^{k} \sum_{j=1}^{l} o_{ij}$$

Steve Counsell

"**NHD**: The hamming distance (HD) provides a measure of disagreement between rows in a binary matrix. The Normalised Hamming Distance (NHD) metric measures agreement between rows in a binary matrix."

— Steve Counsell, Stephen Swift, and Jason Crampton. The Interpretation and Utility of Three Cohesion Metrics for Object-Oriented Design. *ACM Transactions on Software Engineering and Methodology (TOSEM)*, 15(2):123–149, 2006. doi:10.1145/1131421.1131422

```
Alert(AlertType, byte, *text = 0, Bitmap *bm = 0);
~Alert();
VObject *DoCreateDialog();
int Show(char *fmt);
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class Menu *GetMenu();
void InspectorId(char *buf, int sz);
```

k — total number of methods

l — total number of types

$$\text{NHD} = \frac{2}{l \times k \times (k-1)} \times \sum_{j=1}^{k-1} \sum_{i=j+1}^{k} a_{ij}$$

O	AlertType	byte	Bitmap	char	va_list	int
Alert	1	1	1	0	0	0
~Alert	0	0	0	0	0	0
DoCreateDialog	0	0	0	0	0	0
Show	0	0	0	1	0	0
ShowV	0	0	0	1	1	0
GetMenu	0	0	0	0	0	0
InspectorId	0	0	0	1	0	1

(b) The parameter occurrence matrix.

A	Alert	~Alert	DoCreateDialog	Show	ShowV	GetMenu
~Alert	3					
DoCreateDialog	3	6				
Show	2	5	5			
ShowV	1	4	4	5		
GetMenu	3	6	6	5	4	
InspectorId	1	4	4	5	4	4
	13	25	19	15	8	4

(c) The parameter agreement matrix.

"Classes that have 'fat' interfaces are classes whose interfaces are not <u>cohesive</u>. In other words, the interfaces of the class can be broken up into groups of methods."

— Robert C. Martin. *Agile Software Development, Principles, Patterns, and Practices.* ACM, 2002. doi:<u>10.5555/515230</u>

Robert C. Martin

InputStream in Java

Bad:

```
1  abstract class InputStream
2    int read();
3    int read(byte[] b);
4    int read(byte[] b, int o, int l);
5
6  class FileInputStream
7    implements InputStream
8    native int read();
9    native int read(byte[] b, int o, int l);
10   int read(byte[] b)
11     return read(b, 0, b.length);
```

Better (but slower!):

```
1  interface InputStream {
2    int read(byte[] b, int o, int l);
3
4  class FileInputStream
5    implements InputStream
6    native int read(byte[] b, int o, int l);
7
8  class OneByteStream
9    InputStream s;
10   int read()
11     byte[] b = new byte[1];
12     s.read(b, 0, 1);
13     return (int) b[0];
```

Source: Yegor Bugayenko. Why InputStream Design Is Wrong. https://www.yegor256.com/160426.html, apr 2016. [Online; accessed 22-09-2024]

Also Known As...

- "interface" in Java

- "protocol" in Objective-C

- "interface" in C#

- "abstract class" in C++

- absent in Python

- absent in JavaScript

- "interface" in Go

- "trait" in Rust

Source: Yegor Bugayenko. Fat vs. Skinny Design. `https://www.yegor256.com/200219.html`, feb 2020. [Online; accessed 26-10-2024]

References

Jagdish Bansiya. Class Cohesion Metric for Object Oriented Designs. *Journal of Object-Oriented Programming*, 11(8):47–52, 1999.

Yegor Bugayenko. Why InputStream Design Is Wrong. `https://www.yegor256.com/160426.html`, apr 2016. [Online; accessed 22-09-2024].

Yegor Bugayenko. Fat vs. Skinny Design. `https://www.yegor256.com/200219.html`, feb 2020. [Online; accessed 26-10-2024].

Steve Counsell, Stephen Swift, and Jason Crampton. The Interpretation and Utility of Three Cohesion Metrics for Object-Oriented Design. *ACM Transactions on Software Engineering and Methodology (TOSEM)*, 15(2):123–149, 2006. doi:10.1145/1131421.1131422.

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