Object oriented analysis and modeling
Design basics

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M-255

Design - various scopes

- Architecture
- Component-level design
- Low level design

Depending on the project size, there may be more intermediate levels

What we want to attain

- Modularization
- Abstraction
- Information hiding
- Separation of interface and implementation
- Low Coupling
- High Cohesion
- Sufficiency, Completeness, Easy top understand, . . .

Modularization

Modularizes requirements, implementation, test cases, ...

Abstraction

- Identify aspects that are relevant to the problem
- Different concepts in the problem domain may become identical
- Classes that do not represent a concept in the domain may form

Anemic domain model

Objects have no or little behaviour.

M. Fowler, 2003:

> *"The fundamental horror of this anti-pattern is that it's so contrary to the basic idea of object-oriented designing; which is to combine data and process them together. The anemic domain model is just a procedural style design, exactly the kind of thing that object bigots like me ... have been fighting since our early days in Smalltalk. What's worse, many people think that anemic objects are real objects, and thus completely miss the point of what object-oriented design is all about."*

Anemic domain model

- May indicate lack of abstraction
- Not really an OO design
- This my be completely acceptable or even preferred in other design styles (e.g. functional programming design).

Information hiding, Separation of interface and implementation

- Encapsulation - a way how to hide internal information
- Interface should not depend on the implementation

Low Coupling

Coupling is the degree of interdependence between software modules; a measure of how closely connected two routines or modules are. Disadvantages of high coupling:

- A change in one module usually forces a ripple effect of changes in other modules.
- Assembly of modules might require more effort and/or time due to the increased inter-module dependency.
- A particular module might be harder to reuse
- Hard to reuse test
- Message transmission/translation/interpretation overhead
- ...

Coupling

- Coupling types
- Information expert principle
  - Placing the responsibility on the class with the most information required to fulfill it.
  - Reduces coupling.
- Coupling strength, Coupling distance (high coupling between objects in the same package is more acceptable)

Connascence

- Coupling is a relatively vague term. Connascence tries to fix this.
- Two components are connascent if a change in one would require the other to be modified in order to maintain the overall correctness of the system.
- http://connascence.io/

High Cohesion

Cohesion refers to the degree to which the elements inside a module belong together.

- Various metrics: e.g. LCOM4.
- Types of cohesion

Design Verification and Validation

- Verification - Check if all design outputs meet design conditions imposed at the beginning of the process.
- Validation - Check if all design outputs meet the customer needs.

- https://www.slideshare.net/cristalngo/software-design-principles-57388843