Coding

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# Programming Paradigms

## Object Oriented

## Functional

## Declarative

## Aspect-oriented

# Development Methodologies

## DevOps

Calms

1. Culture
2. Automation
3. Lean
4. Measurement
5. Sharing

## Agile

## Extreme

Advocates frequent "releases" in short development cycles, which is intended to improve productivity and introduce checkpoints at which new customer requirements can be adopted.

Other elements of extreme programming include: programming in pairs or doing extensive code review, unit testing of all code, avoiding programming of features until they are actually needed, a flat management structure, code simplicity and clarity, expecting changes in the customer's requirements as time passes and the problem is better understood, and frequent communication with the customer and among programmers.[2][3][4] The methodology takes its name from the idea that the beneficial elements of traditional software engineering practices are taken to "extreme" levels. As an example, code reviews are considered a beneficial practice; taken to the extreme, code can be reviewed continuously, i.e. the practice of pair programming.

## Lean

Lean development can be summarized by seven principles, very close in concept to lean manufacturing principles:

### Eliminate waste

The following are wastes:

Building the wrong feature or product

Mismanaging the backlog

Rework

Unnecessarily complex solutions

Extraneous cognitive load

Psychological distress

Waiting/multitasking

Knowledge loss

Ineffective communication.

### Amplify learning

Software development is a continuous learning process based on iterations when writing code. Software design is a problem solving process involving the developers writing the code and what they have learned. Software value is measured in fitness for use and not in conformance to requirements.

Instead of adding more documentation or detailed planning, different ideas could be tried by writing code and building. The process of user requirements gathering could be simplified by presenting screens to the end-users and getting their input. The accumulation of defects should be prevented by running tests as soon as the code is written.

The learning process is sped up by usage of short iteration cycles – each one coupled with refactoring and integration testing. Increasing feedback via short feedback sessions with customers helps when determining the current phase of development and adjusting efforts for future improvements. During those short sessions both customer representatives and the development team learn more about the domain problem and figure out possible solutions for further development. Thus the customers better understand their needs, based on the existing result of development efforts, and the developers learn how to better satisfy those needs. Another idea in the communication and learning process with a customer is set-based development – this concentrates on communicating the constraints of the future solution and not the possible solutions, thus promoting the birth of the solution via dialogue with the customer.

### Decide as late as possible

Delaying decisions as much as possible until they can be made based on facts and not on uncertain assumptions and predictions.

### Deliver as fast as possible

In the era of rapid technology evolution, it is not the biggest that survives, but the fastest. The sooner the end product is delivered without major defects, the sooner feedback can be received, and incorporated into the next iteration. The shorter the iterations, the better the learning and communication within the team. With speed, decisions can be delayed. Speed assures the fulfilling of the customer's present needs and not what they required yesterday. This gives them the opportunity to delay making up their minds about what they really require until they gain better knowledge. Customers value rapid delivery of a quality product.

### Empower the team

There has been a traditional belief in most businesses about the decision-making in the organization – the managers tell the workers how to do their own job. In a "Work-Out technique", the roles are turned – the managers are taught how to listen to the developers, so they can explain better what actions might be taken, as well as provide suggestions for improvements. The lean approach follows the Agile Principle[7] "find good people and let them do their own job,"[8] encouraging progress, catching errors, and removing impediments, but not micro-managing.

Another mistaken belief has been the consideration of people as resources. People might be resources from the point of view of a statistical data sheet, but in software development, as well as any organizational business, people do need something more than just the list of tasks and the assurance that they will not be disturbed during the completion of the tasks. People need motivation and a higher purpose to work for – purpose within the reachable reality, with the assurance that the team might choose its own commitments. The developers should be given access to the customer; the team leader should provide support and help in difficult situations, as well as ensure that scepticism does not ruin the team’s spirit.

### Build integrity in

The customer needs to have an overall experience of the System. This is the so-called perceived integrity: how it is being advertised, delivered, deployed, accessed, how intuitive its use is, its price and how well it solves problems.

Conceptual integrity means that the system’s separate components work well together as a whole with balance between flexibility, maintainability, efficiency, and responsiveness. This could be achieved by understanding the problem domain and solving it at the same time, not sequentially. The needed information is received in small batch pieces – not in one vast chunk - preferably by face-to-face communication and not any written documentation. The information flow should be constant in both directions – from customer to developers and back, thus avoiding the large stressful amount of information after long development in isolation.

### See the whole

Software systems nowadays are not simply the sum of their parts, but also the product of their interactions. Defects in software tend to accumulate during the development process – by decomposing the big tasks into smaller tasks, and by standardizing different stages of development, the root causes of defects should be found and eliminated. The larger the system, the more organizations that are involved in its development and the more parts are developed by different teams, the greater the importance of having well defined relationships between different vendors, in order to produce a system with smoothly interacting components. During a longer period of development, a stronger subcontractor network is far more beneficial than short-term profit optimizing, which does not enable win-win relationships.

Lean thinking has to be understood well by all members of a project, before implementing in a concrete, real-life situation. "Think big, act small, fail fast; learn rapidly"[9] – these slogans summarize the importance of understanding the field and the suitability of implementing lean principles along the whole software development process. Only when all of the lean principles are implemented together, combined with strong "common sense" with respect to the working environment, is there a basis for success in software development.

## Kaizen

Japanese. Kaizen refers to activities that continuously improve all functions and involve all employees

## Test-driven Development

Relies on the repetition of a very short development cycle: Requirements are turned into very specific test cases, then the software is improved to pass the new tests, only. This is opposed to software development that allows software to be added that is not proven to meet requirements.

## Continuous Test-driven Development

Automated Test-driven Development. Feature available on GitHub and visual studio team services.

## Behaviour-driven development

## Waterfall

Old school big design up front.

## Cowboy

Where programmers have autonomy over the development process. This includes control of the project's schedule, languages, algorithms, tools, frameworks and coding style.

A cowboy coder can be a lone developer or part of a group of developers working with minimal process or discipline.

Anti pattern

## Abstraction Principle

Basic dictum that aims to reduce duplication of information in a program.

## Big Design Up Front

The program's design is to be completed and perfected before that program's implementation is started. It is often associated with the waterfall model of software development.

## Continuous Integration

Security Analysis. (<https://blog.aquasec.com/container-security-automation-keeping-up-with-the-devops-crowd> )

## Model Driven Architecture

The model-driven architecture approach defines system functionality using a platform-independent model (PIM) using an appropriate domain-specific language (DSL).

Then, given a platform model corresponding to CORBA, .NET, the Web, etc., the PIM is translated to one or more platform-specific models (PSMs) that computers can run. This requires mappings and transformations and should be modelled too.

The PSM may use different DSLs or a general purpose language. Automated tools generally perform this translation.

OMG focuses Model-driven architecture on forward engineering, i.e. producing code from abstract, human-elaborated modelling diagrams.

Usually involves Code Generation.

## Open Source

## Separation of Concern. Encapsulation, Modular

### Separation of content and presentation

HTML & CSS

# Development Concepts/Techniques

## Code Generation

## Pairing

Pair Programming.

## Code Review

Simple Definition

A code review is a process where two or more developers visually inspect a set of program code, typically, several times. The code can be a method, a class, or an entire program. The main code-review objectives are:

Best Practice ~ A more efficient, less error-prone, or more elegant way to accomplish a given task.

Error Detection ~ Discovering logical or transitional errors.

Vulnerability Exposure ~ Identifying and averting common vulnerabilities like Cross-Site Scripting [XSS], Injection, Buffer Overflow, Excessive Disclosure, etc. Although many controls are inapplicable and can be ignored, a STIG [e.g., Application Security STIG 4.3] provides an excellent vulnerability checklist.

Malware Discovery ~ This often-overlooked, and very special code-review objective looks for segments of code that appear extraneous, questionable, or flat-out weird. The intent is to discover back doors, Trojans, and time bombs. I say often-overlooked because the very idea of malware and malicious intent may ring overly dramatic to some developers. However - particularly in today’s peril-ridden world - malevolent code is a very real threat and should not be overlooked… especially by USG agencies and departments like the DoD.

Of the four objectives, malware is the only one that requires human detection. A program containing an obvious back door can be scanned using a tool like Fortify and come out looking as clean as the driven snow.

Tools: Atlassian Crucible

## Static Code Analysis

Options:

StyleCop,

NDepend in continuous integration

## Source Code Repo

Options: Bitbucket, VSTS, GitKraken

## Freedom and Responsibility

The Netflix culture of freedom and responsibility empowers engineers to craft solutions using whatever tools they feel are best suited to the task.

## DevOpsDays

DevOpsDays for internal teams, featuring demos, open labs, lightning talks, breakout sessions, and guest keynotes.

## State vs Migrations-based deployments

https://www.red-gate.com/hub/product-learning/sql-source-control/moving-from-application-automation-to-true-devops-by-including-the-database

# Architectural Patterns

## Blackboard System

## Broker Pattern

## Event-driven architecture

## Implicit invocation

## Microservices

## Layers

## Model-View-Whatever

## Entity Component System

## Multitier Architecture

## Naked Objects

## Operational Data Store

## Peer-to-Peer

## Pipe and Filter Architecture

## Service Oriented Architecture

## Space Based Architecture

## Model-Driven Architecture

Provides a set of guidelines for the structuring of specifications, which are expressed as models. Model-driven architecture is a kind of domain engineering, and supports model-driven engineering of software systems

# Solid Principles

## Single Responsibility

A class should have one and only one reason to change, meaning that a class should have only one job.

## Open Closed

Objects or entities should be open for extension, but closed for modification.

## Liskov Substitution

Let q(x) be a property provable about objects of x of type T. Then q(y) should be provable for objects y of type S where S is a subtype of T.

## Interface Segregation

A client should never be forced to implement an interface that it doesn't use, or clients shouldn't be forced to depend on methods they do not use.

## Dependency Inversion or Inversion of Control

Entities must depend on abstractions not on concretions. It states that the high-level module must not depend on the low-level module, but they should depend on abstractions.

# Other Principles/Techniques

## DRY/ Principle Of Abstraction

Do not repeat yourself

Code Reuse, Loose Coupling

## "Program to an 'interface', not an 'implementation'."

## Composition over inheritance: "Favour 'object composition' over 'class inheritance'."

## Generics / Parameterised Types

## Pseudo code

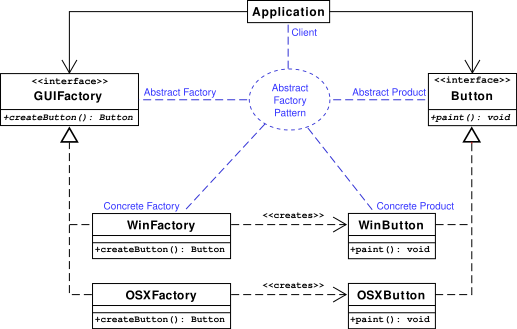
## Object Modelling

# Creational Design Patterns

## Abstract factory (GoF)

[[1]](#_https://en.wikipedia.org/wiki/Abstr) Provides a way to encapsulate a group of individual [factories](https://en.wikipedia.org/wiki/Factory_object) that have a common theme without specifying their concrete classes.

Used in ADO.net.



## Builder (GoF)

Separate the construction of a complex object from its representation, allowing the same construction process to create various representations.

## Dependency Injection (supports Dependency Inversion)

A class accepts the objects it requires from an injector instead of creating the objects directly. Allows for dependencies to easily be swapped out for testing purposes.

Used in ASP.net Core Services

Used in Angular Components

High usefulness

## Factory Method (GoF)

uses factory methods to deal with the problem of [creating objects](https://en.wikipedia.org/wiki/Object_creation) without having to specify the exact [class](https://en.wikipedia.org/wiki/Class_(computer_programming)) of the object that will be created.

Used in In ADO.NET, IDbCommand.CreateParameter.

## Lazy initialization

Tactic of delaying the creation of an object, the calculation of a value, or some other expensive process until the first time it is needed. This pattern appears in the GoF catalog as "virtual proxy", an implementation strategy for the [Proxy](https://en.wikipedia.org/wiki/Proxy_pattern) pattern.

Used in ?

## Multiton

The multiton pattern expands on the singleton concept to manage a [map](https://en.wikipedia.org/wiki/Associative_array) of named instances as key-value pairs.

Used in ?

Low usefulness.

## Object Pool

Avoid expensive acquisition and release of resources by recycling objects that are no longer in use. Can be considered a generalisation of connection pool and thread pool patterns.

Used in System.Threading.ThreadPool and ConnectionPool

## Prototype (GoF)

Specify the kinds of objects to create using a prototypical instance, and create new objects from the 'skeleton' of an existing object, thus boosting performance and keeping memory footprints to a minimum.

## Singleton (GoF)

Ensure a class has only one instance, and provide a global point of access to it.

# Structural Design Patterns

## Adapter, Wrapper, or Translator (GoF)

Convert the interface of a class into another interface clients expect. An adapter lets classes work together that could not otherwise because of incompatible interfaces. The enterprise integration pattern equivalent is the translator.

## Bridge/Handle/Body (GoF)

Decouple an abstraction from its implementation allowing the two to vary independently.

*// Helps in providing truly decoupled architecture*

**public** **interface** IBridge

{

**void** Function1();

**void** Function2();

}

**public** **class** **Bridge1** : IBridge

{

**public** **void** Function1()

{

Console.WriteLine("Bridge1.Function1");

}

**public** **void** Function2()

{

Console.WriteLine("Bridge1.Function2");

}

}

**public** **class** **Bridge2** : IBridge

{

**public** **void** Function1()

{

Console.WriteLine("Bridge2.Function1");

}

**public** **void** Function2()

{

Console.WriteLine("Bridge2.Function2");

}

}

**public** **interface** IAbstractBridge

{

**void** CallMethod1();

**void** CallMethod2();

}

**public** **class** **AbstractBridge** : IAbstractBridge

{

**public** IBridge bridge;

**public** AbstractBridge(IBridge bridge)

{

**this**.bridge = bridge;

}

**public** **void** CallMethod1()

{

**this**.bridge.Function1();

}

public void CallMethod2()

{

**this**.bridge.Function2();

}

}

## ? Decorator (GoF)

Attach additional responsibilities to an object dynamically keeping the same interface. Decorators provide a flexible alternative to sub-classing for extending functionality.

Used in WPF. Grid.Row.

## Extension Object

Adding functionality to a hierarchy without changing the hierarchy.

## ? Façade (GoF)

Provide a unified interface to a set of interfaces in a subsystem. Facade defines a higher-level interface that makes the subsystem easier to use.

## ? Flyweight (GoF)

Use sharing to support large numbers of similar objects efficiently.

## ? Front controller

The pattern relates to the design of Web applications. It provides a centralized entry point for handling requests.

## ? Marker

Empty interface to associate metadata with a class.

## Module

Group several related elements, such as classes, singletons, methods, globally used, into a single conceptual entity.

## ? Proxy

Provide a surrogate or placeholder for another object to control access to it

## Twin

Twin allows modelling of multiple inheritance in programming languages that do not support this feature.

## Composite (GoF)

Compose objects into tree structures to represent part-whole hierarchies. Composite lets

clients treat individual objects and compositions of objects uniformly.

A *recursive composition* is a hierarchical structure of elements, that builds "increasingly complex elements out of simpler ones" (pp36). Each node in the structure knows of its own children and its parent. If an operation is to be performed on the whole structure, each node calls the operation on its children (recursively).

# Behavioural patterns

## ? Blackboard

Artificial intelligence pattern for combining disparate sources of data

## Chain of Responsibility

Avoid coupling the sender of a request to its receiver by giving more than one object a chance to handle the request. Chain the receiving objects and pass the request along the chain until an object handles it.

Use for logging handlers to log at one of a variety of levels.

## Command

Encapsulate a request as an object, thereby allowing for the parameterization of clients with different requests, and the queuing or logging of requests. It also allows for the support of undoable operations

## ? Interpreter

Given a language, define a representation for its grammar along with an interpreter that uses the representation to interpret sentences in the language

## Iterator

Provide a way to access the elements of an aggregate object sequentially without exposing its underlying representation.

## ? Mediator

Define an object that encapsulates how a set of objects interact. Mediator promotes loose coupling by keeping objects from referring to each other explicitly, and it allows their interaction to vary independently.

## ? Memento

Without violating encapsulation, capture and externalize an object's internal state allowing the object to be restored to this state later.

## ? Null Object

Avoid null references by providing a default object.

## Observer/Publish Subscribe

Define a one-to-many dependency between objects where a state change in one object results in all its dependents being notified and updated automatically.

## ? Servant

Define common functionality for a group of classes.

## ? Specification

Re-combinable business logic in a Boolean fashion.

## ? State

Allow an object to alter its behaviour when its internal state changes. The object will appear to change its class.

## Strategy

Define a family of algorithms, encapsulate each one, and make them interchangeable. Strategy lets the algorithm vary independently from clients that use it.

The Strategy Design Pattern allows an object to have some or all of its behavior defined in terms of another object which follows a particular interface. A particular instance of this interface is provided to the client when it is instantiated or invoked, providing the concrete behavior to be used. The Strategy design pattern is used extensively to achieve the Single Responsibility Principle, the Explicit Dependencies Principle, and the Dependency Inversion Principle, and is a key to Dependency Injection and the use of Inversion of Control Containers.

## ? Template Method

Define the skeleton of an algorithm in an operation, deferring some steps to subclasses. Template method lets subclasses redefine certain steps of an algorithm without changing the algorithm's structure.

## ? Visitor

Represent an operation to be performed on the elements of an object structure. Visitor lets a new operation be defined without changing the classes of the elements on which it operates

## Repository Pattern

The Repository Pattern has gained quite a bit of popularity since it was first introduced as a part of Domain-Driven Design in 2004. Essentially, it provides an abstraction of data, so that your application can work with a simple abstraction that has an interface approximating that of a collection. Adding, removing, updating, and selecting items from this collection is done through a series of straightforward methods, without the need to deal with database concerns like connections, commands, cursors, or readers. Using this pattern can help achieve loose coupling and can keep domain objects persistence ignorant. Although the pattern is very popular (or perhaps because of this), it is also frequently misunderstood and misused. There are many different ways to implement the Repository pattern.

# Concurrency patterns

## ? Active Object

Decouples method execution from method invocation that reside in their own thread of control. The goal is to introduce concurrency, by using asynchronous method invocation and a scheduler for handling requests.

## ? Balking

Only execute an action on an object when the object is in a particular state.

## Binding properties

Combining multiple observers to force properties in different objects to be synchronized or coordinated in some way.

Used in MVVM and Angular

## ? Blockchain

Decentralized way to store data and agree on ways of processing it in a Merkle tree, optionally using digital signature for any individual contributions.

## ? Double-checked locking

Reduce the overhead of acquiring a lock by first testing the locking criterion (the 'lock hint') in an unsafe manner; only if that succeeds does the actual locking logic proceed.

## ? Event-based asynchronous

Addresses problems with the asynchronous pattern that occur in multithreaded programs.

## ? Guarded Suspension

Manages operations that require both a lock to be acquired and a precondition to be satisfied before the operation can be executed.

## ? Join

Join-pattern provides a way to write concurrent, parallel and distributed programs by message passing. Compared to the use of threads and locks, this is a high-level programming model.

## Lock

One thread puts a "lock" on a resource, preventing other threads from accessing or modifying it.

## ? Messaging design pattern (MDP)

Allows the interchange of information (i.e. messages) between components and applications.

## ? Monitor object

An object whose methods are subject to mutual exclusion, thus preventing multiple objects from erroneously trying to use it at the same time.

## ? Reactor

A reactor object provides an asynchronous interface to resources that must be handled synchronously.

## ? Read-write lock

Allows concurrent read access to an object, but requires exclusive access for write operations.

## ? Scheduler

Explicitly control when threads may execute single-threaded code.

## Thread Pool

A number of threads are created to perform a number of tasks, which are usually organized in a queue. Typically, there are many more tasks than threads. Can be considered a special case of the object pool pattern.

## Thread-Specific Storage

Static or "global" memory local to a thread

# Formatting

PascalCase

camelCase

\_underscore

?

# Uncategorised

## Modular

## Fluent Interface

Method for constructing object oriented APIs, where the readability of the source code is close to that of ordinary written prose.

## Encapsulation

Refers to the bundling of data with the methods that operate on that data. [5] Encapsulation is used to hide the values or state of a structured data object inside a class, preventing unauthorized parties' direct access to them.

## Session

## Caching

## Logging

## Setting management

## Timing

## Object to Object Mapping (Auto Mapping)

## Domain Layer

### Entities

### Value Objects

### Repositories

### Domain Services

### Specifications

### Unit of Work

### Domain Events (EventBus)

### Data Filters

## Application Layer

### Application Services

### Data Transfer Objects

### Validating Data Transfer Objects

### Authorization

### Feature Management

### Audit Logging

## Distributed Service Layer

### ASP.NET Web API

### Web API Controllers

### Dynamic Web API Layer

### OData Integration

### Swagger UI Integration

## Presentation Layer

### ASP.NET MVC

### MVC Controllers

### MVC Views

### Handling Exceptions

### Localization

### Navigation

### Embedded Resources

### Javascript API

### CSRF/XSRF Protection

## Infrastructure Layer

### Background Services

### Background Jobs and Workers

### Hangfire Integration

### Quartz Integration

### Real Time Services

### Notification System

### SignalR Integration

### Object-Relational Mapping

### EntityFramework Integration

### EntityFramework Core Integration

### NHibernate Integration

### Dapper Integration NEW

# Left Out

## Resource acquisition is initialization (RAII)

# References

### <https://en.wikipedia.org/wiki/Abstract_factory_pattern>

### <http://www.oodesign.com/>

### <https://en.wikipedia.org/wiki/Software_design_pattern>

### <https://en.wikipedia.org/wiki/Architectural_pattern>

<https://en.wikipedia.org/wiki/Lean_software_development>

<http://deviq.com/repository-pattern/>

<http://deviq.com/strategy-design-pattern/>

# Books

### <https://en.wikipedia.org/wiki/The_Pragmatic_Programmer>

### <https://en.wikipedia.org/wiki/Design_Patterns> by Gang of Four

### <https://en.wikipedia.org/wiki/Code_Complete>

### <https://martinfowler.com/books/eaa.html> by Martin Fowler

<https://en.wikipedia.org/wiki/Extreme_programming>

Other reading

<https://en.wikipedia.org/wiki/The_Mythical_Man-Month>