# Layered Architecture

 $Software\ Architecture$ 

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Ogres are like onions.

Orgres have layers, onions have layers... You get it? We both have layers.

- Shrek

In the beginning...

There was the big ball of mud [Foote and Yoder, 1997]

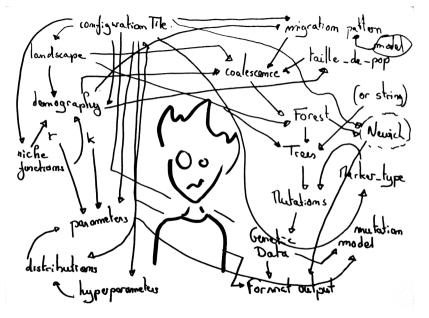


Figure: Image from "How to Avoid Spaghetti Code" [Gulsah, 2020].

## Problem

Any change can affect any other part of the software.

#### "Solution"

## Modularity



<sup>&</sup>lt;sup>1</sup>From https://pixabay.com/illustrations/lego-building-game-toy-drawing-3388163/.

#### Problem

Lack of discipline lets any module communicate with any other module.



<sup>&</sup>lt;sup>2</sup>From https://pixabay.com/photos/lego-to-play-to-build-module-1629073/.

#### "Solution"

# Layered Architecture

Figure: Traditional 4-tier, layered architecture.

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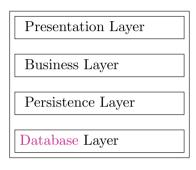


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## Question

Can you identify an example of layered architecture?

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Answer

Pick any website.

## Definition 1. Layer Isolation Principle

Layers should not depend on implementation details of another layer. Layers should only communicate

through well defined interfaces (contracts).

# Definition 2. Neighbour Communication Principle

Components can communicate across layers only

through directly neighbouring layers.

## Definition 3. Downward Dependency Principle

Higher-level layers depend on lower layers, but lower-level layers do not depend on higher layers.

## Definition 4. Upward Notification Principle

Lower layers communicate with higher layers using general interfaces, callbacks and/or events. Dependencies are minimised by not relying on specific details published in a higher layer's interface.

## Definition 5. Sidecar Spanning Principle

A sidecar layer contains interfaces that support complex communication between layers (e.g. design patterns like the observer pattern) or external services (e.g. a logging framework).

Good architectural design...

Applies these principles to deliver simple, modular designs that support modifiability.

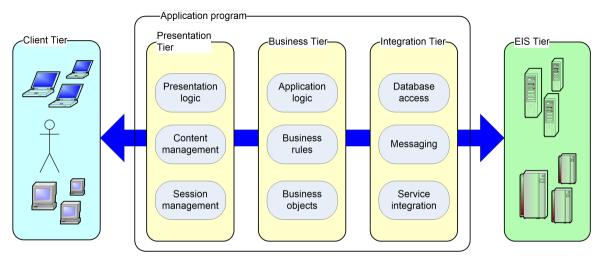


Figure: J2EE layered architecture (from Requirements Analysis and System Design [Maciaszek, 2007]).

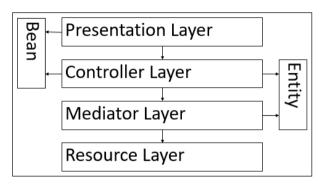


Figure: PCBMER layered architecture with sidecars (adapted from *Requirements Analysis* and System Design[Maciaszek, 2007]).

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Mediator Manages business transactions, enforces business rules, instantiates business objects in the Entity layer, and manages the entity memory cache.

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Entity Classes representing persistent business objects.

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Entity Classes representing persistent business objects.

Resource Manages interactions with external persistent data sources.

#### References

[Foote and Yoder, 1997] Foote, B. and Yoder, J. (1997). Big ball of mud.

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