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]*

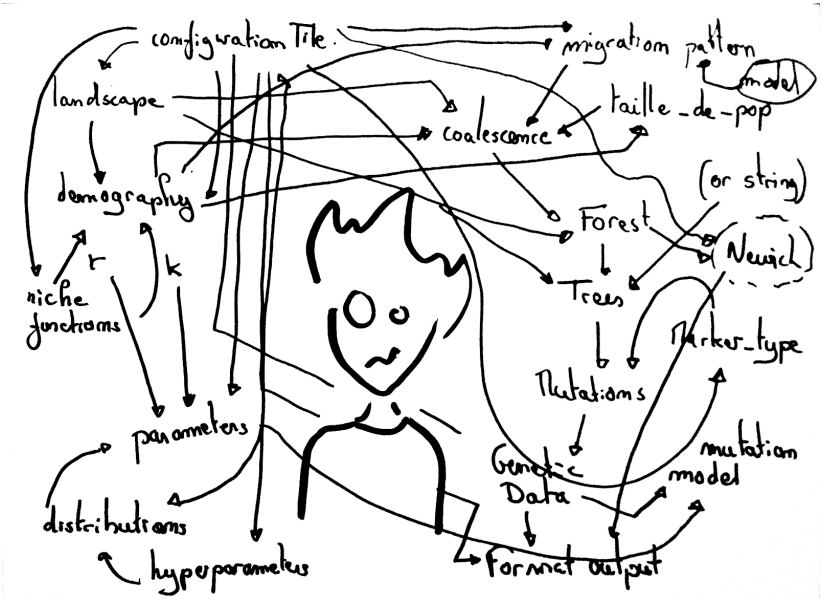


Figure: Image from "How to Avoid Spaghetti Code" *[Gulsah, 2020]*.

Problem

Any change can affect any other part of the software.

"Solution"

Modularity

[1]

[1] From https://pixabay.com/illustrations/lego-building-game-toy-drawing-3388163/.

Problem

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

 [2]

[2] From `https://pixabay.com/photos/lego-to-play-to-build-module-1629073/`.

"Solution"

Layered Architecture

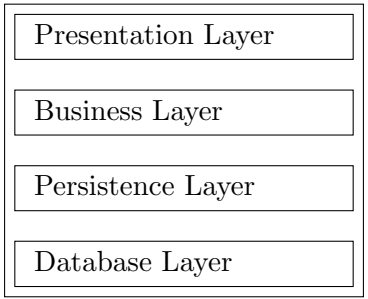
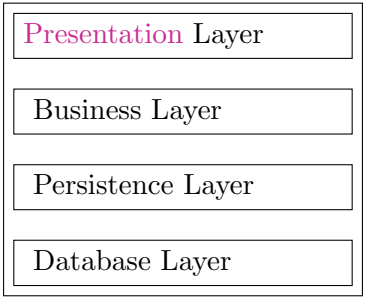


Figure: *Traditional* 4-tier, layered architecture.



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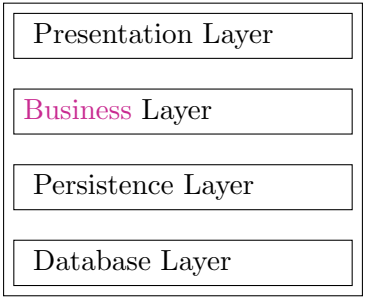

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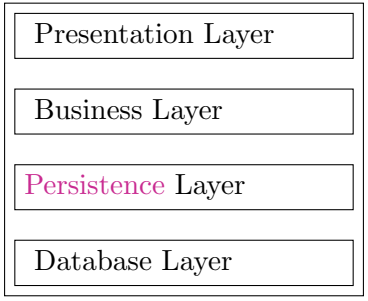

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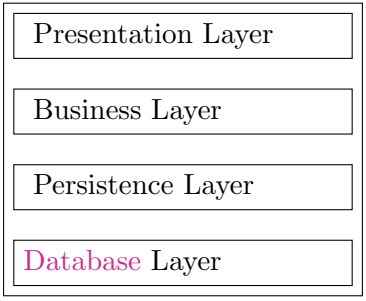

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Question

Can you identify an example of layered architecture?

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Answer

Pick any website.

Definition 0. Layer Isolation Principle

Layers should not depend on implementation details of another layer. Layers should only communicate through well defined interfaces (*contracts*).

Definition 0. Neighbour Communication Principle

Components can communicate across layers only through directly neighbouring layers.

Definition 0. Downward Dependency Principle

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

Definition 0. 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 0. 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. logging framework).

Good architectural design...

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

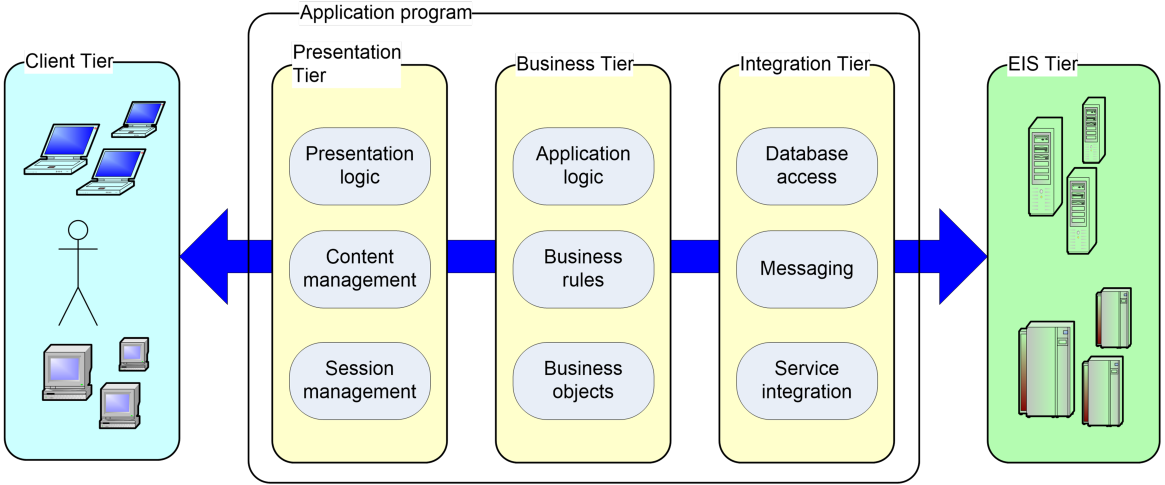

Figure: J2EE layered architecture (from *Requirements Analysis and System Design* *[Maciaszek, 2007]*).

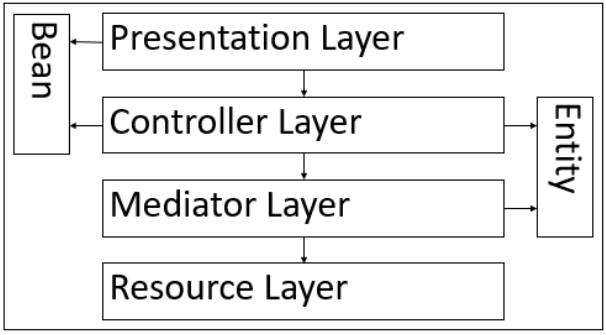

Figure: PCBMER layered architecture with sidecars (adapted from *Requirements Analysis and System Design*[Maciaszek, 2007]).

PCBMER Layers

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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).
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