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]*

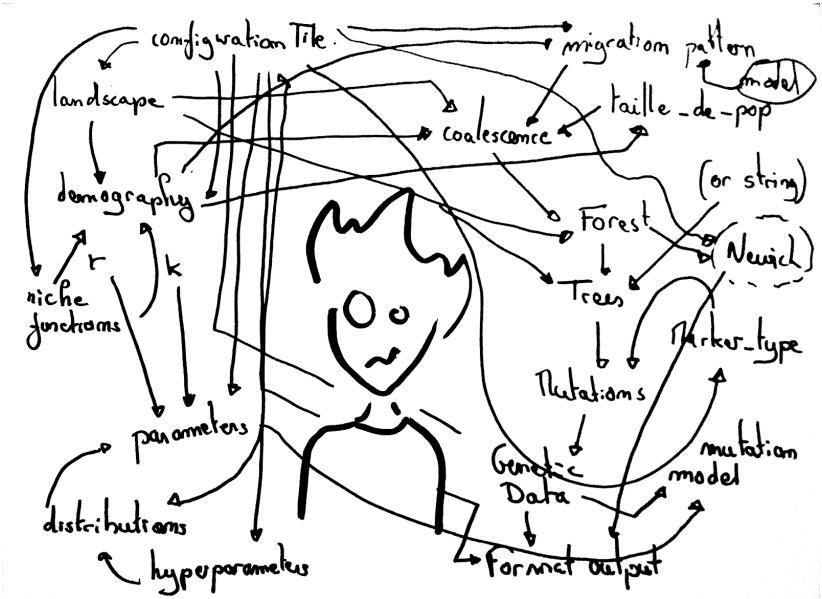


Figure: Image from "How to Avoid Spaghetti Code" *[Gulsah, 2020]*.

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

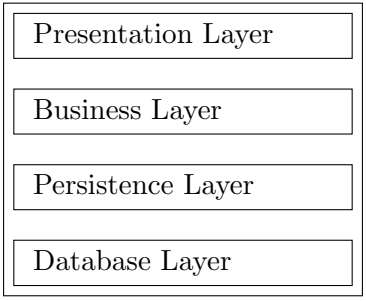
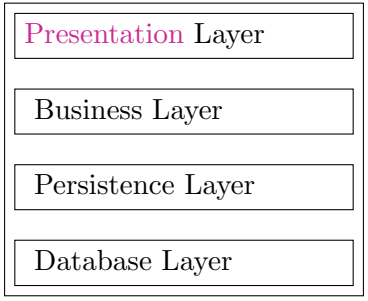


Figure: *Traditional* 4-tier, layered architecture.



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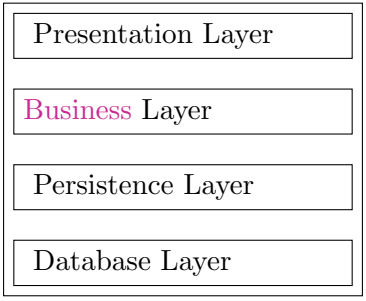

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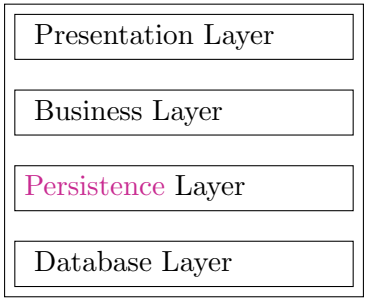

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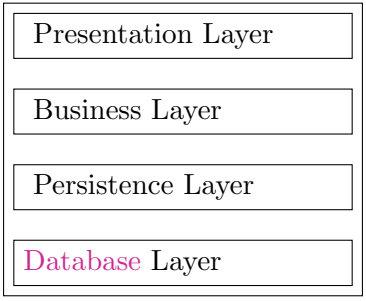

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Question

Can you identify an example of layered architecture?

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Answer

Pick any website.

Definition 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.

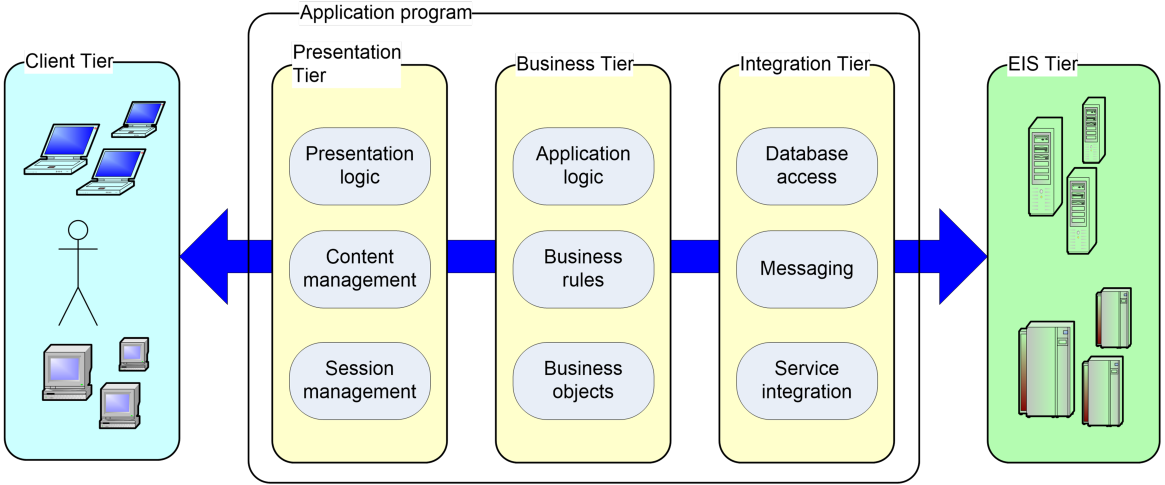

Figure: J2EE layered architecture (from *Requirements Analysis and System Design* *[Maciaszek, 2007]*).

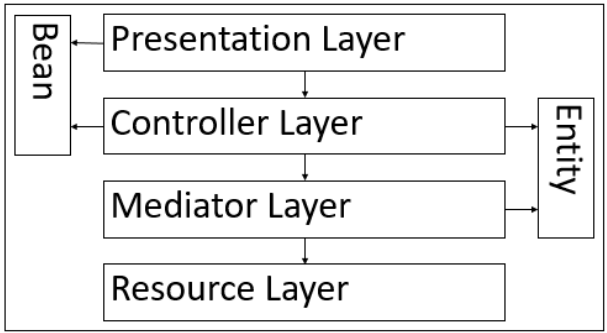

Figure: PCBMER layered architecture with sidecars (adapted from *Requirements Analysis and System Design*[Maciaszek, 2007]).

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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