## Layered Architecture

CSSE6400

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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 [1]

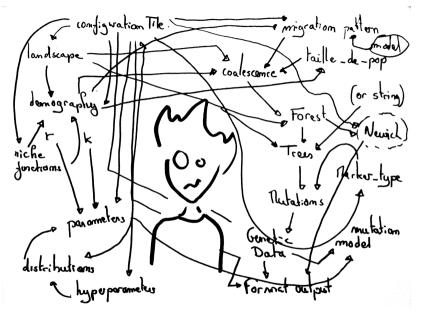


Figure: Image from "How to Avoid Spaghetti Code" [2].

**Problem** 

software.

Any change can affect any other part of the

"Solution"

## Layered architecture

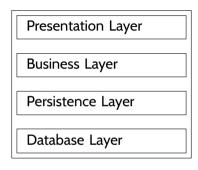


Figure: *Traditional* 4-tier, layered architecture.

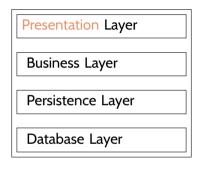


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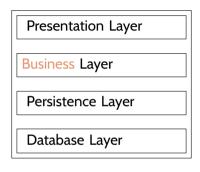


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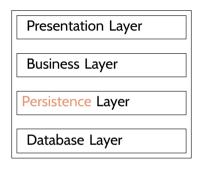


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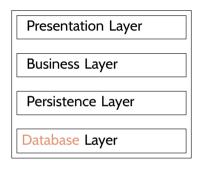


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#### Question

# Can you identify an example of layered architecture?

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**Answer** 

Pick any website.

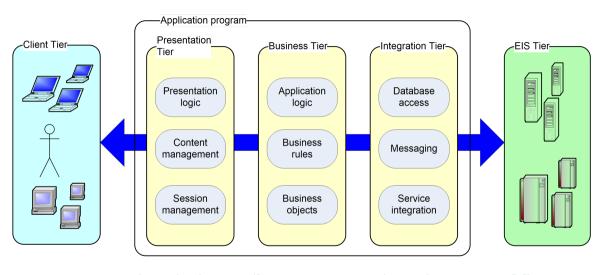


Figure: J2EE layered architecture (from Requirements Analysis and System Design [3]).

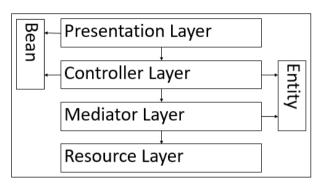


Figure: PCBMER layered architecture with sidecars (adapted from *Requirements Analysis and System Design* [3]).

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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.

Resource Manages interactions with external persistent data sources.

#### 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.

#### References

[1] Brian Foote and Joseph Yoder.

Big ball of mud.

Pattern languages of program design, 4:654–692, 1997.

[2] Gulsah.

How to avoid spaghetti code.

https://tech.zensurance.com/posts/spaghetti-code, November 2020. note = "Accessed: 2022-02-18".

[3] Leszek A. Maciaszek.

Requirements Analysis and System Design.

Addison-Wesley Harlow, 3rd edition, 2007.