CSE 403

Software Engineering

Spring 2023

#11: Software architecture

Logistics

WEEK 4		
04/17	L: Data modeling	
04/18	T:	DUE: GPS!!!
04/19	L: Architecture	Design & Architecture (DnA)
04/20	P:	
04/21	L: Design	

Today

- Software architecture vs. software design
- Common software architecture patterns

Software architecture vs. software design

Why software architecture and design?

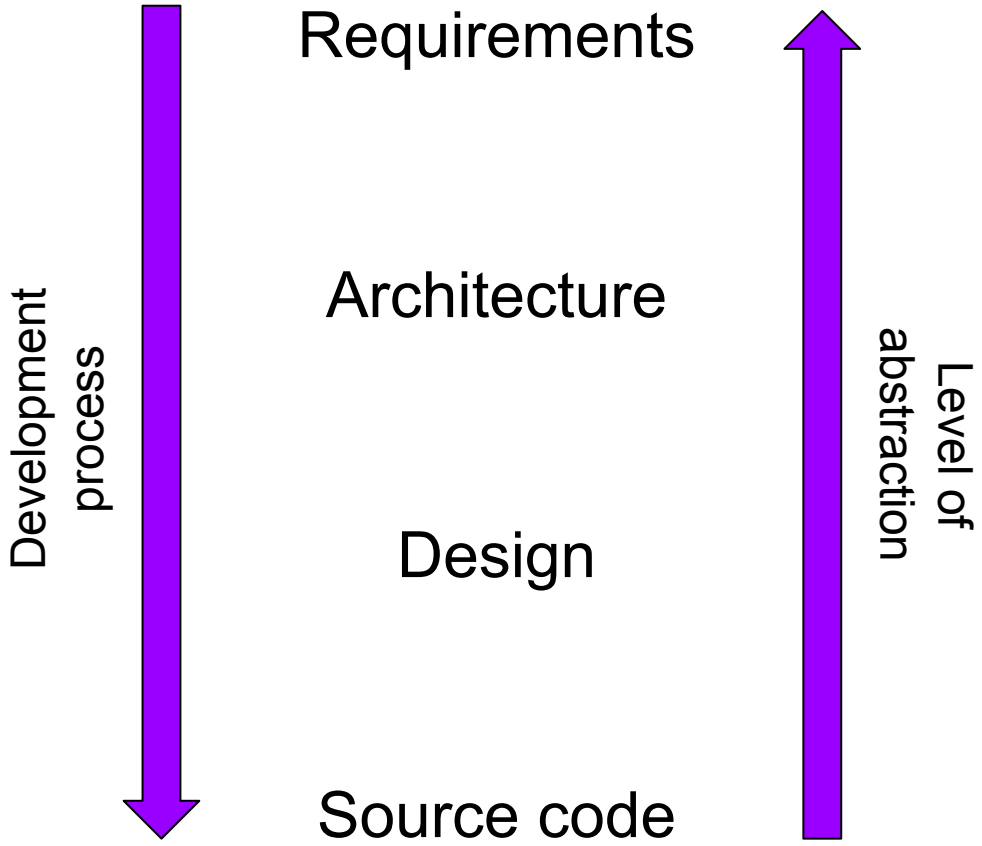
"There are two ways of constructing a software design:

one way is to make it so **simple** that there are *obviously no deficiencies*;

the other is to make it so **complicated** that there are *no obvious deficiencies*." [Tony Hoare]

Goals: separation of concerns and modularity.

Architecture vs. design



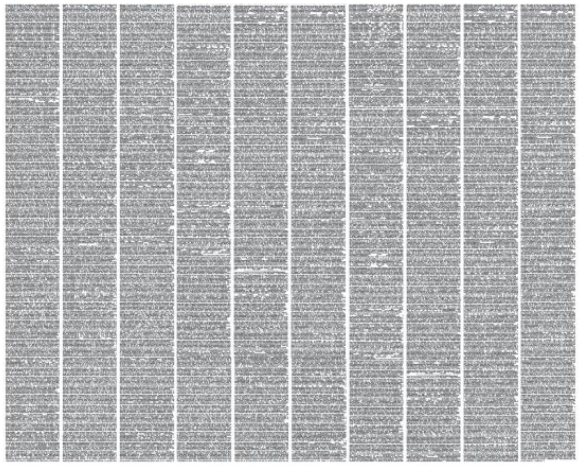
Abstraction

Building an abstract representation of reality

- Ignoring (insignificant) details.
- Focusing on the most important properties.
- Level of abstraction depends on viewpoint and purpose:
  - Communication
  - Component interfaces
  - Verification and validation

Different levels of abstraction

Source code

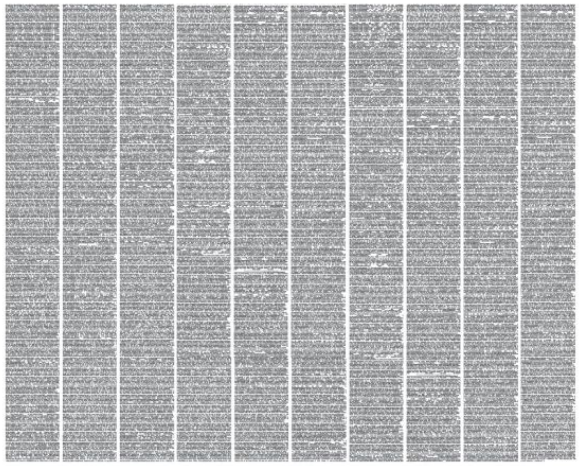


Example: Linux Kernel

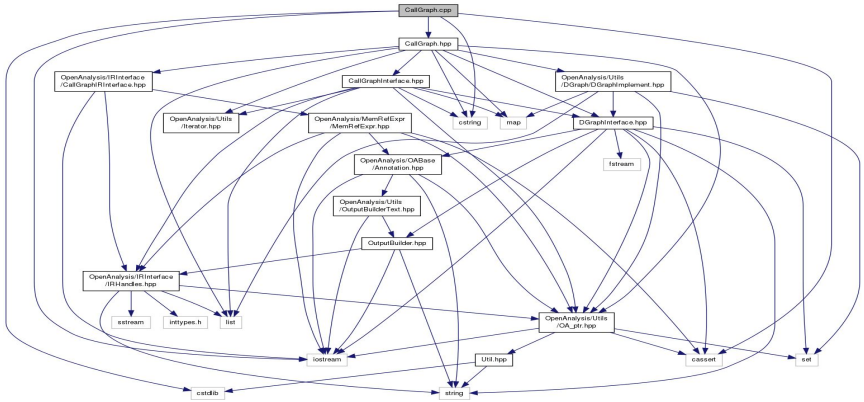
- 16 million Lines of Code!
- **What does the code do?**
- Are there dependencies?
- Are there different components?

Different levels of abstraction

Source code



Call graph



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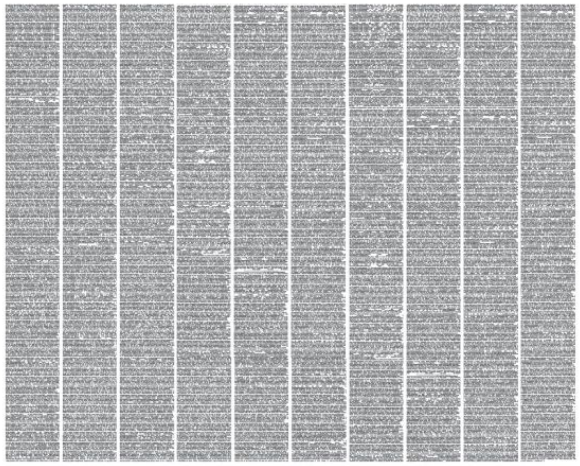

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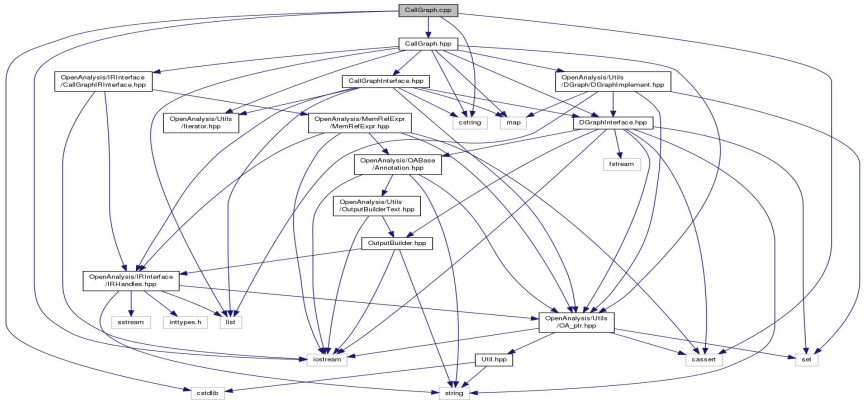

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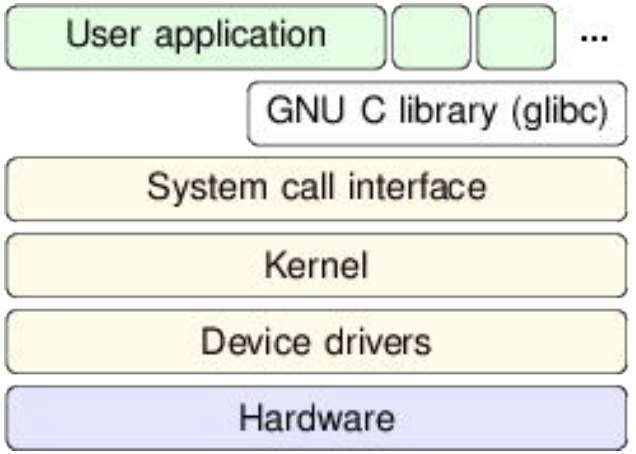
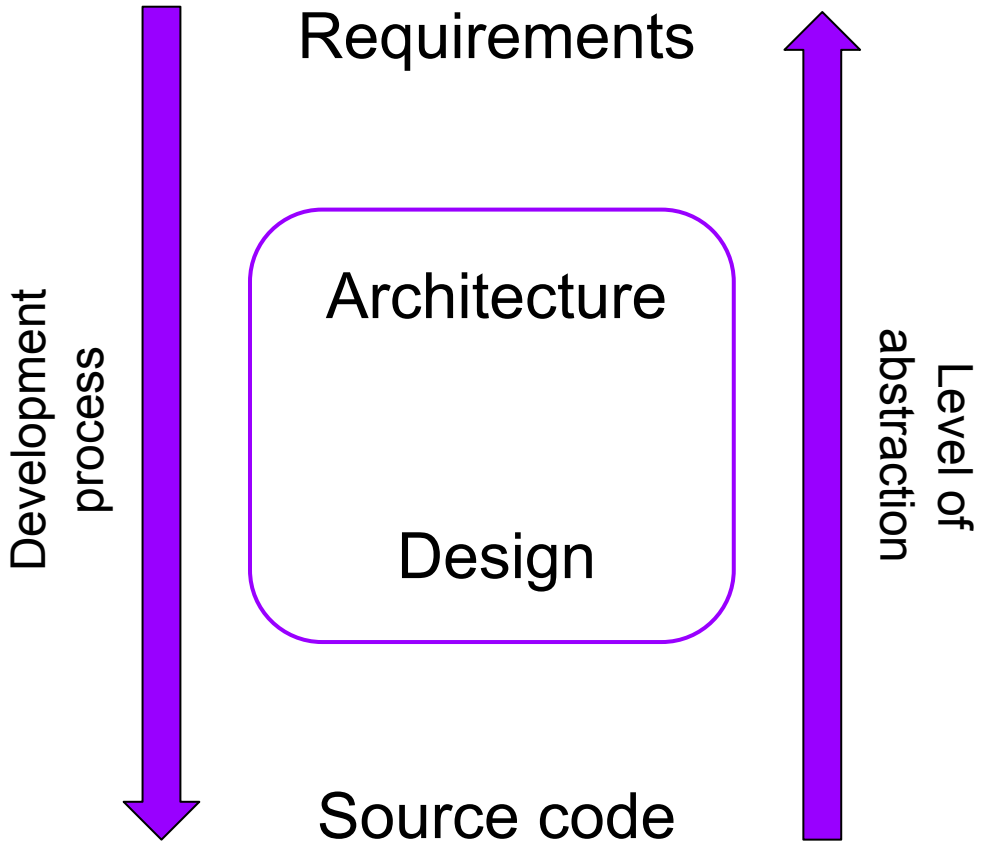
Layer diagram



Architecture vs. design



What's the difference?

Architecture vs. design

Architecture (what components are needed?)

- High-level view of the overall system:
  - What components do exist?
  - What are the protocols between components?
  - …

Design (how are the components developed?)

- Considers individual components:
  - Data representation
  - Interfaces, Class hierarchy
  - …

Architecture vs. design

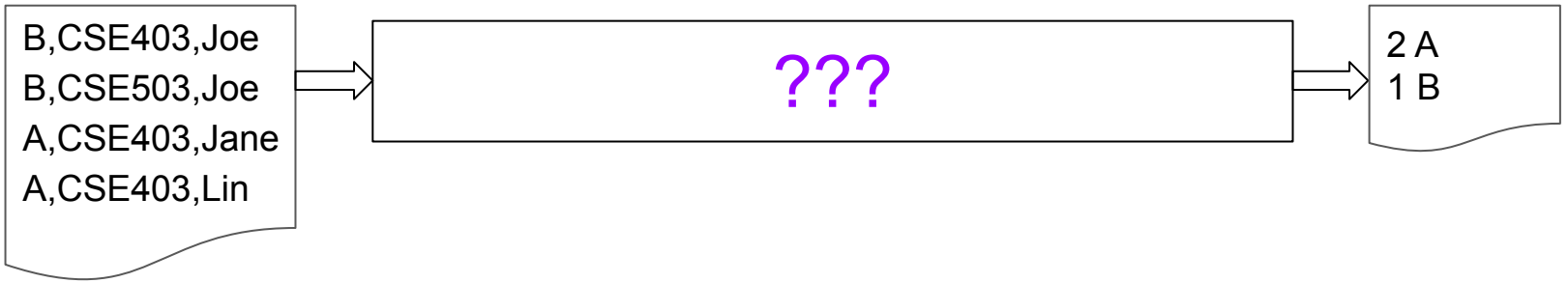
Architecture

[Gates Center Architecture, LMN]

Design

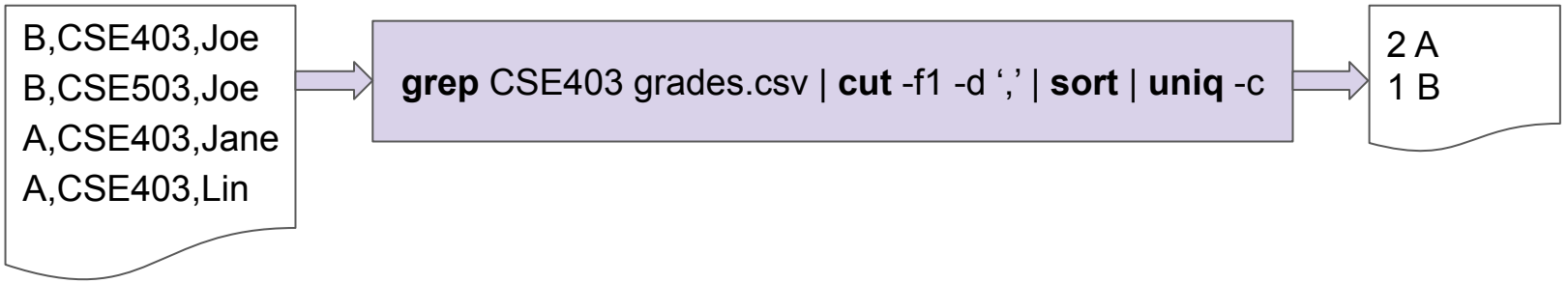
[Office design, New York Times]

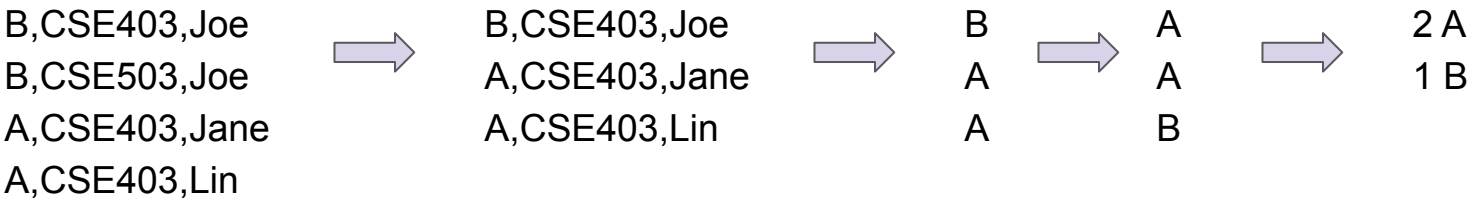
Provocation: How would you solve this problem?



Goal: count CSE403 letter grades.

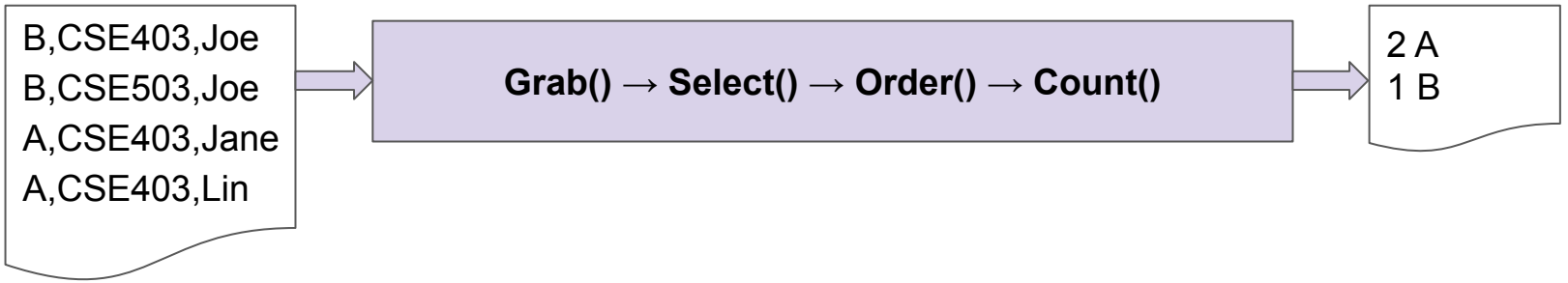
Provocation: The "coding" way!

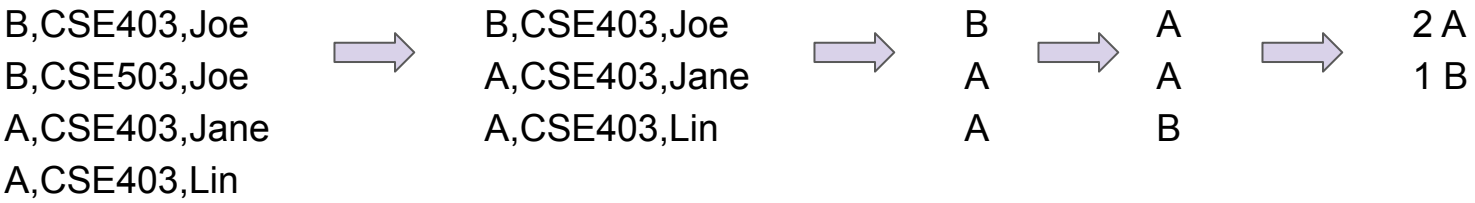




Lower level of abstraction: lang, code, run!

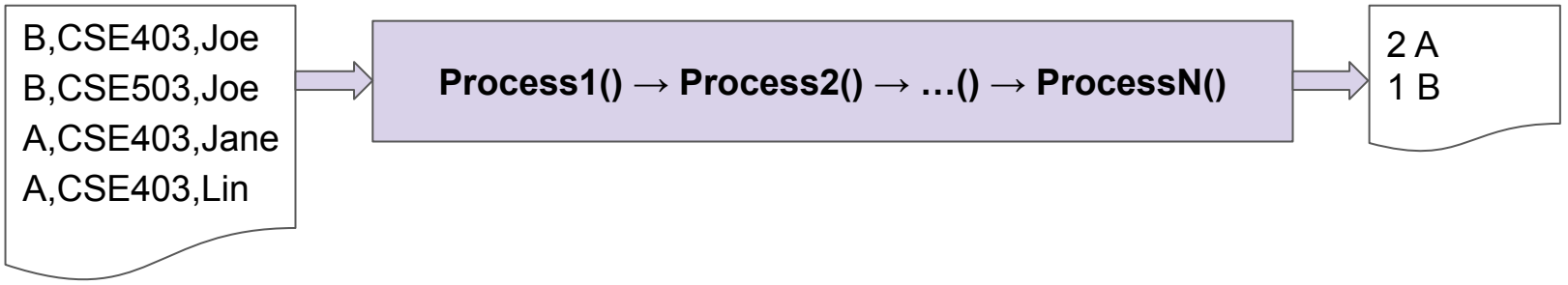
Provocation: The "design" way

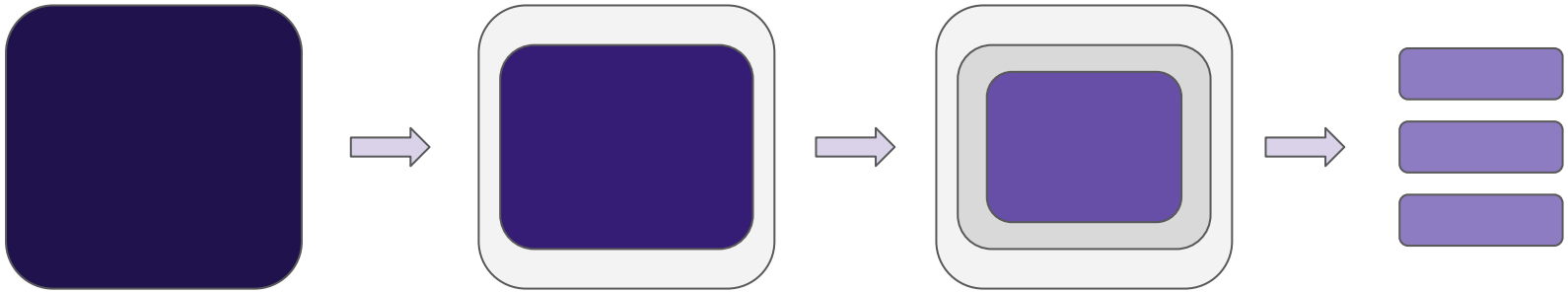




Mid-level of abstraction: component specification!

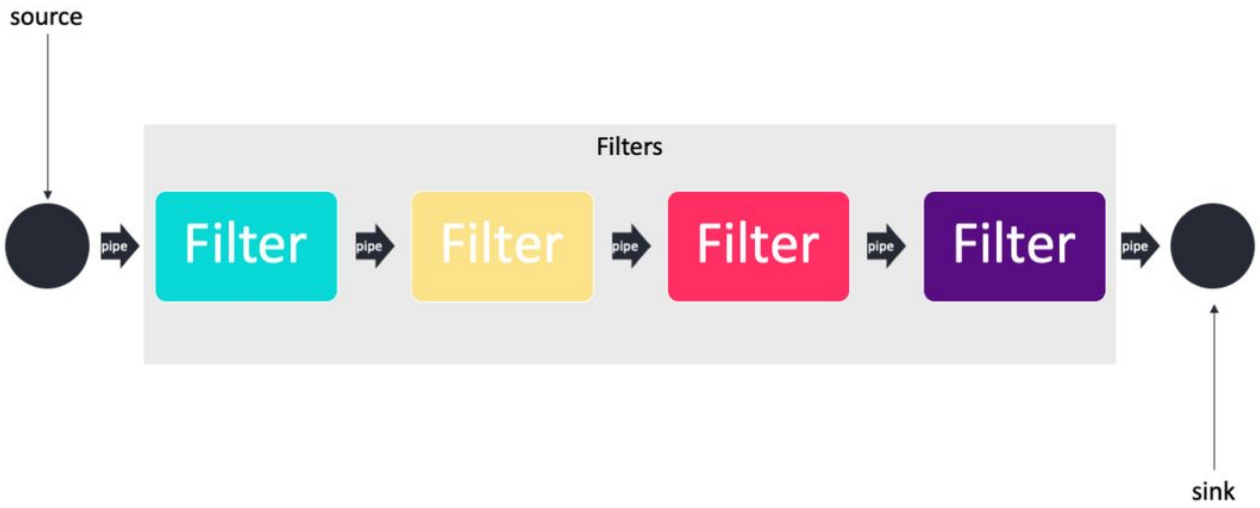
Provocation: The "architecture" way





Higher level of abstraction: components concatenation!

SW Architecture #1: Pipe and Filter

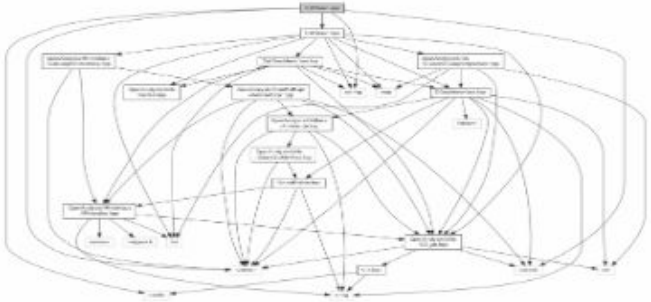


The pipe-and-filter **architecture** doesn't specify the **design** or **implementation** details of the individual components (the filters)!

SW Architecture #2: ???

Source code

Call graph



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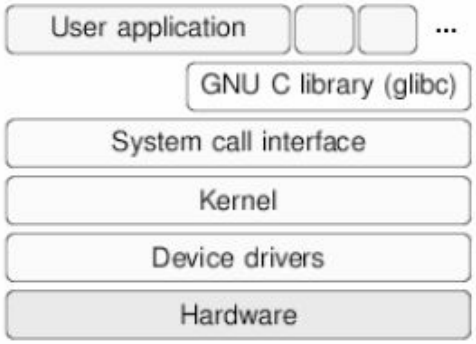
Layer diagram



Which architectural model we have already talked about here?

SW Architecture #2: Layered

Source code

Call graph

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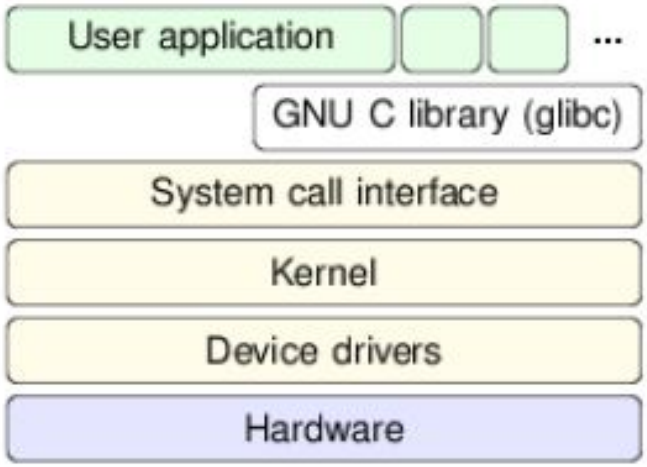
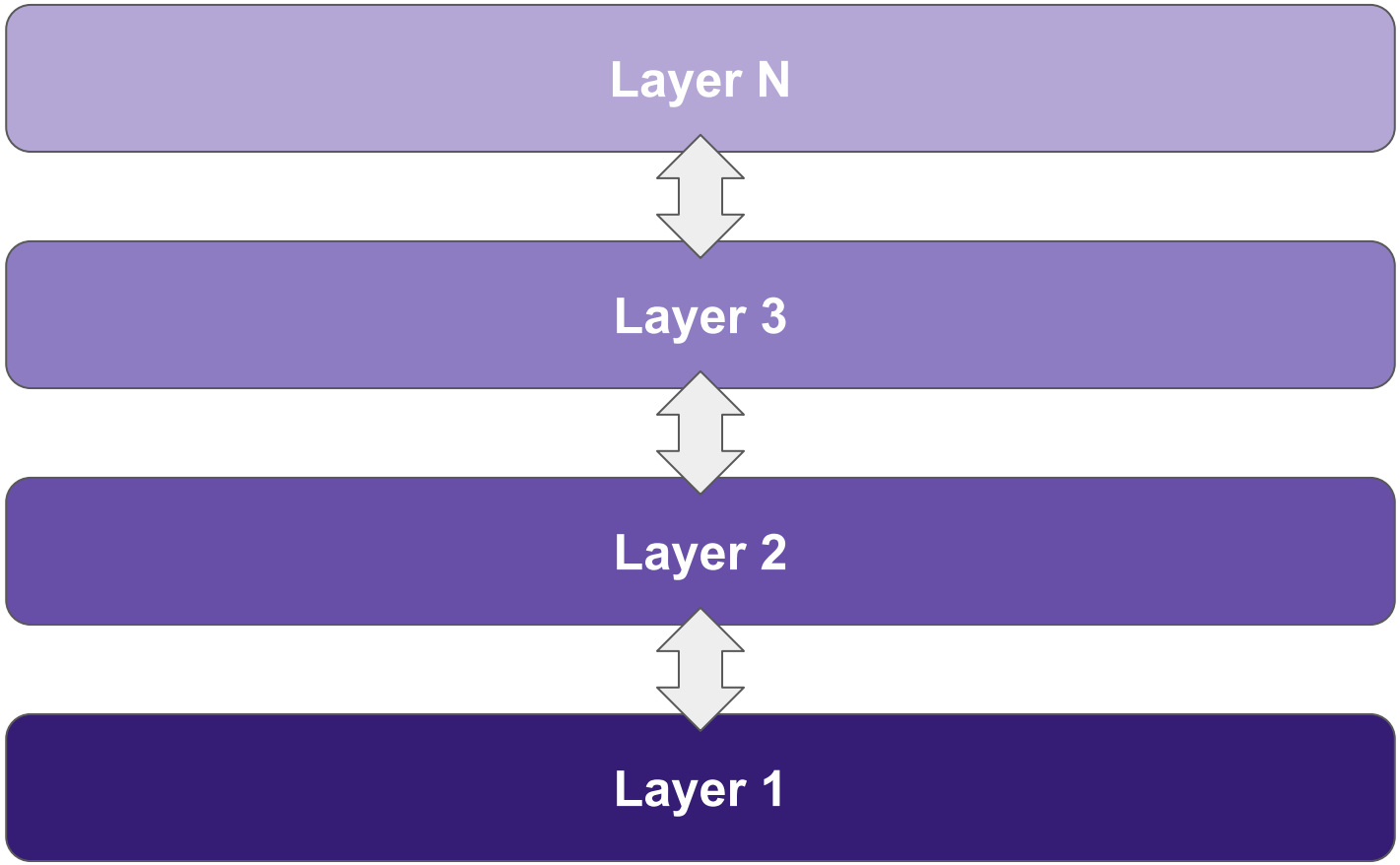
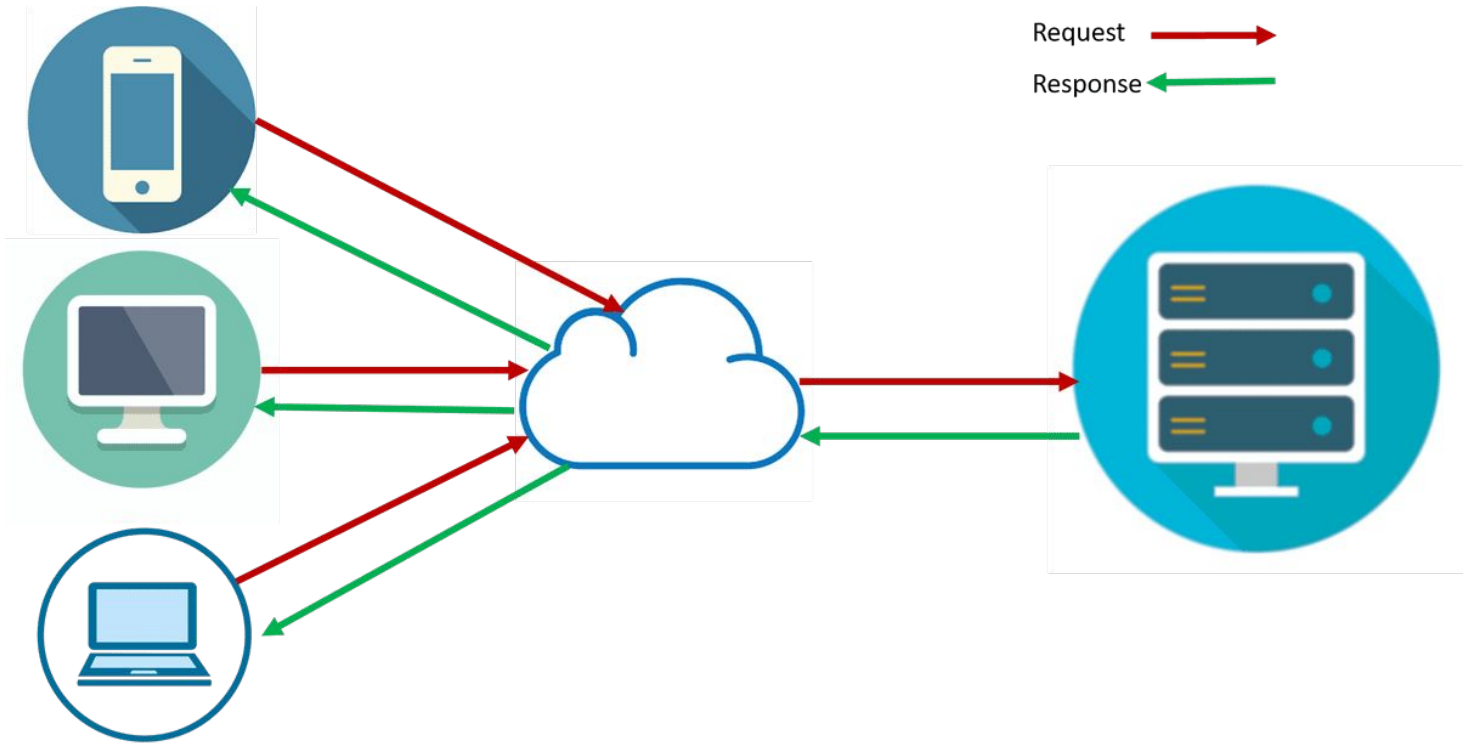


SW Architecture #2: Layered



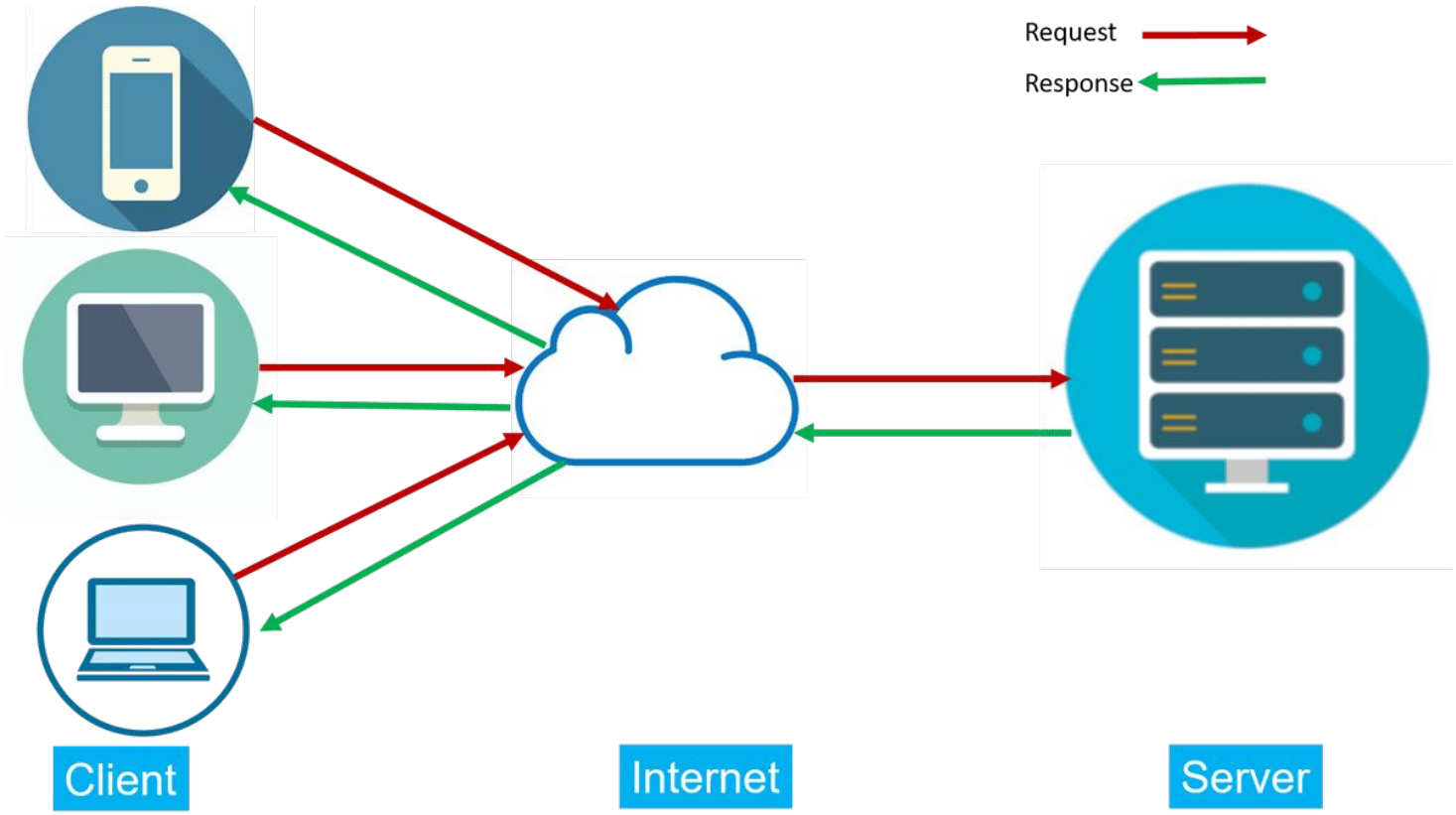
Each layer offers a service to the one on the top!

SW Architecture #3: ???



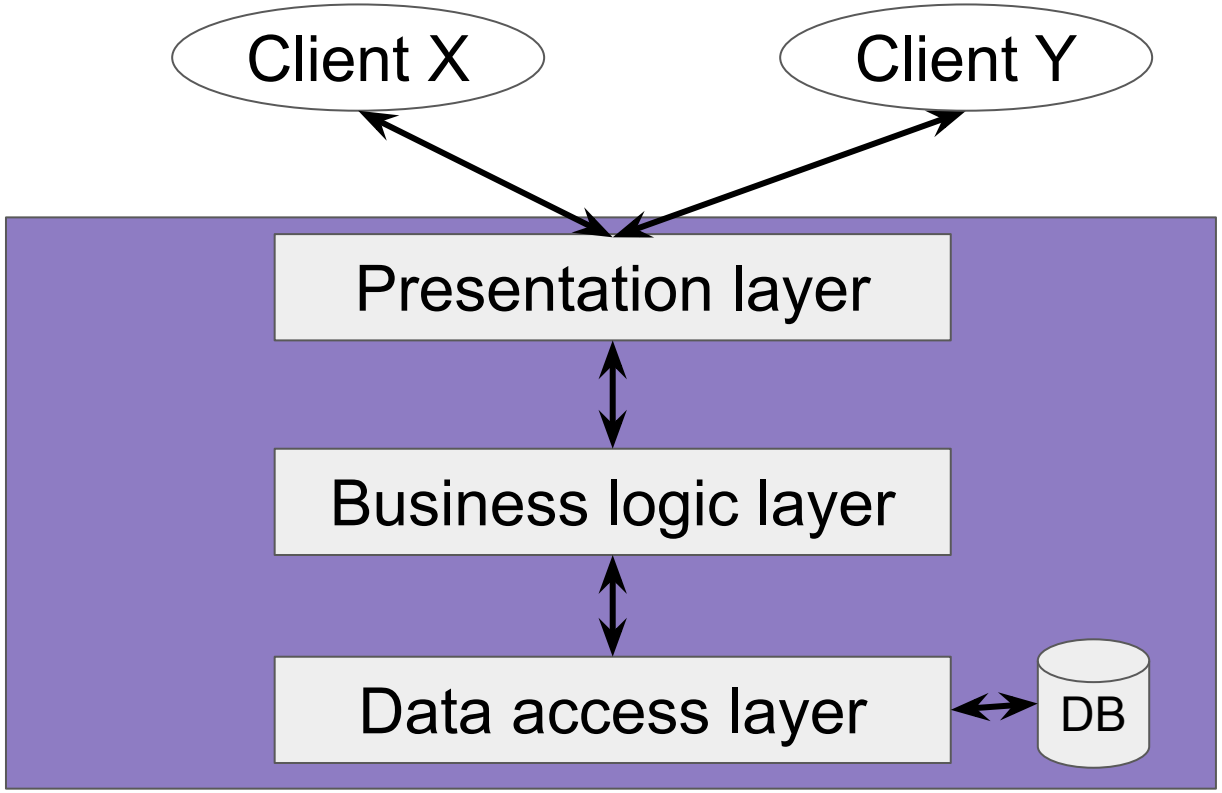
Pretty sure you know this one!

SW Architecture #3: Client-Server



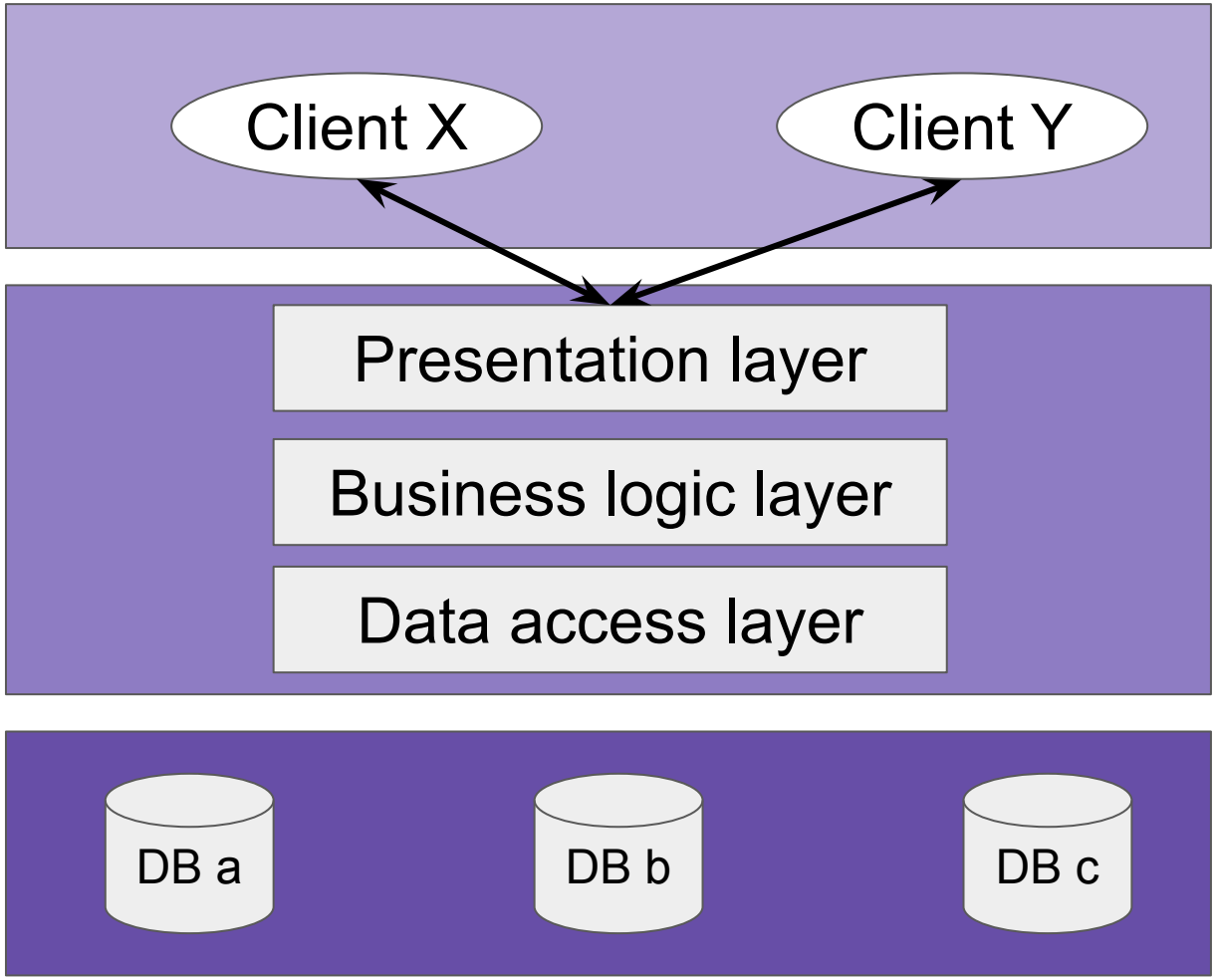
Breaks-up the whole problem into a server, clients, and communication medium!

SW Architecture #3 ½: Client-Server + Layers



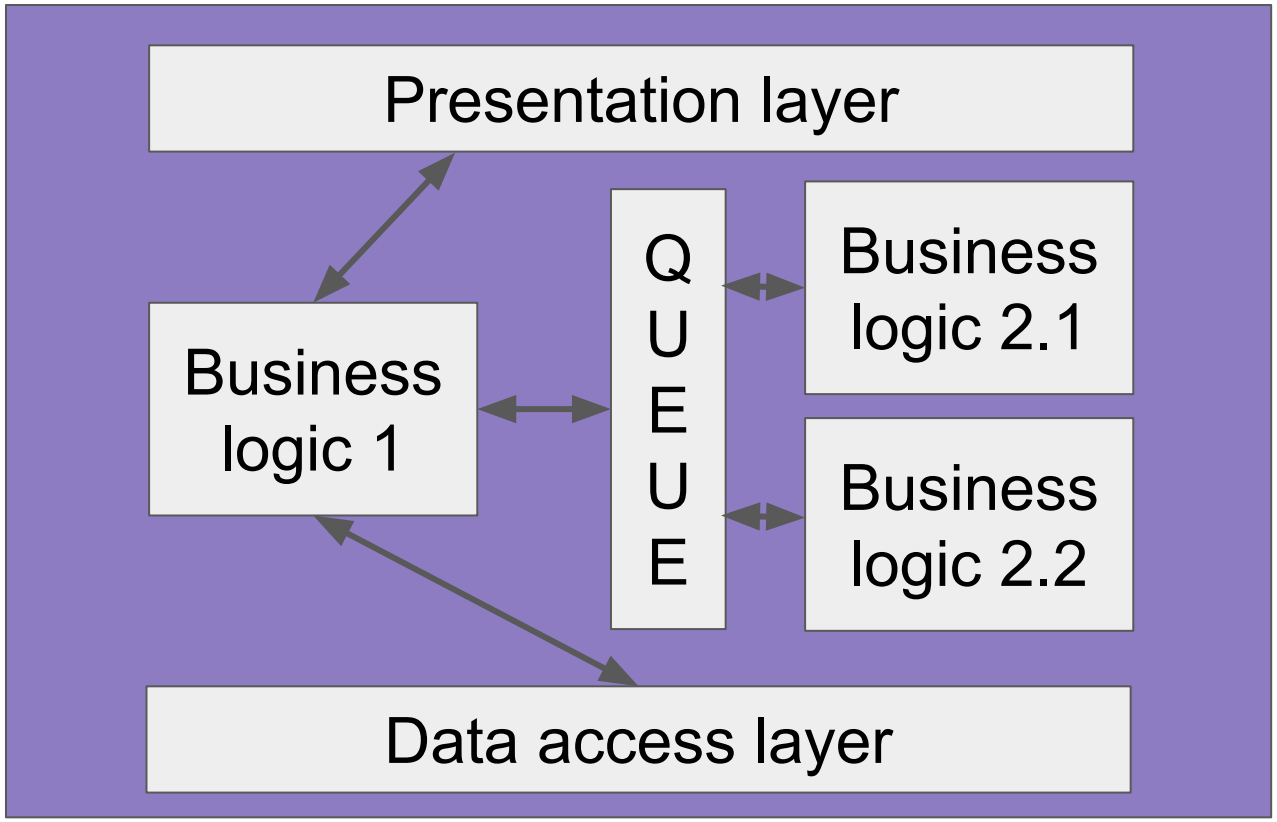
What if your focus is the server part?

SW Architecture #4: (n)-tiered



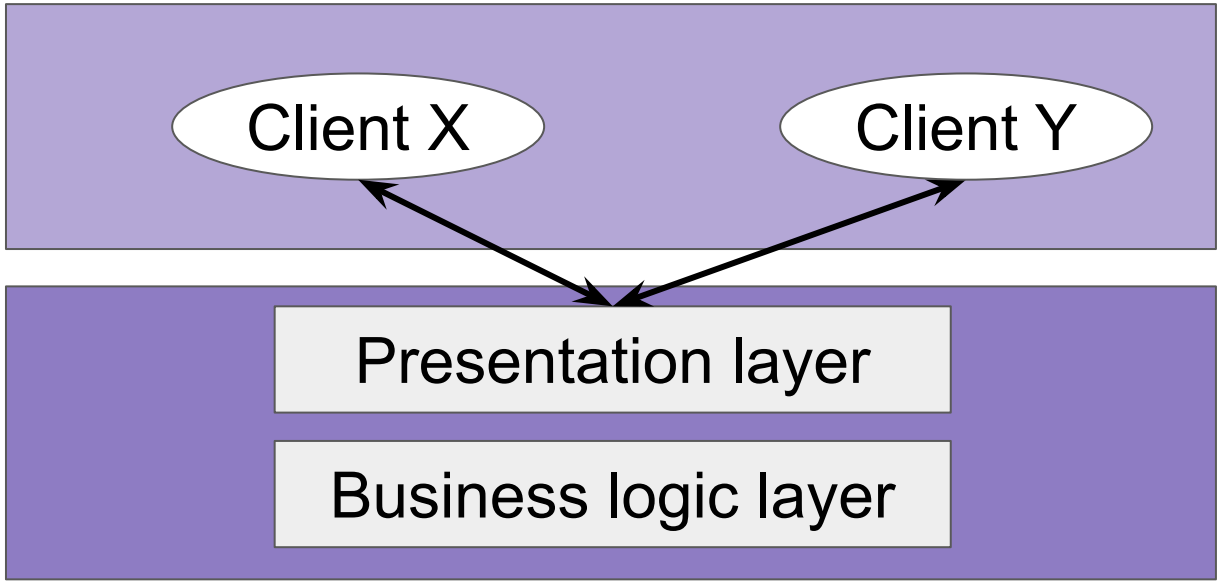
What if things in the server gets too complicated?

SW Architecture #5: Message-Oriented



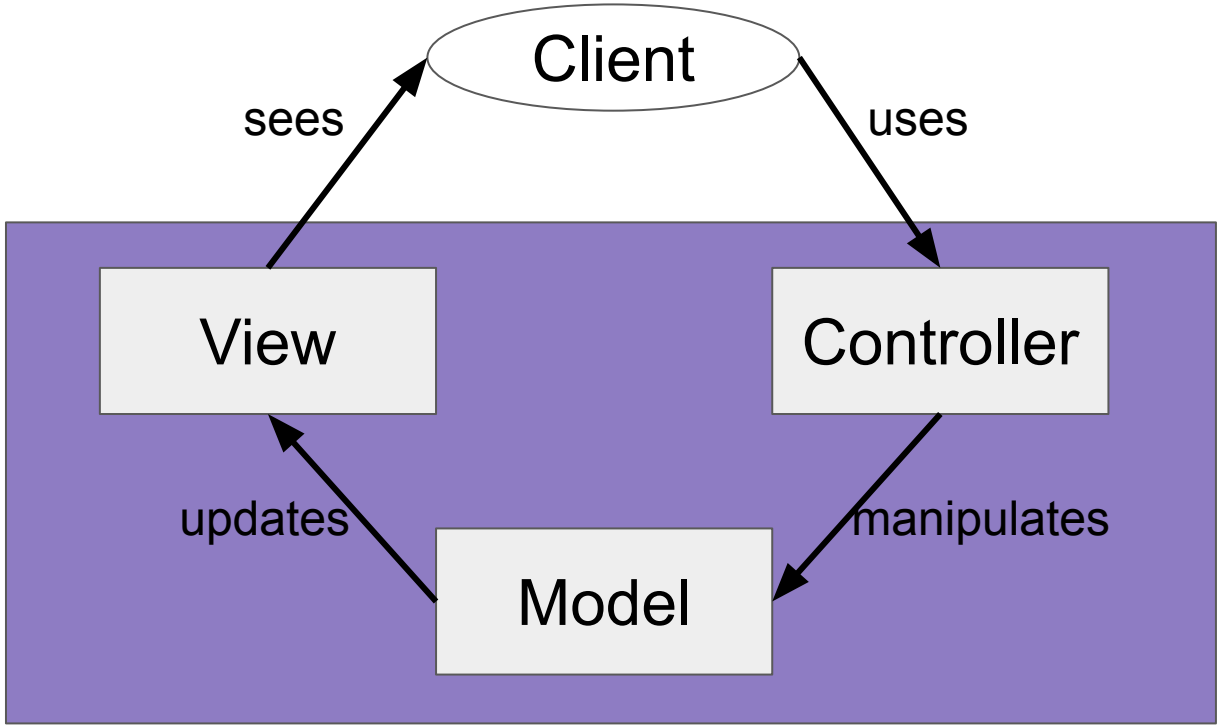
What if things in the server even more complicated and need help to process the load?

SW Architecture #6: ???



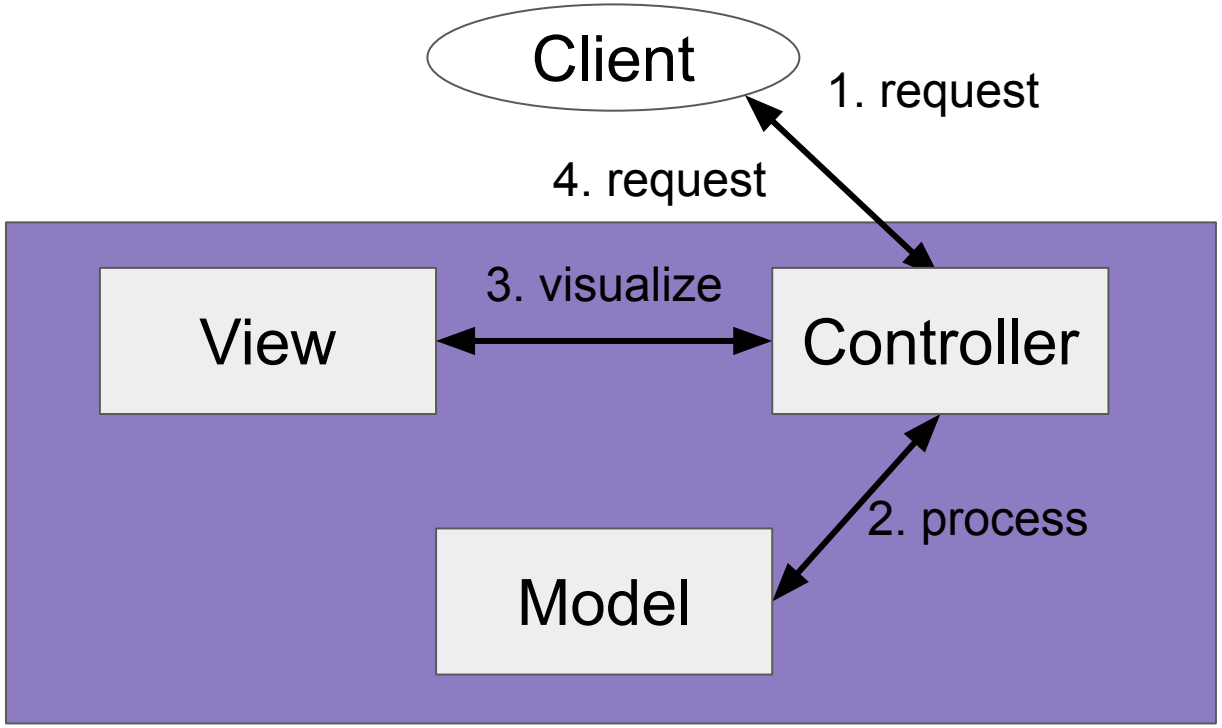
What if we want to focus on the Client and Server Interactions?

SW Architecture #6: MVC *(or one version of it)*



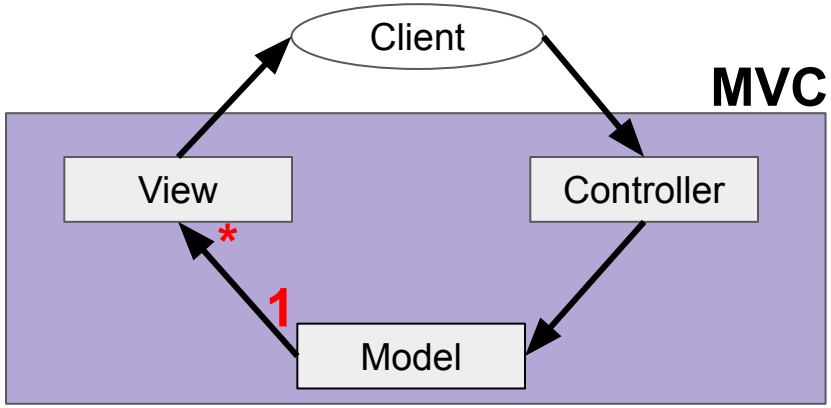
Separates data representation (Model),
visualization (View), and client interaction (Controller)

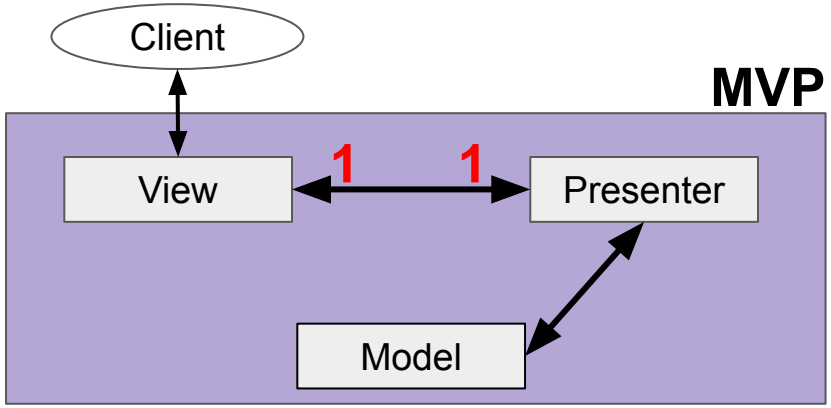
SW Architecture #6: MVC *(or another version of it)*

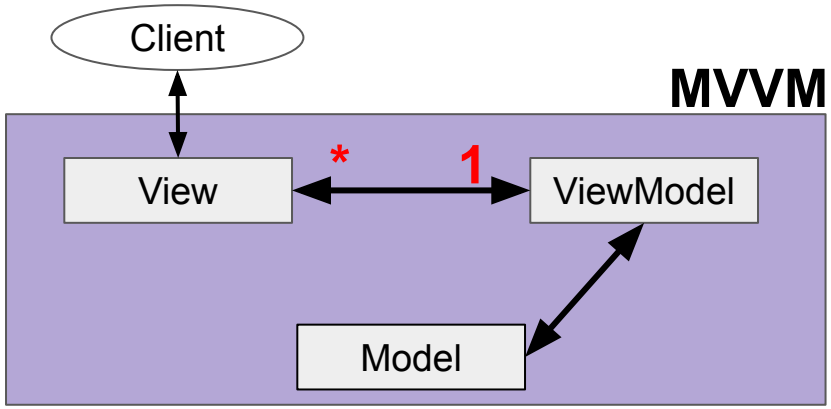


There are different variations out there!

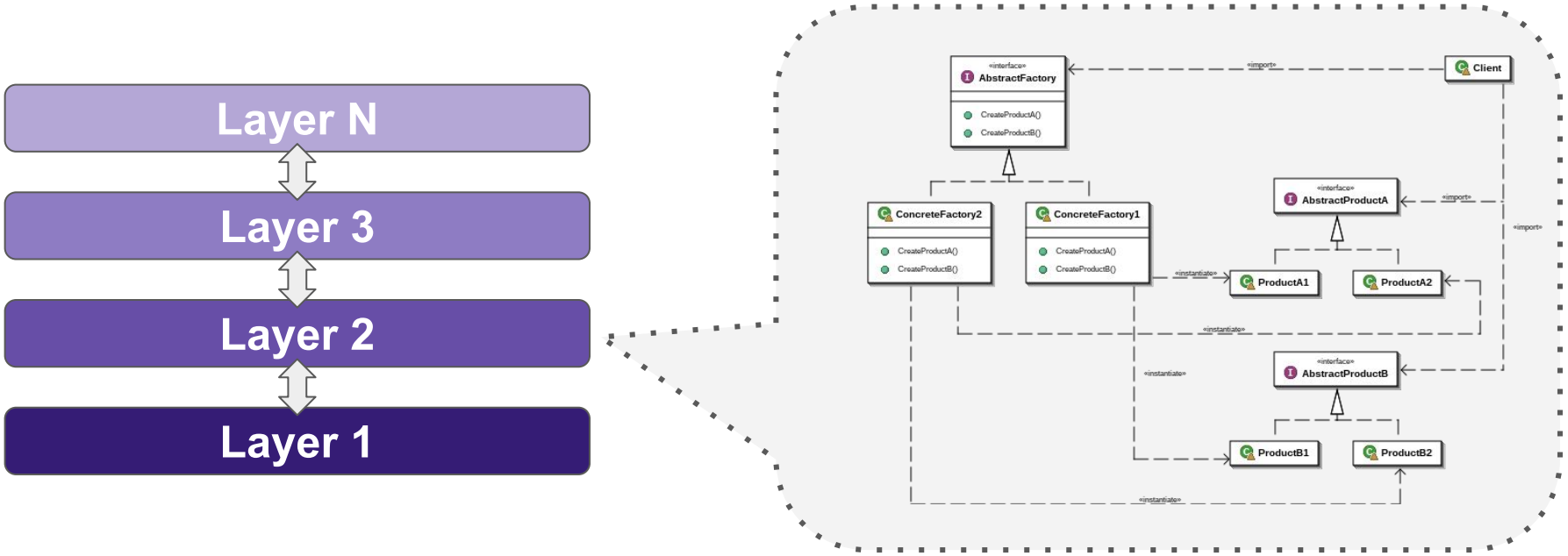
SW Architecture #6.2: MVC vs. MVP vs. MVVM







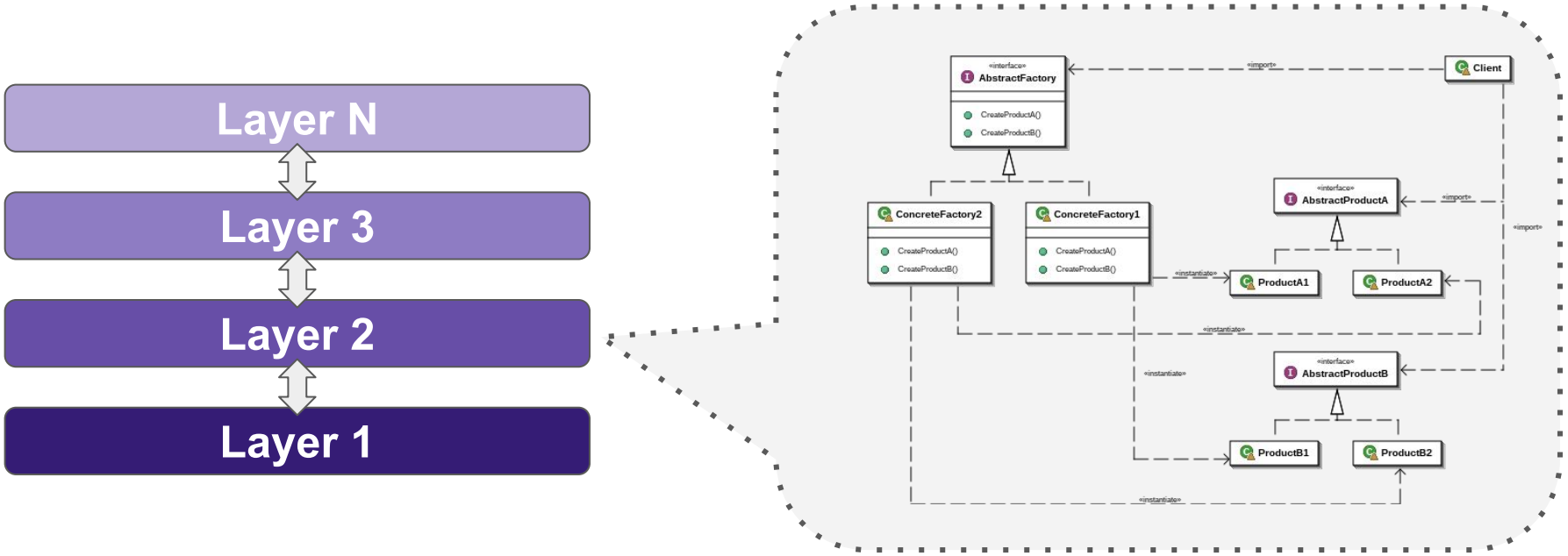
Software architecture vs. design: summary



Architecture and design

- Components and interfaces: understand, communicate, reuse
- Manage complexity: modularity and separation of concerns
- Process: allow effort estimation and progress monitoring

Software architecture vs. design: summary



Questions, please!