

To Ponder

“We ascribe beauty to that which is simple; which has no superfluous parts; which exactly answers its end; which stands related to all things; which is the mean of many extremes.”

Ralph Waldo Emerson (1803-1882)

To Ponder

“A distributed system is one in which the failure of a computer you didn't even know existed can render your own computer unusable.”

Leslie Lamport

Web Applications: Overview and Architecture

Computer Science and Engineering ■ College of Engineering ■ The Ohio State University

Lecture 1

Road Map in Pictures: Web App

Top 10 Best Ice Cream near 281 V x +
yelp.com/search?find_desc=ice%20cream&find_loc=ohio%20state%20university

yelp ice cream ohio state university For Businesses Write a Review Log In Sign Up

Restaurants Home Services Auto Services More

Curbside Pickup
 Open Now 10:40 AM
 Yelp Delivery

Category
Ice Cream & Frozen Yogurt
Restaurants Food
Bars
[See all](#)

Features
 Curbside Pickup
 Open Now 10:40 AM
 Yelp Delivery
[See all](#)

Cities
[See all](#)

Distance
 Bird's-eye View
 Driving (5 mi.)
 Biking (2 mi.)
 Walking (1 mi.)
 Within 4 blocks

1. CRMD (833) 438-2763
1190 N High St
Italian Village
4.5 ★★★★★ 125
Ice Cream & Frozen Yogurt
1.5 Miles
✓ Delivery
"Installed plastic shields, and clearly marked social distancing spots every 6 feet. I feel safe and welcome, and the unique, tasty **ice cream** flavors are the cherry on top! This Isn't your dad's **ice cream** shop, and that's why I love it. Try the puffle cone, it will change your life!" more

2. Graeters Ice Cream (614) 488-3222
1534 W Lane Ave
\$ • Ice Cream & Frozen Yogurt, Candy Stores
1.8 Miles
✓ Delivery ✓ Takeout
"Wonderful **ice cream** and service. Very thankful I decided to go here and get some fresh frozen dairy. Great time to go on a warm afternoon and evening and taste some of the finest treats in the capital." more

3. Jeni's Splendid Ice Creams (614) 294-5364
714 N High St
Short North
4.5 ★★★★★ 465
\$ • Ice Cream & Frozen Yogurt
2.1 Miles
✓ Delivery ✓ Takeout

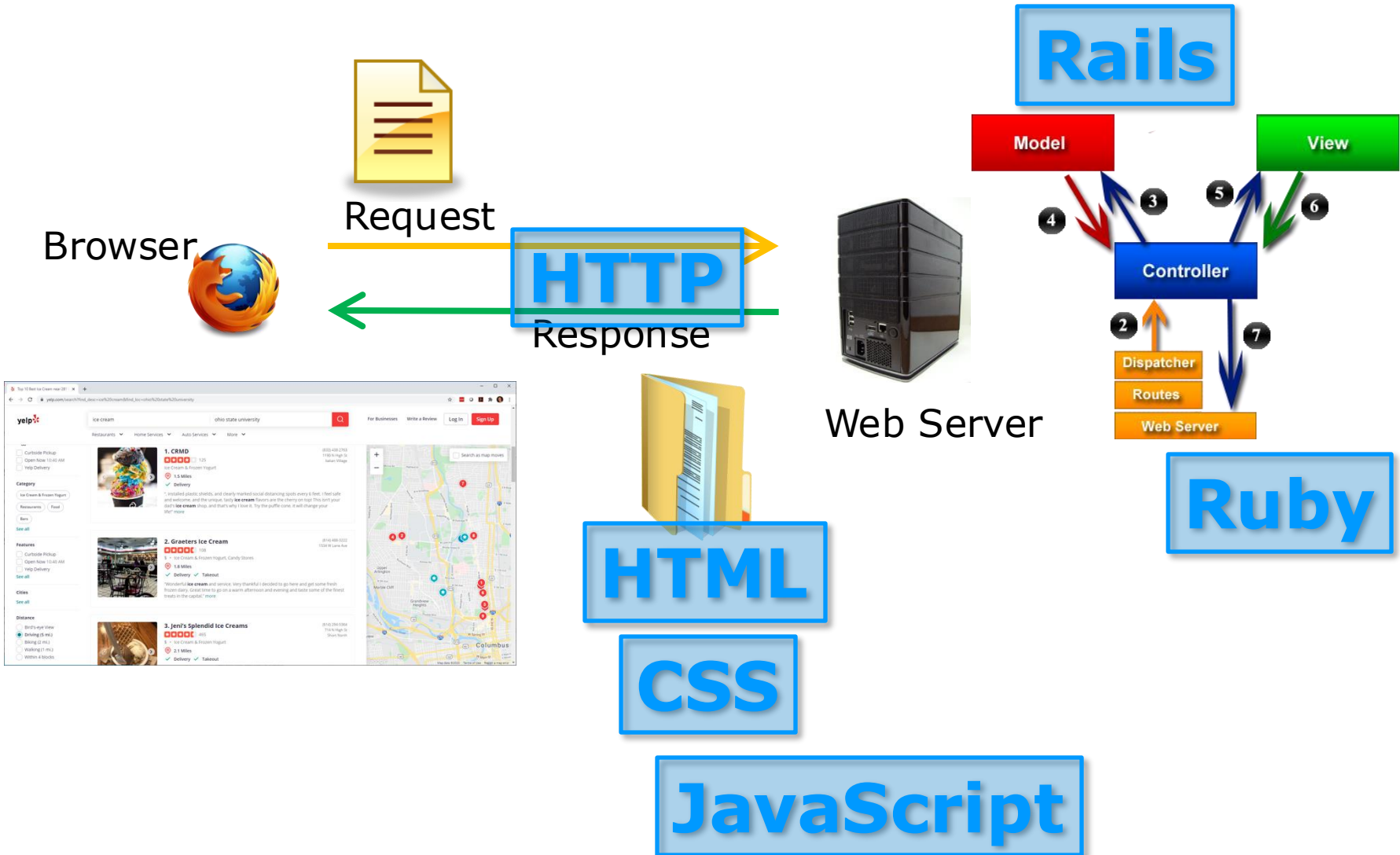
Search as map moves

Map data ©2020 Terms of Use Report a map error

Road Map in Pictures



Road Map in Pictures



Road Map: Schedule of Topics

- A Language
 - Ruby
- Foundations
 - Version Control, Networking, Regular Expressions
- Static web pages
 - HTML & CSS
- Dynamic web pages
 - JavaScript
- Framework for web applications
 - Rails
- Applied Topics
 - Security, Encodings

Resources

- Lectures, office hours, meetings
 - Instructor, grader(s)
 - Each other
- Discord Server
 - Q&A and discussion forum
 - News and announcements
- Class website
 - Handouts, lecture notes, lab assignments
 - Syllabus (note exam requirement)
 - Pointers to more resources
- Carmen
 - Grades, deadlines, rubrics

Mens Sana in Corpore Sano

- Running plan for the semester:
 - Run from here to Louisville, KY
 - Equivalently, run 210 miles
 - Equivalently, run 8 marathons

Technical Content

- Languages and Technologies
 - HTTP
 - HTML, CSS, JavaScript, JSON
 - Ruby, Ruby on Rails
- Tools and techniques
 - Design patterns (MVC)
 - git, linux
 - Regular expressions, unicode, system time
- Advanced topics
 - Programming languages, networking, cryptography, databases, operating systems

Stability of Content: Concepts

- Conceptual underpinnings will be relevant forever
- In this course:
 - Single-point of control over change
 - Abstraction (vs realization)
 - Design patterns
 - Regular Expressions (the math part)
 - Cryptography (the math part)
 - Motivation for version control
 - Time-space performance trade-offs

Stability of Content: Technology

- Some technologies have been around a long time, and will likely be relevant for many more years
- Examples in this course:
 - Linux
 - SQL
 - HTTP
 - HTML
 - CSS
 - JavaScript

Stability of Content: Tools

- Some tools come and go
- They are useful for getting things done now, but may not be as relevant or fashionable in 10 years
- Examples in this course
 - VS Code
 - git
 - Ruby

- Aside on generative AI: GitHub Copilot

Stability of Content: Framework

- There are many frameworks and libraries for web development
- They come and go so quickly, there is always something new
- Examples:
 - Web frameworks (Rails, Express.js...)
 - Ruby gems (Middleman, Nokogiri, Cucumber...)
 - JavaScript libraries (Angular, React...)
 - HTML/CSS libraries (Bootstrap, Bulma, Tailwind...)

Meta Content: Software Eng.

- Lasting relevance
- Project development in the "real world"
 1. Vague open-ended requirements
 2. Large, complex problems
 3. Teams

Topic 1: Vague Requirements

- Two aspects to engineering:
 - Satisfying the constraints (solving the problem)
 - Optimizing the solution (better, faster, cheaper)
- Must first identify and understand the problem
 - Requirements elicitation
- Recognize tradeoffs
 - Improvement in one aspect at the expense of another

Topic 2: Size and Complexity

- “Programming in the large”
 - Does not all fit in one person’s head or schedule
 - Interfaces, modules, components, classes
- Design
 - Measure twice, cut once
- Process
 - Agile, waterfall, TDD,...
- Documentation
- Testing

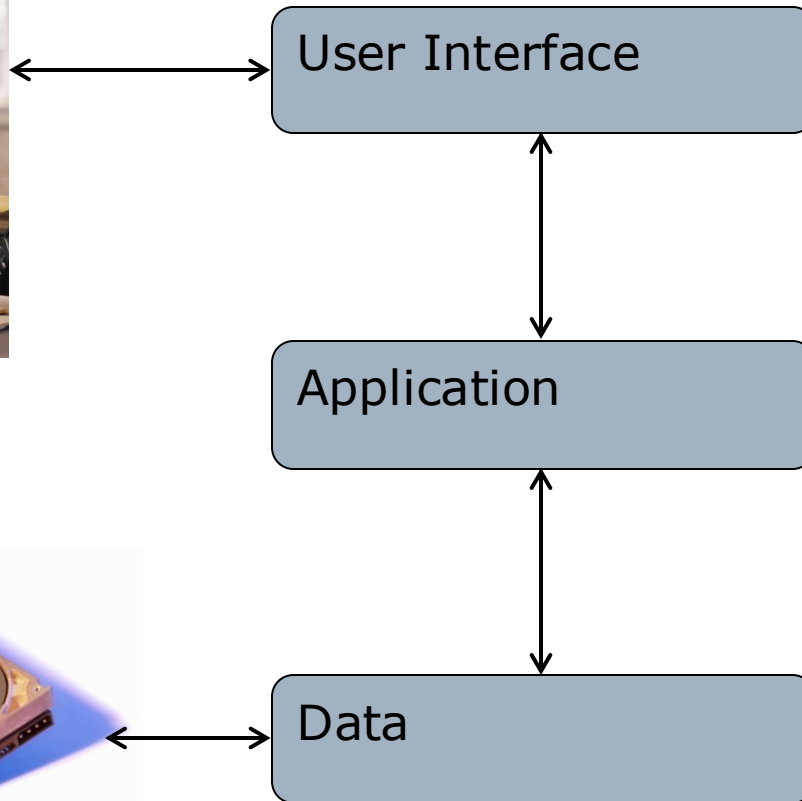
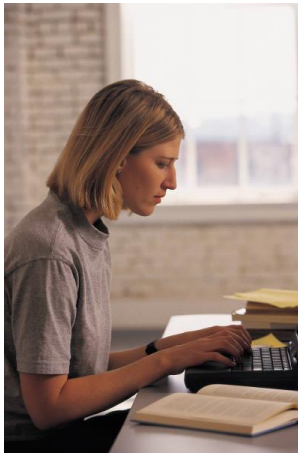
Topic 3: Group Work

- Naïve view of CS: Lone wolf hacker
- Reality: large multidisciplinary teams
 - Developers, testers, marketing, HR, management, clients
 - Communication skills are critical
- Many challenges
 - Rely on others
 - Compromises become necessary
 - Personalities
- Many rewards
 - Accomplish more
 - Learn more

SE In This Course...

- Group work! You will be in 2 groups:
 - A “home group” for projects
 - A “technology team” for tasks
- Multidisciplinary teams
 - Tech teams cut across project groups
- Open-ended projects
- Communication skills
 - Presentations to class

Architecture: Desktop App



Graphical events
(mouse moves,
button pushed)

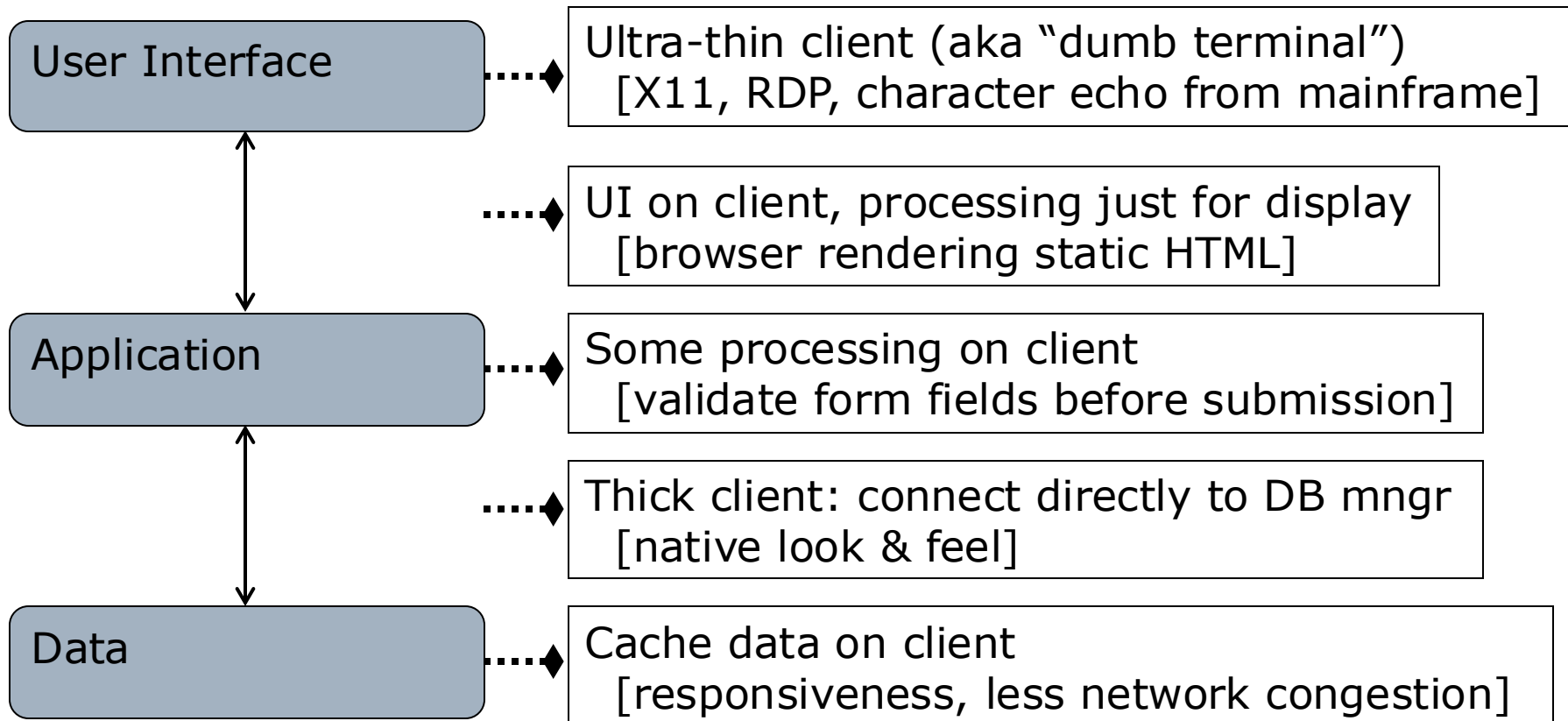
Processing,
Calculating

Persistence,
Transactions,
Triggers

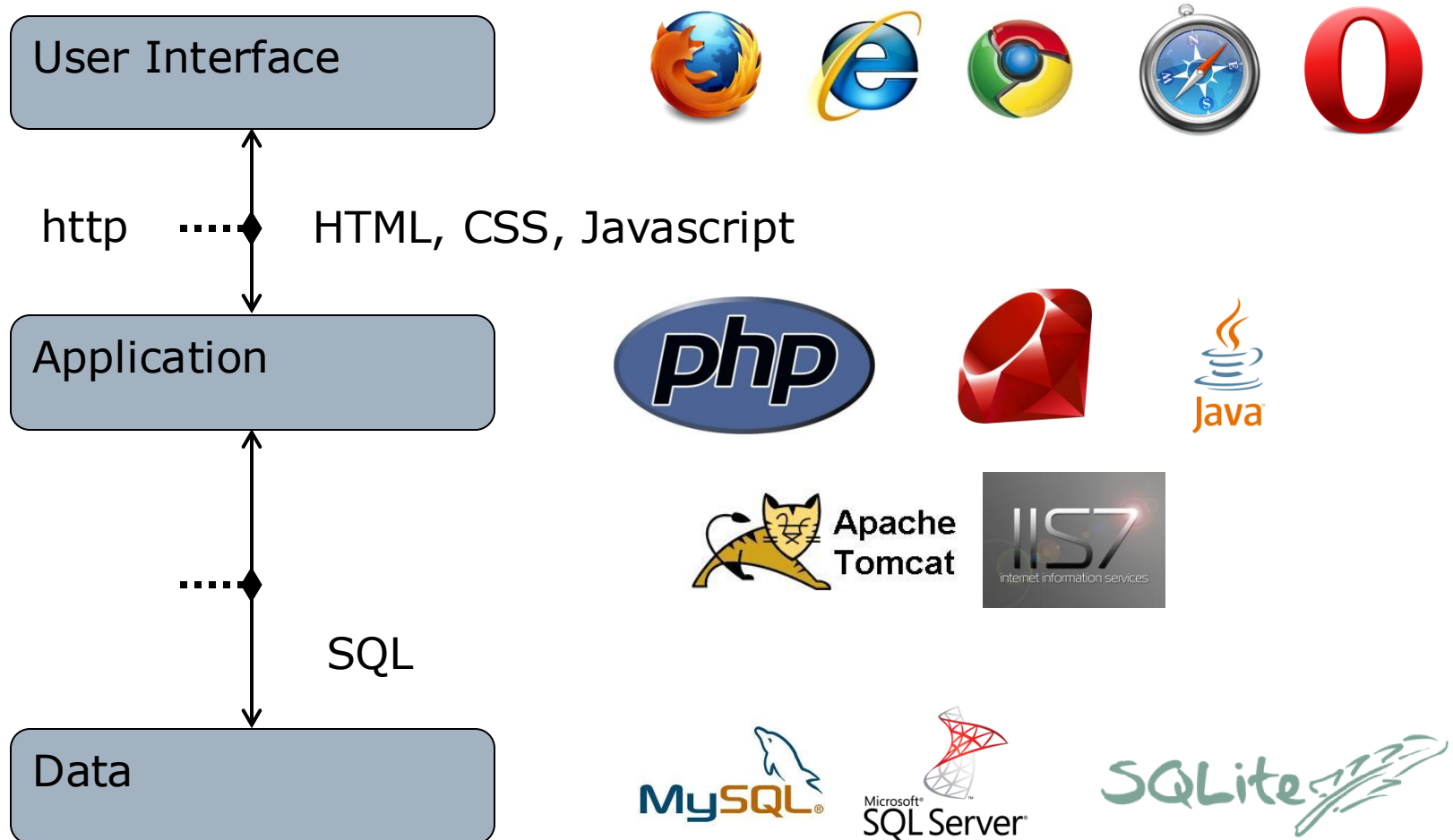


Client-Server App: 2-Tier

Where should we cut?



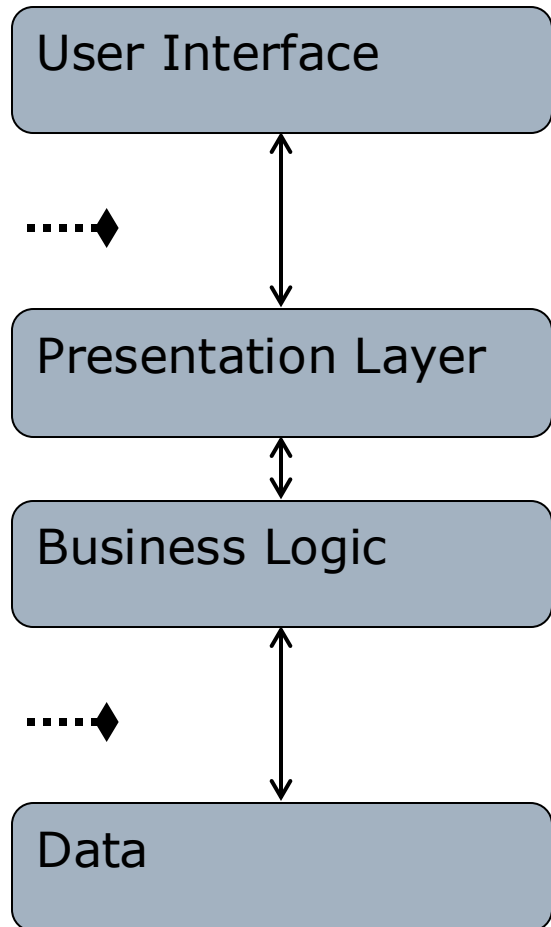
Basic Web App Skeleton: 3-Tier



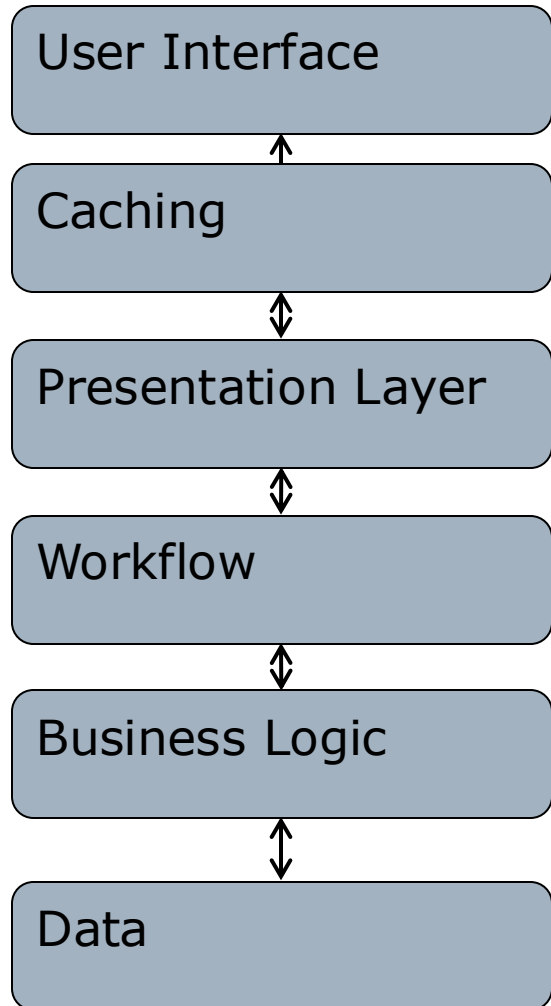
Advantages over Thick Clients

- Performance
 - 1 (expensive) network call to app layer results in many calls to data layer
 - Compute-intensive part on faster machine
- Flexibility
 - Update app logic without changing client
- Robustness
 - Transactions, logging at app level
- Security
 - Login, authentication, encryption all better at app level than data level

Web App Skeleton: 4-Tier



Web App Skeleton: n-Tier...



Summary

- Technical aspects of course content
 - Many different web technologies
 - Rapidly evolving landscape
- Meta content: Software engineering
 - Vague requirements
 - Large systems
 - Teams
- 2-, 3-, 4-, n-Tier Architectures