

Web Applications: Overview and Architecture

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

Lecture 1

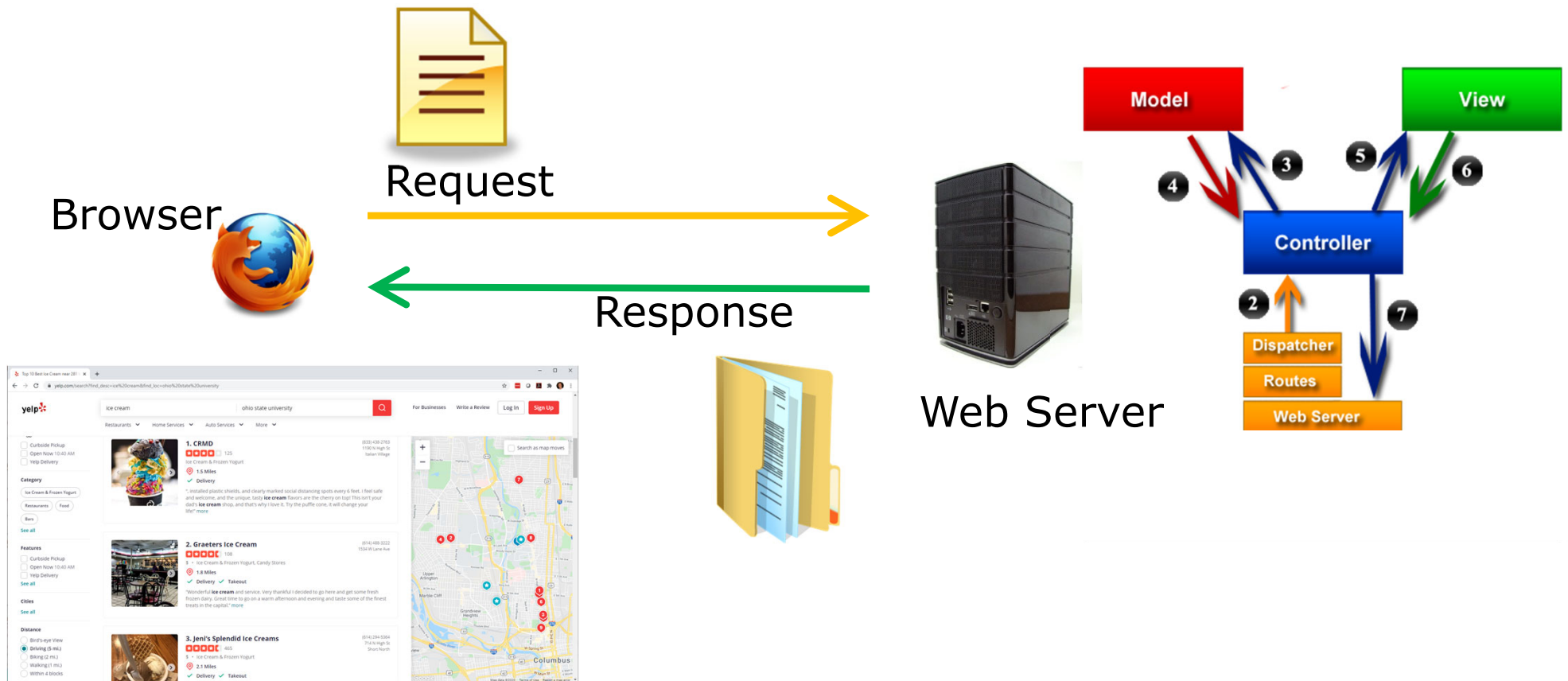
Road Map in Pictures: Web App

The screenshot displays a web browser window showing a Yelp search for "ice cream" near "ohio state university". The search results are sorted by "Top 10 Best Ice Cream near 281". The page features a sidebar with filters for categories, features, and distances. The main content area lists three ice cream shops:

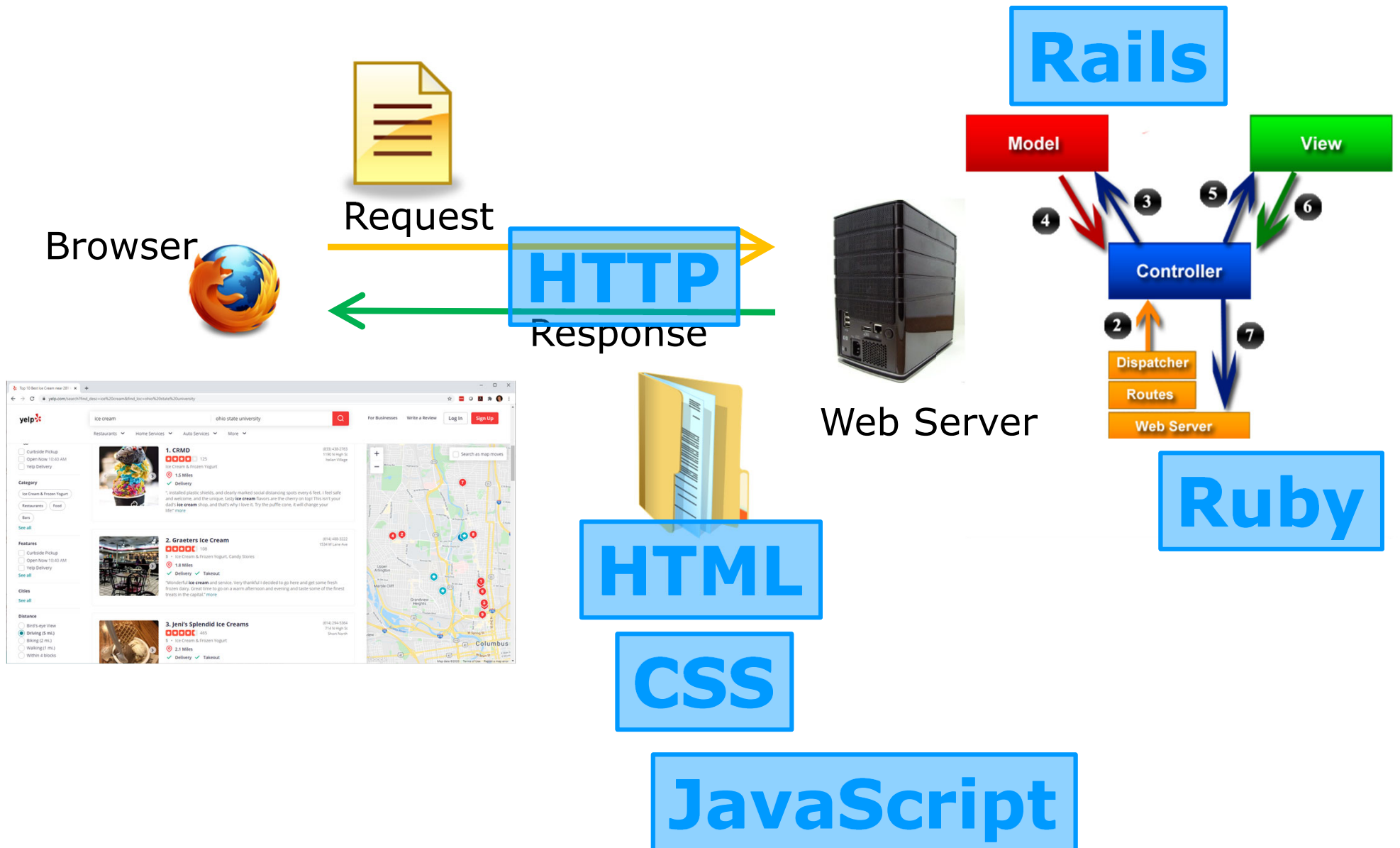
- 1. CRMD**: (833) 438-2763, 1190 N High St, Italian Village. Rating: 4.5 stars (125 reviews). Distance: 1.5 Miles. Features: Delivery. Description: "installed plastic shields, and clearly marked social distancing spots every 6 feet. I feel safe and welcome, and the unique, tasty **ice cream** flavors 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!"
- 2. Graeters Ice Cream**: (614) 488-3222, 1534 W Lane Ave. Rating: 4.5 stars (108 reviews). Distance: 1.8 Miles. Features: Delivery, Takeout. Description: "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."
- 3. Jeni's Splendid Ice Creams**: (614) 294-5364, 714 N High St, Short North. Rating: 4.5 stars (465 reviews). Distance: 2.1 Miles. Features: Delivery, Takeout.

On the right side of the page, a map of Columbus, Ohio, shows the locations of these shops marked with red numbered pins (1-9). The map includes street names, highways, and a search bar that says "Search as map moves".

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 (Increasing Latency)

- Lectures, office hours, meetings
 - Instructor, grader(s)
 - Each other
- Discord Server
 - Group collaboration, messaging
 - Discussion forum, news, announcements
- Class website
 - Handouts, lecture notes, lab assignments
 - Pointers to more resources
- Carmen
 - Syllabus (note exam requirement)
 - Grades

Mens Sana in Corpore Sano

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

Mens Sana in Corpore Sano

- Running plan for the semester:
 - Run from here to Louisville, KY
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- Alternate running plan:

Sun	Mon	Tue	Wed	Thu	Fri	Sat
5 miles	rest	3 miles	rest	4 miles	rest	3 miles

Technical Content

- Languages and Technologies
 - HTTP
 - XML, HTML, CSS, JavaScript
 - 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
 - Ruby
 - git

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 like Rails, Express.js...
 - Ruby gems like Middleman, Nokogiri, Cucumber...
 - JavaScript libraries like Angular, React
 - HTML/CSS libraries like Bootstrap, Baseline, Foundation...

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

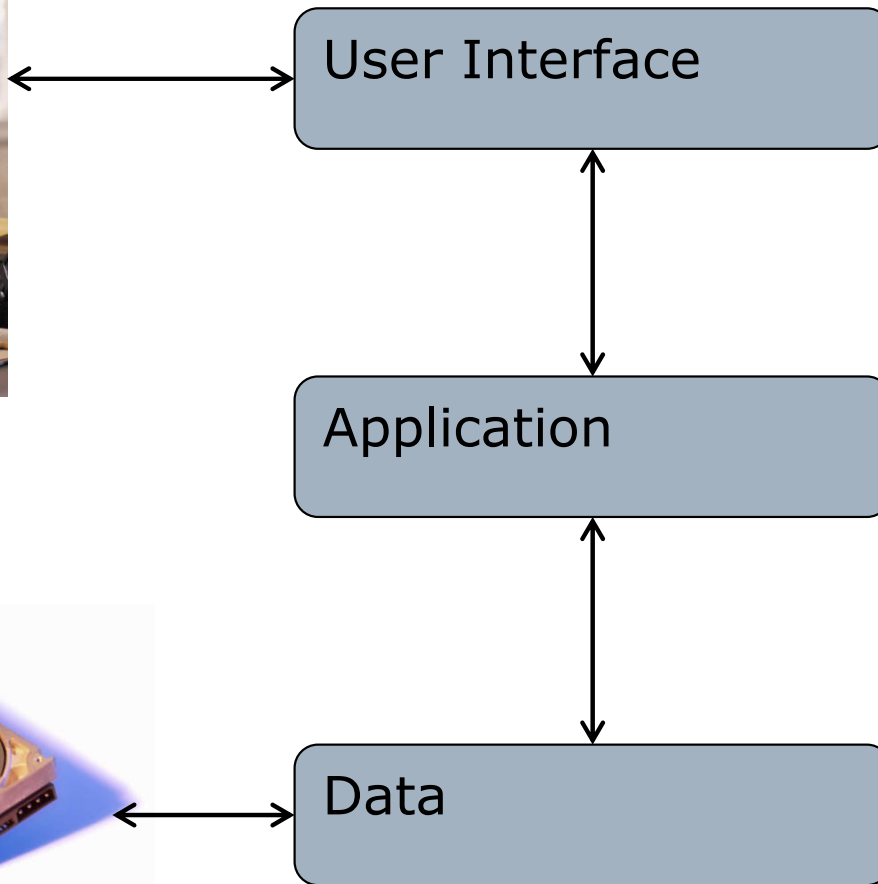
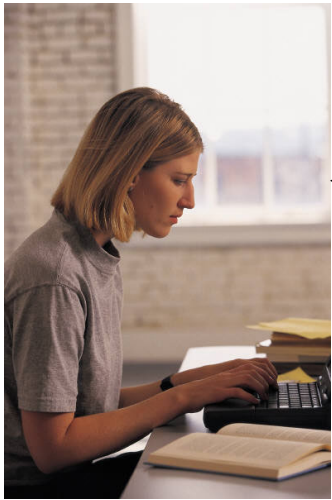
Topic 3: Group Work

- 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)

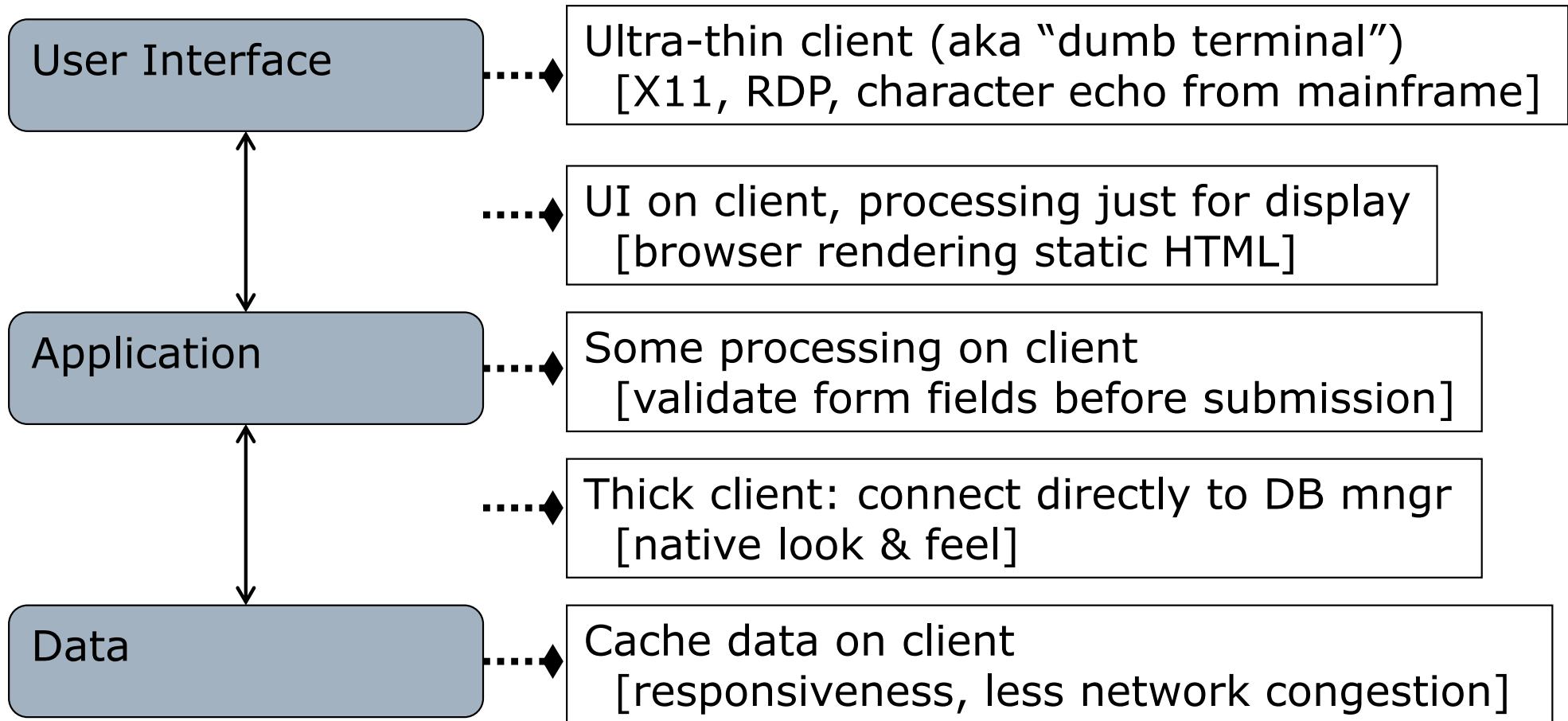
Processing,
Calculating

Persistence,
Transactions,
Triggers



Client-Server App: 2-Tier

Where should we cut?



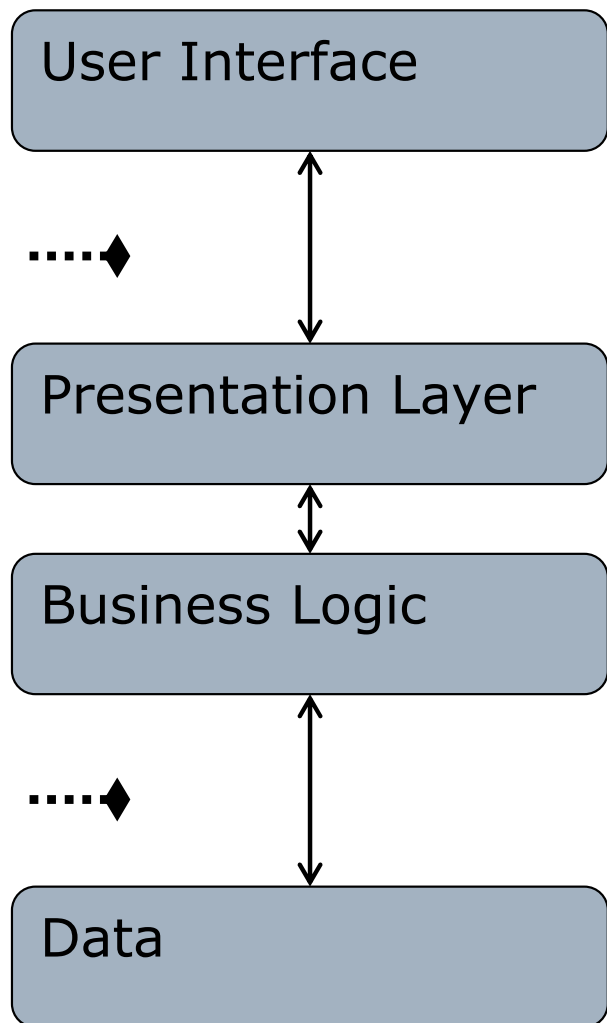
Basic Web App Skeleton: 3-Tier



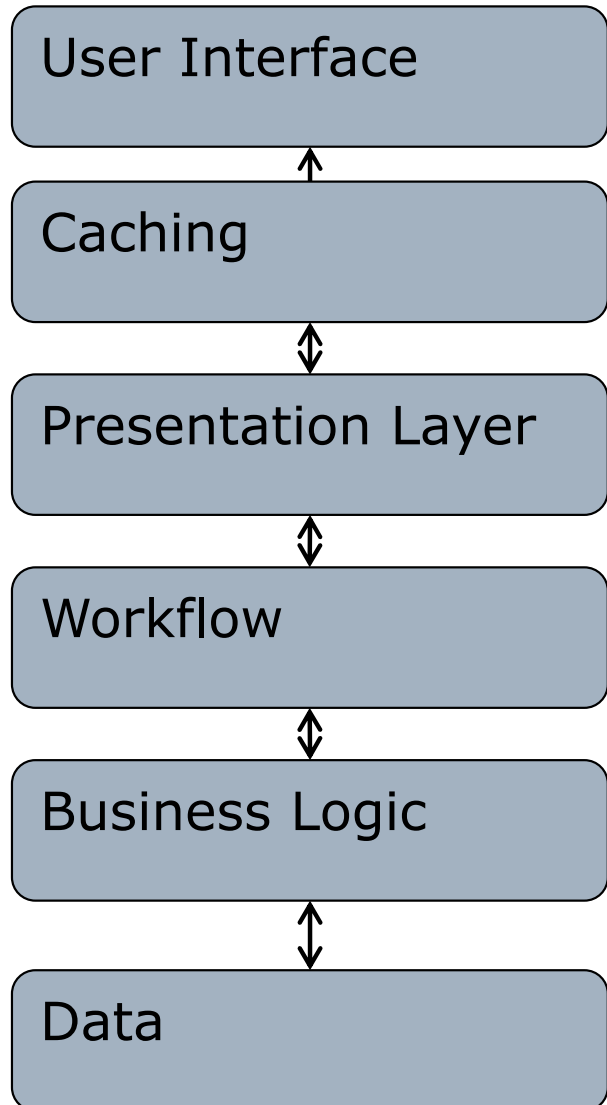
Advantages over Thick Clients

- 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