

# Team 40

**Interactive Learning Tool for Large Size  
Lectures**

# Project Statement

There is an issue with communication and effectiveness in a large classroom setting between the Professor and their students.

Our **web based application** is an attempt to **bridge the gap** in communication by designing a convenient way to interact in a **live lecture** amongst a **large classroom**

# Why is this application needed?

- Students aren't able to talk to professors in large lecture halls
- Students are uncomfortable asking questions in public
- Professors are unable to interact with students effectively
- Professors lose engagement with students

# Our Web Application Will:

Allow Students to:

- Answer polls created by the professor
- Message the class anonymously, and access prior lecture chats to gather information mentioned in the past
- Raise hand, and enter queue to make sure the professor will get back to them
- Direct message professor with questions or concerns

Allow Professor and TA to:

- Create polls
- Take attendance
- Assess performance based on poll data
- Assess participation in class on an individual basis by student
- Address all questions even if they aren't able to be answered during the lecture period

# Users

- Student
  - Shy/Quiet/Tired
  - Overworked/Forgot Something
- TA
  - Nervous
  - Wants to help students learn, but no experience
- Professor
  - Can't keep up with all students in lecture hall
  - New professor
  - Wants feedback
  - Wants to make lectures more engaging

# Project Development Style

- Agile Approach
  - Meet with Faculty Project Lead bi-weekly
  - Obtain feedback, and implement changes discussed
  - Meet as a whole team weekly
  - Meet in our sub-teams weekly
- We utilize GitLab Issues as our means to create stories
- We work in 1 week long sprint increments.

# Project Schedule

- Just finished integrating the frontend/backend
- Finishing all frontend/backend implementation
- Start load testing

A	B	C
Week		
Tasks	Start	Due
Create Mock Designs	9/5/22	9/15/22
Design Document: User Needs	9/7/22	9/22/22
Initial Design For DB Schema	9/14/22	9/22/22
Page Breakdown	9/14/22	10/13/22
Design Document: Requirements	9/14/22	9/22/22
Initial Figma Frontend Design	9/26/22	10/7/22
Hello World Express App	10/3/22	10/7/22
List API's Needed for Frontend	10/3/22	10/7/22
Design Document: Project Plan	10/6/22	10/13/22
Create Database and Schema	10/6/22	10/13/22
Design Document Proposed Design	10/13/22	10/20/22
Containerize Express App	10/20/22	10/27/22
Create Component Definitions	10/20/22	10/27/22
Create Deployment of Express Server	10/27/22	11/3/22
Create React App	10/27/22	11/10/22
Build Basic API's	11/3/22	11/10/22
Implement Express Web Sockets	11/3/22	11/17/22
Working Frontend Application	11/10/22	11/17/22
Test Connection of Frontend/Backend	11/17/22	11/24/22
Integrate Frontend/Backend Deployment	11/28/22	12/2/22
Test Load	12/2/22	12/8/22
Demo	12/8/22	12/15/22
Finalize All API's	1/9/23	1/31/23
Create Additional Features	2/1/23	2/28/23
Finalize Frontend/Backend Implementation	2/27/23	3/2/23
Testing	3/2/23	5/4/23
Final Demo	5/4/23	5/11/23



# Requirements

## Client Specific:

- Intuitive design/use
- Maintainable
- All functionality in one location
  - Without overwhelming user
- Minimalistic look
- Export list of participants
- Dismiss hands raised when

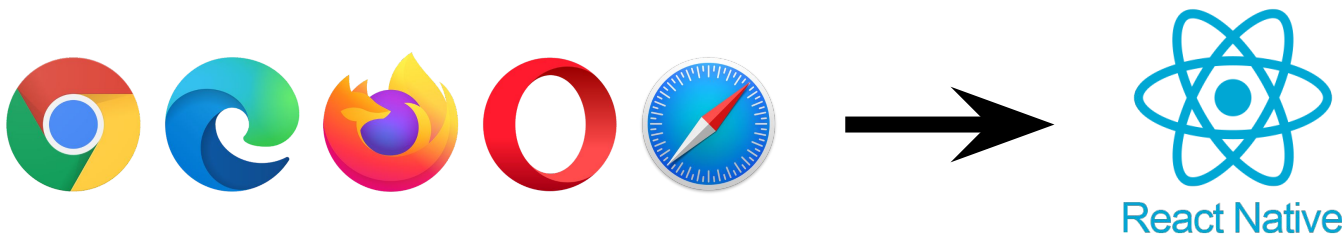
## Team Requirements:

- Able to support 500+ users
- Live Messaging
- Ability to create and answer polls
- Raise hand virtually
- Message Anonymously
- Log and store all posts
- Customizable for both aesthetic and functionality



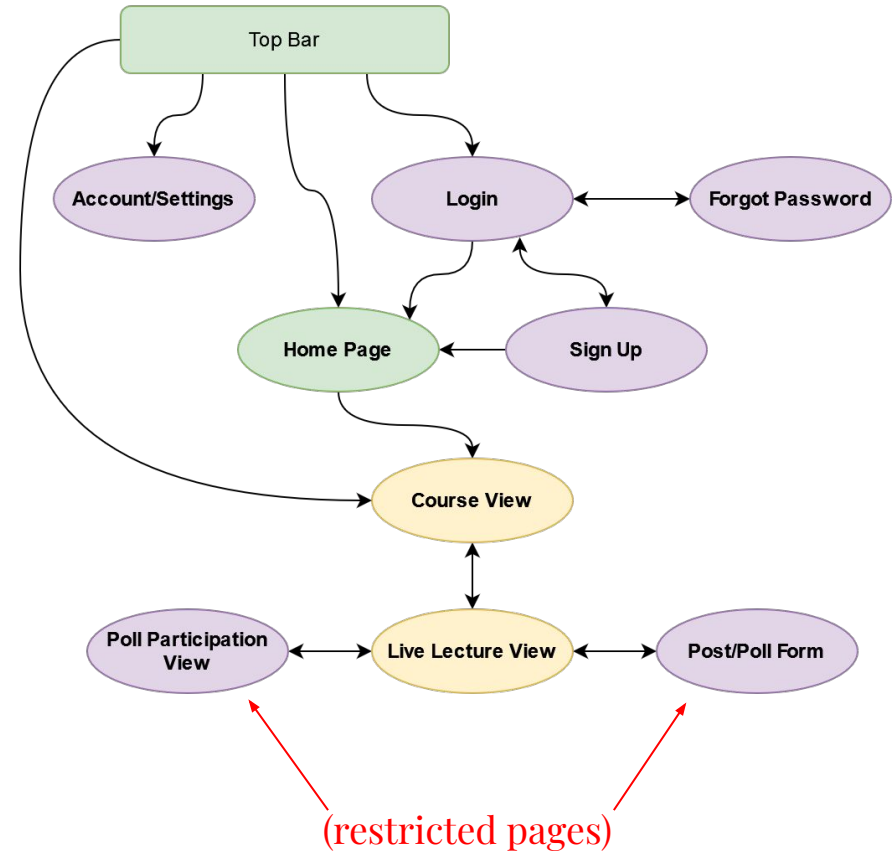
# Design: Frontend - Overview

- React with Webpack
  - Also: Babel, Axios, Redux
- Custom, reusable components
  - Can precisely tailor to requirements
- First iterations in browser
  - Can eventually port to applications using React Native



# Design: Frontend - Page Flow

- Entry point: Login
- Top Bar is always present
- Color key:
  - **Green** = navigational page/component
  - **Purple** = minor page
  - **Yellow** = major page



LIVE A lecture is live right now! JOIN LECTURE

Filter By Date last 24 hours last 7 days all time

- Example Lecture Title Maruf Professor NEW LECTURE
Click here to join - started 14 min ago
9/14/22 - 10:45am
Example Old Lecture Title Maruf Professor
Today we reviewed the structure of a multiplexer and created truth tables for an example multiplexer.
54 min • 243 participants • 43 messages & 2 polls
9/13/22 - 10:45am
Another Example Old Lecture Title Maruf Professor
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LIVE A lecture is live right now! JOIN LECTURE

Filter By Date last 24 hours last 7 days all time By Role Professor TA Student By Post Announcement Question Poll

- Example Lecture Title Maruf Professor NEW LECTURE NEW POST
Click here to join - started 14 min ago
9/14/22 - 10:45am
Example Old Lecture Title Maruf Professor
Today we reviewed the structure of a multiplexer and created truth tables for an example multiplexer.
54 min • 243 participants • 43 messages & 2 polls
9/13/22 - 10:45am
Example Announcement Title Billy Bob Announcement
Lorem ipsum dolor sit amet, consectetur adipiscing elit. Donec vitae est ac lectus posuere molestie vel nec libero. Suspendisse id cursus arcu, in malesuada tortor. Sed quis pellentesque mauris, sed pellentesque quam. Mauris sit amet tellus faucibus, tristique nisi eu, faucibus odio. Nulla ac pretium urna. In mauris sem, molestie ut massa vitae, gravida fermentum sapien. Etiam aliquam risu a magna ultrices posuere. Aliquam erat volutpat.
9/10/22 - 5:32pm
Example Question Title You Student Question
Lorem ipsum dolor sit amet, consectetur adipiscing elit. Donec vitae est ac lectus posuere molestie vel nec libero. Suspendisse id cursus arcu, in malesuada tortor. Sed quis pellentesque mauris, sed pellentesque quam. Mauris sit amet tellus faucibus, tristique nisi eu, faucibus odio. Nulla ac pretium urna. In mauris sem, molestie ut massa vitae, gravida fermentum sapien. Etiam aliquam risu a magna ultrices posuere. Aliquam erat volutpat.
9/10/22 - 11:54am
Another Example Old Lecture Title Maruf Professor
Today we reviewed the structure of a multiplexer and created truth tables for an example multiplexer.
54 min • 243 participants • 43 messages & 2 polls
9/10/22 - 10:45am
Example Announcement Title 2 Billy Bob Announcement
Lorem ipsum dolor sit amet, consectetur adipiscing elit. Donec vitae est ac lectus posuere molestie vel nec libero. Suspendisse id cursus arcu, in malesuada tortor. Sed quis pellentesque mauris, sed pellentesque quam. Mauris sit amet tellus faucibus, tristique nisi eu, faucibus odio. Nulla ac pretium urna. In mauris sem, molestie ut massa vitae, gravida fermentum sapien. Etiam aliquam risu a magna ultrices posuere. Aliquam erat volutpat.
9/14/22 - 5:32pm

future

HOSTED BY Maruf Professor Example Lecture Title Started 14 min ago CLOSE LECTURE

LEAVE Filter By Role Professor TA Student By Type Message Poll

Message from Billy Bob: Lorem ipsum dolor sit amet, consectetur adipiscing elit. Donec vitae est ac lectus posuere molestie vel nec libero. Suspendisse id cursus arcu, in malesuada tortor. Sed quis pellentesque mauris, sed pellentesque quam. Mauris sit amet tellus faucibus, tristique nisi eu, faucibus odio. Nulla ac pretium urna. In mauris sem, molestie ut massa vitae, gravida fermentum sapien. Etiam aliquam risu a magna ultrices posuere. Aliquam erat volutpat.
Message from Anonymous: Hmm, very interesting. Could I get more detail?
9/9/22 - 10:45am You Student

POLL closes in 2 min VIEW PARTICIPATION
If temperature diffuses uniformly and water boils at 100 degrees Celcius, what is the precise circumference of the Sun within 3 significant digits?
5.23 X 10^5
9.72 X 10^15
2.45 X 10^25
2

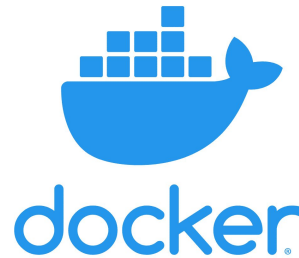
Message from Maruf Professor: Enter new message
Anonymous SEND

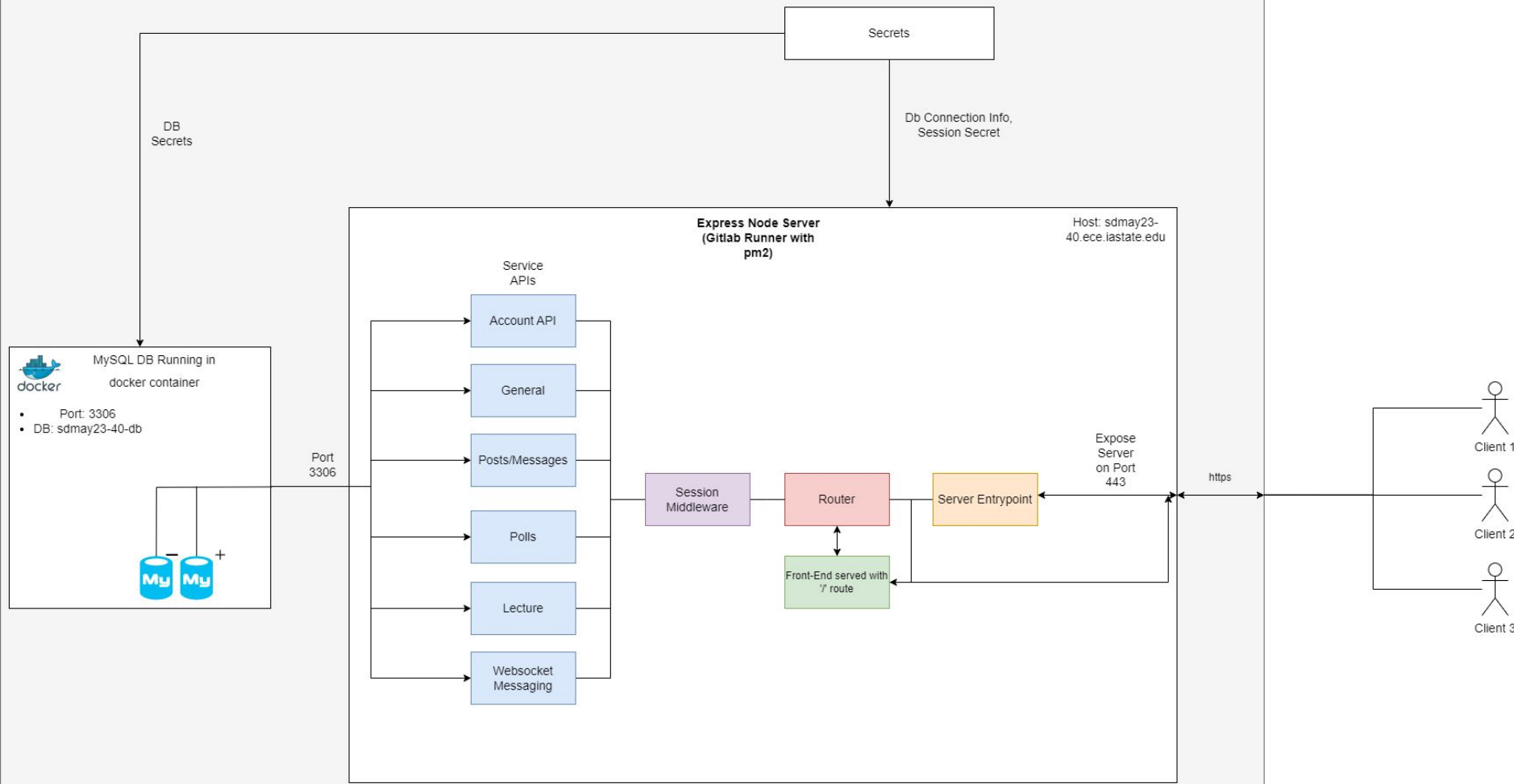
RAISE HAND NEW POLL

# Design: Backend-Overview

- ISU VM
  - Ubuntu
- Express Server
  - Easy to use
  - API creation
  - Handles both backend and frontend
  - Easy Websockets
- MySQL Database
  - Docker MySQL Image
  - Lightweight
  - Easy to use
  - Tons of Documentation
- Pm2 library
  - Load balancing

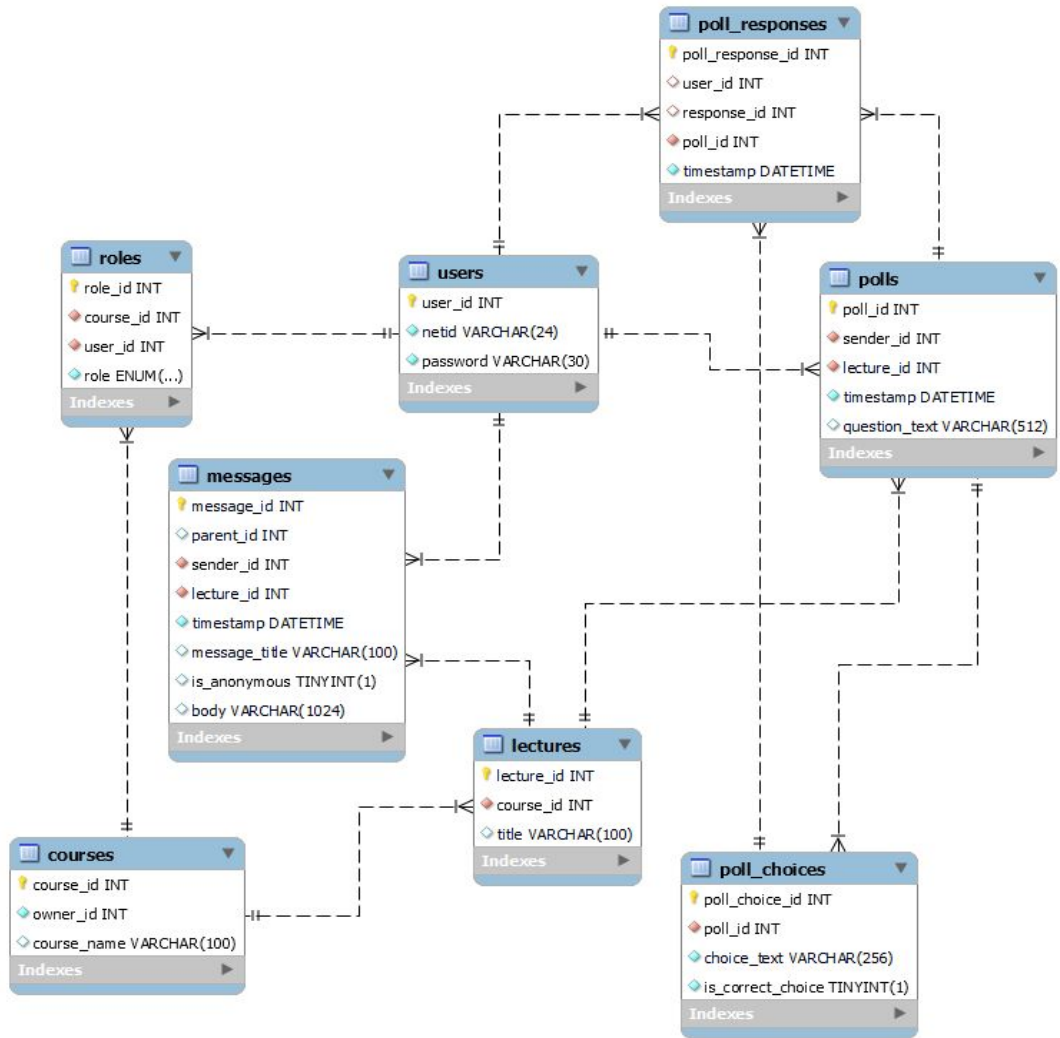
Express JS





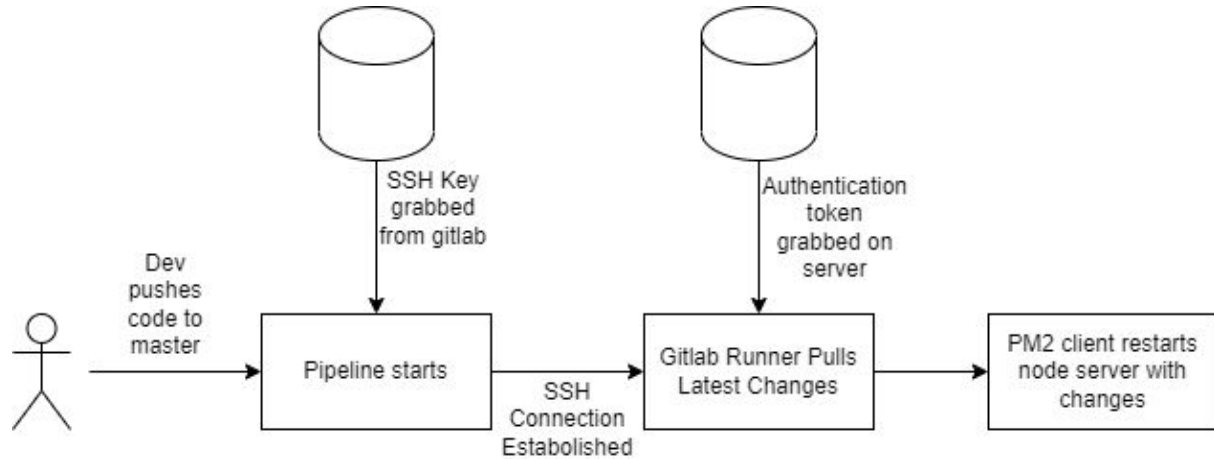
# Design: Database

- MySQL DB running inside of a docker container
- Storage efficient design
  - No data stored multiple times



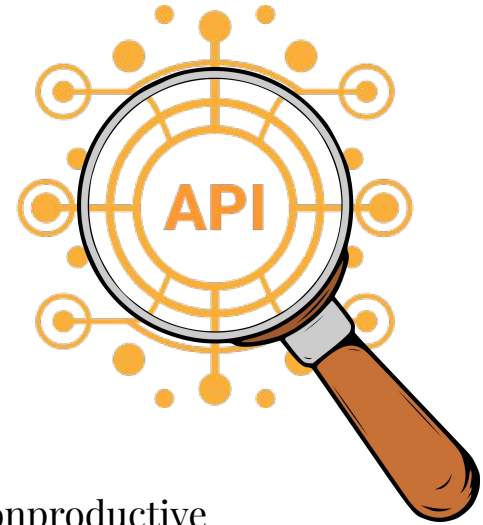
# Design: Deployment Pipeline

- Gitlab Deployment Pipeline
- Utilizes Gitlab runner
- Deploys both Frontend and Backend in single pipeline



# Testing - Overview

- Lightweight testing strategy
  - Non-critical system
- Focus is on APIs
  - Captures core functionality
  - Rigorous testing of frontend rendering is complex and nonproductive
    - Variable view requirements
- When: after minimum viable product





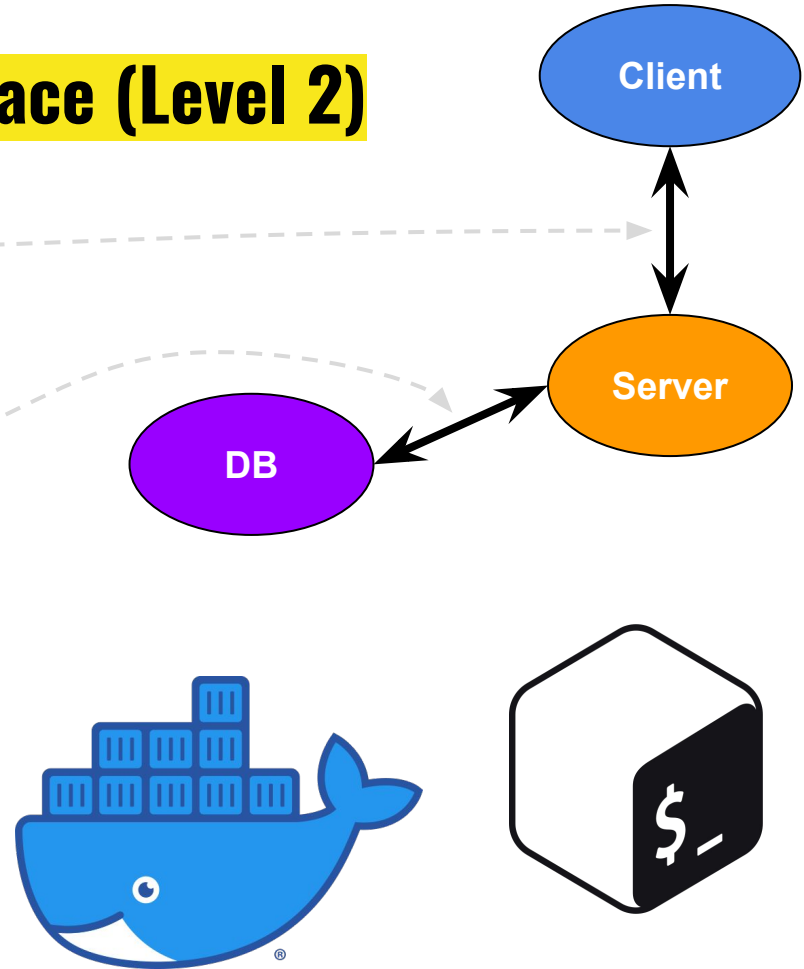
# Testing - Unit (Level 1)

- Frontend:
  - Commonly-used React components
- Backend:
  - Database
  - APIs
- Tools: Jest, Enzyme, MySQL Workbench, Postman



# Testing - Integration & Interface (Level 2)

- Frontend:
  - Page loading/routing
  - Proper component layout
  - WebSocket communication
- Backend:
  - Database-related APIs
- Tools: Jest, Docker, Bash



# Testing - System (Level 3)

- Live-lecture messaging
  - Units: front-end consumers, relevant backend APIs, and database queries
  - Integrations: WebSockets, full backend APIs (with database), health check
- Tools: Jest, Docker, Bash

The screenshot displays a chat interface for a lecture titled "Example Lecture Title", which started 14 minutes ago. A "CLOSE LECTURE" button is in the top right. The chat contains several messages:

- A system message with placeholder text: "Lorem ipsum dolor sit amet, consectetur adipiscing elit. Donec vitae est ac lectus posuere molestie vel nec libero. Suspendisse id cursus arcu, in malesuada tortor. Sed quis pellentesque mauris, sed pellentesque quam. Mauris sit amet tellus faucibus, tristique risi eu, faucibus odio. Nulla ac pretium urna. In mauris sem, molestie ut massa vitae, gravida fermentum sapien. Etiam aliquam risus a magna ultrices posuere. Aliquam erat volutpat." (9/9/22 • 10:45am)
- A message from "Billy Bob" (Student) with the same placeholder text. (9/9/22 • 10:45am)
- A message from "Anonymous" (Student) with the same placeholder text and a file attachment named "important\_stuff.pdf". (9/9/22 • 10:45am)
- A message from "You" (Student) saying "Hmm, very interesting. Could I get more detail?". (9/9/22 • 10:45am)

A "POLL" section is active, titled "If temperature diffuses uniformly and water boils at 100 degrees Celsius, what is the precise circumference of the Sun within 3 significant digits?". It shows four options with checkboxes:

- 5.23 X 10<sup>15</sup>
- 9.72 X 10<sup>15</sup>
- 2.45 X 10<sup>25</sup>
- 2

The poll is set to "close in 2 min" and has a "VIEW PARTICIPATION" button. A message from "Manuf" (Professor) is partially visible at the bottom. At the very bottom, there is a message input field with a "SEND" button and a selection for "Anonymous" with a lock icon.

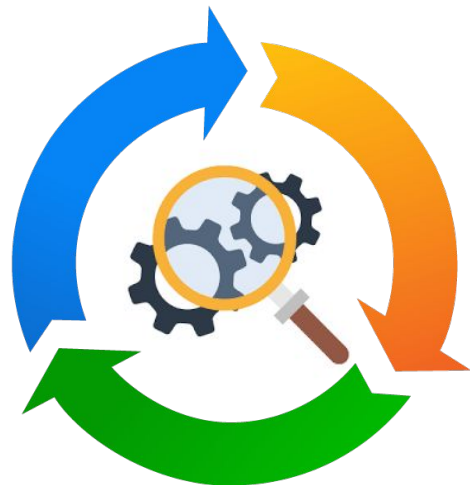
# Testing - Acceptance (Level 4)

- Live demos with client
  - Frequent meetings with client
  - Verify functionality and aesthetic
- Live demos with potential users
  - Students, professors, etc.
  - Get requirement-related feedback



# Testing - Miscellaneous

- Regression testing
  - Automated unit and (some) integration tests in CI/CD pipeline
    - Hit every API endpoint
  - Health check endpoints
- Security testing
  - HTTPS simplifies this
  - Verify endpoints require session
  - Not able to use Okta
  - Possibly implement OAuth 2.0 later



# Conclusion

- **Task:** To create an easy to use communication tool
- **Solution:** Web application that uses React native on the frontend, Express on backend, and MySQL to store information
- Things that could have been done differently
  - More detailed planning
  - Implement some modules earlier - API's
- Future
  - Adding additional features
  - Testing

# Demo Video

