

CS512: Group Project Proposal

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Overview

The goal is to build a lightweight distributed communication system where messages flow directly between browsers without a central relay server. We plan to illustrate key concepts in distributed systems such as decentralized communication and real-time data synchronization.

System Architecture

The first layer would be the **signaling layer** (Firestore), which can be used for initial connection setup before a handshake can happen. Another core layer is the **peer-to-peer layer** (WebRTC DataChannel). After signaling completes, the peers will establish a direct connection using WebRTC, specifically the DataChannel API, which enables low-latency, bidirectional data transfer between browsers. Lastly, we would have a simple **client application layer** (React/Templating Engine and Firebase SDK). This would be a simple web interface to allow users to create or join chat rooms, send messages, and observe real-time updates.

Tentative Tech Stack

- TypeScript (NestJS + React)
- Firebase Firestore
- WebRTC, STUN/TURN servers
- Firebase hosting

Deliverables

There will be two main deliverables. First would be a working P2P messaging **web app** hosted online. We also plan to do an **in-class demo** and **final paper** (≤ 10 pages) documenting architecture, design decisions, challenges, and learning outcomes.