



ISEL
INSTITUTO SUPERIOR DE
ENGENHARIA DE LISBOA

NoteSpace

Multi-platform Web Application for Real-Time Document
Collaboration & Sharing

Project Seminar

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Context

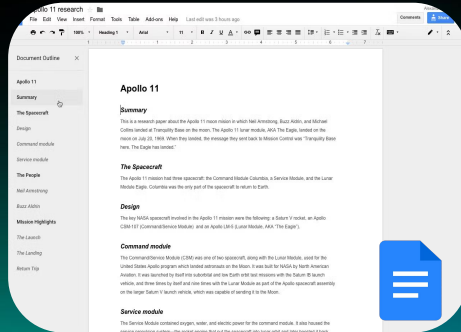
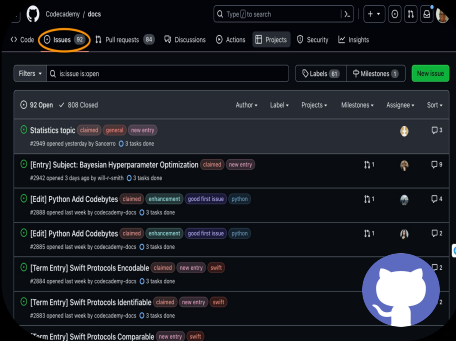
Version Control Platforms

✓ Explicit Version Control

✓ Offline Support

✓ Public Sharing Hub

✓ Workspace Management



Live Collaboration Tools

✓ Real-time Collaboration
✓ Other Collaboration Features

What if we could have both?

Solution



Real-time
Collaboration



Markdown Editor



Workspace
Management



Sharing Platform

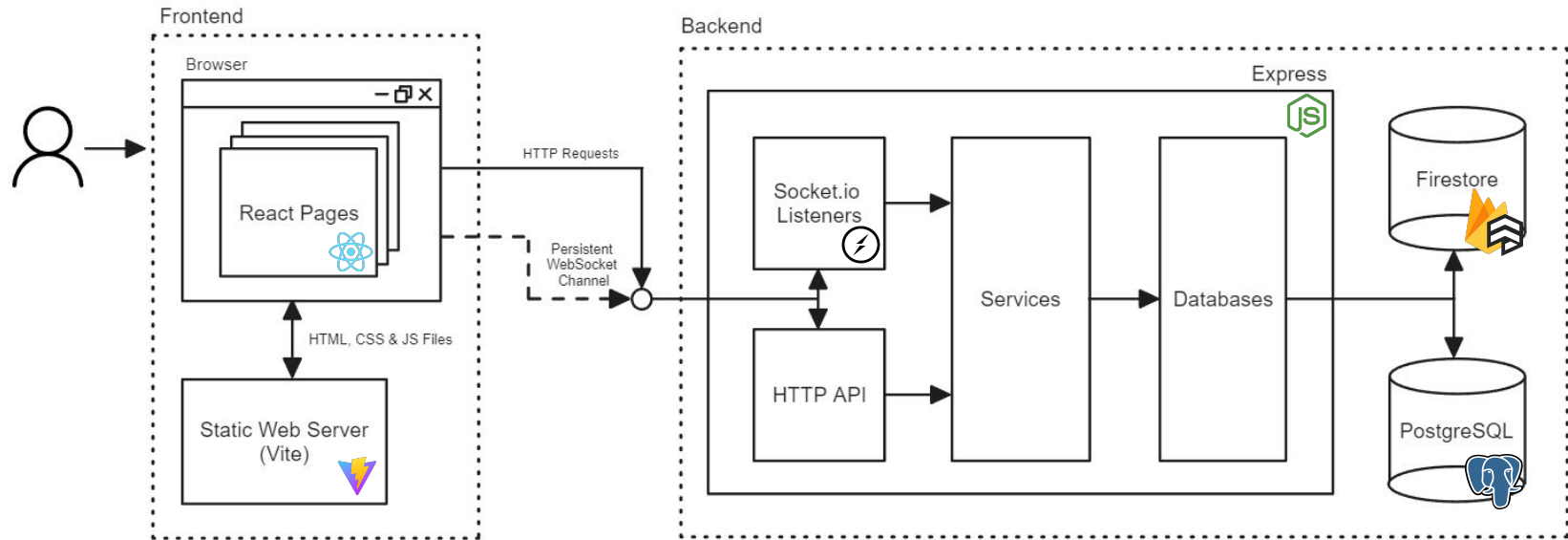


Multi-platform (PWA)



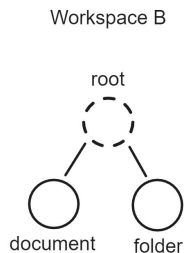
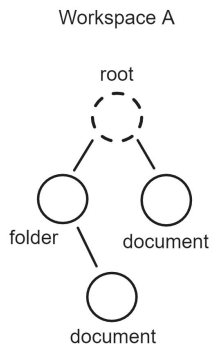
Version Control

System Architecture



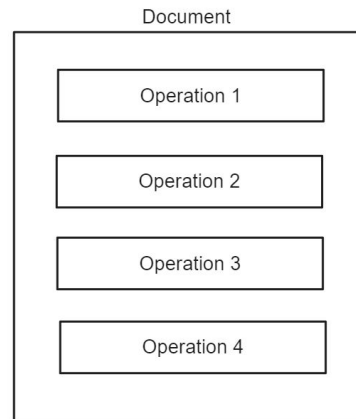
Data Model

Metadata



- Strong data structuring
- Efficiency with complex queries
- Use of triggers

Content Data



- Faster R/W speeds
- Data structure flexibility
- Efficient for large amounts of data

Technologies

Frontend



React



Vite



Vitest

Backend



NodeJS



ExpressJS



Firebase



PostgreSQL

Common

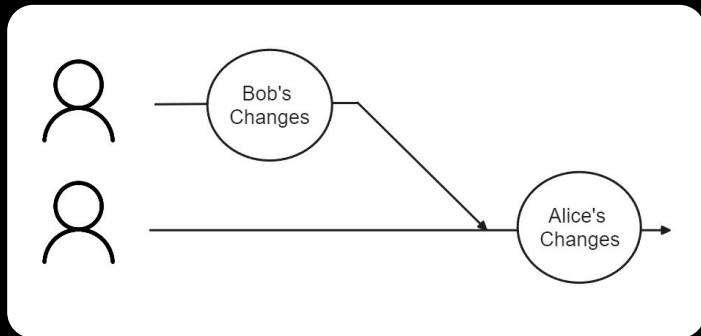


TypeScript



Socket.io

Async vs. Sync Collaboration

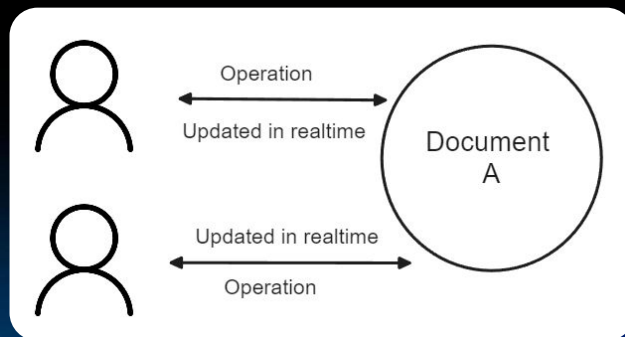


Async Collaboration

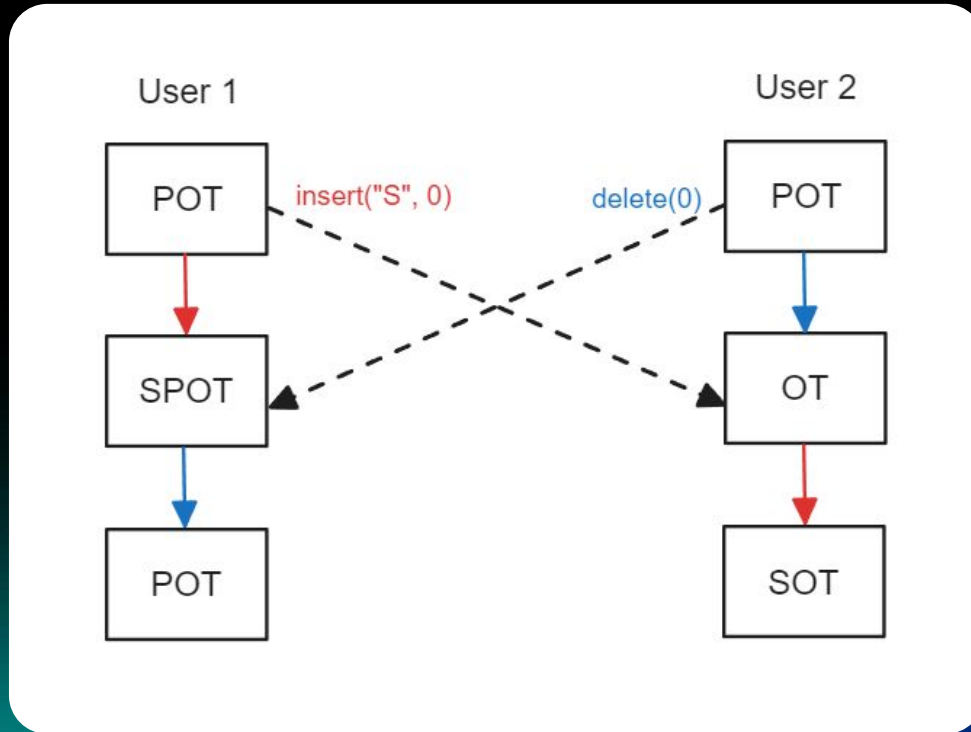
- Manual commits
- Needs to merge before pushing changes
- Used in version control systems

Sync Collaboration

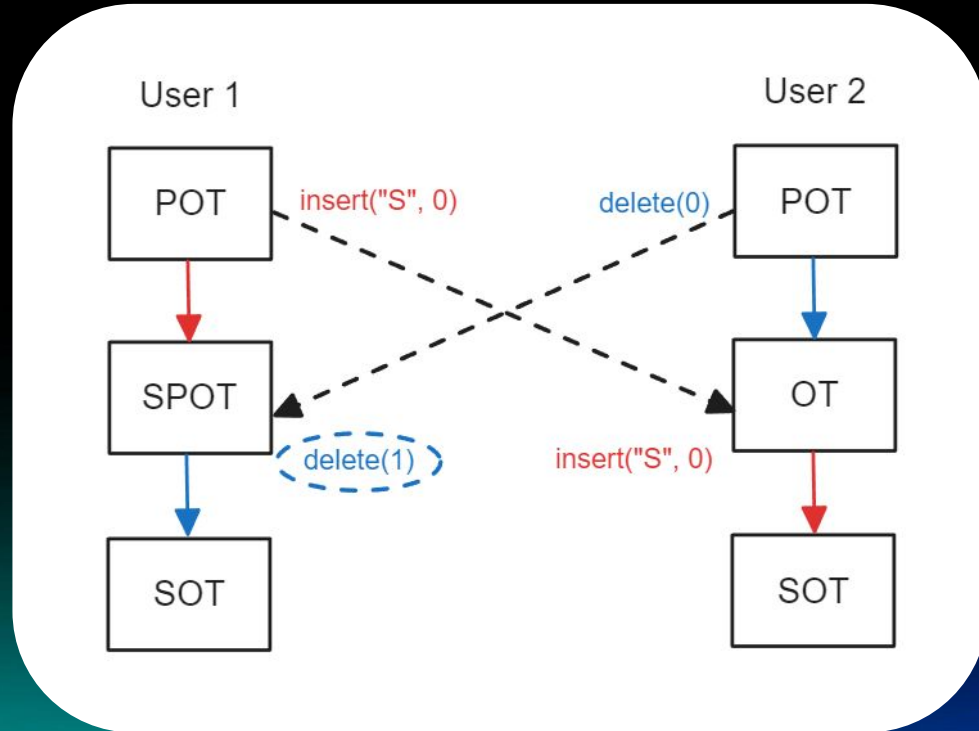
- Simultaneous editing
- Automatic real-time synchronization
- Needs conflict resolution algorithm



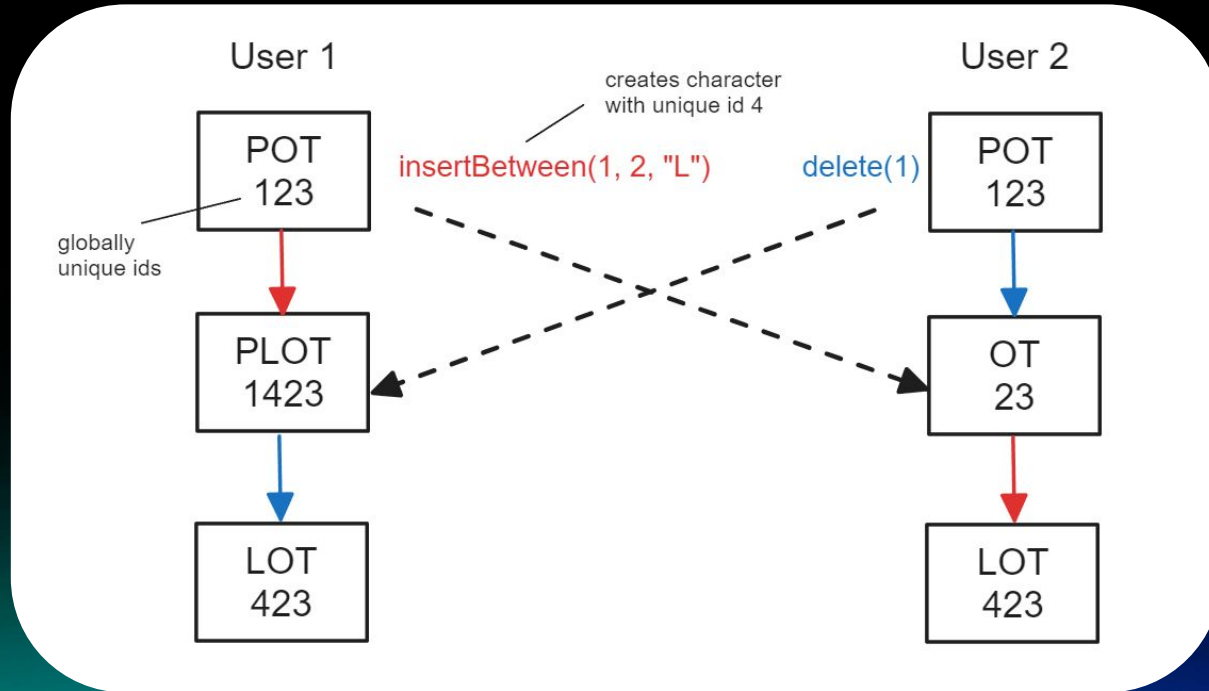
Conflict Resolution Algorithm



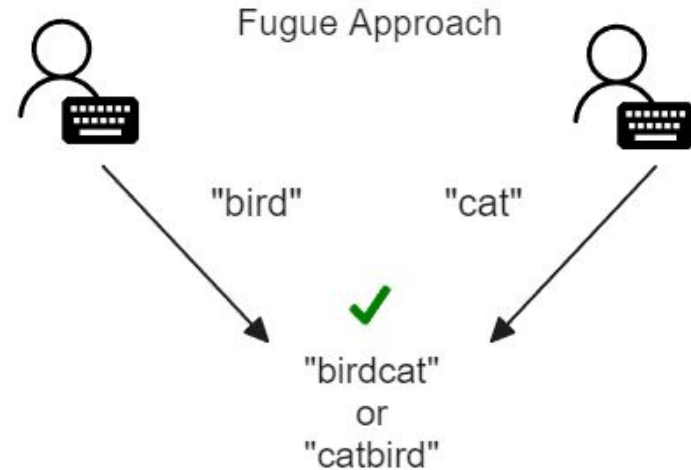
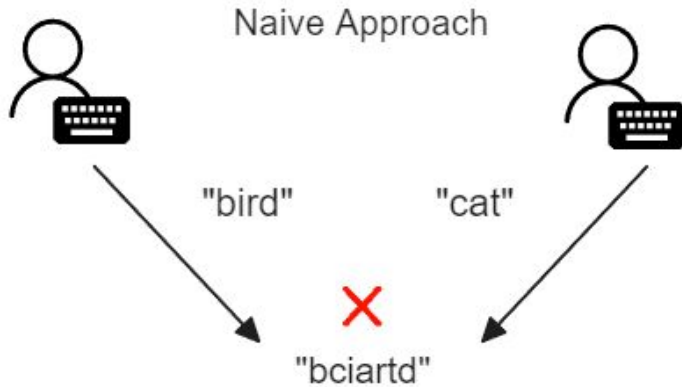
Operational Transformation (OT)



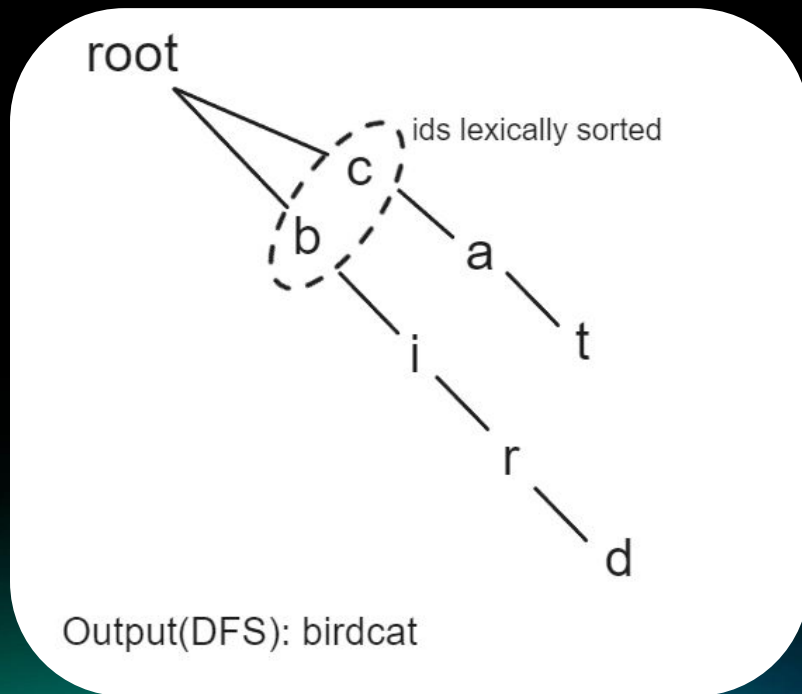
Conflict-Free Replicated Data Types (CRDT)



Interleaving Anomaly

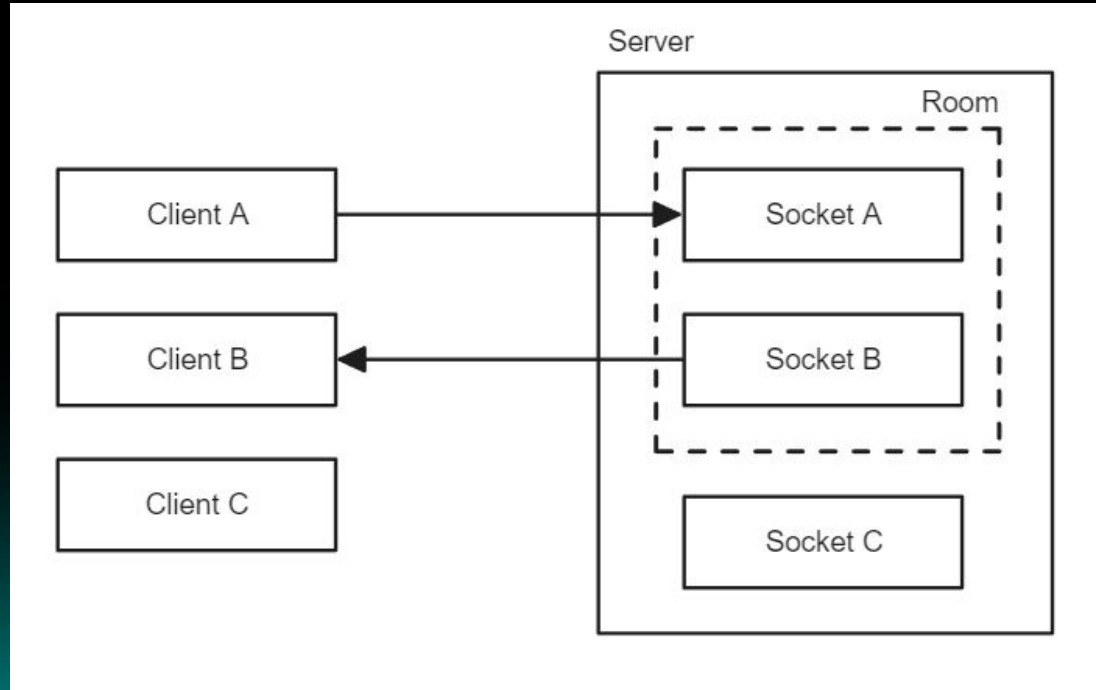


Fugue CRDT

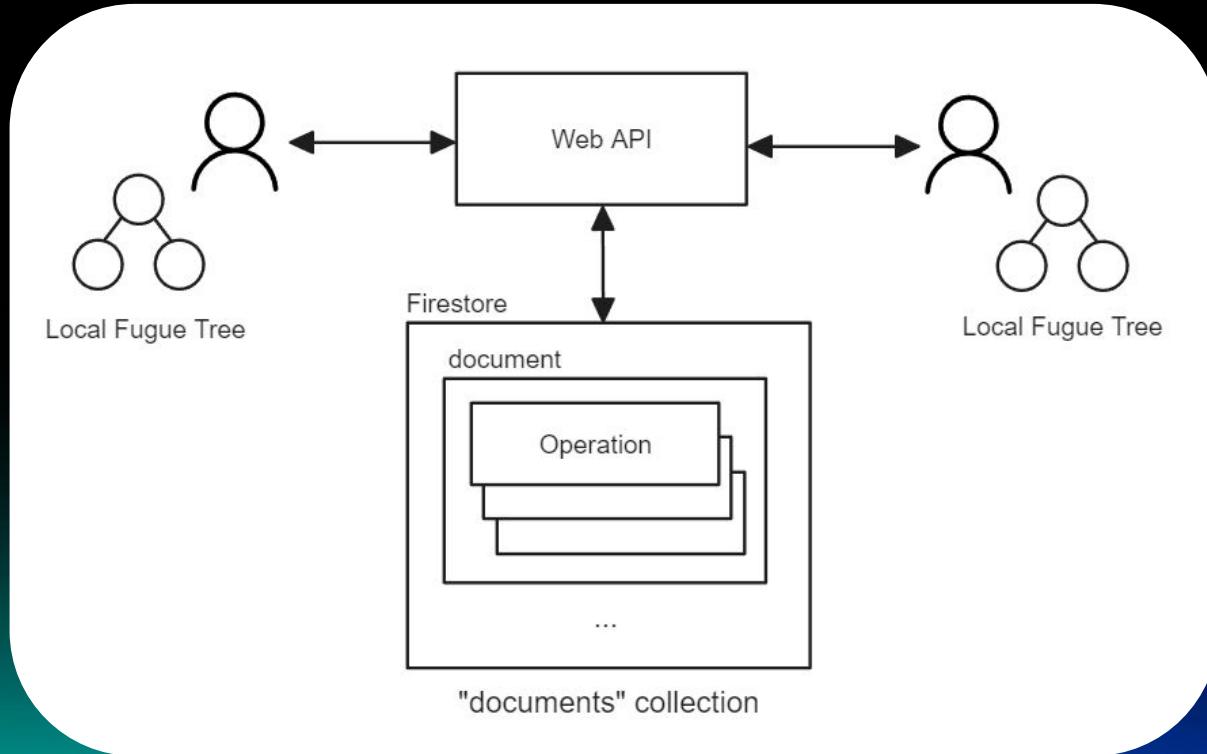


- N-ary tree
- Same side nodes lexically sorted
- Node's id as causal dot
- DFS traversal

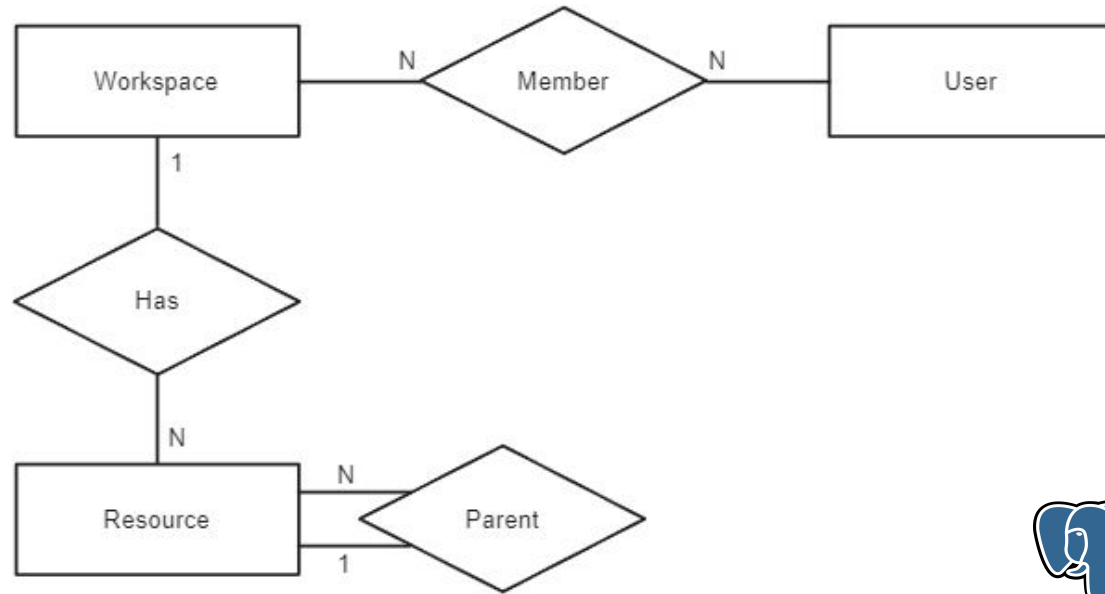
Isolating WebSocket Events with Rooms



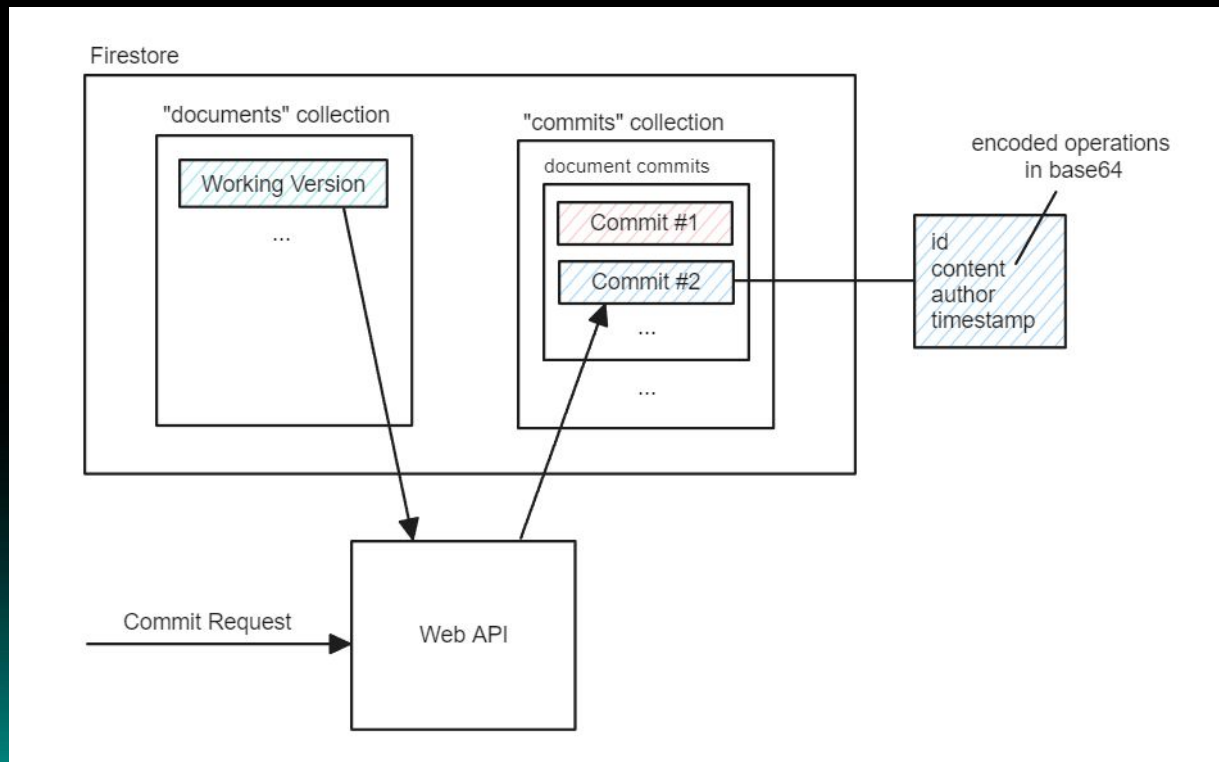
Operation Handling



Workspace Management

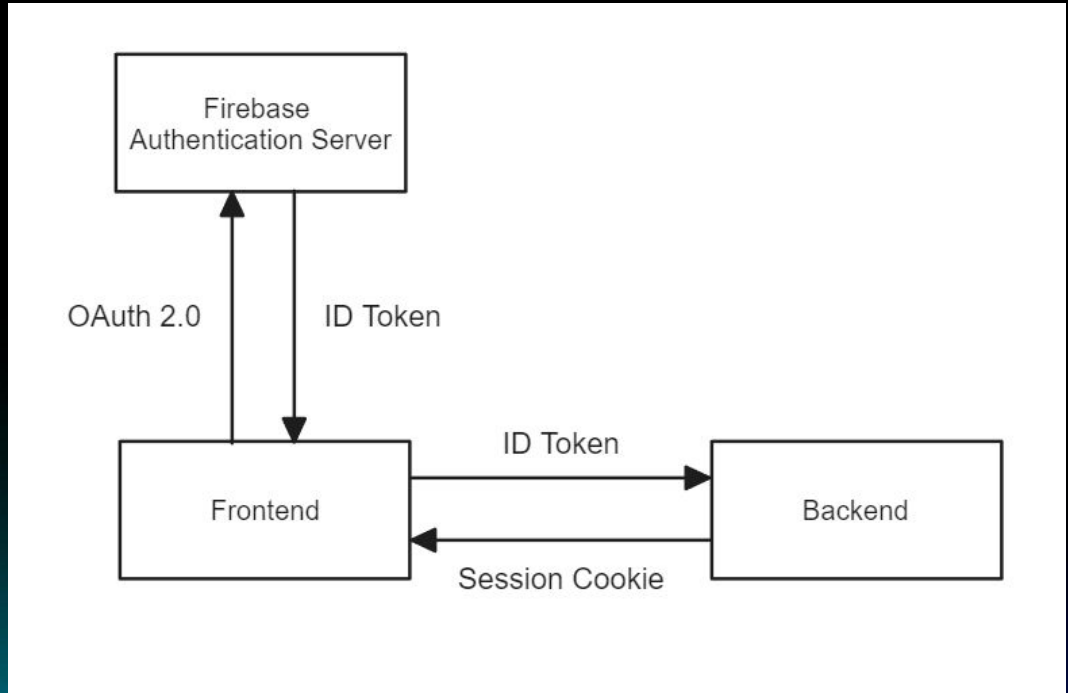


Version Control



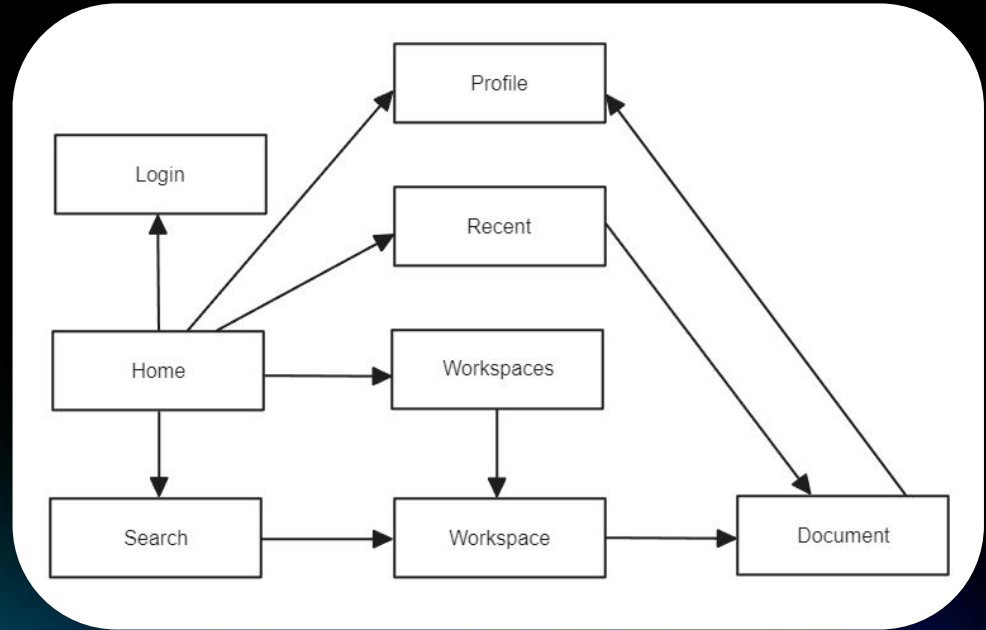
User Authentication - Auth Flow

1. Provider Choice
2. Firebase Authentication
3. Retrieve ID Token
4. API Request with ID Token
5. Session Cookie
6. User Registration



Sharing Platform

- User Profiles
- Workspace Searching
- Recently Edited Documents
- Public Workspace Feed



Progressive Web Apps (PWAs)

- PWAs are web applications that use modern web capabilities to deliver an app-like experience to users
- Combine the best of web and mobile apps
- Require a responsive app and HTTPS connection

Completed Work

- Conflict Resolution Algorithm with Fugue CRDT
- Collaborative Markdown Editor
- Workspace Management
- User Authentication & Authorization
- Version Control System
- Sharing Platform

Future Work

- Offline Mode
- Workspace Member Roles (RBAC)
- Extra Version Control Functionalities
- History (Undo/Redo)
- Scalable Architecture for Multiple Servers
- Responsive Layouts For Mobile

Demonstration