

PeerLearn Labs

PeerLearn — Technical Overview & Analysis (v2)

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1. Scope & Purpose

Defines PeerLearn's MVP, architecture, data model, real-time flows, security essentials, delivery order, and risks.

2. Grounded Facts & Rationale

Summarizes platform choices: .NET 8 LTS, ASP.NET Core, SignalR, React, Slate, Yjs, WebRTC, MongoDB, and EF Core for SQL.

3. MVP Definition

Must-have features: authentication, rooms, shared notes, flashcards/quizzes, and progress tracking. Post-MVP: voice study, badges, analytics.

4. Architecture Overview

Backend: ASP.NET Core (.NET 8 LTS), Frontend: React + Slate + Yjs. Persistence: MongoDB + SQL. Real-time: SignalR, y-websocket. Optional voice via WebRTC + TURN.

5. Data Model (MVP slice)

Outlines core collections/tables: User, Room, Note, Flashcard, QuizResult, Presence.

6. Real-Time Notes Flow

Explains how editor updates propagate through Slate, Yjs, and y-websocket with awareness and snapshots.

7. Voice Chat (Optional)

WebRTC peer connections with TURN fallback, signaled via SignalR.

8. Security Essentials

JWT validation, HttpOnly cookies, HTTPS enforcement, rate limiting, data protection, input validation.

9. Build Order

Sequencing: Auth → Rooms → Notes → Flashcards/Quizzes → Progress tracking → Realtime events → Hardening.

10. Do's & Don'ts

Do: target .NET 8 LTS, use HttpOnly cookies, pick y-websocket for auth. Don't: store tokens in localStorage or rely on y-webrtc for auth-sensitive docs.

11. Risks & Mitigations

Weak token storage, NAT traversal issues, SQL vs MongoDB requirements, real-time conflicts. Mitigated with secure defaults, TURN deployment, hybrid persistence, and periodic snapshots.

12. Delivery Plan (4 Months)

Month 1: Backend setup, auth, rooms

Month 2: Real-time collaboration, flashcards/quizzes

Month 3: Progress tracking, gamification, polish

Month 4: QA, security, performance fixes

13. References

Microsoft .NET lifecycle, ASP.NET Core docs, SignalR, React survey, Slate/Yjs/WebRTC documentation, MongoDB/EF Core, OWASP security, AI providers.