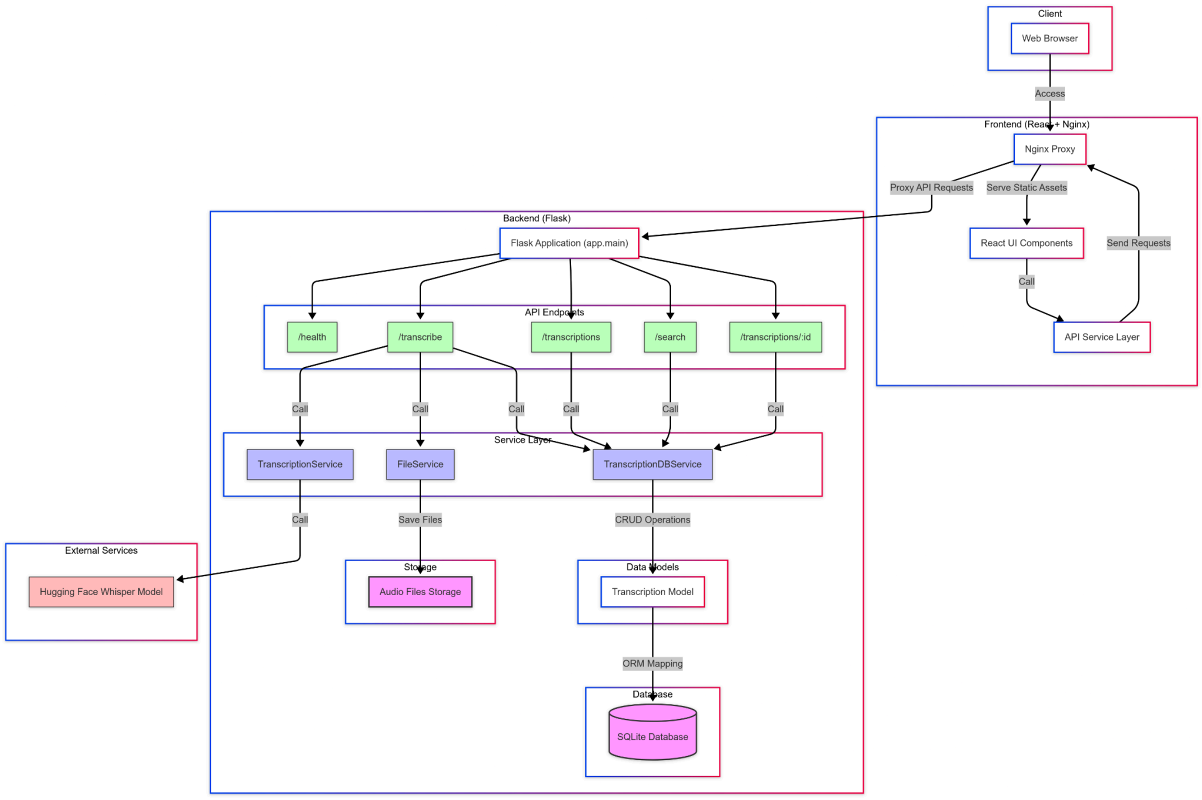
Architecture



1. Client Layer

- **Web Browser**: Users access the application through a web browser

2. Frontend Layer

- **React UI Components**: User interface components
- **API Service Layer**: JavaScript services that encapsulate API calls
- **Nginx Proxy**:
  - Serves static assets
  - Proxies API requests to the backend

3. Backend Layer

- **Flask Application**: Core application entry point
- **API Endpoints**:
  - /health: Health check endpoint
  - /transcribe: Process audio transcription
  - /transcriptions: Retrieve all transcriptions
  - /search: Search transcriptions
  - /transcriptions/:id: Get specific transcription

- **Service Layer**:
    - TranscriptionService:
        - Uses Whisper model for audio transcription
        - Implemented as a singleton
    - FileService:
        - Handles file uploads and storage
        - Generates unique filenames
    - TranscriptionDBService:
        - Encapsulates all database operations
        - Provides CRUD functionality
- **Data Models**:
    - Transcription: Transcription record model

4. Storage Layer

- **SQLite Database**:
    - Persists transcription records
    - Preserved through Docker volumes
- **Audio Files Storage**:
    - Stores uploaded audio files
    - Preserved through Docker volumes

5. External Services

- **Whisper Model**:
    - Provided by Hugging Face Transformers
    - Performs speech recognition

6. Data Flow

1. User uploads audio file
2. Request passes through Nginx proxy to Flask backend
3. FileService saves the audio file
4. TranscriptionService calls Whisper model for transcription
5. TranscriptionDBService saves results to database
6. Results are returned to frontend and displayed to user

7. Storage Volumes

- **sqlite-data**: Persists database
- **uploads-data**: Persists uploaded audio files

8. Some Consideration

1. Why not use asynchronization?

a. The transcription service intentionally uses synchronous processing rather than asynchronous patterns because the Whisper model inference process is primarily CPU-bound rather than I/O-bound. For CPU-intensive tasks like speech recognition, asynchronous programming offers minimal performance benefits since the bottleneck is computational processing power, not waiting for external resources. Adding asynchronous complexity would increase code complexity without meaningful performance gains. For higher throughput, horizontal scaling (adding more service instances) would be more effective than asynchronous implementation within a single instance.