

EchoNest AI - Contract to Component Mapping

Overview

This document maps the service contracts to the four main system components of EchoNest AI, highlighting the responsibilities and dependencies of each component in relation to the contract specifications.

1. Frontend (Web App)

Responsible for Implementing:

- **User Interface for Authentication & Profile Management**
 - Contract: EchoNest_AI_Frontend_Backend_Contract_Part1_Auth_Profile
 - Components: Login forms, registration flows, profile editors, role management UI
- **Content Upload & Management Interface**
 - Contract: EchoNest_AI_Frontend_Backend_Contract_Part2_Content_SSE
 - Components: File upload widgets, progress indicators, content organization UI
- **RAG Chat Interface**
 - Contract: EchoNest_AI_Frontend_Backend_Contract_Part3_RAG_Chat_SSE
 - Components: Chat UI, token streaming display, source attribution, feedback controls
- **Dashboard & Metrics Visualization**
 - Contract: EchoNest_AI_Frontend_Backend_Contract_Part4_Metrics_Diagnostics
 - Components: Analytics dashboards, device status monitors, notification settings

Dependencies:

- Must consume Backend Online Server APIs according to contract specifications

- Must implement SSE consumers for real-time updates (upload progress, chat streaming)
- Must handle authentication token lifecycle (storage, refresh, expiry)

2. Backend Server (Online Version)

Responsible for Implementing:

- **Authentication & User API**
 - Contract: EchoNest_AI_Frontend_Backend_Contract_Part1_Auth_Profile
 - Components: JWT issuer, user database, role management, email verification
- **Content Processing Pipeline**
 - Contract: EchoNest_AI_Frontend_Backend_Contract_Part2_Content_SSE
 - Components: File storage, transcription services, embedding generation
- **RAG & Chat Services**
 - Contract: EchoNest_AI_Frontend_Backend_Contract_Part3_RAG_Chat_SSE
 - Components: Vector database, LLM orchestration, token streaming
- **Metrics & Diagnostics Collection**
 - Contract: EchoNest_AI_Frontend_Backend_Contract_Part4_Metrics_Diagnostics
 - Components: Analytics database, event logging, notification system
- **Device Sync Manifest Service**
 - Contract: EchoNest_AI_Device_Manifest_Sync_Contract
 - Components: Content manifest generator, device authentication, content filtering
- **Content Delivery Service**
 - Contract: EchoNest_AI_Document_Pull_Contract
 - Components: Content CDN, chunked transfer handler, retry logic
- **Device Status Tracking**
 - Contract: EchoNest_AI_Sync_Status_Contract

- Components: Device status database, health monitoring
- **OTA Update Service**
- Contract: EchoNest_AI_OTA_Update_Contract
- Components: Firmware repository, version management, update distribution

Dependencies:

- Must provide APIs for Frontend according to contract specifications
- Must provide sync and OTA services for Device Client
- Must handle device authentication and status reporting

3. Backend Server (Offline Capable)

Responsible for Implementing:

- **Local HTTP Server**
- Contract: EchoNest_AI_Offline_Device_Communication_Contract
- Components: Embedded FastAPI server, local diagnostics endpoints
- **Local LLM Engine**
- Contract: EchoNest_AI_LLM_Fallback_Contract
- Components: GGUF model loader, token counter, prompt sanitizer
- **Local RAG System**
- Contract: EchoNest_AI_Offline_Device_Communication_Contract
- Components: Local vector store, document chunker, query processor
- **Session Management**
- Contract: EchoNest_AI_Offline_Device_Communication_Contract
- Components: In-memory or SQLite session store, conversation context manager

Dependencies:

- Must integrate with Device Client for voice input/output
- Must implement fallback logic according to contract specifications
- Must manage local document cache within resource constraints

4. Device Client (EchoNest-Edge)

Responsible for Implementing:

- **Voice Manager**
 - Contract: EchoNest_AI_Offline_Device_Communication_Contract
 - Components: Microphone interface, STT processor, voice activity detection
- **Sync Manager**
 - Contract: EchoNest_AI_Device_Manifest_Sync_Contract
 - Contract: EchoNest_AI_Document_Pull_Contract
 - Contract: EchoNest_AI_Sync_Status_Contract
 - Components: Manifest fetcher, content downloader, cache manager
- **OTA Update Client**
 - Contract: EchoNest_AI_OTA_Update_Contract
 - Components: Update checker, download manager, safe installer
- **Emotion Controller**
 - Contract: EchoNest_AI_Offline_Device_Communication_Contract
 - Components: LED matrix driver, emotion mapping logic

Dependencies:

- Must communicate with Backend Offline Server via local HTTP
- Must communicate with Backend Online Server for sync and updates
- Must manage hardware interfaces (microphone, LED matrix)
- Must implement fallback strategies for offline operation

Cross-Component Contract Compliance Requirements

1. Authentication Flow

2. Frontend must implement JWT storage and refresh
3. Backend Online must issue and validate JWTs
4. Device Client must securely store device tokens

5. Content Synchronization

- 6. Backend Online must generate accurate manifests
- 7. Device Client must efficiently download and store content
- 8. Backend Offline must utilize cached content for RAG

9. Fallback Mechanisms

- 10. All components must implement appropriate error handling
- 11. Device Client must detect connectivity issues
- 12. Backend Offline must provide degraded but functional service when offline

13. Performance Requirements

- 14. All components must meet the response time objectives specified in contracts
- 15. Device Client and Backend Offline must operate within resource constraints
- 16. Frontend must handle streaming responses for responsive UI