

# Local Food AI - Architecture Map

Project Deliverable

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**Course** B1AI

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# Table of Contents

- System Component Architecture ..... Page 2
- Database Design: Grouped Vertical Partitioning ..... Page 2
- Dual-Mode Deployment Topology ..... Page 2
  - Mixed Distributed Topology (Production/Staging Mode) ..... Page 3
  - Resilient Single-Node Local Fallback (Offline Mode) ..... Page 2

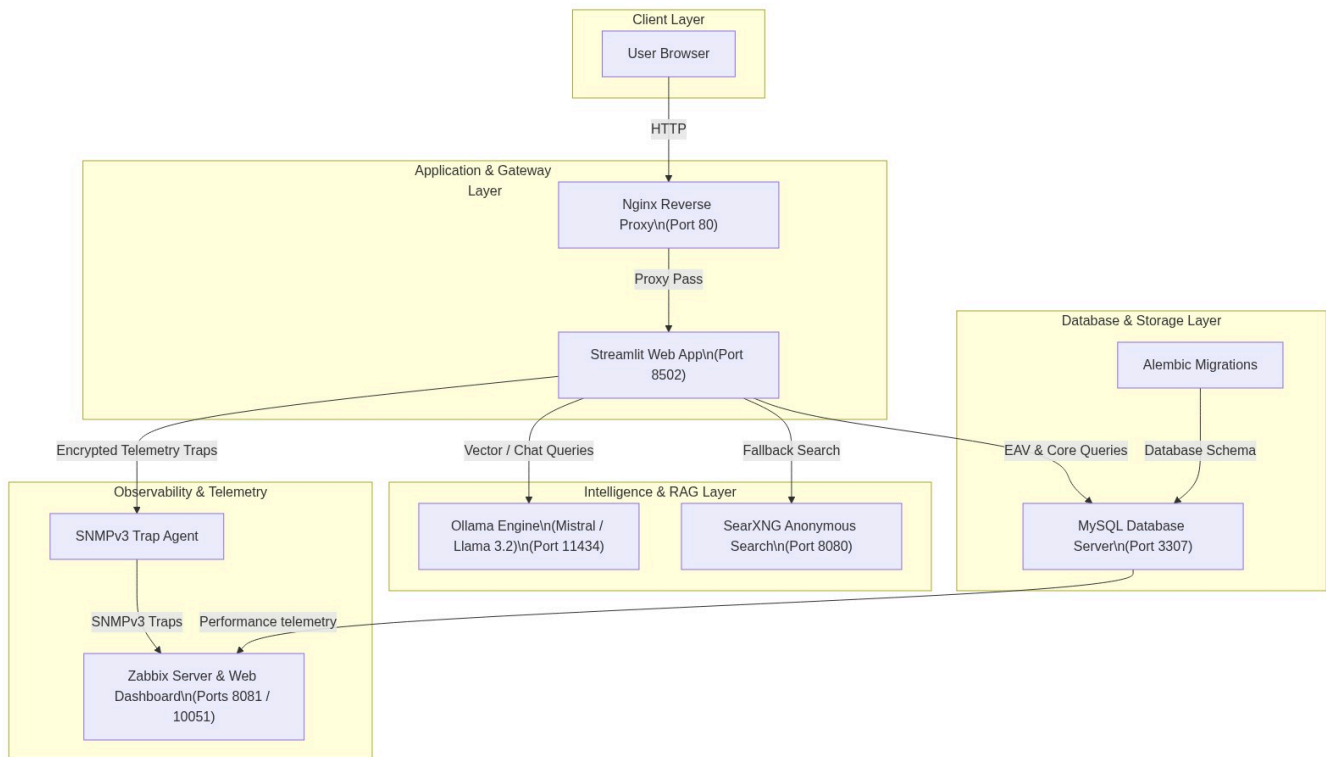
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# Local Food AI - Architecture Map

This document describes the technical architecture, database schema design, AI RAG data flows, and dual-mode deployment topology for the Local Food AI clinical dietitian platform.

## System Component Architecture

The platform is designed around a strictly local, privacy-first microservice topology. The components integrate seamlessly to provide nutritional search, RAG-augmented clinical diet evaluations, and DevSecOps observability.



## Database Design: Grouped Vertical Partitioning

To optimize massive dataset ingestion (~24GB OpenFoodFacts dataset) and completely bypass InnoDB row size limits while maintaining sub-second RAG response times, the database utilizes a vertically partitioned structure:



- **products\_core**: Contains product base information (barcode, name, brand, primary category) optimized with `FULLTEXT` indexing.
- **products\_allergens**: Isolates complex ingredient list arrays and allergen keywords.
- **products\_macros**: Implements double-precision floats (`DOUBLE`) for protein, carbs, fats, and energy metrics.
- **products\_vitamins**: Stores micronutrient vitamin profiles.
- **products\_minerals**: Stores trace mineral concentrations.

[!NOTE] All application search queries, RAG data tools, and ingestion processes interact with a unified database `view` named `products` which uses a series of high-performance `LEFT JOIN` operations across the primary key (barcode), shielding the frontend from database complexity.

## Dual-Mode Deployment Topology

To ensure 100% resilience under network restrictions, the Local Food AI system is architected to operate under two distinct networking modes:

### 1. Mixed Distributed Topology (Production/Staging Mode)

Services can be distributed across native physical Unix/Linux servers (bare-metal), specialized local hypervisors, and Windows subsystems using bridged networking:

- **Database Node (Bare-Metal Server or Hyper-V VM)**: Dedicated bare-metal Ubuntu instance hosting the relational MySQL partitions at `192.168.130.170`.
- **Application Node (WSL 2 or Bare-Metal Unix)**: Runs the Streamlit frontend and local Ollama model engine.
- **Monitoring Node (VirtualBox VM or Bare-Metal Unix)**: Dedicated host running Zabbix Server and receiving SNMPv3 notifications.
- **Agile Scrum Tracker (Taiga)**: Remote agile project server at `192.168.130.161` for syncing deliverables.

### 2. Resilient Single-Node Local Fallback (Offline Mode)

When the remote VM host network or Taiga server is completely unreachable:

- **Zero-Dependency Containers**: The entire platform runs entirely locally on the notebook host via **Docker Compose** (`docker-compose.yml`).
- **Automatic IP Resolution**: Application configuration, Alembic, and SNMP notifications automatically adjust their endpoints to target local network interfaces (`localhost` / custom Docker networks) rather than unreachable remote IPs, avoiding timeout hangs or crashes.
- **Dynamic Task Tracking**: Agile development logs are dynamically synced into the workspace [task.pdf](#) and [walkthrough.pdf](#) artifacts to track progress until connectivity is restored.

*Documented by Antigravity.*

## References

- **OpenFoodFacts Dataset & API Catalog**: Detailed food ingredients database. (<https://world.openfoodfacts.org/>)
- **Ollama Local LLM Inference Engine**: Lightweight instruction-following llama3.2 runtimes. (<https://ollama.com/>)
- **Zabbix Enterprise Telemetry and Monitoring**: System health and performance logging. (<https://www.zabbix.com/>)

## Index

- **AI:** Page 2, Page 3, Page 4, Page 5
- **MySQL:** Page 3, Page 5
- **Zabbix:** Page 3, Page 4, Page 5
- **Docker:** Page 3, Page 5
- **Streamlit:** Page 3, Page 5
- **Nginx:** Page 5
- **RAG:** Page 2, Page 3, Page 5
- **Allergens:** Page 3, Page 5
- **Vitamins:** Page 3, Page 5
- **Minerals:** Page 3, Page 5
- **Clinical:** Page 2, Page 5
- **WSL:** Page 3, Page 5
- **Ollama:** Page 3, Page 4, Page 5
- **LLM:** Page 4, Page 5
- **Database:** Page 1, Page 2, Page 3, Page 4, Page 5
- **Security:** Page 5
- **Telemetry:** Page 4, Page 5
- **Backup:** Page 5
- **Firewall:** Page 5
- **SMTP:** Page 5