The current version is #ident "@(#)$Format:LocalFoodAI_lanfr144:architecture.md:Francois Lange:lanfr144@school.lu:2026/06/11 08:26:59:Francois Lange:lanfr144@school.lu:2026/06/11 08:26:59:1701828b122e0c319e59134ca6511a42ecad9297::$"

Id

Local Food AI - Architecture Map

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

🗺️ System Component Architecture

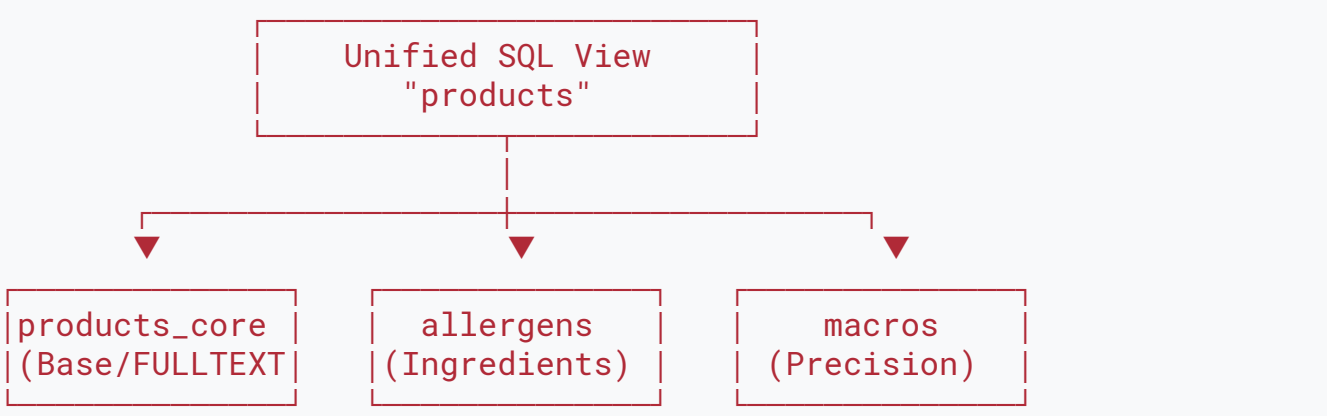
The platform is designed around a strictly local, privacy- rst microservice topology. The components integrate seamlessly to provide nutritional search, RAG-augmented clinical diet evaluations, and DevSecOps observability.

```
graph TD
    subgraph "Client Layer"
        User["User Browser"]
    end

    subgraph "Application & Gateway Layer"
        Nginx["Nginx Reverse Proxy\n(Port 80)"]
        Streamlit["Streamlit Web App\n(Port 8502)"]
    end

    subgraph "Intelligence & RAG Layer"
        Ollama["Ollama Engine\n(Mistral / Llama 3.2)\n(Port 11434)"]
        SearXNG["SearXNG Anonymous Search\n(Port 8080)"]
    end

    subgraph "Database & Storage Layer"
        MySQL["MySQL Database Server\n(Port 3307)"]
        Alembic["Alembic Migrations"]
    end

    subgraph "Observability & Telemetry"
        Zabbix["Zabbix Server & Web Dashboard\n(Ports 8081 / 10051)"]
        SNMP["SNMPv3 Trap Agent"]
    end

    %% Connections
    User -->|HTTP| Nginx
    Nginx -->|Proxy Pass| Streamlit
    Streamlit -->|Vector / Chat Queries| Ollama
    Streamlit -->|Fallback Search| SearXNG
```

```
    Streamlit -->|EAV & Core Queries| MySQL
    Alembic -->|Database Schema| MySQL
    Streamlit -->|Encrypted Telemetry Traps| SNMP
    SNMP -->|SNMPv3 Traps| Zabbix
    MySQL -->|Performance telemetry| Zabbix
```

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:



1. `products_core`: Contains product base information (barcode, name, brand, primary category) optimized with `FULLTEXT` indexing.
2. `products_allergens`: Isolates complex ingredient list arrays and allergen keywords.
3. `products_macros`: Implements double-precision oats (`DOUBLE`) for protein, carbs, fats, and energy metrics.
4. `products_vitamins`: Stores micronutrient vitamin pro les.
5. `products_minerals`: Stores trace mineral concentrations.

> [!NOTE] All application search queries, RAG data tools, and ingestion processes interact with a uni ed 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 are distributed across specialized local hypervisors and Windows subsystems using bridged networking:

Application Node (WSL 2): Runs the Streamlit frontend and local Ollama model engine.
Database Node (Hyper-V VM): Dedicated Ubuntu instance hosting the relational MySQL

partitions at `192.168.130.170`.
Monitoring Node (VirtualBox VM): Dedicated host running Zabbix Server and receiving SNMPv3 noti cations.
Agile Scrum Tracker (Taiga): Remote agile project server at `192.168.130.161` for syncing deliverables.

2. Resilient Single-Node Local Fallback (Of ine 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 con guration, Alembic, and SNMP noti cations 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.md](le:///C:/Users/lanfr144/Documents/DOPRO1/Antigravity/Food/task.md) and [walkthrough.md](le:///C:/Users/lanfr144/Documents/DOPRO1/Antigravity/Food/walkthrough.md) artifacts to track progress until connectivity is restored.

Documented by Antigravity.