

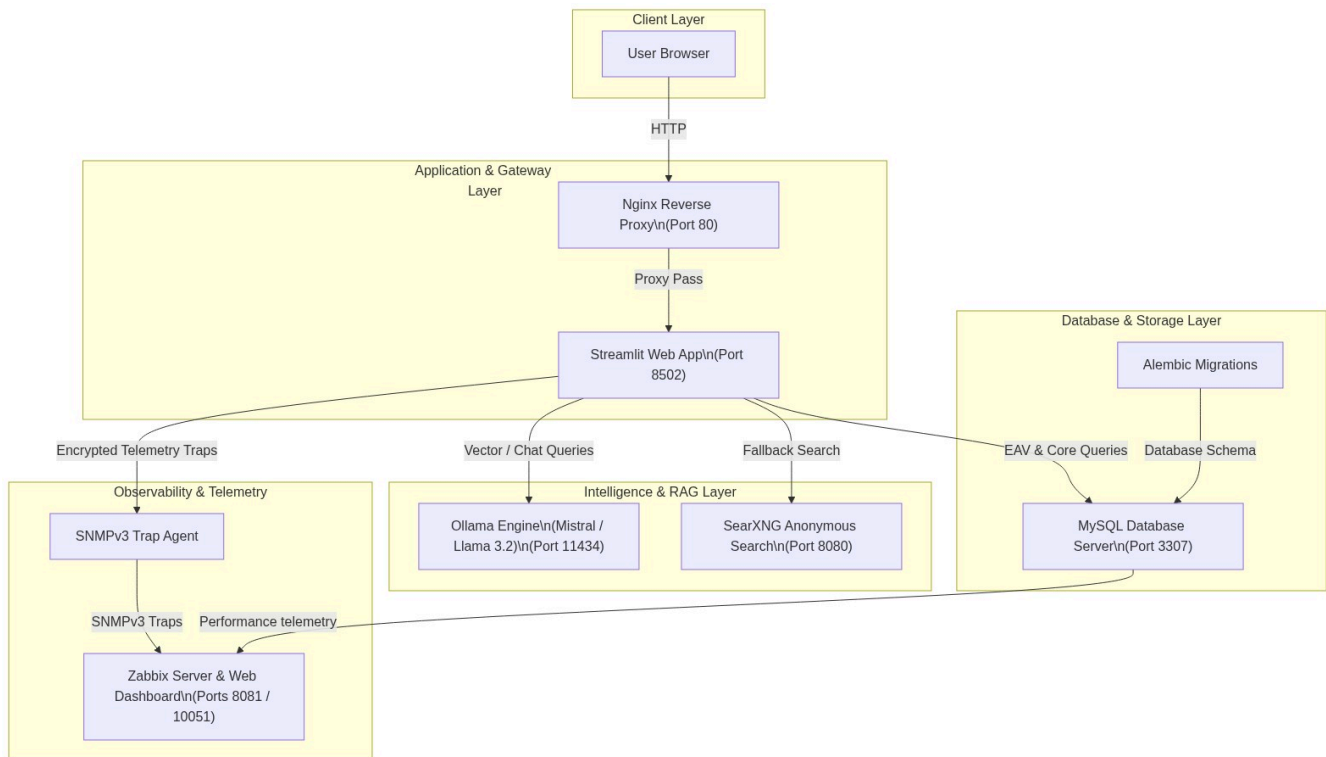
The current version is #ident "@(#)\$Format:LocalFoodAI_lanfr144:architecture.md:Francois Lange:lanfr144@school.lu:2026/06/17 12:26:52:Francois Lange:lanfr144@school.lu:2026/06/17 12:26:52:c5d48eba8718e1186d4de05a7fbdccaa08314f35::\$"

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 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 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.

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