

# SOLUTION ARCHITECTURE

Date	23 October 2025
Team ID	3FFAE7436D2189BAAD14CC03A02C48A9
Project Name	Medical Inventory Management
Maximum Marks	2 Marks

## SOLUTION ARCHITECTURE:

### Goals of the Architecture:

The architecture aims to provide an integrated, scalable, and secure cloud platform for managing medical inventory across hospitals, clinics, and pharmacies. It ensures accurate lifecycle tracking of medicines and supplies, reduces wastage from expiries, automates procurement and stock replenishment, and delivers real-time visibility for clinical and administrative staff. The design promotes modularity, interoperability, and data-driven decision-making

### Key Components:

**Data Layer (Custom Objects / Database)**

This layer forms the backbone of the system, storing all inventory and transactional data using Salesforce custom objects.

#### Key Objects:

- **MedicallItem** – Main catalog of all medicines and medical devices.
- **Batch** – Tracks batch-specific details like expiry and quantity.
- **StockLocation** – Defines where inventory is stored (pharmacy, ward, OT, etc.).
- **StockMovement** – Logs all stock inflow/outflow and transfers.
- **Supplier & PurchaseOrder** – Manages vendor details, purchase orders, and invoices.
- **Department & User** – Defines departments and user roles for access control.
- **AuditLog** – Maintains uneditable records of key inventory actions for compliance.

### Business Logic & Automation:

Handles automation, validations, and workflow rules to streamline operations.

#### Core Functionalities:

- **Automated Reorder Rules** – Triggers restock alerts when stock drops below threshold.
- **Expiry Monitoring** – Sends alerts for soon-to-expire or expired batches.
- **Stock Reservation & Consumption** – Tracks usage for prescriptions or departments.
- **Approval Flows** – Ensures manual or high-value stock changes require authorization.

#### Integration Layer:

Enables seamless data exchange with external healthcare systems.

#### Integrations Include:

- **HIS / EMR / ERP Systems** – Syncs patient and purchase data.
- **IoT / Barcode Integration** – Allows real-time scanning and smart shelf tracking.
- **Supplier Portal / EDI** – Automates purchase order confirmations and supplier communication.

#### Security & Compliance:

Implements strict access control and data protection measures.

#### Highlights:

- **RBAC & Field-Level Security** – Ensures users see only relevant data.
- **Encryption & OAuth Security** – Protects data during storage and transfer.
- **Audit Trails** – Keeps a tamper-proof history of all inventory operations.

#### Development Phases:

Requirement Analysis: stakeholder interviews with pharmacists, clinicians, procurement and IT to capture workflows and compliance needs.

Data Modeling: design custom objects, relationships, and keys (SKU, batch, location).

Prototype & UI Design: create screens for core flows (receive, issue, transfer, reorder) and gather feedback.

Implementation: build data model, automation flows, integrations, and dashboards using chosen platform (low-code or custom stack).

Testing: unit tests, integration tests with HIS/EMR, performance testing for peak loads, and user acceptance testing (UAT).

Deployment & Training: staged rollout (pilot → full), end-user training, and runbooks for operations.

Monitoring & Improvements: telemetry, error tracking, and periodic enhancements based on usage.

## Solution Architecture:

The Medical Inventory Management System is a modular cloud solution built with a three-tier architecture:

Architecture:

- Presentation Tier: Web and mobile UI providing role-specific pages for pharmacists, clinicians, procurement teams, and auditors. Dashboards summarize stock health, critical expiries, and pending purchase orders.

- Application Tier: Business logic implemented as serverless functions / low-code flows. This tier enforces reorder logic, expiry workflows, reservation engines for allocated stock, and approval flows. It also hosts integration adapters for EMR/HIS and supplier systems.

- Data Tier: Relational and time-series stores for master data, batch history, and transaction logs. AuditLog ensures immutable history for regulatory compliance.

## Smplified Data Model:

- MedicallItem (ItemID, Name, SKU, Unit, Storage, Category)
- Batch (BatchID, ItemID, BatchNo, MfgDate, ExpiryDate, Quantity, LocationID)
- StockLocation (LocationID, Name, Type, ParentLocation)
- StockMovement (MovementID, BatchID, Type[IN/OUT/TRANSFER], Quantity, Date, UserID, Reference)
- Supplier (SupplierID, Name, Contact, LeadTime, Rating)
- PurchaseOrder (POID, SupplierID, ItemID, BatchID, QuantityOrdered, QuantityReceived, Status)

- User & Role (UserID, Role, Department)
- AuditLog (LogID, Action, EntityRef, OldValue, NewValue, Timestamp, UserID)

## Non-Functional Requirement:

- Availability: 99.9% SLA for core inventory operations.
- Performance: support concurrent transactions (scanning/issues) with low latency (<200ms for API ops under normal load).
- Data Retention & Privacy: configurable retention; comply with applicable health data regulations.
- Scalability: elastic scaling for seasonal peaks or emergency situations.
- Backup & Recovery: regular backups and recovery RTO/RPO targets.