Software Architecture and Design Specification

Project: Customer Rela onship Management (CRM) System

Version: 1.0

Authors: Rajesh Banginwar, Kavana H, Karthik S, Khushi Mahesh, Kaveri Sharma Date: 14-09-2025

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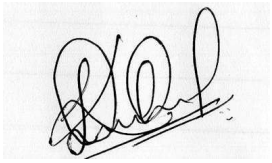
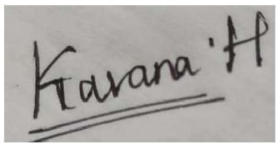
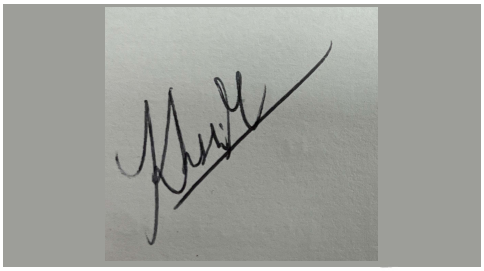
Versi on	Date	Author(s)	Change Summary
1.0	13-09-2025	Team Kryptonite	Ini al dra prepared

Role	Name	Signature /Date
Course Coordinator	Rajesh Banginwar	—------
QA Lead	Karthik S	
Dev Lead	Kavana H	
Product Owner	Kaveri Sharma	

Developer Khushi
Mahesh



1. Introduc on Purpose

This document defines the comprehensive test plan for the Customer Rela onship Management (CRM) System v1.0. It outlines the objec ves, scope, strategy, resources, and schedule for all tes ng ac vi es

1. Scope

The CRM system encompasses:

- Omni-channel campaign management
- Lead capture and scoring
- Sales pipeline management, quo ng, and e-signature func onali es
- Order and payment tracking
- A comprehensive 360° customer view and support cke ng
- Loyalty management
- Automated workflows, repor ng, and analy cal tools

Tes ng will cover all core features of the CRM system, including campaign management, lead capture and qualifica on, sales pipeline management, support cke ng, customer data management, and the loyalty program. The internal logic of third-party services like payment gateways or email providers and hardware interfaces (beyond standard web clients) are excluded from this scope.

Out of scope: internal logic of third-party email/SMS/payment gateways and ERP integra on.

2. Audience

- Developers
- QA engineers
- Security auditors
- Product Owner (Instructor)
- System Admins

3. Defini ons

- CCRM: Customer Rela onship Management
- RBAC: Role-Based Access Control
- MFA: Mul -Factor Authen ca on
- PII: Personally Iden fiable Informa on
- CSAT/NPS: Customer Sa sfac on / Net Promoter Score

- WCAG 2.1 AA: Accessibility compliance standard

2 Document Overview

2.1 How to Use this Document

This document provides CRM architectural deliverables:

- UML diagrams
- API specifica ons
- ADRs (Architecture Decision Records)
- Threat model
- Traceability Matrix

2.2 Related Documents

- SRS v1.0
- Test Plan v1. 3

ARCHITECTURE

3.1 Goals & Constraints

- Goals: Secure, scalable, reliable CRM pla orm with 99.9% up me.
- Constraints: GDPR/PII compliance, WCAG 2.1 AA accessibility, API rate limit

This project aims to build a robust, secure, scalable, and highly reliable CRM pla orm with 99.9% up me. It must comply with GDPR, PII, and WCAG 2.1 Level AA while respec ng API rate limits

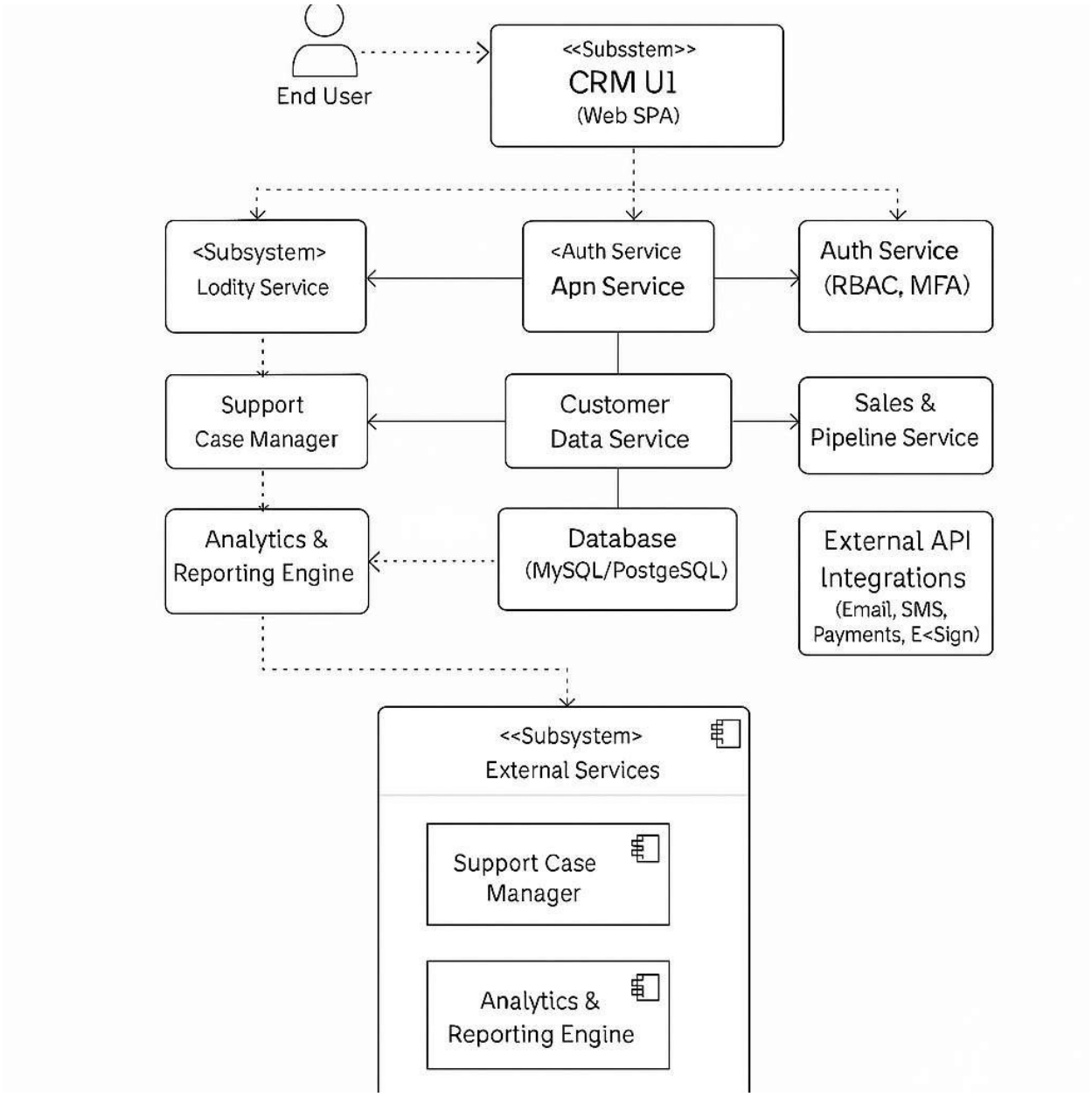
3.2 Stakeholders & Concerns

- Marke ng Managers: Campaign effec veness

- Sales Reps: Deal pipelines, opportunity tracking
- Support Agents: SLA compliance, customer sa sfac on
- System Admins: Manage integra ons, RBAC, monitoring
- Regulators: Data protec on compliance

Various roles u lize data for specific purposes: marke ng managers track campaign effec veness, sales reps monitor deal pipelines and opportuni es, support agents ensure SLA compliance and customer sa sfac on, and system admins manage integra ons, RBAC, and monitoring. Regulators also use data to ensure data protec on compliance.

3.3 Component Diagram



Components:

- CRM UI (Web SPA)
- Auth Service (RBAC, MFA)
- Campaign Manager
- Sales & Pipeline Service
- Customer Data Service

- Support Case Manager
- Loyalty Manager
- Analy cs & Repor ng Engine
- Database (MySQL/PostgreSQL)
- External API Integra ons (Email, SMS, Payments, E-Sign

3.4 Component Descrip ons

This document outlines key components of a system:

- CRM UI: A responsive web interface built with React/Angular.
- Auth Service: Handles authen ca on, role-based access control (RBAC), and mul -factor authen ca on (MFA).
- Customer Data Service: Manages CRUD (Create, Read, Update, Delete) opera ons, data deduplica on, and GDPR dele ons.
- Campaign Manager: Supports email/SMS campaigns and customer segmenta on.

Core CRM Modules:

- Sales Pipeline: Manages leads, opportuni es, and sales forecas ng.
- Case Management: Handles customer support ckets, Service Level Agreements (SLAs) and automated no fica ons.
- Loyalty Manager: Facilitates rewards programs, er management, and customer referrals.
- Analy cs Engine: Provides comprehensive dashboards, reports, and Key Performance Indicator (KPI) tracking

3.5 Technology Stack & Data Stores

- Backend: Java Spring Boot / Node.js
- Frontend: React SPA with REST/GraphQL APIs
- Database: MySQL (rela onal) + Object storage for a achments
- Integra on: APIs (SMTP, SMS, Payment, E-Sign)
- Security: TLS 1.2+, AES-256 encryp on

3.6 Architecture Pa ern & Ra onale

- Chosen Architecture: Layered + Modular Service Architecture
- Reasoning: This approach offers a clear separa on of concerns, improving maintainability and simplifying compliance efforts.
- Rejected Architecture: Full Microservices
- Reasoning for Rejec on: The overhead associated with a full microservices architecture is deemed excessive for a student project scale.

3.7 Risks & Mi ga ons

Risk and Mi ga on Strategies:

- Risk: Data breaches
  - Mi ga on: Implement Role-Based Access Control (RBAC), Mul -Factor Authen ca on (MFA), and comprehensive audit logs.
- Risk: API down me
  - Mi ga on: Employ retry mechanisms with exponen al backoff.
- Risk: Performance bo lenecks
  - Mi ga on: U lize caching and load balancing techniques.

3.8 Requirement Traceability Matrix

Requirement	Service Component
R1 (Authen ca on & RBAC)	Auth Service
R2 (Customer CRUD)	Customer Data Service
R3 (Campaign Management)	Campaign Manager
R4 (Support Tickets)	Case Management
R5 (Loyalty Program)	Loyalty Manager

3.9 Security Architecture (STRIDE)

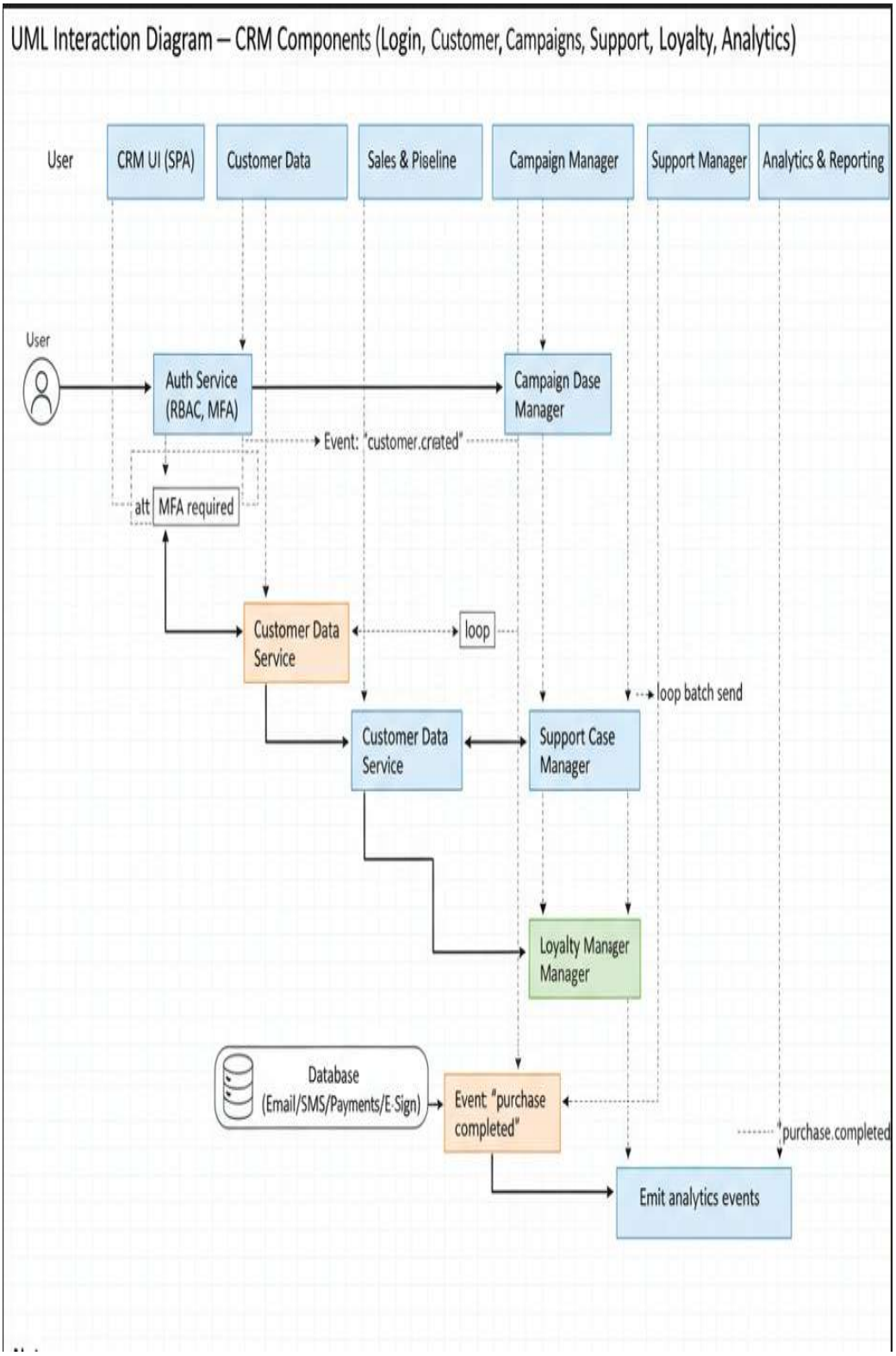
- Spoofing: MFA, OAuth SSO
- Tampering: Encrypted logs, immutability
- Repudia on: Full audit trail with mestamps
- Informa on Disclosure: TLS, AES-256 at rest
- DoS: API rate limi ng, thro ling
- Eleva on of Privilege: RBAC enforcemen

4 Design

4.1 Design Overview

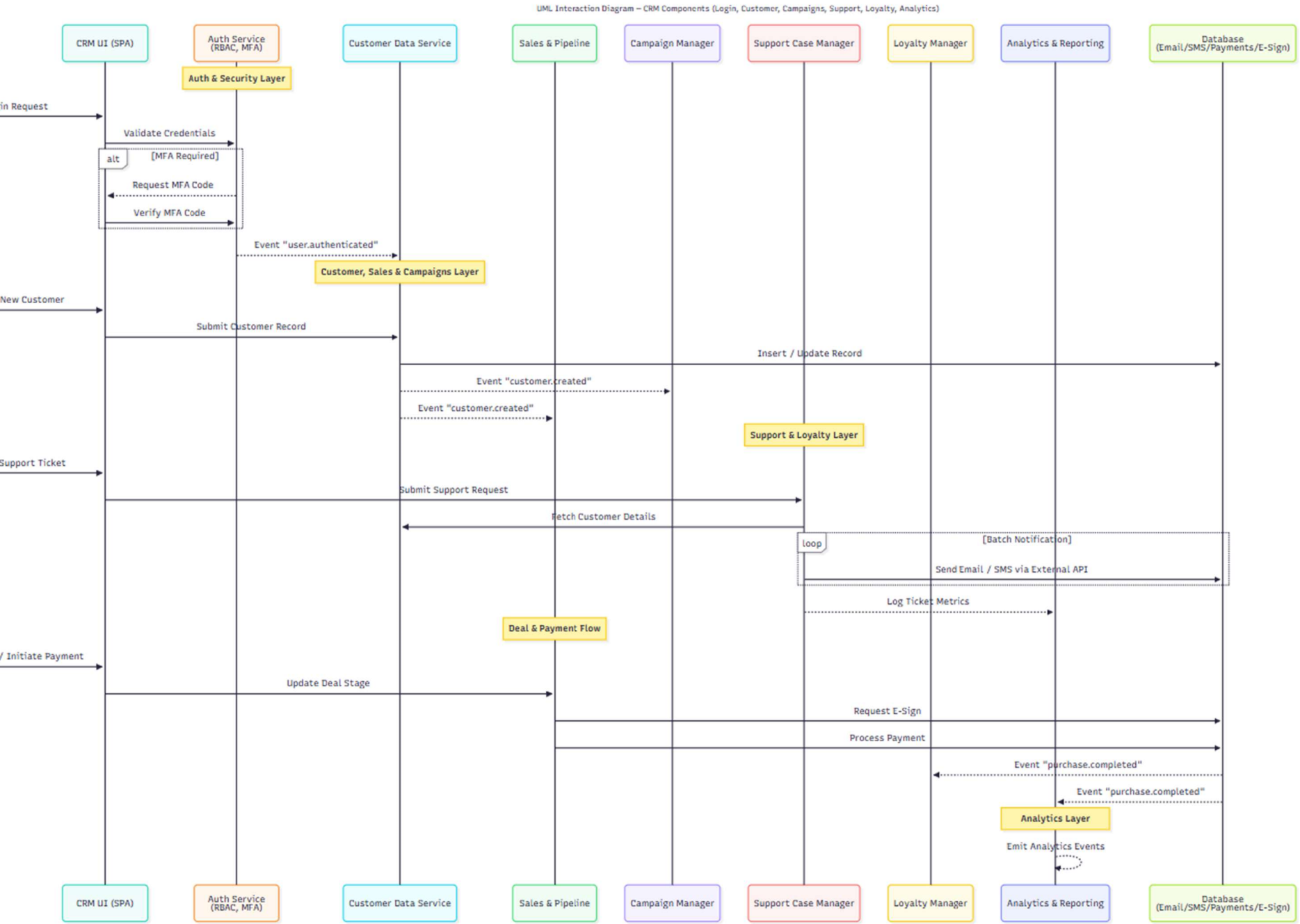
Layered modular design (UI → API → Services → DB). Integra on points abstracted via adapters.

4.2 UML Sequence Diagrams

- 

- Login & MFA flow (User → Auth Service → DB)

- Create a customer record flow. (User → CRM UI → Customer Data Service → DB → Audit logs)


UML Interaction Diagram – CRM Components (Login, Customer, Campaigns, Support, Loyalty, Analytics)
CRM UI (SPA)
Auth Service (RBAC, MFA)
Customer Data Service
Sales & Pipeline
Campaign Manager
Support Case Manager
Loyalty Manager
Analytics & Reporting
Database (Email/SMS/Payments/E-Sign)
Auth & Security Layer
in Request
Validate Credentials
alt
[MFA Required]
Request MFA Code
Verify MFA Code
Event "user.authenticated"
Customer, Sales & Campaigns Layer
New Customer
Submit Customer Record
Insert / Update Record
Event "customer.created"
Event "customer.created"
Support & Loyalty Layer
Support Ticket
Submit Support Request
Fetch Customer Details
loop
[Batch Notification]
Send Email / SMS via External API
Log Ticket Metrics
Deal & Payment Flow
/ Initiate Payment
Update Deal Stage
Request E-Sign
Process Payment
Event "purchase.completed"
Event "purchase.completed"
Analytics Layer
Emit Analytics Events
CRM UI (SPA)
Auth Service (RBAC, MFA)
Customer Data Service
Sales & Pipeline
Campaign Manager
Support Case Manager
Loyalty Manager
Analytics & Reporting
Database (Email/SMS/Payments/E-Sign)

4.3 API Design

1. Endpoint: /auth/login

- **Method:** POST
- **Request Body:**
  - username
  - password
  - otp (**optional**)
- **Response Body:**
  - status
  - token
  - role
- **Error Codes:**
  - 401 Unauthorized
  - 403 MFA required

Endpoint: /customers API Endpoint

- **Method:** POST
- **Request Body:**
  - name
  - email
  - phone
  - company
- **Response Body:**
  - status
  - customerId
- **Error Codes:**
  - 400: Duplicate
  - 422: Validation error

4.4 Error Handling, Logging & Monitoring

- **Error Handling:** Employ standardized JSON error messages for consistent communication.
- **Logging:**
  - Ensure no Personally Identifiable Information (PII) is included in logs.
  - Encrypt logs before shipping them to a central storage system.
- **Monitoring:** Track key metrics such as API latency, uptime percentage, and Service Level Agreement (SLA) breach rate.

4.5 UX Design

- Responsive Single-Page Application (SPA) with dark/light theme options
- Accessible (**WCAG 2.1 AA compliant**)
- **Key Features:**
  - Dashboard navigation
  - Drag-and-drop pipeline board

- Loyalty wallet

4.6 Open Issues & Next Steps

- Integrate biometric login (future)
- Add AI-driven lead scoring
- Mobile app support

5 Appendices

5.1 Glossary

- CRM, RBAC, MFA, SLA, CSAT/NPS, GDPR, TLS

5.2 References

- IEEE 42010 (Software Architecture)
- OWASP Top 10 Security Guidelines
- GDPR / Indian DPDP 2023
- NIST SP 800-160

5.3 Tools

- PlantUML / Draw.io (Diagrams)
- Swagger/Postman (API documentation)
- JMeter (Performance testing)
- Selenium (UI automation