KINTO Operations - Multi-Tenant Architecture

Detailed Implementation Plan

> **Document Version:** 2.0
> **Date:** December 14, 2025
> **Prepared For:** KINTO Operations Team

Executive Summary

This document outlines the complete implementation plan for transforming the KINTO Operations & QA Management System into a full-featured **Enterprise Application Platform** - a revolutionary system where customers describe their requirements in plain language and get fully functional, deployed applications.

> **Platform Vision:**
> `Customer describes requirements → AI generates application → Auto-deploy to Cloud or On-Prem`

Key Capabilities

- **Multi-Tenant SaaS:** Complete data isolation with schema-per-tenant approach
- **Low-Code Platform:** Customers create their own screens and business logic (Phase 5)
- **AI Application Generator:** Natural language to working application (Phase 6)

- **Infrastructure Auto-Selector:** Automatic architecture based on scale requirements (Phase 7)
- **Cloud Auto-Deployment:** One-click deployment to AWS/Azure/GCP (Phase 8)
- **On-Prem Packaging:** Docker/Kubernetes/VM images for enterprise customers (Phase 9)
- **Hybrid Deployment:** Mix of cloud management with on-prem data (Phase 10)

Target Industries

- Power & Utilities (AMI, Billing, Customer Portal)
- Banking & Finance (Loan Management, Collections)
- Insurance (Policy Management, Claims)
- Manufacturing (Current KINTO domain)
- Any industry with custom requirements

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Complete Timeline Summary

Phase	Duration	Weeks	Effort
Phase 1: Core Multi-Tenancy	2 weeks	1-2	Foundation
Phase 2: Licensing & Quotas	1 week	3	Medium
Phase 3: Module Configuration	1 week	4	Medium
Phase 4: Screen Templating	2 weeks	5-6	High
Phase 5: Low-Code Platform	12 weeks	8-19	Very High
Phase 6: AI Application Generator	**10 weeks**	**21-30**	**Very High**
Phase 7: Infrastructure Auto-Selector	**8 weeks**	**31-38**	**High**
Phase 8: Cloud Auto-Deployment	**6 weeks**	**39-44**	**High**
Phase 9: On-Prem Packaging	**6 weeks**	**45-50**	**Medium-High**
Phase 10: Hybrid Deployment	**4 weeks**	**51-54**	**Medium**

Revenue Model by Deployment Type

Deployment	Revenue Model	Typical Pricing
Cloud SaaS	Monthly subscription	₹2,999 - ₹19,999/mo
On-Prem License	One-time + AMC	₹10-50 Lakhs + 18% AMC
Per-Device	Monthly per meter/device	₹5-10/device/month
Hybrid	License + Cloud fee	Custom pricing

Phased Rollout Strategy

Option A: MVP Launch (Week 7)

- Phases 1-4 only (Multi-tenant core)
- Get customers on platform quickly
- Revenue starts early

Option B: Low-Code Launch (Week 19)

- Phases 1-5 (Include Low-Code)
- Customers can self-serve
- Premium pricing possible

Option C: AI Platform Launch (Week 30)

- Phases 1-6 (Include AI Generator)
- Revolutionary "describe and build" feature
- Market differentiator

Option D: Complete Platform (Week 54)

- All 10 phases
- Full cloud + on-prem capability
- Enterprise-ready platform

Phase 6: AI Application Generator

Duration: 10 Weeks | **Complexity:** Very High

This is Revolutionary: Customers describe requirements in natural language, AI generates complete applications.

How It Works

```
Customer types:
"I need a billing system for 5 million electricity meters
 with slab-based tariffs, late fees, and WhatsApp reminders"
                              ↓
                    🤖 AI Processes
                              ↓
GENERATES AUTOMATICALLY:
• Database: customers, meters, readings, bills, payments
• Logic: slab calculations, late fee rules, due dates
• Screens: Customer portal, Admin dashboard, Bill details
• Workflows: Bill generation → Notification → Reminder
• Reports: Collection summary, Outstanding, Revenue analytics
```

Phase 6 Timeline

Week	Focus	Deliverables
21-22	Requirement Parser	NLP extraction, entity recognition, AI prompts
23-25	Schema Generator + Multi-RDBMS	Database schema from entities, dialect generators for 7 databases
26-27	Logic Generator	Business rules, calculations, validation code
28-29	UI Generator	Screen configs, form layouts, dashboard components
30-32	Integration & Testing	End-to-end flow, cross-database testing, documentation

Phase 6 Cost Summary

Component	Duration	Cost
Requirement Parser (AI-powered)	4-5 weeks	₹3-4L
Schema Generator + Multi-RDBMS	4-5 weeks	₹3-3.5L
Logic Generator	2 weeks	₹2L
UI Generator	2 weeks	₹2L
Total Phase 6	**12-14 weeks**	**₹10-11.5L**

Database Abstraction Layer (Multi-RDBMS Support)

Purpose: Generate database-agnostic schemas that work across all major enterprise databases.

Supported Databases

Database	Version	Use Case	License
PostgreSQL	14+	Cloud SaaS, startups	Open Source
MySQL/MariaDB	8.0+	Web applications	Open Source/GPL
SQLite	3.35+	Edge/embedded, small scale	Public Domain
SQL Server	2019+	Enterprise Windows shops	Commercial
Oracle Database	19c+	Banking, large enterprise	Commercial
IBM DB2	11.5+	Mainframe, legacy systems	Commercial
SAP HANA	2.0+	SAP ecosystems	Commercial

Database Compatibility Matrix

Feature	PostgreSQL	SQL Server	Oracle	DB2	MySQL
Multi-tenant schemas	Native	Native	User-based	Native	Database-per-tenant
JSON support	Native JSONB	JSON functions	IS JSON	JSON functions	Native JSON
Full-text search	tsvector	CONTAINS	Oracle Text	Text Extender	FULLTEXT
Partitioning	Native	Native	Native	Native	Native
Row-level security	Native policies	Always Encrypted	VPD	RCAC	Limited

Enterprise Database Considerations

Database	Key Considerations	Typical Customers
SQL Server	Windows integration, Active Directory auth, SSRS reporting	Government, Microsoft shops
Oracle	PL/SQL procedures, RAC clustering, Data Guard	Banks, telecom, utilities
IBM DB2	Mainframe integration, COBOL compatibility	Insurance, legacy systems
SAP HANA	In-memory processing, S/4HANA integration	SAP customers

Phase 7: Infrastructure Auto-Selector

Duration: 8 Weeks | **Complexity:** High

Purpose: Automatically select optimal infrastructure based on scale requirements.

Example Calculation

```
Customer requirement:
"5 million AMI meters, readings every 15 minutes,
 analytics at 1-hour and 6-hour intervals"
                              ↓
CALCULATED REQUIREMENTS:
• 480 million writes/day
• 5,500 writes/second peak
• 50 GB storage/day
• Heavy analytics load
                              ↓
SELECTED STACK:
• TimescaleDB (time-series optimized)
• Kafka (message buffering)
• ClickHouse (analytics)
• Redis Cluster (caching)
```

Architecture Selection Matrix

Load Profile	Database	Queue	Analytics	Cache
Small (<1M/day)	PostgreSQL	Redis Queue	Same DB	Redis
Medium (1M-100M/day)	TimescaleDB	Redis Streams	PostgreSQL views	Redis
Large (100M-1B/day)	TimescaleDB cluster	Kafka	ClickHouse	Redis Cluster
Massive (>1B/day)	Cassandra	Kafka Cluster	ClickHouse Cluster	Redis Cluster

Phase 8: Cloud Auto-Deployment

Duration: 6 Weeks | **Complexity:** High

Purpose: One-click deployment to any major cloud provider.

Supported Clouds

Cloud	Services Used
AWS	EKS, RDS, ElastiCache, MSK
Azure	AKS, Azure Database, Redis, Event Hubs
GCP	GKE, Cloud SQL, Memorystore, Pub/Sub

Deployment Pipeline

```
Customer clicks "Deploy"
        ↓
1. VALIDATION (~30 sec)
   • Check cloud credentials
   • Verify quotas
        ↓
2. INFRASTRUCTURE PROVISIONING (~5-10 min)
   • Generate Terraform
   • Apply infrastructure
        ↓
3. APPLICATION DEPLOYMENT (~3-5 min)
   • Build Docker images
   • Deploy to Kubernetes
   • Run migrations
        ↓
4. POST-DEPLOYMENT (~2 min)
   • Configure DNS
   • Issue SSL certificate
   • Health checks
        ↓
Application LIVE! 🎉
```

Phase 9: On-Prem Packaging System

Duration: 6 Weeks | **Complexity:** Medium-High

Purpose: Generate deployment packages for customer data centers.

Why On-Prem?

- **Data Sovereignty:** Government mandates data stays in-country
- **Security Policies:** No data in public cloud
- **Compliance:** Banking/Finance regulations
- **Latency:** Real-time systems need local processing

Deployment Formats

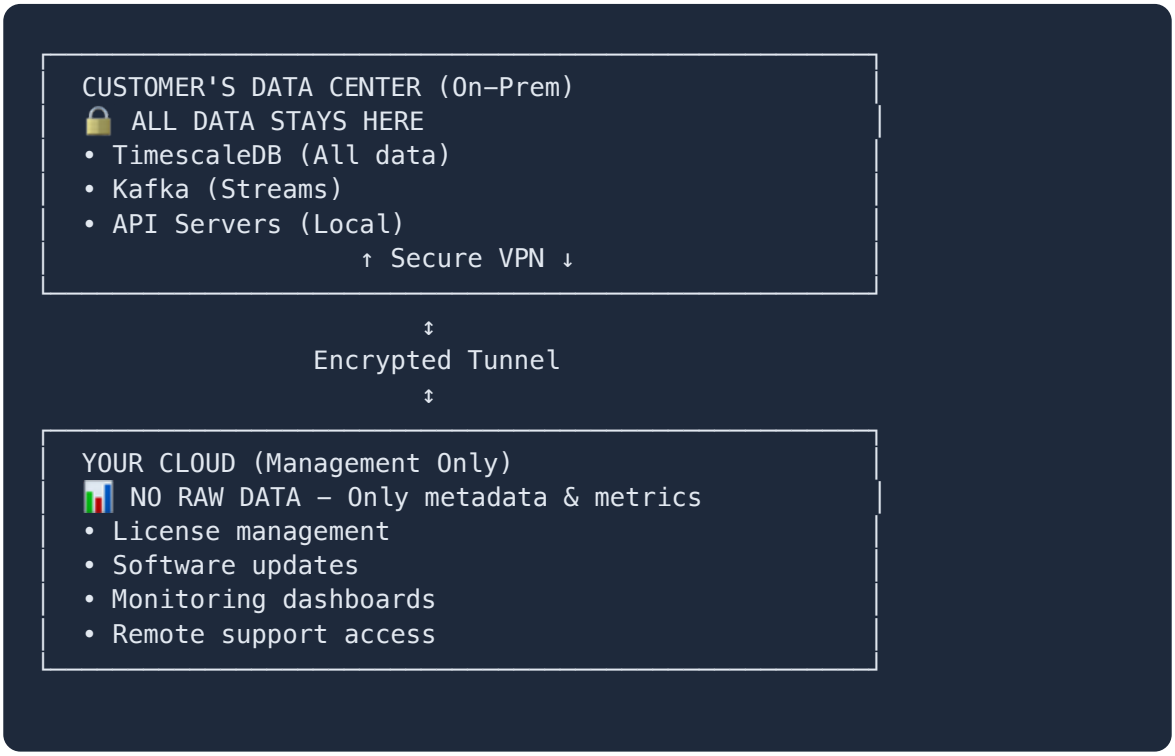
Format	Best For	Complexity
Docker Compose	Small/Medium deployments	Low
Kubernetes Helm	Large scale, enterprise	Medium
VM Images (OVA)	No container experience	Lowest
Ansible Playbooks	Bare metal servers	Medium
Air-Gapped Bundle	No internet environments	High

Phase 10: Hybrid Deployment Support

Duration: 4 Weeks | **Complexity:** Medium

Purpose: Combine on-prem data storage with cloud management.

Hybrid Architecture



What Stays Where

Component	On-Prem	Cloud	Why
Customer Data	✅	❌	Data sovereignty
Meter Readings	✅	❌	Sensitive data
Application Code	✅	❌	Runs locally
License Keys	❌	✅	Validation
Monitoring Metrics	❌	✅	Centralized view
Software Updates	❌	✅	Easy rollout

Summary: The Complete Platform

End-to-End Flow

```
Customer says: "5 million AMI meters, 15-min readings, on-prem deplo
                              ↓
Platform automatically:
1. Understands requirements (AI - Phase 6)
2. Generates database, logic, screens (Low-Code - Phase 5)
3. Calculates load (480M writes/day) (Phase 7)
4. Selects architecture (TimescaleDB + Kafka + ClickHouse)
5. Generates Docker/Kubernetes package (Phase 9)
6. Customer deploys in their data center
7. Cloud dashboard for monitoring/updates (Phase 10)
```

Competitive Advantage

Feature	Traditional Dev	Our Platform
Time to build app	6-12 months	1 day
Technical skill needed	Senior developers	None
Infrastructure setup	Weeks	Minutes
On-prem support	Custom work	Built-in
Scaling	Manual	Automatic

Infrastructure Specifications

Detailed infrastructure requirements for deploying the KINTO platform at different scales.

Scale Tier Definitions

Tier	Records/Day	Devices/Meters	Typical Use Case
Small	< 1 Million	Up to 50,000	Small utilities, SMB manufacturing
Medium	1M - 100M	50K - 1M	Regional utilities, mid-size enterprises
Large	100M - 1B	1M - 5M	State-level utilities, large enterprises
Massive	> 1 Billion	5M - 50M+	National utilities, multi-state operations

Example Calculation (5M AMI Meters):
5,000,000 meters x 96 readings/day (15-min interval) = **480 Million records/day**
Peak load: ~5,500 writes/second | Storage growth: ~50 GB/day

Compute Requirements by Tier

Small Tier (< 1M records/day)

Component	Instance Type	CPU	RAM	Qty
Application Server	t3.large / D2s_v3	2 vCPU	8 GB	2
Database Server	r5.large / E4s_v3	2 vCPU	16 GB	1
Cache Server	t3.medium	2 vCPU	4 GB	1
Total	-	**8 vCPU**	**36 GB**	5

Monthly Estimate: $400-600 (AWS/Azure)

Medium Tier (1M - 100M records/day)

Component	Instance Type	CPU	RAM	Qty
Application Server	c5.xlarge / F4s_v2	4 vCPU	8 GB	3-4
Database Primary	r5.2xlarge / E8s_v3	8 vCPU	64 GB	1
Database Replica	r5.xlarge / E4s_v3	4 vCPU	32 GB	2
Cache Cluster	r5.large	2 vCPU	16 GB	2
Total	-	**38 vCPU**	**200 GB**	10-11

Monthly Estimate: $2,500-4,000 (AWS/Azure)

Large Tier (100M - 1B records/day)

Component	Instance Type	CPU	RAM	Qty
Application Server	c5.2xlarge / F8s_v2	8 vCPU	16 GB	6-8
TimescaleDB Primary	r5.4xlarge	16 vCPU	128 GB	1
TimescaleDB Replicas	r5.2xlarge	8 vCPU	64 GB	3
ClickHouse Analytics	r5.2xlarge	8 vCPU	64 GB	3
Kafka Brokers	m5.2xlarge	8 vCPU	32 GB	3
Redis Cluster	r5.xlarge	4 vCPU	32 GB	6
Total	-	**170 vCPU**	**832 GB**	32-36

Monthly Estimate: $15,000-25,000 (AWS/Azure)

Massive Tier (> 1B records/day)

Component	Instance Type	CPU	RAM	Qty
Application Server	c5.4xlarge	16 vCPU	32 GB	12-20
Cassandra Cluster	i3.2xlarge	8 vCPU	61 GB	9-12
ClickHouse Cluster	r5.4xlarge	16 vCPU	128 GB	6-9
Kafka Cluster	m5.4xlarge	16 vCPU	64 GB	6-9
Redis Cluster	r5.2xlarge	8 vCPU	64 GB	9
Total	-	**500+ vCPU**	**2+ TB**	60-80+

Monthly Estimate: $60,000-120,000 (AWS/Azure)

Storage Requirements

Tier	Database	Backup	Logs	Total (Year 1)
Small	500 GB SSD	1 TB	100 GB	~2 TB
Medium	5 TB NVMe	15 TB	500 GB	~25 TB
Large	50 TB NVMe	150 TB	2 TB	~250 TB
Massive	500 TB NVMe	1.5 PB	10 TB	~2.5 PB

Network Requirements

Tier	Ingress	Egress	Internal	VPN/Direct Connect
Small	100 Mbps	100 Mbps	1 Gbps	Optional
Medium	500 Mbps	500 Mbps	10 Gbps	Recommended
Large	2 Gbps	2 Gbps	25 Gbps	Required
Massive	10+ Gbps	10+ Gbps	100 Gbps	Required (redundant)

Security Specifications

Firewall Rules (Ingress)

Source	Destination	Port	Protocol	Purpose
0.0.0.0/0	Load Balancer	443	HTTPS	Web traffic
0.0.0.0/0	Load Balancer	80	HTTP	Redirect to HTTPS
WhatsApp IPs	API Gateway	443	HTTPS	Webhook callbacks
Office IPs	Bastion	22	SSH	Admin access

Firewall Rules (Egress)

Source	Destination	Port	Protocol	Purpose
App Servers	0.0.0.0/0	443	HTTPS	External API calls
App Servers	0.0.0.0/0	587/465	SMTP	Email delivery
App Servers	WhatsApp API	443	HTTPS	WhatsApp messages
DB Servers	Backup storage	443	HTTPS	Backup uploads

Internal Network Rules

Source	Destination	Port	Protocol	Purpose
App Servers	DB Primary	5432	TCP	PostgreSQL
App Servers	Redis	6379	TCP	Cache/Sessions
App Servers	Kafka	9092	TCP	Message streaming
DB Primary	DB Replicas	5432	TCP	Replication

SSL/TLS Specifications

Requirement	Specification
Minimum TLS Version	TLS 1.2 (TLS 1.3 preferred)
Certificate Type	EV SSL for production, Wildcard for subdomains
Key Size	RSA 2048+ or ECDSA P-256+
HSTS	Enabled, max-age=31536000, includeSubDomains
Certificate Rotation	90 days (automated with ACME)
mTLS	Required for service-to-service (Large/Massive)

WAF Rules

Category	Action	Description
SQL Injection	Block	Detect SQLi patterns
XSS	Block	Cross-site scripting prevention
Rate Limiting	Throttle	1000 req/min per IP
Bot Detection	Challenge	CAPTCHA for suspicious patterns
Geo-blocking	Allow/Block	Country-based access control

DDoS Protection

Tier	Protection Level	Features
Small	Basic (Cloud default)	Volumetric protection
Medium	Standard DDoS Shield	L3/L4 + L7 mitigation
Large	Advanced DDoS Shield	24/7 SOC, SLA guarantee
Massive	Enterprise DDoS	Multi-layer, instant mitigation

High Availability & Disaster Recovery

Tier	Target SLA	Max Downtime/Year	RTO	RPO
Small	99.5%	43.8 hours	4 hours	24 hours
Medium	99.9%	8.76 hours	1 hour	1 hour
Large	99.95%	4.38 hours	15 minutes	15 minutes
Massive	99.99%	52.6 minutes	5 minutes	Near-zero

Cost Estimation Summary

Monthly Infrastructure Costs (Cloud)

Tier	Compute	Storage	Network	Total/Month
Small	$300	$100	$50	**$450-600**
Medium	$2,000	$500	$300	**$2,800-4,000**
Large	$12,000	$3,000	$2,000	**$17,000-25,000**
Massive	$60,000	$15,000	$10,000	**$85,000-120,000**

One-Time On-Prem Costs

Tier	Hardware	Setup	Total
Small	Rs.5-8 Lakhs	Rs.1-2 Lakhs	**Rs.6-10 Lakhs**
Medium	Rs.25-40 Lakhs	Rs.5-8 Lakhs	**Rs.30-48 Lakhs**
Large	Rs.1-2 Crores	Rs.20-30 Lakhs	**Rs.1.2-2.3 Crores**
Massive	Rs.5-10 Crores	Rs.1-2 Crores	**Rs.6-12 Crores**

Industry Compliance Profiles

Pre-configured compliance profiles for regulated industries. Each profile automatically applies specific security, data handling, and integration requirements.

Profile Overview

Profile	Target Industries	Key Regulations	Default Security Tier
Healthcare	Hospitals, Diagnostics, Pharma	HIPAA, ABDM, DISHA	Large
Banking	Banks, NBFCs, Payment Processors	PCI-DSS, RBI IT Guidelines	Massive
Government	PSUs, Ministries, Local Bodies	STQC, MeitY, GIGW	Large
Manufacturing	Factories, Industrial (Default)	ISO 9001, Factory Act	Medium

Healthcare Compliance Profile (HIPAA/ABDM)

Target: Hospitals, Diagnostics, Pharma | **Regulations:** HIPAA, ABDM, DISHA, NABH

Data Protection Requirements

Requirement	Implementation
Field-Level Encryption	Patient ID, Diagnosis codes, Treatment notes encrypted at column level
At-Rest Encryption	AES-256 with customer-managed keys (CMK) for all PHI
In-Transit Encryption	TLS 1.3 mandatory, mTLS for inter-service communication
Data Masking	Automatic masking of patient identifiers in logs and reports
Data Residency	India-only storage zones (for ABDM compliance)

Access Control Requirements

Control	Specification
Authentication	MFA mandatory, session timeout 15 minutes inactive
Biometric Option	Aadhaar-based authentication for clinical staff
Role Segregation	Clinical vs Administrative vs Billing roles strictly separated
Break-Glass Access	Emergency PHI access with immediate notification and audit
Consent Management	Patient consent tracking for every data access

Audit & Retention

Requirement	Duration	Notes
Access Logs	7 years	Every PHI view/modify logged
Consent Records	10 years	Digital consent with timestamp
Medical Records	30 years	Minimum per clinical guidelines
Audit Trail	7 years	Immutable, digitally signed

Integration Stack

```
Healthcare Integration Stack:
├── ABDM Gateway (Health ID, Consent Manager, HIE)
├── HL7 FHIR R4 (Patient, Observation, MedicationRequest)
├── DICOM Integration (PACS connectivity)
└── Lab Information Systems (HL7 v2.x ADT/ORU)
```

Banking Compliance Profile (PCI-DSS/RBI)

Target: Banks, NBFCs, Payment Processors | **Regulations:** PCI-DSS v4.0, RBI IT Guidelines

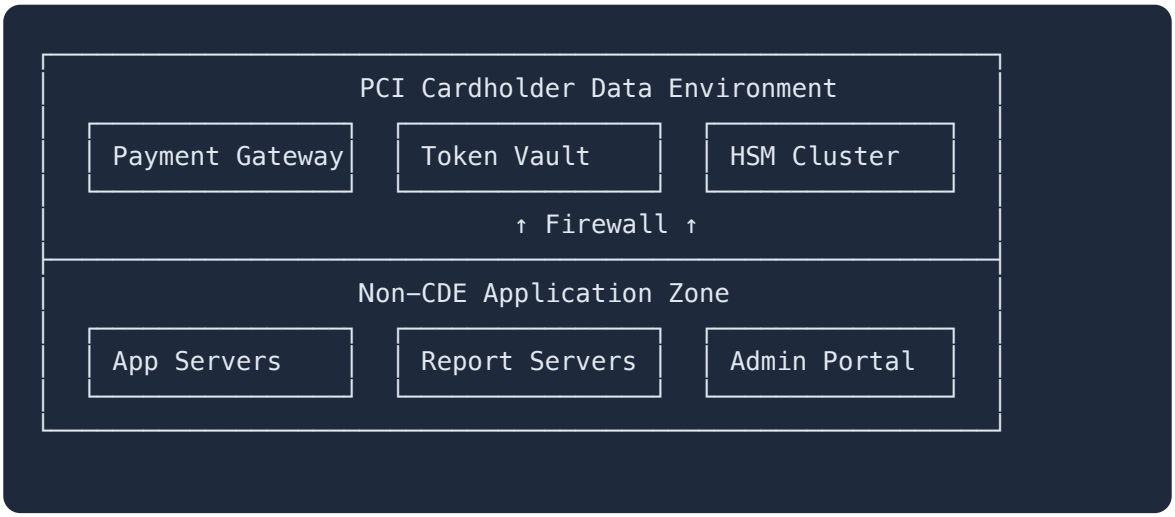
Data Protection Requirements

Requirement	Implementation
PAN Encryption	Card numbers encrypted immediately, never logged
PAN Masking	Display only last 4 digits (****1234)
CVV Prohibition	CVV never stored under any circumstances
PIN Block Security	Hardware Security Module (HSM) for PIN operations
Tokenization	Card data replaced with tokens for processing

Access Control Requirements

Control	Specification
Authentication	MFA with hardware token for privileged access
Unique IDs	No shared accounts, individual accountability
Privilege Escalation	Maker-Checker for all sensitive operations
Access Reviews	Quarterly recertification of all access rights
Admin Access	Just-in-time provisioning, 4-hour maximum

Network Segmentation



Integration Stack

```
Banking Integration Stack:
├── NPCI (UPI, IMPS, NACH, AePS)
├── Core Banking (Finacle, Flexcube, TCS BaNCS)
├── RBI Reporting (Regulatory returns, XBRL)
├── CIBIL/Credit Bureau (Credit score, Inquiry logging)
└── KYC/AML (Video KYC, CKYC Registry, Sanctions screening)
```

Government Compliance Profile (STQC/MeitY)

Target: PSUs, Ministries, Local Bodies | **Regulations:** STQC, GIGW 3.0, IT Act 2000

Data Protection Requirements

Requirement	Implementation
Data Classification	Public / Restricted / Confidential / Secret
Data Localization	All data on Indian soil, no cross-border transfer
Encryption Standards	AES-256 minimum, SHA-256 for hashing
Key Escrow	Government key escrow for certain classifications
RTI Compliance	Automated RTI response tracking

Accessibility & Language

Requirement	Specification
WCAG Compliance	WCAG 2.1 Level AA mandatory
Language Support	Hindi + English mandatory, regional languages
Screen Reader	Full NVDA/JAWS compatibility
Keyboard Navigation	Complete keyboard accessibility
Low Bandwidth	Functional on 2G connections

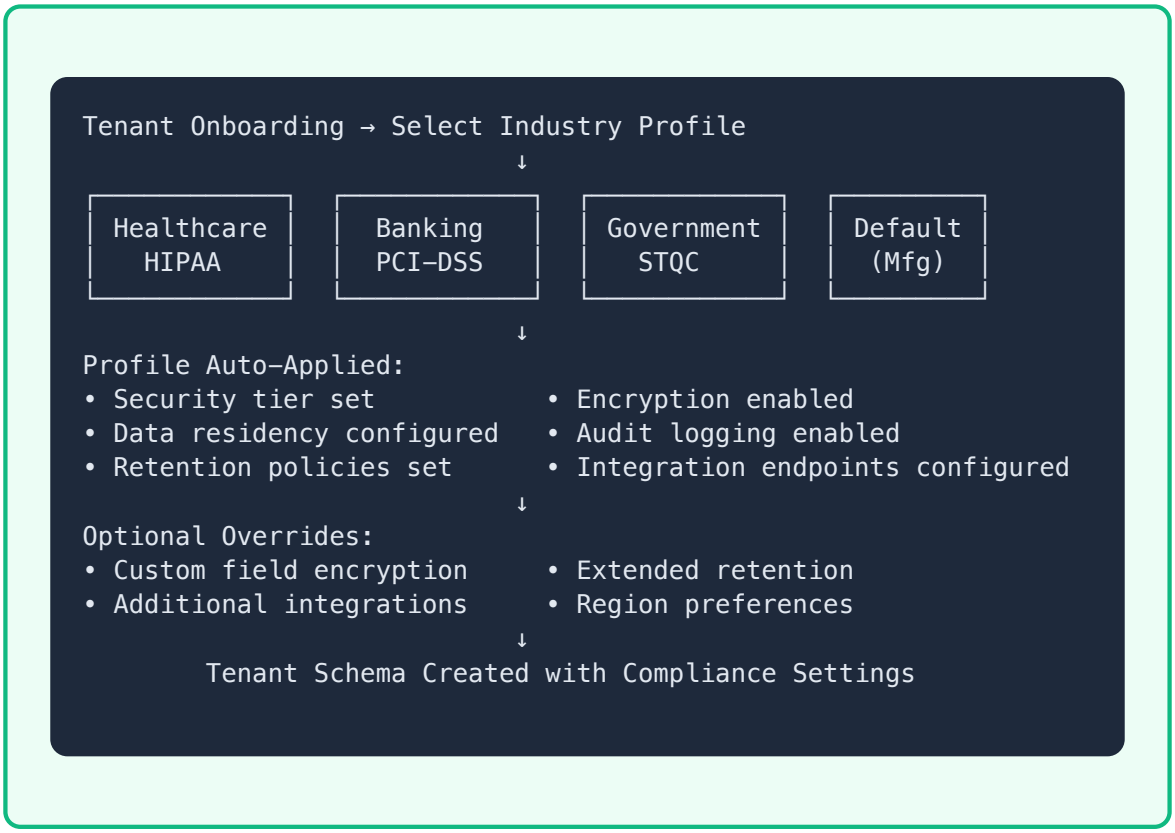
Access Control Requirements

Control	Specification
Authentication	Aadhaar eKYC or eSign mandatory for citizens
SSO Integration	Parichay (Government SSO) integration
Role Hierarchy	Strict government role hierarchy (Gazetted/Non-Gazetted)
Maker-Checker	Dual approval for all citizen-facing actions
Audit Trail	Immutable audit for all government actions

Integration Stack

```
Government Integration Stack:
├── DigiLocker (Document fetch/issue, URI-based access)
├── Aadhaar (Demographic verification, eKYC, Face auth)
├── eSign (Aadhaar eSign, DSC-based, eStamping)
├── UMANG (Service listing, Payment gateway)
├── PayGov (GRAS integration, Challan generation)
└── GSTN (GST verification, e-Invoice generation)
```

Compliance Profile Selection Flow



Compliance Audit Dashboard

Each tenant with a compliance profile gets an audit dashboard:

Metric	Healthcare	Banking	Government
Encryption Status	PHI fields encrypted	PAN/CVV protected	Classified data secured
Access Reviews	Patient consent valid	Quarterly review due	Gazetted approval status
Audit Log Health	7-year retention OK	10-year retention OK	10-year retention OK
Integration Status	ABDM connected	NPCI active	DigiLocker linked
Compliance Score	94%	98%	91%

Document End

KINTO Operations - Multi-Tenant Architecture Implementation Plan v2.0

December 14, 2025