# Application, AI, NFR, Tracking, Integration and Middleware Layers Architecture Overview

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## **1. Application Architecture Layers**

This table outlines the functional layers of the application, including CRM, automation, AI, middleware, and analytics.

1/4

Layer	Examples of Tools	Used For
CRM / Front Office	HubSpot , Salesforce	Sales outreach, marketing campaigns, lead forms
CMS	HubSpot CMS, Shopify CMS, AEM	Content and asset management
Process Automation	IBM BAW, AWS Lambda, EventBridge	Multi-step business workflows, approvals, RPA/IPA
Operational Data Model (System DB)	DynamoDB , Azure SQL, PostgreSQL	Real-time transactional logic, source of truth for app data
Commerce Layer	Shopify, Magento, Composable	Product catalog, shopping cart, and checkout
Payments Layer	Stripe, Shopify Payments	One-time transaction processing
Subscription Payments Layer	Braintree, Shopify Subscriptions	Recurring billing, subscription plans
Al Layer	watsonx Orchestrate , OpenAI , Pinecone , LangChain	LLMs, agents, RAG, automation, content generation
Middleware Layer	n8n, Zapier, Boomi, AWS API Gateway	System orchestration , API routing , automation logic , async data sync
Integration Layer	Custom APIs, Zapier, n8n	Workflow automation , API orchestration , and cross-system data sync
Data Warehouse	Snowflake, Redshift, BigQuery	Canonical model, KPI tracking, dashboards
Data Lake	S3, Snowflake	Raw/unstructured data storage for AI, LLMs, logs, backups
Reporting & Analytics	Power BI, Looker, Tableau, HubSpot Reports	Dashboards , business insights , strategic metrics
Tracking & Attribution	GTM, GA4, Segment, Amplitude, Mixpanel	Behavioral analytics, attribution, funnel tracking
Customer Support	Zendesk, Freshdesk, Kustomer	Help desk, ticketing, customer issue resolution

## 2. Non-Functional Architecture (NFR)

This table defines infrastructure and cross-cutting concerns that support the reliability, scalability, and maintainability of the application stack.

NFR Layer	Examples of Tools	Used For
Security & Compliance	AWS WAF, Cloudflare , Vanta, Drata	Threat protection , data encryption , SOC 2, GDPR , HIPAA
Performance & Scalability	Load Balancer, CDN, Redis, Auto Scaling	High availability , caching , latency reduction
DevOps & CI/CD	GitHub Actions, Jenkins, CircleCI, CodePipeline	Deployment automation, versioning, release orchestration
Environment Management	Docker, Kubernetes, ECS, Terraform	Container orchestration , infra-as- code , env isolation
Monitoring & Observability	Datadog , CloudWatch , New Relic , ELK	System uptime, performance metrics, error tracking
Disaster Recovery & Backup	AWS Backup, Azure Site Recovery	Recovery plans, backup strategy, business continuity
Audit Logging & Traceability	CloudTrail, ELK, Papertrail	Compliance logs, system traceability
Testing & QA Automation	Cypress, Selenium, Postman, TestRail	Automated testing, regression validation
Identity & Access Management (IAM)	Auth0, Cognito, Okta, Azure AD	Authentication , SSO, role-based access control

#### 3. Tracking & Attribution Layer

This layer is specified separately in systems where **analytics and attribution** are critical to performance marketing or user journey optimization.

Tracking Layer	Examples of Tools	Used For
Tag Management	Google Tag Manager (GTM)	Central tag control, script injection
Web Analytics	GA4, Adobe Analytics, Mixpanel, Amplitude	Traffic metrics, funnel analysis, cohort tracking
Attribution & Identity	Segment , RudderStack , Meta Pixel , TikTok Pixel	Customer journeys, UTM tracking, ad attribution
Consent Management	OneTrust, Cookiebot	Compliance with cookie laws (GDPR, CCPA)
Event Stream/Data Capture	Segment , Snowplow , PostHog	Event tracking and piping to data warehouse or CDP

## 4. Al Architecture Layer

The AI Layer powers intelligent automation, personalization, and content generation across the application. It includes LLMs (Large Language Models), agent orchestration tools, RAG (Retrieval-Augmented Generation) infrastructure, and machine learning services. This layer supports both user-facing interactions (like assistants and recommendations) and backend decision-making (like classification, enrichment, and workflow logic).

Function	Examples of Tools	Used For
Al Orchestration / Agent Layer	watsonx Orchestrate , CrewAI , LangChain	Multi-step AI tasks, agent workflows
LLM / NLP Services	OpenAI, Claude, <u>watsonx.ai</u>	Text generation , summarization , classification
RAG Infrastructure	Pinecone , Weaviate , Elasticsearch , LangChain	Retrieval-Augmented Generation (querying your data with LLMs)
Embedding Models	OpenAl Embeddings, Hugging Face, Cohere	Vectorizing internal content for search and RAG
AI Content Generation	GPT-4, ElevenLabs , Runway , MidJourney	Automated content, visuals, speech, and animation
ML Models & Inference	SageMaker , Vertex AI, Azure ML	Custom machine learning models (e.g., churn, fraud, personalization )

### 5. Integration & Middleware Layers

Function	Examples of Tools	Used For
Workflow Automation	Zapier, n8n, Make	Connecting apps and automating business logic with low-code tools
Enterprise iPaaS	Boomi, Workato, <u>Tray.io</u>	Enterprise -grade integration , data transformation , event handling
API Management	AWS API Gateway, Apigee, Kong	Routing, rate limiting, and managing APIs across services
Event Messaging	Kafka, RabbitMQ , SQS	Asynchronous processing and message queueing for microservices
Custom Middleware Services	Node.js, Python, Java microservices	Custom business logic, integration orchestration