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TYPE	AUDIENCE	VERSION	DATE
Reference architecture	Enterprise & Solution Architects	1.0	June 2026

The Enterprise Decision Architecture Series

- Volume 1 — Enterprise Decision Control Plane
- ▶ Volume 2 — Enterprise Decision Layer Reference Architecture (this volume)
- Volume 3 — Enterprise Decision Transformation Playbook
- Volume 4 — Cryptographic Decision Lineage Technical Specification
- Volume 5 — Enterprise Decision Governance & Operations Guide

Companion document. This reference architecture is the technical companion to *MuSIC — The Enterprise Decision Control Plane for AI (v2.1)*. That paper defines the category. This document defines how the category is implemented inside a modern enterprise.

It is written for the architect who has accepted the thesis and now asks the operational question: if I were implementing an Enterprise Decision Layer, how would I architect it, how would it interact with the platforms I already run, and how would each component — Operational Domains, Decision Maps, policy, MCP, lineage — actually work?

Contents

Executive Summary.....3

Purpose of the Enterprise Decision Layer.....4

When Enterprises Need One.....5

Architectural Principles.....6

Chapter 1 — Enterprise AI Architecture Today.....7

Chapter 2 — The Enterprise Decision Layer.....9

Chapter 3 — Reference Architecture.....10

Chapter 4 — Operational Domains.....11

Chapter 5 — Decision Maps.....13

Chapter 6 — Enterprise Decision APIs.....15

Chapter 7 — The Policy Layer.....16

Chapter 8 — Execution Planning.....17

Chapter 9 — MCP Integration Architecture.....19

Chapter 10 — Enterprise Event Architecture.....20

Chapter 11 — Cryptographic Decision Lineage.....21

Chapter 12 — Security Architecture.....24

Chapter 13 — Deployment Models.....25

Chapter 14 — Operational Model.....26

Chapter 15 — Scalability.....27

Chapter 16 — Enterprise Integration Patterns.....28

Chapter 17 — Reference Use Cases.....29

Chapter 18 — Design Principles.....30

Appendix A — Component Responsibility Matrix.....31

Appendix B — Enterprise Decision APIs (Conceptual).....32

Appendix C — Logical Components of a Decision Record.....33

Appendix D — Operational Metrics (Conceptual Overview).....34

Appendix E — Worked Example: Service-to-Sales Acquisition.....35

Appendix F — Glossary.....37

Executive Summary

Enterprises are deploying AI agents across every function, supplied by vendors that do not coordinate with one another. Each agent platform governs the lifecycle of its own agents. None governs how the enterprise decides. The result is operational fragmentation: the same business rule implemented inconsistently across systems, decision logic duplicated and divergent, and no way to reconstruct how an AI-driven decision was made.

The Enterprise Decision Layer is the architectural response. It is a neutral runtime that sits above the systems of record and the agents that act on them, and provides one coordination layer for decision policy, reusable reasoning, execution governance, and tamper-evident lineage. MuSIC is one implementation of that architecture.

This document specifies the layer in implementation terms. It defines the runtime and its components, the reference topology, and the internal mechanics of Operational Domains, Decision Maps, Enterprise Decision APIs, the policy hierarchy, execution planning, MCP integration, the event backbone, Cryptographic Decision Lineage, security, deployment, operations, and scale. It closes with reference use cases and the design principles that govern the layer.

What this document is — and is not

It is a reference architecture: components, responsibilities, topologies, and patterns.

It is implementation-neutral on vendor agents and systems of record — those remain enterprise-owned.

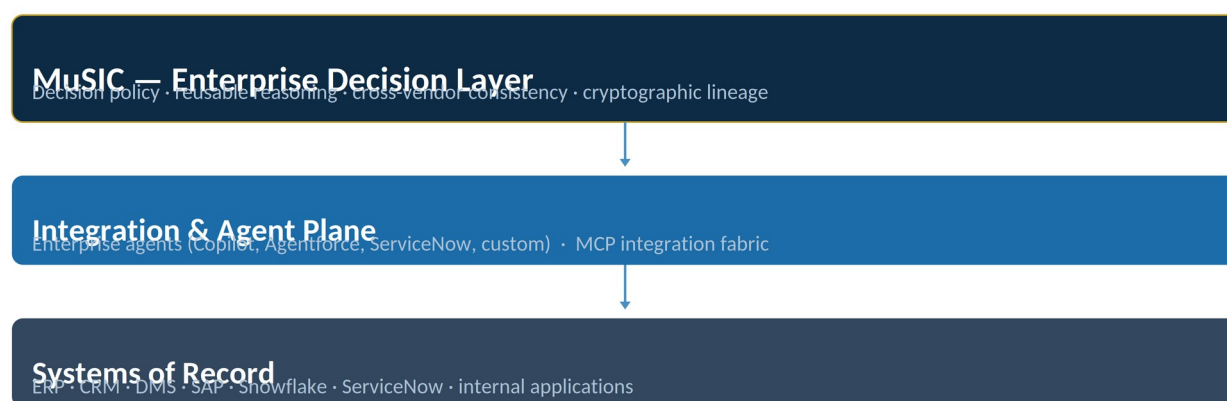
It is not a product manual, a deployment runbook, or marketing material.

It assumes the reader accepts the category thesis established in the companion paper.

Purpose of the Enterprise Decision Layer

The Enterprise Decision Layer exists to make AI-driven decisions consistent, governed, and reconstructable across an enterprise that runs many agents and systems concurrently. It is a horizontal layer, analogous in role to identity or integration: not the system of record, not the application, but the shared infrastructure that every decision passes through.

Figure 2.1 — The Enterprise Decision Layer



The decision layer governs decisions across the planes beneath it. The systems of record remain enterprise-owned.

Figure 2.1 — The Enterprise Decision Layer sits above the integration and agent plane and the systems of record.

Responsibilities

The layer owns four responsibilities that no agent platform or system of record provides on its own: it evaluates enterprise policy on every decision; it generates and weighs alternatives and records confidence; it routes high-stakes decisions to human approval by policy; and it produces a tamper-evident lineage record for every decision it governs. Everything else — the reasoning content, the policies, the agents, the integrations — remains enterprise-owned and runs through the layer rather than being replaced by it.

Non-goals

The layer does not replace ERP, CRM, or any system of record; it does not replace agent platforms such as Copilot Studio, Agentforce, or ServiceNow; and it does not own the enterprise's decision logic. It is deliberately neutral. Its value comes precisely from being the one place where cross-vendor consistency and accountability can be enforced without favoring any single vendor.

When Enterprises Need One

Not every enterprise needs a decision layer on day one. The need emerges predictably as AI deployment scales. The following indicators, observed together, signal that an enterprise has crossed the threshold where the absence of a decision layer has begun to cost more than its adoption.

- More than a handful of agents operate across multiple vendors, each governing its own behavior.
- The same business decision (refund, pricing exception, eligibility) is implemented in more than one system.
- There is no single answer to “which policy was applied to this decision, and why?”
- Policy changes require redeploying or reconfiguring several systems to take effect everywhere.
- Audit, risk, or compliance cannot reconstruct how a specific automated decision was made.
- Decision logic built for one business unit cannot be reused by another without rebuilding it.

Architectural reading

These indicators map to maturity Level 4 in the companion paper — an agent ecosystem without a decision runtime. The decision layer is the Level 5 capability. Adopt it when **cross-vendor consistency and decision accountability** become first-order requirements rather than aspirations.

Architectural Principles

Six principles govern every design decision in this document. They are stated here once and referenced throughout.

Enterprise ownership of cognition. Decision logic, policy, reasoning, and operational knowledge are enterprise-owned assets. The layer hosts and governs them; it does not absorb them.

Neutrality. The layer favors no agent platform and no system of record. It coordinates across all of them, which is only credible if it competes with none of them.

Systems of record stay systems of record. The layer consumes events and invokes governed actions through integration; it never becomes the book of record for enterprise data.

Reusability and compounding. Reasoning is captured as reusable assets (Decision Maps, Operational Domains) that compound in value as they are shared across the enterprise.

Accountability by construction. Every governed decision is recorded in tamper-evident lineage as it is made — not reconstructed afterward from logs.

Policy as a single source of truth. Policy is hierarchical and inherited. One change propagates to every governed decision without redeploying downstream systems.

Chapter 1 — Enterprise AI Architecture Today

A modern enterprise runs a dense and heterogeneous technology estate. Systems of record — ERP and SAP, CRM and Salesforce, dealer or device management systems, ServiceNow, data platforms such as Snowflake and Databricks, and a long tail of internal applications — hold the authoritative state of the business. On top of them, an expanding population of AI capabilities now acts: large language models, vendor agents (Copilot, Agentforce, ServiceNow, Joule), and custom agents, increasingly integrated through the Model Context Protocol (MCP).

Figure 1.1 — Enterprise AI Architecture Today

MISSING: a shared enterprise decision layer

Each agent decides independently. The same business rule is implemented inconsistently across systems. No common policy. No cross-vendor consistency. No way to reconstruct how a decision was made.

Individually correct • collectively inconsistent

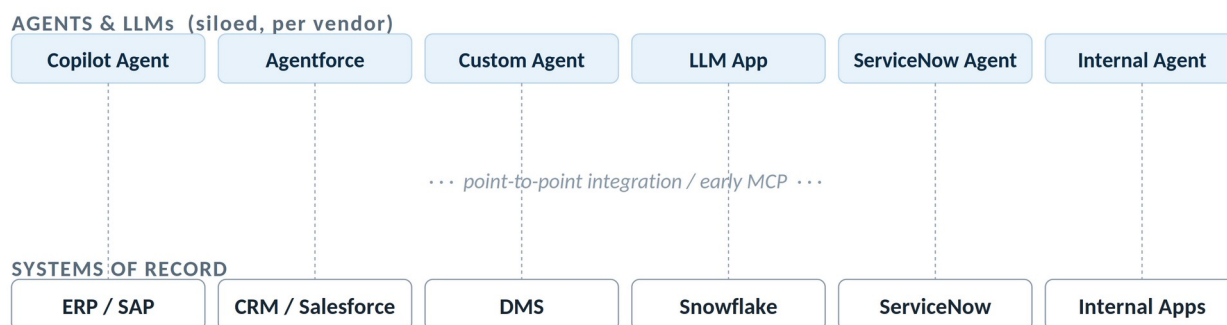


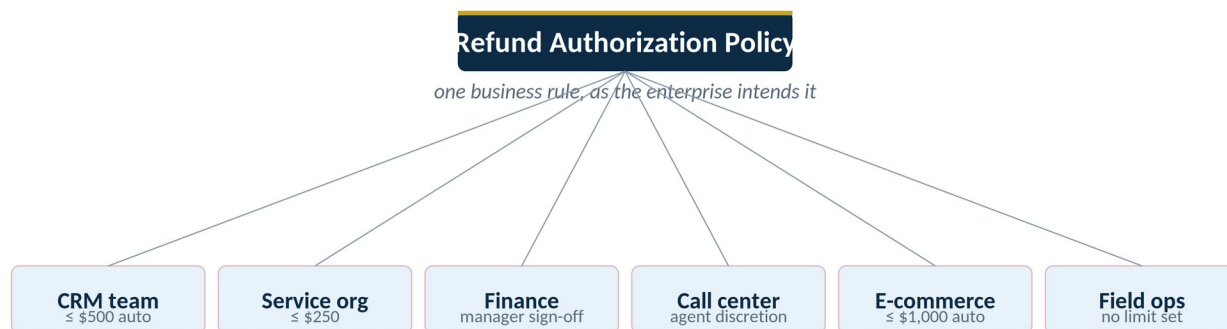
Figure 1.1 — The current enterprise AI estate: capable systems and agents, no shared decision layer.

Each element of this estate works. The systems of record are reliable. The agent platforms are well governed within their own boundaries. MCP is rapidly standardizing integration. The problem is not any single component; it is the absence of a layer that coordinates decisions across them.

How fragmentation forms

Fragmentation does not arrive as a failure. It accumulates as success. Each team deploys agents that solve local problems correctly. Each vendor encodes decision behavior on its own roadmap. Over time, a single business rule acquires multiple implementations — each locally defensible, none enterprise-authoritative.

Figure 1.2 — Operational Fragmentation: One Rule, Six Implementations



Each implementation is locally defensible. None is enterprise-authoritative.

Drift accumulates silently and surfaces years later as divergent customer outcomes and unreconstructable decisions.

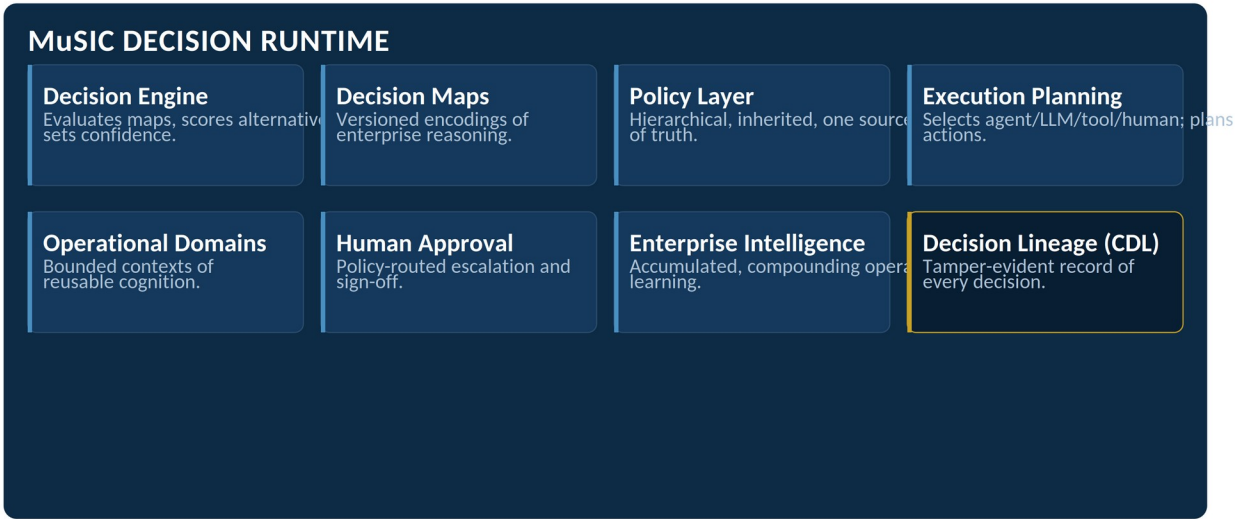
Figure 1.2 — One business rule, implemented inconsistently across teams and systems.

The cost surfaces later: divergent customer outcomes, inconsistent behavior between departments, policy changes that propagate unevenly, and automated decisions that cannot be reconstructed when audit or risk asks how they were made. The estate looks healthy component by component while the enterprise loses decision consistency in aggregate. The remaining chapters specify the layer that closes this gap.

Chapter 2 — The Enterprise Decision Layer

The decision layer is realized as a runtime with a small set of components, each with a single responsibility. This chapter introduces those components and their responsibilities; later chapters specify each in depth.

Figure 2.2 — Decision Runtime Components



Each component has a single responsibility. Together they constitute the decision runtime.

Figure 2.2 — The decision runtime and its components.

Component responsibilities

Decision Engine. Executes Decision Maps: gathers evidence, evaluates policy, generates alternatives, scores them, and assigns confidence. It is the deterministic core of the runtime.

Decision Maps. Versioned encodings of how the enterprise reasons toward a decision — the reusable unit of enterprise reasoning (Chapter 5).

Operational Domains. Bounded contexts that package maps, policies, agents, tools, and lineage into reusable, portable units of enterprise cognition (Chapter 4).

Policy Layer. A hierarchical, inherited policy model that resolves the effective policy for any decision from a single source of truth (Chapter 7).

Execution Planning. Selects executors (agent, LLM, tool, MCP, human), sequences actions, and guarantees completion or clean compensation (Chapter 8).

Human Approval. Policy-routed escalation and sign-off for decisions that exceed defined authority or confidence thresholds.

Enterprise Intelligence. The accumulated, compounding operational learning a domain develops over time.

Cryptographic Decision Lineage (CDL). The tamper-evident record of every governed decision — the runtime's proof layer (Chapter 11).

The runtime governs decisions.
It does not own the enterprise's reasoning — it executes and records it.

Chapter 3 — Reference Architecture

The complete reference topology is shown below. It is read top to bottom as consumption to source: enterprise applications and Decision APIs consume governed decisions; Operational Domains and the runtime produce them; the agent ecosystem and the MCP fabric execute them against the systems of record. Cryptographic Decision Lineage spans the runtime and records the entire path.

Figure 3.1 — MuSIC Enterprise Decision Layer Reference Architecture

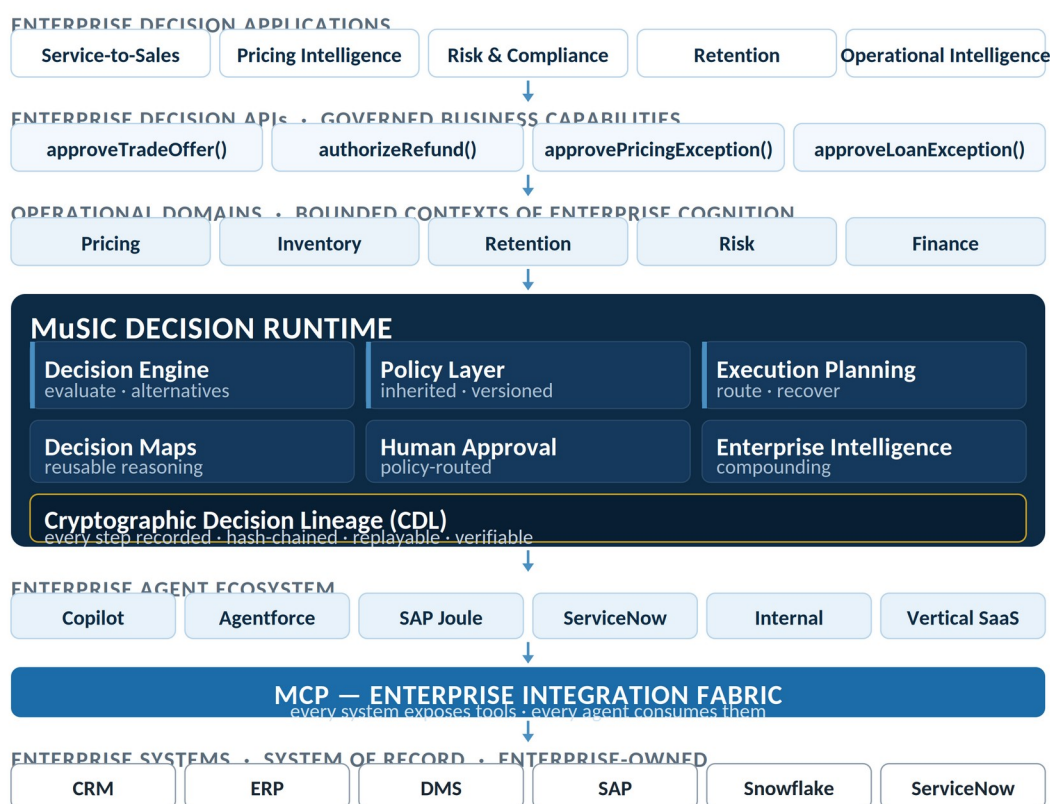


Figure 3.1 — MuSIC Enterprise Decision Layer reference architecture.

Layer-by-layer

Enterprise systems remain the systems of record and stay enterprise-owned. The MCP fabric is the integration layer through which every system exposes tools and every agent and the runtime consume them. The enterprise agent ecosystem executes work; the runtime governs the decisions that work expresses. Operational Domains organize reusable reasoning; Decision APIs expose that reasoning as governed business capabilities; and decision applications consume those capabilities. Lineage is not a separate system bolted to the side — it is integral to the runtime and captures every decision as it is made.

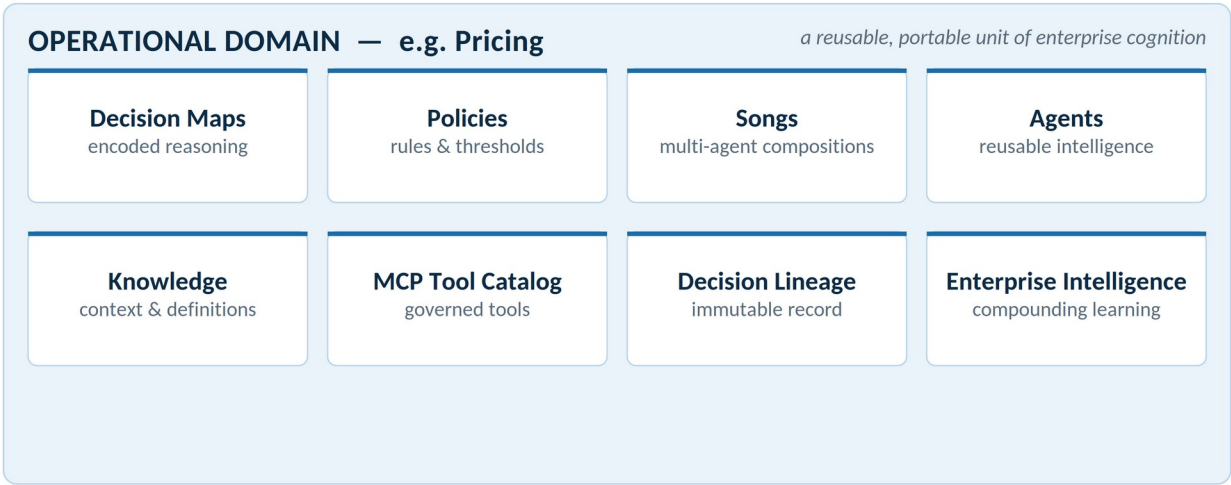
Data and control flow

Business events flow **up** from systems through the fabric to the runtime, where they are reasoned over and decided; governed actions flow **down** through the fabric back into the systems of record. The runtime is the fixed point in the middle through which every AI-driven decision passes.

Chapter 4 — Operational Domains

An Operational Domain is the primary unit of organization in the decision layer. It is a bounded context — in the domain-driven-design sense — that packages everything needed to reason within a coherent area of the business: its Decision Maps, policies, multi-agent compositions, agents, knowledge, governed tool catalog, lineage, and accumulated intelligence.

Figure 4.1 — Anatomy of an Operational Domain



A domain packages reasoning, policy, agents, tools, and lineage as one owned, versioned asset.

Figure 4.1 — The anatomy of an Operational Domain.

Purpose and ownership

A domain has a single accountable owner — typically the business function that owns the decisions within it (pricing, inventory, retention, risk, finance). The owner governs the domain's policies and maps; platform engineering governs the runtime the domain executes on. This separation keeps decision logic with the business and infrastructure with the platform team.

Lifecycle, versioning, and deployment

Domains and the maps within them are versioned assets with a defined lifecycle. Changes are modeled, tested, and — critically — validated by deterministic replay against recorded decisions before promotion. A domain version is deployed as an immutable artifact; rollback is a version pointer change, not a redeploy.

Figure 4.2 — Operational Domain Lifecycle

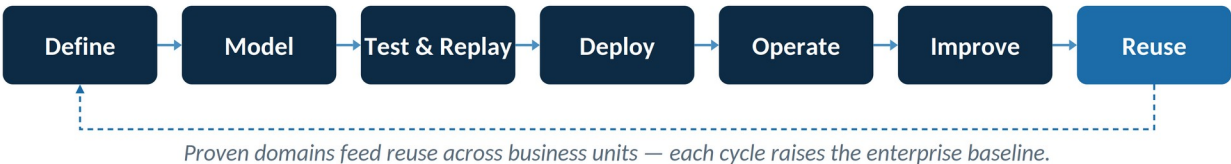
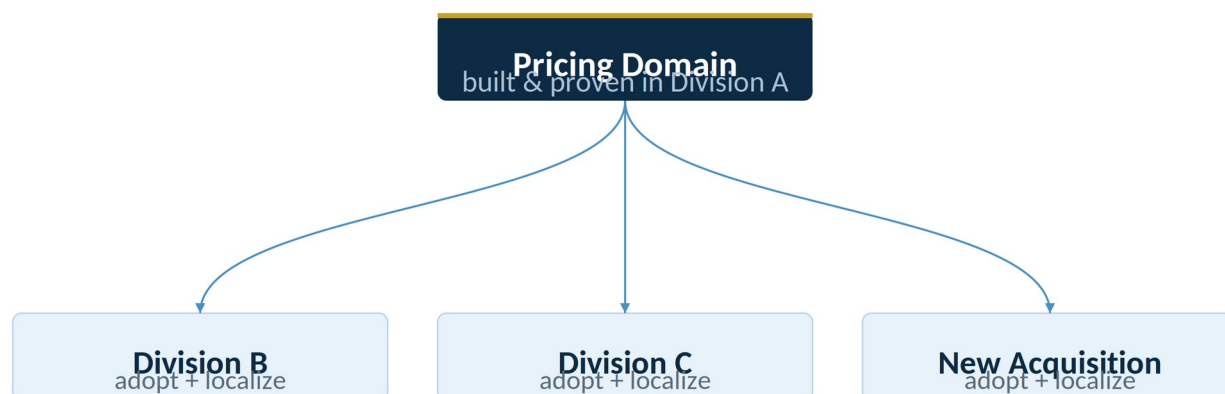


Figure 4.2 — The Operational Domain lifecycle, from definition through reuse.

Reuse and portability

Because a domain encapsulates reasoning, policy, agents, and tools together, it is portable. A Pricing domain proven in one division can be adopted by another, by a new business unit, or by an acquired entity — the receiving unit inherits governed reasoning and adapts only what is genuinely local. This is how decision intelligence compounds: each proven domain raises the baseline for every unit that adopts it next.

Figure 4.3 — Domain Portability Across Business Units



The receiving unit inherits governed reasoning, policy, and tools — and adapts only what is genuinely local.

Figure 4.3 — Domain portability across business units.

Example domains

Pricing. Governs pricing exceptions, discount authority, and margin floors with consistent policy across channels.

Inventory. Optimizes acquisition, allocation, and reconditioning prioritization decisions.

Customer Retention. Governs retention offers and campaign eligibility consistently across every touchpoint.

Risk. Evaluates exposure and eligibility decisions under inherited compliance policy.

Finance. Governs refund authorization, credit exceptions, and approval thresholds.

Healthcare / Manufacturing. Govern clinical-workflow eligibility and production / quality decisions respectively, under domain-specific regulatory policy.

Chapter 5 — Decision Maps

A Decision Map is the reusable encoding of how the enterprise reasons toward a decision. Where a workflow describes the steps to complete a task, a Decision Map describes the reasoning: what evidence is required, which policies apply, what alternatives must be considered, what confidence is acceptable, and when a human must approve. It is best modeled as a directed decision graph.

Figure 5.1 — Decision Map as a Decision Graph

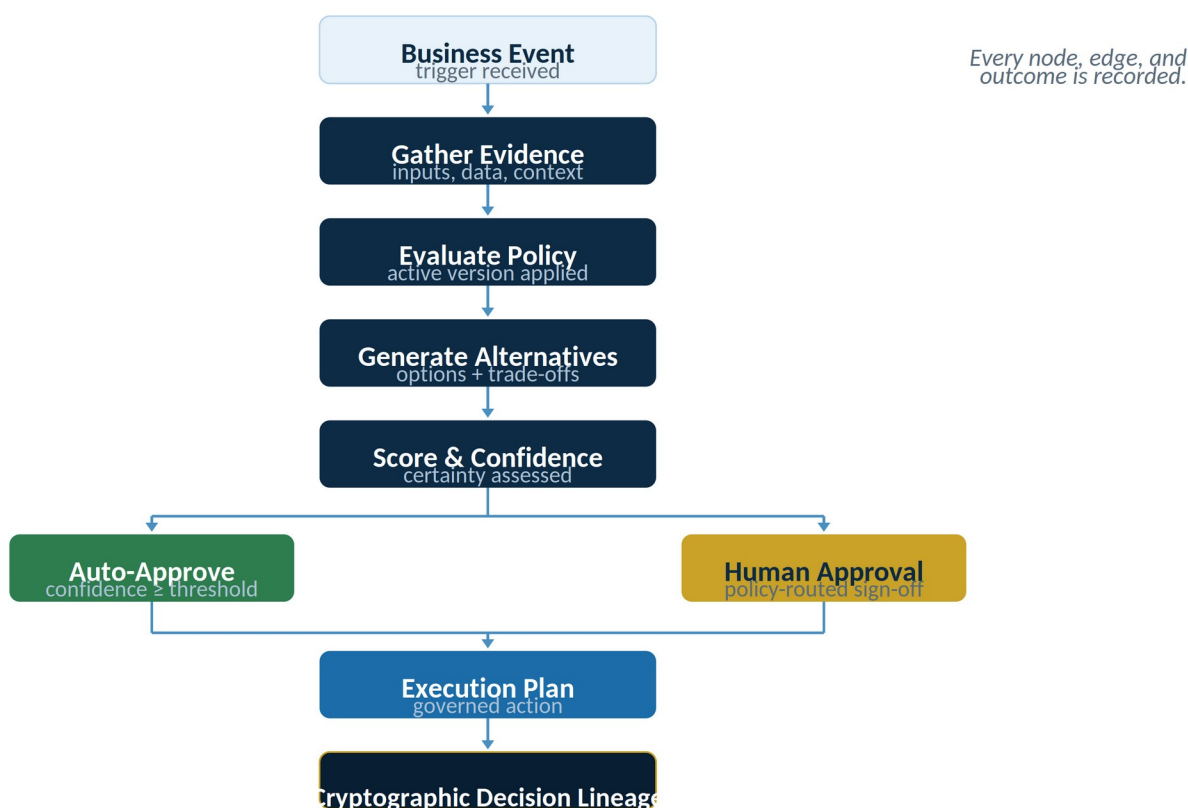


Figure 5.1 — A Decision Map expressed as a decision graph.

Anatomy of a map

Each node is a reasoning step — gather evidence, evaluate policy, generate alternatives, score and assign confidence — and each edge is a governed transition. Terminal branches route to automated execution when confidence meets policy thresholds, or to human approval when it does not. Every node, edge, and outcome is captured in lineage, which is what makes a map replayable.

Lifecycle, versioning, and testing

Maps are versioned and promoted through environments under deterministic gates. A map version cannot reach production until its behavior is reproducible: replaying recorded decisions against the candidate version must produce identical outcomes except where the change is intended. Testing a Decision Map therefore means testing reasoning, not just code paths.

Figure 5.2 — Decision Map Versioning & Promotion



Promotion is gated by deterministic replay against recorded decisions. A map cannot reach production until its behavior is reproducible.

Figure 5.2 — Decision Map versioning and replay-gated promotion.

Replay

Because the map version, policy version, and evidence are recorded together for every decision, any past decision can be re-executed and reproduced exactly. Replay is the foundation of both testing (validating a new version) and audit (reconstructing a specific historical decision).

Figure 5.3 — Deterministic Decision Replay



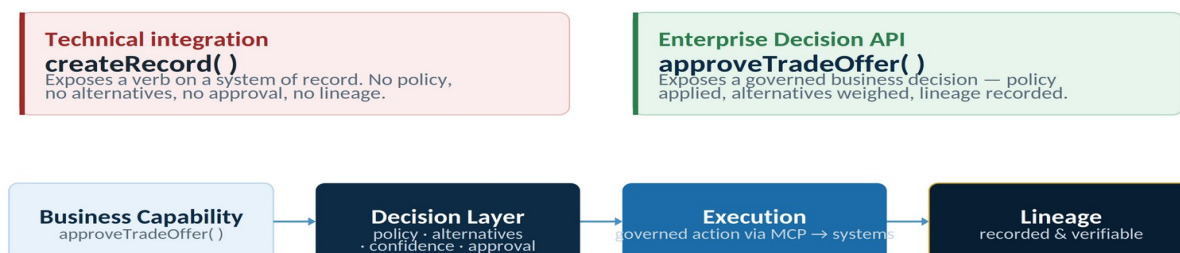
Because the map version, policy version, and evidence are recorded together, any past decision can be re-run and reproduced exactly.

Figure 5.3 — Deterministic replay of a recorded decision.

Chapter 6 — Enterprise Decision APIs

Operational Domains expose their capabilities as Enterprise Decision APIs. The distinction from a conventional technical integration is the central design idea of this chapter: a Decision API exposes a governed business decision, not a verb on a system of record.

Figure 6.1 — Enterprise Decision API vs. Technical Integration



The caller asks for a business outcome. The decision layer governs how that outcome is reached — and records it.
The enterprise stops exposing systems and starts exposing decisions.

Figure 6.1 — An Enterprise Decision API governs the outcome a technical call merely executes.

A call such as `createRecord()` executes a state change with no notion of policy, alternatives, approval, or lineage. A call such as `approveTradeOffer()` expresses a business intent; the decision layer governs how that intent is satisfied — applying policy, weighing alternatives, recording confidence, routing approval, executing through MCP, and writing lineage. The caller asks for an outcome; the layer governs the decision and records it.

Why business-capability APIs matter architecturally

Consistency: every caller of `approveRefund()` gets the same governed behavior, regardless of which agent or app invoked it.

Decoupling: callers depend on a stable business capability, not on the schema of an underlying system of record.

Auditability: each call produces a complete lineage record by construction.

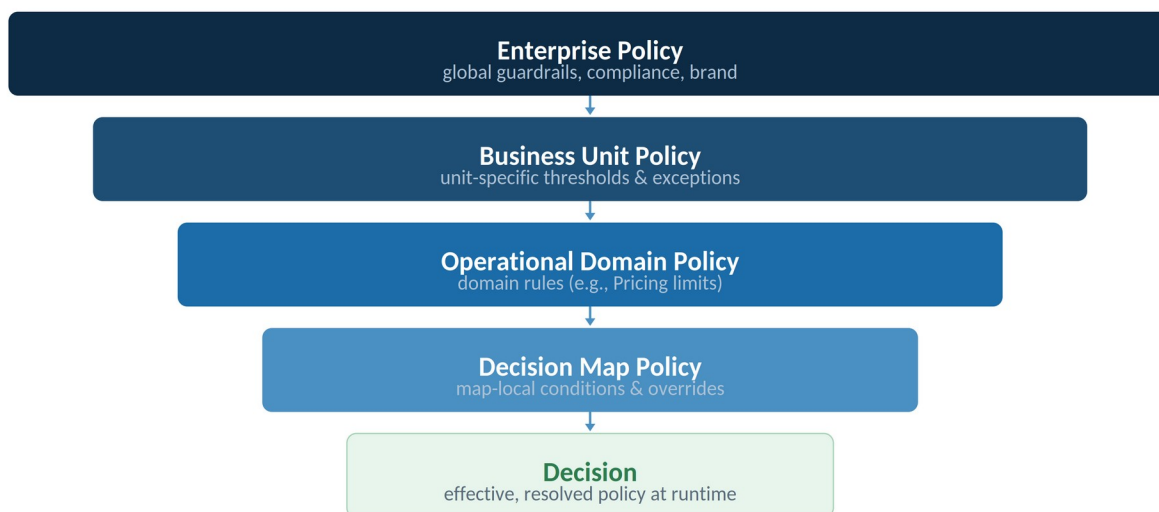
Reuse: one governed capability serves many applications instead of each rebuilding the logic.

The enterprise stops exposing systems and starts exposing decisions.

Chapter 7 — The Policy Layer

Policy is the single source of truth for how the enterprise is permitted to decide. In the decision layer, policy is hierarchical and inherited: each level refines the level above it, and the effective policy applied to any decision is the resolved composition of every level in the chain.

Figure 7.1 — Policy Hierarchy & Inheritance



Each level inherits from the level above and may tighten — never loosen — inherited constraints.

Figure 7.1 — The policy hierarchy and inheritance model.

Inheritance semantics

The hierarchy runs from Enterprise policy (global guardrails, regulatory and brand constraints) through Business Unit policy, Operational Domain policy, and Decision Map policy, down to the effective policy resolved at the moment of a decision. A lower level may tighten an inherited constraint but never loosen it. This guarantees that no domain or map can grant itself authority the enterprise has withheld.

Resolution and propagation

At decision time, the engine resolves the effective policy by composing the chain top-down and applying the most restrictive applicable constraint. Because policy lives in one place and is referenced rather than copied, a change at any level propagates immediately to every governed decision beneath it — with no redeployment of downstream systems. Each resolved policy version is recorded in lineage, so the exact policy in force for any past decision is always recoverable.

Policy as configuration, not code

Policy is versioned data, evaluated by the engine — not logic compiled into agents or systems.

Changes are reviewable, attributable, and reversible by version.

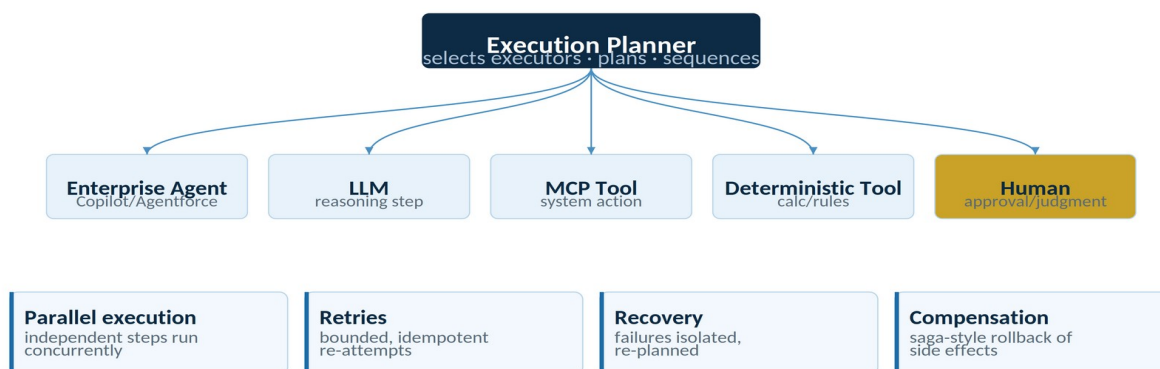
The same policy governs every executor: agent, LLM, tool, or human path.

Propagation latency is a runtime property, measured and monitored (Chapter 14).

Chapter 8 — Execution Planning

Once a decision is reached, it must be carried out reliably across heterogeneous systems. Execution Planning is the runtime component that turns a decision into a governed plan of actions and guarantees that the plan either completes fully or unwinds cleanly.

Figure 8.1 — Execution Planning



The planner chooses the cheapest reliable executor per step and guarantees the decision completes or compensates cleanly.

Figure 8.1 — Execution planning across executors.

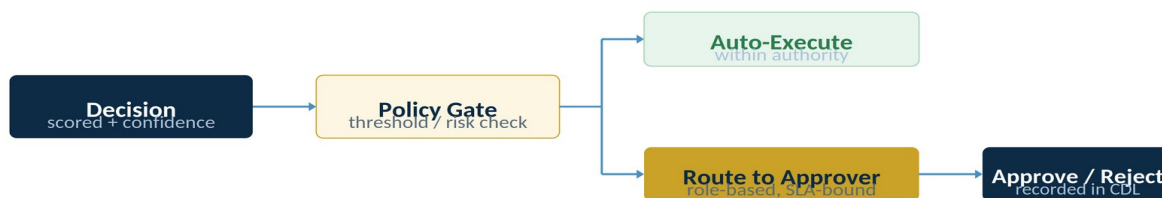
Executor selection

For each step, the planner selects the appropriate executor: an enterprise agent (Copilot, Agentforce, ServiceNow), an LLM for a reasoning step, an MCP tool for a system action, a deterministic tool for calculation or rules, or a human for approval or judgment. Selection favors the cheapest reliable executor that satisfies the step's policy and confidence requirements.

Human-in-the-loop

Escalation is policy-driven, not ad hoc. When a decision exceeds defined authority or falls below a confidence threshold, the planner routes it to a role-based approver under an SLA. Every approval — automated or human — is captured in lineage with who approved, when, and under what authority.

Figure 8.3 — Human-in-the-Loop Approval



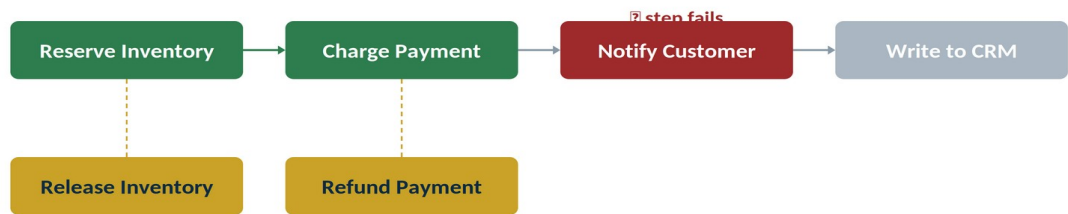
Escalation is policy-driven, not ad hoc. Every approval — human or automated — is captured with who, when, and under what authority.

Figure 8.2 — Policy-driven human-in-the-loop approval.

Reliability: retries, recovery, and compensation

Independent steps run in parallel. Failures are isolated and re-planned; retries are bounded and idempotent. When a step fails after others have produced side effects, the planner executes compensating actions in reverse order — a saga pattern — so the decision leaves no partial state behind.

Figure 8.2 — Compensation & Recovery (Saga Pattern)



On failure, the planner runs compensating actions in reverse order. The decision either completes fully or unwinds cleanly — no partial state.

Figure 8.3 — Compensation and recovery (saga pattern).

Chapter 9 — MCP Integration Architecture

The Model Context Protocol is treated here as enterprise infrastructure — the integration fabric, comparable in role to REST or an enterprise service bus. It is foundational and assumed; it is not, by itself, the source of differentiation. This chapter specifies how the decision layer publishes, discovers, and consumes MCP tools under enterprise governance.

Figure 9.1 — MCP Integration & Enterprise Tool Registry

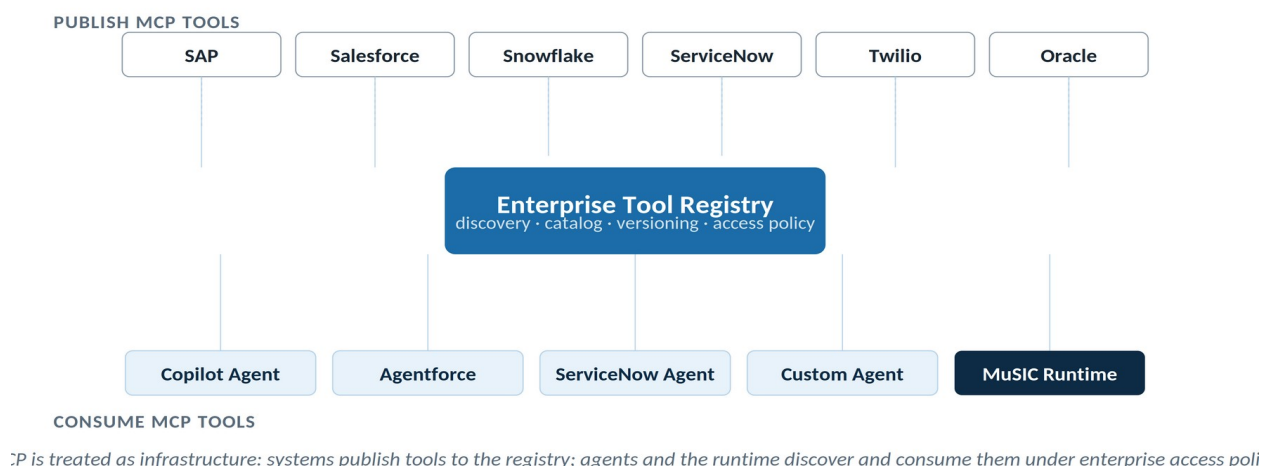


Figure 9.1 — MCP integration and the Enterprise Tool Registry.

The Enterprise Tool Registry

Systems of record and platforms publish MCP tools to an Enterprise Tool Registry. The registry is the governed catalog of every tool available to the enterprise: its schema, version, owner, data classification, and access policy. Agents and the runtime discover tools through the registry rather than through point-to-point wiring.

Governed consumption

Consumption is mediated by policy. The registry binds each tool to an access policy that the runtime enforces at invocation: which domains and roles may call it, under what conditions, and with what data-handling constraints. Every invocation — parameters sent and results returned — is recorded in lineage. Adding a new system to the estate becomes a registry entry, not a bespoke integration project.

Architectural stance on MCP

Assume universal MCP support and design above it. The decision layer's value is not that it speaks MCP — every serious platform will — but that it governs which decisions MCP invocations serve, under what policy, and records them for reconstruction.

Chapter 10 — Enterprise Event Architecture

Decisions are triggered by business events. The decision layer is driven by an event backbone that delivers those events reliably and in order, and lets the runtime process them idempotently at scale.

Figure 10.1 — Enterprise Event Architecture

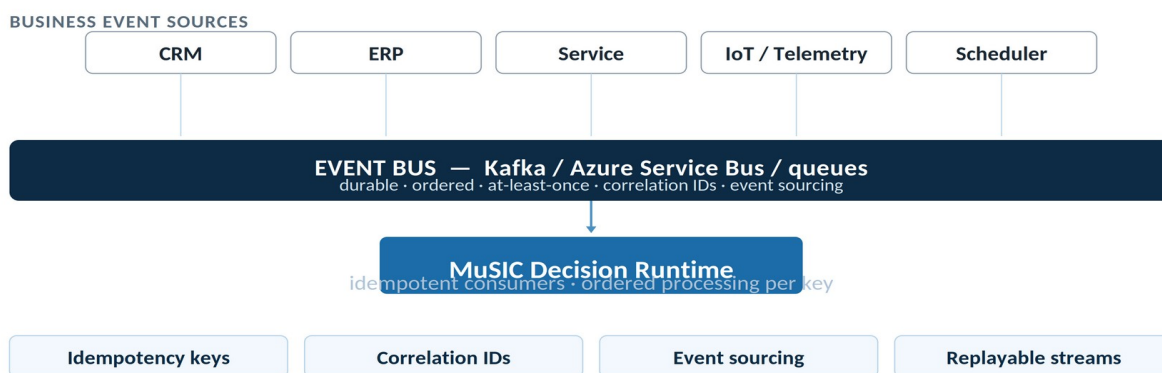


Figure 10.1 — The event backbone driving the decision runtime.

Backbone and delivery

Business events from systems of record, telemetry, and schedulers are published to a durable event bus — Kafka, Azure Service Bus, or an equivalent. The bus provides ordering per partition key, at-least-once delivery, and durable retention. The runtime consumes events as ordered, idempotent streams.

Idempotency, correlation, and event sourcing

Because delivery is at-least-once, every event carries an idempotency key so that re-delivery cannot produce a duplicate decision. Correlation IDs thread an event through the entire decision lifecycle — from trigger to execution to lineage — so a single decision can be traced end to end. The decision stream is itself event-sourced and replayable, which underpins both recovery and audit.

- Idempotency keys prevent duplicate decisions on redelivery.
- Correlation IDs link event → decision → execution → lineage.
- Ordered processing per partition key preserves causal consistency.
- Event-sourced, replayable streams enable recovery and reconstruction.

Chapter 11 — Cryptographic Decision Lineage

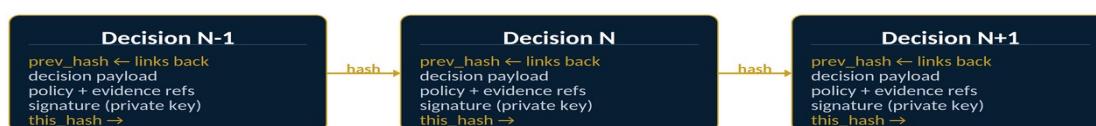
Cryptographic Decision Lineage (CDL) is the proof layer of the decision runtime and the most consequential component in this architecture. It is the mechanism by which the enterprise can answer, for any AI-driven decision, the question traditional logs cannot: not only what happened, but why — and prove it.

Logs capture effects. CDL captures decisions.

The hash chain

CDL is an append-only, hash-chained ledger. Each record embeds the cryptographic hash of its predecessor and is signed with an HSM-backed key. Altering any past record changes its hash, which breaks every subsequent link in the chain — so tampering is immediately and independently detectable. The ledger is immutable by construction, not by policy.

Figure 11.1 — Cryptographic Decision Lineage: Hash Chain



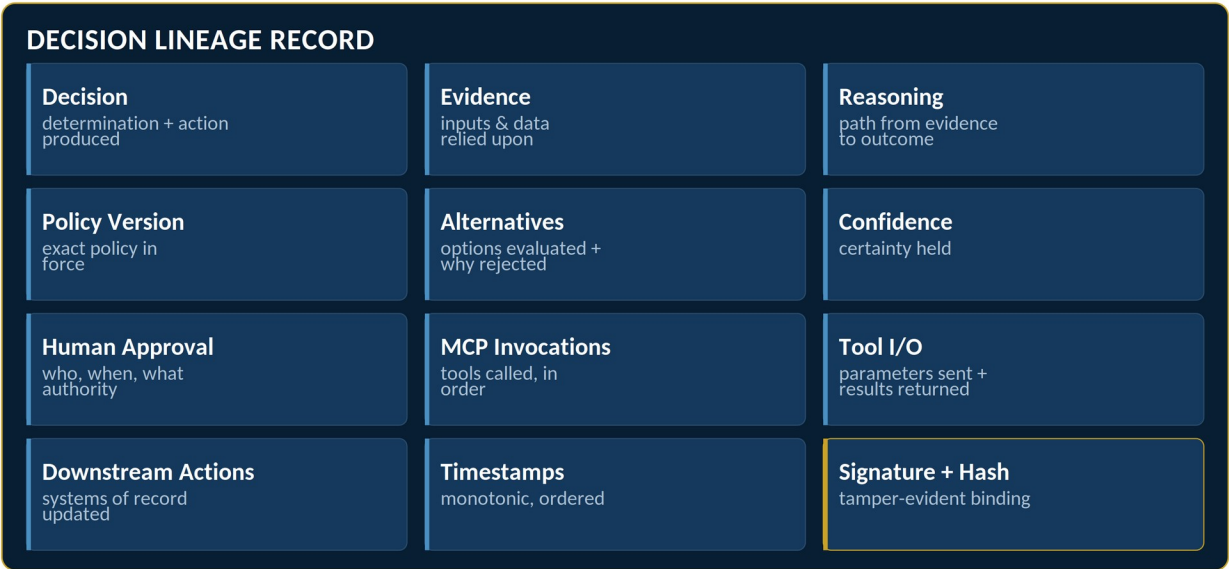
record embeds the hash of its predecessor and is signed. Altering any past record breaks every hash after it — tampering is immediately detected. **Append-only • Immutable • Independently verifiable without trusting the operator.**

Figure 11.1 — The CDL hash chain.

What a record contains

A single lineage record captures the complete decision context: the determination and action, the evidence relied upon, the reasoning path, the exact policy version in force, the alternatives considered and why each was rejected, the confidence held, the human approval (who, when, what authority), every MCP tool invocation with parameters and results, the downstream actions triggered, ordered timestamps, and the signature and hash that bind the record.

Figure 11.2 — Anatomy of a Decision Lineage Record



One record captures not just what happened, but why — the question traditional logs cannot answer.

Figure 11.2 — The anatomy of a decision lineage record.

Storage architecture

Records are written synchronously as part of the decision transaction — a decision is not considered complete until its lineage is durably persisted. The store is an append-only ledger partitioned by domain and tenant, with content-addressed evidence (large inputs stored once and referenced by hash to control size). Signing keys are held in an HSM or cloud key-management service; the chain's verifiability does not depend on trusting the storage operator. Retention is policy-driven and supports legal hold.

Replay, audit, and court-defensibility

Two operations distinguish CDL from any log. Replay re-executes the recorded map version against the recorded evidence to reconstruct a decision exactly as it was made. Verification recomputes the hash chain to confirm the record has not been altered. Together they make decisions reproducible and the record court-defensible — admissible, reconstructable, and tamper-evident — verifiable by any party without trusting the enterprise's word for it.

Figure 11.3 — Replay & Independent Verification



Any party — internal audit, a regulator, opposing counsel — can reconstruct a decision and verify integrity without trusting the operator.
Court-defensible by construction: admissible, reconstructable, tamper-evident.

*Figure 11.3 — Replay and independent verification.***What proof infrastructure provides**

Operational accountability — leadership can see how the runtime decided.

Decision-level investigation — any single decision reconstructed in full.

Reproducible evidence for compliance reviews and regulatory audit.

Court-defensibility — admissible, reconstructable, tamper-evident.

Trust as infrastructure — built into the runtime, not added afterward.

Chapter 12 — Security Architecture

The decision layer governs consequential actions across the enterprise estate, which makes it a high-value control point and a high-value target. Its security architecture follows zero-trust principles end to end.

Figure 12.1 — Security Architecture (Zero Trust)

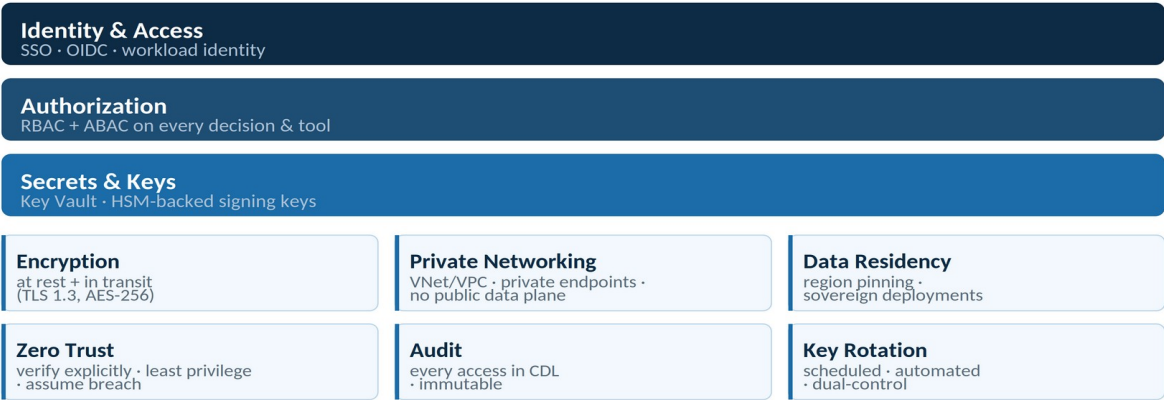


Figure 12.1 — Zero-trust security architecture.

Identity, authorization, and keys

Every caller — human, agent, or workload — authenticates through enterprise identity (SSO/OIDC, workload identity for services). Authorization is enforced on every decision and every tool invocation using a combination of role-based (RBAC) and attribute-based (ABAC) policy, so access depends not only on role but on data classification, domain, and context. Secrets and signing keys are held in a key vault backed by an HSM, with scheduled, dual-control rotation.

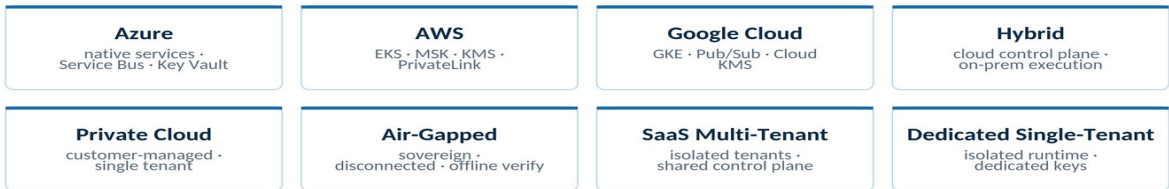
Data protection and isolation

Data is encrypted at rest and in transit (TLS 1.3, AES-256). The data plane runs on private networking with no public endpoints; administrative and tool access traverse private links. Data residency is enforced by region pinning and supports sovereign and air-gapped deployments. Every access is itself recorded in CDL, so the audit trail extends to the security perimeter, not just the decision.

Chapter 13 — Deployment Models

The runtime is designed to be portable across clouds and isolation models. The decision layer and CDL behave identically regardless of where they run; only the underlying primitives (event bus, key management, compute) differ.

Figure 13.1 — Deployment Models



The runtime is portable across clouds and isolation models. The decision layer and CDL behave identically regardless of where they run.

Figure 13.1 — Supported deployment models.

Topologies

On Azure, AWS, and Google Cloud the runtime maps to native managed services for compute, eventing, and key management. Hybrid topologies keep the control plane in the cloud while execution runs on-premises near regulated systems. Private-cloud and dedicated single-tenant models give an enterprise its own isolated runtime and keys. Air-gapped deployments support sovereign and disconnected environments, with offline verification of the CDL chain. SaaS multi-tenant deployments isolate tenants behind a shared control plane.

Selection guidance

Choose the isolation model by data sensitivity and regulatory obligation, not by default. Because the architecture is portable, the deployment model is an operational decision that does not change the application contract — Decision APIs and lineage are identical across all of them.

Chapter 14 — Operational Model

Operating a decision layer means observing decisions, not just infrastructure. The operational model spans four metric families — decisions, policy, agents, and lineage — surfaced through a single dashboard and built on the same lineage record that powers audit.

Figure 14.1 — Operational Model

Decision Metrics	Policy Metrics	Agent Metrics	Lineage & Audit
- volume / sec - auto vs. escalated - confidence distribution - reversal rate	- active versions - exceptions granted - drift alerts - propagation latency	- success / retry rate - latency per executor - tool error rates - cost per decision	- records written - replay requests - verification status - retention compliance

A single operational dashboard spans decisions, policy, agents, and lineage — with replay and incident response built on the same record.

Figure 14.1 — The operational model and dashboard.

Telemetry and metrics

Decision metrics track volume, the ratio of automated to escalated decisions, the confidence distribution, and the reversal rate. Policy metrics track active versions, exceptions granted, drift alerts, and propagation latency. Agent metrics track success and retry rates, latency per executor, tool error rates, and cost per decision. Lineage metrics track records written, replay and verification requests, and retention compliance.

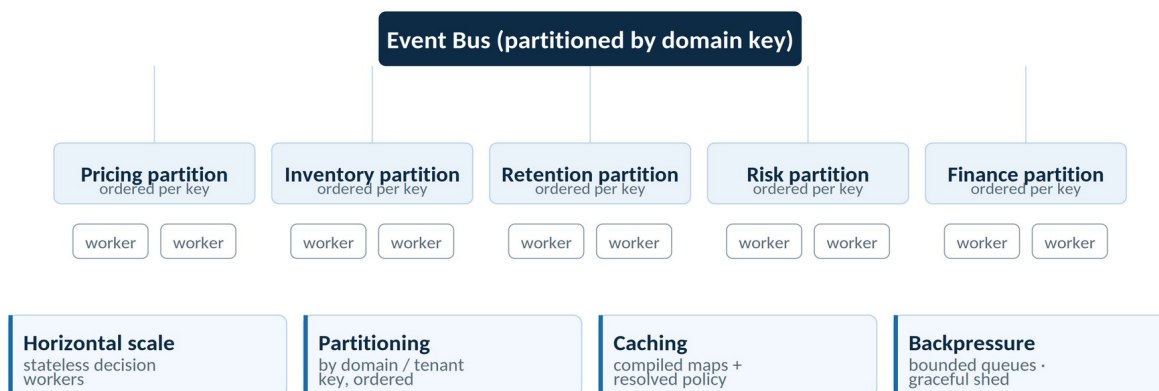
Incident response

Because every decision is recorded and replayable, incident response operates at decision granularity. An anomalous outcome can be reconstructed exactly, its policy and evidence inspected, and the responsible map version identified and rolled back by pointer. Replay turns post-incident analysis from speculation into reconstruction.

Chapter 15 — Scalability

The architecture targets enterprise scale: thousands of agents, thousands of Operational Domains, and millions of decisions. Scale is achieved through stateless horizontal compute and partitioned, ordered event processing.

Figure 15.1 — Scalability & Partitioning



Thousands of domains and millions of decisions scale horizontally; ordering and consistency are preserved per partition key.

Figure 15.1 — Scalability and partitioning.

Scaling strategy

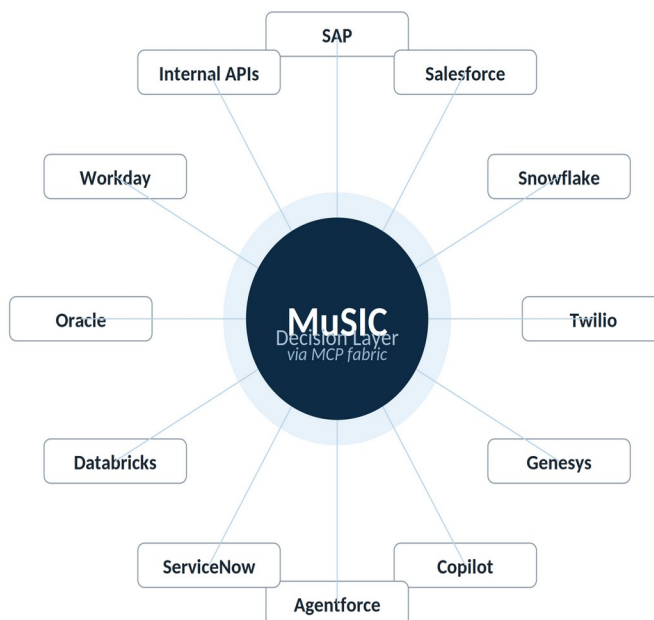
Decision workers are stateless and scale horizontally. The event backbone is partitioned by domain or tenant key, which preserves ordering and causal consistency within a partition while allowing partitions to scale independently. Compiled Decision Maps and resolved policy are cached to keep per-decision latency low. Bounded queues and backpressure protect the runtime under load, shedding or deferring gracefully rather than failing.

- Stateless decision workers — scale out linearly with load.
- Partition by domain / tenant key — ordered within a partition, parallel across them.
- Cache compiled maps and resolved policy — minimize per-decision overhead.
- Bounded queues and backpressure — graceful degradation under spikes.

Chapter 16 — Enterprise Integration Patterns

Integration with the enterprise estate follows one pattern: every system connects through the MCP fabric and the Enterprise Tool Registry. The decision layer is the hub; systems are spokes. This collapses the combinatorial integration problem into a single, governed fabric.

Figure 16.1 — Enterprise Integration via MCP



Every enterprise system integrates through one fabric. Adding a system is a registry entry — not a new bespoke integration.

Figure 16.1 — Enterprise integration through one MCP fabric.

SAP, Salesforce, Snowflake, Twilio, Genesys, Copilot, Agentforce, ServiceNow, Databricks, Oracle, Workday, and internal APIs all integrate the same way: they publish tools to the registry, and the runtime and agents consume them under policy. Adding a system is a registry entry and an access policy — not a new bespoke integration. The integration surface stays constant as the estate grows.

Consequences of a single fabric

Linear, not combinatorial, integration cost as systems are added.

One place to enforce access policy and data classification across all systems.

Uniform lineage — every cross-system action is recorded the same way.

Vendor independence — systems can be swapped behind a stable tool contract.

Chapter 17 — Reference Use Cases

Every vertical realizes the same architecture. A business event enters; a Decision Map reasons over it within an Operational Domain; a Decision API expresses the outcome; execution carries it out through MCP; and CDL records it. Only the maps, policies, and domains differ between industries.

Figure 17.1 — Reference Use-Case Flow



The same six-stage path applies across every industry vertical. Only the maps, policies, and domains differ.

Figure 17.1 — The common six-stage decision flow, applied across verticals.

Vertical applications

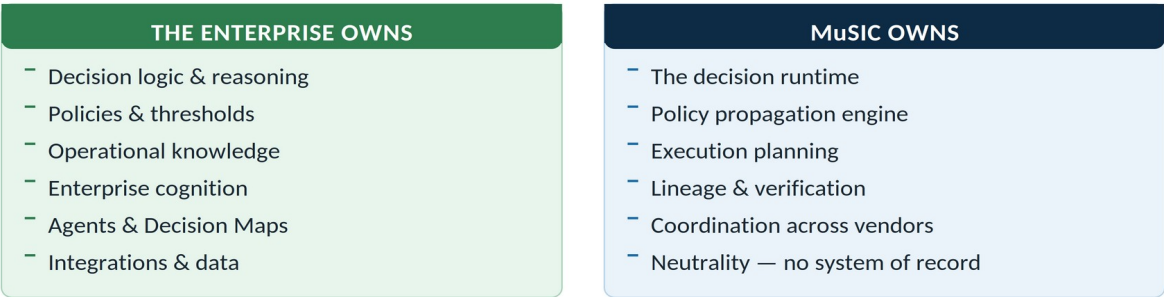
Without an enterprise decision runtime	With MuSIC
Automotive — service-lane vehicle acquisition	Acquisition Domain scores eligibility, governs offer authority, executes via CRM/SMS, records lineage.
Healthcare — care-pathway eligibility	Clinical Domain applies regulatory policy, routes edge cases to clinician approval, records every determination.
Manufacturing — production & quality holds	Quality Domain decides hold/release with confidence thresholds and full traceability.
Financial services — credit & refund exceptions	Risk and Finance Domains govern exception authority with reproducible, auditable lineage.
Government — benefits & case adjudication	Adjudication Domain enforces statutory policy with defensible, reconstructable decisions.
Insurance — claims triage & authorization	Claims Domain governs authorization limits and routes escalations by policy.
Retail — pricing & promotion exceptions	Pricing Domain enforces margin floors consistently across every channel and agent.
Education — admissions & aid decisions	Eligibility Domain applies consistent policy with auditable rationale per decision.

The uniformity is the point. An enterprise that implements the layer for one vertical has implemented the mechanism for all of them; subsequent domains reuse the same runtime, the same APIs, and the same lineage.

Chapter 18 — Design Principles

The architecture in this document reduces to one boundary, drawn deliberately and held consistently: the enterprise owns its cognition; the layer owns the runtime.

Figure 18.1 — The Ownership Boundary



Systems of record stay systems of record. The decision layer is neutral, reusable, and compounds in value over time.

Figure 18.1 — The ownership boundary.

The enterprise owns its decision logic and reasoning, its policies and thresholds, its operational knowledge and accumulated cognition, its agents and Decision Maps, and its integrations and data. The layer owns the runtime that executes them, the policy-propagation engine, execution planning, lineage and verification, and coordination across vendors. The layer is neutral by design — it is not a system of record and competes with none of the platforms it coordinates.

Why the boundary holds

This boundary is not a marketing position; it is what makes the architecture work. A layer that absorbed enterprise reasoning would become another vendor lock-in and forfeit its neutrality. A layer that tried to become a system of record would duplicate the estate it is meant to coordinate. By owning only the runtime, the decision layer can be the one place where consistency and accountability are enforced — and it can compound in value as the enterprise's own cognition accumulates within it.

**Systems of record stay systems of record.
The enterprise owns its cognition. The layer owns the runtime.**

This reference architecture describes how an Enterprise Decision Layer is implemented. The category will be implemented by someone in every enterprise that reaches scale. This document is a specification for doing it deliberately.

Appendix A — Component Responsibility Matrix

The matrix below summarizes the single responsibility of each runtime component and the party accountable for it. It is the authoritative reference for the separation of concerns described in Chapter 2.

Component	Primary responsibility	Accountable owner
Decision Engine	Execute Decision Maps; evaluate policy; generate and score alternatives; assign confidence.	Platform Engineering
Decision Maps	Encode reusable enterprise reasoning as versioned decision graphs.	Business / Domain Owner
Operational Domains	Bound and package reasoning, policy, agents, tools, and lineage as reusable cognition.	Business / Domain Owner
Policy Layer	Resolve effective policy from a hierarchical, inherited source of truth.	Risk / Compliance + Domain
Execution Planning	Select executors; sequence actions; guarantee completion or compensation.	Platform Engineering
Human Approval	Route escalations by policy; capture sign-off and authority.	Business / Domain Owner
Enterprise Intelligence	Accumulate and compound operational learning per domain.	Business / Domain Owner
Cryptographic Decision Lineage	Record every governed decision in a tamper-evident, replayable ledger.	Platform Engineering + Audit
MCP Fabric / Tool Registry	Publish, discover, and govern tools; mediate consumption.	Platform Engineering
Event Backbone	Deliver business events durably, in order, idempotently.	Platform Engineering

Appendix B — Enterprise Decision APIs (Conceptual)

This appendix discusses Enterprise Decision APIs at a conceptual level (Chapter 6). An Enterprise Decision API exposes a governed business decision — not a technical verb on a system of record. It is owned by an Operational Domain, behaves as a stable, versioned business contract, and produces a complete lineage record on every call. Callers depend on the business capability rather than on the internal structure of any underlying system.

The examples below are illustrative and non-normative. They describe the kinds of decisions an enterprise might choose to expose as governed capabilities. They do not describe the APIs of any specific product, and each enterprise defines its own.

Illustrative decision capability	Governed question	Typical owning domain
Authorize a trade-in offer	Offer authority and value.	Acquisition
Authorize a refund	Refund eligibility, amount, and thresholds.	Finance
Approve a pricing exception	Discount authority and margin-floor limits.	Pricing
Schedule a retention offer	Offer eligibility and channel consistency.	Customer Retention
Approve a credit exception	Exception authority under inherited risk policy.	Risk
Authorize a claim	Claims triage and authorization limits.	Claims
Release a production hold	Quality hold / release with confidence thresholds.	Quality
Determine eligibility	Benefit, admission, or care-pathway eligibility.	Eligibility

Contract stability

Decision APIs are versioned business contracts. Callers depend on the capability, not on the structure of an underlying system of record — so systems can be replaced behind a stable contract without changing consumers.

Appendix C — Logical Components of a Decision Record

Chapter 11 describes what a decision record captures. This appendix presents that idea as a conceptual view of the record’s logical components. The record’s internal field structure, data types, and naming conventions are implementation details and are deliberately not specified here.

Figure C.1 — Logical Components of a Decision Record



A conceptual view. The record’s internal field structure and naming are implementation details, deliberately not specified here.

Figure C.1 — The logical components of a decision record, shown conceptually.

Conceptually, a record answers six questions about a governed decision: what was decided; why (the evidence relied upon and the reasoning); under what governance (the policy and decision logic in force); with what human oversight; what was carried out in response; and how its integrity can be independently verified. Large evidence is content-addressed — stored once and referenced — so records stay compact while their contents remain verifiable. The integrity seal binds each record into a tamper-evident chain, making any later alteration detectable without trusting the operator.

Appendix D — Operational Metrics (Conceptual Overview)

The runtime is operated to a set of metrics organized into a few families. They are summarized here at a conceptual level; their detailed definitions, targets, dashboards, and review cadence are specified in Volume 5, the Enterprise Decision Governance & Operations Guide. All are derived from the same lineage that powers audit, so reporting and proof share one source.

Metric family	What it tells the enterprise
Decision	Volume, automation level, confidence health, and quality of governed decisions.
Policy	Consistency of governance — active policy versions, propagation speed, and exception frequency.
Execution	Reliability and economic efficiency of the executors that carry decisions out.
Lineage	Completeness and integrity of the audit trail, and investigation activity.

Appendix E — Worked Example: Service-to-Sales Acquisition

This worked example traces one decision end to end through the architecture, using an automotive service-to-sales acquisition scenario. The objective is to make the six-stage flow (Chapter 17) concrete. All data is illustrative; the example is sanitized and uses no real customer information.

Scenario

A vehicle arrives for routine service. A business event is emitted. The enterprise wants to decide — consistently, within policy, and with full traceability — whether to extend an acquisition offer to the customer, and at what value, before the vehicle leaves the service lane.

Figure 17.1 — Reference Use-Case Flow



The same six-stage path applies across every industry vertical. Only the maps, policies, and domains differ.

Figure E.1 — The six-stage flow instantiated for service-to-sales acquisition.

Stage-by-stage

Stage	What happens	Recorded in CDL
1 • Business Event	Service check-in emits a RepairOrderOpened event to the bus with a correlation ID.	Event payload + correlation ID.
2 • Decision Map	The Acquisition map gathers evidence: vehicle data, equity position, market signals.	Evidence references (content-addressed).
3 • Operational Domain	Acquisition domain policy applies: offer authority, margin floors, eligibility.	Resolved policy version.
4 • Decision API	The acquisition decision capability generates alternatives, scores them, assigns confidence.	Alternatives + confidence.
5 • Execution	Confidence meets threshold → offer written to CRM and SMS sent via governed MCP tools.	MCP invocations + downstream actions.
6 • CDL	The complete record is signed and chained; the decision is now reproducible.	Signature + hash chain link.

Escalation path

Had confidence fallen below the policy threshold — for example, an unusual equity position or a high offer value exceeding lane authority — stage 5 would not auto-execute. Execution Planning would route the decision to a role-based approver under an SLA (Chapter 8). The approver's identity, timing, and authority would be captured in the same lineage record, and the decision would proceed only on approval. The path differs; the accountability does not.

What the example demonstrates

- The reasoning (stages 2–4) is enterprise-owned and identical regardless of which agent initiated it.
- Execution (stage 5) runs through the MCP fabric into existing systems of record — no system is replaced.
- Policy is resolved once, from the hierarchy, and recorded with the decision.
- Lineage spans the entire path, making the decision replayable and independently verifiable.

Appendix F — Glossary

Definitions of the principal terms used in this reference architecture.

Term	Definition
Enterprise Decision Layer	The neutral runtime layer that governs how AI-driven decisions are made across an enterprise.
Decision Runtime	The executable implementation of the decision layer and its components.
Decision Engine	The component that executes Decision Maps and produces governed decisions.
Decision Map	A versioned encoding of enterprise reasoning, modeled as a decision graph.
Operational Domain	A bounded context packaging reasoning, policy, agents, tools, and lineage as reusable cognition.
Enterprise Decision API	A governed business capability (e.g., authorizing a trade-in offer) exposed by a domain.
Policy Hierarchy	The inherited Enterprise → Business Unit → Domain → Map → Decision policy chain.
Execution Planning	Selection of executors and sequencing of actions, with retries and compensation.
MCP	Model Context Protocol — the integration fabric through which systems expose tools to agents and the runtime.
Enterprise Tool Registry	The governed catalog of MCP tools available to the enterprise.
CDL	Cryptographic Decision Lineage — the tamper-evident, replayable record of every governed decision.
Replay	Re-executing a recorded map version against recorded evidence to reconstruct a decision exactly.
Compensation	Saga-style reversal of side effects when a multi-step execution fails.
Enterprise Intelligence	The accumulated, compounding operational learning a domain develops over time.

This is how Enterprise Decision Infrastructure is implemented.