**Story — Rules & Corridor Engine: The Transparent Brain of Compliance**

**Intent (one line)**

Allow compliance teams to **configure, version, and safely evolve trade compliance rules** (license triggers, exceptions, country corridors, end-use checks) — so the system makes **consistent, explainable decisions** today and can be reproduced **exactly the same way** years later.

**Business Outcome**

* Rules are **human-readable, version-controlled, and tenant-aware**.
* SMEs can adopt prebuilt rule packs or add their own — without needing IT.
* Every decision carries a **rule lineage badge**, so auditors can see exactly which rule triggered.
* Rule changes are **safe**, with **dual control** and instant rollback.

**Actors**

* **Rules Designer (Compliance Officer)** – creates/edits rules in a safe UI.
* **Rules Approver (Compliance Manager)** – reviews and promotes rules to ACTIVE.
* **Rules Engine** – evaluates corridor & license logic deterministically.
* **Audit Vault** – stores all rule versions, approvals, rollbacks.
* **Simulation Mode** – allows testing rules before activation.

**Preconditions**

* Jurisdictional data loaded (country codes, embargo programs, ECCN/HS catalog).
* Authority precedence table configured (OFAC > UN > EU, etc.).
* Ruleset repository initialized with baseline templates.

**End-to-End Flow (happy path)**

**1) Rule Modeling**

* Rules created in a **visual corridor builder**:
  + **When:** (Export\_Country = US) AND (Destination IN CN, HK) AND (ECCN = 3A001)
  + **Then:** License Required = TRUE, Program = EAR99, Escalate = YES
* Each rule has:
  + **Scope:** tenant-specific, global, or jurisdictional
  + **Priority:** overrides lower-priority rules if overlapping
  + **Effective Dates:** from/to
  + **Version Tags:** semantic versioning (e.g., v1.3.0)

**Innovation 1 — Visual Corridor Map:** Users can drag & drop countries, products, and partners into a **graph view** showing allowed and blocked corridors.

**2) Draft & Validate**

* Draft rules stored as **DRAFT** in repository.
* **Rule Validator** runs:
  + Syntax & completeness checks
  + Conflict detection (two rules giving contradictory outcomes)
  + Impact Preview: which corridors & products would flip if rule goes live

**3) Simulation Mode**

* Users can run **What-If Simulation**:
  + Choose sample orders/partners
  + See expected license requirement, decision outcome, and counter impact
* Simulation runs against **shadow ruleset** (no production effect).

**Innovation 2 — “Rule Impact Radar”:** Shows % of orders historically impacted by the draft rule — preventing accidental overblocking.

**4) Review & Approve**

* Rules require **dual control**: at least one Approver different from Designer.
* Approver sees:
  + Rule diff (what changed)
  + Simulation results
  + Conflict resolution suggestions
* On approval: ruleset promoted to **ACTIVE** with a version tag.

**5) Activation & Propagation**

* Rules Engine swaps to new version atomically (no partial rule sets).
* Publish RulesetActivated event with version number & change summary.
* Screening Engine & License Engine automatically pick up new version.

**6) Decision Lineage**

* Every screening / license decision logs:
  + rule\_version, rule\_id(s) that matched
  + Inputs evaluated (country pair, ECCN, end-use)
  + Decision outcome (license\_required, allow/block)

**Innovation 3 — “Rule Badge”:** Each decision carries a clickable badge linking directly to the rule text that triggered it.

**7) Rollback & History**

* Ops can roll back to previous rule version instantly.
* History view shows full diff, approvals, who activated, when.
* Archived rules stay queryable for 7–10 years for audit reproduction.

**Alternate / Failure Flows**

**A) Conflicting Rules**

* Conflict Detector highlights conflicts before approval.
* Users can resolve by:
  + Setting precedence (authority > tenant override > global)
  + Merging rules
  + Deactivating redundant rules

**B) Urgent Rule Push**

* “Fast-Track Mode” allows emergency rule activation (single approver) but requires post-approval within 24h or system reverts.

**C) Version Drift**

* If downstream systems using cached rulesets fall behind:
  + Gatekeeper responds with “RULE\_VERSION\_STALE” and forces re-sync.

**Acceptance Criteria**

1. **Versioning**
   * Every rule change creates a new version; versions immutable once promoted.
   * Any past decision can be re-evaluated against the exact rule version used.
2. **Determinism**
   * Same inputs + same ruleset version always yield identical outcome.
3. **Safety**
   * No rule change goes ACTIVE without dual approval (except fast-track mode).
   * Impact Radar must show < configured overblock threshold before approval.
4. **Explainability**
   * Every decision lists matched rules with version and link to rule definition.
5. **Rollback**
   * Rollback to previous version must take effect ≤ 60 seconds.

**Non-Functional Targets**

* **Latency:** Rule evaluation ≤ 100 ms per line from in-memory cache.
* **Audit Storage:** Retain rules & change logs for ≥ 7 years.
* **Multi-Tenant Safety:** Tenant-specific rules never leak to other tenants.

**AI Assist (Assistive, Governed)**

* **Rule Authoring Assistant:** Suggests draft rules based on regulatory text, but requires human approval.
* **Conflict Resolver:** ML ranks most likely resolution when two rules overlap.
* **Impact Forecaster:** Predicts business impact (orders, revenue at risk) of a draft rule.
* **Change Summarizer:** Writes plain-language release notes for each ruleset activation.

**Innovation 4 — “Explainable Rules Graph”:** Decision console can show the exact path taken in the rules graph that led to the outcome — not just the final result.

**Innovation Highlights**

* **Visual Corridor Map:** Intuitive way for SMEs to configure rules without coding.
* **Impact Radar + Simulation Mode:** Prevents unintended overblocking before activation.
* **Dual-Control Workflow:** Ensures compliance & governance.
* **Rule Badges in Decisions:** Every decision clickable back to its triggering rule.
* **Instant Rollback:** Safety net for bad rules.
* **AI-Supported Rule Design:** Speeds up creation but keeps human in the loop.