**Story — License Determination & Counter Reservation: Smarter Than Static Rules**

**Intent (one line)**

For every order, delivery, or shipment line, automatically decide whether a license is required, **pick the best available license**, reserve its counters in real time, and block or hold the transaction if no valid license is available — all with explainability and near-zero manual touch.

**Business Outcome**

* **No shipment leaves without license coverage** (or documented exemption).
* License assignment is **automated**, with humans focusing only on exceptions.
* License counters are **never overrun**, avoiding violations.
* SME users see **clear guidance** on what license to obtain if blocked.

**Actors**

* **License Engine** – evaluates license need & eligibility.
* **Rules Engine** – corridor + ECCN/HS + end-use logic.
* **License Vault** – stores licenses, counters, validity periods, and conditions.
* **Gatekeeper Service** – enforces line-level results at order/delivery/release.
* **Compliance Console** – used to add/approve licenses, review exceptions, and manage counters.
* **Audit Vault** – logs every determination, assignment, and counter transaction.

**Preconditions**

* Materials have ECCN/HS codes and origin maintained (from Classification module).
* Partner/ship-to/destination are known.
* License Vault is populated with active licenses (scope, validity, counters).
* Ruleset version is active (jurisdictional policies loaded).

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

**1) License Determination Trigger**

* Triggered at:
  + **Order line creation/update**
  + **Delivery creation/release**
  + **Manual simulation** (What-If mode)

**2) Corridor & Rule Matching**

* Rules Engine evaluates:
  + Exporter country (from legal unit / plant)
  + Destination country (ship-to / end user)
  + ECCN/HS code + dual-use flag
  + Program exceptions (e.g., de minimis %, license exceptions, STA)
* Result: license\_required: true/false, rule\_id, reason\_code

**Innovation 1 — “Explainable Corridor Graph”:** Store corridor path graph so user can see “why license needed” (country pair + ECCN triggered rule X.Y).

**3) License Selection & Assignment**

* License Engine queries License Vault for:
  + Licenses valid for exporter + destination + ECCN/HS
  + Validity date covers today
  + Remaining counters > required qty/value
* Selects **best-fit license**:
  + Prioritize licenses with soonest expiry (minimize waste)
  + Balance counters across licenses (avoid starving one license)
* Assigns license\_id to order/delivery line.

**Innovation 2 — “Smart License Picker”:** Uses ML heuristic to choose optimal license based on expiry, counter burn rate, and historical consumption.

**4) Counter Reservation**

* Deduct required qty/value from license counters (pessimistic reservation).
* Store reservation\_id, timestamp, user/system ID.

**Innovation 3 — “Atomic Counter Reserve”:** Reservation is ACID — either succeeds or gate blocks line; prevents over-consumption under concurrency.

**5) Gatekeeper Decision**

* If license assigned & counters reserved successfully → **ALLOW**
* If license needed but none available → **HOLD** with Fix: “Apply for license”
* If license expired or counters exceeded → **DENY**

Response payload includes:

{

"enforcement": "HOLD",

"license\_required": true,

"license\_assigned": null,

"reasons": ["No eligible license available for ECCN 3A001 to CN"],

"fix\_suggestions": ["Submit license application for ECCN 3A001", "Reduce quantity to fit remaining quota"]

}

**6) Event Push**

* Publish LicenseDeterminationEvent with license\_id (or reason for no license).
* Write to audit log: rule version, corridor path, license candidate set, counters at time of decision.

**Alternate / Failure Flows**

**A) No Material Classification**

* If ECCN/HS missing → **REVIEW** status with Fix: “Classify material to proceed.”

**B) Counter Race Condition**

* If counters exhausted between reservation and commit → fail transaction; re-run selection for alternate license.

**C) License Exemption Available**

* If rule allows exception (e.g., de minimis), mark transaction **ALLOW under exception** with lineage badge.

**D) License Not Yet Approved**

* If license request is “Pending Approval,” gate result = HOLD until approval granted.

**Acceptance Criteria**

1. **Deterministic License Decision**
   * Same inputs always yield same license\_required + candidate set.
2. **Correct Counter Reservation**
   * Counters never exceed 100% usage (even under concurrency).
3. **Explainability**
   * Each decision shows:
     + Corridor path
     + Rule matched (with version)
     + License chosen (or reason why none was found)
     + Snapshot of counters before/after reservation
4. **Release with License**
   * Orders blocked due to missing license become ALLOW automatically once license uploaded/approved.
5. **Simulation Mode**
   * Users can run a “what-if” simulation to see license requirements & counter impact before booking.
6. **Audit Proof**
   * Every counter transaction logged with:
     + reservation\_id, license\_id, qty/value, user/system, timestamp, and resulting counter balance.

**Non-Functional Targets**

* **Latency:** ≤ 500 ms for license determination & assignment (from cache).
* **Counter Reservation Safety:** ACID transactions, rollback on failure.
* **Availability:** ≥ 99.9% for License Engine & Vault.

**AI Assist (Assistive, Not Autonomous)**

* **License Recommender:** Suggests best-fit license with rationale (expiry, quota, risk).
* **Counter Burn Forecaster:** Predicts when license will be depleted, sends proactive alert.
* **Auto-Draft Application:** Pre-fills license application forms with known data.
* **What-If Optimizer:** Runs simulation for alternate routing or product substitution.

**Innovation 4 — “License Lens Dashboard”:** Visualizes remaining quotas by product/country corridor, predicted burn-out date, and suggests replenishment timing.

**Innovation Highlights**

* **Explainable Corridor Graphs:** Users see *why* a license is required in a visual path view.
* **Smart License Picker:** ML-based license allocation to optimize usage & expiry.
* **Atomic Counter Reservation:** Prevents quota overruns in real-time operations.
* **What-If Simulation:** Lets users test orders before committing, preventing last-minute surprises.
* **License Lens Dashboard:** Turns license management into a proactive tool, not a bottleneck.