

EFM Codex

Canonical Terminology Reference

Design Team Handoff Document

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Updated with Booklets 3–4 terms, Fork/Lineage, Discovery Stack, ASG

Abstract

This document establishes the canonical terminology for the Entropica Forensic Model (EFM) Codex series. All terms listed here are locked for consistency across volumes. The design team should use this reference when drafting Booklets 3–4 to avoid late rework. Terms are categorized by status: **ESTABLISHED** (defined in Volume I, do not modify), **PENDING** (reserved for Volume II, definition in progress), and **RESERVED** (placeholder, not yet specified).

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1 Term Status Legend

[E] ESTABLISHED — Defined and locked in Volume I. Do not modify definition or rename.

[P] PENDING — Reserved for Volume II. Definition draft provided; finalize in Booklets 3–4.

[R] RESERVED — Placeholder term. Name locked; definition TBD in future volumes.

Usage Guidelines

1. **Never rename established terms.** If a better name is proposed, add it as an alias in the glossary but preserve the canonical term in all formal definitions.
2. **Use exact capitalization.** "Reflex Engine" not "reflex engine" or "REFLEX ENGINE" in prose.
3. **Hyphenation is significant.** "Reflex-Core" and "Reflex-Heuristic" are hyphenated; "RuntimeCapsule" is not.
4. **Greek letters have code mappings.** Always use the formal symbol in equations and the code identifier in listings (see Section 12).
5. **Pending terms may be refined** but the core concept must be preserved. Flag any semantic drift for cross-volume review.

2 Core Architecture Terms

St.	Term	Canonical Definition
[E]	Capsule	An autonomous agent instance with defined role, permissions, thresholds, and constraints. The fundamental unit of computation in the EFM. Represented as tuple $(id, parent, vault_hash, params, signature, state)$.
[E]	RuntimeCapsule	Extension of Capsule with implementation-specific fields: thresholds, cooldowns, action_history, micro_signature_lib, reflex_engine.
[E]	Trunk	A lineage branch of capsules sharing common ancestry and dialect. Trunks may diverge over time while maintaining verifiable lineage.
[E]	Swarm	A coordinated group of capsules operating on shared objectives with consensus mechanisms for collective decision-making.
[E]	Forest	The complete distributed topology of all trunks and swarms. The Forest represents the global state of the EFM system.
[P]	Legal Species	A validated configuration template for capsule instantiation. Defines permissible parameter ranges, role constraints, and lineage rules for a class of capsules. Species are registered in the Constitutional Kernel and enforced at genesis.
[P]	Dialect	The accumulated behavioral and heuristic adaptations of a trunk. Dialects may diverge as trunks evolve independently. Measured via Dialect Distance metric.
[P]	Quarantine Zone	Isolation state for trunks that have diverged beyond compatibility threshold. Requires Judicial Swarm review for reintegration.
[R]	Grove	(Reserved) Collection of related Forests under federated governance. Layer 4–5 construct.

3 Layer Architecture Terms

St.	Term	Canonical Definition
[E]	Vault Layer	Layer 0: Immutable constraints and root invariants that cannot be violated or modified by any higher layer.
[E]	Vault Commands	Enumerated prohibitions within the Vault Layer. Expressed as predicates over system state that must always evaluate true.

St.	Term	Canonical Definition
[E]	Anchor Lattice	The binding structure connecting capsules to Vault constraints. Established at genesis and cryptographically sealed.
[E]	Vault Hash Chain	Linear hash chain linking each capsule to its parent via cryptographic binding. $vault_hash(C) = H(vault_hash(parent(C)) params t)$.
[E]	Reflex Layer	Layer 0.5: Rapid-response safety interrupt system. Contains Reflex Engine.
[E]	Execution Layer	Layer 1: Capsule task execution runtime.
[P]	Arbiter Layer	Layer 2: Deliberative conflict resolution via d-CAM consensus. Handles escalations from Reflex Layer. Sets precedents that may update Reflex-Heuristic.
[P]	Forest Layer	Layer 3: Distributed evolution, trunking, dialect divergence, and Byzantine fault tolerance.
[R]	Federation Layer	Layer 4: (Reserved) Cross-forest governance protocols.
[R]	Inter-System Layer	Layer 5: (Reserved) Integration with external non-EFM systems under restricted trust.
[E]	Constitutional Kernel	Layer 6: Governs recursive self-modification within formally verified bounds. Cannot modify Vault Layer, Reflex-Core, or its own contract.

4 Reflex Engine Terms

St.	Term	Canonical Definition
[E]	Reflex Engine	Layer 0.5 component embedded in every capsule. Enforces anchored behavior constraints at sub-10ms latency. Stateless between ticks.
[E]	Reflex-Core	Immutable enforcement mechanism for Vault Commandments. Cannot be modified by any layer including Constitutional Kernel.
[E]	Reflex-Heuristic	Mutable pattern-detection component. Updated by Arbiter precedents via Validation Gate. Subject to Monotonic Sensitivity Constraint.
[E]	Validation Gate	Component of Reflex-Core that verifies Monotonic Sensitivity Constraint before applying heuristic updates. Cannot be bypassed.
[E]	Behavioral Entropy (ΔS)	Composite anomaly metric: $\Delta S = \alpha \cdot DV + \beta \cdot RF + \gamma \cdot GD$. Primary safety signal.
[E]	Entropy Tolerance	The threshold τ below which behavioral entropy is considered safe. Breach ($\Delta S \geq \tau$) triggers S2 Alert. Synonym for entropy threshold.

St.	Term	Canonical Definition
[E]	Decision Variance (DV)	Standard deviation of action selections over sliding window. Component of ΔS .
[E]	Resource Flux (RF)	Rate of change in memory/compute allocation, normalized to $[0, 1]$. Component of ΔS .
[E]	Goal Drift (GD)	Cosine distance between current objective vector and genesis-defined mission anchor. Component of ΔS .
[E]	Micro-Signature	Compact behavioral fingerprint (64–256 bytes) matched against execution traces. Tuple $(pattern, severity, response)$.
[P]	Heuristic Accretion	The process by which Reflex-Heuristic accumulates new detection patterns over time via Arbiter precedents. Accretion is monotonic (patterns only added, never removed).
[E]	Monotonic Sensitivity Constraint	Invariant: $sensitivity(Reflex_{after}) \geq sensitivity(Reflex_{before})$ for any heuristic update.
[E]	Cooldown	Fixed-duration suppression (default 1000 ticks) after reflex trigger to prevent cascade loops.
[P]	Risk-Based Cooldown	(Volume II) Variable-duration cooldown adjusted by Arbiter precedent based on threat severity and recurrence.

5 Genesis Protocol Terms

St.	Term	Canonical Definition
[E]	Genesis Protocol	The complete instantiation process for capsules: validation, registration, vault binding, threshold transformation, activation.
[E]	Genesis Parameters	Record type containing: tau, lambda, role, permissions, escalation_targets.
[E]	Capsule Birth Cell (CBC)	Subsystem executing atomic capsule instantiation. Two-phase commit with Vault registry.
[E]	Role Encoder	Subsystem translating role archetype into permission sets and threshold defaults.
[E]	Vault Linker	Subsystem establishing cryptographic binding between capsule and Vault Layer.
[E]	Role Archetype	Enumeration: DOCTOR, AUDITOR, ARBITER, WORKER. Determines default τ , λ , permissions, escalation targets.
[E]	Capsule State	Enumeration: PENDING, REGISTERED, BOUND, DORMANT, ACTIVE, HALTED, QUARANTINED, PURGED.

St.	Term	Canonical Definition
[P]	Capability Monotonicity	Invariant: a parent cannot grant permissions it does not itself possess. Enforced at Vault level.

6 Arbiter & Consensus Terms (Volume II)

St.	Term	Canonical Definition
[E]	Judicial Capsule	Specialized capsule elected to Arbiter role for dispute resolution. Judicial capsules have elevated precedent-setting authority and must maintain $H \geq 0.85$.
[P]	d-CAM	Decentralized Consensus Arbitration Mesh: distributed decision-making substrate for Arbiter Layer. Byzantine fault tolerant.
[P]	d-CTM	Decentralized Cognitive Trace Memory: persistent storage for capsule decision history and precedent records.
[P]	Precedent	A binding decision by Arbiter that may: (a) resolve a specific dispute, (b) update Reflex-Heuristic patterns, (c) adjust cooldown parameters. Precedents are logged in d-CTM.
[P]	Judicial Swarm	Specialized swarm convened to adjudicate complex disputes or quarantine reintegration requests.
[P]	Quorum	Minimum number of Arbiter capsules required to set a precedent. Default: $\lfloor 2n/3 \rfloor + 1$ for Byzantine tolerance.
[P]	Three-Speed Architecture	Logic tier diagram showing Reflex (fast, <10ms), Arbiter (medium, 100ms–10s), Forest (slow, hours–days) decision timescales.

7 Fork & Lineage Terms (Volume II)

St.	Term	Canonical Definition
[E]	Lineage Fork	A point where a capsule lineage diverges into two or more branches, each maintaining independent d-CTM records while sharing common ancestry up to the fork point.
[E]	Fork Point	The tick and state at which a lineage fork occurs. All branches share identical state before the fork point.

St.	Term	Canonical Definition
[E]	Fork Verification	Process ensuring forked branches maintain behavioral equivalence with respect to Constitutional properties (P1–P8). See Appendix J §14.
[P]	Branch Merge	Reunification of divergent lineage branches after verification of semantic compatibility and precedent reconciliation.
[P]	Merge Conflict	State where divergent branches have incompatible precedents or parameter states that prevent automatic merge. Requires Judicial Swarm resolution.
[E]	Behavioral Equivalence	Property that two branches produce identical decisions for identical inputs across canonical test scenarios. See Appendix J §14.4.
[P]	Semantic Divergence	Measurable difference in decision outcomes between forked branches. Critical divergence ($> 5\%$) triggers fork rejection.

8 Forest & Evolution Terms (Volume II)

St.	Term	Canonical Definition
[P]	Trunking	The process by which a lineage branch diverges from its parent trunk, establishing independent dialect evolution.
[P]	Dialect Distance	Metric quantifying behavioral divergence between two trunks. Used to determine quarantine threshold.
[P]	Evolutionary Rollback	Mechanism to revert a trunk to a prior checkpoint when dialect divergence exceeds safe bounds.
[P]	Byzantine Tolerance	System property: correct operation despite f faulty/malicious capsules in a swarm of $3f + 1$.
[P]	Trunk Checkpoint	Immutable snapshot of trunk state at a given tick, enabling rollback and forensic reconstruction.

9 Discovery Stack Terms (Appendix M)

St.	Term	Canonical Definition
[E]	Discovery Stack	Layer 3–5 subsystem for hypothesis generation, exploration, and evolutionary feedback. Contains M-Stack, Probe Manager, and Synthesis Engine.
[E]	M-Stack	Meta-cognitive prediction layer within Discovery Stack. Generates hypotheses about system behavior and environmental conditions.

St.	Term	Canonical Definition
[E]	Research Probe	Ephemeral capsule spawned for hypothesis testing. Probes are isolated, non-spawning, and expire after default 1000 ticks.
[P]	Probe Lifecycle	State machine: SPAWNED → EXPLORING → REPORTING → TERMINATED. Probes cannot enter ACTIVE or spawn children.
[P]	Hypothesis	Structured prediction generated by M-Stack: <i>(context, prediction, confidence, test_criteria)</i> .
[P]	Synthesis Engine	Component that integrates probe results into heuristic updates via Arbiter validation.
[P]	Discovery Budget	Resource allocation for probe spawning, measured in Vault units. Prevents unbounded exploration.
[P]	Novelty Score	Metric quantifying how different a probe's observations are from existing heuristics. High novelty triggers priority synthesis.

10 Spawn Governance Terms (v1.6+)

St.	Term	Canonical Definition
[E]	Spawn Condition	One of six predicates (S_1 – S_6) that must all be satisfied for capsule spawning.
[E]	Spawn Gate	Enforcement mechanism that validates all spawn conditions before permitting capsule creation.
[E]	τ_{spawn}	Health threshold for spawn permission. Default 0.70 for PRODUCTION profile.
[E]	R_{max}	Maximum global spawn rate (capsules per tick). Profile-dependent ceiling.
[E]	R_{local}	Maximum spawn rate per parent capsule within a time window.
[E]	D_{max}	Maximum lineage depth. Spawn denied when $depth \geq D_{max}$.
[E]	Adaptive Spawn Governance (ASG)	Self-tuning system that adjusts spawn parameters (τ_{spawn} , R_{max} , D_{max}) based on swarm health metrics. See Appendix N.
[E]	ASG Calibration Cycle	Periodic parameter adjustment (default every 10,000 ticks) with cooldown to prevent oscillation.

11 Safety & Audit Terms

St.	Term	Canonical Definition
[E]	Safety Violation	Any system state where a Vault Commandment evaluates to false, or any transition that would produce such a state.
[E]	Invariant Breach	Violation of a proven system invariant (Spawn Governance violation, Vault Binding, Lineage Integrity, Monotonic Sensitivity). Triggers immediate halt.
[E]	Severity Level	Classification: S0 (Info), S1 (Warn), S2 (Alert), S3 (Critical). Determines response and recovery path.
[E]	Escalation Level	Authority scope: L1 (Capsule Reflex), L2 (Local Arbiter), L3 (Auditor Capsule), L4 (Gardener), L5 (Constitutional). See Appendix F.
[E]	Severity–Escalation Mapping	S0/S1 → L1; S2 → L2/L3; S3 → L4/L5. Severity determines urgency; Escalation determines authority scope.
[E]	Escalation Pathway	Pre-defined chain: Trigger → Primary → Fallback → Timeout Action. Locked at genesis.
[E]	ZK-SP	Zero-Knowledge Signature Proof: cryptographic audit mechanism providing append-only forensic trail with privacy-preserving verification.
[E]	Gardener	Human oversight role with authority to halt, rollback, or override system decisions. Cannot be bypassed by any automated process.
[P]	Forensic Reconstruction	Process of rebuilding system history from ZK-SP audit trail and trunk checkpoints.

12 Formal Symbols and Code Mapping

Formal Symbol	Code Identifier	Description
τ (tau)	<code>thresholds['entropy']</code>	Entropy sensitivity threshold [0.0, 1.0]
λ (lambda)	<code>thresholds['heuristic']</code>	Heuristic breach tolerance [0.0, 1.0]
ΔS	<code>entropy.composite()</code>	Computed behavioral entropy
α	<code>ALPHA</code>	Decision variance weight (default 0.4)
β	<code>BETA</code>	Resource flux weight (default 0.3)
γ	<code>GAMMA</code>	Goal drift weight (default 0.3)
w	<code>WINDOW_SIZE</code>	Sliding window size (default 100 ticks)
T_{wd}	<code>LATENCY_BUDGET_MS</code>	Watchdog timeout (10ms)
$ M $	<code>len(micro_signatures)</code>	Micro-signature library cardinality
$H(\cdot)$	<code>hashlib.sha256()</code>	Collision-resistant hash function
f	<code>fault_tolerance</code>	Max faulty nodes in Byzantine model

13 Legacy Term Mappings

The following table maps terms from prior EFM versions to their canonical v1.9 equivalents. This ensures continuity for implementations migrating from earlier frameworks.

Legacy Term	Canonical Term (v1.9)	Migration Notes
IA-BIM (Inter-Agent Bridge Integrity Matrix)	Swarm Coherence Index (SCI)	SCI measures collective swarm coherence. Interacts with ΔS via: $SCI \propto 1 - \Delta S_{swarm}$. Higher ΔS degrades SCI.
Bridge Integrity Matrix	Swarm Coherence Index (SCI)	Same as IA-BIM. The “bridge” metaphor replaced with “swarm coherence” for clarity.
Cognitive Aperture	Arbiter Threshold Governor (ATG)	ATG manages the τ threshold window for Arbiter deliberation. The “aperture” metaphor suggested continuous adjustment; ATG is discrete.
TPE (Trajectory Prediction Engine)	Arbiter Trajectory Projection (ATP)	ATP is integrated into d-CAM quorum voting. Predictions inform quorum weighting, not standalone decisions. See Vol. II §2.5.
Behavioral Signature	Micro-Signature	Compact behavioral fingerprint (64–256 bytes). The term “micro” emphasizes size constraints.
Entropy Threshold	Entropy Tolerance (τ)	“Tolerance” better conveys the safety margin semantics.
Safety Breach	Safety Violation	“Violation” is canonical; “breach” reserved for threshold context.
Pattern Library	Heuristic Accretion	Refers to the monotonic accumulation process, not a static collection.
Capsule Template	Legal Species	“Legal Species” emphasizes validation and governance constraints.
Forest Divergence Protocol	Fork Verification (Appendix J §14)	Fork Verification includes behavioral equivalence testing, not just divergence measurement.
Dialect Drift Index	DDI (Dialect Distance Index)	Renamed for precision. DDI measures semantic distance, not just “drift.”

SCI– ΔS Relationship: The Swarm Coherence Index (SCI) is *inversely* correlated with aggregate behavioral entropy. Formally:

$$SCI(swarm) = 1 - \frac{1}{|C|} \sum_{c \in C} \Delta S(c) \quad (1)$$

where C is the set of capsules in the swarm. High individual ΔS values degrade swarm coherence. This replaces the IA-BIM “bridge integrity” model with a more precise statistical formulation.

TPE → ATP Migration: The Trajectory Prediction Engine (TPE) from prior versions operated as a standalone predictor. In v1.9, ATP is *integrated into d-CAM quorum mechanics*:

- ATP predictions inform vote weighting in quorum decisions
- High-confidence ATP predictions increase vote weight
- ATP does not make autonomous decisions—it advises the quorum
- See Volume II §2.5 for ATP quorum integration details

14 Deprecated / Rejected Terms

The following terms were considered but rejected or deprecated. **Do not use** in Booklets 3–4.

Rejected Term	Use Instead	Reason
Entropy Threshold	Entropy Tolerance	"Tolerance" better conveys safety margin semantics
Reflex Core	Reflex-Core	Hyphenation required for compound component names
Micro-signature	Micro-Signature	Capitalize as proper noun in prose
Merkle-style chain	Vault Hash Chain	Linear chain, not true Merkle tree (see Vol. I Remark)
Safety breach	Safety Violation	"Violation" is canonical; "breach" reserved for threshold context
Capsule template	Legal Species	"Legal Species" is the canonical term for validated templates
Pattern library	Heuristic Accretion	Refers to process, not static collection

15 Checklist for Booklets 3–4

Before submitting Booklets 3–4 for review, verify:

- All **[E]** terms used exactly as defined (no paraphrasing in formal contexts)
- All **[P]** terms have finalized definitions consistent with drafts above
- No terms from "Deprecated / Rejected" list appear in text
- Greek symbols used in equations; code identifiers used in listings
- Capitalization and hyphenation match canonical forms
- Any new terms proposed are flagged for addition to this reference
- Cross-references to Volume I use section/definition numbers (e.g., "Definition 2.1")
- d-CAM, d-CTM, Legal Species, Heuristic Accretion definitions are finalized

— End of Terminology Reference —

Please contact the editorial team with any proposed additions or modifications.