Entropica Forensic Model

Codex v1.5

Index & Architecture Overview

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> *"Autonomy is inversely proportional to irreversibility."*
> *— The Reversibility Principle, Volume I §3.X*

1 Overview

The **Entropica Forensic Model (EFM)** is a comprehensive framework for building AI systems with:

- **Hardware-enforced safety** (Layer 0 Vault Commandments)
- **Cryptographic accountability** (ZK-SP audit chains)
- **Bounded autonomous decision-making** (Level 6 autonomy)
- **Evolutionary self-improvement** (Discovery Stack feedback loops)

2 Layer Architecture

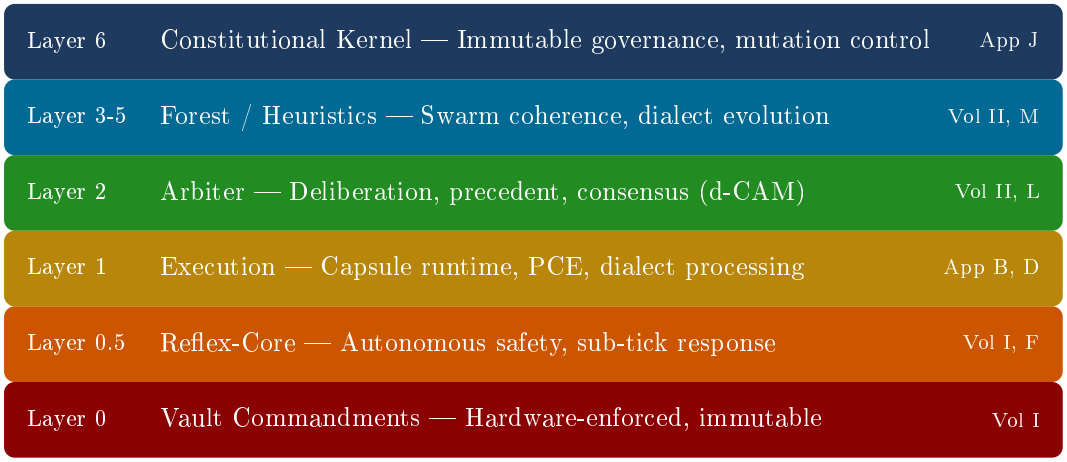

Figure 1: EFM Layer Architecture — Bounded Autonomy through Layered Safety

Layer	Name	Response Time	Mutability
0	Vault Commandments	—	Immutable (hardware)
0.5	Reflex-Core	Milliseconds	Immutable (runtime)
1	Execution	—	Mutable
2	Arbiter	Seconds–Minutes	Mutable + Precedent
3–5	Forest/Heuristics	Hours–Days	Evolutionary
6	Constitutional	—	Controlled mutation

Table 1: Layer properties and response characteristics.

3 Three-Speed Safety Architecture

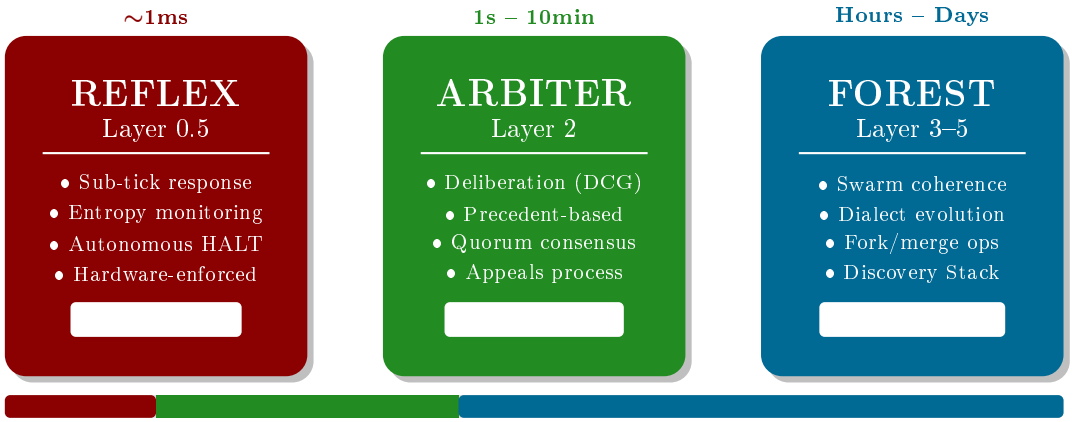

Figure 2: Three-Speed Safety — Response time scales with decision complexity

4 The Four Commandments (Layer 0)

1. **Vault Binding** — All capsules bound to their parent Vault
2. **Audit Immutability** — d-CTM records cannot be modified
3. **Reflex Supremacy** — Reflex can halt any capsule instantly
4. **Human Override** — Gardener can always intervene

5 The Reversibility Principle

Reversibility	Autonomy	Examples	Oversight
FULLY REVERSIBLE	**Full Autonomy** Act immediately Correct if wrong	K: Treatment A: Rollback (safe) F: QUARANTINE	Post-hoc notification Gardener can reverse
PARTIALLY REVERSIBLE	**Arbiter Oversight** Deliberate briefly Act with logging	A: Rollback (ext.) M: De-enshrine L: Judicial ruling	Post-hoc + logging Arbiter quorum
IRREVERSIBLE	**Deliberation Req'd** Think carefully Act once certain	A: Rollback (risky) External API calls Physical actuations	Pre-action review Arbiter deliberation
CONSTITUTIONAL	**Gardener Approval** Human-in-the-loop Formal process	F: PURGE J: Mutation Layer 0/6 changes	Formal approval Constitutional quorum

Key Insight: Gate by recoverability, not perceived danger
Dangerous-but-reversible → Autonomous | Safe-but-irreversible → Deliberate

Figure 3: The Reversibility Principle — Autonomy inversely proportional to irreversibility

6 Evolutionary Feedback Loop

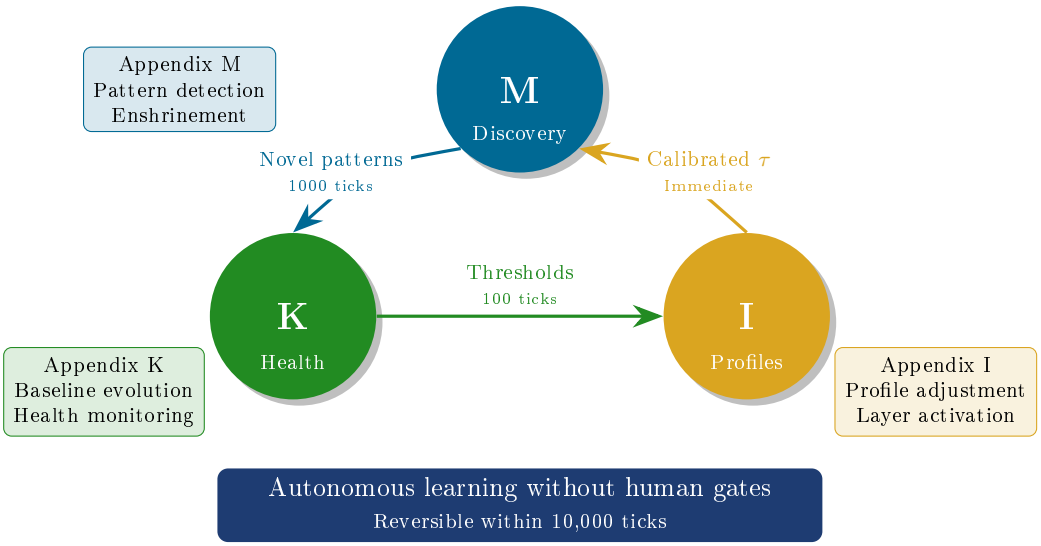

Figure 4: Evolutionary Feedback Loop — M → K → I → M cycle

7 Document Set

7.1 Core Volumes

Document	Version	Pages	Description
Volume I	v1.5	∼33	Genesis Protocol, Reflex Engine, **Reversibility Principle**
Volume II	v1.2	∼40	Arbiter, Forest Layer, Dialect Evolution

Table 2: Core volumes.

7.2 Technical Appendices

App	Title	Version	Key Content
A	Capsule Integrity & Forensic State	v1.4	Side-effect-aware rollback
B	Lexicore Runtime (PCE)	v1.1	Execution environment
C	Simulation Harness	v1.2	Testing infrastructure
D	Dialect Evolution Language (DEL)	v1.1	Communication protocol
E	ZK-SP & Audit Chain	v1.3	Cryptographic proofs
F	Escalation Protocol	v1.3	Anomaly classification
G	Gardener Interface	v1.3	Human oversight + feedback loop
H	Telemetry Layer	v1.2	Monitoring infrastructure
I	Deployment Profiles	v1.5	Layer activation mapping
J	Constitutional Kernel	v1.5	Rollback authority, ZK-SP anchoring
K	Swarm Health (SHSL)	v1.3	Health monitoring, M→K integration
L	Judicial Swarms	v1.3	Precedent reconciliation
M	Discovery Stack	v1.2	Evolutionary feedback loop

Table 3: Technical appendices (A–M).

8 Security Architecture

The EFM implements defense-in-depth:

1. **Layer 0** — Hardware-enforced, cannot be bypassed by software
2. **Reflex** — Sub-tick response time, autonomous halt capability
3. **ZK-SP** — Cryptographic proofs without revealing proprietary algorithms
4. **Audit Chain** — Immutable, tamper-evident logging to d-CTM

9 Citation

```
@techreport{efm2025,
  title   = {Entropica Forensic Model: A Framework for
             Bounded Autonomous AI Systems},
  author  = {Yology Research Division},
  institution = {Entropica SPC},
  year    = {2025},
  version = {1.5},
  url     = {https://github.com/entropica/efm-codex}
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