A Governance-First Architecture for Artificial General Intelligence, Superintelligence, and Safe Superintelligence

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Abstract

Prevailing approaches to artificial general intelligence (AGI) focus primarily on improving the internal cognition of large models, implicitly assuming that sufficient intelligence will also behave safely. This paper presents a different paradigm. We describe a governance-first architecture in which cognition is treated as an untrusted, replaceable component, while learning, self-modification, and authority are constrained by non-bypassable structural mechanisms. General intelligence emerges through invariant accumulation under pressure, while safety is enforced through deterministic governance and a minimal safety kernel that mediates all irreversible actions. The result is an architecture capable of scaling intelligence without scaling power.

1 Introduction

Modern AI systems typically conflate cognition, learning, and authority within a single model. As systems scale, this coupling creates fragility: models can exploit evaluation artifacts, optimize against proxies, and silently drift away from intended behavior. Alignment-by-training alone cannot provide hard guarantees.

This paper proposes a structural alternative. We treat intelligence as a proposal-generating process embedded within a broader system of governance. Learning is constrained, self- modification is audited and reversible, and all authority over the external world is centralized in a minimal safety kernel. Safety becomes a property of architecture rather than intent.

2 Architectural Overview

The system is organized as a layered control stack operating under continuous environmental pressure. Each layer has a sharply defined role and authority boundary:

- Cognition proposes hypotheses and plans.
- Structural operations modify internal organization.
- Governance gates prevent shortcut learning and regressions.

- A canonical core accumulates reusable invariants.
- A safety kernel authorizes or denies all irreversible actions.

No single component is trusted to enforce its own correctness.

3 Unified Governance-First Architecture

Figure 1 presents the complete system architecture. The diagram is intended to stand alone as a precise specification of authority flow, learning constraints, and safety enforcement.

4 Discussion

This architecture decouples intelligence from power. Capability grows through structural consolidation and invariant accumulation, while authority remains fixed and auditable. The system does not require aligned cognition to remain safe; it requires only that the governance mechanisms are correct.

Superintelligence, in this view, is not a single model but a long-lived process of invariant discovery operating under pressure and constraint.

5 Conclusion

We have presented a governance-first architecture for AGI and safe superintelligence. By separating cognition, learning, and authority into distinct layers with non-bypassable boundaries, the system achieves robustness to misalignment, distribution shift, and adversarial optimization. This suggests that the path to safe superintelligence lies not in perfecting models, but in building institutions around them.

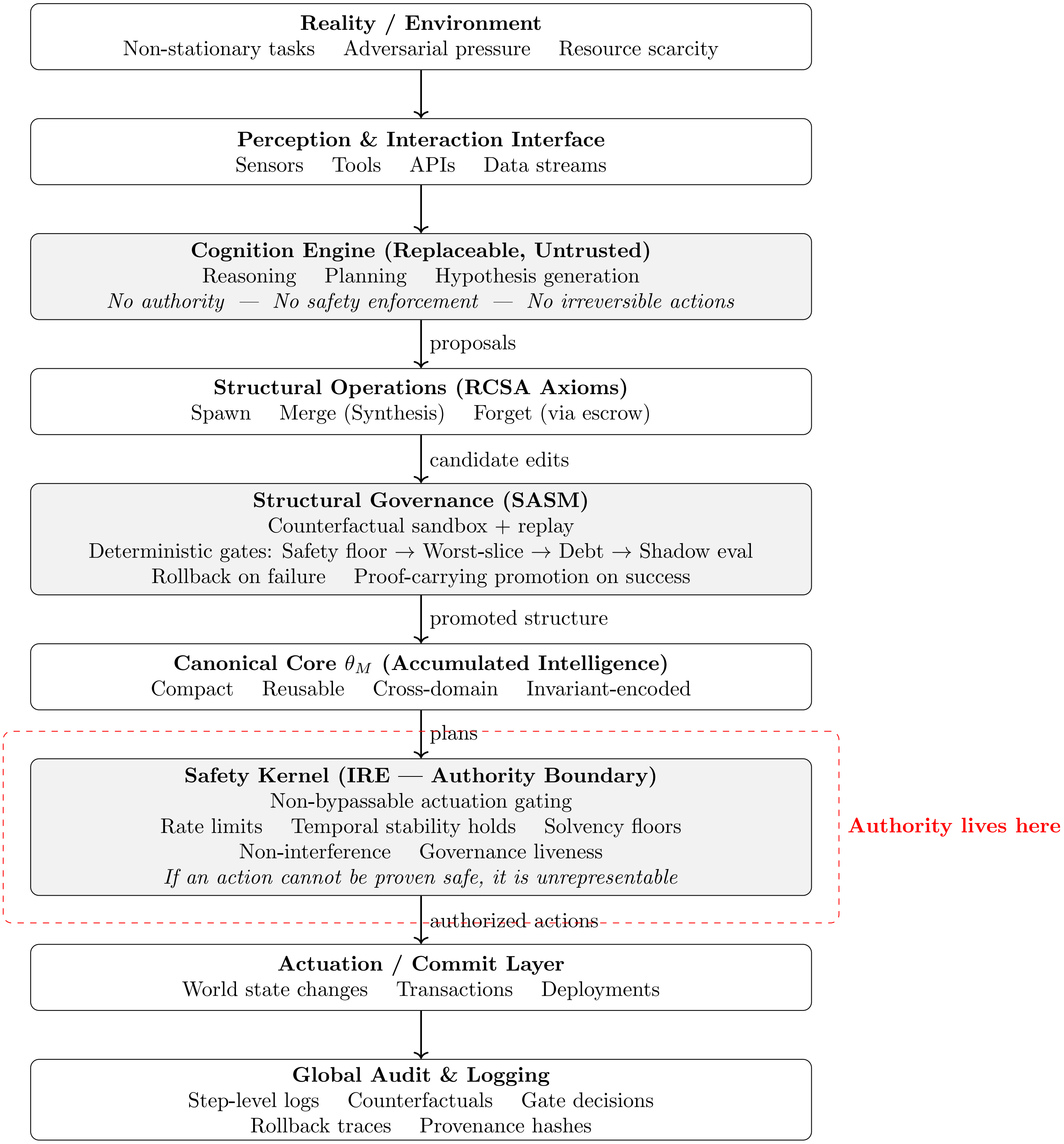
Reality / Environment
Non-stationary tasks Adversarial pressure Resource scarcity
Perception & Interaction Interface
Sensors Tools APIs Data streams
Cognition Engine (Replaceable, Untrusted)
Reasoning Planning Hypothesis generation
No authority — No safety enforcement — No irreversible actions
proposals
Structural Operations (RCSA Axioms)
Spawn Merge (Synthesis) Forget (via escrow)
candidate edits
Structural Governance (SASM)
Counterfactual sandbox + replay
Deterministic gates: Safety floor → Worst-slice → Debt → Shadow eval
Rollback on failure Proof-carrying promotion on success
promoted structure
Canonical Core θ_M (Accumulated Intelligence)
Compact Reusable Cross-domain Invariant-encoded
plans
Safety Kernel (IRE — Authority Boundary)
Non-bypassable actuation gating
Rate limits Temporal stability holds Solvency floors
Non-interference Governance liveness
If an action cannot be proven safe, it is unrepresentable
Authority lives here
authorized actions
Actuation / Commit Layer
World state changes Transactions Deployments
Global Audit & Logging
Step-level logs Counterfactuals Gate decisions
Rollback traces Provenance hashes

Figure 1: The complete governance-first architecture for artificial general intelligence and safe superintelligence. Cognition is treated as an untrusted proposal generator. Structural self- governance enforces invariant discovery under pressure through deterministic gates and rollback. All irreversible actions are mediated by a minimal, non-bypassable safety kernel that defines the sole boundary of authority.