Execution-Bound Governance for AI Systems
Admissibility as a Structural Precondition to Runtime

ABSTRACT

Current AI systems rely on monitoring, validation, and corrective intervention after execution has already become possible. This creates a structural governance gap: invalid or unsafe states remain reachable even when policy, audit, or refusal layers are present.

This paper introduces a constraint-first architectural model in which governance is defined before runtime. The central claim is that governability cannot be achieved by post-hoc evaluation alone, but requires an admissibility layer that determines which transitions may exist at all.

The proposed direction distinguishes between probabilistic reasoning and execution-bound state transition. It argues for a system architecture in which inadmissible transitions are not merely blocked after formation, but rendered structurally unreachable before execution begins.

The paper outlines a layered model connecting input interpretation, admissibility evaluation, execution boundary conditions, and runtime consequence. It further argues that software-only enforcement remains incomplete where execution depends on external permissions, toolchains, or mutable runtime surfaces, motivating a hardware-coupled enforcement direction.

This document is a public architectural note. It establishes the governance model, terminology, and system direction while withholding implementation-specific enforcement logic.

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1. INTRODUCTION

The current paradigm of AI governance is reactive.

Systems generate outputs or initiate actions, and governance mechanisms attempt to validate, filter, or audit those outcomes after they have already become computationally real. While this approach supports traceability and accountability, it does not prevent the existence of invalid system states.

As AI systems move toward multi-step execution, tool integration, and autonomous operation, this limitation becomes structural. The question is no longer whether outputs are correct, but whether certain transitions should have been possible at all.

This paper addresses that gap.

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2. CORE DISTINCTION

A fundamental shift is required:

Traditional Paradigm	Proposed Paradigm
Validation after execution	Admissibility before execution
Control via policy	Control via structural reachability
Monitoring and audit	Prevention by construction
“Was this valid?”	“Could this exist at all?”

Validation evaluates outcomes.
Admissibility defines existence.

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3. ARCHITECTURE MODEL

The proposed architecture introduces a layered structure:

[Input / Intent]
↓
[Admissibility Layer]
↓
[Execution Boundary]
↓
[Runtime / Tool Plane]
↓
[Consequence-Bearing State]

3.1 Input / Intent

User input, system-generated intent, or agent-driven action proposals.

3.2 Admissibility Layer

A pre-execution evaluation layer that determines whether a transition is structurally allowed to exist.

3.3 Execution Boundary

The point at which admissibility must be satisfied for execution to become possible.

3.4 Runtime / Tool Plane

Execution environment, including models, tools, APIs, and external systems.

3.5 Consequence-Bearing State

Any state that produces real-world or system-relevant effects.

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4. STRUCTURAL CLAIM

The central invariant of this model is:

If a transition is inadmissible, the execution path does not exist.

This differs fundamentally from blocking or filtering.

- Blocking assumes a path exists and is stopped.
- Admissibility defines that the path never becomes available.

Governance is therefore not an overlay, but a precondition.

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5. LIMITATIONS OF SOFTWARE-ONLY GOVERNANCE

Software-based governance mechanisms operate within the same execution environment they attempt to control. This introduces structural weaknesses:

- Dependence on external APIs and services
- Reliance on mutable policy layers
- Exposure to quota systems and permission models
- Susceptibility to misconfiguration or drift
- Inability to guarantee non-bypassability under all conditions

Where execution depends on external permission or mutable runtime context, governance cannot be considered fully bound to execution.

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6. DIRECTION: EXECUTION-BOUND ENFORCEMENT

To address these limitations, the architecture points toward a tighter coupling between admissibility and execution.

The key direction is:

Governance must not only evaluate execution, but define the conditions under which execution can exist.

This introduces the concept of **execution-bound enforcement**, where the ability to execute is contingent on admissibility being structurally satisfied.

In this direction, enforcement is no longer purely interpretive or software-defined, but increasingly coupled to the execution boundary itself.

A hardware-coupled enforcement layer represents one possible realization of this principle, where inadmissible transitions are not intercepted after formation, but cannot materialize at the execution interface.

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7. SCOPE AND DISCLOSURE

This document is intentionally limited to the architectural model and system direction.

It does not disclose:

- implementation-specific enforcement logic
- signal structures or control semantics
- internal decision mechanisms
- hardware realization details

The purpose of this publication is to establish the conceptual framework, terminology, and structural shift required for execution-bound governance.

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8. CONCLUSION

AI governance cannot be achieved solely through observation, validation, or correction.

It requires a structural definition of what is allowed to exist.

By introducing admissibility as a precondition to execution, this model shifts governance from retrospective evaluation to pre-execution constraint.

The long-term implication is a transition from:

systems that explain what happened

to:

systems in which inadmissible states never become real

KEY STATEMENT (für Ende / Hervorhebung)

Governance is not applied to execution.
It defines whether execution can exist.