Cognition-Compatible Semantic Agent Objects and Structural Validation

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Introduction: Agents as Data Objects, Not Processes

In conventional systems, agents are inseparable from execution. They exist as processes, sessions, or control loops whose identity and memory are externalized into databases, queues, or orchestration layers. When execution stops, the agent effectively ceases to exist, even if its state has been partially recorded elsewhere.

The cognition-compatible agent schema inverts this relationship. An agent is defined as a persistent data object whose internal structure encodes semantic intent, contextual constraints, memory, governance rules, and evolutionary history. Execution becomes optional and external; semantic identity remains intact and inspectable regardless of runtime continuity.

1. Canonical Semantic Fields

Each semantic agent object may contain a defined set of canonical fields, including intent, context, memory, policy reference, mutation descriptor, and lineage. These fields collectively specify what the agent is attempting to do, under what constraints, how it may evolve, and how its behavior may be audited.

Structural validity depends on field presence and compatibility rather than behavioral completeness. An agent may be structurally admissible without being immediately executable, allowing semantic systems to reason over partially specified or evolving agents without forcing premature execution.

2. Structural Validation Before Execution

Before an agent is allowed to participate in semantic reasoning, mutation, or delegation, its structure is validated. Validation determines whether the fields present are coherent, internally compatible, and admissible under the schema and any referenced policies.

This validation is deterministic and data-driven. It does not depend on runtime behavior, execution history, or centralized registries. Structural admissibility is established prior to execution, ensuring that invalid or incoherent agents never become behavior.

3. Partial Agents and Structural Scaffolding

Real-world systems are asynchronous, distributed, and imperfect. Agents may arrive missing fields, with degraded structure, or in transitional states. The schema explicitly supports partial semantic agents—objects containing only a subset of canonical fields.

Partiality does not imply permissiveness. When allowed by policy, missing fields may be resolved through deterministic structural scaffolding. Any inferred, defaulted, or externally supplied fields are recorded explicitly, preserving auditability and preventing silent semantic drift.

4. Traceable Semantic Lineage

Every authorized mutation or derivation of an agent extends a lineage graph. Lineage fields reference prior semantic states, enabling provenance verification, trust inheritance, and audit of semantic evolution across distributed environments.

Lineage tracking is embedded directly within agent objects, eliminating dependence on centralized logs, external identity services, or post-hoc reconciliation mechanisms.

5. Interoperability Across Distributed Systems

Because semantic agents are self-describing and structurally validated, they can be serialized, transmitted, and rehydrated across heterogeneous systems. Nodes interacting with agents need only understand the schema and validation rules, not the agent's execution history or origin environment.

This enables decentralized semantic networks in which agents cooperate, delegate, and evolve across trust boundaries without requiring shared runtime infrastructure or centralized coordination.

Conclusion

Cognition-compatible semantic agent objects decouple semantic identity from execution. By defining agency as a structurally valid data object with embedded governance and lineage, the schema enables persistence, interoperability, and auditability across distributed systems.

Structural validation replaces orchestration as the primary mechanism of control. This shift provides a durable foundation for autonomous and semi-autonomous systems whose reasoning, memory, and governance must survive beyond any single process, host, or execution context. This schema is presented as a structural model and disclosure, not as a claim of deployment completeness, runtime maturity, or guaranteed outcomes.