

Lineage-Aware Memory Infrastructure for AI Systems

Semantic memory, retrieval boundaries, compression ethics, deterministic replay, and longitudinal continuity for AI systems.

Artifact type	Research Brief
Status	Active research artifact
Primary route	/research/lineage-aware-memory/
Domains	semantic memory, retrieval governance, AI infrastructure, lineage systems
Keywords	semantic memory, AI memory infrastructure, lineage-aware retrieval, deterministic replay, vector retrieval governance, retrieval is not evidence, semantic lineage, AI memory systems

Abstract

Longitudinal AI systems need memory, but memory without lineage becomes a liability. This artifact defines memory as governed infrastructure: every retrieval, summary, cluster, and compression must preserve enough lineage to remain contestable.

Primary architecture reading

Lineage-Aware Memory Infrastructure for AI Systems

User events and source material

Canonical segments and transformations

Atomic reasoning particles and claims

Clusters, bridges, and contradiction surfaces

Siglents and retrieval projections

Layer discipline prevents capability claims from collapsing into unbounded autonomy.

Decision traces and replay validation

Must-have requirements

- Separate retrieval from evidence
- Track transformation lineage
- Expose uncertainty
- Prevent memory from becoming hidden authority

- Support reconstruction for important claims

Good-to-provide enrichments

- Graph-based zoom model
- BLAKE3/Merkle integrity pattern
- Contradiction preservation
- Memory authority tiers

The memory problem

Most AI systems treat memory as convenience. Bluehand treats memory as infrastructure. A useful assistant must remember, but remembering changes power relations: it can preserve context, amplify bias, suppress weak signals, or convert a temporary statement into a durable identity claim. Memory therefore requires governance.

Retrieval is not evidence

Vector search can locate related material, but similarity is not proof. A retrieved fragment is a lead, not an adjudicated fact. Bluehand memory systems should distinguish source material, transformation output, inference, summary, compression, and evidence. This boundary is essential for technical trust and institutional use.

Lineage-aware compression

Compression preserves some structure and destroys other structure. A Siglent-style object can be valuable only if its inputs, transformation rules, authority status, and uncertainty remain visible. The compressed object may help navigation, but it must not replace reconstructable source lineage.

Replay validation

Memory systems should support replay: given a claim or decision trace, the system should reconstruct the meaningful path from source material through transformation to output. Replay cannot guarantee truth, but it raises the cost of silent drift and hallucinated authority.

Implementation notes for blue-hand.org

This artifact should be hosted from [/research/lineage-aware-memory/](#) with an HTML summary page, PDF download link, schema.org TechArticle JSON-LD, OpenGraph metadata, and links back to the Research Library, Systems Atlas, N2 Protocol, and relevant Bluehand systems.

Suggested HTML sections

- The memory problem
- Retrieval is not evidence
- Lineage-aware compression
- Replay validation

SEO and discovery surface

The artifact should use its title as the page H1, subtitle as the meta description basis, and domains/keywords as tags. The copy should remain human-readable; keyword density should arise from precise technical terminology rather than stuffing.

semantic memory	AI memory infrastructure	lineage-aware retrieval	deterministic replay
vector retrieval governance	retrieval is not evidence	semantic lineage	AI memory systems

Governance boundary

This artifact is a public research object, not a claim that every described capability is already deployed in production. Claims about implementation should remain explicitly separated from architectural direction, organizational doctrine, and future-facing design work.

Canonical relationship to Bluehand

This brief supports Bluehand as a research and infrastructure organization working across semantic memory, governed execution, local-first AI, institutional trust, and research venture formation. It should be treated as one node in a larger public knowledge graph, not as standalone marketing collateral.