

Historical Policy-Version Reconstruction

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What Historical Policy-Version Reconstruction Specifies

The architecture preserves policy versions alongside data. Every governance policy update is a credentialed observation with effective-time and supersession metadata. A historical reconstruction at time T retrieves: the data observable at T, the policy versions in force at T, and the credentialing chain that produced both.

Reconstruction re-applies the admissibility rules from time T to the data observable at T. The result is what the system would have determined under the policy in force at the audited time, regardless of what the system would determine under current policy. The capability is structurally distinct from data-time-travel alone.

Why Data-Only Time-Travel Misses the Reconstruction Question

Apache Iceberg, Delta Lake, and similar data-time-travel systems preserve historical data state. A query against historical data shows what the data was at the prior time. The architecture is mature for analytical queries that ask 'what was the data.'

Legal-evidence reconstruction in autonomous incidents asks a different question. Courts ask: 'What did the system know, and under what rules, at time T?' The 'under what rules' element is the policy version, which data-time-travel does not preserve. A vehicle that detected a pedestrian under one policy version and committed an action that under a later policy version would be evaluated differently — the relevant evaluation is under the prior policy, not the current one.

How Policy Versions Compose With Data Versions

Each governance policy is a credentialed observation in the lineage. Policy updates produce successor observations with explicit supersession metadata. The lineage forms a versioned policy history alongside the data history.

Reconstruction at time T walks both histories. The relevant policy version (the latest policy effective at or before T) determines the admissibility rules. The data observable at T (the latest data version effective at or before T, plus the in-flight observations active at T) determines the inputs. Re-applying the rules to the inputs reproduces what the system structurally evaluated at T.

What This Enables for Legal-Grade Reconstruction

Autonomous-vehicle incident reconstruction in litigation gains structural support. The court can reconstruct what the vehicle knew under the policy in force at the moment of the incident, with audit-grade lineage that survives challenge.

Regulatory audit gains the same support. EU AI Act audits, FDA medical-device post-market surveillance, NHTSA autonomous-vehicle safety review all require policy-aware reconstruction. The patent positions the primitive at the layer where legal-

grade and regulatory-grade reconstruction has been operating without structural support.