Lineage-Bound Multilateration

by Nick Clark | Published April 25, 2026

What Lineage-Bound Multilateration Specifies

The multilateration solver accepts credentialed range observations and produces a position estimate. The estimate carries: the contributing observation set (each by reference to the credentialed observation record), the solution covariance derived from observation uncertainties, the residuals identifying observation-quality patterns, and a signature binding the result to the solver identity.

Downstream consumers of the position receive the structured claim rather than just the coordinates. The architecture supports admissibility evaluation of positions just as it supports evaluation of observations.

Why Position-Level Lineage Matters

Position-derived decisions in autonomous systems include actuation decisions (proceed to coordinate, engage at coordinate, deny at coordinate). When these decisions are audited, the audit must reconstruct not just the observations but the position-solution that the observations produced.

Lineage-bound multilateration provides the position-level record. Auditors can verify that the solver produced the claimed position from the claimed observations under the declared uncertainty model. The verification is structural rather than dependent on solver implementation knowledge.

How Position Records Compose With Downstream

Position records flow into downstream systems (path planners, geofence evaluators, actuation governors) as credentialed positional claims. Each downstream consumer admits the position-record before integrating; the admissibility evaluation includes solver identity, observation-set quality, covariance under operational requirements, and freshness.

Position records also flow into lineage retention. The architecture retains position records alongside the contributing observation records, supporting audit reconstruction at both levels.

What This Enables for Decision Audit

Engagement-decision audit (defense, regulatory) gains structured access to the positional basis of decisions. The audit answers 'what coordinates was the system operating against' with verifiable position records rather than reconstructed estimates.

Liability investigation (autonomous-vehicle, surgical-robotics) gains the same. The investigative reconstruction proceeds through the position records to the contributing observations to the contributing modalities to the contributing units. Each step is structurally supported rather than dependent on engineering reconstruction.