

Lineage-Bound Multilateration

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What Lineage-Bound Multilateration Specifies

The architecture treats position estimates as credentialed observations. A position is signed by the producing unit; the signature includes references to the contributing range observations, the multilateration algorithm and parameters, and the uncertainty bound computed from input uncertainties. Every position carries its own auditable provenance.

Lineage is not metadata layered on top — it is part of the position observation. A receiver consuming a position can validate its credential, walk back through the contributing range observations, and verify that the position's uncertainty bound is consistent with the inputs. The position is structurally auditable rather than asserted.

Why Bare Positions Without Lineage Don't Survive Disputes

Conventional position estimates (GPS-derived, V2X-derived, RTK-corrected) are bare values: latitude, longitude, altitude, with sometimes a confidence circle. The values are operationally useful but legally fragile when disputes arise. 'The vehicle was here at this time' depends on the credibility of the producing system; if the system's credibility is challenged, the position falls.

Position disputes are operationally common. Was the vehicle in the restricted zone at time T (insurance liability question)? Was the drone in commercial-air-space at time T (FAA enforcement)? Was the asset in the credentialed custody chain at time T (supply-chain dispute)? Each question requires position evidence that survives challenge. Lineage-bound multilateration produces position evidence that does.

How Lineage Composes Across Jurisdictions

A position computed under one authority's anchor infrastructure can be accepted by another authority through credential verification of the underlying range observations. The receiving authority does not need to recompute or re-survey; it walks the lineage, verifies each contributing observation's credential against authorities it admits, and accepts the position if the lineage is sound under its own admissibility policy.

Cross-jurisdictional position acceptance is therefore configuration rather than re-engineering. A vehicle's position computed in one state is accepted by another state's regulatory authority subject to credential cross-recognition. A maritime asset's position computed under one flag-state authority is accepted by a destination port authority through the same mechanism. The architecture supports the multi-jurisdictional operating reality of modern transportation.

What This Enables for Position-Sensitive Operations

Insurance, regulatory, and liability disputes involving location evidence gain structurally-auditable positions. Forensic reconstruction of accidents, regulatory enforcement actions, and supply-chain custody disputes all benefit from the architectural primitive that produces audit-grade position lineage as a structural property.

Cross-authority operations — international shipping, cross-state autonomous fleets, cross-coalition military operations — gain position acceptance that current per-jurisdiction position infrastructure does not provide structurally. The patent positions the primitive at the layer where position-sensitive operations have been operating with reconstructed-rather-than-structural audit support.