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Multi-Root Composite Lineage Graphs: Provenance Through Entropy Vector Similarity

by [Nick Clark](#) | Published March 27, 2026 | [PDF](#)

Provenance tracking through cosine similarity of entropy vectors linking derivative UUIDs to multiple semantic predecessors with weighted lineage edges. Within the content anchoring system, this capability operates as a structural primitive at the content identity level. It is not an optional enhancement or a configurable plugin but a mandatory architectural property that every participant encounters. The result is a system where multi-root composite lineage graphs is enforced by construction rather than by convention, policy, or external oversight.

What It Is

Provenance tracking through cosine similarity of entropy vectors linking derivative UUIDs to multiple semantic predecessors with weighted lineage edges. This is a structural mechanism within the content anchoring system that operates at the content identity level. It is not advisory, not configurable at the discretion of individual participants, and not dependent on external enforcement infrastructure.

Every interaction within the system encounters this mechanism as a mandatory constraint. The behavior it produces is deterministic: given the same inputs and the same system state, the outcome is identical regardless of which node evaluates it, when the evaluation occurs, or what substrate hosts the computation.

Why It Matters

Conventional content identification systems address this problem through metadata tags, watermarks, or centralized registries. These approaches function adequately under controlled conditions but introduce structural fragility when metadata is stripped, watermarks are removed, or the registry becomes unavailable. The underlying assumption that external identifiers will remain attached to content throughout its lifecycle becomes a liability precisely when reliability matters most.

Multi-root composite lineage graphs removes this fragility by embedding the relevant capability directly into the content identity layer. There is no external dependency that can fail independently, no middleware that can be misconfigured, and no trust assumption that can be violated by a single compromised participant. The guarantee is structural.

How It Works

The mechanism operates through deterministic evaluation embedded in the content anchoring system. When a relevant operation is initiated, the system evaluates the applicable structural constraints against the current state. This evaluation consults the fields, policies, and lineage records that travel with the objects themselves rather than relying on external state that may be stale, unavailable, or compromised.

The outcome of each evaluation is recorded in an append-only lineage structure. This record is cryptographically committed, ensuring that the complete history of decisions, transitions, and state changes remains auditable and tamper-evident. No evaluation outcome can be retroactively altered without breaking the cryptographic chain.

Because the evaluation logic and the data it operates on travel together, the mechanism functions identically across network partitions, substrate migrations, and administrative boundaries. There is no central evaluation point that must be available for the system to operate correctly.

What It Enables

With multi-root composite lineage graphs as an architectural primitive, systems built on this foundation can operate autonomously while maintaining the structural guarantees that centralized architectures achieve through oversight. The capability is not a tradeoff between autonomy and governance but a resolution of the apparent conflict between them.

This enables deployment across centralized cloud infrastructure, federated multi-party environments, fully decentralized networks, and edge installations with intermittent connectivity. The structural guarantees hold regardless of deployment topology because they are properties of the objects and protocols themselves, not properties of the infrastructure that hosts them.

[Content Anchoring All 21 steps →](#)

Computable identity for media. Provenance from structural entropy.

Patent

US 63/808,372 · provisional

Primary Technical Disclosure

[◦ Content Anchoring: Computable Identity for Media That Changes](#)

Secondary Technical

[◦ Multi-Axis Entropy Vector Extraction: Nine Dimensions of Structural Content Identity](#)[◦ Quadrant Decomposition: Spatial Sub-Region Fingerprinting for Partial Similarity Detection](#)[◦ 320-Bit UUID Construction: Multi-Segment Hashing for Negligible Collision Probability](#)[◦ Structure Signature: Background-Invariant Matching Through Gradient-Only Descriptors](#)[◦ Constellation Signature: Geometry-Invariant Matching Across Crop, Scale, and Occlusion](#)[◦ Five-Band Entropy Classification: Content Routing by Structural Complexity](#)[◦ Entropy Saturation-Governed Cache Eviction: UUID Density Replacing Static TTL](#) • [Multi-Root Composite Lineage Graphs: Provenance Through Entropy Vector Similarity](#)[◦ Multi-Modal Content Identity: Unified Pipeline Across Image, Audio, Text, and Video](#)[◦ Rights-Grade Pre-Release Admissibility: Policy Evaluation Before Content Commitment](#)[◦ Training Corpus Governance: Verifiable Lineage From Training Data to Model](#)[◦ Consultation Event Logging: Deterministic Records of Every Generation Reference](#)[◦ Model Output Provenance Fingerprint: Structural Proximity Without Model Access](#)[◦ Creator Attribution and Compensation Routing: Payment From Consultation Lineage](#)[◦ Adversarial Robustness and Deepfake Detection: Content Identity as Detection Substrate](#)[◦ Client-Side Execution Architecture: Privacy-Preserving Entropy Computation on Device](#)[◦ UUID Resolution Query Protocol: Distributed Lookup Across Anchor Node Networks](#)[◦ Orientation Canonicalization: Rotation-Invariant Processing Through Gradient Normalization](#)[◦ Cross-Band Resolution Pathfinding: Traversal Between Entropy Bands Under Mutation](#)

Applications (General)

[◦ Rights-Grade Generative AI: How to Pay Creators, Exclude Forbidden Content, and Prevent Infringement Before Release](#)[◦ Deepfake Detection Through Structural Provenance](#)[◦ Creator Economy Attribution Without Platform Intermediaries](#)[◦ Content Anchoring for Journalism Verification](#)[◦ Content Anchoring for Academic Research Integrity](#)[◦ Content Anchoring for Legal Evidence Chains](#)[◦ Content Anchoring for Insurance Claims Evidence](#)[◦ Content Anchoring for Real Estate Documentation](#)[◦ Content Anchoring for Art Authentication](#)

Applications (Specific)

[◦ C2PA Attaches Provenance to Content. The Content Itself Has No Identity.](#)[◦ Google SynthID Watermarks AI Output. Watermarks Are Not Identity.](#)[◦ Shutterstock Tracks Licensed Media. The Media Itself Cannot Prove Its Own Identity.](#)[◦ Spotify Tracks Every Stream. The Music Itself Has No Computable Identity.](#)[◦ Getty Images Built the World's Largest Licensed Image Library. Image Identity Still Depends on Metadata.](#)[◦ Adobe Stock Integrates Licensed Content Into Creative Workflows. Content Identity Is Still External.](#)[◦ YouTube Content ID Matches Audio and Video. The Content](#)

[Has No Intrinsic Identity.](#)◦ [Audible Magic Identifies Audio Content. The Audio Has No Self-Identifying Properties.](#)◦ [Digimarc Embeds Invisible Watermarks. The Watermark Is Added, Not Intrinsic.](#)◦ [Irdeto Protects Digital Content Through DRM. The Protection Is Applied, Not Intrinsic.](#)
[Content Anchoring overview →](#)

AQ
deterministic
autonomy

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