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Mutation Router With Contextual Signals: Policy-Aware Propagation Path Selection

by Nick Clark | Published March 27, 2026 | PDF

When a mutation is committed within a scope of the adaptive index, it may need to propagate to caches, child scopes, sibling scopes, or parent scopes. The mutation router selects propagation paths based on contextual signals: which scopes are affected, what their current governance state is, which anchors are available, and what propagation policy applies. This ensures that mutations reach every scope that needs them through paths that satisfy governance constraints.

What It Is

The mutation router is the component responsible for determining how a committed mutation propagates beyond its originating scope. Unlike traditional replication systems that broadcast changes through fixed topologies, the mutation router evaluates contextual signals at propagation time to select the optimal path for each destination.

Contextual signals include the trust relationship between source and destination scopes, the current availability of anchors along candidate paths, the sensitivity classification of the mutated data, and the propagation policy defined by both the source and destination governance configurations. The router must satisfy all applicable policies simultaneously.

Why It Matters

In conventional systems, mutation propagation follows fixed replication topologies: master-slave, multi-master, or gossip protocols with uniform dissemination rules. These topologies cannot differentiate between mutations that require high-trust propagation paths and mutations that can propagate through any available channel.

Policy-aware mutation routing introduces governance into the propagation layer. Sensitive mutations can be restricted to trusted paths. Routine mutations can propagate through the fastest available channel. Mutations that cross governance boundaries can be held at the boundary until the receiving scope's anchors explicitly admit them. This granularity is impossible with topology-based replication.

How It Works Structurally

When a mutation is committed, the mutation router computes the set of scopes that require notification. For each destination scope, the router evaluates candidate propagation paths against the propagation policy. Candidate paths are scored by a composite of trust, proximity, and availability, similar to the resolution routing function but applied to mutation dissemination.

The router may select different paths for different destinations. A mutation that affects both a high-trust child scope and a low-trust sibling scope may propagate to the child through a direct anchor-to-anchor channel while propagating to the sibling through an intermediary that the sibling's governance policy trusts.

Propagation acknowledgments flow back through the selected paths, confirming that each destination scope has received and validated the mutation. The originating scope tracks propagation completion and can escalate or retry if acknowledgments are not received within the expected window.

What It Enables

The mutation router enables the adaptive index to maintain consistency across governance boundaries without imposing uniform propagation rules. Cross-organizational data sharing can enforce that mutations propagate only through mutually trusted intermediaries. Multi-classification environments can route sensitive mutations through cleared paths while allowing routine mutations to propagate freely.

This capability transforms mutation propagation from a reliability mechanism into a governance mechanism, ensuring that the spread of changes through the index respects the same authority boundaries that govern the index itself.

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Adaptive Indexing overview →

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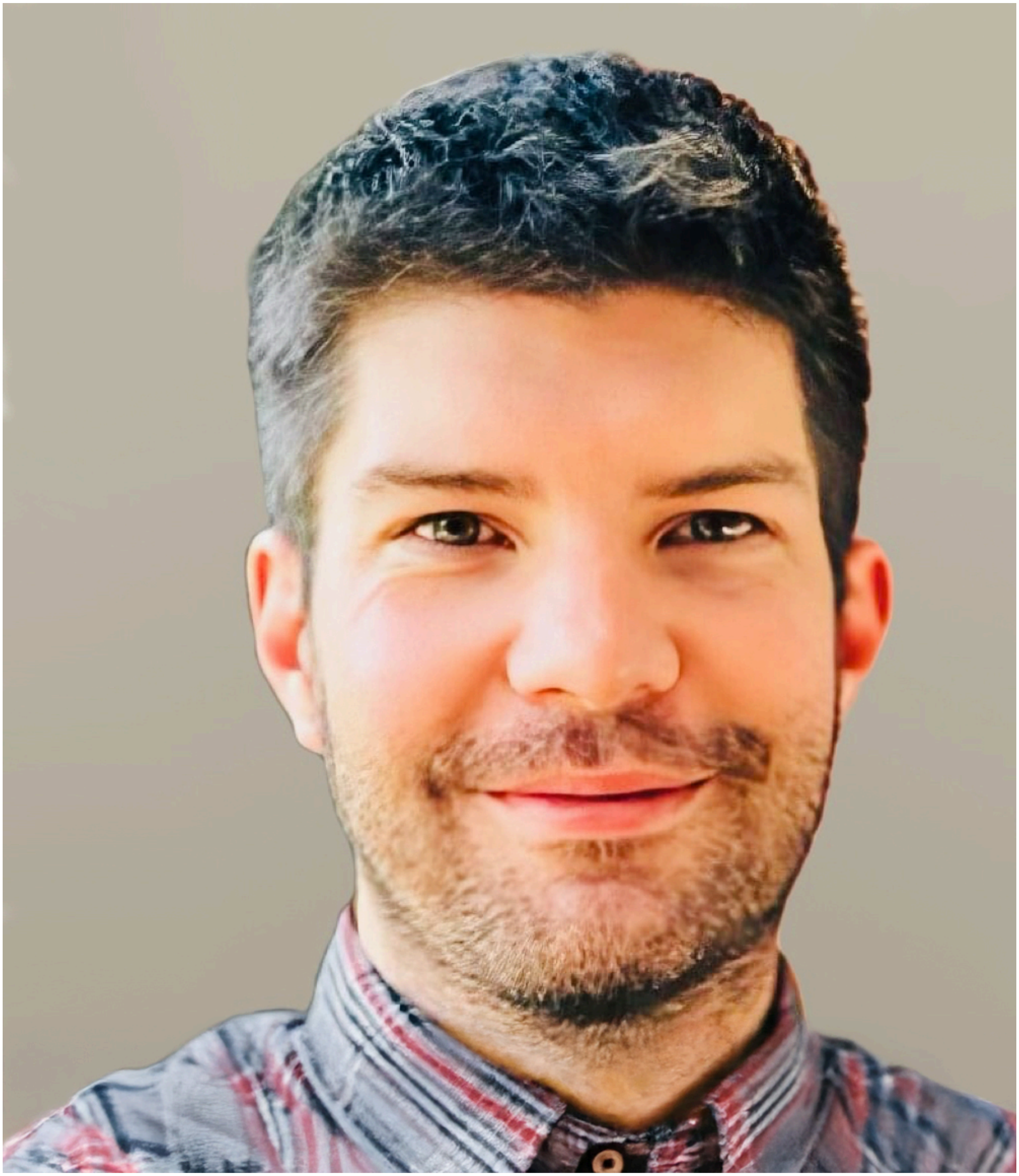
- nick@qu3ry.net
- 72 28 14 36 01


Invented by Nick Clark | Founding Investors: Devin Wilkie