ZeroMQ Eliminated the Broker. Routing Authority Still Lives in Application Code.

by Nick Clark | Published March 28, 2026 | PDF

ZeroMQ provided high-performance, brokerless messaging by embedding routing patterns directly into socket abstractions: pub-sub, push-pull, request-reply, and dealer-router patterns that operate without a central broker. The architectural insight was that routing patterns can be socket properties rather than broker features. But ZeroMQ eliminated the broker without embedding semantic authority in the protocol. Routing is pattern-based, determined by socket type and connection topology. Trust scope and governance authority remain in application code. The gap is between brokerless routing patterns and protocol semantics where authority is intrinsic to the content.

ZeroMQ's socket abstraction model and pattern-based routing influenced an entire generation of messaging libraries. The engineering is elegant. The gap described here is about protocol semantics, not about messaging pattern design.

Pattern-based routing without semantic routing

ZeroMQ routes messages based on socket patterns. A PUB socket broadcasts to all connected SUB sockets. A PUSH socket load-balances across connected PULL sockets. A ROUTER socket uses identity frames for addressed routing. The routing logic is determined by the socket topology, not by the content of the message.

A message sent through a ZeroMQ PUB socket is broadcast regardless of its content, trust level, or governance requirements. The protocol does not inspect what it is carrying. It routes based on the pattern. Different messages with different trust requirements are routed identically.

No trust semantics in the wire protocol

ZeroMQ's wire protocol (ZMTP) defines framing, greeting, and security mechanisms (NULL, PLAIN, CURVE). CURVE provides encryption and authentication between peers. But trust is a connection property, not a message property. All messages on an authenticated connection receive the same trust treatment.

A high-trust governance command and a low-trust telemetry reading on the same connection are treated identically by the protocol. The application must distinguish between them and apply appropriate trust evaluation. The protocol provides no semantic support.

What memory-native protocol semantics provide

A memory-native protocol would embed trust scope and governance authority in each message as protocol-level fields. Routing would consider the content's semantic properties alongside the topology. A high-trust governance command would route differently from a low-trust telemetry reading, not because the application implements different routing logic, but because the protocol routes based on the content's intrinsic authority.

ZeroMQ's brokerless pattern model demonstrated that centralized brokers are not necessary for flexible routing. Memory-native protocol semantics would extend this insight: if routing patterns can be embedded in sockets, governance authority can be embedded in content.

The remaining gap

ZeroMQ proved that messaging patterns can be embedded in the protocol rather than in a broker. The remaining gap is in extending that principle: embedding trust scope and governance authority in the content itself rather than in application code.

Memory-Native Protocol All 21 steps →

Authority intrinsic to the object. Routing by semantic properties.

Patent
US 19/366,760 · filed
Primary Technical Disclosure
○ Memory-Native Networking: A Cognition-Compatible Protocol Substrate
Secondary Technical
○ Protocol-Native Carriers: Agents as the Fundamental Unit of Transmission○ Dynamic Routing Protocol: Memory-Aware Path Selection for Semantic Agents○ Trust-Weighted Route Scoring: Dynamic Path Selection Through Policy-Defined Trust Thresholds○ Network Health Monitoring System: Signed Health Agents as Distributed Operational Telemetry○ Health Agents as Semantic Objects: Operational Metrics That Route Like Any Other Agent○ Dynamic Indexing Protocol: Entropy-Driven Restructuring of Semantic Flows○ Soft-Index Anchors: Ephemeral Index Points Inferred From Agent Lineage○ Adaptive Consensus Protocol: Memory-Native Quorum Without Fixed Validator Sets○ Trust-Weighted Voting in ACP: Domain-Scoped Votes Accumulated Against Agent Memory○ Dynamic Alias Resolution: Zone-Local Semantic Aliases Resolved Through Transport Headers○ Horizontally Composable Protocol Stack: Independent Layers Operating in Parallel○ Transport-Layer Agnosticism: One Protocol Stack Above Any Carrier○ Federated Semantic Zone Deployment: Heterogeneous Nodes Coordinating Across Trust Boundaries○ Health-Triggered Quorum Adjustment: Dynamic Thresholds From Network Stability Signals
Applications (General)
○ Edge Computing Without Central Routing Authority○ IoT Device Mesh Governance at Scale○ Vehicle-to-Vehicle Communication With Intrinsic Governance○ Military Mesh Networks Without Central Routing Authority○ Smart City Infrastructure With Self-Governing Transport○ Satellite Communication With Delay-Tolerant Governance○ Industrial IoT Protocols With Embedded Authority○ Healthcare Device Mesh Networking
Applications (Specific)
○ Starlink Built a Satellite Mesh. The Routing Authority Is Still Terrestrial.○ Zigbee Built a Mesh Protocol for IoT. The Messages It Carries Have No Memory.○ Matter Unified Smart Home Devices. The Protocol Still Separates Data From Authority.○ Helium Decentralized Wireless Coverage. The Protocol That Uses It Did Not Follow.○ LoRaWAN Solved Long-Range IoT. The Messages Are Still Passive Payloads.○ Tailscale Made WireGuard Usable. The Coordination Server Still Holds the Authority.○ QUIC Modernized Transport. The Protocol Carries No Semantic Authority.○ MQTT Connected Billions of IoT Devices. The Broker Still Holds the Authority.○ CoAP Brought REST to Constrained Devices. The Protocol Carries No Governance Semantics.○ gRPC Made Service Communication Type-Safe. The Protocol Carries No Trust Semantics.● ZeroMQ Eliminated the Broker. Routing Authority Still Lives in Application Code.○ WireGuard Simplified VPN Tunnels. The Protocol Has No Semantic Routing Layer.○ Nebula Built Overlay Mesh Networks. The Certificate Authority Is Still Central.○ Calico Enforces Network Policy at the Kernel Level. Policy Authority Is Still External.○ Cilium Made eBPF the Network Data Plane. The Protocol Layer Carries No Governance.○ Weave Net Built a Virtual Network for Containers. The Protocol Carries No Semantic Authority.
Memory-Native Protocol overview →
AQ
deterministic
autonomy

Legal

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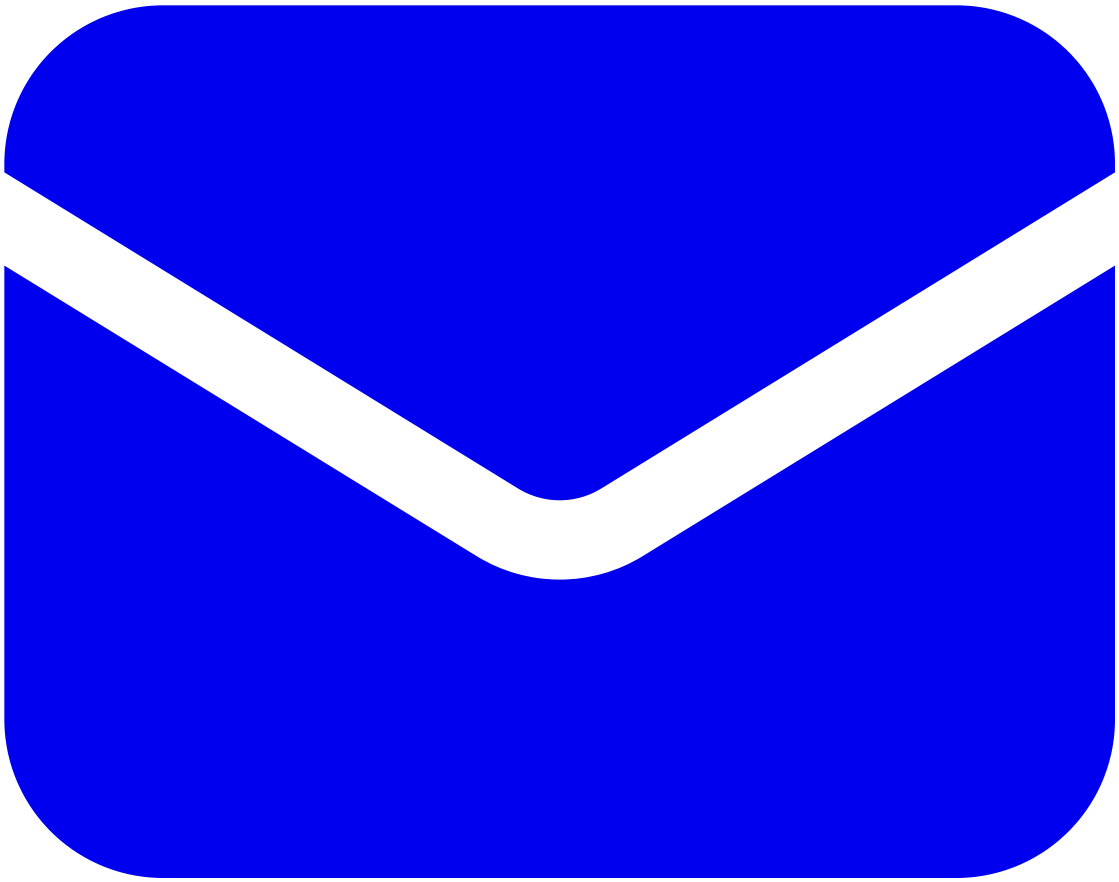

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