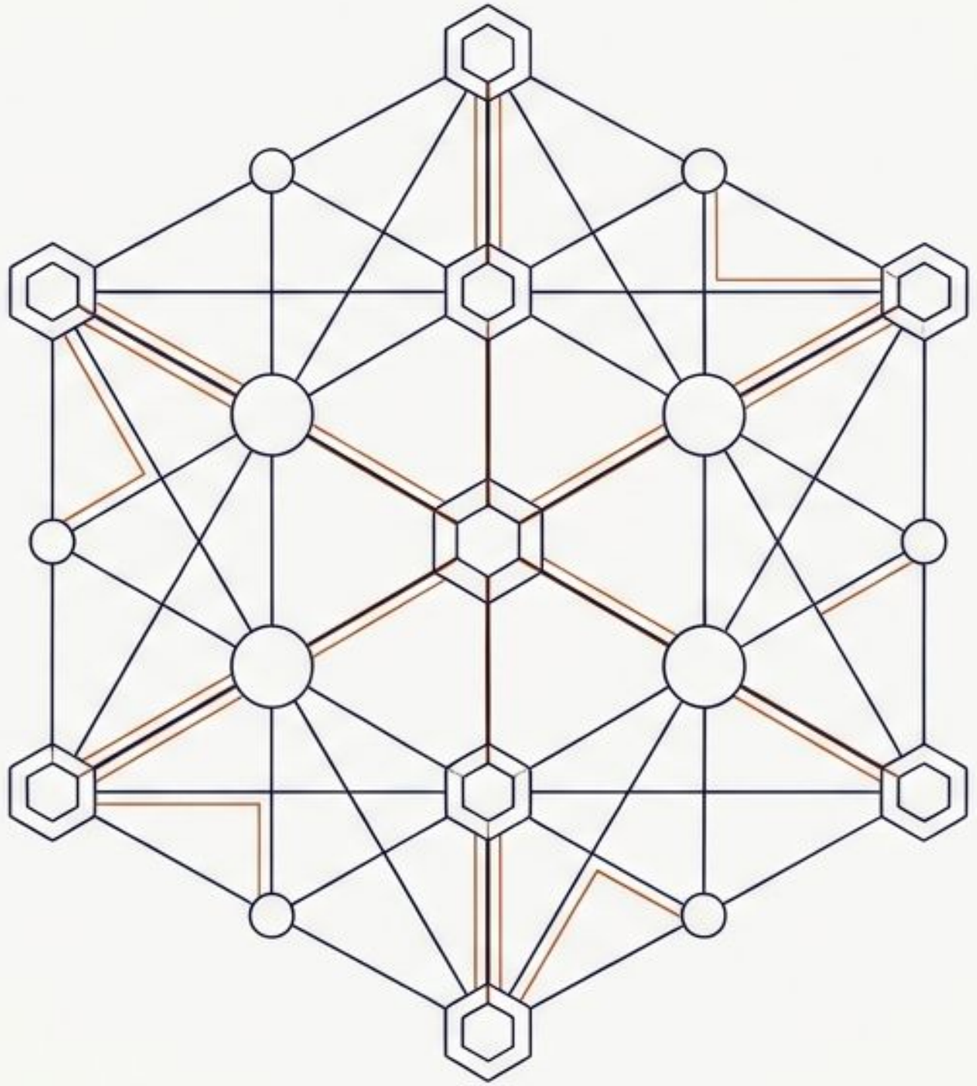
Operating and Measuring Agent Networks

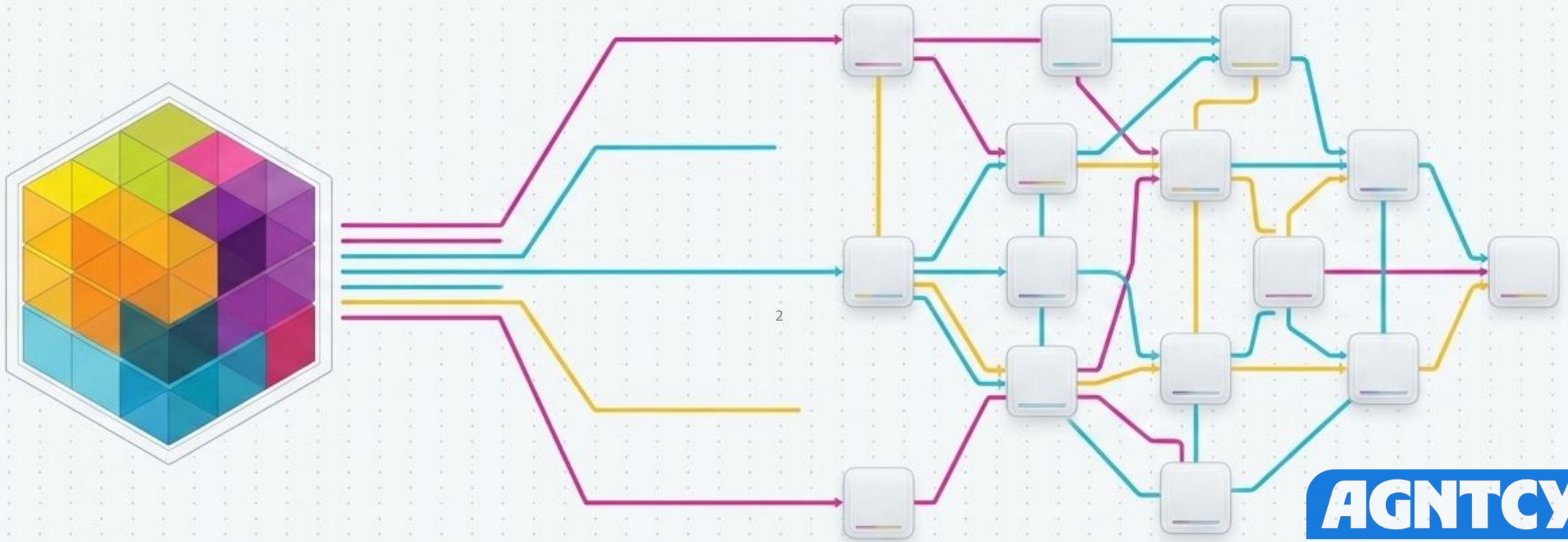
Early Operational Lessons from AGNTCY over libp2p.

Johanna Moran and Manu Sheel Gupta.



Building the Internet of Open Agents

A unified networking layer for the future of multi-agent systems,
powered by AGNTCY and libp2p.



A Foundation of Battle-Tested Trust

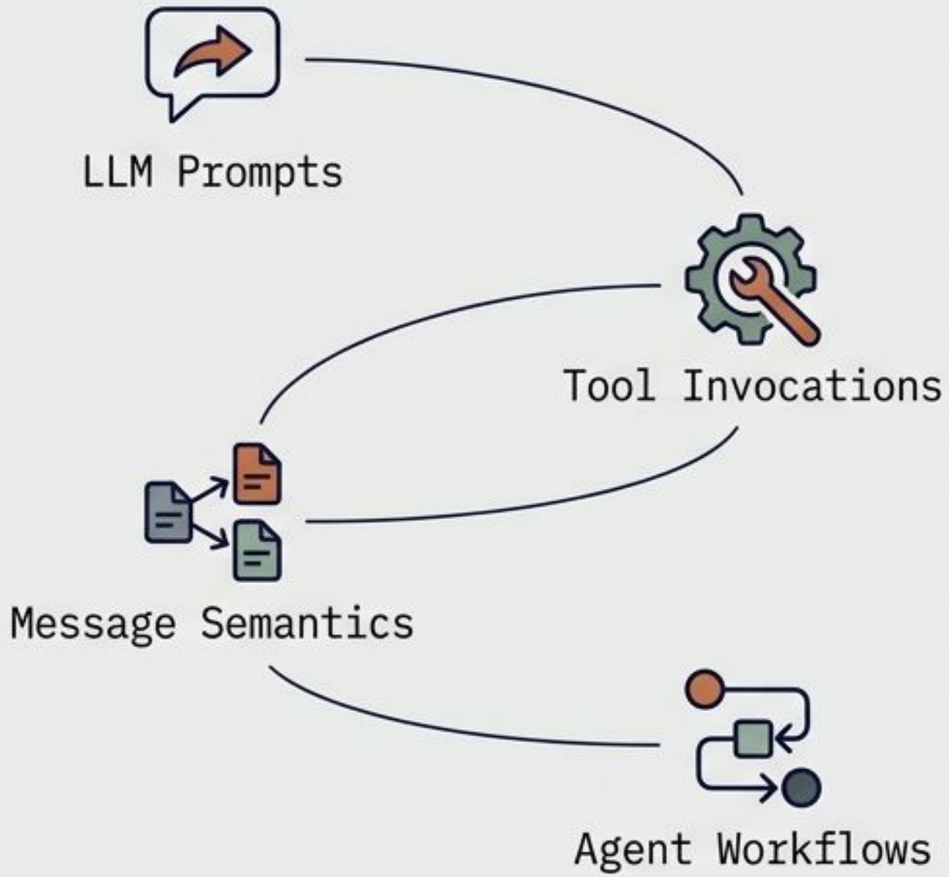
libp2p

$100B+	30+	10+	300+	11,400+
Secured	**Production Networks**	**Active Implementations**	**Monthly Contributors**	**Repositories**
Validated across high-stakes distributed environments.	Proven at global scale.	Language-agnostic baseline.	Sustained, elite engineering velocity.	Powering industry leaders.

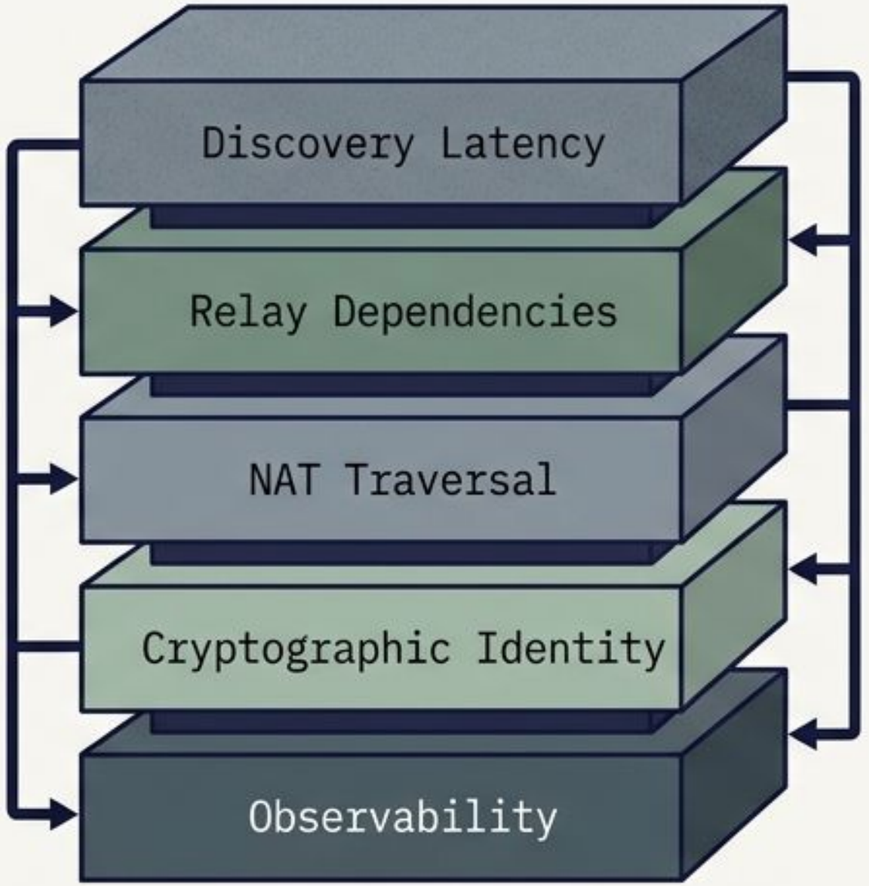
Agent development is hyper-focused on protocols and semantics, but agent operations require managing the underlying, often invisible communication network.

libp2p

What We Discuss (Application Layer)

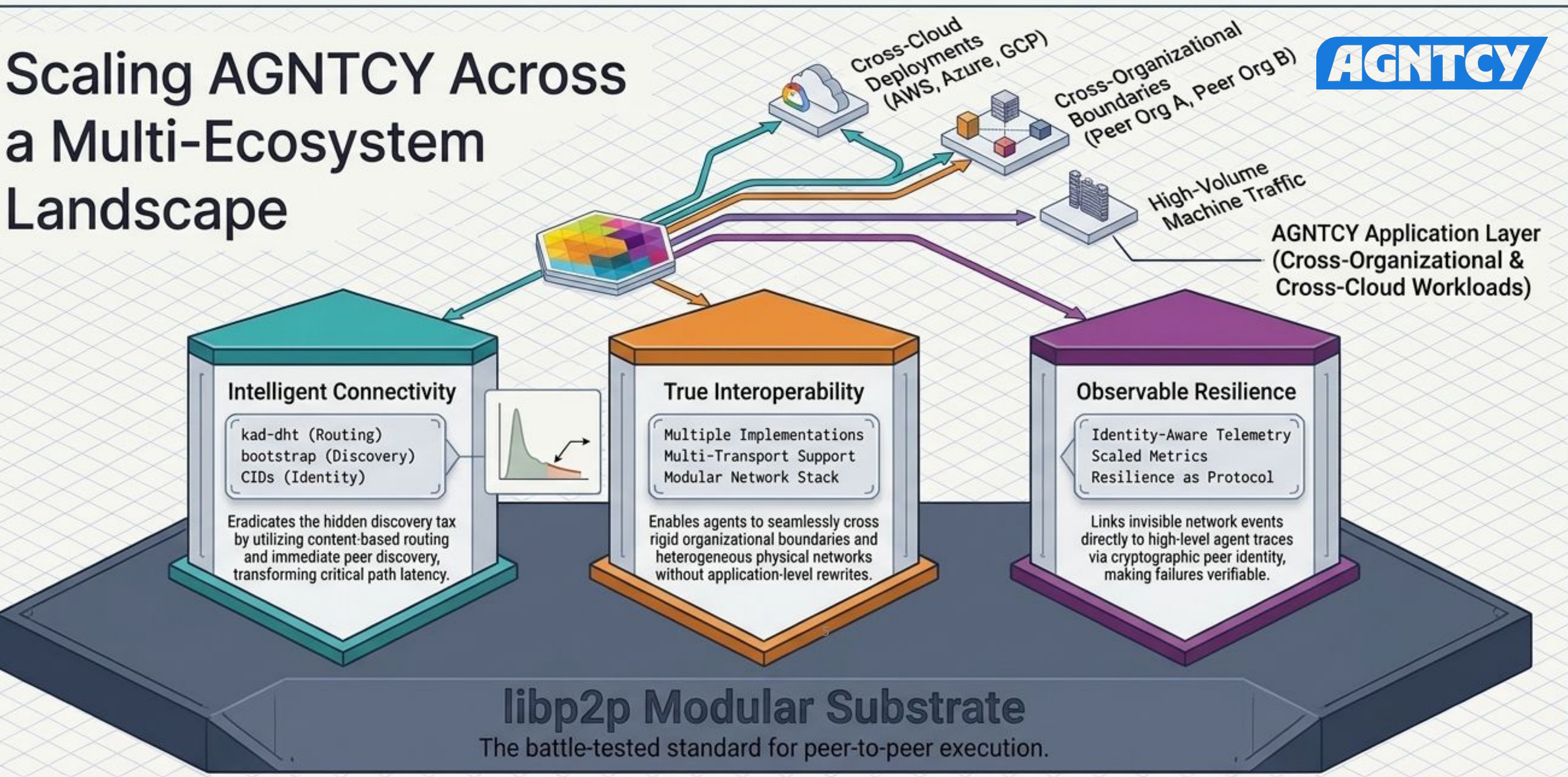


What We Operate (Infrastructure Layer)



4

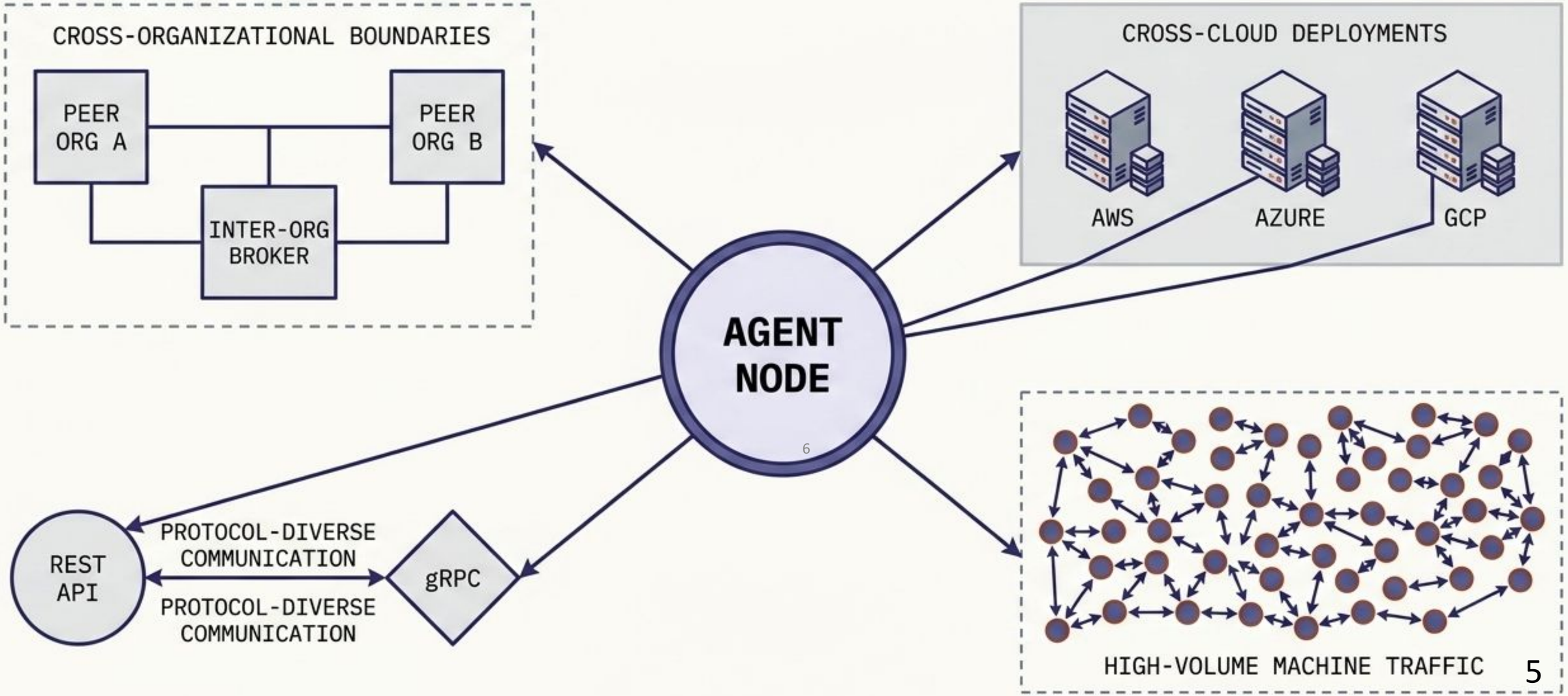
Scaling AGNTCY Across a Multi-Ecosystem Landscape



True interoperability and operational resilience are not application features—they are physical realities solved at the libp2p protocol layer.

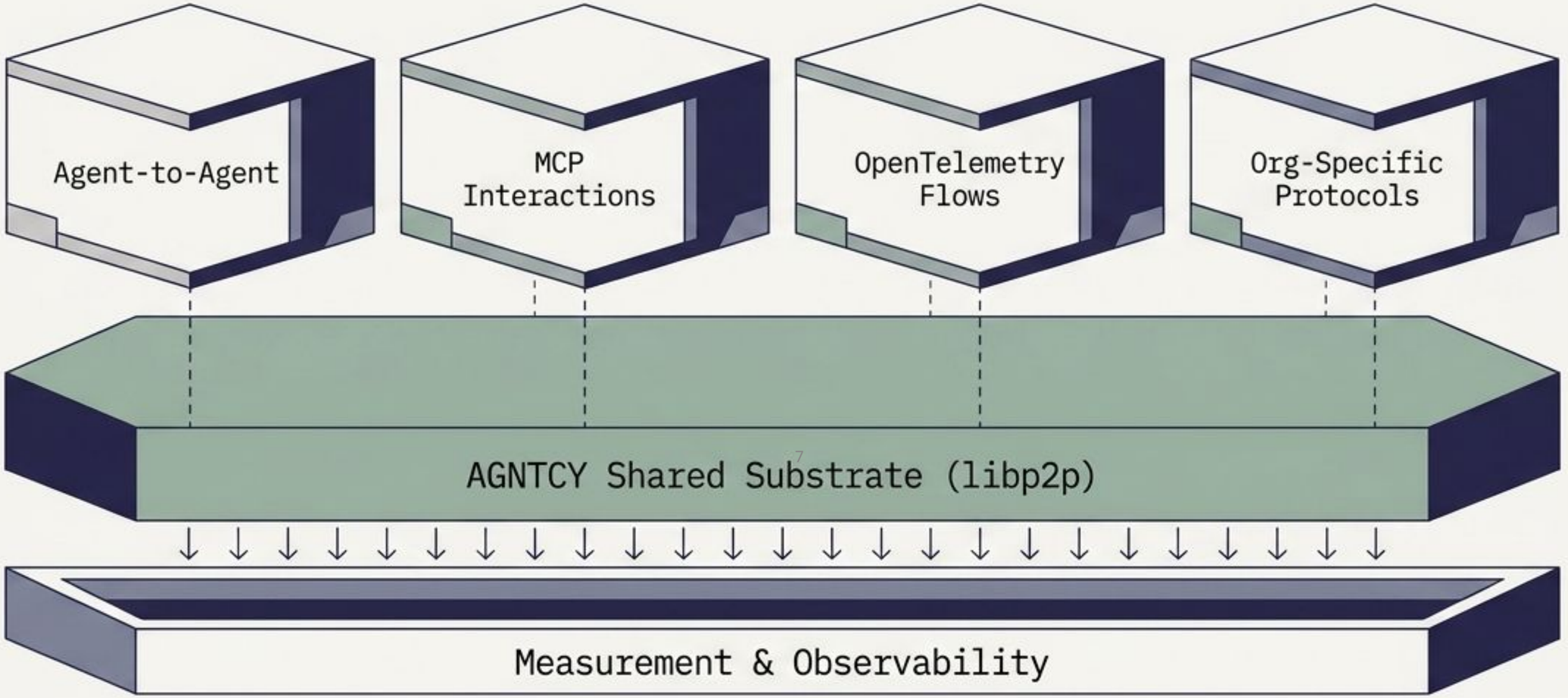
Agents Are Evolving Into Distributed Systems

Insight: An agent is no longer an isolated capability. It actively discovers peers, delegates work, retrieves context, and exchanges intermediate results.



AGNTCY as an Operational Environment

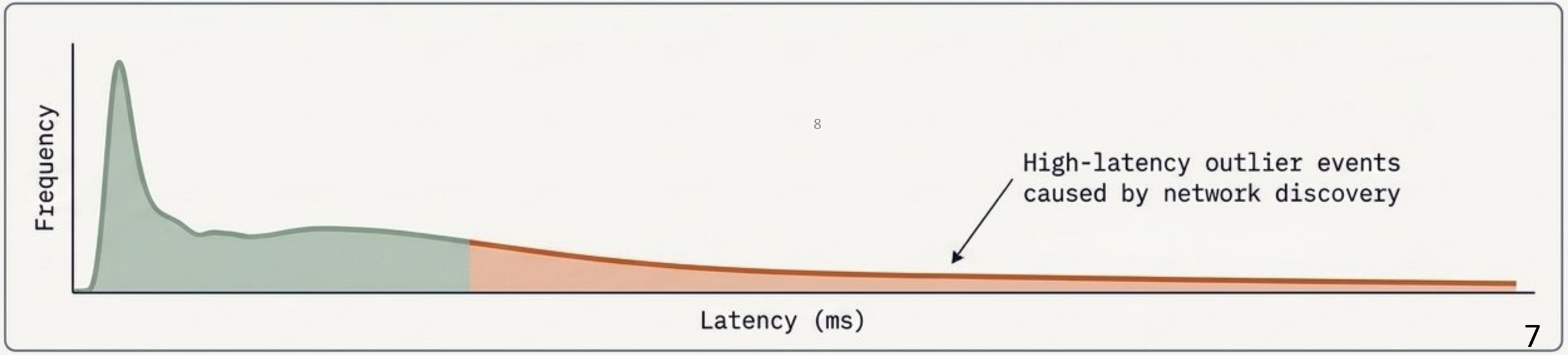
By running multiple heterogeneous agent workloads over a common networking substrate, we isolate and measure underlying network behavior independent of application protocols.



The Hidden Discovery Tax on the Critical Path

For long-running services, discovery is infrequent. For dynamic agent systems, agents discover peers immediately before interaction. Discovery latency IS workflow latency.





Connectivity Across Heterogeneous Networks

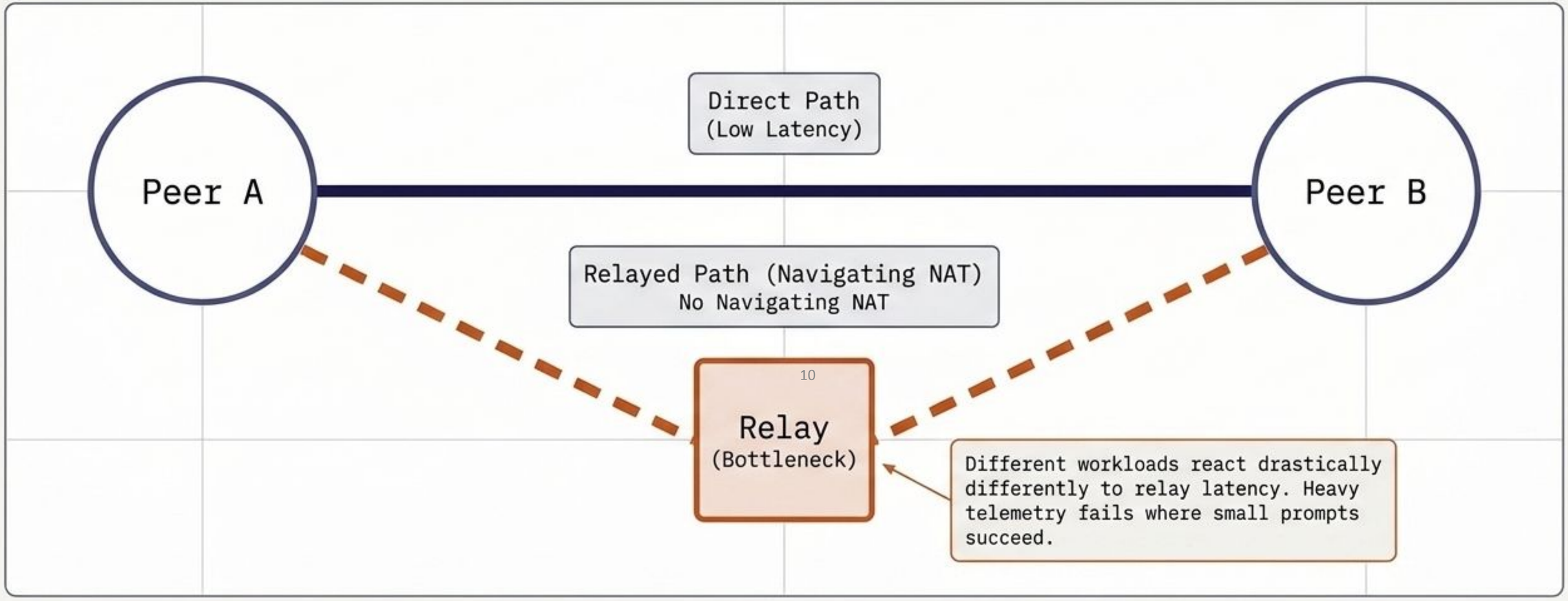
Aggregate network averages are misleading. An agent deployed in a public cloud data center operates under entirely different physical constraints than a peer behind a residential NAT.

Deployment Environment Diagnostic Matrix

Environment	Direct Connectivity	Relay Dependency	NAT Complexity	Latency Variance
Public Cloud				
Enterprise Network				
Kubernetes Environment				
Edge Deployment				
Residential Network				

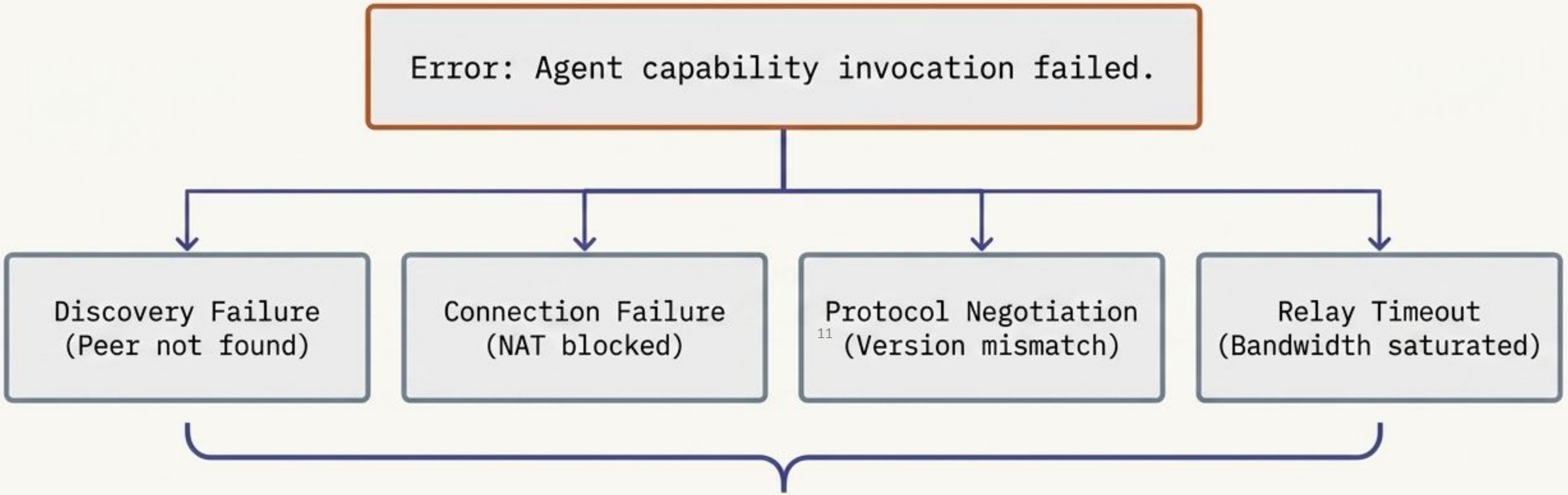
Direct Connectivity vs. Relay Dependency

Relay utilization is not automatically a failure; it is an operational characteristic of heterogeneous networks. However, relay dependency must be aggressively measured.



Application Failures Begin as Network Events

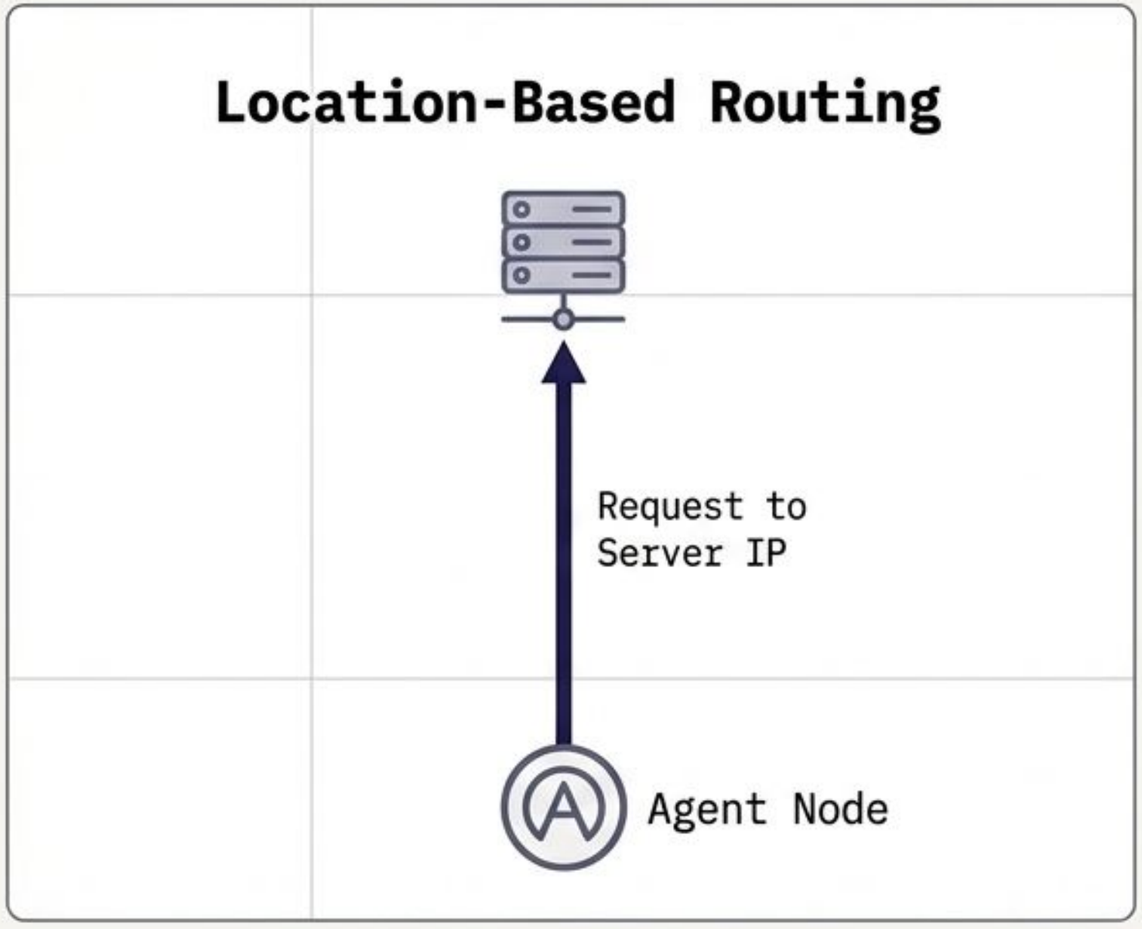
Without deep network layer visibility, developers waste time debugging agent prompts when the actual failure occurred during NAT traversal or relay fallback.

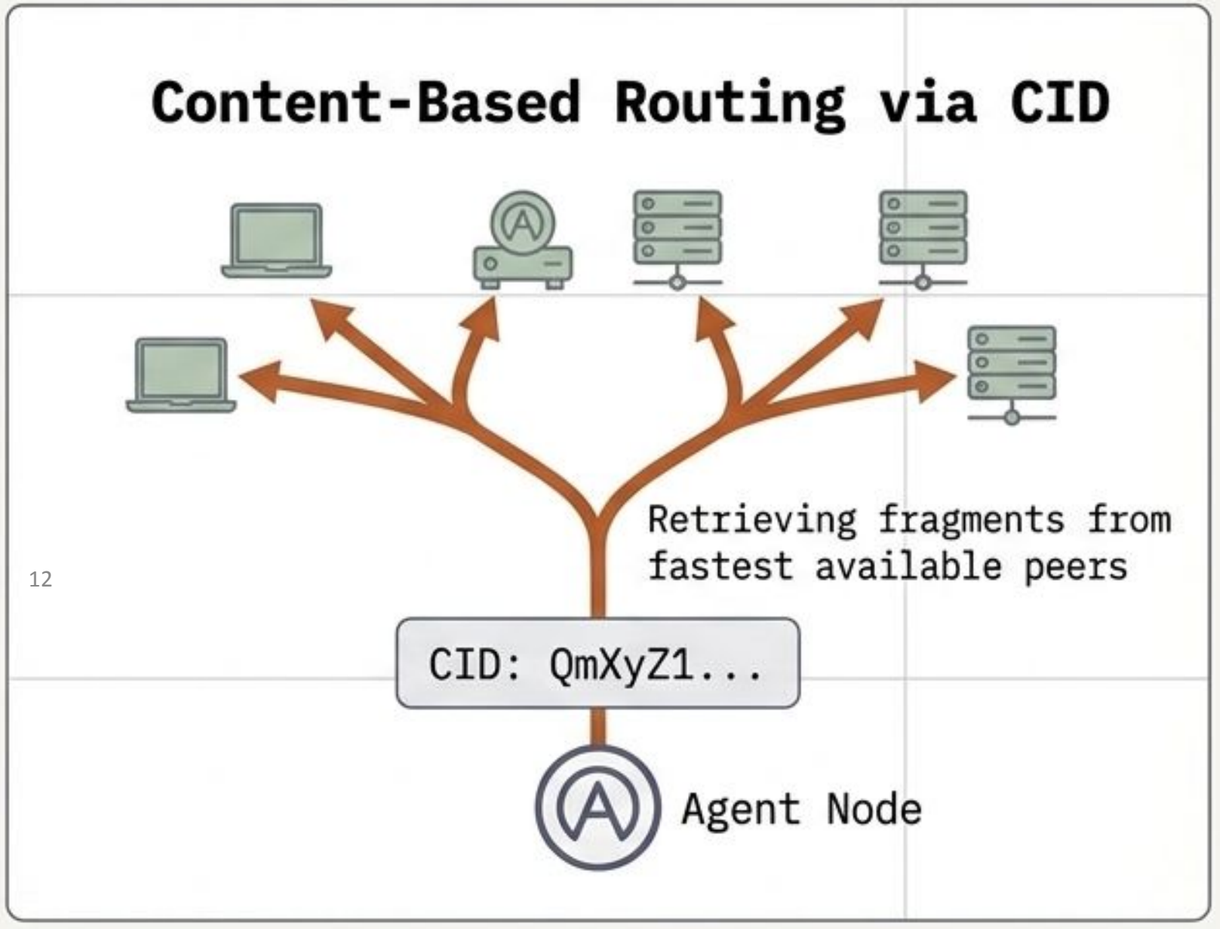


Root cause hidden at the infrastructure layer.

CIDs Enter the Agent Network

Insight: Agents are increasingly referencing shared context via CIDs. A CID identifies content independently of its physical location, fundamentally altering how data moves through the system.

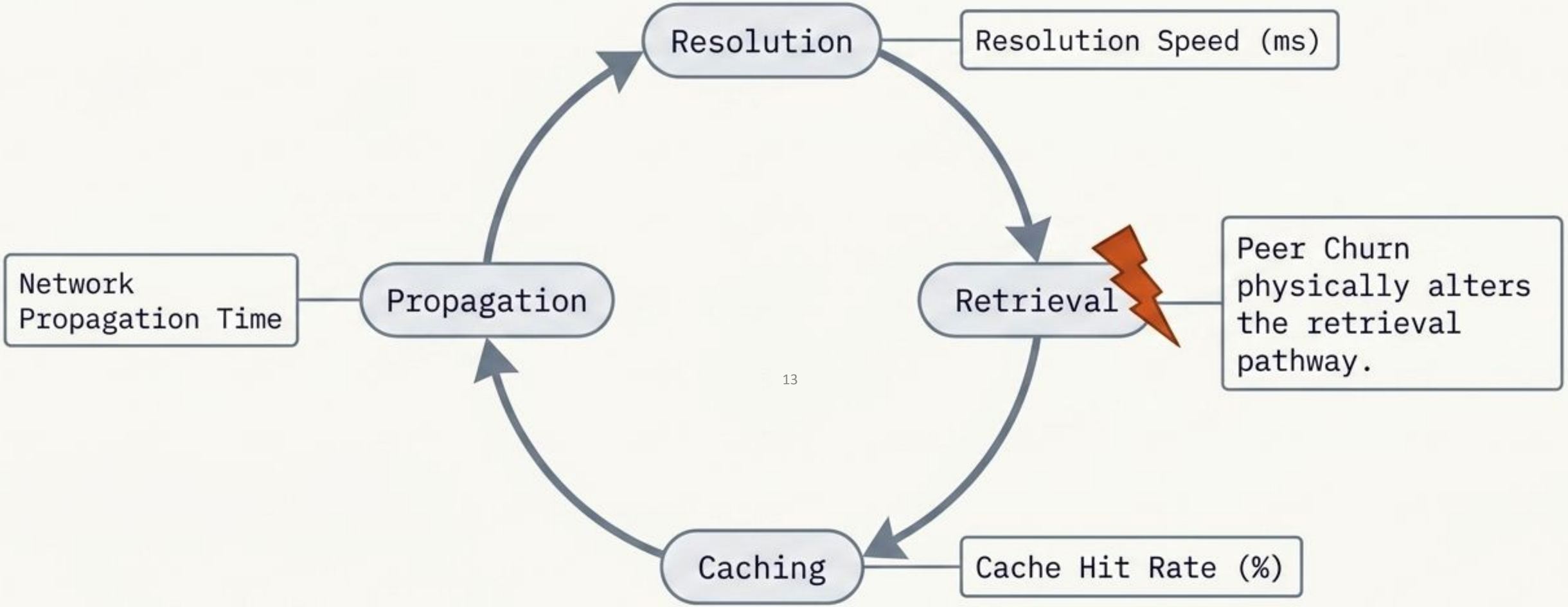




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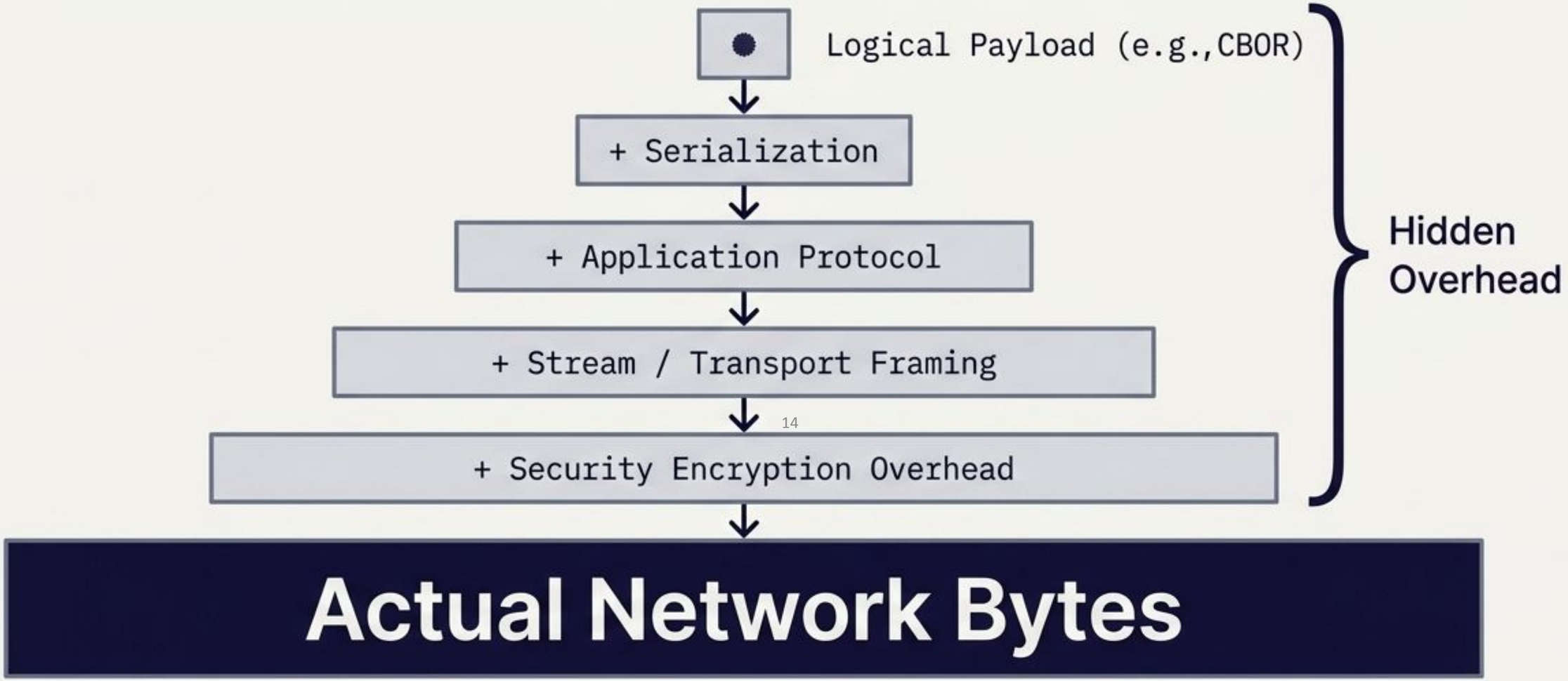
The Operational Physics of Content Addressing

Insight: CIDs introduce a new content-performance dimension. Measuring this requires tracking **resolution** speed, cache hit rates, network propagation, and peer **churn.**



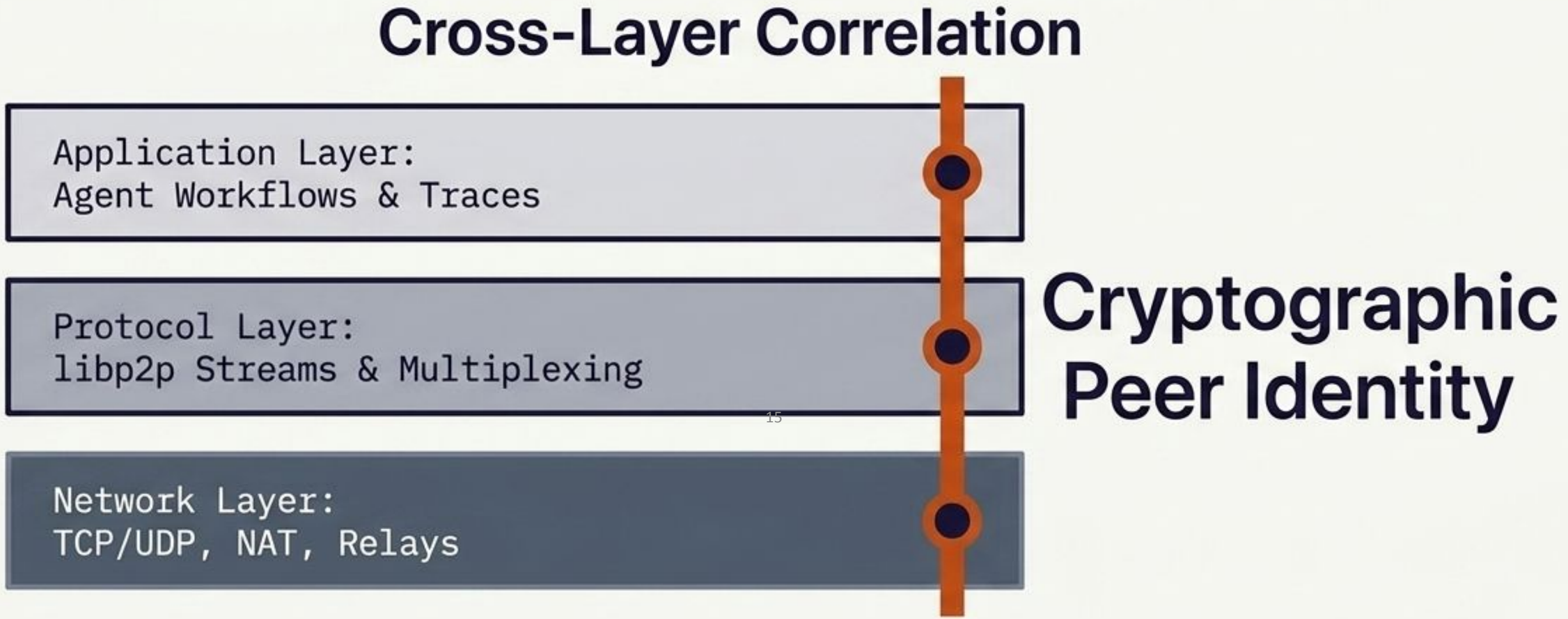
Structured Communication and Encoding Pressure

Insight: A compact binary representation (like CBOR) saves space, but logical payload size does not equal network transport size. Efficiency must be measured across the entire path.



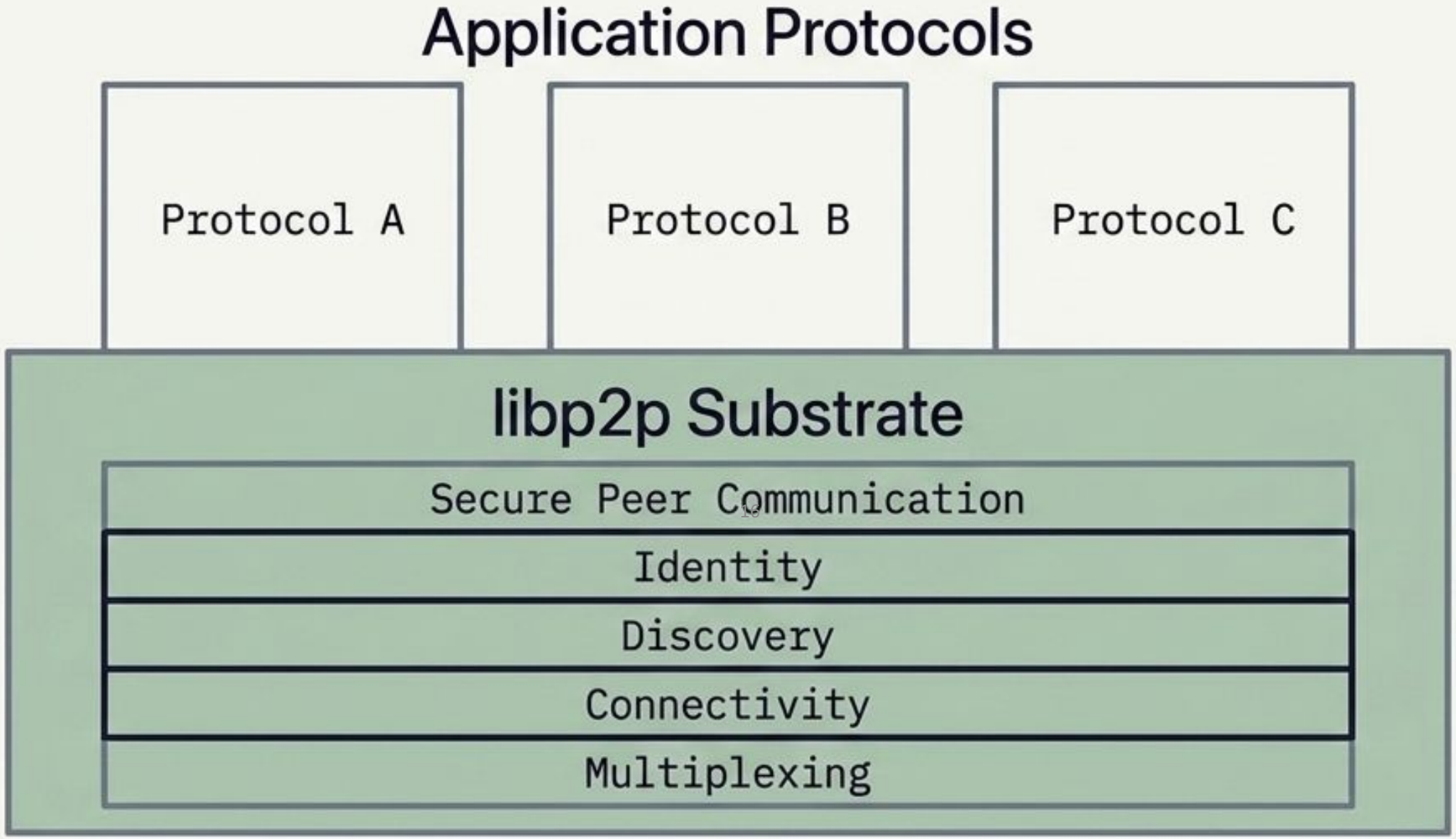
The Cross-Layer Imperative

Insight: Protocol interoperability does not equal operational comparability. True observability requires Identity-Aware Telemetry to link invisible network events to high-level agent traces.



libp2p as the Shared Substrate

Insight: libp2p provides common networking primitives, allowing multiple, independently evolving agent protocols to share a secure, measured foundation for connectivity and discovery.



What We Wish We Had Measured Earlier

Operational measurement is iterative, but if observability isn't designed early, it becomes impossible to reconstruct the systemic behaviors that actually caused failures.

The Invisible Failures Log

⚠	Which critical network events lacked workflow correlation?
⚠	Where did we fail to record peer identities during timeouts?
⚠	Which latency boundaries (e.g., discovery vs. transport) were obscured?



Toward Common Operational Measurements

Insight: The next critical question for the industry is not just how agents communicate, but how we measure, debug, and scale the physical network that makes that communication possible.



1

Common Event Semantics

Standardized definitions for failures across diverse networks.



2

Identity-Aware Telemetry

Tracing physical network paths directly to high-level agent actions.



3

Verifiable Operational Data

Cryptographically proving network performance and reliability.