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Knowledge-Based Agentic AI: The Backbone of Multi-Agent AIOps

Author: Ruth Brown

April 2026

In partnership with:

VITRIA

This Omdia White Paper was commissioned by Vitria.

Introduction

AIOps already delivers measurable operational efficiency, but more complex tasks often face context gaps. KPIs are well tracked, but the true customer impact remains unknown. To address this issue, operators must shift from network-centric operations to approaches that prioritize more than just metrics. But without robust knowledge management, contextual failures will persist.

To transform, operators must reconsider how they create, manage, and leverage data to enable higher levels of automation. Knowledge-based systems, which capture information and its relationships, will be foundational elements for advanced automation and greater accuracy in multi-agent systems. This paper examines the benefits, foundational elements, and advantages of knowledge-based systems for telco multi-agent systems.

AIOps underpinned by data and context

Traditional systems, built on data persistence, record what has happened. In contrast, knowledge-based systems use semantic context, treating dynamic relationships as primary data points. This approach transforms raw, siloed data into meaningful detail, bridging the context gaps that can cause AI hallucinations and undermine trust. Knowledge-based systems enable the following:

- **Decision accuracy:** Context-aware decisions account for impact and dependencies, increasing accuracy from “best guess” based on statistical or inferred data to “trusted decision.”
- **Dynamic resilience:** Operators need autonomous elasticity to resolve issues and adapt to configuration drift in real time. Connecting knowledge across all layers enables greater accuracy and fewer outages.
- **Reactive to proactive:** Linking network and service information and dependencies positions operators to transition from a break-and-fix model to proactive, self-healing autonomy.

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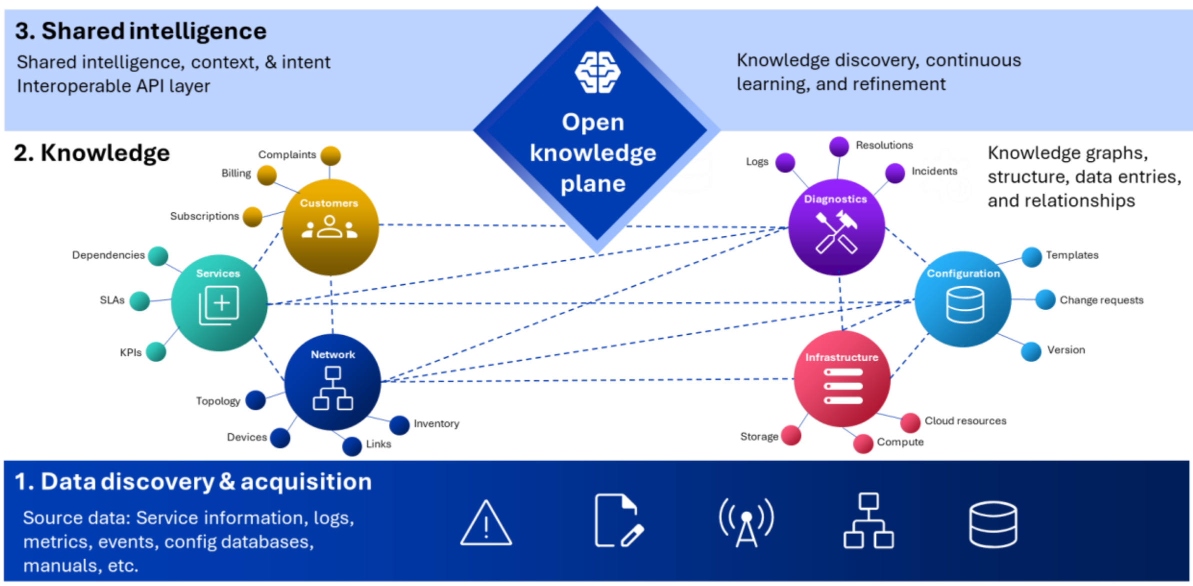
Open knowledge-based systems

Today's multi-layered, multi-vendor, and disaggregated networks challenge traditional data models. Knowledge-based systems (**Figure 1**) provide a consistent process for linking data and relationships, enabling multi-vendor systems to share a common network understanding and strengthening agent decision accuracy.

Figure 1: Knowledge-based system



Source: Omdia

Open knowledge plane systems ingest raw data, align knowledge, and continuously learn. The process can be mapped into three main steps:

- **Data discovery and acquisition:** Heterogeneous source data, including logs, metrics, event data, topology, configuration, etc. This raw, fragmented data—both structured (e.g., logs, topologies, SNMP) and unstructured (e.g., manuals, media)—lacks well-defined labels or relationships.

- **Knowledge:** Using standardized telecom ontologies (e.g., TM Forum, ITU-T), data elements are categorized and labeled. Knowledge graph nodes (e.g., customers, services, network, diagnostics, etc.) are interconnected by edges that define relationships (e.g., depends on, impacts, connected to, and rules). For example, a customer's broadband service uses config version 10.5 and connects to network entities (CPE, fiber drop, OLT, splitter, ONT, etc.). Learned and inferred knowledge (e.g., impact, anomalies, failure patterns) can also be modeled.

- **Shared intelligence:** An open knowledge plane allows multi-vendor agents and workflows to access the same data. Providing knowledge services based on constructed graphs, which continuously discover, learn, and refine knowledge, with user feedback or human validation, improves accuracy and optimizes performance. Standardized application programming interfaces (APIs) ensure accessibility.

Knowledge-based multi-agent systems

Decision-making is shifting from centralized automation, controlled by monolithic scripts, to a distributed model that relies on autonomous agents. Task-oriented AI agents, designed to execute specific, predefined actions within a workflow, utilize tools or APIs and process the responses. Within a multi-agent system or agentic AI operation, these workflows collaborate to address higher-level problems while acting independently.

Accurate data is vital for multi-agent collaboration, enabling task coordination, sharing of insights, and conflict prevention. A dynamic knowledge model that continuously learns and updates is vital for real-time data correlation, validation, and correction. **Table 1** compares legacy relational systems and knowledge-based systems for data management.

Table 1: AI-ready data: Legacy relational systems vs. knowledge-based systems

Data	Legacy relational/siloed systems	Knowledge-based
Structure	• Data attributes are stored in rigid tables. Connecting data requires a data “join.”	• Focus on the data and relationship (e.g., connected to, depends on).
Context	• Lack a wider context of dependencies, requiring manual correlation.	• Context-aware built-in via links.
AI decisions	• Statistical reasoning. AI looks for patterns in raw data without understanding the “why.”	• Semantic reasoning; AI understands the meaning and rules (e.g., “A is a type of B”).
Scalability	• High effort for schema changes. • Slower for complex querying (joins), especially as relationships increase.	• Easy to add/integrate new data types. • Faster querying time, as graphs store the relationship as a physical pointer.
Trust & explainability	• Traditional systems can act as a “black box” for AI and provide output without sharing the logical path.	• Shared intelligence, allowing multiple agents to coordinate actions in real time within defined boundaries, reduces errors.
Governance	• Data governance is managed per table. Inconsistencies between OSS and BSS are common.	• Unified semantic governance; agents can trace relationships and explain the logic behind the action.

Source: Omdia

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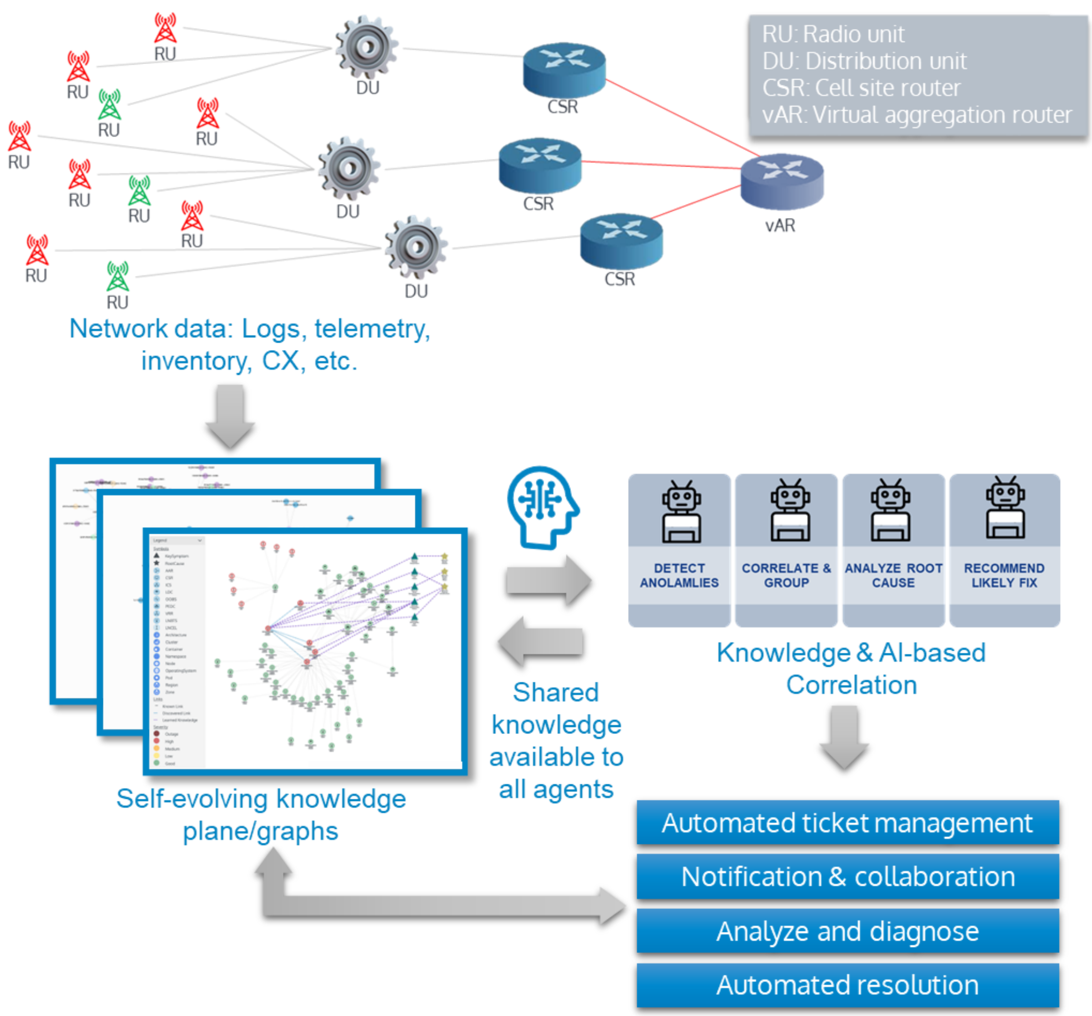
Knowledge-driven agentic AI use cases

Knowledge-driven automation shifts network insights from purely reporting data to understanding the impact on users, networks, and services. Combining deep cross-network, multi-layer, and domain knowledge enhances multiple use cases, including root cause analysis (RCA), improves network health insights, and maps cross-domain knowledge directly to network resource availability for faster provisioning timescales.

Figure 2 illustrates a knowledge-driven multi-agent system for addressing performance degradation. In traditional systems, complex fault diagnosis and remediation can be very time-consuming and need multiple cross-domain network engineers.

Figure 2: Self-evolving knowledge-driven agentic AI resolves degrading performance in a 5G network



Source: Vitria

Within a small geographic region, a number of radio units and cell towers start experiencing a rise in dropped calls and dropped packets. The knowledge-driven multi-agent system proactively resolves the issues as follows:

- A monitoring agent detects these anomalies and accesses the knowledge graph to link the user with their active service, the physical base station, and the transport network serving the RAN. The agent identifies the blast radius, pinpointing the specific subsection of the network with degraded quality.
- A diagnostic agent examines graph edges to evaluate cell congestion, transport network (e.g., link utilization, packet loss), and compute resources (e.g., Kubernetes clusters, pods, memory allocation). Neighboring network nodes and infrastructure are also checked.
- Using graph-augmented reasoning, the diagnostic agent predicts the issue: "What has changed in the last 5 minutes to the virtual aggregation router?" The graph identifies congestion at an aggregation router that can cause Kubernetes container memory issues. Before initiating changes, the agent checks policy constraints in the graph to ensure a safe fix for this root cause.
- After the updates, status nodes turn green and knowledge graphs are updated with the incident's fault diagnosis, RCA, and remediation insights to learn and refine future insights and remediation.

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Conclusions

To meet the real-time processing and accuracy demands of network automation and AI, data must be aggregated, correlated, and validated. Yet, operators continue to face challenges, including data silos, inconsistent formats, and underutilized resources.

Open knowledge-based systems represent a paradigm shift that connects multi-level and diverse datasets, creating a dynamic, real-time web of continuously learning intelligence. As operators increasingly prioritize proactive operations, knowledge will become a foundational capability for multi-agent automation. To support this, operators must focus on establishing standardized telecom ontologies and adopting interoperable, shared knowledge intelligence.

Ruth Brown, Principal Analyst, Mobile Networks | GTM Telecom Insights and Advisory
askananalyst@omdia.com