

WHITE PAPER

# Optimize Network Services

Advanced Service Assurance  
with Neo4j

Amy E. Hodler, Director, Graph Analytics and AI Programs



## White Paper

## TABLE OF CONTENTS

Imperative to Advance Service Assurance	1
Next-Generation Service Assurance Solutions	2
The Network is a Graph	2
Advantages of a Native-Graph Approach	3
Quickly Build Unique Service Assurance Solutions with Neo4j	4
What Companies Are Doing with Neo4j	5

## SERVICE ASSURANCE

Service assurance is the way organizations optimize various services offered over networks (from phone calls and email to video and applications) for a better end-user experience.

# Optimized Network Services

## Advanced Service Assurance

**Amy E. Hodler**, Director, Graph Analytics and AI Programs

### Imperative to Advance Service Assurance

Telecommunications and network operations have changed: network functions virtualization (NFV); software-defined networks (SDN); and significant automation – all intertwined with existing infrastructure. Service complexity is exploding.

Communications service providers (CSP) and enterprise IT operations must [go beyond reactive approaches with human intervention at each layer](#) if they want to keep pace with the snowball of new services, tighter cross-domain dependencies and virtualized networks. Coupled with increasing expectations and service levels, this is pushing organizations to advance their service assurance to include a holistic, accurate and real-time view of the network.

Consequently, CSP and IT teams are looking for scalable, nimble solutions and deep expertise to help them transform and thrive in a highly competitive marketplace. They require next-generation service assurance (NGSA) solutions that are far more inclusive, interactive and responsive in a way that easily reveals end-user impacts.

You can help your customers achieve an all-encompassing NGSA so they can maximize customer satisfaction and long-term profitability by moving them to solutions that provide a complete view of their network and the ability to make real-time decisions.

Across industries, Neo4j is used to [ensure high-performance network and IT operations](#) by companies such as Telenor, Cisco, CenturyLink and HP. Also, three of the top five global telecom equipment companies rely on Neo4j. We have proven expertise enabling network software and services providers to quickly integrate and embed Neo4j so you can get to market faster with unique solutions and achieve a sustainable competitive advantage.

#### SERVICE ASSURANCE PRACTICES

Fault and event management	Traffic engineering and diversity routing
Performance management	Configuration management
Single points of failure (SPOF) detection	Customer experience management
Quality of service (QoS) management	Service level agreement (SLA) monitoring
Network and service testing	Trouble ticket management

# Optimize Network Services with Neo4j

## Next-Generation Service Assurance Solutions

For decades service assurance practices have used fragmented views of the network and services that are typically manually curated and often inaccurate. Sticking to this status quo today will result in costly and unsatisfactory service quality.

Successful companies are embracing next-generation service assurance that leverages a comprehensive, real-time view of services and infrastructure with an eye on end-user experiences, new service creation and predictive modeling.

Communication service providers and enterprise IT operations are leveraging NGSA solutions with innovations in three areas: visibility, scalability and adaptability. However, delivering such advanced solutions is non-trivial with traditional methods that are often too rigid and hierarchical to keep up with today's highly complex and dynamic networks. As a result, many leading telecoms and IT teams are considering more network-native approaches that can accurately reflect their highly-interconnected services and handle their related but disparate data sources. These organizations know that NGSA solutions require a foundation that is dynamic, performant and richly illustrate relationships.

SERVICE ASSURANCE CHALLENGES	NGSA SOLUTION APPROACHES
<b>Degrading performance at scale</b> Response times increase non-linearly as data sets and distribution increases	<b>Real-Time Capabilities</b> Use data models that closely align with the network ontology for extremely fast and efficient queries
<b>Lack of visibility</b> No consolidated view of components, services traffic and customer data layers (or their dependencies)	<b>Eliminate Data Silos</b> Bring together multiple data sources and formats into a single view of all related data
<b>Difficulty correlating cross-domain information</b> Inability to prioritize faults based on end-user/revenue impact or perform advanced root cause analysis	<b>Focus on Relationships</b> Implement a database that is created to highlight the connections between data
<b>Infrastructure complexity and rigidity</b> Inhibited adoption of new capabilities and new data sources	<b>Built for Flexibility</b> Use simple, schema-free data modeling for easier integration of future data sources
<b>Incomplete or inaccurate impact analysis</b> Cumbersome to estimate effects and plan for purposed changes which can lead to unacceptable service impacts	<b>Support Predictive Modeling</b> Use comprehensive data models that can easily map interdependencies and support "what-if" analysis

## The Network is a Graph

Telecommunications and enterprise networks are hyper-connected ecosystems of components, services and behaviors. And yet, critical information is often siloed; from physical items (such as end devices, routers, servers and applications), to activities (like calls, media and data) and customer information (rights and subscriptions). A [graph data model](#) reveals cross-domain dependencies with a single unified view of the infrastructure and topology. Breaking down silos is at the heart of NGSA solutions.

## WHO RELIES ON SERVICE ASSURANCE?

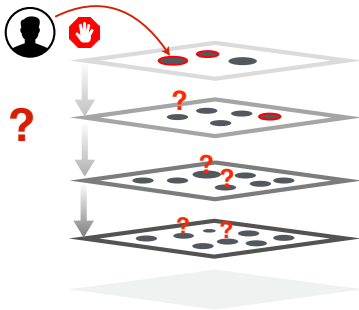
- Telecommunications Industry
- Communications Service Providers
- Network Service Providers

## NEO4J ADOPTION HIGHLIGHTS

- 2 of the 3 largest telecom companies
- 3 of the 5 largest telecom equipment vendors
- 2 of the 5 top U.S. multichannel video providers

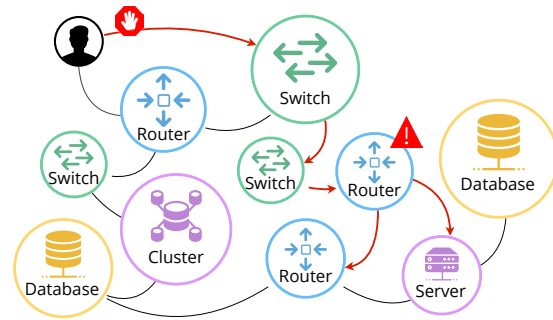
## Optimize Network Services with Neo4j

## Traditional Approach



- Time consuming to discover and map cascading dependencies
- Difficult to correlate cross domain impact
- Inconsistent to poor customer experience and penalties

## Graph Approach



- Impact is readily apparent across domains
- Correlations are intuitive
- Customer experience can be modeled

## KEY NEO4J FEATURES

### Key Benefits

Minutes-to-milliseconds performance, data integrity, model flexibility, developer productivity and hardware efficiency.

### Key Features

Native graph storage and query processing, ACID compliance, causal consistency, enterprise-grade security, clustering and drivers for popular languages and platforms.

## Deployment features

On-premise, cloud or containers.

## Advantages of a Native-Graph Approach

Neo4j, the world's most relied upon graph platform, naturally captures relationships between data and therefore easily models network and service complexity. This [emphasis on connections](#) is unlike relational databases (RDBMS) that require careful schema development and complex joins to map multiple levels of relationships, which are then inflexible when adding new data. Neo4j is specifically designed to store and process such multi-dimensional associations.

Furthermore, service assurance requires performance and predictability, such as monitoring real-time end-user experience for automated responses. Because of its [native graph storage](#), Neo4j thrives in querying such complexity at scale, easily outperforming RDBMS and other NoSQL data stores. To deal with this type of processing, RDMS approaches often resort to batch process or pre-computed schemes which cannot deliver the results needed for immediate results.

## For IT and Network Operators Using Neo4j

Network administrators, system administrators and application operators can readily recognize and understand the actual impact of maintenance activities and avoid surprising users downstream.

Rapidly diagnose failures by correlating and tracing user complaints back to the application and infrastructure or cloud service where they are hosted.

## For Telecom Operators Using Neo4j

Engineers and operators can create a singular view of operations across multiple networks at once, including cell towers, fiber lines, cable, customers and consumer subscribers or content providers.

Improve customer experience by minimizing the impact of system maintenance or outages, such as being able to re-route services during an unexpected interruption, or identifying and preemptively upgrading vulnerable servers based on their maintenance history and availability.

# Optimize Network Services with Neo4j

## Quickly Build Unique Service Assurance Solutions with Neo4j

Neo4j is a highly scalable, native graph platform that delivers real-time insights into data relationships. Incredibly fast writes of dynamic topology and lightning speed traversals means you can provide your customers the ability to make decisions at the pace of their business. Neo4j naturally stores, manages and analyzes data within the context of connections. With the flexibility provided by Neo4j and its schema-less model, you can continually improve your network solutions of all types by accommodating new data sources and formats — without a rewrite of your data model.

Built-in high availability features ensure network and subscriber data is always available to your mission-critical service assurance solution. Data is integrated into a Neo4j cluster and then modeled and queried based on its connections, creating a foundation for crafting advanced capabilities that power your solutions for next generation service assurance.

### Differentiate Your Solution

Augment and enhance existing applications to better leverage data relationships and integrate siloed information. Illustrate your ability to make sense of complex networks.

Capitalize on new market opportunities by creating products and services that uncover hidden patterns and insights.

Provide [performance at scale](#) with native-graph technology designed to query highly connected data and improve response times from minutes to milliseconds when compared to relational databases.

Offer the assurance of partnering with the graph industry market leader with over 15 years delivering hundreds of deployments and 24x7 production applications. Leverage enterprise capabilities that include:

- High performance caching
- Enterprise lock manager
- Clustering
- Hot back-ups

We work closely with customers and partners to help you quickly integrate and even extend Neo4j so you can create distinctive and sustainable solutions. You'll also lower your overall costs by embedding Neo4j advanced graph capabilities for less than the cost of implementing and maintaining traditional relational database solutions. And you can take advantage of our flexible pricing models to align your cost of goods to your business model.

We are 100% dedicated to graph-based solutions and helping our partner ecosystem thrive. We look forward to collaborating on innovative solutions. Please contact your account representative or reach out at [oempartners@neotechnology.com](mailto:oempartners@neotechnology.com) for more information on how we can work together.

### Go To Market Faster

Prototype faster with data models that reflect real-world business models as opposed to relational databases that require very timely programming and joining to relate data.

Complete rapid proof of concept projects by taking advantage of our proven methodologies to ensure you get the most out of integrating Neo4j. We provide expertise, training, and standard or customized workshops to ensure partner success.

Quickly execute when it is time to take concepts into production with the simplicity of storing all data elements and relationships within a native graph database as opposed to the complexity and overhead of implementing solutions layered on top of a relational store.

Quickly iterate and expand your solution with our highly flexible data model that enables you to easily add, remove or change data elements and sources more efficiently without changing the database schema, impacting performance or requiring downtime.

## REASONS NETWORK SOLUTIONS VENDORS CHOOSE NEO4J

### Native Graph Storage

- Lightning speed traversals for real-time impact computation

### Flexibility of a Schema-less Model

- Ease of ingestion/integration of data from multiple sources
- Ease of accommodating changes in a very dynamic environment

### Easy to Integrate

- Declarative query language (Cypher)
- Extensible platform
- Uniform Language Drivers

# Optimize Network Services with Neo4j

## WHY NEO4J?

### Native graph store

Unlike other technologies, Neo4j is designed from the ground up to store and retrieve data and its connections. Relationships are first-class entities in a native graph database – making them easier to query and analyze.

### Flexible schema

Neo4j's versatile property graph model makes it easier for organizations to evolve solutions as data types and sources change.

### Performance and scalability

Neo4j's native graph processing engine supports high-performance graph queries on large user datasets to enable real-time decision making.

### High availability

The built-in, high-availability features of Neo4j ensure your user data is always available to your mission-critical next generation service assurance solution.

## What Companies Are Doing with Neo4j



*Zenoss monitors 1.2 million devices and 17 billion data points a day and more than 60 million data points every 5 minutes.*

Zenoss is a leader in hybrid IT monitoring and analytics software, providing complete visibility for cloud, virtual and physical IT environments. Neo4j is used by the Zenoss Service Impact solution which [maintains the dependencies between IT services in real-time](#), enabling more precise root cause analysis and minimizing downtime.



*"We tried doing our work with RDBMS, but found that the queries were just going too slowly."*

— Peter Walker, Cisco

Since the company's inception, Cisco engineers have been leaders in the development of Internet Protocol (IP)-based networking technologies and today sells hardware, software, networking, and communications technology services. [Cisco uses Neo4j](#) for content management, master data management and as a solution and OEM partner.



*"We use Neo4j to find security issues in our information system, and to give us a fresh perspective on IT... and have a bird's-eye view of all its components."*

— Nicolas Rouyer, Orange

Orange is one of the world's leading telecommunications operators with over 269 million customers including 208 million mobile customers and 19 million fixed broadband customers. Orange is also a [leading provider of global IT and telecommunication services](#) to multinational companies.



*"Neo4j's high performance engine provides flexibility of data representation along with features that go beyond traditional relational databases."*

— Sebastian Verheughe, Telenor

Telenor Norway is the leading supplier of the country's telecommunications and data services. Using Neo4j, they [provide businesses and residential customers with a self-service](#) portal that brings together information about corporate structures, subscription information, price plan and owner/payer/user data, billing accounts and any discount agreements.

Neo4j is the leader in graph database technology. As the world's most widely deployed graph database, we help global brands – including [Comcast](#), [NASA](#), [UBS](#), and [Volvo Cars](#) – to reveal and predict how people, processes and systems are interrelated.

Using this relationships-first approach, applications built with Neo4j tackle connected data challenges such as [analytics and artificial intelligence](#), [fraud detection](#), [real-time recommendations](#), and [knowledge graphs](#). Find out more at [neo4j.com](#).

Questions about Neo4j?

Contact us around the globe:  
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[neo4j.com/contact-us](https://neo4j.com/contact-us)