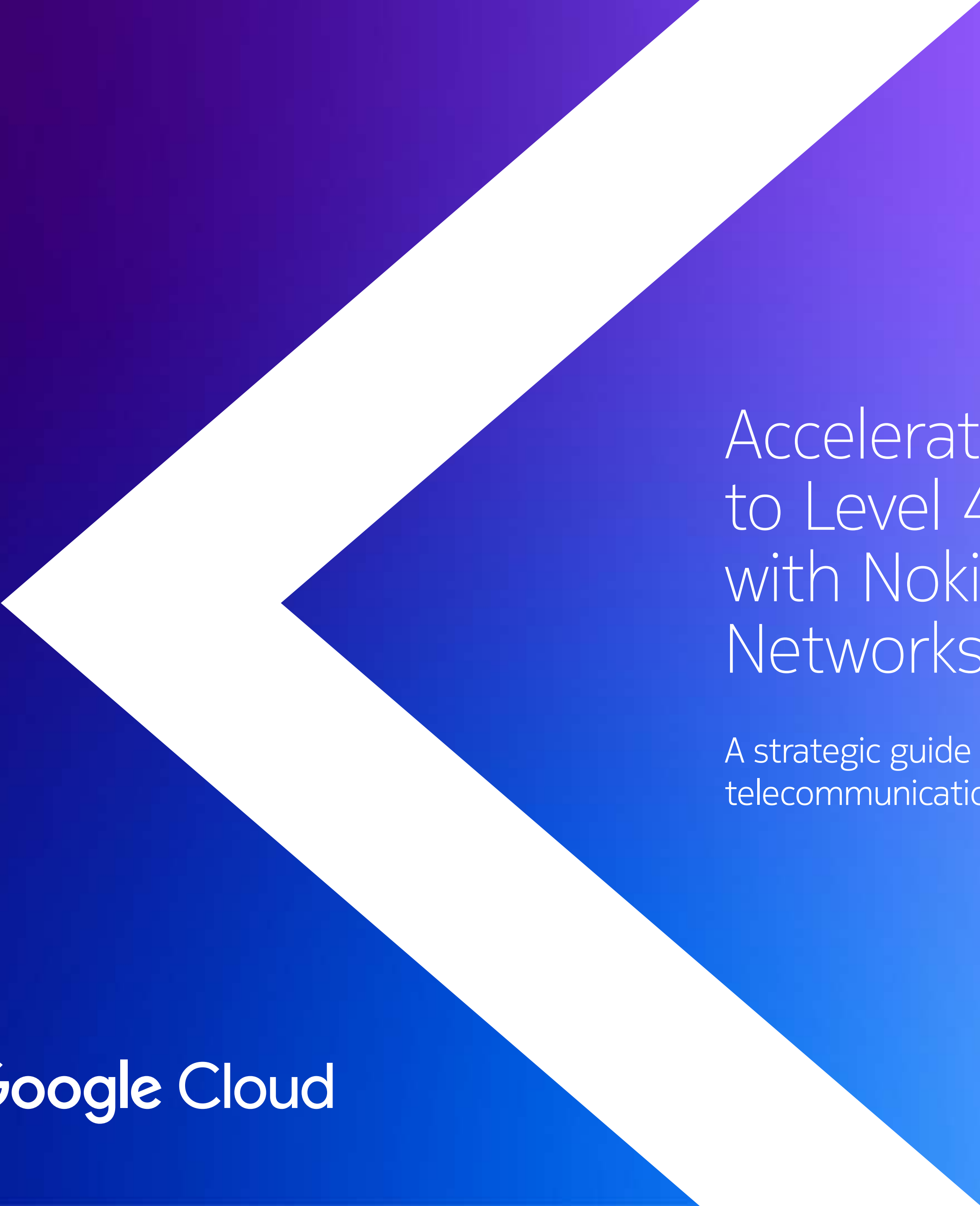




Accelerating the path to Level 4+ autonomy with Nokia Autonomous Networks and Google Cloud

A strategic guide to achieving Level 4+ autonomy for
telecommunication providers

NOKIA

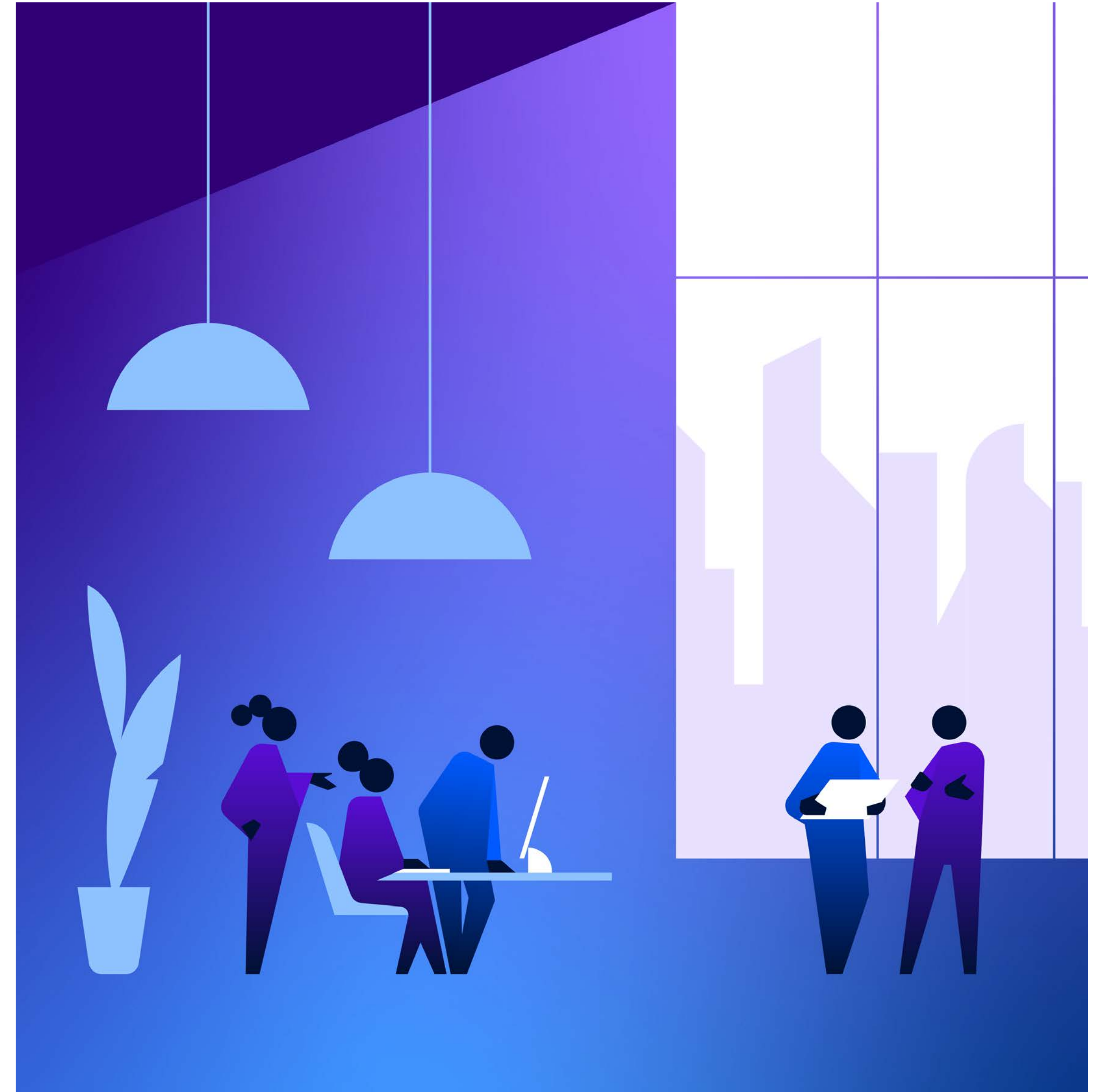
Google Cloud

Executive summary

The telecommunications industry stands at a pivotal juncture. Operational (OpEx) and capital expenditures (CapEx) are rising sharply alongside network complexity, while revenues remain stagnant. With immense pressure to monetize 5G investments, the reliance on manual, reactive processes is no longer sustainable. The time to shift to AI-driven, machine-speed autonomy is now. This eBook demonstrates how the Nokia and Google Cloud strategic partnership delivers a proven, flexible path to Level 4+ autonomy. Merging Nokia's expertise in telecom and automation with Google Cloud's AI and hyperscale capabilities empowers telecommunication providers to modernize operations, reduce costs, and accelerate innovation.

Inside, you will discover:

- ✓ The urgent business drivers for autonomy and why action is critical now.
- ✓ How to overcome foundational data challenges and establish a unified architecture.
- ✓ The Nokia Autonomous Networks suite on Google Cloud – enabling Level 4+ capabilities through a cognitive, modular, multi-cloud platform.
- ✓ The strategic and operational impact demonstrated by leading providers.
- ✓ Practical steps for accelerating your autonomy journey.



Chapter 1

The business case for network autonomy

Modern networks are growing exponentially more complex. The proliferation of 5G with more services to be managed, shorter SW lifecycles and continuous optimizations, the rise of edge computing, and the sheer volume of data create an operational environment that is difficult to manage with traditional methods. This increased complexity and network dynamicity introduces significant business risks to the overall service quality delivered to end customers. In parallel, there's a growing trend of headcount reductions in telecommunication providers to compensate for the reduction of business margins, making the operational challenge even bigger. The core issue is that human-

led operations cannot scale to meet the demands of a digital-first world.

The financial case for network autonomy is clear. Research shows that autonomous networks (AN) can deliver an average telecom operator a yearly benefit of \$800 million, broken down into \$300 million in CapEx savings, \$350 million in OpEx savings, and \$144 million in revenue uplift from faster, more profitable services. Crucially, achieving Level 4+ autonomy, where the network is capable of self-management and predictive optimization, unlocks 30% of this total value¹, making the pursuit of higher autonomy levels a critical business objective.

Telecom operators aim to achieve AN Level 4 by 2026

23%

Telecom operators aim to achieve AN Level 4 by 2030²

85%

1. STL Partners & Nokia. (2024). Achieving next-level network autonomy: A research report on automation, intelligence, and autonomous networks (September 2024). Nokia. <https://www.nokia.com/asset/214230/>

2. Webb, R. (2025, June). A regional guide to autonomous networks. TM Forum. <https://inform.tmforum.org>

Why the time to act is now

Market forces have converged to make network autonomy an immediate priority. Waiting is no longer an option for providers who aim to lead the market.



The maturation of AI

Artificial intelligence (AI), particularly generative and agentic AI, has reached a level of maturity where it can be reliably implemented in mission-critical network operations.



Margin pressure

In a highly competitive market with intense pressure on margins, reducing operational and maintenance (O&M) costs is a top-rated drive for AN adoption.



Unmanageable complexity

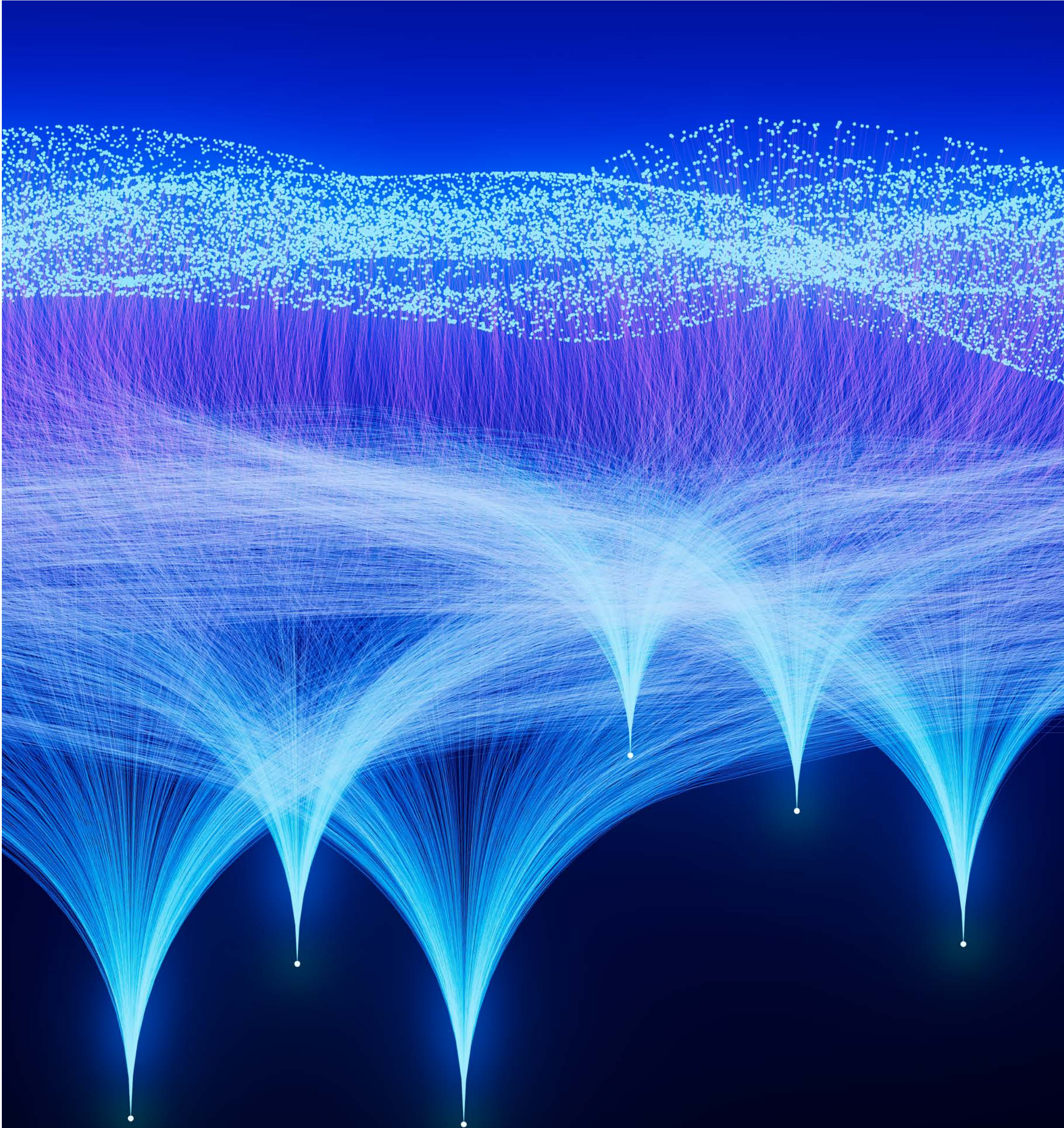
Networks are already buckling under the weight of surging traffic, diverse service demands, and operational complexity. With 5G traffic projected to grow by 76% by 2029 and new services like XR and IoT adding further strain, current manual and semi-automated approaches are no longer viable.



Rising expectations

55% of customers say they would cancel their service after a single bad experience. Autonomous networks empower telecommunication providers to proactively address issues before they impact customers, ensuring consistent service quality and reducing churn.

Providers that delay this transition risk being outmaneuvered by more agile competitors, burdened by unsustainable operational costs, and unable to capitalize on the new service opportunities that 5G, 6G, and beyond will offer. The following chapters will provide a strategic guide for navigating this transition, starting with the foundational element that makes it all possible: data.



Chapter 2

Overcoming data fragmentation: the foundation for autonomy

The path to network autonomy is built on high-quality, accessible data. However, many telecommunication providers are hindered by data fragmentation – the accumulation of poor-quality, unstandardized, and siloed data. It is the byproduct of rapid network expansion, mergers, and the layering of new technologies over legacy infrastructure without a unified data strategy.

Valuable operational data is trapped in fragmented silos across the Radio Access Network (RAN), core, and transport domains. This fragmentation forces data scientists and engineers to spend an estimated 80% of their time simply preparing data, leaving only 20% for actual value creation.

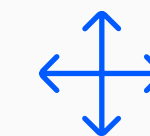
The impact of data fragmentation is severe:

- ☑ **Stifled AI innovation**
Models trained on incomplete data produce unreliable insights, making automated decision-making risky and not trustable.
- ☑ **Operational blind spots**
Without a unified view, correlations across domains, networks, and subscriber dimensions become impossible, hindering the automation of root cause analysis.
- ☑ **Increased costs**
Manual effort to bridge data silos drives up operational expenses.

The foundation for autonomy: unified data architecture

To move from manual operations to scalable autonomy, providers must restructure how data is managed. The solution lies in a modern data architecture based on data mesh principles. Unlike traditional large data lakes, unified data architecture decentralizes data ownership, treating data as a product curated by domain experts but accessible universally.

This approach ensures that data is:



Accessible

Democratized access across the organization, breaking down rigid silos.



High-quality

Curated and validated at the source, ensuring reliability for AI consumption.



Real-time

Available for immediate processing, a prerequisite for dynamic, closed-loop automation.



The critical role of data observability

A modern data architecture must be supported by robust data observability and governance. Just as network observability monitors infrastructure health, data observability monitors the health of the data itself – the continuous monitoring of data quality, detecting anomalies, schema changes, completeness or freshness issues in real-time.

When combined with a multi-domain, multi-data type and strong correlation capabilities, this creates a Unified Data Foundation – a complete, correlated view of the network, service, and subscriber. It is this 360-degree observability that enables an AI agent to confidently detect an anomaly, diagnose the root cause across domains, understand the subscriber impact, and execute a remediation action without human intervention, all within minutes or seconds.

This foundation is the first and most critical step in de-risking the journey to autonomy. In the next chapter, we will explore how the Nokia Autonomous Networks suite leverages this clean data foundation to drive intelligent action.

Chapter 3

The solution: Nokia Autonomous Networks suite

The Nokia Autonomous Networks suite is the engine that drives a network toward full autonomy. It transforms operations with cutting-edge AI, telco-specific knowledge graphs, and intelligent automation, empowering telecommunication providers to create self-managing networks.

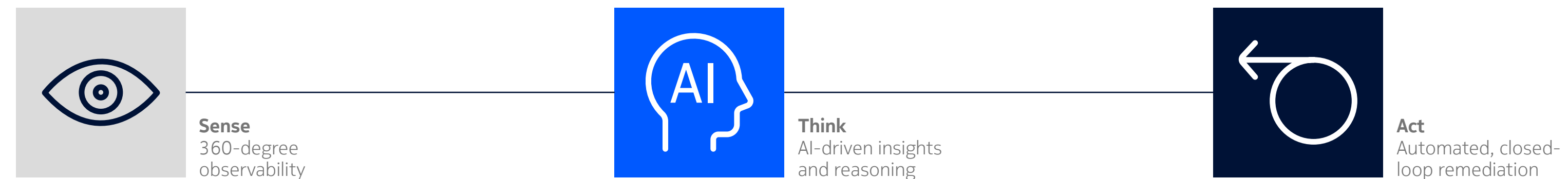
With a fully modular architecture, it is designed for agility and flexibility. Built to be multi-cloud, it runs seamlessly on SaaS, on-premises, hybrid, and public cloud environments, including being powerfully enhanced by Google Cloud.

The suite is composed of two primary layers:

- ✓ **The autonomous networks fabric**
A common intelligence layer that connects and powers applications with trusted data, secure automation, and AI at scale.
- ✓ **The autonomous networks apps** A suite of applications that leverage the Fabric to manage and optimize specific business and operational intents, from service assurance to energy efficiency.

The “sense, think, act” framework in action

At the core of the Nokia Autonomous Networks suite is the cognitive “Sense, Think, Act” framework – a continuous, closed-loop cycle that drives the network toward intelligent self-management.



Sense: 360-degree observability

A network cannot act on what it cannot see. The “Sense” phase focuses on creating unified data collection and 360-degree observability across all network domains, vendors, and technologies. This provides a single source of truth, correlating data from the network, service, devices and subscriber dimensions to create a complete, contextualized view of network health and performance.

Think: AI-driven insights and reasoning

This is where raw data is transformed into actionable intelligence. The “Think” phase leverages AI and machine learning to spot anomalies, predict bottlenecks, and diagnose root causes. The strategic partnership with Google Cloud significantly enhances this capability. By integrating Google Cloud’s powerful generative AI tools like Vertex AI, the suite moves beyond predictive analytics to machine reasoning. This allows the system to understand complex scenarios, assess the impact of potential actions, and formulate optimal strategies for remediation.

Act: automated, closed-loop remediation

The final phase, “Act,” translates insights into autonomous action. The suite enables automated, closed-loop remediation and zero-touch AI agents that execute workflows with minimal or no human intervention. These agents can manage network resources, optimize performance, or resolve faults in real-time based on business or operational intents.

Modular applications driving business value

The modular applications within the suite allow providers to target specific pain points and scale their autonomy journey. Key examples include:



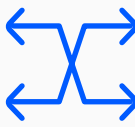
Assurance center

Monitors and assures service quality for offerings like 5G slicing, VoLTE, and over-the-top (OTT) services, ensuring service-level agreements (SLAs) are met.



Cyber-security dome

Delivers advanced, AI-driven threat detection and automated response, providing comprehensive protection across multi-vendor, multi-domain environments while maintaining network performance and service continuity.



Orchestration center

Enables cross-domain, end-to-end service orchestration and lifecycle management, streamlining new service rollouts and dynamic resource allocation for improved agility and operational efficiency.



Chapter 4

Why Nokia and Google Cloud

The journey to Level 4+ autonomy demands a partnership that combines deep industry knowledge with world-class AI technology. By fusing Nokia's global telco expertise, market-leading network operations applications, autonomy-driven enablers and use cases, and operational scale with Google Cloud's industry-leading AI, security, and data infrastructure, our strategic partnership delivers tangible business value.

- ✓ **Faster time-to-value**

Deploy autonomous use cases in weeks, not months.

- ✓ **Significant OpEx reduction**

Drives down costs by resolving incidents without human intervention and optimizing resource usage.

- ✓ **Monetization of 5G/6G investments**

Offer dynamic, intent-based services (such as specialized network slices) that enterprise customers demand.

- ✓ **Accelerated journey to Level 4+ autonomy**

Safely move from “human-led” to “machine-led and human-supervised” operations.



Unmatched synergy

Nokia and Google Cloud combine their strengths to deliver a flexible, future-ready solution that empowers providers to achieve unmatched operational efficiency an autonomy at speed.

✔ Deep AI integration and predictive power

By combining Nokia's domain knowledge with Google Cloud's Graph Machine Learning (Graph ML), we create a high-fidelity Network Digital Twin. This twin maps the complex, multi-dimensional relationships between network elements, services, and subscribers, providing predictive and prescriptive analytics essential for high-level autonomy.

✔ A unified data fabric for unmatched insight

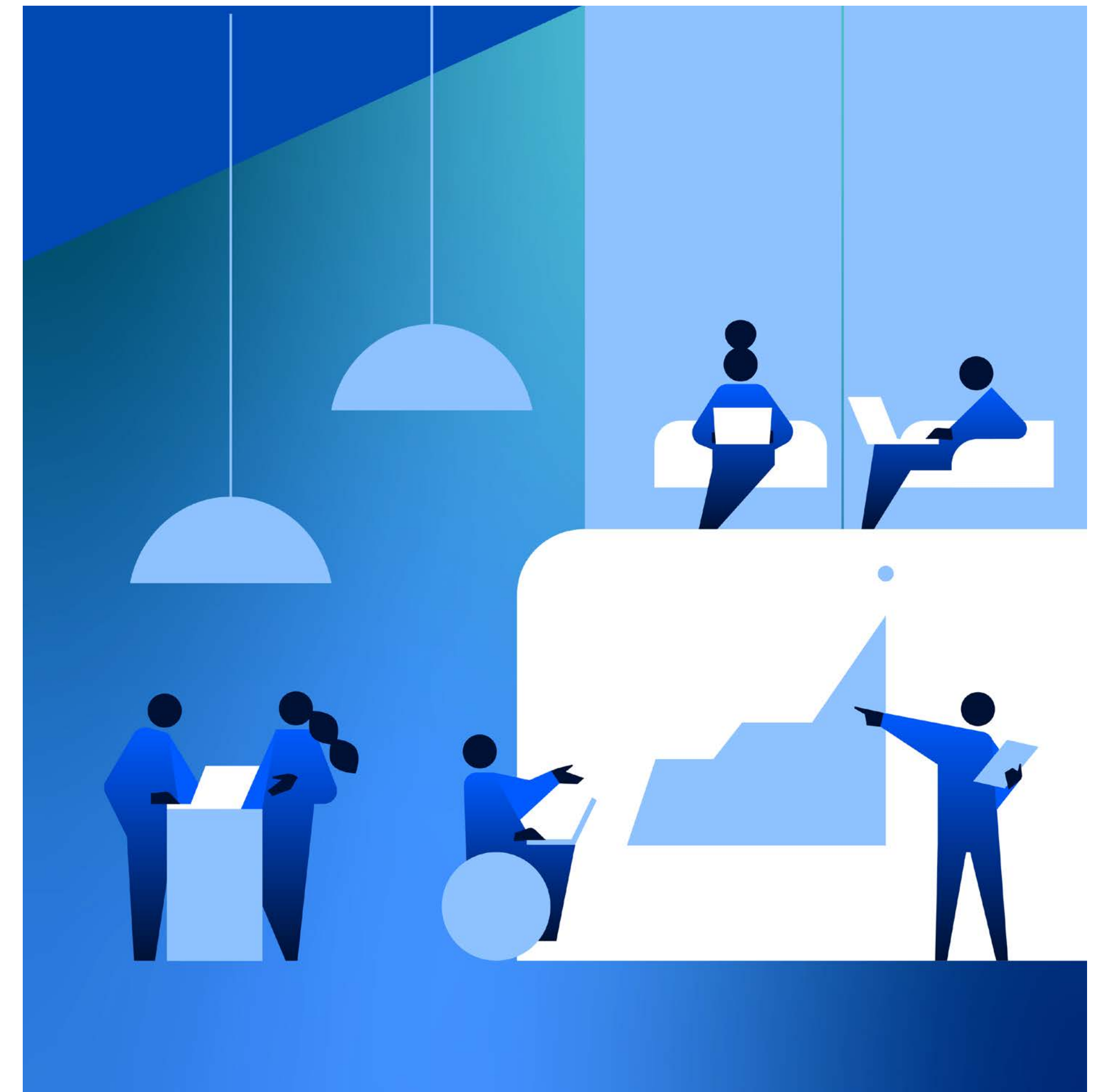
The Autonomous Networks Fabric ingests, standardizes, and governs data from multi-vendor, multi-domain silos, providing a single source of truth for all AI-driven operations. By collecting, storing, and curating data once, it eliminates the fragmentation that hinders automation and ensures all applications work from a consistent, high-quality information base.

✔ The power of agentic automation

The future of network operations lies in agentic automation. Nokia is building cross-domain AI agents, enabled by the Vertex AI agentic framework and Agent Development Kit (ADK), that move the industry toward a truly Intent-Driven Network. A "Remediation Agent," for example, can independently analyze a service degradation, test a fix in the digital twin, and apply the solution to the live network within seconds.

✔ Architectural flexibility and simplified TCO

Nokia Autonomous Networks suite offers unmatched flexibility, supporting hybrid, multi-cloud, SaaS and on-premise strategies. For the fastest time-to-value, the SaaS model on Google Cloud unlocks advanced Level 4+ capabilities, accelerating innovation, reducing hardware costs, and scaling seamlessly with demand – all while ensuring access to the latest AI and cloud technologies.



Chapter 5

Real-world use cases & AI applications

Nokia Autonomous Networks suite, powered by Google Cloud, is delivering transformative outcomes for telecommunication providers globally. By applying AI-driven automation to specific, high-value scenarios, providers are modernizing their operations, accelerating efficiency, and unlocking new revenue streams.

Modernize network and operations

Legacy systems and siloed data create operational bottlenecks that increase costs and slow innovation. Nokia Autonomous Networks suite breaks down these barriers, enabling providers to process vast amounts of data efficiently and scale operations.

Case study

Faced with the challenge of processing massive volumes of network data, Telefónica leveraged Google Cloud to modernize its data architecture. The company achieved 2X the processing power with lower costs in under eight months, demonstrating the immediate financial and operational benefits of adopting a modern, scalable data foundation.

Accelerate efficiency

Operational efficiency is a primary driver for autonomous network adoption. Closed-loop automation and AI-driven insights enabled by the Nokia Autonomous Networks suite directly address this need by reducing manual interventions, preventing faults, and streamlining complex processes.

Case study 1

By integrating Google Cloud, Bell achieved a +75% boost in software delivery productivity. This acceleration allows the company to bring new services and features to market faster.

Case study 2

In Australia, a leading provider using Nokia's Autonomous Networks suite now resolves 40% of all network incidents in a closed loop, entirely without human intervention, significantly improving network reliability and freeing up expert engineers to focus on higher-value tasks.

Revamp monetization

Ultimately, network investments must translate into revenue. Nokia Autonomous Networks suite creates new monetization opportunities by enabling the rapid, automated delivery of complex services that were previously impossible to scale.

Case study

Customers like Lightstorm Telecom Networks are revolutionizing their service delivery with Nokia's Autonomous Networks suite. By automating the end-to-end service lifecycle, they have achieved 500x faster service activation. This allows them to provision wholesale orders and launch new digital services like 5G slicing and IP-VPNs in minutes instead of days, dramatically improving customer satisfaction and accelerating time-to-revenue.

By focusing the Nokia Autonomous Networks suite on solving specific business problems, telecommunication providers can build a more efficient, reliable, and profitable network.

Chapter 6

Path to implementation

Achieving Level 4+ network autonomy is a structured journey. The Nokia and Google Cloud partnership supports telecommunication providers at every phase of this evolution.

Define your priorities and goals

Determine your key business objectives: whether the focus is on network monetization, subscriber experience excellence, operational efficiency, or a combination of these priorities. Identify where operational costs are highest and where the most significant benefits can be realized. Assess potential quick wins to demonstrate value early in the process, and ensure management buy-in to drive alignment and sustained momentum.

Assessment and foundation

Begin by evaluating your current operational maturity baseline – most providers are at Level 2 or Level 3, depending on the domain or process. Map out existing processes, technology capabilities, and data architecture. The next step is to establish a governed data mesh architecture, breaking down silos and creating a unified, high-quality data foundation that becomes the cornerstone for all future progress.

Pilot and scale

With a strong data backbone and the prioritized set of capabilities, move swiftly into piloting key automation use cases. Leverage a sandbox environment to test AI models, automation workflows, and network enhancements safely. Once validated, use cases can be efficiently scaled across multiple domains, vendors, and geographies, ensuring a controlled rollout and measurable business value.

Deployment flexibility

Nokia Autonomous Networks suite offers maximum flexibility. Providers can adopt a cloud-first model on Google Cloud for the fastest time-to-value or use hybrid and on-premise models for unique data residency or regulatory needs. They can also select the AN Apps, out-of-the-box integrations and use-cases required to address their specific needs. Every deployment is designed for elastic scale-out and robust disaster recovery, ensuring operations remain resilient as business demands grow and evolve.

Advance your autonomous networks roadmap

Accelerating network autonomy is no longer just an operational goal; it is a strategic necessity for market leadership. The convergence of rising complexity and flat revenues demands a fundamental shift in how networks are operated.

The Nokia and Google Cloud partnership fuses deep telco insight with industry-leading AI capabilities to deliver a future-ready solution for Level 4+ autonomy. Now is the time to transform your operations and unlock the full value of your network.

Ready to take the next step?

Unlock deeper insights and schedule a tailored consultation with our experts to define your autonomy roadmap.

Discover Nokia Autonomous Networks

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About Nokia

Nokia is a global leader in connectivity for the AI era. With expertise across fixed, mobile, and transport networks, we're advancing connectivity to secure a brighter world.

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