AI in the RAN: A data-first path to full automation

NETSCOUT

How AI is transforming the RAN, from hype to deployment

A conversation with Karsten Gaenger, Principal Product Line Manager for the RAN at NETSCOUT and Monica Paolini, Principal at Senza Fili

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How AI is transforming the RAN, from hype to deployment. A conversation with Karsten Gaenger, Principal Product Line Manager for the RAN at NETSCOUT and Monica Paolini, Principal at Senza Fili

Integrating AI into the RAN is no longer a fanciful promise: it has become an unavoidable tool for managing complexity, increasing network efficiency, and reducing costs in an environment where revenues are stagnant.

Karsten Gaenger, Principal Product Line Manager for the RAN at NETSCOUT, outlines a strategy for integrating AI into the RAN, starting with traditional AI/ML models and gradually integrating LLMs and AI agents, assisting operators on their path to Layer 5 automation.

- **Data reliability: Success depends on high-quality, correlated, AI-normalized datasets**
- **Gradual adoption path: Operators can start with 4G or 5G, and move forward at a manageable pace that fits their needs**
- **Benefit from a diverse ecosystem: APIs, telco-specific LLMs and MCP give operators end-to-end, vendor-independent visibility across capacity, mobility, and services**
- **Beyond KPIs: AI enables scalable root-cause analysis, prediction, and faster repair, with start-to-finish analysis and monitoring of procedures**

Monica Artificial intelligence (AI) in the radio access network (RAN) is a hot topic, but one that is often approached from a high-level perspective that does not address the implementation details.

In this conversation, Karsten Gaenger outlines concrete ways in which AI can be integrated into the RAN and the benefits it can deliver. He has been at NETSCOUT for a long time, but he has a new role.

Karsten, could you tell us about your background and what you do at NETSCOUT?

Karsten: I oversee the RAN products from NETSCOUT on the RAN product line management team. I have been working in product management at NETSCOUT for more than a decade. Previously, I worked at Tektronix Communications for more than a decade, starting in a technical role in engineering. I started my career in the industry over 20 years ago in the academic domain at the Fraunhofer Heinrich Hertz Institute in Berlin. My research there focused on making video transmission robust in mobile networks.

I am happy to oversee the RAN products for NETSCOUT right now. It is a great time to be here, as the industry is changing significantly with AI and machine learning (ML).

Monica: I have been working with NETSCOUT for a long time. What I like about companies like yours is that you constantly try to improve existing networks. Clearly, AI offers an opportunity to take you one step forward by providing more tools to improve network efficiency, performance, and costs.

Let's start with the basic drivers. Why do we need AI in the RAN? What challenges are we facing, and how can we solve them?

Karsten: AI can play a comprehensive role in the future of our industry. I am quite bullish that it will help our customers be successful. We have seen for decades that network complexity is increasing at an accelerated pace. However, it is no secret that service revenues are flat and not growing in line with the adoption of new technologies.

Automation and machine learning are required to manage the network's complexity. 5G is a recent example. This was the first time that 3GPP had released a new generation that could be integrated into existing legacy networks. I think it is the right approach because operators did not want to deploy a whole new network to have coverage to generate commercial revenues. Instead, with close interworking with anchor 4G sites, 5G non-standalone (NSA) allows for 5G coverage in focus areas like downtown cities based on the 4G network.

Watch the video of the conversation

We are now moving into 5G standalone deployments that support more sophisticated use cases.

However, getting two network generations to interwork is hard. The 5G logo may appear on the screen, but the phone may not be connected to a 5G carrier. With carrier aggregation and dual connectivity, for instance, the user experience may not be as good as expected.

RAN teams need more visibility and better tools to pinpoint problems, predict issues, and propose solutions. We are on an accelerated journey toward the industry vision of Level 5 automation, which includes zero-touch and fully automated networks.

Monica: Most of AI and automation in the RAN is for the future because we are just starting. Adoption of automation and AI in today's networks is limited. But as complexity grows, networks would become unmanageable without AI. We could not hire enough people to manage them, even if we had enough qualified people to do so, and we do not.

How do you see the adoption process? What should operators do first? What is the low-hanging fruit?

Karsten: Operators do not have to go from zero to 100 in a step function; they have a choice to deploy AI and ML gradually. They can initially adopt machine learning modules in selected areas first and then gradually grow toward agentic AI. Large language models (LLMs) can eventually help non-technical staff access datasets and understand complex analytics.

Monica: What is NETSCOUT's proposed path for the operators?

Karsten: We have learned in the past that it is essential to manage the timing correctly. There is a risk of being too quick and making wrong decisions, but we also do not want them to be unsuccessful late followers. The challenge is to find the right middle ground.

From the early adoption of ML, we learned that input datasets are crucial to success. We need correlated and AI-normalized data where the correct correlation is embedded in the data. If datasets are uncorrelated, even the most complex AI cannot make sense of the information and extract the relevant relationships between data points. With the right datasets, we can feed models efficiently and get the best return on our investment.

Monica: That is a crucial part. If the data is inaccurate or unreliable, you are not going anywhere. It is a lack of good data that often causes hallucinations.

How do you ensure an operator has the right data, especially in a complex network with different vendors and varying formats and levels of granularity? How do you make sure it all fits together?

Karsten: This is an area where NETSCOUT concentrated early on. We saw that feeding industry data blindly into models resulted in a garbage-in-garbage-out outcome. To avoid this fate, we have worked for years on defining AI-normalized datasets to feed dedicated modules and agents. This helps RAN, device, performance, and optimization teams do their jobs more efficiently.

With AI, ML, and the right datasets, we can address tasks that were previously impossible to do at scale. One example is single-call analysis. This requires state machine processes to analyze calls from start to finish and monitor all procedures, including handovers. You must understand what happened beforehand and what happens after a handover to see how it affects service quality. If you isolate data using only performance counters, the correlation is lost, and the outcome will be poor.

At NETSCOUT, we use a comprehensive view of the call from start to end, correlating the procedures and RF messages with service level insights to generate a real, holistic view of the network. From here, models can pinpoint root causes of service issues rather than just giving indications. They can also identify good neighbor relations and handover zones based on quality of service, latency, and throughput.

We have created AI-normalized datasets that use agentic AI algorithms that generate outcomes for capacity, mobility, and services — three areas where user experience is key. Common interface adoption and, when needed, definition allow for AI agents and datasets to communicate. We are also investigating how to implement the Model Control Protocol (MCP) server and client architecture to integrate agentic AI into our networks.

Monica: What makes NETSCOUT's approach stand out?

Karsten: We focus on vendor-independent datasets in the areas of capacity, mobility, and services. NETSCOUT's cloud-native solution serves a diverse set of customers, ranging from small mining companies with small 5G or 4G private networks to the largest mobile networks with more than half a billion subscribers.

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We work hard to preserve dataset integrity to retain causality. Solutions based on uncorrelated statistics or KPIs lose intelligence. For example, handover KPIs may indicate that the network works properly. However, even after an apparently successful handover, a subscriber may experience call drops or interference. If you do not correlate these procedures throughout the call, you will have an imperfect data view, which will cause even the best AI models to underperform.

Monica: As network complexity grows, you need an end-to-end view to understand why a user might be unhappy, even if individual elements appear to work well and KPIs are good.

How much of the AI, ML and GenAI models do you develop in-house versus using what is already available? How do you avoid reinventing the wheel while still being useful to operators with different networks and needs?

Karsten: NETSCOUT follows a twofold approach. We are not an AI research company; we apply AI to make sense of network data. We use existing modules, models, and algorithms to generate insights from mobile datasets.

We differentiate where AI is used. NETSCOUT plays a role in service assurance, optimization, and pinpointing issues to reduce mean time to repair. We look toward predictive analytics and self-healing for Level 4 and Level 5 autonomous networks.

The AI train has left the station at the Physical and Media Access Control (MAC) Layers. While NETSCOUT does not play a large role there, we see AI adoption in network equipment and Open RAN for interference coordination and scheduling. This is already appearing in products.

Regarding the journey of AI, we are still partly stuck in the hype phase, slowly realizing where AI is useful and what it cannot do.

Companies now realize the importance of keeping ground truth and AI-generated datasets separated to avoid pollution with misleading hallucinations and ensure that models learn from real network data.

NETSCOUT helps the industry to be more successful. For example, operators can increase network capacity by bundling more carriers and bandwidth. To have visibility into how these carriers and band combinations are performing per device and per subscriber, operators need a multidimensional analysis. KPIs alone cannot provide this correlation. NETSCOUT looks at the call from start to finish to establish the correlations needed to make sense of the data.

In the past, radio engineers had to spend hours analyzing a single call. This is not possible at scale for millions of calls. AI and automation can automatically analyze call behavior to provide engineers with situational awareness. From situational awareness, we can move into prediction and proposed problem resolution.

Monica: Operators, as well as vendors and analysts, want to adopt AI, but they must do so in organizations where many do not yet understand the technology. You need to build knowledge and trust to integrate AI successfully with what you already have.

How do you see this integration for your existing clients?

Karsten: There are two dimensions to this: technology and change management. There are risks associated with AI, as well as human adaptation issues.

NETSCOUT is committed to securing existing operators' investments and offers two deployment options: the AI Sensor and the AI Adapter. The AI Sensor is a data collector and processing engine that correlates information for the world of AI. The AI Adapter is for operators who wish to plug into their existing cloud-native processing chains as the first step in their AI journey.

At our 2025 ENGAGE user conference, our CEO, Anil Singhal, announced a NETSCOUT telco-specific LLM, based on the AI Sensor and AI Adapter, that will help organizations become more efficient and give their staff easy access to data that previously required expert knowledge.

A dedicated telecom LLM can provide RAN expert knowledge to everyone in the organization. You could type in a prompt asking how a video conferencing service is performing today. The model will inspect the relevant datasets, analyze them, and provide a well-crafted answer without requiring the user to have deep RAN expertise. It will provide detailed latency and throughput reports with graphs, predictions, as well as proposals for next steps and recommended actions. This can be used in various departments, from call center agents helping complaining customers, to RAN engineers finding root causes.

Monica: How do you deal with power consumption in the AI Sensor, AI Adaptor and LLM models? Some say that adding AI to the RAN will lead to an explosion in processing and power requirements.

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Karsten: Our customers do not need to build large-scale data centers for this. We use pre-trained models. However, we expect AI models will need to be trained within customer networks, as each network behaves differently. The models will learn in a specific RAN environment to provide tailored outcomes.

One example is our AI-based geolocation algorithm, which has been on the market for a few years. We have a dedicated geolocation team with many PhDs. Depending on the network's size, we may have hundreds of thousands of AI geolocation agents. Each individual cell has its own agent that learns the physics of that cell to provide the best geolocation outcome. We geolocate all calls in real time to make spatial sense of performance. The AI algorithm can accurately predict geolocation and recognize known locations, such as a specific street corner, over time, based on the RF environment.

We have achieved excellent results in power consumption efficiency and geolocation based on network footprint. While initial learning consumes power, the models are efficient once they are in a steady state.

Monica: After the learning phase, the model no longer needs to repeat the process continuously. For instance, the model retains the information tied to a specific location, such as the street corner you mention. In this context, what needs to be centralized versus what can be pushed to the edge?

Karsten: While we are totally flexible in this area, operators typically deploy NETSCOUT's products in data centers where they can holistically aggregate distributed data sources. Automated optimization tasks need a broader context, and the real-time nature of an edge deployment with millisecond latency isn't practical.

NETSCOUT supports distributed systems with AI agents at the MAC and PHY layers that do not necessarily need to be fed back to centralized systems.

One challenge we have in distributed systems is solving colliding interests. You might have one application dedicated to energy saving and another dedicated to performance. If you want to increase performance, you usually do not shut down carriers, which is exactly what the energy-saving application might do. This needs to be resolved at a centralized, higher level.

Monica: What is next? What are the highest priorities for NETSCOUT and the industry to move forward successfully?

Karsten: The industry needs to expand and strengthen interoperability. We need APIs and MCP to allow AI agents to talk to each other.

NETSCOUT is committed to providing domain knowledge using these methods for AI initiatives, such as those supported by the AI-RAN Alliance, which includes major industry players.

AI will play a role in 6G standardization, both at the network layer and the data layer. For example, the Fraunhofer Heinrich Hertz Institute is working with Ericsson and Nokia to define standards for 6G video codecs. This will allow source coding and network coding to work together, combining RAN, transport, and data layers in 6G networks to make the video codec network aware.

However, when asked about 6G, operators often say they do not yet have a fully functional 5G standalone network and want to leverage 5G before making the next major investment. Increasing efficiency through AI and automation is applicable to 5G and 4G today. Focusing on AI agents across various domains today will help us move toward a more holistic future with 6G.

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About NETSCOUT

NETSCOUT is a leading provider of service assurance, cybersecurity, and advanced AI/ML analytics solutions. Our portfolio spans both communications service provider and enterprise environments, unlocking the power of IP-based, Deep Packet Inspection (DPI) data to deliver unmatched visibility, performance, and security across hybrid networks.

With the rise of AI-driven operations (AIOps), NETSCOUT is helping customers simplify network complexity and improve user experience by delivering real-time, actionable intelligence. Our solutions enable faster mean time to knowledge (MTTK), proactive issue detection, and automated insights that support smarter decision-making and more resilient infrastructures.

Our market-leading service provider product portfolio is designed to provide end-to-end observability across physical, virtual, and cloud environments. By combining scalable monitoring with AI-powered analytics, we empower operators to assure service quality, secure applications, and accelerate innovation. At NETSCOUT, we help make every user experience exceptional by accelerating the connected world through Visibility Without Borders®.

About Karsten Gaenger

Karsten Gaenger oversees NETSCOUT's RAN product line and portfolio with a focus on analytics and service assurance sectors. He holds an electrical engineering degree in telecommunications and has worked extensively in research and test and measurement roles for more than 20 years. Prior to joining NETSCOUT in 2006, he published several IEEE research papers with the Fraunhofer Institute. Karsten also holds several patents in the telco domain and is the co-author of the Wiley book "LTE Signaling - Troubleshooting and Performance Measurement."

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About Senza Fili

Senza Fili provides advisory support on wireless technologies and services. At Senza Fili, we have in-depth expertise in financial modeling, market forecasts and research, strategy, business plan support, and due diligence. Our client base is international and spans the entire value chain: clients include wireline, fixed wireless, and mobile operators, enterprises and other vertical players, vendors, system integrators, investors, regulators, and industry associations. We provide a bridge between technologies and services, helping our clients assess established and emerging technologies, use these technologies to support new or existing services, and build solid, profitable business models. Independent advice, a strong quantitative orientation, and an international perspective are the hallmarks of our work. For additional information, visit www.senzafili.com.

About Monica Paolini

Monica Paolini, PhD, founded Senza Fili in 2003. She is an expert in wireless technologies. She has helped clients worldwide understand technology and customer requirements, evaluate business plan opportunities, market their services and products, and estimate the market size and revenue opportunity of new and established wireless technologies. She frequently presents at conferences and other industry meetings, and has written many reports and articles on wireless technologies and services. She has a Ph.D. in cognitive science from the University of California, San Diego (US), an MBA from the University of Oxford (UK), and a BA/MA in philosophy from the University of Bologna (Italy).

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