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Networking: the defining factor of AI performance

As well as transforming what networks need to carry, AI is also rewriting what networks must be.

This is because different stages of AI operations call for very different networking behaviors. For instance, AI training models built on large Graphics Processing Unit (GPU) clusters need a reliable, accurate network capable of delivering vast volumes of data – often in short-lived, massive spikes. On the other hand, AI inference environments require ultra-low latency so the model can think, exchange intelligence, and respond in the blink of an eye.

In traditional data center environments, any bottlenecks or vulnerabilities in these areas usually translate into slower applications or a reduced quality of service. However, the operational impact is much more destructive when it comes to AI. Even small inefficiencies like congestion or packet loss can ripple across thousands of accelerators –

disrupting training, rendering valuable compute resources idle and impacting the quality of the AI service itself.

Equally, the economic weight of AI infrastructure can also take its toll on the organizations that lack fit-for-purpose network architecture. Costs associated with power, cooling, and processing are dramatically higher than in conventional data centers, which means every single minute of GPU time counts. If the network therefore fails to deliver consistent performance, organizations risk increasing operating expenses at an alarming rate.

It all stacks up – because in the age of AI, the network is key to system performance, scalability, and cost-efficiency.



Why networking must be approached differently for the age of AI

For decades, networks have evolved at a steady enough rate – incrementally increasing speeds, expanding capacity, and improving efficiency as digital demand grew. But those networking models weren't designed for the sheer pace and precision that AI needs to thrive. This classic “faster speeds and feeds” thinking no longer works, which leaves the industry looking for a better way.

Ultimately, this sudden demand for a different approach to networking calls for a different approach to network design – a rethink from the ground up. And as part of this foundational reset, AI-ready networks must be primed to deliver:

- **Constant reliability**, minimizing downtime and driving the risk of human error toward zero.
- **Predictable performance** consisting of deterministic latency, minimal packet loss, and precise congestion signaling.
- **Architectures built for scale**, optimized for east-west traffic across growing GPU clusters.
- **Integrated hardware and software**, where network elements like silicon, protocols, telemetry, and automation all function as a unified system.
- **Deep operational intelligence**, with networks automated to detect and respond to change in microseconds rather than minutes.
- **Proof under real AI workloads**, guaranteeing technologies that perform reliably when faced with complex, multi-vendor stacks and realistic failure scenarios.

AI has changed the game, and the networks that facilitate it have no choice but to change with it.



Inside the Nokia AI Networking Innovation Lab

The Nokia AI Networking Innovation Lab – located within our Executive Briefing Center in Sunnyvale, California – is a purpose-built hub dedicated to advancing the next generation of AI-ready networking.

We created this facility in recognition of a simple reality: AI cannot be treated as just “another workload” running on a background network. Now more than ever, it’s clear that the underlying network must be re-architected as an active performance system capable of directly influencing how efficient and reliable AI is when it’s operationalized at scale.

The Nokia AI Networking Innovation Lab is a center of excellence where we drive innovation across these AI-ready active performance systems from end-to-end. It’s where we invite a global ecosystem of partners to integrate their solutions with ours. And it’s also where we test and validate the efficacy of our designs under realistic AI conditions.

As a leader in the AI Supercycle, Nokia established the Lab to spearhead three critical pillars of networking development:

- Innovation
- Collaboration
- Validation

These pillars underpin our philosophy of supporting these new networking demands – and it’s how we ensure the networks set to support AI workloads lead the industry.

1

Innovation

Gone are the days of general-purpose networking. To actively support the future of AI, we must instead prioritize the deterministic performance characteristics that these complex new workloads demand. For that complexity to become an operational reality, a new generation of technology is vital.

The Nokia AI Networking Innovation Lab places us at the heart of this transformation. It provides a dedicated space for specialists to boldly experiment with next-gen solutions across the entire networking stack – driving emerging standards forward by testing and evaluating approaches to new protocols, switching silicon, congestion control, real-time telemetry, and automation. Nokia is an active member in the [Ultra Ethernet Consortium \(UEC\)](#) and the [Open Compute Project \(OCP\)](#), both leading organizations in driving innovation within AI networking technology.

Nokia's solutions have powered some of the most demanding networks on earth for years, and that experience and expertise is woven into the methodologies we follow at the lab. It's this experience and hands-on operational rigor that ensures our innovation always remains focused on solving the real challenges of facilitating high-performing AI models.



Case in point: Leading the way in modern data centers

Ethernet is now accepted as the leading protocol to deliver AI networking. **UEC** was formed to deliver an Ethernet based open, interoperable, high performance, full-communications stack architecture to meet the growing network demands of AI & HPC at scale. Nokia is an active member of the UEC and is passionate to test and support its new specifications.

In UEC's **specification 1.0**, the ultra ethernet transport layer (UET), is where most of the new features within spec 1.0 was implemented. Nokia, working alongside Keysight Technologies, [tested this new transport layer](#) by passing live traffic across Nokia's family of data center routers, including both Nokia 7220 and 7250 Interconnect Router (IXR) families.

This test is just the beginning. More features will be tested confirming compliance to UEC Spec 1.0 including – but not limited to – packet trimming and congestion signaling.

In this ongoing testing efforts we demonstrate our active commitment to the Ultra Ethernet Consortium (UEC) Specification 1.0. Crucially, it also shows how the Nokia AI Networking Innovation Lab is actively leading the way in producing high quality solutions for extreme-scale, lossless modern data centers.

“Partnering with Nokia in the AI Networking Innovation Lab has enabled us to benchmark and optimize AI networks under real-world conditions. Keysight emulated AI training workloads at scale across a range of AI transports, from UEC and RoCEv2 to emerging lossless fabric architectures. Together, we are helping accelerate AI network adoption by giving operators and hyperscalers the validated insights needed for confident, large-scale deployment.”

said Ram Periakaruppan, Vice President and GM, Network Applications & Security business at Keysight.

2

Collaboration

At Nokia, we acknowledge that no single vendor can revolutionize AI networking alone. True progress depends on a strong ecosystem of technology providers – such as silicon manufacturers, GPU developers, system vendors, cloud platforms – and standards bodies that work together to create highly-compatible AI-ready solutions.

That's why our philosophy of collaboration is multi-dimensional: at the Nokia AI Networking Innovation Lab, we maintain active participation with best practice authorities like the UEC, the Open Compute Project (OCP), and open-source SONiC, while simultaneously driving co-innovation with leading AI and Cloud providers. Together with these tech partners, we test the interoperability of our designs, optimize system integration, and align development roadmaps across the data center landscape.

Collectively future proofing the latest solutions like this shortens the gap between experimentation and deployment – which in turn means our customers get quicker access to fully interoperable technology uniquely designed to fit seamlessly into real-world AI infrastructure. By orchestrating and incubating collaboration in this way, we encourage every organization – not just Nokia – to accelerate its innovation and reduce the risk of fragmentation within our industry.



Case in point: Co-innovating for success

The strength of the Nokia AI Networking Innovation Lab's collaborative impact is typified by our strategic partnership with Broadcom. Working together, our teams recognized that their Tomahawk-6 silicon represents the state of the art in terms of throughput and speed and **Nokia implemented this silicon on their 7220 IXR H6 data center switches**. With our ultra reliable and modern SR Linux network operating system (NOS), we knew we had a winning combination.

As another testament to the qualities of our co-innovation model, there are certain customers who require running open-source (NOS). For this reason Nokia ensured that we have a hardware solution that can also run on the open-source community SONiC NOS, which itself is another example of Nokia's ongoing collaboration with the broader data center community.

Some of our ecosystem partners



“AMD believes customer collaboration and an open ecosystem are fundamental to accelerating AI innovation. By co-developing solutions with partners, such as Nokia in their AI networking innovation lab, we ensure our AMD enterprise AI solutions are tested with Nokia data center switches on real-world workloads and network demands. An open, standards-driven approach empowers customers to integrate seamlessly across heterogeneous environments, avoiding lock-in and fostering industry-wide advancement in AI.”

Said Travis Karr, Corporate Vice President, HPC and Sovereign AI, AMD.

3

Validation

AI data center environments are as fast paced as they are complex, which means the performance of each new networking solution needs to be proven before it's deemed safe for deployment. For that reason, robust lab-to-field validation processes are embedded as a core function of the Nokia AI Networking Innovation Lab.

The lab's ability to emulate the conditions of modern AI data centers allows our engineers to examine how confidently the cutting-edge network components we create can survive and thrive within real operational scenarios – monitoring how these solutions behave when confronted with diverse hardware, mixed vendors, evolving software stacks, and other operational constraints.

Everything that we learn from innovation and collaboration is brought together by these vigorous, real-world tests. And in turn, the results inform our collection of Nokia Validated Designs (NVDs) – architectural blueprints that have successfully stood up to the scrutiny encountered across all layers of hardware and software across a system. These pre-tested NVDs are downloadable, which allows organizations to quicken time to market and experience predictable performance while simultaneously reducing the risks and downtime typically associated with new technology investments.



Case in point: Moving forward with high-performance infrastructure

For instance, we teamed up with Lenovo and AMD to design, test, and validate a Sovereign AI blueprint using a best-in-class combination of networking, compute, storage, and GPU technologies. Developed through close collaboration between leading technology vendors, the solution has been designed and tested to meet the demanding requirements of modern AI workloads across training, inference, and data processing use cases.

Another example includes our AI-based NVDs where we tested both the training and inference aspects of Artificial Intelligence/Machine Learning (AI/ML) in an architecture suited for AI. This blueprint covers multi-tenancy and leveraged various industry standard benchmark tests to showcase the efficacy of the Nokia AI-DC networking portfolio.

The resulting validated design offers customers, partners, and architects a validated design for deploying AI-ready infrastructure in enterprise and service provider environments. By leveraging this solution, organizations can accelerate adoption, reduce deployment risk, and ensure their data center investments are optimized for the next generation of AI-driven applications.

“Nokia is a strategic networking partner for Nscale as we build towards AI Grid, and the engineering rigour behind their Validated Designs reflects the kind of innovation needed to enable next-generation AI infrastructure. The depth of hardware, software and failure testing behind those blueprints is what will give operators the confidence to deploy complex AI environments faster, with fewer integration risks and less operational disruption. We're excited to collaborate in the AI Networking Innovation Lab to help push the boundaries of AI-native networking and validate the next generation of solutions before they reach production.”

Arno van Huyssteen, VP of Global Telecommunications

Click for more info:

[Lenovo NVD](#)

[Nokia NVDs](#)

Spearheading the future of AI networking with Nokia

With organizations worldwide seeking to fast-track their adoption of AI, the performance and reliability of data center networks is quickly becoming an operational non-negotiable. At Nokia, we're leading this transformation by producing technology that's fit for both now and for the foreseeable future.

Our AI Networking Innovation Lab is the launchpad for this mission. On these premises, we're actively shaping the transition towards AI-native networking by designing, testing, and validating networking components with a keen focus on delivering more value and higher performance to our customers. This technology is forming much of the foundational infrastructure that organizations around the world need to make their AI investments a success.

Co-innovation is another way in which we choose to safeguard the networking industry as a whole. This approach guarantees that the innovations that we – and the world's other most influential AI tech companies – develop within our Lab can be rolled out at scale. By offering our peers the opportunity to develop enhanced interoperability alongside us, we can position ourselves as the pacesetter and coordinator of change within the data center networking market.



The future of AI networking starts with Nokia

The rise of AI marks the most profound technology shift of our time, changing the ecosystem of computing as we know it. With the new and emerging demands of AI training and intelligence inferencing, it'll be network capability that determines whether these investments succeed or fail.

The Nokia AI Networking Innovation Lab was specifically designed for this purpose. It's a specialist environment where the next generation of networking technologies can be devised, tested, and validated alongside other companies that are shaping the

future of AI. The work taking place here will influence the industry-wide best practices and infrastructural fabrics throughout data centers and beyond – ultimately helping our customers to deploy AI with greater confidence.

As the AI Supercycle intensifies, Nokia is committed to being at the forefront of connectivity. The future of AI networking will be defined by smarter, faster, more predictable systems – and the Nokia AI Networking Innovation Lab is where they're being built.

[Learn more](#)

To discover more about what we're creating in the Nokia AI Networking Innovation Lab, [explore our website](#)



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NOKIA

About Nokia

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