# Full Stack Input, Maximum Output: How to Make the Most of AI in Networking

Harnessing the power of a best-of-breed full networking stack to deliver exceptional experiences

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# Rethinking campus and branch networking for the AI era

Learn more about Juniper's AI-Native and cloud-native full stack solution portfolio.

Learn more →

**CEOs across the globe have issued corporate directives to deploy artificial intelligence (AI) across the business. They aim to transform operations and tap into hidden revenues. And vendors across all sectors, including IT networking, are eager to capitalize on the opportunity.**

For networking leaders managing complex and expensive campus and branch environments, pivotal questions have emerged:

- How many advantages can AI really deliver?
- What's the appropriate risk tolerance?
- What's the best way forward to optimize outputs?

With so many options available for deployment, the realities presented by vendor foresight, capabilities, and expertise are more important than ever. And vendors pursuing AI have arguably splintered into a few broad categories, including:

- **Siloed, niche** vendors with miscellaneous AI capabilities who are unable to deliver full stack campus and branch integration
- Vendors featuring various **bolt-on AI** solutions that create the illusion of full stack operational efficiency
- Vendors with **proven full stack architectures** designed from the ground up to harness AI's full potential

The latter represents an important evolution in networking: Tight integration between best-of-breed networking components and innovative AI-Native features is leading to better operator and user experiences—redefining what the term "full stack" means in the modern networking landscape.

Juniper believes that today's leading-edge full stack networks should be highly dynamic and scalable in support of evolving enterprise demands. And they should include AI and automation capabilities that simplify management and slash costs while improving and securing user experiences from start to finish.

This ebook covers the evolving story. It examines the role of data in AI networking and the value of interlocking enterprise-class, full-stack solutions. It also delves into the importance of quality data inputs to ensuring the maximum output of an AI solution in IT networking.

Let's begin.

# max·i·mum out·put [noun]

**The achievement of the highest performance and efficiency in network operations, characterized by delivering exceptional and secure user experiences across LAN and WAN networks. This includes transformational scale and agility, better engagements, simplified operations, and attaining the lowest TCO and OpEx.**

# Key takaways

Through capabilities like predictive analytics and maintenance, automation, and intelligent network monitoring, AI has emerged as a transformative force in networking. In campus and distributed branch environments, the right "full stack" approach can further reduce complexity and costs.

**01**

## True full stack is more than "marchitecture"

A modern strategy employs a unified hardware and software approach (including for AI), underpinned by a 100% open API architecture to streamline operations and improve experiences.

**02**

## AI in networking is high-impact, low risk

AI in networking stands out for its ability to deliver rapid, consistent, and valuable impacts to users and IT.

**03**

## Best-of-breed, full stack input maximizes output

Collecting and using inputs from the LAN, WAN, security, and beyond for AI provides unprecedented opportunities.

**04**

## Foresight and maturity matter

It's vital to apply mature and continuously-learning data science algorithms to well-curated data sets.

**05**

## Organization informs ongoing orchestration

Beyond technology layers, proper organization and orchestration within vendor teams is critical.

**06**

## AI-Native full stack outperforms

Juniper offers the industry's only AI-Native and cloud-native full stack solution that can transform networking possibilities.

The **biggest barriers to NetOps success** include a shortage of skilled personnel, too many management tools, poor network data quality, and lack of cross-domain visibility, according to an EMA study[1]

**Nearly 25% of network operations teams** are still using between 11-25 tools for monitoring, management, and troubleshooting[2]

**30% of network problems** are due to manual errors[3]

## 03 The promise of AI

# The indisputable promise of AI in networking

**Today's campus and branch networks serve as both the circulatory and nervous systems of an enterprise. They channel the essential flow of data and enable swift, intelligent responses.**

Each network connection pulses with the potential to drive productivity and innovation. Yet maintaining this interconnected web has never been more challenging.

IT teams are grappling with rapidly evolving business demands. They are confronted with the difficulty of protecting ever-expanding attack surfaces from sophisticated threats. And they must contend with an onslaught of new devices, connection types, and a proliferation of applications driving bandwidth needs.

Balancing the need to scale against resource and budget constraints and a scarcity of specialized skills only compounds the complexity.

In this landscape, AI has emerged as a truly transformative force in networking. In fact, the most advanced AI networking solutions are already significantly reducing and, in some cases, even eliminating many real-world pain points. Examples include:

- **Predictive analytics and maintenance:** AI-powered network management tools can analyze real-time data and predict potential issues before they occur. This enables proactive maintenance and minimizes downtime. It includes identifying potential security threats, detecting anomalies, and optimizing network performance.
- **Automation and orchestration:** AI-enhanced automation enables networks to self-heal, self-configure, and self-optimize. It all leads to reduced manual intervention and increased overall efficiency while elevating user and operator experiences. AI-powered orchestration tools can also automate complex processes, such as network provisioning and change management.
- **Intelligent network monitoring and insights:** AI-powered monitoring tools provide real-time visibility into network performance and can offer actionable insights and enable data-driven decision making. AI-driven analytics can identify trends, detect patterns, and provide recommendations for optimization, security, and capacity planning.

While these types of capabilities exist today, they are the exception and not the norm. Most solutions lack the integration and data needed to significantly transform day-to-day operations.

> **"If you want to automate tier 2/tier 3 where you dive into the networking stack and try to figure out where the [network] problem is and how to fix it—a lot of general purpose, domain-agnostic AIOps platforms don't do that; they're not domain experts."** [4]

**Shamus McGillicuddy,** Vice President of Research, EMA

## 04 Input matters

# Maximum output starts with optimal data input

**When it comes to extracting full value from AI and machine learning (ML) in networking, the volume, reach, quality, timing, and processing—and resources to analyze and action the data—are critical. After all, effective AI-enabled actions hinge on a comprehensive understanding of the current situation.**

Knowing precisely what is happening, where it's happening, and why it's happening is crucial for informing timely and appropriate responses. And quality data is the cornerstone of everything.

Just as the process of creating an exceptional wine depends on a variety of factors, the generation of quality data for AI in networking does as well. Similar to how wine requires the right grapes, soil, and aging time, networking expertise, hard work, and patience are all essential in nurturing diverse data sets with well-labeled and meticulously curated information.

Anyone can collect baseline data on network health and feed it into an AI engine. However, fostering truly impactful AI capable of enabling exceptional user experience and minimizing false positives involves many considerations. To achieve these goals, vendors must consider everything from organizational structure to hardware/software development, data spectrum, and tool sets. Moreover, it's vital to apply mature and continuously learning data science algorithms to well-curated data sets.

Furthermore, maximizing the output from AI in networking depends on the number and breadth of data inputs. And this is exactly where most AI networking solutions are limited. Currently, some IT networking solutions can collect data from the LAN, some from the WAN. But few solutions can aggregate and utilize data from both the LAN and WAN (and beyond) effectively—what we call the "full stack." This underscores the critical need of vendor foresight in ensuring integration and interoperability.

### The role of input vs output for AI networking improvements

| **Good** | **Better** | **Maximum** |
|---|---|---|
| **LAN or WAN** | **LAN and WAN** | **LAN, WAN, security, location, and more with AI-Native capabilities** |
| Provides a fragmented view of networking performance and security | Begins to offer a more holistic view of network operations, enabling AI systems to make more informed decisions | Delivers a comprehensive data set and provides a panoramic view that enables AI systems to achieve their full potential |
| **Benefits snapshot:** The limited scope restricts potential benefits, yielding basic enhancements in efficiency and threat detection | **Benefits snapshot:** Supports moderate improvements in network management, reducing downtime and identifying more complex issues | **Benefits snapshot:** • Empowers AI to proactively optimize network performance • Enhances security with predictive threat analysis • Delivers personalized user experiences |

# Moving beyond traditional and nascent AI networking models of most vendors, Juniper's AI-Native full stack approach represents the next frontier in network innovation.

## 05 Improving outputs

# How an AI-Native full stack approach advances networking

**So far, we've established why quality data is the lifeblood for AI and why maximum output in networking takes quality data from across the network. The next big question is: What's the best way to get and use quality data at every level to improve networking outputs?**

The best strategy employs a unified approach via industry-leading hardware and software stacks—the full stack—optimizing performance, streamlining operations, and improving user experiences and security. It is underpinned by a microservices cloud and 100% open API architecture to extend to other leading solutions across domains, such as 5G, ITSM, communications platforms, cybersecurity, and mobility.

Juniper is transforming traditional networking data collection by treating networking devices as sensors, capturing comprehensive range data from across the LAN and WAN, as well as integrating security and location-based inputs. For example, key elements of our approach include (see page 12 for the bigger picture):

- **Enhanced end-to-end telemetry:** Measuring 150+ real-time wireless user states through streaming telemetry from routers, switches, and firewalls, enhanced by Mist AI™ for predictive analytics
- **Cloud-native, microservices architecture:** Supporting the real-time processing of AI data and enabling more scalable, resilient, and efficient operation of network management systems
- **Common AI engine:** Unifying network data analysis and decision-making processes under a single, intelligent framework powered by Mist AI that facilitates streamlined operations, predictive problem solving, and adaptive learning across the entire network ecosystem

Through continuous user experience learning based on detailed telemetry data, Juniper incorporates application data alongside network data. This enables the AI system to learn about the applications being used and predict potential impacts on a user's application experience based on adverse network conditions.

Additionally, our pioneering AI-Native Virtual Network Assistant, Marvis™, simplifies management and troubleshooting. Marvis features a conversational interface for streamlined problem solving and an automated action framework, driving continuous network improvement. Marvis also features Marvis Minis, the industry's first digital experience twin. Minis proactively identify connectivity issues before they happen, further protecting users from frustrating network experiences.

In large campus and distributed branch environments, this combination of capabilities is game changing. It effectively removes the rollout, troubleshooting, and maintenance challenges that drive up costs, stretch IT teams to their limits, erode user experiences, and stifle scalability and agility. Together, they comprise a genuine transformation in the enterprise networking approach that will only continue to improve over time.

# 05 Improving outputs

## Seeing the bigger picture

The foundation of a modern full-stack network is critical to its dynamic nature and enabling seamless integration into new networking domains—and beyond. Increasing adaptability will be the harbinger of a new era in IT networking, disrupting traditional TCO models for established technologies and transforming the network experience for both operators and users. Here are a few select examples of capabilities that illustrate how Juniper is reimagining full stack operations:


**FIGURE 1**

AI-Native support keeps getting better with time: the percent of customer IT network tickets proactively solved with AI over the course of several years.

### Integrated location services

Wireless access points (APs) that leverage a 16-element Bluetooth® antenna array for automated AP placement/orientation and accurate asset visibility and vBLE for precise and scalable location services that can increase user engagement and enhance workflows across industries

### High-performing SD-WAN

A tunnel-free, session-based SD-WAN using Session Smart Networking for improved bandwidth utilization and instant failover based on real-time network conditions

### Secure AI-Native Edge

Security, WAN, LAN, and NAC (Network Access Control) in a single operational portal, offering superior coverage for threats at wire-speed, and an important step forward for AI-Native uZTNA and SASE-based architectures

### Seamless data center integration

Industry-first Virtual Network Assistant (VNA) provides end-to-end visibility and assurance across all enterprise domains, from campus and branch to data center

### Advanced Routing Assurance

AI-Native automation and insights for traditional edge routing topologies

### Leading-edge Wi-Fi 6E and Wi-Fi 7 hardware

APs are designed to simplify network operations while maximizing scale and agility. High-power switches for Wi-Fi 7 with proactive centralized power and data management for building systems

## 06 Beyond the tech

# Beyond technology: the importance of organizational structure

**Achieving maximum output from a full stack networking approach isn't solely dependent on the technology deployed; it also significantly hinges on organizational structure.**

Proper organization and orchestration across different technology layers and within the teams themselves are critical to success.

At Juniper, we've engineered a collaborative environment where our data science teams and customer support teams work in tandem. Physically and operationally aligned, both teams use our advanced AIOps tool to stay synchronized with real-time customer issues and feedback.

This close collaboration ensures that our data science experts and domain specialists are consistently aligned with evolving customer needs and prioritization of solutions, continually advancing progress.

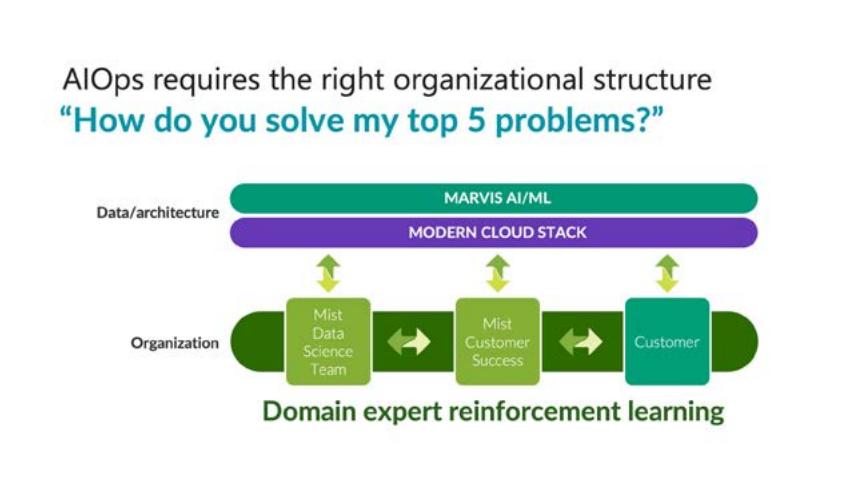


**FIGURE 2**

AIOps is about more than data. It requires the right organizational structure.

Over time, the payoff is more and more granular support, such as integrating data points from solutions like Zoom, Teams, ServiceNow, Cradlepoint, and Zebra to actively predict future performance for proactive troubleshooting down to a specific feature. And the progress will only continue.

Juniper's AIOps speed up deployments, simplify operations, and lower TCO.

Learn how.

## 07 Full stack NOW

# The industry's only AI-Native and cloud-native full stack solution

**Juniper offers the industry's only AI-Native and cloud-native full stack solution that can transform networking possibilities across campuses and distributed branch today.**

### Wireless access

Seamless and secure mobile connections

- Reliable connectivity for students, shoppers, patients, and employees
- Expand and refresh Wi-Fi with agility
- Identify and secure mobile and devices with NAC

### Wired access

Reliable and secure connections for business

- Reliable connectivity for IoT, APs, and wired devices
- Connect and protect IoT and users with microsegmentation
- Identify and secure devices with NAC

### Indoor location services

Deliver insight-based personalized user experiences

- Engage with students, shoppers, patients, and employees
- Indoor GPS and asset location
- Location-based analytics

### Secure branch access

Secure, reliable, and seamless connectivity for global branch offices

- Secure SD-WAN/SASE
- Distributed enterprise
- Optimize WAN for cloud apps

# 07 Full stack NOW

Juniper's combined solutions rely on a combination of telemetry, workflow automation, DevOps, and ML to enable a more adaptive and predictable network. Our holistic approach to AI in networking has led to a host of industry firsts, including:

- **Proactive AI-Driven RF adjustments** for optimal wireless experiences across environments
- **Dynamic packet capture in LAN and WAN**, providing unparalleled automation, visibility and issue resolution
- **Automated root cause analysis** to swiftly diagnose and address network issues, reducing MTTR and eliminating most trouble tickets
- **An AI-Native Digital Experience Twin** to preemptively detect and address potential wired, wireless, and WAN network problems before they impact users

True to its name, our AI-Native Full Stack also extends beyond the campus and branch and further into the distributed enterprise. For example:

- **An AI-Native VNA** that revolutionizes data center operations with proactive insights and simplified knowledgebase queries through an intuitive conversational interface in conjunction with an intent-based networking (IBN) system, enhancing uptime, and expediting resolutions
- **Juniper Mist Routing Assurance** leverages AIOps for advanced WAN operations, providing routing visibility and proactive insights simplifying troubleshooting, lowering MTTR/MTTI, and automating root cause analysis at the enterprise edge
- **AI-Native Security** ensures visibility and enforcement via the right secure infrastructure with best-in-class threat protection across Juniper switches, routers, and APs across campus, branch, data center, and cloud environments, boosting productivity across network and security operations teams

# Full stack THEN?

## Rigid:

*Marchitecture promises high performance but falls short; cobbled-together solutions*

## Cumbersome management:

*Requires multiple management interfaces, often with complex CLI*

## Limited integrations:

*Lacks seamless integrations across networking environments and solutions*

## Reactive:

*Requires manual responses to issues after they occur*

# Full stack NOW

## Dynamic:

*Engineered to of meet enterprise demands of today and tomorrow*

## AI-Native management:

*Unified management, built with integrated AI from the ground up*

## Comprehensive integrations:

*Unified platform featuring leading-edge LAN, WAN, data center, location services, security, and an open API architecture for seamless integrations with ServiceNow, Teams/Zoom, Cradlepoint, Zebra, and more*

## Proactive:

*Capable of identifying issues and mitigating them before they impact users*

# Benefits snapshots

An AI-Native full stack approach brings unprecedented efficiencies to complex campus and branch environments. Here are just a few real-world examples.

> **"The network user experience that Juniper offers far exceeds anything else in the market. Juniper's ease of operations and self-healing capabilities, along with the user experience metrics it provides, are outstanding."**
>
> **Neil Holden,** CIO, Halfords

## 8x faster network refresh

### George Washington University enhances experiences

A modern, cloud-managed wired and wireless network simplifies network management and troubleshooting, leading to consistently better experiences for IT and users.

## Over US $500k savings per year

### London Borough of Brent increases staff productivity

An AI-Native network gives IT clear visibility into issues along with recommended fixes, streamlining ongoing management challenges.

## 90%+ reduction in network trouble tickets

### Halfords relies on AIOps for retail transformation

By pivoting to a cloud-native, AI-Native approach, Halfords has simplified management challenges while enabling next-generation retail shopping solutions.

# The full stack networking action guide

Given the sheer scope of deployments and evolution of networking technology up until recently, complexity has long dominated campus and branch networking. The introduction of AI-Native Networking changes everything.

Although the network is always growing or changing across campus and branch environments, an AI-Native Full Stack approach provides an unprecedented opportunity to cut out needless complexity, such as controllers and fragmented management platforms, and align with best-of-breed solutions across the IT landscape. It can also provide the "just right" level of AI capabilities needed to deliver maximum output, supporting exceptional user and IT experiences at the lowest TCO and OpEx.

And like a fine wine, it will only get better over time.

## 01

### Identify a PoC opportunity

Identify an opportunity in the campus and branch to engage in a PoC (e.g., a new site or appliance upgrade).

## 02

### Start with a low-risk trial

Try AI on Us to deploy with live production traffic and see how our solutions fit your organization. Start anywhere in the full stack with any combination of Wi-Fi, switching, and/or SD-WAN solutions.

## 03

### Experience the difference

See how an AI-Native approach delivers greater simplicity, productivity, and reliability.

## 04

### Expand your deployment

Broaden your reach by incorporating additional areas such as campus, branch locations, NAC, data centers, firewalling, and the Enterprise Edge.

# Next steps

## Explore the Juniper full stack

Go deeper into full stack possibilities and solutions for campus and branch.

**Explore our solutions →**

**AI on Us →**

## See Mist AI in action

See how a modern microservices cloud in Juniper Mist AI delivers true visibility, automation, and assurance.

**Watch our on-demand demo →**

## Why Juniper

Juniper Networks believes that connectivity is not the same as experiencing a great connection. Juniper's AI-Native Networking Platform is built from the ground up to leverage AI to deliver exceptional, highly secure, and sustainable user experiences from the edge to the data center and cloud. You can find additional information at juniper.net or connect with Juniper on X (formerly Twitter), LinkedIn, and Facebook.

## More information

To learn more about Juniper Networks AI-Native Networking Full Stack solution, contact your Juniper representative or partner, or visit our website at: https://www.juniper.net/us/en/campus-and-branch.html

## Notes and references

01 Network Management Megatrends 2024: Skills Gaps, Hybrid and Multi-Cloud, SASE, and AI-Driven Operations. EMA on-demand webinar

02 Ibid.

03 Ibid.

04 The NetOps Expert podcast, episode 9: "AI/ML and NetOps—A Conversation with EMA by the NetOps Expert," July 2024.

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