Juniper Networks | Engineering Simplicity

White Paper

THE AI-DRIVEN CAMPUS

Using artificial intelligence for the campus networks of the next decade

TABLE OF CONTENTS

EXECUTIVE SUMMARY

The network for the next decade centers around delivering better user experiences and simplifying IT operations. Traditional wired and wireless LAN solutions lack the scalability, reliability, performance, and agility needed to address today's challenges and diverse enterprise needs.

The AI-driven campus leverages the power of artificial intelligence (AI) in the era of cloud, mobile, and IoT. Juniper's campus solution combines a robust hardware portfolio with the power of Mist AI™ to streamline network operations, improve user experiences, and enable IT teams to focus on strategic initiatives. This white paper explains the components of an end-to-end, AI-driven campus network driven by Mist AI.

Introduction

Enterprise networks are undergoing massive transitions to accommodate the growing needs of cloud-ready networks, as well as a plethora of mobile and IoT devices. Unfortunately, as the number of devices grows, so does complexity. Cloud-based applications enable new business models, provide greater business agility, and support the adoption of key technologies such as unified communications, video, and other latency-sensitive applications. Additionally, the technological advances and widespread adoption of machine learning (ML) and AI can vastly improve operations and experiences for both IT teams and end users.

Network architects are redesigning their networks to accommodate the modern business requirements of cloud-ready applications for data, voice, and video using open standards and software-driven management platforms to reduce operational costs. The ultimate goal is to leverage simpler automation, telemetry, and AI capabilities to build out the network of the next decade.

The Juniper AI-Driven Campus Network

The Juniper Networks portfolio of cloud services, software, and hardware products delivers end-to-end campus network solutions, extending across the WAN, LAN, Wi-Fi, and security domains—all while supporting open standards like Ethernet VPN-Virtual Extensible LAN (EVPN-VXLAN) to drive architectural simplicity, scale, and performance.

Juniper's AI-driven campus is composed of the following:

- A modern, microservices cloud AIOps platform
- AI-powered Wi-Fi and wired switching
- Campus fabrics
- Cloud-ready campus Ethernet switches
- Enterprise-grade access points with Wi-Fi, Bluetooth LE, and IoT
- Juniper Connected Security and network segmentation
- Junos® operating system
- Junos telemetry

A Modern, Microservices Cloud AIOps Platform

The Juniper® Mist cloud architecture is built around microservices for unparalleled agility, scale, and resiliency. Cloud services scale up or down elastically as needed, eliminating the cost and complexity of monolithic hardware. New enhancements and bug fixes can be delivered almost weekly without network disruption. The platform is 100% programmable using open APIs for full automation and seamless integration with complementary third-party products. The Juniper Mist cloud architecture brings an innovative approach to enterprise networks combining artificial intelligence, machine learning, and data science with the latest microservices technology to deliver a solution like no other.

AI-Powered Wi-Fi and Wired Switching

Juniper applies Mist AI to campus networks, optimizing user experiences and simplifying IT operations across a unified wired and wireless solution. Traditional solutions are more than 15 years old and leverage monolithic code bases that are expensive to scale, prone to bugs, and difficult to manage. User experience is the new uptime—the single most important metric for measuring a successful network infrastructure. How does Juniper do it?

Juniper Mist Wi-Fi Assurance replaces manual troubleshooting tasks with automated wireless operations, making Wi-Fi predictable, reliable, and measurable with visibility into user service levels. Anomaly detection automates triggers to capture packets for event correlation, building network intelligence with Radio Resource Management (RRM) at the client level for unprecedented visibility into the user's experience with the wireless network.

Juniper Mist Wired Assurance (see Figure 1) brings AI-powered automation to wired devices. It leverages rich Junos telemetry from Juniper Networks® EX Series Ethernet Switches to enable simpler operations, shorter mean time to repair (MTTR), and improved visibility for end-user experiences of IoT devices, servers, printers, and so on. Juniper Mist Wired Assurance simplifies all aspects of EX Series switching—from onboarding to provisioning to managing from the Juniper Mist cloud architecture.

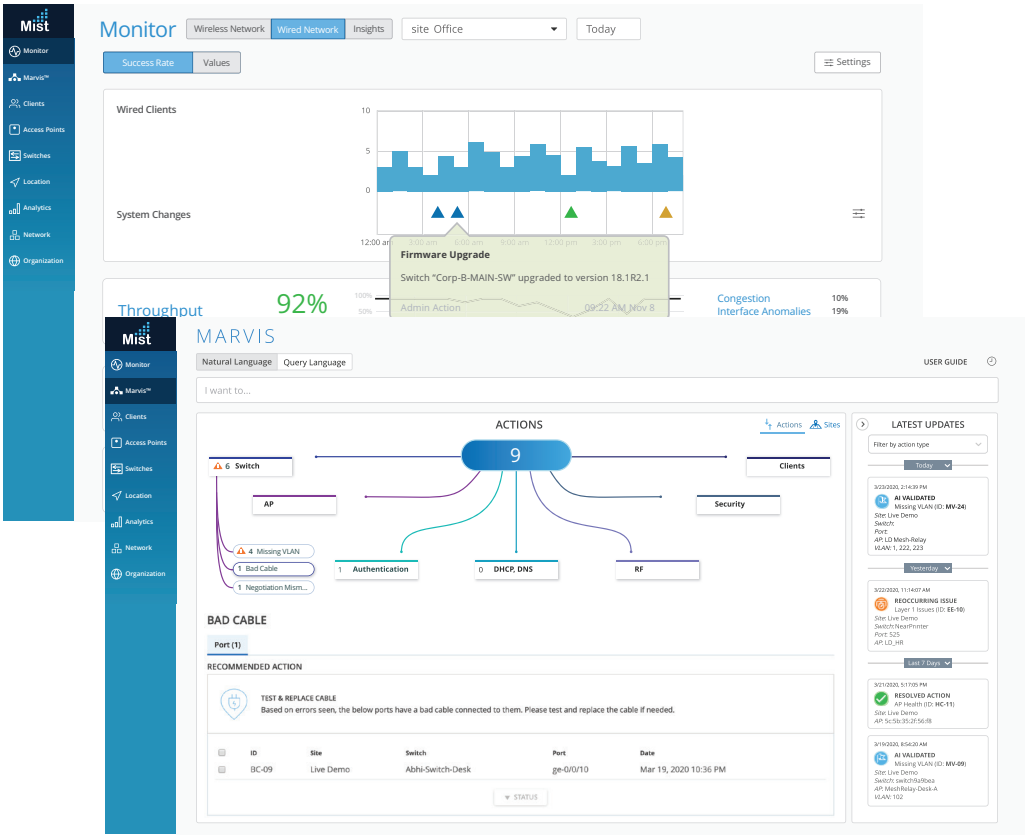

Figure 1: Wired Assurance and Marvis Virtual Network Assistant

Marvis Virtual Network Assistant (Figure 1) is purpose built with Mist AI for enterprise WLAN, LAN, and WAN networks. It applies natural language so users can directly interact with the Mist AI engine, transforming network operations from reactive troubleshooting to proactive remediation through self-driving actions. Marvis increases IT efficiencies, minimizes support tickets, and reduces time to resolution. As AI for IT Operations (AIOps) continues to accelerate, Marvis empowers organizations to manage IT operations at scale with efficiency and accuracy.

Campus Fabrics

The increasing use of IoT devices in the campus dictates that networks be able to scale rapidly without adding complexity. Since many of these devices have limited networking capabilities, they require L2 adjacency across buildings or campuses. This problem was traditionally solved by extending VLANs across these spaces using data plane flood and learn. This approach, however, is inefficient and hard to manage—inefficient due to excess consumption of network bandwidth, and difficult to manage because VLANs need to be extended to new network ports.

EVPN-VXLAN

The AI-driven campus architecture decouples the overlay network from the underlay with technologies such as open-standards Ethernet VPN (EVPN) and Virtual Extensible LAN (VXLAN). This addresses the needs of the modern enterprise network by allowing network administrators to create logical L2 networks across different L3 networks. Juniper supports the following validated EVPN-VXLAN campus fabrics:

- **EVPN multihoming (on collapsed core or distribution)**: A collapsed core architecture combines the core and distribution layers into a single switch, turning the traditional three-tier hierarchal network into a two-tier network. This eliminates the need for Spanning Tree Protocol (STP) across campus networks by providing multihoming capabilities from the access layer to the core layer.
- **IP Clos**: The IP Clos architecture pushes VXLAN Layer 2 gateway functionality to the access layer. This model is also referred to as "end-to-end," given that VXLAN tunnels are terminated at the access layer.
- **Core distribution**: A pair of interconnected EX Series core or distribution switches provide L2 EVPN and L3 VXLAN gateway support. The IP Clos network between the distribution and core layers offers two modes: centrally or edge routed bridging overlay.

An end-to-end EVPN-VXLAN architecture lets you manage your campus and data center as a single IP fabric, with over-the-top (OTT) policy and control provided by Juniper. Any number of switches can be connected in a Clos network or IP fabric, with EVPN-VLAN extending the fabric and connecting multiple enterprise buildings, and VXLAN stretching L2 across the network. An IP Clos network between the distribution and the core layers can exist in two modes: centrally routed bridging overlay or edge routed bridging overlay.

For more information, visit www.juniper.net/assets/us/en/local/pdf/solutionbriefs/3510643-en.pdf.

Aside from EVPN-VXLAN-based architectures, Juniper also supports Virtual Chassis technology, allowing up to 10 interconnected switches to operate as a single, logical device with one IP address. Virtual Chassis technology enables enterprises to separate physical topology from logical groupings of endpoints, ensuring efficient resource utilization.

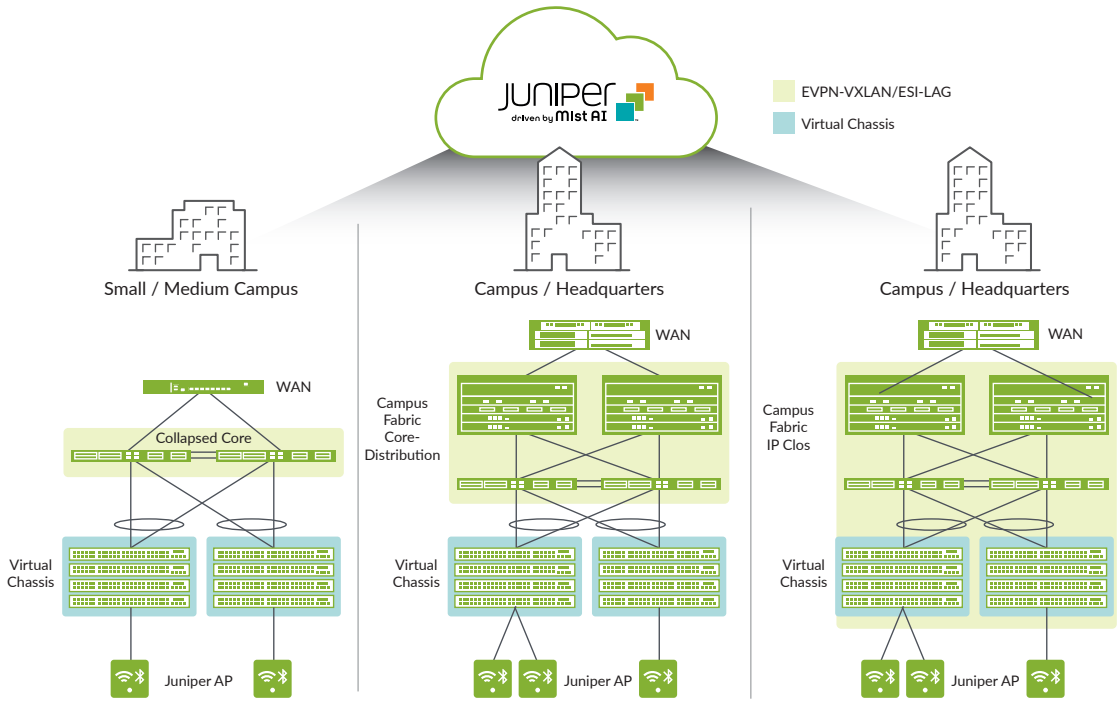

Figure 2: Campus fabrics showing Virtual Chassis and EVPN-VXLAN based architectures.

Cloud-Ready Campus Ethernet Switches

Juniper offers an AI-driven, programmable, and open portfolio of access and core/distribution switches for enterprise campus networks. The access switches are cloud ready and support Juniper Mist Wired Assurance, bringing AIOps to access layer switching. The switches meet a number of campus requirements, such as:

- Cloud-ready and managed by the Juniper Mist cloud architecture
- Multigigabit support
- Media Access Control Security (MACsec) AES128/AES256
- Power over Ethernet (PoE/PoE+/PoE++)
- Scalable fabric architectures via Virtual Chassis and EVPN-VXLAN
- Multivendor support
- Standards-based microsegmentation using group-based policies (GBP)
- Flow-based telemetry

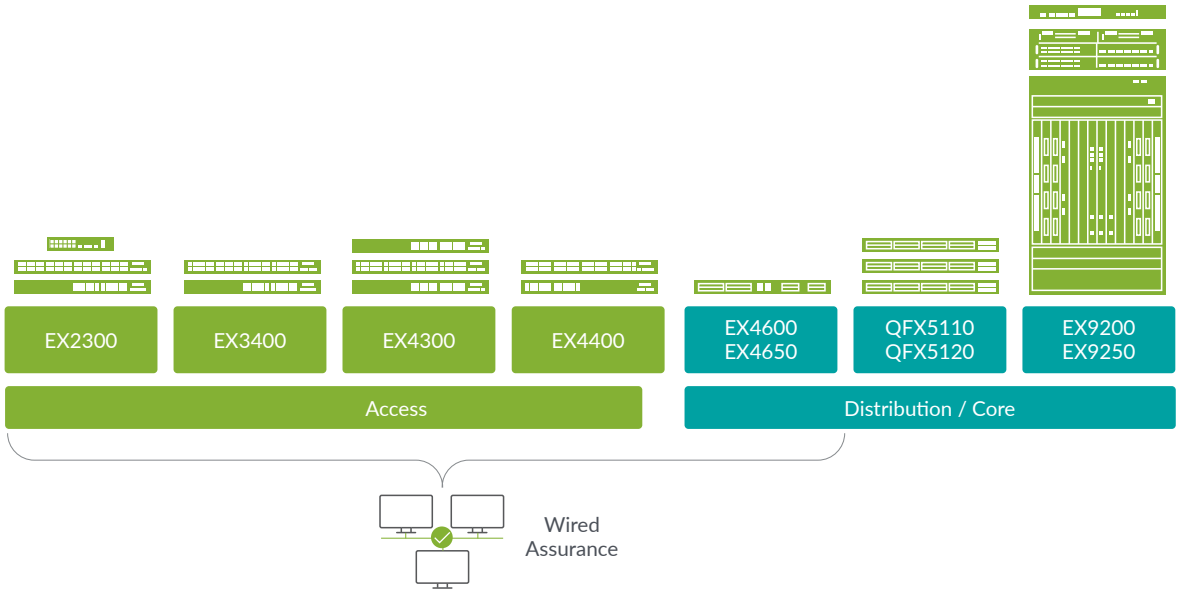

Figure 3: The campus portfolio of EX Series and QFX Series Switches.

Enterprise-Grade Wi-Fi Access Points

Juniper leads the convergence of Wi-Fi, Bluetooth Low Energy (BLE), and IoT with enterprise-grade access points. These products leverage machine learning and event correlation to offer data collection, analysis, and policy enforcement capabilities. The Juniper Series of High-Performance Access Points has a patented dynamic vBLE 16-element antenna array for the industry's most accurate and scalable location services. Juniper Access Points are purpose-built to collect metadata for more than 150 states that flow into the Mist AI engine.

Feature	AP43	AP33	AP32	AP12	AP41	AP21
Wi-Fi standard	802.11ax (Wi-Fi 6) 4x4:4SS	802.11ax (Wi-Fi 6) 5GHz: 4x4:4SS 2.4GHz: 2x2:2SS	802.11ax (Wi-Fi 6) 5GHz: 4x4:4SS 2.4GHz: 2x2:2SS	802.11ax (Wi-Fi 6) 2x2:2SS	802.11ac Wave 2 4x4:4SS	802.11ac Wave 2 2x2:2SS
Antenna options	Internal/External	Internal	Internal/External	Internal	Internal/External	Internal/External
Virtual Bluetooth LE	Yes	Yes	No	No	Yes	Yes

Juniper Connected Security

To combat rising cyberthreats, you need to safeguard users, applications, and infrastructure across the network, end to end and top to bottom. Juniper Connected Security unifies network elements into a single sensor or domain to deliver context-aware threat alerts, then dynamically enforces security policy with software-defined containment designed to reduce the overall attack surface.

By leveraging Juniper switches, Juniper Connected Security provides access security, control, and connection to servers and clients. The access and aggregation switches connect clients and endpoints with endpoint protection software.

Segmentation in Campus Networks

Network architects can adopt a combination of techniques such as micro and macrosegmentation to secure data and assets. A universal EVPN-VXLAN architecture can extend across campuses and data centers for consistent end-to-end network segmentation of endpoints and applications. It also helps minimize Layer 2 flooding to reduce security threats and simplify the network.

- Macrosegmentation is a logical separation of the network inside shared network devices and across shared links. It is achieved in an EVPN-VXLAN network by using VLANs at Layer 2 and virtual routing and forwarding (VRF) at Layer 3. VRF provides isolation by keeping IP traffic between two VRF devices isolated from each other.
- Microsegmentation addresses critical network protection issues by reducing risk and adapting to security demands. Juniper helps implement microsegmentation based on access control lists (ACLs) or firewall filters to control intra-virtual network traffic.

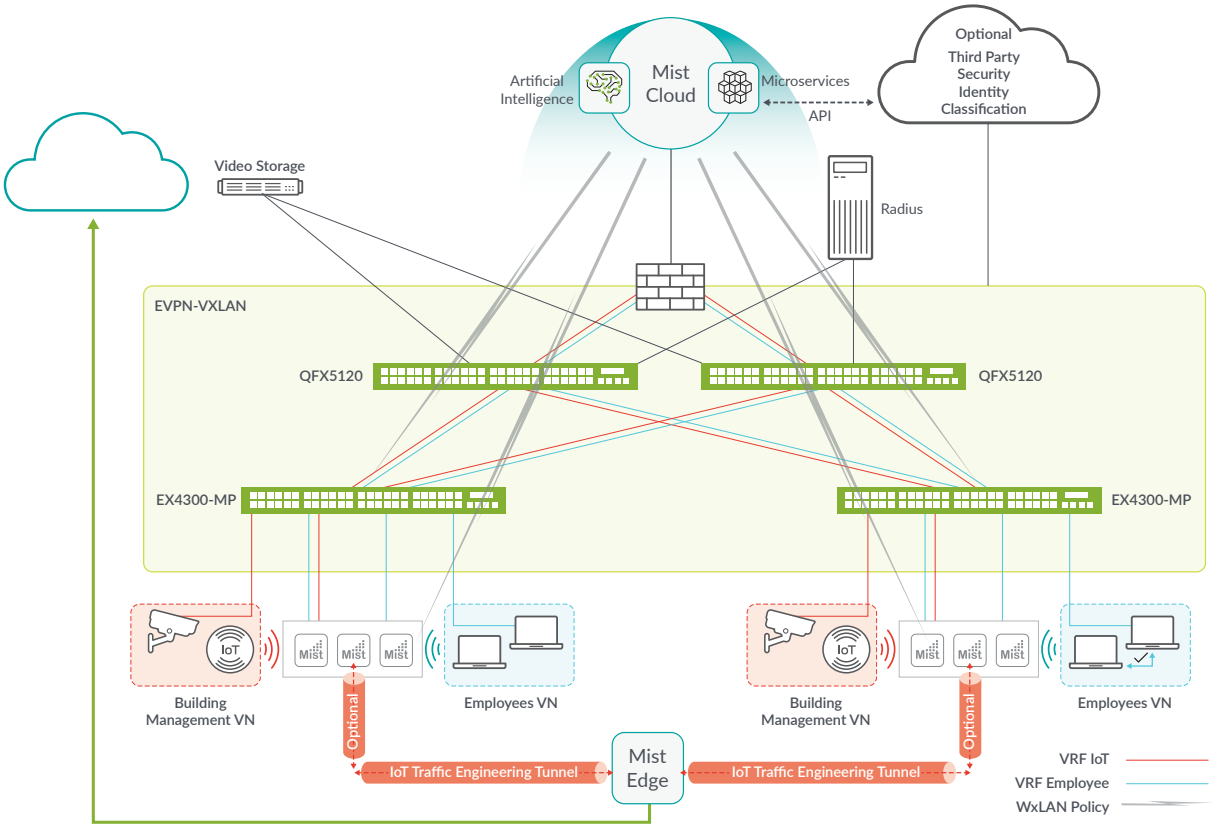

Figure 4: Network segmentation based on employee or device profile

Junos OS: The Foundation of High-Performance Networks

The Junos® operating system provides a common language across Juniper's routing, switching, and security devices. The power of one Junos OS reduces complexity in high-performance networks to increase availability and deploy services faster with lower TCO. The consistent user experience and automated toolsets of Junos OS make planning and training easier, increase the efficiency of day-to day operations, and allow changes to be implemented faster across the network.

What sets Junos OS apart from other network operating systems is the way it is built—one operating system delivered in one software release track and with one modular architecture. Key advantages include:

- One operating system across all types and sizes of platforms reduces the time and effort to plan, deploy, and operate network and security infrastructure.
- One release track meets changing needs in software with stable delivery of new functionality in a steady, time-tested cadence.
- One modular software architecture provides highly available, secure, and scalable software open to automation and partner innovation.

Junos Telemetry

Traditional data models that gather operational health statistics have reached the limits of network scale and efficiency. The Junos telemetry interface overcomes these limitations by relying on a push model to deliver data asynchronously, which eliminates polling. As a result, the Junos telemetry interface is highly scalable and can monitor thousands of objects in a network.

Junos telemetry interface lets you provision sensors to collect and export data for various system resources, such as physical interfaces and firewall filters. Two data models are supported:

- An open and extensible data model defined by Juniper Networks. Because this model features a distributed architecture, it scales easily.
- An OpenConfig data model that generates data as Google protocol buffer (gpb) structured messages in a universal key/value format. gRPC remote procedure calls are based on TCP, and support SSL encryption, so it is considered secure and reliable.

Conclusion

Juniper's AI-driven campus is designed to provide customers with a flexible, standards-based, modern architecture for a cloud-ready future. It meets today's stringent requirements without compromising reliability, security, and agility. Common building blocks, prepackaged automation workflows, and custom automation toolkits extend the benefits of predictive analytics from the data center to the campus and beyond.

Additional Resources

- Campus Design Center
- EX Series Family Webpage
- Juniper Mist Cloud Services
- Live Demo: Wired and Wireless Wednesday
- Live Demo: The AI-Driven Enterprise

About Juniper Networks

Juniper Networks brings simplicity to networking with products, solutions, and services that connect the world. Through engineering innovation, we remove the constraints and complexities of networking in the cloud era to solve the toughest challenges our customers and partners face daily. At Juniper Networks, we believe that the network is a resource for sharing knowledge and human advancement that changes the world. We are committed to imagining groundbreaking ways to deliver automated, scalable, and secure networks to move at the speed of business.

Corporate and Sales Headquarters
Juniper Networks, Inc.
1133 Innovation Way
Sunnyvale, CA 94089 USA
Phone: 888.JUNIPER (888.586.4737)
or +1.408.745.2000
Fax: +1.408.745.2100
www.juniper.net

APAC and EMEA Headquarters
Juniper Networks International B.V.
Boeing Avenue 240
1119 PZ Schiphol-Rijk
Amsterdam, The Netherlands
Phone: +31.207.125.700
Fax: +31.207.125.701

JUNIPER NETWORKS | Engineering Simplicity