# Cloud-Enable the Enterprise with Junos Fusion

Simple, smart, flexible solution for managing the corporate network as a single, logical device

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## Executive Summary

Enterprises worldwide are adopting cloud applications in order to increase their competitiveness, lower IT costs, and provide users with anytime, anywhere access to resources and data. The widespread use of mobile devices, social media, and collaboration tools, along with the growing number of "Internet of Things" (IoT) devices, are all helping drive the adoption of cloud-based applications.

## Introduction

Cloud-enabling the data center is well underway in many organizations. However, to gain the full advantage of cloud-based applications, enterprises need cloud-enabled campus networks as well. The multilayer network architectures traditionally used in the enterprise campus are ill-suited to today's cloud environments—they're static and inflexible, operationally complex, difficult to secure, and expensive to build and operate.

Juniper Networks® Junos® Fusion Enterprise addresses the need for simplified campus networks. Based on Juniper's innovative fabric architecture, Junos Fusion Enterprise treats the enterprise campus network as one logical entity. For enterprises whose campuses also house an on-premises data center, this simplified, single-tier architecture enables IT to use one common core to support access and distribution switches as well as data center top-of-rack access switches.

Simple, smart, and flexible, Junos Fusion Enterprise greatly simplifies management and brings consistency to operations. Junos Fusion Enterprise features high availability, zero touch provisioning (ZTP), and centralized configuration, management, policy, and visibility—capabilities that significantly lower OpEx while making it easier to secure the network.

Built on open, standards-based protocols and open application programming interfaces, this innovative, programmable architecture protects customer investments as well as future-proofs the network. In addition, by using common building blocks, Junos Fusion Enterprise gives organizations an easy, flexible way to transition from traditional enterprise campus network architectures to a cloud-ready enterprise campus.

By simplifying the campus, Junos Fusion Enterprise allows organizations to support new business models, keep up with user expectations and the demands of cloud applications, secure enterprise resources more effectively, and lower total cost of ownership.

## The Drive for a New Approach to Enterprise Campus Networking

Cloud computing has become a mainstay for enterprises worldwide because of the numerous benefits it provides. Cloud-based applications enable new business models, provide greater business agility, and support adoption of key trends such as the increasing use of unified communications, video, and other latency-sensitive applications. Simplified architectures also improve collaboration by supporting the use of applications and data sharing anytime, anywhere, with any device. In particular, the widespread use of mobile devices (both corporate-owned and personal), social media, and collaboration tools, along with the growing number of IoT devices, is increasing enterprise reliance on cloud-based applications. It's no surprise that most new software is being built for the cloud.

While the data center's role in cloud deployments has drawn considerable attention, the enterprise campus network plays a critical role as the on-ramp to cloud-based applications, whether they're delivered via an on-premises data center or private, public, or hybrid cloud. The trend toward centralizing applications and data means that campus traffic is becoming more north-south in direction, which is driving the need for a new approach to campus networking. Cloud architectures help enterprises increase productivity and competitiveness through virtualization and automation technologies that simplify network life-cycle management while delivering operational efficiencies. Cloud-enabling the enterprise campus is key to making configuration, management, and security uniform and simpler across networks.

However, most enterprises still have traditional multilayer enterprise campus network architectures in place, encompassing the access (wired and wireless), distribution, and core layers. Traditional architectures impede an organization's agility in a cloud-based world because they are:

- **Static and inflexible**: Multilayer architectures are static, which makes them inefficient when forwarding traffic and difficult to configure. This hurts business agility and application performance.

- **Operationally complex**: Comprised of numerous layers of switches and VLANs, traditional campus networks require manual deployment and configuration. Network staff typically has to touch one or more pieces of gear every time an employee joins the company, changes locations, or brings a new device onto the network, or whenever a new policy, application, or service is rolled out. These manual processes are time-consuming and prone to error, which drives up OpEx and prevents IT from performing more business-critical tasks.

  In addition, IT typically uses different tools to manage different devices, such as switches, routers, and firewalls, which adds to operational complexity and increases the potential for human errors such as incorrect configurations. Likewise, software upgrades are a major challenge for network operators because all devices must be upgraded to the same software version at once, which requires a long maintenance window. If there are any problems with the new software, it's a huge task to roll back to the previous version, resulting in downtime.

- **Difficult to secure**: Security attacks are increasing in sophistication, number, and type. In fact, it is the variability of these threats that makes them so hard to combat. Error-prone manual network changes can create inconsistencies or even break things, opening up a security gap. Employees who access public Wi-Fi can unknowingly be infected with malware, which they then spread to the corporate network once their device connects. Even a well-meaning employee developing an application can unknowingly download open-source code from an illegitimate website and unleash malware onto the network.

  Today, hackers and cybercriminals are organized businesses building sophisticated software and systems designed to infiltrate enterprises to steal data for financial gain. In the past, security was needed only at the network edge, but now—with new threats popping up every day, sometimes already inside the enterprise perimeter—it has become necessary to secure the entire network.

- **Expensive**: Traditional enterprise campus networks are expensive, requiring considerable capital investment, not to mention cabling and power costs. Network traffic is projected to double year on year, placing significant demands on network infrastructure and staff even as IT budgets remain flat. That means network operators have to handle constantly expanding volumes of traffic, along with increased demands from users and pressure from upper management for greater security, control, monitoring, and measurement of the effectiveness of the network—all without any increase in staff.

What enterprises need is a cloud-ready enterprise campus network that can keep up with user expectations and the demands of cloud applications—one that is extremely simple to deploy and manage, is more effective in securing enterprise resources, and lowers TCO, all so that IT can focus on supporting business imperatives and not network issues.

## Introducing Junos Fusion Enterprise

Juniper Networks designed its Junos Fusion Enterprise solution to address the need for cloud-enabled enterprise campus networks. A key component of Juniper's Unite Cloud Enabled Enterprise, a comprehensive reference architecture for building secure, high-performance corporate networks, Junos Fusion—based on Juniper's innovative fabric architecture—treats the enterprise campus network as one logical entity. By reducing the complex enterprise network to a single platform, Junos Fusion Enterprise greatly simplifies management, reduces both CapEx and OpEx, and brings consistency to operations.

Junos Fusion Enterprise provides a unified enterprise campus network that supports a diverse set of devices, applications, people, and things, while delivering highly available access to resources in the cloud, data center, or WAN. For enterprises whose campuses may also house an on-premises data center, this simplified, single-tier architecture enables IT to use one common core to support all access and distribution switches as well as data center devices; access and distribution switches simply look like extension ports on the core switch.

### Key Components

The Junos Fusion architecture consists of two major components: "Aggregation" devices and "Satellite" devices, which Juniper also calls Linux Forwarding Engines (LFEs). These components work together as a single switching system, flattening the network to a single tier without compromising resiliency.

Network operators can build individual Junos Fusion fabrics comprised of a pair of Aggregation devices and more than 100 Satellite or LFE devices supporting thousands of ports, based on the needs of the network operator. The Junos Fusion fabric is treated as a single logical device, with individual switches appearing as line cards to the management system.
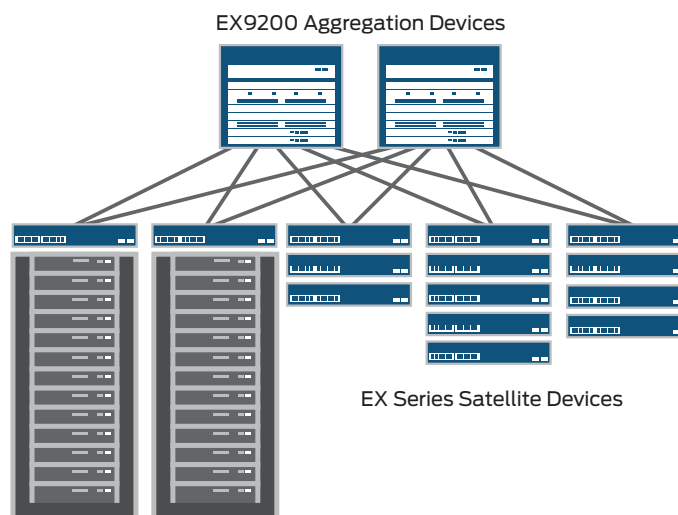


Figure 1: Junos Fusion Enterprise architecture with EX9200 switches as Aggregation devices and EX4300, EX3400, EX2300 and/or EX2300-C switches as Satellite or LFE devices.

**Aggregation devices:** Currently, the Juniper Networks EX9200 line of Ethernet switches functions as Aggregation devices in the Junos Fusion Enterprise architecture. The EX9200 is a line of scalable, programmable, modular Ethernet core switches featuring 13.2 Tbps of chassis throughput; 1GbE, 10GbE, 40GbE, and 100GbE connectivity options; and carrier-class reliability. Its high port densities enable the EX9200 to consolidate and aggregate network layers, dramatically simplifying campus and data center architectures while reducing TCO and lowering power, space, and cooling requirements.

This programmable platform supports ASIC micro-code changes delivered through updates to the Juniper Networks Junos operating system, protecting network investments by allowing existing hardware to support new or future networking protocols. This programmability also allows the EX9200 line to support Junos OS-based automation along with the Junos SDK, which enables integration with Puppet and other automation applications as well as orchestration applications such as OpenStack.

**Satellite devices:** Juniper Networks EX4300, EX3400, EX2300 and EX2300-C Ethernet switches can serve as Satellite or LFE devices in a Junos Fusion Enterprise architecture. Individual EX Series switches, as well as those deployed in a Virtual Chassis configuration, can be members of a Junos Fusion Enterprise fabric; when imported into a Junos Fusion fabric, Virtual Chassis groups are referred to as "clusters" that can include up to 10 switch members. Regardless of the configuration, each switch counts as one unit towards the total number of Satellite devices within the Junos Fusion fabric, although clusters only require a single uplink to the Aggregation device.

## The Junos Fusion Advantage

Unlike traditional campus network architectures, Junos Fusion Enterprise is simple, smart, and flexible—designed specifically to address the shortcomings of today's multilayer architectures and to aid the transition to a cloud-based enterprise infrastructure.

### Simple

Simplicity is key to reducing OpEx, boosting security, and making the enterprise network more agile. In contrast to the static nature and operational complexity of traditional campus networks, Junos Fusion Enterprise greatly simplifies operations by giving network operators a single logical platform and OS version to manage and a single CLI to operate. Likewise, seeing the network as a single logical entity ensures consistency across the campus and makes it easier to locate and isolate threats and secure the network at any point.

Adding new switches, upgrading network software, or quickly reconfiguring the network to accommodate a new application is easy. Junos Fusion Enterprise supports plug-and-play deployment and zero touch provisioning for Satellite devices without any IT intervention. Satellite devices or LFEs are auto-discovered by Aggregation devices and download the correct software image and configuration; likewise, VLANs are auto-sensed and automatically provisioned on the appropriate switch ports. Software Upgrade Groups enable rolling upgrades, providing tremendous flexibility and ensuring the highest application availability by making it easy for operators to qualify new software prior to a full-blown rollout.

In addition, Juniper Networks Junos Space Network Director provides a single point of management for Junos Fusion fabric groups, including those that span both data center and campus devices. This centralized network management and orchestration platform lets IT staff manage network devices and services, including policy, access controls, and VLANs, through a single pane of glass. Junos Space Network Director also lets IT easily visualize campus and data center topologies along with wired and wireless connectivity; analyze traffic; and execute bulk operations.
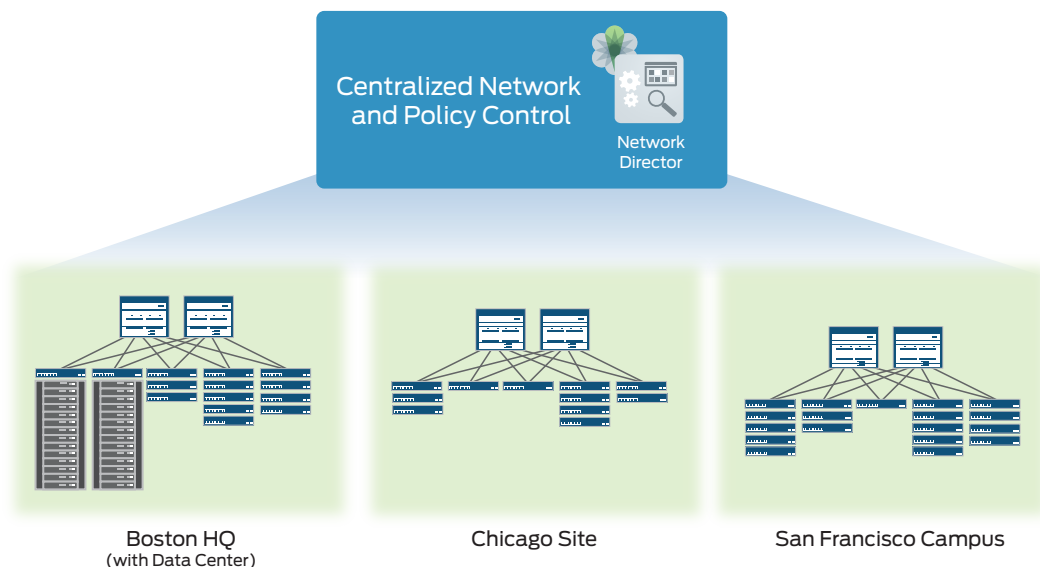


Figure 2: Junos Space Network Director can manage multiple Junos Fusion Enterprise fabrics.

This type of centralized configuration, provisioning, management, policy, and visibility is crucial for business agility and security. For example, with Junos Fusion Enterprise, customers can instantly deploy and update access policies throughout the entire network. IT simply applies policies once, in the EX9200, and Junos Fusion does the rest—there's no need to apply policies to individual devices. Configuration simplicity and consistency are key to eliminating error-prone manual changes that can open up security gaps.

In addition, Junos Fusion Enterprise gives network operators greater visibility into the network, which allows for faster identification, location, and isolation of intruders—capabilities that multilayer architectures just can't provide. Junos Fusion Enterprise is also programmable, with REST APIs for management, orchestration, and event monitoring.

### Smart

The Junos Fusion Enterprise architecture is built on open, standards-based protocols and open APIs, delivering a loosely coupled system with distributed forwarding at scale. It supports native L2, L3, MPLS, and Ethernet VPN (EVPN), providing a bridge to software-defined cloud networking with no protocol or vendor lock-in. Juniper's commitment to programmability and open APIs also gives customers the flexibility to leverage solutions from Juniper's ecosystem of partners.

Junos Fusion Enterprise is also highly resilient. For example, the EX9200 features carrier-grade high availability and application resiliency features, including:

- Separate, dedicated data, control, and management planes
- Master and backup Routing Engines (REs) that can run in active/active mode and support different Junos OS versions for maximum availability and separation
- Hot-swappable, field-replaceable components, including line cards, fans, power supplies, and REs, which greatly simplifies sparing
- Unified in-service software upgrade (unified ISSU), which allows for seamless upgrades with no traffic loss or performance impact.

The EX9200 also features the ability to program its control and management planes via open APIs. This programmability allows the EX9200 to support Junos OS-based automation along with the Junos SDK, which enables integration with Puppet and other automation applications, as well as enabling integration with leading orchestration applications such as OpenStack. Programmability also makes it easier to defend the network against threats and bad actors.

### Flexible

In contrast to static and inflexible multilayer architectures, Juniper designed Junos Fusion Enterprise with flexibility and investment protection in mind. For example, customers can deploy EX4300, EX3400, EX2300 or EX2300-C switches in a multitier architecture today and, with a software upgrade, transform them into Junos Fusion Satellite devices on a wiring-closet by wiring-closet basis, with no change to the physical topology. Customers benefit from the ability to:

- Use the same network hardware for both traditional architectures and Junos Fusion Enterprise
- Have both architectures coexist in the same campus
- Easily migrate from a multilayer architecture to a Junos Fusion Enterprise architecture
- Use the same Junos Fusion architecture across both the data center and campus

Junos Fusion Enterprise also supports seamless migration from 1GbE to 100GbE, with access choices ranging from 100BASE-T to 40GbE, and uplinks between Satellite and Aggregation devices ranging from 10GbE to 40GbE.

In addition, the Junos Fusion Enterprise architecture gives IT the flexibility to interconnect Satellite and Aggregation devices in a variety of ways to best meet the organization's needs. For example, Satellite switches can be:

- Dual-homed to a single Aggregation device
- Dual-homed to redundant Aggregation devices
- Single-homed to a single Aggregation device
- Dual-homed via different Satellite cluster members
- Connected to non-Junos fabric devices using standard Spanning Tree Protocol (STP) or link Aggregation group (LAG)

## Conclusion—Making the Cloud Transition

Enterprises today are embracing the cloud for a host of reasons, including the need for greater agility, universal user access, and lower CapEx and OpEx. Unfortunately, traditional multilayer network architectures are ill-suited to support cloud applications, mobile devices, and the collaboration tools so crucial to business today. Junos Fusion Enterprise is a simple, smart, flexible solution that makes it easy to transition to a cloud-enabled enterprise campus network.

Leveraging virtualization and automation technologies, Junos Fusion Enterprise centralizes control and visibility of the network, significantly reducing operational overhead and streamlining security. The unique architecture of Junos Fusion Enterprise protects a customer's existing investments while also future-proofing the network. Juniper's design choices—support for open, standards-based technologies, programmability, and the use of common building blocks for Junos Fusion Enterprise—were made with an eye to driving down TCO.

By cloud-enabling the enterprise campus, Junos Fusion Enterprise allows organizations to support new business models, helps employees collaborate more effectively, and makes IT a competitive advantage.

## About Juniper Networks

Juniper Networks is in the business of network innovation. From devices to data centers, from consumers to cloud providers, Juniper Networks delivers the software, silicon and systems that transform the experience and economics of networking. The company serves customers and partners worldwide. Additional information can be found at www.juniper.net.

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