JUNOS SOFTWARE: THE POWER OF ONE OPERATING SYSTEM

Reduce Complexity, Achieve Operational Excellence, and Dynamically Deliver Services with Lower TCO
Overview

Juniper Networks® JUNOS® Software offers the power of one operating system to reduce complexity, achieve operational excellence, and dynamically deliver services with lower total cost of ownership (TCO). What sets JUNOS apart from other network operating systems is the way it is built—one operating system delivered in one software release train and with one modular architecture.

The consistent operating environment of JUNOS streamlines network operations and improves the availability, performance, and security of business applications.
Increasing Demands on the High-Performance Network

The network fundamentally runs the operations of high-performance enterprise and service provider businesses. Complex networks that require extensive rework to scale and change can slow down marketplace response and new business initiatives.

While old hardware and outdated or poorly integrated technologies present challenges, it is the software running in IP networks that consumes the most operational time, causes the majority of operational headaches, and creates obstacles to change. Largely based on source code initially built decades ago, legacy network software carries a number of limitations, including:

- **Monolithic software architectures**, which impact network stability, performance, and security with comingle operating system processes vying for the same shared computing resources, and where even a small problem in one process can cascade to affect many others.

- **Complex, error-prone administration tasks**, which add not only time and effort to routine activities but also multiply the risk of human error that can lead to outages or create security vulnerabilities.

- **Multiple release trains and software versions**, which slow down network upgrades with requirements for extensive testing, qualification, and training while impacting the predictable delivery of new service features and fixes.

So, how can you develop a network that scales with traffic growth, adapts along with changing business needs, and delivers new services, all while maintaining the operational stability of your infrastructure?

The solution begins with greater confidence in the underlying network foundation. If you can trust the software supporting your infrastructure, particularly in its most strategic and distributed components, your team can focus more of its time and effort keeping up with traffic demand as well as new application and business requirements.
JUNOS Software: The Foundation of High-Performance Networks

JUNOS Software is a single network operating system integrating routing, switching, and security services. JUNOS helps high-performance businesses to scale and change their network and deliver new services with lower total cost of ownership (TCO).

Different by Design

The key advantages of JUNOS derive primarily from how it is built—what Juniper calls the power of one differences:

- 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 train provides stable delivery of new functionality in a steady, time-tested cadence.
- One modular software architecture provides highly available and scalable software that keeps up with changing needs.

One Operating System

The truly unique nature of JUNOS begins with its most fundamental virtue: a single source code base. This means that Juniper Networks engineers can develop new features one time and then share the code, as applicable, across the many platforms on which JUNOS runs.

A single, cohesive operating system providing a consistent user experience makes planning easier, day-to-day operations more intuitive, and changes faster for customers. Administrators can configure and manage functionality from the basic chassis to complex routing using the same tools across devices to monitor, manage, and update the entire network. Juniper Networks Network and Security Manager provides one management system to manage security, switching, and routing platforms. Inherent interoperability simplifies new feature deployment, software upgrades, and other modifications, allowing operations teams to function more efficiently with less training time and lower costs.

One Software Release

Juniper builds JUNOS along a single “release train”—a disciplined plan for development with strict engineering principles that include rigid quality metrics and testing. Juniper does not replicate or recreate code to form multiple software trains or many different sets of feature packages as is the standard practice for other vendors. Rather, each new release builds on the prior one creating a single release train, delivered in a series of numbered versions. The Juniper Networks approach to software development produces a stable code base that not only reduces the number of unplanned system events, but also the time and trouble of planned maintenance and upgrades.
In over ten years of development, Juniper has delivered new releases of expanding functionality four times each year, year after year. Each new release supports each product family with the code set optimized for its role and application in the network. Whenever you are ready to upgrade, you simply choose and qualify a higher release number than your current version. Juniper provides over three years of support for its extended end-of-life releases. Customers count on the reliability and predictable behavior of the single JUNOS release train and confidently upgrade when they want to enable new functionality in their network.

One Modular Software Architecture

The software architecture of JUNOS is a modular design conceived for flexible, yet stable, innovation across many types of networking functions and sizes of platforms. Modularity and well-defined interfaces throughout the architecture streamline new development and enable complete, holistic integration of services. Through the delivery of one operating system that meets an expanding set of integrated requirements, customers can utilize hardware that can be incrementally expanded to support new growth and services for years to come. The approach extends customer investment not only in devices, but also in their internal systems, practices, and knowledge.

The advantages of modularity reach beyond the stable, evolutionary design of the software. For example, the process modules of the architecture run independently in their own protected memory space, so one module cannot disrupt another by scribbling on its memory. And, the architecture provides separation between control and forwarding functions to support predictable high-performance with powerful scalability from small to very large platforms. The modularity of the JUNOS architecture is thus integral to the high reliability, performance, and scalability delivered by its software design.

Delivering a High-Performance Network Foundation

Propelled by the power of one differences, JUNOS Software has rapidly evolved over the years in many dimensions to accommodate increasingly complex application and service needs. Juniper Networks platforms simultaneously scale integrated security and networking capabilities without compromising high performance and reliability. The consistent operating environment of JUNOS streamlines network operations and improves the availability, performance, and security of business applications.

JUNOS helps customers to save time by reducing operational challenges and improving operational productivity. For example, a survey of more than 120 network organizations found that JUNOS customers spent an average of 25 percent less time on common network operational tasks compared to those using competitive systems. This same study also found that JUNOS reduced the frequency of unplanned events by an average of 24 percent and the duration of unplanned events by an average of 30 percent.
Deploying routing, switching, and security platforms run by JUNOS deliver three key operational advantages to your networking infrastructure:

**Continuous Systems**: Improve network availability and the delivery of applications and services through high-performance software design, high availability features, prevention of human errors, and proactive operations measures.

**Automated Operations**: Increase productivity to lower operational expenses by reducing complexity with time saving configuration, automated scripts for operations tasks, and centralized management.

**Open Innovation**: Enhance flexibility to deliver new services and applications through the open, standards-based philosophy and graceful extensibility of JUNOS, including tools that open development to partners and customers.

### Continuous Systems

The consequence of an outage in a modern multiservice network can be extraordinarily expensive in terms of lost customer connections and transactions, as well as damaged customer confidence and penalties. Many different types of events and errors can cause disruption to network availability. Network equipment downtime can come from planned maintenance activities, unplanned hardware or software events, and most often according to many different studies, human error.

Addressing downtime, therefore, requires a multifaceted design approach that proactively considers all underlying factors. Devices run by JUNOS have a well-deserved reputation for continuous performance and operational stability. The engineering foundations of continuous systems are rooted in the long standing design and software development philosophies of JUNOS; this is not a feature or attribute that can be easily retrofitted. JUNOS functionality for high availability includes expected failover and other service mechanisms, along with a range of capabilities unique to Juniper Networks, such as our disciplined processes for software development, error-resilient configuration, auto scripting abilities, unified in-service software upgrade (ISSU), and automation of technical support services, among others.

Tools for automating operations are essential to maintaining high uptime. They not only reduce the severity and duration when unplanned network events do occur, but also can proactively prevent events from even happening, as discussed in the next section.
Automated Operations
The operational benefits of JUNOS derive not only from the reliability, performance, and security of its design, but also from a dedicated focus on simplified, error-resilient tasks across all operations functions. The hindsight that comes from prior experience has helped JUNOS software engineers find better ways to design operations steps, interfaces, and tools. Many of these improvements simplify operations and reduce human error through increased automation.

Configuration
The JUNOS command-line interface (CLI) is easy to learn, with a feel that is similar to other command sets. Prominent improvements over other systems include error-resilient configuration with changes posted to a candidate file, flexible editing with time-saving shortcuts, automated checks of configurations, rollback flexibility to restore prior configurations, and automated rollback in systems inadvertently isolated by configuration changes.

The most frustrating of human errors are ones that have happened before because they are repeating known mistakes that operations teams could ideally prevent. JUNOS commit scripts directly address this challenge through the customization of the commit verifications that run before a configuration becomes active. A library of scripts can be developed and maintained by your most experienced engineers to ensure that configurations are compliant with your business, network, and security policies. Moreover, these advanced scripting tools include a macro capability that can condense repeated complex configurations into only a few configuration lines and variables.

Monitoring, Troubleshooting, and Problem Resolution
While network operations teams frequently spend their time in reactive mode, proactive discovery of potential issues is the preferred approach. Extensive monitoring and instrumentation capabilities within JUNOS give operations teams broad visibility into system health and device performance, along with the operational status of the network.

One of the characteristics of complex systems is the cascade effect of issues, with small problems capable of rapidly escalating into major ones. JUNOS operation scripts and event policies allow network and security engineers to automate early warning systems that not only detect emerging problems, but can also take immediate steps to avert further issues and restore normal operations. Your operational procedures can be captured in scripts instead of on paper, leveraging expertise across your company. Scripting enables a continuous improvement capability as each outage and issue is diagnosed and proactive avoidance steps are scripted by your top engineers.
Open Innovation

Juniper Networks has promoted and adopted open standards and interfaces to make it easier to manage and operate its network and security platforms in multivendor networks. The time tested interoperability and integration capabilities of JUNOS are evident in deployments in the 40 largest service providers worldwide, and in thousands of enterprise and government networks. The open, standards-based philosophy and graceful extensibility of JUNOS provide the flexibility to evolve your own network architecture to adapt to new, perhaps unforeseen applications and services needs.

The commitment to open standards extends to open interfaces for policy control, network management, and other operations systems. One example is the use of XML as an interface to device configuration and state information. As another, the Partner Solution Development Platform (PSDP) enables customers and partners to develop and deploy new applications on JUNOS. The PSDP provides a powerful set of secure tools and resources, including a software development kit (SDK) with intelligent and secure interfaces to JUNOS routing and service functions.

Portfolio of Platforms

Juniper Networks drives JUNOS innovation through its disciplined development as one network operating system. Juniper solutions provide consistency and reliability with routing, switching, and security platforms run by the same operating system across the high-performance network infrastructure. Our extensive portfolio connects enterprise, branch, and regional offices, central sites and data centers, along with the metro, edge, and core sites of service provider networks. Juniper is leveraging its heritage of best-in-class services and security technology by delivering a broad set of intelligent and dynamic services in JUNOS for security, broadband, voice, and video.

Routing, Switching, and Security

Juniper Networks EX Series Ethernet Switches address the access, aggregation, and core layers of branch office, campus, and data center applications. The EX Series lowers operational expenses, including recurring power and cooling costs. It also reduces capital expenses through innovative virtualization capabilities and the collapsing of network layers. The EX Series meets today’s most advanced switching requirements for security and unified communications with integrated access control policy enforcement and extensive quality of service (QoS) features.

Juniper Networks J Series Services Routers offer predictable high performance and a variety of flexible interfaces that deliver secure, reliable network connectivity to remote, branch, and regional offices. The J Series consolidates market-leading security, application optimization, and voice capabilities onto a single, easy-to-manage platform with options that include integrated Juniper Networks WX Series Application Acceleration Platforms and integrated voice gateway technology from Avaya. Our innovative security approach inseparably integrates routing and firewalls for exceptional performance.
Juniper Networks **M Series Multiservice Edge Routers**, spanning from 5 to 320 Gbps of throughput, uniquely combine best-in-class IP/MPLS capabilities with unmatched reliability, stability, security, and service richness. These multiservice edge routing platforms—deployed predominantly at the service-provider edge and in large, high-performance enterprise applications—enable consolidation of multiple networks onto a single IP/MPLS infrastructure without performance or feature compromise.

**Juniper Networks MX Series Ethernet Services Routers**, spanning from 240 to 960 Gbps of throughput, establish a new industry standard for Ethernet capacity, density, and performance. Offering efficient support of high-density interfaces and high-capacity switching throughput, the MX Series supports a wide range of business and residential applications and services, including high-speed transport and VPN services, next-generation broadband multiplay services, and high-volume Internet data centers.

**Juniper Networks SRX Series Services Gateways** secure enterprise and service provider infrastructure and applications with unrivaled performance and scalability. Based on our revolutionary Dynamic Services Architecture, and engineered from the ground up to offer robust networking and security services, the SRX Series meets the network and security requirements of data center hyper-consolidation, rapid managed services deployments, and aggregation of security solutions.

**Juniper Networks T Series Core Routers**, spanning from 320 Gbps to 25 Tbps of throughput, provide high availability, reliability, performance, and scale, reducing operational and capital costs. The T Series offers sophisticated processing capabilities on a true multiservice platform with seamless integration with optical transport networks. Building core next-generation networks with T Series Core Routers offers a “pay-as-you-grow” path. Providers can reduce operational and capital expenses while customizing the network solution set and user experience.

**Juniper Networks JCS1200 Control System** is the industry’s first high-performance control plane scaling system. JCS1200 introduces independent scale of control and forwarding plane resources to maximize service growth, operational efficiencies, and control. This unique architecture enables service providers to rapidly expand their service offerings, and helps to reduce capital and operating expenditures.
Management and Support

Juniper Networks provides several tools to centrally manage and support networking infrastructure. These products bring new capabilities to network and security management, and include a rich set of features that provide greater control for rapidly creating and deploying new IP services.

**Juniper Networks Advanced Insight Solutions** deliver a comprehensive set of tools and technologies to automate the delivery of network and device information for proactive network protection and support services offered by the Juniper Networks Technical Assistance Center (JTAC).

**Juniper Networks J-Web** is a Web-based GUI that provides users with simple to use tools to administer and manage JUNOS, including configuration, monitoring, and troubleshooting functions.

**Juniper Networks JUNOScope Software** includes monitoring, configuration, inventory, and software management applications for managing IP services for the J Series, M Series, MX Series, and T Series routing platforms.

**Juniper Networks Network and Security Manager** provides an easy-to-use solution that controls all aspects of firewall/VPN security platforms, J Series, M Series, and MX Series routing platforms, EX Series Ethernet Switches, SA Series SSL VPN Appliances, IC Series Unified Access Control Appliances, and IDP Series Intrusion Detection and Prevention Appliances, including device configuration, network settings, and security policy management.

**Juniper Networks SDX300 Service Deployment System** is a robust, customizable application that makes it possible for service providers to rapidly create and deploy new IP services to hundreds of thousands of subscribers.

**Juniper Networks SRC Series Session and Resource Control Modules** provide key policy and control layer functions including policy management, subscriber management, and authentication, authorization, and accounting (AAA), as well as network resource control.
Solution Planning, Implementation, and Deployment

Getting Started with JUNOS

Adoption of any new product or technology initially requires some effort; however, our customers have consistently found the initial short-term activities of JUNOS adoption to be far outweighed by the long-term benefits. As a Juniper Networks customer, you have available to you all of the tools you will need to make the migration to JUNOS simple and safe, from the inherent characteristics of JUNOS itself to a wealth of education and support services.

Juniper Networks Education Services

Certified networking and security professionals are in greater demand than ever before, adding value to your organization through their skilled knowledge, particularly when that knowledge extends across multiple vendors to design best-in-class solutions for your organization. Juniper provides a wide array of training programs and a range of technical certifications. See the complete list of the JUNOS training and certifications at: www.juniper.net/training/.

For teams new to JUNOS Software, the Juniper Networks Technical Certification Program (JNTCP) allows participants to gain practical competence with JUNOS deployment and operations. The Juniper Networks Certification Fast Track Program for enterprises significantly reduces the time and costs of training and certification for experienced networking and security professionals with existing routing, switching, and security knowledge. Find out more at: www.juniper.net/training/fasttrack/.

JUNOS Offers the Power of One Operating System

JUNOS Software is a single network operating system integrating routing, switching, and security services. JUNOS offers the power of one operating system to reduce complexity, achieve operational excellence, and dynamically deliver services with lower TCO. The consistent operating environment of JUNOS streamlines network operations and improves the availability, performance, and security of business applications. Find out more by visiting: www.juniper.net/junos.

About Juniper Networks

Juniper Networks, Inc. is the leader in high-performance networking. Juniper offers a high-performance network infrastructure that creates a responsive and trusted environment for accelerating the deployment of services and applications over a single network. This fuels high-performance businesses. Additional information can be found at www.juniper.net.