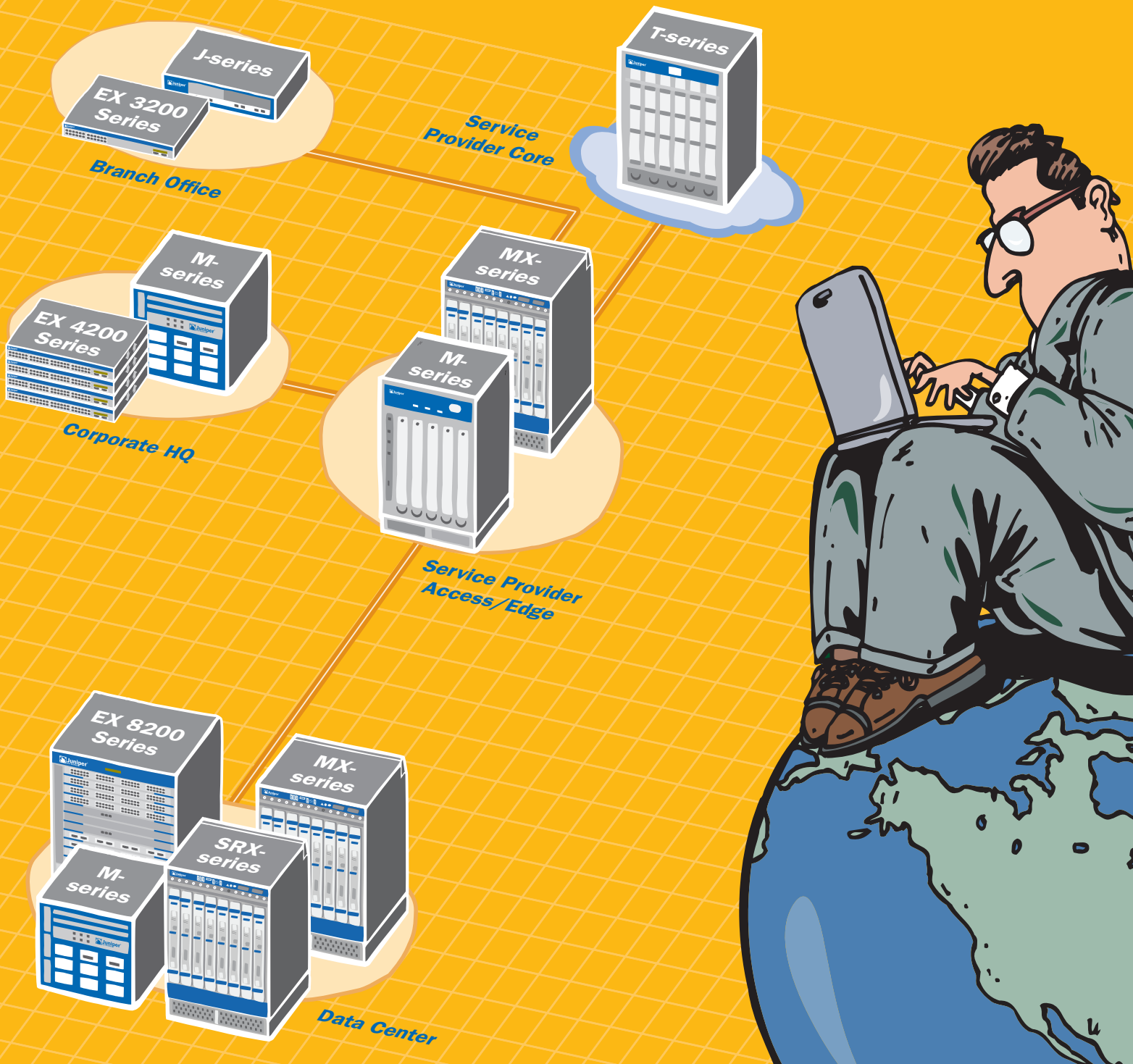# Juniper Networks JUNOS Software

The Power of One Operating System: Reduce Complexity and Drive Operational Excellence to Lower the Cost of Innovation

Your network is the foundation of your business. How does it set you apart to scale, to compete, and to innovate?

JUNOS software delivers the power of one operating system—reducing complexity and driving operational excellence—to lower the cost of innovation.

What sets JUNOS® software apart from other network operating systems is the way it is built—one operating system enhanced through one software release process and built on one modular architecture.

Deploying routing, switching, and security platforms run by JUNOS software provides three key advantages:

- **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**: Drive efficiency to lower operational expenses by reducing complexity with error-resilient 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 software, including tools that open development to partners and customers.

Increasing Demands on Your High-Performance Network

The network fundamentally determines the speed of innovation in high-performance enterprise and service provider businesses. Complex networks that require extensive rework to change can slow down competitive 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While old hardware and outdated or poorly integrated technologies present challenges, it is the software running in IP networks that consumes the most operational time, causes the majority of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 the 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 co-mingled 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 operations tasks**, which add not only time and effort to routine activities but also multiply the risk of human error that can cause extensive 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 does your high-performance business innovate to deliver new high-value services 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 on projects that drive business growth and productivity.

JUNOS Software: The Foundation of High-Performance Networks

High-performance businesses look to Juniper Networks to help solve network challenges as they scale, compete, and innovate. JUNOS software is Juniper Networks' single network operating system running routing, switching and security platforms.

Different by Design

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

- One operating system across platforms reduces the time and effort to plan, deploy and operate.
- One release train provides stable delivery of new features in a steady, time-tested cadence.
- One modular software architecture provides highly available, secure, and evolutionary software.

One Operating System

The truly unique nature of JUNOS software 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 appropriate, across the many platforms run by JUNOS software.

A single, cohesive operating system makes planning easier, day-to-day operations more intuitive, and implementation faster. Network administrators can configure and manage functionality from the chassis to routing using the same tools across devices to monitor, manage, and update the entire network. Built-in interoperability simplifies new feature deployment, software upgrades, and other modifications, allowing IT teams to function more efficiently with less training time and lower costs.

One OS

One Release

One Architecture
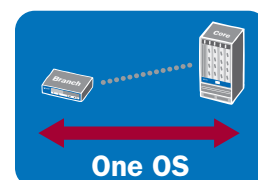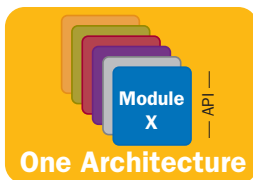
One Software Release

JUNOS software is enhanced through a single "release train"—a disciplined plan for development that supports stable implementation of new features based on rigid quality metrics and testing. Each new version builds upon the prior, so features consistently remain. And each new version is released concurrently for all devices run by JUNOS software.

The Juniper Networks approach to software development produces a more stable code base that not only reduces the number of unplanned system events, but also the time and trouble of planned maintenance and upgrades. To upgrade, you simply choose and qualify a higher release number for each type of platform, unlike other operating systems. Customers have confidence in the reliability and predictable behavior of JUNOS software, and consider upgrades a routinely scheduled maintenance task rather than a high-risk, time-consuming network project.

One Modular Software Architecture

JUNOS software is based on a modular architecture designed for flexible but stable innovation across many types of hardware platforms. The design of independent software modules with protected memory space enhances fault-tolerance. Separation of the control and forwarding functions of the operating system provide predictable high-performance with powerful scalability from small to very large platforms across product lines.

This advanced design supports HA by separating processes so that one does not disrupt another, while providing isolation of any problem for faster troubleshooting and resolution. The modular architecture of JUNOS software streamlines new development and enables complete, holistic integration of newly added services that is much more powerful than the typical bolt-on approach. In developing new capabilities, our engineers can choose to add new modules or to update existing modules, without requiring a total overhaul of the entire code.

Delivering a High-Performance Network Foundation

Accelerated 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.

By improving operational productivity and processes, JUNOS software helps customers to accelerate advanced service and application deployments. For example, a survey of more than 120 network operators found that these JUNOS software customers spent an average of 25 percent less time on common network operational tasks compared to using competitive systems.

Table 1: JUNOS Software Operations Results (Lake Partners 2007)

Survey of 122 Network Operations Team Leaders	
Network Operations Tasks	**Average Time Savings Reported in Using JUNOS Software**
Troubleshooting and Unplanned Events	54%
Monitoring and Optimizing	24%
Upgrading and Maintenance	23%
Adding Infrastructure	29%
All Network Operations Tasks	**25%**

Continuous Systems

The consequence of an outage in a modern multiservice network can be extremely 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 approach to designing systems that proactively considers all of its underlying factors. Devices run by JUNOS software 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 development philosophies of JUNOS software; this is not a feature or attribute that can be easily retrofitted. JUNOS software functionality for high availability include expected failover and other service mechanisms, along with a range of capabilities more unique to Juniper Networks such as our disciplined development process, error-resilient configuration, autoscripting abilities, unified in-service software upgrade (ISSU), 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 occurring, as discussed in the next section.

Automated Operations

The operational benefits of JUNOS software 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 software 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, rollback flexibility to restore prior configurations, and automated rollback in systems inadvertently isolated during 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 software commit scripts directly address this challenge through the customization of the commit verifications that run before a candidate configuration becomes active. A library of scripts can be developed and maintained by your most experienced network engineers to ensure that configurations are compliant with your business and network policies. Moreover, these advanced scripting tools include a macro capability that can condense repeated complex configurations to only a few configuration lines and variables.

Monitoring, Troubleshooting and Problem Resolution

While most network operations groups spend the majority of their time in reactive mode, proactive discovery of potential issues is the preferred approach. Extensive monitoring and instrumentation capabilities within JUNOS software give your operations team broad visibility into system health and device performance.

One of the characteristics of complex systems is the cascade effect of errors. Small problems can rapidly escalate into major ones. JUNOS software operation scripts and event policies allow network 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 network outage is diagnosed and proactive avoidance steps are scripted by your top engineers.

Open Innovation

Juniper Networks has assertively promoted and adopted open standards and interfaces on our security and networking platforms to make it easier to manage and operate them in multivendor networks. The time tested interoperability and integration capabilities of JUNOS software are evident in deployments in the 40 largest service providers worldwide, and in tens of thousands of enterprise and government networks. The open, standards-based philosophy and graceful extensibility of JUNOS software provide the flexibility to evolve your own network architecture to adapt to new, perhaps unforeseen applications and service 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 (eXtensible Markup Language) 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 software. The PSDP provides a powerful set of secure tools and resources, including a software development kit (SDK) with intelligent and secure interfaces to JUNOS software routing and service functions.

Portfolio of Platforms

Juniper Networks aggressively drives JUNOS software innovation through its disciplined development as one network operating system. Juniper's solutions provide consistency and reliability with routing, switching, and security platforms on 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 Networks will continue to leverage its heritage of best-in-class security in delivering JUNOS software innovation.

Routing, Switching, and Security

The Juniper Networks EX-series Ethernet switches address the access, aggregation, and core layers of branch office, campus, and data center applications. The EX-series Ethernet switches lower operational expenses, including recurring power and cooling costs. They also reduce 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.

The 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. J-series services routers consolidate market leading security, application optimization, and voice capabilities onto a single, easy to manage platform. Available options, including integrated Juniper Networks WX application acceleration and integrated voice gateway technology from Avaya. Our innovative security approach inseparably integrates routing and firewalls for exceptional performance.

The Juniper Networks M-series multiservice edge routing portfolio, 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 high-end, high-performance enterprise applications—enable consolidation of multiple networks onto a single IP/MPLS infrastructure without performance or feature compromise.

The Juniper Networks MX-series Ethernet services routers, spanning from 240 Gbps 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.

The Juniper Networks SRX-series dynamic 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 5000 family of gateways meets the network and security requirements of data center hyper-consolidation, rapid managed services deployments, and aggregation of security solutions.

The Juniper Networks T-series core routers, spanning from 320 Gbps to 2.5 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 (NGN) with T-series core routers offers a "pay-as-you-grow" path. Providers can reduce operational and capital expenses while easily customizing the network solution set and user experience.

The Juniper Networks Control System (JCS) is the industry's first high-performance control plane scaling system. JCS 1200 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 JUNOS software. 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 J-Web is a Web-based graphical user interface (GUI) that provides users with simple to use tools to administer and manage JUNOS software, including configuration, monitoring, and troubleshooting functions.

Juniper Networks JUNOScope IP Service Manager includes monitoring, configuration, inventory, and software management applications for managing IP services for the J-, M-, MX-, and T-series routing platforms.

Juniper Networks Network and Security Manager (NSM) provides an easy-to-use solution that controls all aspects of Juniper Networks J-series, EX-series, firewall/VPN, Secure Access (SA), Infranet Controller (IC), and Intrusion Detection and Prevention (IDP) devices, including device configuration, network settings, and security policy management.

Juniper Networks Service Deployment System (SDX) 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 Session and Resource Control portfolio provides key policy and control layer functions including policy management, subscriber management, and authentication, authorization, and accounting (AAA), as well as network resource control.

Juniper Networks Advanced Insight Solutions (AIS) 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).

Performance-Enabling Services and Support
Juniper Networks is the leader in performance-enabling services and support, which are designed to accelerate, extend, and optimize your high-performance network. Our services allow you to bring revenue-generating capabilities online faster so you can realize bigger productivity gains, faster rollouts of new business models and ventures, and greater market reach, while generating higher levels of customer satisfaction. At the same time, Juniper Networks ensures operational excellence by optimizing your network to maintain required levels of performance, reliability, and availability. For more details, please visit **www.juniper.net/ products_and_services**

Getting Started with JUNOS Software

Adoption of any new product or technology initially requires extra effort; however, our customers have consistently found the initial short-term activities of JUNOS software 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 software simple and safe, from the inherent characteristics of JUNOS software itself to a wealth of support services.

Juniper Networks Education Services

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

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

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.

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