Operational Simplicity with Juniper Networks

Combining the Agility of the Cloud with an Intelligent Network to Create the Service Provider of the Future
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Executive Summary
The proliferation of mobile devices, the popularity of social media and apps, and the growing adoption of cloud and collaborative technologies and data analytics are fundamentally changing user behavior and network usage patterns. These changes are driving demand for higher bandwidth, greater network resiliency, and better security, as well as increasing the complexity of enterprise and data center networks.

The upshot of this increased complexity is the added operational costs—carried by the IT organization and ultimately, the business—due to networks that are inherently difficult to manage and operate. Indeed, network complexity is by far the single biggest roadblock to scalability for enterprise and data center networks.

Juniper Networks addresses network complexity in three ways: by designing complexity out of the system; by masking it through sophisticated high-level management tools that span the wired and wireless enterprise, as well as the data center networks; and by automating tasks across the entire network.

With Juniper Networks solutions, enterprises can ensure fast, secure, reliable delivery of voice, video, data, and applications across wired and wireless environments alike. Juniper’s end-to-end network solutions provide robust switching and management capabilities for the enterprise and data center, as well as different flavors of cloud deployments. The breadth of the solutions allows enterprises to enforce security and policy requirements holistically across their organizations.

Introduction: Trends and Challenges for the Data Center and Campus Networks
There are several trends driving the increase in network complexity.

**IT consumerization:** The all-pervading use of smart mobile devices has increased the popularity of bring-your-own-device (BYOD) programs and expectations of seamless connectivity. The scope of these programs, initially limited to smartphones to support employees’ productivity and mobility, has spread to encompass tablets and PCs. According to Gartner, the volume of mobile technology is expected to grow exponentially through 2018. Some companies simply aren’t prepared for what BYOD policies have unleashed. For example, one unexpected consequence of BYOD programs is the doubling or even tripling of the mobile workforce, resulting in unprecedented demand on the network.

Businesses have typically responded to the changing requirements by throwing more hardware at the network to increase capacity and performance. However, this is not a tenable approach for businesses in the long term, since the incremental upgrades have merely added to the complexity of the network.¹

**Communication and collaboration:** The corresponding rise in rich media consumption and unified communications and collaboration applications has also driven up demand on the entire enterprise network. The increasing numbers of users who use the wireless network to access a broad range of business-critical applications have changed the pattern of traffic flow.

Enterprise networks were primarily designed for north-south traffic, which was well understood and managed by network administrators. According to Gartner, however, 80 percent of all traffic in the data center now travels east to west.² With the changing user behavior and use of applications, there can be a combination of traffic patterns that flow north–south or east–west. The network needs to be agile and intelligent enough to handle these flows optimally and efficiently, irrespective of the direction of the flow. Complex networks are incapable of handling such flows optimally, adding to the latency and delay of each transaction.

**Rise of machine data:** Also driving network growth and complexity is the flood of intelligent devices and equipment connected to the network. These include machine-to-machine (M2M) devices—such as printers, projectors, video cameras, and sensors—as well as smart buildings, smart cars, and other types of emerging networked devices. According to The Economist, intelligent devices connected to the Internet are expected to reach 15 billion units by 2015.³ The need to maintain separate wired and wireless networks as the number of connected machines and devices increases results in greater network complexity and operational costs arising from growing space, cooling, and maintenance requirements.

**Cloud adoption:** The final significant trend to impact network complexity today is that of cloud adoption. Businesses are moving data, applications, and operations to the cloud—public, private, or hybrid. End-to-end enterprise and data center networks must be able to support and interoperate with cloud deployments. Most legacy networks are too rigid for the cloud computing universe and incapable of supporting the types of applications that today’s business users are demanding—rich media, social media, and real-time collaboration.

The trends mentioned previously are causing a fundamental shift in how business is being conducted. To be successful, a business has to be agile, responsive, and operate nonstop 24x7—the business relies on the network to accomplish this. However, a complex network cannot provide the foundation for a successful business and poses a challenge for operations, maintenance, and business continuity.

Traditionally, wired and wireless networks have been managed using different tools, requiring staff to train on multiple systems and services more than one management platform. The need to learn and master multiple platforms increases the chances of operational errors and the risk of network downtime.

Most enterprises also have separate LAN, WAN and data center networks that not only lead to disjointed legacy networks, but also complicate the enforcement of security and policy requirements across the entire network.

All this gets in the way of business agility and growth, impeding the IT organization from its primary focus—to add value to the organization. IT and network administrators need to be able to support rapid changes in business requirements by swiftly spinning up new applications, compute resources, or services that easily connect employees, suppliers, and customers. This is possible only if the existing complexity of the network is addressed to simplify operations and management.

Designing Complexity Out of the Network
In previous decades, voice/data networks were successfully converged to solve complexity issues. Later, enterprises struggled with their single-purpose legacy infrastructures, built-in silos, and their location in the enterprise defining them. These infrastructures are challenged to keep pace with rapid changes in compute, storage, and application requirements, resulting in increased network complexity. Today, network products must be designed with simplification as a requirement. Juniper is designing complexity out of the network with advanced management tools, flexible wireless controller systems, and streamlined policy enforcement solutions, as well as by flattening the enterprise switching and data center networks.

Junos Space Network Director
To simplify management of the network for delivery of next-generation cloud services, server virtualization, and rich media applications, Juniper created Juniper Networks® Space Network Director to provide a single-pane-of-glass solution for wired and wireless LANs and data centers. Multiple management tools are consolidated to simplify network operations and deliver a comprehensive advanced platform that prepares enterprises for tomorrow’s applications, services, and workload demands.

Virtual Chassis Technology
Juniper Networks’ unique Virtual Chassis technology has fundamentally changed network architecture by making it simpler, more reliable, and more cost efficient for businesses to deploy and manage their access and core/aggregation networks. Virtual Chassis technology is available on most Juniper switching product lines.

With Virtual Chassis technology, multiple devices or network tiers can be collapsed or consolidated into a single logical entity. For example, in a Virtual Chassis configuration, up to 10 physical switches can be interconnected as a single logical device, simplifying network management by reducing the number of managed devices. Virtual Chassis technology increases network availability while providing enterprises with the flexibility to span distances and scale the network as their business grows, without the operational overhead associated with maintaining a system of independent switches.

In the data center, Virtual Chassis technology simplifies the network by collapsing tiers and flattening the network from three to two layers. This simplification is accomplished by interconnecting Virtual Chassis switch members via high-speed backplane connections over Virtual Chassis ports, conserving valuable access ports and effectively merging what would normally be many LANs into one. As a result, the layers of switching required for network access, as well as latency, are reduced.

This flexibility extends a single Layer 2 access network beyond a single rack, reducing the effort required for network changes such as live server migrations. Moreover, a Virtual Chassis configuration can extend Layer 2 access between sites up to 80 km apart. This innovative approach to networking, along with high-performance packet forwarding capabilities, greatly minimizes the efforts required to deploy new services in today’s virtualized data centers.

Virtual Chassis technology also enables businesses to simplify their enterprise networks. Small-sized to medium-sized campuses (up to 5000 access ports) can collapse their aggregation and core switch layers using the Virtual Chassis solution while consuming fewer 10GbE uplinks. To further simplify the network, up to 10 switches can be interconnected using Virtual Chassis technology to reduce the number of managed devices. Alternatively, up to four Juniper Networks EX2200 Ethernet Switches with Virtual Chassis technology can be interconnected in low-density wiring closets.
In large enterprise networks, collapsing several individual devices into a single logical device eliminates the use of legacy technologies—such as Spanning Tree Protocol (STP)—and the resulting delays from network convergence, enhancing performance and improving resource utilization.

**Virtual Controller Cluster**

For many enterprises, adding wireless access points (APs), controllers, or expanding wireless LAN coverage is a complex, error-prone process that requires multiple configuration steps.

Juniper Networks Virtual Controller Cluster™ technology enables simple, seamless wireless LAN capacity expansion. Simply plug one of Juniper Networks WLC Series Wireless LAN Controllers into a Virtual Chassis Cluster, and it automatically downloads configurations. The system then distributes and load-balances APs among all controllers, including the controller that was just added. All controllers in a Virtual Controller Cluster are managed as a single controller, allowing for simple, seamless, and massive scalability. Because there is a single point of configuration, an update to one device propagates to all members of the cluster. Any APs that are added are automatically configured and placed in service, and software on all controllers can be upgraded in one step. The Virtual Controller Cluster technology is integral to Juniper’s solution to simplify wireless networks by design.

**JunosV Wireless LAN Controller**

Juniper Networks JunosV Wireless LAN Controller is a software instance of Juniper’s wireless controller. It delivers all the functionality of the hardware appliance, but with tremendous deployment flexibility. By providing seamless integration of wired and wireless networks, the JunosV Wireless LAN Controller can help enterprises manage access to the network and services much more effectively. Juniper Networks JunosV Wireless LAN Controller is location-agnostic and platform-agnostic, providing enterprises with maximum deployment options on premises or in the private cloud.

Additionally, the JunosV Wireless LAN Controller can be combined with a cluster of hardware controllers to produce a hybrid cluster—a mix of virtual and physical controllers. Hybrid clusters dramatically simplify life for network managers, allowing them to quickly and easily add capacity with this cost-effective solution—there’s no need to rip and replace. In addition, such mix-and-match platforms allow for consistent features and benefits. There is no need to worry about the specific platform in play, and a consistent feature set simplifies the decision-making process.

**Streamlined Policy and Security**

In order to offer high-value services for entitled users at an optimal network expense, today’s network must adapt in real time to user and application requirements. Juniper Networks Unified Access Control enables access to and delivery of network resources while ensuring comprehensive policy enforcement. It holistically addresses all users who try to connect to the enterprise, regardless of their device. By enabling a single-point-of-policy definition, UAC streamlines the complex process of policy creation and simplifies the update process. With Juniper’s unified policy approach, IT organizations can set policy once and forget about it until a change is needed, confident that the network is secure and network resources are being used appropriately.

**Masking the Complexity of the Network**

One of the biggest challenges with increasingly complex networks is the need for multiple teams, using disparate tools, to manage the myriad systems. This problem is exacerbated by the fact that most of today’s network management tools are poorly designed and difficult to learn and use.

In addition to the features mentioned previously, Juniper Networks Junos® Space Network Director also simplifies the configuration, visualization, monitoring, and administration of even the largest networks. Network operators can use Junos Space Network Director to quickly and easily add capacity with this cost-effective solution—there’s no need to rip and replace. In addition, such mix-and-match platforms allow for consistent features and benefits. There is no need to worry about the specific platform in play, and an entire network view of wired and wireless components and devices, all from one location.

Junos Space Network Director also offers zero-touch provisioning (ZTP), a feature that can be used to quickly and consistently configure devices during initial setup. ZTP simplifies the deployment of networks by not requiring user intervention and accelerates deployment time by providing policy-driven plug-and-play provisioning of the network. It also delivers bulk provisioning to enable faster service rollout and activation, using profile-based and pre-validated configurations to protect against errors. Because these configurations can be performed at logical (access, aggregation, core) or location (sites, buildings, floors, racks) levels, Junos Space Network Director is an especially versatile tool for simplifying network management.
Automating Network Tasks

The final approach Juniper uses to achieve operational simplification is the automation of key network tasks. Junos operating system scripting, automated access control, and unified policy management and enforcement are used to automate key network tasks.

Junos Scripting

Built into Juniper Networks Junos operating system, Junos OS script automation is a powerful and flexible onboard toolset that is available on all Junos OS platforms, including routers, switches, and security devices. An online library of automation scripts can be downloaded and used as needed. The automation scripts are categorized by function—configuration, operations, or network—so you can easily find the automation script that best fits your needs.

- **Configuration automation scripts:** Configuration scripts simplify network deployments and ensure that networks comply with business requirements, such as business rules and network/security policies. Configuration automation scripts do this while minimizing operator errors and optimizing network availability. These scripts also provide change management capabilities that avert and correct errors while simplifying and accelerating the rollout of complex network configurations.

- **Operations automation scripts:** Operations scripts provide network administrators with the flexibility to customize and streamline manual tasks, resulting in greater operational efficiency, minimal disruption to operations, and enhanced productivity. Operations automation scripts also optimize deployments for existing systems and enable greater accuracy when administrators are troubleshooting network problems. By allowing users with varying levels of expertise to change the configuration (while keeping the network consistent), operations scripts also reduce the costs of network events.

- **Network automation scripts:** Network scripts accelerate the resolution of events to reduce downtime and its associated costs. These scripts also automate responses to leading indicators to minimize the impact of events on business operations.

Automated Access Control

Juniper also simplifies network operations by automating the onboarding of clients, regardless of device type or connection method (wired or wireless). Juniper provides simple, secure device onboarding with limited or no IT involvement. Different types of users—both guests and employees on wired and wireless devices—are supported with Juniper solutions.

For onboarding guest devices, Juniper allows self-service provisioning with SMS text on a captive portal. For onboarding employee devices, Juniper offers two solutions—Juniper Networks SmartPass Connect and Juniper Networks Junos Pulse.

SmartPass Connect delivers secure WPA (Wi-Fi Protected Access)/WPA2 wireless and wired network access to both employee-owned (BYOD) and IT-owned devices, providing easy-to-use, clientless-based provisioning that requires no IT involvement. SmartPass Connect pushes a one-time set of configuration settings and unique certificates to the device, which uses it to authenticate to the network.

Junos Pulse provides a combination of automated device provisioning and device-side security. This software enables dynamic SSL VPN connectivity, network access control (NAC), mobile security, and collaboration through a simple user interface. It simplifies and optimizes connectivity to end users and, at the same time, checks their device type and security state, location, identity, and adherence to corporate access control policies.

Unified Policy Management and Enforcement

Juniper also automates network tasks through a comprehensive unified policy enforcement solution. Juniper Networks Unified Access Control is a standards-based, scalable, granular-access control solution that creates and propagates dynamic policies based on user identity and role, device type, applications, and location. It provides network access control for the most complex network, cloud, and application environments, reducing network threat exposure and mitigating risks across the network.

With Juniper, unified policy definition occurs at one central location—the UAC appliance. However, consistent policy enforcement occurs continuously at every point of the Juniper network. When policy changes are needed, IT administrators need to make updates in only one location. The new policy is then automatically enforced everywhere on the network—there is no need to reconfigure or make changes to each enforcement node or network device. Juniper allows network professionals to automate the process of policy management and enforcement throughout the network while consistently delivering services to end users.
Simplify the Network with Juniper Networks

The rising popularity of mobile devices, the growing use of social media and apps, and the increasing acceptance of cloud technology are putting demands on the network for higher bandwidth and greater network resiliency and security. These changes are also increasing the complexity of enterprise and data center networks, which in turn increases operational expenditures (OpEx) and prevents data center networks from scaling when needed.

Juniper Networks addresses network complexity in three ways: by designing complexity out of the system; by masking it through sophisticated high-level management tools that span the wired and wireless enterprise, as well as data center networks; and by automating tasks across the entire network. With Juniper’s solutions, enterprises can ensure fast, secure, reliable delivery of voice, video, data, and applications across wired and wireless environments alike.

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.