WHITE PAPER

JUNIPER NETWORKS EX4200 LINE OF SWITCHES DELIVER TRUE CHASSIS FUNCTIONALITY IN A STACKABLE FORM FACTOR

Combining the Best of Chassis-Based and Stackable Switches

Table of Contents

Table of Figures

Executive Summary

Enterprises are more dependent than ever on their network infrastructure, which supports a wide range of business activities and traffic types. IT is under pressure to build a highly available network that supports converged communications and critical business processes, while at the same time reigning in capital and operational expenses.

Ethernet switches play a critical role in this network infrastructure, but legacy technology fails to meet emerging requirements. Recognizing customer needs for switching platforms that combine the efficiency and cost-effectiveness of stackable switches with the performance of chassis-based switches, Juniper Networks® has introduced the Juniper Network EX4200 line of Ethernet switches with Virtual Chassis technology.

The EX4200 switches merge the pay-as-you-grow economics, small footprint, and low power and cooling requirements of stackable devices with the high availability, port densities, modularity and high-speed backplanes of chassis-based platforms. The EX4200 enables IT to cost-effectively maximize network uptime by deploying highly available equipment wherever needed. At the same time, the EX4200 can reduce IT overhead by creating a single management domain across wiring closets and simplifying connectivity within the data center.

With the EX4200 switches, Juniper Networks is advancing the economics of networking, enabling customers to build the high-performance communication infrastructure they need while lowering capital and operational expenses and freeing funds for more strategic initiatives that increase corporate value.

Introduction

Enterprise networks today support virtually all conceivable business processes and then some. In addition to carrying mission-critical information, corporate networks are providing connectivity for a growing array of devices, from IP telephones and closed circuit TV cameras to building automation systems and more.

With so much critical business activity being conducted online, IT is under pressure to minimize network downtime. Achieving this goal is complicated by the highly distributed nature of the average enterprise; according to some estimates, between 80 and 90 percent of employees work outside the headquarters site. At the same time, IT is being asked to help the enterprise gain a competitive advantage by cutting costs, improving productivity, and deploying technologies that support the company's push into new markets.

Deploying and supporting flexible, non-stop networks in every corporate location is a costly undertaking for most organizations. Many businesses address the economic realities of the IT budget by deploying fixed form-factor switches—simple, cost-effective and scalable solutions that provide basic connectivity for the access layer in distributed locations and can be interconnected to support future port growth.

However, as the demands of the network grow more complex, traditional fixed form-factor switches—commonly referred to as "stackable" switches—fail to deliver the sophisticated capabilities required by today's corporate networks. Instead, businesses find they must deploy more expensive chassis-based switches to satisfy the High Availability (HA) and high-performance requirements that pervade the network, from branch offices and wiring closets to the data center.

Pain Points for High-Performance Enterprises

Recognizing this dilemma, Juniper Networks has developed a new line of Ethernet switches that combines the HA, flexibility and scalability of chassis-based switches with the economical, pay-as you-grow simplicity of stackable switches. With these new switches, Juniper Networks advances the economics of networking by boosting network uptime while cutting capital and operational IT expenses, enabling businesses to reallocate those savings and invest in more strategic initiatives.

Stackable Sweet Spots

For more than 10 years, stackable switches have given IT an inexpensive pay-as-you-grow connectivity platform that is particularly well suited for network access. Available with a fixed configuration of ports in a form factor often referred to as a "pizza box," stackable switches can be deployed quickly, easily and economically. As a result, enterprises have installed stackable switches throughout the access layer in large office facilities, as well as in remote and branch offices of varying sizes ranging from a handful of people to hundreds of employees.

Many enterprises also use stackable switches in their data centers to simplify connecting racks of servers to the network. In this "top-of-rack" scenario, a pair of stackable switches typically sits atop a rack of servers; for redundancy, each server in the rack supports two connections, one to each switch. The switches, in turn, are connected to each other and to the aggregation switches in a dual-homed fashion, providing the necessary "always-on" link between users and critical back-end Web, application and database servers. While this redundant top-of-rack configuration provides some resiliency against equipment failures, stackable switches in general lack many of the HA characteristics found on chassis-based switches, including redundant power, redundant cooling and fast, seamless failover. Despite these drawbacks, stackables are attractive for a number of reasons, including:

- **Low per–port costs:** Because of their simple form factor, stackable switches are a fraction of the cost of chassis-based switches on a per-port basis. With chassis-based platforms, IT must pay for the chassis, power supplies, management modules, and other base components up front, before a single interface card is installed.
- **Pay-as-you-grow capital expense (CAPEX) model:** With stackable switches, IT can expand the network incrementally, one switch at a time. This gives enterprises tremendous flexibility in building their networks to support future growth, and also eliminates up-front investments in chassis-based gear that could be outdated by the time it's fully populated.
- **Small physical footprint:** Stackable switches require less space in wiring closets and data centers than chassis-based switches, giving IT more "head room" in locations where space is at a premium. Likewise, IT has far more flexibility in where it places stackable switches—for example, at the top of a server rack—whereas chassis-based switches can only be installed at the end of a row of server racks.
- **Power efficiency:** According to Nemertes Research, power and cooling costs account for some 60 percent of operations expenses in the data center. Stackable switches generally require less power than a comparably configured chassis-based switch, making them attractive for deployment in the data center as well as in other parts of the enterprise network. In addition to reducing power costs, stackable switches also enable IT to more easily expand switching in locations where there's a cap on available power, such as multi-tenant buildings.
- **Cooling efficiency:** Because stackable switches require less power, they generate less heat, which in turn means they need less cooling than a comparably configured chassis-based switch. This further reduces power consumption and costs, and virtually eliminates the need for external cooling.

In addition to the advantages listed above, many stackable switches today provide Layer 2 through Layer 4 functionality, as well as such features as power over Ethernet (PoE) for IP-enabled devices like telephones, wireless access nodes, security cameras and even clocks. When interconnected, stackable switches can often be treated as a single logical management domain; this "stack of stackables" configuration simplifies operations, enabling IT to manage a group of switches as if it were a single device.

Despite their cost, size and power advantages, stackable switches lack key characteristics of chassis-based switches, such as resiliency and configuration flexibility as well as management efficiency and simplicity. These attributes, among others, are increasingly important as the network assumes a more critical and strategic role in day-to-day business operations.

The Chassis Edge

Chassis-based switches have been optimized for HA and modularity, making them the platform of choice for the network core, aggregation layer, and critical data center applications that require reliable, non-stop operations. Chassis-based switches have been designed with inherent fault tolerance features than can only be approximated by deploying fully redundant stackable switches. And the high-speed, high-port density of chassis-based platforms makes them more efficient to operate and manage than the plethora of independent stackable devices needed to achieve similar port densities.

Traditionally, chassis-based switches have had an edge over stackable switches in parts of the network like the distribution and core aggregation layers, where a high number of fiber-based ports are needed. And because chassis-based platforms are designed for HA, many organizations use them as end-of-row switches in the data center, despite the cable management burden that creates.

Chassis-based switches offer the following advantages over stackable switches:

- **Flexible, modular configuration:** In contrast to the fixed configuration of ports found on stackable switches, chassis-based switches can be populated with the exact mix of low- and high-speed copper- and fiber-based interfaces an enterprise needs. As a result, a single chassis switch can accommodate the various densities of Gigabit Ethernet (GbE) and 10 GbE interfaces required for aggregation and backbone applications.
- **High-performance backplane:** Chassis-based switches use a high-speed backplane to interconnect interface modules with control and services modules. Operating at tens of gigabits per second (Gbps), these backplanes are much faster than the standard GbE interfaces typically used to interconnect stackable switches, as well as the interconnects that vendors provide for "stack of stackables" solutions. A high-performance backplane minimizes potential system bottlenecks and is essential for high speed forwarding.
- **Redundant, highly available power:** Chassis-based switches are typically equipped with dual internal, load-sharing and hot-swappable power supplies. Redundant power eliminates the threat of a single point of failure, while hot-swappable capabilities mean failed power supply units can be replaced in the field without bringing down the network. Redundant power has become critical as enterprises build converged networks that support a range of data, voice, site security and other devices.
- **Redundant, highly available cooling:** Many chassis switches feature redundant fans to ensure sufficient cooling capabilities. If a single fan fails, the remaining fans will continue to cool the chassis switch without compromising functionality. As with the power supplies, field-replaceable fan trays can be hot-swapped without powering down the switch and requiring a network outage.
- **Non-stop forwarding:** Redundant management modules enable chassis-based switches to provide uninterrupted packet forwarding in the event the primary or master management module fails. The "backup" management module typically synchronizes with the "master" to ensure it always has the most current forwarding tables and other key configuration information. When a failure occurs, the hand-off from one control module to another is seamless to avoid a router re-convergence that results in dropped packets; graceful failover allows the backup control module to assume operation with no loss of forwarding information or data.
- **Remote port mirroring:** This management capability accelerates troubleshooting and problem resolution by allowing IT to direct mirrored copies of traffic flows to a centralized location, such as the network operations center, where advanced diagnostic tools and trained personnel are located. Remote IT staff can analyze the mirrored flow to identify, isolate and resolve problems quickly, without interrupting business processes and without replicating the necessary tools and trained personnel in every location.
- **In-service software upgrades:** Chassis-based switches enable IT to perform software upgrades without taking the system down, ensuring maximum uptime. With stackables, IT typically must update each switch individually—a laborious and time-consuming effort that often involves taking each switch out of service.

Not surprisingly, the advanced capabilities and High Availability features of chassis-based switches make them especially desirable for today's mission-critical corporate networks. However, those features come at a price. IT has been forced to pay a premium in terms of per-port and up-front costs, as well as in footprint space for maximum availability in high-impact portions of the network like the core and data center.

But downtime in areas traditionally served by stackables can have drastic financial consequences given the distributed, 24x7 nature of today's enterprises. Consider, for example, the impact of a failed stackable switch on knowledge workers such as financial advisers, insurance agents, or healthcare workers who work in a branch or remote office. A stackable outage can be dire for many workgroups as well, such as call center operators in a remote office or the corporate accounting group at year's end. What enterprises need is a solution that delivers the functionality and High Availability of a chassis-based switch packaged in a simple, scalable and cost-effective stackable form factor.

Juniper Networks EX4200 Line of Switches: The Best of Both Worlds

Recognizing that traditional switch platforms don't meet the needs of today's high-performance enterprises, Juniper Networks has introduced its new EX4200 line of Ethernet switches with Virtual Chassis technology. Juniper is advancing the economics of networking with Virtual Chassis technology, which combines the High Availability, scalability and flexibility of chassis-based platforms with the economical pay-as-you-grow, low-cost-per-port of stackable switches.

Juniper Networks EX4200 switches are available in five models (see Table 1). Using Virtual Chassis technology, up to 10 of the EX4200 switches can be interconnected via a high-speed 128 Gbps virtual backplane to create a Virtual Chassis configuration that operates, and is managed, as a single device.

Each EX4200 switch is also equipped to support optional uplink modules featuring four GbE or two 10 GbE ports. To ensure high availability in wiring closet and data center deployments, the GbE or 10 GbE uplinks may be distributed across any combination of switches that form a single Virtual Chassis configuration, regardless of whether they're in separate wiring closets or at the top of separate racks. In addition, when higher bandwidth is required to connect to aggregation or core switches, IT can link aggregate (LAG) multiple GbE or 10 GbE uplinks from any of the switches that form a Virtual Chassis configuration.

Table 1: EX4200 Switch Product Family

ACCESS PORT CONFIGURATION	POE PORTS	UPLINK OPTIONS	HEIGHT
24-port 10/100/1000BASE-T	8	2-port 10 GbE with pluggable XFP optics 4-port GbE with pluggable SFP optics	1 RU
24-port 10/100/1000BASE-T	24	2-port 10 GbE with pluggable XFP optics 4-port GbE with pluggable SFP optics	1 RU
24-port 100BASE-FX/1000BASE-X (SFP)	N/A	2-port 10 GbE with pluggable XFP optics 4-port GbE with pluggable SFP optics	1 RU
48-port 10/100/1000BASE-T	8	2-port 10 GbE with pluggable XFP optics 4-port GbE with pluggable SFP optics	1 RU
48-port 10/100/1000BASE-T	48	2-port 10 GbE with pluggable XFP optics 4-port GbE with pluggable SFP optics	1 RU

By functioning as a single device rather than individual stacked platforms, the EX4200 switches provides enterprises with the scalability of a chassis-based switch without the network operations and management burden associated with stackables. In addition to HA and scalability, the EX4200 also provides a level of flexibility not possible with either stackable or traditional chassis-based platforms.

For example, the high port densities of the EX4200 gives IT unlimited deployment options in the distributed enterprise. With the ability to support up to 480 copper or 240 fiber GbE ports and up to 20 10 GbE uplinks in a single Virtual Chassis configuration, the EX4200 switches are ideal for both access and GbE aggregation deployments. To date, enterprises have been forced to purchase chassis-based aggregation switches to get the same number and type of fiber-based ports available with the EX4200 switches.

Alternately, the EX4200 can help enterprises flatten their networks and cut costs while boosting availability. When deployed in the wiring closet, the EX4200 can be configured with sufficient high-speed interconnections to link directly to the network core or backbone. This two-tier architecture eliminates the need for the middle tier or aggregation layer found in many medium-sized networks, enabling IT to simplify the network and reduce the total number of switches needed. Simplifying the network in this manner cuts both capital and operational expenses—savings that can be reinvested in strategic initiatives that increase business value or applied directly to the bottom line.

Similarly, the EX4200 switches can greatly simplify connectivity within the data center, eliminating the cable management headaches posed by end-of-row chassis-based platforms on the one hand or an explosion of stackable switches on the other. Organizations that use stackable switches in the data center usually deploy two switches at the top of each rack to ensure HA and sufficient GbE port densities for server connectivity.

For example, IT would typically install and interconnect two stackables per server rack for a total of, in this particular scenario, 10 individual stackable switches across five server racks. In contrast, with the EX4200 switches, IT would still deploy 10 switches but could interconnect them using Virtual Chassis technology to create two configurations consisting of five EX4200 switches each, one from each server rack. The EX4200 switches would be interconnected to ensure each server rack had fully redundant connectivity, but each Virtual Chassis configuration would be managed and maintained as a single unit, reducing the management burden by a factor of five.

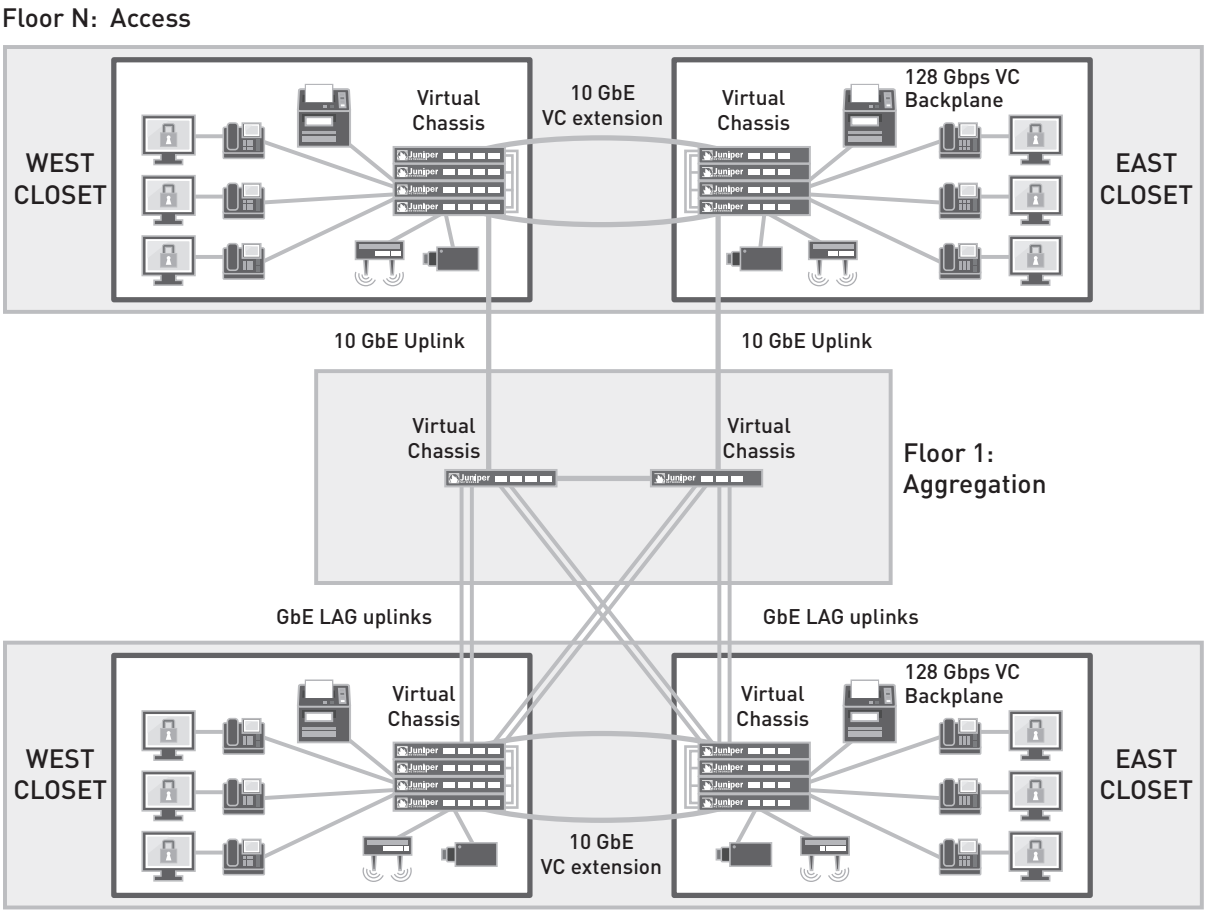

Figure 1: The Juniper Networks EX4200 switches flatten the network by providing sufficient high-speed port densities to link wiring closets directly to core switches in campus environments.

Using the EX4200 switches with Virtual Chassis technology instead of traditional stackable switches in this scenario enables IT to reduce the effective number of individual access switches while cutting operational expenses much more. Juniper Networks EX4200 switches give IT the low price and simplified cabling of stackables with the single management domain and HA of a chassis-based switch, while significantly lowering latency for server-to-server communications.

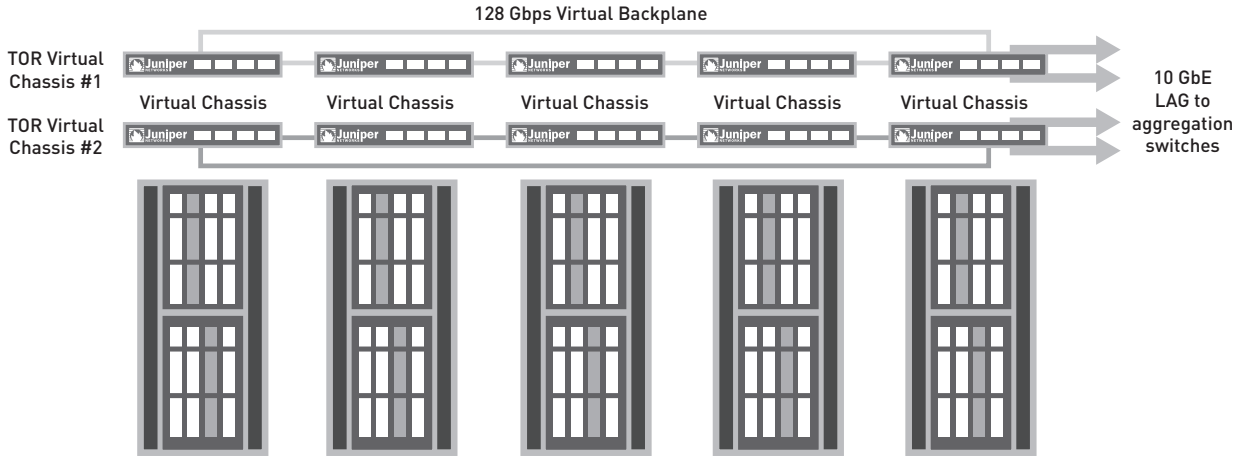

Figure 2: In top-of-rack applications, the Juniper Networks EX4200 switches can be deployed in pairs to provide the necessary redundancy while effectively behaving as two switches, reducing management overhead by a factor of five.

The Juniper Networks Virtual Chassis Advantage

With the EX4200 switches, IT gets the best of both worlds: the deployment flexibility and economics of stackable platforms combined with the advanced Layer 2 though Layer 4 functionality and carrier-class reliability of a high-end chassis platform. In addition, the EX4200 line supports a full suite of converged communications capabilities that greatly simplifies the job of building a converged infrastructure supporting data, voice, telemetry and other traffic.

The EX4200 switches deliver the benefits of both stackable and chassis switches, including:

- **Highly available power:** As with traditional chassis-based platforms, the EX4200 supports dual load-sharing, internal hot-swappable AC power supply units (PSUs) to ensure highly available operations and low mean-time–to-repair (MTTR). External redundant PSUs are also available.

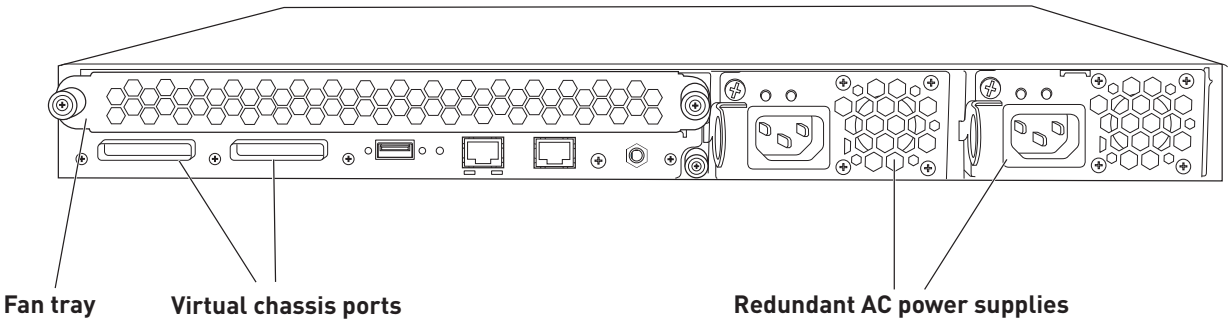

Figure 3: The EX4200 line of switches offer optional redundant field-replaceable, hot-swappable AC power supplies and field-replaceable fan trays as high availability features.

Highly available cooling: Each EX4200 switch features a field-replaceable fan tray with three blowers. If any of the three blowers fail, the remaining fans can provide sufficient cooling, ensuring that the switch continues to operate. Trays with failed blowers can be replaced in the field, eliminating the need to take the switch down and significantly lowering MTTR.

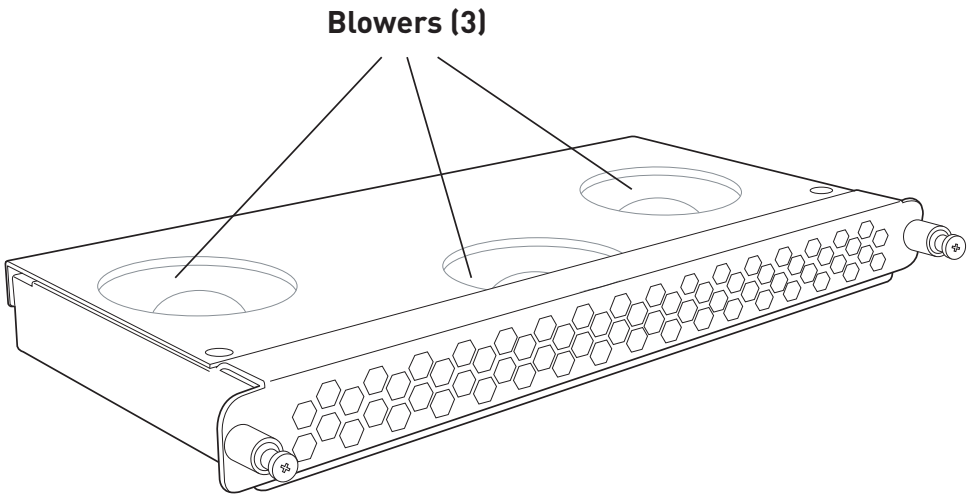

Figure 4: The EX4200 fan tray includes three blowers, providing a built-in backup in the event any one blower should fail.

- **Highly efficient power:** The EX4200 switches also represent an eco-friendly "green" alternative to traditional chassis-based switches. Due to their compact stackable footprint, the EX4200 line generally requires significantly less power than chassis-based switches configured to deliver equivalent connectivity. For example, in aggregation scenarios where 48 fiber-based GbE ports and four 10 GbE uplink ports are needed, two EX4200 switches requiring only 640 watts of power can be deployed—a highly efficient solution compared to a leading vendor's chassis-based platform, which requires 15 rack units and up to 6,000 watts of power to deliver the same fiber port density.
- **Low per-port pricing:** The EX4200 switches achieve a low per-port price by leveraging the economics of the stackable form factor, delivering the rich features and HA of a chassis-based switch at a fraction of the cost to lower CAPEX. In addition, because EX4200 switches in a Virtual Chassis configuration operates as a single device rather than individual switches linked together, operations and management are simplified, reducing operational expenses (OPEX).
- **Pay-as-you-grow CAPEX model:** Using the same CAPEX model as traditional stackables, the EX4200 switches let IT add switch elements as needed while gaining the HA features of a traditional chassis-based platform. Juniper extends this pay-as-you-go model to fiber ports, enabling IT to build a high-density fiber infrastructure incrementally. With the EX4200 switch, enterprises benefit from both lower CAPEX and lower initial deployment costs. In addition, because the EX4200 switches can be deployed in branch offices, wiring closets and data center access portions of the network, IT benefits from common sparing for added savings.
- **Flexible, modular configuration:** Using Virtual Chassis technology, up to 10 individual switch elements capable of line-rate forwarding can be combined as a single virtual device. Copper-based switches are available with 24 or 48 10/100/1000BASE-T ports, for up to 480 ports per Virtual Chassis configuration. A fiber-based switch with 24 100BASE-FX/1000BASE-X ports and small form-factor pluggable transceiver (SFP) optics is also available, allowing for a maximum of 240 fiber ports in a single Virtual Chassis configuration. In addition, each switch unit can be configured with up to four GbE or two 10 GbE front-panel uplink ports, for a maximum of 40 fiber GbE or 20 fiber 10 GbE uplink ports per Virtual Chassis configuration. The optional uplink modules are field replaceable, which gives IT the flexibility to install or swap out uplinks as needs evolve or change.
- **High-performance, extensible backplane:** Each EX4200 switch supports two dedicated backplane ports to provide high-speed connectivity between devices when Virtual Chassis technology is employed. The virtual backplane operates at 128 gigabits per second (Gbps) and can be used to link switch units up to three meters apart. This high-speed interconnect technology, which operates in the same way as a switching fabric in a chassis-based platform, delivers twice the performance of the fastest "stack of stackables" interconnect, and is significantly faster than the standard links typically used to interconnect stackable switches.

In addition to performance advantages, the virtual backplane simplifies operations and management. With traditional stackable switches, each switch maintains its own control plane, including routing and bridging tables. Because the switch elements using Virtual Chassis technology are linked via the virtual backplane, an EX4200 switch operates from a single control plane, with reachability information shared automatically across interconnected switch elements. This eliminates the need for IT to instantiate location and reachability information in each switch, reducing the configuration burden.

The Juniper Networks Virtual Chassis technology also operates over the 10 GbE uplink ports, giving enterprises the flexibility to interconnect units up to hundreds of meters apart as a single, logical device. Using the 10 GbE interconnect, IT can create a Virtual Chassis configuration that spans multiple wiring closets, floors or even buildings that can be managed, monitored and even upgraded as a single device. In addition, using the EX4200 switch's dual uplink ports, IT can easily create a resilient topology (typically a ring) where any link can fail without interrupting network service.

- **Small physical footprint:** Each EX4200 switch is based on a common and compact stackable footprint with a single rack-unit profile—considerably smaller than chassis-based switches, which occupy in the neighborhood of 15 server rack units.
- **Flexible power over Ethernet (PoE):** Traditional stackable switches support only partial PoE. In addition, they require IT to use power management software to enable PoE on selected ports and to control the amount of current per port. Chassis-based switches can deliver full 15.4 watts on all ports, but require a large power supply to operate. In contrast, Juniper's copper-based EX4200 switches provide full and partial Class 3 PoE capabilities, offering 8, 24 and 48 PoE port switch options. Not only do the EX4200 switches offer 15.4 watts on all PoE ports, they do so in a more power-efficient manner than chassis-based switches. The EX4200 series switches' flexible PoE options make it easy for enterprises to connect and power a variety of IP-enabled devices over the network, including voice over IP (VoIP) phones, closed circuit TV systems, badge readers, telemetry centers and automation equipment.
- **Plug-and-play provisioning:** To ease deployment of converged networks, the EX4200 switches support the link-layer discovery protocol (LLDP). LLDP is a standard protocol that allows Ethernet network devices such as switches, routers and wireless access points to discover other nodes on the network and advertise information about themselves to other nodes. With LLDP, the EX4200 can automatically identify VoIP phones, security cameras and other endpoints and determine their power requirements, for example. Because LLDP is a standard, the EX4200 can interoperate with end nodes from multiple vendors. This enables enterprises to freely choose VoIP and other endpoint solutions rather than locking them into a turnkey solution provided by the switch vendor.
- **Advanced quality of service (QoS) and security policies:** Juniper Networks EX4200 switches have been designed with the QoS and security functionality needed to support converged communications. Traditional stackable switches offer minimal QoS and a limited number of access control entries (ACEs). In contrast, the EX4200 switches support rich QoS functionality, with eight queues on every port and a range of policy options that include a low-latency queue, weighted round robin, weighted fair queuing and weighted random-early detection. With up to 14,000 ACEs, the EX4200 switches can support granular QoS and security policies at Layers 2 through 4.
- **Non-stop routing:** When two or more devices are deployed, the EX4200 switches are capable of supporting non-stop routing through a combination of hardware capabilities and software functions embedded in Juniper Networks JUNOS® Software. The mature, time-tested JUNOS runs across the entire Juniper router and switch product lines.

  On the hardware side, each EX4200 switch includes an integrated Route Engine that is a scalable, powerful, ASIC-based packet-forwarding engine. Adapted for the EX4200 switches, the Route Engine delivers the same level of carrier-class performance and reliability to the EX Series switches that Juniper routers bring to the world's largest service provider networks, enabling the EX4200 switches to meet the needs of today's highest performing enterprises.

  To ensure uninterrupted operations, the EX4200 switches provide 1:N redundancy and seamless Routing Engine failover, based on the number of interconnected switch elements (up to a maximum of 10) per Virtual Chassis configuration. This design contrasts with a typical "stack of stackables" in which one switch is elected to serve as the "master" to manage the entire stack. If the designated master fails, the other switches must restart all control plane functions and reboot to elect a new master—a process that precipitates a router re-convergence in which the downed stack is routed around, disrupting established routing tables and forwarding paths.

Some chassis-based switches provide seamless failover by supporting a master and hot-standby or "backup" route engine; in the event one route engine fails, graceful route engine switchover (GRES) takes place. The JUNOS Software executes GRES on the EX4200 switches using the same architectural model that Juniper employs on the chassis-based Juniper Networks T Series Core Routers, M Series Multiservice Edge Routers and MX Series Ethernet Service Routers and Juniper Networks EX8200 line of chassis switches.

What this means is that in each Virtual Chassis configuration consisting of two or more switches, one switch's Routing Engine is elected as the "master" while a second switch serves in hot-standby mode as a backup. The remaining EX4200 switches are ready to assume the backup position if either the master or backup fails. IT can prioritize the Route Engines to assign master and backup status, as well as determine in what order switches will ascend if the master or backup fails, ensuring seamless and immediate failover to keep the network up and running.

JUNOS further supports non-stop routing with its modular architecture that separates control, forwarding and services planes. Each JUNOS daemon runs in its own protected memory space and can restart independently, so that the failure of one module will not disrupt any others. If a malfunction does occur, the failure is contained to that specific module while the rest of the system continues functioning uninterrupted. In contrast, a malfunction often causes a full system crash in switches and routers that run a monolithic operating system.

- **Robust, intuitive management:** The EX4200 switches provide true chassis-like operations and management. In addition to a standard Command Line Interface (CLI), Juniper offers three management options:
  - J-Web, a standard feature on the EX4200, is an embedded device manager that allows users to configure, monitor, troubleshoot and perform system maintenance on individual switches via a browser-based graphical interface.
  - The Juniper Networks Network and Security Manager provides system-level management across multiple switches in a Virtual Chassis configuration, enabling IT to exercise complete control over the entire system from a single console.
  - IT also has the option to export EX4200 switch management data to leading third-party management systems such as HP OpenView, IBM Tivoli and Computer Associates Unicenter, among others.

  In addition, each EX4200 switch has a front-panel LCD display that IT can use for basic configuration, troubleshooting and identification. Juniper has implemented the same slot/module/port numbering schema on the EX4200 as it uses on other chassis-based products and displays this information on the LCD panel, making it easy for IT technicians to find a specific module or port on a specific switch within a Virtual Chassis configuration.
- **Remote port mirroring:** The EX4200 switches supports remote Layer 2 and Layer 3 port mirroring for centralized monitoring and troubleshooting.
- **In-service software upgrades:** As part of their HA characteristics, the EX4200 switches will support in-service software upgrades to facilitate continuous operations. This capability will be available in a future software release.

Conclusion – The Juniper Networks Advantage

With the introduction of its EX4200 line of Ethernet switches, Juniper is advancing the economics of networking, helping enterprises optimize their investments in innovation. By combining the robust features and High Availability of a chassis-based platform with the pay-as-you-grow model of stackable switches, Juniper is giving enterprises a flexible switch platform that enables them to boost uptime while lowering capital and operational expenses. No other platform offers enterprises the economics, footprint, and low power and cooling features of a stackable with the port densities, modularity, high-speed backplane, and HA of a chassis-based platform.

The Juniper Networks EX4200 switches can reduce IT overhead, whether reducing the number of devices, creating a single management domain across wiring closets, or simplifying connectivity within the data center. At the same time, the EX4200 switches enable IT to cost-effectively maximize network uptime by deploying highly available equipment wherever it's needed. For medium- and high-density access environments where incremental growth and HA are requirements, the EX4200 switch is the ideal solution.

Juniper Networks commitment to employ JUNOS on the EX4200 switches—and all of its switch and router products—yields additional benefits for customers. The JUNOS Software development process follows a single release train, which ensures that each new release of JUNOS is available for all platforms at the same time, and that each release is a complete superset of all previous versions. This single software implementation, regardless of platform or release version, greatly simplifies new feature deployment, software upgrades and other network modifications, provides compatibility across all Juniper products running JUNOS, and reduces the learning curve for new deployments. As a result, customers benefit from lower OPEX due to simplified maintenance and management across Juniper products.

Designed to address both the technical and economic requirements of the high-performance enterprise, the Juniper Networks EX4200 line of switches with Virtual Chassis technology can help businesses build highly available, converged networks while reducing capital and operational expenses. By advancing the economics of networking, Juniper helps customers free up funding and time that can be reallocated to strategic initiatives that increase corporate value.

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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