Simplified data center networking with two-tier architectures

By Robert Lesieur and Charles Goldberg

Building an Efficient Data Center with Dell™ PowerConnect™ J-Series switches enables IT departments to consolidate traditional three-tier network architectures to only two tiers—helping to simplify management, increase performance, and reduce costs.

The Dell Efficient Data Center approach is designed around open, capable, and affordable solutions that enable organizations to choose the most appropriate technologies for their needs while helping protect their technology investments. A key component of this strategy is a network that enables high-performance communication in a virtualized environment.

Dell PowerConnect J-Series Ethernet switches are powerful enough to deliver standards-based networking solutions that consolidate the traditional three-tier network architecture to only two tiers. Running Junos from Juniper Networks—a single-source network OS that runs on an integrated security, routing, and switching infrastructure—these switches offer high performance, streamlined scalability, and simplified management. This uniform approach can help IT departments meet the needs of environments ranging from the smallest to the largest networks while controlling costs and tackling the ongoing challenges of a constantly changing business landscape.

Efficient network OS

Junos software helps PowerConnect J-Series switches deliver a range of efficiencies across small to large enterprise networks. For example, a February 2009 study conducted by Forrester Consulting demonstrated that using Junos across switches and routers can help organizations reduce operational costs for a range of specific network tasks, including planning and provisioning, deployment, and planned and unplanned network events.[1] This study reported a 41 percent reduction in overall network operations costs, reflecting combined total savings across specific task categories such as planned maintenance and support, resolution of unplanned network events, and infrastructure deployment, including the following:

- 54 percent savings on costs for planned maintenance and support
- 27 percent savings on costs for network downtime (based on reduction in frequency and duration of unplanned network events)
- 41 percent savings associated with increased network stability and reliability (based on reduced

Efficiency gains

Dell PowerConnect J-Series switches running Juniper Networks® Junos® OS enable streamlined, high-performance networking in virtualized data center environments.

- **Up to 41 percent reduction** in overall network operations costs
- **Easy expansion** with Virtual Chassis technology
- **Simplified management** through a consolidated network design

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[1] "The Total Economic Impact of Juniper Networks' JUNOS network operating system," by Forrester Consulting, February 19, 2009, juniper.net/us/en/reports/junos_tei.pdf.

Traditional network design

Consolidated network design with virtualized access

Wide area network (WAN) interface

Tier 3: Core

Dell PowerConnect J-EX8216 switches

Tier 2: Aggregation

Tier 1: Access

Virtual Chassis

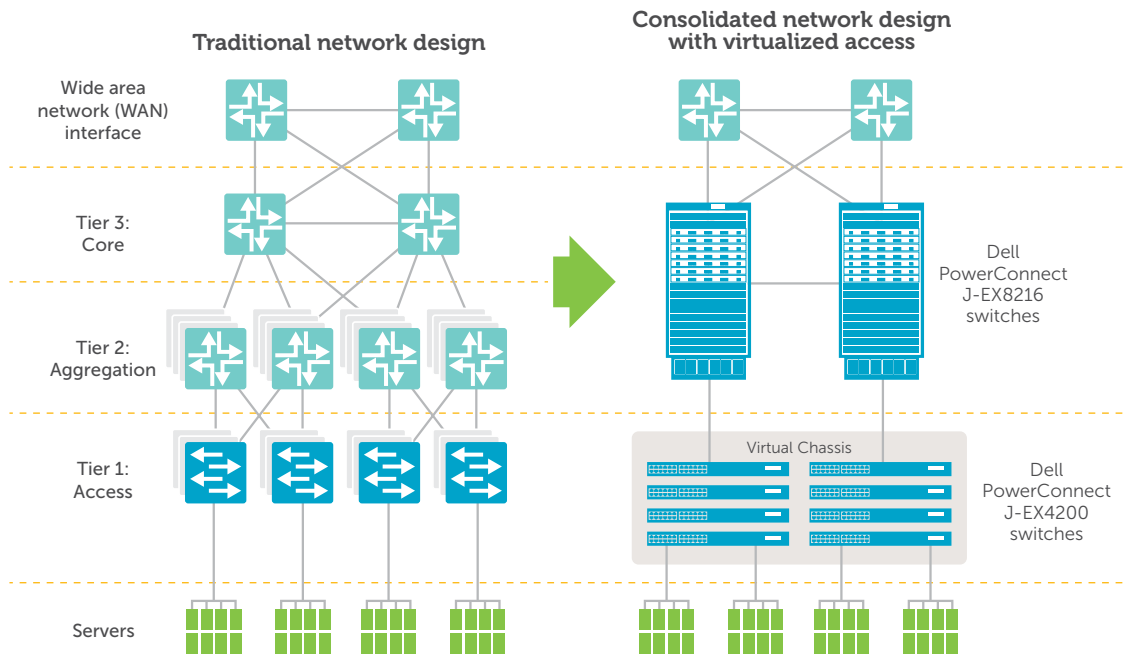Dell PowerConnect J-EX4200 switches

Servers

Figure 1. Dell PowerConnect J-Series switches help to simplify networks and reduce power, cooling, and space requirements

effort needed to handle both planned and unplanned events)

- 40 percent savings associated with decreased time to resolve unplanned network events
- 25 percent savings on infrastructure deployment

Cost-effective, high-performance networking

The PowerConnect J-Series enables organizations to deploy cost-effective switches that deliver the high availability, integrated security, and operational excellence they need today while providing a platform for supporting future requirements. The family comprises two product lines: the PowerConnect J-EX4200 line of Ethernet switches and the PowerConnect J-EX8200 line of modular Ethernet chassis switches. Optimized for high performance, these switches are well suited for highly virtualized data center environments and offer a comprehensive suite of Layer 2 and Layer 3 switching capabilities as part of the base software.

The PowerConnect J-EX4200 line is designed to meet the requirements of a variety of high-performance applications, including branch, campus, and data center access deployments as well as Gigabit Ethernet (GbE) and 10 Gigabit Ethernet (10GbE) aggregation deployments. Organizations can start with a single 24- or 48-port switch. As requirements grow, they can then take advantage of Juniper Networks Virtual Chassis technology to interconnect up to 10 PowerConnect J-EX4200 switches over a 128 Gbps backplane and manage this grouping as a single logical device—delivering a scalable, pay-as-you-grow solution for expanding network environments. (For more information, see the "Simplifying scalability" sidebar.) Flexible GbE and 10GbE uplink options enable high-speed connectivity to aggregation- or core-layer switches that connect multiple data center racks, floors, or buildings. All PowerConnect J-EX4200 switches include high-availability features such as redundant, hot-swappable internal power supplies and field-replaceable, multi-blower fan trays to help ensure maximum uptime.

Using the PowerConnect J-EX4200 GbE access switch in a top-of-rack setting enables administrators to jointly configure up to 10 server racks as a single Virtual Chassis. Each server rack hosts a pair of switches, each one of which is a member of a separate Virtual Chassis configuration. Effectively, each server is connected to both Virtual Chassis, with a redundant interface setting for high availability.

The PowerConnect J-EX8200 line delivers a high-performance, highly available platform for high-density 10GbE-based data center, campus aggregation, and core networks. It comprises two chassis options:

- **PowerConnect J-EX8208:** This model offers 8 dedicated slots in a 14U chassis to support line cards with a variety of 10/100/1000Base-T, 100Base-FX/1000Base-X, and 10GbE interfaces. The switch fabric delivers up to 320 Gbps per slot, enabling wire-rate forwarding performance of 960 million packets per second for packets of any size. A passive backplane is designed to support future

Simplifying scalability

By using Juniper Networks Virtual Chassis technology, IT departments can connect up to 10 PowerConnect J-EX4200 switches to create a single logical device supporting up to 480 10/100/1000Base-T ports or up to 240 100/1000Base-X ports, plus an additional 40 Gigabit Ethernet (GbE) or 20 10 Gigabit Ethernet (10GbE) uplink ports. Different models can be mixed to provide a variety of port and density options. The switches are monitored and managed as a single device, allowing administrators to separate physical topology from logical endpoint groupings and enabling efficient resource utilization. Administrators can also create highly resilient topologies by using the GbE or 10GbE uplink ports to extend the Virtual Chassis configuration across long distances spanning multiple wiring closets, floors, or even buildings.

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Learn more

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scalability up to 6.2 Tbps, providing a built-in migration path for future 100 Gigabit Ethernet (100GbE) deployments.

- **PowerConnect J-EX8216:** This model offers 16 dedicated line-card slots in a 21U chassis and features a switch fabric with forwarding performance of 1.92 billion packets per second, plus the same built-in migration path as the PowerConnect J-EX8208 for future 100GbE deployments.

The PowerConnect J-EX8200 line also offers some of the highest wire-speed 10GbE port densities currently available. Up to three PowerConnect J-EX8208 switches or two PowerConnect J-EX8216 switches can fit in a single 42U rack, for a total of up to 256 wire-speed 10GbE ports per rack.

In the data center, the PowerConnect J-EX8208 switch delivers a high-performance, high-density platform that helps to reduce cost and complexity, enhance overall scalability, and provide carrier-class reliability. Populated with eight-port PowerConnect J-EX8200-8XS 10GbE line cards, this switch can accommodate large numbers of high-speed, line-rate uplinks at any packet size from access layer devices such as PowerConnect J-EX4200 switches deployed in Virtual Chassis top-of-rack configurations—offering a highly scalable way to support additional servers with a reduced number of switches.

Consolidated network tiers

Traditionally, data center networks have had a three-tier design based on access, aggregation, and core layers. Because of scalability requirements, performance limitations, and key feature deficiencies in traditional switches and routers, each tier would typically include a large number of products to be deployed, configured, and managed—increasing the cost and complexity of the data center network.

PowerConnect J-Series switches enable a network design that requires fewer devices, interconnections, and tiers than the traditional approach (see Figure 1). Beyond the obvious cost advantages, this design can offer a range of benefits—including lower latency because of the reduced number of device hops; simplified device management; significant savings on power, cooling, and space; and a reduced number of system failure points.

With its high GbE and 10GbE port densities, the PowerConnect J-EX8208 model can also serve as an end-of-row server access switch—enabling the consolidation of aggregation and core layers and helping to simplify the data center architecture; reduce power, cooling, and space requirements; and reduce total cost of ownership. In environments that require even higher port densities, the PowerConnect J-EX8216 can be used to host over 55,000 servers with a 1:25 uplink oversubscription ratio, with the option to reduce the oversubscription ratio by increasing the number of 10GbE uplinks from the PowerConnect J-EX4200 Virtual Chassis.

Foundation for the Efficient Data Center

Dell PowerConnect J-Series switches form the communication foundation of the Efficient Data Center. These high-performance Ethernet switches enable an architecture that helps simplify complex data centers, increase performance, and significantly reduce costs. By using this architecture, organizations can focus on improving the business—whether this requires deploying new applications, entering new markets, or expanding product portfolios—with a data center infrastructure that can support growth and unexpected demands without adding significant complexity and expense. **PS**