END-TO-END CONVERGED NETWORKING

Juniper Networks QFabric System and Intel VN2VN Solution Simplify and Converge LAN and SAN Networking

Challenge

Lower the costs of unifying LAN and SAN networking technologies for small to medium-size enterprise data centers. Simplify the handling of escalating traffic levels and exponential data growth, and keep up with client demands for enhanced application performance.

Solution

Juniper Networks QFX3500 Switch and Intel VN_Node to VN_Node (VN2VN) solution provide a future-proof infrastructure for the growing demands of small to mid-size businesses. VN2VN enables administrators to consolidate storage and I/O at the network's edge without a complex FCoE switch.

Benefits

• Reduces capital and operating expenses by decreasing equipment in the data center, saving power, cooling, and space costs

• Simplifies overall management and maintenance

• Provides 10GbE access-based modular network design

• Allows easy integration of new services throughout the data center

Demands on the data center are growing every day. There are more end users, more devices, and more data. The model for delivering IT services to satisfy these escalating client demands is evolving from discrete infrastructure to virtualized and converged network environments. The pressures to innovate to meet these demands are high, yet more than 70 percent of IT spending today is used to maintain existing infrastructure.

The network is the critical enabler of all services delivered from the data center. A simple, streamlined, and scalable data center network fabric can result in greater efficiency and productivity, as well as lower operating costs. Such a network also allows the data center to support much higher levels of business agility without becoming a bottleneck that hinders a company's release of new products and services. The converged network reduces IT server sprawl and meets the growing demands of clients. Fibre Channel over Ethernet (FCoE) technology delivered over 10GbE enables enterprise data center administrators to consolidate resources and deliver services quickly in a standardized manner.

Technologies such as 10-gigabit Ethernet (10GbE), standards-based data center bridging (DCB), and FCoE have for some time given large enterprises the ability to consolidate and converge their access layer while driving server, rack, and network efficiencies across the modern data center. Currently, a traditional Fibre Channel Forwarder (FCF) switch is required in FCoE deployments. However, recent developments in FCoE provide additional opportunities for organizations of all sizes to deploy cost-effective and efficient end-to-end FCoE-based solutions. One such new enhancement called Fibre Backbone 6 (FC-BB-6) for the FCoE standard is the new VN2VN protocol, commonly referred to as VN_Node to VN_Node. It delivers a simplified and cost-effective approach for unifying LAN and storage area network (SAN) networks, whereby a dedicated FCF switch is no longer required and the additional costs and complexity of deploying FCoE are eliminated.

This new end-to-end Layer 2 Ethernet mode of FCoE brings into play a number of new options for end-to-end FCoE deployments. Appropriate early deployments for VN2VN include small to medium-sized networks, as well as clusters of server-pooled storage within larger networks, especially those where location matters and high-performance computing (HPC) deployments require efficient block access.

Juniper Networks® QFX3500 Switch is the first top-of-rack switch built not just to solve the challenges of access-layer convergence, but also to support the new end-to-end VN2VN FCoE protocol. The QFX3500 Switch works well with both rack-mount and blade servers, whether deployed by combined or separate LAN and SAN teams. As the first product to leverage a new generation of ASIC technologies, the QFX3500 delivers 1.28 terabits per second (Tbps) of bandwidth implemented with a single ultra-low latency ASIC, as well as soft programmable ports capable of supporting 1GbE, 10GbE, 40GbE, and 2/4/8 Gbps FC. The QFX3500 also supports interfaces such as small form-factor pluggable transceiver (SFP+) GbE copper, 10GbE copper and optical digital-to-analog converter (DAC), and quad SFP (QSFP) dense optical connectivity. Together, Juniper and Intel deliver the industry's first open, standards-based, end-to-end FCoE with FC-BB-6, giving data centers the scale and performance of FC at the cost and simplicity of Ethernet.

The Challenge

Client demands for enhanced application performance are driving the need for high-performance converged network solutions. Enterprise data center administrators, confronted by new business challenges, are increasingly focusing on improving asset utilization to enhance performance and flexibility while reducing costs. FCoE technology enables the consolidation of storage and data networking resources onto a single 10GbE network, decreasing costs and providing the flexibility required to host next-generation enterprise applications.

Generic Ethernet is a best-effort network that does not guarantee delivery of packets. Data Center Bridging (DCB) is the standard that was created to enable storage protocols to be delivered over Ethernet through a set of enhancements that make the Ethernet network lossless. In addition, other Ethernet enhancements provide the ability to control bandwidth allocation, which allows for greater efficiency in bandwidth use.

The adoption of FCoE is an evolutionary process. Most organizations are not going to forego their investments in Fibre Channel to install FCoE. The transformation begins at the SAN edges, where the cabling densities are the highest. Typically, enterprise data center administrators adopt FCoE for new installations or during expansions of existing data centers. While the development of FCoE as an industry standard will bring the deployment of unified data center infrastructures closer to reality, FCoE by itself is not enough to complete the necessary convergence.

One such new development is the new VN2VN mode. This new end-to-end Layer 2 Ethernet mode of FCoE now enables FCoE implementation without requiring a complex FC or FCoE switch. This lower cost and simpler approach to converging LAN and SAN networks is an ideal solution for small and medium size enterprise data centers.

Overall, to achieve the lowest total cost of ownership (TCO) in the data center, businesses must simplify the network, reduce the number of devices, collapse multiple switching tiers, use fewer operating systems across all network devices, and unfurl one unified, converged network fabric across all data center resources. To stand any chance of full network convergence, this simplification is absolutely essential.

The Juniper Networks and Intel End-to-End Solution

The Juniper Networks QFX3500 Switch and Intel Ethernet Converged Network Adapter VN2VN solution consolidates LAN and SAN networks using FCoE VN2VN technology, which enables data center administrators to maximize I/O consolidation. Servers can connect to the QFX3500 Switch using an FCoE network adapter over a 10GbE data center Ethernet, delivering both storage and data traffic (TCP/IP) over a single interface simultaneously. This reduces the complexity of the network and decreases the amount of hardware required. In addition, the solution provides investment protection during the evolution of the data center by providing native Fibre Channel connectivity. QFX3500 devices connect directly into the data center storage array. The QFX3500 acts as an FC gateway over native Fibre Channel (2/4/8 Gbps) connections, and it provides deep buffering and strict traffic prioritization to support storage traffic. The Juniper and Intel converged storage network solution reduces server sprawl and lowers both capital (CapEx) and operating (OpEx) expenses by decreasing the hardware required and simplifying network management.

For smaller businesses, the new FCoE mode has been developed allowing for a fully functional FCoE deployment without the need for either the traditional FC services stack or FC L3 forwarding. Instead, the FCoE end devices directly discover and attach to each other through a pure L2 Ethernet infrastructure. This can be as simple as a DCB-enabled Ethernet switch, with the addition of FCoE Initialization Protocol (FIP) snooping for security. This makes FCoE simpler than either iSCSI or network-attached storage (NAS), since it no longer needs a complex FC (or FCoE) switch, and because the FCoE endpoints have proper discovery mechanisms. This mode of operation is commonly referred to as VN_Node to VN_Node or VN2VN. This mode can be used by itself for small to medium scale FCoE deployments, or it can be used in conjunction with the existing FCoE models for larger deployments to allow them to benefit from local L2 connectivity.

VN2VN is simple. It allows direct end-node to end-node connectivity within an Ethernet Layer 2 domain without explicit FC services and without requiring an FCF. This provides a number of benefits to small and medium sized organizations:

- Simpler network design
- Less expensive switches
- Lower complexity switches
- Lower latency switches

Juniper and Intel now offer the industry's first open, standard-based, end-to-end FCoE to allow data centers the scale and performance of FC at the low cost and simplicity of Ethernet.
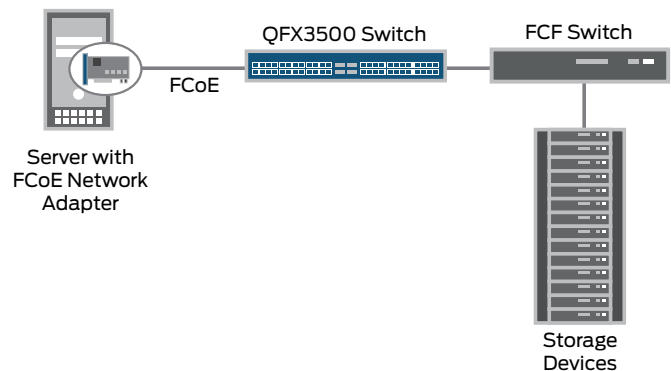

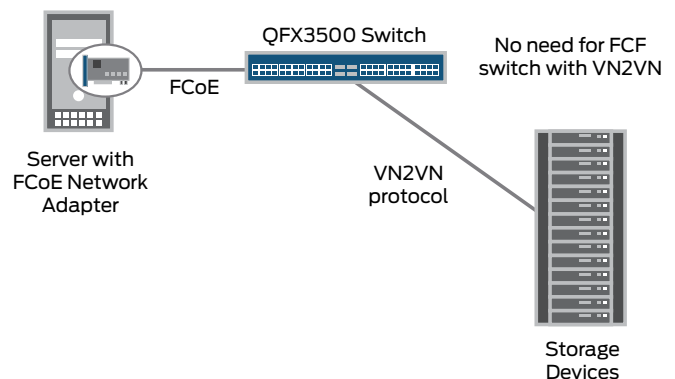Figure 1: Network without VN2VN deployed

Figure 2: Network with VN2VN deployed

Features and Benefits

Feature	Benefit
Performance	
Juniper Networks QFX3500 Switch • 1.28 Tbps of throughput • 960 Mpps of switching capacity • Ultra-low latency and low jitter • Full wire-speed capacity with all ports delivering full performance in both L2 and L3 operation	• Improved application performance for a better user experience • Increased reliability and uptime
Virtualization	
Juniper Networks QFX3500 Switch • Large media access control (MAC) address table • Juniper Networks Junos® Space Virtual Control • Unifies physical and virtual infrastructures and provides a comprehensive management tool • IEEE 802.1Qbg standard to enable Virtual Ethernet Port Aggregator (VEPA)	• Quick deployments in existing data center environments • Secure, isolated applications • Predictable performance for each application
Lower total cost of ownership (TCO)	
• Consolidate I/O hardware to reduce capital (CapEx) and operating expenses (OpEx) • Conserve Peripheral Component Interconnect Express slots in all server environments • Investment protection with backward compatibility, including 4 Gbps and 2 Gbps Fibre Channel technology	• Increased flexibility • Extended investment lifetime

Solution Components

• Juniper Networks QFX3500 Switch for server access
• Juniper Networks QFX3500 Node
• Intel VN2VN over Intel Ethernet Converged Network Adapter

Summary—Transform Your Data Center for Fast, Simple, and Cost-Effective Networking

Juniper Networks QFX3500 Switch is the first top-of-rack switch built to solve all of the challenges posed by access-layer convergence. It is the first fully FC-BB-6-enabled gateway capable of easily supporting upstream DCB switches, including third-party embedded blade shelf switches. It works for both rack-mount and blade servers, and for organizations with combined or separate LAN and SAN teams. It is also the first product to leverage a new generation of powerful ASICs. The QFX3500 Switch supports an FCoE transit switch mode. In addition, the QFX3500 Switch and Juniper Networks QFabric System also support an FCoE-FC Gateway mode. The QFX3500 is an industry first in many ways:

• Fully standards-based with rich implementations from both a DCB and FC-BB-5 perspective
• Purpose-built FCoE transit switches
• Purpose-built FCoE-FC gateway that includes fungible combined Ethernet/FC ports
• Single Packet Forwarding Engine (PFE) design
• Includes feature-rich L3 capabilities
• Supports low latency with cut-through switching
• First switch to support specific FCoE VN2VN capabilities

Together, Juniper and Intel deliver the industry's first open, standards-based, end-to-end FCoE with FC-BB-6—giving data centers the scale and performance of FC at the cost and simplicity of Ethernet. Juniper Networks QFX3500 Switch-based solution for converged network data centers offers high performance and operational simplicity, and lowers your total cost of ownership. Intel assures a high-performance, reliable, and easy-to-use storage solution for your network convergence implementations. Get started today to realize the benefits of a converged storage network in your data center with a Juniper Networks/Intel end-to-end converged networking and storage solution.

• Simpler converged network architecture and less expensive deployment
• Consolidate onto one wire; support multiple protocols simultaneously (TCP/IP, iSCSI and FCoE)
• Reduce the amount of power and cooling required
• Decrease lost productivity
• Speed service delivery
• Innovate to gain competitive advantage
• Manage shared pools of IT resources on a common platform
• Ensure a consistent experience

Next Steps

To learn more about how your converged network and data center can benefit from a Juniper/Intel infrastructure solution, please contact your Juniper Networks representative and visit **www.juniper.net**.

About Intel

Intel (NASDAQ: INTC) is a world leader in computing innovation. The company designs and builds the essential technologies that serve as the foundation for the world's computing devices. Additional information about Intel is available at **www.intel.com**.

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**.

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