SummitStack in the Data Center

Abstract: This white paper describes the challenges in the virtualized server environment and the solution that Extreme Networks® offers – a highly virtualized, centrally manageable switch stacking technology, called SummitStack™, that provides a smooth migration from a current physical, server-based data center to a highly virtualized data center.

Overview

There are several varieties of switch stacking technologies available that are widely used in enterprise wiring closets for management simplification. Stacking technology allows Information Technology (IT) managers to build wiring closet edge access on an as-needed basis and provides flexible network edge deployment with cost-effective initial investments to accommodate Ethernet, Fast Ethernet and Gigabit Ethernet device connectivity.

In the data center environment, connectivity is predominantly Gigabit Ethernet today, but as server virtualization technology has become increasingly popular, so has the demand for 10 GbE connectivity. This creates a business challenge for IT managers—migrate to 10 GbE or add 10 GbE enabled servers?

Businesses are seeking to migrate to virtualized environments at a rapid pace and want to do so in a cost-effective manner that maximizes their network uptime while controlling costs much like the as-needed growth strategy model popularly used in enterprise wiring closets.

This white paper describes the challenges that IT managers face as they plan their adoption of a virtualized server environment and the solution that Extreme Networks offers. Extreme Networks SummitStack is a highly virtualized, centrally manageable switch stacking technology that provides a smooth migration from the current physical, server-based data center to the virtualized, server-based data center.

Stacking Fundamentals: The Difference between Single IP Management and True Stacking

In the networking industry, the word "stacking" is used in numerous ways. This has led to confusion among IT managers who are trying to decide which solution would best meet their network requirements. Fundamentally, the reason for the confusion is due to two notably different methods, which often share the same "stacking" terminology. It is important to understand these different technologies at a high level to determine the most appropriate

technology for the network. To first clarify the differences, here is the summary of two stacking technologies.

Stacking as in "Single IP Management"

"Stacking" is sometimes used to represent the capability to perform "single IP management." Single IP management can provide a solution to consolidate the management instance to one representative switch. This feature helps IP administrators reduce the number of IP addresses used for networking devices, such as Ethernet switches, enabling a simpler way of communicating with multiple switches. Although this capability allows having one management instance, typically single IP management would not provide a method to configure data forwarding-related parameters across multiple switches simultaneously. For example, if you would like to configure VLANs that span multiple switches in the same management domain, you would need to configure them one-by-one, a time consuming task. For single IP management, the connectivity is typically via regular Ethernet technologies, such as Fast Ethernet, Gigabit Ethernet and 10 Gigabit Ethernet, hence the network connectivity and redundancy are based on the IEEE 802.1D Ethernet MAC bridging standard, which includes bridging and spanning tree protocol.

Stacking as in "True Stacking"

"True stacking" provides the capability for multiple stackable switches to behave as one Virtual Chassis™. With true stacking technology, IT administrators benefit from consolidating the management instances for, typically, up to eight Ethernet switches, and also benefit from consolidating the switch forwarding data plane so that the stacked system behaves with the simplicity of a modular chassis system. Using true stacking, the switching system, including switching fabric, is consolidated so that all resources are centrally manageable. IT administrators may create VLANs, Link Aggregation Groups (LAGs), Access Control Lists (ACLs), plus port mirroring across ports in different switches within a stack. For true stacking the connectivity is typically via specialized high-speed interfaces rather than standard Ethernet links. This allows the use of non-Ethernet-based protocols to provide multi-path connectivity and redundancy within a stack.

The table below summarizes the comparison between single IP management and true stacking.

Attribute	Single IP Management	True Stacking
One Management IP Address	Yes	Yes
VLAN Configuration	Only within a switch	Across switches in a stack
Switch Forwarding	Typically limited to Layer-2 switching	Layer-2 or Layer-3 switching
Port Mirroring	Only within a switch	Across switches in a stack
Link Aggregation	Only within a switch	Across switches in a stack
Stacking Link	Typically native Ethernet based	Typically special interface

Table 1. Comparison of Single IP Management and True Stacking

Data Center Trends and Challenges

Many enterprises have started to migrate to a highly virtualized and consolidated data center to help reduce total cost of ownership and management complexity. IT organizations are focusing on moving towards the next generation data center, and data center collocation and managed hosting service providers are now moving towards cloud networking which helps enterprise companies to leverage the cloud-based services for enterprise application instead of physically owning the data center assets.

In both cases, it is becoming more critical to achieve higher capacity and higher scalability with a fixed cost in terms of size of data center, amount of available power resources, and cooling capacity. Most importantly, organizations oftentimes cannot afford to linearly increase labor costs to manage and maintain the data center as performance and capacity rapidly grow.

From a data center networking perspective, the following challenges must be overcome:

- Achieving network bandwidth for high-performance servers which are ready for 10 GbE

- Avoiding linear increases in bandwidth cost as bandwidth requirements quickly grow

- Simplifying network management tasks so that the data center is easy to manage as it grows

- Minimizing power consumption and cooling requirements to help control energy costs

These challenges must be translated into technologies that can help boost the performance of the data center at a lower cost. This creates a strong need for high-performance switching and high-performance stacking technology to come to together as a solution to provide a highly available architecture.

Extreme Networks SummitStack Solution

Extreme Networks SummitStack solution supports applications in the enterprise campus edge, aggregation points and data centers, by providing an architecture that is highly scalable, highly resilient and yet easy to manage.

This technology offers unique multi-platform stacking which allows IT administrators to physically connect up to eight individual switches together as a single logical unit. This logical unit reduces the management overhead of fixed configuration switches because they behave as a single switch with a single IP address and a single point of authentication.

A stack of SummitStack switches can be thought of as a Virtual Chassis. Each switch acts as if it was occupying a slot in a much larger multi-slot chassis and is controlled by the master. The high-speed stacking links can be thought of as functioning like the backplanes of a chassis switch. SummitStack permits mixing and matching different models of Summit® switches in a stack. Extreme Networks multi-platform stacking creates options for IT managers to provide the needed port configuration whether from Ethernet and Fast Ethernet to Gigabit Ethernet and 10 Gigabit Ethernet via passive and active copper plus active fiber and optional long reach optics. IT managers can provision features, such as Power over Ethernet Plus (PoE-plus), where needed and at a substantially lower cost.

SummitStack technology also affords the option to use standard cabling and optics technologies employed for 10 GbE, such as XFP, SFP+, 10GBASE-T and XENPAK, to provide stacking functionality. Called SummitStack-V, this stacking option can be used to create flexible physical stacking topologies without the requirement for dedicated stacking cables that can be more cumbersome, have limited lengths and can be more expensive. SummitStack-V also enables long distance stacking connectivity of up to 40 km while reducing cable complexity.

The SummitStack technology for fixed configuration switches provides simplified yet agile operations for scalable converged networks. This technology supports many network topology designs and is Ethernet based requiring no new hardware or interfaces. SummitStack stacking offers customers a flexible way to increase switch density and capacity, benefit from port configuration choices, and control up-front capital expenditures.

SummitStack Multi-Platform Stacking

As new beneficial technologies become available, it is critical to be able to smoothly incorporate them throughout the network. SummitStack, used in the data center application, provides seamless migration from GbE servers to 10 GbE servers without adding the complexity of managing two different types of switches, or increasing the cost by using a 10 GbE port as a GbE port when the majority of servers are still GbE based. Extreme Networks SummitStack technology allows you to create a stack with different types of switches[1, 2, 3], and still provides the virtualized single management instance so that the system can be managed like a modular chassis switch. By enabling multi-platform switch stacking with other compatible Summit switches, IT managers can create a very cost-effective and high performance, top-of-rack design with hybrid network ports configured for GbE and 10 GbE.

Summit X460 series switches support SummitStack, which provides 40 Gbps (SummitStack module) or 80 Gbps (SummitStack-V80 module) of stacking bandwidth. The SummitStack module offers high-speed 40 Gbps stacking performance, and provides compatibility among Summit stackable switches.[1, 2] Alternatively, you may choose high-speed 80 Gbps stacking, which is ideal for demanding applications where a high volume of traffic traverses through the stacking links, yet bandwidth is not compromised through stacking. SummitStack-V80 also breaks the distance limitation for stacking technology by using QSFP+ technology. SummitStack-V80 can support passive copper cable, active fiber cable, and QSFP+ optical transceivers (which will be the standard technology for 40 GbE). With SummitStack-V80, Summit X460 switches provide a flexible stacking solution inside the data center or central office to create a virtualized switching infrastructure across rows of racks, a design also called cross-rack stacking.

Summit X480 switches support SummitStack, which provides 40 Gbps (VIM2-SummitStack) or 128 Gbps (VIM2-SummitStack128) of stacking bandwidth. High-speed 128 Gbps stacking is ideal for demanding applications where a high volume of traffic traverses through the stacking links, yet bandwidth is not compromised through stacking. High-speed stacking is very useful for top-of-rack deployments when paired with Summit X480 and Summit X650 switches (requires optional conversion cable) and gigabit aggregation in large enterprise or data center networks. With the longer 5-meter stacking cables, stacking can be configured horizontally across racks, as opposed to a typical stacking system installed vertically in a rack.

Extreme Networks Summit X650 series of 10 GbE switches support the next level of stacking technologies – SummitStack512 and SummitStack256. Compared to SummitStack which runs at 40 Gbps bi-directional, SummitStack512 and SummitStack256 provide 512 Gbps and 256 Gbps respectively and offer cost-effective and high-performance data center switching with the stackable configuration 10 GbE switches.

VIM1-SummitStack™ (Default Option)
• 40 Gbps SummitStack Ports
• 4 Gigabit SFP Ports

VIM1-10G8X
• 40 Gbps SummitStack Ports
• 8 Port 10 Gigabit SFP+
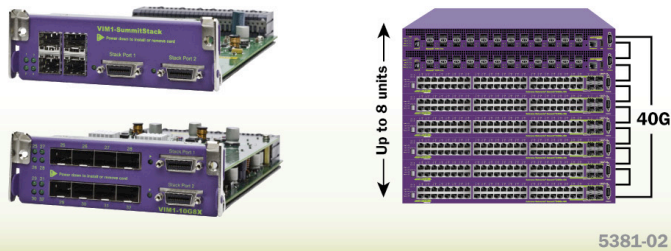
Up to 8 units

40G

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Figure 1. SummitStack Modules and Stacking Example

SummitStack512

One of the challenges in building the data center is to predict the need for performance. SummitStack512 technology helps solve this challenge and is supported on the optional VIM1-SummitStack512 modules for Summit X650 series switches. SummitStack512 provides non-blocking 48-port 10 GbE switching performance in just two rack units of height in the 19 inch rack system. SummitStack512 gives the flexibility of being able to start deployment with just one Summit X650 switch for up to 24-port of 10 GbE connectivity, then later add another Summit X650 switch with VIM1-SummitStack512 modules to double the density. This unique capability helps to support the increasing need for 10 GbE enabled high-performance servers, and can be used for smaller data center core networks with management redundancy in place.

SummitStack256

SummitStack256 provides a flexible "as-needed" growth model suitable for end-of-row or "virtual" end-of-row network configuration where multiple Summit X650 switches can be used for data center connectivity by stacking up to eight switches together which provides up to 192 ports of 10 GbE connectivity. The virtual end-of-row configuration provides a similar physical installation as a top-of-rack installation, while providing a unified management instance for up to eight switches. SummitStack256 offers horizontal stacking by using a high-speed stacking connection so that the oversubscription at stacking ports can be minimized.

The other way to provide "as-needed" data center connectivity is to use the same SummitStack256 solution for end-of-row configuration. Dedicate one rack for network equipment and place Ethernet cabling (fiber or copper) from the stacked end-of-row switch to each server rack.

SummitStack128

SummitStack128 offers 128 Gbps of throughput supporting high volumes of traffic within stacking links. Stacking GbE Summit X450 and 10 GbE Summit X650 switches offers data center and other high-speed networks the flexibility to align their switching infrastructure with the bandwidth and scalability needs of their applications. In addition longer 5-meter stacking cables permit horizontal stacking across racks, as opposed to a traditional, vertical stacking within a rack. Cross-rack stacking enables data centers to simplify management of GbE and 10 GbE switching ports within their network.

SummitStack-V/Stacking over 10 Gigabit Ethernet

SummitStack technology affords the capability to utilize existing 10 GbE ports as stacking ports among compatible switches.3 This allows the use of standard cabling technologies used for 10 GbE, such as XFP, SFP+, 10GBASE-T and XENPAK, to enable stacking over these high-speed ports. SummitStack-V provides longer distance connectivity for stacking of up to 40 km (24.85 miles) while reducing cable complexity. It is possible to build stacks of switches between rows in a data center, or between data centers on a campus, or even between remote sites. When SummitStack-V is enabled on a 10 GbE port, it must be directly connected to its corresponding switch port.
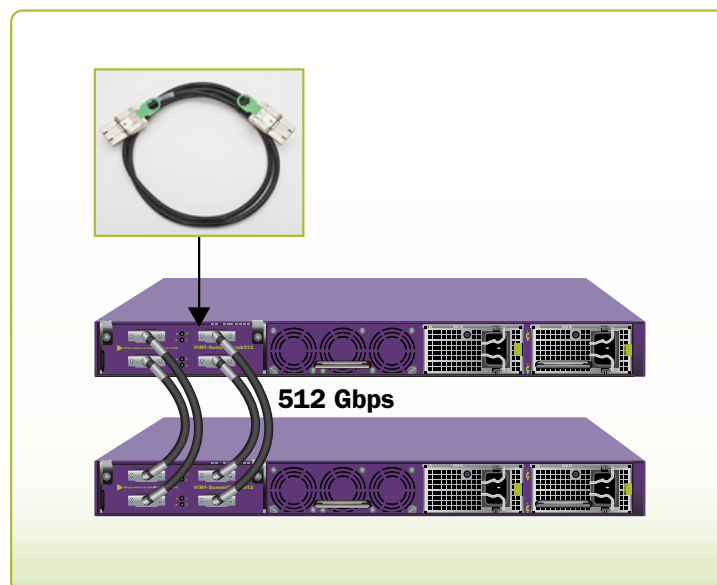

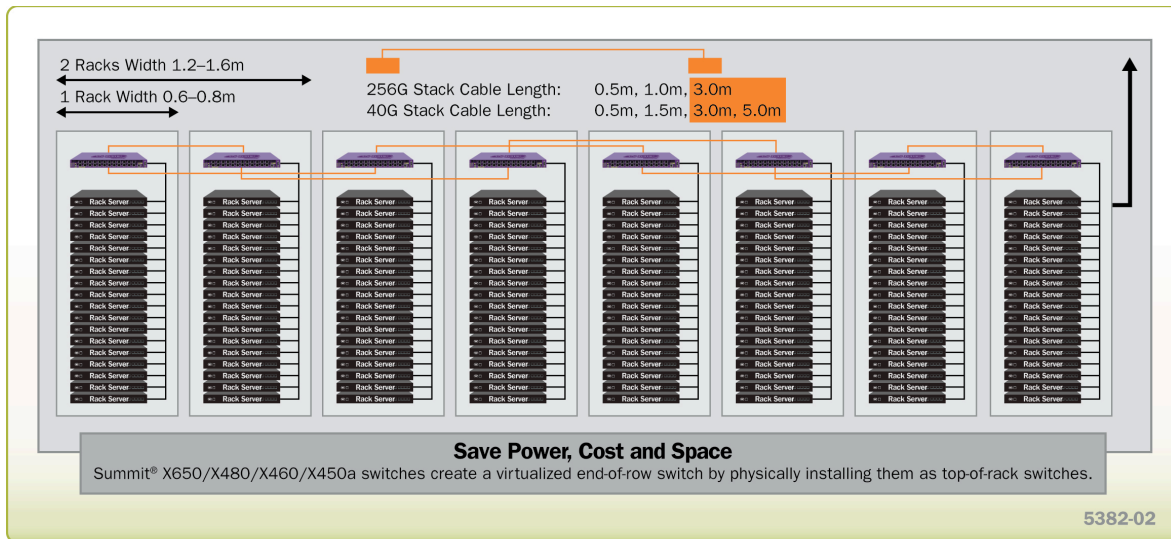**Figure 2. High-Speed SummitStack Stacking**
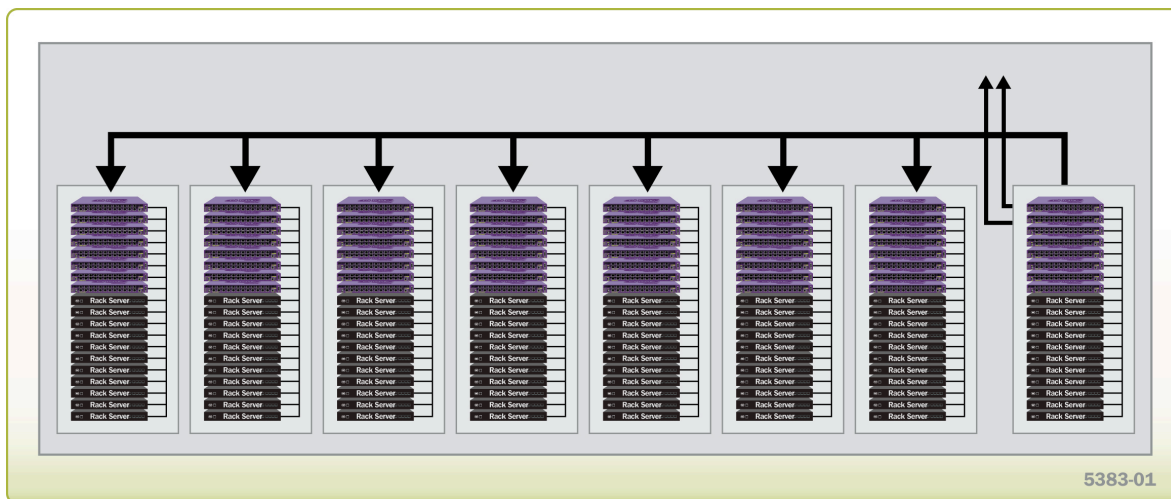
Figure 3. Virtual End-of-Row SummitStack Configuration

Within the figure:
2 Racks Width 1.2–1.6m
1 Rack Width 0.6–0.8m
256G Stack Cable Length: 0.5m, 1.0m, 3.0m
40G Stack Cable Length: 0.5m, 1.5m, 3.0m, 5.0m

Save Power, Cost and Space
Summit® X650/X480/X460/X450a switches create a virtualized end-of-row switch by physically installing them as top-of-rack switches.

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Figure 4. Stacked End-of-Row SummitStack Configuration

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Summary

With the growing need for a highly virtualized server environment, network switch configuration and management can quickly become a challenge. Extreme Networks offers a flexible and high-performance stacking solution for the emerging data center network and helps reduce the burden of managing many switches in the network by simplifying the network design with SummitStack technology.

[1] SummitStack (40 Gbps) supports multi-platform stacking among Summit X250e, X450a, X450e, X460, X480 and X650 switches running the same version of ExtremeXOS.

[2] SummitStack-V80 (80 Gbps) supports Summit X460 switches with planned multi-platform stacking support for Summit X480 and Summit X650 switches running the same version of ExtremeXOS.

[3] SummitStack-V (10 Gbps) direct connections are compatible among Summit X450e, X450a, X460, X480 and X650 switches running the same version of ExtremeXOS (version 12.5 minimum).