Managed Hosting and Cloud Data Center Architecture Overview

Abstract

The Extreme Networks® Managed Hosting and Cloud Data Center Architecture is designed to meet the needs of service providers in this fast-growing market. This architecture is built around highly virtualized environments where infrastructure scale, virtualization lifecycle management, performance, automation, and integration into existing management and provisioning platforms are required. From a networking perspective, the ability to provide high-performance 10 GbE and 40 GbE in an open, standards-based framework is essential. Extreme Networks architecture helps service providers move from a physical to a highly virtualized infrastructure and into the cloud via an open architecture without forcing an operating methodology or requiring a forklift upgrade. This white paper will address the key issues and outline an open and modular design to support the managed hosting and cloud networks of the future.

Make Your Network Mobile

Market Overview

Enterprises of all sizes and across all market segments and geographies are rapidly looking to leverage outsourced data center business models. These IT outsource models range from simple colocation, to dedicated and managed hosting, and onto public and hybrid cloud service models such as Infrastructure as a Service (IaaS), Compute as a Service (CaaS) and Storage as a Service (StaaS). This new business model of outsourcing various components and associated applications of the enterprise IT infrastructure is rapidly changing the face of IT around the globe. According to In-Stat, cloud spending is expected to grow from below $3B in 2010 to surpass $13B by 2014[1]. Large, multi-tenant data center environments are driving entirely new solutions and network-level requirements to support the evolving service offerings. The challenges facing these environments include: scale, density, management, provisioning and multi-tenancy. As with the enterprise, virtualization is playing a key role in the architecting and delivery of these services. Extreme Networks understands these requirements and offers an open and scalable approach that provides the infrastructure to enable rapidly growing hosting and cloud service models as they migrate from physical to virtual to cloud.

Virtualization Changes Managed Hosting and Enables the Cloud

Virtualization is clearly driving much of the innovation around managed hosting and cloud-based services. The benefits to the service provider include: reduced cost, better resource utilization, rapid service delivery and mobility of applications within and across data centers, all while reducing CapEx and OpEx.

However, these benefits come at the price of increased infrastructure complexity which can be seen in many forms. First, virtualization increases layers of networking and dissolves the network edge by adding switching into the server in the form of the Virtual Switch (vSwitch). Second, there has been a proliferation of different hypervisors in the marketplace, each with its own unique virtual switch implementation and management tools. It is common to see hypervisors such as Red Hat KVM, Citrix, VMware and Microsoft used across the industry and often in the same environments.

Service providers are finding it challenging to deal with the added management and provisioning complexity of this new service delivery architecture. For both service (SLAs) and security reasons, the network infrastructure needs to be able to stay in sync with the virtualized server environment. However, many network-level virtualization capabilities and automation tools have not kept up with the rapid adoption of virtualized architectures and the new mobility of applications found in cloud-based architectures.

Scaling the Network to Meet the Needs of Managed Hosting and Cloud-Based Architectures

Managed hosting and cloud service providers base their business models on leveraging internal infrastructure across a large number of users. This model has created a significant increase in the requirements for scale in the network. Historically, there was a single application per server; today it is common to see 10s and in some cases hundreds of virtual machines on a single server. Specifically, this has resulted in a significant increase in Layer 2 and Layer 3 table size requirements, both at the top-of-rack and at the aggregation/core of the network.

Virtualization is thus driving the new Layer 2 scale requirement. In a cloud architecture, the industry best practice is to build large, flat Layer 2 networks. These large Layer 2 networks are moving the switch table size requirement from thousands to tens of thousands and even hundreds of thousands in a single switch.

Mobility across Layer 3 boundaries is driving the requirement for large Layer 3 table sizes. Service providers need the capability to freely move customers and applications across Layer 3 boundaries within a data center as well as across data centers. To enable this functionality at cloud-scale rates, network table sizes need to grow from thousands to hundreds of thousands to address the rapid scale associated with the cloud.

These “at scale” deployment scenarios have led to a significant increase in utilization of server resources and the network. It is common for workloads to fully saturate multiple Gigabit Ethernet links at the server, creating increased cost and complexity at the networking level. This has driven many service providers to adopt an architecture that supports 10 GbE at the server and 40 GbE uplinks to accommodate the increased capacity requirements. Today, 10 GbE is available and is the fastest growing segment of the switching marketplace. It is common to see 10 GbE in blade servers and 10 GbE LAN on Motherboard (LoM) is coming soon to the rack server marketplace. As this technology matures, it will likely be the standard infrastructure for cloud-based deployments. It has become clear that 40 GbE will be the technology of choice for data center uplinks for

[1] Potter, Greg. US Business Spending by Size of Business and Vertical, 2009–2014: Cloud Computing and Managed Hosting Services. In-Stat, 2010. (In-Stat Report Reference #IN1004792VSMSE)

the foreseeable future. Using technologies such as link aggregation in the network, 40 GbE can achieve the required bandwidth at lower costs than 100 GbE.

As these technologies mature, service providers are challenged to install an infrastructure today that can meet the coming needs for scale, both in terms of Layer 2 and Layer 3 table size and network bandwidth. Navigating these waters requires proper planning to help ensure that equipment purchased today, can scale to meet the evolving needs over the next 3-7 years.

Providing an Open and Automated Architecture

The network and surrounding infrastructure is the cost of goods in most hosting cloud-based service models. To drive down costs and enable the differentiation of services, the architecture must remain open and easily integrated through industry-standard interfaces, however, the standards regarding non-proprietary, open architecture are evolving rapidly. Clearly, the IEEE plays a big role but new hosting and cloud-based organizations have worked to overcome vendor lock-in models. Examples of these organizations include OpenStack and the Open Data Center Alliance (ODCA).

Further, within these cloud-based hosting environments, service models are evolving towards "zero touch" service provisioning and increased velocity of add/change/delete transactions. These trends are requiring hosting and cloud service providers to tightly integrate the infrastructure with the upstream management and provisioning of platforms, including automation of routine tasks associated with provisioning of services.

Today, standards-based solutions not only support integration between server virtualization and the network, but can also be leveraged to support integration between management and provisioning platforms. These technologies ensure an open, multi-vendor model.

Methods also exist today that enable service providers to significantly increase the use of automation and allow integration of the infrastructure elements with the service-level provisioning process. These tools include scripting, dynamic scripting (trigger-based) and XML interfaces to name a few. It is becoming more and more common to find multi-vendor integration via XML interfaces. Many vendors today publish APIs that enable this collaboration in an open manner.

The Extreme Networks Architecture

The Extreme Networks architecture enables hosting and cloud-based architectures to move from physical to virtual to cloud without forcing a certain technology, or operating methodology on the user—all without stranding existing network assets. The foundation, or pillars, of this strategy that is built into the reference architecture include:

- A robust, high-performance network infrastructure that reduces complexity through the elimination of network tiers
- The ability to efficiently integrate with virtualization
- The scalability to meet "at-scale" cloud requirements
- A highly automated and customizable environment providing interoperability and integration with the infrastructure required to deliver cloud-based services

The Physical Network

Extreme Networks has a robust product portfolio geared towards the managed hosting and cloud-based market segment. These products include high-performance 1/10/40 GbE switching platforms for top-of-rack and end-of-row or mid-row based solutions. Included in the portfolio are products capable of providing high fan out (96 port 1 GbE and 24 port 10 GbE) as well as products that enable significant cable consolidation (as much as 83%) in the data center by utilizing the TE Connectivity MRJ21 cabling solution designed for high-density data center environments. The MRJ21 integrates six Gigabit Ethernet ports into a single cable. With the ability to support up to 96 ports per blade and 768 ports per chassis with one sixth of the number of cables typically used in other architectures, this architecture provides more flexibility when connecting a blade server chassis to the network. The combination of performance and fan out enables a more simplified network design while collapsing the tiers of the network from a traditional five-tier architecture to a one- or two-tier design. See Figure 1.

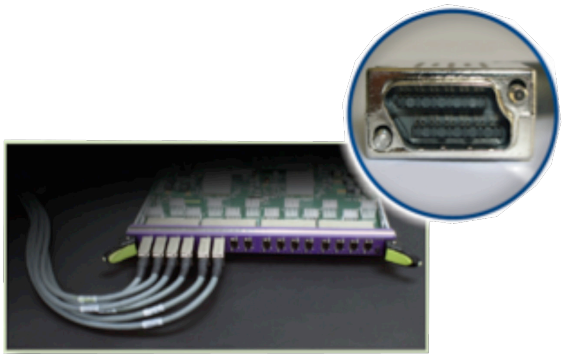

Figure 1: TE Connectivity MRJ21 Cabling Solution.

The Virtualization Aware Infrastructure – Efficiently Managing the Integration Between the Network and Server

As services such as Infrastructure as a Service (IaaS), Compute as a Service (CaaS) and Storage as a Service (StaaS) evolve, service providers need to automatically configure the network infrastructure to provide these services in a no-touch service provisioning model. To achieve this, the network component needs to be dynamically configured at the time of service initiation or change in an automated, real-time way. This requires a robust network architecture that is both virtualization aware and open so it can be tightly integrated into the management and provisioning platform of the service provider. Traditionally, the network has not been closely integrated with either compute-based or storage-based service models. Users today can only provision at the compute or the storage level. By contrast, Extreme Networks XNV™ (ExtremeXOS® Network Virtualization) technology, coupled with the Ridgeline™ management platform can provide full, virtual machine lifecycle management across hypervisors to enable these services. See Figure 2.

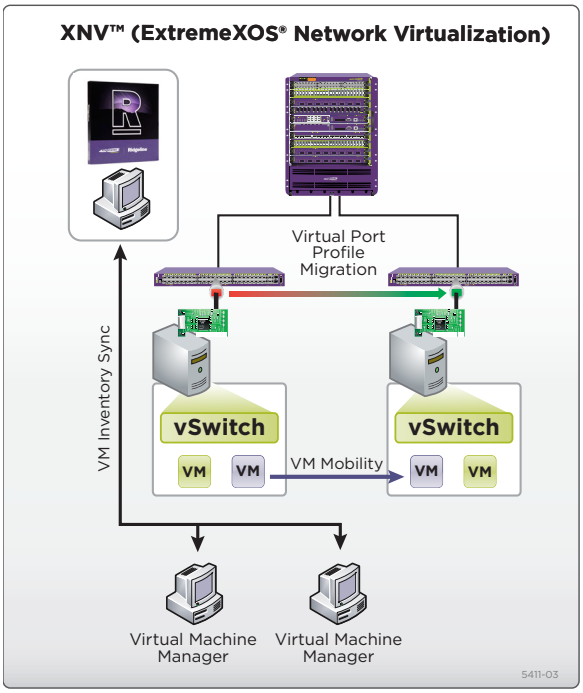

Figure 2: XNV for Virtual Machine Lifecycle Management.

Moving the Switching Back into the Network

Direct Attach™ is Extreme Networks implementation of virtual machine switching conducted in the network. Various vendors have taken the path of implementing virtual machine switching within the server through the hypervisor-based Virtual Switch (vSwitch).

Extreme Networks Direct Attach approach takes the path of moving virtual machine switching back into the network and out of the server domain. This allows administrators to leverage mature, well understood and fully capable network switches at wire speed for virtual machine switching, while still enjoying the benefits of server virtualization.

In essence, Direct Attach allows virtual machines to be "directly attached" to the network without going through a software switch on the server. In doing this, Direct Attach enables reduction in switching tiers by eliminating the virtual switch tier which in turn can reduce cost, end-to-end latency and oversubscription in the network, as well as simplify management. Finally, Direct Attach allows uniform network-based enforcement of security, compliance and regulatory policies in a hypervisor agnostic manner. See Figure 3.

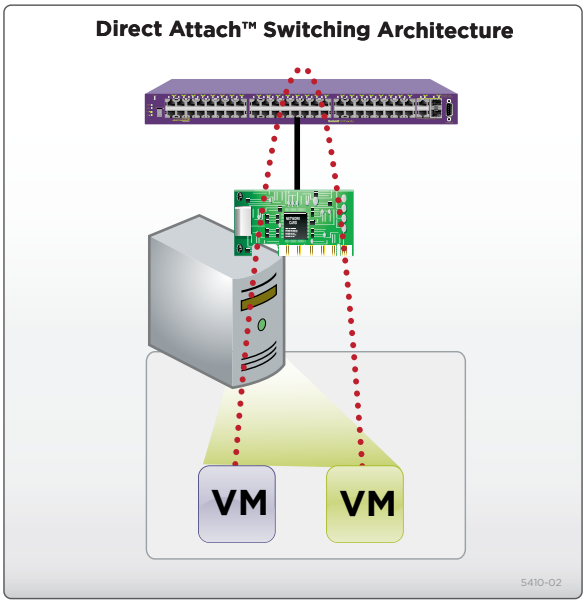

Figure 3: Direct Attach Switching Architecture.

Automation and Customization

As data centers deploy at scale, with added complexity and computational density, it becomes increasingly important to be able to automate redundant tasks and simplify add/change/delete processes within the data center. Furthermore, as integration of data center storage, networking and server resources increases, the network administrator needs the ability to easily integrate and customize deployments via common APIs. The ability to tightly couple all components of the infrastructure and orchestrate the management of the pieces via a common platform becomes essential to realizing the benefits of highly virtualized and cloud

environments. The Extreme Networks switch portfolio is designed from the ground up to support automation and customization in the data center. The key elements to enabling automation and customization within the data center include:

- A single modular operating system, ExtremeXOS, that runs across the product portfolio
- Support for standard XML API and SDK for easy integration with third-party management and provisioning platforms
- Dynamic scripting capability that enables easy automation of routine tasks
- A powerful management platform for managing and configuring the entire network
- Support for loadable modules that enable various functionality and capabilities

Extreme Network Features

40 GbE

40 GbE is poised to become a data center infrastructure requirement where it serves as an aggregation technology necessary to support data centers with high-performance 10 GbE servers and storage targets. Extreme Networks data center solutions provide superior scale both on the Summit® stackable and BlackDiamond® modular chassis-based products with support for both 40 GbE today and 100 GbE when needed in the future.

Layer 2 Scalability

Large data center operators are quickly running into scale issues in the data center. Rapid growth of virtualization has created an explosion in the number of MAC address space needed to support private and public cloud environments.

VPLS

Cloud data centers are looking to connect multiple racks and/or data center sites as one Layer 2 domain across Layer 3 boundaries. By using VPLS in the data center, cloud service providers are able to deploy virtualization and scale across Layer 3 boundaries.

Multi-Switch Link Aggregation (M-LAG)

The proliferation of virtual machines has driven the need for full link utilization of the network. Extreme Networks enables the full utilization of all paths through the network via its M-LAG capabilities. By replacing typical Spanning Tree architectures with M-LAG capabilities, networks can double their link utilization over the existing infrastructure.

Stacking

SummitStack™ stacking technology provides a highly scalable, highly resilient and easy-to-manage stacking solution for demanding data center applications. Stacking can be achieved horizontally or vertically and across long distances. This technology offers multi-platform stacking with up to eight individual switches treated as a single logical unit. This logical unit reduces the management overhead of fixed configuration switches.

CLEAR-Flow

CLEAR-Flow is a broad framework for implementing security, monitoring and anomaly detection in ExtremeXOS software. Rather than simply looking at the source and destination of traffic, CLEAR-Flow allows you to specify certain types of traffic that require more attention, such as iSCSI traffic. Once certain criteria for this traffic are met, the switch can either take an immediate, predetermined action; or it can send a copy of the traffic to another device for analysis.

Converged Enhanced Ethernet (CEE)

CEE is rapidly emerging as the standard for providing lossless storage services in the data center. CEE applies to both FCoE and iSCSI-based storage architectures.

ExtremeXOS

ExtremeXOS is a highly available and modular operating system that supports the entire Extreme Networks product portfolio, from edge to core. Running the same operating system across the entire data center enables ease of use, consistency of features and the ability to apply automation across the network simply.

Ridgeline

Ridgeline is a scalable, full-featured network management tool that simplifies configuration, troubleshooting and status monitoring of IP-based networks. Ridgeline offers a comprehensive set of features that enable the integration with other platforms via an XML interface and virtualization life cycle management on a network-wide basis.

Reference Architecture Diagrams

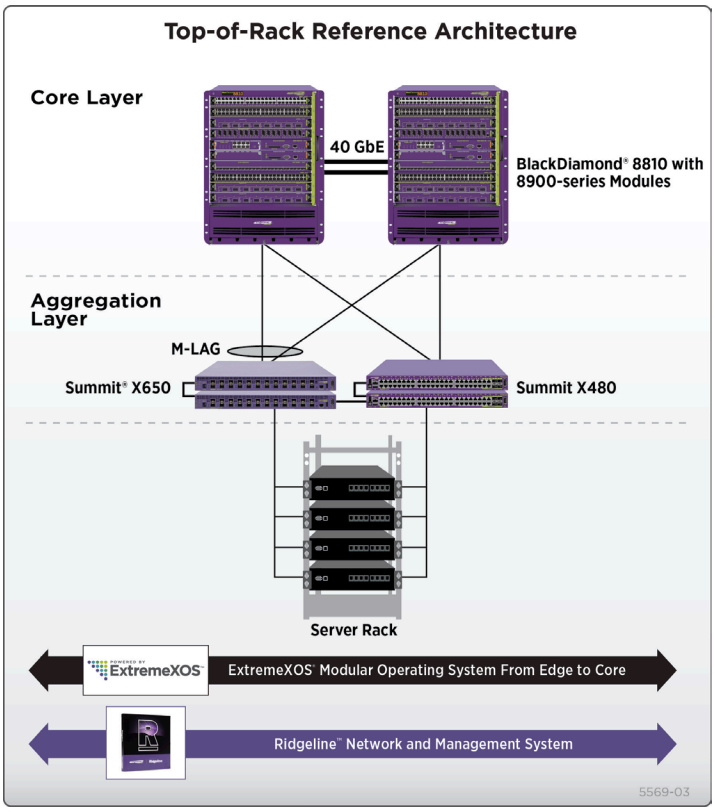

Figure 4: Top-of-Rack Reference Architecture

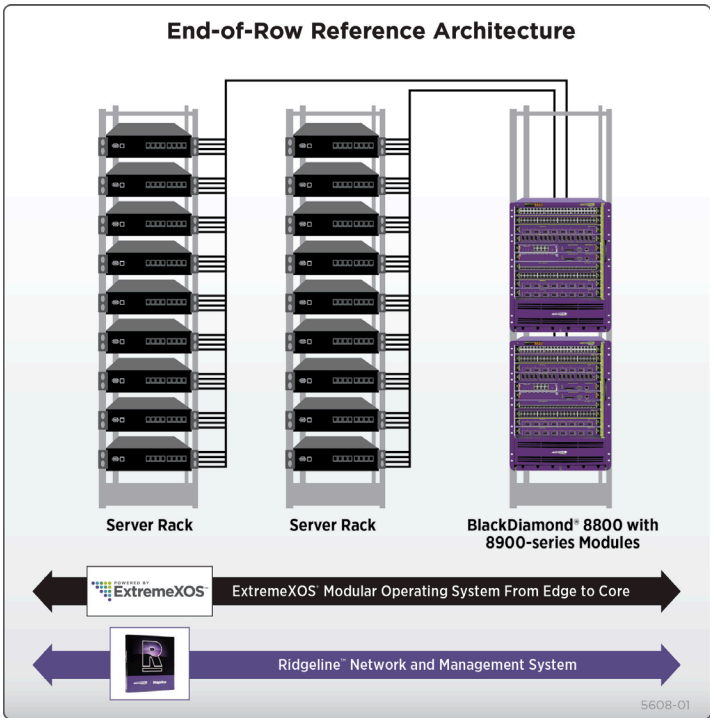

Figure 5: End-of-Row Reference Architecture

Core/Aggregation Layer

The BlackDiamond 8800 series is used in hosting and cloud-based architectures to provide high-performance and high fan out 1/10/40 GbE core and aggregation solutions. Designed to meet both the scale and performance needs of the most demanding environments, the BlackDiamond 8800 series with its 96-port Gigabit Ethernet module and reduced cabling architecture (via MRJ21) can support up to 768 Gigabit Ethernet connections per chassis. The BlackDiamond 8900-series modules also support high-dentisty 10 GbE and 40 GbE line cards for scale-up investment protection. Additional cloud and managed hosting features include:

- Low power consumption
- Large Layer 2 and Layer 3 table sizes
- IPv4 and IPv6 support
- Converged Enhanced Ethernet
- CLEAR-Flow for lossless Ethernet storage capabilities across iSCSI SAN environments
- Single operating system (ExtremeXOS)
- Open automation and integration capabilities
- Ridgeline network management platform
- XML integration with virtualization management platforms
- XNV – Virtualization lifecycle management
- 802.1Qbg (VEPA) enabled switching architecture

Access Layer

The award-winning Summit product family of fixed configuration top-of-rack switches are purpose built to meet the needs of demanding data center environments. Both high density 1 GbE and 10 GbE products provide high-performance line rate capability. The Summit product family comes with the Virtual Interface Module (VIM) that provides an easy upgrade to 40 GbE in the fixed, top-of-rack configurations. The Summit family features 24 port 10GBASE-T implementation with support for up to 100 meters. Features also include Layer 2 and Layer 3 functionality with scale of up to 512K MAC table size and 4,096 VLANs, providing superior scalability for a top-of-rack switch. Cloud and managed hosting features include:

- Low power consumption
- Cross platform stacking
- Large Layer 2 and Layer 3 table sizes
- IPv4 and IPv6 support
- Converged Enhanced Ethernet
- CLEAR-Flow for lossless Ethernet storage capabilities across iSCSI SAN environments
- Single operating system (ExtremeXOS)
- Open automation and integration capabilities
- Ridgeline network management platform
- XML integration with virtualization management platforms
- XNV – Virtualization lifecycle management
- 802.1Qbg (VEPA) enabled switching architecture

Summary

Extreme Networks Managed Hosting and Cloud Data Center Architecture leverages applied performance through a flexible network architecture built on a family of fixed and modular switching platforms that enables a flattening of network tiers while providing the network scale to meet the needs of the future. Network-level virtualization awareness and lifecycle management features help enable the network to be highly automated and cloud-ready so it can be more easily integrated into the world around it.

For more information on Extreme Networks solutions, please visit www.extremenetworks.com

Make Your Network Mobile

Corporate and North America
Extreme Networks, Inc.
3585 Monroe Street
Santa Clara, CA 95051 USA
Phone +1 408 579 2800

Europe, Middle East, Africa and South America
Phone +31 30 800 5100

Asia Pacific
Phone +65 6836 5437

Japan
Phone +81 3 5842 4011

www.extremenetworks.com