

Secure Data Center Architecture for Today's Transformative IT Environment

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Introduction

Cloud, mobility, and big data are driving business change and IT transformation. Enterprise businesses and service providers across all industries are constantly looking for a competitive advantage, and reliance on applications and the data center have never been greater.

The network is physically complex, difficult to manage, and not suited for the dynamic application environments prevalent in today's data centers. In addition, most businesses are dealing with data centers that are distributed across multiple sites and clouds, adding even more complexity. Finally, because the data center is so dynamic, the network is constantly asked to do more and support new applications, while ensuring integration with legacy applications and requiring more frequent refresh cycles. The network poses two specific problems in the data center:

1. Impedes time to value—network complexity gets in the way of delivering data center agility.
2. Low value over time—every time a new application, technology, or protocol is introduced, the network needs to be ripped out and replaced.

The growing popularity and adoption of switching fabrics, new protocols, automation, orchestration, security technologies, and software-defined networks (SDNs) are strong indicators of the need for a more agile network in the data center. Juniper Networks has applied its networking expertise to the problems of today's data centers to develop the MetaFabric™ architecture—a combination of switching, routing, security, software, orchestration, and SDN, all working in conjunction with an open technology ecosystem to accelerate the deployment and delivery of applications for enterprises and service providers.

The MetaFabric architecture addresses the problems common in today's data center by delivering a network and security architecture that accelerates time to value, while simultaneously increasing value over time.

Scope

This document provides an overview of the MetaFabric architecture and contains a high-level overview of the validated design, referred to as the MetaFabric Reference Architecture. This document is a condensed version of the complete Juniper MetaFabric Design and Implementation Guide, which addresses design recommendations in greater detail and provides a complete set of configurations for the elements of the solution.

The primary audience for this guide includes the following technical resources:

- Network/data center/cloud architects—Responsible for creating the overall design of the network architecture that supports their company's business objectives
- Data center engineers—Responsible for working with architects, planners, and operation engineers to design and implement the solution

Framework

The MetaFabric Reference Architecture has been verified by Juniper solution testing, which uses a detailed framework that validates the solution from both a network and application perspective. Testing and measuring applications at scale verifies the integration of the network, compute, storage, and virtualization components.

Juniper Networks validated solutions are complete, purpose-built, domain architectures that:

- Solve specific problems
- Have undergone end-to-end validation testing
- Are thoroughly documented to provide clear deployment guidance

Juniper Networks solution validation labs subject all solutions to extensive testing using both simulation and live network elements to ensure comprehensive validation. Customer use cases, common domain examples, and field experience are combined to generate prescriptive configurations and architectures to inform customer and partner implementations of Juniper solutions. A solution-based approach enables partners and customers to reduce time to certify and verify new designs by providing tested, prescriptive configurations to use as a baseline. And Juniper solution validation provides the peace of mind and confidence that the solution behaves as described in a real-world production environment.

MetaFabric Architecture

The concept behind the MetaFabric architecture is to introduce a single data center blueprint that focuses on three key pillars of operation (Figure 1). The MetaFabric architecture is simple, requiring network and security components that are simple to acquire, deploy, and integrate. The simplification of Juniper devices and network architectures extends from operations, through automation and orchestration, and into physical and virtual environments. A focus on simplicity ultimately enables better network performance, reliability, and reduced operational expense.

The MetaFabric architecture is open and designed to maximize flexibility. This open approach is evident across the devices in the solution and extends to how Juniper works with technology partners. This open approach provides flexibility to integrate any heterogeneous data center environment, support any application, any policy, or any SDN protocol without disrupting services or leading to vendor lock-in.

Finally, the MetaFabric architecture is smart. It uses network intelligence and analytics to drive insight and turn raw data into actionable knowledge to enable a flexible and adaptable data center network.

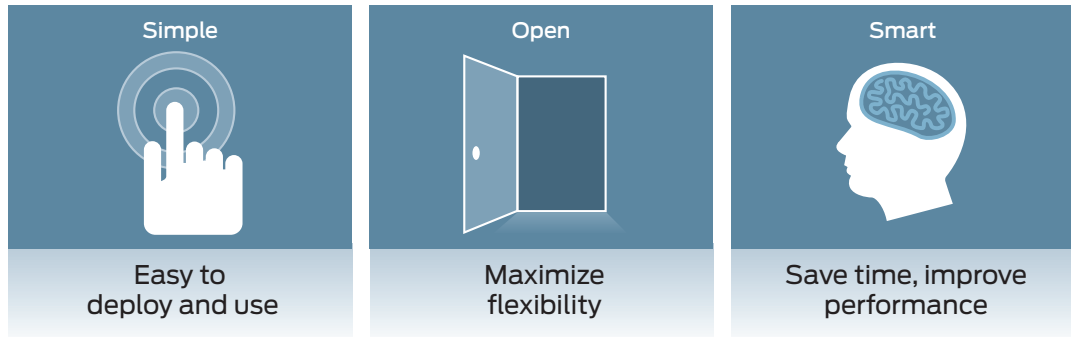


Figure 1: The MetaFabric architecture

Data center architecture is traditionally complex to manage and operate, forcing the business to cage applications and services based on geographic dependencies rather than in response to business requirements. The MetaFabric architecture is built on a foundation that enables simple, open, and smart integration between premises data centers, managed service and hosted service providers, and cloud service providers (Figure 2). The architecture focuses on agility, empowering application changes to happen quickly and with minimal business impact. The architecture allows the network to serve as a facilitator of this agility rather than a hindrance.

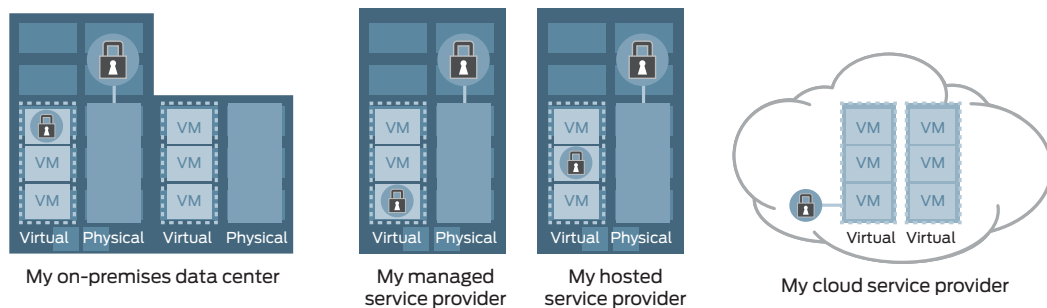


Figure 2: Data center challenge

The MetaFabric architecture accelerates time to value by seamlessly coordinating between applications, devices, and locations, enabling optimal and agile resource utilization across the entire data center footprint. The MetaFabric architecture enables the network and applications to interact at an agile pace, resulting in soaring productivity, tumbling network costs, and a consistent, exceptional user experience across the entire business.

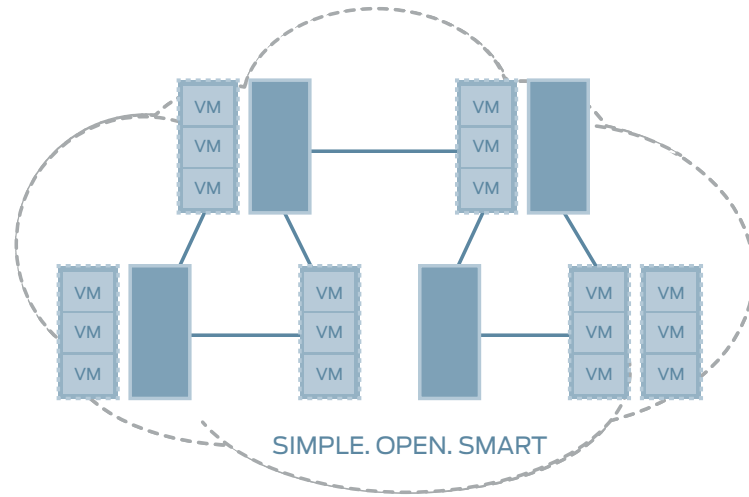


Figure 3: MetaFabric architecture overview

MetaFabric Reference Architecture

The MetaFabric Reference Architecture is a validated end-to-end solution, tested by Juniper Networks and detailed in the MetaFabric Design and Implementation Guide, which enables the enterprise data center to orchestrate compute, storage, and network resources in a way that enables agility in the data center. The solution creates a solid base upon which data center administrators can provision, manage, and maintain business-critical applications within the virtual data center environment. The MetaFabric Reference Architecture supports a complete software stack that covers four major application categories—compute management, network management, network services, and business-critical applications (Figure 4).

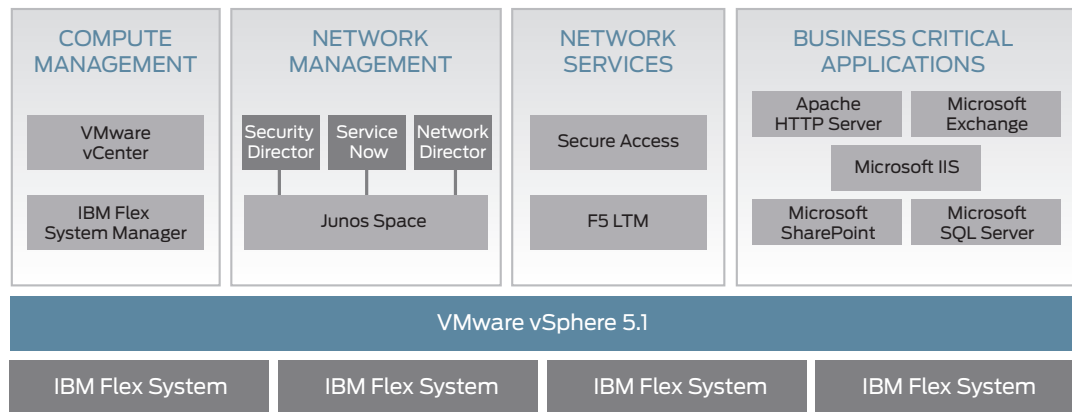


Figure 4: MetaFabric Reference Architecture software stack

Solution Profile Overview

All applications tested in this solution were virtualized using VMware vSphere 5.1 running on IBM hardware. Server virtualization enables operators to achieve scale and operational cost savings through reduced complexity and hardware requirements.

Business Critical Applications

The MetaFabric Reference Architecture employs a suite of common business applications to ensure a complete test and verification of the solution. The applications tested as part of the MetaFabric Reference Architecture include:

- Microsoft SharePoint
- Microsoft Exchange
- MediaWiki
- Microsoft SQL Server
- Microsoft Internet Information Services (IIS)
- Microsoft Windows
- Linux
- Apache HTTP Server

Compute Management

Juniper does not manufacture hardware in this segment, though the solution is built and tested using a mix of standalone and rack-mounted servers, as well as consolidated chassis-based blade servers that host multiple virtual machines (VMs). In partnership with VMware, we are using VMware vCenter to manage compute resources. VMware vCenter is a virtualization management platform that enables centralized control and visibility into compute, storage, and network resources. VMware vCenter is used on a daily basis by data center operators to enable efficient management and provisioning of virtualized data center resources.

Network Management

The MetaFabric Reference Architecture uses Juniper Networks® Junos® Space Network Director for all network management and orchestration. The key differentiator is that Network Director integrates directly with VMware vSphere to handle all VLAN orchestration upon events such as adding a new VM or vMotion, removing a network card, and many other events that result in a VLAN change. Network Director is able to provision and orchestrate VLANs on the physical network through integration with VMware vSphere.

Network Services

The MetaFabric Reference Architecture is built to enable the addition of network services to the virtual environment, either in hardware or virtualized form. The current iteration of the solution covers the largest and most common network services in the IT data center—network load balancing and security. Load balancing can be handled by a physical device, such as an F5 Networks device, or it can be handled virtually, by a software-based load balancer hosted in a virtual machine. The MetaFabric Reference Architecture leverages the edge firewall to enforce north-to-south security from the perimeter and virtual gateway (such as the Juniper Networks vGW Virtual Gateway) to enforce east-to-west security between virtual machines.

End-To-End Design

The MetaFabric Reference Architecture is a complete end-to-end design that includes all network elements from the edge to the data center (Figure 5). Edge routers handle routing between the carrier core network and the MetaFabric architecture environment. The edge firewalls handle security functions such as Network Address Translation (NAT), intrusion detection and prevention (IDP), security policy enforcement, and VPN services. The core switch is the point of the reference architecture where multitenancy is initiated, enabling the creation of multiple discreet environments within which server and data center virtualization can occur.

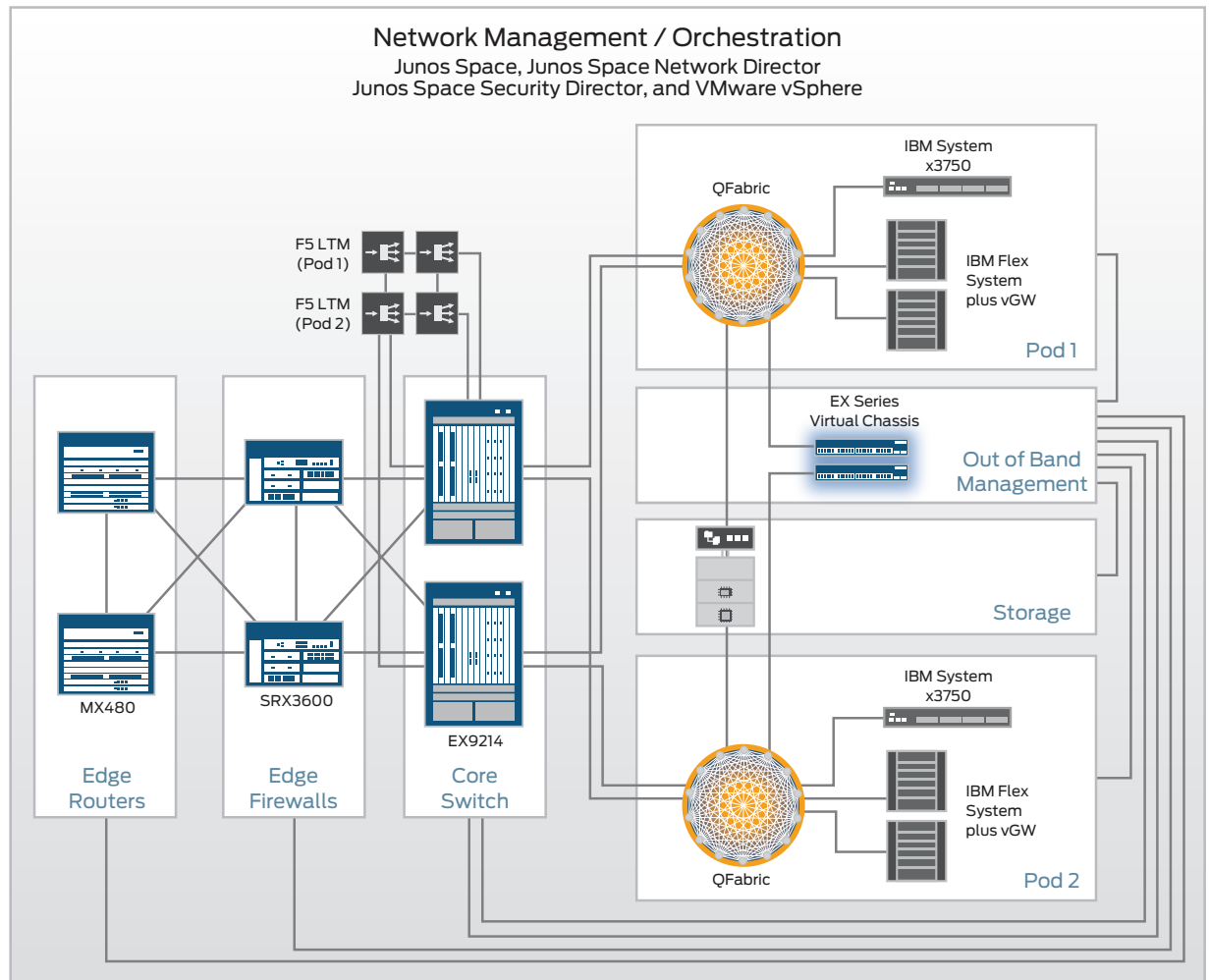


Figure 5: MetaFabric Reference Architecture overview

Reference Solution Architecture Types

The application hosting and data center switching component of the MetaFabric Reference Architecture offers several design choices. A new data center with few requirements and needing a spine and leaf access switch network may start with a top-of-rack Juniper Networks QFX3500 switch and/or a QFX3600 switch. As the business needs outgrow this access network, the same components can be used to migrate to a medium-sized access network by redeploying the QFX3500 and/or QFX3600 switches as edge node devices in a Juniper Networks QFX3000-M QFabric™ System. Finally, as the data center scales beyond this medium access scenario, the existing components can be integrated into a larger access option, featuring the programmable Juniper Networks EX9214 Ethernet Switch as a core switch that serves multiple QFX3000-M PODs (points of delivery). This architecture is designed for growth and enables clean progression between the various options in the data center (Table 1).

Table 1: MetaFabric Reference Architecture Sizing Options

Attribute	Small	Medium	Large
Server Ports	336	768	4,032
Switches	7	16	84
Rack Units	9	20	152

Design Considerations

Specific hardware and software inventories and configurations are provided in the MetaFabric Design and Implementation Guide.

The MetaFabric Reference Architecture solves the integration, VM mobility, and VM visibility challenges in the data center. The methodology used in the MetaFabric Reference Architecture maps directly to business and technical requirements. These requirements guide the careful selection of architecture, products, and protocols that make the most sense in a virtualized IT enterprise data center.

The MetaFabric Reference Architecture is verified by Juniper solution testing, a detailed framework that validates the solution from both a network and an application perspective. Testing and measuring applications at scale verifies the integration of the network, compute, storage, and virtualization components. Juniper solution testing provides the peace of mind and confidence that the solution behaves as described in a real-world production environment.

The MetaFabric Design and Implementation Guide, a comprehensive document written for architects and engineers, starts with a high-level overview of the challenges and then drills down into the details and options that make up the reference architecture. The MetaFabric Design and Implementation Guide is the ultimate point of reference for building a virtualized data center using Juniper Networks and third-party vendor elements. The key areas of this guide are:

- Business requirements and segment overview: This section provides a foundation for understanding the challenges that must be overcome to implement a MetaFabric Reference Architecture.
- Design recommendations and considerations: This section weighs the alternatives and provides clear guidance on the best way to build a data center to meet MetaFabric Reference Architecture requirements.
- Solution implementation and configuration: This section illustrates how to implement and maintain the solution in a production environment.

Why Implement Juniper Networks MetaFabric Architecture?

The MetaFabric architecture is simple, open, and smart. Easy to deploy and use, it features open source innovation to enable integration with partners and other vendors, and to enable the data center to avoid vendor lock-in. The MetaFabric architecture also uses network intelligence and analytics to make the network a source of knowledge and actionable intelligence rather than a line item expense.

The data center fabric offers a single point of management for each POD, and scalable, reusable components that enable agile growth in response to new business requirements. The Juniper Networks QFabric System offers a single point of management for the entire POD, enabling a single point of provisioning, management, and troubleshooting to the network operator.

Another benefit of the MetaFabric architecture is the ability to implement hypervisor security with full introspection using Juniper Networks vGW Virtual Gateway, a comprehensive virtualization security solution that includes a high-performance, hypervisor-based stateful firewall, integrated intrusion detection system (IDS), virtualization-specific antivirus protection, and unrivaled scalability for managing multitenant cloud data center security. The vGW Virtual Gateway also offers full introspection, or a level of VM visibility that enables the operator to monitor software, patches, and files installed on a VM from a central location. An additional benefit of vGW is that it is designed to be centrally managed from a single-pane view, enabling administrators a comprehensive view of virtual network security and virtual machine inventory.

The QFabric System offers yet another level of differentiation to the MetaFabric architecture. The Layer2/Layer 3 fabric features a single management interface that can be directly managed as a single device, or centrally managed as part of an end-to-end data center orchestration system.

Finally, Juniper offers secure remote access into the data center environment using the Juniper Networks SA Series SSL VPN Appliances as remote access systems. The SA Series line enables multifactor authentication, granular security controls, and user scale that gives multitenant data centers the ability to provide many thousands of administrators access into their respective data center environments.

Conclusion

The data center challenges of integration, VM mobility, and VM visibility are solved with Juniper Networks MetaFabric architecture, which delivers a modular, tested approach to data center provisioning and expansion, enabling the enterprise to plan and deploy new virtualized services with a single orchestration plane that spans the entire data center footprint. Data center integration is achieved using a single-pane network management system, combined with network and virtualization systems that support Virtual Chassis technology and single points of management per tier.

The VM mobility challenge in the data center is resolved through a single point of orchestration that addresses the entire data center stack, as well as through the use of network systems that support multichassis link aggregation and single management interfaces on Virtual Chassis systems. Finally, the challenge of VM visibility is resolved through the use of Juniper Networks vGW Virtual Gateway with VM introspection, giving the data center administrator an unparalleled view into virtual machine resources, software, and patch levels.

This architecture enables a scalable, cost-effective approach to data center networking that addresses common issues in the environment, while alleviating the cost pressures typically associated with data center operations.

Additional Resources

Juniper Networks Data Center Solutions: www.juniper.net/us/en/solutions/enterprise/data-center/

Juniper Networks QFabric System: www.juniper.net/us/en/products-services/switching/qfabric-system/

Juniper Networks EX Series Ethernet Switches: www.juniper.net/us/en/products-services/switching/ex-series/

Juniper Networks SA Series SSL VPN Appliances: www.juniper.net/us/en/products-services/security/sa-series/

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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8030012-002-EN Jan 2014

 Printed on recycled paper

