

Juniper Networks MetaFabric Architecture

Enabling a Simple, Open, and Smart Data Center



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Executive Summary

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.

In the data center, where virtualization reigns supreme, IT leaders are now looking at the network as the next frontier in how to achieve greater agility and efficiencies while also driving down costs.

But 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. And finally, because the data center is so dynamic, the network is constantly being asked to do more and support new applications while ensuring integration with legacy applications, necessitating even more frequent refresh cycles. The network, therefore, poses two specific problems in the data center:

1. It impedes time to value¹: Network complexity gets in the way of delivering data center agility.
2. It has low value over time²: 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. Juniper Networks has applied its networking expertise to the problems of today's data centers to develop and deliver 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 alike.

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.

Introduction

Three mega trends—cloud, mobility, and big data—are fundamentally transforming business. Enterprises and service providers across all industries are constantly looking for ways to capitalize on new revenue streams, deliver innovative products, customize services, and create value for their customers.

This drives a much tighter alignment between the business and IT. To thrive in this environment, IT needs to be agile, efficient, and cost-effective. Data centers in particular need to be dynamic enough to meet both new and legacy application requirements while exhibiting all of these characteristics.

When the business demands it, applications are created, deployed, scaled up and down, moved, retired, and modified at an incredibly rapid pace. Unfortunately, legacy networks have traditionally been obstacles to delivering this agility because they are rigid and complex, difficult to manage and troubleshoot, and not well integrated with the rest of the infrastructure or what those applications need. Finally, the pressure is on the business to put all of the pieces together, but this typically requires extremely time-consuming training as well as manual processes for staging, testing, and installation.

Furthermore, because the data center is so dynamic, businesses are also faced with having to refresh the network just to keep up. Converged infrastructures may be acceptable in the short term, but every time a new protocol, technology, or application is introduced, the network needs to be replaced to support it. More often than not, businesses do not have the luxury to rip out the old network and replace it with a new one, so this adds even more complexity for businesses dealing with a heterogeneous environment.

To summarize, the two key problems with the data center network are as follows:

1. It impedes time to value because it's complex and the network gets in the way of delivering data center agility.
2. It has low value over time because every time a new application, technology, or protocol is added, the network needs to be ripped out and replaced.

IT leaders need to rethink their network and security architectures in order to meet these demands and build a proper data center foundation for delivering value to their organizations over time.

¹ Time to value (TTV) is a business term that describes the period of time between a request for a specific value and the initial delivery of the value requested. A value is a desirable business goal; it can be a quantifiable (tangible) or abstract (intangible).

² Value over time describes the difference between the present value of the future returns from an investment and the amount of investment.

Data Center Myths vs. Realities

It's no secret that the data center network is the current scapegoat for lack of IT agility. After all, its shortcomings are well-documented: it's physically complex, with too many devices and too many cables; it's operationally complex, with manual configuration schemes, CLIs, and customized scripts; it's painful to troubleshoot and lacks visibility. Not only that, it's extremely difficult and time-consuming to refresh or re-architect.

Recently, the industry has tried to solve these problems with simplified network architectures, automation tools, and, of course, the introduction of software-defined networking (SDN). However, many of these solutions assume an idealized version of the data center—one that has been perpetuated by the following myths.

Myth #1: The data center only exists within your four walls.

Reality: Data centers are not confined to a single physical location. In fact for most businesses, the data center is distributed across multiple locations. Some of these data centers are assets owned and operated by the business itself, while others may be managed by a third party, colocated in another facility, or simply rented as a service from a cloud provider. The reality is that all of these distributed assets are considered "data centers."

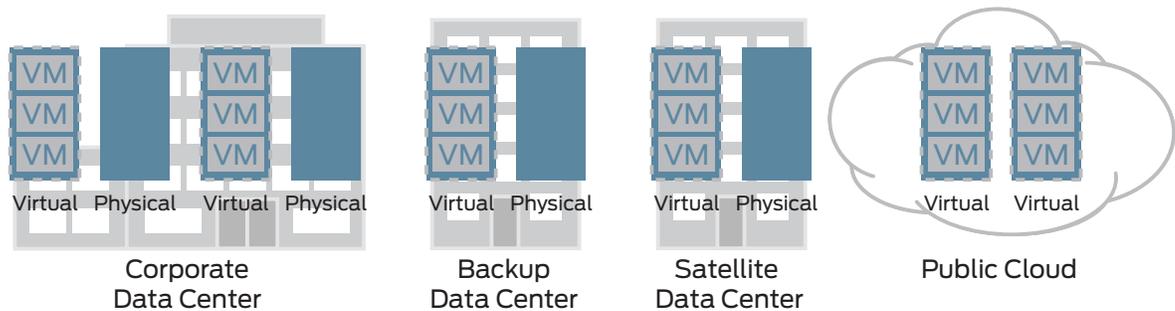


Figure 1: Data centers are distributed across multiple locations.

Myth #2: Data centers are (or soon will be) 100% virtualized.

Reality: Data centers will remain a mix of virtual and physical elements. While there are large numbers of customers using varying degrees of server virtualization, even the most progressive will still have applications that are not virtualized. This might be because of legacy application architectures, or simply because there are bare-metal servers and non-x86 endpoints that can't be fully virtualized.

Myth #3: Workload mobility is easy and pervasive.

Reality: Workload mobility is not as easy as it sounds. Typically, it is limited to very specific maintenance windows for backing up applications and data. Whether it's between geographic locations or within a single building, it is difficult because of the performance and bandwidth required to move applications and the data sets they access closer together.

Myth #4: Security is focused on the application.

Reality: Security policies are bound to geographic locations and delivery platforms (hardware or software), increasing overall complexity. Thanks to the way security has evolved in the data center, businesses are frequently forced to stitch together different products to address different areas within their data center.

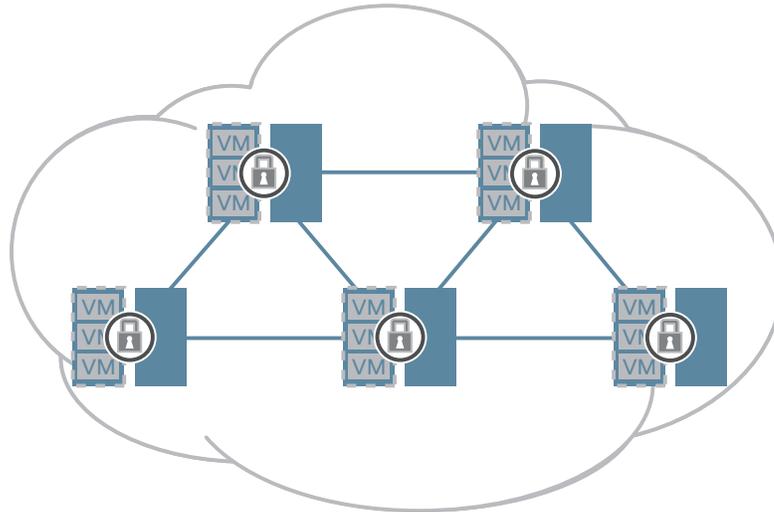
These realities are due largely to how businesses have evolved through organic growth, mergers and acquisitions, expansion, and consolidation. The problem in this environment is that applications are effectively caged by their geographic location and because of the fragmentation of the network and security solutions. This makes the sharing of information, assets, and data much more difficult because of the aforementioned complexity, security policies, compliance and performance concerns. So while it should not matter if an application is coming from a local data center, remote data center, or a cloud data center, the reality today is that it does.

In order to truly achieve the IT agility necessary for applications, these data centers need to be coordinated and interconnected. Resources need to be shared not just within, but also across data centers, and this can only be done with the right network foundation.

This is what Juniper's MetaFabric architecture provides.

MetaFabric Architecture: Enabling a Simple, Open, and Smart Data Center

MetaFabric architecture enables a simple, smart, and open data center that accelerates the deployment and delivery of applications within and across multiple sites and clouds.



Unified, secure, reliable network

Figure 2: The MetaFabric architecture

This architecture gets around the complexity and compromises associated with the geographic distribution of data centers and their compute and storage nodes, whether they are owned by the enterprise or are rented in a public cloud.

When the network and the applications it carries interact at a pace that ensures that neither has to wait on the other, productivity soars, the cost of the network tumbles, employees get the best application experience, and the overall availability of the data center improves.

The MetaFabric architecture achieves two things: it accelerates the time to value for data center investments, and it maximizes the value over time for data center networking and security.

MetaFabric architecture makes this possible because it's built on three basic principles:

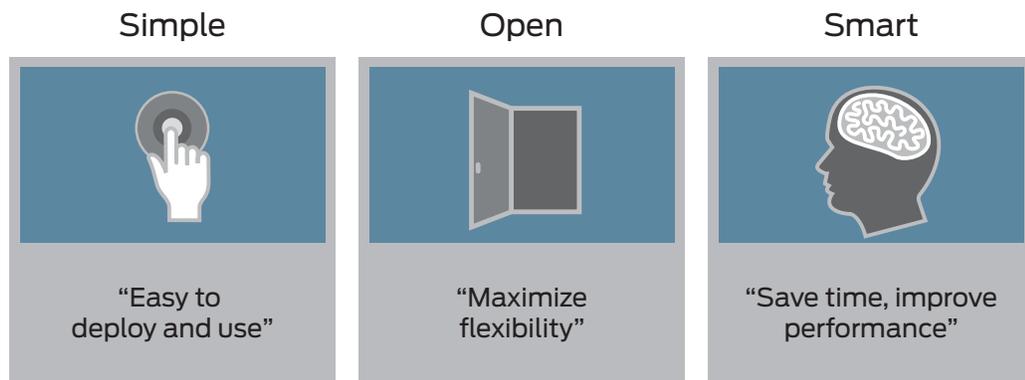


Figure 3: Three principles of a MetaFabric Architecture

- **It's simple:** MetaFabric architecture has a simplified approach across the physical infrastructure, virtual infrastructure, and network and security operations, reducing operating expenses and making the data center network and security easy to deploy, operate, integrate, and scale.
- **It's open:** MetaFabric architecture is based on openness, extending across devices, interfaces, interaction with the open ecosystem, and open communities. As such, it integrates with new and legacy applications in any heterogeneous data center environment, ending vendor lock-in and enabling the freedom to choose any protocol, orchestration platform, security technology, and SDN controller.
- **It's smart:** MetaFabric architecture uses end-to-end network visualization, correlation, analytics, and automation to give organizations insight that helps them make better, more informed decisions for adapting to a changing business climate. It also allows organizations to deploy a proactive, intelligent network optimized for their applications.

Making MetaFabric Architecture Real

When these principles are applied to today's data centers, MetaFabric architecture can deliver the following key technical benefits:

- **Simplified management:** Juniper has a track record of simplifying data center management through a variety of unique switching architectures such as Virtual Chassis, Virtual Chassis Fabric, Junos Fusion and QFabric technology, as well as other standards-based spine-and-leaf and Layer 3 fabrics. With MetaFabric architecture, these architectures can now extend across multiple locations to deliver simplified multisite management. Customers can maintain flexibility by choosing applications such as Juniper Networks Junos® Space Network Director, SDN controllers (including Juniper Networks Contrail and VMware NSX), and cloud orchestration platforms such as OpenStack.
- **Consistent control plane:** Everything in a MetaFabric architecture can share information and propagate state within and across locations, effectively federating intelligence. Juniper does this with standards-based networking protocols and also extends that to make the control plane aware of the virtual network overlays and SDN protocols. This federation makes it easier to mix physical and virtual worlds with gateway devices like Juniper Networks MX Series 3D Universal Edge Routers that can perform “any-to-any translations” across different protocols and technologies.
- **Optimized data plane:** MetaFabric architecture maximizes performance by optimizing the paths for traffic flows. Within a data center, this is accomplished through any-to-any switching fabrics with low, deterministic latency. Across locations, protocols such as Ethernet VPN (EVPN) automatically and dynamically change the path for traffic flows, ensuring the best performance and most efficient use of resources at any given time.
- **Available network and security:** Whether it's adopting a new application, upgrading software on devices, adding a rack, adding a pod, or even adding a new data center, availability has been designed from the ground up to be delivered in a hitless fashion while preserving open, standards-based technologies. The network needs to outlast everything else in the data center, and change has always been its worst enemy. MetaFabric architecture has been designed to solve this problem.

These principles and technical benefits make MetaFabric architecture the ideal network and security data center solution, supporting IT leaders who are striving to accelerate time to value while maximizing value over time.

What's in a MetaFabric Architecture?

MetaFabric architecture is not a single product or technology. It is a complete data center solution that includes a combination of powerful switching, routing, and security platforms leveraging feature-rich silicon, programmable systems, adaptable software, orchestration, SDN, and open APIs that enable integration with the technology ecosystem.

MetaFabric Architecture: Where to Start?

Data centers are extremely diverse. Some are heavily virtualized; some are built to support private clouds with full automation; some are designed for performance and low latency; some are designed for scale; some are even moving forward with SDN. A MetaFabric architecture addresses each of these scenarios, providing simple and open building blocks that allow customers to start wherever they want. A MetaFabric architecture includes:

- Switches that are optimized for the data center, offering the perfect combination of performance, features, and flexibility needed to support any switching fabric architecture for any application
- Routers that are simple, high performance gateways with the ability to interconnect multiple data center sites, clouds, virtual, physical, and SDN workloads using standard protocols and open interfaces
- A simple, fully open and agile SDN solution that automates and orchestrates the creation of virtual networks for new services, greater business agility, and revenue growth
- Data center security solutions that leap past next-generation firewalls by adding technologies that defend, detect, and respond to targeted threats in an adaptive manner
- Smart automation and orchestration management tools that provide network visualization, analysis, and control for accelerated application delivery and higher application availability
- A diverse technology ecosystem that extends innovation from the network out to Juniper data center partners across compute, storage, virtualization, security, SDN, and orchestration

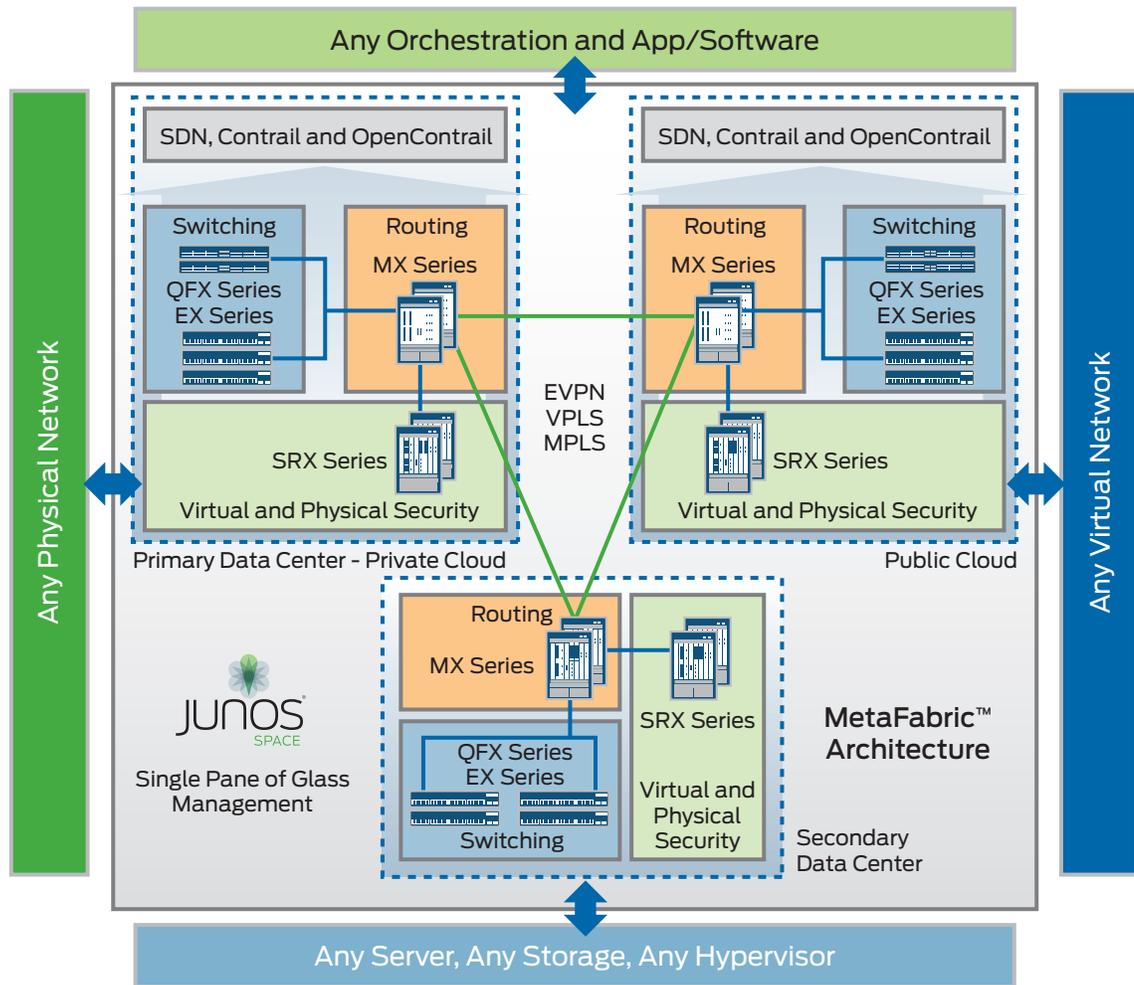


Figure 4: The building blocks of a MetaFabric Architecture

Juniper helps customers build their data centers with the MetaFabric architecture by providing the simple and open building blocks required to simplify deployment and migration. With this approach, customers can start with whatever their business needs dictate today (whether it’s security, switching architectures, data center interconnectivity, SDN, and so on) and gradually evolve and migrate while protecting their investment over time.

Who Benefits from MetaFabric Architecture?

Anyone can benefit from a MetaFabric architecture, even businesses with a single data center location that need a network that can deliver application agility while maintaining a simple and open approach. And extending those benefits to multiple locations and clouds can make the advantages even more substantial.

For organizations looking at cloud, mobility, and big data as opportunities to accelerate their business, a MetaFabric architecture is the right approach to achieve faster time to value and a higher value over time. This applies to any business in any vertical across enterprise and service provider segments, including (but not limited to):

- IT enterprise data centers that are on a path to more virtualization
- Financial services data centers looking for greater reliability and performance
- Data centers in government agencies looking at specific security needs
- Large enterprise customers looking at SDN to help orchestrate their private clouds
- Cloud service providers looking to maximize their revenue per user (RPU) through new service offerings

Conclusion

Ultimately, Juniper believes there are no limits to the type of data center that the MetaFabric architecture can enable. With the continued adoption of switching fabrics, automation, orchestration security technologies, and SDN, the data center will continue to be driven by applications and the need for greater agility.

Juniper is committed to helping its customers along this journey by delivering the right simple, open, and smart foundation for aligning the network to business objectives now, while maintaining flexibility for the future.

Today, that might mean delivering a better mobile customer experience, or solving a big data problem with analytics, or creating flexible and elastic services within the cloud—making MetaFabric architecture the right architecture for the future.

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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