HP FlexFabric

Virtualize network connections and capacity—From the edge to the core

An HP Converged Infrastructure innovation primer

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Data center networking dynamics

The fundamental nature of data center computing is rapidly changing. The traditional model of separately provisioned and maintained server, storage, and network resources are constraining data center agility and pushing budget envelopes to the limit. IT organizations recognize that these static pools of isolated resources are being underutilized—a problem that can be exacerbated when dedicated infrastructure or computer systems are used to support different classes of data center workloads. One response has been for IT organizations to adopt virtualization and blade technologies, which enable a more flexible and highly utilized infrastructure. These new, more scalable technologies can be dynamically provisioned to meet continuously evolving business requirements. At the same time, these technologies apply new pressures to the multiple networks in the data center, further worsening spend issues. And it increases the burden on the IT teams that support them:

- A proliferation of virtual machines is driving much more frequent changes to network configurations.
- Data center network processes must be coordinated through multiple IT teams and are too time-consuming.
- Increases in server utilization require more network bandwidth per server.
- Traditional hierarchical network designs cannot scale nor provide the performance, low latency, availability, and quality of service demanded by a virtualized data center.
- Blade technology is further escalating the number of connections to be managed and increasing bandwidth density.

Network teams are faced with a race to build out data center network capacity and to effectively provision connectivity at an increasing speed. To keep pace, IT organizations need a network architecture that is more coherent, flexible, and agile. But they don't want to give up the stability, high availability, and security offered by the proven compute and storage networks currently installed in their data centers.

HP is creating a new balance by combining some of the best, new, standards-based technologies with a streamlined, modular architecture that fully optimizes virtualized resources, while meeting business requirements for low total cost of ownership, faster time-to-service, and critical requirements for reliability, IT governance, and compliance.

Introducing HP FlexFabric

HP FlexFabric is the next-generation, highly scalable data center fabric architecture of an HP Converged Infrastructure. With FlexFabric, you can provision your network resources efficiently and securely to accelerate deployment of virtualized workloads. With highly-scalable platforms and advanced networking and management technologies, FlexFabric network designs are simpler, flatter, and easier to manage and grow over time. This open architecture uses industry standards to simplify server and storage network connections while providing seamless interoperability with existing core data center networks. FlexFabric combines intelligence at the server edge with a focus on centrally-managed connection policy management to enable virtualization-aware networking and security, predictable performance, and rapid, business-driven provisioning of data center resources.
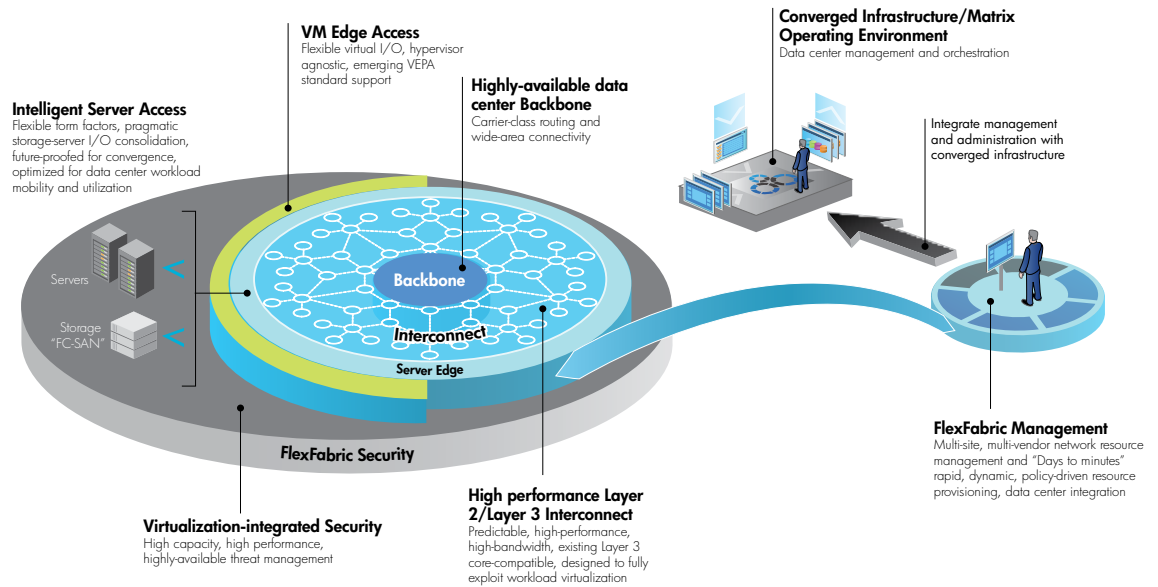
FlexFabric can enable your IT organization to build a wire-once data center that responds to application and workload mobility, and provides resource elasticity. You can move your network connections with your workloads as you migrate them across or between data centers. Also, the fabric can stretch and reclaim pools of resources to meet rapidly changing needs. High-performance threat management tools unify physical and virtual security into a common, extensible framework. Dynamic provisioning capabilities fully exploit virtualized connections to achieve new levels of data center efficiency and accelerate time-to-service. The FlexFabric management and provisioning tools help align the fabric with governance policies and service-level agreements (SLAs), while reducing the cost of operations.

HP FlexFabric benefits

- Improved business agility, faster time-to-service and higher resource utilization by dynamically and securely scaling capacity and provisioning connections to meet virtualized application demands "on the fly"
- Breakthrough cost reductions by converging and consolidating server, storage, and network connectivity onto a common fabric with a flatter topology and fewer switches
- Predictable performance and low latency to support some of the most demanding application workloads

- Modular, scalable, industry standards-based platforms and multi-site, multi-vendor management tools to connect and manage thousands of server and storage devices using industry-standard building blocks
- Investment protection for existing Layer 3 core systems with seamless compatibility and support for open standards
- Flexibility to manage and administer server, storage, and network resources in any organizational model—from completely separate to fully integrated—while consistently enforcing governance, security and SLA policies
- Removal of costly and time-consuming change management processes, while reducing the number of error-prone or conflicting configuration steps
- Support for a wide range of data center deployment models

FlexFabric delivers true "networking-as-a-service" to the various consumers of connectivity within the data center and accelerate deployment of applications and services. It provides a unified connectivity infrastructure—across servers, storage, and networking—that dynamically adapts to the demands of the heavily virtualized and more flexible data center architectures of tomorrow, while meeting increasing pressures for price/performance and time-to-service.

The key attributes of HP FlexFabric

By radically simplifying and flattening network designs and using emerging data center networking standards, HP FlexFabric creates a more robust, flexible, and efficient data center network infrastructure. Rather than relying on a traditional hierarchical networking architecture, FlexFabric offers a flatter data center topology with edge intelligence, designed to complement the intelligent virtualized network interfaces offered by the latest HP data center servers and storage systems. This flat fabric interconnect is more fungible and provides superior network performance and quality of service.

To manage the FlexFabric network, you can design and centrally manage fully-virtualized network connections and resources that allow for dynamic provisioning from the edge to the core and support for application mobility, enabling connections to move with workloads as they migrate across the fabric. This allows resources to be created, moved, and scaled from centralized connection pools "on the fly," putting to work an integrated resource and provisioning management toolset.

To secure the FlexFabric network, a virtualization-integrated security framework provides business continuity with unified, high performance physical/virtual server network security architecture. This framework enables seamless threat management and leverages a global threat intelligence network to block bad traffic in virtual and physical environments.

FlexFabric is designed to support a much wider set of data center architectures, workloads, and requirements than is otherwise possible with traditional data center networking approaches. It supports specialized back office, cloud, web, or high-performance computing models. Instead of locking organizations into a proprietary end-to-end solution, FlexFabric gives them the flexibility to incrementally deploy a heterogeneous data center network that meets their workload needs and protects existing investments.

Predictable performance supports diverse workloads

A highly scalable, flat network domain enables HP FlexFabric to deliver flexible provisioning, ultra-low latency, high performance, and fast workload mobility. The architecture provides breakthrough cost structures by removing networking layers and complexity, and applying new technologies including higher speed Ethernet links, active load balancing, and link aggregation within the server edge and advanced multi-switch virtualization and management in the interconnect. Multiple server edge and interconnect switches can be virtualized and managed as single logical devices with improved utilization, high availability, scalability, and flexibility to handle virtualized workloads with very high throughput. Capacity can be dynamically scaled or divided.

FlexFabric networks are designed to meet the security, resiliency, and reliability requirements expected in today's data center.

Open and standards-based for investment protection

FlexFabric is designed to interoperate with existing third-party Layer 3 core switches to protect existing investments and enable smooth network migration. This standards-based approach removes the risk of vendor lock-in and lets your organization incrementally deploy a FlexFabric network without disruptive forklift upgrades. You can mix and match existing operational processes with new approaches using industry-leading HP products to coordinate IT teams. Finally, this approach helps your organization manage the high purchase, support, and operations costs associated with proprietary environments.

Pragmatic deployment of new technologies

HP FlexFabric utilizes the latest emerging industry standards, including higher speed Ethernet links, Virtual Ethernet Port Aggregation (VEPA), Fibre Channel over Ethernet (FCoE), and Converged Enhanced Ethernet (CEE). The CEE standard enables Ethernet to deliver a "lossless" transport technology with congestion management and flow control features needed in storage environments. Leveraging FCoE today, FlexFabric server edge platforms allow for sensible storage-server I/O consolidation with assured compatibility with existing Fibre Channel Storage Area Networks (FC-SANs). This allows users to reduce cost and complexity without jeopardizing business continuity. HP is championing many of these and other emerging standards in the IEEE and other organizations, to give users a data center fabric that protects their technology investments instead of proprietary approaches that can cause organizational disruption and wholesale equipment replacement.

Data center-integrated management and provisioning for business agility

With management and provisioning integrated down to the component level—including networking and virtual I/O—HP is revolutionizing data center provisioning and operation. Comprehensive network resource management tools allow users to administer networks across multiple sites and against

a combination of HP and multi-vendor platforms from a single pane of glass. Integrated FlexFabric provisioning capabilities reduce time to service and the chance of costly errors while accelerating IT alignment with business demands and goals. FlexFabric enables administrators to centrally define connection and network policies that can be dynamically matched to workloads and provisioned "on the fly" from pools of available resources. The FlexFabric model allows a "design once, replicate many" approach to provisioning that is optimized for workload mobility, streamlines network provisioning, and reduces the number of error-prone or possibly conflicting configuration steps that make change management time-consuming and costly.

FlexFabric removes a major barrier to automation and orchestration—the "all-or-nothing" proposition organizations face with other data center management frameworks. Designed to support a wide range of IT organizational models, FlexFabric offers interfaces designed specifically for each operator type found in IT teams. Network administrators can provision resources in advance and make them available to server and storage teams to utilize instantly when needed, saving time and speeding service.

FlexFabric management integrates seamlessly across the entire spectrum of HP data center management systems to streamline the activities of your data center IT teams without requiring extensive overhauls of organizational structure and processes. This powerful system can automate and coordinate network services with application deployment, and free up data center administrators from repetitive operational activities that drain IT budgets.

FlexFabric provides open interfaces for third-party functionality that integrates application delivery and virtualization engines. Finally, FlexFabric management is fully integrated with industry-leading IT orchestration and management systems from HP, giving your IT staff unprecedented control that spans networks, servers, applications, and even physical plant attributes.

The FlexFabric evolution path

Deliver "networking as a service" to the Converged Infrastructure

FlexFabric is more than just an aspirational model of the ideal data center network. Users can deploy networks today that deliver on the FlexFabric value proposition—aggressively or incrementally—in keeping with overall technology and business objectives. This evolutionary and flexible approach to data center deployment across the infrastructure puts real user needs, investment protection, and business continuity at the top of the list of principles guiding our vision for a Converged Infrastructure network.

Today—A network foundation for FlexFabric agility

First introduced in 2006, Virtual Connect technology is a key enabler of an integrated, data center-aligned network, and delivers against foundation HP FlexFabric principles by providing some of the simplest, most flexible ways in the world to provide high-performance, secure server connectivity. With reduced complexity, improved agility, and reduced cost, Virtual Connect radically simplifies network infrastructure and provisioning without disrupting "upstream" network operations.

HP Virtual Connect virtualizes server edge I/O, enabling server administrators to provision Local Area Network (LAN) and Storage Area Network (SAN) resources in advance, and then enable them when needed. Virtual Connect enables server administrators to move workloads and virtual machines, or add, move, or replace servers transparently to LANs and SANs in minutes without having to engage LAN and SAN administrators.

Attacking head-on the expensive proliferation of Ethernet connections caused by increased network capacity requirements for virtual machines, HP Virtual Connect FlexFabric modules and adaptors can reduce sprawl at the edge by 95%. Virtual Connect FlexFabric modules provides up to four physical connections for each network port, with the unique ability to fine-tune bandwidth to adapt to virtual server workload demands on the fly. The system administrator can now define the hardware personalities of these connections as FlexNICs to support only Ethernet traffic or as FlexHBAs that combine Ethernet and Fibre Channel or iSCSI protocol support. Each connection has 100 percent hardware-level performance and provides the I/O connections needed to take full advantage of multi-core processors and to support more virtual machines per physical server. Each server can support many more connections—up to 40—with less investment in expensive network equipment on the server, in the enclosure and in the corporate network.

The bandwidth of each connection can be fine-tuned and adapted with 100 Mb increments up to 10 Gb as workload demands change. The server comes with 10 Gb capability built into it, ready for today's investments in 10 Gb networks and converged fabric technologies like Fibre Channel over Ethernet. Virtual

Connect FlexFabric modules allow users to take advantage of edge convergence by providing Fibre Channel over Ethernet (FCoE) downlinks to the blades while maintaining standard and proven Ethernet LAN, Fibre Channel SAN, and iSCSI external connections with their associated IT practices. This allows system administrators to simplify enclosure infrastructure and lower costs by combining Ethernet, Fibre Channel, and iSCSI protocols over one wire and managing them from a single management application and interface. For any virtual server environment, Virtual Connect FlexFabric modules and adapters are simply some of the most affordable, flexible, and power-efficient solutions available from any blade portfolio.

For organizations preferring a traditional server edge implementation, network management and design methodology, HP offers scalable blade-based switching. For users looking to achieve high levels of server connectivity consolidation and top-of-rack switch platforms that deliver high performance, advanced multi-switch virtualization, and flexible connectivity, options like FCoE that provide cost-effective storage-server I/O consolidation and 1 Gb to 10 Gb migration are available. With the 6120 series of blade switches or the A5820 series of fixed and semi-modular top-of-rack switches, users have multiple ways to incrementally deploy a FlexFabric server edge that are in keeping with traditional network designs.

Complementing the FlexFabric Server Edge offering, HP offers a complete portfolio of enterprise-class interconnect and backbone platforms that deliver aggregation, core switching, and enterprise routing functionality. These platforms are built on cutting-edge technology and provide industry-leading performance, lower power consumption, and lower TCO with a unified switch operating system that let users built simpler, flatter networks with comprehensive management. Complete feature functionality and mission-critical high availability means that users can deploy a wide variety of designs to accommodate existing Layer 3 core investments or to radically simplify the network in collapsed aggregation/core designs. Advanced multi-switch virtualization technologies allow users to build cost-effective, large layer 2 aggregation layers ideally suited for large-scale virtualization installations. With a continued commitment to open standards-based interoperability, users can easily integrate, proven third-party data center applications and technologies, and avoid vendor lock-in. These data center networking products include the A-series of switches and routers, such as A6600/A8800 enterprise routers and the industry's highest performance A12500 series switches.

HP provides powerful tools for managing large-scale FlexFabric networks both in advanced Virtual Connect-based and traditional network server edge deployments. With HP Virtual Connect Enterprise Manager, users can manage the setup and migration of up to 16,000 Virtual connect-based servers from a single pane of glass. As the foundation for comprehensive network resource management across the entire enterprise network, Intelligent Management Center (IMC) lets users manage an entire multi-site, multi-vendor network, edge to core, from a single management console.

Securing the FlexFabric is a set of tools that brings threat management for both virtual and physical networking together into a single, enterprise-class architecture. The HP TippingPoint Secure Virtualization Framework lets users leverage highly scalable appliance-based Intrusion Prevention Systems (IPS) to comprehensively secure VM-to-VM as well as inter-server and inter-network traffic from a common IPS infrastructure. Combined with a wide range of security subscription services that leverage a global threat intelligence network to block bad traffic in virtual and physical environments, users can provide continuity as they scale out server virtualization deployments.

Tomorrow—A new model for deploying networking as a service

With a vision toward provisioning of network connectivity and resources completely synchronized in an end-to-end data center orchestration layer, HP has developed the Data Center Connection Manager (DCM) appliance as a proof-point for how networking can be enabled to accelerate deployment of virtualized server workloads.

HP Data Center Connection Manager begins to implement the HP FlexFabric dynamic provisioning vision. DCM allows network architects to preconfigure server connection policies that are enforced at the network edge through common RADIUS and DHCP standards. Virtual and physical server interfaces are individually associated or subscribed to connection profiles from a pool of resources by the server administrator at build time, allowing rapid, secure provisioning and workload mobility without the repetitive manual tasks and turnaround time associated with provisioning today. These policies can drive events directly to the HP BSA Network Automation software product suite, enabling deep levels of dynamic automation to provision firewalls or application delivery controllers in response to server provisioning, de-provisioning or configuration changes. These capabilities give network administrators the power to deploy, manage, and evolve server connectivity flexibly, quickly, and in line with business policy and demands.

Beyond—The evolution to a fully-converged, synchronized FlexFabric network

HP is committed to serving the diverse needs of modern data centers without imposing a specific operating model, proprietary architecture, or network fabric. With advances in next generation high-speed connectivity including 10B-BaseT (10 Gbps over copper) and 40 Gb/100 Gb fiber, FlexFabric can evolve to allow your organization to build single, large Layer 2 domains with thousands of direct, low-cost 10 Gbps Ethernet-connected servers, in virtual or non-virtual, rack mount or blade environments, all with equal ultra-low latency paths. The fabric supports Converged Enhanced Ethernet (CEE) either from the server edge or through the aggregation layers, offer full support for Fiber Channel over Ethernet (FCoE), and be capable providing active load balancing across converged and traditional Ethernet-only connections.

To drive next generation security and forwarding capabilities, FlexFabric uses emerging industry standards to build and support virtual switches and virtual I/O adapters. HP has co-authored the IEEE Virtual Ethernet Port Aggregator (VEPA) proposal, which aims to provide multi-vendor, standardized discovery, configuration, and forwarding for virtual switching. FlexFabric plans to be capable of managing VEPA and other virtual I/O components from day one. This standards-based approach gives your IT organization a choice of virtualization vendors and approaches.

Most importantly, FlexFabric allows the rest of the data center infrastructure to exploit the benefits of server, storage, and network virtualization going forward. The nature of I/O buses and adapters is expected to change dramatically in the next five years; as the portion of server deployments whose I/O is completely virtualized increases, the nature of server I/O itself can evolve. No vendor is better positioned for this new world—from a skill set and intellectual property perspective—than HP, because HP is the only company with deep intellectual property in servers, blade servers, networking, storage, and virtualized I/O.

Ultimately, our goal is to allow IT to deploy new systems into a converged infrastructure that can automatically discover capacity, add it to resource pools, and put it to work to support the needs of business applications. As IT takes advantage of application convergence and uses cloud computing, HP can be a comprehensive partner to help you drive down maintenance costs, change economics, and enable your data center network and IT staff help your organization thrive and respond to business demands.

Your next step

To learn more about the HP vision of Converged Infrastructure and how the HP FlexFabric plays a key role in it, visit
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