HP switch virtualization technologies can improve the performance and resiliency of enterprise networks while simplifying operations.
Table of contents

3 Executive summary
3 New network pain points emerge
4 Overcome network shortfalls with HP FlexNetwork architecture
5 Achieve new levels of network performance and resiliency
6 Using HP switch virtualization technologies
8 Freedom to choose
8 Additional Resources
Executive summary

The global digital economy has reinvented virtually every aspect of how businesses—and you—work. An exponential growth of data, the full embrace of mobility, the shift to virtualization and cloud computing, and the rise of video and media-rich collaborative tools are fundamentally redefining when, where, and how you work.

These changes are placing unprecedented demands on your IT infrastructure. Networks are being pushed to the breaking point. Enterprise networks are still being built based on decades-old assumptions about how businesses use technology. And these networks are increasingly fragile, hard to manage, vulnerable to security threats, and above all, costly. Businesses also risk losing competitive ground and missing out on the next wave of opportunity.

Businesses can use the new ways of working—mobility, cloud computing, collaboration, and more—to power new levels of innovation and productivity. But they also need to rethink traditional practices so they can optimize their networks for how applications are designed and delivered today. By modernizing your network, you can take advantage of more efficient network architectures and high-performance technologies. And this allows you to improve your competitiveness while whittling away IT costs.

This paper describes how the HP switch virtualization technologies can deliver high-performance and highly available switching while simplifying management and lowering costs. It is aimed at CTOs, CIOs, IT managers, or business managers, who are interested in making their enterprise network more flexible.

New network pain points emerge

How IT is delivered—from data centers to corporate campuses to far-flung branch offices—has fundamentally changed from the era of client-server applications. The conventional, 3-tier network is proving to be complex and costly—and ultimately does not deliver the necessary levels of agility, performance, and security.

Networks were designed as 3-tier architectures to support the typical traffic flow from servers to users. But service-oriented architecture (SOA) application models and server virtualization have drastically changed how traffic flows inside the data center. Instead of most traffic flowing from servers to clients, most traffic now flows from server to server. The need for bandwidth at the server edge has grown dramatically.

In fact, Gartner says, "If enterprises do not change the tiered network design, they will experience increased congestion, as traffic levels between servers in the data center will grow during the next two to three years." ¹

Traditional 3-tier architectures also use outdated networking technologies that are unsuitable for large enterprise networks. The Spanning Tree Protocol (STP), in particular, is one legacy that has been hampering enterprise network performance and scalability. STP is used to ensure that there is only one active path between any two Ethernet switches in the network so that no loops exist. If an active link or switch fails, STP automatically chooses an alternate path, so the network operates normally again.

The reconvergence to the new path can take several seconds with STP, which is a lifetime in modern computing. Financial transactions are executed in milliseconds and impatient users tapping away at their keyboards do not want to wait until an outdated network protocol does its job.

In addition, STP and its more modern variants eat up valuable network bandwidth, making it less available for applications and data. Half—or more—of the available network bandwidth can be off limits to data because of STP’s overhead.

¹ “Your Data Center Network is Heading for Traffic Chaos”, April 2011.
Campus and branch office networks are being battered by new demands as well. With businesses operating around the clock, network reliability has never been so critical. The importance of network availability and resiliency is compounded by the migration to public and private clouds. Quite simply, if the connection between the user in the branch and the service in the cloud breaks, work halts.

Demand for more capacity is inexorably rising, whether it is on the WAN or LAN. Meeting the growth requirements from data center to branch office demands a more elegant solution than adding more routing, switching, and security products, which leads to even greater complexity and cost.

Despite the rising demands, IT is under unrelenting pressure to lower costs. With IT expenditures taking a major slice out of any organization’s operating budget, IT costs are a natural target for reductions. IT needs a way to scale up network capacity and reliability at a price it can afford.

**Overcome network shortfalls with HP FlexNetwork architecture**

Fortunately, it doesn’t have to be this way. HP created the FlexNetwork architecture, one of the leading modular, end-to-end network architecture that overcomes these legacy network shortfalls. HP FlexNetwork architecture delivers the scale, security, and manageability needed for cloud-based, rich-media-centric, and mobile applications. With the HP FlexNetwork architecture, enterprises can align their networks with their business requirements as they change.

The HP FlexNetwork architecture is an open and standards-based solution that enables scalability in three dimensions: security, agility, and consistency. With it, businesses can build best-in-class networks that meet the specific requirements of the data center, corporate campus, and branch office, rather than being forced into a one-size-fits-all design.

With HP FlexNetwork, enterprises can move from the legacy 3-tier network to a 2-tier design, which supports the demands of virtualization, while also simplifying the design, management, and operations of the network.
Achieve new levels of network performance and resiliency

HP FlexNetwork architecture leverages a set of switch virtualization technologies that allow enterprises to dramatically simplify the design and operations of their data center, campus, and branch office Ethernet networks. HP switch virtualization technologies essentially “flattens” data center and campus networks, helping eliminate the need for a dedicated aggregation layer. It provides direct, higher capacity connections between users and network resources. It allows enterprises to overcome the limitations of legacy design and inefficient protocols by delivering new levels of network performance and resiliency.

HP switch virtualization technologies extend the performance and scalability benefits of modular, chassis-based switches to both modular and stackable switches. No longer do businesses need to compromise enterprise capabilities for the convenience and cost of a stackable switch.

HP switch virtualization technologies, including HP Intelligent Resilient Framework (IRF), HP Mesh Technology and HP 2920 Stacking Technology, are included in a variety of HP data center, campus and branch office switches. The operation of the three network virtualization technologies is similar, although there are some differences explored later in this paper.

All switches in a stack or domain are managed as a single entity using one IP address by the managing logical switch. If the primary switch fails, a new switch is instantly selected, which prevents service interruption, and helps ensure application and network continuity.

HP switch virtualization technologies:

• **Simplify the network design**: Simplifying the data center or campus network from three tiers to two tiers with HP switch virtualization technologies has many benefits, including higher performance with less complexity. Helping eliminate network layers reduces the latency that’s inherent in multi-tier networks, enabling better user experience, whether it is for voice, video, and other highly sensitive applications. With fewer network devices to purchase and manage, both capital and operational expenses are lower.

• **Enable higher performance**: HP switch virtualization technologies deliver greater efficiency and performance. Unlike with STP, which can consume half of the network bandwidth, HP switch virtualization technologies gives you all the bandwidth you are paying for. HP switch virtualization technologies keep all the links active and enable efficient, high-bandwidth connectivity throughout the switching plane. This is true even for multicast data, which is often a major consumer of network bandwidth.


- **Deliver greater resiliency:** Use HP switch virtualization technologies to decrease network downtime by providing higher levels of availability and resiliency. HP switch virtualization technologies deliver faster failover than STP and its relatives, which means higher availability. For example, when a link or switch failure occurs, HP IRF can recover rapidly and reconverge the network in less than 50 milliseconds. While, HP 3800 Switch Series with Mesh Technology reconverges the network with less than 5 milliseconds of latency, representing up to 76 percent lower stacking latency than competitive products. 

- **Ease of management:** No longer do you need to connect, configure, and manage switches individually. HP switch virtualization technologies create a single logical switch by grouping several physical switches into a stack or domain with a single IP address. You can then control multiple active switches via a single management interface, which vastly simplifies network configuration and operations.

- **Add capacity as you grow:** Enterprises can add capacity on a pay-as-you-grow basis by adding switches to the stack. Businesses can achieve massively scalable performance that’s necessary for today’s intensive applications, whether it is virtualized workload mobility in the data center or video on-demand in the branch, you can do it on your terms. Initial acquisition costs are lower because you buy only the capacity you need and there’s no compromise on scalability as needs grow.

## Using HP switch virtualization technologies

HP switch virtualization technologies are used across the FlexFabric, FlexCampus, and FlexBranch architectures. HP has developed two technologies that aggregate multiple switches into a larger switch. HP IRF utilizes standard 10 or 40 Gig interfaces, that can be designated as IRF links, to interconnect the switches and HP Meshed Stacking and 2920 Stacking use dedicated stacking modules and interfaces to accomplish the same objective. HP IRF technology is leveraged across the HP switch portfolio, including for the HP 12xxx, 10xxx, 75xx, 58xx, 55xx, 5120, and 3600 v2 Switch Series. Also, HP IRF is designed for the unforgiving data center and campus environments. Up to nine HP switches of the same family can be combined into a single domain to create an ultra-resilient virtual switching fabric. The fabric may comprise hundreds or even thousands of 1GbE or 10GbE switch ports.

You can utilize multiple 10 or 40GbE between switches to further boost performance. This allows scalable on-demand capacity to support critical business applications.

HP IRF also delivers a network-based in-service software upgrade (ISSU) capability that allows individual HP IRF-enabled switches to be taken offline for servicing or software upgrades without affecting traffic going to other switches in the HP IRF domain.

HP Meshed Stacking and 2920 Stacking deliver a high-performance scalable network to support media-intensive applications for campus and branch offices. The HP 3800 Switch Series provides the industry’s highest level of resiliency in a 1U stackable switch, and the HP 2920 Switch Series provides fixed-port, Basic Layer 3 switching with modular 10G capabilities and each of these switches offer virtualization solutions.

Up to 10 HP 3800 Switch Series can be configured in a ring topology. In this configuration, a link or switch failure creates a chain topology, which enables continued operations. Also, up to five HP 3800 switches can be fully meshed using HP Mesh technology. With each switch directly connected in a mesh configuration, a link or switch failure results in minimal to no impact on the performance of the remaining network.

Configuration of the HP 3800 is truly plug and play. A single management interface is used to configure up to 10 switches in a stack. Software updates are simple, too. You only need to update one switch and the others are updated automatically. When the time comes to add capacity, additional switches can be added to the stack.

The HP 3800 Switch Series has dual-redundant power supplies so that a power failure does not impact the network. The switch can be serviced in the field, with hot-swappable power supplies and a hot-swappable fan tray. These hardware innovations, in conjunction with a robust Layer 3 feature set, including BGP, OSPF, Virtual Router Redundancy Protocol VRRP, and more, makes the HP 3800 Switch Series one of the most agile and resilient stackable network infrastructure solutions available.

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The HP 3800 Switch Series provides comprehensive protection against threats focused on the critical path of the network. It supports IEEE 802.1x for network access control. It also supports virus throttling for attack mitigation and traffic mirroring. The management interface is also encrypted and sensitive configuration information is protected.

The HP 2920 Switch Series can stack up to 4 switches in a chain or ring topology. In the ring configuration, a link or switch failure creates a chain topology, which enables continued operations. Like the HP 3800 Switch Series configuration of the HP 2920 is also truly plug and play. A single management interface is used to configure up to all 4 switches in a stack. Software updates are simple, too. You only need to update one switch and the others are updated automatically. When the time comes to add capacity, additional switches can be added to the stack.

The HP 2920 Switch Series has a removable power supply in case the need for additional Power over Ethernet power is required or if switch needs to be serviced in the field. Also, this switch series provides the flexibility to add 10G uplinks through optional modules that slot into the back of the box. These hardware innovations, in conjunction with a Basic Layer 3 feature set, including Static and RIP routing makes the HP 2920 Switch Series one of the most flexible, stackable network infrastructure solutions available.

Both the HP 3800 and HP 2920 Switch Series are ideal for organizations that place a priority on green IT, as the switches support the IEEE 802.3az Energy Efficiency Ethernet for reduced power consumption. Also, depending on the traffic pattern and idle periods, the power savings can be substantial. For instance, the HP 3800 Switch Series provides up to 13 percent lower energy consumption than competitive products. These switches also support 10GbE over standard copper cabling as well as IPv6. In addition, both families support OpenFlow and are part of the HP Software Defined Network solution.

Software updates may be required.
Freedom to choose

With HP, enterprises have the freedom to choose best-in-class networking technologies for their data centers, campus, and branch offices. HP switch virtualization technologies, a key element in the FlexNetwork architecture, allow enterprises to simplify and scale their networks while helping eliminate time-worn designs and protocols. With HP FlexNetwork, enterprises can free themselves from vendor lock-in and build a high-performance, scalable, and affordable network that supports how businesses and people work today.

Table 1. HP Switch virtualization technologies

<table>
<thead>
<tr>
<th>Differences</th>
<th>Single IP address management</th>
<th>Simple network operation</th>
<th>Distributed link aggregation</th>
<th>Sharing of resources (routing/forwarding tables)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Intelligent Resilient Framework (IRF)</td>
<td>Mesh stacking on HP 3800 series</td>
<td>HP 2920 series stacking</td>
<td></td>
</tr>
<tr>
<td>Max switches in stack</td>
<td>9</td>
<td>10</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Topologies</td>
<td>Ring, chain</td>
<td>Ring, chain, mesh</td>
<td>Ring, chain</td>
<td></td>
</tr>
<tr>
<td>Cable lengths</td>
<td>Up to 70 km</td>
<td>Up to 5, 1, 3 meter</td>
<td>5, 1, 3 meter</td>
<td></td>
</tr>
<tr>
<td>Throughput</td>
<td>20 Gbps/link, Up to 320 Gbps/switch</td>
<td>80 Gbps/link, Up to 3.4 Gbps/module</td>
<td>40 Gbps/link, Up to 80 Gbps/module</td>
<td></td>
</tr>
<tr>
<td>Modular/built-in</td>
<td>Built-in/modular</td>
<td>Modular</td>
<td>Modular</td>
<td></td>
</tr>
</tbody>
</table>

Additional Resources

To learn more about HP products, contact your HP sales representative. For more information on HP Networking visit [hp.com/go/networking](http://hp.com/go/networking)

Reducing network complexity, boosting performance with HP IRF technology [hp.com/networking/irf](http://hp.com/networking/irf)


HP 2920 Switch Product Tour [hp.com/networking/2920](http://hp.com/networking/2920)