HP Virtual Connect Flex-10 technology: Convergence with FlexFabric components

Technology brief

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Introduction

HP Virtual Connect (VC) Flex-10 technology is a hardware-based solution that lets you split a 10 Gb/s server network connection into four variable partitions. Flex-10 technology lets you replace multiple lower bandwidth physical NIC ports with a single Flex-10 port. This reduces management requirements, the number of NICs and interconnect modules needed, and power and operational costs.

Now that we have achieved an acceptable level of LAN convergence with Flex-10 technology, the next logical step is to add LAN/SAN convergence technology. Virtual Connect FlexFabric broadens Virtual Connect Flex-10 technology to provide solutions for converging different network protocols.

This technology brief discusses the HP hardware and software technology that make up VC Flex-10 modules, VC FlexFabric modules, and FlexFabric adapters. The brief also examines how they function with Virtual Connect.

We also discuss Flex-10 compatibility with 10 Gb Ethernet architecture and Fibre Channel over Ethernet (FCoE). This paper should help you decide whether Flex-10 is appropriate for your network environment. If you already use Flex-10, the paper can help you understand the advantages and requirements of adding Virtual Connect FlexFabric modules and FlexFabric adapters to your existing infrastructure.

HP Virtual Connect Flex-10 overview

Flex-10 technology lets you configure a single 10 Gb Ethernet port to represent four FlexNICs (Figure 1). A FlexNIC is an actual PCIe function that appears to the system ROM, OS, or hypervisor as a discrete physical NIC with its own driver instance. It is not a virtual NIC contained in a software layer.

![Figure 1. Simple 10 Gb Ethernet port compared to Flex-10 partitioned bandwidth](image)

You set the bandwidth available to each FlexNIC using the Virtual Connect Manager CLI or GUI and change the bandwidth allocations dynamically without having to reboot the server. You can adjust bandwidth of each FlexNIC in 100 Mb increments, according to your server workload.
Flex-10 NIC devices currently available are dual-port LAN-on-motherboard NICs (LOMs) or mezzanine cards that support up to four FlexNICs per port. VC Flex-10 interconnect modules support up to 64 FlexNICs. The modules also support traditional (non-Flex-10) 10 Gb and 1 Gb NIC devices.

Because Flex-10 technology is hardware-based, FlexNICs eliminate the processor overhead required to operate virtualized NICs in virtual machines and with traditional operating systems. It lets you add multiple NICs without adding more server NIC mezzanine cards and associated interconnect modules.

**Traffic flow in Flex-10 devices and modules**

Traffic moves from the Flex-10 NIC device (LOM or mezzanine card) to the Flex-10 module on a single, physical pathway. This pathway uses the 10GBase-KR (IEEE specification 802.3ap) single lane, serial Ethernet backplane connection standard.

While FlexNICs share the same physical port, traffic flow for each is isolated with its own MAC address and FlexNIC VLAN tags. You can map each FlexNIC to one or more Virtual Connect networks (vNets) and isolate data traffic by using OS or driver generated VLAN tags (Figure 2).

The FlexNIC device adds its own outer VLAN tag before the packet travels to the associated VC Flex-10 module. This may be in addition to any OS-generated VLAN tags. The outer VLAN tag is an industry-standard “service” or “provider” VLAN tag.1 Provider VLAN tags are transparent to users and administrators.

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1 Also called “Q-in-Q” tagging, 802.1QinQ is an amendment to IEEE 802.1Q and lets multiple VLAN headers be inserted into a single frame.
Either the host OS or FlexNIC driver places a VLAN tag in the packet. The VC Flex-10 module preserves or translates the VLAN tag when it travels through the module. Virtual Connect can act as a VLAN bridge and translate between the VLAN numbering scheme used on the servers and the scheme used on the upstream physical switches in the data center network.

Four connection modes affect whether Virtual Connect preserves or translates the VLAN tag:

- Mapping mode—using a shared uplink set (SUS)
- Mapping mode—using a dedicated link
- Tunneling mode—using a SUS
- Tunneling mode—using a dedicated link

Mapping mode

In mapping mode, Virtual Connect examines all the VLAN tags. Mapping mode is primarily designed for use with shared uplink sets.

A SUS is a Virtual Connect specific term that is equivalent to a “trunk” or “VLAN trunk.” A SUS can carry traffic from multiple Virtual Connect networks (vNets) over the same physical link. Each vNet uses a specific VLAN tag to identify it on that SUS. On a SUS, the VLAN tagging is done at the VC/data center boundary. For example, the OS adds VLAN tags when packets leave the Virtual Connect-enabled enclosure and removes them when packets enter the Virtual Connect module. Packets are forwarded according to that vNet’s rules and the domain’s connection mode (VLAN tunneling or mapping mode).

Virtual Connect applies these SUS rules per domain:

- 320 Unique VLANs per Virtual Connect Ethernet module
- 128 Unique VLANs per SUS
- 28 Unique Server Mapped VLANs per Server Profile Network Connection (28 VLANs x 4 FlexNICs gives a maximum of 112 unique vLANs)

Figure 3 shows how Flex-10 handles OS-tagged and untagged packets in mapping mode. It shows how Virtual Connect adds and translates the VLAN tags as the packet moves from the OS through the FlexNIC, the Flex-10 module, and then out to the external network. The FlexNIC adds its tag that identifies the FlexNIC that the packet came from. For example, Figure 3b shows a SUS with OS-tagged packets. Virtual Connect combines that outer FlexNIC VLAN tag and the inner OS tag to map an Ethernet packet to a particular vNet.

Mapping is typically not used with a dedicated uplink because the dedicated uplink represents a single network assigned to only one vNet. The vNet associated with a dedicated uplink only supports untagged packets from the server NIC ports or FlexNICs associated with the vNet. This means that all packets transmitted by the dedicated uplink will be untagged and Virtual Connect strips off the outer FlexNIC VLAN tag before sending on to the external network (Figure 3c). Virtual Connect will drop all VLAN tagged packets (Figure 3d).
Virtual Connect can also map multiple networks to a single server NIC (non-Flex-10) or FlexNIC port. Figure 4 shows how a single FlexNIC handles packets with multiple OS tags (defined by different “OS TAG” colors in the figure). In this example, the Flex-10 NIC adds an outer VLAN tag to represent the FlexNIC the packets are associated with. These double-tagged packets map to vNet destinations within the VC modules, as indicated by the vNet colors matching the OS tag colors. Packets arriving from a SUS uplink have a single VLAN tag that is remapped to the appropriate vNet within the VC modules. After packets have been assigned to a VC vNet (regardless of where they came from), the modules determine the destination of the packet via a MAC address lookup on that vNet. The VC module forwards the packet to the appropriate downlink (server) or uplink (SUS) port. The packet remapping from vNet to downlink or uplink follows the same process in reverse operation. OS-tagged packets with destinations outside the VC domain use SUS uplinks that can carry packets for multiple vNet networks over the same link(s).
Virtual Connect adds or translates the VLAN OS tag in mapping mode. The figure shows only one 10 Gb port for the LOM or mezzanine card, but all FlexNIC devices have two ports.

Mapping is preferred over tunneling because it is more efficient and powerful. Mapping makes the server-side VLANs independent of the network-side VLANs.

However, on a mapped connection, the VC firmware limits the connections to 128 VLANs from an uplink set. If you need more than 128 VLANs on a single link, you must use tunneling.

**Tunneling mode**

In tunneling mode, Virtual Connect passes OS-tagged and untagged data straight through the VC Flex-10 module without examining it. Tunneling mode is designed for dedicated uplinks.

When operating in tunneling mode, Virtual Connect makes its forwarding decisions purely on the MAC addresses and the vNet server port assignments associated with that dedicated uplink. The dedicated uplink can carry multiple VLANs over the same link, but these VLANs are transparent to Virtual Connect and are associated with a single vNet. Because Virtual Connect is ignoring the VLANs, there are no limits to the number of VLANs supported by a dedicated uplink in a Virtual Connect Domain operating in VLAN tunneling mode.

Figure 5 shows how Flex-10 technology handles tagged and untagged packets in tunneling mode.
Figure 5. Virtual Connect Flex-10 tagging method used in tunneling mode

Virtual Connect Flex-10 VLAN Tunnel Mode

<table>
<thead>
<tr>
<th>OS Transmits Packet</th>
<th>FlexNIC Transmits Packet</th>
<th>Packet enters VC Flex-10 module</th>
<th>Packet exits VC Flex-10 module</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shared Uplink Set (SUS)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OS sends untagged packet</td>
<td>FlexNIC adds tag</td>
<td>VC replaces FlexNIC tag with vNet tag</td>
<td>VC translates vNet tag upon egress on uplink</td>
</tr>
<tr>
<td>OS sends tagged packet</td>
<td>FlexNIC adds tag</td>
<td>VC drops packet</td>
<td>Nothing is transmitted</td>
</tr>
</tbody>
</table>

Dedicated Uplink

<table>
<thead>
<tr>
<th>OS Transmits Packet</th>
<th>FlexNIC Transmits Packet</th>
<th>Packet enters VC Flex-10 module</th>
<th>Packet exits VC Flex-10 module</th>
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<td>OS sends untagged packet</td>
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<td>VC removes vNet tag upon egress on uplink</td>
</tr>
</tbody>
</table>

Figure 6 illustrates a Virtual Connect Flex-10 VLAN tunneling configuration. This example shows one dedicated uplink for tunneling OS-generated tags through a Flex-10 NIC device and VC module to an external data center switch. If the OS sends an orange-tagged packet through the Flex-10 NIC device, that packet passes through to the data center switch without examination. The data center switch then sends the OS-tagged packet back into the Virtual Connect Flex-10 interconnect module through the SUS and to the intended target. In this case, the target is a legacy 1 Gb (non-Flex-10) NIC connected to the vNet using a SUS.
Virtual Connect Flex-10 management

Our engineers designed FlexNICs to be treated exactly like existing server NICs in a VC environment whenever possible. Table 2 describes VC features that differ when using a Flex-10 device.

<table>
<thead>
<tr>
<th>Function</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dynamic Network Assignment</td>
<td>Each FlexNIC on a physical port must be on a different vNet. If you try to attach a FlexNIC to a vNet that already has another FlexNIC on the same physical port, the assignment will fail and you will get an error. You must reboot the server before any FlexNIC network assignment changes take effect.</td>
</tr>
<tr>
<td>Port Monitoring</td>
<td>You can enable port monitoring per physical port. The monitoring port shows traffic from all FlexNICs on a single physical port. You can configure filters on a network analyzer to filter unwanted traffic.</td>
</tr>
<tr>
<td>Internet Group Management Protocol (IGMP) snooping</td>
<td>The bit map will be extended to sub-ports that represent physical functions on the switch.</td>
</tr>
<tr>
<td>Function</td>
<td>Status</td>
</tr>
<tr>
<td>----------------</td>
<td>----------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Private Networks</td>
<td>FlexNICs in a private network cannot communicate directly with other server NICs and FlexNICs in the same network. These ports can only send traffic upstream through the VC domain and out the uplinks to your external networks. In the reverse direction, there is no restriction on upstream ports.</td>
</tr>
<tr>
<td>Server VLAN handling</td>
<td>Flex-10 supports both VLAN tunneling and VLAN mapping on FlexNICs.</td>
</tr>
<tr>
<td>SmartLink</td>
<td>SmartLink functionality is identical between standard 1 Gb NICs and FlexNICs when using VC v2.30 or greater.</td>
</tr>
</tbody>
</table>

**FlexNIC addressing**

You can use either Virtual Connect-assigned or default MAC addresses for FlexNICs. When using default MAC addresses, FlexNICs will still have unique MAC addresses.

You can assign each FlexNIC on a physical port to a different vNet (Figure 7a) or leave it unassigned, but you cannot assign multiple FlexNICs on a single port to the same vNet (Figure 7b). Some administrators may want to associate multiple NICs with the same network for increased bandwidth. If you need additional bandwidth in a Flex-10 environment, rather than assigning multiple FlexNICs to a single port, you can reduce bandwidth on an underutilized FlexNIC and give that bandwidth to the FlexNIC that requires it.

**Figure 7.** FlexNIC assignment: 7a shows each FlexNIC assigned to a different vNet. 7b shows that you cannot assign multiple FlexNICs to the same vNet.

**Virtual Connect server profiles and Flex-10**

When you set up the Virtual Connect server profiles for Flex-10, consider the following:

- A Virtual Connect server profile can contain up to 24 NIC ports (for a single, half height BladeSystem server with two Flex-10 mezz cards).
• You can assign existing non-Flex-10 server profiles to Flex-10 ports. The connection port speed defaults to Auto.

• Flex-10 lets you specify the preferred port speed and the maximum port speed for a VC network or a connection with multiple networks (mapped VLANs). When you create and edit profiles, any connection to this network defaults to the preferred speed. You cannot choose a speed greater than the maximum available bandwidth.

• The Flex-10 modules support non-FlexNIC 1 Gb server ports, but you cannot configure bandwidth speeds on them.

Convergence with VC FlexFabric modules and FlexFabric adapters

HP has launched a suite of products within the VC family that extends Flex-10 technology into LAN/SAN convergence. VC FlexFabric modules and FlexFabric adapters can converge Ethernet, Fibre Channel, or accelerated iSCSI traffic into a single 10 Gb data stream, partition that 10 Gb bandwidth into multiple adjustable bandwidths, and preserve routing information for all data classes.

Until now legacy Ethernet has been unable to support the requirements of lossless, block-based storage traffic. Data Center Bridging (DCB, also called Converged Enhanced Ethernet) allows lossless behavior even in heavily congested networks. This makes it ideal for handling block storage traffic in a converged network environment. FCoE protocols perform best on DCB-enabled Ethernet networks so that Ethernet can now carry storage traffic. FlexFabric adapters use DCB-standard packets to encapsulate Fibre Channel as FCoE.

The IEEE 802.1 Work Group has nearly completed developing these standards for DCB. However, the implementation is still relatively immature and the IEEE has not finalized the protocols for converged networks throughout the data center. This is why we are using known technology requirements to converge networks only at the server-network edge in BladeSystem enclosures—VC technology splits apart the converged stream to native Ethernet LANs and Fibre Channel SANs at the FlexFabric modules before going to external connections. We view this approach as the best opportunity for taking advantage of “converged network” benefits, where the standards are the most stable so you can obtain the greatest return on investment.

Figure 8 shows how FlexFabric adapters converge FCoE and IP data streams. The FlexFabric adapter encapsulates Fibre Channel packets as FCoE and consolidates the Fibre Channel and IP traffic into one 10 Gb data stream. The FlexFabric interconnect module separates the converged traffic. Fibre Channel and IP traffic continue beyond the server-network edge using the existing native Ethernet and Fibre Channel infrastructure.
VC FlexFabric adapters

A FlexFabric adapter is more than a converged network adapter (CNA) because it provides standard NIC functions, Flex-10 NIC device capabilities, and Fibre Channel or iSCSI FlexHBA capability. A single FlexFabric adapter cannot converge both Fibre Channel and iSCSI traffic at the same time.

Each FlexFabric adapter contains two 10 Gb Ethernet ports. Each 10 Gb Ethernet port has four Flex-10 physical functions (PFs)—either FlexNICs or FlexHBAs.

A FlexHBA is an actual PCIe physical function on the FlexFabric adapter that you can configure to handle storage traffic. The server ROM, OS, and hypervisor recognize the PCIe function as an HBA device. As with a FlexNIC, you can adjust the FlexHBA transmit bandwidth in 100Mb increments up to 10 Gb.

FlexFabric physical function assignments

You can assign storage traffic (Fibre Channel or SCSI) as a FlexHBA only to the second PF of each FlexFabric adapter port. We use the second PF of each port as the storage function because in a traditional CNA this is the PF used for storage access. If you do not need block storage access, you
can disable the FlexFabric adapter storage function and configure the second PF as another FlexNIC function. The first, third, and fourth PFs work only as FlexNIC devices and will always have a NIC personality. The like-numbered PFs (F1, F2, F3, F4) of each port on the same FlexFabric adapter must have the same personality. (You could also disable one or both of the like-numbered PFs.) This means that Fibre Channel FlexHBA and iSCSI FlexHBA cannot exist on the same FlexFabric adapter at the same time.

You can configure the FlexFabric adapter profile through the Virtual Connect Manager (VCM). VCM determines the “personality” of each of the PFs on the FlexFabric adapter. The VCM configuration also negotiates with the VC FlexFabric module and assigns a VLAN to each PF. The LAN traffic may also have VLAN tags from the OS. This depends on the use of tunneling and shared uplink sets (SUS).

The OS sees each PCI PF on the FlexFabric adapter as a conventional hardware NIC, Fibre Channel HBA, or iSCSI HBA device. Each PF advertises its VLAN assignment designated by the VCM server profile. The advertised device type and VLAN assignment steers individual traffic classes to the appropriate PF (F1, F2, F3, or F4) on the FlexFabric adapter (Figure 9).

**Figure 9.** FlexFabric adapter configured for Fibre Channel and displaying data traffic on one 10 Gb Ethernet port

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**HBA driver support**

You can use the same drivers for the FlexHBA function on a FlexFabric adapter as those for a traditional Fibre Channel HBA adapter (as long as the drivers are from the same vendor). You can also use Virtual Connect to manage the FlexHBA option ROM image and boot parameters. FlexHBAs support boot from SAN capabilities just like legacy Fibre Channel or iSCSI HBAs.
iSCSI data traffic

FlexFabric adapters handle iSCSI data in the same way as they do FC—the converged traffic leaves the FlexFabric adapter as a single data stream. However, iSCSI can share the same networks and uplinks from the VC FlexFabric module where the LAN/IP data streams flow because it does not need DCB-enhanced networks.

Determining FlexFabric adapter “personality”

A FlexFabric adapter’s “personality” makes up the attributes that let the second PF on each of the two ports handle different data classes. Using the VC Manager (VCM), you can create a profile that determines the personality of the second PF of each physical port of a FlexFabric adapter.

VCM personality profiles for FlexFabric adapters have the following characteristics:

- Maximum of two Fibre Channel or iSCSI FlexHBA functions per FlexFabric adapter, one per port
- Failover support
- Support for Multipath I/O\(^2\) (MPIO) logic in OS for FlexHBAs
- CHAP\(^3\) and Mutual CHAP support for iSCSI FlexHBA point-to-point protocol authentication
- Up to 128 targets per iSCSI or Fibre Channel FlexHBA
- Target discovery for FlexHBAs
- Boot from SAN parameters and target information specified in Virtual Connect, iSCSI BIOS Utility, and/or OS for each FlexHBA

FlexHBA addressing

Just as with FlexNICs, you can use either VC-assigned or server factory default MAC addresses for iSCSI or FCoE FlexHBAs. The primary difference with the FlexHBA is that instead of having four PF functions for LAN/IP traffic per port, you can configure the second PF function on each port of the FlexFabric adapter for storage traffic. When using server factory default MAC addresses, FlexHBAs will still have unique MAC addresses.

For FCoE FlexHBAs, you can assign and manage not only MAC addresses, but you can also assign World Wide Names (WWNs) from pools of managed addresses. This capability makes managing WWNs consistent for both native Fibre Channel environments and FCoE enabled converged network environments within the VC domains. VC FlexFabric’s goal is to let you manage converged and non-converged data center infrastructure components with common management procedures to simplify the transition from non-converged to converged technology.

Mapping FlexHBAs to vNets or vFabrics

You can assign each FlexHBA on a physical port to a different vNet or vFabric depending on the personality of the FlexHBA function. Because iSCSI traffic uses regular Ethernet protocols, you can assign iSCSI traffic to a vNet.

A vNet is a simple network connection between one or many server NICs and one or many uplink ports.

A vFabric is an object within a VC Fibre Channel or VC FlexFabric module that represents a unique SAN fabric. Unlike vNets, vFabrics do not span multiple VC modules. As a result, vFabric traffic cannot travel across stacking links from one module to another. Fibre Channel or FCoE traffic that

\(^2\) MPIO logic maps redundant data paths between initiators and targets to provide alternate routing in the event of device or link failure

\(^3\) Challenge Handshake Authentication Protocol (CHAP) authentication
travels to/from servers attached to a VC module must be forwarded to/from the Fibre Channel uplinks on that module. You can assign one or more Fibre Channel uplinks on a module to the same vFabric. The VC module checks the fabric login information to make sure that all the Fibre Channel uplink ports connect to the same external SAN Fabric. You can assign server Fibre Channel or FCoE ports to only one vFabric; consequently, the ports can connect to only one external SAN fabric. VC modules use FC N_Port mode operation on the Fibre Channel uplink ports. This will load balance each server’s connection to a vFabric as an N_Port ID Virtualization (NPIV) login across all vFabric uplinks attached to the same external SAN fabric.

You can assign an FCoE FlexHBA function on a physical port to any vFabric. The VC storage administrators define the vFabrics. If you don’t assign the FlexHBA function to a vFabric, the FCoE FlexHBA function will report a logical “link down” condition.

You can assign an iSCSI FlexHBA function on a physical port to any vNet. The VC network administrators define the vNets. You can assign an iSCSI FlexHBA either to a vNet dedicated for iSCSI storage traffic, or to a vNet shared with NIC/IP FlexNIC traffic. The iSCSI FlexHBA function reports a logical link down condition if it is unassigned.

In typical environments, you will connect the FCoE (or iSCSI) FlexHBA functions to different vFabrics (or vNets) for redundant storage connections. Figure 9 illustrates this for FCoE.

Figure 9. Redundant FCoE FlexHBA vFabric assignment

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VC FlexFabric products

With VC firmware v3.15, VC FlexFabric components add DCB and FCoE functionality to the existing 10 Gb data stream partitioning and adjustable bandwidth capabilities found in Flex-10. VC firmware

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4 N_Port ID Virtualization (NPIV) is an industry-standard Fibre Channel (FC) protocol that lets you assign multiple FC addresses on the same physical link. HP is the first vendor to offer an NPIV-based FC interconnect option for HP BladeSystem c-Class architecture.
v3.10 already introduced the ability for Flex-10 adapters and modules to carry iSCSI storage traffic over Ethernet networks.

**HP FlexFabric Converged Network adapters**

FlexFabric adapters are integrated or optional mezzanine cards. Most ProLiant G7 server blades include either integrated NC551i or NC553i FlexFabric adapters. FlexFabric adapters support all VC Flex-10 and VC FlexFabric functions (this includes FlexNIC and FlexHBA personality functions).

You can use mezzanine HP NC551m FlexFabric adapters on currently shipping ProLiant BL G6 BladeSystem servers. Mezzanine FlexFabric adapters are not supported on ProLiant G1 or G5 servers.

For iSCSI storage, all FlexFabric adapters support full protocol offload that provides 120% better CPU efficiency when compared to software initiators, letting the server handle increased virtualization workloads and compute-intensive applications. The FlexFabric adapters optimize network and storage traffic with hardware acceleration and offloads for stateless TCP/IP, TCP Offload Engine (TOE), Fibre Channel, and iSCSI.

**HP Virtual Connect FlexFabric 10 Gb/24-port module**

The current VC FlexFabric 10 Gb/24-port module includes eight SFP+ connections for uplinks to external Ethernet and native Fibre Channel switches over fiber optic or copper cables.

With this module, you can use four ports to connect to Ethernet switches and four ports to connect to either Ethernet switches or native Fibre Channel switches. As with existing VC Ethernet modules, there are also two internal cross-connect links for redundancy that are shared with two of the Ethernet-only faceplate ports. If you use one or both of these cross-connect links, the corresponding faceplate port is not available.

You can stack VC FlexFabric modules the same way you do with existing Ethernet VC Ethernet modules. You can use any of the faceplate SFP+ for stacking up to four enclosures. As with the HP Fibre Channel VC modules, this module does not support Fibre Channel data transfer across stacking links.

The network topology rules used to deploy traditional VC networks (Ethernet and Fibre Channel) do not change when deploying VC FlexFabric solutions.

The VC FlexFabric module uses the same port management as existing VC Fibre Channel modules.

Four of the external uplink SFP+ ports are Ethernet only and can only accommodate Ethernet SFP or SFP+ transceivers. The four other external uplink SFP+ ports can be configured as either Ethernet or Fibre Channel by installing the appropriate Ethernet or Fibre channel SFP or SFP+ transceivers into the SFP+ transceiver socket on the module. See the QuickSpecs for more information.

If you swap the SFP/SFP+ transceiver to a different type (Ethernet or Fibre Channel) after it has been configured and provisioned with the VC management software, the system will disable the port and flag an error event to the management system until the configuration has been corrected or the correct transceiver type is installed.

**Interoperability of Flex-10 and FlexFabric components**

VC FlexFabric modules connect to a variety of integrated and mezzanine based Ethernet NIC devices: 1 Gb, 10 Gb, or Flex-10 LOM devices and mezzanine cards. Standard NICs recognize the

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VC FlexFabric module as a standard 1 Gb or 10 Gb VC module. Flex-10 NICs recognize the VC FlexFabric module as a VC Flex-10 module. FlexFabric modules are fully backward compatible.

You can connect FlexFabric adapters to any existing Ethernet interconnect module, not just the VC FlexFabric module. The FlexFabric adapters do not support Fibre channel or iSCSI when connected to 1 Gb or 10 Gb Ethernet interconnects—they act like standard 1 Gb or 10 Gb Ethernet NICs. FlexFabric adapters act like Flex-10 NIC devices when connected to VC Flex-10 modules.

VC modules are not switches, but they are fully compatible with industry-standard Ethernet and Fibre Channel infrastructure from a wide variety of vendors. HP qualifies every product with switch products from leading vendors such as HP Networking, Cisco, Brocade, and Juniper. They are also tested with a number of OS/hypervisor products and target storage arrays. HP is committed to ensuring interoperability with the network infrastructure that our customers deploy.

**HP management software support for FlexFabric**

VC firmware v3.15 supports the new Data Center Bridging (DCB) and FCoE protocols. It supports the HP Virtual Connect FlexFabric 10 Gb/24-port module and HP NC551 Dual Port FlexFabric 10 Gb Converged Network adapters. VC firmware v3.15 also supports full iSCSI offload, centralized iSCSI connection management, and centralized iSCSI boot parameter management.

You can use HP Insight Control software with VC FlexFabric modules and FlexFabric adapters. This includes using Virtual Connect Enterprise Manager (VCEM) to manage large numbers of FlexFabric modules and track module movement, data center wide, within the converged network. HP Insight Dynamics, Orchestration, and Insight failover and recovery services will also support VC FlexFabric modules in 2010 sometime after the initial release.

**Transition to FlexFabric technology**

If your IT organization has not yet adopted 10 Gb network technology at the server access layer, you can connect VC FlexFabric modules and Flex-10 modules to 1 Gb Ethernet networks using SFP transceivers. When you upgrade data center access layer switches to 10 Gb Ethernet technology, you can replace 1 Gb SFP transceivers with 10 Gb SFP+ transceivers for an easy transition to 10 Gb. In this way, server-to-server communication within an enclosure or multi-closure domain can take advantage of 10 Gb while you wait to upgrade the external networks.

Flex-Fabric technology provides a significant reduction in cabling, switches, and required ports at the server edge. HP BladeSystem customers can connect servers to network and storage infrastructure with a single server connection and a single VC interconnect module. You can connect to Fibre Channel SANs or to iSCSI storage using accelerated iSCSI technology (fully accelerated and hardware off-loaded) over a Flex-10 connection. A single pair of VC FlexFabric modules will aggregate an entire enclosure’s traffic and provide redundancy. In addition to the reduced qualification, purchase, and installation requirements, you’ll require fewer spares and fewer firmware updates. VC FlexFabric modules and FlexFabric adapters provide high performance data transfer, full management, and boot from storage options with both Fibre Channel and iSCSI. HP lets you build on existing Fibre Channel investments or build new networks using iSCSI where it makes sense.

Figure 10 shows how you can use VC FlexFabric modules to reduce the number of modules you need by up to 75%. Each module includes 16 ports that connect to the FlexFabric adapters on the server blades. If you want redundancy, you need two VC FlexFabric modules to support a full C7000 enclosure.
Future capabilities

The current “one hop” approach carries converged network traffic to the server edge. HP expects that future iterations of the VC FlexFabric module will be able to pass FCoE beyond the server edge to a DCB-enabled network so that Fibre Channel traffic can be separated further upstream in the network. These future iterations of Virtual Connect technology will depend on compliance with fully ratified DCB standards to ensure preservation of current network infrastructure investment while we address data center challenges.

Conclusion

HP VC Flex-10 technology is a hardware-based solution that lets you simplify network I/O by splitting a 10 Gb/s server network connection into four variable partitions. Flex-10 technology lets data centers implement 10 Gb Ethernet architecture and minimize infrastructure costs. Flex-10 technology and products give you more NICs yet minimizes the number of physical NIC and interconnect modules required to support multi-network configurations. This is well suited for virtual machine environments hosted on ProLiant blade servers.

HP VC FlexFabric modules and HP FlexFabric adapters extend the Flex-10 capabilities to include converged networking. This technology allows HP BladeSystem customers to connect servers to network and storage infrastructure with a single server connection and a single VC interconnect module supporting Ethernet, Fibre Channel, and iSCSI networking. VC FlexFabric requires up to 95% less hardware to qualify, purchase, install, and maintain in blade enclosures. You can reduce costs up to 65% by converging and consolidating server, storage, and network connectivity onto a common fabric with a flatter topology and fewer switches. Built on open industry standards, both VC Flex-10
modules and VC FlexFabric modules let you simplify networking hardware within HP BladeSystem enclosures without any disruption or forklift upgrades of your external data center networks.

For more information

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<th>Resource description</th>
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