

**Compliments of**



**3rd Edition**

# **HP Virtual Connect**

# **FOR DUMMIES®**

A Wiley Brand

## **Learn:**

- What's new with Virtual Connect
- How HP Virtual Connect simplifies your data center, lowers costs, and saves time
- About the HP Virtual Connect product family

**Ray Nix  
Chuck Klein**



HP is a technology solutions provider to consumers, businesses, and institutions globally. The company's offerings span IT infrastructure, global services, business and home computing, and imaging and printing. HP's annual revenue is more than \$100B. More information about HP (NYSE, Nasdaq: HPQ) is available at <http://www.hp.com>.

HP Virtual Connect for HP BladeSystem simplifies the setup of server connections to LANs and SANs, allowing server administrators to quickly add or replace servers and move workloads without needing to involve network and storage teams. HP Virtual Connect Flex-10 is the first interconnect technology to reduce the cost and amount of network equipment needed compared to switches, while providing precise bandwidth control for every server Ethernet connection. Virtual Connect Enterprise Manager provides a single intuitive console that manages server connectivity for hundreds of Virtual Connect domains and thousands of servers.

# **HP Virtual Connect**

FOR  
**DUMMIES®**

A Wiley Brand

***3rd Edition***

**by Ray Nix and Chuck Klein**

FOR  
**DUMMIES®**

A Wiley Brand

## **HP Virtual Connect For Dummies® 3rd Edition**

Published by  
**John Wiley & Sons, Inc.**  
111 River St.  
Hoboken, NJ 07030-5774  
[www.wiley.com](http://www.wiley.com)

Copyright © 2014 by John Wiley & Sons, Inc., Hoboken, New Jersey

No part of this publication may be reproduced, stored in a retrieval system or transmitted in any form or by any means, electronic, mechanical, photocopying, recording, scanning or otherwise, except as permitted under Sections 107 or 108 of the 1976 United States Copyright Act, without the prior written permission of the Publisher. Requests to the Publisher for permission should be addressed to the Permissions Department, John Wiley & Sons, Inc., 111 River Street, Hoboken, NJ 07030, (201) 748-6011, fax (201) 748-6008, or online at <http://www.wiley.com/go/permissions>.

**Trademarks:** Wiley, For Dummies, the Dummies Man logo, The Dummies Way, Dummies.com, Making Everything Easier, and related trade dress are trademarks or registered trademarks of John Wiley & Sons, Inc. and/or its affiliates in the United States and other countries, and may not be used without written permission. HP and the HP logo are trademarks of Hewlett-Packard Development Company, L.P. All other trademarks are the property of their respective owners. John Wiley & Sons, Inc., is not associated with any product or vendor mentioned in this book.

**LIMIT OF LIABILITY/DISCLAIMER OF WARRANTY: THE PUBLISHER AND THE AUTHOR MAKE NO REPRESENTATIONS OR WARRANTIES WITH RESPECT TO THE ACCURACY OR COMPLETENESS OF THE CONTENTS OF THIS WORK AND SPECIFICALLY DISCLAIM ALL WARRANTIES, INCLUDING WITHOUT LIMITATION WARRANTIES OF FITNESS FOR A PARTICULAR PURPOSE. NO WARRANTY MAY BE CREATED OR EXTENDED BY SALES OR PROMOTIONAL MATERIALS. THE ADVICE AND STRATEGIES CONTAINED HEREIN MAY NOT BE SUITABLE FOR EVERY SITUATION. THIS WORK IS SOLD WITH THE UNDERSTANDING THAT THE PUBLISHER IS NOT ENGAGED IN RENDERING LEGAL, ACCOUNTING, OR OTHER PROFESSIONAL SERVICES. IF PROFESSIONAL ASSISTANCE IS REQUIRED, THE SERVICES OF A COMPETENT PROFESSIONAL PERSON SHOULD BE SOUGHT. NEITHER THE PUBLISHER NOR THE AUTHOR SHALL BE LIABLE FOR DAMAGES ARISING HEREFROM. THE FACT THAT AN ORGANIZATION OR WEBSITE IS REFERRED TO IN THIS WORK AS A CITATION AND/OR A POTENTIAL SOURCE OF FURTHER INFORMATION DOES NOT MEAN THAT THE AUTHOR OR THE PUBLISHER ENDORSES THE INFORMATION THE ORGANIZATION OR WEBSITE MAY PROVIDE OR RECOMMENDATIONS IT MAY MAKE. FURTHER, READERS SHOULD BE AWARE THAT INTERNET WEBSITES LISTED IN THIS WORK MAY HAVE CHANGED OR DISAPPEARED BETWEEN WHEN THIS WORK WAS WRITTEN AND WHEN IT IS READ.**

For general information on our other products and services, or how to create a custom *For Dummies* book for your business or organization, please contact our Business Development Department in the U.S. at 877-409-4177, contact [info@dummies.biz](mailto:info@dummies.biz), or visit [www.wiley.com/go/custompub](http://www.wiley.com/go/custompub). For information about licensing the *For Dummies* brand for products or services, contact [BrandedRights&Licenses@Wiley.com](mailto:BrandedRights&Licenses@Wiley.com).

ISBN 978-1-118-58599-3 (pbk); ISBN 978-1-118-58670-9 (ebk)

Manufactured in the United States of America

10 9 8 7 6 5 4 3 2 1

# Table of Contents

---

## *Introduction*..... 1

About This Book .....	1
Icons Used in This Book.....	2

## *Part 1: Getting Started with Networking and Virtual Connect* ..... 3

### **Chapter 1: A Quick Introduction to Networking .....** 5

The Parts You Need.....	5
Servers and blades .....	6
More on enclosures and bays .....	8
Network adapter .....	8
Ethernet .....	8
Fibre Channel.....	9
Converged Network Adapter .....	9
Cables.....	10
Ethernet .....	10
Fibre Channel.....	10
Traditional connection choices .....	11
Pass-Thru modules.....	11
Blade switches .....	11
The People You Need .....	12
System administrator.....	12
LAN administrator .....	12
SAN administrator .....	13
The Problem with Cables and Switches.....	13
Too many cables.....	13
Too much to manage.....	13
The Introduction of Server Virtualization.....	14
Converging Your IT Infrastructure .....	14
HP Converged Infrastructure .....	15

### **Chapter 2: The HP Virtual Connect Solution..... 17**

Rethinking Infrastructure.....	17
Grow Your Infrastructure over Time.....	19
Smarter Management .....	20
Managing Larger Virtual Connect Installations.....	23

HP VC Flex-10/10D Module.....	26
Flexibility.....	26
HP Virtual Connect Flex-10 Technology.....	26
Reduce interconnect modules .....	27
Control and adjust bandwidth .....	29
Extending the Flex-10 advantage to converged infrastructure .....	30
Where to use Fibre Channel over Ethernet.....	31
The Virtual Connect FlexFabric advantage.....	32
Cost Savings.....	33
HP VC Flex-10/10D Module.....	35
Perspectives on HP Virtual Connect Installation.....	36
Installation planning.....	36
MAC and WWN address choices.....	37
Virtual Connect Fibre Channel saves fabric domain IDs.....	38
<b>Chapter 3: Virtual Connect Modules . . . . .</b>	<b>41</b>
The Virtual Connect FlexFabric 10Gb/24-Port Module .....	41
The Virtual Connect Flex-10/10D Module .....	43
The Fibre Channel Modules.....	44
Virtual Connect 8Gb 20-Port Fibre Channel Module .....	44
Virtual Connect 8Gb 24-Port Fibre Channel Module .....	45
Building a c-Class Enclosure.....	45
<b>Part II: Diving into Virtual Connect . . . . .</b>	<b>39</b>
<b>Chapter 4: Looking More Closely at Virtual Connect . . . . .</b>	<b>47</b>
Cost Reductions and TCO.....	48
Easier Hardware Management .....	48
Virtual Connect module isn't a switch.....	49
Higher availability and fault recovery.....	49
Virtual Connect uplink failures don't require reconvergence on the external network.....	50
Can connect to any industry standard network components .....	51
Easier Network Connection Management.....	51
Provides diagnostic tools .....	51
Fibre Channel (FC) login distribution and failover features .....	52
Other seasoned technology .....	52



Urban Myths about Virtual Connect .....	53
Myth: Virtual Connect doesn't provide visibility into the Virtual Connect Domain for Network Admins.....	53
Myth: VC Flex-10 doesn't provide the bandwidth control that QoS would .....	54
Myth: Virtual Connect users can't leverage existing network management tools .....	54
Myth: VC doesn't interoperate with the Nexus 1000v .....	55
<b>Chapter 5: Eleven Benefits of HP Virtual Connect .....</b>	<b>57</b>
Flat SAN Technology .....	57
Fewer Cables and Switches .....	58
More Applications on Fewer Servers (More Server I/O)....	58
Lowered Expenses .....	59
Reduced Staff Time on Configuration and Management....	59
Scalable Management That Grows with You.....	60
Match Bandwidth Supply to Application Demand .....	60
Connect to Any Brand of LAN or SAN .....	60
Flexibility with Server Models .....	61
Failover Process and Redundant Access .....	61
A Complete Server Network Connection Solution .....	62

## Publisher's Acknowledgments

We're proud of this book and of the people who worked on it. For details on how to create a custom For Dummies book for your business or organization, contact [info@dummies.biz](mailto:info@dummies.biz) or visit [www.wiley.com/go/custompub](http://www.wiley.com/go/custompub). For details on licensing the For Dummies brand for products or services, contact [BrandedRights&Licenses@Wiley.com](mailto:BrandedRights&Licenses@Wiley.com).

Some of the people who helped bring this book to market include the following:

### ***Acquisitions, Editorial, and Vertical Websites***

**Project Editor:** Jennifer Bingham

**Editorial Manager:** Rev Mengle

**Acquisitions Editor:** Steve Hayes

**Business Development Representative:**  
Karen Hattan

**Custom Publishing Project Specialist:**  
Michael Sullivan

### ***Composition Services***

**Senior Project Coordinator:** Kristie Rees

**Layout and Graphics:** Erin Zeltner

**Proofreaders:** Jessica Kramer,  
Toni Settle

**HP Contributor:** Molly Lombardi

---

### **Publishing and Editorial for Technology Dummies**

**Richard Swadley**, Vice President and Executive Group Publisher

**Andy Cummings**, Vice President and Publisher

**Mary C. Corder**, Editorial Director

### **Publishing and Editorial for Consumer Dummies**

**Kathleen Nebenhaus**, Vice President and Executive Publisher

**David Palmer**, Associate Publisher

**Kristin Ferguson-Wagstaffe**, Product Development Director

### **Composition Services**

**Debbie Staley**, Director of Composition Services

### **Business Development**

**Lisa Coleman**, Director, New Market and Brand Development

# Introduction



**T**oday, most companies have spent 20 or 30 years learning how to work well with computer networks. Despite all that experience, network configurations still often require intricate choreography among highly trained and specialized network, storage, and systems personnel to set things up, and then to keep everything running smoothly.

HP offers *server edge virtualization*; a technology that simplifies IT by separating the management of computer servers from the management of the networks connected to them.

With HP Virtual Connect, you can simplify your server connectivity to your networks — and reduce equipment sprawl at the server-to-network edge. System administrators become self-sufficient to add or replace servers and move workloads from one server to another, while freeing LAN and SAN administrators from common server tasks. By implementing Virtual Connect technology with the Flex-10 Ethernet and FlexFabric modules, you can also reduce the amount of network connection equipment, network hardware costs, and network power consumption. So, read on, and see whether HP Virtual Connect sounds like the right answer for your company!

## About This Book

This is the third edition of *HP Virtual Connect For Dummies*. We've updated the text to include information on the Virtual Connect Flex-10/10D module, Flat SAN Technology, and the latest on their capabilities and benefits.

This book introduces the core concepts and technologies for HP Virtual Connect and uses information supplied by HP so you can get a good idea of how HP Virtual Connect works. This book was written for HP.

Consider this a reference tool that you can go back to whenever you need to learn more about what HP Virtual Connect is all about. We introduce some basic networking concepts in the first chapter, but do assume a certain level of expertise about industry terminology in some of the later chapters.

## Icons Used in This Book

Throughout this book, you'll notice a couple helpful little icons that mark certain types of information.



Get out your pen! This icon marks important information that you should keep in mind.



Yeah, yeah, we know this book includes a fair share of technical information. This icon marks areas that delve more deeply into technical details.

## Part I

# Getting Started with Networking and Virtual Connect

getting started  
with

networking

## *In this part . . .*

- ✓ Discover the basics of networking
- ✓ Find need-to-know info about HP Virtual Connect so you can get up to speed

## **Chapter 1**

---

# **A Quick Introduction to Networking**

---

### ***In This Chapter***

- ▶ Knowing what parts you need
  - ▶ Getting to know those who work on your network
  - ▶ Dealing with cables and switches
  - ▶ Introducing converged infrastructure
- 

**Y**

ou probably use computer networks every day from your own PC, whether it's a private network within your own company or when you use the Internet for research or communication. However, if you don't know what's "under the hood" of your network, then you won't know how virtualizing connections can help your business become more efficient and save money. Building and managing corporate networks can be very complicated topics. However, in this chapter, we talk about how to connect your computer servers to a network at a high level. If you feel you need to learn more about the basics of networking or you're simply curious, read on.

## ***The Parts You Need***

Today's computer networks have several different parts that you need in order to connect to the information you require.



*Infrastructure* refers to all the servers, cables, storage, power supplies, fans, enclosures, racks, and networking components that make up your computing environment. Sometimes the term also includes the software that runs on all this gear.

## Servers and blades

You've probably heard of computer servers and wondered what the difference is between a server and other computers. A *server* is a computer that provides common, centralized *services* to client computers — that is, client computers connect to the server and can access files and services on the server. The server is designed with more memory, more processing power, access to more storage space, and usually with more network connection capacity. Servers must also be online constantly and must therefore be very reliable. Many servers include redundant features such as additional power supplies and network connections that can take over in case one fails.

As your business information needs grow, you can add more servers and connect them together to create a larger infrastructure with more power and capacity. Fortunately, you don't need to have all your servers connected to individual monitors and keyboards so you can manage them. More streamlined and modular servers called *server blades* save space but still provide all the compute power you may need.



These server blades, an example of which is shown in Figure 1-1, sit in a *blade enclosure*, which also houses the connectivity, cooling, and power equipment. These enclosures sit in a frame called a *rack*, also shown in the figure. The enclosure has a number of mounting slots called *bays*.

Some racks are small and sit in regular office space. You may also place a rack in a specific area, such as a cooled server room, for security reasons or to provide a central location for monitoring, maintaining, and expanding your infrastructure.



**Figure 1-1: HP BladeSystem c7000 with HP ProLiant Gen8 servers in a rack.**

## More on enclosures and bays

Fortunately you don't have to keep server blades lying around everywhere in a pile (and they wouldn't work well if you kept them in a pile anyway). Instead, you place the server blades in an enclosure that provides similar components to what you find in your desktop or laptop computer including:

- ✓ Power for all server blades in the enclosure.
- ✓ Fans for cooling, because servers produce heat, and as the enclosure becomes more populated, more heat is generated. (Many are also in air conditioned server rooms.)
- ✓ A number of expansion slots called *bays*, which house server blades or other types of blade devices including switching, and storage or backup devices.
- ✓ Networking interconnect devices to connect the server blades to client computers and other devices (like storage) outside of the enclosure.
- ✓ An enclosure midplane to connect many of these components together without wires. In a laptop or desktop, something similar is a motherboard that provides connection without all the wires.

## Network adapter

Another essential component to your network is the *network adapter*, which enables all your servers, clients, switches, storage, and other devices to communicate with each other. Network adapters have typically come in two flavors: Ethernet and Fibre Channel. And they're beginning to show up in a third flavor: a Converged Network Adapter (CNA).

### Ethernet

You may be surprised to know that networking technologies that were developed in the 1970s are still in use. When people were sporting big hair and loud clothing, the smart people at the Xerox Palo Alto Research Center created *Ethernet*, a group of networking technologies that define a number of wiring and

signaling protocols. Ethernet was standardized around 1980, and as the years have gone by, the speed of Ethernet (and the networking components) have become ever faster.

An Ethernet adapter is called a *Network Interface Controller*, known popularly as a *NIC*. Most computers (including perhaps the one you use now) have NICs built right into the main circuit board (or motherboard) of the computer. Depending on the server blade you buy, the motherboard can include a NIC, which is referred to as a LAN on Motherboard (or LOM). Many NICs have two ports so you can make two separate network connections from one NIC.

### ***Fibre Channel***

If you've heard about your company having a storage area network (also known by its acronym SAN), then you may have heard about *Fibre Channel*, or FC. Fibre Channel provides the means to connect your network to a separate (and sometimes remote) computer storage device through a Host Bus Adapter (or HBA).

For example, you may have a disk array that contains numerous hard disks connected to your network for storage. The SAN connects the hard disks to your servers and is typically shared by all the servers.

What happens if you don't have enough NICs and/or HBAs connected to the server? You can always add more by installing add-on cards, also referred to as *mezzanine cards* (whether you can do this depends on the capability of your server blade, though).

### ***Converged Network Adapter***

You may have heard about the Converged Network Adapter (CNA) recently. This type of network adapter has the ability to communicate over Ethernet links and supports both Ethernet and Fibre Channel. The Fibre Channel data is carried by a new protocol called Fibre Channel over Ethernet (FCoE). So a CNA consolidates your LAN and SAN traffic over one adapter that acts as both NIC and HBA.

HP incorporates these capabilities right into its server blades so there is nothing extra to buy. No extra NICs, no extra HBAs — they're already there. HP also incorporates iSCSI offload technology that allows its CNAs to support Ethernet, Fibre Channel, and high-performance iSCSI. In fact, HP provides more capabilities in its CNAs, which is why they are called FlexFabric Adapters. We talk more about them in Chapter 2.

## Cables

Wireless networking has become pretty common, especially among home network users, and you may be wondering whether anyone actually uses cables anymore. Didn't those go the way of analog TV signals? Sorry guys, if you have a business network, the only way to connect a server to the network is by *hard-wiring* it — not only because wiring is more reliable and faster than wireless, but also because it provides greater security than wireless connections. Businesses primarily use Ethernet and Fibre Channel interconnect technologies today.

### Ethernet

As of this writing, the fastest Ethernet speed for servers (that is, the fastest rate that the Ethernet protocol can transmit data over a standard Ethernet cable) is 10 gigabits per second (often written as 10 Gbps). The organization that sets Ethernet standards, the IEEE (Institute of Electrical and Electronics Engineers), has established standards for higher speed Ethernet bandwidths.

In 2010, the higher speed Ethernet task force (called 802.3ba) completed its work to modify the 802.3 standard to support speeds higher than 10 Gbps.

The speeds chosen by 802.3ba were 40 and 100 Gbps, which support both end-point and link aggregation needs. In addition to the higher speeds that have been ratified, Ethernet cables today can support other speeds including 10 megabits per second (10 Mbps), 100 Mbps (or Fast Ethernet), and 1 Gbps (or Gigabit Ethernet).



### Fibre Channel

Although the name suggests that Fibre Channel connections are typically made with fiber-optic cables, you can have Fibre

Channel run with copper wire as well. Like Ethernet, you typically connect Fibre Channel cables between two devices through a Fibre Channel switch.

However, Fibre Channel speeds are different from Ethernet speeds. FC speeds come in two categories:

- ✓ The **interoperable category** has FC cable speeds of 1 Gbps, 2 Gbps, 4 Gbps, 8 Gbps, and 16Gbps. By *interoperable*, we mean these connections can automatically adjust to the fastest speed that equipment on both ends of the cable can handle.
- ✓ The **high-speed category** has FC cable speeds of 10 Gbps and 20 Gbps. These cables don't support lower speeds and are used primarily for connecting multiple FC switches.

## *Traditional connection choices*

There used to be only two choices when it came to connecting your server blades to your network: Pass-Thru and blade switches. The following sections discuss these options in more detail.

### *Pass-Thru modules*

A *Pass-Thru module* is an interconnection device that provides a one-to-one direct link between each blade Ethernet NIC or Fibre Channel HBA and a switch outside the enclosure. Each connection uses a separate cable.

The problem with Pass-Thru modules is that you have many network cables coming out of every module. If you have a medium-sized to large network, the number of cables can be overwhelming to manage. They also add a lot of expense because they require so many costly switch ports at the other end of those cables.

### *Blade switches*

*Blade switches* are available for a number of network types. However, blade switches are relatively small, and one enclosure with 16 servers may need 6 or 8 switches. If you have a large network with many more servers, then you will require an awful lot of switches, which will be very difficult to manage.

# The People You Need

Who are these people you need to keep your compute infrastructure humming along? You may have passed these people in the hall and know their names from the company directory, but you may not know what they do each day to keep the data and information flowing.

## *System administrator*

The *system administrator* manages your computer servers and everything that runs on them, like your business applications, your operating systems, your virtual machines, and connections to your communication and storage networks. Those responsibilities can involve everything from installing and maintaining antivirus and antimalware protection, to implementing drivers and new operating systems, to setting backup policies.



If you have a one-person technical staff, the system administrator is also responsible for the work of the LAN and SAN architecture and operation, besides the server stuff. This job includes designing the infrastructure, troubleshooting bugs, and being responsible for overall company system and data security. This job can be even more complicated than when there are more people to share the load. So simplifying IT operations is even more critical for this person.

## *LAN administrator*

The *LAN administrator* is the person responsible for keeping the network online day in and day out. This person is responsible for the networking connections, security, performance, reliability, policy administration, and maintenance.

When connections aren't working, it could mean that a component failed or someone changed a server or storage device, so coordination with the server and storage administrators is very important. The LAN administrator is responsible for resolving any connection and conflict issues.

## **SAN administrator**

The *SAN administrator* may also be called the storage administrator. This person is the specialist responsible for setting up, assigning, and maintaining the storage arrays shared by the servers and the network that connects them to all devices. As in the LAN administrator case, the SAN is a complicated network, and its administrator must ensure its connectivity, security, performance, reliability, and overall smooth operation. If any problems arise with the SAN, then the SAN administrator is tasked with finding the problem, offering solutions, and managing any interruptions in service. The SAN administrator is also responsible for managing the addresses used in the Fibre Channel connections. These addresses are called Worldwide Names or WWNs.

## **The Problem with Cables and Switches**

When you add up the number of people and parts you can have in an IT operation, and especially as the number of people and parts (like server blades) grows, everything gets very complicated, so a common directive in IT is to keep the compute infrastructure as simple as possible. Yet companies are daunted by many logistical problems that keep them from optimizing their networks.

### **Too many cables**

A rack full of servers can have hundreds of network cables — especially when using individual rack-mounted servers or Pass-Thru devices in blade servers. As your IT demand grows, especially as you virtualize more servers, you'll need more network connections on each server, and Pass-Thru modules can render the flood of cables practically unmanageable.

### **Too much to manage**

Switches can lower the number of cables, but as your compute infrastructure grows, you grow the number of switches as well.

Every switch needs maintenance, updates, and coordination. So, the more switches you add, the greater the management load you're forcing on the LAN and SAN administrators. And server virtualization multiplies the number of switches you will need, so the management effort can get out of hand, fast!

## The Introduction of Server Virtualization

Historically, as companies grew and built up their infrastructures, they added new servers, networks, and storage capacity for each new application. This *application isolation* often offered simpler set-up, better performance, and more reliability. Most importantly, if one business application and the infrastructure supporting it needed to change or had a problem, other applications weren't affected.

However, this *silo* application deployment approach left excessive pockets of unused server capacity. Virtual machines (VMs) — essentially many server environments within one physical server — helped address these issues.

Setting up networks, IP addresses, VLANs, subnets, and so on requires substantial planning and coordination between server and network teams. Although planning for a single server may not seem like a huge effort, provisioning multiple VMs on many rack or server blades can result in greater complexity. The problem isn't initial provisioning as much as the inevitable adjustments that ripple back and forth because a routine server change can force adjustments up and down the line.

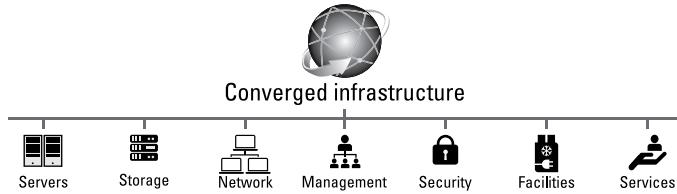
## Converging Your IT Infrastructure

Over the past 15 to 20 years, applications and information technologies have become more complex and business processes more inflexible. This *IT sprawl* has driven costs up to the point where about 70 percent of the IT budget typically goes to maintaining the infrastructure (just keeping the lights on), and only 30 percent goes to business innovation.

Businesses know that innovation is important — it opens new markets, drives efficiency, and sharpens the competitive edge. And businesses are ready for the next generation of data centers to overcome IT sprawl and apply more of the IT department's efforts and budgets to building the business. The rest of this book covers converged infrastructure in greater detail.

## HP Converged Infrastructure

Servers, storage, networks, power and cooling, and management tools are now designed to be more open, simpler, and much better integrated. HP's Converged Infrastructure offers all these technologies firmly based on industry standards (see Figure 1-2). HP can furnish only the pieces you need or a fully integrated solution so your business can reduce the costs of your IT budget that's dedicated to keeping your infrastructure up and running. For more specifics on HP's offerings, see Chapters 3, 4, and 5.



To deliver this level of IT value requires an innovative technology partner who has the architecture, the open technologies, and a broad ecosystem of partners. Welcome to the new style of IT.

**Figure 1-2: HP Converged Infrastructure.**



# Chapter 2

# The HP Virtual Connect Solution

## *In This Chapter*

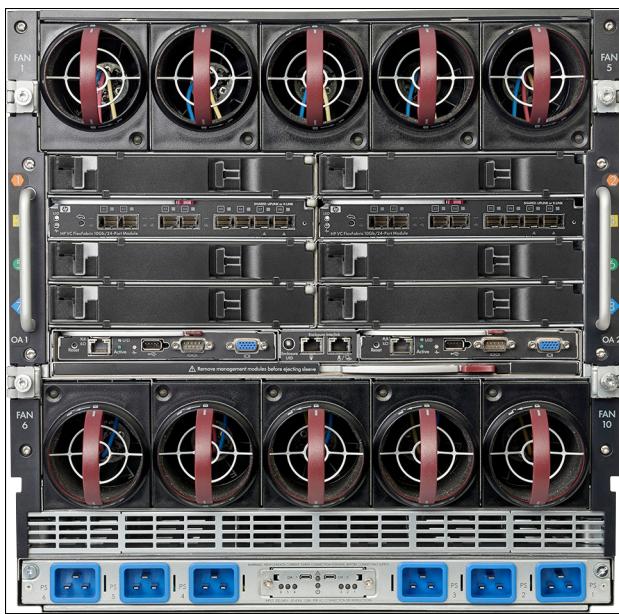
- ▶ Taking a fresh look at IT infrastructure
- ▶ Growing your network over time
- ▶ Managing smarter
- ▶ Looking at Virtual Connect from different perspectives

**H**ewlett-Packard (HP) has created a combination hardware and software server edge virtualization solution called Virtual Connect.

## *Rethinking Infrastructure*

HP started by rethinking IT infrastructure and developed HP BladeSystem (see Figure 2-1), which brings together the traditional features of *racked* environments, including the server, storage, power and cooling, networking, and management. Then HP improved on them by building an integrated system to save cost, energy, and time, and to make the infrastructure change-ready for today's ever-evolving IT demands.

HP BladeSystem also improves the infrastructure by eliminating all the server-to-network connection cables and adding built-in infrastructure management tools like the Onboard Administrator.



**Figure 2-1:** Back of HP BladeSystem showing interconnects and fans.

---

While bringing all the infrastructure pieces together in HP BladeSystem, HP added another huge advance to server connectivity and management with server edge virtualization. Virtual Connect frees up administrators from the constraints of a traditional infrastructure by adding a virtualization layer between the network and the servers. The HP Virtual Connect solution allows system administrators to perform such tasks as adding or changing a server, or moving the workload from one server to another without needing to involve LAN and SAN administrators in every change.

HP created Virtual Connect to adapt to the needs of your network and business applications. For example:

- | ✓ You can use HP's Virtual Connect Flex-10/10D Ethernet modules or Virtual Connect FlexFabric 10Gb/24-Port modules, and Flex-10 NIC and FlexFabric Adapters to save on cost and equipment, and to increase flexibility and bandwidth control. (You can find out more about these later in this chapter.)

- ✓ If you have another vendor's network switches already incorporated in your business, HP Virtual Connect can integrate seamlessly — so you don't have to start again from scratch.

HP Virtual Connect FlexFabric and Flex-10 Ethernet modules and FlexFabric and Flex-10 Adapters are already capable of the faster 10Gb speed, but FlexFabric adapters can also talk to any 1Gb Ethernet or 2, 4, or 8 Gb Fibre Channel equipment at the slower speed. This means that Virtual Connect will work with your lower speed equipment now, and also work with any faster 10Gb Ethernet network equipment you buy going forward. The same is true for the Virtual Connect 8Gb FC modules — they will communicate with your slower FC equipment, but are ready for faster speeds when you upgrade. This means you can upgrade at your own pace as your budget allows — instead of being forced into a *forklift upgrade*. That is, you won't have to undergo a massive upgrade to your network that will require a lot of new hardware, money, and effort.

The end result is a flexible infrastructure that lets you add or replace servers and move workloads quickly to meet *your* needs, instead of forcing your business application to adjust to the demands of a rigid set of equipment.



## *Grow Your Infrastructure over Time*

HP Virtual Connect supports as many as 16 servers — and hundreds of virtual machines — in a single BladeSystem c7000 enclosure. That doesn't mean you need to start with 16 servers — you can start small and as your company grows you can build up your infrastructure. HP also offers a smaller c3000 enclosure that holds up to eight half-height server blades.

To get started, have your system, LAN, and SAN administrators provision your LAN and SAN connections once in Virtual Connect. The next time you add a server, your system administrator won't have to call the LAN or SAN administrators — the system administrator can add the new server blade into the enclosure, assign the appropriate server profile containing

your defined network connections, and go. There is no need to coordinate with the LAN and SAN administrators. (Don't worry — we talk about the Virtual Connect hardware and how to set it up later in this chapter.)



Because the LAN and SAN administrators don't have to be involved after deployment, you may worry they would lose control of their networks. But actually, they don't lose any control. Virtual Connect isn't part of the LAN or SAN; it just connects the servers to those networks. Built-in authentication controls establish role-based authority. Some configuration tasks are reserved for LAN administrators, some for SAN administrators, and others for system administrators. Everyone keeps the authority and responsibility they had before Virtual Connect — the difference is that now they're more productive and get the work done faster.

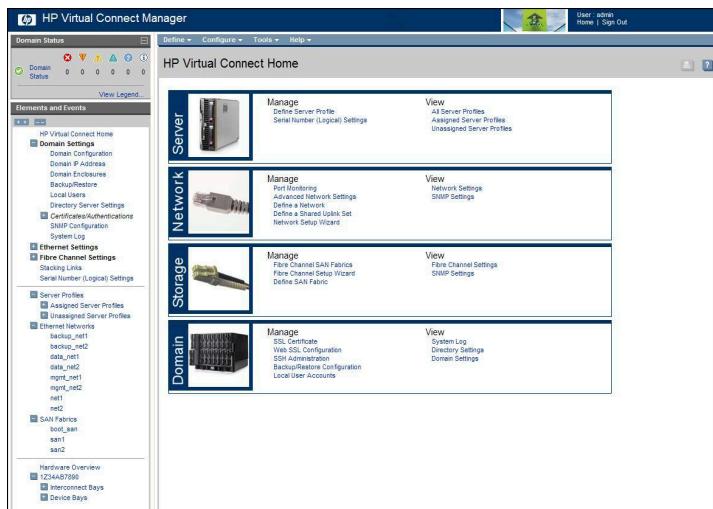
## *Smarter Management*

Although you can reduce the number of cables with switches in your network, HP Virtual Connect goes several giant leaps further.

To set up and administer the network addresses, connection profiles, and other Virtual Connect resources, HP provides management options for large and small environments. HP Virtual Connect Manager provides a built-in Web GUI interface and a fully scriptable Command Line Interface (CLI) designed to manage single Virtual Connect domains. A Virtual Connect *domain* is a collection of up to four BladeSystem enclosures full of servers and network connections that are cabled together as a single manageable element.

Virtual Connect Enterprise Manager (VCEM) is a software application that centralizes server connectivity and workload management for hundreds of Virtual Connect domains and thousands of servers from a single console. Virtual Connect Enterprise Manager can control up to 1,000 enclosures today — that's a whopping 16,000 blade servers!

If you're new to Virtual Connect, then your initial step will be to access Virtual Connect Manager through your Web browser to set up your first Virtual Connect Domain as shown in Figure 2-2.

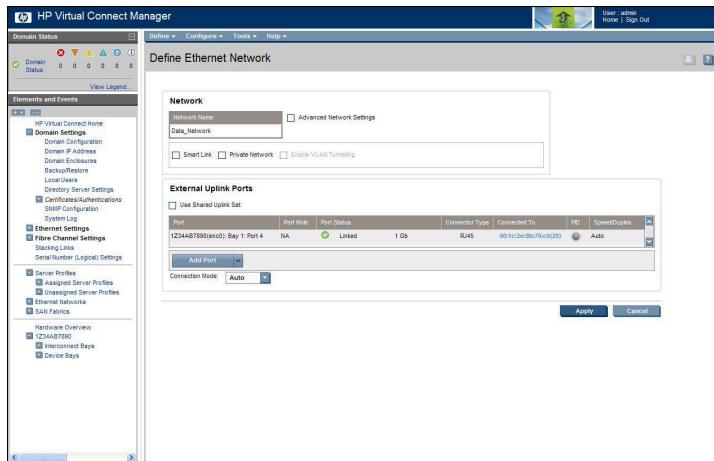


**Figure 2-2: HP Virtual Connect Manager GUI.**

The Virtual Connect Manager, also called VC Manager, contains utilities and a Profile Wizard that allows the system administrator to create and allocate server connection profiles to servers. These server connection profiles include the NIC media access control (MAC) addresses, Fibre Channel host bus adapter (HBA) worldwide names (WWNs), SAN boot configurations, and other information that enables a server to establish connections to preferred LANs and SANs.

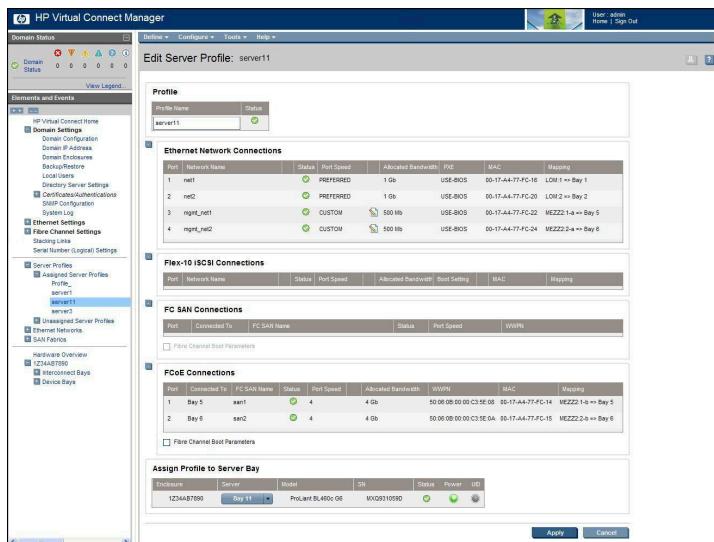
As part of the initial Virtual Connect configuration, the system administrator must work with the LAN and SAN administrators to set appropriate policies that identify which networks the servers may connect to. Once the networks are identified, the system administrator can define these in VC Manager as available resources as shown in Figure 2-3.

**REMEMBER** Virtual Connect technology separates the management of server connections from the management of networks. The LAN and SAN administrators are still responsible for defining and presenting the networks and subnetworks, but the system administrator is now self-sufficient to define and modify server connections to those networks when needed.



**Figure 2-3:** HP Virtual Connect Manager Define Ethernet Network screen.

The system administrator can now use VC Manager to create and assign server connection profiles to individual servers and establish network connections as shown in Figure 2-4.



**Figure 2-4:** HP Virtual Connect Manager Server Profile contents.

Connection profiles are actually assigned to the enclosure bay and not the server that's plugged into the bay, which provides constant network connectivity and enables several benefits that include:

- ✓ Network connections can be preassigned to empty bays to provide rapid server deployment — just add servers, and Virtual Connect does the rest.
- ✓ Allows servers to be replaced in minutes by the system administrator without involving LAN and SAN administrators — any server located in a bay will always use the connection definitions in the associated profile.
- ✓ Connection profiles can be moved to different enclosure bays — this allows system administrators to quickly reallocate server connections and workloads to spare servers in the event of a server failure, or to perform simple migrations.



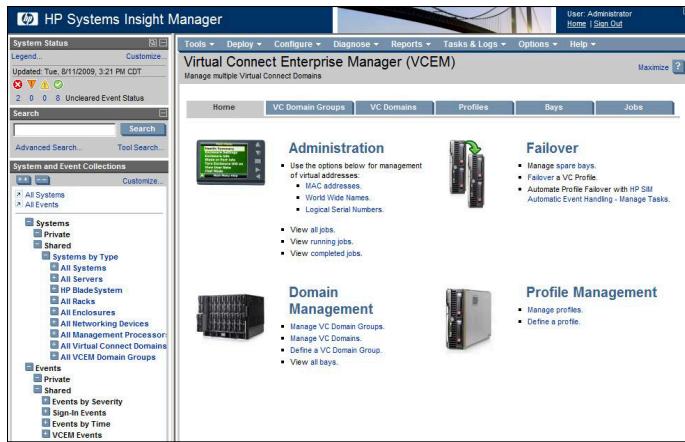
All network assignments and other parameters defined in a connection profile always remain with the profile, even when it's moved to another server.

## *Managing Larger Virtual Connect Installations*

If you have a larger infrastructure to manage, typically four or more HP BladeSystem enclosures, the Virtual Connect Enterprise Manager (VCEM), shown in Figure 2-5, simplifies connection and change management, reduces risk, and provides automated profile failover for thousands of server blades.

The core capabilities provided by VCEM include the following:

- ✓ A single intuitive console that manages connectivity for hundreds of Virtual Connect domains and thousands of servers.



**Figure 2-5:** HP Virtual Connect Enterprise Manager GUI.

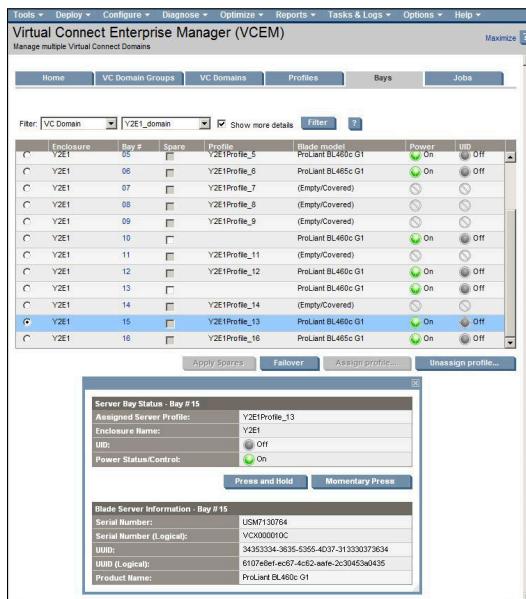
- ✓ A central repository that administers all the MAC addresses and WWNs, which simplifies address management and eliminates the risk of conflicts.
- ✓ The capability to manage groups of Virtual Connect domains using common configuration profiles. This capability increases configuration consistency, limits errors, simplifies enclosure deployment, and enables network connection changes to be made once and pushed to multiple Virtual Connect domains.
- ✓ The capability to move server connection profiles and associated workloads between Virtual Connect Domains. This enables system administrators to add or replace servers and move workloads across the data center in minutes without help from LAN and SAN administrators. Profile movement can be controlled manually from the VCEM user interface, via a command line script, or automated using the VCEM Profile Failover feature (see Figure 2-6), which automatically selects a new target server from a pool of user-defined spares.



VCEM is a highly scalable solution that keeps pace with your management needs as the network grows.

VCEM profile movement and failover can be used to perform common data center tasks faster and more efficiently, such as:

- ✓ Server blade recovery
- ✓ Hardware maintenance with reduced downtime
- ✓ Rapid server repurposing to meet changing workload and application priorities



**Figure 2-6: HP Virtual Connect Enterprise Manager Failover and Spares screen.**

When moving Virtual Connect server profiles, the fastest completion times are achieved when the source and target servers are configured for *boot-from-SAN*. The automated profile failover functionality delivered in VCEM requires a boot-from-SAN environment.



## HP OneView

Today, virtualization, cloud computing, and Big Data require dynamic infrastructure. HP OneView is a central integrated management platform that can manage all the infrastructure needed to work with these technologies, including Virtual Connect.

HP OneView provides:

- ✓ A modern, consumer-inspired design to increase your productivity and collaboration, enabling you to deploy infrastructure faster
- ✓ A software-defined architecture that automates operations and captures your best practices, delivering faster server configuration
- ✓ An open, extensible platform design that rapidly adapts to your business needs

## Flexibility

You would expect HP to follow industry standards, and that's what it's done with Virtual Connect. HP recommends having two identical Virtual Connect Modules side by side when looking to implement redundancy. Each port of a dual-ported server NIC or FlexFabric Adapter can connect to a different Virtual Connect module to create separate connections for use with built-in NIC teaming for failover or simple load balancing.

## HP Virtual Connect Flex-10 Technology

Virtual Connect Flex-10 is an HP network connection technology that's available only with Virtual Connect — and is built into Flex-10 and FlexFabric modules, NICs, and HP servers.

Virtual Connect Flex-10 technology can reduce the number of modules or switches you may need.

So what makes these NICs so special? When you connect one of these NICs to a Virtual Connect Flex-10 or FlexFabric Module, each port becomes four individual NICs (called FlexNICs) that share 10Gb of bandwidth. Each FlexNIC offers full hardware-level performance.

Because HP's Virtual Connect Flex-10/10D and FlexFabric modules are 10Gb fast, you can take advantage of 10Gb connection speed when you're ready to upgrade any slower network components. These modules deliver a number of benefits that the following sections discuss in detail.

Two hardware components are needed to make a Flex-10 connection:

- ✓ Flex-10 or FlexFabric adapters, which are included on most of the HP ProLiant Gen8 server blades as dual-port NICs (called *Flexible LOMs*) or available as dual-port mezzanine cards
- ✓ One of the Virtual Connect Flex-10/10D or Virtual Connect FlexFabric Modules

## *Reduce interconnect modules*

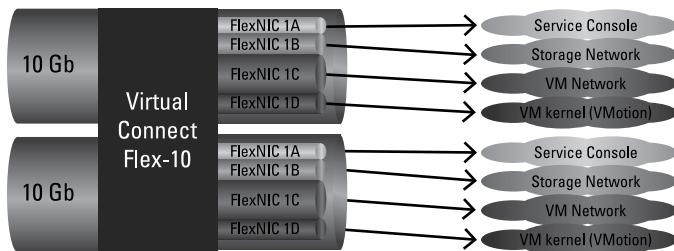
You can reduce the number of switches and NICs and eliminate Fibre Channel Host Bust Adapters (HBAs). How is this possible, you ask?

Each standard NIC or HBA on a server blade needs to connect to a switch or Pass-Thru module. Therefore, if you need four redundant Ethernet networks, you need eight NICs on each server blade and eight interconnect modules in the enclosure interconnect bays and that leaves no room for Fibre Channel and/or InfiniBand in the enclosure.

What's more, each of those eight standard NICs has a fixed speed — either a 1Gb NIC or a 10Gb NIC (for which you'll pay more). Many applications could really use more than 1Gb, but very few need the entire 10Gb; however, when using standard NICs, you must pick one or the other when it comes to setting the bandwidth. So your application is either starved for bandwidth and you must trunk together multiple NICs for your applications to run properly, or you plug in a 10Gb NIC and underutilize its bandwidth.



HP created Flex-10 technology (see Figure 2-7) to deal with this issue. To get those same eight NICs and four redundant networks using Flex-10, you don't need any mezzanine cards and you only need two Virtual Connect Flex-10/10D or Virtual Connect FlexFabric interconnect modules in the enclosure. Therefore, you only have to buy two modules instead of eight. (And you need to power only two instead of eight — think of how green you'll be!)



**Figure 2-7:** With a Flex-10 or FlexFabric dual-port NIC, two 10Gb ports provide eight FlexNIC connections.

---

But you can eliminate even more hardware if you converge Ethernet and Fibre Channel onto a single FlexFabric adapter. With 10Gb FlexFabric Adapters on server blades and just two Virtual Connect FlexFabric 10Gb Modules or two Virtual Connect Flex-10/10D Modules, you can eliminate HBAs on each server and Fibre Channel SAN switches in each HP BladeSystem enclosure.

The FlexibleLOM HP FlexFabric 10Gb 2-port 554FLB Adapter (see Figure 2-8), provide six FlexNIC and two FlexHBA connections or eight FlexNIC connections on each server.



**Figure 2-8:** HP FlexFabric 10Gb 2-port 554FLB Adapter.

---

## *Control and adjust bandwidth*

Flex-10 technology also offers a significant operational advantage: You can dynamically fine-tune the speed of each FlexNIC or FlexHBA in 100Mb increments from 100Mb to 10Gb.

Most applications need bandwidth within a certain range, and until Virtual Connect Flex-10 came along, IT departments were hamstrung by their infrastructure. If a management console required only 500Mb of bandwidth, you would overprovision by 100 percent with a 1Gb NIC. If you needed much more bandwidth, you would consider either trunking several 1Gb NICs or buying more expensive equipment (such as adapters and switch ports) for 10Gb NICs — and probably underutilize the full 10Gb capacity that you bought.

With Flex-10 or FlexFabric adapters, you have 10Gb to share across four FlexNICs or three FlexNICs and one FlexHBA. If you want one FlexNIC to have 3Gb of bandwidth and another to have 1Gb, then you can set the other FlexNICs and FlexHBAs to any value you want as long as their sum doesn't exceed 6Gb (because you have a maximum shareable bandwidth of 10Gb). You can adjust that bandwidth on the fly so that the bandwidth for a virtual machine application can be adjusted as conditions change.

Unless you need more than six Ethernet and two Fibre Channel or iSCSI connections on a server, you won't ever need to buy a NIC or HBA mezzanine card again. However, if you do require additional connections or bandwidth, you can add mezzanine cards and Virtual Connect modules to expand capacity up to 24 connections and 60Gb bandwidth on half-height HP ProLiant blade servers. That is typically far more than most servers require today.

This flexibility assures system administrators that there is enough network bandwidth available. Virtual Connect modules allow the system administrator to set a ceiling on the bandwidth available to any FlexNIC or FlexHBA. If the system admin doesn't have a particular value, Virtual Connect can set a recommended value. And the LAN administrator can set limits too, so that demand from the server connections doesn't overwhelm the network capacity.

With Virtual Connect v4.01, bandwidth optimization was added to Flex-10 and FlexFabric adapters, allowing unused bandwidth to be shared with FlexNICs belonging to the same port on the same Flex-10 adapter. This allows administrators to set minimum and maximum bandwidth values for FlexNICs. The minimum is guaranteed bandwidth available when any traffic is present. The maximum bandwidth value is considered best effort and can't exceed the 10Gb port bandwidth. So, in a Virtual Machine (VM) migration use case, a FlexNIC can be set to minimum value of 3Gb and maximum value of 10Gb. When other FlexNICs on the same port aren't using their allocated bandwidth, the idle 7Gb of bandwidth is allocated to the VM migration FlexNIC (see Figure 2-9, which shows bandwidth optimization).

## *Extending the Flex-10 advantage to converged infrastructure*

The Virtual Connect FlexFabric Modules and Virtual Connect Flex-10/10D modules and FlexFabric Adapters can converge Ethernet and Fibre Channel traffic from HP server blades. So, instead of using separate Ethernet and Fibre Channel adapters and switches, both types of traffic are combined on a single wire from the server to the Virtual Connect module.

Two new standards are combined with Virtual Connect and Flex-10 technology to accomplish this:

- Fibre Channel over Ethernet (FCoE) encapsulates Fibre Channel frames so they can be transmitted over network Ethernet.
- Data Center Bridging (DCB) improves Ethernet performance to resemble the quality of a Fibre Channel network. DCB has also been called *Converged Enhanced Ethernet (CEE)* and *lossless Ethernet*.

HP's Virtual Connect FlexFabric module, Flex-10/10D module, and FlexFabric Adapters support these standards.

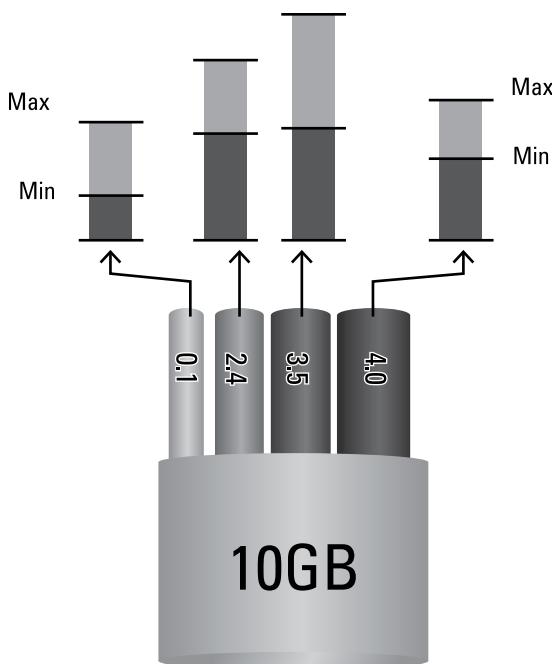


Figure 2-9: New bandwidth optimization scheme.

### Where to use Fibre Channel over Ethernet

You can use FCoE to converge within a BladeSystem enclosure and connect directly to your LAN and SAN. You can also extend the converged traffic outside enclosures to upstream switches such as a top-of-rack switches that connect to LAN and SAN.



These are also known as single-hop and dual-hop convergence. Each Virtual Connect module or switch is counted as a hop.

Virtual Connect offers two convergence options that deliver significant operational and capital expenditure savings:

- **Single-hop convergence:** Since the introduction of the Virtual Connect FlexFabric Module in 2010, many HP customers have taken advantage of single-hop convergence. By eliminating HBAs, Fibre Channel transceivers, optical cables, and SAN switches, the greatest benefit is typically found without making any changes to existing LAN and SAN infrastructure. With both Ethernet and native Fibre

Channel uplink ports, the Virtual Connect FlexFabric module simplifies hardware and reduces costs while preserving network investments.

- ✓ **Dual-hop convergence:** Some customers are beginning to use dual-hop convergence to simplify cabling inside racks of BladeSystem enclosures. Virtual Connect v4.01 enabled this capability in Virtual Connect Flex-10/10D and Virtual Connect FlexFabric modules. This new feature allows the FCoE traffic to be propagated out of the c-Class enclosure to an external switch that handles the conversion of FCoE to Fibre Channel traffic.

A Dual-Hop FCoE solution has several advantages when compared to traditional FC and Ethernet designs. Dual-Hop FCoE allows you to replace expensive optical Fibre Channel cables and transceivers with less expensive copper Direct Attach Cables (DACs) to connect enclosures to upstream switches. This simplifies the in-rack cable installation and reduces the overall solution cost.

This feature is described as Dual-Hop FCoE because there are two FCoE hops between the server and the point where FCoE is converted to native Fibre Channel and connected to a native Fibre Channel SAN.

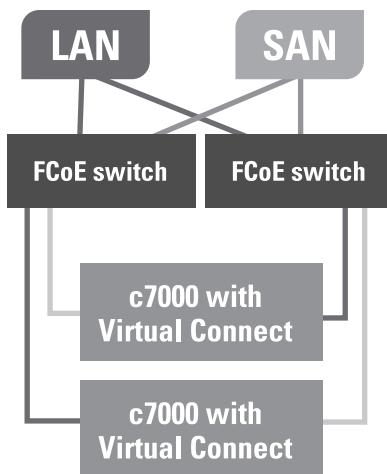
Virtual Connect doesn't currently support network designs with more than two hops. Although HP intends to support these designs in the future, there are significant interoperability testing and potential refinements to these networks before they reach the level of reliability required by Fibre Channel networks.

Dual-Hop FCoE with HP Virtual Connect is currently supported only with the following modules:

- ✓ HP Virtual Connect FlexFabric 10Gb/24-port Module
- ✓ HP Virtual Connect Flex-10/10D Ethernet Module

### ***The Virtual Connect FlexFabric advantage***

Virtual Connect FlexFabric modules use industry-standard FCoE inside the BladeSystem c7000 enclosure and also bring the data traffic out of the FlexFabric modules in the familiar form of today's industry standard Ethernet, Fibre Channel, and iSCSI. You can save money and avoid operational disruption. What's more, you don't need to buy a new generation of switches until you want to. See Figure 2-10 for a visual.



**Figure 2-10:** How FCoE works inside the c7000.

The FlexFabric Adapter that's available as a FlexibleLOM for the server, and as a mezzanine card, takes the place of both Ethernet NICs and Fibre Channel HBAs. The industry term for this basic capability is Converged Network Adapter (CNA), but HP enhances its FlexFabric Adapter with the power of Flex-10 capabilities.

## Cost Savings

The one thing that's most important to any executive: What's the ROI? The HP Virtual Connect FlexFabric and Flex-10 solutions provide savings in four areas:

- ✓ Less equipment to buy and pay for
- ✓ Bandwidth control matches supply to your application needs while reducing overall network demand
- ✓ LAN and SAN administrators' time isn't wasted because the system administrator is more self-sufficient
- ✓ Less equipment means less hardware to manage and lower power bills

Figure 2-11 illustrates a Virtual Connect Flex-10 configuration when setting up a best-practice network configuration for VMware. The minimum recommendation for NICs in a VMware configuration is six, and they're compared here between traditional 1Gb bandwidth technology and Virtual Connect Flex-10.

	NIC 1 Service Console (OS, Mgt Net, Backup)	NIC 2 VMkernel (VMotion, iSCSI, NFS)	NIC 3 VM Network	NIC 4 Service Console (OS, Mgt Net, Backup)	NIC 5 VMkernel (VMotion, iSCSI, NFS)	NIC 6 VM Network
Traditional 1 Gb Technology	1Gb	1Gb	1Gb	1Gb	1Gb	1Gb
Virtual Connect Flex-10	0.5Gb	1Gb	8.5Gb	0.5Gb	1Gb	8.5Gb

*Comparisons are for six-NIC configurations comparing Virtual Connect Flex-10 to Cisco 3120X 1/10Gb switches.*

**Figure 2-11: A VMware Best Practice Network Configuration Comparison.**

As you can see, with the traditional 1Gb technology each NIC is stuck at 1Gb no matter what your needs for that NIC are. For example, the service console on NIC 1 needs only half of the 1Gb bandwidth for that NIC, so you overprovision by 100 percent. With Virtual Connect Flex-10 technology, you can adjust the bandwidth to 500Mb. Then you can increase your bandwidth for other FlexNICs. You're not forced into any infrastructure constraints with FlexNICs.

HP crunched the numbers in this VMware comparison and found that when compared to traditional 1Gb technology, HP Virtual Connect Flex-10:

- ✓ Is less expensive to buy
- ✓ Consumes less power (given up to 240W per enclosure)
- ✓ Offers higher total bandwidth
- ✓ Allows more flexibility to allocate bandwidth across networks
- ✓ Has higher bandwidth per link

In fact, in some configurations, Virtual Connect FlexFabric can reduce your hardware at the server edge significantly. This also means you can reduce equipment and power costs.

HP offers two major cost and hassle savers with the Virtual Connect FlexFabric module and FlexFabric Adapter. First, HP builds the FlexFabric Adapter into most server blades as standard, so you don't have to buy any mezzanine cards. And second, HP doesn't charge any license fee to allow module ports to pass storage traffic, so you don't have to pay for and track licenses.



Another expense reducer is the standardization of configuration that using Virtual Connect Flex-10 technology provides. Because IT departments and related support divisions are busy enough as it is, businesses with large numbers of applications try to limit the number of different configurations available. In most cases, there will be four or five certified infrastructure configurations that specify how to configure racks, enclosures, servers, network connections, and more.

HP has addressed this all-important issue with FlexFabric or Flex-10 adapters — and the eight Flex functions you get right on the server blades. One pair of modules connected to these adapters may meet the needs of all your server configurations.

## ***HP VC Flex-10/10D Module***

The HP VC Flex-10/10D Module is a 30-port, next-generation Flex-10 Module with 600 Gb of full-duplex bandwidth capacity. It has ten dedicated SFP+ based uplinks that can operate at 1/10GbE and four inter-stacking links. The VC Flex-10/10D Module provides up to four times the number of connections (FlexNICs) per server port, without increasing the number of NICs or managed switches required to connect them, by using Flex-10 technology. By virtue of the dual-hop feature, it extends VC Flex-10 to include one Fibre Channel or accelerated iSCSI storage connection (FlexHBA) with three Ethernet connections (FlexNICs) per 10 Gb port.

With this VC module, you can replace four interconnect modules with one module to support Ethernet, Fibre Channel, and iSCSI connections. This reduces overheads — including cards, switches, and cables — over traditional Ethernet and SAN switches.

# Perspectives on HP Virtual Connect Installation

One question that's probably foremost on your mind is: What will your IT team have to do when it comes time to install HP Virtual Connect? The following sections provide some key operational aspects. Though this discussion is pretty high level, this section does get a little more technical in case you want to share this information with your IT team and get its feedback.

## Installation planning

Your system administrator must work with your LAN and SAN administrators to plan how Virtual Connect will connect to the networks. Fortunately, Virtual Connect Manager provides installation wizards for the different administrators to make the process simple and straightforward. Here are some of the key steps in the installation process:

- ✓ Identify the number of required uplinks based on network bandwidth requirements.
- ✓ Configure upstream Ethernet network switch ports for Link Aggregation Control Protocol (LACP) if needed, or verify that the ports are configured. If link aggregation is required, you must configure the upstream switch ports that connect to the Virtual Connect module for 802.3ad (LACP).
- ✓ Determine whether factory MAC addresses and WWNs will be used or whether you will implement Virtual Connect assigned addresses.
- ✓ Establish the required connections to connect servers and VLANs to the core network.
- ✓ Decide on any other specific VLAN requirements.
- ✓ Identify the number of Fibre Channel uplinks based on SAN bandwidth requirements.
- ✓ Ensure the upstream Fibre Channel switch ports are configured for N\_Port ID Virtualization (NPIV).
- ✓ Decide how each server will connect to the Fibre Channel fabrics and establish the required connections.



A physical connection from the server to the network is complete only after you connect the Virtual Connect module(s) to the upstream data center switches, define Virtual Connect networks, and assign server profile(s) in Virtual Connect Manager.

## *MAC and WWN address choices*

MAC addresses and WWNs (World Wide Names — sometimes called World Wide IDs) are critical to how your servers communicate with your LANs and SANs. Virtual Connect offers three choices for setting MAC addresses and WWNs. The LAN, SAN, and system administrators need to agree on which method is most useful for their situation. The addresses can be assigned in these ways:

- ✓ Use the factory-implemented MAC addresses that come with the NICs and the factory-implemented WWNs that come with the HBAs. These MAC and WWN addresses are each unique and registered with international agencies to ensure no duplication.
- ✓ Virtual Connect–assigned addresses, which are also uniquely assigned and registered. When you use Virtual Connect–assigned addresses, Virtual Connect assigns the MAC and WWN addresses with the server profile when you create it. Virtual Connect can also move the profile and its assigned addresses from one server to another. For these reasons, HP recommends that you use Virtual Connect–assigned addresses.
- ✓ You can also set the MAC and WWN addresses yourself, and Virtual Connect will manage them.
- ✓ In order to get the Virtual Connect benefits of being able to add or replace a server and moving workloads from one server to another without impacting the LAN or SAN, you will need Virtual Connect to manage the addresses, whether it assigned them or you assign them yourself. Using the factory-implemented default values will not allow Virtual Connect to provide these benefits.

## *Virtual Connect Fibre Channel saves fabric domain IDs*

One of the great advantages of Virtual Connect for your Fibre Channel SAN is that you aren't limited by the number of switches in your FC SAN fabric. Every FC fabric is limited in the number of switches it can allow. If a user has many server blade enclosures, the number of FC switches needed is often too many to fit into the FC fabric limits.

Virtual Connect Fibre Channel overcomes this problem. Because the Virtual Connect FC modules aren't switches, they don't count against FC fabric limits. So Virtual Connect is able to reduce your FC cable count, even when switches can't do that. At the same time, it provides all the Virtual Connect advantages described earlier.

## Part II

# Diving into Virtual Connect



## *In this part . . .*

- ✓ Find information about specific Virtual Connect modules
- ✓ Find out how to best use Virtual Connect

## Chapter 3

# Virtual Connect Modules

### *In This Chapter*

- ▶ Examining the Virtual Connect FlexFabric 10Gb/24-Port Module
- ▶ Looking at the Virtual Connect Flex-10/10D Ethernet Module
- ▶ Getting to know the Virtual Connect Fibre Channel Modules
- ▶ Building a BladeSystem c-Class enclosure

**I**n this chapter, we discuss the Virtual Connect modules and how they work, so you can get a better idea of how Virtual Connect technology will work in your business.

This analysis requires that we get into more technical detail about Virtual Connect — not so technical that it becomes unreadable, but enough to help you get a more in-depth understanding about Virtual Connect products.

Virtual Connect works with the HP BladeSystem c-Class series of enclosures, which come in two different models: the c7000 and c3000. The difference is that the c3000 holds up to four full-height or eight half-height server blades with four bays for interconnect modules. The c7000 holds double what the c3000 holds: 8 full-height server blades or 16 half-height blades and 8 rear bays for interconnect modules.



## *The Virtual Connect FlexFabric 10Gb/24-Port Module*

The Virtual Connect FlexFabric Module allows you to bring Ethernet, Fibre Channel, and high-performance iSCSI into a

single module. Because the Virtual Connect FlexFabric Module uses industry-standard Ethernet and Fibre Channel on its uplinks, it will happily communicate in existing environments using those protocols.

The Virtual Connect FlexFabric module also includes 10Gb downlink connections to the servers and offers a combination of uplinks to the data center network. What's more, the Virtual Connect FlexFabric module is single-wide so you can install two of them side by side in the enclosure interconnect bays for redundancy. You can stack the Virtual Connect FlexFabric modules in up to four enclosures, and your IT team can manage them using Virtual Connect Manager or Virtual Connect Enterprise Manager.



The Virtual Connect FlexFabric 10Gb/24-Port Module (see Figure 3-1) includes the following features:

- ✓ It has 16 10Gb downlinks to servers. That is, the module has one connection to one FlexFabric Adapter on each of 16 half-height servers, or if you have full-height servers, the module connects with two FlexFabric Adapters on each of the 8 servers. The module connects automatically across the signal midplane in the c-Class enclosure.
- ✓ It provides ten uplink ports to the data center network including:
  - Four 10Gb SR, LR fiber and copper SFP+ (Ethernet and Fibre Channel)
  - Four 10Gb SR, LRM and LR fiber and copper SFP+ (Ethernet)
  - Two 10Gb internal cross-connect links for stacking and failover when there is another Virtual Connect FlexFabric module beside it
- ✓ It supports a wide variety of signal-aggregation methods including NPIV, VLANs, EtherChannel, NIC teaming, and shared port uplinks.
- ✓ FlexFabric modules in four enclosures can be stacked together with cables so you can manage four enclosures of Virtual Connect modules as one management domain.



Figure 3-1: The HP Virtual Connect FlexFabric 10Gb/24-Port Module.

## The Virtual Connect Flex-10/10D Module

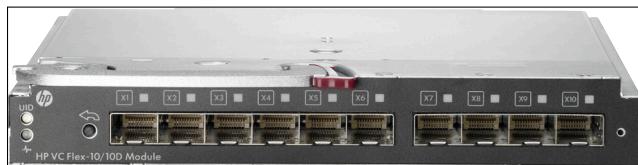
The HP Virtual Connect (VC) Flex-10/10D Module is a next-generation Flex-10 module having 30 ports with total effective full-duplex bandwidth of 600Gb. It has 10 dedicated SFP+ uplinks, which can be either 1 or 10GbE and has 4x 10GbE dedicated inter-stacking links (ISL). The VC Flex-10/10D Module converges traffic onto a single fabric with FCoE, iSCSI and LAN. It is a cost-effective solution for dual-hop FCoE environments connecting converged traffic to top-of-rack switches.



The Virtual Connect Flex-10/10D (see Figure 3-2) module includes the following features:

- ✓ Sixteen 10Gb downlinks in the center of the chassis
- ✓ Four 10Gb cross connects
- ✓ Ten 10Gb SR, LR, or LRM fiber uplinks SFP+
- ✓ One internal interface to c-Class Onboard Administrator
- ✓ Connections include SFP+ SR, LR, LRM SFP SX, RJ-45, and SFP + Copper
- ✓ The module includes a simple GUI, setup wizards, embedded SNMP v1 and v2, and SMI-S CLI port mirroring. Any uplink port can be used as a dedicated mirrored port from the server port(s)

- ✓ High availability features include Link Aggregation Protocol, automatic loop protection, mirrored profile database, and multipath heartbeat between redundant modules
- ✓ Security includes LDAP, SSL, TACACS+, and RADIUS. Role-based management including support Network Access Group.



**Figure 3-2:** The HP Virtual Connect Flex-10/10D module.

---

## The Fibre Channel Modules

HP offers two models of the Virtual Connect Fibre Channel (FC) module today: two 8Gb modules with more bandwidth to support virtualization or other high bandwidth applications. You will need to have at least one Virtual Connect Ethernet or FlexFabric module installed in the same enclosure along with the FC modules because the embedded device monitoring and management, including Virtual Connect Manager, runs on the Flex-10 or FlexFabric modules. The following sections go over the three models in more detail.

### *Virtual Connect 8Gb 20-Port Fibre Channel Module*

The HP Virtual Connect 8Gb 20-Port Fibre Channel (FC) Module (Figure 3-3) operates just like the 4Gb model except it doubles the bandwidth and offers the lowest cost per port. It also brings next generation 8Gb technology that includes backward compatibility with 2Gb and 4Gb networks. It is ideal for environments and applications that require high bandwidth connections, increased network management, and role-based security features. (And who isn't looking to save money, get more speed, and acquire easy management features these days?)



**Figure 3-3:** The HP Virtual Connect 8Gb 20-Port Fibre Channel Module.

## *Virtual Connect 8Gb 24-Port Fibre Channel Module*

The HP Virtual Connect 8Gb 24-Port Fibre Channel (FC) Module (Figure 3-4) operates just like the 20-Port 8Gb model, but it has two additional advantages: It offers twice as many uplink ports for greater flexibility and less oversubscription, and it supports twice as many NPIV connections per HBA. This module offers the greatest density of ports in the Virtual Connect Fibre Channel line and is ideal for virtual machine environments.



**Figure 3-4:** The HP Virtual Connect 8Gb 24-Port Fibre Channel Module.

## *Building a c-Class Enclosure*

Because Virtual Connect modules are built for HP BladeSystem c-Class enclosures, they all have the same size and form factor so they'll plug into any of the interconnect bays in a c3000 or c7000 enclosure. If you plug in two of the same model side-by-side, you get redundant access to the NICs or HBAs on each server.

To connect to your LANs and SANs using Virtual Connect modules, you need to do the following:

- ✓ With Virtual Connect FlexFabric modules, connect Ethernet ports to data center Ethernet switches and Flexports running FC to the data center FC switches.
- ✓ With Virtual Connect Flex-10/10D modules running FCoE, either connect the module to supported data center FCoE switch or the data center Ethernet switches.
- ✓ Connect the Virtual Connect FC modules to the data center FC switches. You can connect to a variety of switches including those made by HP, Brocade, Cisco, McData, and QLogic.
- ✓ Set up Virtual Connect and assign connection profiles using Virtual Connect Manager or Virtual Connect Enterprise Manager.

That's all there is to it! You're ready to go. Turn to Chapter 4 for a closer look at Virtual Connect (especially if you want to convince your boss of the return on investment).

## Chapter 4

# Looking More Closely at Virtual Connect

### *In This Chapter*

- ▶ Reducing costs
- ▶ Managing hardware and networks more easily
- ▶ Addressing some misinformation

This chapter answers some of the “Yes, but . . .” questions you and your IT team may have, and also dispels some of the myths that HP has run across as it’s introduced Virtual Connect to customers around the world.

Hopefully this chapter can help answer many of your questions about Virtual Connect. Though you may be sold on the solution, one or more decision-makers in your company may not be. If you need to convince others, be sure to check out Chapter 5 so you can tell people the 11 reasons to choose HP Virtual Connect.

Some of the information in this chapter goes into deeper technical details about Virtual Connect for the benefit of your IT staff — and some information is for financial staff that you need to convince, and any executives you need to present with a rock-solid ROI statement. We also discuss some specific advantages of both Virtual Connect Flex-10 and FlexFabric modules. With each section, we include a brief overview of what the section is about in case the person you’re trying to convince isn’t exactly detail oriented.

## Cost Reductions and TCO

Virtual Connect Flex-10 provides a number of cost reductions over traditional server/network connections — not only on the day you purchase it, but every day going forward. The Virtual Connect FlexFabric module builds on those benefits to save even more. These cost savings include:

- ✓ **Lower hardware costs:** First of all, you buy a whole lot less stuff! With the Virtual Connect FlexFabric module, you can reduce sprawl at the server edge, cut network connection hardware costs, and get four times the number of connections without buying any NIC cards or HBAs (host bus adapters) or CNAs (converged network adapters). HP ProLiant server blades already have the Ethernet and FC capability built into them at no added cost. And, you don't have to buy expensive licenses and keep track of them for storage connectivity.
- ✓ **Lower energy costs:** With less equipment to use, you lower your energy costs. Those energy cost savings go up substantially with Virtual Connect because you need to power substantially fewer LAN and SAN connection components.
- ✓ **Lower operation expenses:** Save time and labor. Virtual Connect helps the system administrators be self-sufficient, so they can add a new server, replace one, or move the workload from one server to another in minutes instead of the days or weeks it takes now. It also frees up the LAN and SAN administrators to do their own work without unnecessary interruptions. Just think of the savings in coordinating meeting times!

Virtual Connect eliminates equipment to maintain and makes the work easier and faster for everyone, and that reduces operations expense.

## Easier Hardware Management

Virtual Connect technology provides your IT team with easier hardware management in a number of ways. The following sections go over how in more detail.

## *Virtual Connect module isn't a switch*

Virtual Connect isn't a switch, isn't part of the network, and it doesn't control anything in the network. And those are all good things. Data center Ethernet switches are complicated machines. They're part of a complex network of switches and routers in which every change needs to be controlled by a LAN or SAN administrator with special skills and insights into that network. Likewise, the server infrastructure is a complicated system that demands the special skills and insights of the system administrator.

Virtual Connect allows servers to connect to the network in a way that doesn't affect the network at all. So the system administrator can add new servers, make server changes, and manage Virtual Connect without the network administrator needing to get involved.

Virtual Connect uses server-edge virtualization to allow this seamless interaction. Its Ethernet and FlexFabric modules use tried-and-true Layer 2 bridging functionality, but their primary function is to provide server connection virtualization and management features that don't exist in traditional switches. HP has built in some functions that are common on switches, but they only serve the purpose of allowing Virtual Connect to work smoothly with any brand of Ethernet data center networks.

Virtual Connect Fibre Channel modules aren't switches, either. They use industry standard N\_Port ID Virtualization to reduce cables without complex switching functionality or using up your limited SAN fabric IDs.

## *Higher availability and fault recovery*

Everyone in the company knows (or should know) that every second your network is down your business is losing money. HP has designed Virtual Connect with both high availability and quick fault recovery.



Virtual Connect uses configuration check pointing/synchronization across adjacent Virtual Connect Ethernet or FlexFabric modules within each HP BladeSystem c-Class enclosure. In the unlikely event that a Virtual Connect Ethernet, FlexFabric, or Fibre Channel (FC) module fails, the Virtual Connect Domain uses Ethernet or FlexFabric modules in adjacent bays to retain the complete Virtual Connect configuration. Virtual Connect supports plug-n-play, so after the failed Virtual Connect module is replaced, it applies the configuration to the new module automatically.

HP goes a couple steps further when it comes to bullet-proofing your infrastructure. HP server blades are typically connected to more than one redundant Virtual Connect module, so it's not easy to lose the connection to your network. Virtual Connect also supports exporting the Virtual Connect domain configuration to an external source in case you need to restore the configuration manually.

## *Virtual Connect uplink failures don't require reconvergence on the external network*

If a Virtual Connect module encounters a connection problem with the external network, you don't need to go to the external network and reconverge those uplinks.

Virtual Connect Ethernet and FlexFabric modules don't participate in the data center network Spanning Tree. They present themselves to the network as a termination endpoint, like a server NIC. Virtual Connect employs an internal loop avoidance method to make sure no loops can be created in the server connections.

Because Spanning Tree Protocol (STP) isn't used to manage Layer 2 redundancy in Virtual Connect, Spanning Tree reconvergence will not occur. Fundamentally, Virtual Connect failovers between Virtual Connect uplinks behave the same way as failovers between server NICs in a NIC Team or NIC Bond. That is, the failover from one uplink or NIC is transparent to the data center network Spanning Tree.

## ***Can connect to any industry standard network components***

Virtual Connect Ethernet and FlexFabric modules are completely IEEE Ethernet standards compliant, so they communicate effectively with any brand of IEEE standard switches. HP Networking offers a full range of products that are all IEEE standards compliant. However, HP realizes that companies use brands of networking equipment other than its own. HP makes it easy for you to connect Virtual Connect to Cisco Catalyst and Nexus switches. Over 100,000 Virtual Connect Ethernet modules are operating with Cisco networks every day.



Virtual Connect Fibre Channel modules are also completely compliant with the INCITS T11 industry standards that define all Fibre Channel operation. So any brand of FC switches that meets the T11 standards will work smoothly with Virtual Connect Fibre Channel.

## ***Easier Network Connection Management***

Virtual Connect was designed not only to provide server edge virtualization functionality, but also to work smoothly with the LAN and SAN networks it was connected to. So it provides easier connection management in several key ways. The following sections provide more details.

### ***Provides diagnostic tools***

Virtual Connect Manager has a lot of different ways for your system and network administrators to use their favorite tools to diagnose, monitor, and configure Virtual Connect. These include:

- ✓ You can create scripts in a Secure Shell (SSH) command-line interface.
- ✓ You can use any management tool that supports command-line interface scripts to remotely configure Virtual Connect.

- ✓ You can monitor Virtual Connect with any management tool that supports SNMP (Simple Network Management Protocol). Virtual Connect supports both SNMPv1 and SNMPv2 traps as well as traps for key, predefined threshold conditions, and per-destination configuration of traps.
- ✓ Virtual Connect also supports *port mirroring* or monitoring of server NIC traffic to Virtual Connect uplinks for troubleshooting.

## ***Fibre Channel (FC) login distribution and failover features***

The Virtual Connect Fibre Channel connection provides login distribution and failover on FC uplinks to the SAN. A failure in your server connectivity with the SAN is a major problem. So HP has designed Virtual Connect Fibre Channel with built-in functionality that can automatically log in to another active Fibre Channel port if a Fibre Channel connection fails.

In other words, Virtual Connect provides Fibre Channel (FC) login distribution and failover features, which means that the SAN administrator can automatically distribute server HBA fabric logins across all Virtual Connect Fibre Channel (VC-FC) uplink ports on the same VC-FC module. Should a port fail or lose the link, the VC-FC module automatically relogs the WWN into the fabric on another active VC-FC uplink port from the same VC-FC module.

## ***Other seasoned technology***

To continue the discussion on the use of seasoned technologies to power Virtual Connect and give it the flexibility you need, Virtual Connect supports a large number of other seasoned networking technologies that include:

- ✓ Network management tools
- ✓ Secure external management
- ✓ Private VLANs
- ✓ Deterministic load balancing for multiple LACP channels

- ✓ VLAN trunking to server-based NICs
- ✓ Network visibility into the Virtual Connect domain for network administrators
- ✓ Network Quality of Service (QoS) feature to prioritize traffic types
- ✓ Clusterlike technology between Virtual Connect Ethernet modules
- ✓ Stacking multiple Virtual Connect Ethernet modules
- ✓ Single web management window to manage all Virtual Connect modules
- ✓ IGMP snooping v1 and v2
- ✓ Nested NPIV
- ✓ MAC and WWN address management
- ✓ Multiple Virtual Connect Fibre Channel fabrics
- ✓ Support statistics for all Ethernet ports down to each FlexNIC on the port

## *Urban Myths about Virtual Connect*

A few myths are floating around out there about Virtual Connect, but HP has addressed these myths based on real-life deployments. If you've heard some of these and need the facts, here they are.

### *Myth: Virtual Connect doesn't provide visibility into the Virtual Connect Domain for Network Admins*

Virtual Connect is about keeping things simple. It provides several user interface options and features for managing and monitoring Virtual Connect to fit with the variety of methods HP's customers use. VC supports both a web interface

(HTTPS) and a CLI interface (SSH). In addition, VC supports per-interface statistics for every server NIC port, server HBA port, VC Ethernet uplink port, and VC Fibre Channel uplink port. These statistics can be monitored via the management interfaces or via SNMP/SMI-S polling. In addition to local statistics and SNMP polling of statistics, VC provides SNMP traps for events that cause VC Domain status changes. Virtual Connect also supports port mirroring, to an external network analyzer, of Ethernet traffic to/from any server NIC port(s).

## ***Myth: VC Flex-10 doesn't provide the bandwidth control that QoS would***

Virtual Connect Flex-10 provides server administrators greater flexibility to prioritize application traffic by dedicating specific FlexNICs for specific networks, and providing segregation of traffic that can't be allowed to coexist on the same physical NIC. Though a virtual server hypervisor could provide rate-limiting features to control bandwidth, this doesn't exist for physical servers. Virtual Connect Flex-10 allows either the server or network administrator to set and enforce bandwidth settings at the FlexNIC partition, and Virtual Connect Flex-10 can provide a consistent method of management and segregation regardless of the physical host OS. With Virtual Connect 4.01, industry standard QoS is supported as a standard method of traffic classification and prioritization.

## ***Myth: Virtual Connect users can't leverage existing network management tools***

Not true! Virtual Connect supports configuration scripting via a CLI interface (SSH) and monitoring using SNMP. Any management tools that support CLI scripting can be used to remotely configure Virtual Connect. Any management tool that supports SNMP can be used to monitor Virtual Connect.

## *Myth: VC doesn't interoperate with the Nexus 1000v*

The Cisco Nexus 1000v is a software vSwitch that works in a VMware hypervisor. It interoperates with any other Layer 2 networking device that supports industry standard protocols. Even the vPC-HM (Virtual Port Channel – Host Mode; where MAC addresses are pinned to dvUplinkPorts) supports Layer 2 devices that can't support LACP upstream. Virtual Connect is pure industry standard Layer 2, so it works just fine with the Nexus 1000v.



## Chapter 5

# Eleven Benefits of HP Virtual Connect

### *In This Chapter*

- Eleven benefits of HP Virtual Connect

**D**espite all the best efforts of this book, you may need to put your arguments in a digestible form so decision-makers can quickly understand the benefits of HP Virtual Connect. Some of this information is repeated from earlier chapters so you can use this chapter to help make your case.

## *Flat SAN Technology*

The VC Direct-Attach Fibre Channel for 3PAR Storage Systems was introduced with Virtual Connect 3.70 and supported on Virtual Connect FlexFabric modules with 3PAR storage devices. This feature enables storage admins to connect VC FlexFabric modules directly to highly scalable 3PAR storage, including T, V, and F series without an intermediate SAN. At the same time, it provides all the SAN telemetry needed to manage a SAN network via VCM/CLI today and VCEM in the future.

SAN infrastructure is one of the biggest drains on OpEx and CapEx for FC based storage and Virtual Connect can eliminate it. This results in a system with fewer parts, lower latency, and faster provisioning. All delivered by reducing a complex multilayer SAN infrastructure and flattening it into a Single Tier Flat SAN. Simpler is always better!

## Fewer Cables and Switches

The traditional choice for connecting your blade servers to your LAN and SAN is between too many cables and too many switches. Pass-Thru modules leave you with too many cables and expensive switch connections on the network end of the cables. Blade server switches are small, so you end up with too many to comfortably manage.

Virtual Connect is a great alternative for consolidating all your Ethernet and Fibre Channel connections into much less equipment. It reduces the number of cables like a switch would, but is much simpler and doesn't add more load on the LAN and SAN administrators who manage the switches. And it also slashes the number of modules, adapter cards, and transceivers you need.

Virtual Connect is part of the server infrastructure and provides a virtualization layer between the servers and the Ethernet and SAN networks so they won't see any changes in the server connections. And the FlexFabric, Ethernet, and Fibre Channel (FC) Virtual Connect modules have plenty of ports. What's more, when you incorporate Virtual Connect Flex-10/10D Ethernet or FlexFabric modules as part of your infrastructure, each port becomes four individual physical functions that share 10Gb of bandwidth among them, so you have less network connection equipment to buy and less to power. HP stepped up consolidation even further with FlexFabric modules and FlexFabric Adapters, which eliminate the need for separate HBA cards and SAN switches.

## More Applications on Fewer Servers (More Server I/O)

As you virtualize your infrastructure by consolidating applications onto virtual machines on fewer servers, the I/O demand for each of those servers increases. HP Virtual Connect Flex-10 technology provides eight functions on a single integrated adapter built into the server to handle all the additional connections. And if you really need more connections, you can get a total of 24 per server blade by adding more mezzanine cards to support even greater virtual machine I/O demands.

## Lowered Expenses

Virtual Connect has a model for nearly every IT need. If you need more than two NICs on each server, which is often the case, you can dramatically lower your expenses by using Virtual Connect Flex-10 or FlexFabric modules. With Virtual Connect FlexFabric modules, you can reduce network sprawl at the server edge. That includes switches, cables, network adapters, storage adapters, and more. With Virtual Connect Direct-Attach Fibre Channel for 3PAR Storage Systems, you can now eliminate your SAN Fabric too. You can reduce your cost for network connection hardware.



With fewer hardware components that need electricity, you'll also save on power costs with Virtual Connect FlexFabric modules.

## Reduced Staff Time on Configuration and Management

When servers are directly connected to switches, those switches must be managed by the LAN and SAN administrators. Whenever there is a change in the network, like adding a new server blade, your system administrator, as well as the LAN and SAN administrators, must plan the changes that could take days, weeks, or even months to implement.

With Virtual Connect, your IT team only needs to plan the network connections once and apply them to each bay in the enclosure using Virtual Connect server profiles. When you need to add and replace servers, the system administrator can make those changes, and the LAN and SAN administrators don't have to do anything. The network provisioning was already done, and that frees up your LAN and SAN administrators from the disruption of server maintenance.

Virtual Connect makes the system administrator self-sufficient. Why tie up three people when one can get the job done?

## *Scalable Management That Grows with You*

HP provides flexible management options for small and large data centers. Use the built-in Virtual Connect Manager if you don't intend to manage more than four enclosures of Virtual Connect. If you plan to grow your data center, Virtual Connect Enterprise Manager is a scalable application that administers connections and workloads for hundreds of Virtual Connect Domains and thousands of servers from a single console.

## *Match Bandwidth Supply to Application Demand*

Virtual Connect Flex-10 technology allows your system administrator to match the amount of bandwidth for each adapter port to the needs of the application using that connection. It allows you to set the bandwidth for each FlexNIC or FlexHBA. Furthermore, the administrator can change bandwidth settings on the fly without the need to reboot, so you can quickly adjust to variations in application demand. In addition, bandwidth partitioning capabilities on Flex-10 adapters have been enhanced to support optimal use of the unused bandwidth of other FlexNICs belonging to same port. The new enhancement allows administrators to set minimum and maximum bandwidth allocations for each FlexNIC that will allow any unused port bandwidth to be allocated to FlexNICs without operator intervention.

## *Connect to Any Brand of LAN or SAN*

Virtual Connect supports industry standard network protocols so you can incorporate it easily into your existing infrastructure. By using standard Ethernet, Fibre Channel, and iSCSI protocols, you're assured that Virtual Connect modules will work seamlessly with any brand of existing networking

infrastructures. All the faster Virtual Connect modules are backward compatible with slower networking hardware, so you can upgrade on your own timetable as budgets permit.

## *Flexibility with Server Models*

Virtual Connect provides all kinds of flexibility. It interoperates with all HP BladeSystem servers. Most server blades already come with FlexFabric Adapters built into them. Older blades have Flex-10 Adapters built into them. And both Flex-10 and FlexFabric Adapters are available as mezzanine cards. FlexFabric, Flex-10, and the other Virtual Connect modules are interchangeable with each other and have a wide variety of backward and forward compatibilities. HP has tried to make it so that every logical combination of servers and modules work together in simple, economical ways to meet your needs. If you're curious, check out the details with your HP sales representative or visit [www.hp.com/go/virtualconnect](http://www.hp.com/go/virtualconnect).

Virtual Connect Flex-10 technology brings you the ultimate flexibility for your server configuration standards. Instead of needing four or five different interconnect configurations to meet the needs of your different standard server configurations, you'll probably only need a pair of Virtual Connect Flex-10 or Virtual Connect FlexFabric modules — period. No mezzanine cards. No variety of interconnect devices. Fewer spare parts, and fewer part numbers to worry about.

## *Failover Process and Redundant Access*

Virtual Connect provides resilience. It uses configuration checkpointing and synchronization across adjacent Virtual Connect Ethernet modules within each HP c-Class enclosure. In the unlikely event that a Virtual Connect FlexFabric, Ethernet, or Fibre Channel module fails, the Virtual Connect Domain uses Ethernet or FlexFabric modules to retain the complete Virtual Connect configuration. Virtual Connect supports plug-n-play standards, so that after the network administrator replaces the failed module, the configuration is applied to a new module automatically.

With the design of Virtual Connect, HP server blades are typically connected to more than one redundant Virtual Connect module so there's no single point of failure in your system. Virtual Connect also supports the export of the Virtual Connect domain configuration to an external source in case you need to restore the configuration manually.

## *A Complete Server Network Connection Solution*

HP Virtual Connect solves problems that most IT operations face every day: They have too many cables and too many switches, too much management burden, too much power consumption, and too much expense.



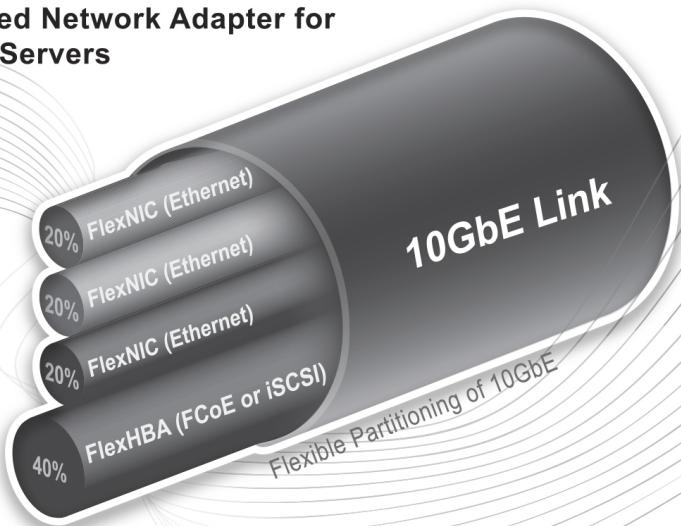
Virtual Connect simplifies network connectivity so your IT organization can work smarter, reduce costs, and respond faster to business needs.

## Notes

## Notes

# MEET BROADCOM'S NetXtreme II® TECHNOLOGY

The Ideal Converged Network Adapter for  
HP ProLiant Gen8 Servers



HP Virtual Connect FlexFabric 10Gb CNAs featuring Broadcom NetXtreme II technology offer the most flexible and easy to manage networking solution for HP ProLiant Gen8 servers.

- **Performance:** Outperform other CNA competitors in key networking and storage metrics.\* (e.g., IOPS, Throughput)
- **Full CNA Solutions:** Adapters combine networking with FCoE/iSCSI storage protocol offload.
- **Default HP Adapter:** NetXtreme-enabled adapters are HP's default selection for the ProLiant Gen8 family of servers, providing consistency across the entire product portfolio.

<http://go.broadcom.com/HP>



\*Demartek® June 2012

Broadcom®, the pulse logo, Connecting everything®, the Connecting everything logo, NetXtreme II® are among the trademarks of Broadcom Corporation and/or its affiliates in the United States, certain other countries and/or the EU. Any other trademarks or trade names mentioned are the property of their respective owners.

These materials are the copyright of John Wiley & Sons, Inc. and any dissemination, distribution, or unauthorized use is strictly prohibited.



connect • monitor • manage

CONNECT

# Emulex Connects HP FlexFabric *with HP Servers and HP Storage*

011100 110011 10001  
00011 000 111000 1001011

Only HP 10GbE solutions provided by Emulex enable differentiated 'all in one' I/O capability (FCoE, iSCSI, 10GbE) - at the price of 10GbE!

HP 10Gb Ethernet (10GbE) adapters and Fibre Channel Host Bus Adapter (HBA) solutions provided by Emulex offer seamless I/O connectivity across HP ProLiant servers and the new HP 3PAR StoreServ arrays. One common driver stack simplifies deployment across the entire infrastructure from the HP FlexibleLOM adapters and HP 8Gb Fibre Channel (FC) mezzanine HBAs with connectivity to HP Storage, including HP 3PAR Store-Serv Storage, StoreVirtual, StoreOnce and StorALL Storage.

Reduce operational expenditures (OPEX) and increase ROI by combining HP FlexibleLOM adapters with 8Gb FC mezzanine HBAs. Why complicate deployment of I/O solutions by selecting multiple vendors for FC and 10GbE?

For more information on HP/Emulex solutions,  
please visit [www.emulex.com/hp](http://www.emulex.com/hp)



 **EMULEX®**

# QLogic, the go-to Partner for Converged Infrastructure Connectivity.

**QLogic ASICs and Virtual Connect Fibre Channel Modules** deliver simplified connectivity and management.

**QLogic Mezzanine Cards** deliver the best real-world Fibre Channel performance!

**QLogic helps HP deliver innovative solutions like** Virtual Connect Direct Attach for 3PAR.



For more information on QLogic solutions for HP visit [www.qlogic.com/go/hp](http://www.qlogic.com/go/hp)

# Overcome today's server connection complexity while reducing costs and power consumption

With HP Virtual Connect, you can simplify your server connectivity to your network — and reduce cables without adding switches to manage. System administrators become self-sufficient to add or replace servers and move workloads from one server to another in minutes, freeing LAN and SAN administrators from common server tasks.

- ***Understand server networking — before learning about HP Virtual Connect, first get the basics***
- ***Discover the HP Virtual Connect approach — Virtual Connect simplifies server connections to LANs and SANs, and any needed changes to those connections***
- ***Find out how easy it can be — how HP Virtual Connect enables server administrators to easily move workloads and to add, move, and replace servers on the fly***
- ***Get the lowdown on HP Virtual Connect benefits — all the details you need to know to understand what Virtual Connect does and what it can do for you***



**Open the book and find:**

- A list of reasons why HP Virtual Connect will benefit your organization
- A section about how HP Virtual Connect really works
- How VC FlexFabric modules eliminate server connection sprawl
- The simple, powerful management tools for Virtual Connect
- Answers to your questions on Virtual Connect

**Making Everything Easier!™**

**Go to Dummies.com®**  
for videos, step-by-step examples,  
how-to articles, or to shop!

FOR  
**DUMMIES®**  
A Wiley Brand



Also available  
as an e-book

978-1-118-58599-3

Client Tracking Number: 4AA3-1106ENW

Not for resale