



# **HP Virtual Connect FlexFabric Cookbook**

## **– With HP Virtual Connect Flex-20/40 F8**

(Version 4.10 through 4.30 Firmware Enhancements)

September 2014

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# Purpose

The purpose of this Virtual Connect Cookbook is to provide users of Virtual Connect with a better understanding of the concepts and steps required when integrating HP BladeSystem and Virtual Connect Flex-10, Flex-10/10D, FlexFabric 10Gb/24-Port and the new FlexFabric-20/40 F8 components into an existing network.

The scenarios in this Cookbook vary from simplistic to more complex while covering a range of typical building blocks to use when designing Virtual Connect Flex-10 or FlexFabric solutions. Although these scenarios are shown individually, some scenarios could be combined to create a more complex and versatile Virtual Connect environment, such as the combined use of Shared Uplink Sets (SUS) and vNet Tunnels. Or Active/Active networks for North/South traffic flows, such as iSCSI or VDI, while also having the primary network traffic configured in a separate Shared Uplink Set with Active/Standby uplinks.

In addition to the features added in earlier releases 4.20 is a major release containing several new features, including support for 20Gb Network adapters and QSFP+ 40Gb uplinks and a 40Gb to 10Gb splitter cable (to enable integration into 10Gb environments much easier) with the new FlexFabric-20/40 F8 modules. In addition, release 4.30 provided additional features, such as Partial Domain stacking, support for Gen 9 servers and 4K VLAN support. These feature enhancements as discussed in the following sections.

This Cookbook will highlight and discuss some of these added features.

The scenarios as written are meant to be self-contained configurations and do not build on earlier scenarios, with this you may find some repetition or duplication of configuration across scenarios. If you are new to Virtual Connect, to gain a better understanding of Virtual Connect, spend some time reviewing the introductory sections and additional referenced material before moving to the scenarios.

This paper is not meant to be a complete or detailed guide to Virtual Connect, Flex-10/Flex-20 or FlexFabric, but is intended to provide the reader with some valid examples of how Virtual Connect could be deployed within their environments. Many additional configurations or scenarios could also be implemented. Please refer to the following section for additional reference material on Virtual Connect, Flex-10/Flex-20, FlexFabric 10/24-Port and FlexFabric 20/40 F8.

## Documentation feedback

HP welcomes your feedback. To make comments and suggestions about product documentation, send a message to [docsfeedback@hp.com](mailto:docsfeedback@hp.com). Include the document title and manufacturing part number of this paper, (found on the last page of this document). All submissions become the property of HP.

## Documentation revisions

Revisions or changes to this document since initial release are highlighted in the table below.

Revision Date:	Summary of Changes
Sept 30, 2014	Initial release -
Jan 5, 2015	Corrected statements in all Windows 2012 R2 Scenarios, regarding supported NIC teaming Load Balancing modes
Sept 29, 2015	Updated FlexFabric and Ethernet Adapters list on page 30

# The Virtual Connect Cookbook Series:

## **Virtual Connect 1Gb Ethernet Cookbook**

Virtual Connect can be used to support both Ethernet and Fibre Channel connections. The Virtual Connect 1Gb Ethernet Cookbook is provided with basic Virtual Connect configurations in a 1Gb environment. Earlier releases of the Virtual Connect Ethernet Cookbook cover both 1Gb and 10Gb solutions; however, the most recent release of the Virtual Connect 1Gb Cookbook cover only 1Gb Ethernet Solutions up to Virtual Connect firmware release 3.6x.

<http://h20000.www2.hp.com/bc/docs/support/SupportManual/c01990371/c01990371.pdf>  
[\(www.hp.com/go/blades\)](http://www.hp.com/go/blades)

## **FCoE Cookbook for HP Virtual Connect**

Virtual Connect provides the ability to pass FCoE to an external FCoE capable network switch. This guide provides concepts, deployment guidelines and use case scenarios for HP Virtual Connect when using Fibre Channel over Ethernet through FIP Snooping under the T11 FC-BB-5 specification.

For FIP Snooping and FCoE connectivity, please refer to the *FCoE Cookbook for HP Virtual Connect*  
<http://bizsupport1.austin.hp.com/bc/docs/support/SupportManual/c03808925/c03808925.pdf>  
[\(www.hp.com/go/blades\)](http://www.hp.com/go/blades)

## **FC Cookbook for HP Virtual Connect**

Virtual Connect can be used to support both Ethernet and Fibre Channel connections; however, this guide is focused completely on the Ethernet configuration.

For Fibre Channel connectivity, please refer to the *FC Cookbook for HP Virtual Connect*  
<http://bizsupport1.austin.hp.com/bc/docs/support/SupportManual/c01702940/c01702940.pdf>  
[\(www.hp.com/go/blades\)](http://www.hp.com/go/blades)

## **iSCSI Cookbook for HP Virtual Connect**

Virtual Connect can be used to support iSCSI accelerated connections, including iSCSI boot, however, this guide is focused completely on the Ethernet and iSCSI configuration.

For iSCSI connectivity, please refer to the *iSCSI Cookbook for HP Virtual Connect*  
<http://h20000.www2.hp.com/bc/docs/support/SupportManual/c02533991/c02533991.pdf>  
[\(www.hp.com/go/blades\)](http://www.hp.com/go/blades)

# Introduction to Virtual Connect Flex-10/Flex-20 and FlexFabric Technologies

Virtual Connect is an industry standards-based implementation of server-edge virtualization. It puts an abstraction layer between the servers and the external networks so the LAN and SAN see a pool of servers rather than individual servers. Once the LAN and SAN connections are physically made to the pool of servers, the server administrator uses Virtual Connect management tools (Virtual Connect Manager (VCM) or Virtual Connect Enterprise Manager (VCEM)) to create a profile for each server.

Virtual Connect FlexFabric is an extension to Virtual Connect Flex-10/Flex-20 which leverages Fibre Channel over Ethernet (FCoE) protocols. By leveraging FCoE for connectivity to existing Fibre Channel SAN networks, we can reduce the number of switch modules and HBAs required within the server blade and enclosure. This in turn further reduces cost, complexity, power and administrative overhead.

This paper will discuss the differences between the Virtual Connect Flex-10/10D, Virtual Connect FlexFabric 10Gb/24-Port and Virtual Connect FlexFabric-20/40 F8 modules and provides information and suggestions to assist the reader in determining the best option for their implementation of HP BladeSystem and Virtual Connect. However, it is also important to understand that as Virtual Connect FlexFabric is leveraging FCoE functionality, that functionality is contained within the Virtual Connect environment and a knowledge of, or infrastructure to support FCoE outside the enclosure is not required. For additional information on Virtual Connect, Flex-10/Flex-20 and/or FlexFabric, please review the documents below.

# New Features:

## Version 4.10 of Virtual Connect contains support for the following enhancements:

The user guide contains information about the following changes in VC 4.10:

- Discontinued support for old hardware:
    - HP 4Gb VC-FC Module (409513-B21) is no longer supported
  - Manageability enhancements:
    - VC management support for IPv6
      - Note:** Use of IPv6 requires OA and iLO from SPP 2013.09.0 (B) or higher SPP releases.
      - Ability to hide unused FlexNICs. The FlexNICs (physical functions) that do not map to profile connections are not enumerated in the OS as network interfaces.
      - Auto-deployment feature, which allows for the configuration of a VC domain from a centralized location using DHCP and TFTP
      - Improved accommodation of non-HP DACs and FC transceivers. The port status condition "Non-HP" replaces the "Uncertified" port status condition.
  - SR-IOV support
    - Ability to enable SR-IOV on certain FLBs and mezzanine cards for Gen8 servers and LOMs for the HP ProLiant BL620c G7 and HP ProLiant BL680c G7 Server Blades
    - VC SR-IOV supports the following adapters:
      - HP Flex-10 10Gb 2-port 530FLB Adapter
      - HP FlexFabric 10Gb 2-port 534FLB Adapter
      - HP Flex-10 10Gb 2-port 530M Adapter
      - HP FlexFabric 10Gb 2-port 534M Adapter
      - HP NC552m Flex-10 Adapter
      - HP NC553m 10Gb 2-P FlexFabric Converged Network Adapter
      - HP FlexFabric 10Gb 2-port 554M Adapter
      - HP Flex-10 10Gb 2-port 552M Adapter
      - HP FlexFabric 10Gb 2-port 554FLB Adapter
    - VC SR-IOV supports the following operating systems:
      - Windows 2012 and higher (64-bit)
      - VMware ESXi 5.1 and higher (64-bit)
      - RHEL 5.8 and higher (64-bit with KVM)
      - RHEL 6.2 and higher (64-bit with KVM)
      - SLES 11 SP2 and higher (64-bit with KVM)
- The following HP products are now supported:
  - The HP ProLiant BL460c Gen8 Server Blade
  - The HP FlexFabric 10Gb 2-port 534FLB Adapter
  - The HP FlexFabric 10Gb 2-port 534M Adapter
  - The HP QMH2672 16Gb FC HBA for BladeSystem c-Class

## Please refer to the VC 4.10 Release notes and User Guides for further information

### 4.10 Release Notes

<http://bizsupport2.austin.hp.com/bc/docs/support/SupportManual/c03923055/c03923055-3.pdf>

### 4.10 CLI User Guide

<http://bizsupport2.austin.hp.com/bc/docs/support/SupportManual/c03917551/c03917551-2.pdf>

### 4.10 User Guide

[http://h20628.www2.hp.com/km-ext/kmcstdirect/emr\\_na-c03921656-2.pdf](http://h20628.www2.hp.com/km-ext/kmcstdirect/emr_na-c03921656-2.pdf)

## **Virtual Connect Firmware 4.20 includes the following new features:**

Version 4.20 of Virtual Connect contains support for the following enhancements:

- Enablement of Virtual Connect Flex-20 Technology
- Manageability enhancements:
  - The sFlow feature allows network administrators to monitor and analyze the network traffic flow in the datacenter. The sFlow settings can be modified by users with Network, Domain, or Server user role permissions.
  - FIP snooping information display, which provides FCoE connectivity details for administrators.
  - CLI show config command, with the includepoolinfo option to save a configuration script that includes MACs, WWNs, and virtual serial numbers for your domain. For more information, see the HP Virtual Connect Manager Command Line Interface for c-Class BladeSystem User Guide on the HP website (<http://www.hp.com/go/vc/manuals>).
- The following HP products are now supported:
  - HP Virtual Connect FlexFabric-20/40 F8 Module
  - HP FlexFabric 20Gb 2-port 630FLB/M Adapter
  - HP LPe1605 16Gb FC HBA for BladeSystem c-Class

## **Please refer to the VC 4.20 Release notes for further information**

### **4.20 Release Notes**

<http://bizsupport2.austin.hp.com/bc/docs/support/SupportManual/c04227197/c04227197.pdf>

### **4.20 CLI Guide**

<http://bizsupport2.austin.hp.com/bc/docs/support/SupportManual/c04227190/c04227190.pdf>

### **4.20 User Guide**

[http://h20628.www2.hp.com/km-ext/kmcstdirect/emr\\_na-c04227172-2.pdf](http://h20628.www2.hp.com/km-ext/kmcstdirect/emr_na-c04227172-2.pdf)

## **Virtual Connect Firmware 4.30 includes the following new features:**

Version 4.30 of Virtual Connect contains support for the following enhancements:

- UEFI boot mode support
  - Configure server boot modes
- PXE IP boot order
  - Configure the PXE IP boot order
- FIPS mode 140-2 support
  - For a current status on FIPS certification, see the HP website (<http://government.hp.com/Certifications.aspx>).
- Configure partially stacked domains to isolate specific networks and fabrics (Domain Slicing)
- 40Gb FIP snooping supported with QSFP+
- Monitor, detect, and report pause flood conditions on uplink and stacking link ports.
- Configure SNMPv3 users, security levels, and informs
  - Increase VC domain network management security and administrative frameworks.
- Configure more VLANs:
  - Configure a maximum of 8,192 VLANs per domain.
  - Configure a maximum of 4,094 VLANs per shared uplink set.
- The following HP products are now supported:
  - HP ProLiant BL460c Gen9 Server Blades
  - HP FlexFabric 20Gb 2-port 650M Adapter
  - HP FlexFabric 20Gb 2-port 650FLB Adapter
  - HP FlexFabric 10Gb 2-port 536FLB Adapter

## **Please refer to the VC 4.30 Release notes for further information**

### **4.30 Release Notes**

<http://bizsupport2.austin.hp.com/bc/docs/support/SupportManual/c04389285-2/c04389285-2.pdf>

### **4.30 CLI Guide**

<http://bizsupport2.austin.hp.com/bc/docs/support/SupportManual/c04383986-2/c04383986-2.pdf>

### **4.30 User Guide**

[http://h20628.www2.hp.com/km-ext/kmcstdirect/emr\\_na-c04383983-2.pdf](http://h20628.www2.hp.com/km-ext/kmcstdirect/emr_na-c04383983-2.pdf)

## **Virtual Connect Support Utility (VCSU) Release 1.10.1**

Virtual Connect Support Utility enables administrators to upgrade Virtual Connect Ethernet and Fibre Channel module firmware, and to perform other maintenance tasks remotely using a standalone command line or interactive utility.

When the utility initiates a firmware upgrade process, VCSU performs an automatic health check, and then all modules are updated at the same time. The utility displays a message indicating that an update is in progress and the percentage completed. After the module firmware updates are complete, the utility activates all of the modules. The default module activation order restart modules in a specific order, to reduce or eliminate the need for a complete outage. The utility provides the ability to select the activation mode, to potentially speed the deployment of firmware, in the event of a planned outage. You can use the utility to confirm the health state of the prior to an upgrade.

**Note:** VCSU 1.10.1 (or later) must be used when installing or upgrading a Virtual Connect 4.30.

## **Additional Virtual Connect Reference Material**

*Links to HP Virtual Connect technology site, provides a great deal of reference information on*

### **HP Virtual Connect Flex-10 and FlexFabric home page**

<http://www.hp.com/go/virtualconnect/>

### **HP Virtual Connect Information Library**

<http://www.hp.com/go/virtualconnect/docs>

### **Overview of HP Virtual Connect Technologies**

<http://h20195.www2.hp.com/V2/GetPDF.aspx%2F4AA4-8174ENW.pdf>

### **HP Virtual Connect FlexFabric 20/40 F8**

<http://www8.hp.com/us/en/products/virtual-connects/product-detail.html?oid=6239367#!tab%3Dfeatures>

### **HP Virtual Connect Traffic Flow**

<http://h20000.www2.hp.com/bc/docs/support/SupportManual/c03154250/c03154250.pdf>

### **HP Virtual Connect for c-Class BladeSystem Setup and Installation Guide**

[http://h20628.www2.hp.com/km-ext/kmcstdirect/emr\\_na-c01732252-18.pdf](http://h20628.www2.hp.com/km-ext/kmcstdirect/emr_na-c01732252-18.pdf)

### **Efficiently managing Virtual Connect environments**

[http://h20000.www2.hp.com/bc/docs/support/SupportManual/c03028646/c03028646.pdf](http://h20000。www2.hp.com/bc/docs/support/SupportManual/c03028646/c03028646.pdf)

### **HP Virtual Connect Direct-Attach Fibre Channel for HP 3PAR (FlatSAN) Solution brief**

<http://h20195.www2.hp.com/V2/GetPDF.aspx/4AA4-1557ENW.pdf>

### **HP BladeSystem Network Reference Architecture - FlexFabric and VMware vSphere 5**

<http://h20000.www2.hp.com/bc/docs/support/SupportManual/c03278211/c03278211.pdf>

### **Virtual Connect User, Setup and CLI Guides**

<http://h20000.www2.hp.com/bizsupport/TechSupport/DocumentIndex.jsp?contentType=SupportManual&lang=en&cc=us&docIndexId=64180&taskId=101&prodTypeId=3709945&prodSeriesId=3794423>

### **HP Virtual Connect FlexFabric Solutions Recipe**

<http://vibsdepot.hp.com/hpq/recipes/>

### **Virtual Connect Multi-Enclosure Stacking Reference Guide**

<http://h20000.www2.hp.com/bc/docs/support/SupportManual/c02102153/c02102153.pdf>

### **Virtual Connect for the CISCO Administrator**

<http://h20000.www2.hp.com/bc/docs/support/SupportManual/c01386629/c01386629.pdf>

HP Virtual Connect for c-Class BladeSystem Setup and Installation Guide Version 4.01 and later

<http://bizsupport2.austin.hp.com/bc/docs/support/SupportManual/c03801914/c03801914.pdf>

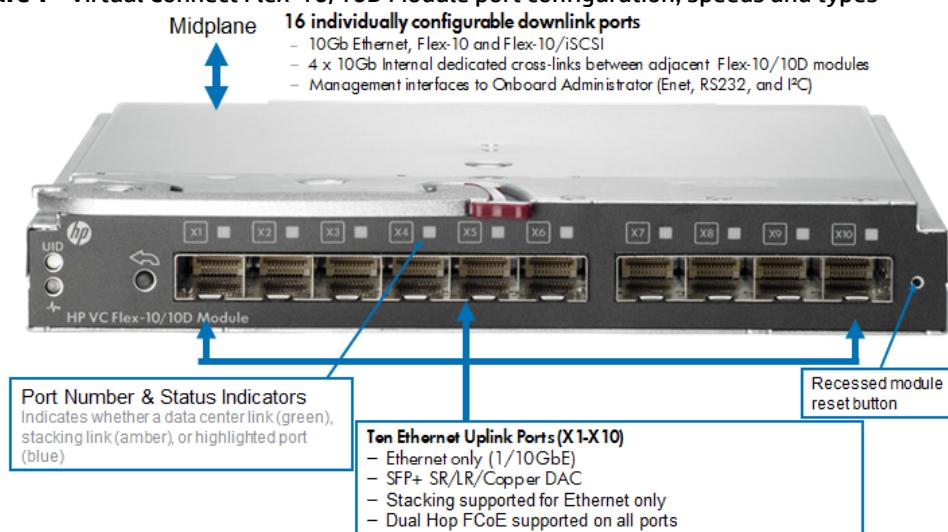
# Virtual Connect Ethernet Modules

## Virtual Connect Flex-10/10D Module Uplink Port Mappings

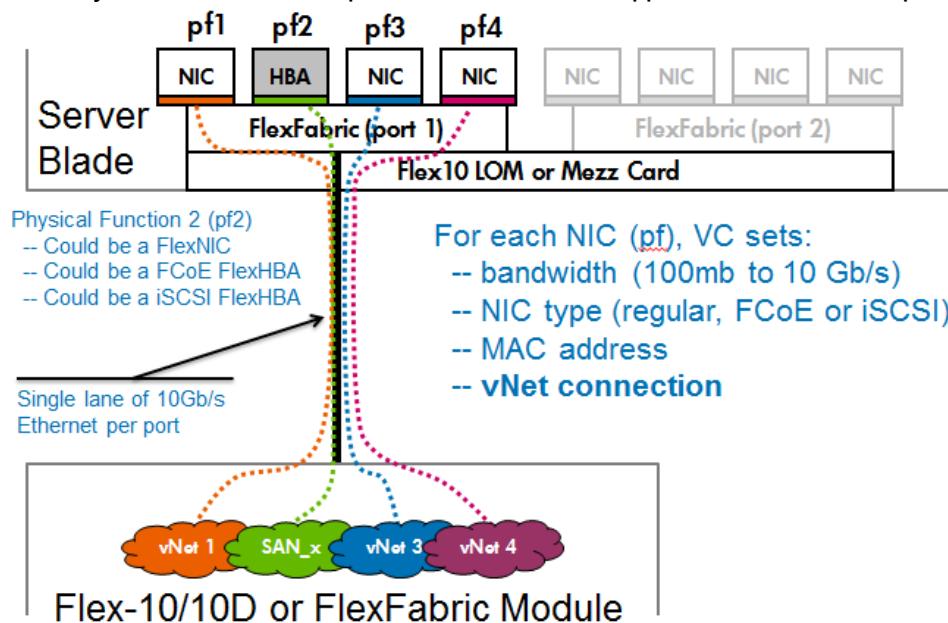
It is important to note how the external uplink ports on the Flex-10 module are configured. The graphic below outlines the type and speed each port can be configured as.

- Ports X1 – X10; Can be configured as 1Gb or 10Gb Ethernet or FCoE (ALL external ports can be used, no sharing of these ports with internal stacking, as with previous modules)
- Ports X11-X14; Internal cross connections for horizontal stacking and are NOT shared with any external connections
- Uplink Ports X1-X10 support 0.5–15m length DAC as stacking or uplink. If greater lengths are required, fibre optic cables would be required

**Figure 1 - Virtual Connect Flex-10/10D Module port configuration, speeds and types**



**Figure 2 - FlexNIC Connections** – It is important to note that Physical Function two (pf2) can be configured as Ethernet, iSCSI (iSCSI and Dual Hop FCoE are supported with Flex-10/10D, G7 and later blades using a supported FlexFabric Adapter). Physical Functions 1, 3 and 4 would be assigned as Ethernet only connections. Dual Hop FCoE connections are supported on all external uplink ports



## Virtual Connect FlexFabric 10Gb/24-Port Module Uplink Port Mappings

It is important to note how the external uplink ports on the FlexFabric 10Gb/24-Port module are configured. The graphic below outlines the type and speed each port can be configured as.

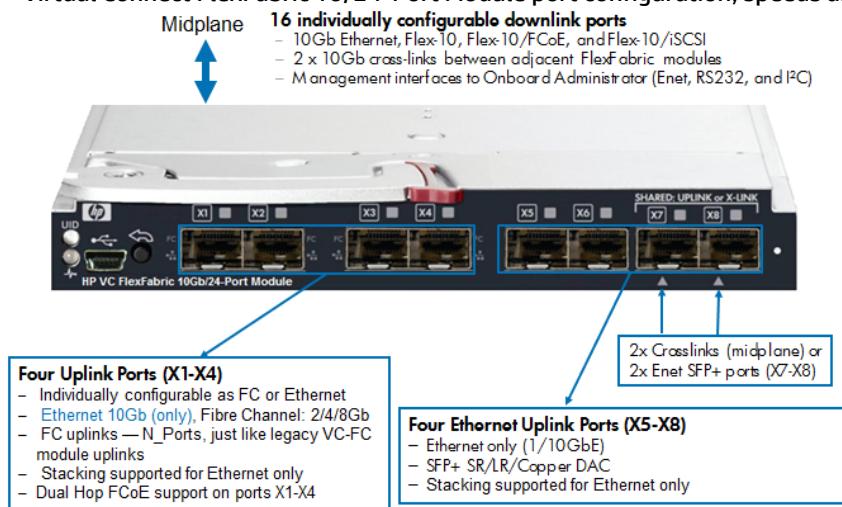
- Ports X1 – X4; Can be configured as 10Gb Ethernet or Fibre Channel, FC speeds supported = 2Gb, 4Gb or 8Gb using 4Gb or 8Gb FC SFP modules, please refer to the FlexFabric Quick Spec for a list of supported SFP modules
- Ports X5 – X8: Can be configured as 1Gb or 10Gb Ethernet
- Ports X7 – X8; Are also shared as internal stacking links and should not be used for external connections, at the very least one horizontal stacking link is required, if modules are in adjacent bays.

**Note:** Within FlexFabric, Stacking only applies to Ethernet traffic, not FCoE or Fibre Channel

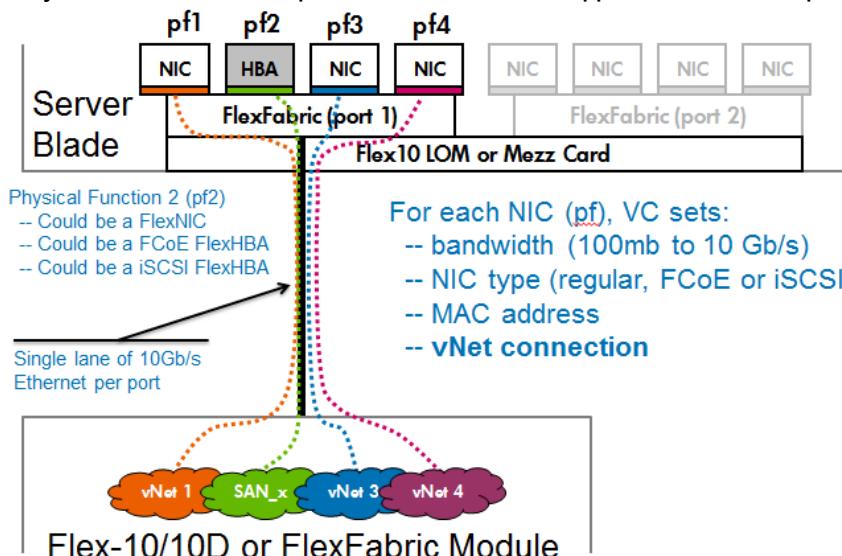
- Uplink ports X1-X4 support 0.5–5m length DAC as stacking or uplink
- Uplink Ports X5-X8 support 0.5–7m length DAC as stacking or uplink

**Note:** 5m DAC cables are supported on all ports with FlexFabric, in addition, 7-15m DAC cables are also supported on ports X5 through X8. Flex-10 supports 15m DAC cables on ALL ports.

**Figure 3 – Virtual Connect FlexFabric 10/24-Port Module port configuration, speeds and types**



**Figure 4 - FlexNIC Connections** – It is important to note that Physical Function two (pf2) can be configured as Ethernet, iSCSI or FCoE (iSCSI and FCoE are supported with VC FlexFabric, G7 and later blades using a supported FlexFabric Adapter). Physical Functions 1, 3 and 4 would be assigned as Ethernet only connections. Dual Hop FCoE connections are supported on external ports X1 through X4

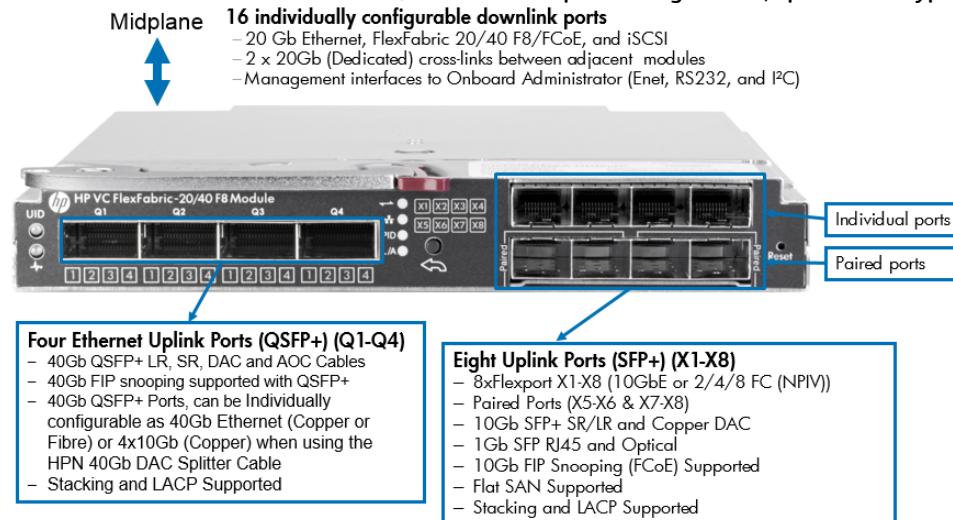


## Virtual Connect FlexFabric-20/40 F8 Module Uplink Port Mappings

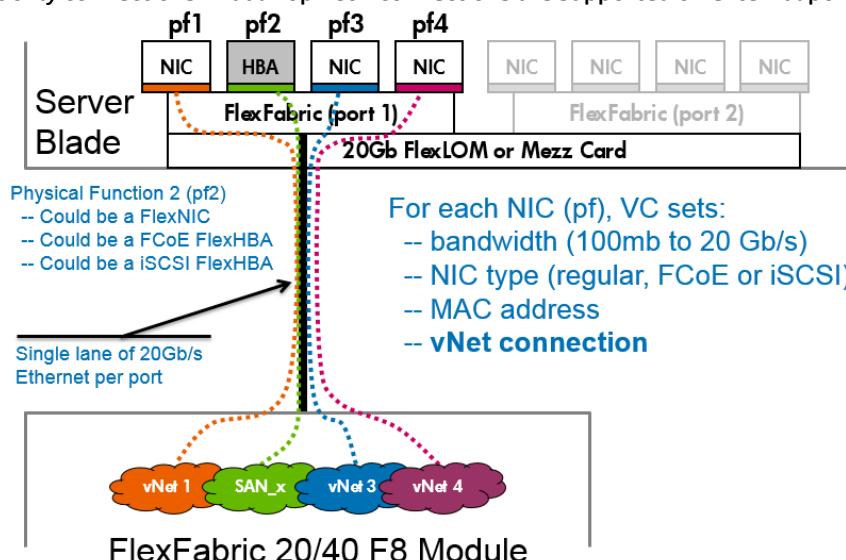
It is important to note how the external uplink ports on the FlexFabric-20/40 F8 module are configured. The graphic below outlines the type and speed each port can be configured as.

- Ports X1 – X4; Can be configured as 10Gb Ethernet, or Fibre Channel
- Ports X5 – X6: Are paired and can be configured as 10Gb Ethernet or Fibre Channel
- Ports X7 – X8; are paired and can be configured as 10Gb Ethernet or Fibre Channel
- Ports Q1 – Q4: QSFP+ 40Gb Ethernet and can be configured as 40Gb Ethernet or a 4x10Gb Ethernet per port when using the HPN DAC Splitter cable
- 2x 20Gb (Dedicated) Internal Ports are configured for Cross Connect

**Figure 5 – Virtual Connect FlexFabric-20/40 F8 Module port configuration, speeds and types**



**Figure 6 - FlexNIC Connections** – It is important to note that Physical Function two (pf2) can be configured as Ethernet, iSCSI or FCoE (iSCSI and FCoE are supported with VC FlexFabric, G7 and later blades using a supported FlexFabric Adapter). Physical Functions 1, 3 and 4 would be assigned as Ethernet only connections. Dual Hop FCoE connections are supported on external ports X1 through X8

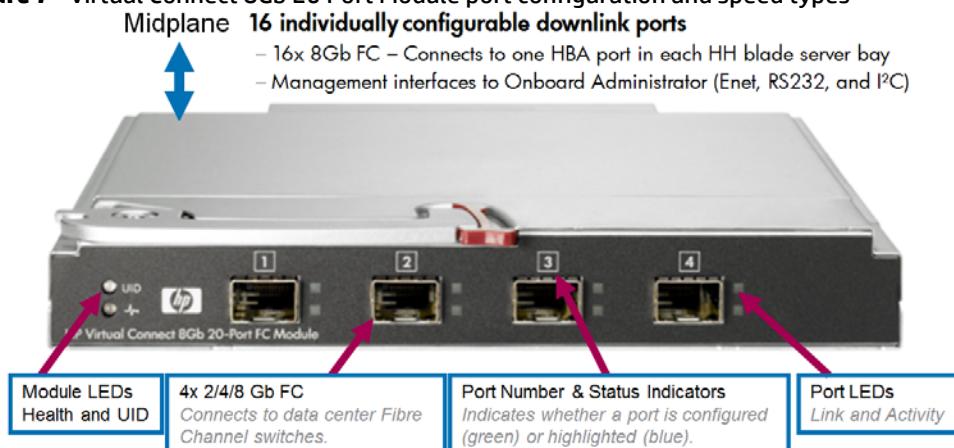


## Virtual Connect 8Gb 20-Port Fibre Channel Module Uplink Port Mappings

It is important to note how the external uplink ports on the VC-FC module are configured. The graphic below outlines the type and speed each port can be configured as.

- Ports 1 - 4; Can be operate at Fibre Channel speeds of 2Gb, 4Gb or 8Gb using 4Gb or 8Gb FC SFP modules
- The VC 8Gb 20 Port module ships with NO SFP modules, Please refer to the VC 8Gb 20 Port module Quick Spec for a list of supported SFP modules

**Figure 7 - Virtual Connect 8Gb 20 Port Module port configuration and speed types**

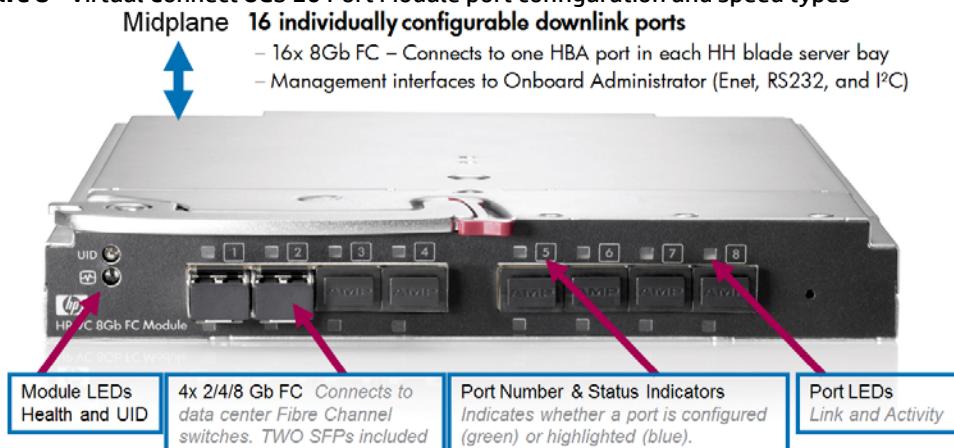


## Virtual Connect 8Gb 24-Port Fibre Channel Module Uplink Port Mappings

It is important to note how the external uplink ports on the VC-FC module are configured. The graphic below outlines the type and speed each port can be configured as.

- Ports 1 - 8; Can be operate at Fibre Channel speeds of 2Gb, 4Gb or 8Gb using 4Gb or 8Gb FC SFP modules
- The VC 8Gb 24 Port module ships with TWO 8Gb FC SFP modules installed, please refer to the VC 8Gb 24 Port module Quick Spec for a list of supported SFP modules

**Figure 8 - Virtual Connect 8Gb 20 Port Module port configuration and speed types**



## Connecting to Brocade 8Gb Fibre Channel Fabric at 8Gb (with FabricOS 6.x.x)

When VC 8Gb 20-port FC or VC FlexFabric 10Gb/24-port module Fibre Channel uplink ports are configured to operate at 8Gb speed and connecting to HP B-series (Brocade) Fibre Channel SAN switches, the minimum supported version of the Brocade Fabric OS (FOS) is v6.3.1 and v6.4.x. In addition, a fill word on those switch ports must be configured with option “Mode 3” to prevent connectivity issues at 8Gb speed.

**Note:** This setting only affects 8Gb Brocade SAN Switches with devices logged in at 8G (not required on 16GB SAN Switches).

On Brocade FC switches, use the command;

- portCfgFillWord (portCfgFillWord <Port#> <Mode>) to configure this setting:

Mode	Link Init/Fill Word
Mode 0	IDLE/IDLE
Mode 1	ARBF/ARBF
Mode 2	IDLE/ARBF
Mode 3	If ARBF/ARBF fails use IDLE/ARBF

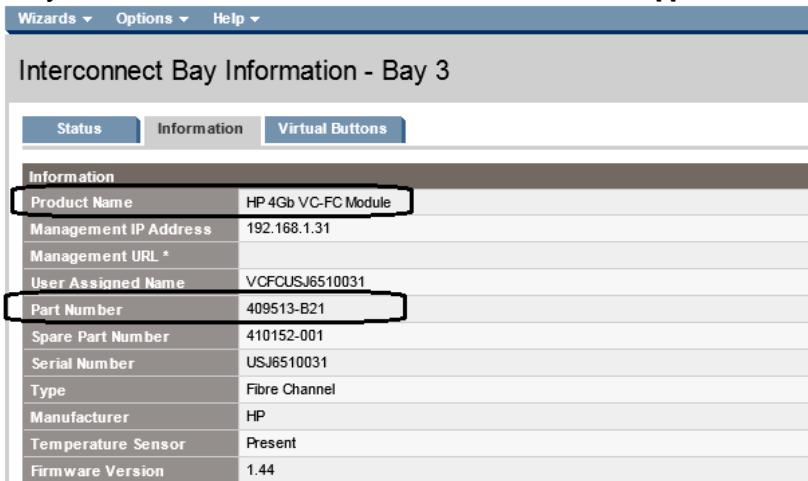
Changing the mode is disruptive regardless of the speed the port is operating at. The setting is retained and applied any time an 8G device logs in. Upgrades to FOS v6.3.1 or v6.4 from prior releases supporting only modes 0 and 1 will not change the existing setting, but a switch or port reset to factory defaults with FOS v6.3.1 or v6.4 will be configured to Mode 0 by default. The default setting on new units may vary by vendor. Please use portcfgshow CLI to view the current portcfgfillword status for that port.

Modes 2 and 3 are compliant with FC-FS-3 specifications (standards specify the IDLE/ARBF behavior of Mode 2 which is used by Mode 3 if ARBF/ARBF fails after 3 attempts). For most environments, Brocade recommends using Mode 3, as it provides more flexibility and compatibility with a wide range of devices. In the event that the default setting or Mode 3 does not work with a particular device, contact your switch vendor for further assistance. When connecting to Brocade 8Gb SAN Switches at 8Gb, with FOS v6.3.1 or v6.4.x “portCfgFillWord” must be set to Mode 3 – If ARBF/ARBF fails use IDLE/ARBF.

## Virtual Connect Fibre Channel 4Gb (B21) Module support - Discontinued

There were TWO versions of the 4Gb VC-FC module produced. The first was part #409513-B21 and the second module, which has a more robust chipset, part #409513-B22. Support for the -B21 version of the 20 port 4Gb VC-FC module was dropped from the code base in VC Firmware version 4.10. Therefore, as described in the Virtual Connect release notes since release 4.10, the 20 Port 4Gb VC-FC modules (part #409513-B21) is no longer supported and cannot be upgraded past VC 4.01 (FC firmware version 1.44). If the domain contains these modules, you will not be able to upgrade the domain beyond VC firmware version 4.01. If you still have 4Gb VC-FC modules in your enclosure, you can verify whether they are the B21 or B22 version, by logging in to the OA and navigating to the Interconnect Bay as shown below.

**Figure 9 - Verify 4Gb VC-VF Module version (the module below is unsupported)**



# Virtual Connect Features and Capabilities

## Virtual Connect VLAN Support – Shared Uplink Set

Shared Uplink Sets provide administrators with the ability to distribute VLANs into discrete and defined Ethernet Networks (vNet.) These vNets can then be mapped logically to a Server Profile Network Connection allowing only the required VLANs to be associated with the specific server NIC port. This also allows the flexibility to have various network connections for different physical Operating System instances (i.e. VMware ESX host and physical Windows host.)

## Legacy VLAN Capacity

Legacy VLAN capacity mode allows up to 320 VLANs per Ethernet module, 128 VLANs per Shared Uplink Set and, up to 28 VLANs are allowed per FlexNIC port. Care must be taken not to exceed the limit per physical server port.

The following Shared Uplink Set rules apply to legacy capacity mode:

- 320 VLANs per Virtual Connect Ethernet Module
- 128 VLANs per Shared Uplink Set (single uplink port)
- 28 unique server mapped VLANs per server profile network connection

The above configuration rules apply only to a Shared Uplink set. If support for a larger numbers of VLANs is required, a VLAN Tunnel can be configured to support a large number of VLANs. Please see the Virtual Connect Release Notes for future details.

## Expanded VLAN Capacity – Added in Virtual Connect 3.30 Release

This mode allows up to 1000 VLANs per domain when implementing a Share Uplink Set (SUS). The number of VLANs per shared uplink set is restricted to 1000. In addition, up to 162 VLANs are allowed per physical server port, with no restriction on how those VLANs are distributed among the server connections mapped to the same physical server port. Care must be taken not to exceed the limit per physical server port. For example, if you configure 150 VLAN mappings for a server connection (FlexNIC:a) of a FlexFabric physical server port, then you can only map 12 VLANs to the remaining three server connections (FlexNIC:b, FlexNIC:c, and FlexNIC:d) of the same physical server port. If you exceed the 162 VLAN limit, the physical server port is disabled and the four server connections are marked as Failed. Also, keep in mind that the FCoE SAN or iSCSI connection is also counted as a network mapping. In the event that greater numbers of VLANs are needed a vNet Tunnel can be used simultaneously with VLAN mapping.

The following Shared Uplink Set rules apply:

- 1000 VLANs per Virtual Connect Ethernet domain,
- 162 VLANs per Ethernet server port
- The above configuration rules apply only to a Shared Uplink set. If support for a greater numbers of VLANs is required, a VLAN Tunnel can be configured to support a large number of VLANs. Please see the Virtual Connect Release Notes for further details.

**Note:** Virtual Connect Release 4.30 adds the ability to configure up to 4096 VLANs per shared uplink set and 8192 networks per domain, however, there is still a limit of 1000 in use VLANs per domain.

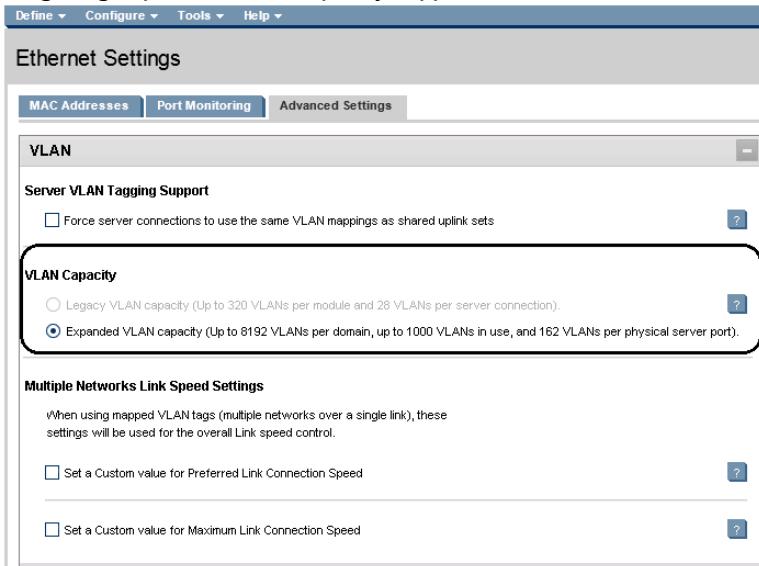
When creating the Virtual Connect Domain, the default configuration in 3.30 is Legacy VLAN Capacity Mode (in Virtual Connect 4.01, the default mode is now Expanded VLAN Capacity).

**Note:** Expanded VLAN Capacity mode is not supported on the following 1Gb based Virtual Connect Ethernet modules, such as:

- HP 1/10Gb VC Ethernet Module
- HP 1/10Gb-F VC Ethernet Module

If these modules are inserted into an enclosure that is in Expanded VLAN Capacity mode, they are marked as incompatible. If these modules are installed in an enclosure, converting to Expanded VLAN Capacity mode will not be permitted.

**Figure 10 - Configuring Expanded VLAN Capacity support**



## 4096 VLAN Support

Virtual Connect 4.30 now provides the ability to define up to 4096 VLANs then consume only the VLANs you need, when you need them. There is nothing to change or enable to take advantage of the 4096 VLAN feature, however; we are still limited to a total of 1000 active VLAN per domain, as shown in the following graphics, and 162 configured VLANs per FlexNIC.

**Figure 11 -** The Networks page provides the ability to quickly determine how many VLANs are implemented and in use. A VLAN is considered to be in use, once it is assigned to a server FlexNIC. Any VLANs that are later unassigned, will be returned to the pool

Status	Ethernet Networks	In-Use	Type	PO	Shared Uplink Set (VLAN ID)	Overall Port Status (count)	Connector Type (count)	Action
Green	Tunnel-1	Yes	ENET	0	0	(2)	SFP-DAC (2)	Edit
Green	Tunnel-2	Yes	ENET	0	0	(2)	SFP-DAC (2)	Edit
Green	VLAN-101-1	Yes	ENET	0	VLAN-Trunk-1 (101)	(1)	SFP-DAC (1)	Edit
Green	VLAN-101-2	Yes	ENET	0	VLAN-Trunk-1 (101)	(1)	SFP-DAC (1)	Edit
Green	VLAN-102-1	Yes	ENET	0	VLAN-Trunk-1 (102)	(1)	SFP-DAC (1)	Edit
Green	VLAN-403-2	No	ENET	0	VLAN-Trunk-2 (403)	(1)	SFP-DAC (1)	Edit

In-Use Networks		Total Networks	
6 / 1000	3802 / 8192	0	0
Networks	OK STATUS	DISABLED STATUS	UNKNOWN/BAD STATUS
3802	3802	0	0
Ports	OK STATUS	DISABLED STATUS	UNKNOWN/BAD STATUS
6	0	0	0

As an effect of only activating networks once they have been assigned to a server profile, you will notice a slight change in behavior when you are creating networks (within a Shared Uplink Set, a Simple vNet or a tunnel). In previous releases of Virtual Connect, once a network was defined, with uplinks assigned, those uplinks would become active, however; with Virtual Connect 4.30, we leave the uplinks in Standby until one of the networks connected to the uplink is assigned to a server profile. The following video details this change, as do examples provided within each scenario.

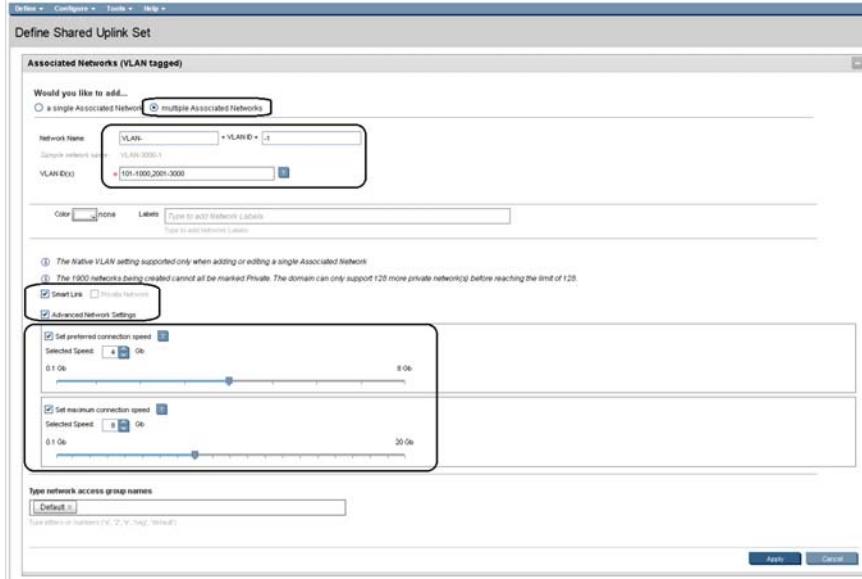
### Virtual Connect v4.30 Link State Implementation

<http://h20621.www2.hp.com/video-gallery/us/en/products/blades/EMV4A011/r/video/>

## Bulk VLAN Creation

In addition to providing support for a greater number of VLANs, Virtual Connect now provides the ability to create several VLANs, within a Shared Uplink Set (SUS), in a single operation. Using the Bulk VLAN creation feature in the GUI or the add network-range command in the CLI many VLANs can be added to a SUS. In addition, copying an existing SUS is also now possible. When creating an Active/Active SUS configuration, you can create the first SUS, and then copy it.

**Figure 12 - Example of adding multiple VLANs to a SUS through the GUI**



## Bulk VLAN Creation (CLI)

Here is an example of creating a shared Uplink Set using the CLI command “add network-range” to create more than 1000 VLANs shown above.

```
add uplinkset VLAN-Trunk-1
add uplinkport enc0:1:X5 Uplinkset=VLAN-Trunk-1 speed=auto
add uplinkport enc0:1:X6 Uplinkset=VLAN-Trunk-1 speed=auto
add network-range -quiet UplinkSet=VLAN-Trunk-1 NamePrefix=VLAN- NameSuffix=-1
VLANIds=101-1000,2001-3000 State=enabled PrefSpeedType=auto SmartLink=enabled
```

## Copying a Shared Uplink Sets

Virtual Connect provides the ability to copy a Shared Uplink Set. This can be very handy when defining an Active/Active Shared Uplink Set design. You simply create the first SUS, and then copy it.

For example, after creating Shared Uplink Set VLAN-Trunk-1 you can copy it to VLAN-Trunk-2, assign uplinks to the new SUS and ensure all networks have SmartLink enabled. This can be accomplished as follows;

```
copy uplinkset VLAN-Trunk-1 VLAN-Trunk-2 fromVlanStr=1 toVlanStr=2 replace=last
add uplinkport enc0:2:X5 Uplinkset=VLAN-Trunk-2 speed=auto
add uplinkport enc0:2:X6 Uplinkset=VLAN-Trunk-2 speed=auto
set network-range -quiet UplinkSet=VLAN-Trunk-2 VLANIds=101-1000,2001-3000
SmartLink=enabled
```

## vNets and Tunnels

There are two types of vNets. The first is a simple vNet that will pass only untagged frames. The second is a vNet tunnel which will pass tagged frames for one or many VLANs.

## vNet

The vNet is a simple network connection between one or many server NICs to one or many uplink ports.

A vNet could be used to connect a single VLAN, without tagging, to one or many server NICs. If this network is configured as a VLAN, by configuring the upstream switch port as an access or untagged port, by extension, any server connected to this vNet would reside in that VLAN, but would not need to be configured to interpret the VLAN tags.

### Benefits of a vNet

A vNet is a simple, untagged network, that can be used to quickly connect a server, or set of servers to an untagged network within your infrastructure. No VLANs are required to utilize a vNet.

### vNet Tunnel

A tunneled vNet will pass VLAN tagged frames, without the need to interpret or forward those frames based on the VLAN tag. Within a tunneled vNet the VLAN tag is completely ignored by Virtual Connect and the frame is forwarded to the appropriate connection (server NIC[s] or uplinks) depending on frame direction flow. In this case, the end server would need to be configured to interpret the VLAN tags. This could be a server with a local operating system, in which the network stack would need to be configured to understand which VLAN the server was in, or a virtualization host with a vSwitch supporting multiple VLANs.

The tunneled vNet can support up to 4096 VLANs.

### Benefits of a vNet Tunnel

A vNet Tunnel can present one or many VLANs to a server NIC. When additional VLANs are added to the upstream switch port, they are made available to the server NIC with no changes required within Virtual Connect. All presented VLANs are passed through the tunnel, unchanged.

### Shared Uplink Set (SUS)

The SUS provides the ability to support VLAN tagging and forward frames based on the VLAN tags of those frames. The SUS connects one or many server NICs to one or many uplink ports. A SUS would be configured for the specific VLANs it will support. If support for additional VLANs is required, those VLANs need to be configured within the SUS.

When connecting a server NIC to a network within a SUS, there are two choices provided. The key difference between these two options is the state in which the frame is passed to the server NIC. When configuring a server NIC for network connection;

1. Selecting a single network – which would be mapped to a specific VLAN.  
If a single network is selected, the frames will be presented to the server NIC WITHOUT a VLAN tag. In this case the host operating system does not need to understand which VLAN it resides in. When the server transmits frames back to Virtual Connect, those frames will not be tagged, however; Virtual Connect will add the VLAN tag and forward the frame onto the correct VLAN.
2. Selecting multiple networks – which would provide connectivity to several VLANs.  
The “Multiple Networks” connection feature provides the ability to use a Shared Uplink Set to present multiple networks to a single NIC. If you select Multiple Networks when assigning a Network to a server NIC, you will have the ability to configure multiple Networks (VLANs) on that server NIC. At this point Virtual Connect tags ALL the packets presented to the NIC — unless the Native check box is selected for one of the networks, in which case packets from this network (VLAN) will be untagged, and any untagged packets leaving the server will be placed on this Network (VLAN).

You can create a Shared Uplink Set that contains ALL the VLANs you want to present to your servers, then present only ONE network (the one associated with the VLAN you want the server NIC on) to the Windows, LINUX or the ESX Console NIC, then select Multiple Networks for the NIC connected to the ESX vSwitch and select ALL the networks that we want presented to the ESX host vSwitch. The vSwitch will then break out the VLANs into port groups and present them to the guests. Using Mapped VLAN Tags minimizes the number of uplinks required.

## Benefits of a SUS

The Shared Uplink Set (SUS) is the most popular Virtual Configuration as it provides the most flexibility to connect a server profile to either or both tagged and untagged network connections, which simplifies the overall configuration and minimizes the number of uplink cables required to support the network connections.

## MAC Cache Failover

When a Virtual Connect Ethernet uplink that was previously in standby mode becomes active, it can take several minutes for external Ethernet switches to recognize that the c-Class server blades can now be reached on this newly-active connection. Enabling Fast MAC Cache Failover causes Virtual Connect to transmit Ethernet packets on newly-active links, which enables the external Ethernet switches to identify the new connection more quickly (and update their MAC caches appropriately). This transmission sequence repeats a few times at the MAC refresh interval (5 seconds recommended) and completes in about 1 minute.

When implementing Virtual Connect in an Active/Standby configuration, where some of the links connected to a Virtual Connect Network (whether a SUS or vNet) are in standby, MAC Cache Fail-over would be employed to notify the switch as a link transitions from Standby to Active within Virtual Connect.

**Note:** Be sure to set switches to allow MAC addresses to move from one port to another without waiting for an expiration period or causing a lock out.

## Virtual Connect QoS

QoS is used to provide different priorities for designated networking traffic flows and guarantee a certain level of performance through resource reservation. QoS is important for reasons such as:

- Providing Service Level Agreements for network traffic and to optimize network utilization
- Different traffic types such as management, back up, and voice having different requirements for throughput, jitter, delays and packet loss
- IP-TV, VOIP and expansion of internet is creating additional traffic and latency requirements
- In some cases, capacity cannot be increased. Even when possible, increasing capacity may still encounter issues if traffic needs to be re-routed due to a failure

Traffic must be categorized and then classified. Once classified, traffic is given priorities and scheduled for transmission. For end to end QoS, all hops along the way must be configured with similar QoS policies of classification and traffic management. Virtual Connect manages and guarantees its own QoS settings as one of the hops within the networking infrastructure.

See Appendix F: for additional information on QoS.

## Network Access Groups (NAG)

With Virtual Connect 3.30 and later, network access groups are defined by the network administrator and associated with a set of networks that can be shared by a single server. Each server profile is associated with one network access group. A network cannot be assigned to the server profile unless the profile is a member of the network access group associated with that network. A network access group can contain multiple networks. A network can reside in more than one network access group, such as a management or VMotion VLAN.

Up to 128 network access groups are supported in the domain. Ethernet networks and server profiles that are not assigned to a specific network access group are added to the domain Default network access group automatically. The Default network access group is predefined by VCM and cannot be removed or renamed.

If you are updating to Virtual Connect 3.30, all current networks are added to the Default network access group and all server profiles are set to use the Default network access group. Network communication within the network access group behaves similarly to earlier versions of Virtual Connect firmware, because all profiles can reach all networks.

If you create a new network access group, NetGroup1, and copy or move existing networks from the Default network access group to NetGroup1, then a profile that uses NetGroup1 cannot use networks included in the Default network access group. Similarly, if you create a new network and assign it to NetGroup1 but not to the Default network access group, then a profile that uses the Default network access group cannot use the new network. Therefore, an administrator cannot inadvertently, or intentionally, place a server on networks that reside in different Network Access Groups.

## **Virtual Connect LACP Timers**

Virtual Connect provides two options for configuring uplink redundancy (Auto and Failover). When the connection mode is set to "Auto", Virtual Connect uses Link Aggregation Control Protocol to aggregate uplink ports from a Network or Shared Uplink Set into Link Aggregation Groups. As part of the LACP negotiation to form a LAG, the remote switch sends a request for the frequency of the control packets (LACPDU). This frequency can be "short" or "long." Short is every 1 second with a 3 second timeout. Long is every 30 seconds with a 90 second timeout.

Prior to Virtual Connect 4.01 this setting defaulted to short. Starting with Virtual Connect 4.01 this setting can be set to short or long. The domain-wide setting can be changed on the Ethernet Settings (Advanced Settings) screen. Additionally, each Network or Shared Uplink Set also has a LACP timer setting. There are three possible values: Domain-Default, Short, or Long. The domain default option sets the LACP timer to the domain-wide default value that is specified on the Advanced Ethernet Settings screen.

This setting specifies the domain-wide default LACP timer. VCM uses this value to set the duration of the LACP timeout and to request the rate at which LACP control packets are to be received on LACP-supported interfaces. Changes to the domain-wide setting are immediately applied to all existing networks and shared uplink sets.

Using the "long" setting can help prevent loss of LAGs while performing in-service upgrades on upstream switch firmware.

## **Multiple Networks Link Speed Settings (Min/Max Bandwidth Control)**

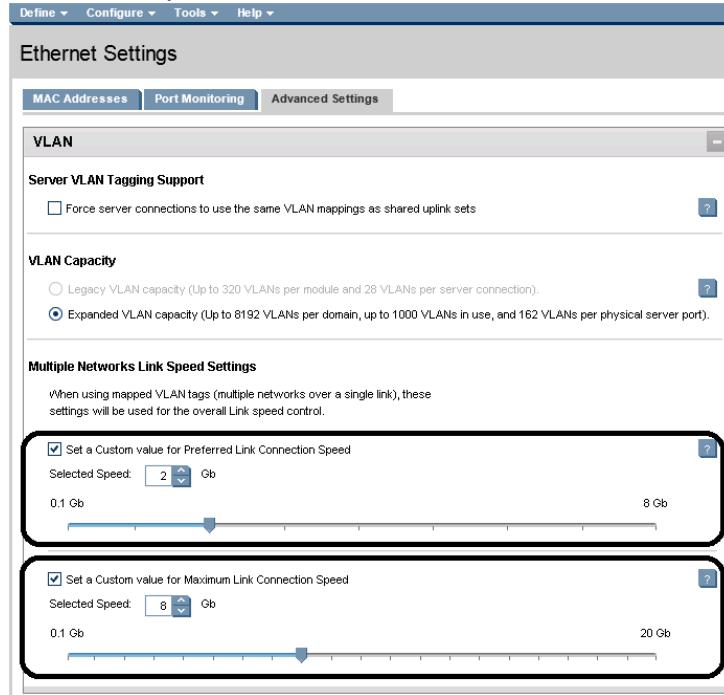
A new feature to Virtual Connect 4.01 provides the ability to configure a minimum and maximum preferred NIC link speed for server downlinks. This setting can be configured as a global default for NICs configured with multiple networks, but can also be fine-tuned at the individual NIC level. The default global Preferred Speed is set to 20Gb. The "Maximum Link Connection Speed" setting can be configured to enable a NIC to transmit at a speed greater than its configured speed. The default Maximum speed is set to 20Gb. If these settings remain as default, each NIC, although configured for a set speed (minimum guaranteed speed), will be able to transmit at a rate as high as 20Gb when using FlexFabric-20/40 F8 and the new 20Gb NIC. Servers with 10Gb NICs installed will be limited to 10Gb speeds. This feature is also known as "Min/Max".

## **Configuring Multiple Networks Link Speed Settings (Min/Max)**

Configure the global default setting for Preferred Link Speed to 2Gb and the Maximum Speed to 8Gb. This global setting applies to connections configured for Multiple Networks only.

- On the Virtual Connect Manager screen, Left pane, click Ethernet Settings, Advanced Settings
- Select Set a Custom value for Preferred Link Connection Speed
  - Set for 2Gb
- Select Set a Custom value for Maximum Link Connection Speed
  - Set for 8Gb
- Select Apply

**Figure 13 - Set Custom Link Speeds**



The following command can be copied and pasted into an SSH based CLI session with Virtual Connect;

```
# Set Preferred and Maximum Connection Speeds  
set enet-vlan PrefSpeedType=Custom PrefSpeed=2000  
set enet-vlan MaxSpeedType=Custom MaxSpeed=8000
```

## Configuring Throughput Statistics

Telemetry support for network devices caters to seamless operations and interoperability by providing visibility into what is happening on the network at any given time. It offers extensive and useful detection capabilities which can be coupled with upstream systems for analysis and trending of observed activity.

The Throughput Statistics configuration determines how often the Throughput Statistics are collected and the supported time frame for sample collection before overwriting existing samples. When the time frame for sample collection is reached, the oldest sample is removed to allocate room for the new sample. Configuration changes can be made without having to enable Throughput Statistics. Applying configuration changes when Throughput statistics is enabled clears all existing samples.

Some conditions can clear existing Throughput Statistics:

- Disabling the collection of Throughput Statistics clears all existing samples.
- Changing the sampling rate clears all existing samples.
- Power cycling a Virtual connect Ethernet module clears all Throughput Statistics samples for that module.

Collected samples are available for analysis on the Throughput Statistics screen, accessible by selecting Throughput Statistics from the Tools pull-down menu.

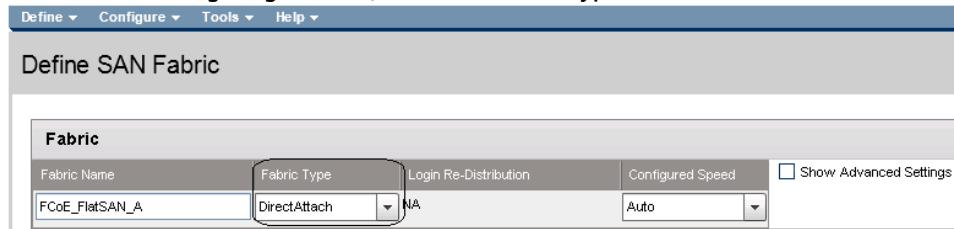
The following table describes the available actions for changing Throughput Statistics settings.

Task	Action
Enable/disable	Select (enable) or clear (disable) the Enable Throughput Statistics checkbox
Change sampling rate	Select a sampling rate from the Configuration list. Supported sampling rates include: <ul style="list-style-type: none"> <li>• Sample rate of 1 minute, collecting up to 5 hours of samples.</li> <li>• Sample rate of 2 minutes, collecting up to 10 hours of samples.</li> <li>• Sample rate of 3 minutes, collecting up to 15 hours of samples.</li> <li>• Sample rate of 4 minutes, collecting up to 20 hours of samples.</li> <li>• Sample rate of 5 minutes, collecting up to 25 hours of samples.</li> <li>• Sample rate of 1 hour, collecting up to 12.5 days of samples.</li> </ul>

## Virtual Connect DirectAttach Virtual Connect SAN fabrics (FlatSAN with 3PAR)

Virtual Connect Direct Attached SAN fabrics, provides the ability to directly connect HP FlexFabric 10/24-Port or FlexFabric-20/40 F8 modules to an HP 3PAR storage array and completely eliminate the need for a traditional SAN fabric and the administrative overhead associated with maintaining the fabric. FlatSAN is supported on FlexFabric modules through Ports X1-X4, simply connect the FlexFabric 10/24-Port modules to available ports on the 3PAR array and configure the Virtual Connect fabrics for "DirectAttach".

**Figure 14 - When configuring FlatSAN, chose the Fabric Type of "DirectAttach"**

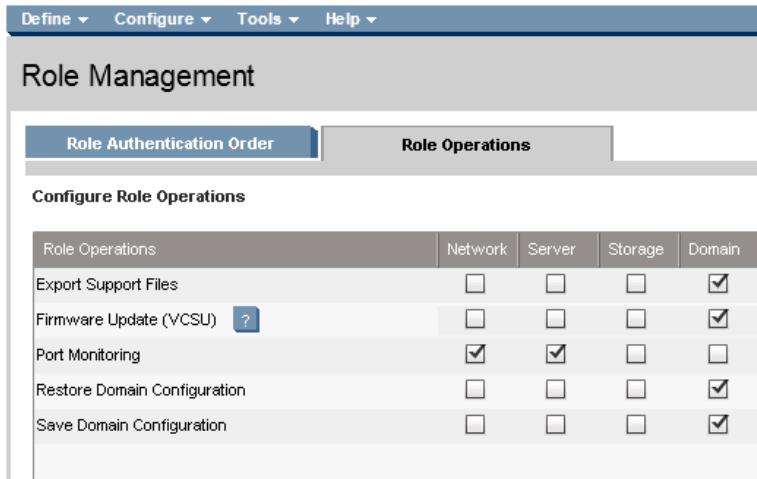


**Note:** See Scenario 6 in the FC Cookbook for HP Virtual Connect for details on implementation of FlatSAN.  
<http://bizsupport1.austin.hp.com/bc/docs/support/SupportManual/c01702940/c01702940.pdf>

## Role Management

Added to Virtual Connect 4.01 is the ability to provide a more granular control of each of the operational user roles provided.

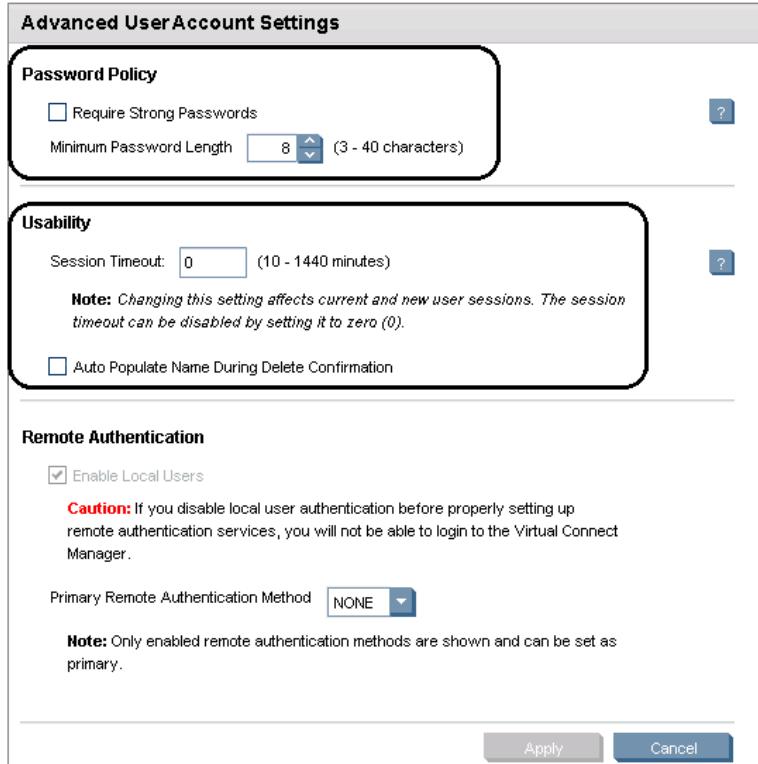
**Figure 15 – Role Operations provides the ability to set the level of access a specific operational role is provided**



## Enhancements to Advanced User Account Settings

In Virtual Connect version 4.10 a default login time-out was implemented and set to 15 minutes for both the GUI and CLI. As this feature applies to both the GUI and CLI and can be disabled by configuring to "0" for no time-out. You can also enable a strong password policy and set password length.

**Figure 16 - Advanced User Account Settings - Login Time-out**



## Partially Stacked Domain

Virtual Connect Release 4.30 now provides the ability to "Partially Stack" the Virtual Connect modules within an enclosure. Those Users that are familiar with previous releases of Virtual Connect that had multiple pairs of Ethernet or FlexFabric modules within a single enclosure, understood that ALL modules needed to be inter-connected (stacked). Within the horizontal bays, connectivity was provided through the enclosure mid-plane, however, vertical connectivity needed to occur externally. This was a requirement for a properly connected and managed Virtual Connect domain, however; for users that require an air gap separation between module slices or Horizontal Bays, this had not been supported and resulted in a "Stacking Link" error within the VC Domain.

Virtual Connect Release 4.30 provides three stacking modes and are configurable as described below;

- Full Stacking is the default stacking mode for the VC domain. In Full Stacking, all Ethernet modules within the domain are connected by horizontal cross connects or by external stacking cables.
- Horizontal Stacking disables all vertical stacking links. In horizontal stacking mode, each horizontal bay pair is a separate logical interconnect. For example, if bay 1 and bay 2 are populated, they form a Logical Interconnect and if Bays 3 and 4 had Ethernet modules installed, they would form an additional Logical Interconnect, which would provide "AIR GAP" between the two "slices"
- Primary Slice Stacking disables all stacking links outside of the primary slice. The primary slice is the primary and standby interconnect modules for the enclosure. In primary slice stacking, the primary slice is a logical interconnect.

Additional information on Domain Stacking is provided in the Virtual connect 4.30 User Guide.

# VMware ESXi 5.5

VMware ESX 5.5 is fully supported with BladeSystem and Virtual Connect. However, it is important to ensure that the proper Network Adapter and HBA drivers and firmware are properly installed. As of this writing, the following drivers and firmware should be used. However; please refer to the latest release of the “VMware FW and Software Recipe” guide located at <http://vibsdepot.hp.com/> for current recommendations.

Emulex 55x and 650 FlexFabric Adapter driver and Firmware recommendations:

Emulex NC55x FlexFabric Adapter Firmware	10.2.340.19
VMware ESXi Ethernet Driver for Emulex (be2net - ESXi 5.0/5.1) (elxnet - ESXi 5.5)	ESXi 5.0 - /5.1 - 10.2.293.0-10EM.500 ESXi 5.1 - 10.2.293.0-10EM.510 ESXi 5.5 - 10.2.298.5
VMware ESXi iSCSI Driver for Emulex (lpfc820 - ESXi 5.0/5.1) (lpfc - ESXi 5.5)	ESXi 5.0/5.1/5.5 - 10.2.250.0
VMware ESXi Fibre Channel Driver for Emulex (lpfc820 - ESXi 5.0/5.1) (lpfc - ESXi 5.5)	ESXi 5.0/5.1 - 10.2.292.0 ESXi 5.5 - 10.2.298.12

Broadcom 534 and 630 FlexFabric Adapter driver and Firmware recommendations:

Broadcom/QLogic FlexFabric Adapter Firmware	7.10.37
VMware ESXi Ethernet Driver for Broadcom/QLogic - bnx2x	ESXi 5.0/5.1 - 2.710.39.v50.2 ESXi 5.5 - 2.710.39.v55.2
VMware ESXi iSCSI Driver for Broadcom/QLogic - bnx2x	ESXi 5.0/5.1 - 2.710.30.v50.2 ESXi 5.5 - 2.710.30.v55.2
VMware ESX/ESXi Fibre Channel Driver for Broadcom/QLogic - bnx2fc	ESXi 5.0/5.1 - 1.710.35.v50.1 ESXi 5.5 - 1.710.35.v55.1

**Note:** As noted in the “September 2014 VMware FW and Software Recipe”

<http://vibsdepot.hp.com/hpq/recipes/September2014VMwareRecipe16.0.pdf>

**Note:** For the most up to date recipe document please visit “vibsdepot” at <http://vibsdepot.hp.com>

## Emulex Adapter NC553/554

Figure 17 - Example of the Emulex 554 FlexFabric Adapter BIOS at version as 4.2.401.2155



**Figure 18 – Example of the Emulex be2net driver and firmware level as displayed in vCenter, under the Hardware Status tab**

The screenshot shows the vCenter interface for a host named 'esx-1.vanlab.net' running VMware ESXi 5.5.0. The 'Hardware Status' tab is selected. The 'System summary' section indicates the BIOS manufacturer is HP, BIOS version is 131, and the model is ProLiant BL460c Gen8, with serial number VCX0000V00, tag 23.0, and asset tag unknown. There are no alerts or warnings. The 'Sensors' view is selected, showing a tree of hardware components and their status. Under 'Software Components', several 'be2net device firmware' entries are listed, all showing version 4.2.401.2215. One entry, 'be2net driver', is highlighted with a red box and shows version 4.2.327.0.

Sensor	Status	Details
Processor	Normal	
Memory	Normal	
PCI	Normal	
Fan	Normal	
Voltage	Normal	
Temperature	Normal	
Network	Normal	
Battery	Normal	
Storage	Normal	
Software Components		
Alt Boot Bank: VMware ESXi 5.1.0 build-1065491	Normal	
BMC Firmware (node 0) 46:10000	Normal	
Smart Array Controller HPSA1	Normal	
System BIOS	Normal	
VMware ESXi 5.1.0 build-1117900	Normal	
ata-pata-amd	Normal	
ata-pata-atixp	Normal	
ata-pata-cmd64x	Normal	
ata-pata-hpt32n	Normal	
ata-pata-pdc2027x	Normal	
ata-pata-serverworks	Normal	
ata-pata-sil680	Normal	
ata-pata-via	Normal	
be2net device firmware	Version: be2net device firmware 4.2.401.2215	
be2net device firmware	Version: be2net device firmware 4.2.401.2215	
be2net device firmware	Version: be2net device firmware 4.2.401.2215	
be2net device firmware	Version: be2net device firmware 4.2.401.2215	
be2net device firmware	Version: be2net device firmware 4.2.401.2215	
be2net device firmware	Version: be2net device firmware 4.2.401.2215	
be2net driver	Version: be2net driver 4.2.327.0	
be2net driver	Version: be2net driver 4.2.327.0	
be2net driver	Version: be2net driver 4.2.327.0	
be2net driver	Version: be2net driver 4.2.327.0	
be2net driver	Version: be2net driver 4.2.327.0	
be2net driver	Version: be2net driver 4.2.327.0	

## Broadcom Adapters (534 and 630)

The Broadcom adapters (534 and 650) provide an FCoE capability, however, it presents a little differently than the Emulex discussed above. These adapters use a Broadcom BCM578x0S-Based chipset. When installed with VMware 5.x, you will need to enable the FCoE capabilities of the adapter if you plan to connect to a Fibre Channel based SAN.

**Figure 19 - After installing ESXi 5.5, no installed FC adapters appeared to be enabled.**

The screenshot shows the vCenter interface for a host named 'esx-1.vanlab.net' running VMware ESXi 5.5.0. The 'Hardware' tab is selected. The 'Storage Adapters' section lists a single entry: 'Smart Array P220i' with device 'vhba0' and type 'Block SCSI'. The 'Add...', 'Remove', 'Refresh', and 'Rescan All...' buttons are visible at the top right of the table.

Device	Type	WWN
vhba0	Block SCSI	

**Note:** Make sure that the Virtual Connect Profile for this server has FCoE connections defined.

**Note:** VMware KB 2034702 provides additional details on how to enable the FCoE function of this adapter. <http://kb.vmware.com/kb/2034702>

Follow the steps and screen shots below to enable the Broadcom 534FLB/m (and 630FLB/m) FCoE adapters within ESXi 5.x. In order to use the cli method described below, you will need to enable SSH within the ESXi host. You should also be able to enable the FCoE adapters within the vCenter console, however, I found this option to be greyed out.

**Figure 20** - SSH to the ESXi host and determine which vmnics provide FCoE, on a half-height blade it should be vmnic2 and vmnic3

```
esx-1.vanlab.net - PuTTY
~ #
~ #
~ # esxcli fcoe nic list
vmnic2
    User Priority: 3
    Source MAC: 00:17:a4:77:7c:16
    Active: true
    Priority Settable: false
    Source MAC Settable: false
    VLAN Range Settable: false

vmnic3
    User Priority: 3
    Source MAC: 00:17:a4:77:7c:17
    Active: true
    Priority Settable: false
    Source MAC Settable: false
    VLAN Range Settable: false
~ #
```

**Figure 21** - Discover the fcoe vmnics as shown below

```
esx-1.vanlab.net - PuTTY
~ #
~ #
~ # esxcli fcoe nic discover -n vmnic2
Discovery enabled on device 'vmnic2'
~ # esxcli fcoe nic discover -n vmnic3
Discovery enabled on device 'vmnic3'
~ #
```

**Figure 22** - Once discovered, the FCoE NICs should now appear in the Storage Adapters screen – Example 10Gb 534 FlexFabric Adapter

Device	Type	WWN
NetXtreme II BCM57810 10 Gigabit Ethernet	Fibre Channel o...	50:06:0b:00:00:c2:de:05 50:06:0b:00:00:c2:de:04
NetXtreme II BCM57840 10/20 Gigabit Ethernet	Fibre Channel o...	50:06:0b:00:00:c2:de:07 50:06:0b:00:00:c2:de:06
Smart Array P220i	Block SCSI	
vmhba0		

**Figure 23** - Once discovered, the FCoE NICs should now appear in the Storage Adapters screen – Example 20Gb 650 FlexFabric Adapter

Device	Type	WWN
NetXtreme II BCM57840 10/20 Gigabit Ethernet	Fibre Channel o...	50:06:0b:00:00:c2:ae:05 50:06:0b:00:00:c2:ae:04
NetXtreme II BCM57840 10/20 Gigabit Ethernet	Fibre Channel o...	50:06:0b:00:00:c2:ae:07 50:06:0b:00:00:c2:ae:06
Smart Array P220i	Block SCSI	
vmhba0		

**Figure 24 - Presented Storage - 200GB SAN LUN**

Identification	Status	Device	Drive Type	Capacity	Free	Type	Last Update
datastore1	Normal	HP Serial Attached...	Non-SSD	271.75 GB	258.57 GB	VMFS5	8/30/2014 9:30:44 AM
DataStore-1	Normal	HP Fibre Channel...	Non-SSD	199.75 GB	198.80 GB	VMFS5	8/30/2014 9:30:44 AM

If you have previously determined which vmnics provide the FCoE function, as an alternative, you could also use the following VMware cli command to enable the FCoE function on each NIC. You will first need to enable SSH on the ESX host.

**Figure 25 - SSH to the ESX host and execute the esxcfg-fcoe command as shown below**

```
esx-1.vanlab.net - PuTTY
login as: root
Using keyboard-interactive authentication.
Password:
The time and date of this login have been sent to the system logs.

VMware offers supported, powerful system administration tools. Please
see www.vmware.com/go/sysadmintools for details.

The ESXi Shell can be disabled by an administrative user. See the
vSphere Security documentation for more information.
~ # esxcfg-fcoe -d vmnic2
~ # esxcfg-fcoe -d vmnic3
~ #
```

# Choosing the Correct Virtual Connect Module

When choosing between Flex-10/10D, FlexFabric 10Gb/24-Port Module or the new FlexFabric-20/40 F8 Module, the first question to ask is whether a direct connection to a Fibre Channel (3PAR) SAN fabric will be required, today or in the future. The key difference between Flex-10 and FlexFabric is that FlexFabric modules leverage the built in FlexFabric Adapter provided in the G7, Gen 8 and Gen 9 BladeSystem servers to provide FCoE (Fibre Channel) connectivity. FCoE connectivity is provided through the integrated FlexFabric Adapter and the FlexFabric modules, the FlexFabric modules connect directly to the existing Fibre Channel switch fabrics, or directly to a 3PAR Array, no additional components would be required, such as a traditional FC HBA.

With the release of Virtual connect firmware 4.01, the Flex-10/10D and FlexFabric modules can also be utilized to provide dual hop FCoE connectivity to a switch that supports FCoE connections, in which case the FCoE traffic would traverse the Ethernet uplinks and connect to the SAN through the ToR or Core switch.

Virtual Connect 3.70 provided a new capability when connecting to HP's 3PAR storage arrays using Fibre Channel, allowing the 3PAR array to be directly connected to the FlexFabric modules. This feature is called "FlatSAN" and provides the ability to completely eliminate the need for a fibre channel SAN fabric, further reducing the cost of implementation and management of a blade server environment.

If direct connection to a Fibre Channel SAN fabric is not required, then all the capabilities of the FlexFabric Adapter in the G7, Gen 8 and Gen 9 Blades and Virtual Connect can be obtained through the use of the Flex-10/10D modules, the only feature not available would be direct connection to a fibre channel SAN fabric. Fibre Channel connectivity could be added through the use of traditional Virtual Connect Fibre Channel modules, and FC HBAs. iSCSI support is provided through either FlexFabric or Flex-10/10D modules.

If Flex-10/10D modules are used with Virtual connect Fibre Channel modules, ensure an HBA is installed in the appropriate MEZZ slot in the blade and simply configure a "FC HBA" within the server profile and map it to the appropriate FC SAN Fabrics. In this case, FCoE SAN Fabrics and FCoE FlexFabric Adapters would not be utilized for FC connectivity. An example of this configuration is provided in Scenario 9.

The Scenarios provided in this document could be implemented on either; Flex-10, Flex-10/10D (with or without VC-FC Modules for FC connections) or FlexFabric 10Gb/24-Port Module or the new Virtual Connect FlexFabric-20/40 F8 modules.

**Note:** Dual hop FCoE connectivity is provided through Flex-10/10D, FlexFabric 10Gb/24-Port and FlexFabric-20/40 F8 modules only. The original Flex-10 module does not support dual hop FCoE.

## FlexFabric Adapters

The following adapters are supported with Virtual Connect Flex-10, Flex-10/10D, FlexFabric 10/24-Port and the New FlexFabric 20/40 F8;

Gen 9 Blades – 20Gb FlexFabric FCoE/iSCSI support

- HP FlexFabric 20Gb 2-port 630FLB/M Adapter
- HP FlexFabric 20Gb 2-port 650FLB/M Adapter

Gen 9 Blades – 10Gb FlexFabric FCoE/iSCSI support

- HP FlexFabric 10Gb 2-port 536FLB/M Adapter

Gen 8 Blades – 20Gb FlexFabric FCoE/iSCSI support

- HP FlexFabric 20Gb 2-port 630FLB/M Adapter
- HP FlexFabric 20Gb 2-port 650FLB/M Adapter

Gen 8 Blades – 10Gb FlexFabric FCoE/iSCSI support

- HP FlexFabric 10Gb 2-port 534FLB/M Adapter
- HP FlexFabric 10Gb 2-port 554FLB/M Adapter

Gen 8 Blades – Flex-10 Ethernet only (no Storage function)

- HP Flex-10 10Gb 2-port 530FLB/M Adapter
- HP Flex-10 10Gb 2-port 552M Adapter

Gen 7 and older Blades – FlexFabric FCoE/iSCSI support

- HP NC553i 10Gb FlexFabric adapter
- HP NC553m 10Gb 2-port FlexFabric Adapter

Gen 7 and older Blades – Flex-10 Ethernet Only

- HP NC532m 10Gb Dual Port Flex-10 Ethernet Adapter
- HP NC542m 10Gb Dual Port Flex-10 Ethernet Adapter
- HP NC552m 10Gb Dual Port Flex-10 Ethernet Adapter

The Min/Max bandwidth optimization feature released in Virtual Connect 4.01 excludes support for the following adapters:

- HP NC551i Dual Port FlexFabric 10Gb Converged Network Adapter
- HP NC551m Dual Port FlexFabric 10Gb Converged Network Adapter
- HP NC550m 10Gb 2-port PCIe x8 Flex-10 Ethernet Adapter

## Ethernet Adapters

Ethernet adapters NOT support with Flex-10 or FlexFabric.

(These adapters will work with Flex-10/Flex-20/FlexFabric, however, do not provide the “FlexFabric” functionality and will operate at 1Gb only).

- HP Ethernet 10Gb 2-port 560FLB/M Adapter
- HP Ethernet 10Gb 2-port 570FLB/M Adapter

**Note:** All 1Gb Blade LAN adapters will function with any of the Virtual Connect 10Gb or 20Gb modules, however, may operate at 1Gb.

# Determining Network Traffic Patterns and Virtual Connect network design (Active/Standby vs. Active/Active)

When choosing which Virtual Connect network design to use (Active/Active (A/A) vs. Active/Standby (A/S) uplinks), consider the type of network traffic this enclosure will need to support. For example, will there be much server to server traffic needed within the enclosure, or is the traffic flow mainly in/out bound of the enclosure.

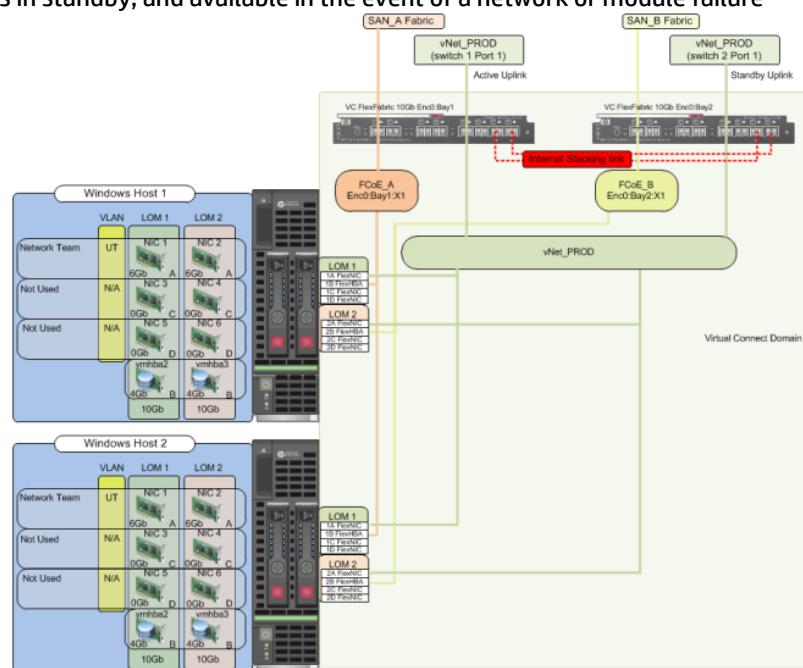
Network traffic patterns, North/South (N/S) vs. East/West (E/W), should be considered when designing a Virtual Connect solution as network connectivity can be implemented in a way to maximize the connected bandwidth and/or minimize the need for server to server traffic to leave the enclosure when communicating on the same VLAN with other servers within the same enclosure.

For example; if the solution being implemented will have a high level of in/out or North/South traffic flow, an A/A network design would likely be the better solution as it would enable all connected uplinks. However, if a greater level of network traffic is between systems within the same enclosure/VLAN, such as a multi-tiered application, then a better design may be A/S, as this would minimize or eliminate any server to server communications from leaving the enclosure to only return on a different uplink/path.

Determining whether network connectivity is A/A vs. A/S is not a domain configuration issue or concern. Networks are independent of one another and both A/A and A/S networks could be implemented in the same Virtual Connect domains. As an example, an iSCSI connection could be configured as A/A to support a high rate of N/S traffic between targets and initiators. Whereas the LAN connectivity for the users and applications could be more E/W where an A/S network design could be implemented.

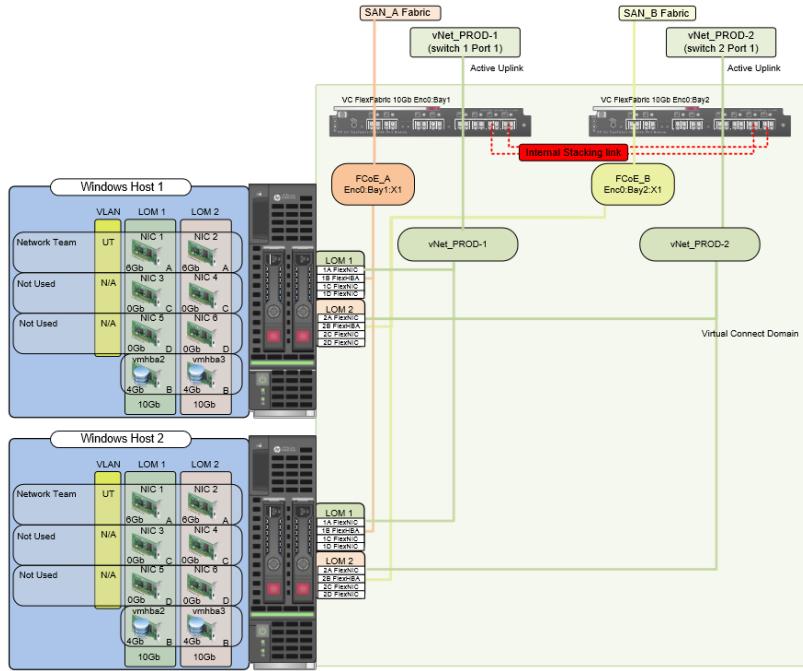
In an active/standby network design, all servers would have both NICs connected to the same Virtual Connect network. All communications between servers within the Virtual Connect Domain would occur through this network, no matter which network adapter is active. In the example below, if Windows Host 1 is active on NIC 1 and Windows Host 2 is active on NIC 2, the communications between servers will cross the internal stacking links. For external communications, all servers in the enclosure will use the Active uplink (currently) connected to Bay 1, no matter which NIC they are active on.

**Figure 26** - This is an example of an Active/Standy network configuration. One uplink is active, while the other is in standby, and available in the event of a network or module failure

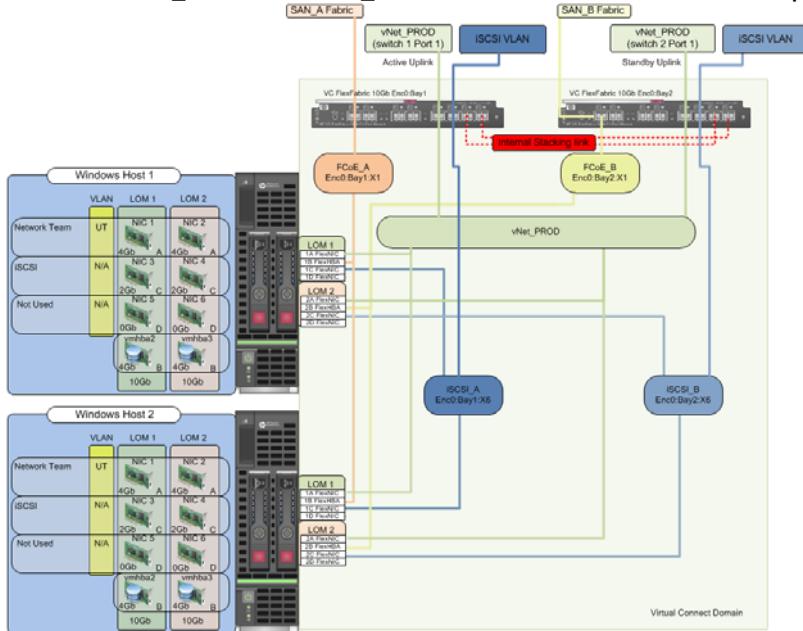


In an A/A network design, all servers would have their NICs connected to opposite Virtual Connect networks. Communications between servers within the Virtual Connect Domain would depend on which NIC each server was active on. In the following example, if Windows Host 1 is active on NIC 1 and Windows Host 2 is active on NIC 2, the communications between servers will NOT cross the internal stacking links and would need to leave the enclosure and re-enter via the opposite module; however, if a higher rate of external communications is required, vs. peer to peer, then an active/active configuration may be preferred as both uplinks would be actively forwarding traffic. Also, if both servers were active on the same NIC, then communications between servers would remain within the module/enclosure.

**Figure 27** - This is an example of an Active/Active network configuration. Both uplinks are actively forwarding traffic.



**Figure 28** - Both A/A (iSCSI\_x) and A/S (vNet\_PROD) networks are used in this example.



**Note:** Alternatively, if Fibre Channel will not be required, the iSCSI networks could be connected as iSCSI hardware accelerated and would be connected to the FlexHBA.

# Connecting Directly Virtual Connect to the CORE

Virtual Connect technology adds a virtualization layer between the edge of the server and the edge of the existing LAN and SAN. As a result, the external networks connect to a shared resource pool of MAC addresses and WWNs rather than to MACs/WWNs of individual servers.

## LAN-Safe

From the external networking view, Virtual Connect, or the Ethernet uplinks between the Virtual Connect module and the first connected switch appear to be multiple NICs on a large server. Virtual Connect ports at the enclosure edge look to the network like server connections. This is analogous to a VMware environment that provides multiple MAC addresses to the network through a single NIC port on a server. Multiple connections from the Virtual Connect module can be used to provide additional, aggregated, bandwidth or higher availability solutions.

Virtual Connect works seamlessly with your external network:

- Does not participate in Spanning Tree Protocol (STP) on the network uplinks to the data center. This avoids potential STP configuration errors that can negatively affect switches in the network and the servers connected to those switches
- Uses internal loop prevention algorithms to automatically detect and prevent loops inside a Virtual Connect domain. Virtual Connect ensures that there is only one active uplink for any single network at one time, unless configured for Link Aggregation (LACP)
- Allows aggregation of uplinks to data center networks (using LACP and fail-over)
- Supports VLAN tagging on egress or pass-thru of VLAN tags in tunneled mode
- Supports Link Layer Discovery Protocol (LLDP) and Jumbo Frames

Virtual Connect was designed to connect to the network as an endpoint device, as such, it is capable of connecting to any network switch, at any layer, including directly to the core switch, providing the ability to significantly flatten the network.

# Single Domain/Enclosure Scenarios

## Overview

This Cookbook will provide several configuration scenarios of Virtual Connect Flex-10/10D, FlexFabric 10/24-Port and FlexFabric-20/40 F8 modules, using an HP BladeSystem c7000 enclosure. Virtual Connect also supports Multi-Enclosure stacking, for up to 4 enclosures, which provides a single point of management and can further reduce cable connectivity requirements. For Virtual connect stacked configurations, see the Virtual Connect Multi-Enclosure Stacking Reference Guide. Each scenario will provide an overview of the configuration, show how to complete that configuration and include both GUI and CLI (scripted) methods. Where possible, examples for Windows and/or VMware vSphere will also be provided.

## Requirements

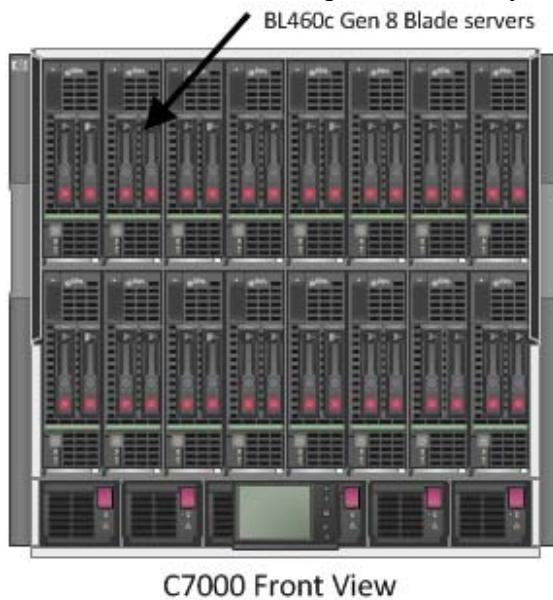
This Cookbook will utilize a single HP BladeSystem c7000 enclosure with TWO Virtual Connect Flex10/10D, FlexFabric 10/24-Port, or FlexFabric-20/40 F8 modules installed in I/O Bays 1 and 2 and a BL460c Gen 8 half height BladeSystem Servers in server Bay 1 or Bay 2. Some of the scenarios will provide Ethernet only connections, in which case Flex-10/10D modules may be used. In the scenarios where Fibre Channel connectivity is required, FlexFabric 10/24-Port modules will be used, with the exception of Scenario 9 which uses Flex-10/10D and Virtual Connect Fibre Channel modules.

The server's integrated FlexFabric Adapter will connect to Bays 1 and 2, with two 10Gb or 20Gb FlexFabric adapter ports. Each FlexFabric Adapter port supports Ethernet and iSCSI or Fibre Channel over Ethernet (FCoE) when connected to FlexFabric modules. Port 1 will connect to the FlexFabric module in Bay 1 and Port 2 will connect to the FlexFabric module in Bay 2.

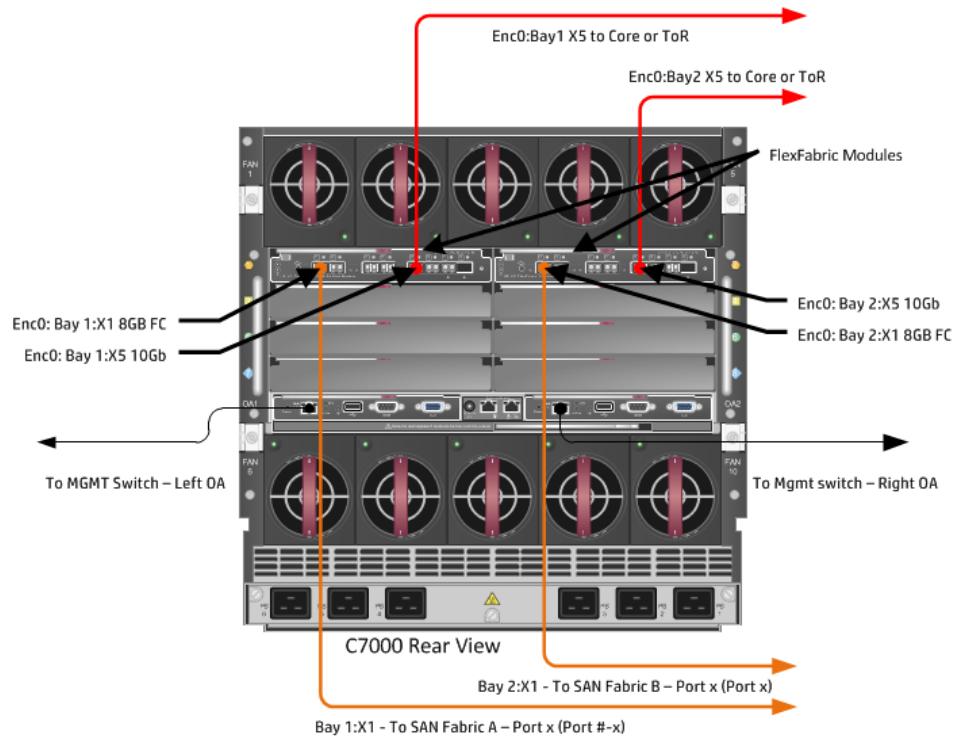
For Ethernet connectivity the Flex-10/10D and FlexFabric 10/24-Port modules are connected to a pair of 10Gb Ethernet switches for standard LAN connectivity. The FlexFabric-20/40 F8 modules are connected to a pair of 40Gb Ethernet switches for standard LAN connectivity. The FlexFabric modules and VC-FC modules are linked to a pair of 8Gb Brocade fibre channel switches for SAN connectivity.

In each scenario, it's assumed that a Virtual Connect Domain has been created either through the GUI or a CLI script and no Virtual Connect Networks, uplink sets or Server Profiles have been created. Virtual Connect scripting examples are provided within each scenario as well as additional examples in Appendices.

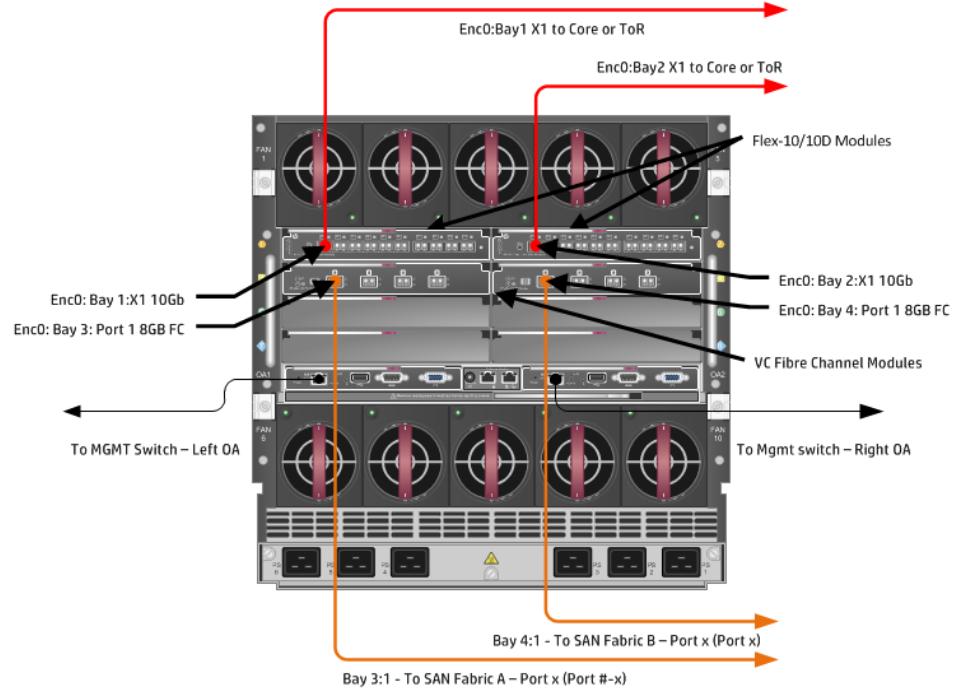
**Figure 29-** c7000 enclosure front view with Half Height Gen 8 BladeSystem servers installed



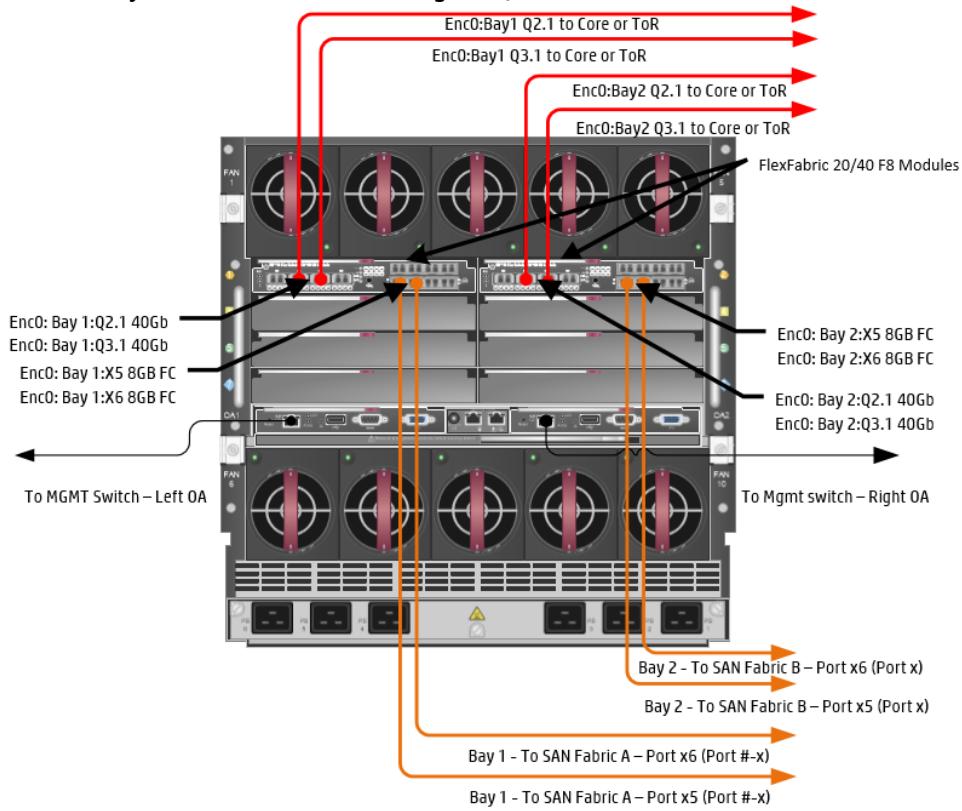
**Figure 30 -**c7000 enclosure rear view with Virtual Connect FlexFabric 10/24-Port Modules installed in Interconnect bays 1 & 2



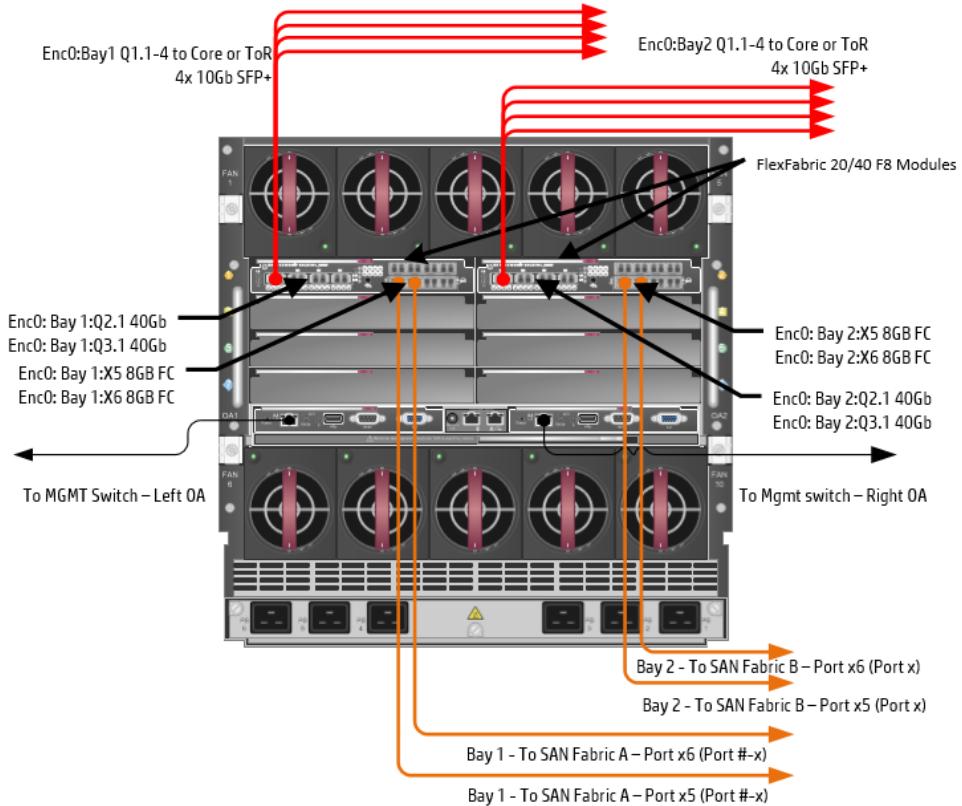
**Figure 31 -**c7000 enclosure rear view with Virtual Connect Flex-10/10D modules in Bays 1 & 2 and Virtual Connect 20 Port 8Gb Fibre Channel Modules installed in Interconnect bays 3 & 4. If Fibre Channel connectivity is not required, the Fibre Channel modules would not be required



**Figure 32 - c7000 enclosure rear view with Virtual Connect FlexFabric-20/40 F8 modules installed in interconnect Bays 1 & 2 and connected using the QSFP+ 40Gb cables**



**Figure 33 - c7000 enclosure rear view with Virtual Connect FlexFabric-20/40 F8 modules installed in interconnect Bays 1 & 2 and connected using the QSFP+ 10Gb Splitter cable**



# Scenario 1 – Simple vNet with Active/Standby Uplinks – Ethernet and FCoE – Windows 2012 R2

## Overview

This simple configuration uses the Virtual Connect vNet along with FCoE for SAN connectivity. When VLAN mapping is not required, the vNet is the simplest way to connect Virtual Connect to a network and server. In this scenario, the upstream network switch connects a network to a single port on each FlexFabric 10/24-Port module. In addition, Fibre Channel uplinks will also be connected to the FlexFabric 10/24-Port modules to connect to the existing Fibre Channel infrastructure.

No special upstream switch configuration is required as the switch is in the factory default configuration, typically configured as an Access or untagged port on either the default VLAN or a specific VLAN. In this scenario, Virtual Connect does not receive VLAN tags.

When configuring Virtual Connect, we can provide several ways to implement network fail-over or redundancy. One option would be to connect TWO uplinks to a single vNet; those two uplinks would connect from different Virtual Connect modules within the enclosure and could then connect to the same or two different upstream switches, depending on your redundancy needs. An alternative would be to configure TWO separate vNets, each with a single or multiple uplinks configured. Each option has its advantages and disadvantages. For example; an Active/Standby configuration places the redundancy at the VC level, where Active/Active places it at the OS NIC teaming or bonding level. We will review the first option in this scenario.

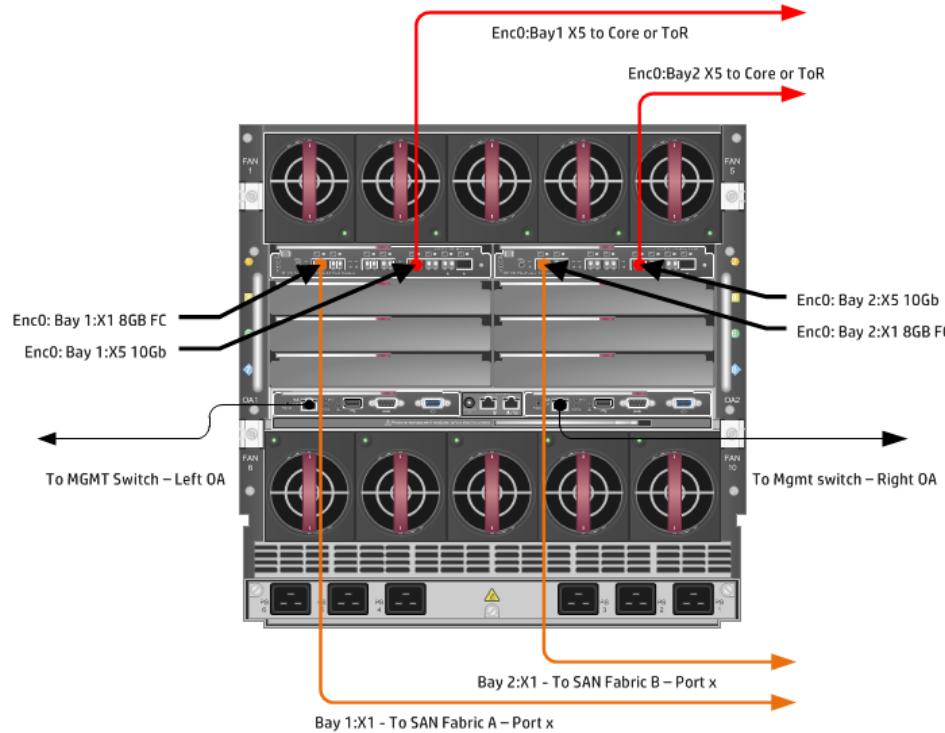
In addition, several vNets can be configured to support the required networks to the servers within the BladeSystem enclosure. These networks could be used to separate the various network traffic types, such as iSCSI, backup and VMotion from production network traffic.

This scenario will also leverage the Fibre Channel over Ethernet (FCoE) capabilities of the FlexFabric modules. Each Fibre channel fabric will have one uplink connected to each of the FlexFabric modules.

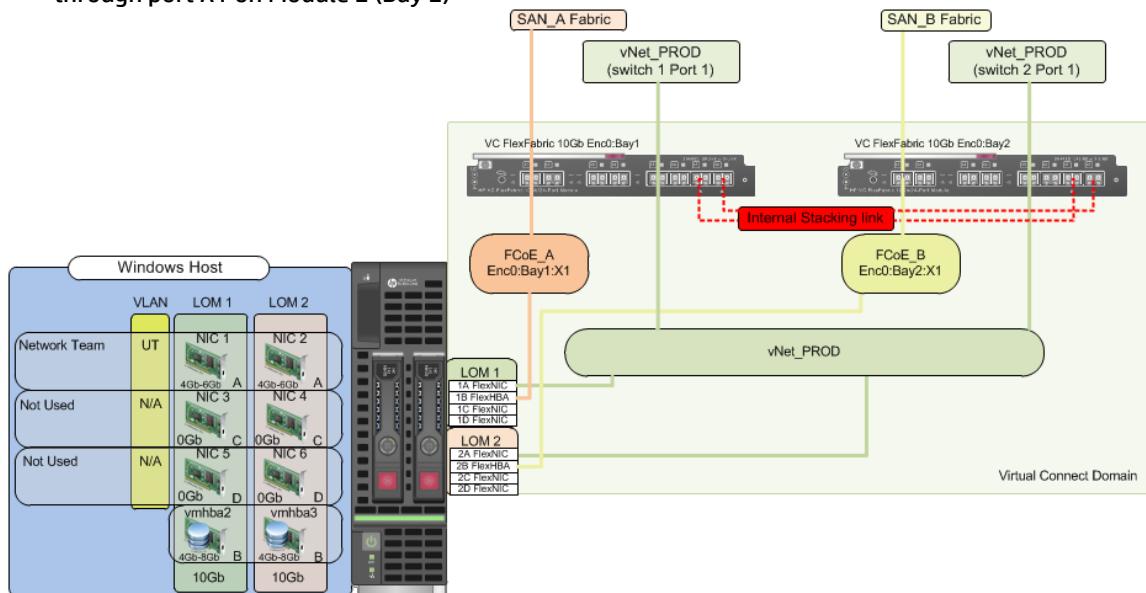
## Requirements

This scenario will support both Ethernet and fibre channel connectivity. In order to implement this scenario, an HP BladeSystem c7000 enclosure with one or more server blades and TWO Virtual Connect FlexFabric 10/24-Port modules, installed in I/O Bays 1 & 2 are required. In addition, we will require ONE or TWO external Network switches. As Virtual Connect does not appear to the network as a switch and is transparent to the network, any standard managed switch will work with Virtual Connect. The Fibre Channel uplinks will connect to the existing FC SAN fabrics. The SAN switch ports will need to be configured to support NPIV logins. One uplink from each FlexFabric module will be connected to the existing SAN fabrics.

**Figure 34 - Physical View;** Shows one Ethernet uplink from Ports X5 on Module 1 and 2 to Port 1 on each network switch. The SAN fabrics are also connected redundantly, with TWO uplinks per fabric, from ports X1 and X2 on module 1 to Fabric A and ports X1 and X2 to Fabric B.



**Figure 35 - Logical View;** Shows a single Ethernet uplink from Port X5 on Module 1 on the first network switch and a single uplink from Port X5 on Module 2 to the second network switch. Both Ethernet uplinks are connected to the same vNet, vNet\_PROD. In addition, SAN Fabric FCoE\_A connects to the existing SAN Fabric A through port X1 on Module 1 (Bay 1) and FCoE\_B connects to the existing SAN Fabric B through port X1 on Module 2 (Bay 2)



# Installation and configuration

## Switch configuration

As the Virtual Connect module acts as an edge switch, Virtual Connect can connect to the network at either the distribution level or directly to the core switch.

The appendices provide a summary of the cli commands required to configure various switches for connection to Virtual Connect. The configuration information provided in the appendices for this scenario assumes the following information:

- The switch ports are configured as ACCESS or untagged ports, either presenting the Default VLAN or a specific VLAN and will be forwarding untagged frames
- As an alternative, if the switch ports were configured as TRUNK ports and forwarding multiple VLANs, Virtual Connect would forward those tagged frames to the host NICs configured for this network, however; the Virtual Connect network would need to be configured for VLAN Tunneling. The connected host would then need to be configured to interpret those VLAN tags.

The network switch port should be configured for Spanning Tree Edge as Virtual Connect appears to the switch as an access device and not another switch. By configuring the port as Spanning Tree Edge, it allows the switch to place the port into a forwarding state much quicker than otherwise, this allows a newly connected port to come online and begin forwarding much quicker.

The SAN switch ports connecting to the FlexFabric 10/24-Port module must be configured to accept NPIV logins.

## Configuring the VC module

- Physically connect Port 1 of network switch 1 to Port X5 of the VC module in Bay 1
- Physically connect Port 1 of network switch 2 to Port X5 of the VC module in Bay 2

**Note:** If you have only one network switch, connect VC port X5 (Bay 2) to an alternate port on the same switch. This will NOT create a network loop and Spanning Tree is not required.

- Physically connect Port X1 on the FlexFabric in module Bay 1 to a switch port in SAN Fabric A
- Physically connect Port X1 on the FlexFabric in module Bay 2 to a switch port in SAN Fabric B

## VC CLI commands

In addition to the GUI many of the configuration settings within VC can also be accomplished via a CLI command set. In order to connect to VC via a CLI, open an SSH connection to the IP address of the active VCM. Once logged in, VC provides a CLI with help menus. The Virtual Connect CLI guide also provides many useful examples. Throughout this scenario the CLI commands to configure VC for each setting are provided.

## Configuring Expanded VLAN Capacity via GUI

Virtual Connect release 3.30 provided an expanded VLAN capacity mode when using Shared Uplink Sets, this mode can be enabled through the Ethernet Settings tab or the VC CLI. The default configuration for a new Domain install is “Expanded VLAN Capacity” mode, Legacy mode is no longer available and the Domain cannot be downgraded.

Virtual Connect 4.30 now provides the ability to define up to 4096 VLANs then consume only the VLANs you need, when you need them. There is nothing to change or enable to take advantage of the 4096 VLAN feature.

## To verify the VLAN Capacity mode

- On the Virtual Connect Manager screen, Left pane, click Ethernet Settings, Advanced Settings
- Select Expanded VLAN capacity
- Verify Expanded VLAN Capacity is configured and Legacy VLAN Capacity is greyed out.

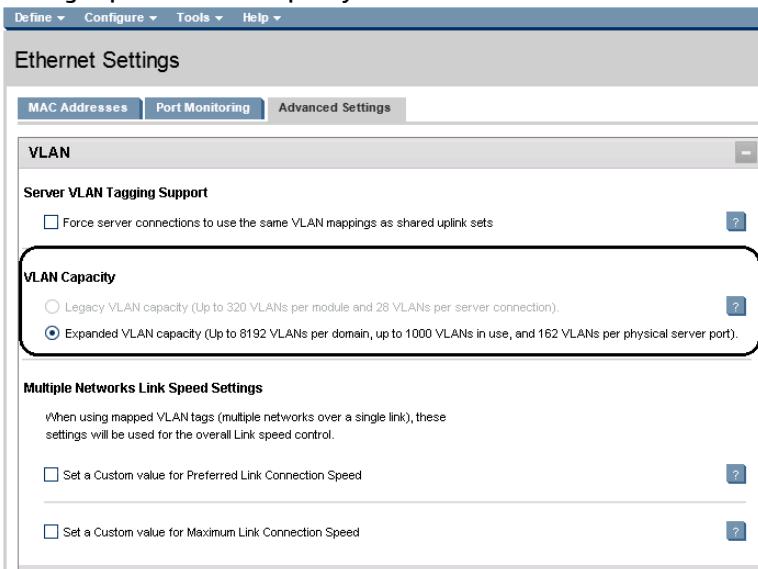
**Note:** Legacy VLAN mode will only be presented if 1Gb Virtual Connect Modules are present, in which case the domain would be limited to Firmware version 3.6x.

## Configuring Expanded VLAN Capacity via CLI

The following command can be copied and pasted into an SSH based CLI session with Virtual Connect;

```
# Set Expanded VLAN Capacity  
set enet-vlan -quiet VlanCapacity=Expanded
```

**Figure 36 - Enabling Expanded VLAN Capacity**



**Note:** If a 1Gb VC Ethernet module is present in the Domain, Expanded VLAN capacity will be greyed out, this is only supported with 10Gb and 20Gb based Virtual Connect modules. Also, once Expanded VLAN capacity is selected, moving back to Legacy VLAN capacity mode will require a domain deletion and rebuild.

## Configuring Fast MAC Cache Failover

When an uplink on a VC Ethernet Module that was previously in standby mode becomes active, it can take several minutes for external Ethernet switches to recognize that the c-Class server blades must now be reached on this newly active connection.

Enabling Fast MAC Cache Failover forces Virtual Connect to transmit Ethernet packets on newly active links, which enables the external Ethernet switches to identify the new connection more quickly (and update their MAC caches appropriately). This transmission sequence repeats a few times at the MAC refresh interval (five seconds is the recommended interval) and completes in about one minute.

## Configuring the VC Module for Fast Mac Cache Fail-over via GUI (Ethernet settings)

Set Fast MAC Cache Fail-over to 5 Seconds

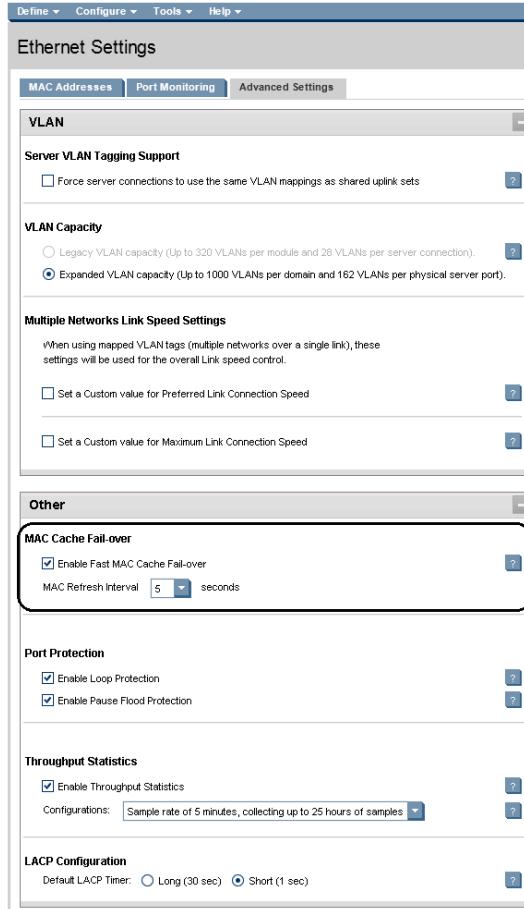
- On the Virtual Connect Manager screen, Left pane, click Ethernet Settings, Advanced Settings
- Click the “Other” tab
- Select Fast MAC Cache Fail-over with a refresh of 5
- Select Apply

## Configuring the VC Module for Fast Mac Cache Fail-over via CLI (Ethernet settings)

The following command can be copied and pasted into an SSH based CLI session with Virtual Connect;

```
# Set Advanced Ethernet Settings to Enable Fast MAC cache fail-over  
set mac-cache Enabled=True Refresh=5
```

**Figure 37 - Set Fast MAC Cache, under Ethernet Settings “Advanced Settings”)**



## Defining a new vNet via GUI

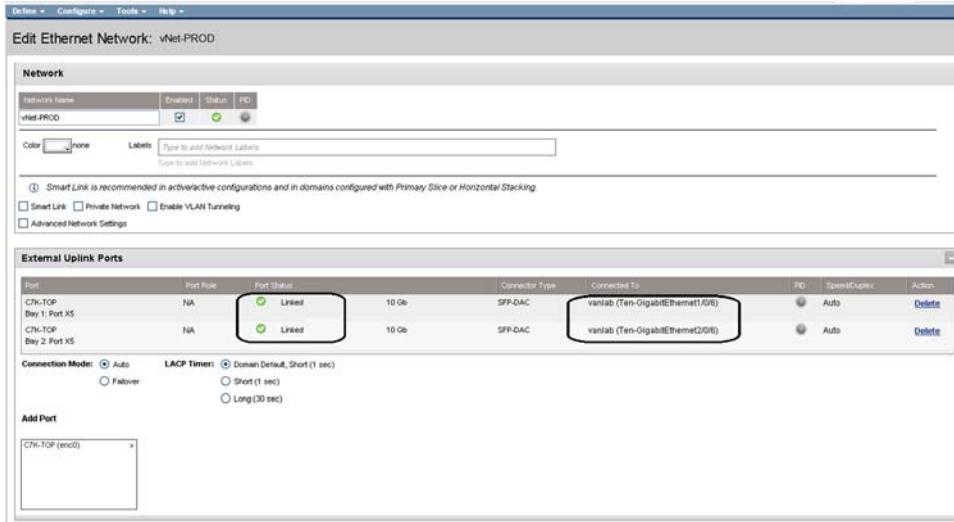
Create a vNet and name it “vNet-PROD”

- Login to Virtual Connect, if a Domain has not been created, create it now, but cancel out of the configuration wizards after the domain has been created.
- On the Virtual Connect Manager screen, click Define, Ethernet Network to create a vNet
- Enter the Network Name of “vNet-PROD”
  - Note; Do NOT select any options (ie; SmartLink, Private Networks or Enable VLAN Tunnel)
- Select Add Port, then add the following ports;
  - Enclosure 1 (enc0), Bay 1, Port X5
  - Enclosure 1 (enc0), Bay 2, Port X5
- Leave Connection Mode as Auto
- Optionally, Select Advanced Network Settings and set the Preferred speed to 4Gb and the Maximum speed to 6Gb.
- Select Apply

**Note:** By connecting TWO Uplinks from this vNet we have provided a redundant path to the network. As each uplink originates from a different VC module, one uplink will be Active and the second will be in Standby. This configuration provides the ability to lose an uplink cable, network switch or depending on how the NICs are configured at the server (teamed or un-teamed), even a VC module. An Active/Standby configuration also provides better East/West connectivity.

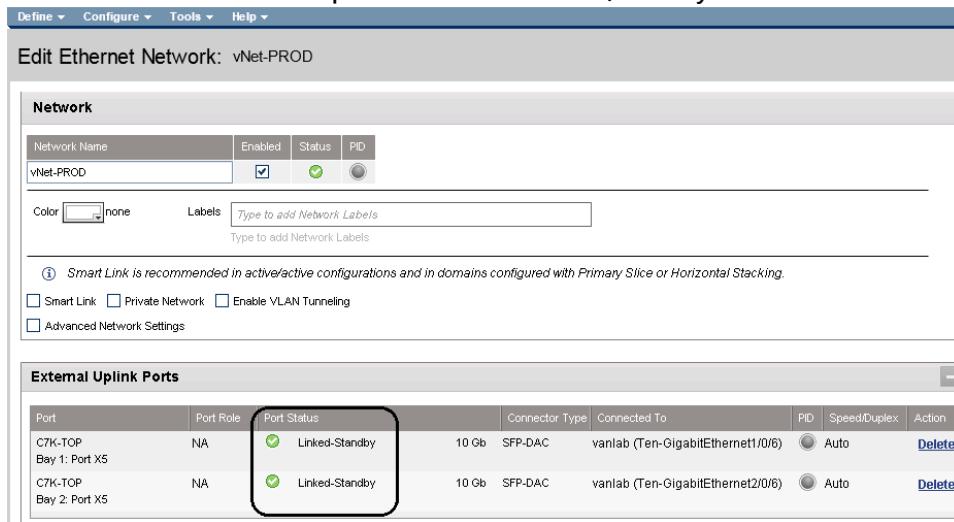
**Note:** SmartLink – In this configuration SmartLink should NOT be enabled. SmartLink is used to turn off downlink ports within Virtual Connect, if ALL available uplinks to a vNet are down. We will use SmartLink in a later scenario.

**Figure 38 - Define Ethernet Network (vNet-PROD)**



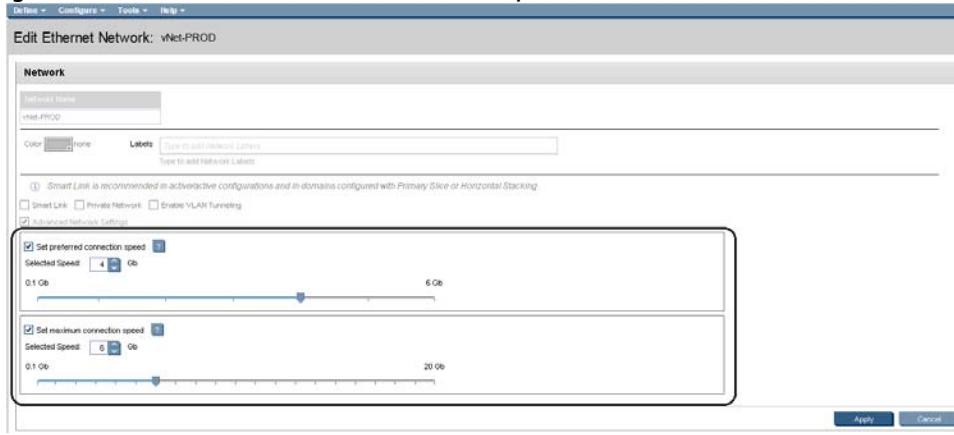
**Note:** The Port Status and Connected to information. If the connected switch has LLDP enabled, the connected to information should be displayed as below.

**Figure 39 - You will see that ALL Uplinks are still in a Linked/Standby state**



**Note:** That both of the network connections are shown as “Linked/Standby”, this state will NOT change until the network has been assigned to a server profile. This behavior is new within VC 4.30 and is provided to accommodate the new 4096 VLAN feature.

**Figure 40** - Configuring the Advanced network setting for Min/Max Network Speed. We will see how this configuration is utilized when we create the server profile



**Note:** That the Maximum speed is shown here as 20Gb, this is to accommodate the new FlexFabric-20/40 F8 modules, 10Gb modules will still be limited to a maximum of 10Gb.

## Defining a new vNet via CLI

The following command(s) can be copied and pasted into an SSH based CLI session with Virtual Connect

```
# Create the vNet "vNet-PROD" and configure uplinks as discussed above
add Network vNet-PROD
add uplinkport enc0:1:X5 Network=vNet-PROD speed=auto
add uplinkport enc0:2:X5 Network=vNet-PROD speed=auto
set network vNet-PROD SmartLink=Disabled
```

**Note:** Optionally, if you wish to utilize the new Min/Max NIC speed setting provided within Virtual Connect, you can set this Network to a “Preferred” Speed and a “Maximum Speed”. This provides the ability to quickly create server profiles, using the NIC speed setting of “Preferred”, then allowing Virtual Connect to configure the NIC speeds for both the minimum speed as well as the maximum speed. Use the setting below to configure the Min. Max. NIC speeds for this network. It is also important to note, that this does NOT affect the network uplink speed, which will remain at 10Gb (or 1Gb if connected to a 1Gb switch port).

```
set network vNet-PROD SmartLink=Disabled PrefSpeedType=Custom PrefSpeed=4000
MaxSpeedType=Custom MaxSpeed=6000
```

## Defining a new (FCoE) SAN Fabric via GUI

Create a Fabric and name it “FCoE\_A”

- On the Virtual Connect Manager screen, click Define, SAN Fabric to create the first Fabric
- Enter the Network Name of “FCoE\_A”
- Select Add Port, then add the following ports;
  - Enclosure 1, Bay 1, Port X1
- Ensure Fabric Type is set to “FabricAttach”
- Select Show Advanced Settings
  - Select Manual Login Re-Distribution (FlexFabric Only)
  - Select Set Preferred FCoE Connect Speed
    - Configure for 4Gb
  - Select Set Maximum FCoE Connect Speed
    - Configure for 8Gb
- Select Apply

Create a second Fabric and name it “FCoE\_B”

- On the Virtual Connect Manager screen, click Define, SAN Fabric to create the second Fabric
- Enter the Network Name of “FCoE\_B”
- Select Add Port, then add the following ports;
  - Enclosure 1, Bay 2, Port X1
- Ensure Fabric Type is set to “FabricAttach”
- Select Show Advanced Settings
  - Select Manual Login Re-Distribution (FlexFabric Only)
  - Select Set Preferred FCoE Connect Speed
    - Configure for 4Gb
  - Select Set Maximum FCoE Connect Speed
    - Configure for 8Gb

Select Apply

## Defining SAN Fabrics via CLI

The following command(s) can be copied and pasted into an SSH based CLI session with Virtual Connect

```
#Create the SAN Fabrics FCoE_A and FCoE_B and configure uplinks as discussed above
add fabric FCoE_A Type=FabricAttach Bay=1 Ports=1 Speed=Auto LinkDist=Manual
PrefSpeedType=Custom PrefSpeed=4000 MaxSpeedType=Custom MaxSpeed=8000
add fabric FCoE_B Type=FabricAttach Bay=2 Ports=1 Speed=Auto LinkDist=Manual
PrefSpeedType=Custom PrefSpeed=4000 MaxSpeedType=Custom MaxSpeed=8000
```

**Figure 41 - SAN Configuration and Advanced Settings**

**Figure 42 - FCoE SAN fabrics configured with two 8Gb uplinks per fabric. Note the bay and port numbers on the right**

## Defining a Server Profile with NIC and FCoE Connections, via GUI

Each server NIC will connect to a specific network.

On the Virtual Connect Manager screen, click Define, Server Profile to create a Server Profile

- Create a server profile called “App-1”
- Select to “Hide Unused FlexNICs”
- In the Network Port 1 drop down box, select “vNet-PROD”
- In the Network Port 2 drop down box, select “vNet-PROD”
- Expand the FCoE Connections box, for Bay 1, select FCoE\_A for Bay 2, select FCoE\_B
- Do not configure FC SAN or iSCSI Connection
- In the Assign the Profile to a Server Bay, select Bay 1 and apply

Prior to applying the profile, ensure that the server in Bay 1 is currently OFF

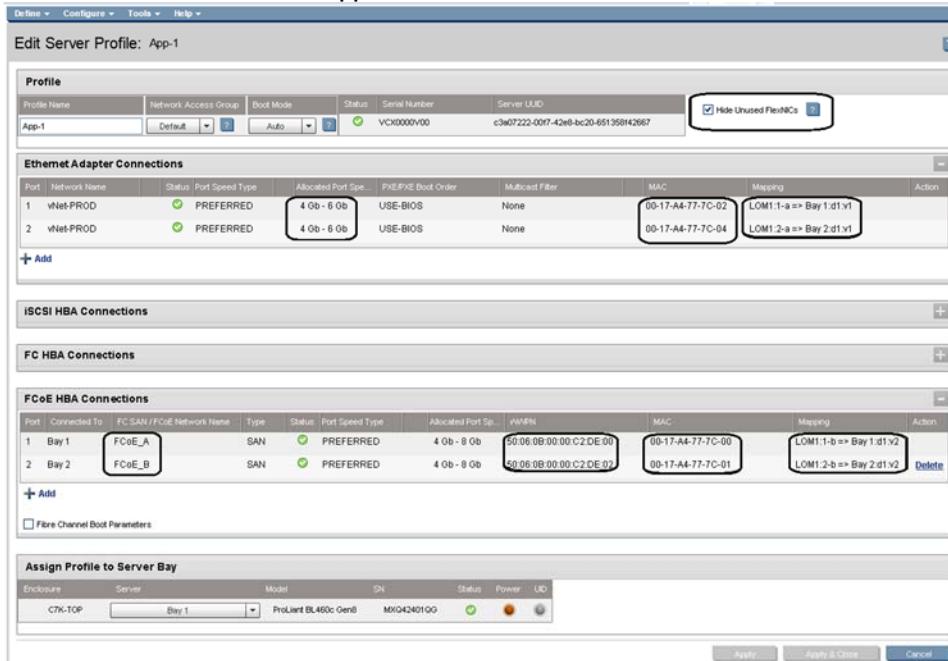
**Note:** You should now have a server profile assigned to Bay 1, with 2 Server NIC connections. NICs 1&2 should be connected to network vNet\_PROD and FCoE SAN fabrics FCoE\_A and FCoE\_B.

## Defining a Server Profile with NIC and FCoE Connections, via CLI

The following command(s) can be copied and pasted into an SSH based CLI session with Virtual Connect

```
# Create and Assign Server Profile App-1 to server bay 1
add profile App-1 -nodefaultfcconn -nodefaultfcoeconn NAG=Default HideUnusedFlexNICs=true
set enet-connection App-1 1 pxe=Enabled Network=vNet-PROD
set enet-connection App-1 2 pxe=Disabled Network=vNet-PROD
add fcoe-connection App-1 Fabric=FCoE_A SpeedType=4Gb
add fcoe-connection App-1 Fabric=FCoE_B SpeedType=4Gb
assign profile App-1 enc0:1
```

**Figure 43 - Define Server Profile (App- 1)**



**Note:** Observe the speed settings for both NIC and SAN connections and the new “Max” parameter, as well as the MAC and WWN addresses. Also, note that the FCoE connections are assigned to the two SAN fabrics created earlier and use ports LOM:1-b and LOM:2-b. Also, note the new feature to “Hide Unused FlexNICs”. In this profile, we will now see only TWO NICs in the server OS.

**Figure 44 - Server Profile View Bay 1**

The screenshot shows the 'Server Profile View Bay 1' interface. At the top, the 'Overall Status' is green. Below it, the 'Assigned Server Profile' is 'App-1'. In the 'Power Status/Control' section, the status is 'Off' and there is a 'Momentary Press' button. The 'Blade Server Information' table includes fields like Serial Number (MXQ42401QG), Product Name (ProLiant BL460c Gen8), and Asset Tag ([Unknown]). The 'Server Ethernet Adapter Information' table lists two ports (Port 1 and Port 2) with multiple LOM adapters each. The MAC addresses for the FCoE ports are highlighted with blue boxes and circled in red.

Ethernet Adapter	Flex NC	Location	Module	Model	MAC Address	Network	WWN	SAN Fabric
Port 1								
LOM1:1- FLB1	Bay 1:d1:v1	HP FlexFabric 10Gb 2-	00-17-A4-77-	vNet-PROD	50:06:08:00:00:C2:DE:00	FCoE_A		
LOM1:1- FLB1	Bay 1:d1:v2	Port 534FLB Adapter	7C-02					
LOM1:1- FLB1	Bay 1:d1:v3	HP FlexFabric 10Gb 2-	00-17-A4-77-	vNet-PROD	50:06:08:00:00:C2:DE:02	FCoE_B		
LOM1:1- FLB1	Bay 1:d1:v4	Port 534FLB Adapter	7C-00					
LOM1:2- FLB1	Bay 2:d1:v1	HP FlexFabric 10Gb 2-	9C-B6-54-87-		50:06:08:00:00:C2:DE:00	FCoE_A		
LOM1:2- FLB1	Bay 2:d1:v2	Port 534FLB Adapter	5F-92					
LOM1:2- FLB1	Bay 2:d1:v3	HP FlexFabric 10Gb 2-	9C-B6-54-87-		50:06:08:00:00:C2:DE:02	FCoE_B		
LOM1:2- FLB1	Bay 2:d1:v4	Port 534FLB Adapter	5F-97					

## Verify Network Link State

As discussed earlier in this document, in Virtual connect 4.30 there was a change to the link state behavior when a network as no connections to a server profile. Once a connection is made to the server profile, the uplinks will become Active, as previously expected.

**Figure 45 - You can now see that after vNet-PROD is assigned to a profile, the link status has changed and, as expected, one of the links is now “Linked/Active”**

The screenshot shows the 'Edit Ethernet Network: vNet-PROD' interface. Under the 'Network' tab, the network name is 'vNet-PROD' with 'Enabled' checked. Under 'External Uplink Ports', two ports are listed: C7K-TOP Bay 1: Port X5 and C7K-TOP Bay 2: Port X5. Both ports have their status set to 'Linked-Active'. The 'Connection Mode' is set to 'Auto'. The 'Add Port' section shows a placeholder for 'C7K-TOP (enc0)'.

Port	Port Role	Port Status	Connector Type	Connected To	POD	Speed/Duplex	Action
C7K-TOP Bay 1: Port X5	NA	Linked-Active	10 Gb	SFP-DAC	vanilab (Ten-GigabitEthernet1/0/6)	Auto	Delete
C7K-TOP Bay 2: Port X5	NA	Linked-Standby	10 Gb	SFP-DAC	vanilab (Ten-GigabitEthernet2/0/6)	Auto	Delete

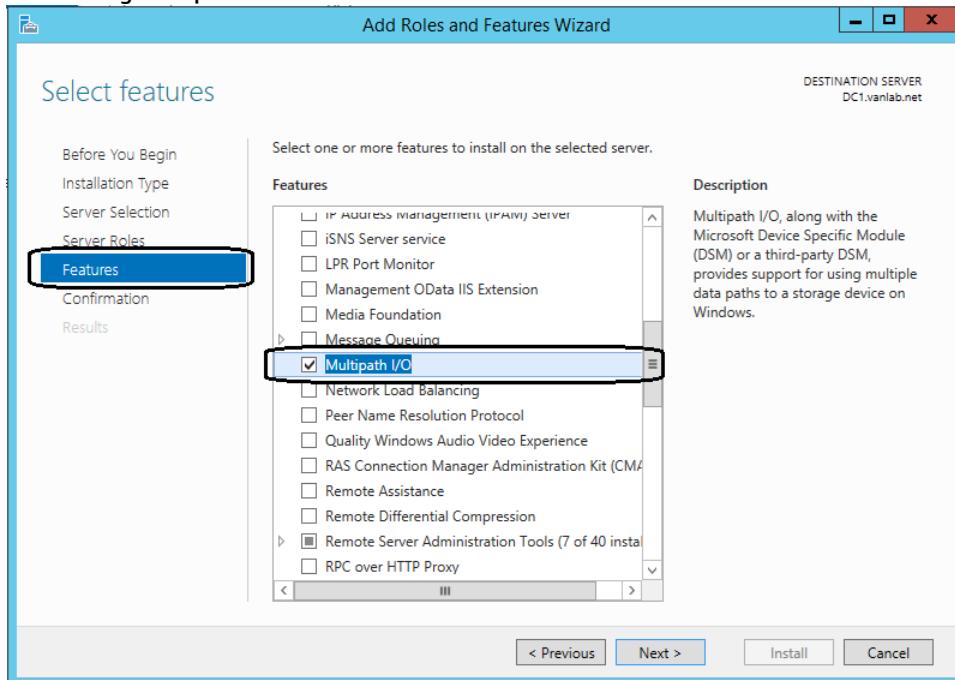
## Enabling MPIO on Windows 2012 R2

Once the OS is installed, you will be required to enable the Multi-Path IO (MPIO) feature within Windows 2012 R2 and install the MPIO software for your SAN, you can then enable the additional SAN paths to the server/storage.

**Note:** Please refer to the FC Cookbook for HP Virtual Connect for additional details on Fibre Channel Connectivity.

<http://bizsupport1.austin.hp.com/bc/docs/support/SupportManual/c01702940/c01702940.pdf>

**Figure 46 - Enabling Multipath IO within Windows 2012R2**



## Review

In this scenario we have created a simple vNet utilizing uplinks originating from each FlexFabric 10/24-Port Module, by doing so we provide redundant connections out of the Virtual Connect domain, where one uplink will be active and the alternate uplink will be in standby. We also create two FCoE SAN Fabrics, utilizing a single uplink each.

We created a server profile, with two NICs connected to the same vNet, which provides the ability to sustain a link or module failure and not lose connection to the network, this configuration also guarantees that ALL server to server communications within the enclosure will remain inside the enclosure. Alternatively, we could have created two vNets and assigned uplinks from one module to each vNet, providing an Active/Active uplink scenario.

Additionally, FCoE port 1 is connected to SAN fabric FCoE\_A and FCoE SAN port 1 is connected to SAN Fabric FCoE\_B, providing a multi-pathed connection to the SAN.

Additional uplinks could be added to either the San fabrics or the Ethernet networks, which could increase performance and/or availability.

## Results – Windows 2012 R2 Networking Examples

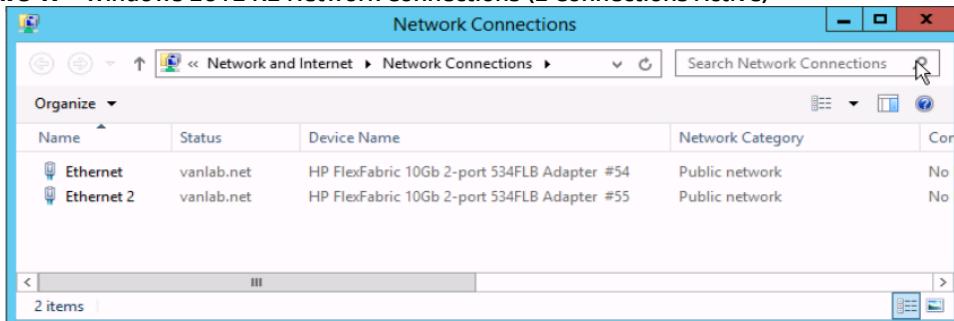
We have successfully configured FlexFabric with a simple vNet and redundant SAN fabrics. We have created a server profile to connect to the vNet with TWO NICs and the SAN fabrics using the FCoE connections created within the profile.

Although both Ethernet and Fibre channel connectivity is provided by the FlexFabric Adapter used in the G7 through Gen 9 servers; each capability (LAN and SAN) is provided by a different component of the adapter, they appear in the server as individual network and SAN adapters.

The following graphics show a Windows 2012 R2 server with TWO FlexNICs configured at 6Gb. You will also notice that Windows believes there are only 2 NICs within this server as we have configured the profile to hide the unused FlexNICs, the extra NICs are offline and could later be added to the profile, if needed. If we did not require SAN connectivity on this server, the FCoE connections could be deleted and the server would then have 8 NIC ports available to the OS.

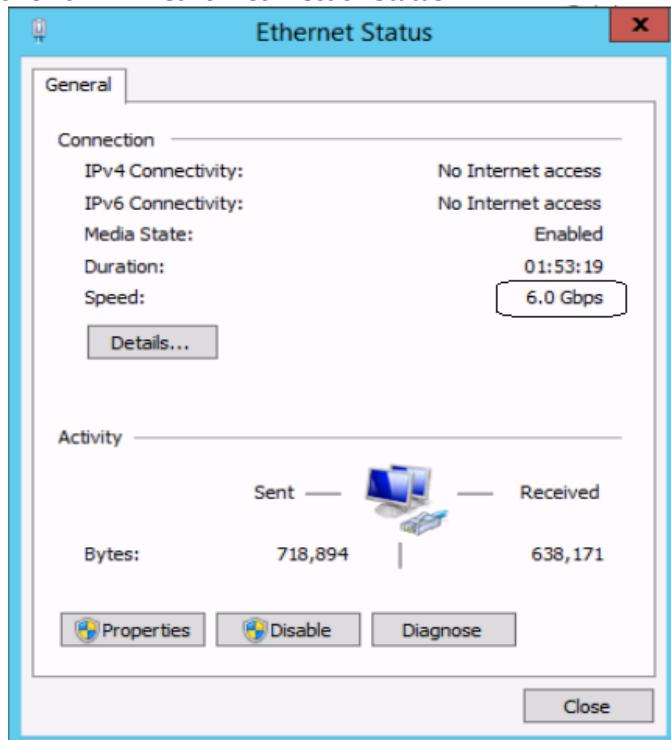
**Note:** The BL465c G7 and BL685c G7 utilize an NC551i chipset (BE2), whereas the BL460c G7, BL620c G7 and BL680c G7 utilize an NC553i chipset (BE3) and the Gen 8 blades typically have a NC554 adapter which also utilizes the BE3 chipset. Both the BE2 and BE3 chipsets share common drivers and firmware. Gen 8 Blade servers are provided with a “FlexLOM” which is a removal integrated Network adapter. This provides flexibility in NIC choice. The 554FLB is a B3 based chipset NIC, the 534FLB is a Broadcom based NIC. The example below is a 534FLB in a BL460c Gen 8 Blade server.

**Figure 47 - Windows 2012 R2 Network Connections (2 Connections Active)**



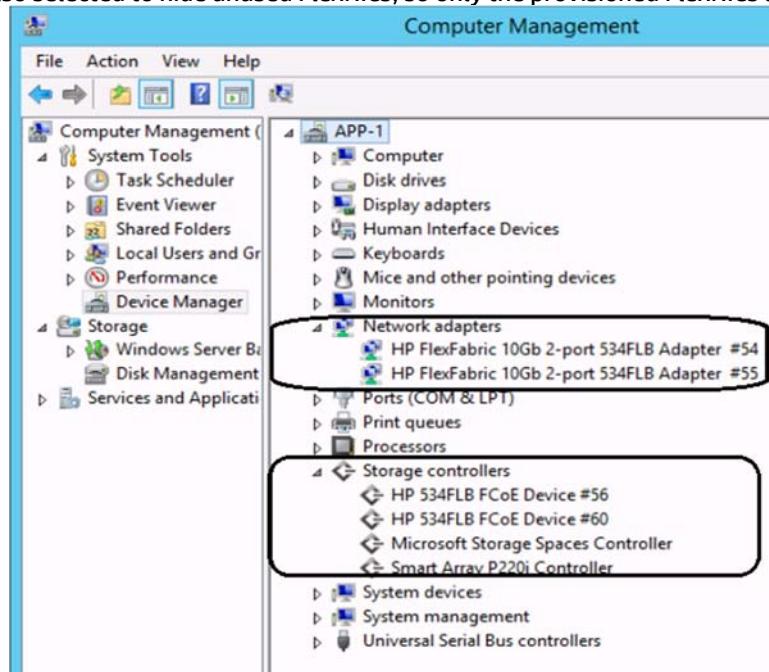
**Note:** If you are familiar with Virtual Connect Flex-10 technology, you will notice not all NICs were presented, and only the configured NICs are displayed. This is because we selected the new feature to hide unused FlexNICs.

**Figure 48 - Windows 2012 R2 Network Connection Status**



**Note:** As of Windows 2008 and later the actual NIC speed is displayed as configured in server Profile. Also, note that the speed displayed is the maximum speed setting, not the minimum setting.

**Figure 49 -** Windows 2012 R2, Device Manager, we have only configured two of the NICs and two FCoE HBAs. We also selected to hide unused FlexNICs, so only the provisioned FlexNICs are shown



The following graphics provides an example of a Windows 2012 R2 server with TWO NICs connected to the network, initially each NIC has its own TCP/IP address, alternatively, both NICs could be teamed to provide NIC fail-over redundancy. If an active uplink or network switch were to fail, Virtual Connect would fail-over to the standby uplink. In the event of a Virtual Connect FlexFabric module failure, the server's NIC teaming software would see one of the NICs go offline, assuming it was the active NIC, NIC teaming would fail-over to the standby NIC.

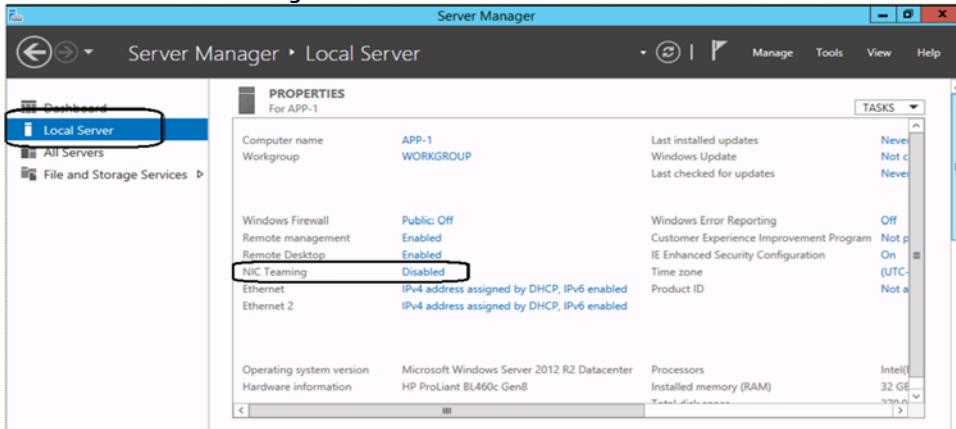
**Figure 50 -** Both NICs for Profile App-1 are connected to the network through vNet-PROD

A screenshot of an Administrator Windows PowerShell window titled 'Administrator: Windows PowerShell'. The command 'ipconfig' is run, displaying network configuration details. It shows two Ethernet adapters: 'Ethernet adapter Ethernet 2:' and 'Ethernet adapter Ethernet:'. Both adapters have identical configurations: Connection-specific DNS Suffix . . . . . : vanlab.net, Link-local IPv6 Address . . . . . : fe80::b8ed:7669:da33:9fe9%13, IPv4 Address . . . . . : 192.168.1.138, Subnet Mask . . . . . : 255.255.255.0, and Default Gateway . . . . . : 192.168.1.254. A 'Tunnel adapter isatap.vanlab.net:' is also listed, showing Media State . . . . . : Media disconnected and Connection-specific DNS Suffix . . . . . : vanlab.net. The prompt at the bottom is PS C:\Users\Administrator>

## NIC Teaming

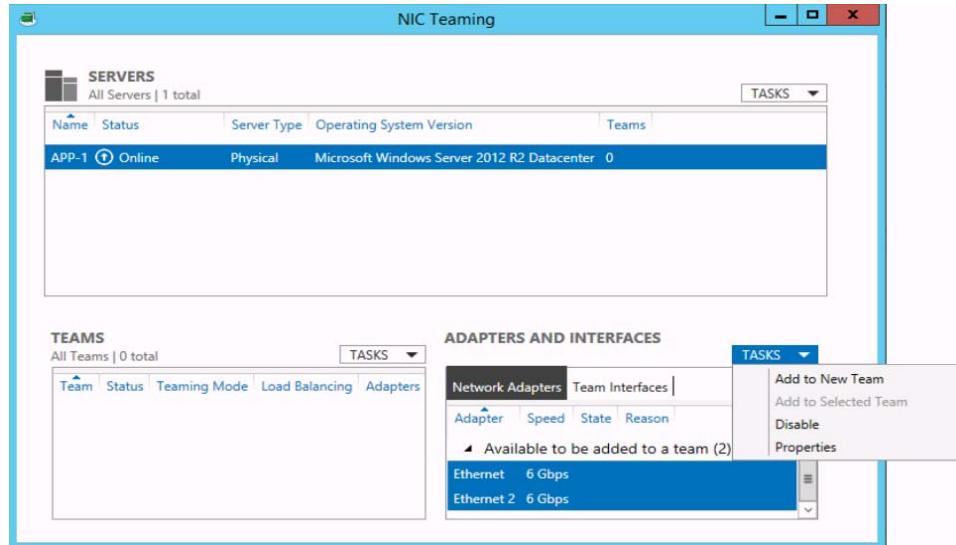
If higher availability is desired, NIC teaming in Virtual Connect works the same way as in standard network configurations. NIC Teaming is now provided as part of the Windows 2012 R2 OS. To configure NIC Teaming in windows 2012 R2, open Server Manager, select Local Server and click on “Disabled” to the right of NIC Teaming.

**Figure 51 - Enable NIC Teaming**

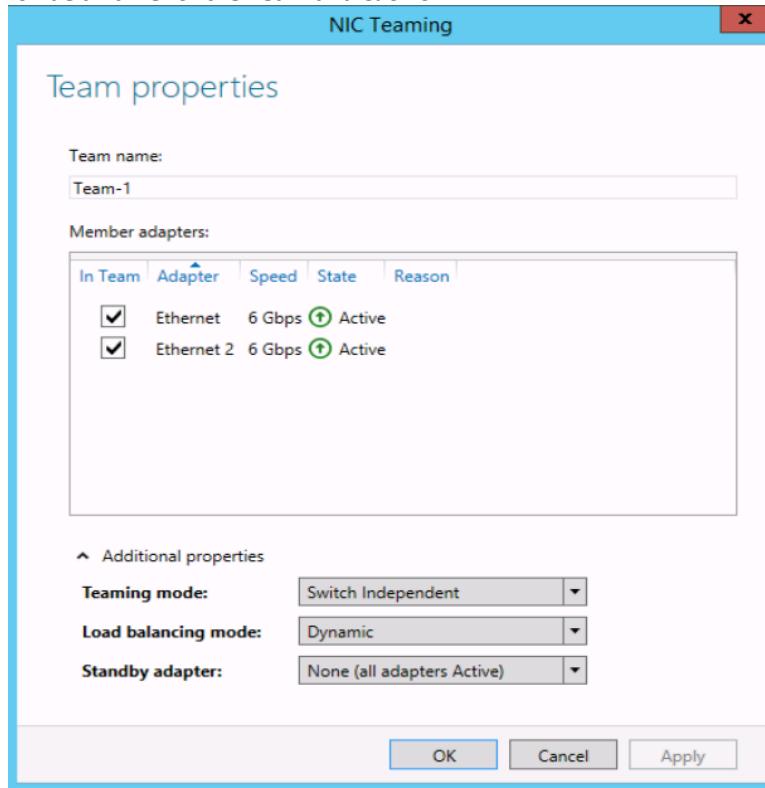


In the bottom right pane of the NIC teaming utility, highlight the two NICs you want to team and Click Tasks, then select “Add to team”. In the New Team configuration Box, provide a name for the Team and Click OK.

**Figure 52 - Create the NIC Team**

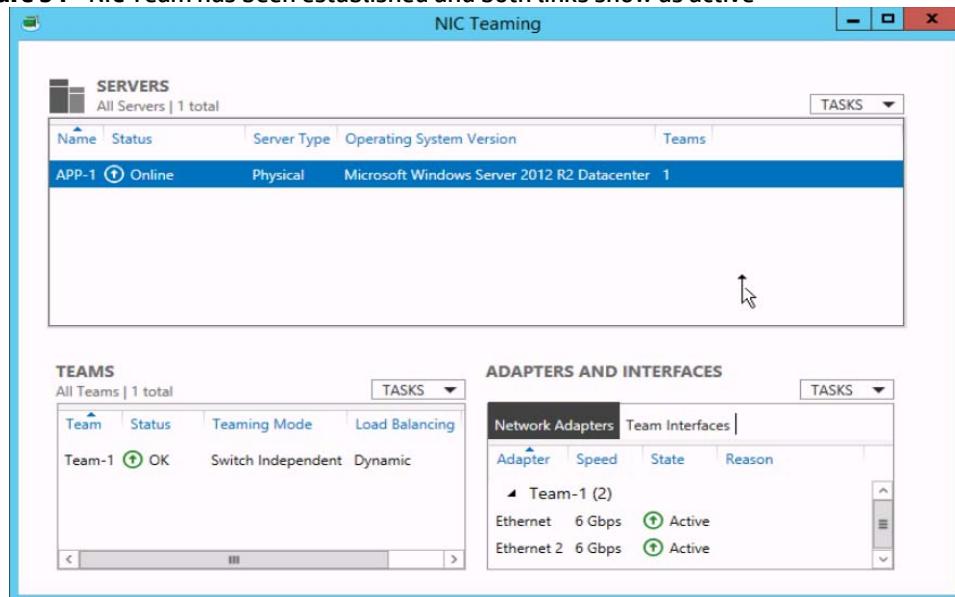


**Figure 53 - Provide a name for the Team and Click OK**

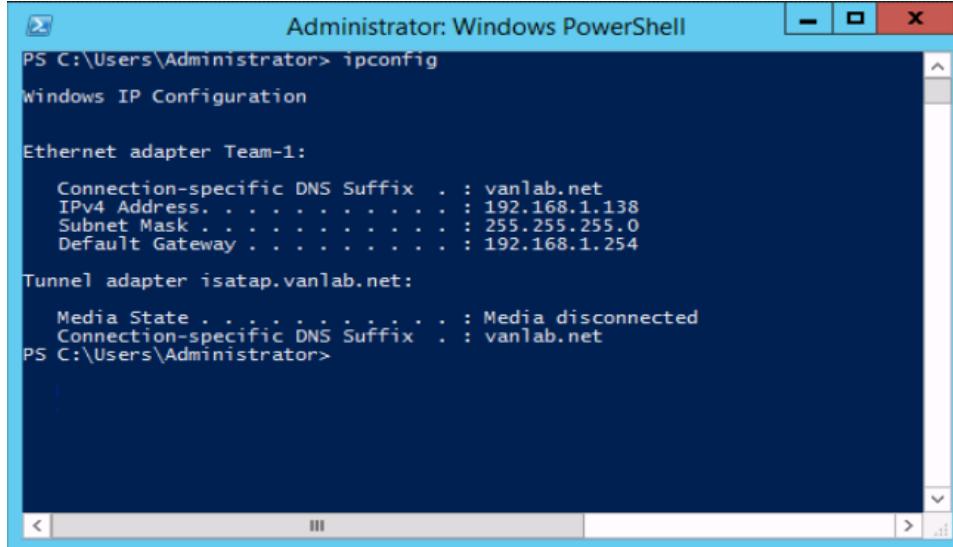


**Note:** You can select the Additional properties drop down and alter the Teaming Mode, the default mode of "Switch Independent" is supported with Virtual Connect, however, Static Teaming and LACP modes are not supported. You can also select Load Balancing and adapter standby modes.

**Figure 54 - NIC Team has been established and both links show as active**



**Figure 55 - Both NICs are teamed and connect to the network with a common IP Address**



```
Administrator: Windows PowerShell
PS C:\Users\Administrator> ipconfig

Windows IP Configuration

Ethernet adapter Team-1:

Connection-specific DNS Suffix . : vanlab.net
IPv4 Address . . . . . : 192.168.1.138
Subnet Mask . . . . . : 255.255.255.0
Default Gateway . . . . . : 192.168.1.254

Tunnel adapter isatap.vanlab.net:

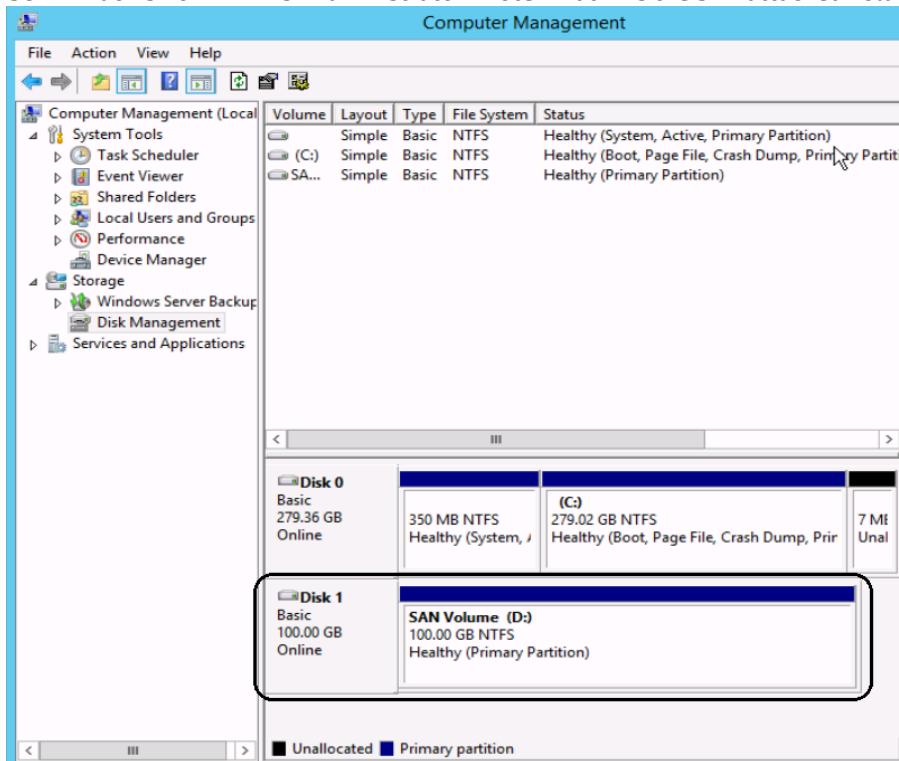
Media State . . . . . : Media disconnected
Connection-specific DNS Suffix . : vanlab.net
PS C:\Users\Administrator>
```

**Note:** IPv6 was disabled within Windows

## Results – Windows 2012 R2 SAN Connectivity

Before attaching the storage LUNs to the server profile, make sure the MPIO feature is installed and configured within the windows operating system and the MPIO software for your SAN is also installed. Also make sure that you have enabled ALL the SAN fabric Zones for this server, to ensure proper SAN connectivity fail-over.

**Figure 56 - Windows 2012 R2 Disk Administrator. Note: That D: is the SAN attached volume**



# Summary

We presented a Virtual Connect Network scenario by creating a simple vNet, we configured the new Min/Max Network speed setting for the vNet. A dual path SAN fabric for storage connectivity was also configured.

When VC profile App-1 is applied to the server in bay1 and the server is powered up, it has one NIC connected through each FlexFabric module connected to “vNet-PROD”, which connects to the network infrastructure through the 10Gb uplinks. These NICs could now be configured as individual NICs with their own IP address or as a pair of TEAMED NICs. Either NIC could be active. As a result, this server could access the network through either NIC or either uplink cable, depending on which is active at the time. Each NIC is configured for a guaranteed minimum bandwidth of 4Gb, with a maximum of 6Gb of network bandwidth and each FCoE port is configured for 4Gb of SAN bandwidth with the ability to burst to a maximum of 8Gb. We also enabled the new “Hide Unused FlexNICs” feature, so these unused NICs would not appear in the server OS.

Additional NICs could be added within FlexFabric, by simply powering the server off and adding up to a total of 6 NICs, the NIC speed can then be adjusted accordingly to suit the needs of each NIC. If additional or less SAN bandwidth is required, the speed of the SAN connection can also be adjusted.

As additional servers are added to the enclosure, simply create additional profiles, or copy existing profiles, configure the NICs for LAN and SAN fabrics as required and apply them to the appropriate server bays and power the server on.

# Scenario 2 –Shared Uplink Sets with Active/Active uplinks and 802.3ad (LACP) - Ethernet and FCoE – Windows 2012 R2

## Overview

This scenario will implement the Shared Uplink Set (SUS) to provide support for multiple VLANs. The upstream network switches connect to each FlexFabric 10/24-Port module and two separate Shared Uplink Sets, providing an Active/Active configuration, LACP will be used to aggregate those links.

As multiple VLANs will be supported in this configuration, the upstream switch ports connecting to the FlexFabric modules will be configured to properly present those VLANs. In this scenario, the upstream switch ports will be configured for VLAN trunking/VLAN tagging.

When configuring Virtual Connect, we can provide several ways to implement network fail-over or redundancy. One option would be to connect TWO uplinks to a single Virtual Connect network; those two uplinks would connect from different Virtual Connect modules within the enclosure and could then connect to the same upstream switch or two different upstream switches, depending on your redundancy needs. An alternative would be to configure TWO separate Virtual Connect networks, each with a single, or multiple, uplinks configured. Each option has its advantages and disadvantages. For example; an Active/Standby configuration places the redundancy at the VC level, where Active/Active places it at the OS NIC teaming or bonding level. We will review the second option in this scenario.

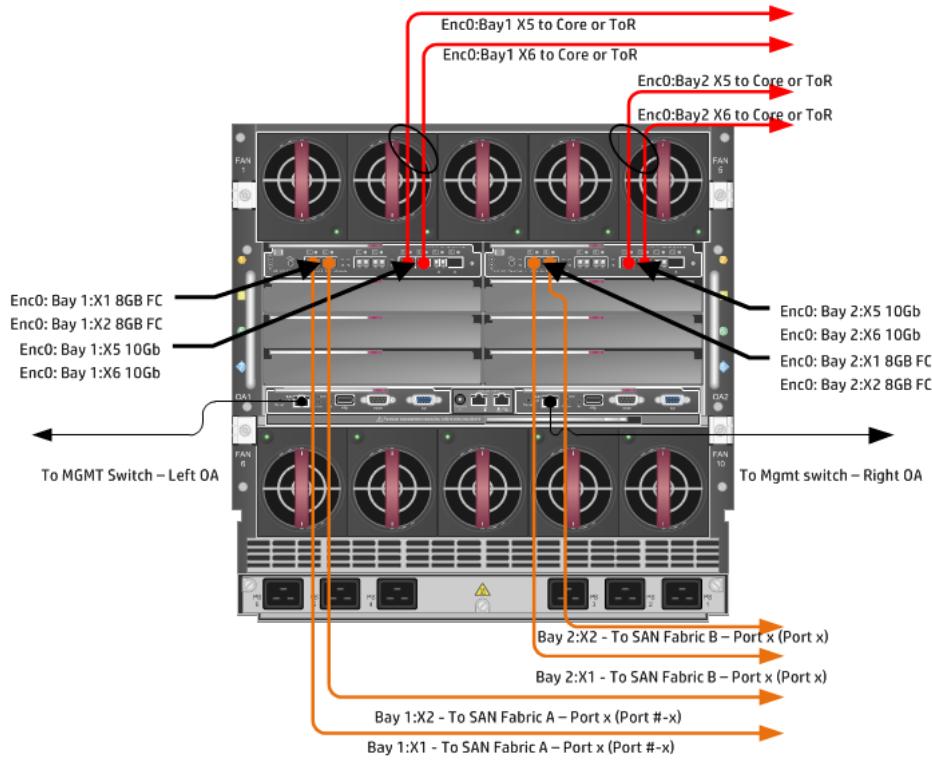
In addition, several Virtual Connect Networks can be configured to support the required networks to the servers within the BladeSystem enclosure. These networks could be used to separate the various network traffic types, such as iSCSI, backup and VMotion from production network traffic.

This scenario will also leverage the Fibre Channel over Ethernet (FCoE) capabilities of the FlexFabric modules. Each fibre channel fabric will have two uplinks connected to each of the FlexFabric modules.

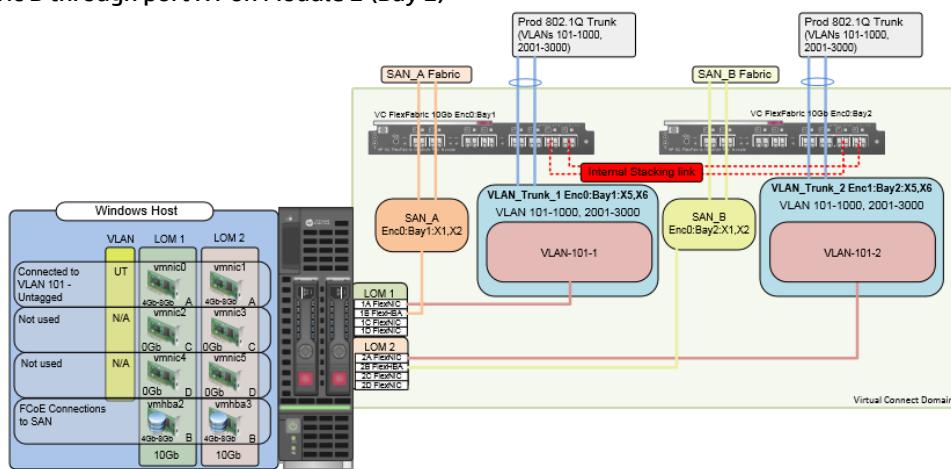
## Requirements

This scenario will support both Ethernet and fibre channel connectivity. In order to implement this scenario, an HP BladeSystem c7000 enclosure with one or more server blades and TWO Virtual Connect FlexFabric 10/24-Port modules, installed in I/O Bays 1 & 2 are required. In addition, we will require ONE or TWO external Network switches. As Virtual Connect does not appear to the network as a switch and is transparent to the network, any standard managed switch will work with Virtual Connect. The Fibre Channel uplinks will connect to the existing FC SAN fabrics. The SAN switch ports will need to be configured to support NPIV logins. Two uplinks from each FlexFabric module will be connected to the existing SAN fabrics.

**Figure 57 - Physical View;** Shows two Ethernet uplinks from Ports X5 and X6 on Module 1 and 2 to Ports 1 and 2 on each network switch. The SAN fabrics are also connected redundantly, with TWO uplinks per fabric, from ports X1 and X2 on module 1 to Fabric A and ports X1 and X2 to Fabric B.



**Figure 58 - Logical View;** The server blade profile is configured with TWO FlexNICs and 2 FlexHBAs. NICs 1 and 2 are connected to VLAN-101-x which are part of the Shared Uplink Sets, VLAN-Trunk-1 and VLAN-Trunk-2 respectively. The VLAN-Trunks are connected, at 10Gb, to a network switch, through Ports X5 and X6 on each FlexFabric 10/24-Port Module in Bays 1 and 2. The FCoE SAN connections are connected through ports X1 and X2 on each FlexFabric module. In addition, SAN Fabric FCoE\_A connects to the existing SAN Fabric A through port X1 on Module 1 (Bay 1) and FCoE\_B connects to the existing SAN Fabric B through port X1 on Module 2 (Bay 2)



# Installation and configuration

## Switch configuration

As the Virtual Connect module acts as an edge switch, Virtual Connect can connect to the network at either the distribution level or directly to the core switch.

The appendices provide a summary of the cli commands required to configure various switches for connection to Virtual Connection. The configuration information provided in the appendices for this scenario assumes the following information:

- The switch ports are configured as VLAN TRUNK ports (tagging) to support several VLANs. All frames will be forwarded to Virtual Connect with VLAN tags. Optionally, one VLAN could be configured as (Default) untagged, if so, then a corresponding vNet within the Shared Uplink Set would be configured and set as “Default”

**Note:** When adding additional uplinks to the SUS, if the additional uplinks are connecting from the same FlexFabric 10/24-Port module to the same switch, in order to ensure all The uplinks are active, the switch ports will need to be configured for LACP within the same Link Aggregation Group.

The network switch port should be configured for Spanning Tree Edge as Virtual Connect appears to the switch as an access device and not another switch. By configuring the port as Spanning Tree Edge, it allows the switch to place the port into a forwarding state much quicker than otherwise, this allows a newly connected port to come online and begin forwarding much quicker.

The SAN switch ports connecting to the FlexFabric 10/24-Port module must be configured to accept NPIV logins.

## Configuring the VC module

- Physically connect Port 1 of network switch 1 to Port X5 of the VC module in Bay 1
- Physically connect Port 2 of network switch 1 to Port X6 of the VC module in Bay 1
- Physically connect Port 1 of network switch 2 to Port X5 of the VC module in Bay 2
- Physically connect Port 2 of network switch 2 to Port X6 of the VC module in Bay 2

**Note:** If you have only one network switch, connect VC ports X5 and X6 (Bay 2) to an alternate ports on the same switch. This will NOT create a network loop and Spanning Tree is not required.

- Physically connect Ports X1/X2 on the FlexFabric in module Bay 1 to switch ports in SAN Fabric A
- Physically connect Ports X1/X2 on the FlexFabric in module Bay 2 to switch ports in SAN Fabric B

## VC CLI commands

Many of the configuration settings within VC can also be accomplished via a CLI command set. In order to connect to VC via a CLI, open an SSH connection to the IP address of the active VCM. Once logged in, VC provides a CLI with help menus. Through this scenario the CLI commands to configure VC for each setting will also be provided.

## Configuring Expanded VLAN Capacity via GUI

Virtual Connect release 3.30 provided an expanded VLAN capacity mode when using Shared Uplink Sets, this mode can be enabled through the Ethernet Settings tab or the VC CLI. The default configuration for a new Domain install is “Expanded VLAN Capacity” mode, Legacy mode is no longer available and the Domain cannot be downgraded.

Virtual Connect 4.30 now provides the ability to define up to 4096 VLANs then consume only the VLANs you need, when you need them. There is nothing to change or enable to take advantage of the 4096 VLAN feature.

## To verify the VLAN Capacity mode

- On the Virtual Connect Manager screen, Left pane, click Ethernet Settings, Advanced Settings
- Select Expanded VLAN capacity
- Verify Expanded VLAN Capacity is configured and Legacy VLAN Capacity is greyed out.

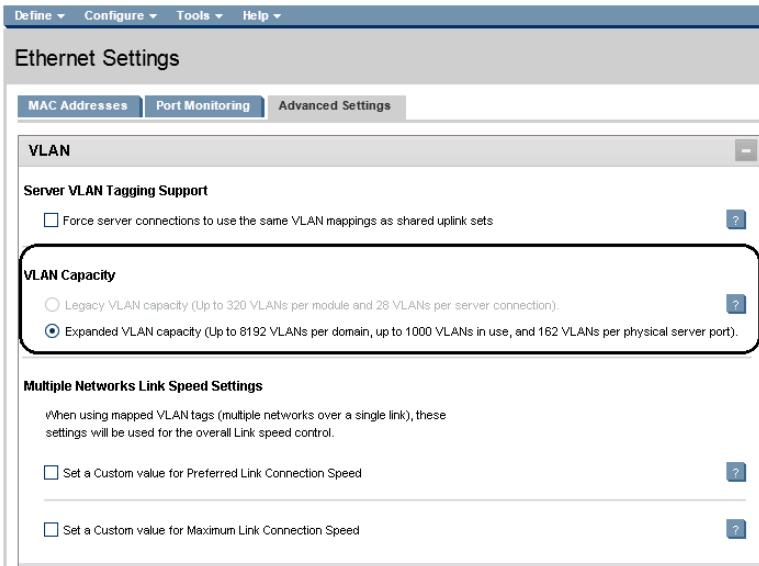
**Note:** Legacy VLAN mode will only be presented if 1Gb Virtual Connect Modules are present, in which case the domain would be limited to Firmware version 3.6x.

## Configuring Expanded VLAN Capacity via CLI

The following command can be copied and pasted into an SSH based CLI session with Virtual Connect;

```
# Set Expanded VLAN Capacity  
set enet-vlan -quiet VlanCapacity=Expanded
```

**Figure 59 - Enabling Expanded VLAN Capacity**



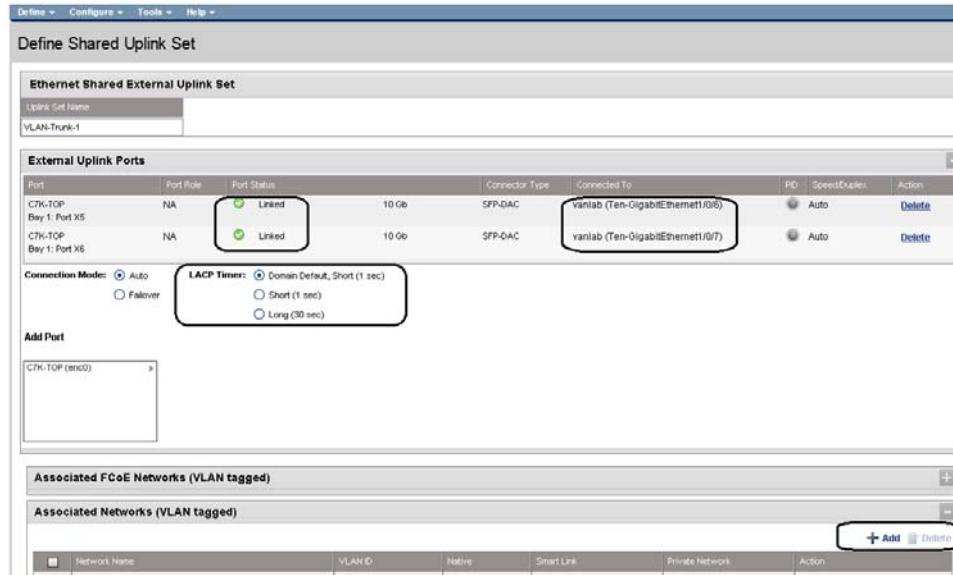
**Note:** If a 1Gb VC Ethernet module is present in the Domain, Expanded VLAN capacity will be greyed out, this is only supported with 10Gb and 20Gb based Virtual Connect modules. Also, once Expanded VLAN capacity is selected, moving back to Legacy VLAN capacity mode will require a domain deletion and rebuild.

## Defining a new Shared Uplink Set (VLAN-Trunk-1)

Connect Ports X5 and X6 of FlexFabric 10/24-Port module in Bay 1 to Ports 1 and 2 on switch 1  
Create a SUS named VLAN-Trunk-1 and connect it to FlexFabric Ports X5 and X6 on Module 1

- On the Virtual Connect Home page, select Define, Shared Uplink Set
- Insert Uplink Set Name as VLAN-Trunk-1
- Select Add Port, then add the following port;
  - Enclosure 1, Bay 1, Port X5
  - Enclosure 1, Bay 1, Port X6

**Figure 60 - Shared Uplink Set (VLAN-Trunk-1) Uplinks Assigned**

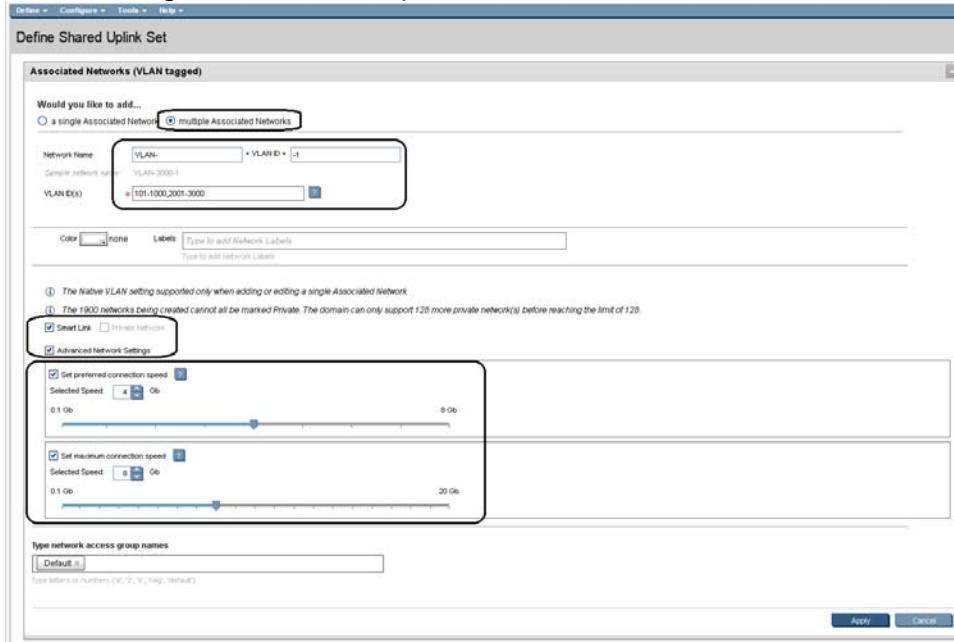


**Note:** The uplinks are still simply “linked” and will not go Linked/Active until after at least one networking is assigned to a Profile.

- Click Add Networks and select the Multiple Networks radio button and add the following VLANs;
  - Enter Name as VLAN-
  - Enter Suffix as -1
  - Enter VLAN IDs as follows (and shown in the following graphic);
    - 101-1000,2001-3000
- Enable SmartLink on ALL networks
- Click Advanced
  - Configure Preferred speed to 4Gb
  - Configure Maximum speed to 8Gb
- Click Apply

**Note:** You can optionally specify a network “color” or “Label” when creating a shared Uplinkset and its networks. In the example above we have not set either color or label. As you can see, we have configured for over 2000 VLANs, will then assign to the server NICs, only the networks we require. Also notice the new configurable LACP Timer setting.

**Figure 61 - Creating VLANs in a Shared Uplink Set**



**Note:** If the VC domain is not in Expanded VLAN capacity mode, you will receive an error when attempting to create more than 128 VLANs in a SUS. If that occurs, go to Advanced Ethernet Settings and select Expanded VLAN capacity mode and apply.

After clicking apply, a list of VLANs will be presented as shown below. If one VLAN in the trunk is untagged/native, see note below.

- Click Apply at the bottom of the page to create the Shared Uplink Set

**Figure 62 - Associated VLANs for Shared Uplink Set VLAN-Trunk-1**

Network Name	VLAN ID	Native	Smart Link	Private Network	Action
VLAN-101-1	101	false	true	false	Edit
VLAN-102-1	102	false	true	false	Edit
VLAN-103-1	103	false	true	false	Edit
VLAN-104-1	104	false	true	false	Edit
VLAN-105-1	105	false	true	false	Edit
VLAN-106-1	106	false	true	false	Edit
VLAN-107-1	107	false	true	false	Edit
VLAN-108-1	108	false	true	false	Edit
VLAN-109-1	109	false	true	false	Edit
VLAN-110-1	110	false	true	false	Edit
VLAN-111-1	111	false	true	false	Edit
VLAN-112-1	112	false	true	false	Edit
VLAN-113-1	113	false	true	false	Edit
VLAN-114-1	114	false	true	false	Edit
VLAN-115-1	115	false	true	false	Edit
VLAN-116-1	116	false	true	false	Edit
VLAN-117-1	117	false	true	false	Edit
VLAN-118-1	118	false	true	false	Edit
VLAN-119-1	119	false	true	false	Edit
VLAN-120-1	120	false	true	false	Edit
VLAN-121-1	121	false	true	false	Edit
VLAN-122-1	122	false	true	false	Edit
VLAN-123-1	123	false	true	false	Edit
VLAN-124-1	124	false	true	false	Edit

**Note:** Optionally, if one of the VLANs in the trunk to this shared uplink set were configured as Native or Untagged, you would be required to “edit” that VLAN in the screen above, and configure Native as TRUE. This would need to be set for BOTH VLAN-Trunk-1 and VLAN-Trunk-2.

**Figure 63 - You will see that ALL Uplinks are still in a Linked/Standby state**

Shared Uplink Sets						
External Connections		Associated Networks				
Shared Uplink Set	Has FCoE	Port Status	Connector Type	Uplink Port	Action	Add
✓ VLAN-Trunk-1	false	Linked-Standby	10 Gb	SFP-DAC	✓ C7K-TOP: Bay 1: Port X5	Edit
		Linked-Standby	10 Gb	SFP-DAC	✓ C7K-TOP: Bay 1: Port X6	

**Note:** That both of the network connections are shown as “Linked/Standby”, this state will NOT change until the network has been assigned to a server profile. This behavior is new within VC 4.30 and is provided to accommodate the new 4096 VLAN feature.

### Defining a new Shared Uplink Set (VLAN-Trunk-2) (Copying a Shared Uplink Set)

The second Shared Uplink Set could be created in the same manner as VLAN-Trunk-1 however; VC now provides the ability to COPY a VC Network or Shared Uplink Set.

- Connect Ports X5 and X6 of FlexFabric 10/24-Port module in bay 2 to Ports 1 and 2 on switch 2
- In the VC GUI screen, select Shared Uplink Sets in the left pane, in the right pane VLAN-Trunk-1 will be displayed, left click VLAN-Trunk-1, it will appear as blue, right click and select COPY
- Edit the Settings as shown in the following graphic, the new SUS name will be VLAN-Trunk-2 and ALL the associated VLANs will have a suffix of 2
- In step 3, ADD uplinks X5 and X6 from Bay 2
- Click OK
- The SUS and ALL VLANs will be created

**Figure 64 - Copying a SUS and ALL VLANs**

Copy Shared Uplink Set

1 Shared Uplink Set Name  
Name: VLAN-Trunk-2

2 Associated Networks (VLANs)  
Replace last instance(s) of 1 with 2

VLAN-Trunk-1 Original		VLAN-Trunk-2 Copy	
VLAN-101-1		VLAN-101-2	
VLAN-102-1		VLAN-102-2	
VLAN-103-1		VLAN-103-2	
VLAN-104-1		VLAN-104-2	
VLAN-105-1		VLAN-105-2	
VLAN-106-1		VLAN-106-2	

3 External Uplink Ports

Port	Port Role	Port Status	Connector Type	Connected To
------	-----------	-------------	----------------	--------------

You will then be required to scroll down and add the uplinks to the Shared Uplink Set, and then click OK to create the SUS.

## Defining a new Shared Uplink Set via CLI

The following script can be used to create the first Shared Uplink Set (VLAN-Trunk-1)

*The following command(s) can be copied and pasted into an SSH based CLI session with Virtual Connect*

```
# Create Shared Uplink Set VLAN-Trunk-1 and configure uplinks
add uplinkset VLAN-Trunk-1
add uplinkport enc0:1:X5 Uplinkset=VLAN-Trunk-1 speed=auto
add uplinkport enc0:1:X6 Uplinkset=VLAN-Trunk-1 speed=auto

# Create Networks VLAN-1001-1 through VLAN-1000-1 and VLAN-2001-1 through VLAN-3000-1
# for Shared Uplink Set VLAN-Trunk-1
add network-range -quiet UplinkSet=VLAN-Trunk-1 NamePrefix=VLAN- NameSuffix=-1
VLANIds=101-1000,2001-3000 State=enabled PrefSpeedType=Custom PrefSpeed=4000
MaxSpeedType=Custom MaxSpeed=8000 SmartLink=enabled
```

**Note:** Refer to Appendix D; “Scripting the Native VLAN” for scripting examples.

The following script can be used to create the Second Shared Uplink Set (VLAN-Trunk-2)

```
# Create Shared Uplink Set VLAN-Trunk-2 and configure uplinks
add uplinkset VLAN-Trunk-2
add uplinkport enc0:2:X5 Uplinkset=VLAN-Trunk-2 speed=auto
add uplinkport enc0:2:X6 Uplinkset=VLAN-Trunk-2 speed=auto

# Create Networks VLAN101-2 through VLAN1000-2 and VLAN-2001-2 through VLAN-3000-2
# for Shared Uplink Set VLAN-Trunk-2
add network-range -quiet UplinkSet=VLAN-Trunk-2 NamePrefix=VLAN- NameSuffix=-2
VLANIds=101-1000,2001-3000 State=enabled PrefSpeedType=Custom PrefSpeed=4000
MaxSpeedType=Custom MaxSpeed=8000 SmartLink=enabled
```

**Note:** In this scenario we have created two independent Share Uplink Sets (SUS), each originating from the opposite FlexFabric Modules, by doing so we provide the ability to create separate and redundant connections out of the Virtual Connect domain. When we create the server profiles, you will see how the NICs will connect to VLANs accessed through the opposite VC module, which provides the ability to create an Active / Active uplink scenario. Alternatively, we could have created a single SUS and assigned both sets of these uplink ports to the same SUS, however, this would have provided an Active/Standby uplink scenario, as shown in Scenario 5.

**Note:** As we configured the Min/Max network speed setting for these networks, you will notice in each profile that ALL configured NICs will have a max. configured speed of 8Gb. If you wish to limit the speed of specific networks, you could edit each network and configure an appropriate speed.

## Defining a new (FCoE) SAN Fabric via GUI

Create a Fabric and name it “FCoE\_A”

- On the Virtual Connect Manager screen, click Define, SAN Fabric to create the first Fabric
- Enter the Network Name of “FCoE\_A”
- Select Add Port, then add the following ports;
  - Enclosure 1, Bay 1, Port X1
  - Enclosure 1, Bay 1, Port X2
- Ensure Fabric Type is set to “FabricAttach”
- Select Show Advanced Settings
  - Select Automatic Login Re-Distribution (FlexFabric Only)
  - Select Set Preferred FCoE Connect Speed
    - Configure for 4Gb
  - Select Set Maximum FCoE Connect Speed
    - Configure for 8Gb
- Select Apply

Create a second Fabric and name it "FCoE\_B"

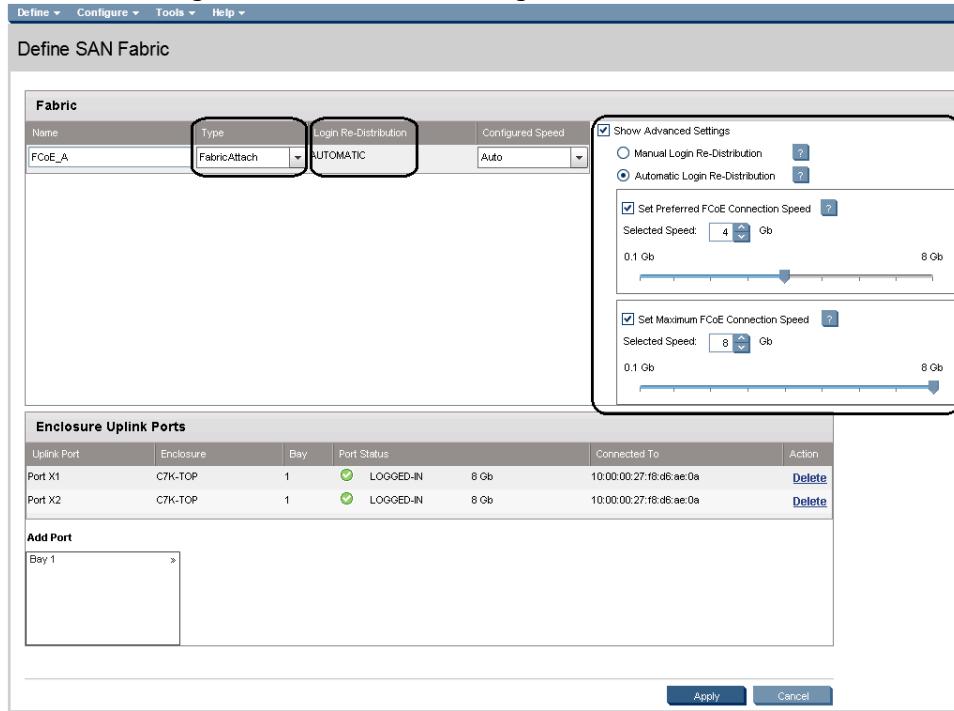
- On the Virtual Connect Manager screen, click Define, SAN Fabric to create the second Fabric
- Enter the Network Name of "FCoE\_B"
- Select Add Port, then add the following ports:
  - Enclosure 1, Bay 2, Port X1
  - Enclosure 1, Bay 2, Port X2
- Ensure Fabric Type is set to "FabricAttach"
- Select Show Advanced Settings
  - Select Automatic Login Re-Distribution (FlexFabric Only)
  - Select Set Preferred FCoE Connect Speed
    - Configure for 4Gb
  - Select Set Maximum FCoE Connect Speed
    - Configure for 8Gb
- Select Apply

## Defining SAN Fabrics via CLI

The following command(s) can be copied and pasted into an SSH based CLI session with Virtual Connect

```
#Create the SAN Fabrics FCoE_A and FCoE_B and configure uplinks as discussed above
add fabric FCoE_A Type=FabricAttach Bay=1 Ports=1,2 Speed=Auto LinkDist=Auto
PrefSpeedType=Custom PrefSpeed=4000 MaxSpeedType=Custom MaxSpeed=8000
add fabric FCoE_B Type=FabricAttach Bay=2 Ports=1,2 Speed=Auto LinkDist=Auto
PrefSpeedType=Custom PrefSpeed=4000 MaxSpeedType=Custom MaxSpeed=8000
```

**Figure 65 - SAN Configuration and Advanced Settings**



**Figure 66** - FCoE SAN fabrics configured with two 8Gb uplinks per fabric. Note the bay and port numbers on the right

SAN Fabrics										
External Connections		Server Connections								
Status	SAN Fabric	Type	Login Re-Distribution	Port Status	Connected To	Enclosure	Bay	Port	Action	Add
<span style="color: green;">✓</span>	FCoE_A	FabricAttach	AUTOMATIC	<span style="color: green;">✓</span> LOGGED-IN	8 Gb	10:00:00:27:f8:d6:ae:0a	C7K-TOP	1	X1	<span style="color: blue;">Edit</span> <span style="color: blue;">▼</span>
				<span style="color: green;">✓</span> LOGGED-IN	8 Gb	10:00:00:27:f8:d6:ae:0a	C7K-TOP	1	X2	<span style="color: blue;">Edit</span> <span style="color: blue;">▼</span>
<span style="color: green;">✓</span>	FCoE_B	FabricAttach	AUTOMATIC	<span style="color: green;">✓</span> LOGGED-IN	8 Gb	10:00:00:27:f8:d6:8b:9c	C7K-TOP	2	X1	<span style="color: blue;">Edit</span> <span style="color: blue;">▼</span>
				<span style="color: green;">✓</span> LOGGED-IN	8 Gb	10:00:00:27:f8:d6:8b:9c	C7K-TOP	2	X2	<span style="color: blue;">Edit</span> <span style="color: blue;">▼</span>

## Defining a Server Profile

We will create a server profile with two server NICs.

Although, we have created Shared Uplink Sets with several VLANs, each server NIC, for this scenario, will connect to VLAN 101, all other networks/VLANs will remain unused.

- On the main menu, select Define, then Server Profile
- Create a server profile called “App-1”
- Select to “Hide Unused FlexNICs”
- In the Network Port 1 drop down box, select VLAN-101-1
- In the Network Port 2 drop down box, select VLAN-101-2
- Expand the FCoE Connections box, for Bay 1, select FCoE\_A for Bay 2, select FCoE\_B
- Do not configure FC SAN or iSCSI Connection
- In the Assign Profile to Server Bay box, locate the Select Location drop down and select Bay 1, then apply

Prior to applying the profile, ensure that the server in Bay 1 is currently OFF

**Note:** You should now have a server profile assigned to Bay 1, with 2 Server NIC connections. NICs 1&2 should be connected to networks VLAN-101-1 and VLAN-101-2 and FCoE SAN fabrics FCoE\_A and FCoE\_B.

## Defining a Server Profile via CLI

The following command(s) can be copied and pasted into an SSH based CLI session with Virtual Connect

```
# Create Server Profile App-1
add profile App-1 -nodefaultfcconn -nodefaultfcoeconn NAG=Default HideUnusedFlexNICs=true
set enet-connection App-1 1 pxe=Enabled Network=VLAN-101-1
set enet-connection App-1 2 pxe=Disabled Network=VLAN-101-2
Add fcoe-connection App-1 Fabric=FCoE_A SpeedType=4Gb
Add fcoe-connection App-1 Fabric=FCoE_B SpeedType=4Gb
poweroff server 1
assign profile App-1 enc0:1
```

**Note:** The speed of the NIC and SAN connections, as well as the MAC and WWN. Also, that the FCoE connections are assigned to the two SAN fabrics created earlier and use ports LOM:1-b and LOM:2-b.

**Figure 67 - Define a Server Profile (App-1)**

The screenshot shows the 'Edit Server Profile' interface for 'App-1'. The top bar includes 'Define', 'Configure', 'Tools', and 'Help'. The main area has tabs for 'Profile Name' (App-1), 'Network Access Group' (Default), 'Boot Mode' (Auto), 'Status' (Green), 'Serial Number' (VCX0000V00), and 'Server UUID' (c47df6cf-427c-417d-9429-1dc8e6f565e0). A checked checkbox 'Hide Unused FlexNICs' is visible.

- Ethernet Adapter Connections:** Shows two ports: VLAN-101-1 and VLAN-101-2, both set to PREFERRED status. They are mapped to LOM1:1-a and LOM1:2-a respectively.
- iSCSI HBA Connections:** Shows two ports: Bay 1 and Bay 2. Both are SAN type and PREFERRED status. They are mapped to FCoE\_A and FCoE\_B respectively.
- FCoE HBA Connections:** Shows two ports: Bay 1 and Bay 2. Both are SAN type and PREFERRED status. They are mapped to LOM1:1-b and LOM1:2-b respectively.
- Assign Profile to Server Bay:** Shows a single bay entry: C7K-TOP, Bay 1, assigned to Proliant BL460c Gen8 with serial MXQ42401QG.

**Figure 68 - Server Profile View Bay 1**

The screenshot shows the 'Server Profile View Bay 1' interface for a ProLiant BL460c Gen8 server. The top bar includes 'Define', 'Configure', 'Tools', and 'Help'.

### Bay 1 (ProLiant BL460c Gen8)

**Device Bay Status - Bay # 1**

Overall Status:	Green
Hardware Status:	Green
VC Status:	Green
Assigned Server Profile:	App-1
Enclosure Name:	C7K-TOP
UID:	Off
Power Status/Control:	Off

**Momentary Press**

**Blade Server Information - Bay # 1**

Serial Number:	MXQ42401QG
Serial Number (Logical):	VCX0000V00
UUID:	30343237-3638-584D-5134-323430315147
UUID (Logical):	c47df6cf-427c-417d-9429-1dc8e6f565e0
Product Name:	ProLiant BL460c Gen8
Server Name:	APP-1
Part Number:	724086-B21
Asset Tag:	[Unknown n]
UEFI Capable:	false
Boot Mode:	Legacy

**Server Ethernet Adapter Information**

Ethernet Adapter	Flex NIC	Location	Module Port	Model	MAC Address	Network	WWN	SAN Fabric
<b>Port 1</b>								
LOM1:1-	FLB1	Bay 1:d1:v1	HP FlexFabric 10Gb 2-Port 534FLB Adapter	00-17-A4-77-7C-02	VLAN-101-1			
LOM1:1-	FLB1	Bay 1:d1:v2	HP FlexFabric 10Gb 2-Port 534FLB Adapter	00-17-A4-77-7C-00		50:06:0B:00:00:C2:DE:00	FCoE_A	
LOM1:1-	FLB1	Bay 1:d1:v3	HP FlexFabric 10Gb 2-Port 534FLB Adapter	9C-B6-54-87-5F-92				
LOM1:1-	FLB1	Bay 1:d1:v4	HP FlexFabric 10Gb 2-Port 534FLB Adapter	9C-B6-54-87-5F-93				
<b>Port 2</b>								
LOM1:2-	FLB1	Bay 2:d1:v1	HP FlexFabric 10Gb 2-Port 534FLB Adapter	00-17-A4-77-7C-04	VLAN-101-2			
LOM1:2-	FLB1	Bay 2:d1:v2	HP FlexFabric 10Gb 2-Port 534FLB Adapter	00-17-A4-77-7C-01		50:06:0B:00:00:C2:DE:02	FCoE_B	
LOM1:2-	FLB1	Bay 2:d1:v3	HP FlexFabric 10Gb 2-Port 534FLB Adapter	9C-B6-54-87-5F-96				
LOM1:2-	FLB1	Bay 2:d1:v4	HP FlexFabric 10Gb 2-Port 534FLB Adapter	9C-B6-54-87-5F-97				

## Verify Network Link State

As discussed earlier in this document, in Virtual connect 4.30 there was a change to the link state behavior when a network has no connections to a server profile. Once a connection is made to the server profile, the uplinks will become Active, as previously expected.

**Figure 69 - All Links now appear in a Linked/Active state.**

Shared Uplink Sets						
External Connections		Associated Networks				
Shared Uplink Set	Has FCoE	Port Status	Connector Type	Uplink Port	Action	
VLAN-Trunk-1	false	<input checked="" type="checkbox"/> Linked-Active <input checked="" type="checkbox"/> Linked-Active <input checked="" type="checkbox"/> Linked-Active <input checked="" type="checkbox"/> Linked-Active	10 Gb	SFP-DAC	<input checked="" type="checkbox"/> C7K-TOP: Bay 1: Port X5 <input checked="" type="checkbox"/> C7K-TOP: Bay 1: Port X6 <input checked="" type="checkbox"/> C7K-TOP: Bay 2: Port X5 <input checked="" type="checkbox"/> C7K-TOP: Bay 2: Port X6	<input type="button" value="Edit"/>
VLAN-Trunk-2	false	<input checked="" type="checkbox"/> Linked-Active <input checked="" type="checkbox"/> Linked-Active <input checked="" type="checkbox"/> Linked-Active <input checked="" type="checkbox"/> Linked-Active	10 Gb	SFP-DAC	<input checked="" type="checkbox"/> C7K-TOP: Bay 1: Port X5 <input checked="" type="checkbox"/> C7K-TOP: Bay 1: Port X6 <input checked="" type="checkbox"/> C7K-TOP: Bay 2: Port X5 <input checked="" type="checkbox"/> C7K-TOP: Bay 2: Port X6	<input type="button" value="Edit"/>

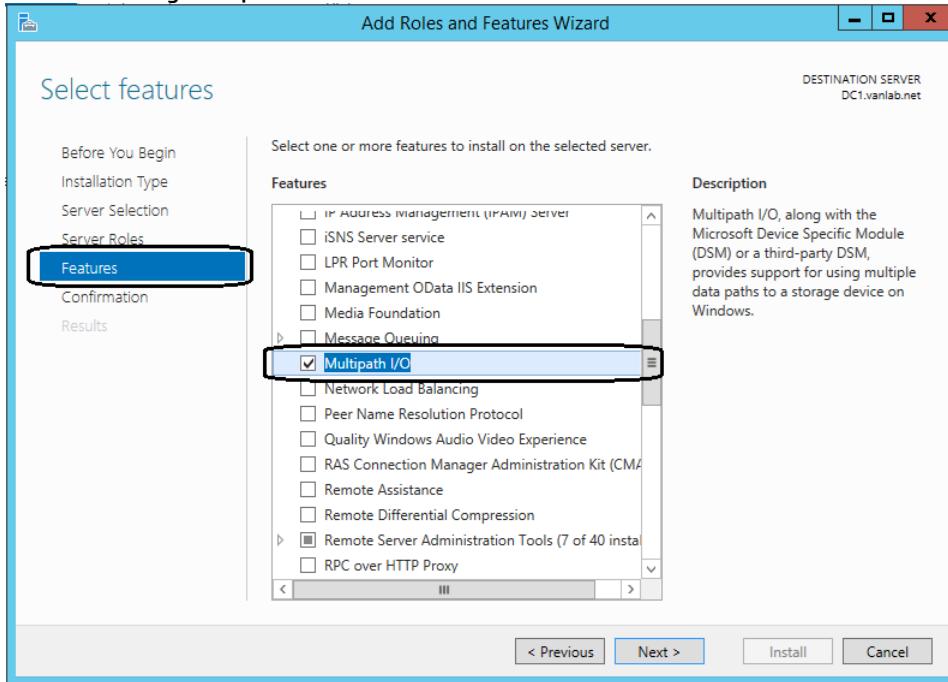
## Enabling MPIO on Windows 2012 R2

Once the OS is installed, you will be required to enable the Multi-Path IO (MPIO) feature within Windows 2012 R2 and install the MPIO software for your SAN, you can then enable the additional SAN paths to the server/storage.

**Note:** Please refer to the FC Cookbook for HP Virtual Connect for additional details on Fibre Channel Connectivity.

<http://bizsupport1.austin.hp.com/bc/docs/support/SupportManual/c01702940/c01702940.pdf>

**Figure 70 - Enabling Multipath IO within Windows 2012R2**



# Review

In this scenario we have created Two Shared Uplink Sets (SUS), providing support for many VLANs. Uplinks originating from each FlexFabric Module connect to each SUS, by doing so we provide redundant connections out of the Virtual Connect domain. As multiple uplinks are used for each SUS, we have also leveraged LACP to improve uplink performance. In this scenario, all uplinks will be active.

We also created two FCoE SAN Fabrics.

We created a server profile, with two NICs connected to the same external VLAN (101) through VC networks VLAN-101-1 and VLAN-101-2, which provides the ability to sustain a link or module failure and not lose connection to the network. VLAN101-1 and VLAN101-2 are configured to support VLAN 101, frames will be presented to the NIC(s) without VLAN tags (untagged), these two NICs are connected to the same VLAN, but taking a different path out of the enclosure.

Additionally, FCoE port 1 is connected to SAN fabric FCoE\_A and FCoE SAN port 2 is connected to SAN Fabric FCoE\_B, providing a multi-pathed connection to the SAN.

Additional uplinks could be added to either the SAN fabrics or the Ethernet networks, which could increase performance and/or availability.

## Results – Windows 2012 R2 Networking Examples

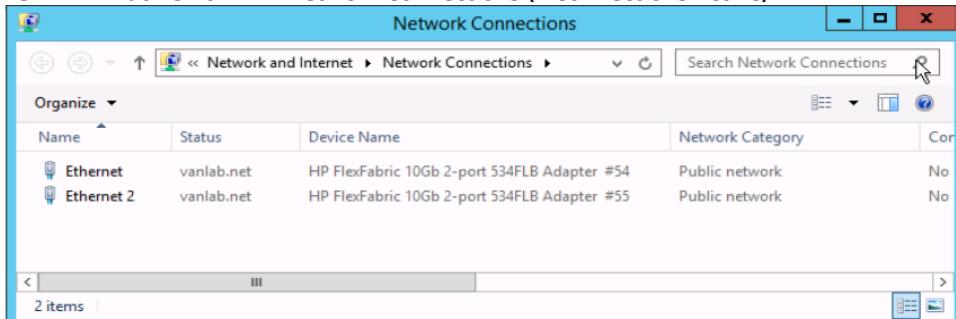
We have successfully configured FlexFabric with a shared uplink set and redundant SAN fabrics. We have created a server profile to connect the TWO NICs to VLAN 101 and the SAN fabrics using the FCoE connections created within the profile.

Although both Ethernet and Fibre channel connectivity is provided by the FlexFabric Adapter used in the G7 through Gen 9 servers; each capability (LAN and SAN) is provided by a different component of the adapter, they appear in the server as individual network and SAN adapters.

The following graphics show a Windows 2012 R2 server with TWO FlexNICs configured at 8Gb. You will also notice that Windows believes there are only 2 NICs within this server as we have configured the profile to hide the unused FlexNICs, the extra NICs are offline and could later be added to the profile, if needed. If we did not require SAN connectivity on this server, the FCoE connections could be deleted and the server would then have 8 NIC ports available to the OS.

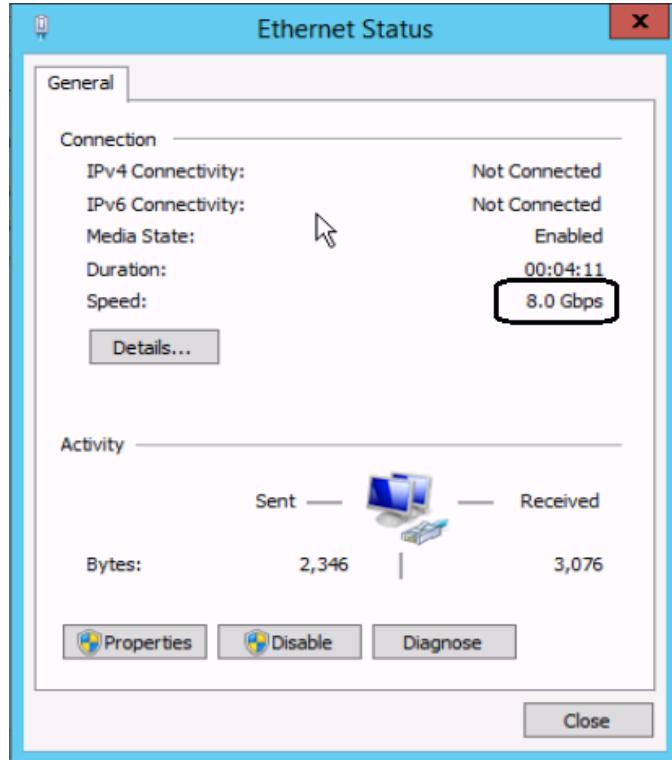
**Note:** The BL465c G7 and BL685c G7 utilize an NC551i chipset (BE2), whereas the BL460c G7, BL620c G7 and BL680c G7 utilize an NC553i chipset (BE3) and the Gen 8 blades typically have a NC554 adapter which also utilizes the BE3 chipset. Both the BE2 and BE3 chipsets share common drivers and firmware. Gen 8 Blade servers are provided with a “FlexLOM” which is a removal integrated Network adapter. This provides flexibility in NIC choice. The 554FLB is a B3 based chipset NIC, the 534FLB is a Broadcom based NIC. The example below is a 534FLB in a BL460c Gen 8 Blade server.

**Figure 71 - Windows 2012 R2 Network Connections (2 Connections Active)**



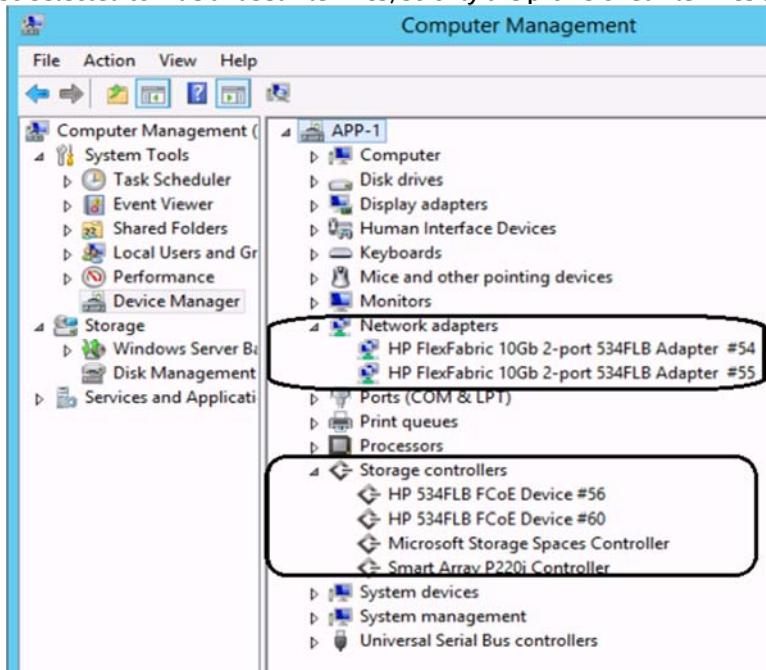
**Note:** If you are familiar with Virtual Connect Flex-10 technology, you will notice not all NICs were presented, and only the configured NICs are displayed. This is because we selected the new feature to hide unused FlexNICs.

**Figure 72 - Windows 2012 R2 Network Connection Status**



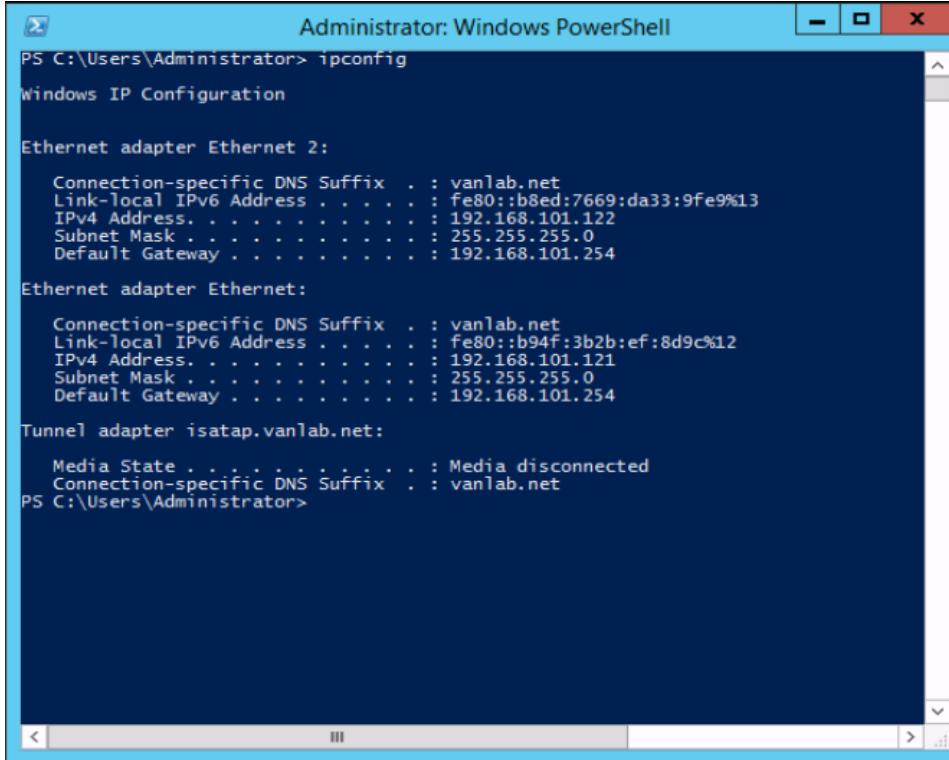
**Note:** As of Windows 2008 and later the actual NIC speed is displayed as configured in server Profile. Also, note that the speed displayed is the maximum speed setting, not the minimum setting.

**Figure 73 - Windows 2012 R2, Device Manager**, we have only configured two of the NICs and two FCoE HBAs. We also selected to hide unused FlexNICs, so only the provisioned FlexNICs are shown



The following graphics provides an example of a Windows 2012 R2 server with TWO NICs connected to the network, initially each NIC has its own TCP/IP address, alternatively, both NICs could be teamed to provide NIC fail-over redundancy. If an active uplink or network switch were to fail, Virtual Connect would fail-over to the standby uplink. In the event of a Virtual Connect FlexFabric module failure, the server's NIC teaming software would see one of the NICs go offline, assuming it was the active NIC, NIC teaming would fail-over to the standby NIC.

**Figure 74 - Both NICs for Profile App-1 are connected to the network through VLAN-101-x**



```

Administrator: Windows PowerShell
PS C:\Users\Administrator> ipconfig

Windows IP Configuration

Ethernet adapter Ethernet 2:

Connection-specific DNS Suffix . : vanlab.net
Link-local IPv6 Address . . . . . : fe80::b8ed:7669:da33:9fe9%13
IPv4 Address . . . . . : 192.168.101.122
Subnet Mask . . . . . : 255.255.255.0
Default Gateway . . . . . : 192.168.101.254

Ethernet adapter Ethernet:

Connection-specific DNS Suffix . : vanlab.net
Link-local IPv6 Address . . . . . : fe80::b94f:3b2b:ef:8d9c%12
IPv4 Address . . . . . : 192.168.101.121
Subnet Mask . . . . . : 255.255.255.0
Default Gateway . . . . . : 192.168.101.254

Tunnel adapter isatap.vanlab.net:

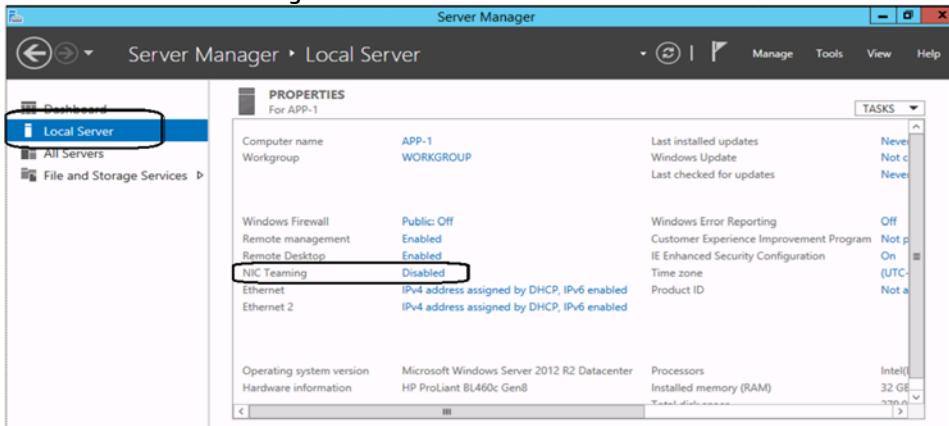
Media State . . . . . : Media disconnected
Connection-specific DNS Suffix . : vanlab.net
PS C:\Users\Administrator>

```

## NIC Teaming

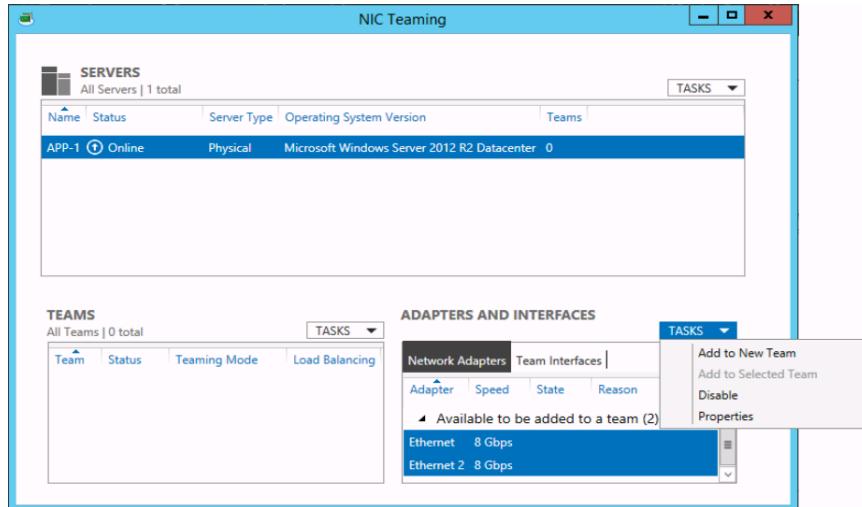
If higher availability is desired, NIC teaming in Virtual Connect works the same way as in standard network configurations. NIC Teaming is now provided as part of the Windows 2012 R2 OS. To configure NIC Teaming in windows 2012 R2, open Server Manager, select Local Server and click on “Disabled” to the right of NIC Teaming.

**Figure 75 - Enable NIC Teaming**



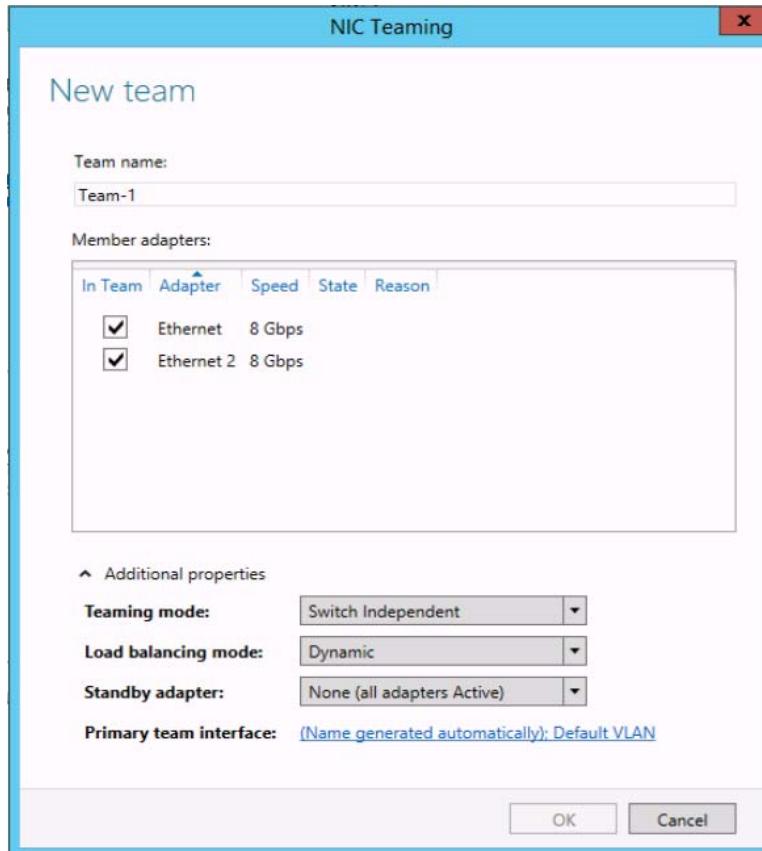
In the bottom right pane of the NIC teaming utility, highlight the two NICs you want to team and Click Tasks, then select “Add to team”.

**Figure 76 - Create the NIC Team**



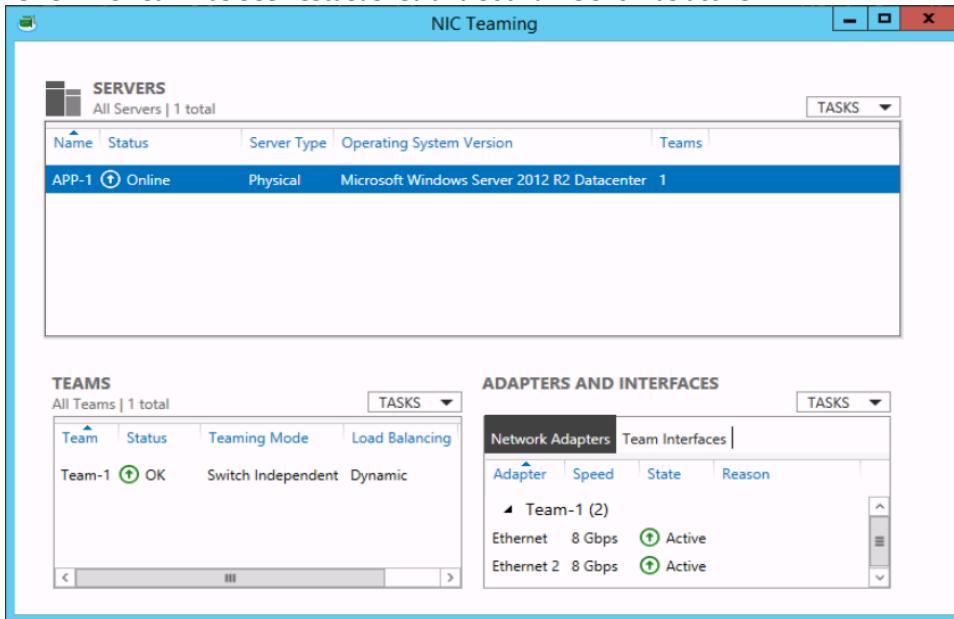
In the bottom right pane of the NIC teaming utility, highlight the two NICs you want to team and Click Tasks, then select “Add to team”. In the New Team configuration Box, provide a name for the Team and Click OK.

**Figure 77 - Provide a name for the Team and Click OK**



**Note:** You can select the Additional properties drop down and alter the Teaming Mode, the default mode of “Switch Independent” is supported with Virtual Connect, however, Static Teaming and LACP modes are not supported. You can also select Load Balancing and adapter standby modes.

**Figure 78 - NIC Team has been established and both links show as active**



**Figure 79 - Both NICs are teamed and connect to the network with a common IP Address**

```
Administrator: Windows PowerShell
PS C:\Users\Administrator> ipconfig

Windows IP Configuration

Ethernet adapter Team-1:
  Connection-specific DNS Suffix . : vanlab.net
  IPv4 Address . . . . . : 192.168.101.122
  Subnet Mask . . . . . : 255.255.255.0
  Default Gateway . . . . . : 192.168.101.254

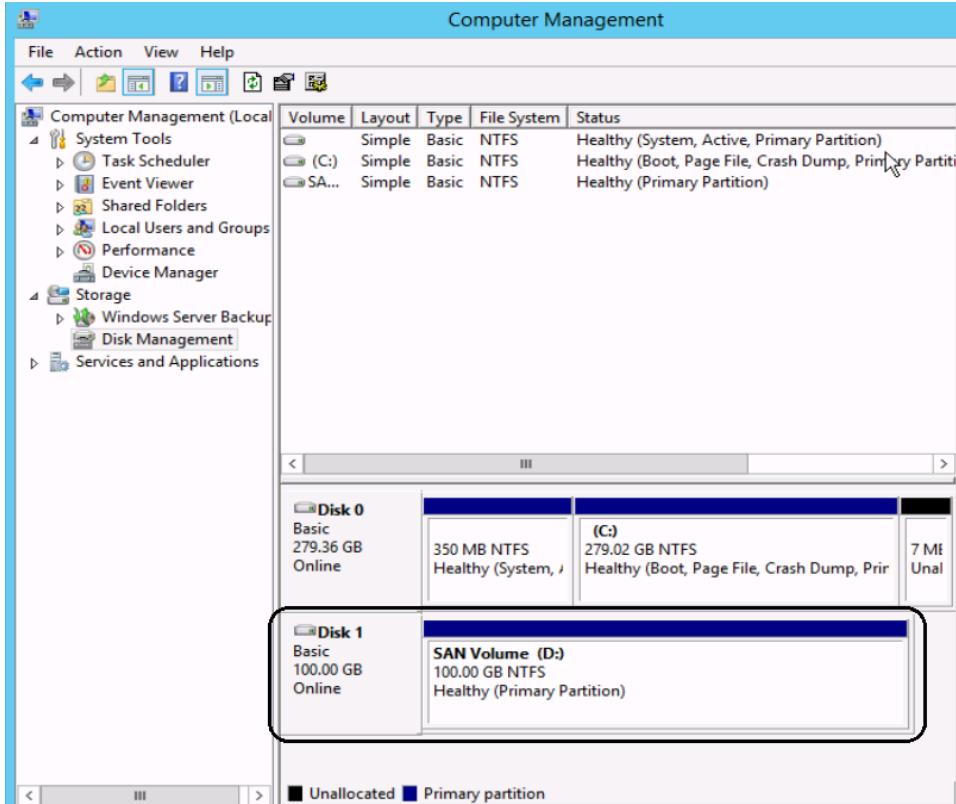
Tunnel adapter isatap.vanlab.net:
  Media State . . . . . : Media disconnected
  Connection-specific DNS Suffix . : vanlab.net
PS C:\Users\Administrator>
```

**Note:** IPv6 was disabled within Windows

## Results – Windows 2012 R2 SAN Connectivity

Before attaching the storage LUNs to the server profile, make sure the MPIO feature is installed and configured with the windows operating system and the MPIO software for your SAN is also installed. Also make sure that you have enabled ALL the SAN fabric Zones for this server, to ensure proper SAN connectivity fail-over.

**Figure 80** - Windows 2012 R2 Disk Administrator. Note: That D: is the SAN attached volume



## Summary

We presented a Virtual Connect Network scenario by creating two shared uplink sets (SUS), each SUS is connected with TWO active uplinks, both Shard Uplink Sets can actively pass traffic. We included a dual path SAN fabric for storage connectivity.

When VC profile App-1 is applied to the server in bay1 and the server is powered up, it has one NIC connected through FlexFabric 10/24-Port module 1 (connected to VLAN-101-1), the second NIC is connected through FlexFabric 10/24-Port module 2 (connected to VLAN-101-2). Each NIC is configured at 8Gb. These NICs could now be configured as individual NICs with their own IP address or as a pair of TEAMED NICs. Either NIC could be active. As a result, this server could access the network through either NIC or either uplink, depending on which NIC is active at the time. Each NIC is configured for a guaranteed minimum bandwidth of 4Gb, with a maximum of 8Gb of network bandwidth and each FCoE port is configured for 4Gb of SAN bandwidth with the ability to burst to a maximum of 8Gb. We also enabled the new “Hide Unused FlexNICs” feature, so these unused NICs would not appear in the server OS.

Additional NICs could be added within FlexFabric, by simply powering the server off and adding up to a total of 6 NICs, the NIC speed can then be adjusted accordingly to suit the needs of each NIC. If additional or less SAN bandwidth is required, the speed of the SAN connection can also be adjusted.

As additional servers are added to the enclosure, simply create additional profiles, or copy existing profiles, configure the NICs for LAN and SAN fabrics as required and apply them to the appropriate server bays and power the server on.

# **Scenario 3 – Shared Uplink Set with Active/Active Uplinks and 802.3ad (LACP) - Ethernet and FCoE Boot from SAN – Windows 2012 R2**

## **Overview**

This scenario will implement the Shared Uplink Set (SUS) to provide support for multiple VLANs. The upstream network switches connect a shared uplink set to two ports on each FlexFabric 10/24-Port modules, LACP will be used to aggregate those links. This scenario is identical to Scenario 2, however, scenario 3 also provides the steps to configure a Windows 2012 R2 server to Boot from SAN using the FCoE connections provided by FlexFabric. When using Virtual Connect/FlexFabric in a Boot from SAN implementation, no custom or special HBA configuration is required. The HBA configuration is controlled by Virtual Connect and maintained as part of the server profile. Once the server profile has been configured and applied to the server bays, the controller will be configured on the next and subsequent boot. When we later configure the server profile, we will also configure the HBA boot parameters.

As multiple VLANs will be supported in this configuration, the upstream switch ports connecting to the FlexFabric 10/24-Port modules will be configured to properly present those VLANs. In this scenario, the upstream switch ports will be configured for VLAN trunking/VLAN tagging.

When configuring Virtual Connect, we can provide several ways to implement network fail-over or redundancy. One option would be to connect TWO uplinks to a single Virtual Connect network; those two uplinks would connect from different Virtual Connect modules within the enclosure and could then connect to the same upstream switch or two different upstream switches, depending on your redundancy needs. An alternative would be to configure TWO separate Virtual Connect networks, each with a single, or multiple, uplinks configured. Each option has its advantages and disadvantages. For example; an Active/Standby configuration places the redundancy at the VC level, where Active/Active places it at the OS NIC teaming or bonding level. We will review the second option in this scenario.

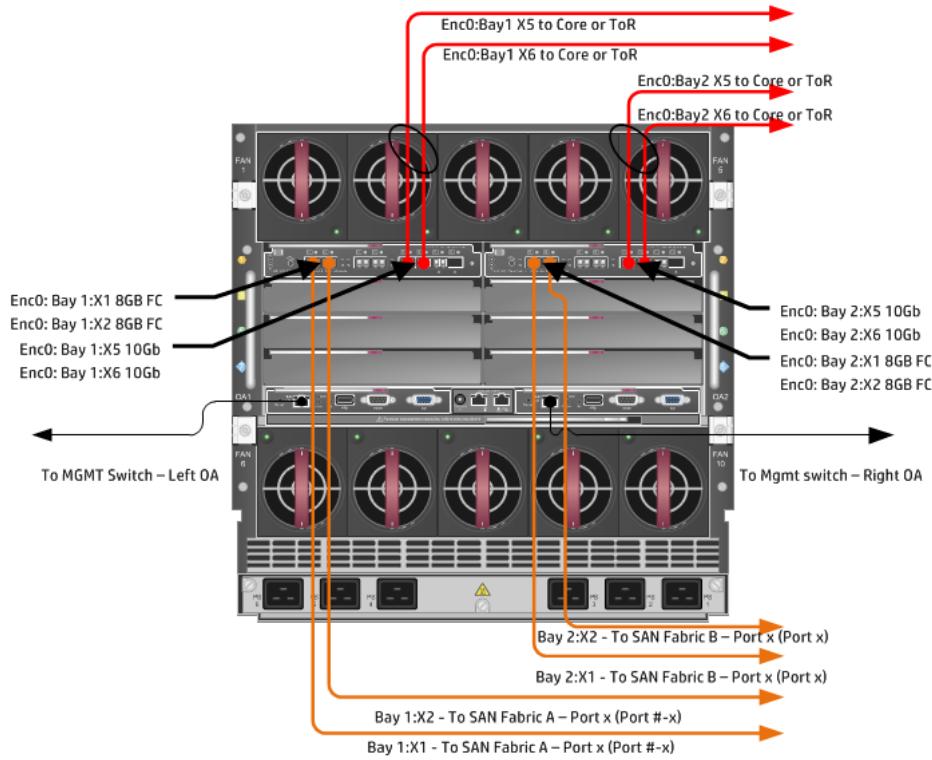
In addition, several Virtual Connect Networks can be configured to support the required networks to the servers within the BladeSystem enclosure. These networks could be used to separate the various network traffic types, such as iSCSI, backup and VMotion from production network traffic.

This scenario will also leverage the Fibre Channel over Ethernet (FCoE) capabilities of the FlexFabric 10/24-Port modules. Each fibre channel fabric will have two uplinks connected to each of the FlexFabric 10/24-Port modules.

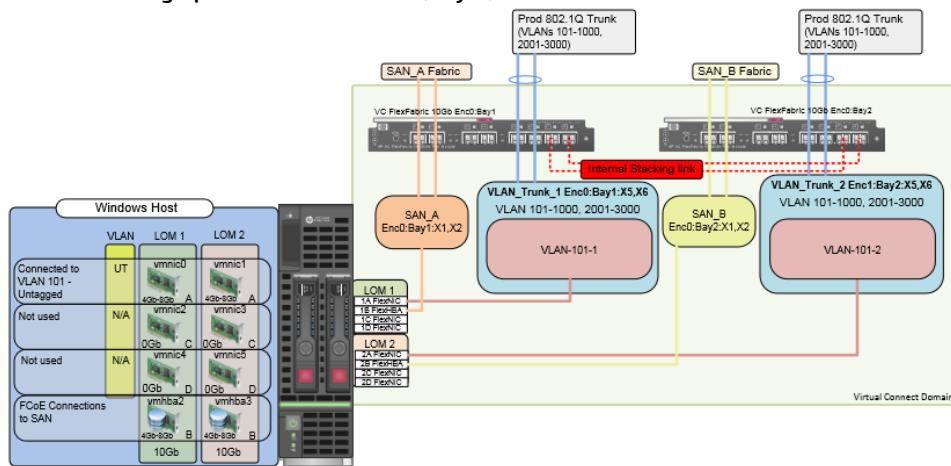
## **Requirements**

This scenario will support both Ethernet and fibre channel connectivity. In order to implement this scenario, an HP BladeSystem c7000 enclosure with one or more server blades and TWO Virtual Connect FlexFabric 10/24-Port modules, installed in I/O Bays 1 & 2 are required. In addition, we will require ONE or TWO external Network switches. As Virtual Connect does not appear to the network as a switch and is transparent to the network, any standard managed switch will work with Virtual Connect. The fibre channel uplinks will connect to the existing FC SAN fabrics. The SAN switch ports will need to be configured to support NPIV logins. Two uplinks from each FlexFabric module will be connected to the existing SAN fabrics.

**Figure 81 - Physical View;** Shows two Ethernet uplinks from Ports X5 and X6 on Module 1 and 2 to Ports 1 and 2 on each network switch. The SAN fabrics are also connected redundantly, with TWO uplinks per fabric, from ports X1 and X2 on module 1 to Fabric A and ports X1 and X2 to Fabric B.



**Figure 82 - Logical View;** The server blade profile is configured with TWO FlexNICs and 2 FlexHBAs. NICs 1 and 2 are connected to VLAN-101-x which are part of the Shared Uplink Sets, VLAN-Trunk-1 and VLAN-Trunk-2 respectively. The VLAN-Trunks are connected, at 10Gb, to a network switch, through Ports X5 and X6 on each FlexFabric 10/24-Port Module in Bays 1 and 2. The FCoE SAN connections are connected through ports X1 and X2 on each FlexFabric 10/24-Port module. In addition, SAN Fabric FCoE\_A connects to the existing SAN Fabric A through port X1 on Module 1 (Bay 1) and FCoE\_B connects to the existing SAN Fabric B through port X1 on Module 2 (Bay 2).



# Installation and configuration

## Switch configuration

As the Virtual Connect module acts as an edge switch, Virtual Connect can connect to the network at either the distribution level or directly to the core switch.

The appendices provide a summary of the cli commands required to configure various switches for connection to Virtual Connect. The configuration information provided in the appendices for this scenario assumes the following information:

- The switch ports are configured as VLAN TRUNK ports (tagging) to support several VLANs. All frames will be forwarded to Virtual Connect with VLAN tags. Optionally, one VLAN could be configured as (Default) untagged, if so, then a corresponding vNet within the Shared Uplink Set would be configured and set as “Default”

**Note:** When adding additional uplinks to the SUS, if the additional uplinks are connecting from the same FlexFabric 10/24-Port module to the same switch, in order to ensure all The uplinks are active, the switch ports will need to be configured for LACP within the same Link Aggregation Group.

The network switch port should be configured for Spanning Tree Edge as Virtual Connect appears to the switch as an access device and not another switch. By configuring the port as Spanning Tree Edge, it allows the switch to place the port into a forwarding state much quicker than otherwise, this allows a newly connected port to come online and begin forwarding much quicker.

The SAN switch ports connecting to the FlexFabric 10/24-Port module must be configured to accept NPIV logins.

## Configuring the VC module

- Physically connect Port 1 of network switch 1 to Port X5 of the VC module in Bay 1
- Physically connect Port 2 of network switch 1 to Port X6 of the VC module in Bay 1
- Physically connect Port 1 of network switch 2 to Port X5 of the VC module in Bay 2
- Physically connect Port 2 of network switch 2 to Port X6 of the VC module in Bay 2

**Note:** If you have only one network switch, connect VC ports X5 and X6 (Bay 2) to an alternate port on the same switch. This will NOT create a network loop and Spanning Tree is not required.

- Physically connect Ports X1/X2 on the FlexFabric in module Bay 1 to switch ports in SAN Fabric A
- Physically connect Ports X1/X2 on the FlexFabric in module Bay 2 to switch ports in SAN Fabric B

## VC CLI commands

Many of the configuration settings within VC can also be accomplished via a CLI command set. In order to connect to VC via a CLI, open an SSH connection to the IP address of the active VCM. Once logged in, VC provides a CLI with help menus. Through this scenario the CLI commands to configure VC for each setting will also be provided.

## Configuring Expanded VLAN Capacity via GUI

Virtual Connect release 3.30 provided an expanded VLAN capacity mode when using Shared Uplink Sets, this mode can be enabled through the Ethernet Settings tab or the VC CLI. The default configuration for a new Domain install is “Expanded VLAN Capacity” mode, Legacy mode is no longer available and the Domain cannot be downgraded.

Virtual Connect 4.30 now provides the ability to define up to 4096 VLANs then consume only the VLANs you need, when you need them. There is nothing to change or enable to take advantage of the 4096 VLAN feature.

## To verify the VLAN Capacity mode

- On the Virtual Connect Manager screen, Left pane, click Ethernet Settings, Advanced Settings
- Select Expanded VLAN capacity
- Verify Expanded VLAN Capacity is configured and Legacy VLAN Capacity is greyed out.

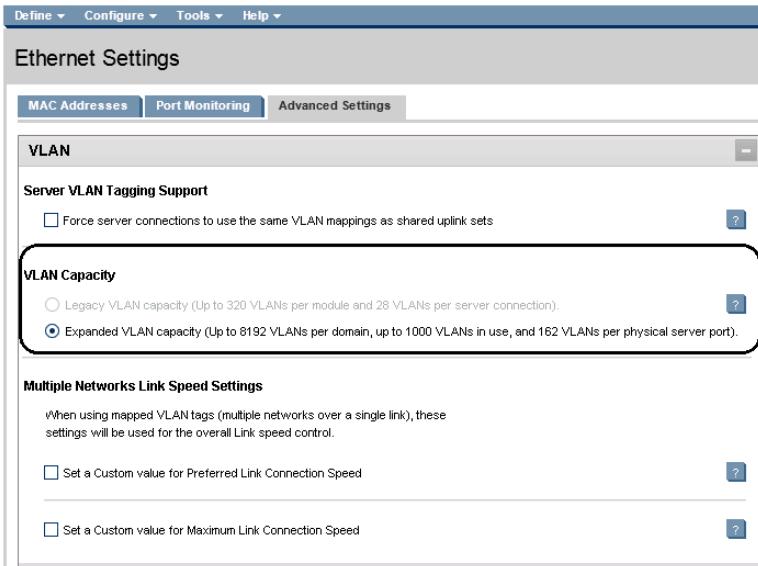
**Note:** Legacy VLAN mode will only be presented if 1Gb Virtual Connect Modules are present, in which case the domain would be limited to Firmware version 3.6x.

## Configuring Expanded VLAN Capacity via CLI

The following command can be copied and pasted into an SSH based CLI session with Virtual Connect;

```
# Set Expanded VLAN Capacity  
set enet-vlan -quiet VlanCapacity=Expanded
```

**Figure 83 - Enabling Expanded VLAN Capacity**



**Note:** If a 1Gb VC Ethernet module is present in the Domain, Expanded VLAN capacity will be greyed out, this is only supported with 10Gb and 20Gb based Virtual Connect modules. Also, once Expanded VLAN capacity is selected, moving back to Legacy VLAN capacity mode will require a domain deletion and rebuild.

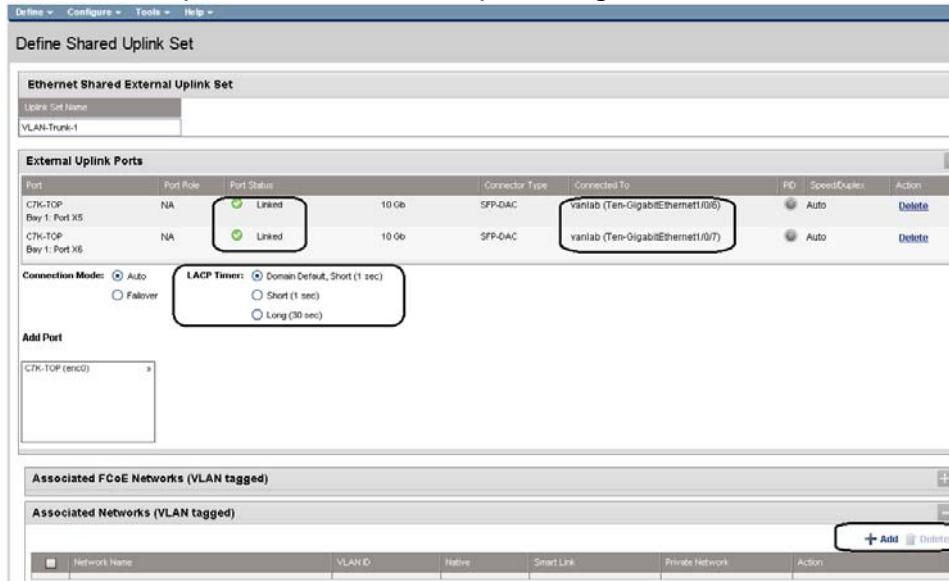
## Defining a new Shared Uplink Set (VLAN-Trunk-1)

Connect Ports X5 and X6 of FlexFabric 10/24-Port module in Bay 1 to Ports 1 and 2 on switch 1

Create a SUS named VLAN-Trunk-1 and connect it to FlexFabric 10/24-Port Ports X5 and X6 on Module 1

- On the Virtual Connect Home page, select Define, Shared Uplink Set
- Insert Uplink Set Name as VLAN-Trunk-1
- Select Add Port, then add the following port;
  - Enclosure 1, Bay 1, Port X5
  - Enclosure 1, Bay 1, Port X6

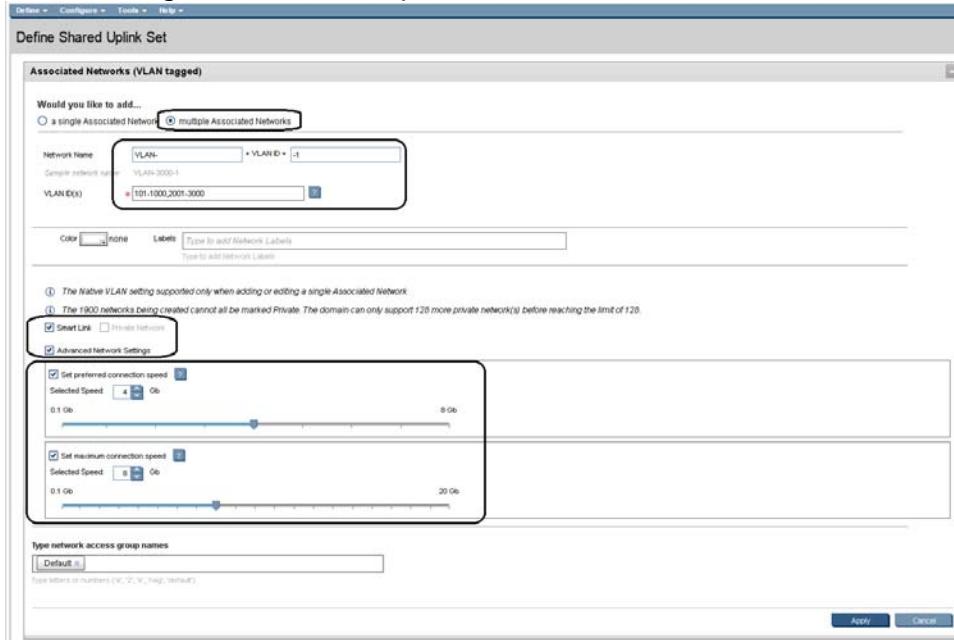
**Figure 84 - Shared Uplink Set (VLAN-Trunk-1) Uplinks Assigned**



- Click Add Networks and select the Multiple Networks radio button and add the following VLANs;
  - Enter Name as VLAN-
  - Enter Suffix as -1
  - Enter VLAN IDs as follows (and shown in the following graphic);
  - 101-1000,2001-3000
- Enable SmartLink on ALL networks
- Click Advanced
  - Configure Preferred speed to 4Gb
  - Configure Maximum speed to 8Gb
- Click Apply

**Note:** You can optionally specify a network “color” or “Label” when creating a shared Uplinkset and its networks. In the example above we have not set either color or label. Also notice the new configurable LACP Timer setting.

**Figure 85 - Creating VLANs in a Shared Uplink Set**



**Note:** If the VC domain is not in Expanded VLAN capacity mode, you will receive an error when attempting to create more than 128 VLANs in a SUS. If that occurs, go to Advanced Ethernet Settings and select Expanded VLAN capacity mode and apply.

After clicking apply, a list of VLANs will be presented as shown below. If one VLAN in the trunk is untagged/native, see note below.

- Click Apply at the bottom of the page to create the Shared Uplink Set

**Figure 86 - Associated VLANs for Shared Uplink Set VLAN-Trunk-1**

Network Name	VLAN ID	Native	Smart Link	Private Network	Action
VLAN-101-1	101	false	true	false	Edit
VLAN-102-1	102	false	true	false	Edit
VLAN-103-1	103	false	true	false	Edit
VLAN-104-1	104	false	true	false	Edit
VLAN-105-1	105	false	true	false	Edit
VLAN-106-1	106	false	true	false	Edit
VLAN-107-1	107	false	true	false	Edit
VLAN-108-1	108	false	true	false	Edit
VLAN-109-1	109	false	true	false	Edit
VLAN-110-1	110	false	true	false	Edit
VLAN-111-1	111	false	true	false	Edit
VLAN-112-1	112	false	true	false	Edit
VLAN-113-1	113	false	true	false	Edit
VLAN-114-1	114	false	true	false	Edit
VLAN-115-1	115	false	true	false	Edit
VLAN-116-1	116	false	true	false	Edit
VLAN-117-1	117	false	true	false	Edit
VLAN-118-1	118	false	true	false	Edit
VLAN-119-1	119	false	true	false	Edit
VLAN-120-1	120	false	true	false	Edit
VLAN-121-1	121	false	true	false	Edit
VLAN-122-1	122	false	true	false	Edit
VLAN-123-1	123	false	true	false	Edit
VLAN-124-1	124	false	true	false	Edit

**Note:** Optionally, if one of the VLANs in the trunk to this shared uplink set were configured as Native or Untagged, you would be required to “edit” that VLAN in the screen above, and configure Native as TRUE. This would need to be set for BOTH VLAN-Trunk-1 and VLAN-Trunk-2.

**Figure 87 - You will see that ALL Uplinks are still in a Linked/Standby state**

Shared Uplink Set	Has FCoE	Port Status	Connector Type	Uplink Port	Action
VLAN-Trunk-1	false	<input checked="" type="checkbox"/> Linked-Standby <input checked="" type="checkbox"/> Linked-Standby	10 Gb SFP-DAC	<input checked="" type="checkbox"/> C7K-TOP: Bay 1: Port X5 <input checked="" type="checkbox"/> C7K-TOP: Bay 1: Port X6	Edit
VLAN-Trunk-2					

**Note:** That both of the network connections are shown as “Linked/Standby”, this state will NOT change until the network has been assigned to a server profile. This behavior is new within VC 4.30 and is provided to accommodate the new 4096 VLAN feature.

### Defining a new Shared Uplink Set (VLAN-Trunk-2)(Copying a Shared Uplink Set)

The second Shared Uplink Set could be created in the same manner as VLAN-Trunk-1 however; VC now provides the ability to COPY a VC Network or Shared Uplink Set.

- Connect Ports X5 and X6 of FlexFabric 10/24-Port module in Bay 2 to Ports 1 and 2 on switch 2
- In the VC GUI screen, select Shared Uplink Sets in the left pane, in the right pane VLAN-Trunk-1 will be displayed, left click VLAN-Trunk-1, it will appear as blue, right click and select COPY
- Edit the Settings as shown below, the new SUS name will be VLAN-Trunk-2 and ALL the associated VLANs with have a suffix of 2
- In step 3, ADD uplinks X5 and X6 from Bay 2
- Click OK
- The SUS and ALL VLANs will be created

**Figure 88 - Copying a SUS and ALL VLANs**

Copy Shared Uplink Set

1 Shared Uplink Set Name  
Name: VLAN-Trunk-2

2 Associated Networks (VLANs)  
Replace last instance(s) of 1 with 2

VLAN-Trunk-1 Original		VLAN-Trunk-2 Copy	
VLAN-101-1		VLAN-101-2	
VLAN-102-1		VLAN-102-2	
VLAN-103-1		VLAN-103-2	
VLAN-104-1		VLAN-104-2	
VLAN-105-1		VLAN-105-2	
VLAN-106-1		VLAN-106-2	

3 External Uplink Ports

Port	Port Role	Port Status	Connector Type	Connected To

## Defining a new Shared Uplink Set via CLI

The following script can be used to create the first Shared Uplink Set (VLAN-Trunk-1)

*The following command(s) can be copied and pasted into an SSH based CLI session with Virtual Connect*

```
# Create Shared Uplink Set VLAN-Trunk-1 and configure uplinks
```

```
add uplinkset VLAN-Trunk-1
add uplinkport enc0:1:X5 UplinkSet=VLAN-Trunk-1 speed=auto
add uplinkport enc0:1:X6 UplinkSet=VLAN-Trunk-1 speed=auto

# Create Networks VLAN-1001-1 through VLAN-1000-1 and VLAN-2001-1 through VLAN-3000-1
# for Shared Uplink Set VLAN-Trunk-1
add network-range -quiet UplinkSet=VLAN-Trunk-1 NamePrefix=VLAN- NameSuffix=-1
VLANIds=101-1000,2101-3000 State=enabled PrefSpeedType=Custom PrefSpeed=4000
MaxSpeedType=Custom MaxSpeed=8000 SmartLink=enabled
```

The following script can be used to create the Second Shared Uplink Set (VLAN-Trunk-2)

```
# Create Shared Uplink Set VLAN-Trunk-2 and configure uplinks
```

```
add uplinkset VLAN-Trunk-2
add uplinkport enc0:2:X5 UplinkSet=VLAN-Trunk-2 speed=auto
add uplinkport enc0:2:X6 UplinkSet=VLAN-Trunk-2 speed=auto
```

```
# Create Networks VLAN101-2 through VLAN1000-2 and VLAN-2001-2 through VLAN-3000-2
# for Shared Uplink Set VLAN-Trunk-2
add network-range -quiet UplinkSet=VLAN-Trunk-2 NamePrefix=VLAN- NameSuffix=-2
VLANIds=101-1000,2101-3000 State=enabled PrefSpeedType=Custom PrefSpeed=4000
MaxSpeedType=Custom MaxSpeed=8000 SmartLink=enabled
```

Please refer to Appendix D; “Scripting the Native VLAN” for scripting examples.

**Note:** In this scenario we have created two independent Share Uplink Sets (SUS), each originating from the opposite FlexFabric 10/24-Port Modules, by doing so we provide the ability to create separate and redundant connections out of the Virtual Connect domain. When we create the server profiles, you will see how the NICs will connect to VLANs accessed through the opposite VC module, which provides the ability to create an Active / Active uplink scenario. Alternatively, we could have created a single SUS and assigned both sets of these uplink ports to the same SUS, however, this would have provided an Active/Standby uplink scenario, as shown in Scenario 5.

## Defining a new (FCoE) SAN Fabric via GUI

Create a Fabric and name it “FCoE\_A”

- On the Virtual Connect Manager screen, click Define, SAN Fabric to create the first Fabric
- Enter the Network Name of “FCoE\_A”
- Select Add Port, then add the following ports:
  - Enclosure 1, Bay 1, Port X1
  - Enclosure 1, Bay 1, Port X2
- Ensure Fabric Type is set to “FabricAttach”
- Select Show Advanced Settings
  - Select Automatic Login Re-Distribution (FlexFabric Only)
  - Select Set Preferred FCoE Connect Speed
    - Configure for 4Gb
  - Select Set Maximum FCoE Connect Speed
    - Configure for 8Gb
- Select Apply

Create a second Fabric and name it "FCoE\_B"

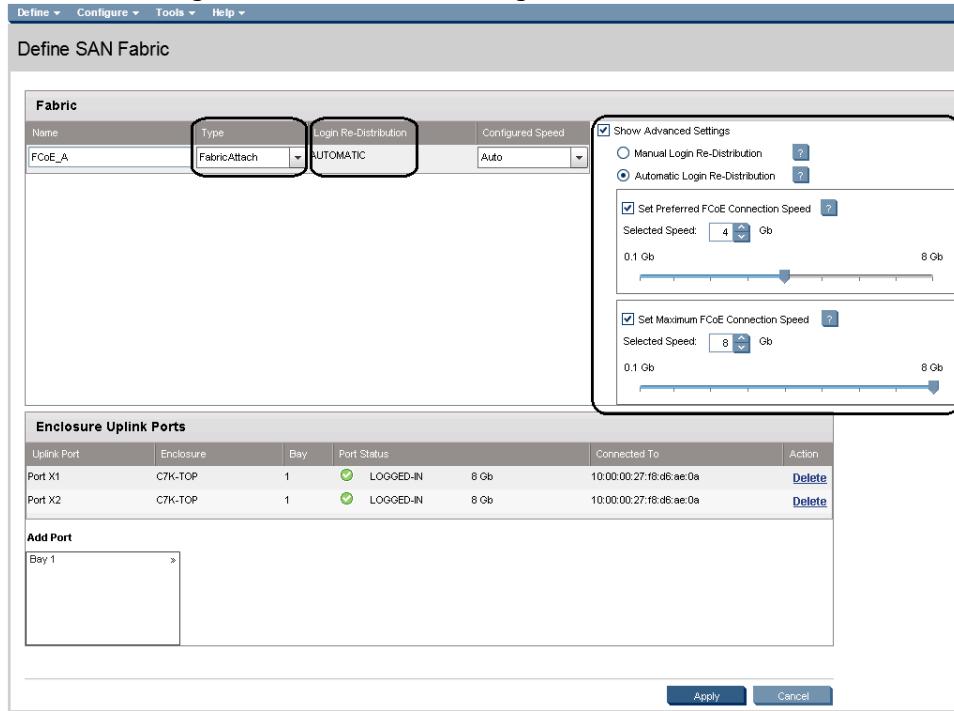
- On the Virtual Connect Manager screen, click Define, SAN Fabric to create the second Fabric
- Enter the Network Name of "FCoE\_B"
- Select Add Port, then add the following ports:
  - Enclosure 1, Bay 2, Port X1
  - Enclosure 1, Bay 2, Port X2
- Ensure Fabric Type is set to "FabricAttach"
- Select Show Advanced Settings
  - Select Automatic Login Re-Distribution (FlexFabric Only)
  - Select Set Preferred FCoE Connect Speed
    - Configure for 4Gb
  - Select Set Maximum FCoE Connect Speed
    - Configure for 8Gb
- Select Apply

## Defining SAN Fabrics via CLI

The following command(s) can be copied and pasted into an SSH based CLI session with Virtual Connect

```
#Create the SAN Fabrics FCoE_A and FCoE_B and configure uplinks as discussed above
add fabric FCoE_A Type=FabricAttach Bay=1 Ports=1,2 Speed=Auto LinkDist=Auto
PrefSpeedType=Custom PrefSpeed=4000 MaxSpeedType=Custom MaxSpeed=8000
add fabric FCoE_B Type=FabricAttach Bay=2 Ports=1,2 Speed=Auto LinkDist=Auto
PrefSpeedType=Custom PrefSpeed=4000 MaxSpeedType=Custom MaxSpeed=8000
```

**Figure 89 - SAN Configuration and Advanced Settings**



**Figure 90 - FCoE SAN fabrics configured with two 8Gb uplinks per fabric. Note the bay and port numbers on the right**

SAN Fabrics										
External Connections			Server Connections							
Status	SAN Fabric	Type	Login Re-Distribution	Port Status	Connected To	Enclosure	Bay	Port	Action	
<span style="color: green;">✓</span>	FCoE_A	FabricAttach	AUTOMATIC	<span style="color: green;">✓</span> LOGGED-IN	8 Gb	10:00:00:27:f8:d6:ae:0a	C7K-TOP	1	X1	<span style="color: blue;">Edit</span> <span style="color: blue;">▼</span>
				<span style="color: green;">✓</span> LOGGED-IN	8 Gb	10:00:00:27:f8:d6:ae:0a	C7K-TOP	1	X2	<span style="color: blue;">Edit</span> <span style="color: blue;">▼</span>
<span style="color: green;">✓</span>	FCoE_B	FabricAttach	AUTOMATIC	<span style="color: green;">✓</span> LOGGED-IN	8 Gb	10:00:00:27:f8:d6:8b:9c	C7K-TOP	2	X1	<span style="color: blue;">Edit</span> <span style="color: blue;">▼</span>
				<span style="color: green;">✓</span> LOGGED-IN	8 Gb	10:00:00:27:f8:d6:8b:9c	C7K-TOP	2	X2	<span style="color: blue;">Edit</span> <span style="color: blue;">▼</span>

## Defining a Server Profile

We will create a server profile with two server NICs.  
Each server NIC will connect to a specific network.

- On the main menu, select Define, then Server Profile
- Create a server profile called “App-1”
- Select to “Hide Unused FlexNICs”
- In the Network Port 1 drop down box, select VLAN-101-1
- In the Network Port 2 drop down box, select VLAN-101-2
- Expand the FCoE Connections box, for Bay 1, select FCoE\_A for Bay 2, select FCoE\_B
- Select the “Fibre Channel Boot Parameters” box under the FCoE configuration box
  - Select PORT 1 and click on the drop down under “SAN Boot” and select “Primary”
  - Click on the Target Port Name field and enter the SAN controller ID
  - Click on the LUN field and enter the boot LUN number, which is typically 1
  - Click on PORT 2 and click on the drop down under “SAN Boot” and select “Secondary”
  - Click on the Target Port Name field and enter the SAN controller ID
  - Click on the LUN field and enter the boot LUN number, which is typically 1
  - Click Apply
- Do not configure iSCSI HBA or FC HBA Connection
- In the Assign Profile to Server Bay box, locate the Select Location drop down and select Bay 1, then apply

Prior to applying the profile, ensure that the server in Bay 1 is currently OFF

**Note:** You should now have a server profile assigned to Bay 1, with 2 Server NIC connections. NICs 1&2 should be connected to networks VLAN101-1 and VLAN101-2 and FCoE SAN fabrics FCoE\_A and FCoE\_B.

## Defining a Server Profile via CLI

The following command(s) can be copied and pasted into an SSH based CLI session with Virtual Connect

```
# Create Server Profile App-1
add profile App-1 -nodefaultfcconn -nodefaultfcoeconn NAG=Default HideUnusedFlexNICs=true
set enet-connection App-1 1 pxe=Enabled Network=VLAN-101-1
set enet-connection App-1 2 pxe=Disabled Network=VLAN-101-2
add fcoe-connection App-1
set fcoe-connection App-1:1 Fabric=FCoE_A SpeedType=4Gb BootPriority=Primary
BootPort=50:08:05:F3:00:00:58:11 BootLun=1
add fcoe-connection App-1
set fcoe-connection App-1:2 Fabric=FCoE_B SpeedType=4Gb BootPriority=Secondary
BootPort=50:08:05:F3:00:00:58:12 BootLun=1
poweroff server 1
assign profile App-1 enc0:1
```

**Note:** You will need to locate the WWN and Boot LUN numbers for the controller you are booting to and substitute the addresses above.

**Note:** The speed of the NIC and SAN connections, as well as the MAC and WWN. Also, note that the FCoE connections are assigned to the two SAN fabrics created earlier and use ports LOM:1-b and LOM:2-b.

**Figure 91 - Define a Server Profile (App-1)**

The screenshot shows the 'Edit Server Profile: App-1' window. At the top, there are tabs for 'Delete', 'Configure', 'Tools', and 'Help'. Below the tabs, the profile name is set to 'App-1' and the boot mode is 'Auto'. The 'Hide Unused FlexNICs' checkbox is checked.

**Ethernet Adapter Connections:**

Port	Network Name	Status	Port Speed Type	Allocated Port Spd...	PXE/PE Boot Order	Multicast Filter	MAC	Mapping	Action
1	VLAN-101-1	PREFERRED	4 Gb - 8 Gb	4 Gb - 8 Gb	USE-BIOS	None	00-17-A4-77-7C-02	LOM1-1-a => Bay 1.d1.v1	
2	VLAN-101-2	PREFERRED	4 Gb - 8 Gb	4 Gb - 8 Gb	USE-BIOS	None	00-17-A4-77-7C-04	LOM1-2-a => Bay 2.d1.v1	

**iSCSI HBA Connections:**

**FCoE HBA Connections:**

Port	Connected To	FC SAN / FCoE Network Name	Type	Status	Port Speed Type	Allocated Port Sp...	WWPN	MAC	Mapping	Action
1	Bay 1	FCoE_A	SAN	PREFERRED	4 Gb - 8 Gb	4 Gb - 8 Gb	50:08:00:00:00:C2:DE:00	00-17-A4-77-7C-00	LOM1-1-b => Bay 1.d1.v2	
2	Bay 2	FCoE_B	SAN	PREFERRED	4 Gb - 8 Gb	4 Gb - 8 Gb	50:08:00:00:00:C2:DE:02	00-17-A4-77-7C-01	LOM1-2-b => Bay 2.d1.v2	Delete

**Assign Profile to Server Bay:**

Enclosure	Server	Model	SN	Status	Power	UD
CTK-TOP	Bay 1	ProLiant BL460c Gen8	MX042401QG	Green	On	

**Figure 92 - Boot from SAN Connection Settings**

The screenshot shows the 'FCoE HBA Connections' dialog. It lists two ports: Port 1 (PRIMARY) and Port 2 (SECONDARY). The SAN Boot column contains the WWPN for each port. The Target Port Name (WWPN) column is empty. The LUN column shows value 1 for both ports.

Port	SAN Boot	Target Port Name (WWPN)	LUN
1	PRIMARY	50:08:05:F3:00:00:58:11	1
2	SECONDARY	50:08:05:F3:00:00:58:12	1

At the bottom, there are 'Apply' and 'Cancel' buttons.

**Note:** When choosing the Primary and Secondary ports, ensure that each port can access the ID provided on the fabric, the SAN Administrator should be able to provide this address, or it can also be discovered through the HBA/FlexFabric Adapter BIOS utilities. The LUN number will vary depending on SAN Array vendor/model and the order in which the LUNs were assigned to the host within the SAN configuration.

**Figure 93 - Server Profile View Bay 1**

The screenshot shows the 'Server Profile View Bay 1' interface. At the top, there's a navigation bar with 'Define', 'Configure', 'Tools', and 'Help' dropdowns. Below the navigation bar, the title 'Bay 1 (ProLiant BL460c Gen8)' is displayed.

**Device Bay Status - Bay # 1**

Overall Status:	Green checkmark
Hardware Status:	Green checkmark
VC Status:	Green checkmark
Assigned Server Profile:	App-1
Enclosure Name:	C7K-TOP
UID:	Gray circle icon
Power Status/Control:	Orange circle icon labeled 'Off' with a 'Momentary Press' button below it.

**Blade Server Information - Bay # 1**

Serial Number:	MXQ42401QG
Serial Number (Logical):	VCX0000V00
UUID:	30343237-3638-584D-5134-323430315147
UUID (Logical):	c47df6cf-427c-417d-9429-1dc8e6f565e0
Product Name:	ProLiant BL460c Gen8
Server Name:	APP-1
Part Number:	724086-B21
Asset Tag:	[Unknown]
UEFI Capable:	false
Boot Mode:	Legacy

**Server Ethernet Adapter Information**

Ethernet Adapter	Flex NIC	Location	Module Port	Model	MAC Address	Network	WWN	SAN Fabric
<b>Port 1</b>								
LOM1:1-a	FLB1	Bay 1:d1:y1	HP FlexFabric 10Gb 2-Port 534FLB Adapter	00-17-A4-77-7C-02	VLAN-101-1			
LOM1:1-b	FLB1	Bay 1:d1:y2	HP FlexFabric 10Gb 2-Port 534FLB Adapter	00-17-A4-77-7C-00	50:06:0B:00:00:C2:DE:00	FCoE_A		
LOM1:1-c	FLB1	Bay 1:d1:y3	HP FlexFabric 10Gb 2-Port 534FLB Adapter	9C-B6-54-87-5F-92				
LOM1:1-d	FLB1	Bay 1:d1:y4	HP FlexFabric 10Gb 2-Port 534FLB Adapter	9C-B6-54-87-5F-93				
<b>Port 2</b>								
LOM1:2-a	FLB1	Bay 2:d1:y1	HP FlexFabric 10Gb 2-Port 534FLB Adapter	00-17-A4-77-7C-04	VLAN-101-2			
LOM1:2-b	FLB1	Bay 2:d1:y2	HP FlexFabric 10Gb 2-Port 534FLB Adapter	00-17-A4-77-7C-01	50:06:0B:00:00:C2:DE:02	FCoE_B		
LOM1:2-c	FLB1	Bay 2:d1:y3	HP FlexFabric 10Gb 2-Port 534FLB Adapter	9C-B6-54-87-5F-96				
LOM1:2-d	FLB1	Bay 2:d1:y4	HP FlexFabric 10Gb 2-Port 534FLB Adapter	9C-B6-54-87-5F-97				

## Verify Network Link State

As discussed earlier in this document, in Virtual connect 4.30 there was a change to the link state behavior when a network as no connections to a server profile. Once a connection is made to the server profile, the uplinks will become Active, as previously expected.

**Figure 94 - All Links now appear in a Linked/Active state.**

The screenshot shows the 'Shared Uplink Sets' interface. At the top, there's a navigation bar with 'Define', 'Configure', 'Tools', and 'Help' dropdowns. Below the navigation bar, the title 'Shared Uplink Sets' is displayed.

**Shared Uplink Sets**

External Connections	Associated Networks	Port Status				Action	
		<input checked="" type="checkbox"/> VLAN-Trunk-1	false	<input checked="" type="checkbox"/> Linked-Active	10 Gb SFP-DAC	<input checked="" type="checkbox"/> C7K-TOP: Bay 1: Port X5	<b>Edit</b>
		<input checked="" type="checkbox"/> VLAN-Trunk-2	false	<input checked="" type="checkbox"/> Linked-Active	10 Gb SFP-DAC	<input checked="" type="checkbox"/> C7K-TOP: Bay 1: Port X6	<b>Edit</b>
				<input checked="" type="checkbox"/> Linked-Active	10 Gb SFP-DAC	<input checked="" type="checkbox"/> C7K-TOP: Bay 2: Port X5	<b>Edit</b>
				<input checked="" type="checkbox"/> Linked-Active	10 Gb SFP-DAC	<input checked="" type="checkbox"/> C7K-TOP: Bay 2: Port X6	<b>Edit</b>

## Installing Windows 2012 R2 for Boot to SAN with Broadcom FlexFabric Adapters (534/630)

As the Broadcom FlexFabric Adapters are relatively new, their drivers are not included within the Windows 2012R2 distribution ISO. The Whitepaper linked below provides details on how to prepare the Windows media with the latest Broadcom drivers. Prior to attempting to install Windows 2012 R2 for Boot to SAN, please review this whitepaper and take the appropriate actions.

### HP Boot from SAN Configuration Guide:

<http://bizsupport2.austin.hp.com/bc/docs/support/SupportManual/c01861120-5/c01861120-5.pdf>

**Note:** I found that in order to slipstream the drivers in to Windows 2012 R2, that a newer version of the Microsoft Deployment and Integration Toolkit was required (Windows 8.1 Update, using DISM 6.3.9600.17029).

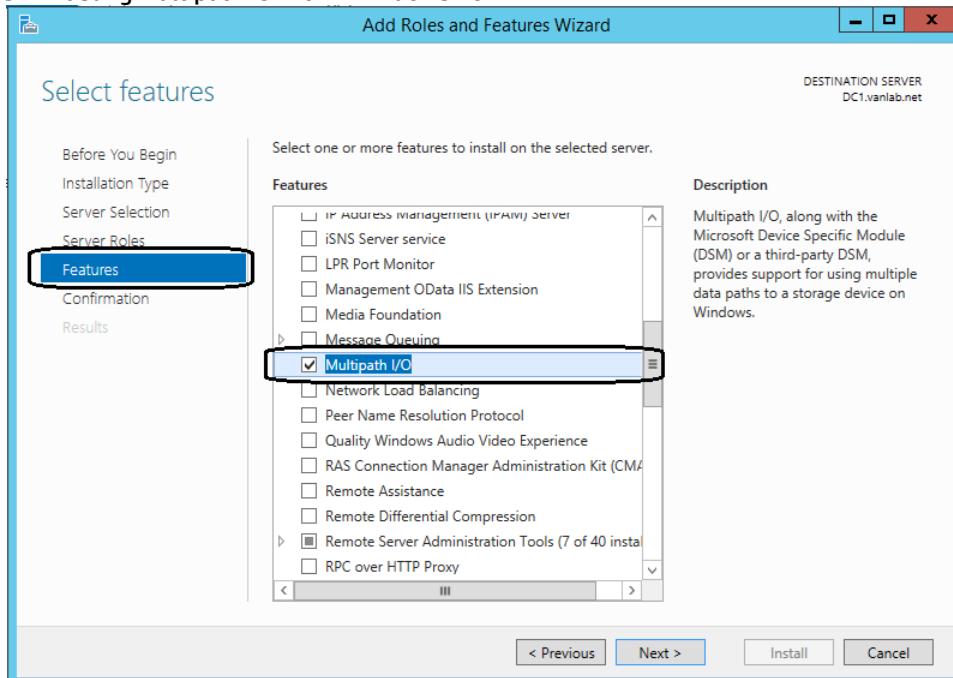
## Enabling MPIO on Windows 2012 R2

As discussed in the Whitepaper referenced above, in order to install windows on to a Boot from SAN LUN, you will need to zone the server to a single path. Once the OS is installed, you will be required to enable the Multi-Path IO (MPIO) feature within Windows 2012 R2 and install the MPIO software for your SAN, you can then enable the additional SAN paths to the server/storage.

**Note:** Please refer to the FC Cookbook for HP Virtual Connect for additional details on Fibre Channel Connectivity.

<http://bizsupport1.austin.hp.com/bc/docs/support/SupportManual/c01702940/c01702940.pdf>

**Figure 95 - Enabling Multipath IO within Windows 2012R2**



# Review

In this scenario we have created Two Shared Uplink Sets (SUS), providing support for many VLANs. Uplinks originating from each FlexFabric 10/24-Port Module connect to each SUS, by doing so we provide redundant connections out of the Virtual Connect domain. As multiple uplinks are used for each SUS, we have also leveraged LACP to improve uplink performance. In this scenario, all uplinks will be active. We also created two FCoE SAN Fabrics.

We created a server profile, with two NICs connected to the same external VLAN (101) through VC networks VLAN-101-1 and VLAN-101-2, which provides the ability to sustain a link or module failure and not lose connection to the network. VLAN101-1 and VLAN101-2 are configured to support VLAN 101, frames will be presented to the NIC(s) without VLAN tags (untagged), these two NICs are connected to the same VLAN, but taking a different path out of the enclosure.

Additionally, FCoE port 1 is connected to SAN fabric FCoE\_A and FCoE SAN port 2 is connected to SAN Fabric FCoE\_B, providing a multi-pathed connection to the SAN. The server profile was also configured for Boot to SAN over the FCoE connections. With Virtual Connect, there is no need to configure the SAN HBA directly when booting to SAN, all required configuration is maintained in the server profile. During installation of windows 2012 R2, ensure that Microsoft the MPIO role is enabled and MPIO software for your SAN is also installed. The FCoE SAN fabric connects to each SAN fabric over two uplinks per module.

## Results – Windows 2012 R2 Networking Examples

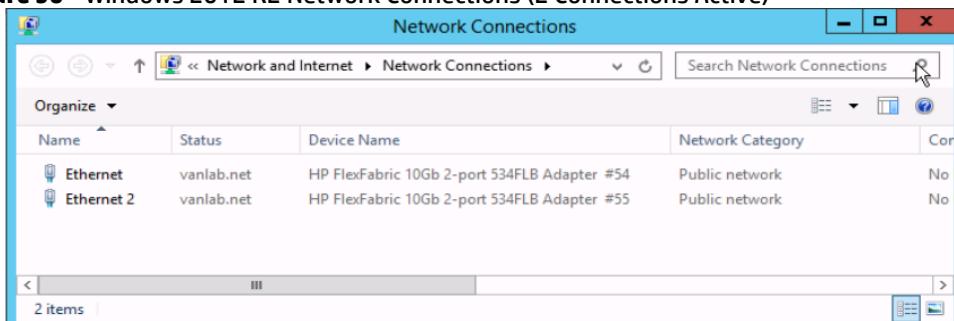
We have successfully configured FlexFabric with a shared uplink set and redundant SAN fabrics. We have created a server profile to connect the TWO NICs to VLAN 101 and the SAN fabrics using the FCoE connections created within the profile.

Although both Ethernet and Fibre channel connectivity is provided by the FlexFabric Adapter used in the G7 through Gen 9 servers; each capability (LAN and SAN) is provided by a different component of the adapter, they appear in the server as individual network and SAN adapters.

The following graphics show a Windows 2012 R2 server with TWO FlexNICs configured at 8Gb. You will also notice that Windows believes there are only 2 NICs within this server as we have configured the profile to hide the unused FlexNICs, the extra NICs are offline and could later be added to the profile, if needed. If we did not require SAN connectivity on this server, the FCoE connections could be deleted and the server would then have 8 NIC ports available to the OS.

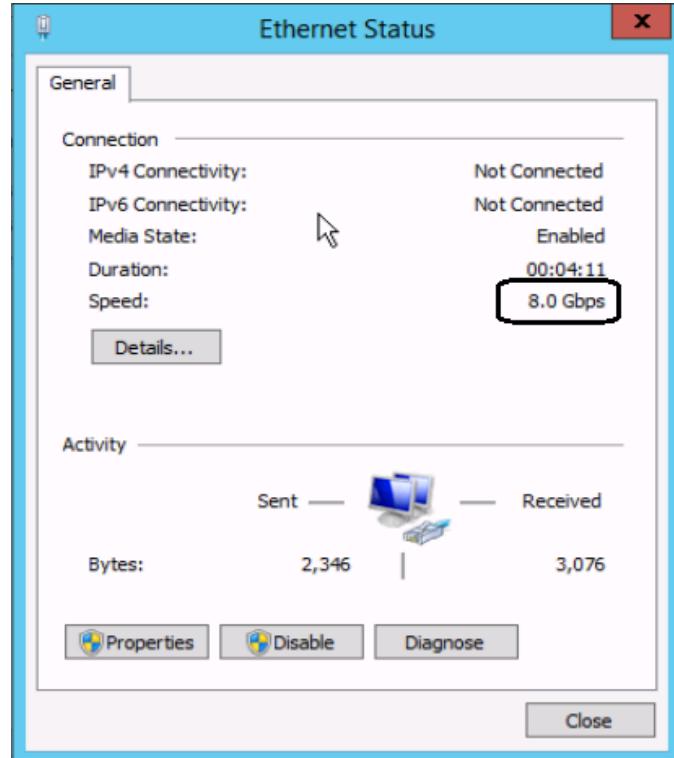
**Note:** The BL465c G7 and BL685c G7 utilize an NC551i chipset (BE2), whereas the BL460c G7, BL620c G7 and BL680c G7 utilize an NC553i chipset (BE3) and the Gen 8 blades typically have a NC554 adapter which also utilizes the BE3 chipset. Both the BE2 and BE3 chipsets share common drivers and firmware. Gen 8 Blade servers are provided with a “FlexLOM” which is a removal integrated Network adapter. This provides flexibility in NIC choice. The 554FLB is a B3 based chipset NIC, the 534FLB is a Broadcom based NIC. The example below is a 534FLB in a BL460c Gen 8 Blade server.

**Figure 96 - Windows 2012 R2 Network Connections (2 Connections Active)**



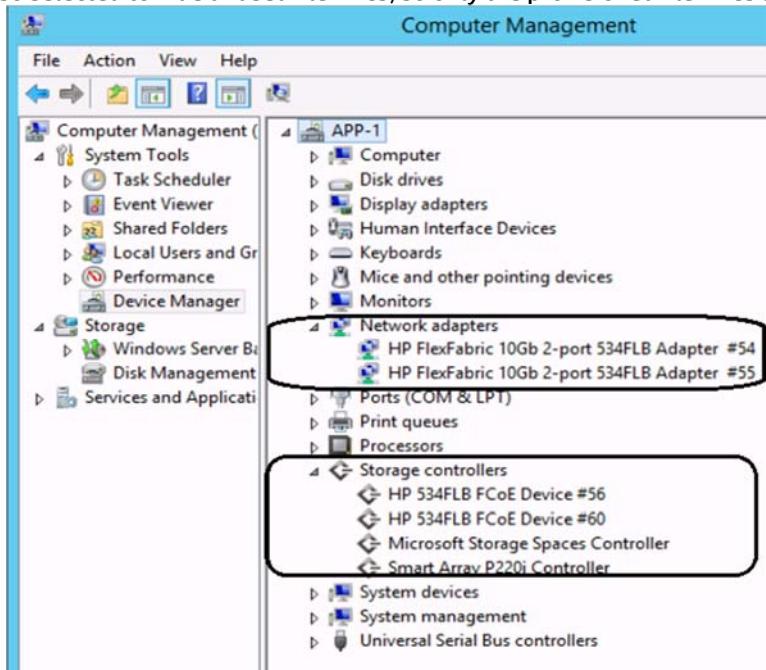
**Note:** If you are familiar with Virtual Connect Flex-10 technology, you will notice not all NICs were presented, and only the configured NICs are displayed. This is because we selected the new feature to hide unused FlexNICs.

**Figure 97 - Windows 2012 R2 Network Connection Status**



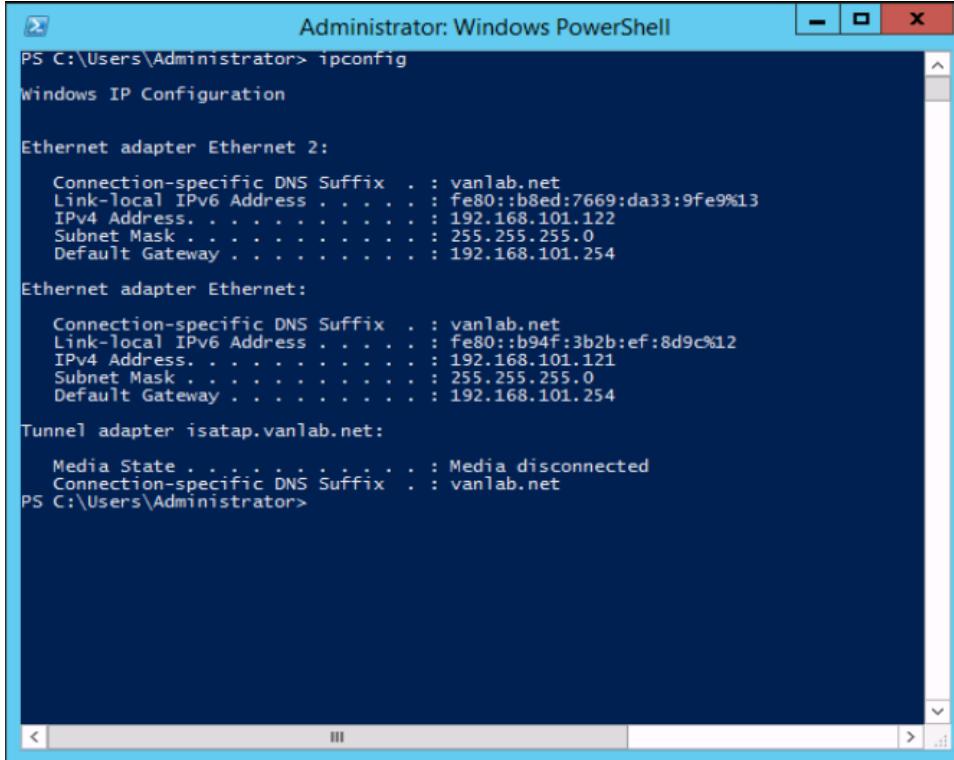
**Note:** As of Windows 2008 and later the actual NIC speed is displayed as configured in server Profile. Also, note that the speed displayed is the maximum speed setting, not the minimum setting.

**Figure 98 - Windows 2012 R2, Device Manager**, we have only configured two of the NICs and two FCoE HBAs. We also selected to hide unused FlexNICs, so only the provisioned FlexNICs are shown



The following graphics provides an example of a Windows 2012 R2 server with TWO NICs connected to the network, initially each NIC has its own TCP/IP address, alternatively, both NICs could be teamed to provide NIC fail-over redundancy. If an active uplink or network switch were to fail, Virtual Connect would fail-over to the standby uplink. In the event of a Virtual Connect FlexFabric module failure, the server's NIC teaming software would see one of the NICs go offline, assuming it was the active NIC, NIC teaming would fail-over to the standby NIC.

**Figure 99 - Both NICs for Profile App-1 are connected to the network through VLAN-101-x**



```

Administrator: Windows PowerShell
PS C:\Users\Administrator> ipconfig

Windows IP Configuration

Ethernet adapter Ethernet 2:

Connection-specific DNS Suffix . : vanlab.net
Link-local IPv6 Address . . . . . : fe80::b8ed:7669:da33:9fe9%13
IPv4 Address . . . . . : 192.168.101.122
Subnet Mask . . . . . : 255.255.255.0
Default Gateway . . . . . : 192.168.101.254

Ethernet adapter Ethernet:

Connection-specific DNS Suffix . : vanlab.net
Link-local IPv6 Address . . . . . : fe80::b94f:3b2b:ef:8d9c%12
IPv4 Address . . . . . : 192.168.101.121
Subnet Mask . . . . . : 255.255.255.0
Default Gateway . . . . . : 192.168.101.254

Tunnel adapter isatap.vanlab.net:

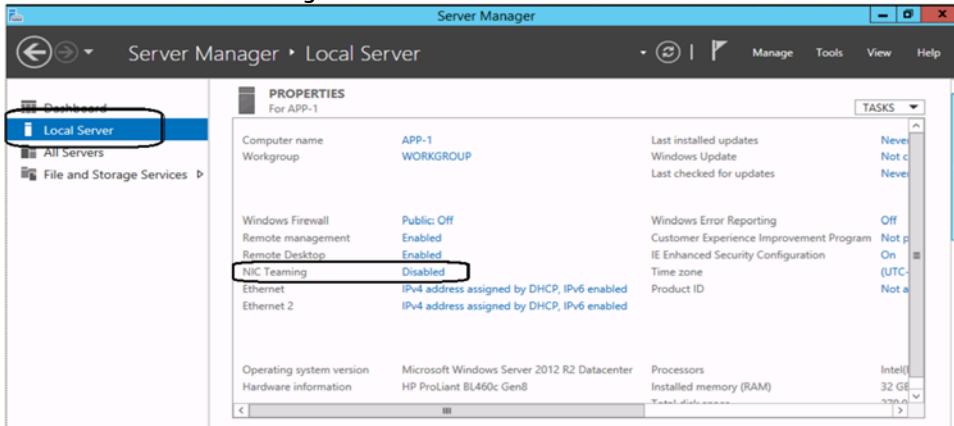
Media State . . . . . : Media disconnected
Connection-specific DNS Suffix . : vanlab.net
PS C:\Users\Administrator>

```

## NIC Teaming

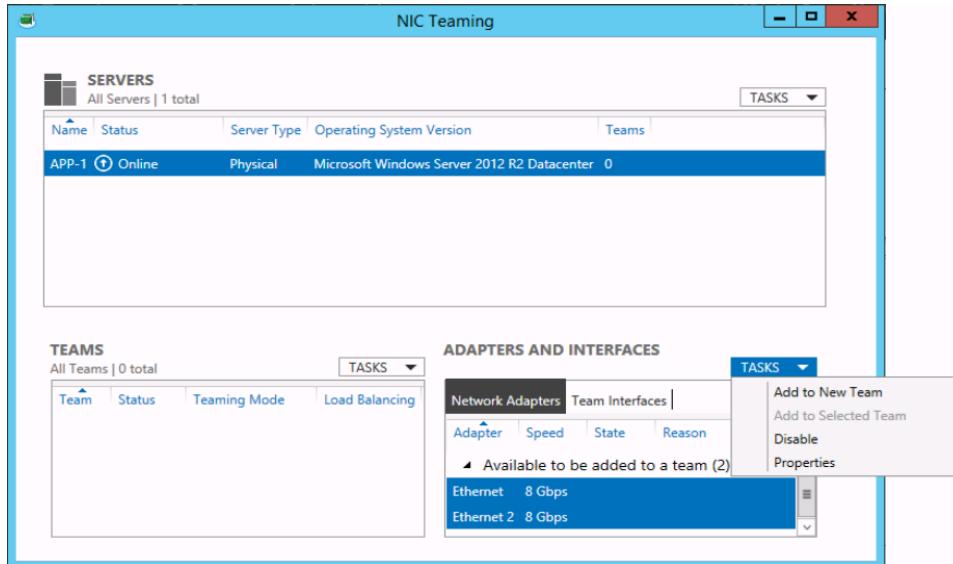
If higher availability is desired, NIC teaming in Virtual Connect works the same way as in standard network configurations. NIC Teaming is now provided as part of the Windows 2012 R2 OS. To configure NIC Teaming in windows 2012 R2, open Server Manager, select Local Server and click on “Disabled” to the right of NIC Teaming.

**Figure 100 - Enable NIC Teaming**



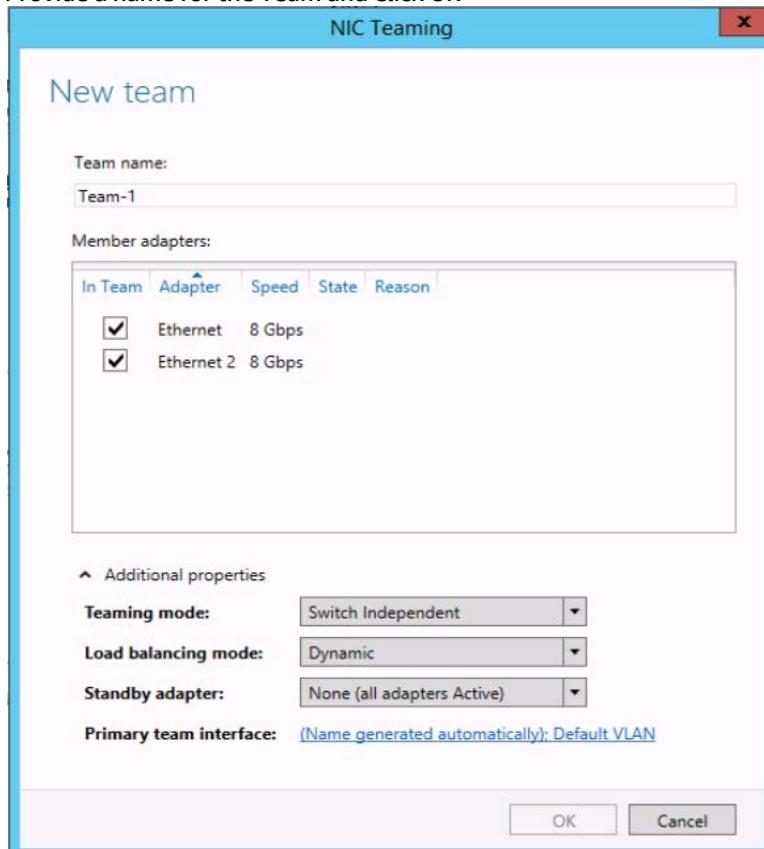
In the bottom right pane of the NIC teaming utility, highlight the two NICs you want to team and Click Tasks, then select “Add to team”.

**Figure 101 - Create the NIC Team**



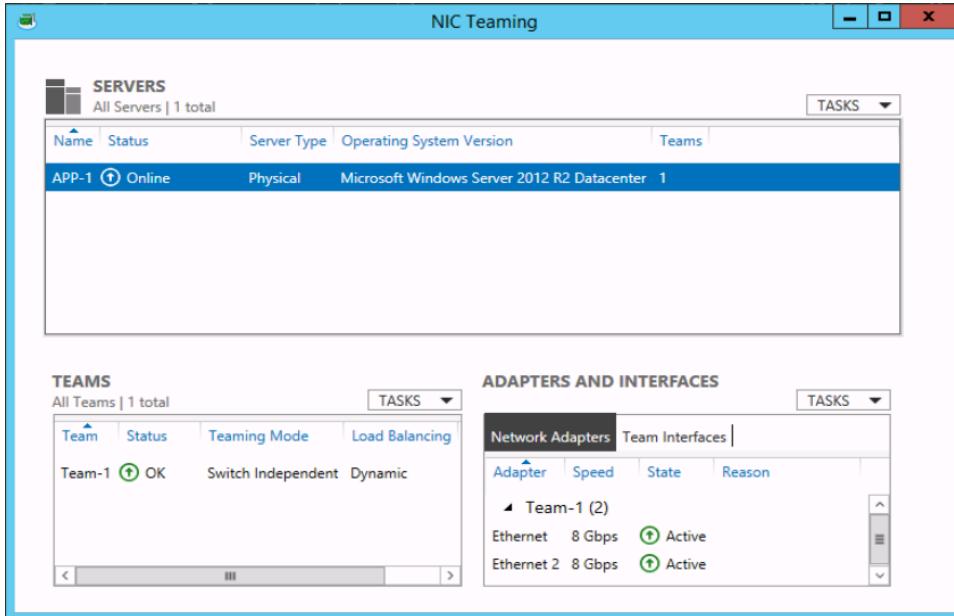
In the bottom right pane of the NIC teaming utility, highlight the two NICs you want to team and Click Tasks, then select “Add to team”. In the New Team configuration Box, provide a name for the Team and Click OK.

**Figure 102 - Provide a name for the Team and Click OK**



**Note:** You can select the Additional properties drop down and alter the Teaming Mode, the default mode of “Switch Independent” is supported with Virtual Connect, however, Static Teaming and LACP modes are not supported. You can also select Load Balancing and adapter standby modes.

**Figure 103 - NIC Team has been established and both links show as active**



**Figure 104 - Both NICs are teamed and connect to the network with a common IP Address**

```

Administrator: Windows PowerShell
PS C:\Users\Administrator> ipconfig

Windows IP Configuration

Ethernet adapter Team-1:
  Connection-specific DNS Suffix . : vanlab.net
  IPv4 Address . . . . . : 192.168.101.122
  Subnet Mask . . . . . : 255.255.255.0
  Default Gateway . . . . . : 192.168.101.254

Tunnel adapter isatap.vanlab.net:
  Media State . . . . . : Media disconnected
  Connection-specific DNS Suffix . : vanlab.net
PS C:\Users\Administrator>

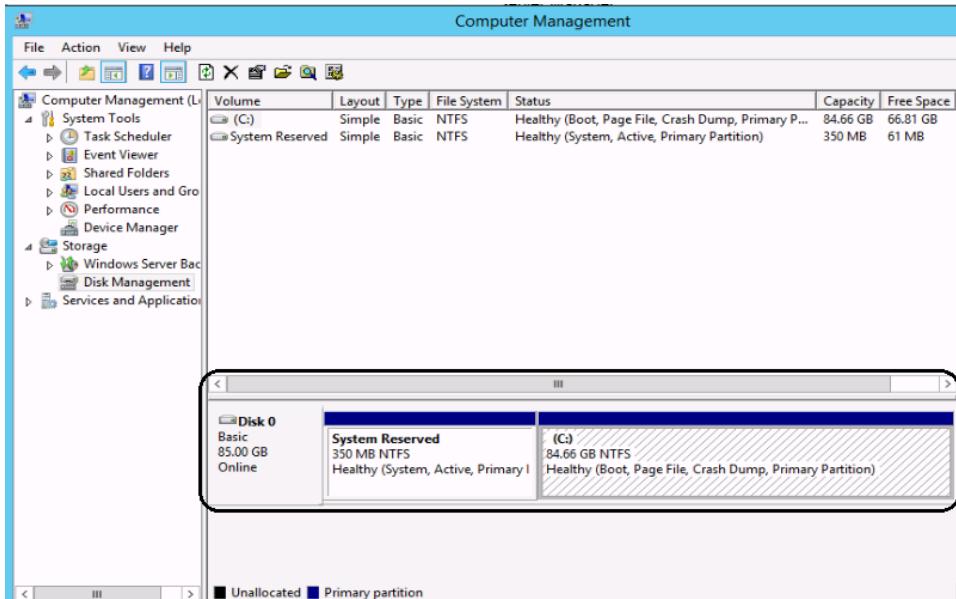
```

**Note:** IPv6 was disabled within Windows

## Results – Windows 2012 R2 SAN Connectivity

Before attaching the storage LUNs to the server profile, make sure the MPIO feature is installed and configured with MPIO feature is installed and configured within the windows operating system and the MPIO software for your SAN is also installed. Also make sure that you have enabled ALL the SAN fabric Zones for this server, to ensure proper SAN connectivity fail-over.

**Figure 105 - Windows 2012 R2 Disk Administrator. Note: That D: is the SAN attached volume**



## Summary

We presented a Virtual Connect Network scenario by creating two shared uplink sets (SUS), each SUS is connected with TWO active uplinks, both SUS' can actively pass traffic. We included a dual path FCoE SAN fabric for storage connectivity and boot to SAN.

When VC profile App-1 is applied to the server in bay1 and the server is powered up, it has one NIC connected through FlexFabric 10/24-Port module 1 (connected to VLAN-101-1), the second NIC is connected through FlexFabric 10/24-Port module 2 (connected to VLAN-101-2). These NICs could now be configured as individual NICs with their own IP address or as a pair of TEAMED NICs. Either NIC could be active. As a result, this server could access the network through either NIC or either uplink, depending on which NIC is active at the time. Each NIC is configured for a guaranteed minimum bandwidth of 4Gb, with a maximum of 8Gb of network bandwidth and each FCoE port is configured for 4Gb of SAN bandwidth with the ability to burst to a maximum of 8Gb. We also enabled the new "Hide Unused FlexNICs" feature, so these unused NICs would not appear in the server OS.

We also configured the server profile to Boot to SAN, this configuration is part of the profile, if the profile is moved to a different server bay, the Boot to SAN information will follow with the profile. The profile can also be copied and assigned to additional server bays, each new profile will retain the Boot to SAN configuration, however, will also acquire new WWN addresses.

Additional NICs could be added within FlexFabric, by simply powering the server off and adding up to a total of 6 NICs, the NIC speed can then be adjusted accordingly to suit the needs of each NIC. If additional or less SAN bandwidth is required, the speed of the SAN connection can also be adjusted.

As additional servers are added to the enclosure, simply create additional profiles, or copy existing profiles, configure the NICs for LAN and SAN fabrics as required and apply them to the appropriate server bays and power the server on.

# **Scenario 4 – Shared Uplink Set with Active/Active Uplinks and 802.3ad (LACP) – Ethernet, FCoE SAN - Windows 2012 R2 Hyper-V**

## **Overview**

This scenario will implement the Shared Uplink Set (SUS) to provide support for multiple VLANs. The upstream network switches connect a shared uplink set to two ports on each FlexFabric 10/24-Port modules, LACP will be used to aggregate those links.

As multiple VLANs will be supported in this configuration, the upstream switch ports connecting to the FlexFabric 10/24-Port modules will be configured to properly present those VLANs. In this scenario, the upstream switch ports will be configured for VLAN trunking/VLAN tagging.

When configuring Virtual Connect, we can provide several ways to implement network fail-over or redundancy. One option would be to connect TWO uplinks to a single Virtual Connect network; those two uplinks would connect from different Virtual Connect modules within the enclosure and could then connect to the same upstream switch or two different upstream switches, depending on your redundancy needs. An alternative would be to configure TWO separate Virtual Connect networks, each with a single, or multiple, uplinks configured. Each option has its advantages and disadvantages. For example; an Active/Standby configuration places the redundancy at the VC level, where Active/Active places it at the OS NIC teaming or bonding level. We will review the second option in this scenario.

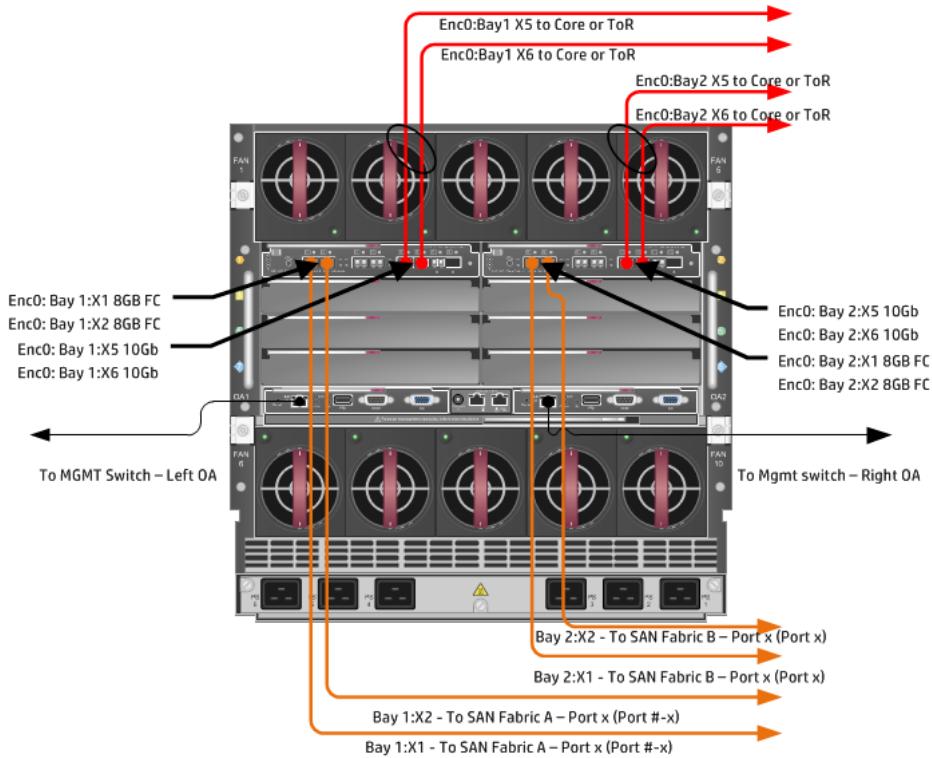
In addition, several Virtual Connect Networks can be configured to support the required networks to the servers within the BladeSystem enclosure. These networks could be used to separate the various network traffic types, such as iSCSI, backup and VMotion from production network traffic.

This scenario will also leverage the Fibre Channel over Ethernet (FCoE) capabilities of the FlexFabric 10/24-Port modules. Each fibre channel fabric will have two uplinks connected to each of the FlexFabric 10/24-Port modules.

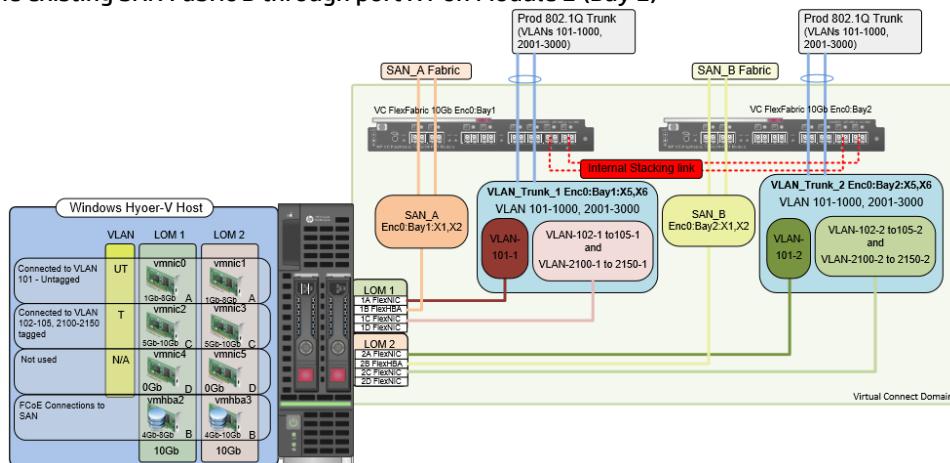
## **Requirements**

This scenario will support both Ethernet and fibre channel connectivity. In order to implement this scenario, an HP BladeSystem c7000 enclosure with one or more server blades and TWO Virtual Connect FlexFabric 10/24-Port modules, installed in I/O Bays 1 & 2 are required. In addition, we will require ONE or TWO external Network switches. As Virtual Connect does not appear to the network as a switch and is transparent to the network, any standard managed switch will work with Virtual Connect. The fibre channel uplinks will connect to the existing FC SAN fabrics. The SAN switch ports will need to be configured to support NPIV logins. Two uplinks from each FlexFabric 10/24-Port module will be connected to the existing SAN fabrics.

**Figure 106 - Physical View;** Shows two Ethernet uplinks from Ports X5 and X6 on Module 1 and 2 to Ports 1 and 2 on each network switch. The SAN fabrics are also connected redundantly, with TWO uplinks per fabric, from ports X1 and X2 on module 1 to Fabric A and ports X1 and X2 to Fabric B.



**Figure 107 - Logical View;** The server blade profile is configured with Four FlexNICs and 2 FlexHBAs. NICs 1 and 2 are connected to VLAN-101-x, NICs 3 and 4 are connected to multiple networks VLAN-102-x through VLAN-105-x and VLAN-2100 through 2150-x, which are part of the Shared Uplink Sets, VLAN-Trunk-1 and VLAN-Trunk-2 respectively. The VLAN-Trunks are connected, at 10Gb, to a network switch, through Ports X5 and X6 on each FlexFabric 10/24-Port Module in Bays 1 and 2. In addition, SAN Fabric FCoE\_A connects to the existing SAN Fabric A through port X1 on Module 1 (Bay 1) and FCoE\_B connects to the existing SAN Fabric B through port X1 on Module 2 (Bay 2)



# Installation and configuration

## Switch configuration

Appendices A and B provide a summary of the commands required to configure the switch in either a Cisco or HP Networking (with both ProCurve and Comware examples). The configuration information provided in the appendices assumes the following information:

- The switch ports are configured as VLAN TRUNK ports (tagging) to support several VLANs. All frames will be forwarded to Virtual Connect with VLAN tags. Optionally, one VLAN could be configured as (Default) untagged, if so, then a corresponding vNet within the Shared Uplink Set would be configured and set as “Default”.

**Note:** When adding additional uplinks to the SUS, if the additional uplinks are connecting from the same FlexFabric 10/24-Port module to the same switch, in order to ensure all The uplinks are active, the switch ports will need to be configured for LACP within the same Link Aggregation Group.

The network switch port should be configured for Spanning Tree Edge as Virtual Connect appears to the switch as an access device and not another switch. By configuring the port as Spanning Tree Edge, it allows the switch to place the port into a forwarding state much quicker than otherwise, this allows a newly connected port to come online and begin forwarding much quicker.

The SAN connection will be made with redundant connections to each Fabric. SAN switch ports connecting to the FlexFabric 10/24-Port module must be configured to accept NPIV logins.

## Configuring the VC module

- Physically connect Port 1 of network switch 1 to Port X5 of the VC module in Bay 1
- Physically connect Port 2 of network switch 1 to Port X6 of the VC module in Bay 1
- Physically connect Port 1 of network switch 2 to Port X5 of the VC module in Bay 2
- Physically connect Port 2 of network switch 2 to Port X6 of the VC module in Bay 2

**Note:** If you have only one network switch, connect VC ports X5 and X6 (Bay 2) to an alternate port on the same switch. This will NOT create a network loop and Spanning Tree is not required.

- Physically connect Ports X1/X2 on the FlexFabric in module Bay 1 to switch ports in SAN Fabric A
- Physically connect Ports X1/X2 on the FlexFabric in module Bay 2 to switch ports in SAN Fabric B

## VC CLI commands

Many of the configuration settings within VC can also be accomplished via a CLI command set. In order to connect to VC via a CLI, open an SSH connection to the IP address of the active VCM. Once logged in, VC provides a CLI with help menus. Through this scenario the CLI commands to configure VC for each setting will also be provided.

## Configuring Expanded VLAN Capacity via GUI

Virtual Connect release 3.30 provided an expanded VLAN capacity mode when using Shared Uplink Sets, this mode can be enabled through the Ethernet Settings tab or the VC CLI. The default configuration for a new Domain install is “Expanded VLAN Capacity” mode, Legacy mode is no longer available and the Domain cannot be downgraded.

Virtual Connect 4.30 now provides the ability to define up to 4096 VLANs then consume only the VLANs you need, when you need them. There is nothing to change or enable to take advantage of the 4096 VLAN feature.

## To verify the VLAN Capacity mode

- On the Virtual Connect Manager screen, Left pane, click Ethernet Settings, Advanced Settings
- Select Expanded VLAN capacity
- Verify Expanded VLAN Capacity is configured and Legacy VLAN Capacity is greyed out.

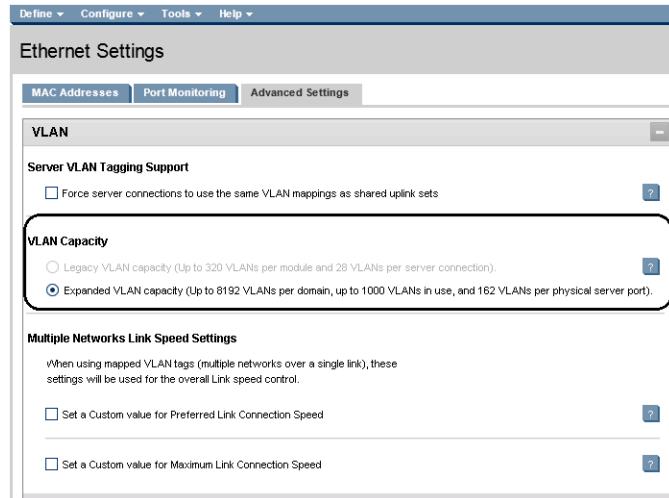
**Note:** Legacy VLAN mode will only be presented if 1Gb Virtual Connect Modules are present, in which case the domain would be limited to Firmware version 3.6x.

## Configuring Expanded VLAN Capacity via CLI

The following command can be copied and pasted into an SSH based CLI session with Virtual Connect;

```
# Set Expanded VLAN Capacity  
set enet-vlan -quiet VlanCapacity=Expanded
```

**Figure 108 - Enabling Expanded VLAN Capacity**



**Note:** If a 1Gb VC Ethernet module is present in the Domain, Expanded VLAN capacity will be greyed out, this is only supported with 10Gb and 20Gb based Virtual Connect modules. Also, once Expanded VLAN capacity is selected, moving back to Legacy VLAN capacity mode will require a domain deletion and rebuild.

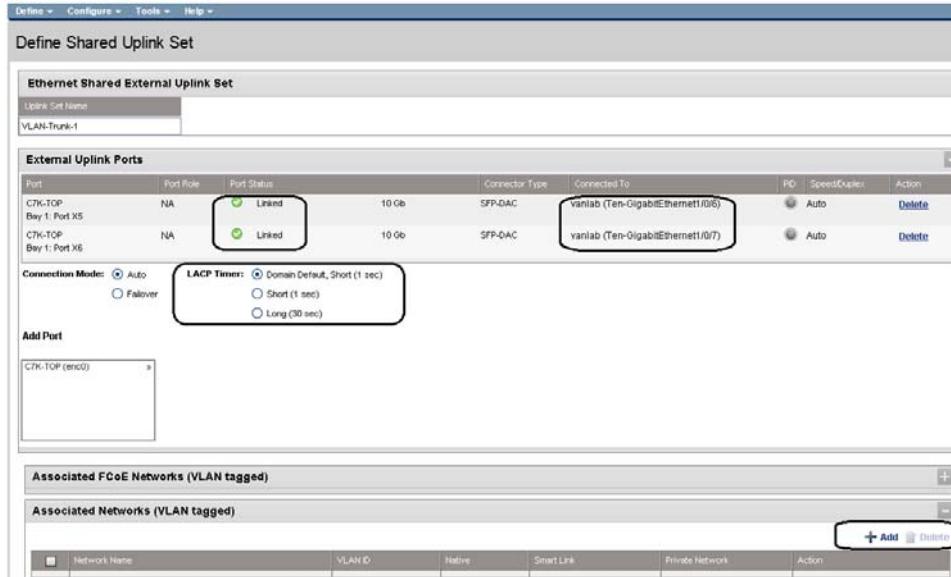
## Defining a new Shared Uplink Set (VLAN-Trunk-1)

Connect Ports X5 and X6 of FlexFabric module in Bay 1 to Ports 1 and 2 on switch 1

Create a SUS named VLAN-Trunk-1 and connect it to FlexFabric Ports X5 and X6 on Module 1

- On the Virtual Connect Home page, select Define, Shared Uplink Set
- Insert Uplink Set Name as VLAN-Trunk-1
- Select Add Port, then add the following port;
  - Enclosure 1, Bay 1, Port X5
  - Enclosure 1, Bay 1, Port X6

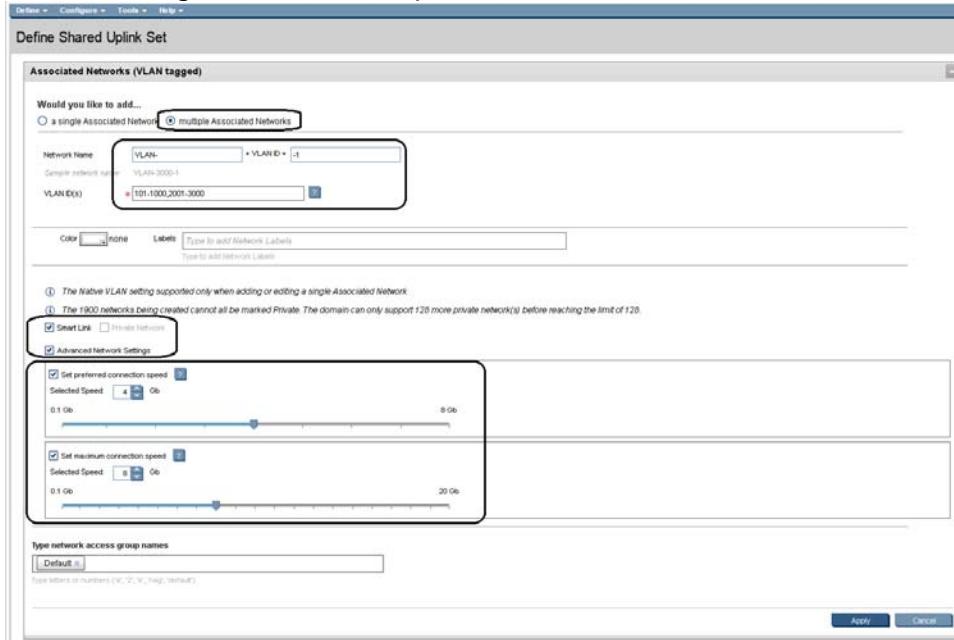
**Figure 109 - Shared Uplink Set (VLAN-Trunk-1) Uplinks Assigned**



- Click Add Networks and select the Multiple Networks radio button and add the following VLANs;
  - Enter Name as VLAN-
  - Enter Suffix as -1
  - Enter VLAN IDs as follows (and shown in the following graphic);
    - 101-1000,2001-3000
- Enable SmartLink on ALL networks
- Click Advanced
  - Configure Preferred speed to 4Gb
  - Configure Maximum speed to 8Gb
- Click Apply

**Note:** You can optionally specify a network “color” or “Label” when creating a shared Uplinkset and its networks. In the example above we have not set either color or label. Also notice the new configurable LACP Timer setting.

**Figure 110 - Creating VLANs in a Shared Uplink Set**



**Note:** If the VC domain is not in Expanded VLAN capacity mode, you will receive an error when attempting to create more than 128 VLANs in a SUS. If that occurs, go to Advanced Ethernet Settings and select Expanded VLAN capacity mode and apply.

After clicking apply, a list of VLANs will be presented as shown below. If one VLAN in the trunk is untagged/native, see note below.

- Click Apply at the bottom of the page to create the Shared Uplink Set

**Figure 111 - Associated VLANs for Shared Uplink Set VLAN-Trunk-1**

Network Name	VLAN ID	Native	Smart Link	Private Network	Action
VLAN-101-1	101	false	true	false	Edit
VLAN-102-1	102	false	true	false	Edit
VLAN-103-1	103	false	true	false	Edit
VLAN-104-1	104	false	true	false	Edit
VLAN-105-1	105	false	true	false	Edit
VLAN-106-1	106	false	true	false	Edit
VLAN-107-1	107	false	true	false	Edit
VLAN-108-1	108	false	true	false	Edit
VLAN-109-1	109	false	true	false	Edit
VLAN-110-1	110	false	true	false	Edit
VLAN-111-1	111	false	true	false	Edit
VLAN-112-1	112	false	true	false	Edit
VLAN-113-1	113	false	true	false	Edit
VLAN-114-1	114	false	true	false	Edit
VLAN-115-1	115	false	true	false	Edit
VLAN-116-1	116	false	true	false	Edit
VLAN-117-1	117	false	true	false	Edit
VLAN-118-1	118	false	true	false	Edit
VLAN-119-1	119	false	true	false	Edit
VLAN-120-1	120	false	true	false	Edit
VLAN-121-1	121	false	true	false	Edit
VLAN-122-1	122	false	true	false	Edit
VLAN-123-1	123	false	true	false	Edit
VLAN-124-1	124	false	true	false	Edit

**Note:** Optionally, if one of the VLANs in the trunk to this shared uplink set were configured as Native or Untagged, you would be required to “edit” that VLAN in the screen above, and configure Native as TRUE. This would need to be set for BOTH VLAN-Trunk-1 and VLAN-Trunk-2.

**Figure 112 - You will see that ALL Uplinks are still in a Linked/Standy state**

Shared Uplink Set	Has FCoE	Port Status	Connector Type	Uplink Port	Action
VLAN-Trunk-1	false	Linked-Standy	10 Gb	SFP-DAC	C7K-TOP: Bay 1: Port X5
		Linked-Standy	10 Gb	SFP-DAC	C7K-TOP: Bay 1: Port X6

**Note:** That both of the network connections are shown as “Linked/Standy”, this state will NOT change until the network has been assigned to a server profile. This behavior is new within VC 4.30 and is provided to accommodate the new 4096 VLAN feature.

### Defining a new Shared Uplink Set (VLAN-Trunk-2)(Copying a Shared Uplink Set)

The second Shared Uplink Set could be created in the same manner as VLAN-Trunk-1 however; VC now provides the ability to COPY a VC Network or Shared Uplink Set.

- Connect Ports X5 and X6 of FlexFabric 10/24-Port module in Bay 2 to Ports 1 and 2 on switch 2
- In the VC GUI screen, select Shared Uplink Sets in the left pane, in the right pane VLAN-Trunk-1 will be displayed, left click VLAN-Trunk-1, it will appear as blue, right click and select COPY
- Edit the Settings as shown below, the new SUS name will be VLAN-Trunk-2 and ALL the associated VLANs with have a suffix of 2
- In step 3, ADD uplinks X5 and X6 from Bay 2
- Click OK
- The SUS and ALL VLANs will be created

**Figure 113 - Copying a SUS and ALL VLANs**

Copy Shared Uplink Set

1 Shared Uplink Set Name  
Name: VLAN-Trunk-2

2 Associated Networks (VLANs)  
Replace last instance(s) of 1 with 2

VLAN-Trunk-1 Original		VLAN-Trunk-2 Copy	
VLAN-101-1		VLAN-101-2	
VLAN-102-1		VLAN-102-2	
VLAN-103-1		VLAN-103-2	
VLAN-104-1		VLAN-104-2	
VLAN-105-1		VLAN-105-2	
VLAN-106-1		VLAN-106-2	

3 External Uplink Ports

Port	Port Role	Port Status	Connector Type	Connected To
				▼

## Defining a new Shared Uplink Set via CLI

The following script can be used to create the first Shared Uplink Set (VLAN-Trunk-1)

*The following command(s) can be copied and pasted into an SSH based CLI session with Virtual Connect*

```
# Create Shared Uplink Set VLAN-Trunk-1 and configure uplinks
```

```
add uplinkset VLAN-Trunk-1
add uplinkport enc0:1:X5 Uplinkset=VLAN-Trunk-1 speed=auto
add uplinkport enc0:1:X6 Uplinkset=VLAN-Trunk-1 speed=auto

# Create Networks VLAN-1001-1 through VLAN-1000-1 and VLAN-2001-1 through VLAN-3000-1
# for Shared Uplink Set VLAN-Trunk-1
add network-range -quiet UplinkSet=VLAN-Trunk-1 NamePrefix=VLAN- NameSuffix=-1
VLANIds=101-1000,2001-3000 State=enabled PrefSpeedType=Custom PrefSpeed=4000
MaxSpeedType=Custom MaxSpeed=8000 SmartLink=enabled
```

The following script can be used to create the Second Shared Uplink Set (VLAN-Trunk-2)

```
# Create Shared Uplink Set VLAN-Trunk-2 and configure uplinks
```

```
add uplinkset VLAN-Trunk-2
add uplinkport enc0:2:X5 Uplinkset=VLAN-Trunk-2 speed=auto
add uplinkport enc0:2:X6 Uplinkset=VLAN-Trunk-2 speed=auto
```

```
# Create Networks VLAN101-2 through VLAN1000-2 and VLAN-2001-2 through VLAN-3000-2
# for Shared Uplink Set VLAN-Trunk-2
add network-range -quiet UplinkSet=VLAN-Trunk-2 NamePrefix=VLAN- NameSuffix=-2
VLANIds=101-1000,2001-3000 State=enabled PrefSpeedType=Custom PrefSpeed=4000
MaxSpeedType=Custom MaxSpeed=8000 SmartLink=enabled
```

Please refer to Appendix D; “Scripting the Native VLAN” for scripting examples.

**Note:** In this scenario we have created two independent Share Uplink Sets (SUS), each originating from the opposite FlexFabric Modules, by doing so we provide the ability to create separate and redundant connections out of the Virtual Connect domain. When we create the server profiles, you will see how the NICs will connect to VLANs accessed through the opposite VC module, which provides the ability to create an Active / Active uplink scenario. Alternatively, we could have created a single SUS and assigned both sets of these uplink ports to the same SUS, however, this would have provided an Active/Standby uplink scenario, as shown in Scenario 5.

## Defining a new (FCoE) SAN Fabric via GUI

Create a Fabric and name it “FCoE\_A”

- On the Virtual Connect Manager screen, click Define, SAN Fabric to create the first Fabric
- Enter the Network Name of “FCoE\_A”
- Select Add Port, then add the following ports:
  - Enclosure 1, Bay 1, Port X1
  - Enclosure 1, Bay 1, Port X2
- Ensure Fabric Type is set to “FabricAttach”
- Select Show Advanced Settings
  - Select Automatic Login Re-Distribution (FlexFabric Only)
  - Select Set Preferred FCoE Connect Speed
    - Configure for 4Gb
  - Select Set Maximum FCoE Connect Speed
    - Configure for 8Gb
- Select Apply

Create a second Fabric and name it "FCoE\_B"

- On the Virtual Connect Manager screen, click Define, SAN Fabric to create the second Fabric
- Enter the Network Name of "FCoE\_B"
- Select Add Port, then add the following ports:
  - Enclosure 1, Bay 2, Port X1
  - Enclosure 1, Bay 2, Port X2
- Ensure Fabric Type is set to "FabricAttach"
- Select Show Advanced Settings
  - Select Automatic Login Re-Distribution (FlexFabric Only)
  - Select Set Preferred FCoE Connect Speed
    - Configure for 4Gb
  - Select Set Maximum FCoE Connect Speed
    - Configure for 8Gb
- Select Apply

## Defining SAN Fabrics via CLI

The following command(s) can be copied and pasted into an SSH based CLI session with Virtual Connect

```
#Create the SAN Fabrics FCoE_A and FCoE_B and configure uplinks as discussed above
add fabric FCoE_A Type=FabricAttach Bay=1 Ports=1,2 Speed=Auto LinkDist=Auto
PrefSpeedType=Custom PrefSpeed=4000 MaxSpeedType=Custom MaxSpeed=8000
add fabric FCoE_B Type=FabricAttach Bay=2 Ports=1,2 Speed=Auto LinkDist=Auto
PrefSpeedType=Custom PrefSpeed=4000 MaxSpeedType=Custom MaxSpeed=8000
```

**Figure 114 - SAN Configuration and Advanced Settings**

The screenshot shows the 'Define SAN Fabric' interface. In the 'Fabric' section, 'FCoE\_A' is selected with 'FabricAttach' type, 'AUTOMATIC' login re-distribution, and 'Auto' configured speed. The 'Show Advanced Settings' checkbox is checked, revealing options for 'Automatic Login Re-Distribution' (selected), 'Set Preferred FCoE Connection Speed' (selected, 4 Gb), and 'Set Maximum FCoE Connection Speed' (selected, 8 Gb). In the 'Enclosure Uplink Ports' section, two ports are listed: Port X1 (C7K-TOP, Bay 1, LOGGED-IN, 8 Gb, connected to 10:00:00:27:f6:d6:ae:0a) and Port X2 (C7K-TOP, Bay 1, LOGGED-IN, 8 Gb, connected to 10:00:00:27:f6:d6:ae:0a). The 'Add Port' section shows 'Bay 1' selected. At the bottom are 'Apply' and 'Cancel' buttons.

**Figure 115 - FCoE SAN fabrics configured with 2 8Gb uplinks per fabric. Note the bay and port numbers on the right**

Status	SAN Fabric	Type	Login Re-Distribution	Port Status	Connected To	Enclosure	Bay	Port	Action
<span style="color: green;">✓</span>	FCoE_A	FabricAttach	AUTOMATIC	<span style="color: green;">✓</span> LOGGED-IN	8 Gb	10:00:00:27:f8:d6:ae:0a	C7K-TOP	1	X1
				<span style="color: green;">✓</span> LOGGED-IN					<span style="color: blue;">Edit</span> <span style="color: blue;">▼</span>
<span style="color: green;">✓</span>	FCoE_B	FabricAttach	AUTOMATIC	<span style="color: green;">✓</span> LOGGED-IN	8 Gb	10:00:00:27:f8:d6:8b:9c	C7K-TOP	2	X1
				<span style="color: green;">✓</span> LOGGED-IN					<span style="color: blue;">Edit</span> <span style="color: blue;">▼</span>

## Defining a Server Profile

We will create a server profile with two server NICs.

Each server NIC will connect to a specific network.

- On the main menu, select Define, then Server Profile
- Create a server profile called “App-1”
- Select to “Hide Unused FlexNICs”
- In the Network Port 1 drop down box, select VLAN101-1
- Set the port speed to Custom at 1Gb
- In the Network Port 2 drop down box, select VLAN101-2
- Set the port speed to Custom at 1Gb
- Select ADD network (add two additional network connections)
- In the Network Port 3 drop down box, select Multiple Networks
- Configure for networks VLAN-102-1 through VLAN-105-1 and VLAN-2100-1 through VLAN-2150-1
- Leave the network speed as Auto
- In the Network Port 4 drop down box, select Multiple Networks
- Configure for networks VLAN-102-2 through VLAN-105-2 and VLAN-2100-2 through VLAN-2150-2
- Leave the network speed as Auto
- Expand the FCoE Connections box, for Bay 1, select FCoE\_A for Bay 2, select FCoE\_B
- Do not configure FC SAN or iSCSI Connection
- In the Assign Profile to Server Bay box, locate the Select Location drop down and select Bay 1, then apply

Prior to applying the profile, ensure that the server in Bay 1 is currently OFF

**Note:** You should now have a server profile assigned to Bay 1, with 4 Server NIC connections. NICs 1&2 should be connected to networks VLAN-101-x, NICs 3&4 should be connected to networks VLAN102-x through VLAN105-x and VLAN-2100-x through VLAN-2150-x. FCoE SAN fabrics are connected to, Port 1 - FCoE\_A and Port 2 - FCoE\_B.

## Defining a Server Profile via CLI

The following command(s) can be copied and pasted into an SSH based CLI session with Virtual Connect

```
# Create Server Profile App-1
add profile App-1 -nodefaultfcconn -nodefaultfcoeconn NAG=Default HideUnusedFlexNICs=true
set enet-connection App-1 1 pxe=Enabled Network=VLAN-101-1 SpeedType=Custom
Speed=1000
set enet-connection App-1 2 pxe=Disabled Network=VLAN-101-2 SpeedType=Custom
Speed=1000
add enet-connection App-1 pxe=Disabled
add server-port-map-range App-1:3 UplinkSet=VLAN-Trunk-1 VLanIds=102-105,2100-2150
add enet-connection App-1 pxe=Disabled
add server-port-map-range App-1:4 UplinkSet=VLAN-Trunk-1 VLanIds=102-105,2100-2150
```

```

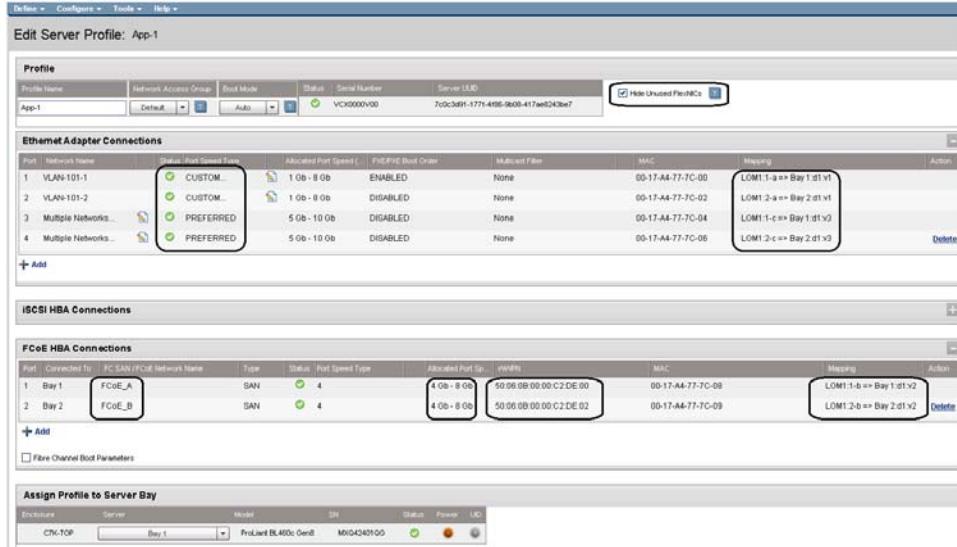
set enet-connection App-1 3 SpeedType=Preferred
set enet-connection App-1 4 SpeedType=Preferred
add fcoe-connection App-1 Fabric=FCoE_A SpeedType=4Gb
add fcoe-connection App-1 Fabric=FCoE_B SpeedType=4Gb
poweroff server 1
assign profile App-1 enc0:1

```

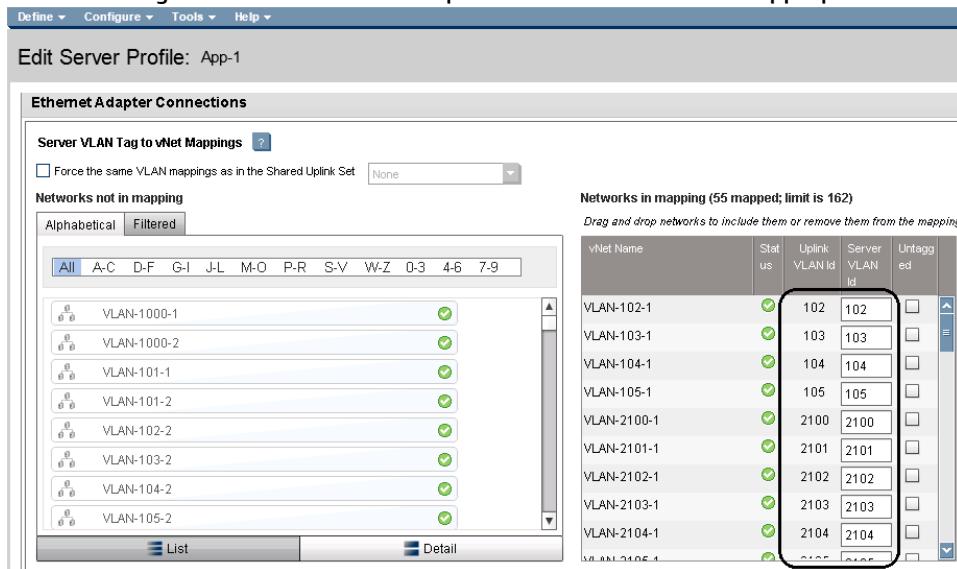
**Note:** The “add server-port-map-range” command is new to VC firmware release 3.30 and can be used to map many VLANs to a server NIC, in a single command. Prior releases would have required one command to create the NIC and one additional command per VLAN mapping added. This command will make profile scripting much easier, less complicated and quicker.

**Note:** The speed of the NIC and SAN connections, as well as the MAC and WWN. Also, note that the FCoE connections are assigned to the two SAN fabrics created earlier and use ports LOM:1-b and LOM:2-b.

**Figure 116 - Define a Server Profile (App-1) Hyper-V Host**



**Figure 117 - Configure NICs 3 and 4 for multiple Networks and select the appropriate VLANs**



**Note:** “Server VLAN ID” and “Untagged” boxes can be edited. One network per port could be marked as “Untagged”, in which case the server would not be configured for tagging on that VLAN. It is also possible to change the VLAN ID that is presented to the server (VLAN translation), in which case the communications between Virtual Connect and the network would be the VLAN ID in grey, if the Server VLAN ID box to the right were changed, VC would communicate with the server on the new VLAN ID, providing a VLAN translation function. VLAN translation could be a very useful feature, in the event that VLAN renumbering is required within the datacenter. The network VLAN numbers and Shared Uplink Set configurations could be changed to reflect the new VLAN IDs used, however, the old VLAN IDs could still be presented to the server providing the ability to delay or eliminate the need to change the VLAN ID used within the server/vSwitch.

**Figure 118 - Server Profile View Bay 1**

The screenshot shows the 'Server Profile View Bay 1' interface for a ProLiant BL460c Gen8 server. The top navigation bar includes 'Define', 'Configure', 'Tools', and 'Help'. The main content area is divided into three sections:

- Device Bay Status - Bay # 1:**

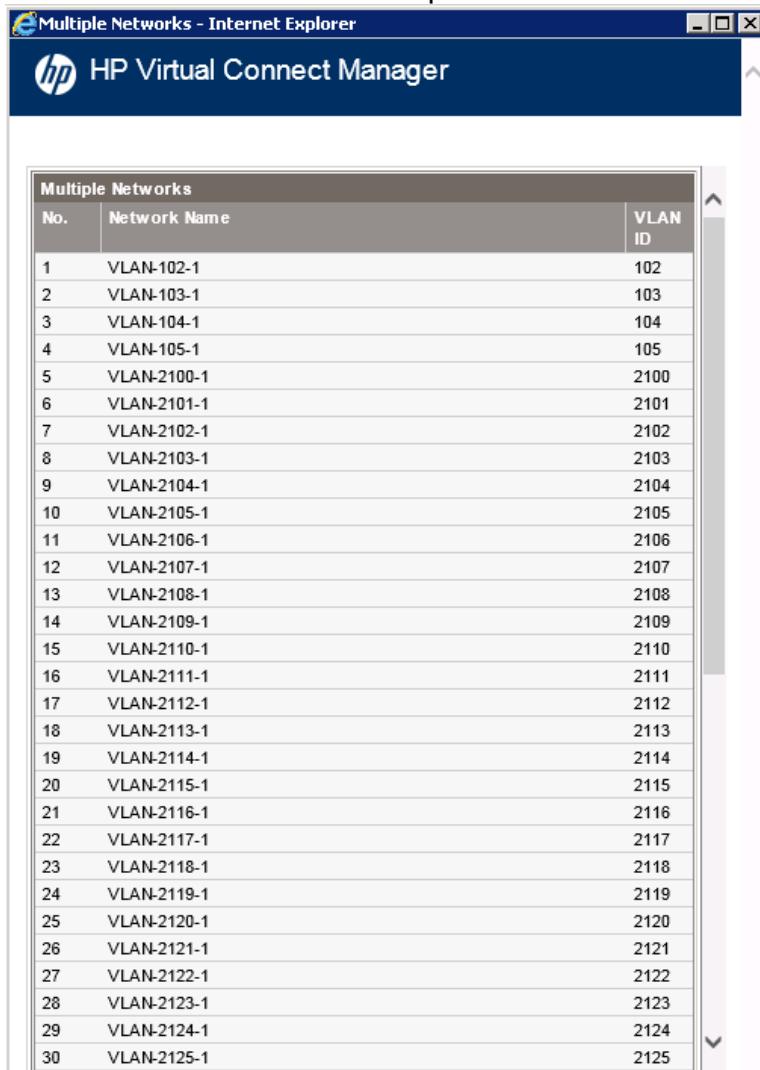
Overall Status:	Green checkmark
Hardware Status:	Green checkmark
VC Status:	Green checkmark
Assigned Server Profile:	App-1
Enclosure Name:	C7K-TOP
UID:	Off
Power Status/Control:	Off

**Momentary Press** button is located at the bottom right of this section.
- Blade Server Information - Bay # 1:**

Serial Number:	MXQ42401QG
Serial Number (Logical):	VCX0000V00
UUID:	30343237-3638-584D-5134-323430315147
UUID (Logical):	7c0c3d91-177f-4f86-9b08-417ae8243be7
Product Name:	ProLiant BL460c Gen8
Server Name:	APP-1
Part Number:	724086-B21
Asset Tag:	[Unknown]
UEFI Capable:	false
Boot Mode:	Legacy
- Server Ethernet Adapter Information:**

Ethernet Adapter	Flex NIC	Location	Module Port	Model	MAC Address	Network	WWN	SAN Fabric
<b>Port 1</b>								
LOM1:1-a	FLB1	Bay 1:d1:v1	HP FlexFabric 10Gb 2-Port 534FLB Adapter	00-17-A4-77-7C-00	VLAN-101-1			
LOM1:1-b	FLB1	Bay 1:d1:v2	HP FlexFabric 10Gb 2-Port 534FLB Adapter	00-17-A4-77-7C-08		50:06:0B:00:00:C2:DE:00	FCoE_A	
LOM1:1-c	FLB1	Bay 1:d1:v3	HP FlexFabric 10Gb 2-Port 534FLB Adapter	00-17-A4-77-7C-04	Multiple Networks			
LOM1:1-d	FLB1	Bay 1:d1:v4	HP FlexFabric 10Gb 2-Port 534FLB Adapter	9C-B6-54-87-5F-93				
<b>Port 2</b>								
LOM1:2-a	FLB1	Bay 2:d1:v1	HP FlexFabric 10Gb 2-Port 534FLB Adapter	00-17-A4-77-7C-02	VLAN-101-2			
LOM1:2-b	FLB1	Bay 2:d1:v2	HP FlexFabric 10Gb 2-Port 534FLB Adapter	00-17-A4-77-7C-09		50:06:0B:00:00:C2:DE:02	FCoE_B	
LOM1:2-c	FLB1	Bay 2:d1:v3	HP FlexFabric 10Gb 2-Port 534FLB Adapter	00-17-A4-77-7C-06	Multiple Networks			
LOM1:2-d	FLB1	Bay 2:d1:v4	HP FlexFabric 10Gb 2-Port 534FLB Adapter	9C-B6-54-87-5F-97				

**Figure 119** - By clicking on the “Multiple Networks” statement for each LOM, the following page is displayed, which lists the VLAN connections for this port.



The screenshot shows a Microsoft Internet Explorer window titled "Multiple Networks - Internet Explorer". The title bar also displays "HP Virtual Connect Manager". The main content area is a table titled "Multiple Networks" with columns "No.", "Network Name", and "VLAN ID". The table lists 30 entries from 1 to 30, each corresponding to a VLAN connection. The "VLAN ID" column shows values ranging from 102 to 2125.

No.	Network Name	VLAN ID
1	VLAN-102-1	102
2	VLAN-103-1	103
3	VLAN-104-1	104
4	VLAN-105-1	105
5	VLAN-2100-1	2100
6	VLAN-2101-1	2101
7	VLAN-2102-1	2102
8	VLAN-2103-1	2103
9	VLAN-2104-1	2104
10	VLAN-2105-1	2105
11	VLAN-2106-1	2106
12	VLAN-2107-1	2107
13	VLAN-2108-1	2108
14	VLAN-2109-1	2109
15	VLAN-2110-1	2110
16	VLAN-2111-1	2111
17	VLAN-2112-1	2112
18	VLAN-2113-1	2113
19	VLAN-2114-1	2114
20	VLAN-2115-1	2115
21	VLAN-2116-1	2116
22	VLAN-2117-1	2117
23	VLAN-2118-1	2118
24	VLAN-2119-1	2119
25	VLAN-2120-1	2120
26	VLAN-2121-1	2121
27	VLAN-2122-1	2122
28	VLAN-2123-1	2123
29	VLAN-2124-1	2124
30	VLAN-2125-1	2125

## Verify Network Link State

As discussed earlier in this document, in Virtual connect 4.30 there was a change to the link state behavior when a network has no connections to a server profile. Once a connection is made to the server profile, the uplinks will become Active, as previously expected.

**Figure 120** - All Links now appear in a Linked/Active state.



The screenshot shows a software interface titled "Shared Uplink Sets". The top menu includes "Define", "Configure", "Tools", and "Help". Below the title is a toolbar with icons for "Add", "Edit", and "Delete". The main area is divided into two tabs: "External Connections" and "Associated Networks". The "External Connections" tab is selected. It displays a table with columns "Shared Uplink Set", "Has FCoE", "Port Status", "Connector Type", "Uplink Port", and "Action". There are two entries: "VLAN-Trunk-1" and "VLAN-Trunk-2". Both entries show "false" under "Has FCoE". Under "Port Status", all four ports for both trunks are listed as "Linked-Active". Under "Connector Type", all ports are listed as "10 Gb". Under "Uplink Port", the ports are listed as "SFP-DAC". Under "Action", there are "Edit" buttons for each entry.

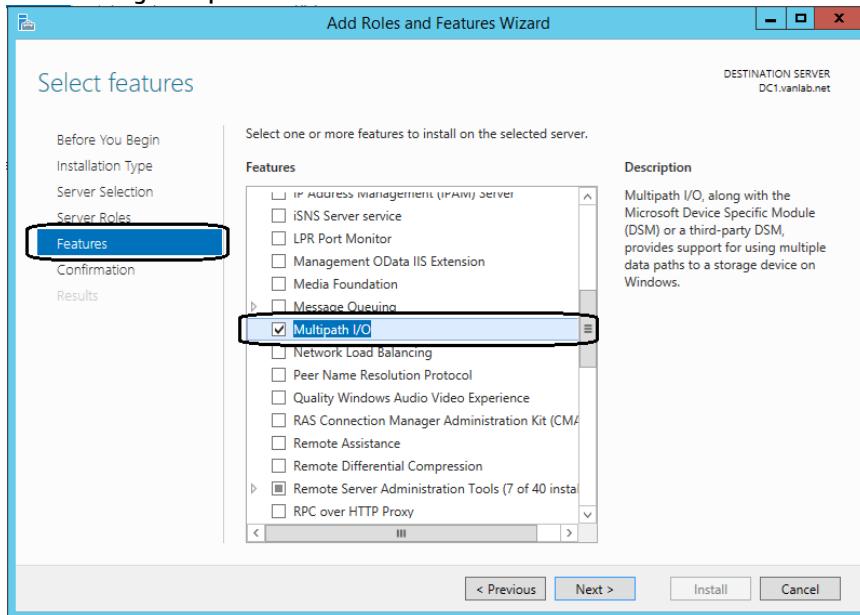
Shared Uplink Set	Has FCoE	Port Status	Connector Type	Uplink Port	Action	
VLAN-Trunk-1	false	<input checked="" type="checkbox"/> Linked-Active <input checked="" type="checkbox"/> Linked-Active	10 Gb	SFP-DAC	<input checked="" type="checkbox"/> C7K-TOP: Bay 1: Port X5 <input checked="" type="checkbox"/> C7K-TOP: Bay 1: Port X6	<a href="#">Edit</a>
VLAN-Trunk-2	false	<input checked="" type="checkbox"/> Linked-Active <input checked="" type="checkbox"/> Linked-Active	10 Gb	SFP-DAC	<input checked="" type="checkbox"/> C7K-TOP: Bay 2: Port X5 <input checked="" type="checkbox"/> C7K-TOP: Bay 2: Port X6	<a href="#">Edit</a>

## Enabling MPIO on Windows 2012 R2

Once the OS is installed, you will be required to enable the Multi-Path IO (MPIO) feature within Windows 2012 R2 and install the MPIO software for your SAN, you can then enable the additional SAN paths to the server/storage.

**Note:** Please refer to the FC Cookbook for HP Virtual Connect for additional details on Fibre Channel Connectivity.<http://bizsupport1.austin.hp.com/bc/docs/support/SupportManual/c01702940/c01702940.pdf>

**Figure 121 - Enabling Multipath IO within Windows 2012R2**



## Review

In this scenario we have created Two Shared Uplink Sets (SUS), providing support for many VLANs. Uplinks originating from each FlexFabric 10/24-Port Module connect to each SUS, by doing so we provide redundant connections out of the Virtual Connect domain. As multiple uplinks are used for each SUS, we have also leveraged LACP to improve uplink performance. In this scenario, all uplinks will be active. We also create two FCoE SAN Fabrics.

We created a server profile, with FOUR NICs. Two connected to the same VLAN (101), Port 1 connects to VLAN-101-1 and Port 2 connects to VLAN-101-2, which provides the ability to sustain a link or module failure and not lose connection to the network. VLAN-101-1 and VLAN-101-2 are configured to support VLAN 101, frames will be presented to the NIC(s) without VLAN tags (untagged), these two NICs are connected to the same VLAN, but taking a different path out of the enclosure.

Network Ports 3 and 4 were added, these NICs will be connected to "Multiple Networks" and each NIC will then be configured for networks VLAN-102-x through VLAN-105-x and networks VLAN-2100-x through VLAN-2150-x. As these networks are tagging, frames will be presented to the server with VLAN tags. NICs 3 and 4 will be teamed and connected to a Hyper-V virtual switch. VLAN tagged frames for these networks will be forwarded to the Virtual switch and then passed on to the appropriate Virtual Machine, VLAN tags will be removed as the frames are passed to the virtual machine. NICs 1 and 2 had their speed set to 1Gb and NICs 3 and 4 were set to Auto and will receive 5Gb of bandwidth. We also enabled the new "Hide Unused FlexNICs" feature, so these unused NICs would not appear in the server OS.

Additionally, FCoE port 1 is connected to SAN fabric FCoE\_A and FCoE SAN port 2 is connected to SAN Fabric FCoE\_B, providing a multi-pathed connection to the SAN. The FCoE SAN fabric connects to each SAN fabric over a pair of uplinks per module. SAN logins are distributed across the multiple paths.

## Results – Windows 2012 R2 Networking Examples

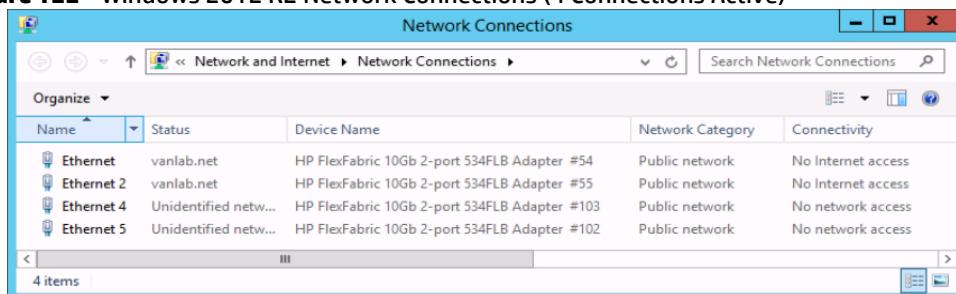
We have successfully configured FlexFabric with a shared uplink set and redundant SAN fabrics. We have created a server profile to connect the FOUR NICs, TWO connected to VLAN 101, TWO connected to multiple VLANs and TWO SAN fabrics using the FCoE connections created within the profile.

Although both Ethernet and Fibre channel connectivity is provided by the FlexFabric Adapter used in the G7 through Gen 9 servers; each capability (LAN and SAN) is provided by a different component of the adapter, they appear in the server as individual network and SAN adapters.

The following graphics show a Windows 2012 R2 server with FOUR FlexNICs configured at 10Gb. You will also notice that Windows believes there are only 4 NICs within this server as we have configured the profile to hide the unused FlexNICs, the extra NICs are offline and could later be added to the profile, if needed. If we did not require SAN connectivity on this server, the FCoE connections could be deleted and the server would then have 8 NIC ports available to the OS.

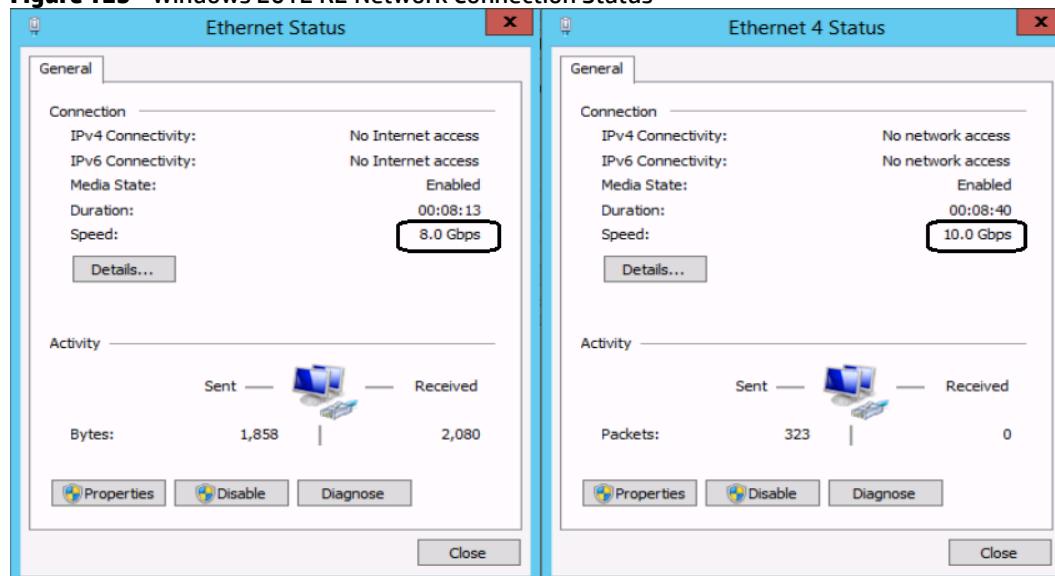
**Note:** The BL465c G7 and BL685c G7 utilize an NC551i chipset (BE2), whereas the BL460c G7, BL620c G7 and BL680c G7 utilize an NC553i chipset (BE3) and the Gen 8 blades typically have a NC554 adapter which also utilizes the BE3 chipset. Both the BE2 and BE3 chipsets share common drivers and firmware. Gen 8 Blade servers are provided with a “FlexLOM” which is a removal integrated Network adapter. This provides flexibility in NIC choice. The 554FLB is a B3 based chipset NIC, the 534FLB is a Broadcom based NIC. The example below is a 534FLB in a BL460c Gen 8 Blade server.

**Figure 122 - Windows 2012 R2 Network Connections (4 Connections Active)**



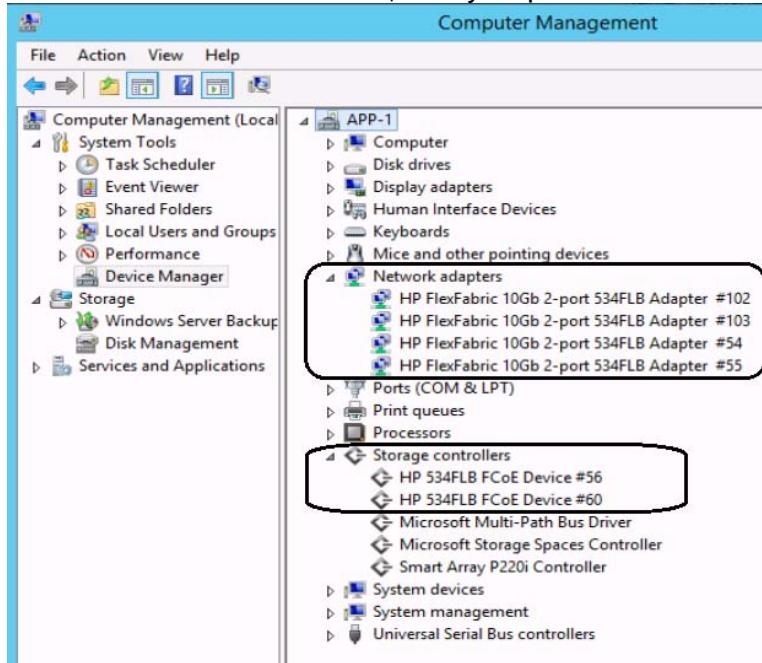
**Note:** If you are familiar with Virtual Connect Flex-10 technology, you will notice not all NICs were presented, and only the configured NICs are displayed. This is because we selected the new feature to hide unused FlexNICs.

**Figure 123 - Windows 2012 R2 Network Connection Status**



**Note:** As of Windows 2008 and later the actual NIC speed is displayed as configured in server Profile. Also, note that the speed displayed is the maximum speed setting, not the minimum setting.

**Figure 124 -** Windows 2012 R2, Device Manager, we have only configured two of the NICs and two FCoE HBAs. We also selected to hide unused FlexNICs, so only the provisioned FlexNICs are shown



The following graphics provides an example of a Windows 2012 R2 server with FOUR NICs connected to the network, initially each NIC has its own TCP/IP address, alternatively, NICs could be teamed to provide NIC fail-over redundancy. If an active uplink or network switch were to fail, Virtual Connect would fail-over to the standby uplink. In the event of a Virtual Connect FlexFabric module failure, the server's NIC teaming software would see one of the NICs go offline, assuming it was the active NIC, NIC teaming would fail-over to the standby NIC.

**Figure 125 -** Both NICs for Profile App-1 are connected to the network through VLAN-101-x

```
Administrator: Windows PowerShell
PS C:\Users\Administrator> ipconfig

Windows IP Configuration

Ethernet adapter Ethernet 5:
  Connection-specific DNS Suffix . : 
  Autoconfiguration IPv4 Address. . . . . : 169.254.69.191
  Subnet Mask . . . . . : 255.255.0.0
  Default Gateway . . . . . : 

Ethernet adapter Ethernet 4:
  Connection-specific DNS Suffix . : 
  Autoconfiguration IPv4 Address. . . . . : 169.254.86.52
  Subnet Mask . . . . . : 255.255.0.0
  Default Gateway . . . . . : 

Ethernet adapter Ethernet 2:
  Connection-specific DNS Suffix . : vanlab.net
  Link-local IPv6 Address . . . . . : fe80::180e:3093:4dac:6d67%13
  IPv4 Address . . . . . : 192.168.101.121
  Subnet Mask . . . . . : 255.255.255.0
  Default Gateway . . . . . : 192.168.101.254

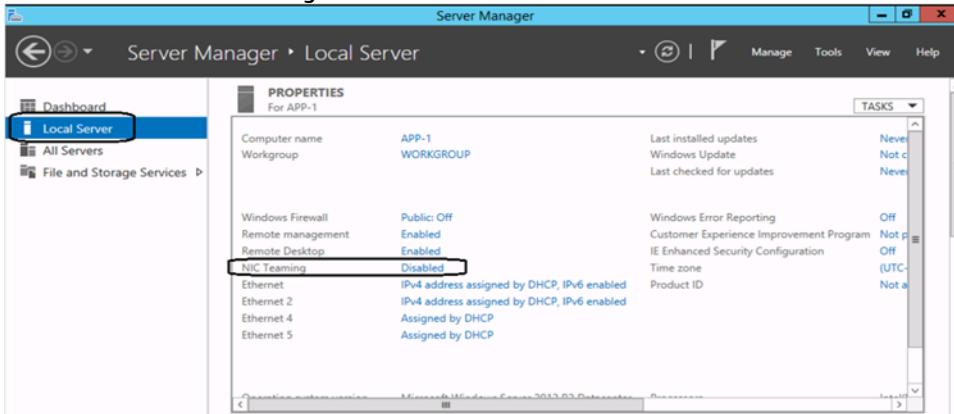
Ethernet adapter Ethernet:
  Connection-specific DNS Suffix . : vanlab.net
  Link-local IPv6 Address . . . . . : fe80::1405:79258:80ff:9ff8%12
  IPv4 Address . . . . . : 192.168.101.125
  Subnet Mask . . . . . : 255.255.255.0
  Default Gateway . . . . . : 192.168.101.254

Tunnel adapter isatap.vanlab.net:
  Media State . . . . . : Media disconnected
  Connection-specific DNS Suffix . . . . . : 
```

## NIC Teaming

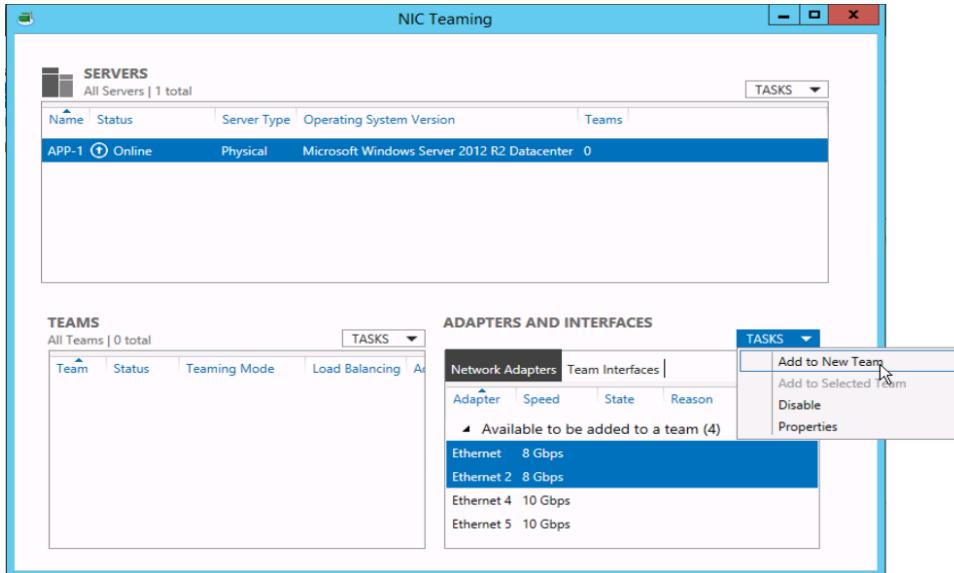
If higher availability is desired, NIC teaming in Virtual Connect works the same way as in standard network configurations. NIC Teaming is now provided as part of the Windows 2012 R2 OS. To configure NIC Teaming in windows 2012 R2, open Server Manager, select Local Server and click on “Disabled” to the right of NIC Teaming.

**Figure 126 - Enable NIC Teaming**



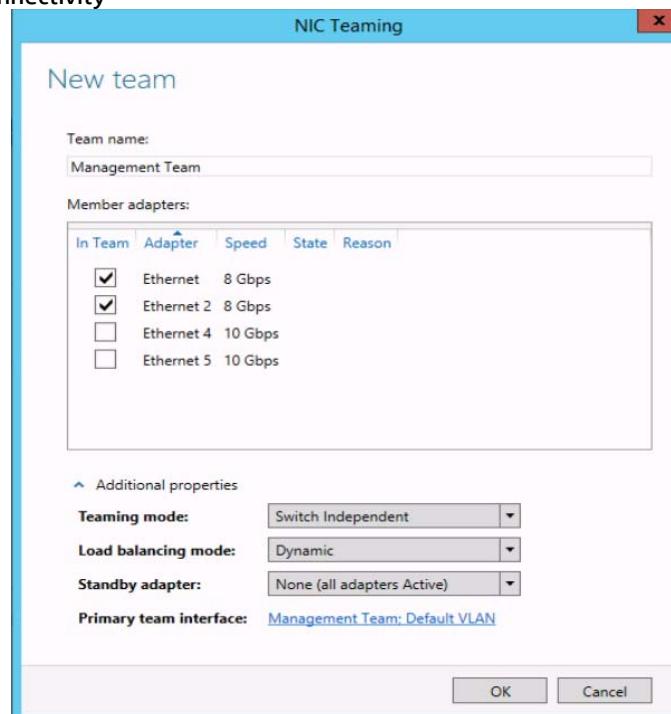
In the bottom right pane of the NIC teaming utility, highlight the two NICs you want to team and Click Tasks, then select “Add to team”.

**Figure 127 - Create the NIC Team**

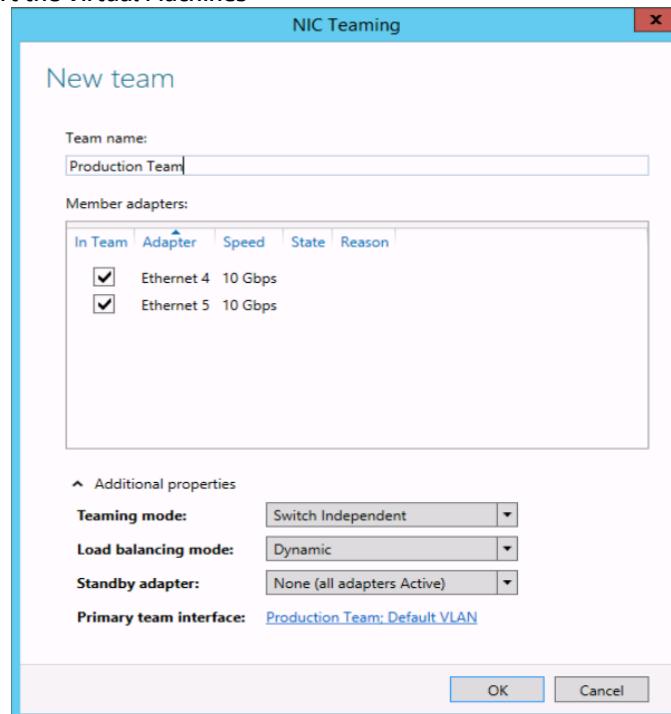


In the bottom right pane of the NIC teaming utility, highlight the two NICs you want to team and Click Tasks, then select “Add to team”. In the New Team configuration Box, provide a name for the Team and Click OK.

**Figure 128** - Provide a name for the Team and Click OK – This Team will connect to VLAN-101 to provide management connectivity

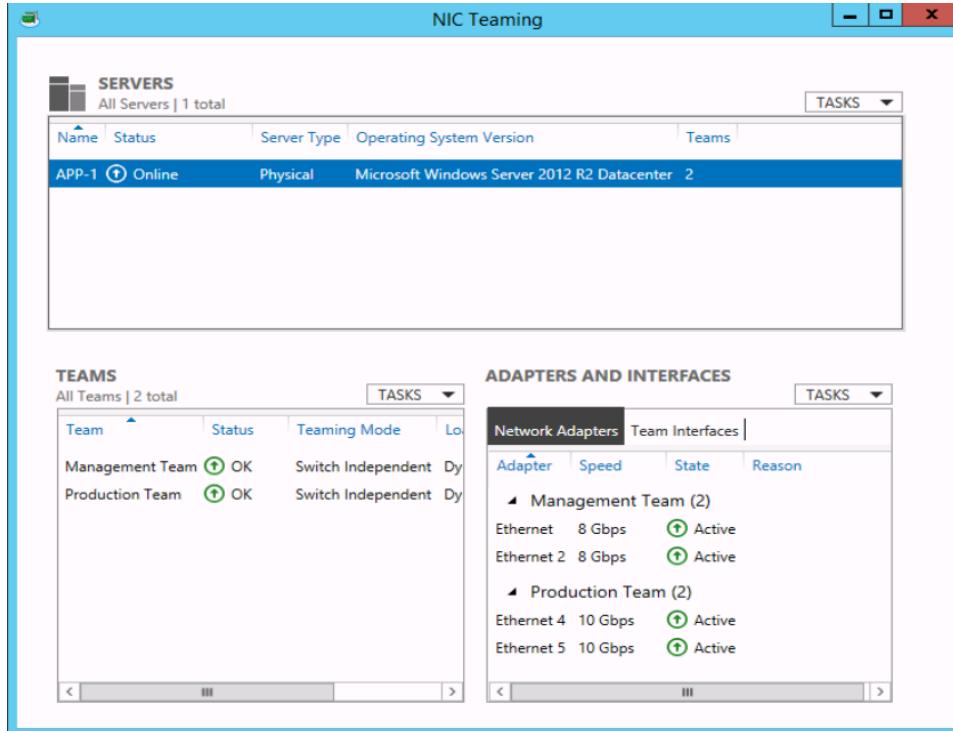


**Figure 129** - Provide a name for the Team and click OK - This Team is connected to Multiple Networks, which will support the Virtual Machines



**Note:** You can select the Additional properties drop down and alter the Teaming Mode, the default mode of "Switch Independent" is supported with Virtual Connect, however, Static Teaming and LACP modes are not supported. You can also select Load Balancing and adapter standby modes.

**Figure 130 - NIC Team has been established and both links show as active**



**Figure 131 – Two NICs are teamed for Production and two NICs are teamed for Management. The Management Team was able to obtain an IP address, however, the production Team has only tagged VLANs, it will not obtain an IP from DHCP**

```
Administrator: Windows PowerShell
PS C:\Users\Administrator> ipconfig

Windows IP Configuration

Ethernet adapter Production Team:

    Connection-specific DNS Suffix  . : vanlab.net
    Link-local IPv6 Address . . . . . : fe80::545e:6073:322:a680%35
    Autoconfiguration IPv4 Address. . . . . : 169.254.166.128
    Subnet Mask . . . . . : 255.255.0.0
    Default Gateway . . . . . :

Ethernet adapter Management Team:

    Connection-specific DNS Suffix  . : vanlab.net
    Link-local IPv6 Address . . . . . : fe80::3dbd:63f0:16bc:2859%29
    IPv4 Address. . . . . : 192.168.101.121
    Subnet Mask . . . . . : 255.255.255.0
    Default Gateway . . . . . : 192.168.101.254

Tunnel adapter isatap.vanlab.net:

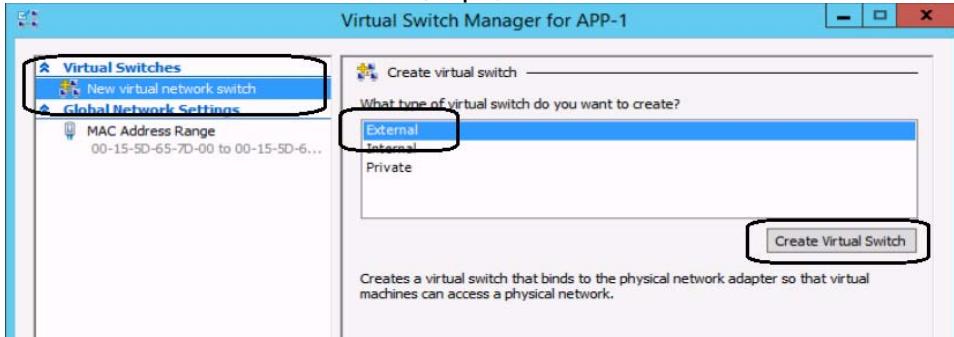
    Media State . . . . . : Media disconnected
    Connection-specific DNS Suffix  . : vanlab.net

PS C:\Users\Administrator>
```

## Configuring Hyper-V Virtual Network

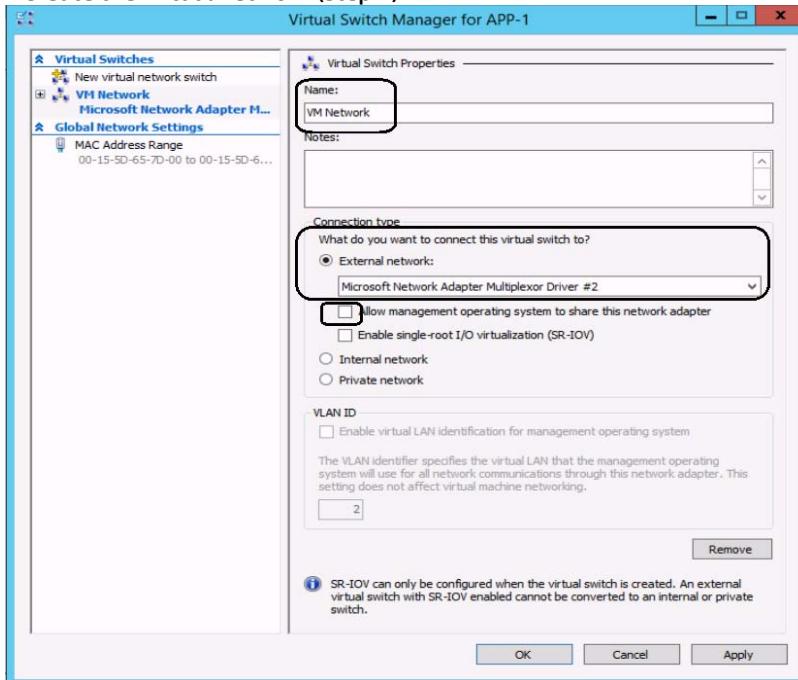
On the Windows 2012 R2 server, verify that the Hyper-V role has been added. Open the Hyper-V manager console in Window 2012 R2 and click on Virtual Network Manager. Select New Virtual Network, in the create Virtual Network box, select “External” and click ADD.

**Figure 132 - Create a new virtual network (step 1)**



Create the Virtual network for the guest Virtual Machines. Name the virtual network as “VM Network”, select (in this instant) Multiplexor Driver #2, which is the Team we created early that will support the Product VLANs (which Virtual Connect is configured for VLAN tagging on VLANs 102-105 and 2100-2150). Optionally, if this network will not be used to manage the host, de-select Allow management operating system to share this network adapter. Click apply to create the virtual network, a warning box will appear and the network adapter may reset as the virtual network is created.

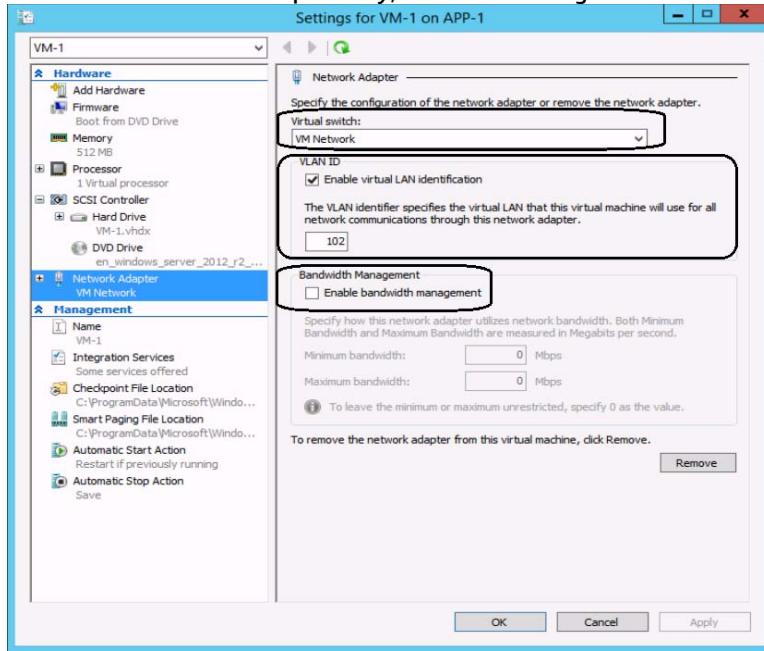
**Figure 133 - Create the virtual network (step 2)**



## Creating a Virtual Machine and connecting to the virtual network

Click “NEW” in the Hyper-V manager and select Virtual Machine to create a new virtual machine. In the Virtual Machine settings box, click on the network adapter and configure it to use the VM Network created earlier, click on “enable virtual LAN identification” and input the VLAN ID 102. This system will then be connected to VLAN 102, click OK to apply the settings. The next step will be to install an operating system in the virtual machine and then test network connectivity.

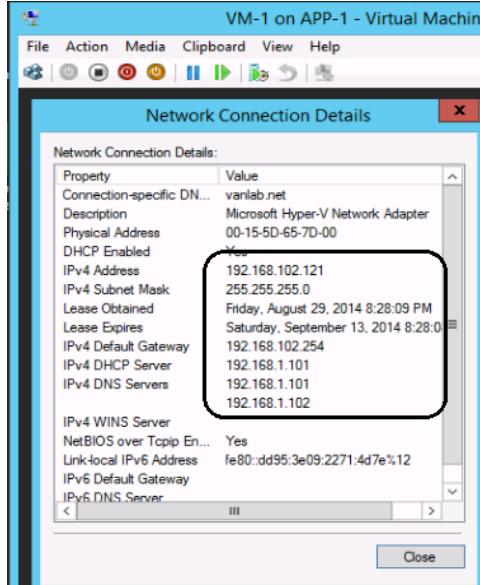
**Figure 134 -** Configure the virtual machine to use the new vSwitch that was created earlier, also, select VLAN ID and enter 102 for VLAN 102. Optionally, select and configure Bandwidth Management



## Testing VM connectivity

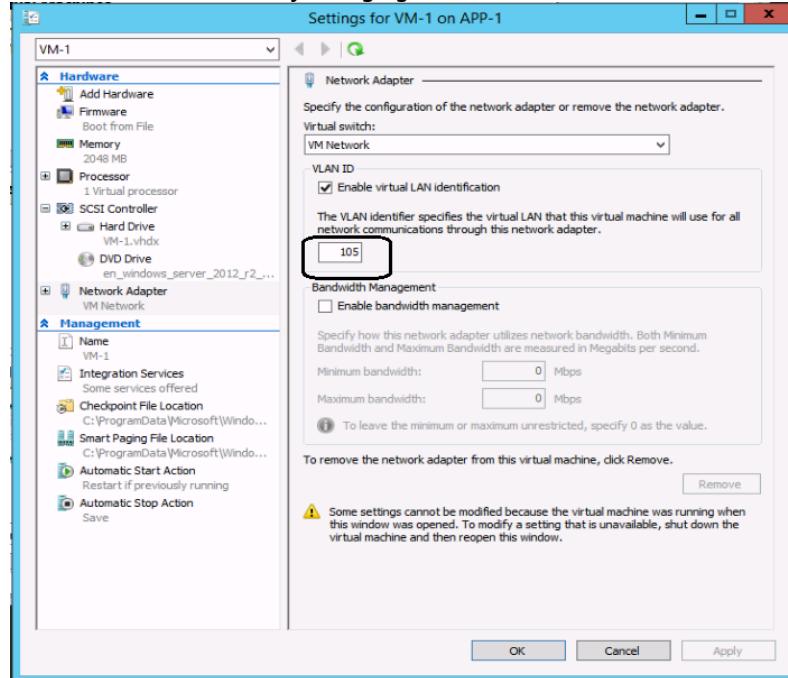
After installing Windows 2012 R2 onto the VM, we can move the VM from VLAN 102 to any other VLAN that is presented to the server via Team #2, by simply changing the VM ID that is configured on the Network Adapter within the VM Settings page.

**Figure 135 –** VM1 has received an IP address on VLAN 102

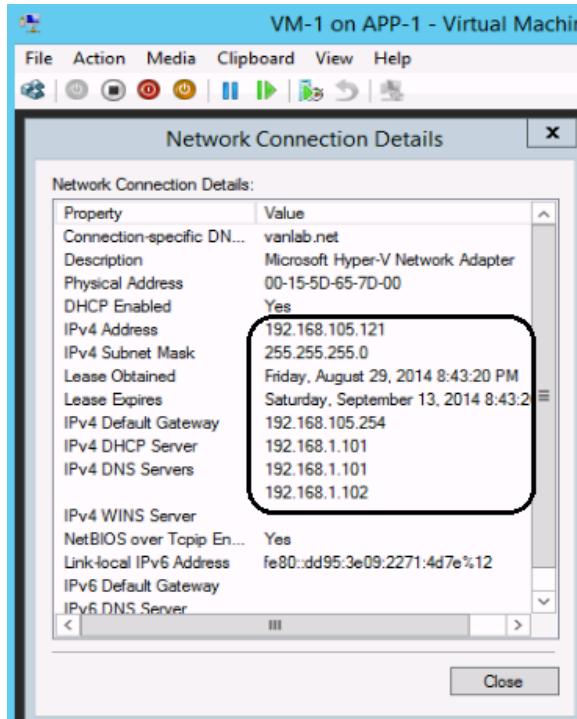


By simply changing the VLAN ID indicated in the Settings of the Network Adapter for this VM, we can change the VLAN that this VM connects to.

**Figure 136** – Move VM1 to VLAN 105 by changing the VLAN ID used for this VM.



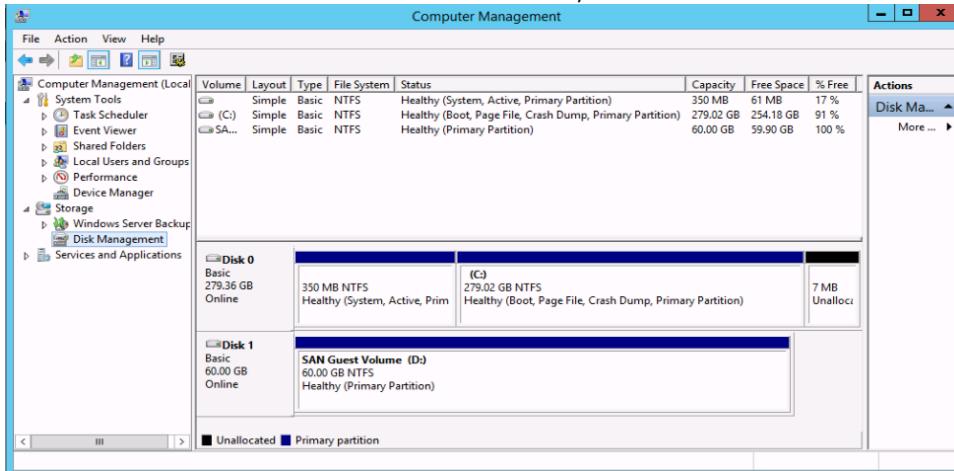
**Figure 137** – VM1 has now received an IP address on VLAN 105.



## Results – Windows 2012 R2 SAN Connectivity

Before attaching the storage LUNs to the server profile, make sure the MPIO feature is installed and configured with MPIO feature is installed and configured within the windows operating system and the MPIO software for your SAN is also installed. Also make sure that you have enabled ALL the SAN fabric Zones for this server, to ensure proper SAN connectivity fail-over.

**Figure 138 - Windows 2012 R2 Disk Administrator.** Note; that D: is the SAN attached volume



## Summary

We presented a Virtual Connect Network and SAN scenario by creating two shared uplink sets (SUS), each SUS is connected with TWO active uplinks; both SUS' can actively pass traffic. We included a dual path SAN fabric for storage connectivity.

When VC profile App-1 is applied to the server in bay1 and the server is powered up, it has one NIC connected through the FlexFabric 10/24-Port module 1 in Bay 1 (connected to VLAN-101-1), the second NIC is connected through the FlexFabric 10/24-Port module in Bay 2 (connected to VLAN-101-2). Each NIC is configured at 1Gb. These NICs are teamed (MGMT) and will be used to manage the Hyper-v host. Either NIC or path could be active. The second pair of NICs is also teamed (Production) and the team is configured in promiscuous mode to support multiple tagged VLANs (102-105 and 2100-2150). Each of these NICs is configured for 5Gb. Either NIC could be active. As a result, this server could access the network through either NIC or either uplink, depending on which NIC is active at the time. This host is also configured for FCoE based SAN access and connects to a SAN LUN to store the Guest VMs. Each FCoE port is configured for 4Gb of SAN bandwidth.

Additional NICs could be added within FlexFabric, by simply powering the server off and adding up to a total of 6 NICs, the NIC speed can then be adjusted accordingly to suit the needs of each NIC. If additional or less SAN bandwidth is required, the speed of the SAN connection can also be adjusted. If the FCoE SAN connections are not required, these could be deleted, in which two additional NIC ports would then be made available to the host.

We then added the Hyper-V role to the server and created a VM guest. The guest was configured for VLAN 102, and then was later moved to VLAN 105, by simply changing the VLAN id as configured in the VM settings tab. Additional VLANs can be configured within the Shared Uplink Set and presented to the NIC team supporting the guests; those VLANs would then be made available to Hyper-V manager and any VM guests.

As additional servers are added to the enclosure, simply create additional profiles, or copy existing profiles, configure the NICs for LAN and SAN fabrics as required and apply them to the appropriate server bays and power the server on.

# **Scenario 5 – Shared Uplink Set with Active/Standby Uplinks and 802.3ad (LACP) - Ethernet and FCoE SAN – vSphere 5.5**

## **Overview**

This scenario will implement the Shared Uplink Set (SUS) to provide support for multiple VLANs. The upstream network switches connect a shared uplink set to two ports on each FlexFabric 10/24-Port modules, LACP will be used to aggregate those links.

As multiple VLANs will be supported in this configuration, the upstream switch ports connecting to the FlexFabric 10/24-Port modules will be configured to properly present those VLANs. In this scenario, the upstream switch ports will be configured for VLAN trunking/VLAN tagging.

When configuring Virtual Connect, we can provide several ways to implement network fail-over or redundancy. One option would be to connect multiple uplinks to a single Virtual Connect network; those uplinks would connect from different Virtual Connect modules within the enclosure and could then connect to the same upstream switch or two different upstream switches, depending on your redundancy needs. An alternative would be to configure TWO separate Virtual Connect networks, each with a single, or multiple, uplinks configured. Each option has its advantages and disadvantages. For example; an Active/Standby configuration places the redundancy at the VC level, where Active/Active places it at the OS NIC teaming or bonding level. We will review the first option in this scenario.

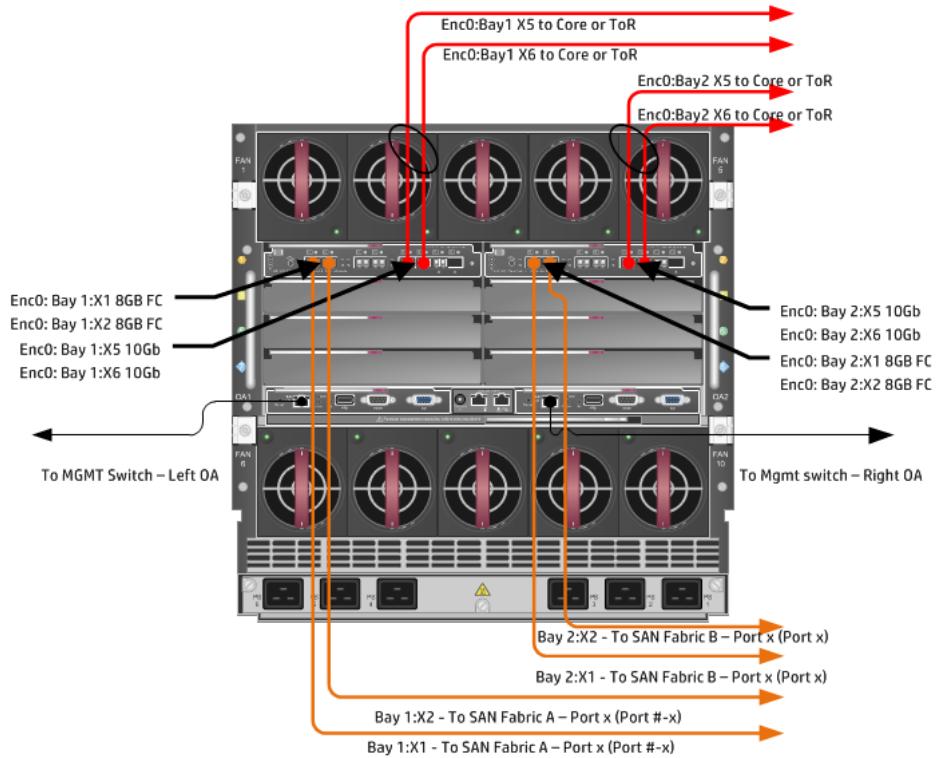
In addition, several Virtual Connect Networks can be configured to support the required networks to the servers within the BladeSystem enclosure. These networks could be used to separate the various network traffic types, such as iSCSI, backup and VMotion from production network traffic.

This scenario will also leverage the Fibre Channel over Ethernet (FCoE) capabilities of the FlexFabric 10/24-Port modules. Each fibre channel fabric will have two uplinks connected to each of the FlexFabric 10/24-Port modules.

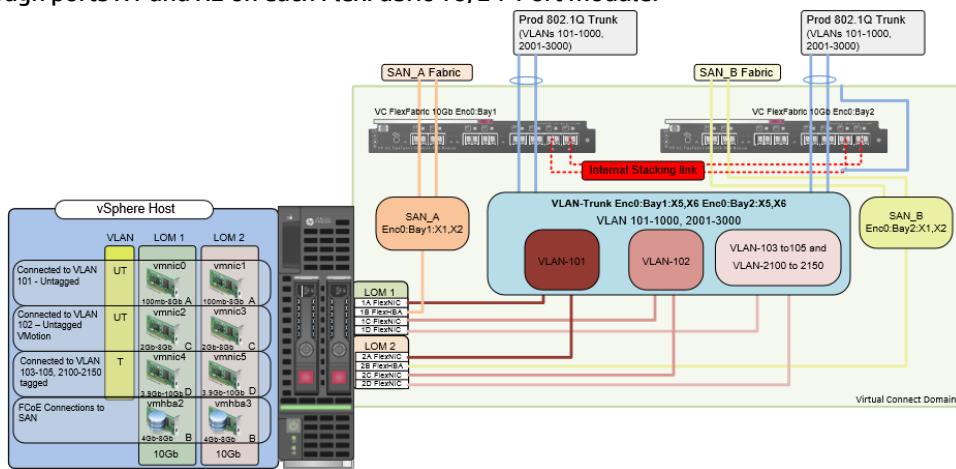
## **Requirements**

This scenario will support both Ethernet and fibre channel connectivity. In order to implement this scenario, an HP BladeSystem c7000 enclosure with one or more server blades and TWO Virtual Connect FlexFabric 10/24-Port modules, installed in I/O Bays 1 & 2 are required. In addition, we will require ONE or TWO external Network switches. As Virtual Connect does not appear to the network as a switch and is transparent to the network, any standard managed switch will work with Virtual Connect. The Fibre Channel uplinks will connect to the existing FC SAN fabrics. The SAN switch ports will need to be configured to support NPIV logins. Two uplinks from each FlexFabric 10/24-Port module will be connected to the existing SAN fabrics.

**Figure 139 - Physical View:** Shows two Ethernet uplinks from Ports X5 and X6 on Modules 1 and 2 to Ports 1 and 2 on each network switch. The SAN fabrics are also connected redundantly, with TWO uplinks per fabric, from ports X1 and X2 on module 1 to Fabric A and ports X1 and X2 to Fabric B.



**Figure 140 - Logical View:** The server blade profile is configured with SIX FlexNICs and 2 FlexHBAs. NICs 1 and 2 are connected to VLAN-101, NICs 3 and 4 are connected to VLAN-102 and NICs 4 and 5 are connected to VLAN-103 through VLAN-105 and VLAN-2100 through VLAN-2150, which are part of the Shared Uplink Set, VLAN-Trunk. The VLAN-Trunk is connected, at 10Gb, to a network switch, through Ports X5 and X6 on each FlexFabric 10/24-Port Module in Bays 1 and 2. This configuration will cause one set of uplinks to be Active and the other to be in Standby. The FCoE SAN connections are connected through ports X1 and X2 on each FlexFabric 10/24-Port module.



# Installation and configuration

## Switch configuration

As the Virtual Connect module acts as an edge switch, Virtual Connect can connect to the network at either the distribution level or directly to the core switch.

The appendices provide a summary of the cli commands required to configure various switches for connection to Virtual Connect. The configuration information provided in the appendices for this scenario assumes the following information:

- The switch ports are configured as VLAN TRUNK ports (tagging) to support several VLANs. All frames will be forwarded to Virtual Connect with VLAN tags. Optionally, one VLAN could be configured as (Default) untagged, if so, then a corresponding vNet within the Shared Uplink Set would be configured and set as “Default”.

**Note:** When adding additional uplinks to the SUS, if the additional uplinks are connecting from the same FlexFabric 10/24-Port module to the same switch, in order to ensure all The uplinks are active, the switch ports will need to be configured for LACP within the same Link Aggregation Group.

The network switch port should be configured for Spanning Tree Edge as Virtual Connect appears to the switch as an access device and not another switch. By configuring the port as Spanning Tree Edge, it allows the switch to place the port into a forwarding state much quicker than otherwise, this allows a newly connected port to come online and begin forwarding much quicker.

The SAN connection will be made with redundant connections to each Fabric. SAN switch ports connecting to the FlexFabric 10/24-Port module must be configured to accept NPIV logins.

## Configuring the VC module

- Physically connect Port 1 of network switch 1 to Port X5 of the VC module in Bay 1
- Physically connect Port 2 of network switch 1 to Port X6 of the VC module in Bay 1
- Physically connect Port 1 of network switch 2 to Port X5 of the VC module in Bay 2
- Physically connect Port 2 of network switch 2 to Port X6 of the VC module in Bay 2

**Note:** If you have only one network switch, connect VC ports X5 and X6 (Bay 2) to an alternate port on the same switch. This will NOT create a network loop and Spanning Tree is not required.

- Physically connect Ports X1/X2 on the FlexFabric in module Bay 1 to switch ports in SAN Fabric A
- Physically connect Ports X1/X2 on the FlexFabric in module Bay 2 to switch ports in SAN Fabric B

## VC CLI commands

Many of the configuration settings within VC can also be accomplished via a CLI command set. In order to connect to VC via a CLI, open an SSH connection to the IP address of the active VCM. Once logged in, VC provides a CLI with help menus. Through this scenario the CLI commands to configure VC for each setting will also be provided.

## Configuring Expanded VLAN Capacity via GUI

Virtual Connect release 3.30 provided an expanded VLAN capacity mode when using Shared Uplink Sets, this mode can be enabled through the Ethernet Settings tab or the VC CLI. The default configuration for a new Domain install is “Expanded VLAN Capacity” mode, Legacy mode is no longer available and the Domain cannot be downgraded.

Virtual Connect 4.30 now provides the ability to define up to 4096 VLANs then consume only the VLANs you need, when you need them. There is nothing to change or enable to take advantage of the 4096 VLAN feature.

## To verify the VLAN Capacity mode

- On the Virtual Connect Manager screen, Left pane, click Ethernet Settings, Advanced Settings
- Select Expanded VLAN capacity
- Verify Expanded VLAN Capacity is configured and Legacy VLAN Capacity is greyed out.

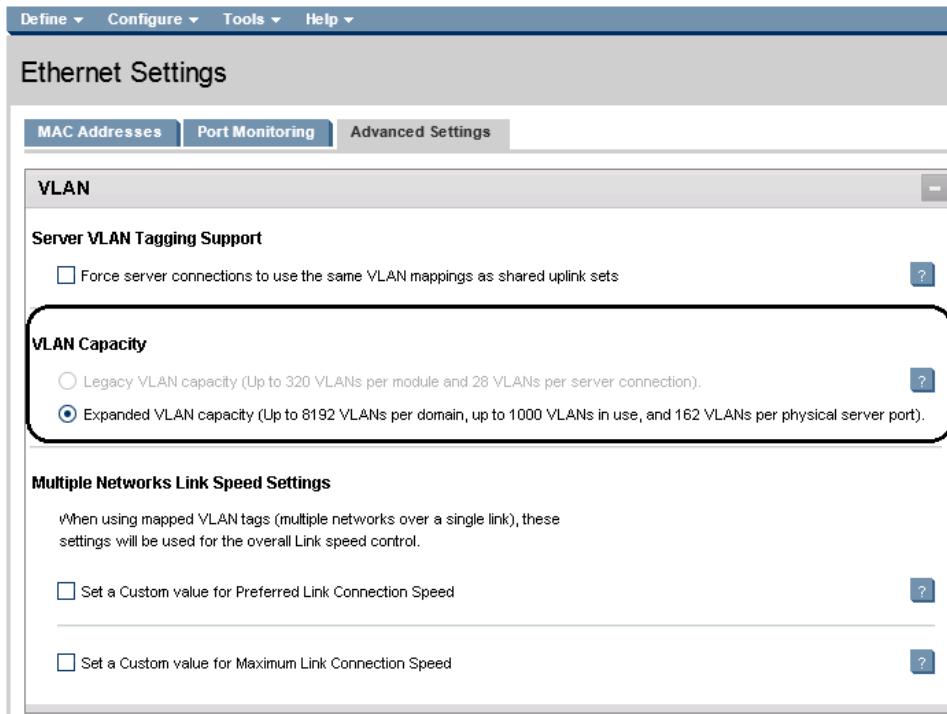
**Note:** Legacy VLAN mode will only be presented if 1Gb Virtual Connect Modules are present, in which case the domain would be limited to Firmware version 3.6x.

## Configuring Expanded VLAN Capacity via CLI

The following command can be copied and pasted into an SSH based CLI session with Virtual Connect;

```
# Set Expanded VLAN Capacity  
set enet-vlan -quiet VlanCapacity=Expanded
```

**Figure 141 - Enabling Expanded VLAN Capacity**



**Note:** If a 1Gb VC Ethernet module is present in the Domain, Expanded VLAN capacity will be greyed out, this is only supported with 10Gb and 20Gb based Virtual Connect modules. Also, once Expanded VLAN capacity is selected, moving back to Legacy VLAN capacity mode will require a domain deletion and rebuild.

## Configuring Fast MAC Cache Failover

When an uplink on a VC Ethernet Module that was previously in standby mode becomes active, it can take several minutes for external Ethernet switches to recognize that the c-Class server blades must now be reached on this newly active connection.

Enabling Fast MAC Cache Failover forces Virtual Connect to transmit Ethernet packets on newly active links, which enables the external Ethernet switches to identify the new connection more quickly (and update their MAC caches appropriately). This transmission sequence repeats a few times at the MAC refresh interval (five seconds is the recommended interval) and completes in about one minute.

## Configuring the VC Module for Fast Mac Cache Fail-over via GUI (Ethernet settings)

### Set Fast MAC Cache Fail-over to 5 Seconds

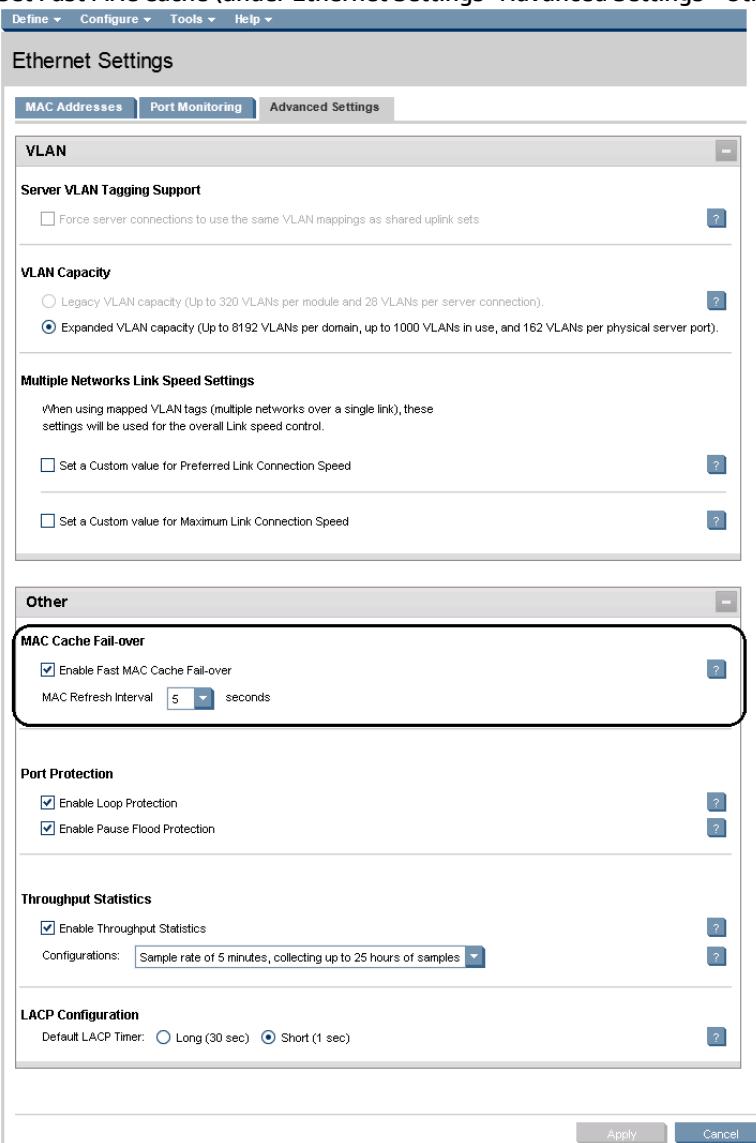
- On the Virtual Connect Manager screen, Left pane, click Ethernet Settings, Advanced Settings
- Click the “Other” tab
- Select Fast MAC Cache Fail-over with a refresh of 5
- Select Apply

## Configuring the VC Module for Fast Mac Cache Fail-over via CLI (Ethernet settings)

The following command can be copied and pasted into an SSH based CLI session with Virtual Connect;

```
# Set Advanced Ethernet Settings to Enable Fast MAC cache fail-over  
set mac-cache Enabled=True Refresh=5
```

**Figure 142 - Set Fast MAC Cache (under Ethernet Settings “Advanced Settings - Other)**



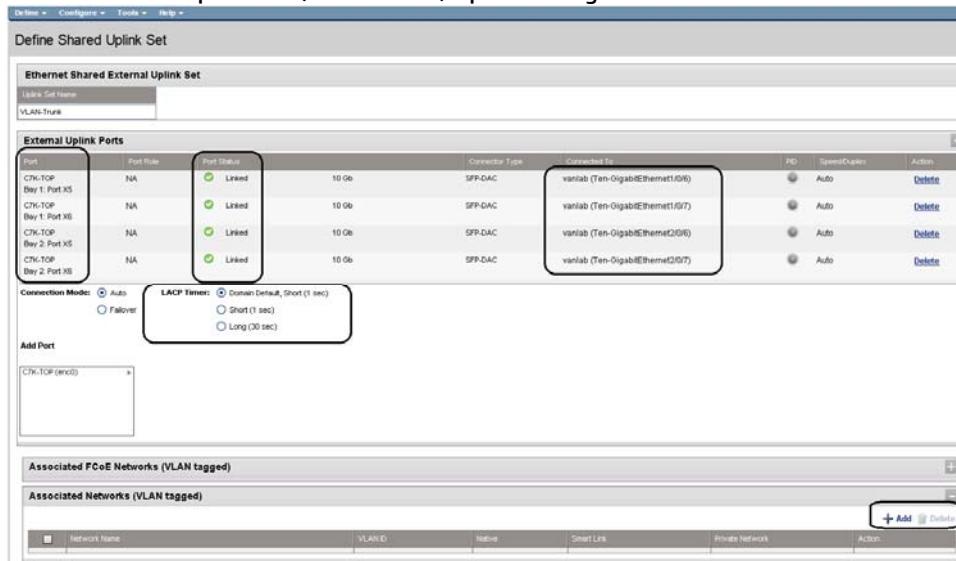
## Defining a new Shared Uplink Set (VLAN-Trunk)

Connect Ports X5 and X6 of FlexFabric 10/24-Port module in Bay 1 to Ports 1 and 2 on switch 1, then connect Ports X5 and X6 from FlexFabric 10/24-Port Module 2 to ports 1 and 2 of switch 2.

Create a SUS named “VLAN-Trunk” and connect it to FlexFabric 10/24-Port Ports X5 and X6 on both modules 1 and 2

- On the Virtual Connect Home page, select Define, Shared Uplink Set
- Insert Uplink Set Name as VLAN-Trunk-1
- Select Add Port, then add the following port;
  - Enclosure 1, Bay 1, Port X5
  - Enclosure 1, Bay 1, Port X6
  - Enclosure 1, Bay 2, Port X5
  - Enclosure 1, Bay 2, Port X6

**Figure 143 - Shared Uplink Set (VLAN-Trunk) Uplinks Assigned**

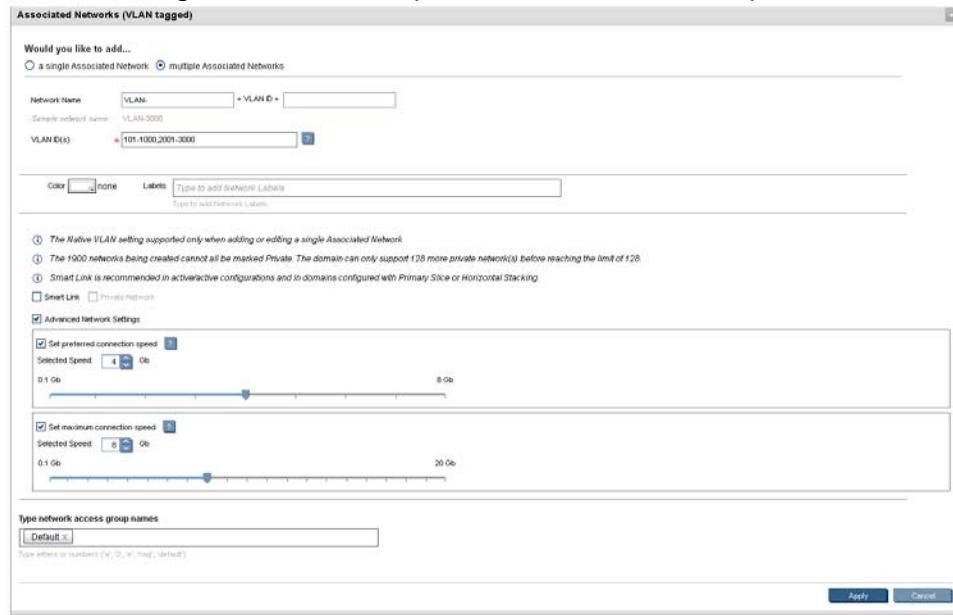


- Click Add Networks and select the Multiple Networks radio button and add the following VLANs;
  - Enter Name as VLAN-
  - Enter VLAN IDs as follows (and shown in the following graphic);
- 101-1000,2001-3000
- SmartLink is not required
- Click Advanced
  - Configure Preferred speed to 4Gb
  - Configure Maximum speed to 8Gb
- Click Apply

**Note:** You can optionally specify a network “color” or “Label” when creating a shared Uplinkset and its networks. In the example above we have not set either color or label.

**Note:** The uplinks are still simply “linked” and will not go Linked/Active until after at least one networking is assigned to a Profile. This is new behavior in VC 4.30.

**Figure 144 - Creating VLANs in a Shared Uplink Set. Note: No suffix is required.**



**Note:** If the VC domain is not in Expanded VLAN capacity mode, you will receive an error when attempting to create more than 128 VLANs in a SUS. If that occurs, go to Advanced Ethernet Settings and select Expanded VLAN capacity mode and apply.

**Note:** When configuring Preferred and Maximum networks speeds, these speeds will only be reflected when the network is configured individually on a specific NIC. In order to set a Maximum network speed for a NIC configured with Multiple Networks, configure the “Multiple Networks Link Speed Settings” under Ethernet, Advanced Settings in the left tree view pane of the VC console.

After clicking apply, a list of VLANs will be presented as shown below. If one VLAN in the trunk is untagged/native, see note below.

- Click Apply at the bottom of the page to create the Shared Uplink Set

**Figure 145 - Associated VLANs for Shared Uplink Set "VLAN-Trunk"**

The screenshot shows a software interface titled 'Edit Shared Uplink Set: VLAN-Trunk'. Below it is a table titled 'Associated Networks (VLAN tagged)'. The table has columns: Network Name, VLAN ID, Native, Smart Link, Private Network, and Action. There are 24 rows, each representing a VLAN from 101 to 124. All rows have 'false' in the Native column and 'false' in the Smart Link column. The Private Network column also contains 'false'. The Action column has 'Edit' links for each row.

	Network Name	VLAN ID	Native	Smart Link	Private Network	Action
<input type="checkbox"/>	VLAN-101	101	false	false	false	<a href="#">Edit</a>
<input type="checkbox"/>	VLAN-102	102	false	false	false	<a href="#">Edit</a>
<input type="checkbox"/>	VLAN-103	103	false	false	false	<a href="#">Edit</a>
<input type="checkbox"/>	VLAN-104	104	false	false	false	<a href="#">Edit</a>
<input type="checkbox"/>	VLAN-105	105	false	false	false	<a href="#">Edit</a>
<input type="checkbox"/>	VLAN-106	106	false	false	false	<a href="#">Edit</a>
<input type="checkbox"/>	VLAN-107	107	false	false	false	<a href="#">Edit</a>
<input type="checkbox"/>	VLAN-108	108	false	false	false	<a href="#">Edit</a>
<input type="checkbox"/>	VLAN-109	109	false	false	false	<a href="#">Edit</a>
<input type="checkbox"/>	VLAN-110	110	false	false	false	<a href="#">Edit</a>
<input type="checkbox"/>	VLAN-111	111	false	false	false	<a href="#">Edit</a>
<input type="checkbox"/>	VLAN-112	112	false	false	false	<a href="#">Edit</a>
<input type="checkbox"/>	VLAN-113	113	false	false	false	<a href="#">Edit</a>
<input type="checkbox"/>	VLAN-114	114	false	false	false	<a href="#">Edit</a>
<input type="checkbox"/>	VLAN-115	115	false	false	false	<a href="#">Edit</a>
<input type="checkbox"/>	VLAN-116	116	false	false	false	<a href="#">Edit</a>
<input type="checkbox"/>	VLAN-117	117	false	false	false	<a href="#">Edit</a>
<input type="checkbox"/>	VLAN-118	118	false	false	false	<a href="#">Edit</a>
<input type="checkbox"/>	VLAN-119	119	false	false	false	<a href="#">Edit</a>
<input type="checkbox"/>	VLAN-120	120	false	false	false	<a href="#">Edit</a>
<input type="checkbox"/>	VLAN-121	121	false	false	false	<a href="#">Edit</a>
<input type="checkbox"/>	VLAN-122	122	false	false	false	<a href="#">Edit</a>
<input type="checkbox"/>	VLAN-123	123	false	false	false	<a href="#">Edit</a>
<input type="checkbox"/>	VLAN-124	124	false	false	false	<a href="#">Edit</a>

**Note:** Optionally, if one of the VLANs in the trunk to this shared uplink set were configured as Native or Untagged, you would be required to “edit” that VLAN in the screen above, and configure Native as TRUE.

Please refer to Appendix D; “Scripting the Native VLAN” for scripting examples.

**Figure 146 - You will see that ALL Uplinks are still in a Linked/Standy state**

The screenshot shows a software interface titled 'Shared Uplink Sets'. Below it is a table titled 'Associated Networks'. The table has columns: Shared Uplink Set, Has FCoE, Port Status, Connector Type, Uplink Port, and Action. There is one row for 'VLAN-Trunk'. The 'Port Status' column contains four entries, all of which are 'Linked-Standby'. The 'Uplink Port' column lists four ports: 'C7K-TOP: Bay 1: Port X5', 'C7K-TOP: Bay 1: Port X6', 'C7K-TOP: Bay 2: Port X5', and 'C7K-TOP: Bay 2: Port X6'. The 'Action' column has an 'Edit' link.

Shared Uplink Set	Has FCoE	Port Status	Connector Type	Uplink Port	Action
<input checked="" type="checkbox"/> VLAN-Trunk	false	<input checked="" type="checkbox"/> Linked-Standby <input checked="" type="checkbox"/> Linked-Standby <input checked="" type="checkbox"/> Linked-Standby <input checked="" type="checkbox"/> Linked-Standby	10 Gb SFP-DAC	C7K-TOP: Bay 1: Port X5	<a href="#">Edit</a>

**Note:** That both of the network connections are shown as “Linked/Standy”, this state will NOT change until the network has been assigned to a server profile. This behavior is new within VC 4.30 and is provided to accommodate the new 4096 VLAN feature.

## Defining a new Shared Uplink Set via CLI

The following script can be used to create the first Shared Uplink Set (VLAN-Trunk-1)

The following command(s) can be copied and pasted into an SSH based CLI session with Virtual Connect

```
# Create Shared Uplink Set "VLAN-Trunk" and configure uplinks
add uplinkset VLAN-Trunk
add uplinkport enc0:1:X5 Uplinkset=VLAN-Trunk speed=auto
add uplinkport enc0:1:X6 Uplinkset=VLAN-Trunk speed=auto
add uplinkport enc0:2:X5 Uplinkset=VLAN-Trunk speed=auto
add uplinkport enc0:2:X6 Uplinkset=VLAN-Trunk speed=auto
# Create Networks VLAN-101 through VLAN-1000 and 2001-3000 for Shared Uplink Set "VLAN-Trunk"
add network-range -quiet UplinkSet=VLAN-Trunk NamePrefix=VLAN- VLANIds=101-105,2100-2400 NAGs=Default PrefSpeedType=Custom PrefSpeed=4000 MaxSpeedType=Custom MaxSpeed=8000 SmartLink=Enabled
```

**Note:** In this scenario we have created a single Share Uplink Set (SUS) with both active and standby uplinks originating from the opposite FlexFabric Modules, by doing so we provide the ability to create separate and redundant connections out of the Virtual Connect domain. When we create the server profiles, you will see how the NICs will connect to the same VLANs accessed through the same VC module, which provides the ability to create an Active / Standby uplink scenario.

## Defining a new (FCoE) SAN Fabric via GUI

Create a Fabric and name it “FCoE\_A”

- On the Virtual Connect Manager screen, click Define, SAN Fabric to create the first Fabric
- Enter the Network Name of “FCoE\_A”
- Select Add Port, then add the following ports;
  - Enclosure 1, Bay 1, Port X1
  - Enclosure 1, Bay 1, Port X2
- Ensure Fabric Type is set to “FabricAttach”
- Select Show Advanced Settings
  - Select Automatic Login Re-Distribution (FlexFabric Only)
  - Select Set Preferred FCoE Connect Speed
    - Configure for 4Gb
  - Select Set Maximum FCoE Connect Speed
    - Configure for 8Gb
- Select Apply

Create a second Fabric and name it “FCoE\_B”

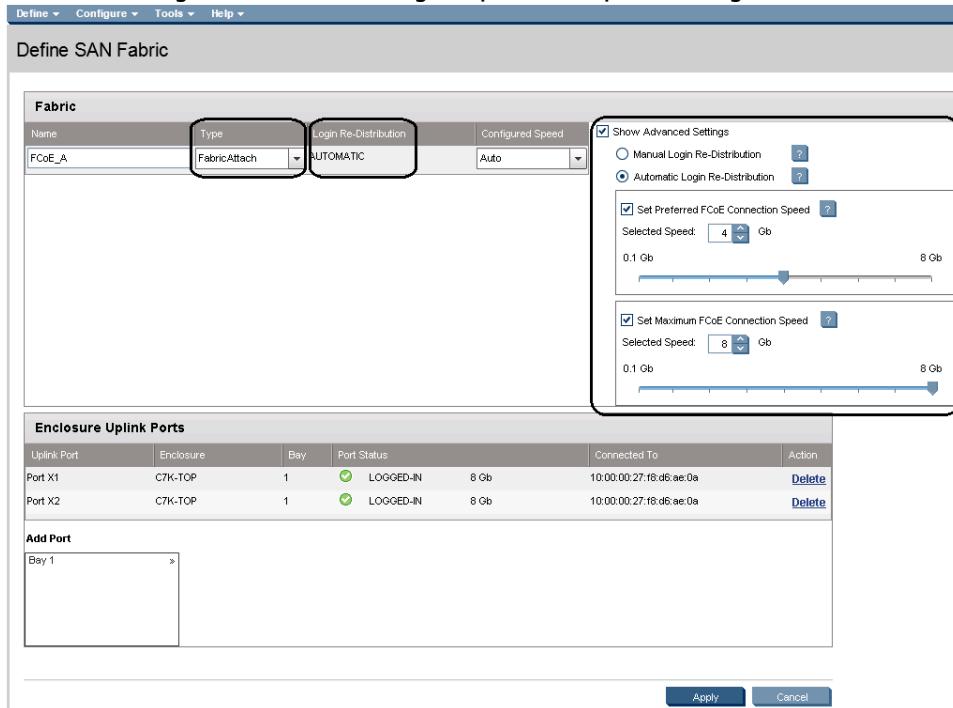
- On the Virtual Connect Manager screen, click Define, SAN Fabric to create the second Fabric
- Enter the Network Name of “FCoE\_B”
- Select Add Port, then add the following ports;
  - Enclosure 1, Bay 2, Port X1
  - Enclosure 1, Bay 2, Port X2
- Ensure Fabric Type is set to “FabricAttach”
- Select Show Advanced Settings
  - Select Automatic Login Re-Distribution (FlexFabric Only)
  - Select Set Preferred FCoE Connect Speed
    - Configure for 4Gb
  - Select Set Maximum FCoE Connect Speed
    - Configure for 8Gb
- Select Apply

## Defining SAN Fabrics via CLI

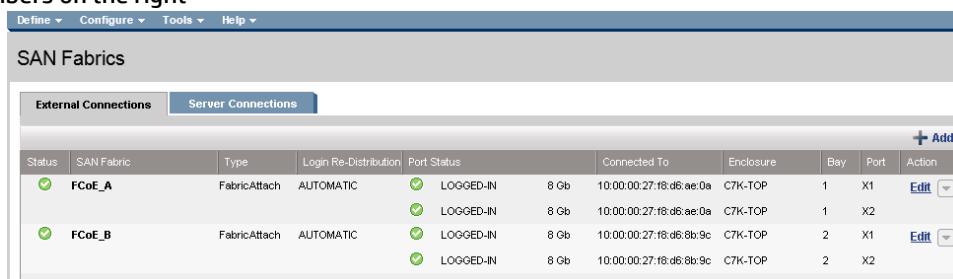
The following command(s) can be copied and pasted into an SSH based CLI session with Virtual Connect

```
#Create the SAN Fabrics FCoE_A and FCoE_B and configure uplinks as discussed above
add fabric FCoE_A Type=FabricAttach Bay=1 Ports=1,2 Speed=Auto LinkDist=Auto
PrefSpeedType=Custom PrefSpeed=4000 MaxSpeedType=Custom MaxSpeed=8000
add fabric FCoE_B Type=FabricAttach Bay=2 Ports=1,2 Speed=Auto LinkDist=Auto
PrefSpeedType=Custom PrefSpeed=4000 MaxSpeedType=Custom MaxSpeed=8000
```

**Figure 147 - SAN Login Distribution Setting and preferred Speed Settings**



**Figure 148 - FCoE SAN fabrics configured with two 8Gb uplinks per fabric. Note the bay and port numbers on the right**



## Defining a Server Profile

We will create a server profile with SIX server NICs and TWO SAN adapters. Each server NIC will connect to a specific network.

- On the main menu, select Define, then Server Profile
- Create a server profile called “ESX-1”
- Select to “Hide Unused FlexNICs”
- In the Network Port 1 drop down box, select a Network, then chose VLAN101
- Set the port speed to Custom at 100Mb
- In the Network Port 2 drop down box, select a Network, then chose VLAN101
- Set the port speed to Custom at 100Mb
- Select ADD network (add four additional network connections)
- In the Network Port 3 drop down box, select a Network, then chose VLAN-102
- Set the port speed to Custom at 2Gb
- In the Network Port 4 drop down box, select a Network, then chose VLAN-102
- Set the port speed to Custom at 2Gb
- In the Network Port 5 drop down box, select Multiple Networks
- Configure for networks VLAN-103 through VLAN-105 and VLAN-2100 through VLAN-2150
- Leave the network speed as Auto
- In the Network Port 6 drop down box, select Multiple Networks
- Configure for networks VLAN-103 through VLAN-105 and VLAN-2100 through VLAN-2150
- Leave the network speed as Auto
- Expand the FCoE Connections box, for Bay 1, select FCoE\_A for Bay 2, select FCoE\_B
- Do not configure FC SAN or iSCSI Connection
- In the Assign Profile to Server Bay box, locate the Select Location drop down and select Bay 1, then apply

Prior to applying the profile, ensure that the server in Bay 1 is currently OFF

**Note:** You should now have a server profile assigned to Bay 2, with 4 Server NIC connections. NICs 1&2 should be connected to networks VLAN-101 (MGMT), NICs 3&4 should be connected VLAN-102 (VMotion) to networks VLAN103 through VLAN105 and VLAN-2100 through VLAN-2150. FCoE SAN fabrics are connected to, Port 1 - FCoE\_A and Port 2 - FCoE\_B.

## Defining a Server Profile via CLI

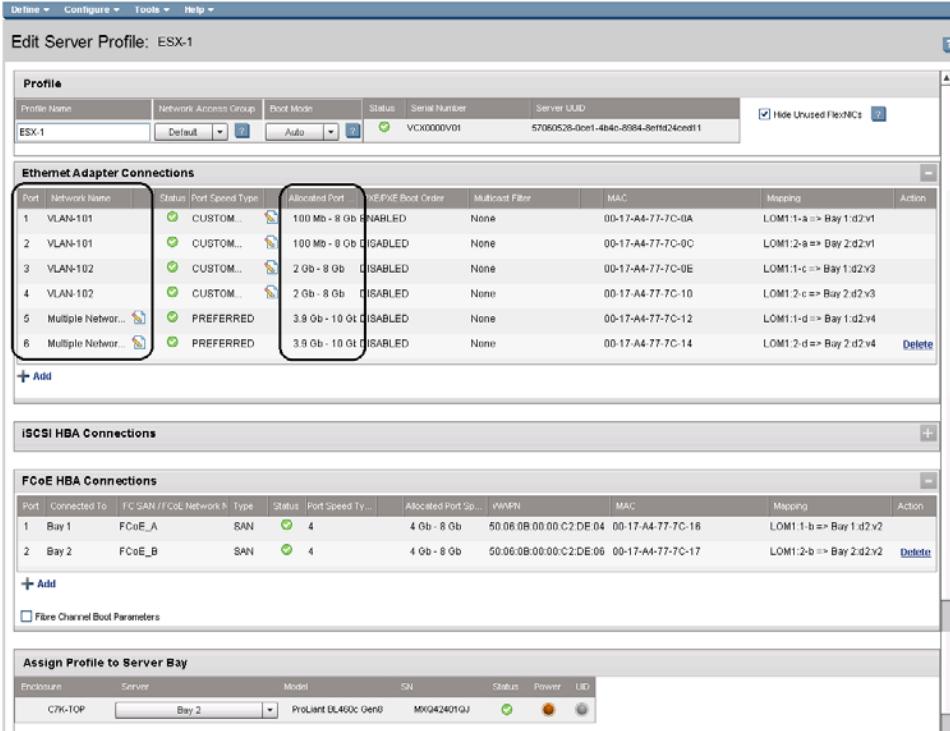
The following command(s) can be copied and pasted into an SSH based CLI session with Virtual Connect

```
# Create Server Profile ESX-1
add profile ESX-1 -nodefaultfcoconn -nodefaultfcoeconn NAG=Default HideUnusedFlexNICs=true
set enet-connection ESX-1 1 pxe=Enabled Network=VLAN-101 SpeedType=Custom Speed=100
set enet-connection ESX-1 2 pxe=Disabled Network=VLAN-101 SpeedType=Custom Speed=100
add enet-connection ESX-1 pxe=Disabled Network=VLAN-102 SpeedType=Custom Speed=2000
add enet-connection ESX-1 pxe=Disabled Network=VLAN-102 SpeedType=Custom Speed=2000
add enet-connection ESX-1 pxe=Disabled
add server-port-map-range ESX-1:5 UplinkSet=VLAN-Trunk VLanIds=103-105,2100-2150
add enet-connection ESX-1 pxe=Disabled
add server-port-map-range ESX-1:6 UplinkSet=VLAN-Trunk VLanIds=103-105,2100-2150
add fcoe-connection ESX-1 Fabric=FCoE_A SpeedType=4Gb
add fcoe-connection ESX-1 Fabric=FCoE_B SpeedType=4Gb
poweroff server 2
assign profile ESX-1 enc0:2
```

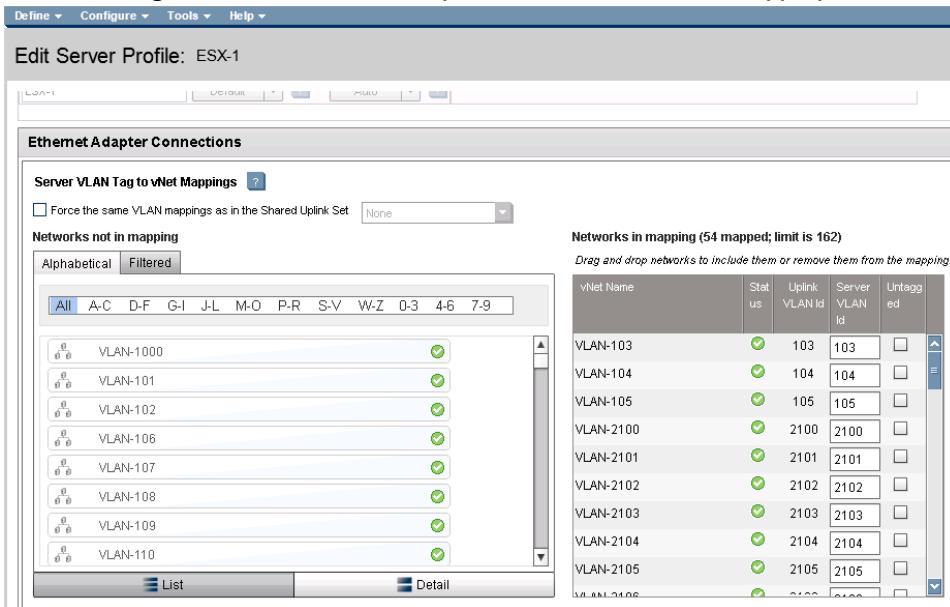
**Note:** The “add server-port-map-range” command is new to VC firmware release 3.30 and can be used to map many VLANs to a server NIC, in a single command. Prior releases would have required one command to create the NIC and one additional command per VLAN mapping added. This command will make profile scripting much easier, less complicated and quicker.

**Note:** The speed of the NIC and SAN connections, as well as the MAC and WWN. Also, note that the FCoE connections are assigned to the two SAN fabrics created earlier and use ports LOM:1-b and LOM:2-b.

**Figure 149 - Define a Server Profile ESX-1, assigned to Bay 2**



**Figure 150 - Configure NICs 5 and 6 for multiple Networks and select the appropriate VLANs**



**Note:** "Server VLAN ID" and "Untagged" boxes can be edited. One network per port could be marked as "Untagged", in which case the server would not be configured for tagging on that VLAN. It is also possible to change the VLAN ID that is presented to the server (VLAN translation), in which case the communications between Virtual Connect and the network would be the VLAN ID in grey, if the Server VLAN ID box to the right were changed, VC would communicate with the server on the new VLAN ID, providing a VLAN translation function. VLAN translation could be a very useful feature, in the event that VLAN renumbering is required within the datacenter. The network VLAN numbers and Shared Uplink Set configurations could be changed to reflect the new VLAN IDs used, however, the old VLAN IDs could still be presented to the server providing the ability to delay or eliminate the need to change the VLAN ID used within the server/vSwitch.

**Figure 151 - Server Profile View Bay 2**

The screenshot shows the vSphere Web Client interface for a ProLiant BL460c Gen8 server in Bay 2. The top navigation bar includes Define, Configure, Tools, and Help.

### Device Bay Status - Bay # 2

Overall Status:	Green checkmark
Hardware Status:	Green checkmark
VC Status:	Green checkmark
Assigned Server Profile:	ESX-1
Enclosure Name:	C7K-TOP
UID:	Off
Power Status/Control:	Off

**Momentary Press**

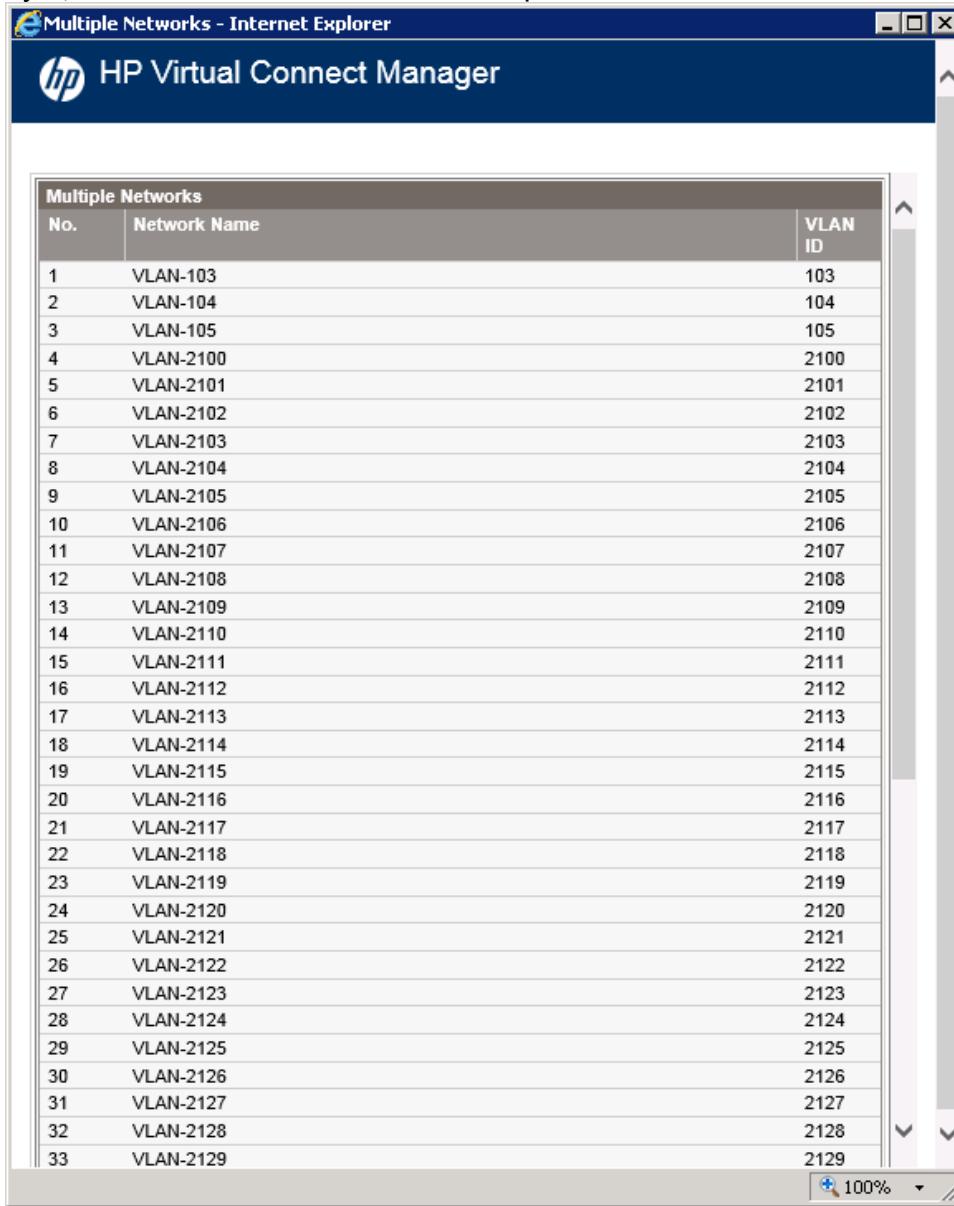
### Blade Server Information - Bay # 2

Serial Number:	MXQ42401QJ
Serial Number (Logical):	VCX0000V01
UUID:	30343237-3638-584D-5134-32343031514A
UUID (Logical):	57060528-0ce1-4b4c-8984-8effd24ced11
Product Name:	ProLiant BL460c Gen8
Server Name:	APP-2
Part Number:	724086-B21
Asset Tag:	[Unknown]
UEFI Capable:	false
Boot Mode:	Legacy

### Server Ethernet Adapter Information

Ethernet Adapter	Flex NIC	Location	Module Port	Model	MAC Address	Network	WWN	SAN Fabric
<b>Port 1</b>								
LOM1:1-a	FLB1	Bay 1:d2:v1		HP FlexFabric 10Gb 2-Port 534FLB Adapter	00-17-A4-77-7C-0A	VLAN-101	50:06:0B:00:00:C2:DE:04	FCoE_A
LOM1:1-b	FLB1	Bay 1:d2:v2		HP FlexFabric 10Gb 2-Port 534FLB Adapter	00-17-A4-77-7C-16	VLAN-102		
LOM1:1-c	FLB1	Bay 1:d2:v3		HP FlexFabric 10Gb 2-Port 534FLB Adapter	00-17-A4-77-7C-0E	Multiple Networks		
LOM1:1-d	FLB1	Bay 1:d2:v4		HP FlexFabric 10Gb 2-Port 534FLB Adapter	00-17-A4-77-7C-12			
<b>Port 2</b>								
LOM1:2-a	FLB1	Bay 2:d2:v1		HP FlexFabric 10Gb 2-Port 534FLB Adapter	00-17-A4-77-7C-0C	VLAN-101	50:06:0B:00:00:C2:DE:06	FCoE_B
LOM1:2-b	FLB1	Bay 2:d2:v2		HP FlexFabric 10Gb 2-Port 534FLB Adapter	00-17-A4-77-7C-17	VLAN-102		
LOM1:2-c	FLB1	Bay 2:d2:v3		HP FlexFabric 10Gb 2-Port 534FLB Adapter	00-17-A4-77-7C-10	Multiple Networks		
LOM1:2-d	FLB1	Bay 2:d2:v4		HP FlexFabric 10Gb 2-Port 534FLB Adapter	00-17-A4-77-7C-14			

**Figure 152** - By clicking on the “Multiple Networks” statement for each LOM, the following page is displayed, which lists the VLAN connections for this port.



The screenshot shows a Microsoft Internet Explorer window titled "Multiple Networks - Internet Explorer". The main content area is titled "HP Virtual Connect Manager". Below this, there is a table with the following columns: "No.", "Network Name", and "VLAN ID". The table lists 33 entries, each corresponding to a VLAN ID from 103 to 2129. The "Network Name" column contains names such as "VLAN-103", "VLAN-104", "VLAN-105", etc., up to "VLAN-2129". The "VLAN ID" column contains the corresponding numerical values.

No.	Network Name	VLAN ID
1	VLAN-103	103
2	VLAN-104	104
3	VLAN-105	105
4	VLAN-2100	2100
5	VLAN-2101	2101
6	VLAN-2102	2102
7	VLAN-2103	2103
8	VLAN-2104	2104
9	VLAN-2105	2105
10	VLAN-2106	2106
11	VLAN-2107	2107
12	VLAN-2108	2108
13	VLAN-2109	2109
14	VLAN-2110	2110
15	VLAN-2111	2111
16	VLAN-2112	2112
17	VLAN-2113	2113
18	VLAN-2114	2114
19	VLAN-2115	2115
20	VLAN-2116	2116
21	VLAN-2117	2117
22	VLAN-2118	2118
23	VLAN-2119	2119
24	VLAN-2120	2120
25	VLAN-2121	2121
26	VLAN-2122	2122
27	VLAN-2123	2123
28	VLAN-2124	2124
29	VLAN-2125	2125
30	VLAN-2126	2126
31	VLAN-2127	2127
32	VLAN-2128	2128
33	VLAN-2129	2129

## Verify Network Link State

As discussed earlier in this document, in Virtual connect 4.30 there was a change to the link state behavior when a network as no connections to a server profile. Once a connection is made to the server profile, the uplinks will become Active, as previously expected.

**Figure 153** - All Links now appear in a Linked/Active (and Linked/Standby) state.



The screenshot shows a software interface titled "Shared Uplink Sets". The top menu bar includes "Define", "Configure", "Tools", and "Help". The main window has tabs for "External Connections" and "Associated Networks", with "External Connections" selected. A table displays "Shared Uplink Set" information. The table has columns: "Shared Uplink Set", "Has FCoE", "Port Status", "Connector Type", and "Uplink Port". There are four entries in the table:

Shared Uplink Set	Has FCoE	Port Status	Connector Type	Uplink Port	Action
VLAN Trunk	false	Linked-Active Linked-Active Linked-Standby Linked-Standby	10 Gb SFP-DAC 10 Gb SFP-DAC 10 Gb SFP-DAC 10 Gb SFP-DAC	CTK-TOP: Bay 1: Port X5 CTK-TOP: Bay 1: Port X8 CTK-TOP: Bay 2: Port X5 CTK-TOP: Bay 2: Port X8	+ Add Edit

# Review

In this scenario we have created One Shared Uplink Set (SUS), providing support for many VLANs. Uplinks originating from each FlexFabric 10/24-Port Module connect to the same SUS, by doing so we provide redundant connections out of the Virtual Connect domain. As multiple uplinks are used from each module, we have also leveraged LACP to improve uplink performance. In this scenario, uplinks from one module only will be active at any given time. We also create two FCoE SAN Fabrics.

We created a server profile, with SIX NICs. Two connected to the same VLAN (101), Ports 1 and 2 connect to VLAN-101, which provides the ability to sustain a link or module failure and not lose connection to the network, these NICs were set to 100Mb with a Maximum speed of 8Gb. VLAN-101 frames will be presented to the NIC(s) without VLAN tags (untagged), these two NICs are connected to the same VLAN, but taking a different path through the enclosure. VLAN 101 is used for Management connections to the ESX host.

Network Ports 3 and 4 connect to the same VLAN (102), these NICs were set to 2Gb with a maximum speed of 8Gb. VLAN-102 frames will be presented to the NIC(s) without VLAN tags (untagged), these two NICs are connected to the same VLAN, but taking a different path out of the enclosure. VLAN 102 is used for VMotion.

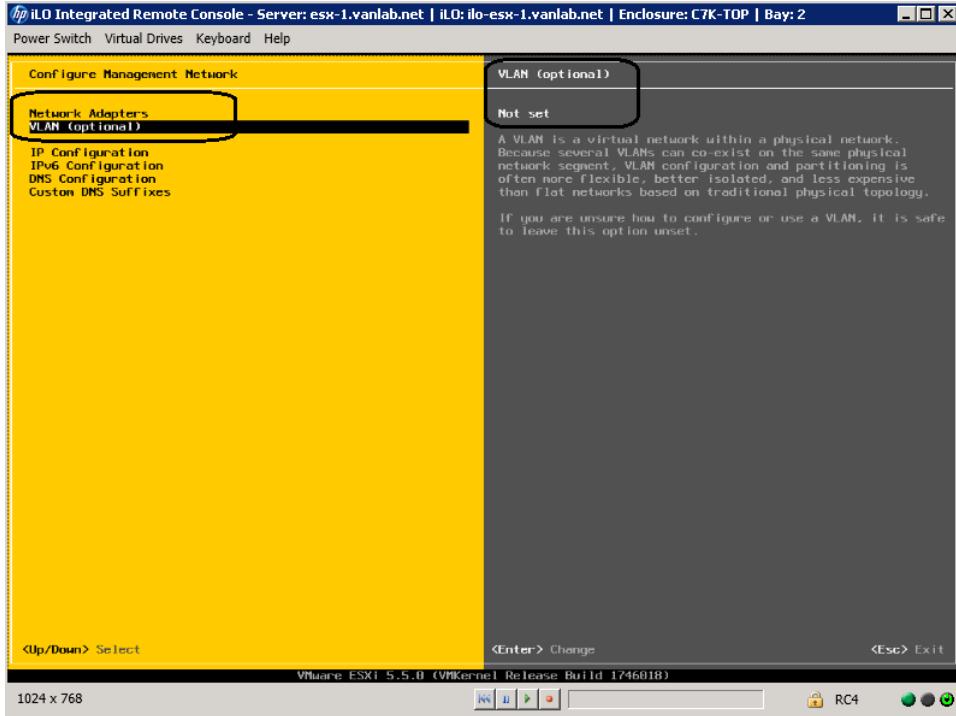
Network Ports 5 and 6 were added, these NICs will be connected to “Multiple Networks” and each NIC has been configured for networks VLAN-103 through VLAN-105 and networks VLAN-2100 through VLAN-2150. As these networks are tagging, frames will be presented to the server with VLAN tags. NICs 5 and 6 will be connected to the same vSwitch to support VM connections. VLAN tagged frames for these networks will be forwarded to the Virtual switch and then passed on to the appropriate Virtual Machine, VLAN tags will be removed as the frames are passed to the virtual machine. These NICs will use the remaining available bandwidth of 3.9Gb with a maximum speed of 10Gb.

Additionally, FCoE port 1 is connected to SAN fabric FCoE\_A and FCoE SAN port 2 is connected to SAN Fabric FCoE\_B, providing a multi-pathed connection to the SAN. The SAN fabric connections are set to 8Gb/Sec.

The FCoE SAN fabric connects to each SAN fabric over a pair of uplinks per module. SAN logins are distributed across the multiple paths.

The following graphic provides an example of an ESX server with TWO NICs connected to the same console vSwitch configured for VLAN 101, which was the Default (untagged) VLAN. Additional vSwitches have been configured for VMotion and product VLANs.

**Figure 154** - As NICs 1 and 2 are connected directly to VLAN-101, the connection acts as an Access or Untagged switch port, you need to ensure that the Hypervisor is NOT configured for VLAN tagging. However, if you want to put this server onto a VLAN that is tagged, this setting will need to be configured for that VLAN.



## Results – vSphere Networking Examples

We successfully configured FlexFabric with Share Uplink Sets, supporting several VLANs and redundant SAN fabrics. We created a server profile to connect to the various vNet with SIX NICs and the SAN fabrics using the FCoE connections created within the profile.

Although both Ethernet and Fibre channel connectivity is provided by the FlexFabric Adapter used in the G7 through Gen 9 servers; each capability (LAN and SAN) is provided by a different component of the adapter, they appear in the server as individual network and SAN adapters.

The following graphics show an ESXi 5.5 server with SIX FlexNICs configured, two at 100Mb (console), two at 2Gb (VMotion) and two at 3.9Gb (Guests port groups), however, as we utilized the new Min/Max network bandwidth feature of Virtual Connect 4.01, the NIC speeds will now be displayed at their maximum configured speed, therefore; when configuring NICs within the ESXi host, you may need to compare MAX addresses to confirm the correct NIC has been selected.

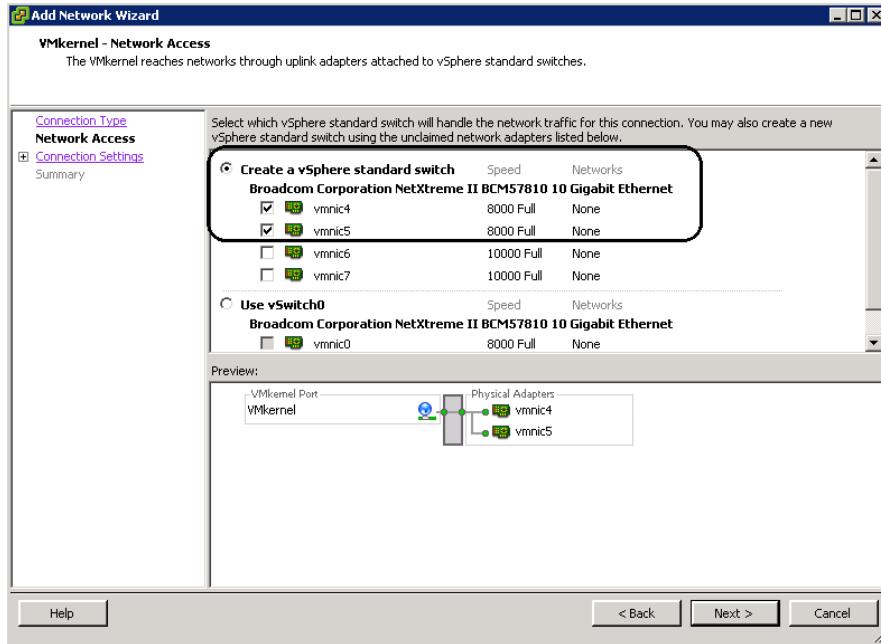
If we did not require SAN connectivity on this server, the FCoE connections could be deleted and the server would then have 8 NIC ports available to the OS. In addition, if we did not want FCoE connectivity and instead wanted to leverage iSCSI, we could delete the FCoE connected and re-create those connects as iSCSI connections, with offload and optionally iSCSI boot.

**Note:** The BL465c G7 and BL685c G7 utilize an NC551i chipset (BE2), whereas the BL460c G7, BL620c G7 and BL680c G7 utilize an NC553i chipset (BE3) and the Gen 8 blades typically have a NC554 adapter which also utilizes the BE3 chipset. Both the BE2 and BE3 chipsets share common drivers and firmware.

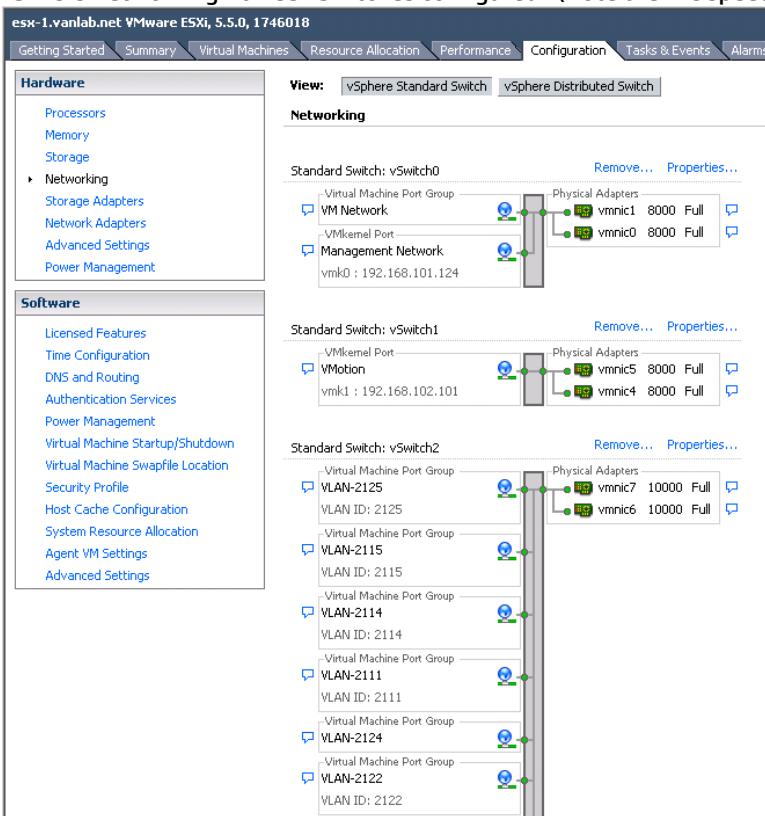
Virtual Connect supports the use of either Standard or Distributed vSwitches, examples of both are provided below.

## vSphere Standard vSwitch

**Figure 155 – ESXi 5.5 Network Connections**

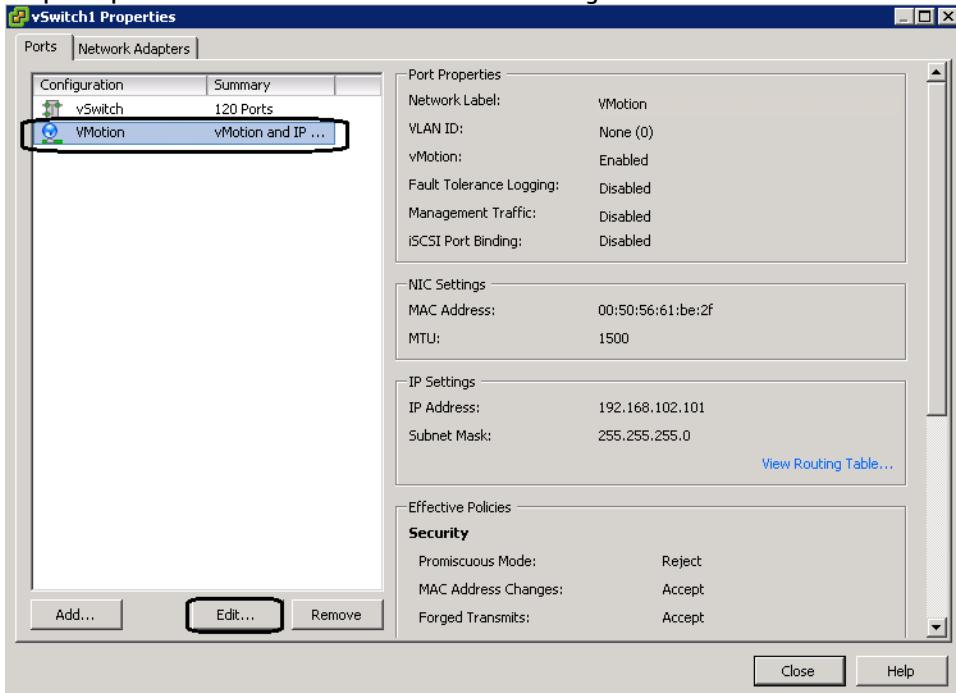


**Figure 156 – ESXi 5.5 networking - three vSwitches configured. (Note the NIC speeds)**

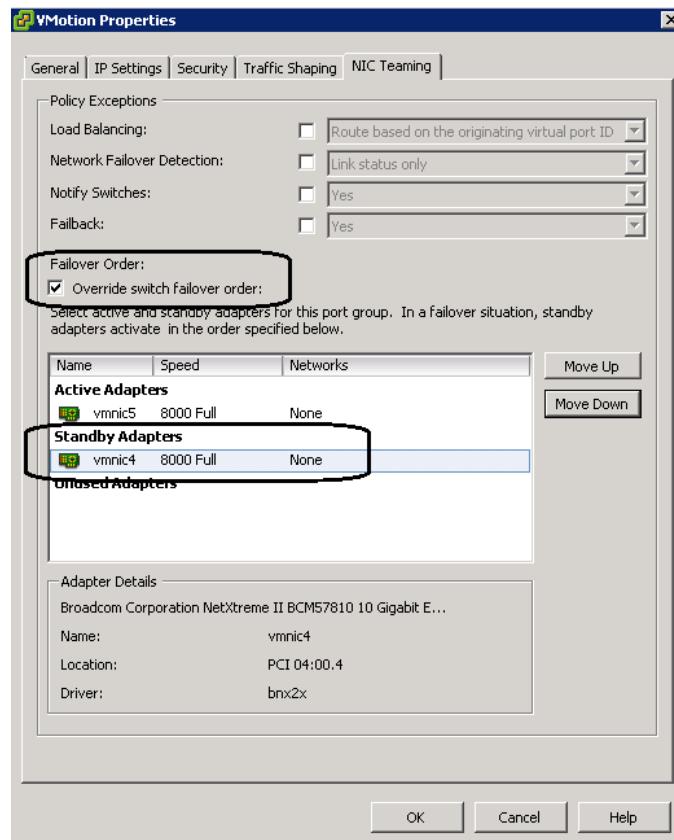


**Note:** As VLAN 101 is untagged, the management network port group should be defined as untagged. This will allow the server to be deployed, without having the set a VLAN ID for the management network.

**Figure 157** - You may want to specify a specific NIC for VMotion traffic. This will ensure that all VMotion traffic between servers within the enclosure will remain on the same VC module, reducing the likelihood of multiple hops between servers. Edit the VMotion Configuration.

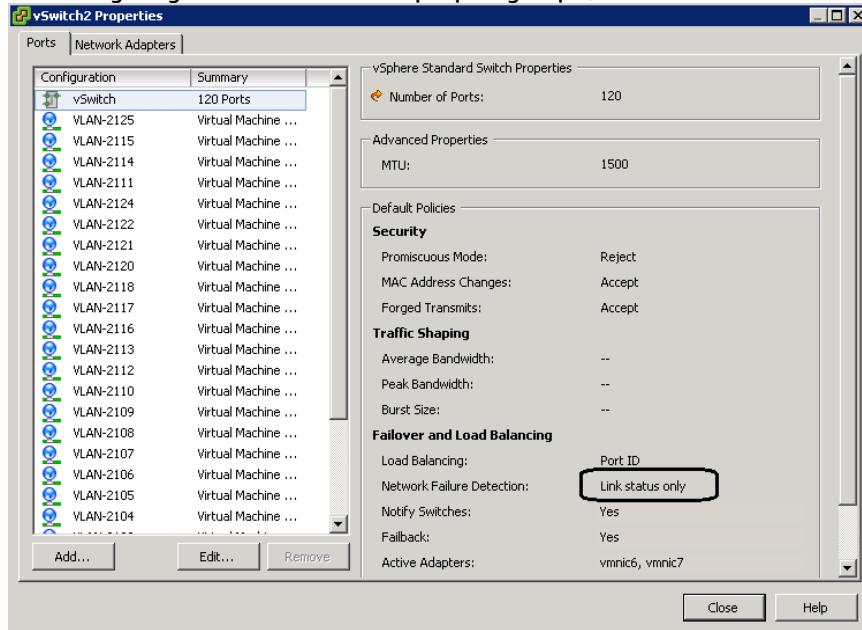


**Figure 158** – Edit the NIC Team for VMotion and set one of the Adapters in Standby, this will ensure that ALL VMotion traffic remains on the SAME VC module. ESX NIC vmnic5 is connected to the VC module in bay 1.

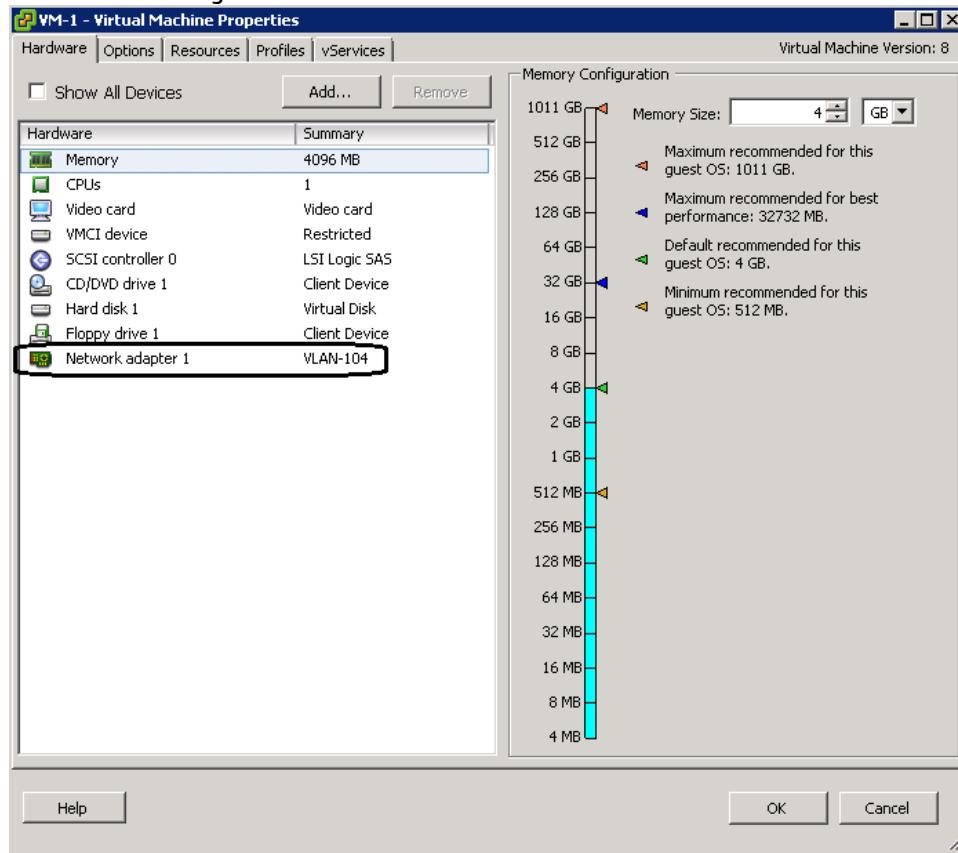


**Note:** As this Scenario is based on an Active/Standby configuration, to ensure that ALL VMotion traffic between servers within the enclosure is contained to the same module, on each server edit the VMotion vSwitch properties and move one of the Adapters to Standby. This will ensure that ALL VMotion traffic will occur on the same Virtual Connect module.

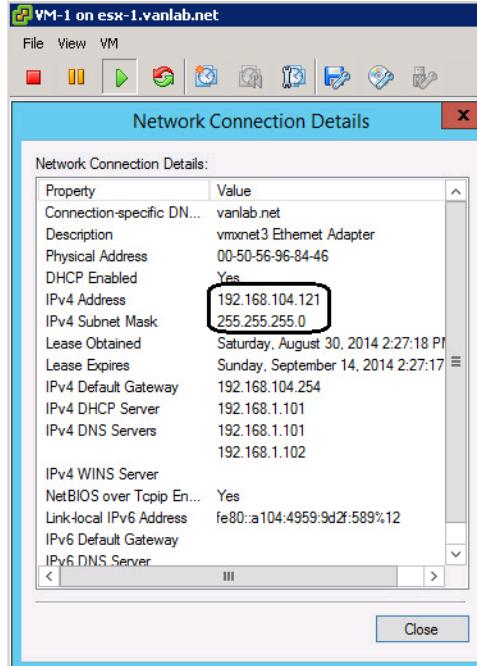
**Figure 159 - Configuring the vSwitch for multiple port groups / VLANs**



**Figure 160 - VM1 configured for VLAN 104**



**Figure 161 - VM1 on VLAN 104**



## vSphere Distributed vSwitch

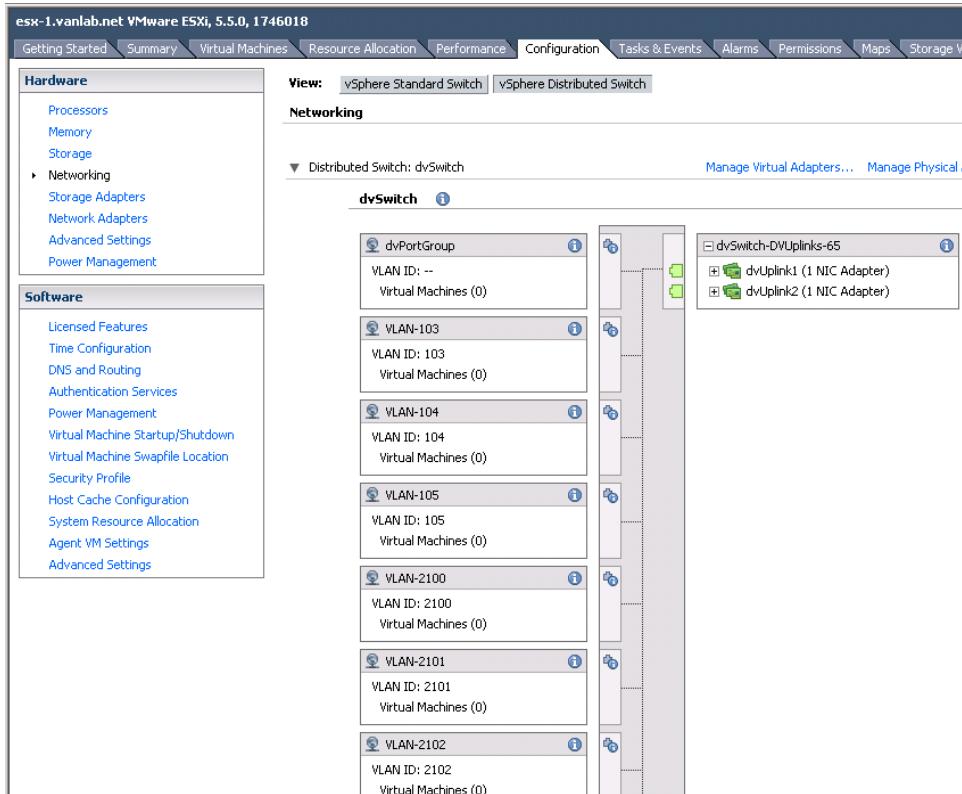
**Figure 162 - Management and VMotion NICs are connected to Standard vSwitches**

The screenshot shows the 'Configuration' tab in the vSphere Web Client for host esx-1.vanlab.net. The 'Networking' section displays two standard switches:

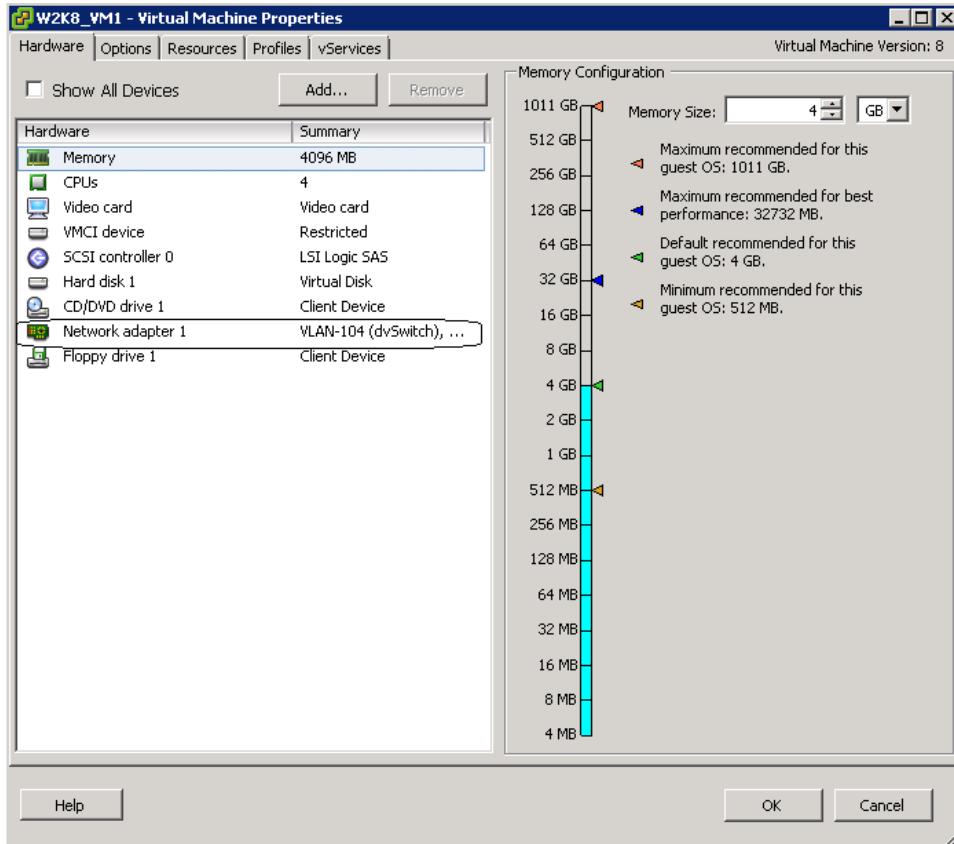
- vSwitch0:** Contains a VM Network port group connected to vmnic1 (8000 Full) and a Management Network port group connected to vmnic0 (8000 Full).
- vSwitch1:** Contains a VMotion port group connected to vmnic5 (8000 Full) and vmnic4 (8000 Full).

The left sidebar shows the navigation menu with 'Networking' selected under 'Hardware'.

**Figure 163 - VM Networks are connected to a Distributed vSwitch**



**Figure 164 - VM Connected to VLAN 104 on Distributed vSwitch**



# Results – vSphere SAN Connectivity

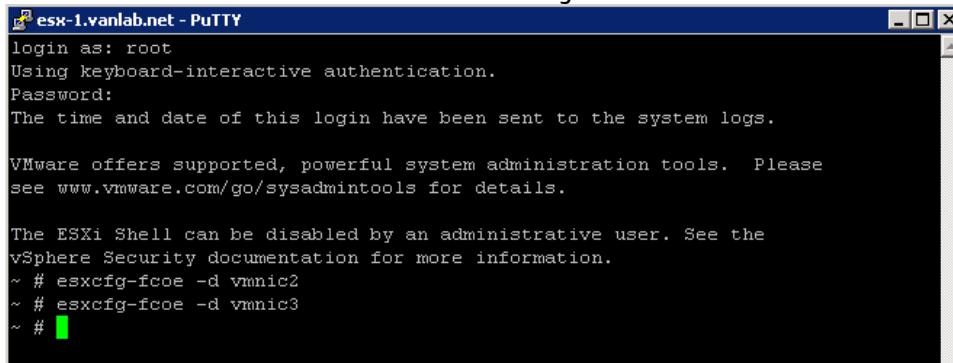
## Broadcom Adapters (534 and 630)

The Broadcom adapters (534 and 650) provide an FCoE capability, however, it presents a little differently than the Emulex discussed above. These adapters use a Broadcom BCM578xOS-Based chipset. When installed with VMWare 5.x, you will need to enable the FCoE capabilities of the adapter if you plan to connect to a Fibre Channel based SAN.

**Note:** This is not required if using the Emulex network adapters.

**Note:** Additional information on enabling the FCoE function in ESXi is provided in the Introduction section, under VMWare ESXi 5.5.

**Figure 165** – SSH to the ESX host and execute the esxcfg-fcoe command as shown below

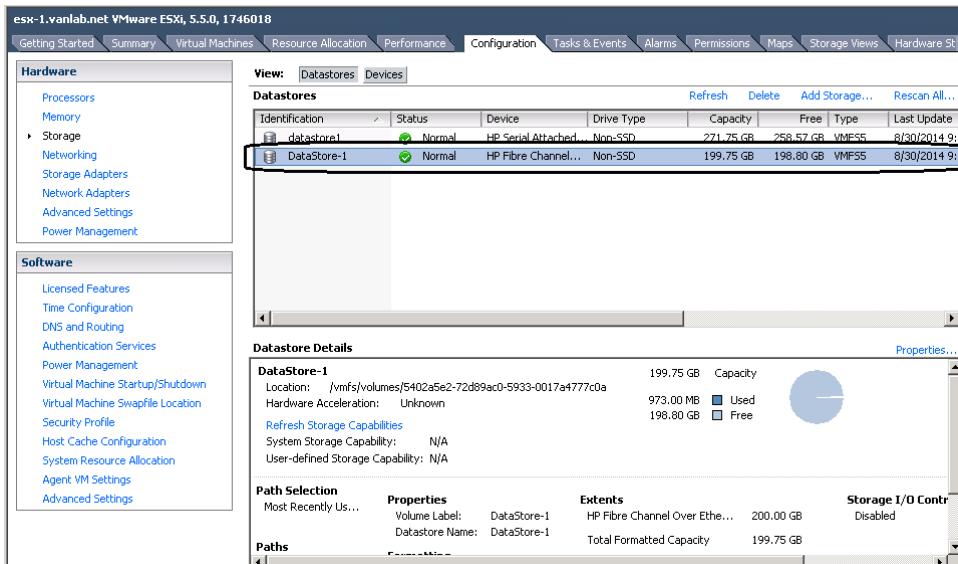


```
esx-1.vanlab.net - PuTTY
login as: root
Using keyboard-interactive authentication.
Password:
The time and date of this login have been sent to the system logs.

VMware offers supported, powerful system administration tools. Please
see www.vmware.com/go/sysadmintools for details.

The ESXi Shell can be disabled by an administrative user. See the
vSphere Security documentation for more information.
~ # esxcfg-fcoe -d vmnic2
~ # esxcfg-fcoe -d vmnic3
~ #
```

**Figure 166** – ESXi 5.5 storage configuration, the Shared Storage LUN is provided through the FCoE connections to the SAN.



# Summary

We presented a Virtual Connect Network scenario by creating a single shared uplink set (SUS). The SUS is connected to TWO different LAN switches through 4 uplinks, two from each FlexFabric 10/24-Port module. We included a dual path SAN fabric for storage connectivity.

When VC profile ESX-1 is applied to the server in bay 2 and the server is powered up, it has one NIC connected through FlexFabric 10/24-Port module 1 (connected to VLAN-101), the second NIC is connected through FlexFabric 10/24-Port module 2 (connected to VLAN-101). Each NIC is configured at 100Mb. These NICs are connected to the console vSwitch. The second pair of NICs are connected to the second vSwitch, which is configured for VMotion and is connected to VLAN102 through NICs 3 and 4 which are configured at 2Gb. The last pair of NICs 5 and 6, are connected to the third vSwitch, which is configured to support VLANs 103 through 105 and 2100 through 2150. This host is also configured for FCoE based SAN access and connects to a SAN LUN to store the Guest VMs. Each FCoE port is configured for 8Gb of SAN bandwidth.

In the event of a LAN switch or uplink cable failure, VC would fail-over the uplinks to the alternate path. The host operating system would likely not realize a failure and fail-over occurred, however, the systems connected to these VLANs would now be accessible though different LAN switches/ports.

As additional servers are added to the enclosure, simply create additional profiles, or copy existing profiles, configure the NICs for LAN and SAN fabrics as required and apply them to the appropriate server bays and power the server on.

# Scenario 6 – Shared Uplink Set with Active/Active Uplinks, 802.3ad (LACP) - Ethernet and FCoE SAN – vSphere 5.5

## Overview

This scenario will implement the Shared Uplink Set (SUS) to provide support for multiple VLANs. The upstream network switches connect a shared uplink set to two ports on each FlexFabric 10/24-Port modules, LACP will be used to aggregate those links.

As multiple VLANs will be supported in this configuration, the upstream switch ports connecting to the FlexFabric 10/24-Port modules will be configured to properly present those VLANs. In this scenario, the upstream switch ports will be configured for VLAN trunking/VLAN tagging.

When configuring Virtual Connect, we can provide several ways to implement network fail-over or redundancy. One option would be to connect TWO uplinks to a single Virtual Connect network; those two uplinks would connect from different Virtual Connect modules within the enclosure and could then connect to the same upstream switch or two different upstream switches, depending on your redundancy needs. An alternative would be to configure TWO separate Virtual Connect networks, each with a single, or multiple, uplinks configured. Each option has its advantages and disadvantages. For example; an Active/Standby configuration places the redundancy at the VC level, where Active/Active places it at the OS NIC teaming or bonding level. We will review the second option in this scenario.

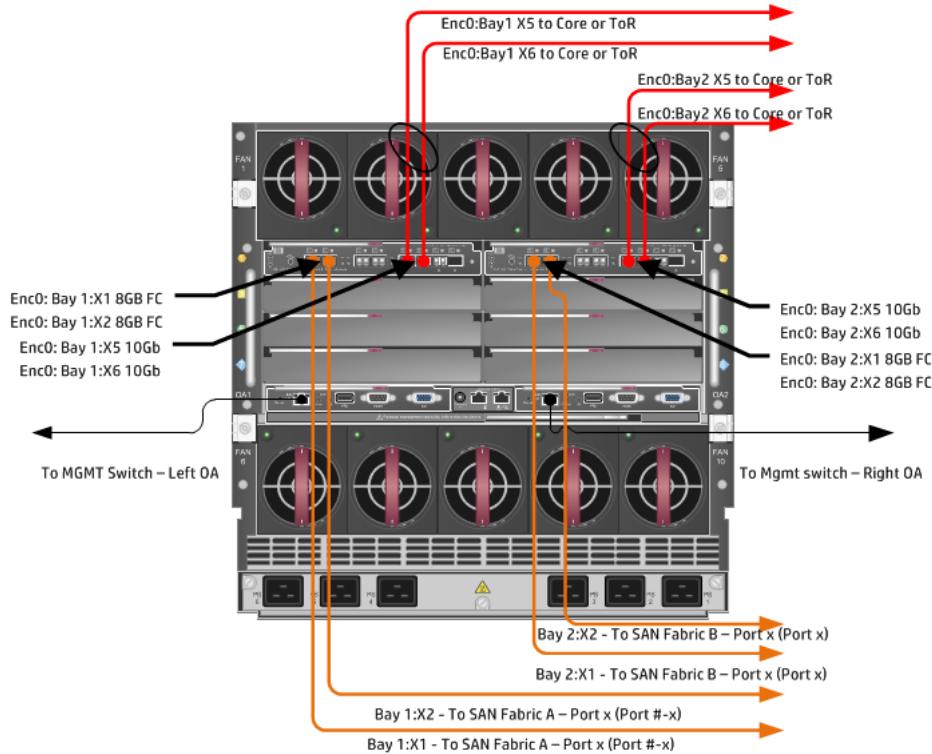
In addition, several Virtual Connect Networks can be configured to support the required networks to the servers within the BladeSystem enclosure. These networks could be used to separate the various network traffic types, such as iSCSI, backup and VMotion from production network traffic.

This scenario will also leverage the Fibre Channel over Ethernet (FCoE) capabilities of the FlexFabric 10/24-Port modules. Each fibre channel fabric will have two uplinks connected to each of the FlexFabric 10/24-Port modules.

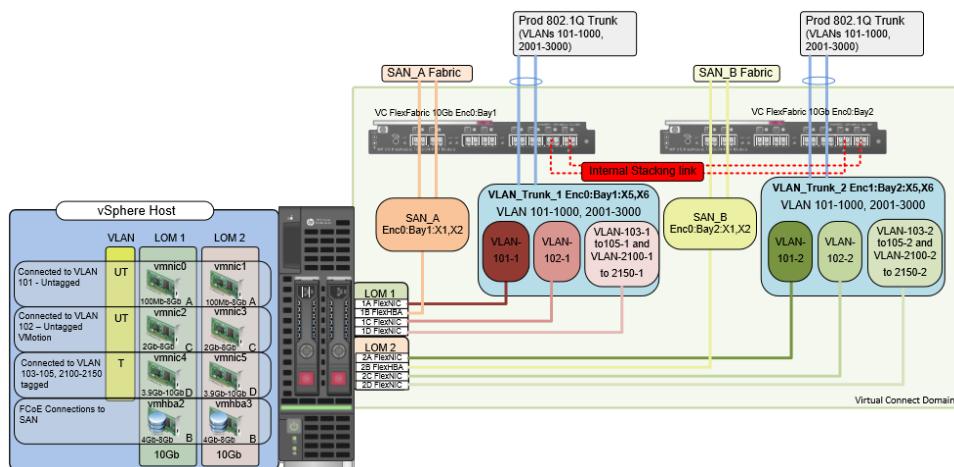
## Requirements

This scenario will support both Ethernet and fibre channel connectivity. In order to implement this scenario, an HP BladeSystem c7000 enclosure with one or more server blades and TWO Virtual Connect FlexFabric 10/24-Port modules, installed in I/O Bays 1 & 2 are required. In addition, we will require ONE or TWO external Network switches. As Virtual Connect does not appear to the network as a switch and is transparent to the network, any standard managed switch will work with Virtual Connect. The Fibre Channel uplinks will connect to the existing FC SAN fabrics. The SAN switch ports will need to be configured to support NPIV logins. Two uplinks from each FlexFabric 10/24-Port module will be connected to the existing SAN fabrics.

**Figure 167 - Physical View:** Shows two Ethernet uplinks from Ports X5 and X6 on Module 1 to Ports 1 and 2 on the first network switch and two Ethernet uplinks from Ports X5 and X6 on Module 2 to Ports 1 and 2 on the second network switch. The SAN fabrics are also connected redundantly, with TWO uplinks per fabric, from ports X1 and X2 on module 1 to Fabric A and ports X1 and X2 to Fabric B.



**Figure 168 - Logical View:** The server blade profile is configured with SIX FlexNICs and 2 FlexHBAs. NICs 1 and 2 are connected to VLAN-101-x, NICs 3 and 4 are connected to VLAN-102-x, and NICs 4 and 5 are connected to VLAN-103-x through VLAN-105-x and VLAN-2100x through VLAN-2150-x, which are part of the Shared Uplink Sets, VLAN-Trunk-1 and VLAN-Trunk-2 respectively. The VLAN-Trunks are connected, at 10Gb, to a network switch, through Ports X5 and X6 on each FlexFabric 10/24-Port Module in Bays 1 and 2. The FCoE SAN connections are connected through ports X1 and X2 on each FlexFabric 10/24-Port module.



# Installation and configuration

## Switch configuration

As the Virtual Connect module acts as an edge switch, Virtual Connect can connect to the network at either the distribution level or directly to the core switch.

The appendices provide a summary of the cli commands required to configure various switches for connection to Virtual Connect. The configuration information provided in the appendices for this scenario assumes the following information:

- The switch ports are configured as VLAN TRUNK ports (tagging) to support several VLANs. All frames will be forwarded to Virtual Connect with VLAN tags. Optionally, one VLAN could be configured as (Default) untagged, if so, then a corresponding vNet within the Shared Uplink Set would be configured and set as “Default”.

**Note:** When adding additional uplinks to the SUS, if the additional uplinks are connecting from the same FlexFabric 10/24-Port module to the same switch, in order to ensure all The uplinks are active, the switch ports will need to be configured for LACP within the same Link Aggregation Group.

The network switch port should be configured for Spanning Tree Edge as Virtual Connect appears to the switch as an access device and not another switch. By configuring the port as Spanning Tree Edge, it allows the switch to place the port into a forwarding state much quicker than otherwise, this allows a newly connected port to come online and begin forwarding much quicker.

The SAN connection will be made with redundant connections to each Fabric. SAN switch ports connecting to the FlexFabric 10/24-Port module must be configured to accept NPIV logins.

## Configuring the VC module

- Physically connect Port 1 of network switch 1 to Port X5 of the VC module in Bay 1
- Physically connect Port 2 of network switch 1 to Port X6 of the VC module in Bay 1
- Physically connect Port 1 of network switch 2 to Port X5 of the VC module in Bay 2
- Physically connect Port 2 of network switch 2 to Port X6 of the VC module in Bay 2

**Note:** If you have only one network switch, connect VC ports X5 and X6 (Bay 2) to an alternate port on the same switch. This will NOT create a network loop and Spanning Tree is not required.

- Physically connect Ports X1/X2 on the FlexFabric in module Bay 1 to switch ports in SAN Fabric A
- Physically connect Ports X1/X2 on the FlexFabric in module Bay 2 to switch ports in SAN Fabric B

## VC CLI commands

Many of the configuration settings within VC can also be accomplished via a CLI command set. In order to connect to VC via a CLI, open an SSH connection to the IP address of the active VCM. Once logged in, VC provides a CLI with help menus. Through this scenario the CLI commands to configure VC for each setting will also be provided.

## Configuring Expanded VLAN Capacity via GUI

Virtual Connect release 3.30 provided an expanded VLAN capacity mode when using Shared Uplink Sets, this mode can be enabled through the Ethernet Settings tab or the VC CLI. The default configuration for a new Domain install is “Expanded VLAN Capacity” mode, Legacy mode is no longer available and the Domain cannot be downgraded.

Virtual Connect 4.30 now provides the ability to define up to 4096 VLANs then consume only the VLANs you need, when you need them. There is nothing to change or enable to take advantage of the 4096 VLAN feature.

## To verify the VLAN Capacity mode

- On the Virtual Connect Manager screen, Left pane, click Ethernet Settings, Advanced Settings
- Select Expanded VLAN capacity
- Verify Expanded VLAN Capacity is configured and Legacy VLAN Capacity is greyed out.

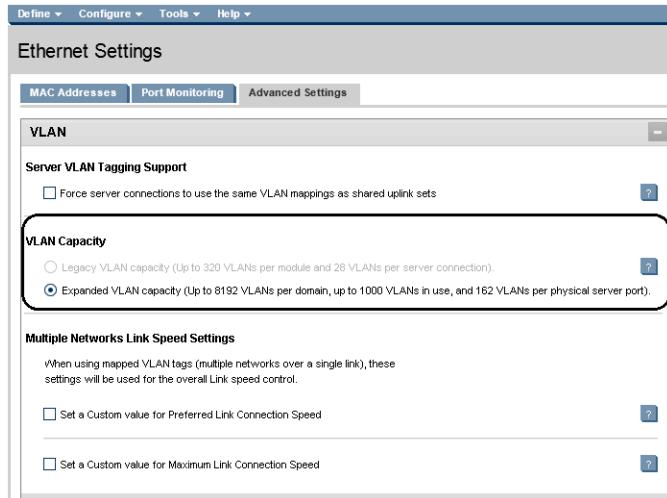
**Note:** Legacy VLAN mode will only be presented if 1Gb Virtual Connect Modules are present, in which case the domain would be limited to Firmware version 3.6x.

## Configuring Expanded VLAN Capacity via CLI

The following command can be copied and pasted into an SSH based CLI session with Virtual Connect;

```
# Set Expanded VLAN Capacity  
set enet-vlan -quiet VlanCapacity=Expanded
```

**Figure 169 - Enabling Expanded VLAN Capacity**



**Note:** If a 1Gb VC Ethernet module is present in the Domain, Expanded VLAN capacity will be greyed out, this is only supported with 10Gb and 20Gb based Virtual Connect modules. Also, once Expanded VLAN capacity is selected, moving back to Legacy VLAN capacity mode will require a domain deletion and rebuild.

## Defining a new Shared Uplink Set (VLAN-Trunk-1)

Connect Ports X5 and X6 of FlexFabric module in Bay 1 to Ports 1 and 2 on switch 1

Create a SUS named VLAN-Trunk-1 and connect it to FlexFabric 10/24-Port Ports X5 and X6 on Module 1

- On the Virtual Connect Home page, select Define, Shared Uplink Set
- Insert Uplink Set Name as VLAN-Trunk-1
- Select Add Port, then add the following port;
  - Enclosure 1, Bay 1, Port X5
  - Enclosure 1, Bay 1, Port X6

**Figure 170 - Shared Uplink Set (VLAN-Trunk-1) Uplinks Assigned**

The screenshot shows the 'Define Shared Uplink Set' interface. In the 'External Uplink Ports' section, two ports are listed as 'Linked' to 'vanilab (Ten-GigabitEthernet1/0/6)' and 'vanilab (Ten-GigabitEthernet1/0/7)'. The 'Connection Mode' is set to 'Auto'. Under 'Associated FCoE Networks (VLAN tagged)', there is a table with one entry: 'Network Name' (VLAN-3000-1), 'VLAN ID' (-1), 'Native', 'SmartLink', 'Private Network', and an 'Action' column with 'Add' and 'Delete' buttons.

- Click Add Networks and select the Multiple Networks radio button and add the following VLANs;
  - Enter Name as VLAN-
  - Enter Suffix as -1
  - Enter VLAN IDs as follows (and shown in the following graphic);
- 101-1000,2001-3000
- Enable SmartLink on ALL networks
- Click Advanced
  - Configure Preferred speed to 4Gb
  - Configure Maximum speed to 8Gb
- Click Apply

**Note:** You can optionally specify a network “color” or “Label” when creating a shared Uplinkset and its networks. In the example above we have not set either color or label.

**Figure 171 - Creating VLANs in a Shared Uplink Set**

The screenshot shows the 'Associated Networks (VLAN tagged)' configuration dialog. It lists a single network entry: 'Network Name' (VLAN-3000-1), 'VLAN ID' (-1), 'Native', 'SmartLink', 'Private Network', and an 'Action' column with 'Add' and 'Delete' buttons. Below this, there are sections for 'Color' (none), 'Labels' (Type to add Network Labels), and 'Advanced Network Settings' (checkboxes for Smart Link and Private Network). At the bottom, there is a 'Type network access group names' field with 'Default' selected and a note about character limits.

**Note:** When configuring Preferred and Maximum networks speeds, these speeds will only be reflected when the network is configured individually on a specific NIC. In order to set a Maximum network speed for a NIC configured with Multiple Networks, configure the “Multiple Networks Link Speed Settings” under Ethernet, Advanced Settings in the left tree view pane of the VC console.

After clicking apply, a list of VLANs will be presented as shown below. If one VLAN in the trunk is untagged/native, see note below.

- Click Apply at the bottom of the page to create the Shared Uplink Set

**Figure 172 - Associated VLANs for Shared Uplink Set VLAN-Trunk-1**

Network Name	VLAN ID	Native	Smart Link	Private Network	Action
VLAN-101-1	101	false	true	false	Edit
VLAN-102-1	102	false	true	false	Edit
VLAN-103-1	103	false	true	false	Edit
VLAN-104-1	104	false	true	false	Edit
VLAN-105-1	105	false	true	false	Edit
VLAN-106-1	106	false	true	false	Edit
VLAN-107-1	107	false	true	false	Edit
VLAN-108-1	108	false	true	false	Edit
VLAN-109-1	109	false	true	false	Edit
VLAN-110-1	110	false	true	false	Edit
VLAN-111-1	111	false	true	false	Edit
VLAN-112-1	112	false	true	false	Edit
VLAN-113-1	113	false	true	false	Edit
VLAN-114-1	114	false	true	false	Edit
VLAN-115-1	115	false	true	false	Edit
VLAN-116-1	116	false	true	false	Edit
VLAN-117-1	117	false	true	false	Edit
VLAN-118-1	118	false	true	false	Edit
VLAN-119-1	119	false	true	false	Edit
VLAN-120-1	120	false	true	false	Edit
VLAN-121-1	121	false	true	false	Edit
VLAN-122-1	122	false	true	false	Edit
VLAN-123-1	123	false	true	false	Edit
VLAN-124-1	124	false	true	false	Edit

Apply Cancel

**Note:** Optionally, if one of the VLANs in the trunk to this shared uplink set were configured as Native or Untagged, you would be required to “edit” that VLAN in the screen above, and configure Native as TRUE. This would need to be set for BOTH VLAN-Trunk-1 and VLAN-Trunk-2.

Please refer to Appendix D; “Scripting the Native VLAN” for scripting examples.

**Figure 173 - You will see that ALL Uplinks are still in a Linked/Standy state**

Shared Uplink Set	Has FCoE	Port Status	Connector Type	Uplink Port	Action
VLAN-Trunk-1	false	Linked-Standby	10 Gb	SFP-DAC	C7K-TOP: Bay 1: Port X5
		Linked-Standby	10 Gb	SFP-DAC	C7K-TOP: Bay 1: Port X6

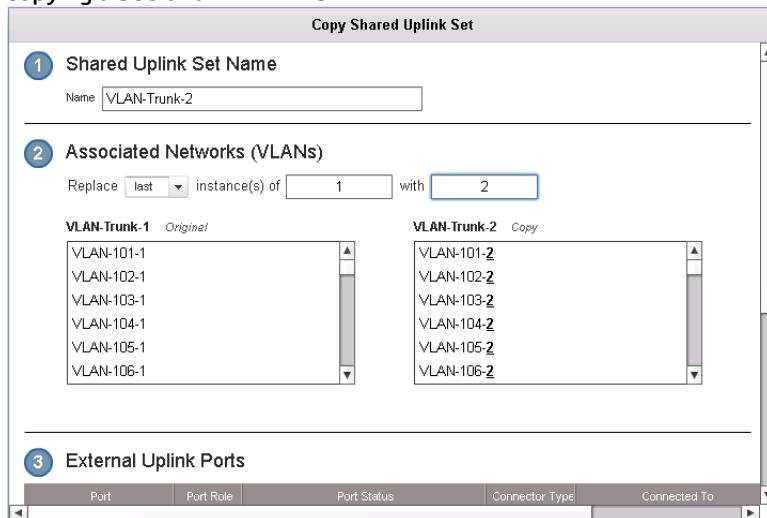
**Note:** That both of the network connections are shown as “Linked/Standy”, this state will NOT change until the network has been assigned to a server profile. This behavior is new within VC 4.30 and is provided to accommodate the new 4096 VLAN feature.

## Defining a new Shared Uplink Set (VLAN-Trunk-2) (Copying a Shared UplinkSet)

The second Shared Uplink Set could be created in the same manner as VLAN-Trunk-1 however; VC now provides the ability to COPY a VC Network or Shared Uplink Set.

- Connect Ports X5 and X6 of FlexFabric 10/24-Port module in Bay 2 to Ports 1 and 2 on switch 2
- In the VC GUI screen, select Shared Uplink Sets in the left pane, in the right pane VLAN-Trunk-1 will be displayed, left click VLAN-Trunk-1, it will appear as blue, right click and select COPY
- Edit the Settings as shown below, the new SUS name will be VLAN-Trunk-2 and ALL the associated VLANs will have a suffix of 2
- In step 3, ADD uplinks X5 and X6 from Bay 2
- Click OK
- The SUS and ALL VLANs will be created

**Figure 174 - Copying a SUS and ALL VLANs**



## Defining a new Shared Uplink Set via CLI

The following script can be used to create the first Shared Uplink Set (VLAN-Trunk-1)

*The following command(s) can be copied and pasted into an SSH based CLI session with Virtual Connect*

```
# Create Shared Uplink Set VLAN-Trunk-1 and configure uplinks
add uplinkset VLAN-Trunk-1
add uplinkport enc0:1:X5 Uplinkset=VLAN-Trunk-1 speed=auto
add uplinkport enc0:1:X6 Uplinkset=VLAN-Trunk-1 speed=auto

# Create Networks VLAN-1001-1 through VLAN-1000-1 and VLAN-2001-1 through VLAN-3000-1 for Shared Uplink Set VLAN-Trunk-1
add network-range -quiet UplinkSet=VLAN-Trunk-1 NamePrefix=VLAN- NameSuffix=-1
VLANIds=101-1000,2000-3000 State=enabled PrefSpeedType=Custom PrefSpeed=4000
MaxSpeedType=Custom MaxSpeed=8000 SmartLink=enabled
```

The following script can be used to create the Second Shared Uplink Set (VLAN-Trunk-2)

```
# Create Shared Uplink Set VLAN-Trunk-2 and configure uplinks
add uplinkset VLAN-Trunk-2
add uplinkport enc0:2:X5 Uplinkset=VLAN-Trunk-2 speed=auto
add uplinkport enc0:2:X6 Uplinkset=VLAN-Trunk-2 speed=auto
```

```
# Create Networks VLAN101-2 through VLAN1000-2 and VLAN-2001-2 through VLAN-3000-2
for Shared Uplink Set VLAN-Trunk-2
add network-range -quiet UplinkSet=VLAN-Trunk-2 NamePrefix=VLAN- NameSuffix=-2
VLANIds=101-1000,2000-3000 State=enabled PrefSpeedType=Custom PrefSpeed=4000
MaxSpeedType=Custom MaxSpeed=8000 SmartLink=enabled
```

**Note:** In this scenario we have created two independent Share Uplink Sets (SUS), each originating from the opposite FlexFabric 10/24-Port Modules, by doing so we provide the ability to create separate and redundant connections out of the Virtual Connect domain. When we create the server profiles, you will see how the NICs will connect to VLANs accessed through the opposite VC module, which provides the ability to create an Active / Active uplink scenario. Alternatively, we could have created a single SUS and assigned both sets of these uplink ports to the same SUS, however, this would have provided an Active/Standby uplink scenario, as shown in Scenario 5.

## Defining a new (FCoE) SAN Fabric via GUI

Create a Fabric and name it “FCoE\_A”

- On the Virtual Connect Manager screen, click Define, SAN Fabric to create the first Fabric
- Enter the Network Name of “FCoE\_A”
- Select Add Port, then add the following ports;
  - Enclosure 1, Bay 1, Port X1
  - Enclosure 1, Bay 1, Port X2
- Ensure Fabric Type is set to “FabricAttach”
- Select Show Advanced Settings
  - Select Automatic Login Re-Distribution (FlexFabric Only)
  - Select Set Preferred FCoE Connect Speed
    - Configure for 4Gb
  - Select Set Maximum FCoE Connect Speed
    - Configure for 8Gb
- Select Apply

Create a second Fabric and name it “FCoE\_B”

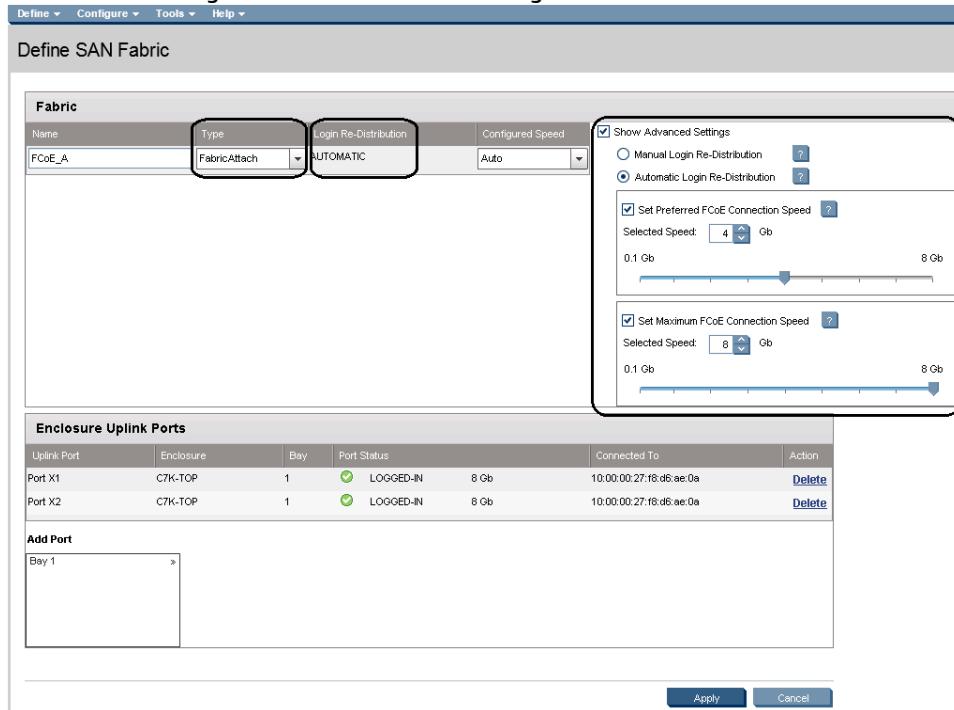
- On the Virtual Connect Manager screen, click Define, SAN Fabric to create the second Fabric
- Enter the Network Name of “FCoE\_B”
- Select Add Port, then add the following ports;
  - Enclosure 1, Bay 2, Port X1
  - Enclosure 1, Bay 2, Port X2
- Ensure Fabric Type is set to “FabricAttach”
- Select Show Advanced Settings
  - Select Automatic Login Re-Distribution (FlexFabric Only)
  - Select Set Preferred FCoE Connect Speed
    - Configure for 4Gb
  - Select Set Maximum FCoE Connect Speed
    - Configure for 8Gb
- Select Apply

## Defining SAN Fabrics via CLI

The following command(s) can be copied and pasted into an SSH based CLI session with Virtual Connect

```
#Create the SAN Fabrics FCoE_A and FCoE_B and configure uplinks as discussed above
add fabric FCoE_A Type=FabricAttach Bay=1 Ports=1,2 Speed=Auto LinkDist=Auto
PrefSpeedType=Custom PrefSpeed=4000 MaxSpeedType=Custom MaxSpeed=8000
add fabric FCoE_B Type=FabricAttach Bay=2 Ports=1,2 Speed=Auto LinkDist=Auto
PrefSpeedType=Custom PrefSpeed=4000 MaxSpeedType=Custom MaxSpeed=8000
```

**Figure 175 - SAN Configuration and Advanced Settings**



**Figure 176 - FCoE SAN fabrics configured with two 8Gb uplinks per fabric. Note the bay and port numbers on the right**

SAN Fabrics										
External Connections		Server Connections								
Status	SAN Fabric	Type	Login Re-Distribution	Port Status	Connected To	Enclosure	Bay	Port	Action	Add
<input checked="" type="checkbox"/>	FCoE_A	FabricAttach	AUTOMATIC	<input checked="" type="checkbox"/> LOGGED-IN	8 Gb	10:00:00:27:f8:d6:ae:0a	C7K-TOP	1	X1	<a href="#">Edit</a>
<input checked="" type="checkbox"/>		FabricAttach	AUTOMATIC	<input checked="" type="checkbox"/> LOGGED-IN	8 Gb	10:00:00:27:f8:d6:ae:0a	C7K-TOP	1	X2	<a href="#">Edit</a>
<input checked="" type="checkbox"/>	FCoE_B	FabricAttach	AUTOMATIC	<input checked="" type="checkbox"/> LOGGED-IN	8 Gb	10:00:00:27:f8:d6:8b:9c	C7K-TOP	2	X1	<a href="#">Edit</a>
<input checked="" type="checkbox"/>		FabricAttach	AUTOMATIC	<input checked="" type="checkbox"/> LOGGED-IN	8 Gb	10:00:00:27:f8:d6:8b:9c	C7K-TOP	2	X2	<a href="#">Edit</a>

## Defining a Server Profile

We will create a server profile with SIX server NICs and TWO SAN adapters.

Each server NIC will connect to a specific network.

- On the main menu, select Define, then Server Profile
- Create a server profile called “ESX-1”
- Select to “Hide Unused FlexNICs”
- In the Network Port 1 drop down box, select a Network, then chose VLAN101-1
- Set the port speed to Custom at 100Mb
- In the Network Port 2 drop down box, select a Network, then chose VLAN101-2
- Set the port speed to Custom at 100Mb
- Select ADD network (add four additional network connections)
- In the Network Port 3 drop down box, select a Network, then chose VLAN-102-1
- Set the port speed to Custom at 2Gb
- In the Network Port 4 drop down box, select a Network, then chose VLAN-102-2
- Set the port speed to Custom at 2Gb
- In the Network Port 5 drop down box, select Multiple Networks
- Configure for networks VLAN-103-1 through VLAN-105-1 and VLAN-2100-1 through VLAN-2150-1
- Leave the network speed as Auto
- In the Network Port 6 drop down box, select Multiple Networks
- Configure for networks VLAN-103-2 through VLAN-105-2 and VLAN-2100-2 through VLAN-2150-2
- Leave the network speed as Auto
- Expand the FCoE Connections box, for Bay 1, select FCoE\_A for Bay 2, select FCoE\_B
- Do not configure FC SAN or iSCSI Connection
- In the Assign Profile to Server Bay box, locate the Select Location drop down and select Bay 2, then apply

Prior to applying the profile, ensure that the server in Bay 2 is currently OFF

**Note:** You should now have a server profile assigned to Bay 2, with 4 Server NIC connections. NICs 1&2 should be connected to networks VLAN-101-x (MGMT), NICs 3&4 should be connected VLAN-102-x (VMotion) to networks VLAN103-x through VLAN105-x and VLAN-2100-x through VLAN-2150-x. FCoE SAN fabrics are connected to, Port 1 - FCoE\_A and Port 2 - FCoE\_B.

## Defining a Server Profile via CLI

The following command(s) can be copied and pasted into an SSH based CLI session with Virtual Connect

```
# Create Server Profile ESX-1
add profile ESX-1 -nodefaultfcconn -nodefaultfcoecconn
set enet-connection ESX-1 1 pxe=Enabled Network=VLAN-101-1 SpeedType=Custom Speed=100
set enet-connection ESX-1 2 pxe=Disabled Network=VLAN-101-2 SpeedType=Custom Speed=100
add enet-connection ESX-1 3 pxe=Disabled Network=VLAN-102-1 SpeedType=Custom Speed=2000
add enet-connection ESX-1 4 pxe=Disabled Network=VLAN-102-2 SpeedType=Custom Speed=2000
add enet-connection ESX-1 5 pxe=Disabled
add server-port-map-range ESX-1:5 UplinkSet=VLAN-Trunk-1 VLanIds=103-105,2100-2150
add enet-connection ESX-1 6 pxe=Disabled
add server-port-map-range ESX-1:6 UplinkSet=VLAN-Trunk-2 VLanIds=103-105,2100-2150
add fcoe-connection ESX-1 Fabric=FCoE_A SpeedType=4Gb
add fcoe-connection ESX-1 Fabric=FCoE_B SpeedType=4Gb
poweroff server 2
assign profile ESX-1 enc0:2
```

**Note:** The “add server-port-map-range” command is new to VC firmware release 3.30 and can be used to map many VLANs to a server NIC, in a single command. Prior releases would have required one command to create the NIC and one additional command per VLAN mapping added. This command will make profile scripting much easier, less complicated and quicker.

**Note:** The speed of the NIC and SAN connections, as well as the MAC and WWN. Also, note that the FCoE connections are assigned to the two SAN fabrics created earlier and use ports LOM:1-b and LOM:2-b.

**Figure 177 - Define a Server Profile ESX-1, assigned to Bay 2**

The screenshot shows the 'Edit Server Profile: ESX-1' interface. Under 'Ethernet Adapter Connections', there are six entries: VLAN-101-1 through VLAN-102-2, and 'Multiple Networks...' and 'Multiple Networks...'. The 'Multiple Networks...' entries are circled in red. Under 'iSCSI HBA Connections', there are two entries: 'FCoE\_A' and 'FCoE\_B'. Both are circled in red. The 'Assign Profile to Server Bay' section shows 'Bay 2' selected. At the bottom right are 'Apply', 'Apply & Close', and 'Cancel' buttons.

**Figure 178 - Configure NICs 5 and 6 for multiple Networks and select the appropriate VLANs**

The screenshot shows the 'Edit Server Profile: ESX-1' interface. Under 'Ethernet Adapter Connections', it shows 'Server VLAN Tag to vNet Mappings'. A dropdown menu 'None' is highlighted. Below it is a table of 'Networks not in mapping' with columns: All, A-C, D-F, G-I, J-L, M-O, P-R, S-V, W-Z, D-3, 4-6, 7-9. Several networks are listed: VLAN-1000-1, VLAN-1000-2, VLAN-101-1, VLAN-101-2, VLAN-102-1, VLAN-102-2, VLAN-103-2, and VLAN-104-2. To the right is a table titled 'Networks in mapping (54 mapped; limit is 162)'. It lists vNet names, status, uplink VLAN ID, server VLAN ID, and untagged status. Many entries have their server VLAN ID boxes checked.

**Note:** “Server VLAN ID” and “Untagged” boxes can be edited. One network per port could be marked as “Untagged”, in which case the server would not be configured for tagging on that VLAN. It is also possible to change the VLAN ID that is presented to the server (VLAN translation), in which case the communications between Virtual Connect and the network would be the VLAN ID in grey, if the Server VLAN ID box to the right were changed, VC would communicate with the server on the new VLAN ID, providing a VLAN translation function. VLAN translation could be a very useful feature, in the event that VLAN renumbering is required within the datacenter. The network VLAN numbers and Shared Uplink Set configurations could be changed to reflect the new VLAN IDs used, however, the old VLAN IDs could still be presented to the server providing the ability to delay or eliminate the need to change the VLAN ID used within the server/vSwitch.

**Figure 179 - Server Profile View Bay 2**

The screenshot shows the 'Server Profile View Bay 2' interface for a ProLiant BL460c Gen8 server. The top navigation bar includes 'Define', 'Configure', 'Tools', and 'Help'.

**Device Bay Status - Bay # 2**

Overall Status:	<span style="color: green;">✓</span>
Hardware Status:	<span style="color: green;">✓</span>
VC Status:	<span style="color: green;">✓</span>
Assigned Server Profile:	ESX-1
Enclosure Name:	C7K-TOP
UID:	<span style="color: gray;">●</span>
Power Status/Control:	<span style="color: green;">●</span> On

**Momentary Press**   **Press and Hold**

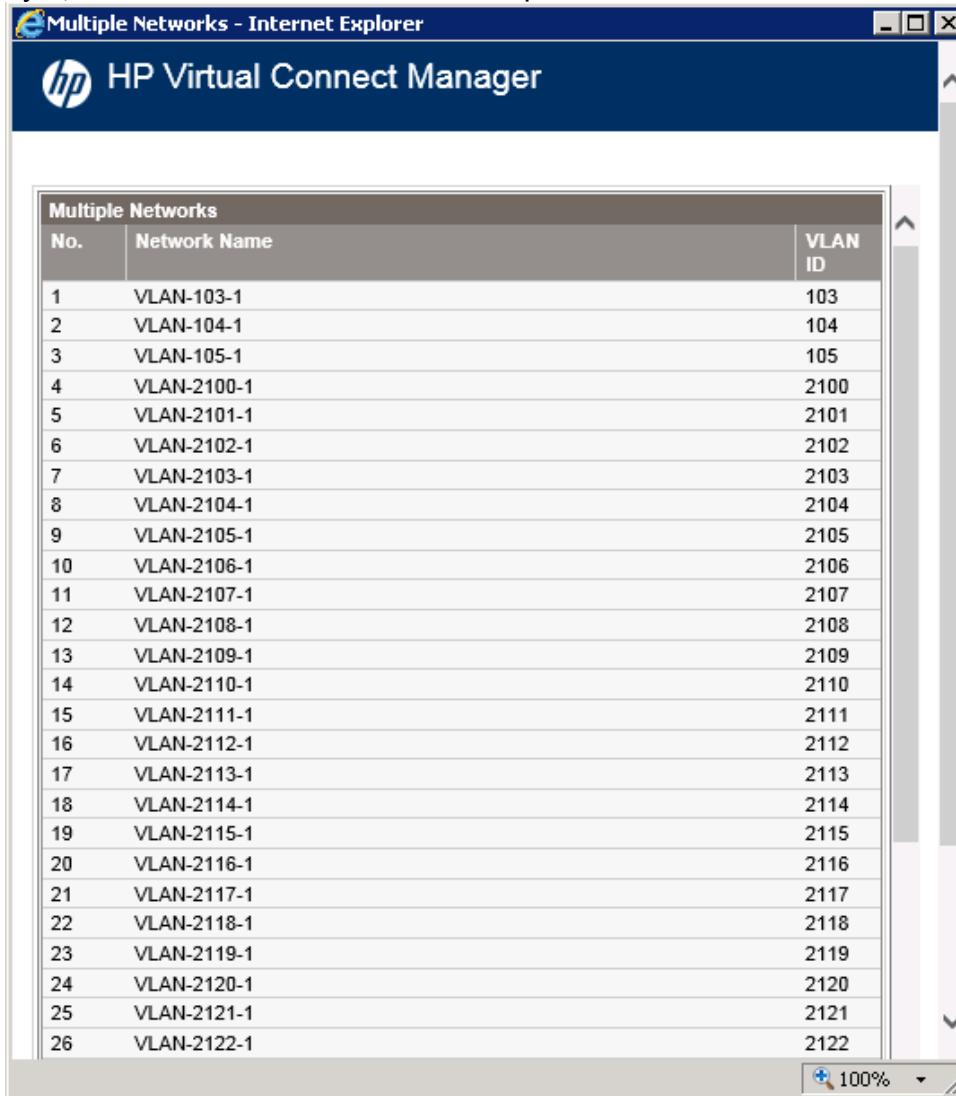
**Blade Server Information - Bay # 2**

Serial Number:	MXQ42401QJ
Serial Number (Logical):	VCX0000V01
UUID:	30343237-3638-584D-5134-32343031514A
UUID (Logical):	0c5d1304-49da-4dc2-8f25-b4fd63873260
Product Name:	ProLiant BL460c Gen8
Server Name:	esx-1.vanlab.net
Part Number:	724086-B21
Asset Tag:	[Unknown]
UEFI Capable:	false
Boot Mode:	Legacy

**Server Ethernet Adapter Information**

Ethernet Adapter	Flex NIC	Location	Module Port	Model	MAC Address	Network	WWN	SAN Fabric
<b>Port 1</b>								
LOM1:1-a	FLB1	Bay 1:d2:v1	HP FlexFabric 10Gb 2-Port 534FLB Adapter	00-17-A4-77-7C-0A	<span style="border: 1px solid blue; padding: 2px;">VLAN-101-1</span>		50:06:0B:00:00:C2:DE:04	<span style="border: 1px solid blue; padding: 2px;">FCoE_A</span>
LOM1:1-b	FLB1	Bay 1:d2:v2	HP FlexFabric 10Gb 2-Port 534FLB Adapter	00-17-A4-77-7C-16	<span style="border: 1px solid blue; padding: 2px;">VLAN-102-1</span>			
LOM1:1-c	FLB1	Bay 1:d2:v3	HP FlexFabric 10Gb 2-Port 534FLB Adapter	00-17-A4-77-7C-0E	<span style="border: 1px solid blue; padding: 2px;">Multiple Networks</span>			
LOM1:1-d	FLB1	Bay 1:d2:v4	HP FlexFabric 10Gb 2-Port 534FLB Adapter	00-17-A4-77-7C-12				
<b>Port 2</b>								
LOM1:2-a	FLB1	Bay 2:d2:v1	HP FlexFabric 10Gb 2-Port 534FLB Adapter	00-17-A4-77-7C-0C	<span style="border: 1px solid blue; padding: 2px;">VLAN-101-2</span>		50:06:0B:00:00:C2:DE:06	<span style="border: 1px solid blue; padding: 2px;">FCoE_B</span>
LOM1:2-b	FLB1	Bay 2:d2:v2	HP FlexFabric 10Gb 2-Port 534FLB Adapter	00-17-A4-77-7C-17	<span style="border: 1px solid blue; padding: 2px;">VLAN-102-2</span>			
LOM1:2-c	FLB1	Bay 2:d2:v3	HP FlexFabric 10Gb 2-Port 534FLB Adapter	00-17-A4-77-7C-10	<span style="border: 1px solid blue; padding: 2px;">Multiple Networks</span>			
LOM1:2-d	FLB1	Bay 2:d2:v4	HP FlexFabric 10Gb 2-Port 534FLB Adapter	00-17-A4-77-7C-14				

**Figure 180** - By clicking on the “Multiple Networks” statement for each LOM, the following page is displayed, which lists the VLAN connections for this port.



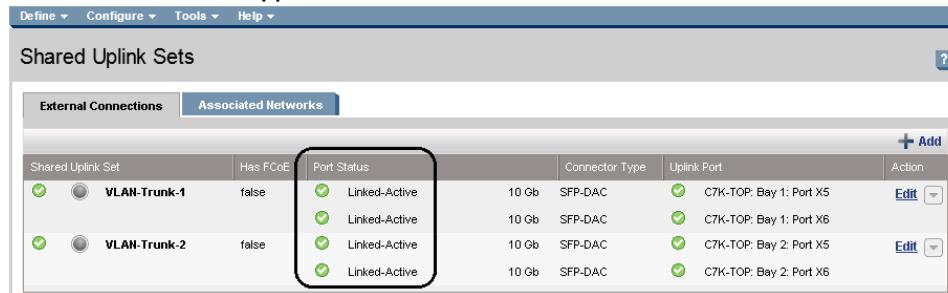
The screenshot shows a table titled "Multiple Networks" with columns "No.", "Network Name", and "VLAN ID". The table lists 26 entries from 1 to 26, each corresponding to a VLAN connection. The "VLAN ID" column shows values ranging from 103 to 2122.

No.	Network Name	VLAN ID
1	VLAN-103-1	103
2	VLAN-104-1	104
3	VLAN-105-1	105
4	VLAN-2100-1	2100
5	VLAN-2101-1	2101
6	VLAN-2102-1	2102
7	VLAN-2103-1	2103
8	VLAN-2104-1	2104
9	VLAN-2105-1	2105
10	VLAN-2106-1	2106
11	VLAN-2107-1	2107
12	VLAN-2108-1	2108
13	VLAN-2109-1	2109
14	VLAN-2110-1	2110
15	VLAN-2111-1	2111
16	VLAN-2112-1	2112
17	VLAN-2113-1	2113
18	VLAN-2114-1	2114
19	VLAN-2115-1	2115
20	VLAN-2116-1	2116
21	VLAN-2117-1	2117
22	VLAN-2118-1	2118
23	VLAN-2119-1	2119
24	VLAN-2120-1	2120
25	VLAN-2121-1	2121
26	VLAN-2122-1	2122

## Verify Network Link State

As discussed earlier in this document, in Virtual connect 4.30 there was a change to the link state behavior when a network has no connections to a server profile. Once a connection is made to the server profile, the uplinks will become Active, as previously expected.

**Figure 181** - All Links now appear in a Linked/Active state.



The screenshot shows a table titled "Shared Uplink Sets" with tabs "External Connections" and "Associated Networks". The table lists two shared uplink sets: "VLAN-Trunk-1" and "VLAN-Trunk-2". Each set has four uplink ports, all of which are listed as "Linked-Active". The "Action" column for each row contains an "Edit" button.

Shared Uplink Set	Has FCoE	Port Status	Connector Type	Uplink Port	Action
VLAN-Trunk-1	false	Linked-Active Linked-Active	10 Gb SFP-DAC	C7K-TOP: Bay 1: Port X5	Edit
VLAN-Trunk-1	false	Linked-Active Linked-Active	10 Gb SFP-DAC	C7K-TOP: Bay 1: Port X6	Edit
VLAN-Trunk-2	false	Linked-Active Linked-Active	10 Gb SFP-DAC	C7K-TOP: Bay 2: Port X5	Edit
VLAN-Trunk-2	false	Linked-Active Linked-Active	10 Gb SFP-DAC	C7K-TOP: Bay 2: Port X6	Edit

# Review

In this scenario we have created Two Shared Uplink Sets (SUS), providing support for many VLANs. Uplinks originating from each FlexFabric Module connect to each SUS, by doing so we provide redundant connections out of the Virtual Connect domain. As multiple uplinks are used for each SUS, we have also leveraged LACP to improve uplink performance. In this scenario, all uplinks will be active. We also create two FCoE SAN Fabrics.

We created a server profile, with SIX NICs. Two connected to the same VLAN (101), Port 1 connects to VLAN-101-1 and Port 2 connects to VLAN-101-2, which provides the ability to sustain a link or module failure and not lose connection to the network, these NICs were set to 100Mb/Sec with the Maximum speed set to 8Gb. VLAN-101-1 and VLAN-101-2 are configured to support VLAN 101, frames will be presented to the NIC(s) without VLAN tags (untagged), these two NICs are connected to the same VLAN, but taking a different path out of the enclosure. VLAN 101 is used for Management connections to the ESX host.

Network Ports 3 and 4 connect to the same VLAN (102), Port 3 connects to VLAN-102-1 and Port 4 connects to VLAN-102-2, which provides the ability to sustain a link or module failure and not lose connection to the network, these NICs were set to 2Gb/Sec with the Maximum speed set to 8Gb. VLAN-102-1 and VLAN-102-2 are configured to support VLAN 102, frames will be presented to the NIC(s) without VLAN tags (untagged), these two NICs are connected to the same VLAN, but taking a different path out of the enclosure. VLAN 102 is used for VMotion.

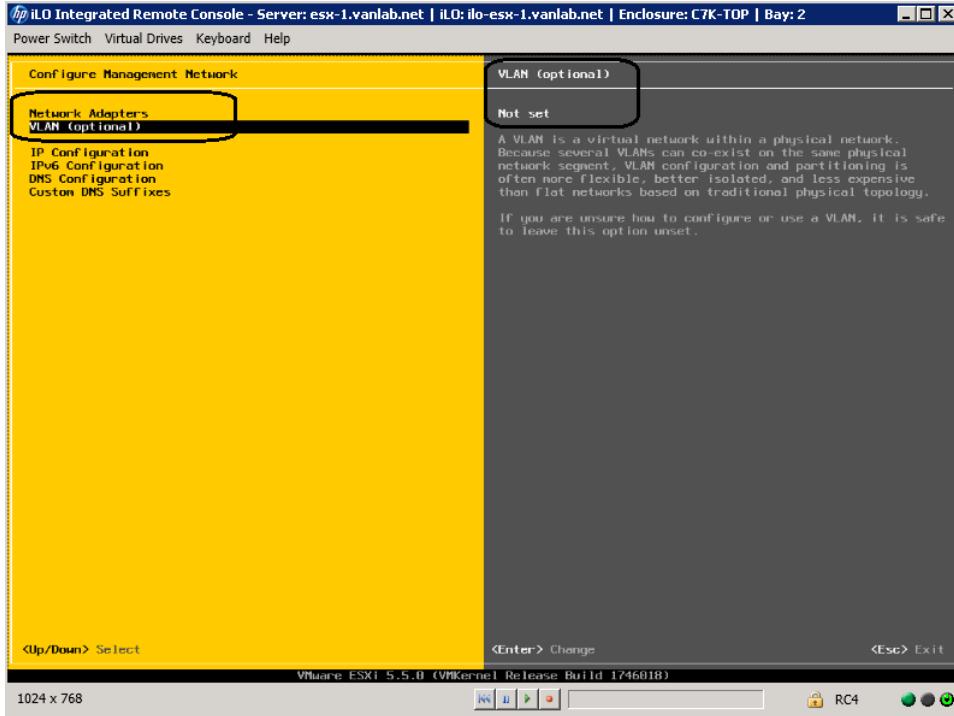
Network Ports 5 and 6 were added, these NICs will be connected to “Multiple Networks” and each NIC will then be configured for networks VLAN103-x through VLAN105-x and networks VLAN-2100-x through VLAN-2150-x. As these networks are tagging, frames will be presented to the server with VLAN tags. NICs 5 and 6 will be connected to the same vSwitch to support VM connections. VLAN tagged frames for these networks will be forwarded to the Virtual switch and then passed on to the appropriate Virtual Machine, VLAN tags will be removed as the frames are passed to the virtual machine. These NICs will use the remaining available bandwidth of 3.9Gb/Sec with the Maximum speed set to 10Gb.

Additionally, FCoE port 1 is connected to SAN fabric FCoE\_A and FCoE SAN port 2 is connected to SAN Fabric FCoE\_B, providing a multi-pathed connection to the SAN. The SAN fabric connections are set to 4Gb/Sec.

The FCoE SAN fabric connects to each SAN fabric over a pair of uplinks per module. SAN logins are distributed across the multiple paths.

The following graphic provides an example of an ESX server with TWO NICs connected to the same console vSwitch configured for VLAN 101, which was the Default (untagged) VLAN. Additional vSwitches have been configured for VMotion and product VLANs.

**Figure 182** - As NICs 1 and 2 are connected directly to VLAN-101, the connection acts as an Access or Untagged switch port, you need to ensure that the Hypervisor is NOT configured for VLAN tagging. However, if you want to put this server onto a VLAN that is tagged, this setting will need to be configured for that VLAN.



## Results – vSphere Networking Examples

We successfully configured FlexFabric with Share Uplink Sets, supporting several VLANs and redundant SAN fabrics. We created a server profile to connect to the various vNet with SIX NICs and the SAN fabrics using the FCoE connections created within the profile.

Although both Ethernet and Fibre channel connectivity is provided by the FlexFabric Adapter used in the G7 through Gen 9 servers; each capability (LAN and SAN) is provided by a different component of the adapter, they appear in the server as individual network and SAN adapters.

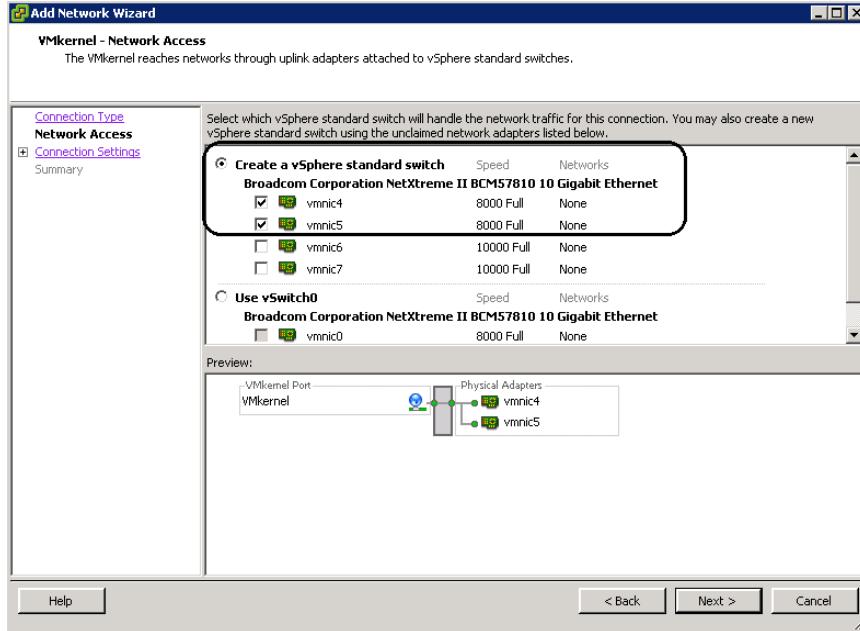
The following graphics show an ESXi 5.1 server with SIX FlexNICs configured, FOUR presented at 8Gb (two on the console network and two on the VMotion network) and two at 10Gb (Guest VLAN port groups). If we did not require SAN connectivity on this server, the FCoE connections could be deleted and the server would then have 8 NIC ports available to the OS. In addition, if we did not want FCoE connectivity and instead wanted to leverage iSCSI, we could delete the FCoE connected and re-create those connects as iSCSI connections, with offload and optionally iSCSI boot.

**Note:** The BL465c G7 and BL685c G7 utilize an NC551i chipset (BE2), whereas the BL460c G7, BL620c G7 and BL680c G7 utilize an NC553i chipset (BE3) and the Gen 8 blades typically have a NC554 adapter which also utilizes the BE3 chipset. Both the BE2 and BE3 chipsets share common drivers and firmware.

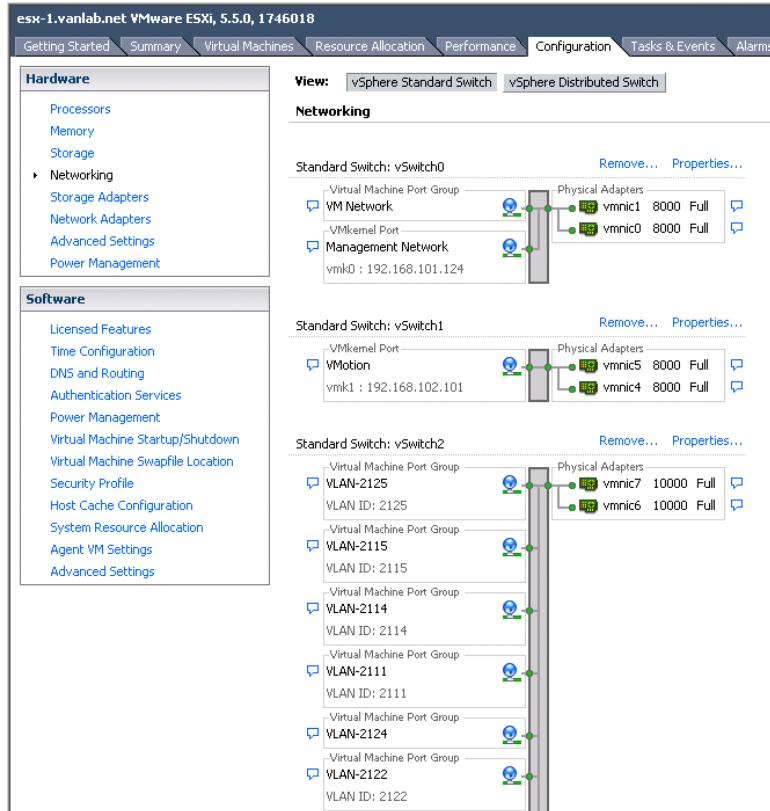
Virtual Connect supports the use of either Standard or Distributed vSwitches, examples of both are provided below.

## vSphere Standard vSwitch

**Figure 183 – ESXi 5.5 Network Connections**

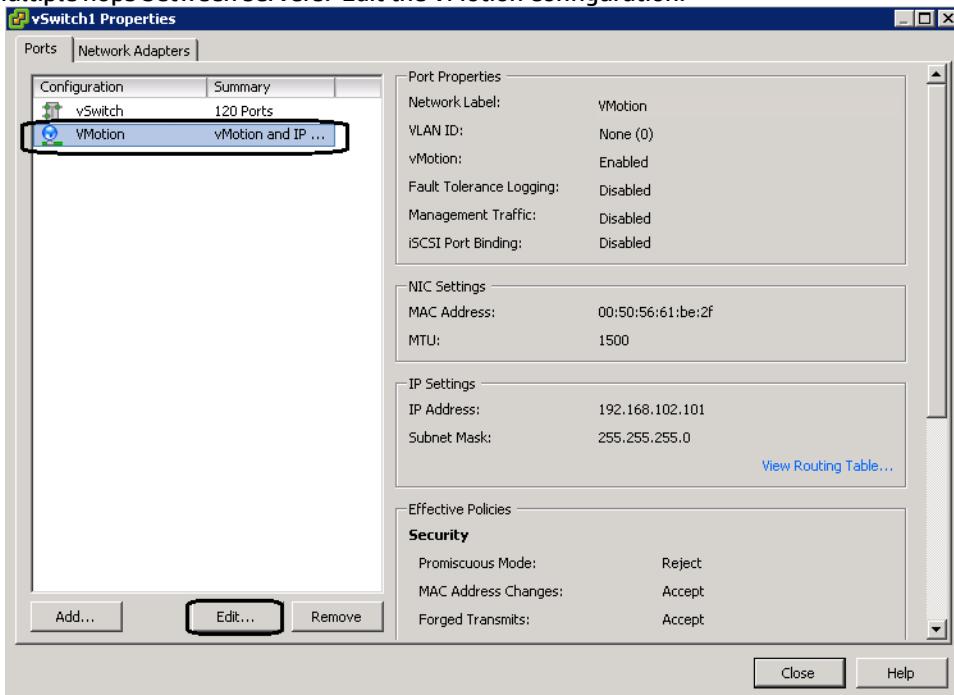


**Figure 184 – ESXi 5.5 networking – three vSwitches configured. (Note the NIC speeds)**

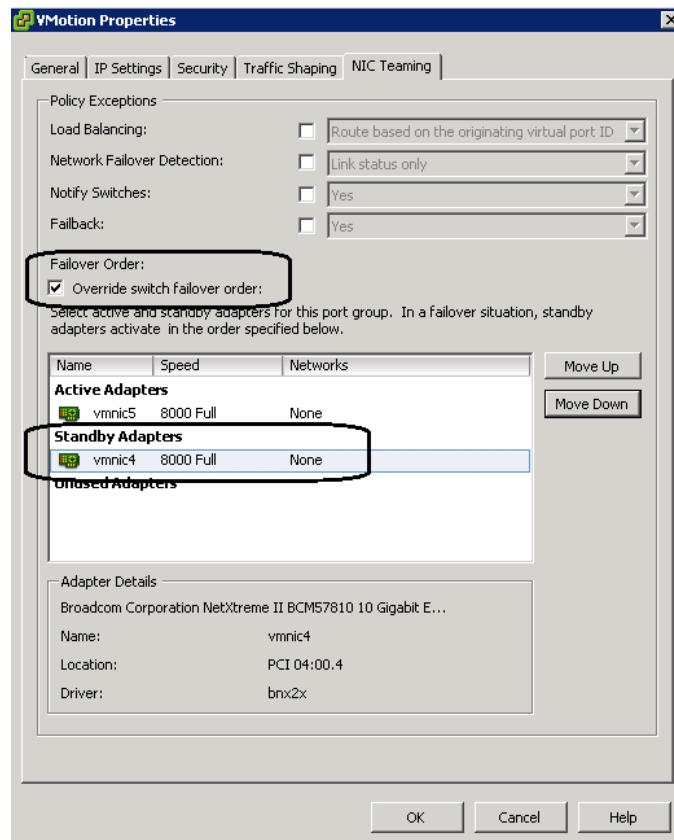


**Note:** As VLAN 101 is set as untagged at the upstream switch port, the management network port group should be defined as untagged. This will allow the server to be deployed, without having to set a VLAN ID for the management network.

**Figure 185** - You may want to specify a specific NIC for VMotion traffic. This will ensure that all VMotion traffic between servers within the enclosure will remain on the same VC module, reducing the likelihood of multiple hops between servers. Edit the VMotion Configuration.

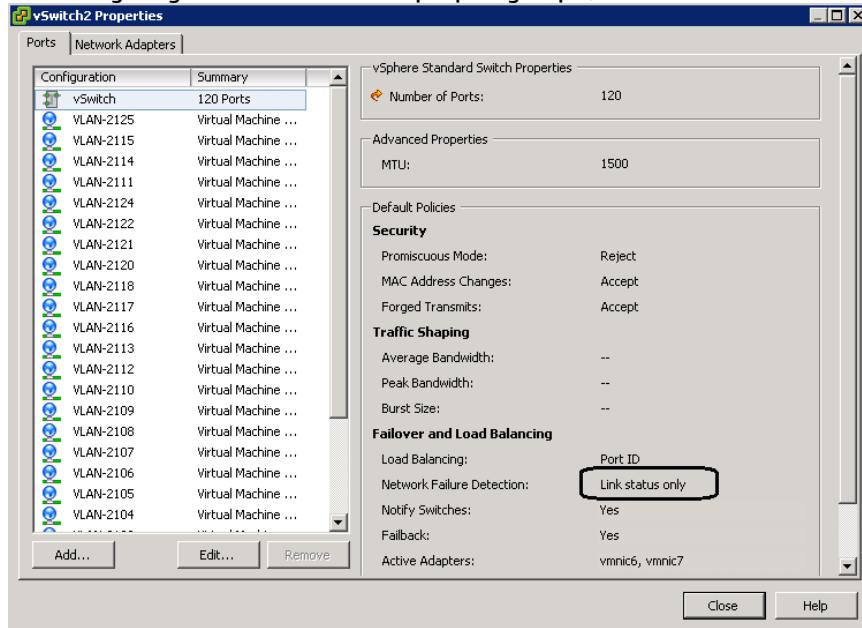


**Figure 186** - Edit the NIC Team for VMotion and set one of the Adapters in Standby, this will ensure that ALL VMotion traffic remains on the SAME VC module. ESX NIC vmnic5 is connected to the VC module in bay 1.

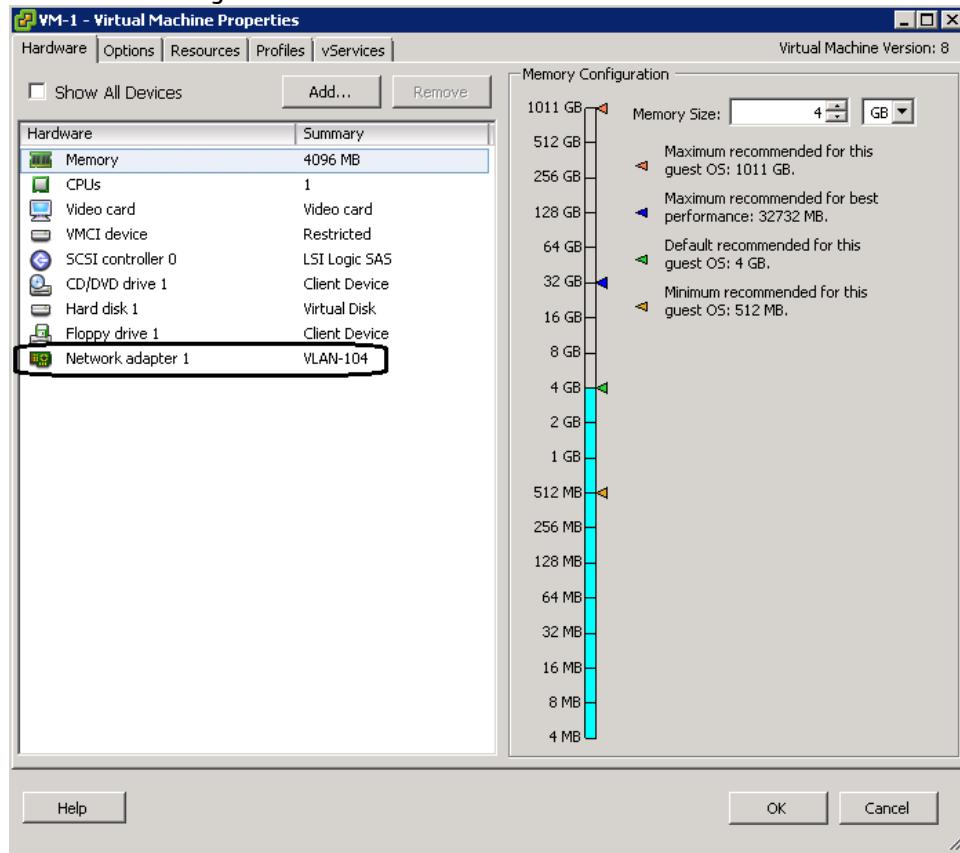


**Note:** As this Scenario is based on an Active/Active configuration, to ensure that ALL VMotion traffic between servers within the enclosure is contained to the same module, on each server edit the VMotion vSwitch properties and move one of the Adapters to Standby. This will ensure that ALL VMotion traffic will occur on the same Virtual Connect module.

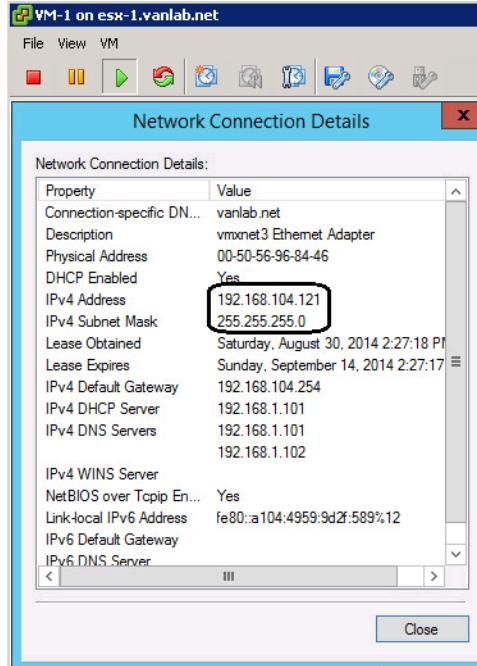
**Figure 187 - Configuring the vSwitch for multiple port groups / VLANs**



**Figure 188 - VM1 configured for VLAN 104**

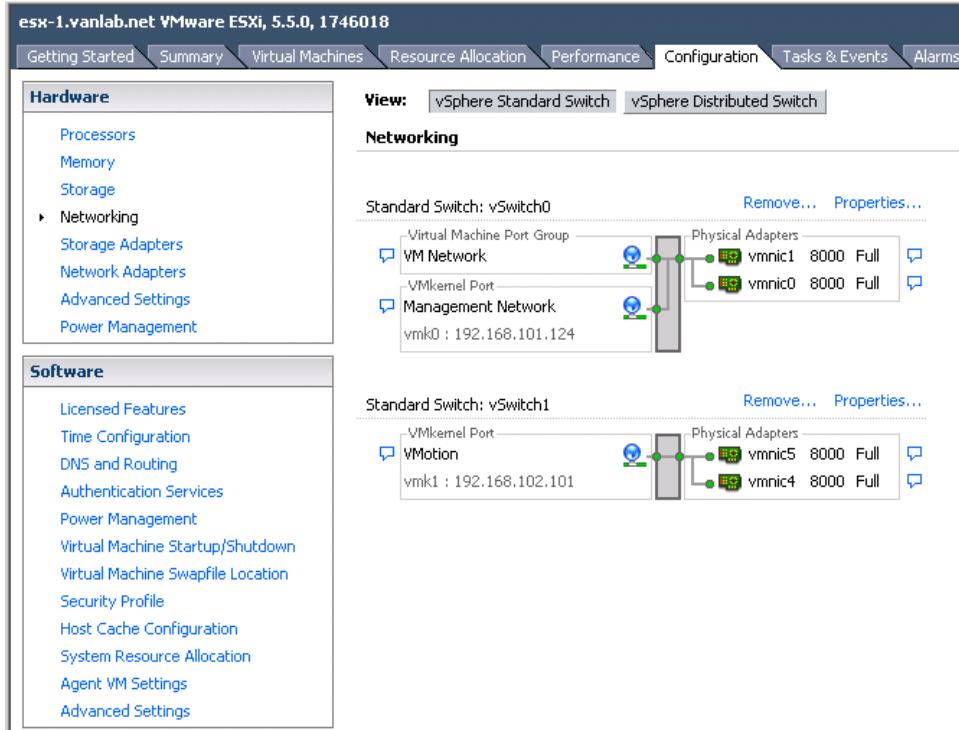


**Figure 189 - VM1 on VLAN 104**

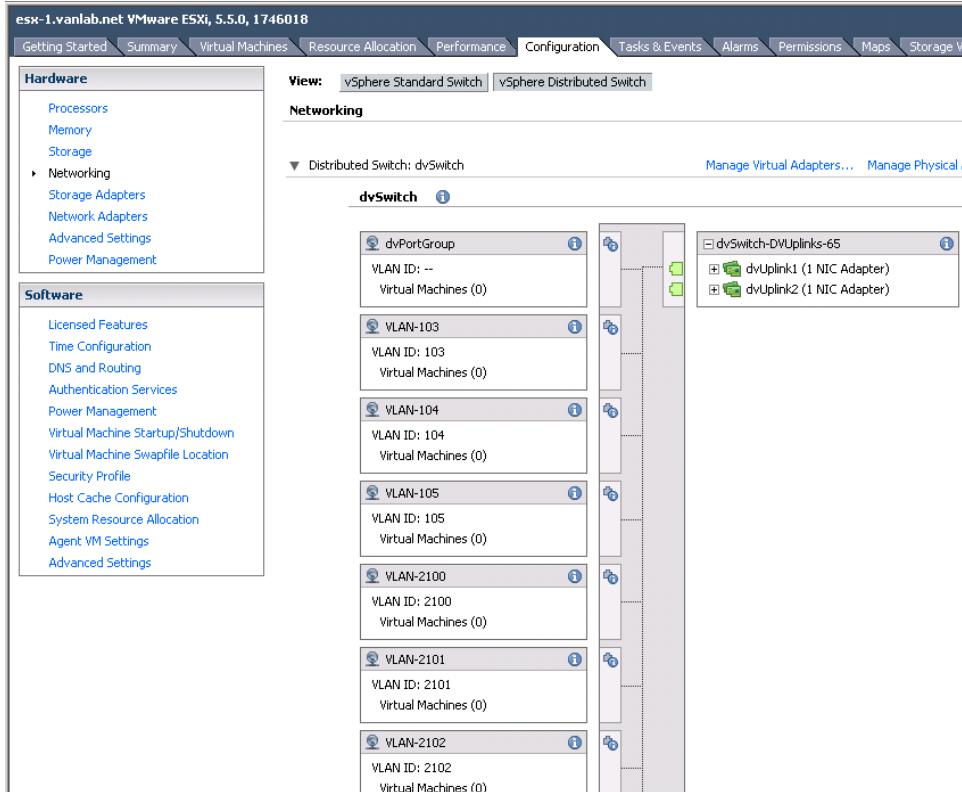


## vSphere Distributed vSwitch

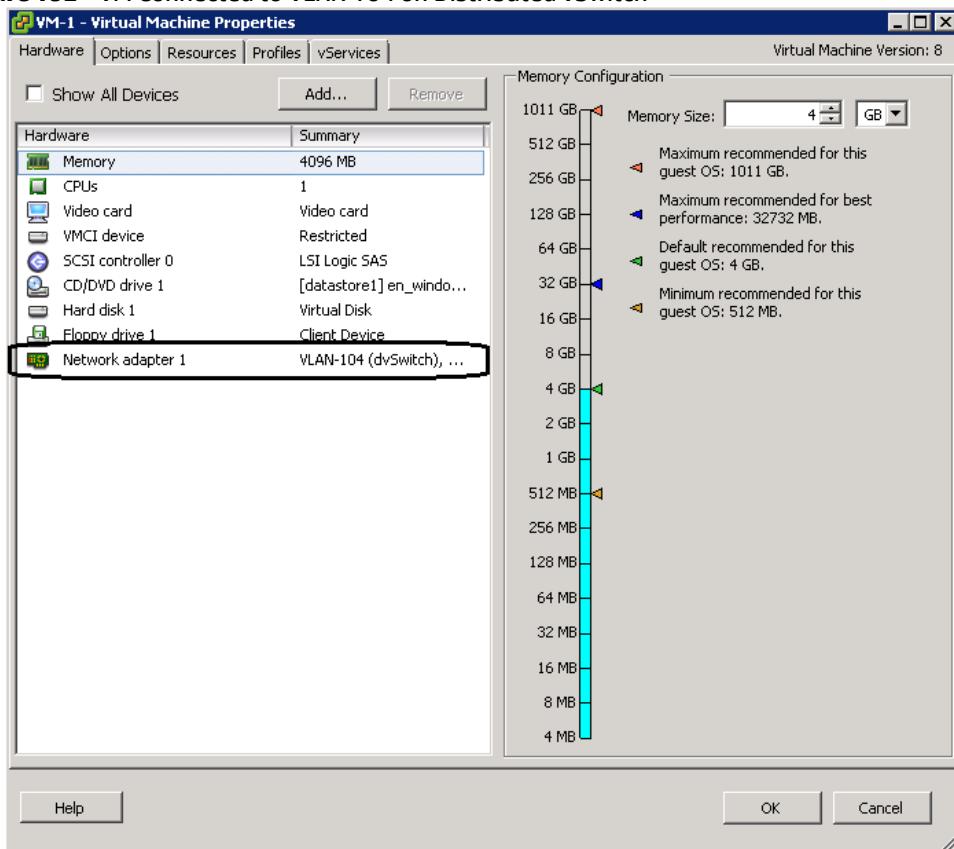
**Figure 190 - Management and VMotion NICs are connected to Standard vSwitches**



**Figure 191 - VM Networks are connected to a Distributed vSwitch**



**Figure 192 - VM Connected to VLAN 104 on Distributed vSwitch**



# Results – vSphere SAN Connectivity

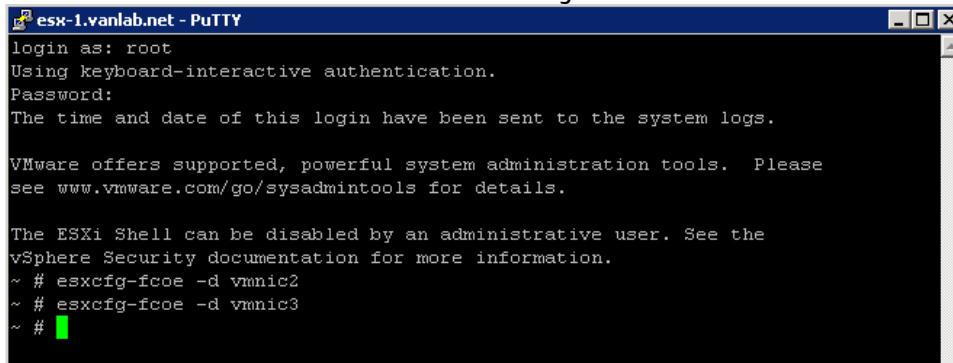
## Broadcom Adapters (534 and 630)

The Broadcom adapters (534 and 650) provide an FCoE capability, however, it presents a little differently than the Emulex discussed above. These adapters use a Broadcom BCM578xOS-Based chipset. When installed with VMWare 5.x, you will need to enable the FCoE capabilities of the adapter if you plan to connect to a Fibre Channel based SAN.

**Note:** This is not required if using the Emulex network adapters.

**Note:** Additional information on enabling the FCoE function in ESXi is provided in the Introduction section, under VMWare ESXi 5.5.

**Figure 193 – SSH to the ESX host and execute the esxcfg-fcoe command as shown below**

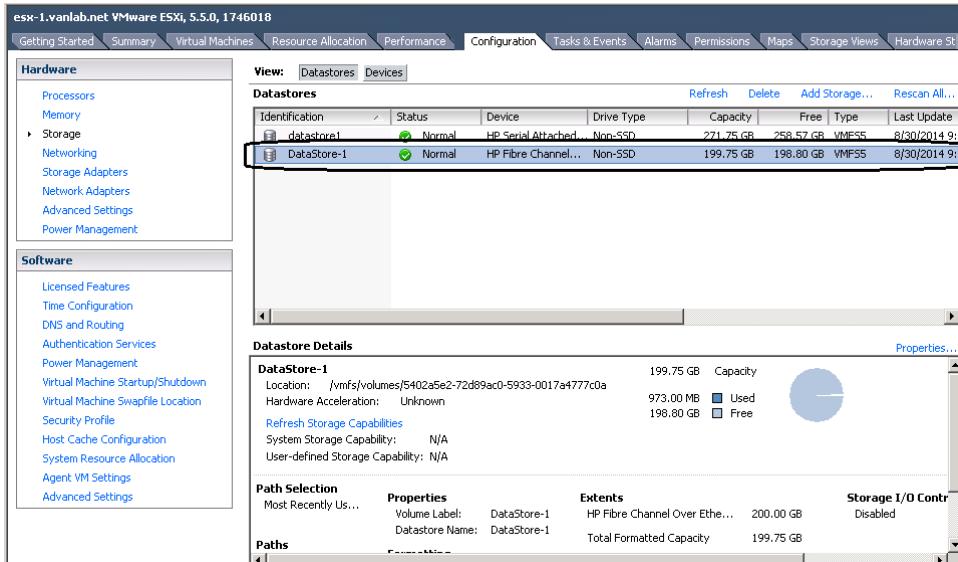


```
esx-1.vanlab.net - PuTTY
login as: root
Using keyboard-interactive authentication.
Password:
The time and date of this login have been sent to the system logs.

VMware offers supported, powerful system administration tools. Please
see www.vmware.com/go/sysadmintools for details.

The ESXi Shell can be disabled by an administrative user. See the
vSphere Security documentation for more information.
~ # esxcfg-fcoe -d vmnic2
~ # esxcfg-fcoe -d vmnic3
~ #
```

**Figure 194 – ESXi 5.5 storage configuration, the Shared Storage LUN is provided through the FCoE connections to the SAN.**



# Summary

We presented a Virtual Connect Network scenario by creating two shared uplink sets (SUS), each SUS is connected with TWO active uplinks; both SUS' can actively pass traffic. We included a dual path SAN fabric for storage connectivity.

When VC profile ESX-1 is applied to the server in bay 2 and the server is powered up, it has one NIC connected through FlexFabric 10/24-Port module 1 (connected to VLAN-101-1), the second NIC is connected through FlexFabric 10/24-Port module 2 (connected to VLAN-101-2). Each NIC is configured at 100Mb. These NICs are connected to the management vSwitch. The second pair of NICs are connected to the second vSwitch, which is configured for VMotion and is connected to VLAN102-x through NICs 3 and 4 which are configured at 2Gb. The last pair of NICs 5 and 6, are connected to the third vSwitch, which is configured to support VLANs 103 through 105 and 2100 through 2150. This host is also configured for FCoE based SAN access and connects to a SAN LUN to store the Guest VMs. Each FCoE port is configured for 4Gb of SAN bandwidth.

As additional servers are added to the enclosure, simply create additional profiles, or copy existing profiles, configure the NICs for LAN and SAN fabrics as required and apply them to the appropriate server bays and power the server on.

# **Scenario 7 – Tunneled VLANs and Shared Uplink Set with Active/Active Uplinks and 802.3ad (LACP) - Ethernet and FCoE SAN – vSphere 5.5**

## **Overview**

This scenario will implement the VLAN-Tunnel to provide support for multiple VLANs. The upstream network switches connect VLAN-Tunnels to two ports on each FlexFabric 10/24-Port modules, LACP will be used to aggregate those links. A Shared Uplink Set will also be used to provide connectivity for the Management and VMotion networks only.

As multiple VLANs will be supported in this configuration, the upstream switch ports connecting to the FlexFabric 10/24-Port modules will be configured to properly present those VLANs. In this scenario, the upstream switch ports will be configured for VLAN trunking/VLAN tagging.

When configuring Virtual Connect, we can provide several ways to implement network fail-over or redundancy. One option would be to connect TWO uplinks to a single Virtual Connect network; those two uplinks would connect from different Virtual Connect modules within the enclosure and could then connect to the same upstream switch or two different upstream switches, depending on your redundancy needs. An alternative would be to configure TWO separate Virtual Connect networks, each with a single, or multiple, uplinks configured. Each option has its advantages and disadvantages. For example; an Active/Standby configuration places the redundancy at the VC level, where Active/Active places it at the OS NIC teaming or bonding level. We will review the second option in this scenario.

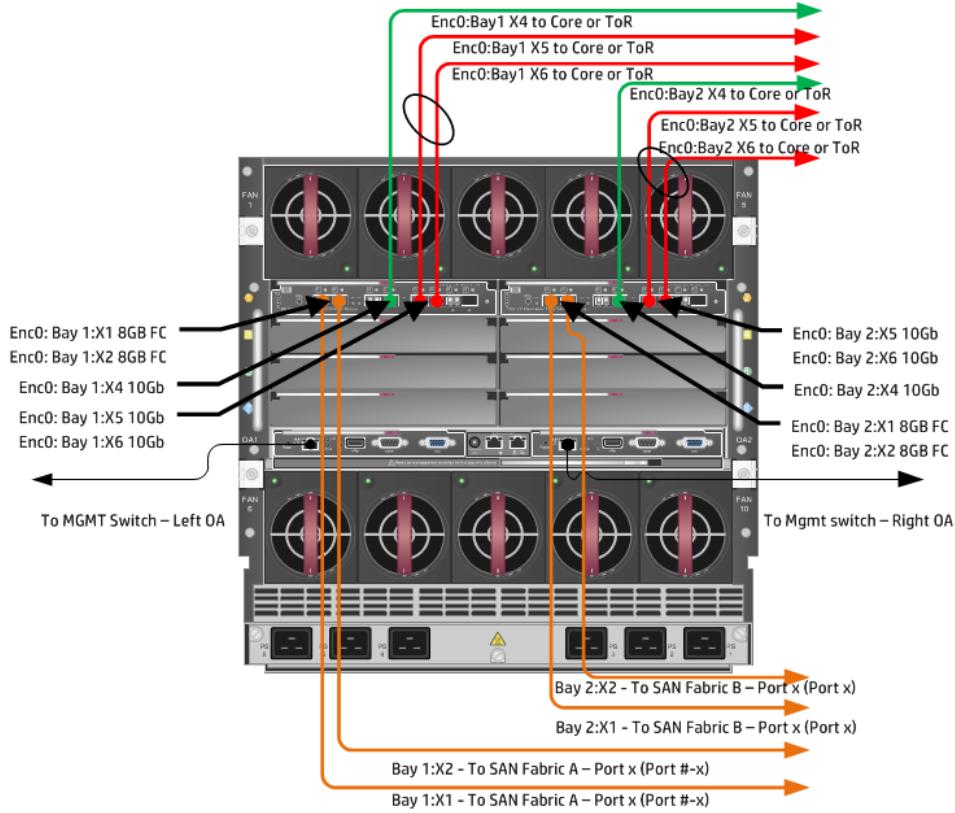
In addition, several Virtual Connect Networks can be configured to support the required networks to the servers within the BladeSystem enclosure. These networks could be used to separate the various network traffic types, such as iSCSI, backup and VMotion from production network traffic.

This scenario will also leverage the Fibre Channel over Ethernet (FCoE) capabilities of the FlexFabric 10/24-Port modules. Each fibre channel fabric will have two uplinks connected to each of the FlexFabric 10/24-Port modules.

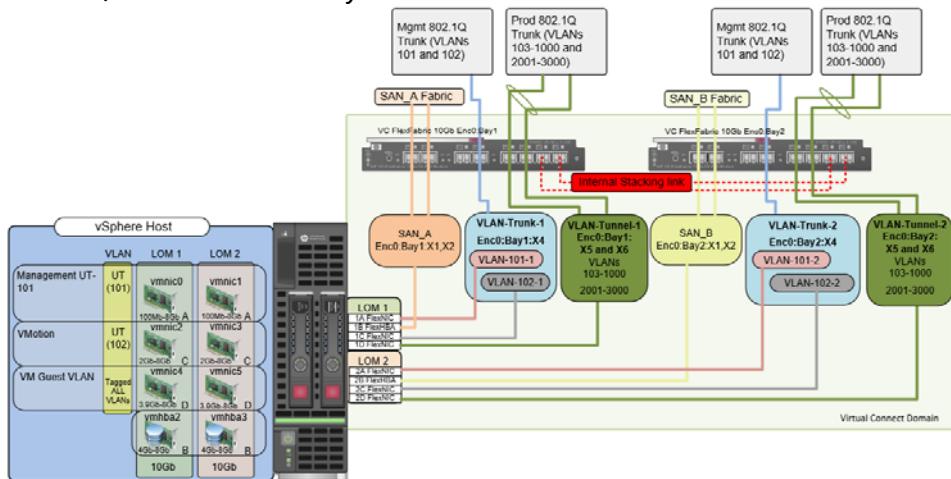
## **Requirements**

This scenario will support both Ethernet and fibre channel connectivity. In order to implement this scenario, an HP BladeSystem c7000 enclosure with one or more server blades and TWO Virtual Connect FlexFabric 10/24-Port modules, installed in I/O Bays 1 & 2 are required. In addition, we will require ONE or TWO external Network switches. As Virtual Connect does not appear to the network as a switch and is transparent to the network, any standard managed switch will work with Virtual Connect. The Fibre Channel uplinks will connect to the existing FC SAN fabrics. The SAN switch ports will need to be configured to support NPIV logins. Two uplinks from each FlexFabric 10/24-Port module will be connected to the existing SAN fabrics.

**Figure 195 - Physical View;** Shows three Ethernet uplinks from Ports X4, X5 and X6 on Module 1 to Ports 1, 2 and 3 on the first network switch and three Ethernet uplinks from Ports X4, X5 and X6 on Module 2 to Ports 1, 2 and 3 on the second network switch. The SAN fabrics are also connected redundantly, with TWO uplinks per fabric, from ports X1 and X2 on module 1 to Fabric A and ports X1 and X2 to Fabric B.



**Figure 196 - Logical View;** The server blade profile is configured with SIX FlexNICs and 2 FlexHBAs. NICs 1 and 2 are connected to VLAN-101-x, NICs 3 and 4 are connected to VLAN-102-x, which are part of the Shared Uplink Sets VLAN-Trunk-1 and VLAN-Trunk-2, respectively. The VLAN-Trunks are connected, at 10Gb, to a network switch, through Port X4 on each FlexFabric 10/24-Port Module in Bays 1 and 2. NICs 5 and 6 are connected to VLAN-Tunnel-x which is supporting the VM guest VLANs 103-105 and 2100-2150. The VLAN-Tunnels are connected, at 10Gb, to a network switch, through Ports X5 and X6 on each FlexFabric 10/24-Port Module in Bays 1 and 2.



# Installation and configuration

## Switch configuration

As the Virtual Connect module acts as an edge switch, Virtual Connect can connect to the network at either the distribution level or directly to the core switch.

The appendices provide a summary of the cli commands required to configure various switches for connection to Virtual Connect. The configuration information provided in the appendices for this scenario assumes the following information:

- Whether connecting to a Shared Uplink Set or Tunnel, the switch ports are configured as VLAN TRUNK ports (tagging) to support several VLANs. All frames will be forwarded to Virtual Connect with VLAN tags. Optionally, one VLAN could be configured as (Default) untagged, if so, then a corresponding vNet within the Shared Uplink Set would be configured and set as "Default".

**Note:** When adding additional uplinks to the Tunnel, if the additional uplinks are connecting from the same FlexFabric 10/24-Port module to the same switch, in order to ensure all uplinks are active, the switch ports connected to each Tunnel will need to be configured for LACP within the same Link Aggregation Group.

The network switch port should be configured for Spanning Tree Edge as Virtual Connect appears to the switch as an access device and not another switch. By configuring the port as Spanning Tree Edge, it allows the switch to place the port into a forwarding state much quicker than otherwise, this allows a newly connected port to come online and begin forwarding much quicker.

The SAN connection will be made with redundant connections to each Fabric. SAN switch ports connecting to the FlexFabric 10/24-Port module must be configured to accept NPIV logins.

## Configuring the VC module

- Physically connect Port 1 of network switch 1 to Port X4 of the VC module in Bay 1
- Physically connect Port 2 of network switch 1 to Port X5 of the VC module in Bay 1
- Physically connect Port 3 of network switch 1 to Port X6 of the VC module in Bay 1
- Physically connect Port 1 of network switch 2 to Port X4 of the VC module in Bay 2
- Physically connect Port 2 of network switch 2 to Port X5 of the VC module in Bay 2
- Physically connect Port 3 of network switch 1 to Port X6 of the VC module in Bay 2

**Note:** If you have only one network switch, connect VC ports X4, X5 & X6 (Bay 2) to an alternate port on the same switch. This will NOT create a network loop and Spanning Tree is not required.

- Physically connect Ports X1/X2 on the FlexFabric in module Bay 1 to switch ports in SAN Fabric A
- Physically connect Ports X1/X2 on the FlexFabric in module Bay 2 to switch ports in SAN Fabric B

## VC CLI commands

Many of the configuration settings within VC can also be accomplished via a CLI command set. In order to connect to VC via a CLI, open an SSH connection to the IP address of the active VCM. Once logged in, VC provides a CLI with help menus. Through this scenario the CLI commands to configure VC for each setting will also be provided.

## Configuring Expanded VLAN Capacity via GUI

Virtual Connect release 3.30 provided an expanded VLAN capacity mode when using Shared Uplink Sets, this mode can be enabled through the Ethernet Settings tab or the VC CLI. The default configuration for a new Domain install is "Expanded VLAN Capacity" mode, Legacy mode is no longer available and the Domain cannot be downgraded.

Virtual Connect 4.30 now provides the ability to define up to 4096 VLANs then consume only the VLANs you need, when you need them. There is nothing to change or enable to take advantage of the 4096 VLAN feature.

## To verify the VLAN Capacity mode

- On the Virtual Connect Manager screen, Left pane, click Ethernet Settings, Advanced Settings
- Select Expanded VLAN capacity
- Verify Expanded VLAN Capacity is configured and Legacy VLAN Capacity is greyed out.

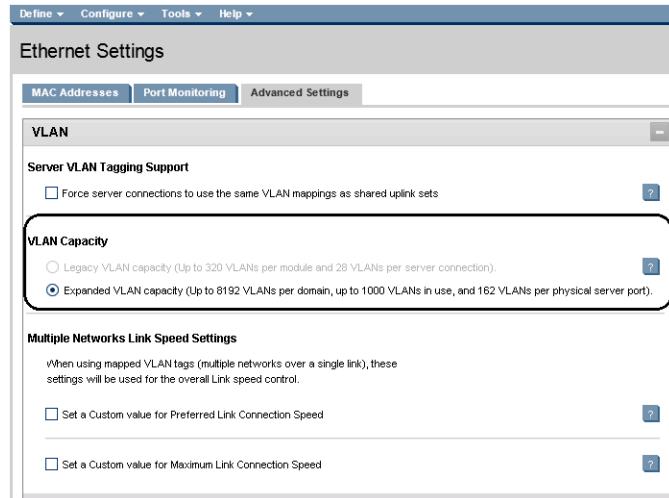
**Note:** Legacy VLAN mode will only be presented if 1Gb Virtual Connect Modules are present, in which case the domain would be limited to Firmware version 3.6x.

## Configuring Expanded VLAN Capacity via CLI

The following command can be copied and pasted into an SSH based CLI session with Virtual Connect;

```
# Set Expanded VLAN Capacity  
set enet-vlan -quiet VlanCapacity=Expanded
```

**Figure 197 - Enabling Expanded VLAN Capacity**



**Note:** If a 1Gb VC Ethernet module is present in the Domain, Expanded VLAN capacity will be greyed out, this is only supported with 10Gb and 20Gb based Virtual Connect modules. Also, once Expanded VLAN capacity is selected, moving back to Legacy VLAN capacity mode will require a domain deletion and rebuild.

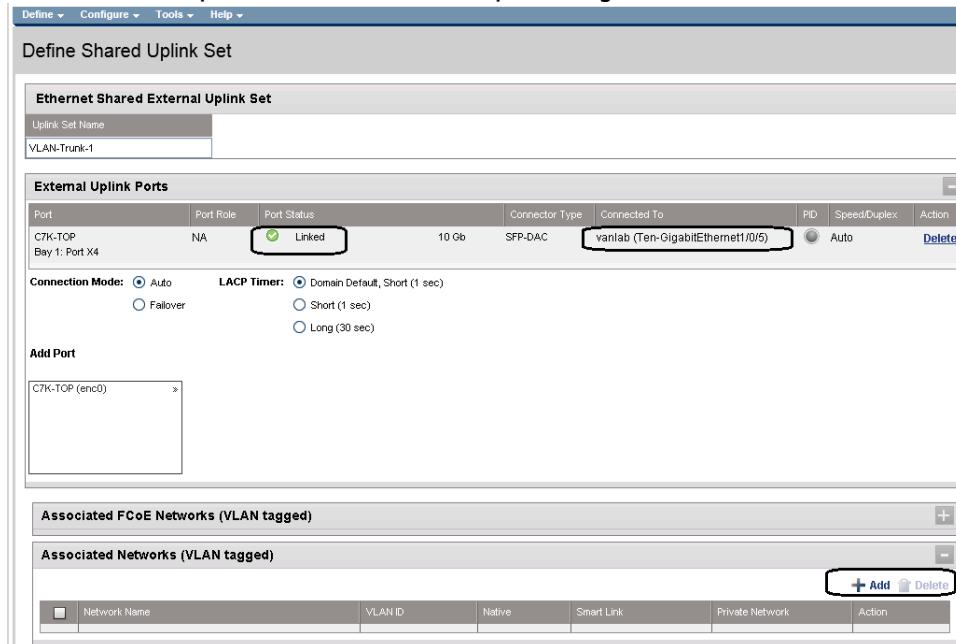
## Defining a new Shared Uplink Set (VLAN-Trunk-1)

Connect Port X6 of FlexFabric 10/24-Port module 1 to Port 2 on switch 1

Create a SUS named VLAN-Trunk-1 and connect it to FlexFabric 10/24-Port Port X6 on Module 1

- On the Virtual Connect Home page, select Define, Shared Uplink Set
- Insert Uplink Set Name as VLAN-Trunk-1
- Select Add Port, then add the following port;
  - Enclosure 1, Bay 1, Port X4

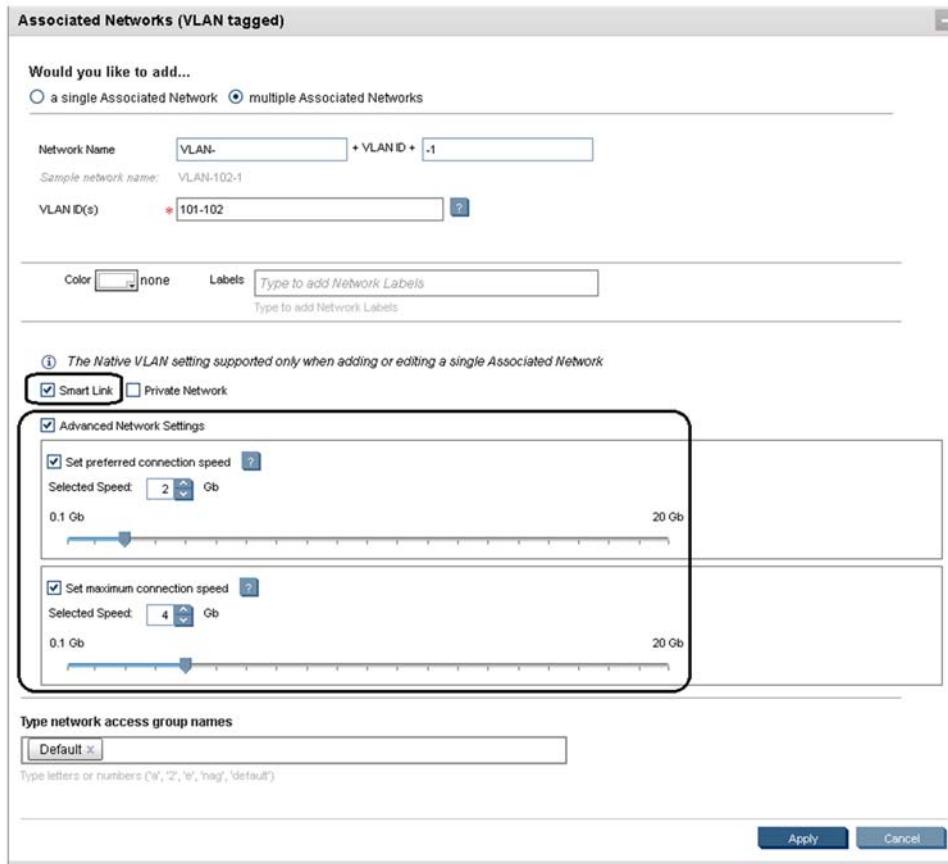
**Figure 198 - Shared Uplink Set (VLAN-Trunk-1) Uplink Assigned**



- Click Add Networks and select the Multiple Networks radio button and add the following VLANs;
  - Enter Name as VLAN-
  - Enter Suffix as -1
  - Enter VLAN IDs as follows (and shown in the following graphic);
- 101-102
- Enable SmartLink on ALL networks
- Click Advanced
  - Configure Preferred speed to 2Gb
  - Configure Maximum speed to 4Gb
- Click Apply

**Note:** You can optionally specify a network “color” or “Label” when creating a shared Uplinkset and its networks. In the example above we have not set either color or label.

**Figure 199 - Creating VLANs in a Shared Uplink Set**



**Note:** If the VC domain is not in Expanded VLAN capacity mode, you will receive an error when attempting to create more than 128 VLANs in a SUS. If that occurs, go to Advanced Ethernet Settings and select Expanded VLAN capacity mode and apply.

After clicking apply, a list of VLANs will be presented as shown below. If one VLAN in the trunk is untagged/native, see note below.

- Click Apply at the bottom of the page to create the Shared Uplink Set

**Figure 200 - Associated VLANs for Shared Uplink Set VLAN-Trunk-1**

The screenshot shows the 'Define Shared Uplink Set' interface. In the 'Ethernet Shared External Uplink Set' section, 'Uplink Set Name' is set to 'VLAN-Trunk-1'. The 'External Uplink Ports' table lists 'C7K-TOP Bay 1: Port X4' with 'Port Role' as 'NA', 'Port Status' as 'Linked', 'Connector Type' as 'SFP-DAC', 'Connected To' as 'vanlab (Ten-GigabitEthernet1/0/5)', 'PID' as 'Auto', and 'Speed/Duplex' as 'Auto'. Under 'Connection Mode', 'Auto' is selected. In the 'Associated FCoE Networks (VLAN tagged)' and 'Associated Networks (VLAN tagged)' sections, both show tables with two entries: 'VLAN-101-1' and 'VLAN-102-1' with VLAN IDs 101 and 102 respectively. The 'Associated Networks' table includes columns for Network Name, VLAN ID, Native, Smart Link, Private Network, and Action. At the bottom are 'Apply' and 'Cancel' buttons.

**Note:** Optionally, if one of the VLANs in the trunk to this shared uplink set were configured as Native or Untagged, you would be required to “edit” that VLAN in the screen above, and configure Native as TRUE. This would need to be set for BOTH VLAN-Trunk-1 and VLAN-Trunk-2.

**Figure 201 - Associated VLANs for Shared Uplink Set VLAN-Trunk-1**

The screenshot shows the 'Associated Networks (VLAN tagged)' interface for VLAN-Trunk-1. It displays a table with two entries: 'VLAN-101-1' and 'VLAN-102-1'. The table columns are Network Name, VLAN ID, Native, Smart Link, Private Network, and Action. At the bottom are 'Apply' and 'Cancel' buttons.

**Note:** Optionally, if one of the VLANs in the trunk to this shared uplink set were configured as Native or Untagged, you would be required to “edit” that VLAN in the screen above, and configure Native as TRUE. This would need to be set for BOTH VLAN-Trunk-1 and VLAN-Trunk-2.

Please refer to Appendix D; “Scripting the Native VLAN” for scripting examples.

**Figure 202 - You will see that ALL Uplinks are still in a Linked/Standy state**

The screenshot shows the 'Shared Uplink Sets' interface. It displays a table with one entry: 'VLAN-Trunk-1'. The 'Has FCoE' field is 'false'. The 'Port Status' field is highlighted with a red box and shows 'Linked-Standby'. Other fields include 'Connector Type' (10 Gb SFP-DAC), 'Uplink Port' (C7K-TOP: Bay 1: Port X4), and 'Action' (Edit). At the bottom are 'Apply' and 'Cancel' buttons.

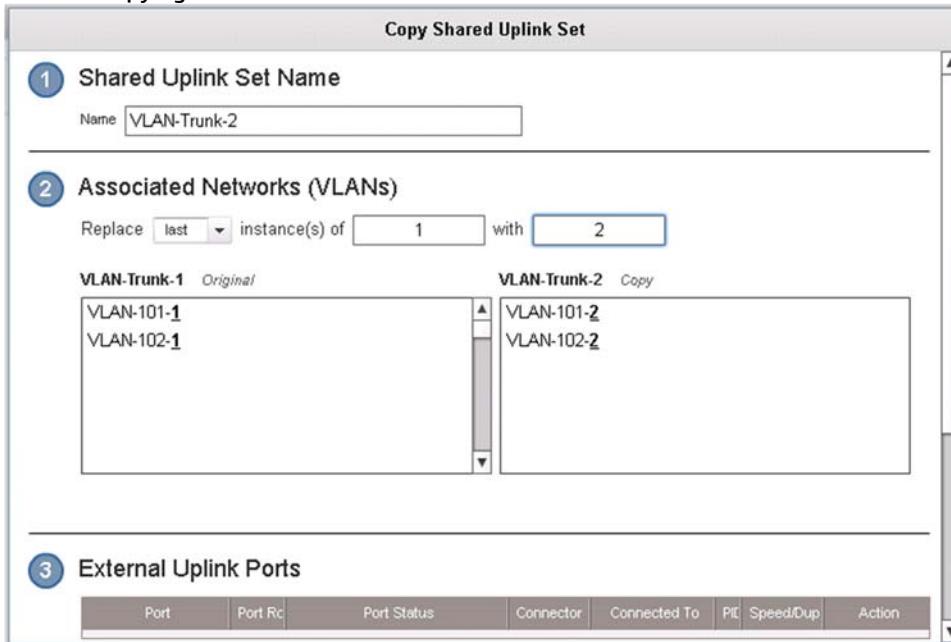
**Note:** That both of the network connections are shown as “Linked/Standy”, this state will NOT change until the network has been assigned to a server profile. This behavior is new within VC 4.30 and is provided to accommodate the new 4096 VLAN feature.

## Defining a new Shared Uplink Set (VLAN-Trunk-2) (Copying a Shared UplinkSet)

The second Shared Uplink Set could be created in the same manner as VLAN-Trunk-1 however; VC now provides the ability to COPY a VC Network or Shared Uplink Set.

- Connect Port X4 of FlexFabric 10/24-Port module 2 to Port 2 on switch 2
- In the VC GUI screen, select Shared Uplink Sets in the left pane, in the right pane VLAN-Trunk-1 will be displayed, left click VLAN-Trunk-1, it will appear as blue, right click and select COPY
- Edit the Settings as shown below, the new SUS name will be VLAN-Trunk-2 and ALL the associated VLANs will have a suffix of 2
- In step 3, ADD uplink X4 from Bay 2
- Click OK
- The SUS and ALL VLANs will be created

**Figure 203 - Copying a SUS and ALL VLANs**



## Defining a new Shared Uplink Set via CLI

The following script can be used to create the first Shared Uplink Set (VLAN-Trunk-1)

*The following command(s) can be copied and pasted into an SSH based CLI session with Virtual Connect*

```
# Create Shared Uplink Set VLAN-Trunk-1 and configure uplinks
add uplinkset VLAN-Trunk-1
add uplinkport enc0:1:X4 Uplinkset=VLAN-Trunk-1 speed=auto
# Create Networks VLAN-101-1 through VLAN-102-1 for Shared Uplink Set VLAN-Trunk-1
add network-range -quiet UplinkSet=VLAN-Trunk-1 NamePrefix=VLAN- NameSuffix=-1
VLANIds=101-102 State=enabled PrefSpeedType=Custom PrefSpeed=2000
MaxSpeedType=Custom MaxSpeed=4000 SmartLink=enabled
```

The following script can be used to create the Second Shared Uplink Set (VLAN-Trunk-2)

```
# Create Shared Uplink Set VLAN-Trunk-2 and configure uplinks
add uplinkset VLAN-Trunk-2
add uplinkport enc0:2:X4 Uplinkset=VLAN-Trunk-2 speed=auto
# Create Networks VLAN101-2 through VLAN102-2 for Shared Uplink Set VLAN-Trunk-2
add network-range -quiet UplinkSet=VLAN-Trunk-2 NamePrefix=VLAN- NameSuffix=-2
VLANIds=101-102 State=enabled PrefSpeedType=Custom PrefSpeed=2000
MaxSpeedType=Custom MaxSpeed=4000 SmartLink=enabled
```

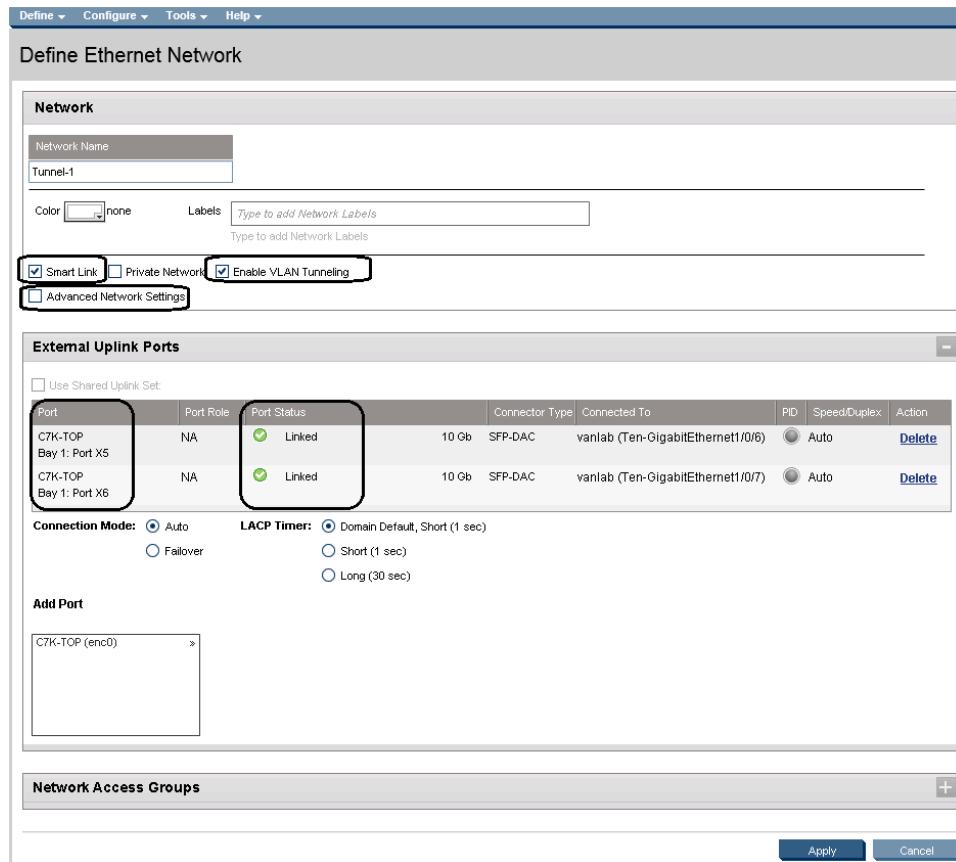
## Defining a new vNet Tunnel (Tunnel-1)

Connect Port X5 and X6 of FlexFabric 10/24-Port module 1 to Port 3 and 4 on switch 1

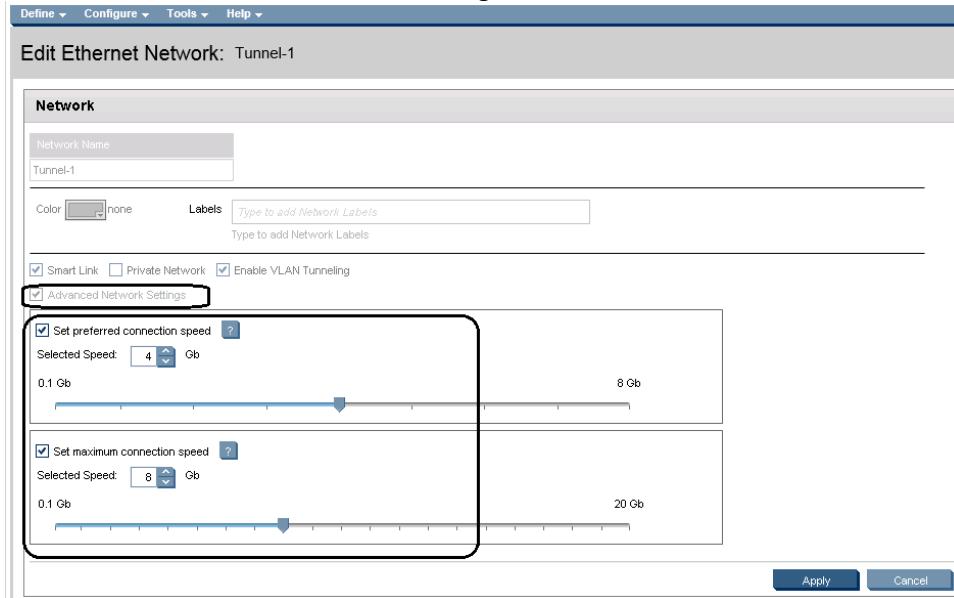
Create an Ethernet Network named Tunnel-1 and connect it to FlexFabric 10/24-Port Ports X5 and X6 on Module 1

- On the Virtual Connect Home page, select Define a Network
- Insert Network Name as Tunnel-1
- Select Add Port, then add the following port;
  - Enclosure 1, Bay 1, Ports X5 and X6
  - Enable SmartLink
  - Enable VLAN Tunneling
- Click Advanced
  - Configure Preferred speed to 4Gb
  - Configure Maximum speed to 8Gb
- Click Apply

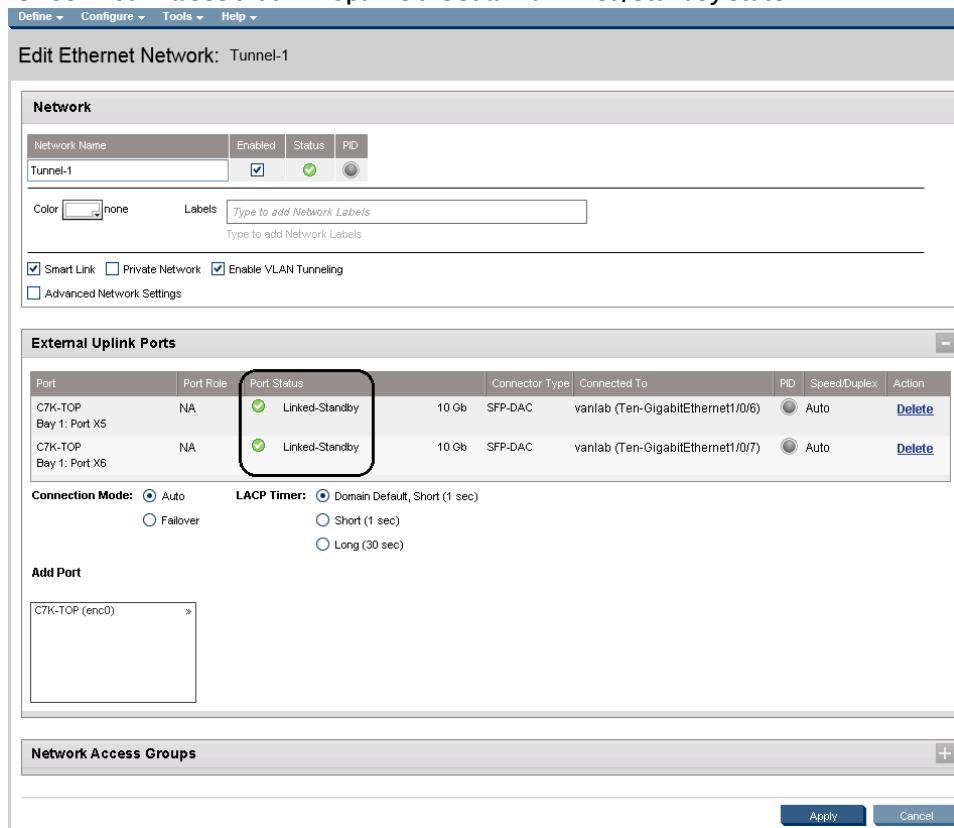
**Figure 204 - Tunnel Network Tunnel-1**



**Figure 205 - Tunnel-1 Advanced network settings**



**Figure 206 - You will see that ALL Uplinks are still in a Linked/Standy state**



**Note:** That both of the network connections are shown as "Linked/Standy", this state will NOT change until the network has been assigned to a server profile. This behavior is new within VC 4.30 and is provided to accommodate the new 4096 VLAN feature.

## Defining a new vNet Tunnel (Tunnel-2)

Connect Port X5 and X6 of FlexFabric 10/24-Port module 2 to Ports 3 and 4 on switch 2  
Create an Ethernet Network named Tunnel-2 and connect it to FlexFabric 10/24-Port Ports X5 and X6 on Module 2

- On the Virtual Connect Home page, select Define a Network
- Insert Network Name as Tunnel-2
- Select Add Port, then add the following port;
  - Enclosure 1, Bay 2, Ports X5 and X6
  - Enable SmartLink
  - Enable VLAN Tunneling
- Click Advanced
  - Configure Preferred speed to 4Gb
  - Configure Maximum speed to 8Gb
- Click Apply

**Note:** The vNet Tunnel provides the ability to pass an unlimited number of VLANs to the server NIC,. Typically, that NIC would be connected to Hypervisor vSwitch. By using a Tunnel, we can exceed any VLAN limits that VC may have, example; VC 3.30 will support up to 1000 VLAN in a Shared Uplink Set, the Tunnel allows us to exceed that limit. In addition, the Tunnel allows the Network administrator to add and remove VLANs at will, without the need to configure those VLANs within Virtual Connect, they will however, need to be configured in the Hypervisor.

## Defining a new Network Tunnel via CLI

The following script can be used to create the vNet Tunnel (Tunnel-1)

*The following command(s) can be copied and pasted into an SSH based CLI session with Virtual Connect*

```
# Create vNet Tunnel "Tunnel-1" and configure uplinks
add network Tunnel-1 VLanTunnel=Enabled LacpTimer=Domain-Default PrefSpeedType=Custom
PrefSpeed=4000 MaxSpeedType=Custom MaxSpeed=8000
add uplinkport enc0:1:X5 Network=Tunnel-1 Speed=Auto
add uplinkport enc0:1:X6 Network=Tunnel-1 Speed=Auto
set network VLAN-Tunnel-1 SmartLink=Enabled

# Create vNet Tunnel "Tunnel-2" and configure uplinks
add network Tunnel-2 VLanTunnel=Enabled LacpTimer=Domain-Default PrefSpeedType=Custom
PrefSpeed=4000 MaxSpeedType=Custom MaxSpeed=8000
add uplinkport enc0:2:X5 Network=Tunnel-2 Speed=Auto
add uplinkport enc0:2:X6 Network=Tunnel-2 Speed=Auto
set network VLAN-Tunnel-2 SmartLink=Enabled
```

**Note:** In this scenario we have created two independent Share Uplink Sets (SUS), each originating from the opposite FlexFabric 10/24-Port Modules, by doing so we provide the ability to create separate and redundant connections out of the Virtual Connect domain. When we create the server profiles, you will see how the NICs will connect to VLANs accessed through the opposite VC module, which provides the ability to create an Active / Active uplink scenario. Alternatively, we could have created a single SUS and assigned both sets of these uplink ports to the same SUS, however, this would have provided an Active/Standby uplink scenario, as shown in Scenario 5.

In addition to the Shared Uplink Set, we also created a pair of vNet (Network) Tunnels. The Tunnel can be used to pass many VLANs (up to 4094 VLANs) without the need to define each VLAN, as in the Shared Uplink Set.

## Defining a new (FCoE) SAN Fabric via GUI

Create a Fabric and name it “FCoE\_A”

- On the Virtual Connect Manager screen, click Define, SAN Fabric to create the first Fabric
- Enter the Network Name of “FCoE\_A”
- Select Add Port, then add the following ports;
  - Enclosure 1, Bay 1, Port X1
  - Enclosure 1, Bay 1, Port X2
- Ensure Fabric Type is set to “FabricAttach”
- Select Show Advanced Settings
  - Select Automatic Login Re-Distribution (FlexFabric Only)
  - Select Set Preferred FCoE Connect Speed
    - Configure for 4Gb
  - Select Set Maximum FCoE Connect Speed
    - Configure for 8Gb
- Select Apply

Create a second Fabric and name it “FCoE\_B”

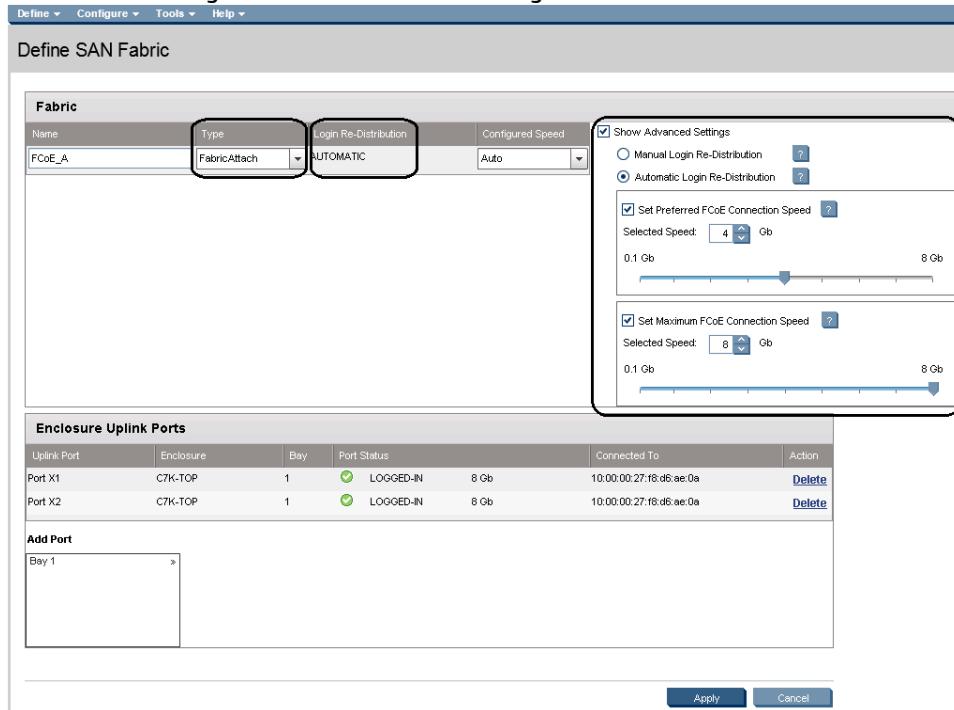
- On the Virtual Connect Manager screen, click Define, SAN Fabric to create the second Fabric
- Enter the Network Name of “FCoE\_B”
- Select Add Port, then add the following ports;
  - Enclosure 1, Bay 2, Port X1
  - Enclosure 1, Bay 2, Port X2
- Ensure Fabric Type is set to “FabricAttach”
- Select Show Advanced Settings
  - Select Automatic Login Re-Distribution (FlexFabric Only)
  - Select Set Preferred FCoE Connect Speed
    - Configure for 4Gb
  - Select Set Maximum FCoE Connect Speed
    - Configure for 8Gb
- Select Apply

## Defining SAN Fabrics via CLI

The following command(s) can be copied and pasted into an SSH based CLI session with Virtual Connect

```
#Create the SAN Fabrics FCoE_A and FCoE_B and configure uplinks as discussed above
add fabric FCoE_A Type=FabricAttach Bay=1 Ports=1,2 Speed=Auto LinkDist=Auto
PrefSpeedType=Custom PrefSpeed=4000 MaxSpeedType=Custom MaxSpeed=8000
add fabric FCoE_B Type=FabricAttach Bay=2 Ports=1,2 Speed=Auto LinkDist=Auto
PrefSpeedType=Custom PrefSpeed=4000 MaxSpeedType=Custom MaxSpeed=8000
```

**Figure 207 - SAN Configuration and Advanced Settings**



**Figure 208 - FCoE SAN fabrics configured with two 8Gb uplinks per fabric. Note the bay and port numbers on the right**

SAN Fabrics										
External Connections		Server Connections								
Status	SAN Fabric	Type	Login Re-Distribution	Port Status	Connected To	Enclosure	Bay	Port	Action	Add
✓	FCoE_A	FabricAttach	AUTOMATIC	✓ LOGGED-IN	8 Gb	10:00:00:27:f8:d6:ae:0a	C7K-TOP	1 X1	Edit	
✓				✓ LOGGED-IN	8 Gb	10:00:00:27:f8:d6:ae:0a	C7K-TOP	1 X2		
✓	FCoE_B	FabricAttach	AUTOMATIC	✓ LOGGED-IN	8 Gb	10:00:00:27:f8:d6:8b:9c	C7K-TOP	2 X1	Edit	
✓				✓ LOGGED-IN	8 Gb	10:00:00:27:f8:d6:8b:9c	C7K-TOP	2 X2		

## Defining a Server Profile

We will create a server profile with SIX server NICs and TWO SAN adapters.

Each server NIC will connect to a specific network.

- On the main menu, select Define, then Server Profile
- Create a server profile called “ESX-1”
- Select to “Hide Unused FlexNICs”
- In the Network Port 1 drop down box, select a Network, then chose VLAN101-1
- Set the port speed to Custom at 100Mb
- In the Network Port 2 drop down box, select a Network, then chose VLAN101-2
- Set the port speed to Custom at 100Mb
- Select ADD network (add four additional network connections)
- In the Network Port 3 drop down box, select a Network, then chose VLAN-102-1
- Leave the network speed as Preferred
- In the Network Port 4 drop down box, select a Network, then chose VLAN-102-2
- Leave the network speed as Preferred
- In the Network Port 5 drop down box, select a Network and chose Tunnel-1
- Leave the network speed as Preferred
- In the Network Port 6 drop down box, select a Network and chose Tunnel-2
- Leave the network speed as Preferred
- Expand the FCoE Connections box, for Bay 1, select FCoE\_A for Bay 2, select FCoE\_B
- Leave the SAN Port speed as Preferred
- Do not configure FC SAN or iSCSI Connection
- In the Assign Profile to Server Bay box, locate the Select Location drop down and select Bay 2, then apply

Prior to applying the profile, ensure that the server in Bay 2 is currently OFF

**Note:** You should now have a server profile assigned to Bay 2, with 6 Server NIC connections. NICs 1&2 should be connected to VLAN VLAN-101-x (MGMT), NICs 3&4 should be connected and VLAN-102x (VMotion) and NICs 5 and 6 are connected to VLAN-Tunnel-x (VM Guest Networks). FCoE SAN fabrics are connected to, Port 1 - FCoE\_A and Port 2 - FCoE\_B.

## Defining a Server Profile via CLI

The following command(s) can be copied and pasted into an SSH based CLI session with Virtual Connect

```
# Create Server Profile ESX-1
add profile ESX-1 -nodefaultfcconn -nodefaultfcoeconn NAG=Default HideUnusedFlexNICs=true
set enet-connection ESX-1 1 pxe=Enabled Network=VLAN-101-1 SpeedType=Custom Speed=100
set enet-connection ESX-1 2 pxe=Disabled Network=VLAN-101-2 SpeedType=Custom Speed=100
add enet-connection ESX-1 pxe=Disabled Network=VLAN-102-1
add enet-connection ESX-1 pxe=Disabled Network=VLAN-102-2
add enet-connection ESX-1 pxe=Disabled Network=Tunnel-1 SpeedType=Auto
add enet-connection ESX-1 pxe=Disabled Network=Tunnel-2 SpeedType=Auto
add fcoe-connection ESX-1 Fabric=FCoE_A SpeedType=Preferred
add fcoe-connection ESX-1 Fabric=FCoE_B SpeedType=Preferred
Poweroff server 2
assign profile ESX-1 enc0:2
```

**Note:** The speed of the NIC and SAN connections, as well as the MAC and WWN. Also, note that the FCoE connections are assigned to the two SAN fabrics created earlier and use ports LOM:1-b and LOM:2-b.

**Figure 209 - Define a Server Profile (ESX-1) ESXi 5 NICs 5 & 6 are connected to the vNet tunnels VLAN-Tunnel-x**

**Figure 210- Server Profile View Bay 2**

## Verify Network Link State

As discussed earlier in this document, in Virtual connect 4.30 there was a change to the link state behavior when a network as no connections to a server profile. Once a connection is made to the server profile, the uplinks will become Active, as previously expected.

**Figure 211 - All Links now appear in a Linked/Active state.**

Shared Uplink Set	Has FCoE	Port Status	Connector Type	Uplink Port	Action
VLAN-Trunk-1	false	Linked-Active	10 Gb	SFP-DAC	C7K-TOP: Bay 1: Port X5
		Linked-Active	10 Gb	SFP-DAC	C7K-TOP: Bay 1: Port X6
VLAN-Trunk-2	false	Linked-Active	10 Gb	SFP-DAC	C7K-TOP: Bay 2: Port X5
		Linked-Active	10 Gb	SFP-DAC	C7K-TOP: Bay 2: Port X6

## Review

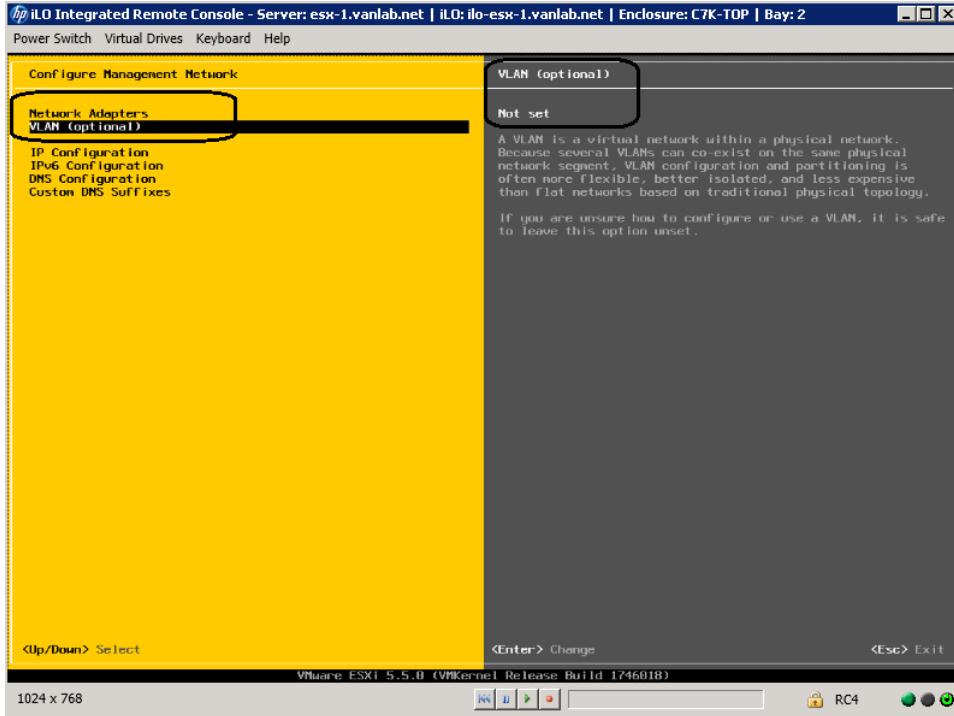
In this scenario we have created Two Shared Uplink Sets (SUS), providing support for our infrastructure VLANs (101 and 102). Uplinks originating from each FlexFabric Module connect to each SUS, by doing so we provide redundant connections out of the Virtual Connect domain. Additionally, we have created a pair of vNet Network Tunnels. These Tunnels will provide the ability to transparently pass any and all VLANs between the connected servers and network switches, each VLAN Tunnel has TWO active uplinks to provide additional connectivity to the network. In this scenario, all uplinks will be active. We also create two FCoE SAN Fabrics.

We created a server profile, with SIX NICs. NICs 1 and 2 connect to VLAN 101 (untagged), NICs 3 and 4 connect VLAN 102 (untagged) and NICs 5 and 6 connect to the VLAN tunnels which will provide connection to VLANs 103-105 and 2100-2400 (tagged). By connecting to the networks in pairs of NICs, we provide the ability to sustain a link or module failure and not loose connection to the network. We have configured NICs 1 and 2 with a custom NIC speed of 100Mb, NICs 3 and 4 were left as preferred, which was configured to 2Gb when we created the Shared Uplink Set and NICs 5 and 6 are set to auto and will accept the remaining bandwidth.

Additionally, FCoE port 1 is connected to SAN fabric FCoE\_A and FCoE port 2 is connected to SAN Fabric FCoE\_B, providing a multi-pathed connection to the SAN. The SAN fabric connections are set to 4Gb/Sec.

The FCoE SAN fabric connects to each SAN fabric over a pair of uplinks per module. SAN logins are distributed across the multiple paths.

**Figure 212** - As NICs 1 and 2 are connected directly to VLAN-101, the connection acts as an Access or Untagged switch port, you need to ensure that the Hypervisor is NOT configured for VLAN tagging. However, if you want to put this server onto a VLAN that is tagged, this setting will need to be configured for that VLAN.



## Results – vSphere Networking Examples

We successfully configured FlexFabric with Share Uplink Sets, supporting several VLANs and redundant SAN fabrics. We created a server profile to connect to the various vNet with SIX NICs and the SAN fabrics using the FCoE connections created within the profile.

Although both Ethernet and Fibre channel connectivity is provided by the FlexFabric Adapter used in the G7 through Gen 9 servers; each capability (LAN and SAN) is provided by a different component of the adapter, they appear in the server as individual network and SAN adapters.

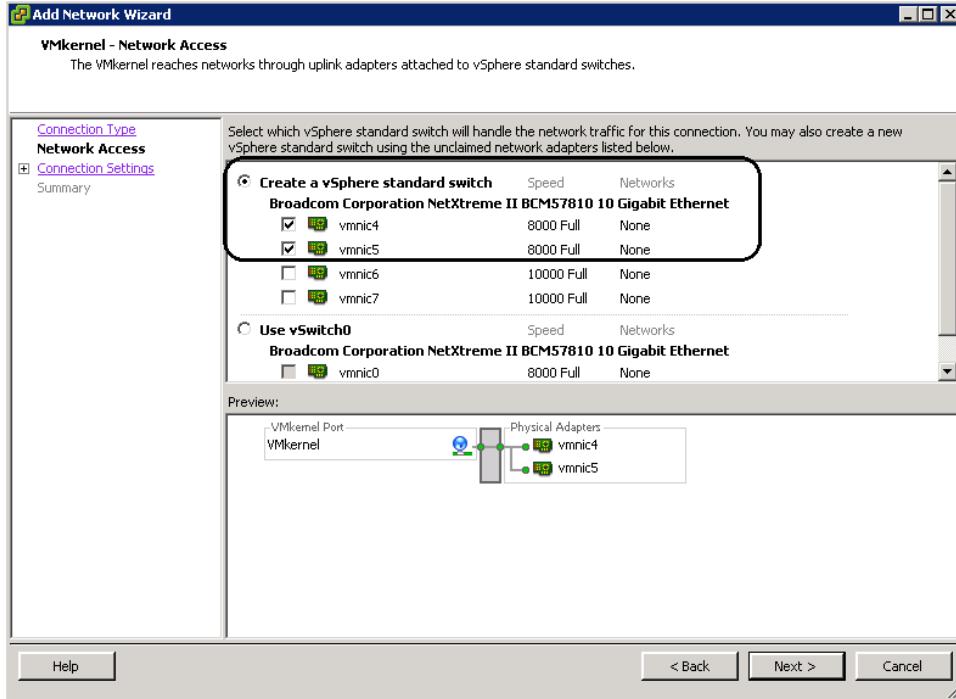
The following graphics show an ESXi 5.5 server with SIX FlexNICs configured, FOUR presented at 8Gb (two on the console network and two on the VMotion network) and two at 10Gb (Guest VLAN port groups). If we did not require SAN connectivity on this server, the FCoE connections could be deleted and the server would then have 8 NIC ports available to the OS. In addition, if we did not want FCoE connectivity and instead wanted to leverage iSCSI, we could delete the FCoE connected and re-create those connects as iSCSI connections, with offload and optionally iSCSI boot.

**Note:** The BL465c G7 and BL685c G7 utilize an NC551i chipset (BE2), whereas the BL460c G7, BL620c G7 and BL680c G7 utilize an NC553i chipset (BE3) and the Gen 8 blades typically have a NC554 adapter which also utilizes the BE3 chipset. Both the BE2 and BE3 chipsets share common drivers and firmware.

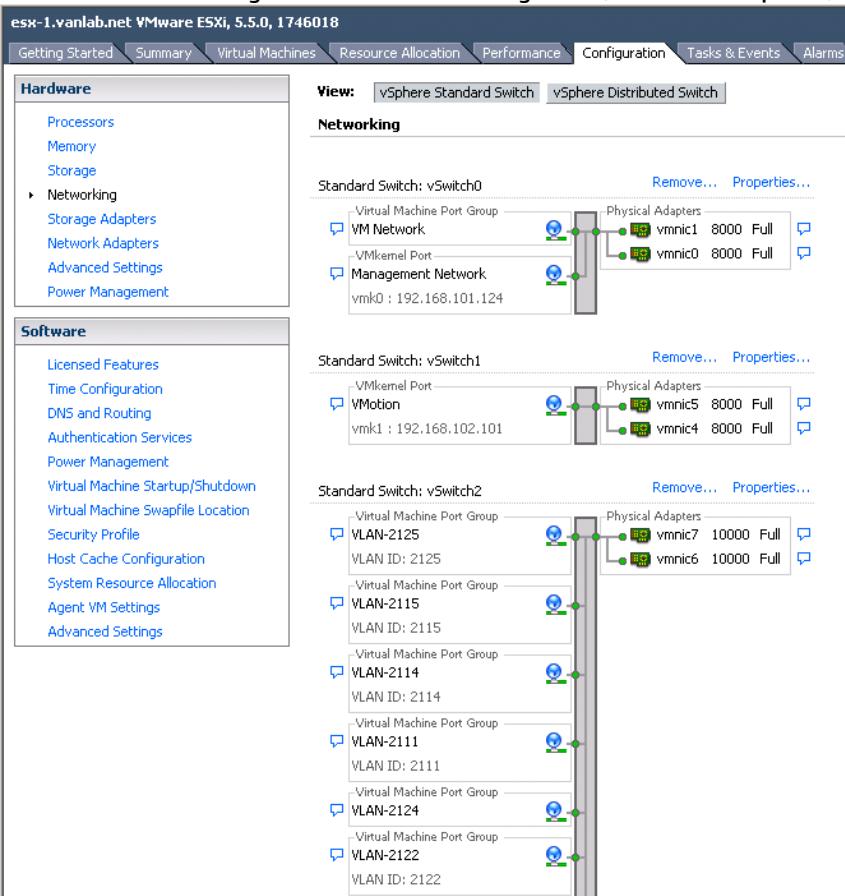
The following graphic provides an example of an ESX server with TWO NICs connected to the same console vSwitch configured for VLAN 101, which was the Default (untagged) VLAN. Additional vSwitches have been configured for VMotion and product VLANs.

## vSphere Standard vSwitch

**Figure 213 – ESXi 5.5 Network Connections**

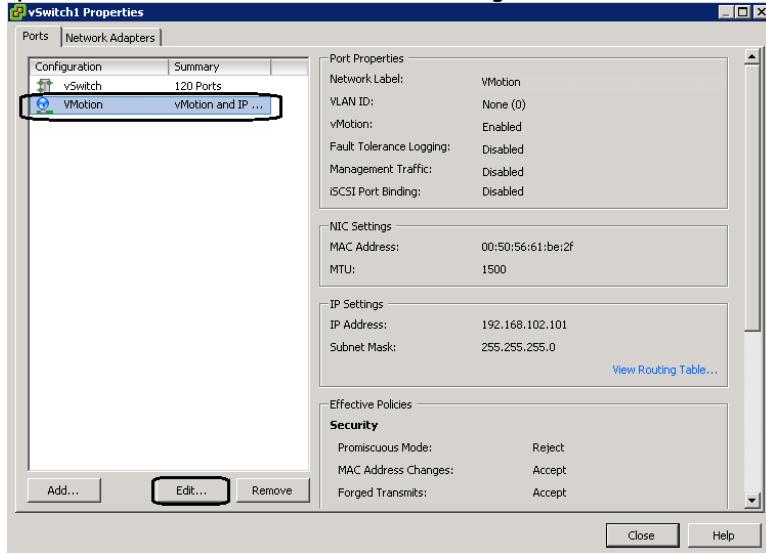


**Figure 214 – ESXi 5.5 Networking – three vSwitches configured. (Note the NIC speeds)**

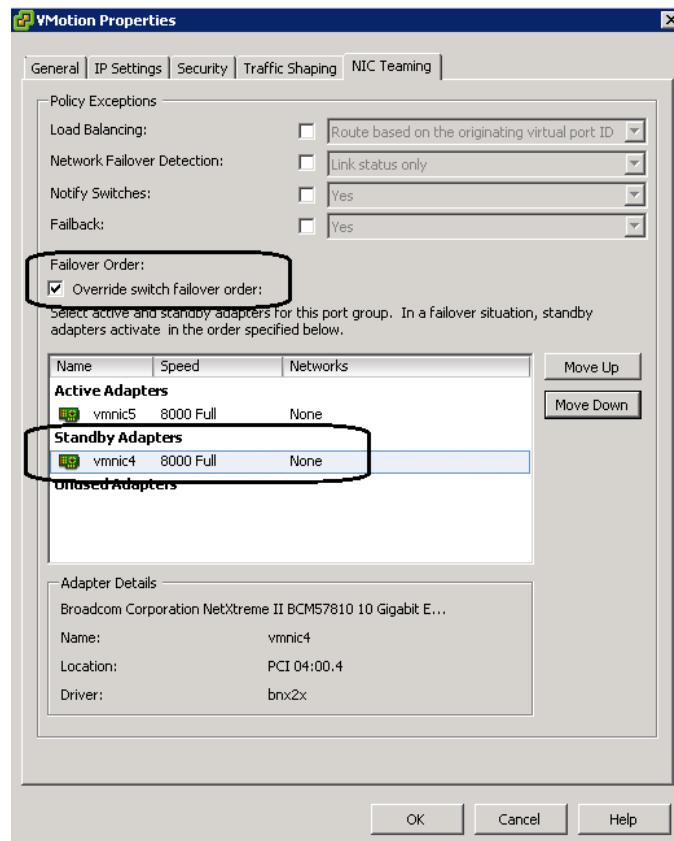


**Note:** As VLAN 101 is set as untagged, the management network port group should be defined as untagged. This will allow the server to be deployed, without having to set a VLAN ID for the management network.

**Figure 215** - You may want to specify a specific NIC for VMotion traffic. This will ensure that all VMotion traffic between servers within the enclosure will remain on the same VC module, reducing the likelihood of multiple hops between servers. Edit the VMotion Configuration.

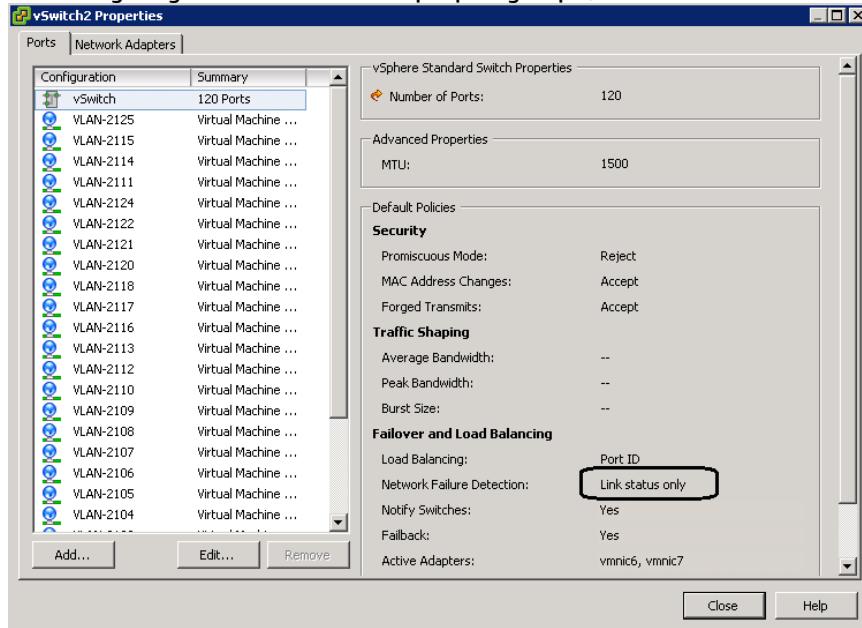


**Figure 216** - Edit the NIC Team for VMotion and set one of the Adapters in Standby, this will ensure that ALL VMotion traffic remains on the SAME VC module. ESX NIC vmnic5 is connected to the VC module in bay 1.

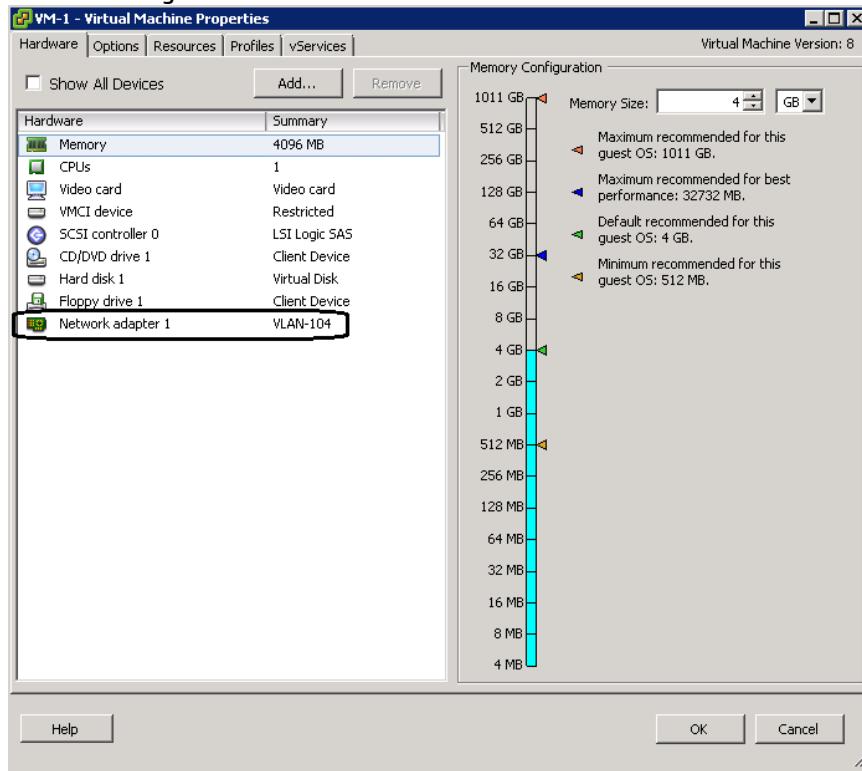


**Note:** As this Scenario is based on an Active/Active configuration, to ensure that ALL VMotion traffic between servers within the enclosure is contained to the same module, on each server edit the VMotion vSwitch properties and move one of the Adapters to Standby. This will ensure that ALL VMotion traffic will occur on the same Virtual Connect module.

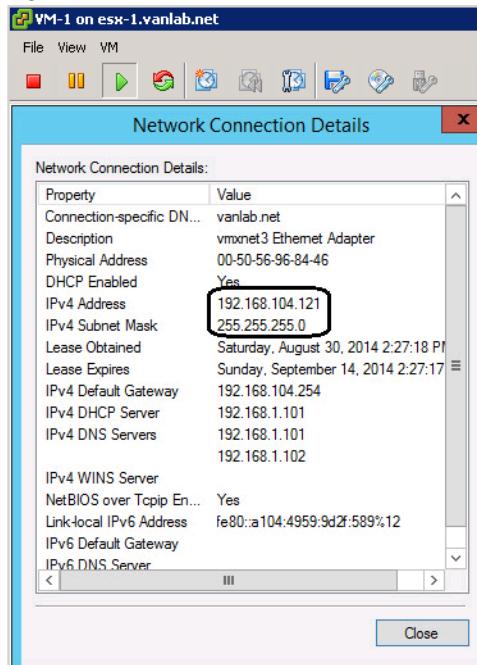
**Figure 217 - Configuring the vSwitch for multiple port groups / VLANs**



**Figure 218 - VM1 configured for VLAN 104**



**Figure 219 - VM1 on VLAN 104**



## vSphere Distributed vSwitch

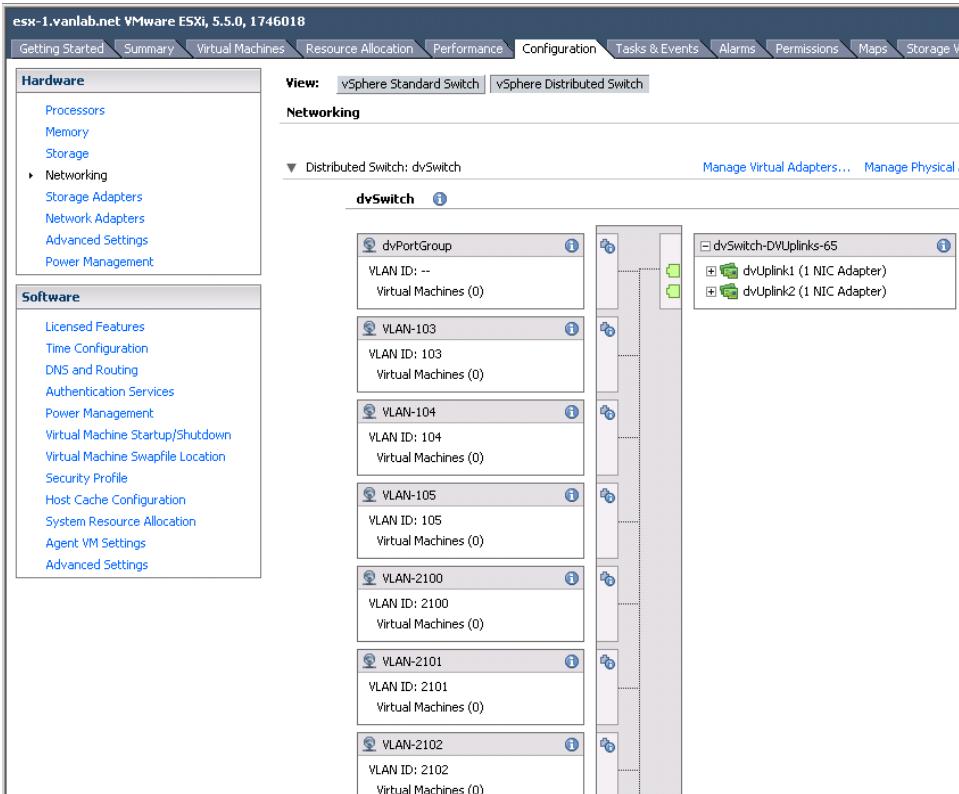
**Figure 220 - Management and VMotion NICs are connected to Standard vSwitches**

The screenshot shows the VMware ESXi Configuration interface for host **esx-1.vanlab.net VMware ESXi, 5.5.0, 1746018**. The **Configuration** tab is selected. The left sidebar lists **Hardware** (Processors, Memory, Storage, Networking, Storage Adapters, Network Adapters, Advanced Settings, Power Management) and **Software** (Licensed Features, Time Configuration, DNS and Routing, Authentication Services, Power Management, Virtual Machine Startup/Shutdown, Virtual Machine Swapfile Location, Security Profile, Host Cache Configuration, System Resource Allocation, Agent VM Settings, Advanced Settings).

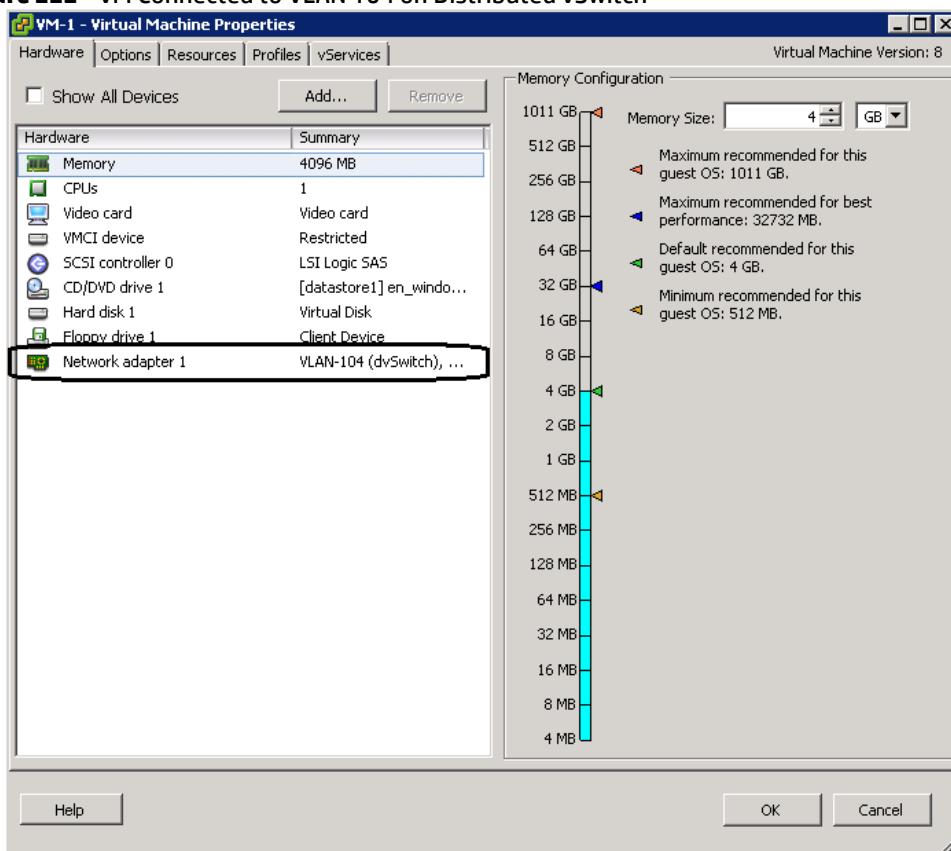
The **Networking** section displays two **Standard Switch: vSwitch0** and **Standard Switch: vSwitch1**.

- vSwitch0:**
  - VM Network:** Connected to **vmnic1** (8000 Full).
  - Management Network:** Connected to **vmnic0** (8000 Full).
- vSwitch1:**
  - VMotion:** Connected to **vmnic5** (8000 Full) and **vmnic4** (8000 Full).

**Figure 221 - VM Networks are connected to a Distributed vSwitch**



**Figure 222 - VM Connected to VLAN 104 on Distributed vSwitch**



# Results – vSphere SAN Connectivity

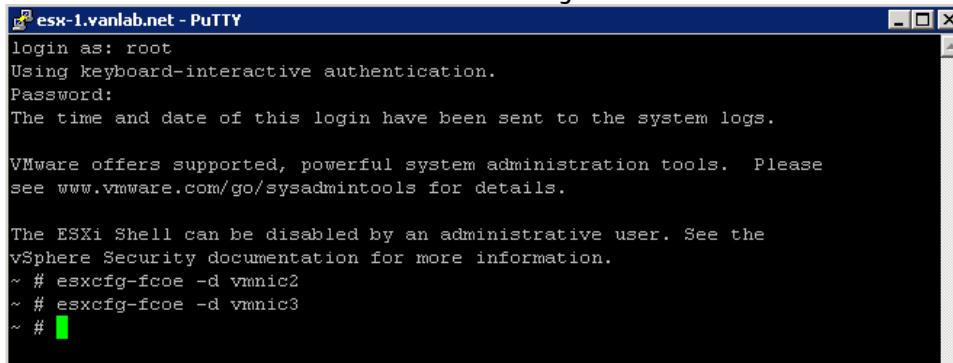
## Broadcom Adapters (534 and 630)

The Broadcom adapters (534 and 650) provide an FCoE capability, however, it presents a little differently than the Emulex discussed above. These adapters use a Broadcom BCM578xOS-Based chipset. When installed with VMWare 5.x, you will need to enable the FCoE capabilities of the adapter if you plan to connect to a Fibre Channel based SAN.

**Note:** This is not required if using the Emulex network adapters.

**Note:** Additional information on enabling the FCoE function in ESXi is provided in the Introduction section, under VMWare ESXi 5.5.

**Figure 223 – SSH to the ESX host and execute the esxcfg-fcoe command as shown below**

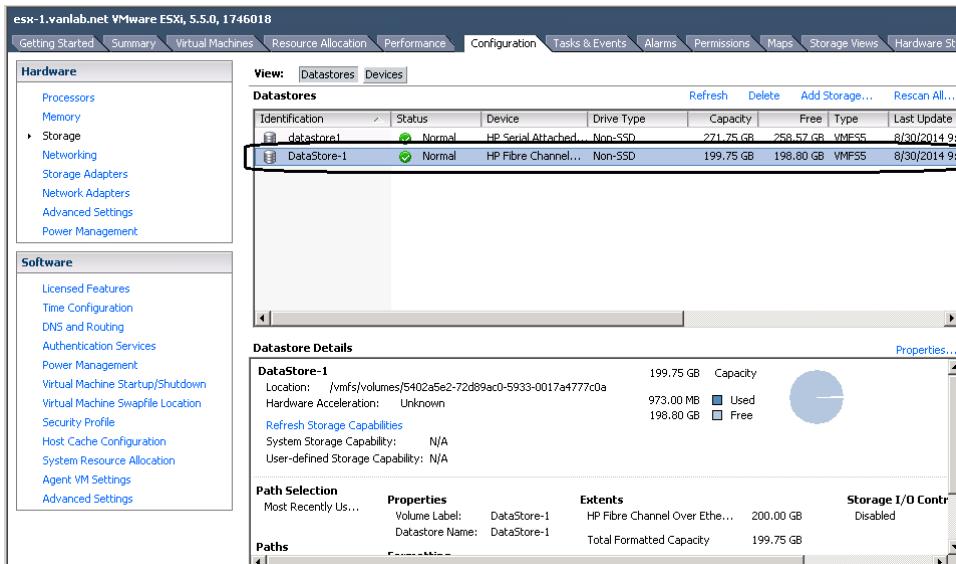


```
esx-1.vanlab.net - PuTTY
login as: root
Using keyboard-interactive authentication.
Password:
The time and date of this login have been sent to the system logs.

VMware offers supported, powerful system administration tools. Please
see www.vmware.com/go/sysadmintools for details.

The ESXi Shell can be disabled by an administrative user. See the
vSphere Security documentation for more information.
~ # esxcfg-fcoe -d vmnic2
~ # esxcfg-fcoe -d vmnic3
~ #
```

**Figure 224 – ESXi 5.5 storage configuration, the Shared Storage LUN is provided through the FCoE connections to the SAN.**



# Summary

We presented a Virtual Connect Network scenario by creating two shared uplink sets (SUS), each SUS is connected with one active uplink; both SUS' can actively pass traffic. The SUS' will be used to support the management and VMotion VLANs. We also configured two VLAN Tunnels, which will provide connectivity for the production VLANs for the VM hosts. We included a dual path SAN fabric for storage connectivity.

When VC profile ESX-1 is applied to the server in bay 2 and the server is powered up, it has one NIC connected through FlexFabric 10/24-Port module 1 (connected to VLAN-101-1), the second NIC is connected through FlexFabric 10/24-Port module 2 (connected to VLAN-101-2). Each NIC is configured at 100Mb. These NICs are connected to the console vSwitch. The second pair of NICs are connected to the second vSwitch, which is configured for VMotion and is connected to VLAN-102-x through NICs 3 and 4 which are configured at 2Gb. The last pair of NICs 5 and 6, are configured at 3.9Gb and connected to the third vSwitch, which is configured to support VLANs 103 through 105 and 2100 through 2400. This host is also configured for FCoE based SAN access and connects to a SAN LUN to store the Guest VMs. Each FCoE port is configured for 4Gb of SAN bandwidth.

As additional servers are added to the enclosure, simply create additional profiles, or copy existing profiles, configure the NICs for LAN and SAN fabrics as required and apply them to the appropriate server bays and power the server on.

# **Scenario 8 – Network Access Groups in a Shared Uplink Set - Ethernet and FCoE SAN – Windows 2012 R2**

## **Overview**

This scenario will implement the Shared Uplink Set (SUS) to provide support for multiple VLANs and will also leverage Network Access Groups to provide access control to specific VLANs.

The Network Access Group (NAG) is a feature enhancement with VC firmware release 3.30 and provides the ability to group VLANs based on application or security boundaries. We will create a Shared Uplink Set, and then identify VLANs that will associate with different applications and then create Network Access Groups to contain those VLANs. We can then create server profiles and assign server profiles to specific Network Access Groups, which will restrict their ability to connect to networks which are outside the Network Access Group they belong to.

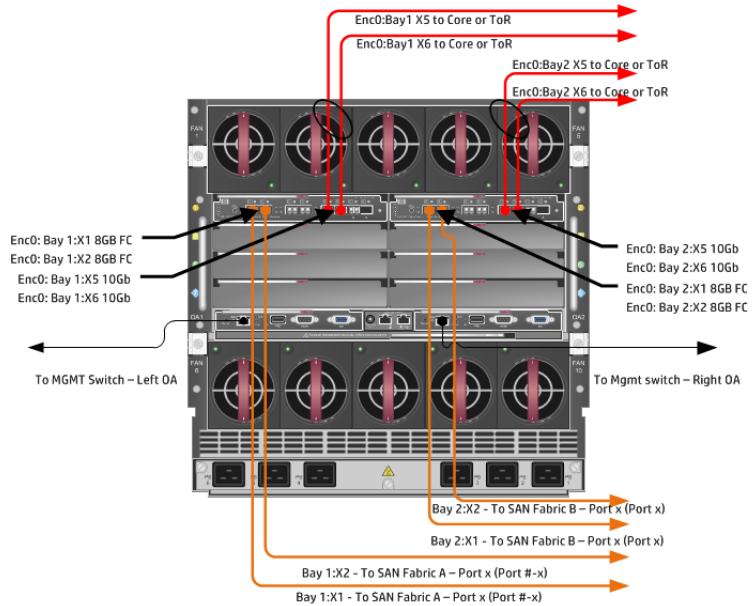
As multiple VLANs will be supported in this configuration, the upstream switch ports connecting to the FlexFabric 10/24-Port modules will be configured to properly present those VLANs. The upstream switch ports will be configured for VLAN trunking/VLAN tagging. LACP will also be used to connect two uplinks per module.

This scenario will focus on Ethernet connectivity only; however, FCoE connectivity is still supported when using Network Access Groups.

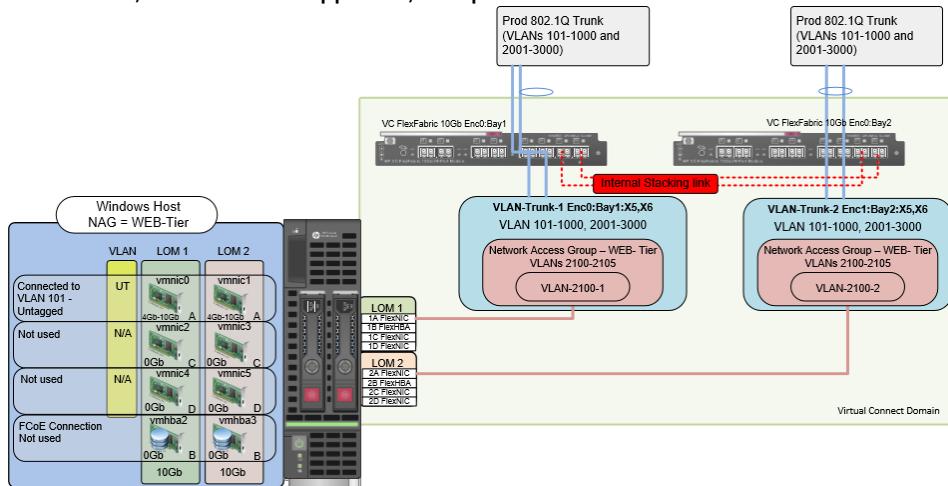
## **Requirements**

In order to implement this scenario, an HP BladeSystem c7000 enclosure with one or more server blades and TWO Virtual Connect FlexFabric 10/24-Port (or Flex-10) modules, installed in I/O Bays 1& 2 are required. In addition, we will require ONE or TWO external Network switches. As Virtual Connect does not appear to the network as a switch and is transparent to the network, any standard managed switch will work with Virtual Connect.

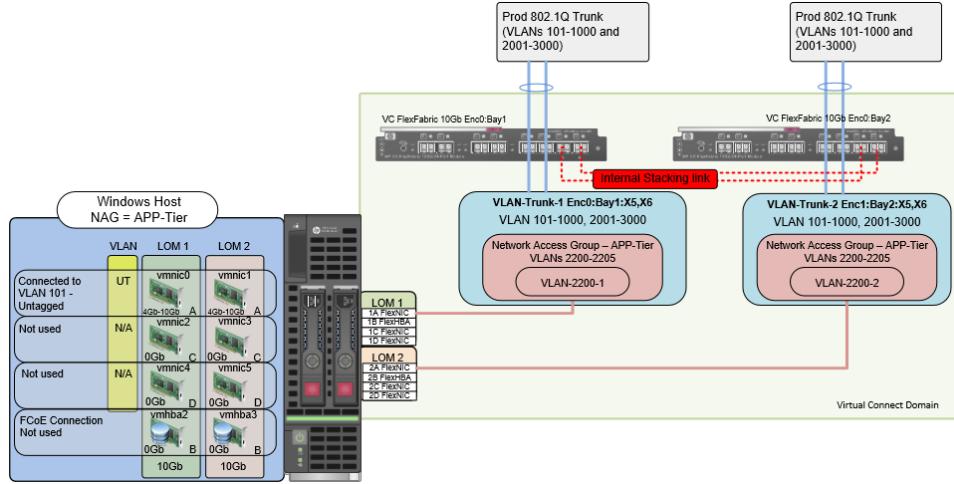
**Figure 225 - Physical View:** Shows two Ethernet uplinks from Ports X5 and X6 on Module 1 to Ports 1 and 2 on the first network switch and two Ethernet uplinks from Ports X5 and X6 on Module 2 to Ports 1 and 2 on the second network switch.



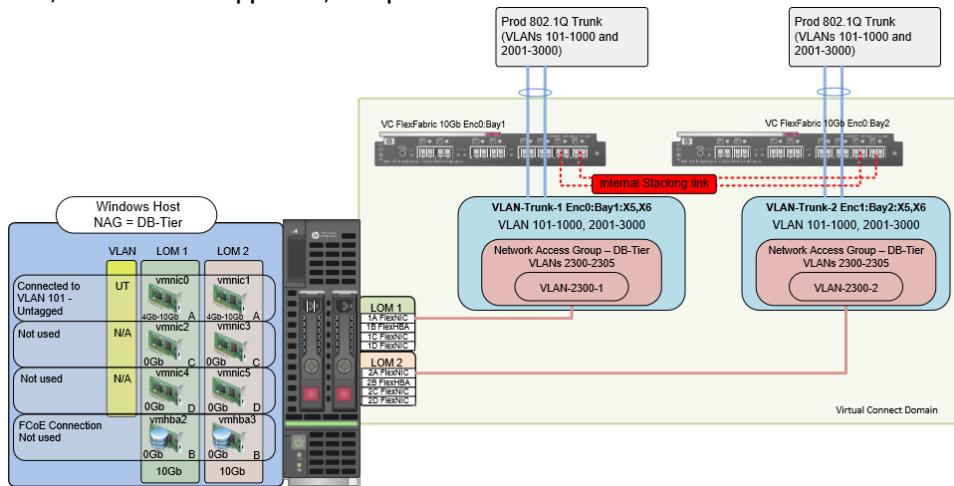
**Figure 226 - Logical View – WEB-0001:** The server blade profile WEB-0001 is configured with TWO FlexNICs and is assigned to the Network Access Group (NAG) “WEB-Tier”. All VLANs are presented to FlexFabric 10/24-Port using Shared Uplink Sets (VLAN-Trunk-1 and VLAN-Trunk-2) through Ports X5 and X6 on each FlexFabric 10/24-Port Module in Bays 1 and 2. The WEB-Tier NAG contains VLANs specified for WEB servers only. This profile will have access to only the VLANs (2100-2105) that are configured in the WEB-Tier NAG and has been configured for VLAN 2100. FCoE SAN connections were not configured for this scenario, but would be supported, if required.



**Figure 227 - Logical View – APP-0001;** The server blade profile APP-0001 is configured with TWO FlexNICs and is assigned to the Network Access Group (NAG) “APP-Tier”. All VLANs are presented to FlexFabric 10/24-Port using Shared Uplink Sets (VLAN-Trunk-1 and VLAN-Trunk-2) through Ports X5 and X6 on each FlexFabric 10/24-Port Module in Bays 1 and 2. The APP-Tier NAG contains VLANs specified for APP servers only. This profile will have access to only the VLANs (2200-2205) that are configured in the APP-Tier NAG and has been configured for VLAN 2200. FCoE SAN connections were not configured for this scenario, but would be supported, if required.



**Figure 228 - Logical View – DB-0001;** The server blade profile DB-0001 is configured with TWO FlexNICs and is assigned to the Network Access Group (NAG) “DB-Tier”. All VLANs are presented to FlexFabric 10/24-Port using Shared Uplink Sets (VLAN-Trunk-1 and VLAN-Trunk-2) through Ports X5 and X6 on each FlexFabric 10/24-Port Module in Bays 1 and 2. The DB-Tier NAG contains VLANs specified for DB servers only. This profile will have access to only the VLANs (2300-2305) that are configured in the DB-Tier NAG and has been configured for VLAN 2300. FCoE SAN connections were not configured for this scenario, but would be supported, if required.



# Installation and configuration

## Switch configuration

As the Virtual Connect module acts as an edge switch, Virtual Connect can connect to the network at either the distribution level or directly to the core switch.

The appendices provide a summary of the cli commands required to configure various switches for connection to Virtual Connect. The configuration information provided in the appendices for this scenario assumes the following information:

- The switch ports are configured as VLAN TRUNK ports (tagging) to support several VLANs. All frames will be forwarded to Virtual Connect with VLAN tags. Optionally, one VLAN could be configured as (Default) untagged, if so, then a corresponding vNet within the Shared Uplink Set would be configured and set as “Default”.

**Note:** When adding additional uplinks to the SUS, if the additional uplinks are connecting from the same FlexFabric 10/24-Port module to the same switch, in order to ensure all The uplinks are active, the switch ports will need to be configured for LACP within the same Link Aggregation Group.

The network switch port should be configured for Spanning Tree Edge as Virtual Connect appears to the switch as an access device and not another switch. By configuring the port as Spanning Tree Edge, it allows the switch to place the port into a forwarding state much quicker than otherwise, this allows a newly connected port to come online and begin forwarding much quicker.

## Configuring the VC module

- Physically connect Port 1 of network switch 1 to Port X5 of the VC module in Bay 1
- Physically connect Port 2 of network switch 1 to Port X6 of the VC module in Bay 1
- Physically connect Port 1 of network switch 2 to Port X5 of the VC module in Bay 2
- Physically connect Port 2 of network switch 2 to Port X6 of the VC module in Bay 2

**Note:** If you have only one network switch, connect VC ports X5 & X6 (Bay 2) to an alternate port on the same switch. This will NOT create a network loop and Spanning Tree is not required.

## VC CLI commands

Many of the configuration settings within VC can also be accomplished via a CLI command set. In order to connect to VC via a CLI, open an SSH connection to the IP address of the active VCM. Once logged in, VC provides a CLI with help menus. Through this scenario the CLI commands to configure VC for each setting will also be provided.

## Configuring Expanded VLAN Capacity via GUI

Virtual Connect release 3.30 provided an expanded VLAN capacity mode when using Shared Uplink Sets, this mode can be enabled through the Ethernet Settings tab or the VC CLI. The default configuration for a new Domain install is “Expanded VLAN Capacity” mode, Legacy mode is no longer available and the Domain cannot be downgraded.

Virtual Connect 4.30 now provides the ability to define up to 4096 VLANs then consume only the VLANs you need, when you need them. There is nothing to change or enable to take advantage of the 4096 VLAN feature.

## To verify the VLAN Capacity mode

- On the Virtual Connect Manager screen, Left pane, click Ethernet Settings, Advanced Settings
- Select Expanded VLAN capacity
- Verify Expanded VLAN Capacity is configured and Legacy VLAN Capacity is greyed out.

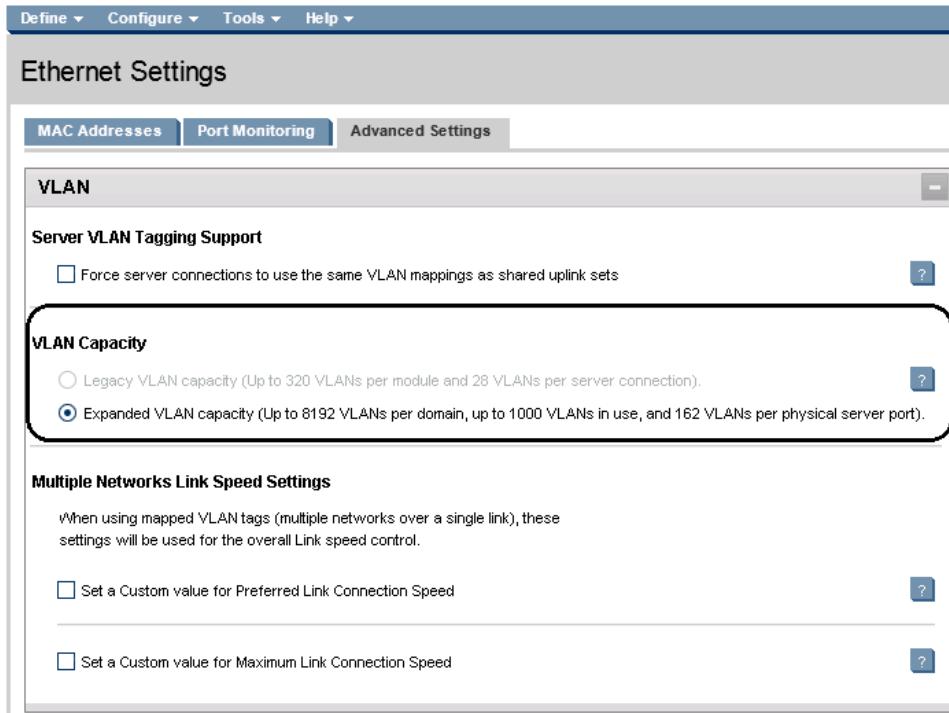
**Note:** Legacy VLAN mode will only be presented if 1Gb Virtual Connect Modules are present, in which case the domain would be limited to Firmware version 3.6x.

## Configuring Expanded VLAN Capacity via CLI

The following command can be copied and pasted into an SSH based CLI session with Virtual Connect;

```
# Set Expanded VLAN Capacity  
set enet-vlan -quiet VlanCapacity=Expanded
```

**Figure 229 - Enabling Expanded VLAN Capacity**



**Note:** If a 1Gb VC Ethernet module is present in the Domain, Expanded VLAN capacity will be greyed out, this is only supported with 10Gb and 20Gb based Virtual Connect modules. Also, once Expanded VLAN capacity is selected, moving back to Legacy VLAN capacity mode will require a domain deletion and rebuild.

## Defining a new Shared Uplink Set (VLAN-Trunk-1)

Connect Ports X5 and X6 of FlexFabric 10/24-Port module in Bay 1 to Ports 1 and 2 on switch 1

Create a SUS named VLAN-Trunk-1 and connect it to FlexFabric 10/24-Port Ports X5 and X6 on Module 1

- On the Virtual Connect Home page, select Define, Shared Uplink Set
- Insert Uplink Set Name as VLAN-Trunk-1
- Select Add Port, then add the following port;
  - Enclosure 1, Bay 1, Port X5
  - Enclosure 1, Bay 1, Port X6

**Figure 230 - Shared Uplink Set (VLAN-Trunk-1) Uplinks Assigned**

The screenshot shows the 'Define Shared Uplink Set' interface. In the 'External Uplink Ports' section, two ports are listed: C7K-TOP Bay 1: Port X5 and C7K-TOP Bay 1: Port X6, both connected to 'vanilab (Ten-GigabitEthernet1/0/6)' and 'vanilab (Ten-GigabitEthernet1/0/7)' respectively. The 'Connection Mode' is set to 'Auto'. Under 'LACP Timer', the 'Domain Default, Short (1 sec)' option is selected. An 'Add Port' button is visible. Below this, sections for 'Associated FCoE Networks (VLAN tagged)' and 'Associated Networks (VLAN tagged)' are shown, each with an 'Add' button.

- Click Add Networks and select the Multiple Networks radio button and add the following VLANs;
  - Enter Name as VLAN-
  - Enter Suffix as -1
  - Enter VLAN IDs as follows (and shown in the following graphic);
- 101-1000,2001-3000
- Enable SmartLink on ALL networks
- Click Advanced
  - Configure Preferred speed to 4Gb
  - Configure Maximum speed to 8Gb
- Click Apply

**Note:** You can optionally specify a network “color” or “Label” when creating a shared Uplinkset and its networks. In the example above we have not set either color or label.

**Figure 231 - Creating VLANs in a Shared Uplink Set**

The screenshot shows the 'Associated Networks (VLAN tagged)' configuration dialog. It asks if you want to add a single or multiple associated networks. A 'VLAN-' entry field has '-1' selected. Below it, a 'VLAN ID(s)' field contains '101-1000,2001-3000'. The 'Color' and 'Labels' fields are empty. A note says 'The Native VLAN setting supported only when adding or editing a single Associated Network'. Another note says 'The 1000 networks being created cannot all be marked Private. The domain can only support 128 more private network(s) before reaching the limit of 128.' Under 'Advanced Network Settings', connection speeds are set to 4Gb and 8Gb. At the bottom, a 'Type network access group names' field contains 'Default'.

**Note:** If the VC domain is not in Expanded VLAN capacity mode, you will receive an error when attempting to create more than 128 VLANs in a SUS. If that occurs, go to Advanced Ethernet Settings and select Expanded VLAN capacity mode and apply.

After clicking apply, a list of VLANs will be presented as shown below. If one VLAN in the trunk is untagged/native, see note below.

- Click Apply at the bottom of the page to create the Shared Uplink Set

**Figure 232 - Associated VLANs for Shared Uplink Set VLAN-Trunk-1**

	Network Name	VLAN ID	Native	Smart Link	Private Network	Action
<input type="checkbox"/>	VLAN-101	101	false	false	false	<a href="#">Edit</a>
<input type="checkbox"/>	VLAN-102	102	false	false	false	<a href="#">Edit</a>
<input type="checkbox"/>	VLAN-103	103	false	false	false	<a href="#">Edit</a>
<input type="checkbox"/>	VLAN-104	104	false	false	false	<a href="#">Edit</a>
<input type="checkbox"/>	VLAN-105	105	false	false	false	<a href="#">Edit</a>
<input type="checkbox"/>	VLAN-106	106	false	false	false	<a href="#">Edit</a>
<input type="checkbox"/>	VLAN-107	107	false	false	false	<a href="#">Edit</a>
<input type="checkbox"/>	VLAN-108	108	false	false	false	<a href="#">Edit</a>
<input type="checkbox"/>	VLAN-109	109	false	false	false	<a href="#">Edit</a>
<input type="checkbox"/>	VLAN-110	110	false	false	false	<a href="#">Edit</a>
<input type="checkbox"/>	VLAN-111	111	false	false	false	<a href="#">Edit</a>
<input type="checkbox"/>	VLAN-112	112	false	false	false	<a href="#">Edit</a>
<input type="checkbox"/>	VLAN-113	113	false	false	false	<a href="#">Edit</a>
<input type="checkbox"/>	VLAN-114	114	false	false	false	<a href="#">Edit</a>
<input type="checkbox"/>	VLAN-115	115	false	false	false	<a href="#">Edit</a>
<input type="checkbox"/>	VLAN-116	116	false	false	false	<a href="#">Edit</a>
<input type="checkbox"/>	VLAN-117	117	false	false	false	<a href="#">Edit</a>
<input type="checkbox"/>	VLAN-118	118	false	false	false	<a href="#">Edit</a>
<input type="checkbox"/>	VLAN-119	119	false	false	false	<a href="#">Edit</a>
<input type="checkbox"/>	VLAN-120	120	false	false	false	<a href="#">Edit</a>
<input type="checkbox"/>	VLAN-121	121	false	false	false	<a href="#">Edit</a>
<input type="checkbox"/>	VLAN-122	122	false	false	false	<a href="#">Edit</a>
<input type="checkbox"/>	VLAN-123	123	false	false	false	<a href="#">Edit</a>
<input type="checkbox"/>	VLAN-124	124	false	false	false	<a href="#">Edit</a>

**Note:** Optionally, if one of the VLANs in the trunk to this shared uplink set were configured as Native or Untagged, you would be required to “edit” that VLAN in the screen above, and configure Native as TRUE. This would need to be set for BOTH VLAN-Trunk-1 and VLAN-Trunk-2.

Please refer to Appendix D; “Scripting the Native VLAN” for scripting examples.

**Figure 233 - You will see that ALL Uplinks are still in a Linked/Standy state**

Shared Uplink Set	Has FCoE	Port Status	Connector Type	Uplink Port	Action
<input checked="" type="checkbox"/> VLAN-Trunk-1	false	<input checked="" type="checkbox"/> Linked-Standby <input checked="" type="checkbox"/> Linked-Standby	10 Gb SFP-DAC	<input checked="" type="checkbox"/> C7K-TOP: Bay 1: Port X5 <input checked="" type="checkbox"/> C7K-TOP: Bay 1: Port X6	<a href="#">Edit</a>

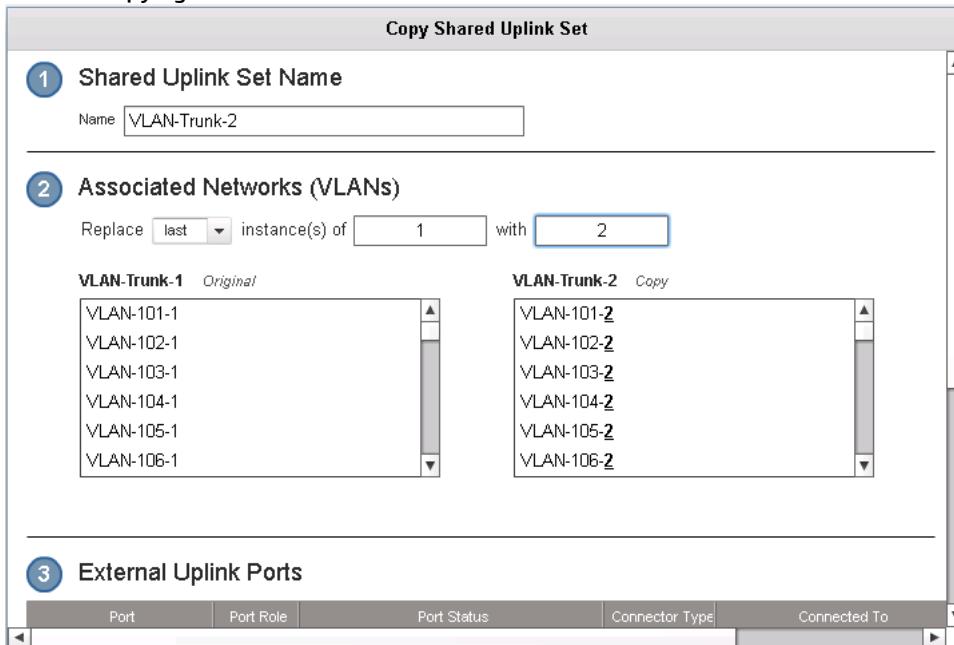
**Note:** That both of the network connections are shown as “Linked/Standy”, this state will NOT change until the network has been assigned to a server profile. This behavior is new within VC 4.30 and is provided to accommodate the new 4096 VLAN feature.

## Defining a new Shared Uplink Set (VLAN-Trunk-2) (Copying a Shared UplinkSet)

The second Shared Uplink Set could be created in the same manner as VLAN-Trunk-1 however; VC now provides the ability to COPY a VC Network or Shared Uplink Set.

- Connect Ports X5 and X6 of FlexFabric 10/24-Port module in Bay 2 to Ports 1 and 2 on switch 2
- In the VC GUI screen, select Shared Uplink Sets in the left pane, in the right pane VLAN-Trunk-1 will be displayed, left click VLAN-Trunk-1, it will appear as blue, right click and select COPY
- Edit the Settings as shown below, the new SUS name will be VLAN-Trunk-2 and ALL the associated VLANs will have a suffix of 2
- In step 3, ADD uplinks X5 and X6 from Bay 2
- Click OK
- The SUS and ALL VLANs will be created

**Figure 234 - Copying a SUS and ALL VLANs**



## Defining a new Shared Uplink Set via CLI

The following script can be used to create the first Shared Uplink Set (VLAN-Trunk-1)

The following command(s) can be copied and pasted into an SSH based CLI session with Virtual Connect

```
# Create Shared Uplink Set VLAN-Trunk-1 and configure uplinks
add uplinkset VLAN-Trunk-1
add uplinkport enc0:1:X5 Uplinkset=VLAN-Trunk-1 speed=auto
add uplinkport enc0:1:X6 Uplinkset=VLAN-Trunk-1 speed=auto

# Create Networks VLAN101-1 through VLAN1000-1 and VLAN-2001-1 through VLAN-3000-1
# for Shared Uplink Set VLAN-Trunk-1
add network-range -quiet UplinkSet=VLAN-Trunk-1 NamePrefix=VLAN- NameSuffix=-1
VLANIds=101-1000,2001-3000 State=enabled PrefSpeedType=Custom PrefSpeed=4000
MaxSpeedType=Custom MaxSpeed=8000 SmartLink=enabled
```

The following script can be used to create the Second Shared Uplink Set (VLAN-Trunk-2)

```
# Create Shared Uplink Set VLAN-Trunk-2 and configure uplinks
add uplinkset VLAN-Trunk-2
add uplinkport enc0:2:X5 Uplinkset=VLAN-Trunk-2 speed=auto
add uplinkport enc0:2:X6 Uplinkset=VLAN-Trunk-2 speed=auto

# Create Networks VLAN101-2 through VLAN1000-2 and VLAN-2001-2 through VLAN-3000-2
for Shared Uplink Set VLAN-Trunk-2
add network-range -quiet UplinkSet=VLAN-Trunk-2 NamePrefix=VLAN- NameSuffix=-2
VLANIds=101-1000,2001-3000 State=enabled PrefSpeedType=Custom PrefSpeed=4000
MaxSpeedType=Custom MaxSpeed=8000 SmartLink=enabled
```

**Note:** In this scenario we have created two independent Share Uplink Sets (SUS), each originating from the opposite FlexFabric 10/24-Port Modules, by doing so we provide the ability to create separate and redundant connections out of the Virtual Connect domain. When we create the server profiles, you will see how the NICs will connect to VLANs accessed through the opposite VC module, which provides the ability to create an Active / Active uplink scenario. Alternatively, we could have created a single SUS and assigned both sets of these uplink ports to the same SUS, however, this would have provided an Active/Standby uplink scenario, as shown in Scenario 5.

## Defining the Network Access Groups

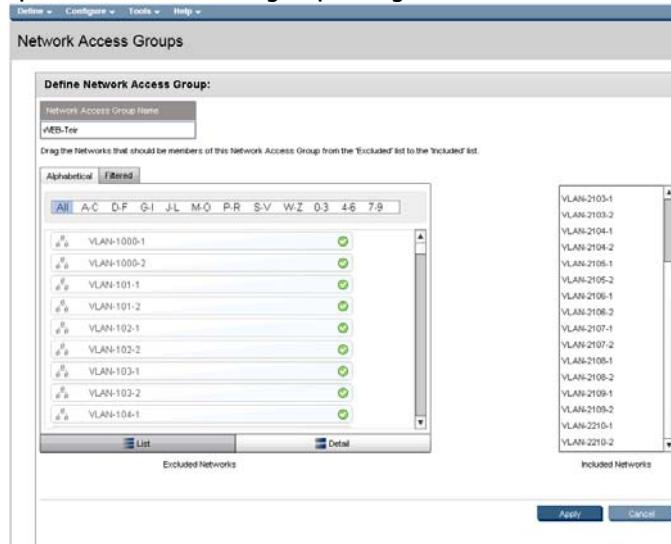
Networks can be placed into Network Access Groups when they are created, alternatively, existing networks can be manually placed in Network Access Groups using the following steps.

We will create Network Access groups to organize the various VLANs

- On the main menu, select Define, then Network Access Group
- Create a Network Access Group called “WEB-Tier”
- Include VLANs 2100-2110 (Ensure that you include both the -1 and -2 networks)
- Create a Network Access Group called “APP-Tier”
- Include VLANs 2200-2210 (Ensure that you include both the -1 and -2 networks)
- Create a second Network Access Group called “DB-Tier”
- Include VLANs 2300-2310 (Ensure that you include both the -1 and -2 networks)

**Note:** Once the above Network Access Groups have been defined, you can edit the Default Network Access Group and remove the above VLANs, this will ensure that in order to use these VLANs the server profile MUST be in the correct Network Access group. If a common network (VLAN) is used for management or monitoring, ensure that network is in ALL Network Access Groups.

**Figure 235** - Example of Network Access group configuration



## Defining the Network Access Groups (CLI)

```
# Create the Network Access Group for the WEB-Tier  
add network-access-group WEB-Tier  
add nag-network Nag=WEB-Tier Network=VLAN-2100-1,VLAN-2101-1,VLAN-2102-1,VLAN-2103-  
1,VLAN-2104-1,VLAN-2105-1,VLAN-2100-2,VLAN-2101-2,VLAN-2102-2,VLAN-2103-2,VLAN-  
2104-2,VLAN-2105-2,VLAN-2106-1,VLAN-2106-2,VLAN-2107-1,VLAN-2107-2,VLAN-2108-  
1,VLAN-2108-2,VLAN-2109-1,VLAN-2109-2,VLAN-2110-1,VLAN-2110-2  
  
# Create the Network Access Group for the APP-Tier  
add network-access-group APP-Tier  
add nag-network Nag=APP-Tier Network=VLAN-2200-1,VLAN-2201-1,VLAN-2202-1,VLAN-2203-  
1,VLAN-2204-1,VLAN-2205-1,VLAN-2200-2,VLAN-2201-2,VLAN-2202-2,VLAN-2203-2,VLAN-  
2204-2,VLAN-2205-2,VLAN-2206-1,VLAN-2206-2,VLAN-2207-1,VLAN-2207-2,VLAN-2208-  
1,VLAN-2208-2,VLAN-2209-1,VLAN-2209-2,VLAN-2210-1,VLAN-2210-2  
  
# Create the Network Access Group for the DB-Tier  
add network-access-group DB-Tier  
add nag-network Nag=DB-Tier Network=VLAN-2300-1,VLAN-2301-1,VLAN-2302-1,VLAN-2303-  
1,VLAN-2304-1,VLAN-2305-1,VLAN-2300-2,VLAN-2301-2,VLAN-2302-2,VLAN-2303-2,VLAN-  
2304-2,VLAN-2305-2,VLAN-2306-1,VLAN-2306-2,VLAN-2307-1,VLAN-2307-2,VLAN-2308-  
1,VLAN-2308-2,VLAN-2309-1,VLAN-2309-2,VLAN-2310-1,VLAN-2310-2
```

## Defining a Server Profile (WEB-Tier)

We will create a server profile with TWO server NICs.

Each server NIC will connect to a specific network.

- On the main menu, select Define, then Server Profile
- Create a server profile called “WEB-1”
- Select to “Hide Unused FlexNICs”
- In the Network Access group drop down chose WEB-Tier
- In the Network Port 1 drop down box, select a Network, then chose VLAN-2100-1

**Note:** You will notice that only the VLANs that were defined in the WEB-Tier NAG will be available for selection

- Leave Port Speed as Preferred
- In the Network Port 2 drop down box, select a Network, then chose VLAN-2100-2
- Leave Port Speed as Preferred
- Do not configure FCoE, FC SAN or iSCSI Connections
- In the Assign Profile to Server Bay box, locate the Select Location drop down and select Bay 1, then apply

Prior to applying the profile, ensure that the server in Bay 1 is currently OFF

**Note:** You should now have a server profile assigned to Bay 1, with 2 Server NIC connections. NICs 1&2 should be connected to networks VLAN-2100-x.

## Defining a Server Profile (APP-Tier)

We will create a server profile with TWO server NICs.

Each server NIC will connect to a specific network.

- On the main menu, select Define, then Server Profile
- Create a server profile called “APP-1”
- Select to “Hide Unused FlexNICs”
- In the Network Access group drop down chose APP-Tier
- In the Network Port 1 drop down box, select a Network, then chose VLAN-2200-1

**Note:** You will notice that only the VLANs that were defined in the APP-Tier NAG will be available for selection

- Leave Port Speed as Preferred
- In the Network Port 2 drop down box, select a Network, then chose VLAN-2200-2
- Leave Port Speed as Preferred
- Do not configure FCoE, FC SAN or iSCSI Connections
- In the Assign Profile to Server Bay box, locate the Select Location drop down and select Bay 1, then apply

Prior to applying the profile, ensure that the server in Bay 2 is currently OFF

**Note:** You should now have a server profile assigned to Bay 2, with 2 Server NIC connections. NICs 1&2 should be connected to networks VLAN-2200-x.

## Defining a Server Profile (DB-Tier)

We will create a server profile with TWO server NICs.

Each server NIC will connect to a specific network.

- On the main menu, select Define, then Server Profile
- Create a server profile called “DB-1”
- Select to “Hide Unused FlexNICs”
- In the Network Access group drop down chose DB-Tier
- In the Network Port 1 drop down box, select a Network, then chose VLAN-2300-1

**Note:** You will notice that only the VLANs that were defined in the WEB-Tier NAG will be available for selection

- Leave Port Speed as Preferred
- In the Network Port 2 drop down box, select a Network, then chose VLAN-2300-2
- Leave Port Speed as Preferred
- Do not configure FCoE, FC SAN or iSCSI Connections
- In the Assign Profile to Server Bay box, locate the Select Location drop down and select Bay 3, then apply

Prior to applying the profile, ensure that the server in Bay 3 is currently OFF

**Note:** You should now have a server profile assigned to Bay 3, with 2 Server NIC connections. NICs 1&2 should be connected to networks VLAN-2300-x.

**Note:** As these servers are all in difference VLANs they will not be able to communicate with each other within the enclosure and will be required to go through an external router or firewall to do so.

## Defining a Server Profile via CLI

```
# Create and Assign Server Profile WEB-1 to server bay 1
add profile WEB-1 -nodefaultfcconn -nodefaultfcoeconn Nag=WEB-Tier HideUnusedFlexNICs=true
set enet-connection WEB-1 1 pxe=Enabled Network=VLAN-2100-1
set enet-connection WEB-1 2 pxe=Disabled Network=VLAN-2100-2
set profile WEB-1 Nag=WEB-Tier
assign profile WEB-1 enc0:1
```

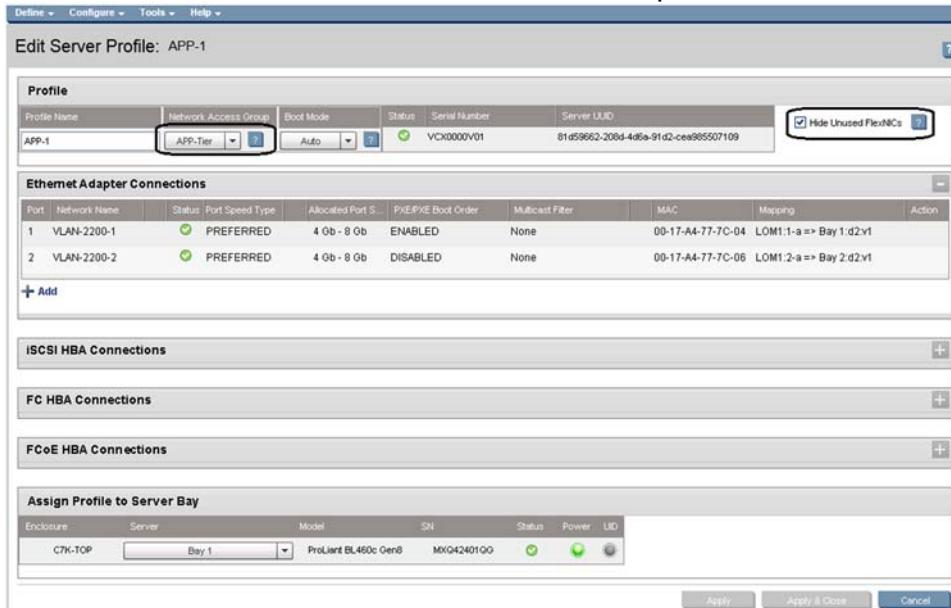
```

# Create and Assign Server Profile APP-1 to server bay 2
add profile APP-1 -nodefaultfcconn -nodefaultfcoecconn Nag=APP-Tier HideUnusedFlexNICs=true
set enet-connection APP-1 1 pxe=Enabled Network=VLAN-2200-1
set enet-connection APP-1 2 pxe=Disabled Network=VLAN-2200-2
set profile APP-1 Nag=APP-Tier
assign profile APP-1 enc0:2

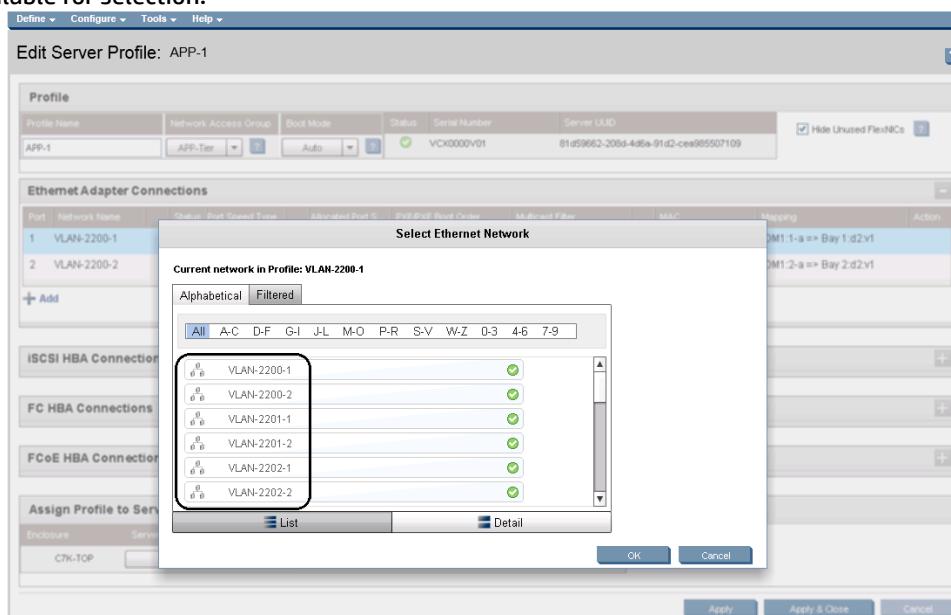
# Create and Assign Server Profile DB-1 to server bay 3
add profile DB-1 -nodefaultfcconn -nodefaultfcoecconn Nag=DB-Tier HideUnusedFlexNICs=true
set enet-connection DB-1 1 pxe=Enabled Network=VLAN-2300-1
set enet-connection DB-1 2 pxe=Disabled Network=VLAN-2300-2
set profile DB-1 Nag=DB-Tier
assign profile DB-1 enc0:3

```

**Figure 236 - Define a Server Profile (APP-0001) Windows (Example APP-Tier)**



**Figure 237 - Configure NICs 1 and 2 for VLAN 2200, only VLANs in the Network Access Group APP-Tier are available for selection.**



**Figure 238 - Server Profile APP-0001 View Bay 1**

The screenshot shows the 'Server Profile APP-0001 View Bay 1' interface. At the top, there are tabs for Define, Configure, Tools, and Help. Below the tabs, the title 'Bay 1 (ProLiant BL460c Gen8)' is displayed.

**Device Bay Status - Bay # 1**

Overall Status:	Green checkmark
Hardware Status:	Green checkmark
VC Status:	Green checkmark
Assigned Server Profile:	App-1
Enclosure Name:	C7K-TOP
UID:	Off
Power Status/Control:	Green checkmark On

**Blade Server Information - Bay # 1**

Serial Number:	MXQ42401QG
Serial Number (Logical):	VCK0000V00
UUID:	30343237-3638-584D-5134-323430315147
UUID (Logical):	c3a07222-00f7-42e8-bc20-651358f42667
Product Name:	ProLiant BL460c Gen8
Server Name:	APP-1
Part Number:	724086-B21
Asset Tag:	[Unknown]
UEFI Capable:	false
Boot Mode:	Legacy

**Server Ethernet Adapter Information**

Ethernet Adapter	Flex NC	Location	Module Port	Model	MAC Address	Network
<b>Port 1</b>						
LOM1:1-a	FLB1	Bay 1:d2:v1	HP FlexFabric 10Gb 2-Port 534FLB Adapter	00-17-A4-77-7C-04	VLAN-2200-1	
LOM1:1-b	FLB1	Bay 1:d2:v2	HP FlexFabric 10Gb 2-Port 534FLB Adapter	9C-B6-54-87-5F-91		
LOM1:1-c	FLB1	Bay 1:d2:v3	HP FlexFabric 10Gb 2-Port 534FLB Adapter	9C-B6-54-87-5F-92		
LOM1:1-d	FLB1	Bay 1:d2:v4	HP FlexFabric 10Gb 2-Port 534FLB Adapter	9C-B6-54-87-5F-93		
<b>Port 2</b>						
LOM1:2-a	FLB1	Bay 2:d2:v1	HP FlexFabric 10Gb 2-Port 534FLB Adapter	00-17-A4-77-7C-06	VLAN-2200-2	
LOM1:2-b	FLB1	Bay 2:d2:v2	HP FlexFabric 10Gb 2-Port 534FLB Adapter	9C-B6-54-87-5F-95		
LOM1:2-c	FLB1	Bay 2:d2:v3	HP FlexFabric 10Gb 2-Port 534FLB Adapter	9C-B6-54-87-5F-96		
LOM1:2-d	FLB1	Bay 2:d2:v4	HP FlexFabric 10Gb 2-Port 534FLB Adapter	9C-B6-54-87-5F-97		

## Verify Network Link State

As discussed earlier in this document, in Virtual connect 4.30 there was a change to the link state behavior when a network as no connections to a server profile. Once a connection is made to the server profile, the uplinks will become Active, as previously expected.

**Figure 239 - All Links now appear in a Linked/Active state.**

The screenshot shows the 'Shared Uplink Sets' interface. At the top, there are tabs for Define, Configure, Tools, and Help. Below the tabs, the title 'Shared Uplink Sets' is displayed.

**Shared Uplink Sets**

External Connections	Associated Networks				
<b>Shared Uplink Sets</b>					
Shared Uplink Set	Has FCoE	Port Status	Connector Type	Uplink Port	Action
<input checked="" type="checkbox"/> VLAN-Trunk-1	false	<input checked="" type="checkbox"/> Linked-Active <input checked="" type="checkbox"/> Linked-Active	10 Gb SFP-DAC	<input checked="" type="checkbox"/> C7K-TOP: Bay 1: Port X5	<input type="button" value="Edit"/>
<input checked="" type="checkbox"/> VLAN-Trunk-2	false	<input checked="" type="checkbox"/> Linked-Active <input checked="" type="checkbox"/> Linked-Active	10 Gb SFP-DAC	<input checked="" type="checkbox"/> C7K-TOP: Bay 1: Port X6	<input type="button" value="Edit"/>
			10 Gb SFP-DAC	<input checked="" type="checkbox"/> C7K-TOP: Bay 2: Port X5	<input type="button" value="Edit"/>
			10 Gb SFP-DAC	<input checked="" type="checkbox"/> C7K-TOP: Bay 2: Port X6	<input type="button" value="Edit"/>

# Review

In this scenario we have created Two Shared Uplink Sets (SUS), providing support for many VLANs. Uplinks originating from each FlexFabric 10/24-Port Module connect to each SUS, by doing so we provide redundant connections out of the Virtual Connect domain. As multiple uplinks are used for each SUS, we have also leveraged LACP to improve uplink performance. In this scenario, all uplinks will be active.

We defined Network Access Groups for Web, APP and DB Tiers and assigned networks to those groups. We created three server profiles, each with two NICs configured at 8Gb each. Each profile resides in a specific Network Access Group. Based on Network Access Group membership, the servers are provided access to only their respective VLANs.

Virtual Connect networks can reside in one or many Network Access Groups. This provides the ability to have a Management, VMotion or Backup networks assigned to ALL servers, but then segment Finance, DMZ, Application or WEB VLANs into specific network groups.

There are no SAN connections in this scenario.

## Results – Windows 2012 R2 Networking Examples

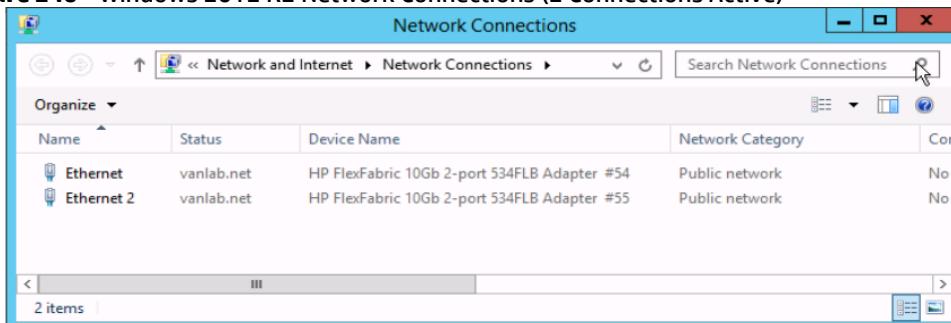
We have successfully configured FlexFabric with a shared uplink set and redundant SAN fabrics. We have created a server profile to connect the TWO NICs to VLAN 101 and the SAN fabrics using the FCoE connections created within the profile.

Although both Ethernet and Fibre channel connectivity is provided by the FlexFabric Adapter used in the G7 through Gen 9 servers; each capability (LAN and SAN) is provided by a different component of the adapter, they appear in the server as individual network and SAN adapters.

The following graphics show a Windows 2012 R2 server with TWO FlexNICs configured at 8Gb. You will also notice that Windows believes there are only 2 NICs within this server as we have configured the profile to hide the unused FlexNICs, the extra NICs are offline and could later be added to the profile, if needed. If we did not require SAN connectivity on this server, the FCoE connections could be deleted and the server would then have 8 NIC ports available to the OS.

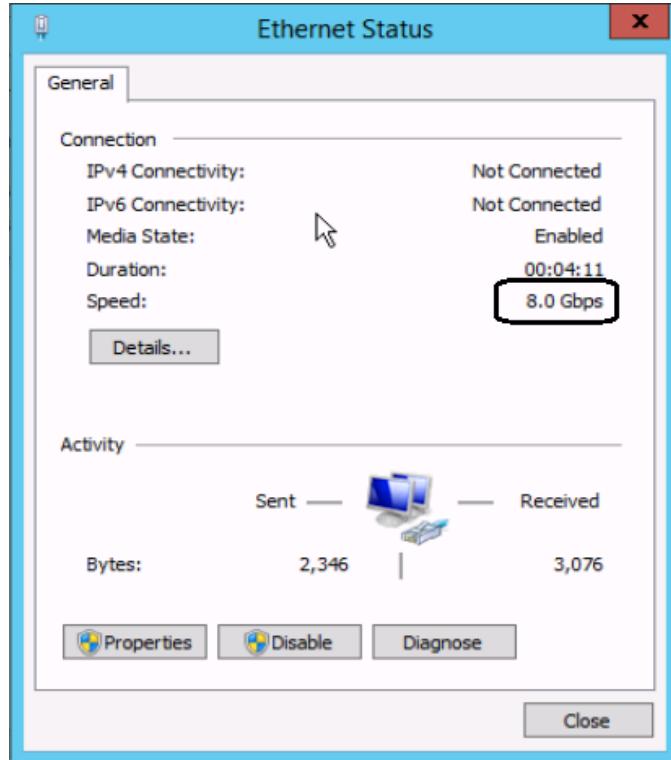
**Note:** The BL465c G7 and BL685c G7 utilize an NC551i chipset (BE2), whereas the BL460c G7, BL620c G7 and BL680c G7 utilize an NC553i chipset (BE3) and the Gen 8 blades typically have a NC554 adapter which also utilizes the BE3 chipset. Both the BE2 and BE3 chipsets share common drivers and firmware. Gen 8 Blade servers are provided with a “FlexLOM” which is a removal integrated Network adapter. This provides flexibility in NIC choice. The 554FLB is a B3 based chipset NIC, the 534FLB is a Broadcom based NIC. The example below is a 534FLB in a BL460c Gen 8 Blade server.

**Figure 240 - Windows 2012 R2 Network Connections (2 Connections Active)**



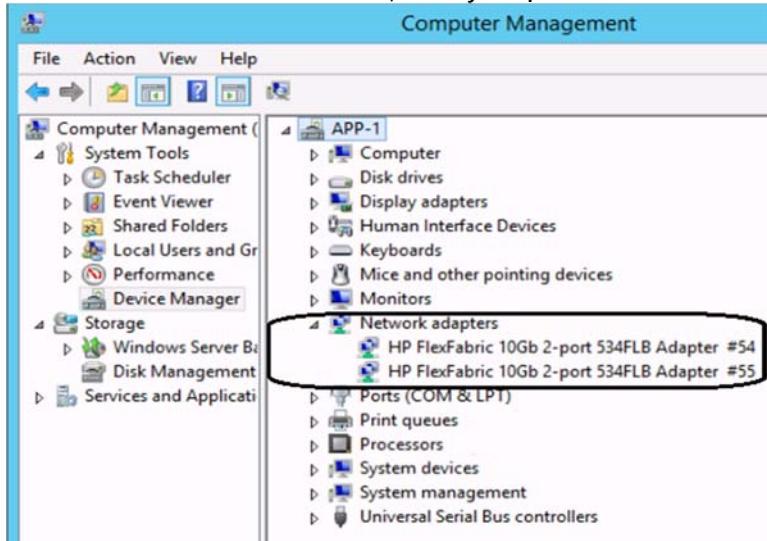
**Note:** If you are familiar with Virtual Connect Flex-10 technology, you will notice not all NICs were presented, and only the configured NICs are displayed. This is because we selected the new feature to hide unused FlexNICs.

**Figure 241 - Windows 2012 R2 Network Connection Status**



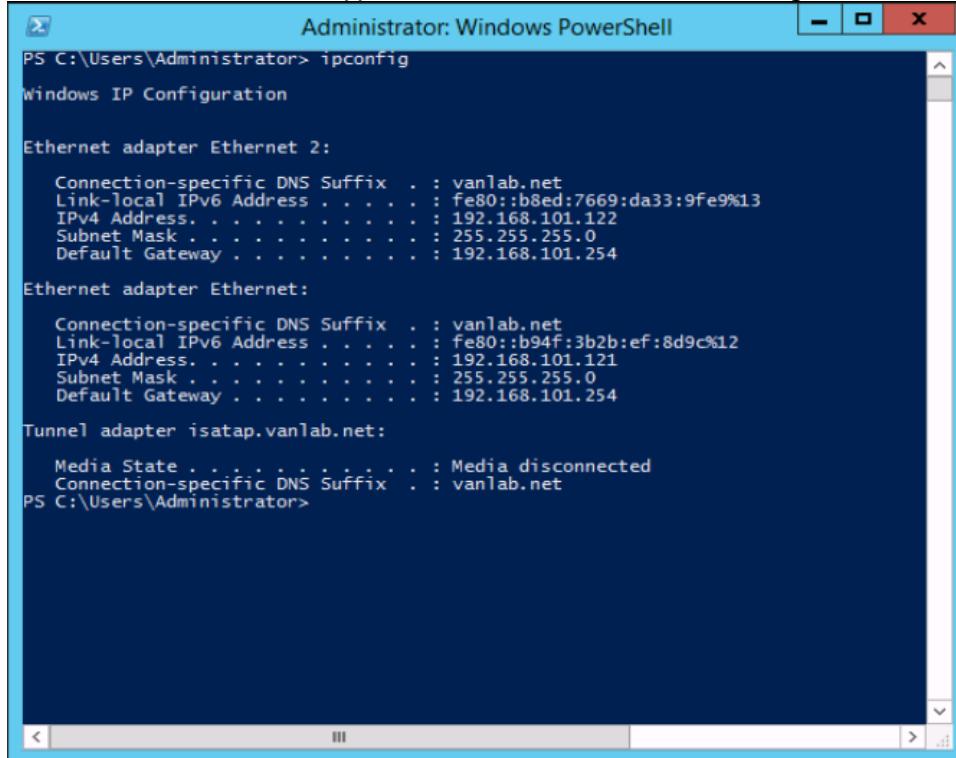
**Note:** As of Windows 2008 and later the actual NIC speed is displayed as configured in server Profile. Also, note that the speed displayed is the maximum speed setting, not the minimum setting.

**Figure 242 - Windows 2012 R2, Device Manager**, we have only configured two of the NICs and two FCoE HBAs. We also selected to hide unused FlexNICs, so only the provisioned FlexNICs are shown



The following graphics provides an example of a Windows 2012 R2 server with TWO NICs connected to the network, initially each NIC has its own TCP/IP address, alternatively, both NICs could be teamed to provide NIC fail-over redundancy. If an active uplink or network switch were to fail, Virtual Connect would fail-over to the standby uplink. In the event of a Virtual Connect FlexFabric module failure, the server's NIC teaming software would see one of the NICs go offline, assuming it was the active NIC, NIC teaming would fail-over to the standby NIC.

**Figure 243 - Both NICs for Profile App-1 are connected to the network through VLAN-101-x**



```
Administrator: Windows PowerShell
PS C:\Users\Administrator> ipconfig

Windows IP Configuration

Ethernet adapter Ethernet 2:

Connection-specific DNS Suffix . : vanlab.net
Link-Local IPv6 Address . . . . . : fe80::b8ed:7669:da33:9fe9%13
IPv4 Address . . . . . : 192.168.101.122
Subnet Mask . . . . . : 255.255.255.0
Default Gateway . . . . . : 192.168.101.254

Ethernet adapter Ethernet:

Connection-specific DNS Suffix . : vanlab.net
Link-Local IPv6 Address . . . . . : fe80::b94f:3b2b:ef:8d9c%12
IPv4 Address . . . . . : 192.168.101.121
Subnet Mask . . . . . : 255.255.255.0
Default Gateway . . . . . : 192.168.101.254

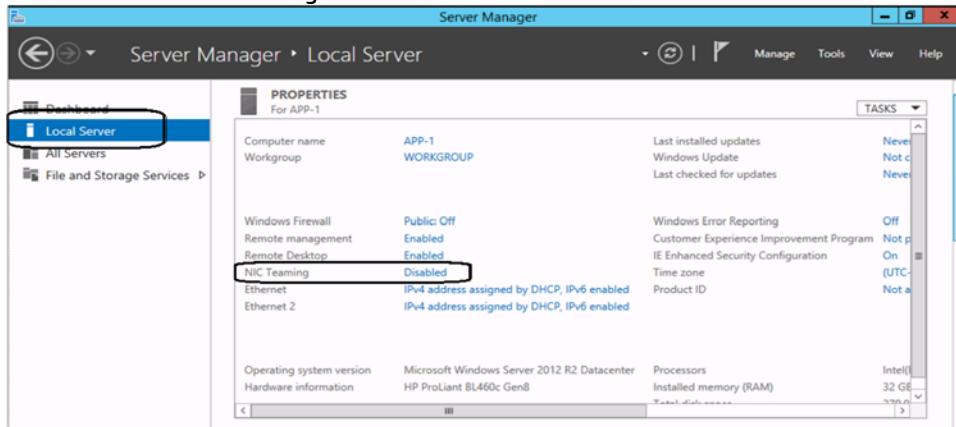
Tunnel adapter isatap.vanlab.net:

Media State . . . . . : Media disconnected
Connection-specific DNS Suffix . : vanlab.net
PS C:\Users\Administrator>
```

## NIC Teaming

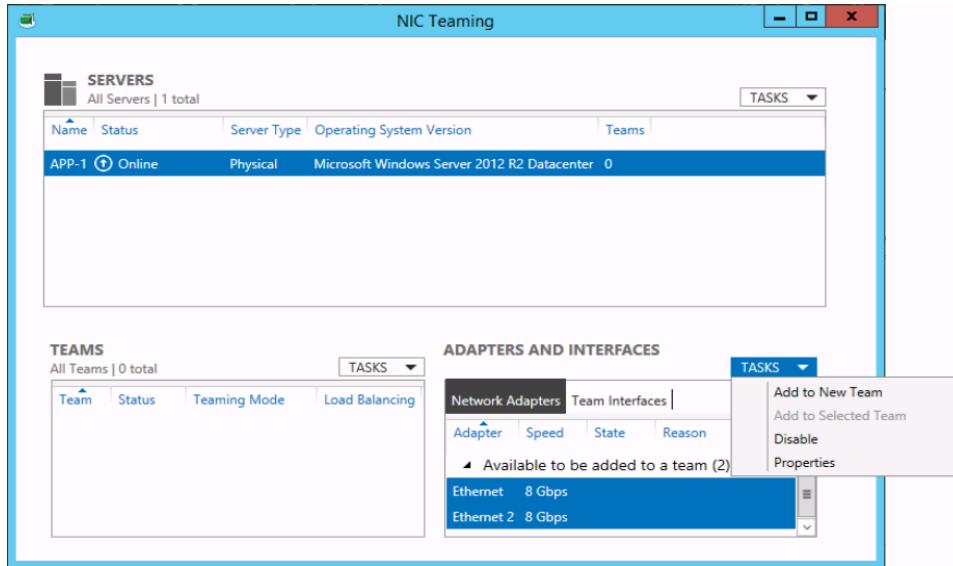
If higher availability is desired, NIC teaming in Virtual Connect works the same way as in standard network configurations. NIC Teaming is now provided as part of the Windows 2012 R2 OS. To configure NIC Teaming in windows 2012 R2, open Server Manager, select Local Server and click on “Disabled” to the right of NIC Teaming.

**Figure 244 - Enable NIC Teaming**



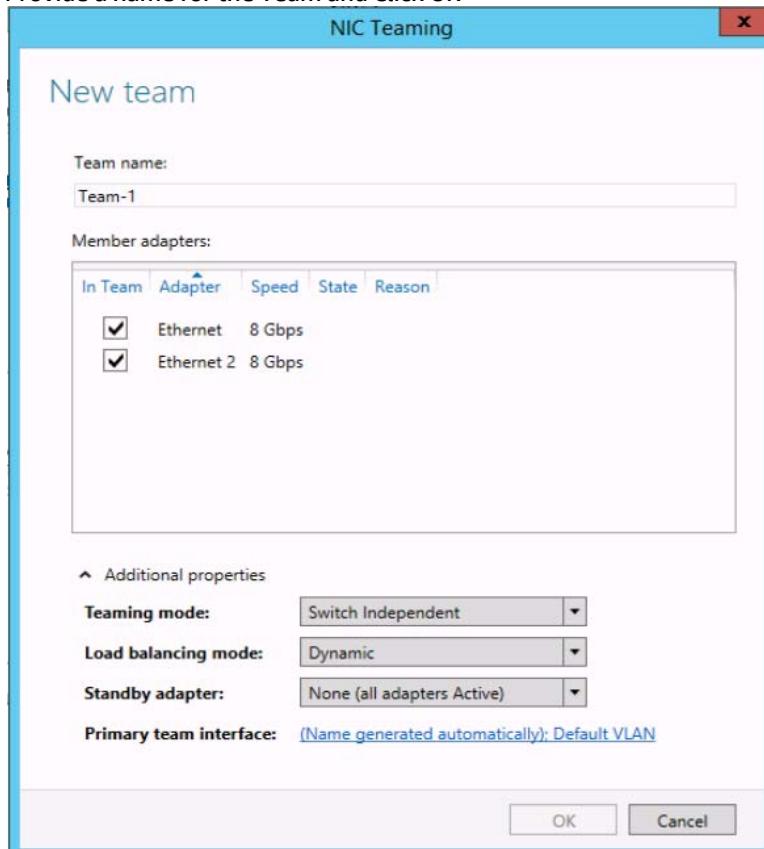
In the bottom right pane of the NIC teaming utility, highlight the two NICs you want to team and Click Tasks, then select “Add to team”.

**Figure 245 - Create the NIC Team**



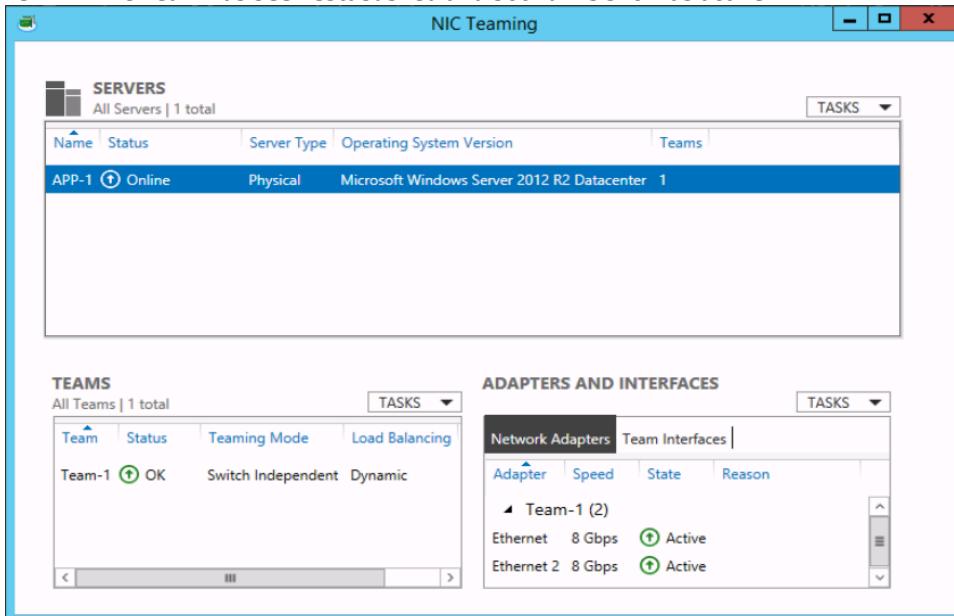
In the bottom right pane of the NIC teaming utility, highlight the two NICs you want to team and Click Tasks, then select “Add to team”. In the New Team configuration Box, provide a name for the Team and Click OK.

**Figure 246 - Provide a name for the Team and Click OK**



**Note:** you can select the Additional properties drop down and alter the Teaming Mode, the default mode of “Switch Independent” is supported with Virtual Connect, however, Static Teaming and LACP modes are not supported. You can also select Load Balancing and adapter standby modes.

**Figure 247 - NIC Team has been established and both links show as active**



**Figure 248 - Both NICs are teamed and connect to the network with a common IP Address**

```

Administrator: Windows PowerShell
PS C:\Users\Administrator> ipconfig

Windows IP Configuration

Ethernet adapter Team-1:
  Connection-specific DNS Suffix . : vanlab.net
  IPv4 Address . . . . . : 192.168.101.122
  Subnet Mask . . . . . : 255.255.255.0
  Default Gateway . . . . . : 192.168.101.254

Tunnel adapter isatap.vanlab.net:
  Media State . . . . . : Media disconnected
  Connection-specific DNS Suffix . : vanlab.net
PS C:\Users\Administrator>

```

**Note:** IPv6 was disabled within Windows

# Summary

We presented a Virtual Connect Network scenario by creating two shared uplink sets (SUS), each SUS is connected with TWO active uplinks, both SUS' can actively pass traffic.

When VC profile APP-0001 is applied to the server in bay1 and the server is powered up, it has one NIC connected through FlexFabric 10/24-Port module 1 (connected to VLAN-2100-1), the second NIC is connected through FlexFabric 10/24-Port module 2 (connected to VLAN-2100-2). VLAN access is controlled by Profile membership of a specific Network Access group, profile WEB-0001 is a member of the WEB-Tier Network Access Group and can be connected to any VLAN in that group, but only VLANs in that group.

These NICs could now be configured as individual NICs with their own IP address or as a pair of TEAMED NICs. Either NIC could be active. As a result, this server could access the network through either NIC or either uplink, depending on which NIC is active at the time. Each NIC is configured for 8Gb of network bandwidth.

Additional NICs could be added within FlexFabric, by simply powering the server off and adding up to a total of 8 NICs, (or SIX NICs and TWO FCoE connections) speed can then be adjusted accordingly to suit the needs of each NIC. However, any additional NICs would still need to adhere to the Network Access Group policy.

Network Access Groups for the Web and DB tiers were also created and have profiles configured and assigned to Bays 2 and 3.

As additional servers are added to the enclosure, simply create additional profiles, or copy existing profiles, configure the NICs for LAN and SAN fabrics as required and apply them to the appropriate server bays and power the server on.

# **Scenario 9 – Shared Uplink Set with Active/Active Uplinks, 802.3ad (LACP) – Flex-10 and VC-Fibre Channel SAN – vSphere 5.5**

## **Overview**

This scenario will implement the Shared Uplink Set (SUS) to provide support for multiple VLANs. The upstream network switches connect a shared uplink set to two ports on each Flex-10/10D modules, LACP will be used to aggregate those links.

As multiple VLANs will be supported in this configuration, the upstream switch ports connecting to the Flex-10/10D modules will be configured to properly present those VLANs. In this scenario, the upstream switch ports will be configured for VLAN trunking/VLAN tagging.

When configuring Virtual Connect, we can provide several ways to implement network fail-over or redundancy. One option would be to connect TWO uplinks to a single Virtual Connect network; those two uplinks would connect from different Virtual Connect modules within the enclosure and could then connect to the same upstream switch or two different upstream switches, depending on your redundancy needs. An alternative would be to configure TWO separate Virtual Connect networks, each with a single, or multiple, uplinks configured. Each option has its advantages and disadvantages. For example; an Active/Standby configuration places the redundancy at the VC level, where Active/Active places it at the OS NIC teaming or bonding level. We will review the second option in this scenario.

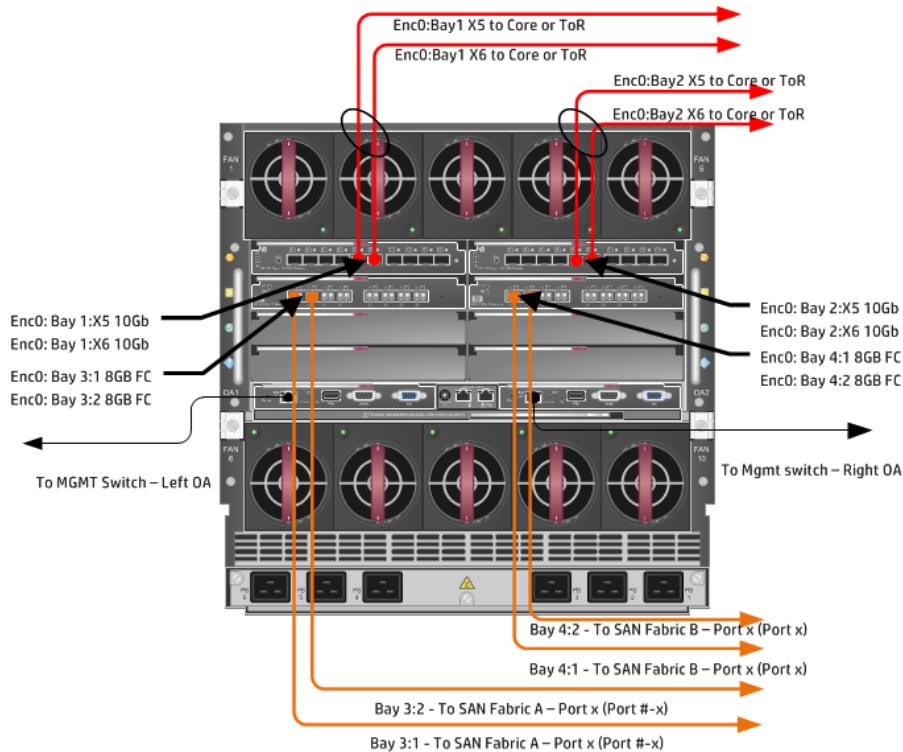
In addition, several Virtual Connect Networks can be configured to support the required networks to the servers within the BladeSystem enclosure. These networks could be used to separate the various network traffic types, such as iSCSI, backup and VMotion from production network traffic.

This scenario will also leverage separate Fibre Channel HBAs and connect to the SAN fabrics through Virtual Connect Fibre Channel modules. Each fibre channel fabric will have two uplinks connected to each of the Virtual Connect Fibre Channel modules.

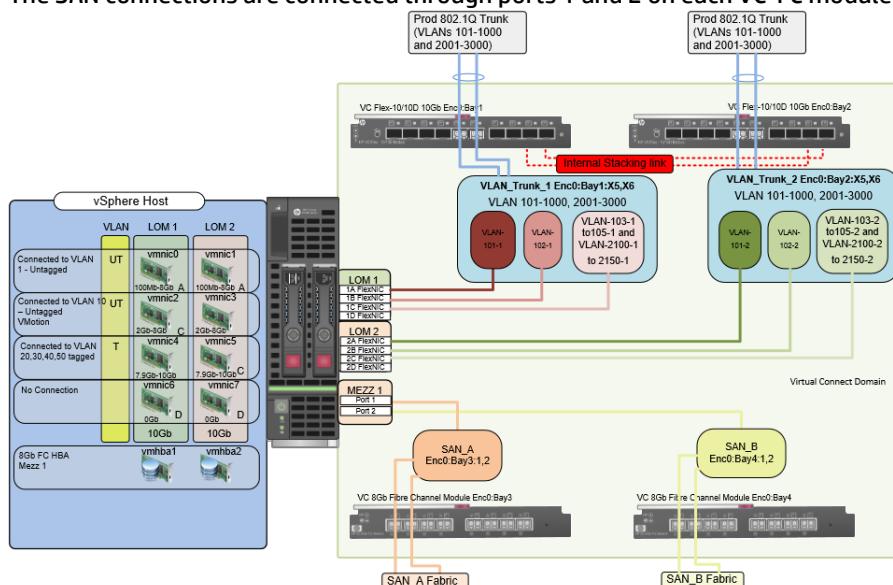
## **Requirements**

This scenario will support both Ethernet and fibre channel connectivity. In order to implement this scenario, an HP BladeSystem c7000 enclosure with one or more server blades and TWO Virtual Connect Flex-10 or Flex-10/10D modules, installed in I/O Bays 1 & 2 and two Virtual Connect Fibre Channel (VC-FC) Modules in Bays 3 and 4. In addition, we will require ONE or TWO external Network and SAN switches. As Virtual Connect does not appear to the network as a switch and is transparent to the network, any standard managed switch will work with Virtual Connect. The Fibre Channel uplinks will connect to the existing FC SAN fabrics. The SAN switch ports will need to be configured to support NPIV logins. Two uplinks from each VC-FC module will be connected to the existing SAN fabrics.

**Figure 249 - Physical View;** Shows two Ethernet uplinks from Ports X5 and X6 on Module 1 to Ports 1 and 2 on the first network switch and two Ethernet uplinks from Ports X5 and X6 on Module 2 to Ports 1 and 2 on the second network switch. The SAN fabrics are also connected redundantly, with TWO uplinks per fabric, from ports 1 and 2 of the VC-FC Modules in Bays 3 and 4.



**Figure 250 - Logical View;** The server blade profile is configured with SIX FlexNICs and 2 HBAs. NICs 1 and 2 are connected to VLAN-101-x, NICs 3 and 4 are connected to VLAN-102-x and NICs 5 and 6 are connected to VLANs 103-x through VLAN-105-x and VLAN-2100x through VLAN-2150-x, which are part of the Shared Uplink Sets, VLAN-Trunk-1 and VLAN-Trunk-2 respectively. The VLAN-Trunks are connected, at 10Gb, to a network switch, through Ports X5 and X6 on each Flex-10/10D Module in Bays 1 and 2. The SAN connections are connected through ports 1 and 2 on each VC-FC module in Bays 3 and 4.



# Installation and configuration

## Switch configuration

As the Virtual Connect module acts as an edge switch, Virtual Connect can connect to the network at either the distribution level or directly to the core switch.

The appendices provide a summary of the cli commands required to configure various switches for connection to Virtual Connect. The configuration information provided in the appendices for this scenario assumes the following information:

- The switch ports are configured as VLAN TRUNK ports (tagging) to support several VLANs. All frames will be forwarded to Virtual Connect with VLAN tags. Optionally, one VLAN could be configured as (Default) untagged, if so, then a corresponding vNet within the Shared Uplink Set would be configured and set as “Default”.

**Note:** When adding additional uplinks to the SUS, if the additional uplinks are connecting from the same Flex-10 module to the same switch, in order to ensure all uplinks are active, the switch ports will need to be configured for LACP within the same Link Aggregation Group.

The network switch port should be configured for Spanning Tree Edge as Virtual Connect appears to the switch as an access device and not another switch. By configuring the port as Spanning Tree Edge, it allows the switch to place the port into a forwarding state much quicker than otherwise, this allows a newly connected port to come online and begin forwarding much quicker.

The SAN connection will be made with redundant connections to each Fabric. SAN switch ports connecting to the VC-FC module must be configured to accept NPIV logins.

## Configuring the VC module

- Physically connect Port 1 of network switch 1 to Port X5 of the VC module in Bay 1
- Physically connect Port 2 of network switch 1 to Port X6 of the VC module in Bay 1
- Physically connect Port 1 of network switch 2 to Port X5 of the VC module in Bay 2
- Physically connect Port 2 of network switch 2 to Port X6 of the VC module in Bay 2

**Note:** If you have only one network switch, connect VC ports X5 & X6 (Bay 2) to an alternate port on the same switch. This will NOT create a network loop and Spanning Tree is not required.

- Physically connect Ports 1&2 on the VC-FC in module Bay 3 to switch ports in SAN Fabric A
- Physically connect Ports 1&2 on the VC-FC in module Bay 4 to switch ports in SAN Fabric B

## VC CLI commands

Many of the configuration settings within VC can also be accomplished via a CLI command set. In order to connect to VC via a CLI, open an SSH connection to the IP address of the active VCM. Once logged in, VC provides a CLI with help menus. Through this scenario the CLI commands to configure VC for each setting will also be provided.

## Configuring Expanded VLAN Capacity via GUI

Virtual Connect release 3.30 provided an expanded VLAN capacity mode when using Shared Uplink Sets, this mode can be enabled through the Ethernet Settings tab or the VC CLI. The default configuration for a new Domain install is “Expanded VLAN Capacity” mode, Legacy mode is no longer available and the Domain cannot be downgraded.

Virtual Connect 4.30 now provides the ability to define up to 4096 VLANs then consume only the VLANs you need, when you need them. There is nothing to change or enable to take advantage of the 4096 VLAN feature.

## To verify the VLAN Capacity mode

- On the Virtual Connect Manager screen, Left pane, click Ethernet Settings, Advanced Settings
- Select Expanded VLAN capacity
- Verify Expanded VLAN Capacity is configured and Legacy VLAN Capacity is greyed out.

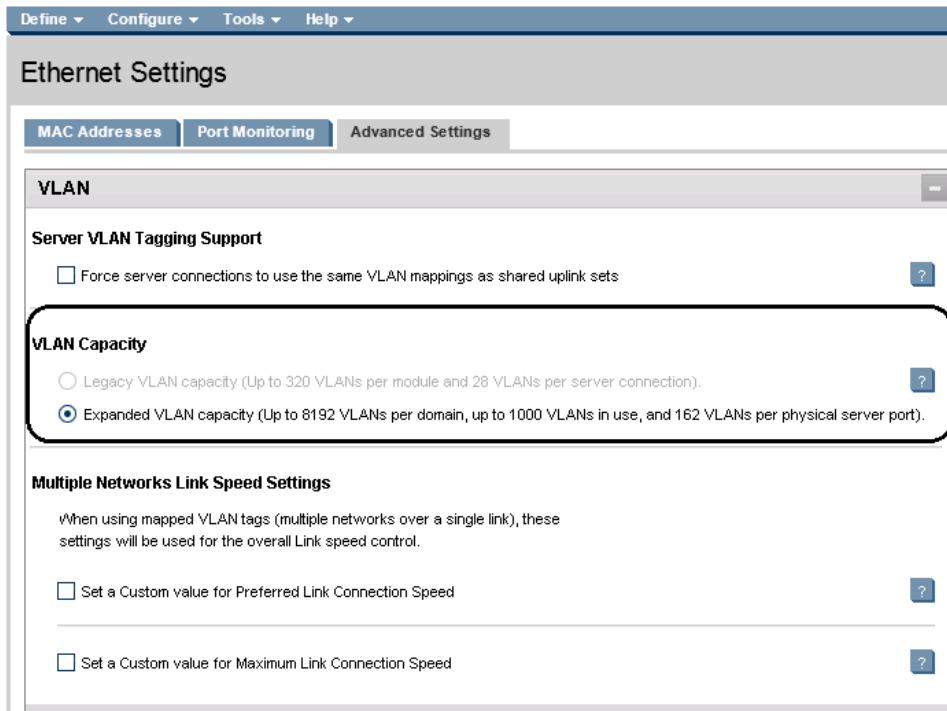
**Note:** Legacy VLAN mode will only be presented if 1Gb Virtual Connect Modules are present, in which case the domain would be limited to Firmware version 3.6x.

## Configuring Expanded VLAN Capacity via CLI

The following command can be copied and pasted into an SSH based CLI session with Virtual Connect;

```
# Set Expanded VLAN Capacity  
set enet-vlan -quiet VlanCapacity=Expanded
```

**Figure 251 - Enabling Expanded VLAN Capacity**



**Note:** If a 1Gb VC Ethernet module is present in the Domain, Expanded VLAN capacity will be greyed out, this is only supported with 10Gb and 20Gb based Virtual Connect modules. Also, once Expanded VLAN capacity is selected, moving back to Legacy VLAN capacity mode will require a domain deletion and rebuild.

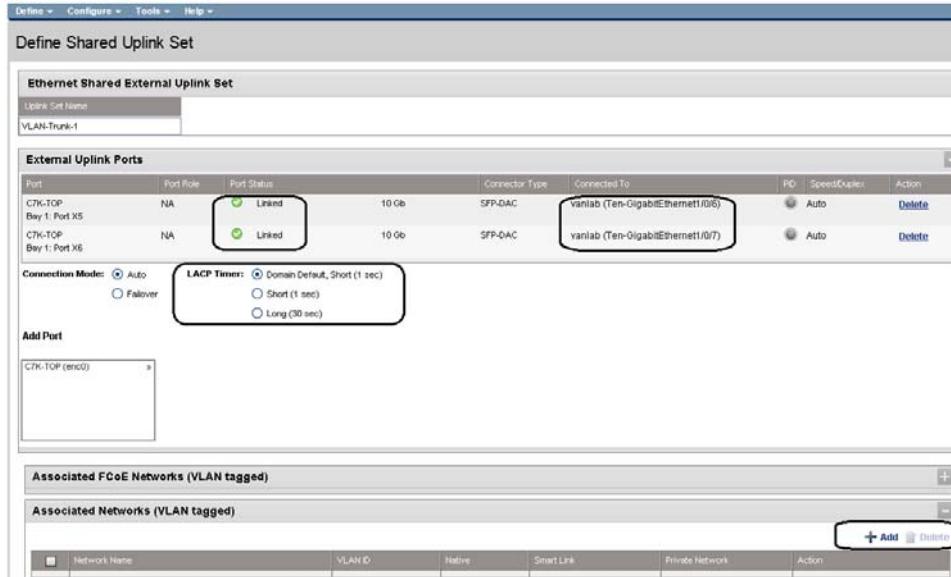
## Defining a new Shared Uplink Set (VLAN-Trunk-1)

Connect Ports X5 and X6 of the Flex-10/10D module in Bay 1 to Ports 1 and 2 on switch 1

Create a SUS named VLAN-Trunk-1 and connect it to the Flex-10/10D Ports X5 and X6 on Module 1

- On the Virtual Connect Home page, select Define, Shared Uplink Set
- Insert Uplink Set Name as VLAN-Trunk-1
- Select Add Port, then add the following port;
  - Enclosure 1, Bay 1, Port X5
  - Enclosure 1, Bay 1, Port X6

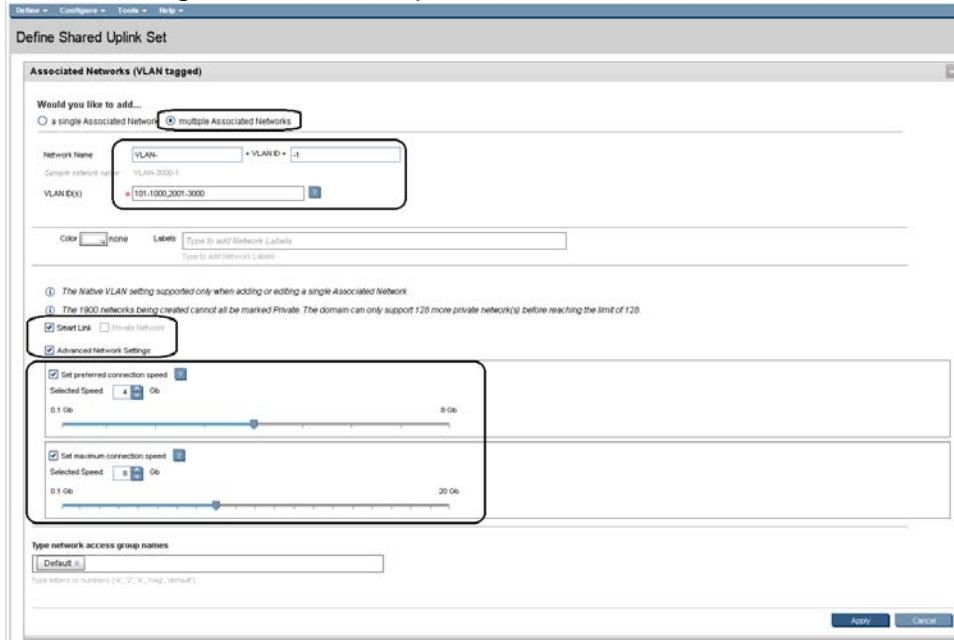
**Figure 252 - Shared Uplink Set (VLAN-Trunk-1) Uplinks Assigned**



- Click Add Networks and select the Multiple Networks radio button and add the following VLANs;
  - Enter Name as VLAN-
  - Enter Suffix as -1
  - Enter VLAN IDs as follows (and shown in the following graphic);
- 101-1000,2001-3000
- Enable SmartLink on ALL networks
- Click Advanced
  - Configure Preferred speed to 4Gb
  - Configure Maximum speed to 8Gb
- Click Apply

**Note:** You can optionally specify a network “color” or “Label” when creating a shared Uplinkset and its networks. In the example above we have not set either color or label.

**Figure 253 - Creating VLANs in a Shared Uplink Set**



**Note:** When configuring Preferred and Maximum networks speeds, these speeds will only be reflected when the network is configured individually on a specific NIC. In order to set a Maximum network speed for a NIC configured with Multiple Networks, configure the “Multiple Networks Link Speed Settings” under Ethernet, Advanced Settings in the left tree view pane of the VC console.

After clicking apply, a list of VLANs will be presented as shown below. If one VLAN in the trunk is untagged/native, see note below.

- Click Apply at the bottom of the page to create the Shared Uplink Set

**Figure 254 - Associated VLANs for Shared Uplink Set VLAN-Trunk-1**

Network Name	VLAN ID	Native	Smart Link	Private Network	Action
VLAN-101-1	101	false	true	false	Edit
VLAN-102-1	102	false	true	false	Edit
VLAN-103-1	103	false	true	false	Edit
VLAN-104-1	104	false	true	false	Edit
VLAN-105-1	105	false	true	false	Edit
VLAN-106-1	106	false	true	false	Edit
VLAN-107-1	107	false	true	false	Edit
VLAN-108-1	108	false	true	false	Edit
VLAN-109-1	109	false	true	false	Edit
VLAN-110-1	110	false	true	false	Edit
VLAN-111-1	111	false	true	false	Edit
VLAN-112-1	112	false	true	false	Edit
VLAN-113-1	113	false	true	false	Edit
VLAN-114-1	114	false	true	false	Edit
VLAN-115-1	115	false	true	false	Edit
VLAN-116-1	116	false	true	false	Edit
VLAN-117-1	117	false	true	false	Edit
VLAN-118-1	118	false	true	false	Edit
VLAN-119-1	119	false	true	false	Edit
VLAN-120-1	120	false	true	false	Edit
VLAN-121-1	121	false	true	false	Edit
VLAN-122-1	122	false	true	false	Edit
VLAN-123-1	123	false	true	false	Edit
VLAN-124-1	124	false	true	false	Edit

**Note:** Optionally, if one of the VLANs in the trunk to this shared uplink set were configured as Native or Untagged, you would be required to “edit” that VLAN in the screen above, and configure Native as TRUE. This would need to be set for BOTH VLAN-Trunk-1 and VLAN-Trunk-2.

Please refer to Appendix D; “Scripting the Native VLAN” for scripting examples.

**Figure 255 - You will see that ALL Adapters are still in a Linked/Standby state**

Shared Uplink Set	Has FCoE	Port Status	Connector Type	Uplink Port	Action
VLAN-Trunk-1	false	Linked-Standby	10 Gb SFP-DAC	C7K-TOP: Bay 1: Port X5	Edit
VLAN-Trunk-1		Linked-Standby	10 Gb SFP-DAC	C7K-TOP: Bay 1: Port X6	

**Note:** That both of the network connections are shown as “Linked/Standby”, this state will NOT change until the network has been assigned to a server profile. This behavior is new within VC 4.30 and is provided to accommodate the new 4096 VLAN feature.

### Defining a new Shared Uplink Set (VLAN-Trunk-2) (Copying a Shared UplinkSet)

The second Shared Uplink Set could be created in the same manner as VLAN-Trunk-1 however; VC now provides the ability to COPY a VC Network or Shared Uplink Set.

- Connect Ports X5 and X6 of the Flex-10/10D module in Bay 2 to Ports 1 and 2 on switch 2
- In the VC GUI screen, select Shared Uplink Sets in the left pane, in the right pane VLAN-Trunk-1 will be displayed, left click VLAN-Trunk-1, it will appear as blue, right click and select COPY
- Edit the Settings as shown below, the new SUS name will be VLAN-Trunk-2 and ALL the associated VLANs with have a suffix of 2
- In step 3, ADD uplinks X5 and X6 from Bay 2
- Click OK
- The SUS and ALL VLANs will be created

**Figure 256 - Copying a SUS and ALL VLANs**

Copy Shared Uplink Set

1 Shared Uplink Set Name  
Name: VLAN-Trunk-2

2 Associated Networks (VLANs)  
Replace last instance(s) of 1 with 2

VLAN-Trunk-1 Original		VLAN-Trunk-2 Copy	
VLAN-101-1		VLAN-101-2	
VLAN-102-1		VLAN-102-2	
VLAN-103-1		VLAN-103-2	
VLAN-104-1		VLAN-104-2	
VLAN-105-1		VLAN-105-2	
VLAN-106-1		VLAN-106-2	

3 External Uplink Ports

Port	Port Role	Port Status	Connector Type	Connected To

## Defining a new Shared Uplink Set via CLI

The following script can be used to create the first Shared Uplink Set (VLAN-Trunk-1)

The following command(s) can be copied and pasted into an SSH based CLI session with Virtual Connect

```
# Create Shared Uplink Set VLAN-Trunk-1 and configure uplinks
add uplinkset VLAN-Trunk-1
add uplinkport enc0:1:X5 Uplinkset=VLAN-Trunk-1 speed=auto
add uplinkport enc0:1:X6 Uplinkset=VLAN-Trunk-1 speed=auto

# Create Networks VLAN101-1 through VLAN1000-1 and VLAN-2001-1 through VLAN-3000-1
for Shared Uplink Set VLAN-Trunk-1
add network-range -quiet UplinkSet=VLAN-Trunk-1 NamePrefix=VLAN- NameSuffix=-1
VLANIds=101-1000,2001-3000 State=enabled PrefSpeedType=Custom PrefSpeed=4000
MaxSpeedType=Custom MaxSpeed=8000 SmartLink=enabled
```

The following script can be used to create the Second Shared Uplink Set (VLAN-Trunk-2)

```
# Create Shared Uplink Set VLAN-Trunk-2 and configure uplinks
add uplinkset VLAN-Trunk-2
add uplinkport enc0:2:X5 Uplinkset=VLAN-Trunk-2 speed=auto
add uplinkport enc0:2:X6 Uplinkset=VLAN-Trunk-2 speed=auto

# Create Networks VLAN101-2 through VLAN1000-2 and VLAN-2001-2 through VLAN-3000-2
for Shared Uplink Set VLAN-Trunk-2
add network-range -quiet UplinkSet=VLAN-Trunk-2 NamePrefix=VLAN- NameSuffix=-2
VLANIds=101-1000,2001-3000 State=enabled PrefSpeedType=Custom PrefSpeed=4000
MaxSpeedType=Custom MaxSpeed=8000 SmartLink=enabled
```

**Note:** In this scenario we have created two independent Share Uplink Sets (SUS), each originating from the opposite Flex-10/10D Modules, by doing so we provide the ability to create separate and redundant connections out of the Virtual Connect domain. When we create the server profiles, you will see how the NICs will connect to VLANs accessed through the opposite VC module, which provides the ability to create an Active / Active uplink scenario. Alternatively, we could have created a single SUS and assigned both sets of these uplink ports to the same SUS, however, this would have provided an Active/Standby uplink scenario, as shown in Scenario 5.

## Defining a new SAN Fabric via GUI

Create a Fabric and name it “SAN\_A”

- On the Virtual Connect Manager screen, click Define, SAN Fabric to create the first Fabric
- Enter the Network Name of “SAN\_A”
- Select Add Port, then add the following ports;
  - Enclosure 1, Bay 3, Port 1
  - Enclosure 1, Bay 3, Port 2
- Select Apply

Create a second Fabric and name it “SAN\_B”

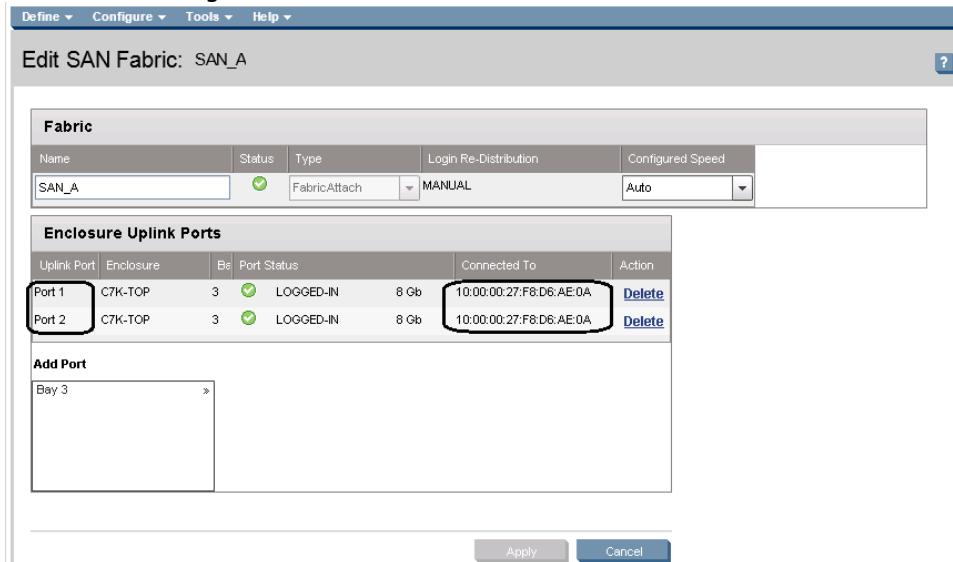
- On the Virtual Connect Manager screen, click Define, SAN Fabric to create the second Fabric
- Enter the Network Name of “SAN\_B”
- Select Add Port, then add the following ports;
  - Enclosure 1, Bay 4, Port 1
  - Enclosure 1, Bay 4, Port 2
- Select Apply

## Defining SAN Fabrics via CLI

The following command(s) can be copied and pasted into an SSH based CLI session with Virtual Connect

```
#Create the SAN Fabrics SAN_A and SAN_B and configure uplinks as discussed above  
add fabric SAN_A Bay=3 Ports=1,2  
add fabric SAN_B Bay=4 Ports=1,2
```

**Figure 257 - SAN Configuration**



**Figure 258 - SAN fabrics configured with two 8Gb uplinks per fabric. Note the bay and port numbers on the right**

SAN Fabrics										
External Connections		Server Connections								
Status	SAN Fabric	Type	Login Re-Distribution	Port Status	Connected To	Enclosure	Bay	Port	Action	Add
✓	SAN_A	FabricAttach	MANUAL	✓ LOGGED-IN	8 Gb 10:00:00:27:F8:D6:AE:0A	C7K-TOP	3	1	<a href="#">Edit</a>	
✓				✓ LOGGED-IN	8 Gb 10:00:00:27:F8:D6:AE:0A					
✓	SAN_B	FabricAttach	MANUAL	✓ LOGGED-IN	8 Gb 10:00:00:27:F8:D6:8B:9C	C7K-TOP	4	1	<a href="#">Edit</a>	
✓				✓ LOGGED-IN	8 Gb 10:00:00:27:F8:D6:8B:9C					

## Defining a Server Profile

We will create a server profile with SIX server NICs and TWO SAN adapters.

Each server NIC will connect to a specific network.

- On the main menu, select Define, then Server Profile
- Create a server profile called “ESX-1”
- Select to “Hide Unused FlexNICs”
- In the Network Port 1 drop down box, select a Network, then chose VLAN101-1
- Set the port speed to Custom at 100Mb
- In the Network Port 2 drop down box, select a Network, then chose VLAN101-2
- Set the port speed to Custom at 100Mb
- Select ADD network (add four additional network connections)
- In the Network Port 3 drop down box, select a Network, then chose VLAN-102-1
- Set the port speed to Custom at 2Gb
- In the Network Port 4 drop down box, select a Network, then chose VLAN-102-2
- Set the port speed to Custom at 2Gb
- In the Network Port 5 drop down box, select Multiple Networks
- Configure for networks VLAN-103-1 through VLAN-105-1 and VLAN-2100-1 through VLAN-2150-1
- Leave the network speed as Auto
- In the Network Port 6 drop down box, select Multiple Networks
- Configure for networks VLAN-103-2 through VLAN-105-2 and VLAN-2100-2 through VLAN-2150-2
- Leave the network speed as Auto
- Expand the FC SAN Connections box, for Bay 1, select SAN\_A for Bay 2, select SAN\_B
- Do not configure FCoE SAN or iSCSI Connection
- In the Assign Profile to Server Bay box, locate the Select Location drop down and select Bay 2, then apply

Prior to applying the profile, ensure that the server in Bay 2 is currently OFF

**Note:** You should now have a server profile assigned to Bay 2, with 6 Server NIC connections. NICs 1&2 should be connected to networks VLAN-101-x (MGMT), NICs 3&4 should be connected VLAN-102-x (VMotion) and NICs 5&6 are connected to networks VLAN103-x through VLAN105-x and VLAN-2100-x through VLAN-2150-x. FC SAN fabrics are connected to, Port 1 - SAN\_A and Port 2 - SAN\_B. if additional NICs are required, you could ADD two more NICs to this profile and assigned them to VLANs as required.

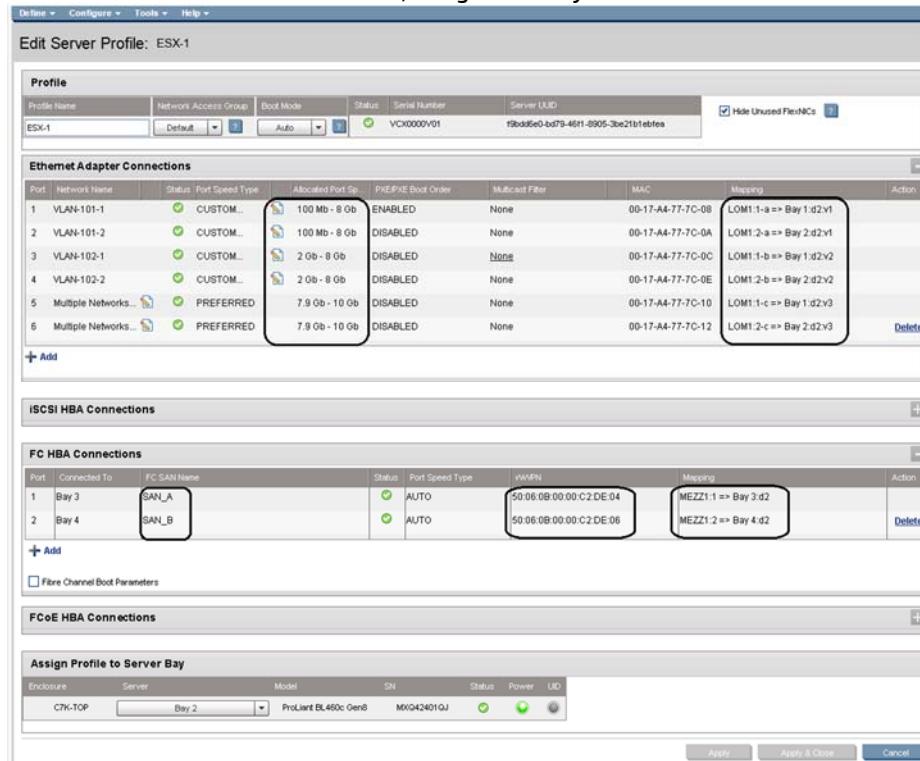
## Defining a Server Profile via CLI

The following command(s) can be copied and pasted into an SSH based CLI session with Virtual Connect

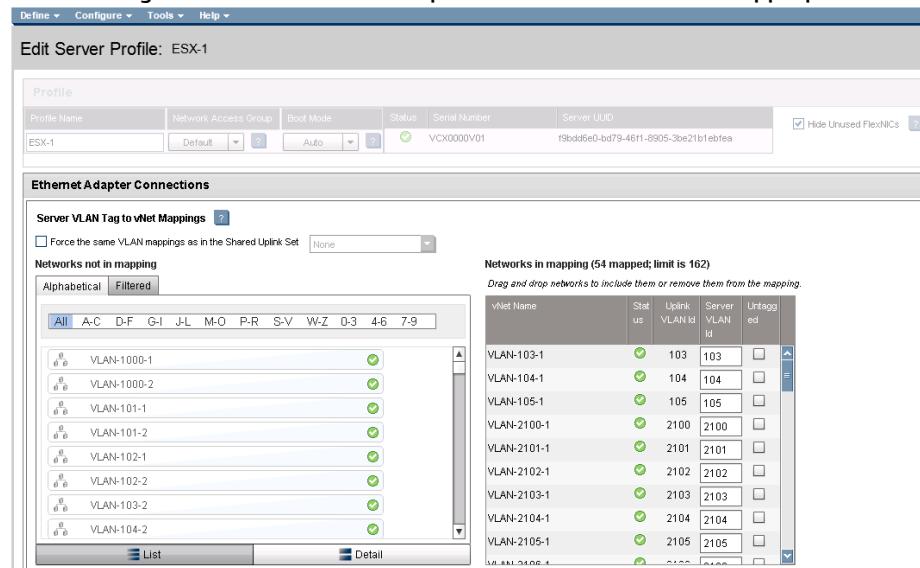
```
# Create Server Profile ESX-1
add profile ESX-1 -nodefaultfcconn -nodefaultfcoeconn NAG=Default HideUnusedFlexNICs=true
set enet-connection ESX-1 1 pxe=Enabled Network=VLAN-101-1 SpeedType=Custom Speed=100
set enet-connection ESX-1 2 pxe=Disabled Network=VLAN-101-2 SpeedType=Custom Speed=100
add enet-connection ESX-1 pxe=Disabled Network=VLAN-102-1 SpeedType=Custom Speed=2000
add enet-connection ESX-1 pxe=Disabled Network=VLAN-102-2 SpeedType=Custom Speed=2000
add enet-connection ESX-1 pxe=Disabled
add server-port-map-range ESX-1:5 UplinkSet=VLAN-Trunk-1 VLanIds=103-105,2100-2150
add enet-connection ESX-1 pxe=Disabled
add server-port-map-range ESX-1:6 UplinkSet=VLAN-Trunk-2 VLanIds=103-105,2100-2150
add fc-connection ESX-1 Fabric=SAN_A
add fc-connection ESX-1 Fabric=SAN_B
poweroff server 2
assign profile ESX-1 enc0:2
Poweron server 2
```

**Note:** The “add server-port-map-range” command is new to VC firmware release 3.30 and can be used to map many VLANs to a server NIC, in a single command. Prior releases would have required one command to create the NIC and one additional command per VLAN mapping added. This command will make profile scripting much easier, less complicated and quicker.

**Figure 259 - Define a Server Profile ESX-1, assigned to Bay 2**



**Figure 260 - Configure NICs 5 and 6 for multiple Networks and select the appropriate VLANs**



**Note:** “Server VLAN ID” and “Untagged” boxes can be edited. One network per port could be marked as “Untagged”, in which case the server would not be configured for tagging on that VLAN. It is also possible to change the VLAN ID that is presented to the server (VLAN translation), in which case the communications between Virtual Connect and the network would be the VLAN ID in grey, if the Server VLAN ID box to the right were changed, VC would communicate with the server on the new VLAN ID, providing a VLAN translation function. VLAN translation could be a very useful feature, in the event that VLAN renumbering is required within the datacenter. The network VLAN numbers and Shared Uplink Set configurations could be changed to reflect the new VLAN IDs used, however, the old VLAN IDs could still be presented to the server providing the ability to delay or eliminate the need to change the VLAN ID used within the server/vSwitch.

**Figure 261 - Server Profile View Bay 2**

The screenshot shows the vSphere Web Client interface for a ProLiant BL460c Gen8 server in Bay 2. The top navigation bar includes tabs for Define, Configure, Tools, and Help. The main content area is divided into several sections:

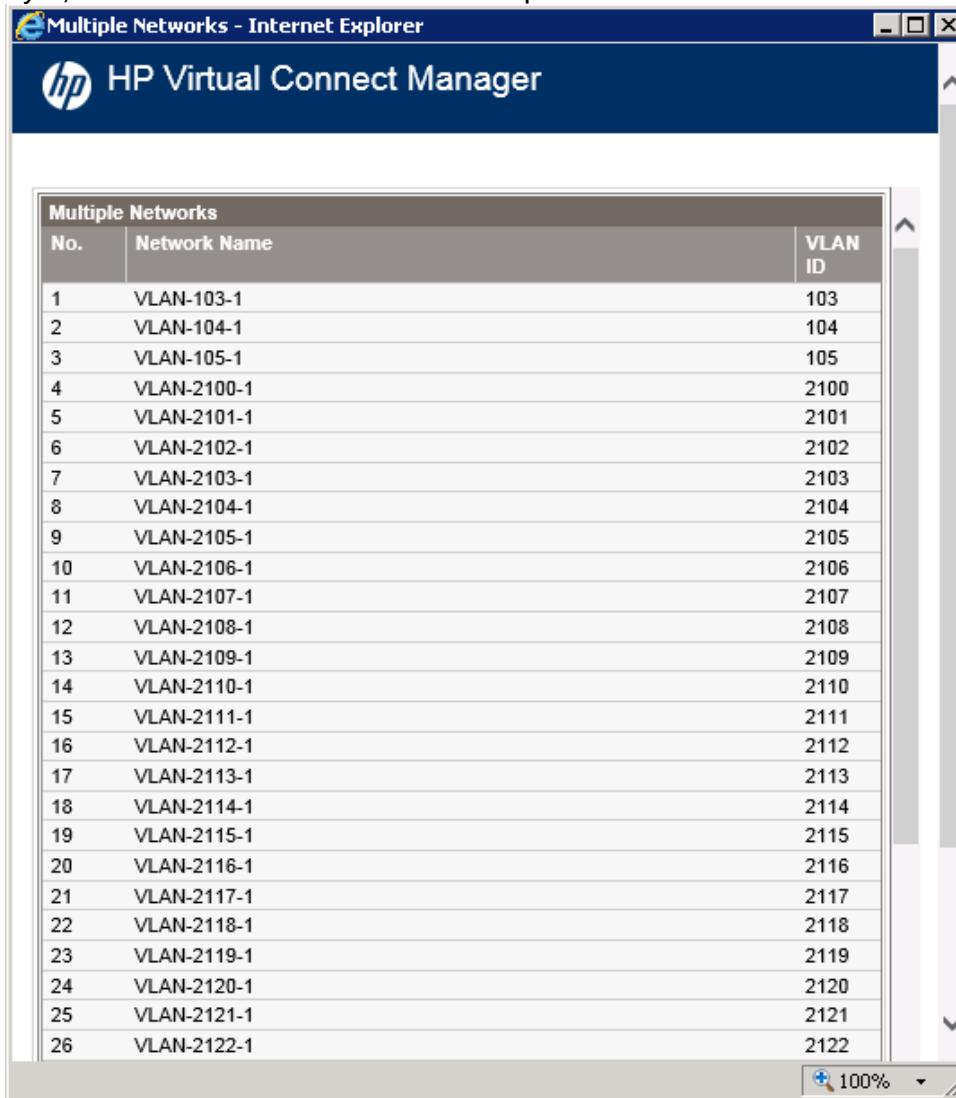
- Device Bay Status - Bay # 2:**
  - Overall Status: ✓
  - Hardware Status: ✓
  - VC Status: ✓
  - Assigned Server Profile: ESX-1
  - Enclosure Name: C7K-TOP
  - UID: ■
  - Power Status/Control: ■ On (with buttons for Momentary Press and Press and Hold)
- Blade Server Information - Bay # 2:**

Serial Number:	MXQ42401QJ
Serial Number (Logical):	VCX0000V01
UUID:	30343237-3638-584D-5134-32343031514A
UUID (Logical):	f9bdd6e0-bd79-46f1-8905-3be21b1ebfea
Product Name:	ProLiant BL460c Gen8
Server Name:	esx-1.vanlab.net
Part Number:	724086-B21
Asset Tag:	[Unknown]
UEFI Capable:	false
Boot Mode:	Legacy
- Server Ethernet Adapter Information:**

Ethernet Adapter	Flex NIC	Location	Module Port	Model	MAC Address	Network
<b>Port 1</b>						
LOM1:1-a	FLB1	Bay 1:d2:v1	HP FlexFabric 10Gb 2-Port 534FLB Adapter	00-17-A4-77-7C-08		VLAN-101-1
LOM1:1-b	FLB1	Bay 1:d2:v2	HP FlexFabric 10Gb 2-Port 534FLB Adapter	00-17-A4-77-7C-0C		VLAN-102-1
LOM1:1-c	FLB1	Bay 1:d2:v3	HP FlexFabric 10Gb 2-Port 534FLB Adapter	00-17-A4-77-7C-10		Multiple Networks
LOM1:1-d	FLB1	Bay 1:d2:v4	HP FlexFabric 10Gb 2-Port 534FLB Adapter	9C-B6-54-87-5F-93		
<b>Port 2</b>						
LOM1:2-a	FLB1	Bay 2:d2:v1	HP FlexFabric 10Gb 2-Port 534FLB Adapter	00-17-A4-77-7C-0A		VLAN-101-2
LOM1:2-b	FLB1	Bay 2:d2:v2	HP FlexFabric 10Gb 2-Port 534FLB Adapter	00-17-A4-77-7C-0E		VLAN-102-2
LOM1:2-c	FLB1	Bay 2:d2:v3	HP FlexFabric 10Gb 2-Port 534FLB Adapter	00-17-A4-77-7C-12		Multiple Networks
LOM1:2-d	FLB1	Bay 2:d2:v4	HP FlexFabric 10Gb 2-Port 534FLB Adapter	9C-B6-54-87-5F-97		
- SAN Ports:**

Port Number	Adapter	Module Port	Model	WWN	SAN Fabric
Port 1	MEZZ1	Bay 3:d2	QLogic QMH2572 8Gb FC HBA for HP BladeSystem c-Class	50:06:0B:00:00:C2:DE:04	<span style="border: 1px solid black; padding: 2px;">SAN_A</span>
Port 2	MEZZ1	Bay 4:d2	QLogic QMH2572 8Gb FC HBA for HP BladeSystem c-Class	50:06:0B:00:00:C2:DE:06	<span style="border: 1px solid black; padding: 2px;">SAN_B</span>

**Figure 262** - By clicking on the “Multiple Networks” statement for each LOM, the following page is displayed, which lists the VLAN connections for this port.



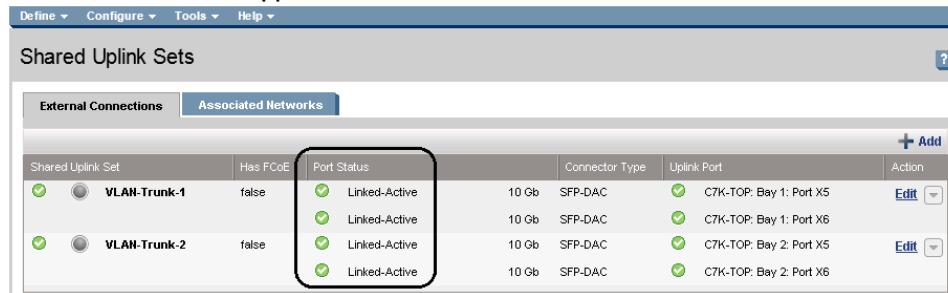
The screenshot shows a Microsoft Internet Explorer window titled "Multiple Networks - Internet Explorer". The main content is a table from the "HP Virtual Connect Manager" interface. The table is titled "Multiple Networks" and has three columns: "No.", "Network Name", and "VLAN ID". The "No." column contains numbers from 1 to 26. The "Network Name" column lists various VLAN identifiers such as VLAN-103-1 through VLAN-2122-1. The "VLAN ID" column lists corresponding values ranging from 103 to 2122. The table is scrollable, indicated by vertical scroll bars on the right side.

No.	Network Name	VLAN ID
1	VLAN-103-1	103
2	VLAN-104-1	104
3	VLAN-105-1	105
4	VLAN-2100-1	2100
5	VLAN-2101-1	2101
6	VLAN-2102-1	2102
7	VLAN-2103-1	2103
8	VLAN-2104-1	2104
9	VLAN-2105-1	2105
10	VLAN-2106-1	2106
11	VLAN-2107-1	2107
12	VLAN-2108-1	2108
13	VLAN-2109-1	2109
14	VLAN-2110-1	2110
15	VLAN-2111-1	2111
16	VLAN-2112-1	2112
17	VLAN-2113-1	2113
18	VLAN-2114-1	2114
19	VLAN-2115-1	2115
20	VLAN-2116-1	2116
21	VLAN-2117-1	2117
22	VLAN-2118-1	2118
23	VLAN-2119-1	2119
24	VLAN-2120-1	2120
25	VLAN-2121-1	2121
26	VLAN-2122-1	2122

## Verify Network Link State

As discussed earlier in this document, in Virtual connect 4.30 there was a change to the link state behavior when a network has no connections to a server profile. Once a connection is made to the server profile, the uplinks will become Active, as previously expected.

**Figure 263** - All Links now appear in a Linked/Active state.



The screenshot shows a software interface titled "Shared Uplink Sets". At the top, there are tabs for "External Connections" and "Associated Networks", with "External Connections" being the active tab. Below the tabs is a table with the following data:

Shared Uplink Set	Has FCoE	Port Status	Connector Type	Uplink Port	Action	
VLAN-Trunk-1	false	<input checked="" type="checkbox"/> Linked-Active <input checked="" type="checkbox"/> Linked-Active	10 Gb	SFP-DAC	<input checked="" type="checkbox"/> C7K-TOP: Bay 1: Port X5 <input checked="" type="checkbox"/> C7K-TOP: Bay 1: Port X6	<input type="button" value="Edit"/>
VLAN-Trunk-2	false	<input checked="" type="checkbox"/> Linked-Active <input checked="" type="checkbox"/> Linked-Active <input checked="" type="checkbox"/> Linked-Active	10 Gb	SFP-DAC	<input checked="" type="checkbox"/> C7K-TOP: Bay 2: Port X5 <input checked="" type="checkbox"/> C7K-TOP: Bay 2: Port X6	<input type="button" value="Edit"/>

# Review

In this scenario we have created Two Shared Uplink Sets (SUS), providing support for many VLANs. Uplinks originating from each Flex-10/10D Module connect to each SUS, by doing so we provide redundant connections out of the Virtual Connect domain. As multiple uplinks are used for each SUS, we have also leveraged LACP to improve uplink performance. In this scenario, all uplinks will be active. We also create two SAN Fabrics.

We created a server profile, with SIX NICs. Two connected to the same VLAN (101), Port 1 connects to VLAN-101-1 and Port 2 connects to VLAN-101-2, which provides the ability to sustain a link or module failure and not lose connection to the network, these NICs were set to 100Mb/Sec with the Maximum speed set to 8Gb. VLAN-101-1 and VLAN-101-2 are configured to support VLAN 101, frames will be presented to the NIC(s) without VLAN tags (untagged), these two NICs are connected to the same VLAN, but taking a different path out of the enclosure. VLAN 101 is used for Management connections to the ESX host.

Network Ports 3 and 4 connect to the same VLAN (102), Port 3 connects to VLAN-102-1 and Port 4 connects to VLAN-102-2, which provides the ability to sustain a link or module failure and not lose connection to the network, these NICs were set to 2Gb/Sec with the Maximum speed set to 8Gb. VLAN-102-1 and VLAN-102-2 are configured to support VLAN 102, frames will be presented to the NIC(s) without VLAN tags (untagged), these two NICs are connected to the same VLAN, but taking a different path out of the enclosure. VLAN 102 is used for VMotion.

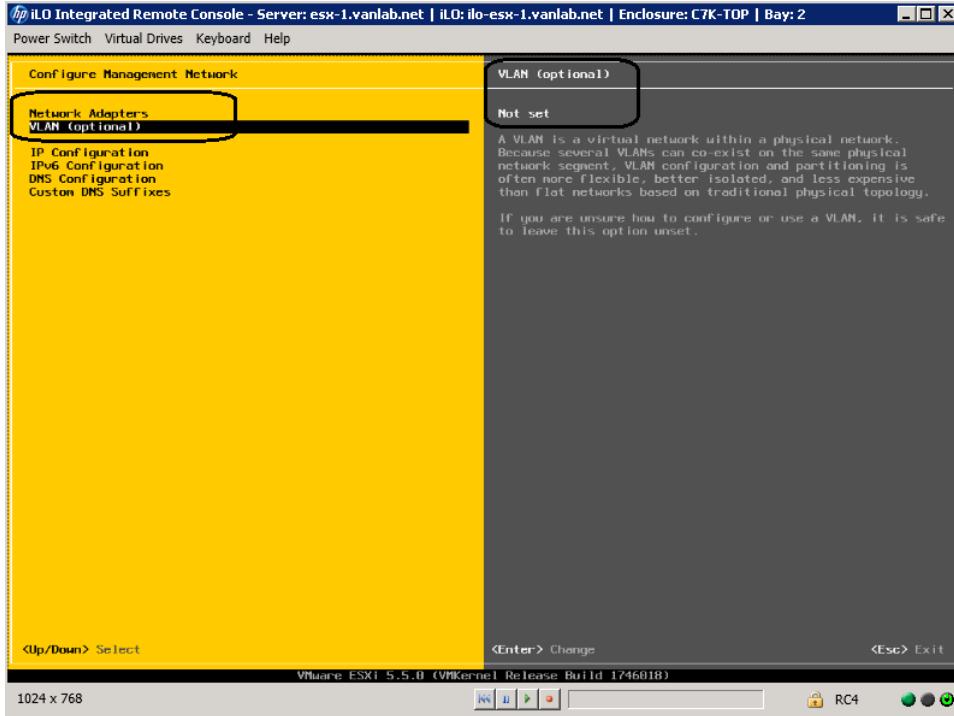
Network Ports 5 and 6 were added, these NICs will be connected to “Multiple Networks” and each NIC will then be configured for networks VLAN103-x through VLAN105-x and networks VLAN-2100-x through VLAN-2150-x. As these networks are tagging, frames will be presented to the server with VLAN tags. NICs 5 and 6 will be connected to the same vSwitch to support VM connections. VLAN tagged frames for these networks will be forwarded to the Virtual switch and then passed on to the appropriate Virtual Machine, VLAN tags will be removed as the frames are passed to the virtual machine. These NICs will use the remaining available bandwidth of 7.9Gb/Sec with the Maximum speed set to 10Gb.

Additionally, FC port 1 is connected to SAN fabric SAN\_A and FC port 2 is connected to SAN Fabric SAN\_B, providing a multi-pathed connection to the SAN. As this scenario utilized separate FC HBA and Virtual connect Fibre Channel modules, SAN connectivity is 8Gb per port.

The Virtual Connect SAN fabrics connect to each SAN fabric over a pair of uplinks per module. SAN logins are distributed across the multiple paths.

The following graphic provides an example of an ESX server with TWO NICs connected to the same console vSwitch configured for VLAN 101, which was the Default (untagged) VLAN. Additional vSwitches have been configured for VMotion and product VLANs.

**Figure 264** - As NICs 1 and 2 are connected directly to VLAN-101, the connection acts as an Access or Untagged switch port, you need to ensure that the Hypervisor is NOT configured for VLAN tagging. However, if you want to put this server onto a VLAN that is tagged, this setting will need to be configured for that VLAN.



## Results – vSphere Networking Examples

We successfully configured Flex-10 with Share Uplink Sets, supporting several VLANs and redundant SAN fabrics. We created a server profile to connect to the various vNet with SIX NICs and the SAN fabrics using the FC connections created within the profile.

In this Scenario, Ethernet and Fibre channel connectivity is provided through separate adapters.

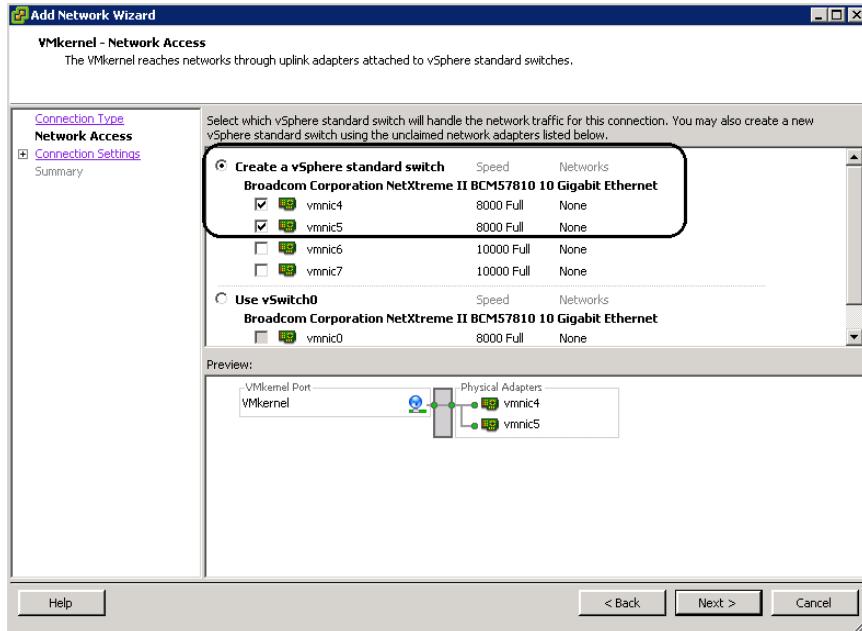
The following graphics show an ESXi 5.5 server with SIX FlexNICs configured, FOUR presented at 8Gb (two on the console network and two on the VMotion network) and two at 10Gb (Guest VLAN port groups). If we require additional NICs on this server, two additional NICs could be provided to the server for a total of 8 NIC ports available to the OS.

**Note:** The BL465c G7 and BL685c G7 utilize an NC551i chipset (BE2), whereas the BL460c G7, BL620c G7 and BL680c G7 utilize an NC553i chipset (BE3) and the Gen 8 blades typically have a NC554 adapter which also utilizes the BE3 chipset. Both the BE2 and BE3 chipsets share common drivers and firmware.

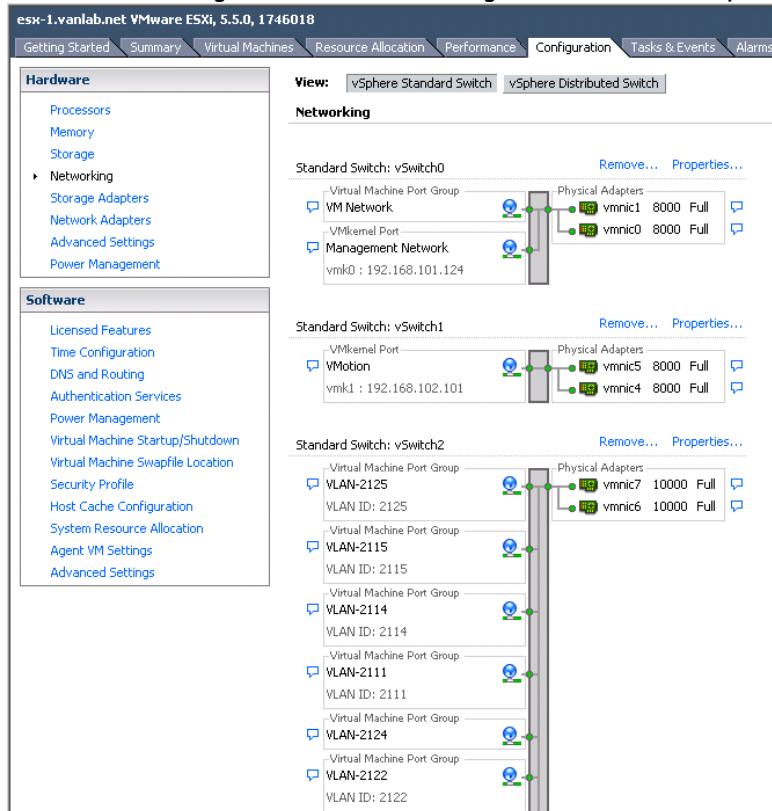
Virtual Connect supports the use of either Standard or Distributed vSwitches, examples of both are provided below.

## vSphere Standard vSwitch

**Figure 265 – ESXi 5.5 Network Connections**

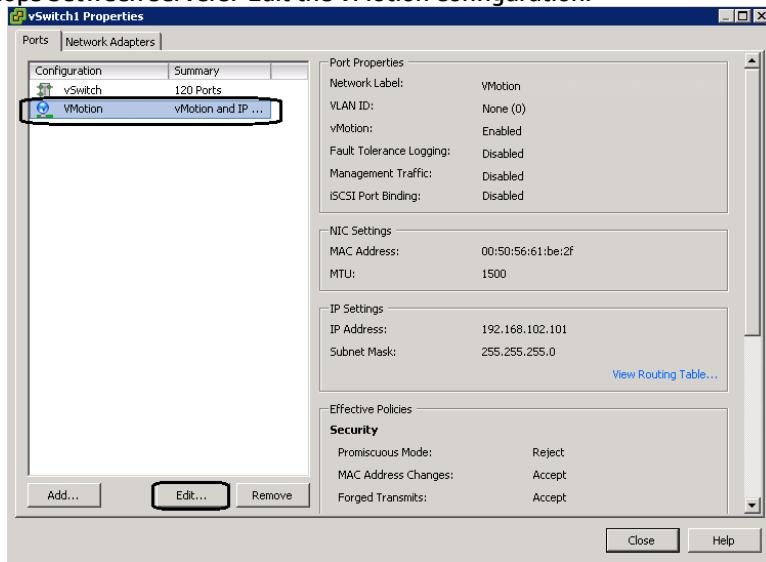


**Figure 266 – ESXi 5.5 networking – three vSwitches configured. (Note the NIC speeds)**

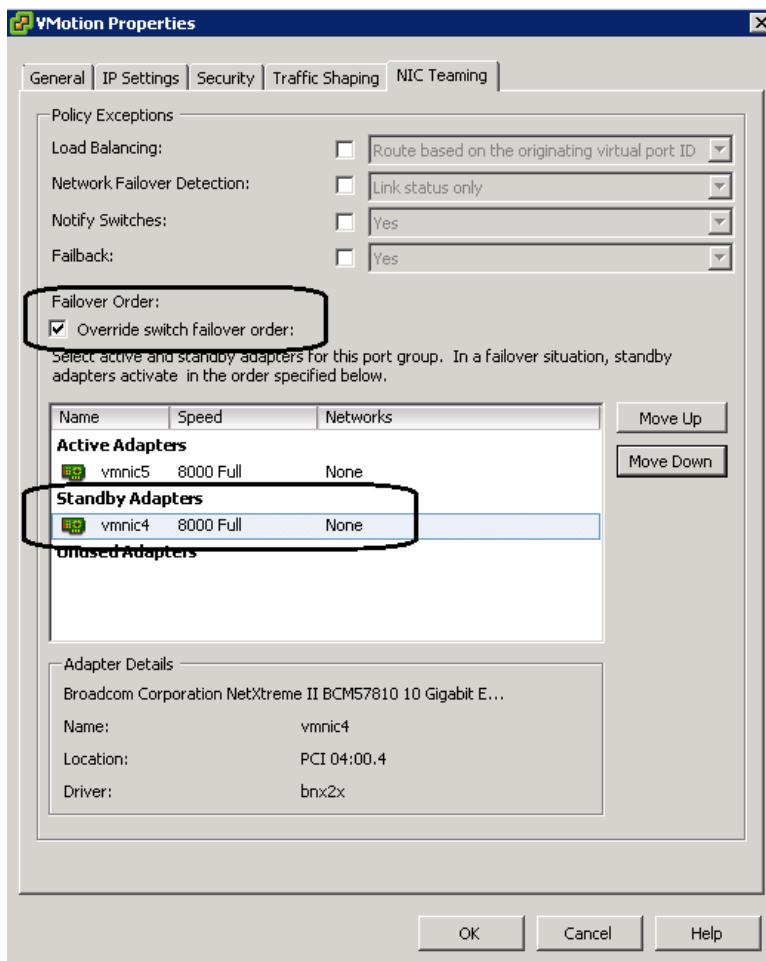


**Note:** As VLAN 101 is set as untagged at the upstream switch port, the management network port group should be defined as untagged. This will allow the server to be deployed, without having to set a VLAN ID for the management network.

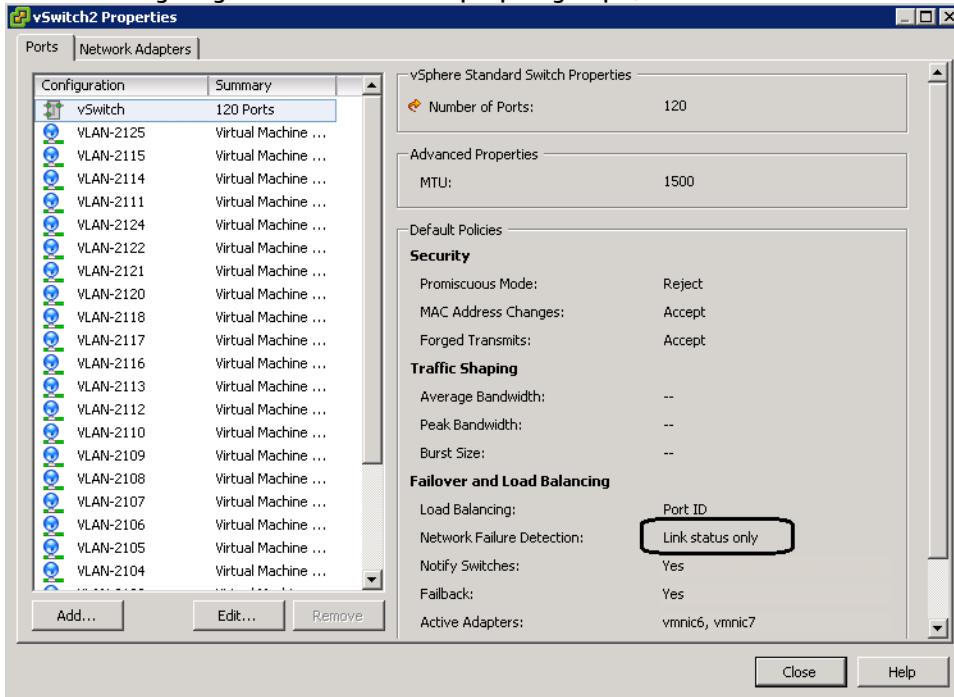
**Figure 267** - You may want to specify a specific NIC for VMotion traffic. This will ensure that all VMotion traffic between servers within the enclosure will remain on the same VC module, reducing the likelihood of multiple hops between servers. Edit the VMotion Configuration.



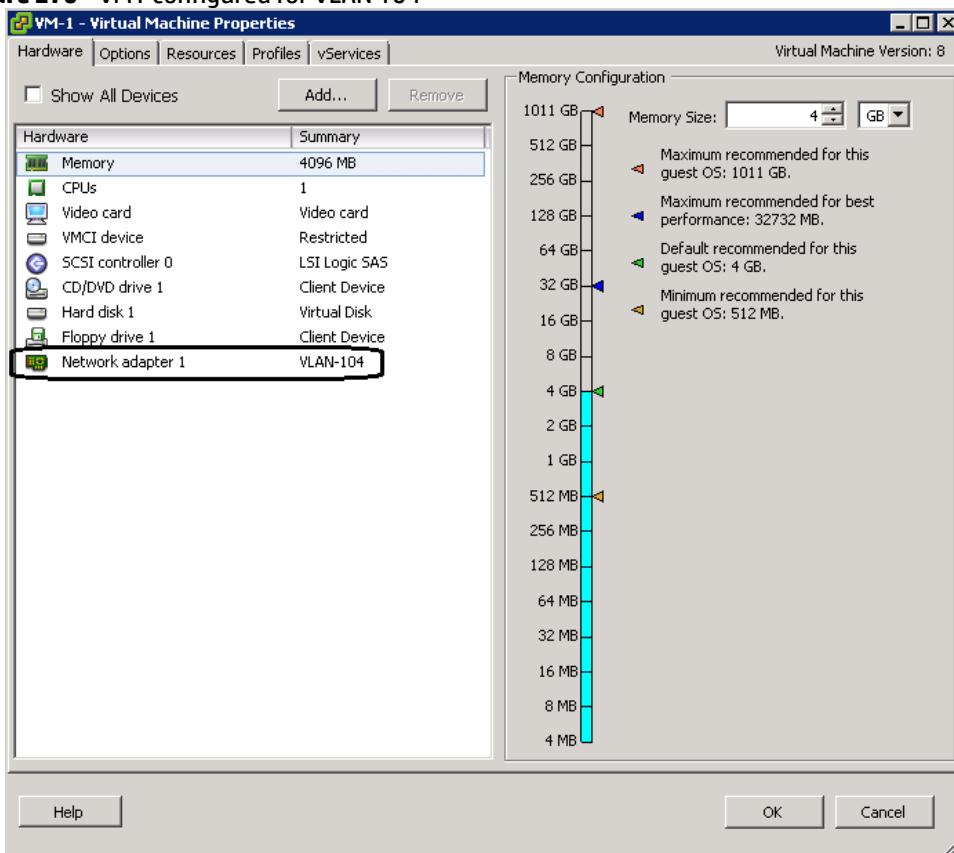
**Figure 268** - Edit the NIC Team for VMotion and set one of the Adapters in Standby, this will ensure that ALL VMotion traffic remains on the SAME VC module. ESX NIC vmnic3 is connected to the VC module in bay 1.



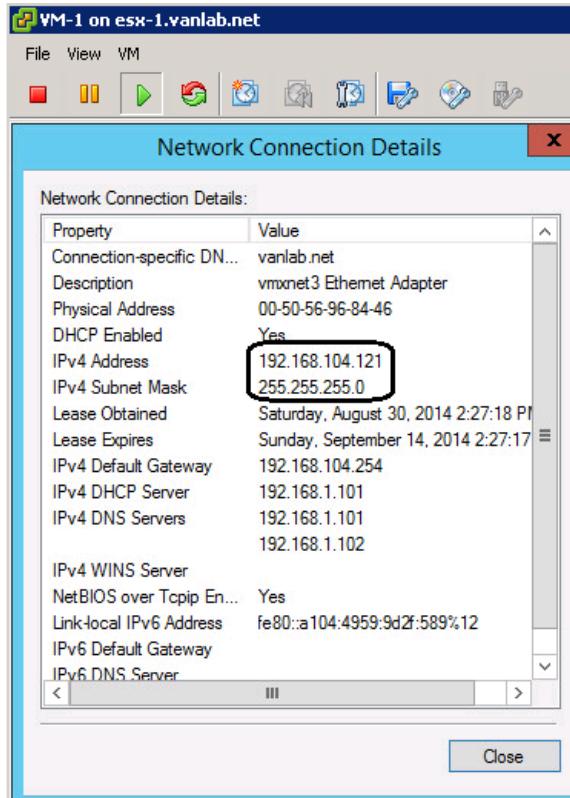
**Figure 269 - Configuring the vSwitch for multiple port groups / VLANs**



**Figure 270 - VM1 configured for VLAN 104**

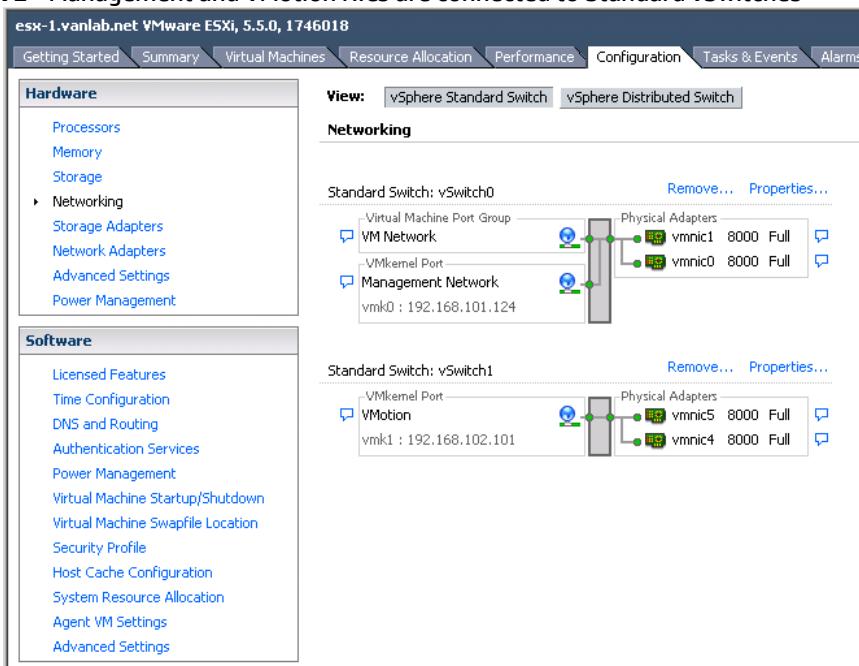


**Figure 271 - VM1 on VLAN 104**

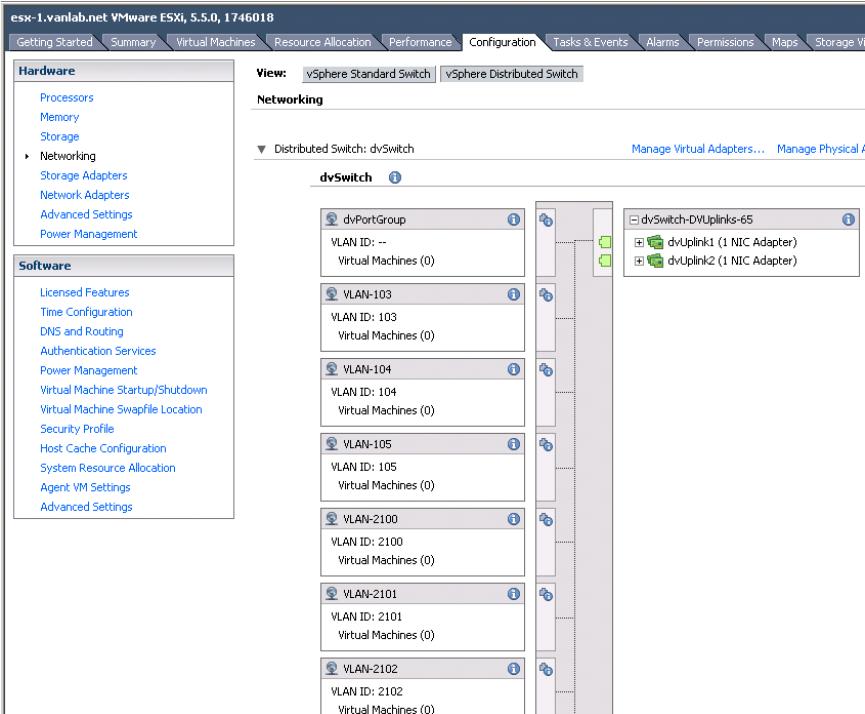


## vSphere Distributed vSwitch

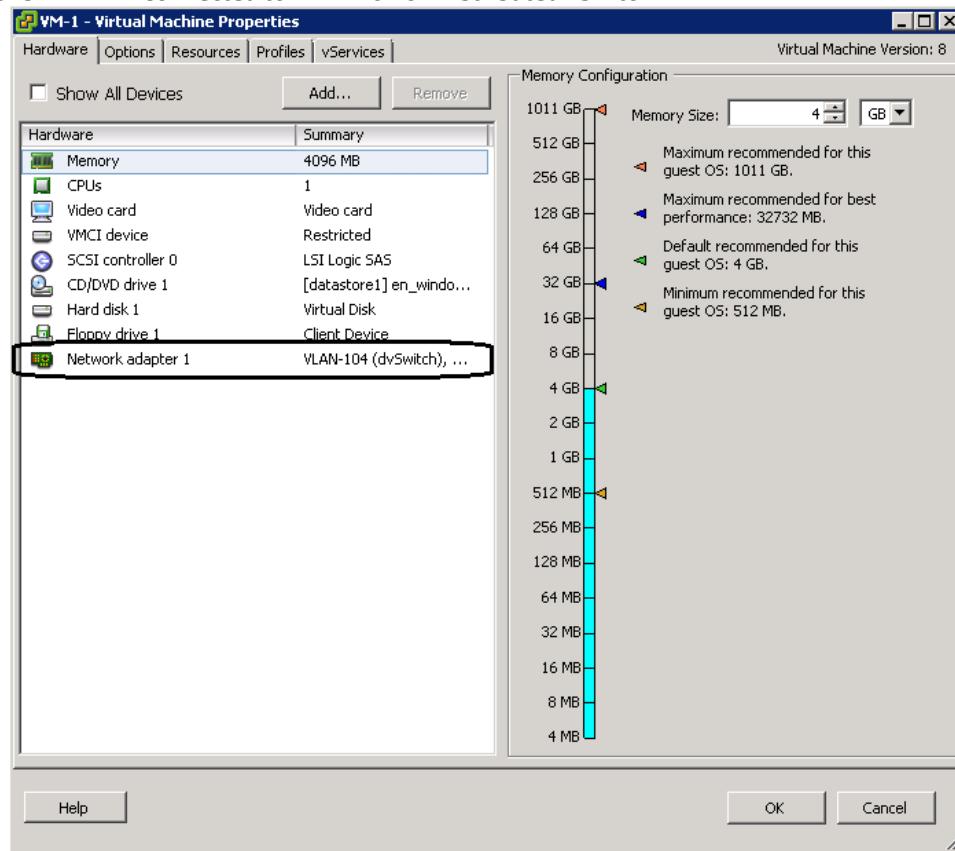
**Figure 272 - Management and VMotion NICs are connected to Standard vSwitches**



**Figure 273 - VM Networks are connected to a Distributed vSwitch**



**Figure 274 - VM Connected to VLAN 104 on Distributed vSwitch**



## Results – vSphere SAN Connectivity

As traditional Fibre Channel HBA's were used for this scenario, no additional configuration was required.

**Figure 275** - ESXi 5 storage configuration, the Shared Storage LUN is provided through the FC connections to the SAN.

Identification	Status	Device	Drive Type	Capacity	Free	Type	Last Update
datastore1	Normal	HP Serial Attached...	Non-SSD	271.75 GB	258.57 GB	VMFS5	8/30/2014 9:41
Datastore-1	Normal	HP Fibre Channel...	Non-SSD	199.75 GB	198.80 GB	VMFS5	8/30/2014 9:41

## Summary

We presented a Virtual Connect Network scenario by creating two shared uplink sets (SUS), each SUS is connected with TWO active uplinks; both SUS' can actively pass traffic. We included a dual path SAN fabric for storage connectivity using separate VC-FC modules and an 8Gb FC HBA.

When VC profile ESX-1 is applied to the server in bay 2 and the server is powered up, it has one NIC connected through Flex-10/10D module 1 (connected to VLAN-101-1), the second NIC is connected through Flex-10/10D module 2 (connected to VLAN-101-2). Each NIC is configured at 100Mb. These NICs are connected to the console vSwitch. The second pair of NICs are connected to the second vSwitch, which is configured for VMotion and is connected to VLAN102-x through NICs 3 and 4 which are configured at 2Gb to a maximum of 8Gb. The last pair of NICs 5 and 6, are connected to the third vSwitch, which is configured to support VLANs 103 through 105 and 2100 through 2150 and configured for 7.9Gb to a maximum of 10Gb. This host is also configured for FC based SAN access and connects to a SAN LUN to store the Guest VMs. Each FC port is configured for 8Gb of SAN bandwidth.

As additional servers are added to the enclosure, simply create additional profiles, or copy existing profiles, configure the NICs for LAN and SAN fabrics as required and apply them to the appropriate server bays and power the server on.

# Scenario 10 – Shared Uplink Set with Active/Active Uplinks and 802.3ad (LACP) – FlexFabric-20/40 F8 - Windows 2012 R2 Hyper-V

## Overview

This scenario will implement the Shared Uplink Set (SUS) to provide support for multiple VLANs. The upstream network switches connect a shared uplink set to two ports on each FlexFabric-20/40 F8 modules, LACP will be used to aggregate those links.

As multiple VLANs will be supported in this configuration, the upstream switch ports connecting to the FlexFabric-20/40 F8 modules will be configured to properly present those VLANs. In this scenario, the upstream switch ports will be configured for VLAN trunking/VLAN tagging.

When configuring Virtual Connect, we can provide several ways to implement network fail-over or redundancy. One option would be to connect TWO uplinks to a single Virtual Connect network; those two uplinks would connect from different Virtual Connect modules within the enclosure and could then connect to the same upstream switch or two different upstream switches, depending on your redundancy needs. An alternative would be to configure TWO separate Virtual Connect networks, each with a single, or multiple, uplinks configured. Each option has its advantages and disadvantages. For example; an Active/Standby configuration places the redundancy at the VC level, where Active/Active places it at the OS NIC teaming or bonding level. We will review the second option in this scenario.

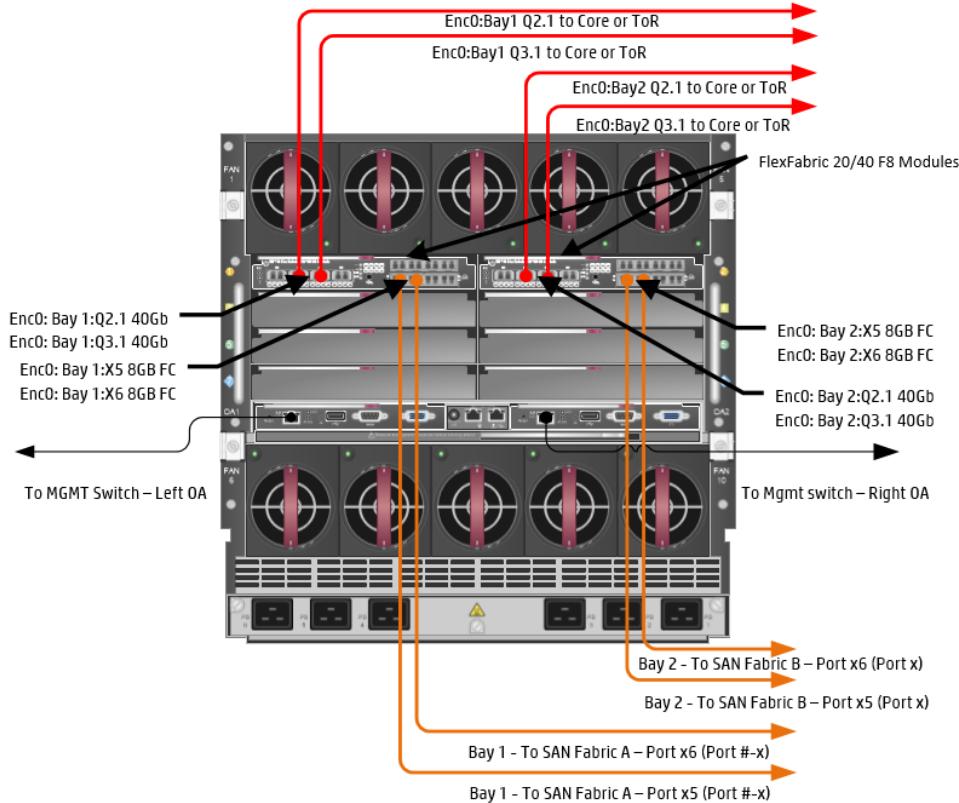
In addition, several Virtual Connect Networks can be configured to support the required networks to the servers within the BladeSystem enclosure. These networks could be used to separate the various network traffic types, such as iSCSI, backup and VMotion from production network traffic.

This scenario will also leverage the Fibre Channel over Ethernet (FCoE) capabilities of the FlexFabric-20/40 F8 modules. Each fibre channel fabric will have two uplinks connected at 8Gb to each of the FlexFabric-20/40 F8 modules.

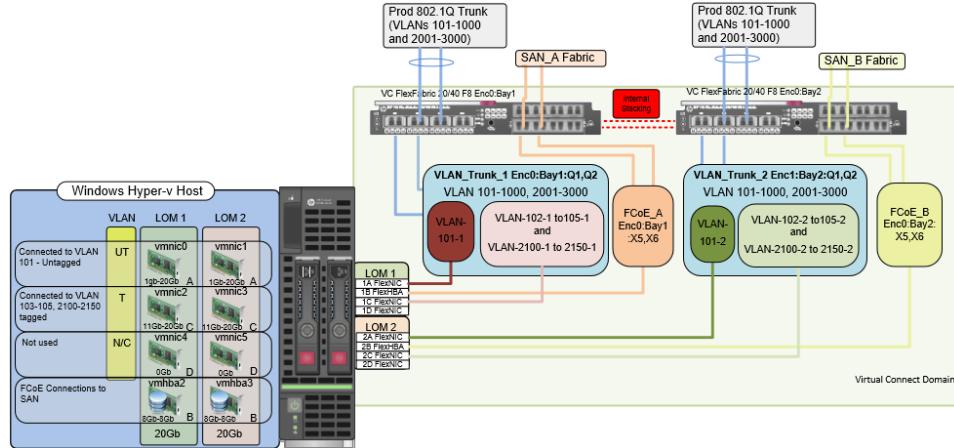
## Requirements

This scenario will support both Ethernet and fibre channel connectivity. In order to implement this scenario, an HP BladeSystem c7000 enclosure with one or more server blades and TWO Virtual Connect FlexFabric-20/40 F8 modules, installed in I/O Bays 1& 2 are required. In addition, we will require ONE or TWO external Network switches. As Virtual Connect does not appear to the network as a switch and is transparent to the network, any standard managed switch will work with Virtual Connect. The fibre channel uplinks will connect to the existing FC SAN fabrics. The SAN switch ports will need to be configured to support NPIV logins. Two uplinks from each FlexFabric-20/40 F8 module will be connected to the existing SAN fabrics.

**Figure 276 - Physical View;** Shows two Ethernet uplinks from Ports Q2 and Q3 on Module 1 to Ports on the first network switch and two Ethernet uplinks from Ports Q2 and Q3 on Module 2 to Ports on the second network switch. The SAN fabrics are also connected redundantly, with TWO uplinks per fabric, from ports X5 and X6 on module 1 to Fabric A and ports X5 and X6 on module 2 to Fabric B.



**Figure 277 - Logical View;** The server blade profile is configured with Four FlexNICs and 2 FlexHBAs. NICs 1 and 2 are connected to VLAN-101-x, NICs 3 and 4 are connected to multiple networks VLAN-102-x through VLAN-105-x and VLAN-2100 through 2150-x, which are part of the Shared Uplink Sets, VLAN-Trunk-1 and VLAN-Trunk-2 respectively. The VLAN-Trunks are connected, at 40Gb, to a network switch, through Ports Q2 and Q3 on each FlexFabric-20/40 F8 Module in Bays 1 and 2. In addition, FCoE\_A connects to the existing SAN Fabric A through port X5 and X6 on Module 1 (Bay 1) and FCoE\_B connects to the existing SAN Fabric B through port X5 and X6 on Module 2 (Bay 2).



# Installation and configuration

## Switch configuration

Appendices A and B provide a summary of the commands required to configure the switch in either a Cisco or HP Networking (with both ProCurve and Comware examples). The configuration information provided in the appendices assumes the following information:

- The switch ports are configured as VLAN TRUNK ports (tagging) to support several VLANs. All frames will be forwarded to Virtual Connect with VLAN tags. Optionally, one VLAN could be configured as (Default) untagged, if so, then a corresponding vNet within the Shared Uplink Set would be configured and set as “Default”.

**Note:** When adding additional uplinks to the SUS, if the additional uplinks are connecting from the same FlexFabric-20/40 F8 module to the same switch, in order to ensure all The uplinks are active, the switch ports will need to be configured for LACP within the same Link Aggregation Group.

The network switch port should be configured for Spanning Tree Edge as Virtual Connect appears to the switch as an access device and not another switch. By configuring the port as Spanning Tree Edge, it allows the switch to place the port into a forwarding state much quicker than otherwise, this allows a newly connected port to come online and begin forwarding much quicker.

The SAN connection will be made with redundant connections to each Fabric. SAN switch ports connecting to the FlexFabric-20/40 F8 module must be configured to accept NPIV logins.

## Configuring the VC module

- Physically connect Port 1 of network switch 1 to Port Q2 of the VC module in Bay 1
- Physically connect Port 2 of network switch 1 to Port Q3 of the VC module in Bay 1
- Physically connect Port 1 of network switch 2 to Port Q2 of the VC module in Bay 2
- Physically connect Port 2 of network switch 2 to Port Q3 of the VC module in Bay 2

**Note:** If you have only one network switch, connect VC ports Q2 and Q3 (Bay 2) to an alternate port on the same switch. This will NOT create a network loop and Spanning Tree is not required.

**Note:** If you currently do not have access to 40Gb switch ports, you can still utilize the QSFP ports on the FlexFabric-20/40 F8 module, through the user of the QSFP+ to 4x 10G SFP+ Splitter cable. This splitter cable is provided in lengths up to 5m, and splits the QSFP+ port in to 4x 10Gb SFP+ connections. These connections can be managed as independent 10Gb connections, or configured in an LACP group to aggregate the connect to 40Gb.

- Physically connect Ports X5/X6 on the FlexFabric-20/40 F8 in module Bay 1 to switch ports in SAN Fabric A
- Physically connect Ports X5/X6 on the FlexFabric-20/40 F8 in module Bay 2 to switch ports in SAN Fabric B

## VC CLI commands

Many of the configuration settings within VC can also be accomplished via a CLI command set. In order to connect to VC via a CLI, open an SSH connection to the IP address of the active VCM. Once logged in, VC provides a CLI with help menus. Through this scenario the CLI commands to configure VC for each setting will also be provided.

## Configuring Expanded VLAN Capacity via GUI

Virtual Connect release 3.30 provided an expanded VLAN capacity mode when using Shared Uplink Sets, this mode can be enabled through the Ethernet Settings tab or the VC CLI. The default configuration for a new Domain install is “Expanded VLAN Capacity” mode, Legacy mode is no longer available and the Domain cannot be downgraded.

Virtual Connect 4.30 now provides the ability to define up to 4096 VLANs then consume only the VLANs you need, when you need them. There is nothing to change or enable to take advantage of the 4096 VLAN feature.

## To verify the VLAN Capacity mode

- On the Virtual Connect Manager screen, Left pane, click Ethernet Settings, Advanced Settings
- Select Expanded VLAN capacity
- Verify Expanded VLAN Capacity is configured and Legacy VLAN Capacity is greyed out.

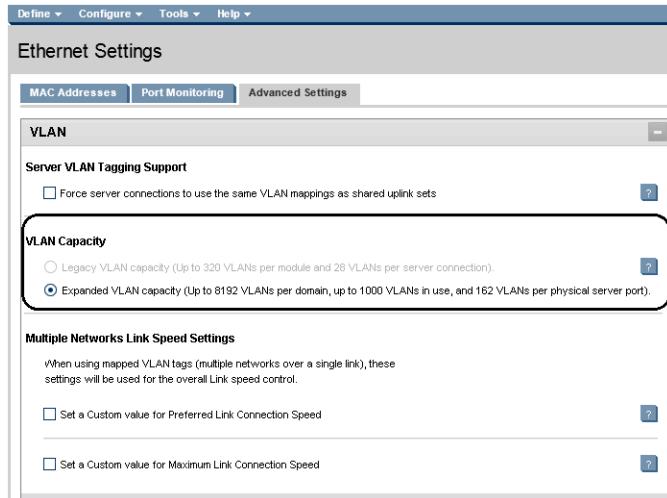
**Note:** Legacy VLAN mode will only be presented if 1Gb Virtual Connect Modules are present, in which case the domain would be limited to Firmware version 3.6x.

## Configuring Expanded VLAN Capacity via CLI

The following command can be copied and pasted into an SSH based CLI session with Virtual Connect;

```
# Set Expanded VLAN Capacity  
set enet-vlan -quiet VlanCapacity=Expanded
```

**Figure 278 - Enabling Expanded VLAN Capacity**



**Note:** If a 1Gb VC Ethernet module is present in the Domain, Expanded VLAN capacity will be greyed out, this is only supported with 10Gb and 20Gb based Virtual Connect modules. Also, once Expanded VLAN capacity is selected, moving back to Legacy VLAN capacity mode will require a domain deletion and rebuild.

## Defining a new Shared Uplink Set (VLAN-Trunk-1)

Connect Ports X5 and X6 of FlexFabric-20/40 F8 module in Bay 1 to Ports 1 and 2 on switch 1

Create a SUS named VLAN-Trunk-1 and connect it to FlexFabric-20/40 F8 Ports X5 and X6 on Module 1

- On the Virtual Connect Home page, select Define, Shared Uplink Set
- Insert Uplink Set Name as VLAN-Trunk-1
- Select Add Port, then add the following port;
  - Enclosure 1, Bay 1, Port Q1
  - Enclosure 1, Bay 1, Port Q2

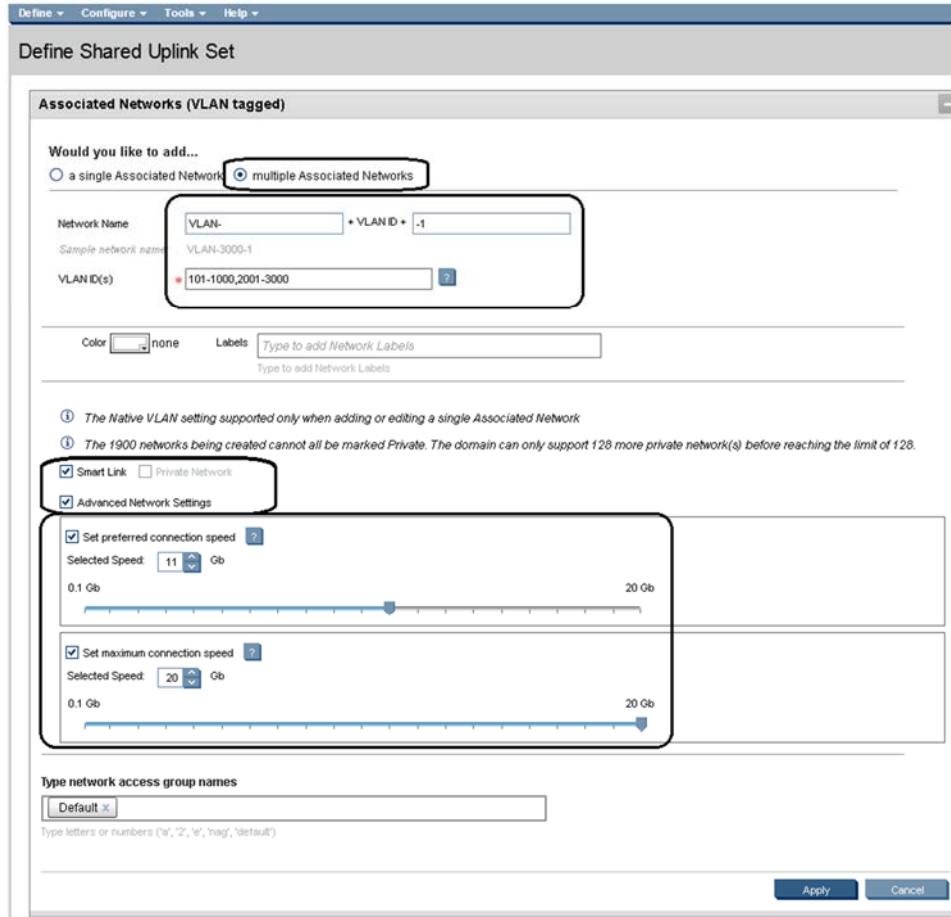
**Figure 279 - Shared Uplink Set (VLAN-Trunk-1) Uplinks Assigned**

The screenshot shows the 'Define Shared Uplink Set' interface. In the 'Ethernet Shared External Uplink Set' section, 'Uplink Set Name' is set to 'VLAN-Trunk-1'. The 'External Uplink Ports' table lists two ports: 'C7K-Bottom Bay 1: Port Q2.1' and 'C7K-Bottom Bay 1: Port Q3.1', both configured as 'Linked'. The 'Connection Mode' is set to 'Auto' and the 'LACP Timer' is set to 'Domain Default, Short (1 sec)'. Below the table, there's an 'Add Port' section with a dropdown menu showing 'C7K-Bottom'. Under 'Associated FCoE Networks (VLAN tagged)' and 'Associated Networks (VLAN tagged)', there are tables with columns like Network Name, VLAN ID, Native, Smart Link, Private Network, and Action. The 'Action' column for the 'Associated Networks' table includes an 'Add' button (circled in red) and a 'Delete' button. At the bottom right are 'Apply' and 'Cancel' buttons.

- Click Add Networks and select the Multiple Networks radio button and add the following VLANs;
  - Enter Name as VLAN-
  - Enter Suffix as -1
  - Enter VLAN IDs as follows (and shown in the following graphic);
  - 101-1000,2001-3000
- Enable SmartLink on ALL networks
- Click Advanced
  - Configure Preferred speed to 8Gb
  - Configure Maximum speed to 20Gb
- Click Apply

**Note:** You can optionally specify a network “color” or “Label” when creating a shared Uplinkset and its networks. In the example above we have not set either color or label. Also notice the new configurable LACP Timer setting.

**Figure 280 - Creating VLANs in a Shared Uplink Set**



**Note:** If the VC domain is not in Expanded VLAN capacity mode, you will receive an error when attempting to create more than 128 VLANs in a SUS. If that occurs, go to Advanced Ethernet Settings and select Expanded VLAN capacity mode and apply.

After clicking apply, a list of VLANs will be presented as shown below. If one VLAN in the trunk is untagged/native, see note below.

- Click Apply at the bottom of the page to create the Shared Uplink Set

**Figure 281 - Associated VLANs for Shared Uplink Set VLAN-Trunk-1**

Network Name	VLAN ID	Native	Smart Link	Private Network	Action
VLAN-101-1	101	false	true	false	Edit
VLAN-102-1	102	false	true	false	Edit
VLAN-103-1	103	false	true	false	Edit
VLAN-104-1	104	false	true	false	Edit
VLAN-105-1	105	false	true	false	Edit
VLAN-106-1	106	false	true	false	Edit
VLAN-107-1	107	false	true	false	Edit
VLAN-108-1	108	false	true	false	Edit
VLAN-109-1	109	false	true	false	Edit
VLAN-110-1	110	false	true	false	Edit
VLAN-111-1	111	false	true	false	Edit
VLAN-112-1	112	false	true	false	Edit
VLAN-113-1	113	false	true	false	Edit
VLAN-114-1	114	false	true	false	Edit
VLAN-115-1	115	false	true	false	Edit
VLAN-116-1	116	false	true	false	Edit
VLAN-117-1	117	false	true	false	Edit
VLAN-118-1	118	false	true	false	Edit
VLAN-119-1	119	false	true	false	Edit
VLAN-120-1	120	false	true	false	Edit
VLAN-121-1	121	false	true	false	Edit
VLAN-122-1	122	false	true	false	Edit
VLAN-123-1	123	false	true	false	Edit
VLAN-124-1	124	false	true	false	Edit

Apply      Cancel

**Note:** Optionally, if one of the VLANs in the trunk to this shared uplink set were configured as Native or Untagged, you would be required to “edit” that VLAN in the screen above, and configure Native as TRUE. This would need to be set for BOTH VLAN-Trunk-1 and VLAN-Trunk-2.

**Figure 282 - You will see that ALL Uplinks are still in a Linked/Standby state**

Shared Uplink Set	Has FCoE	Port Status	Connector Type	Uplink Port	Action
VLAN-Trunk-1	false	Linked-Standby Linked-Standby	40 Gb QSFP+CR4 40 Gb QSFP+CR4	C7K-Bottom: Bay 1: Port Q2.1 C7K-Bottom: Bay 1: Port Q3.1	Edit

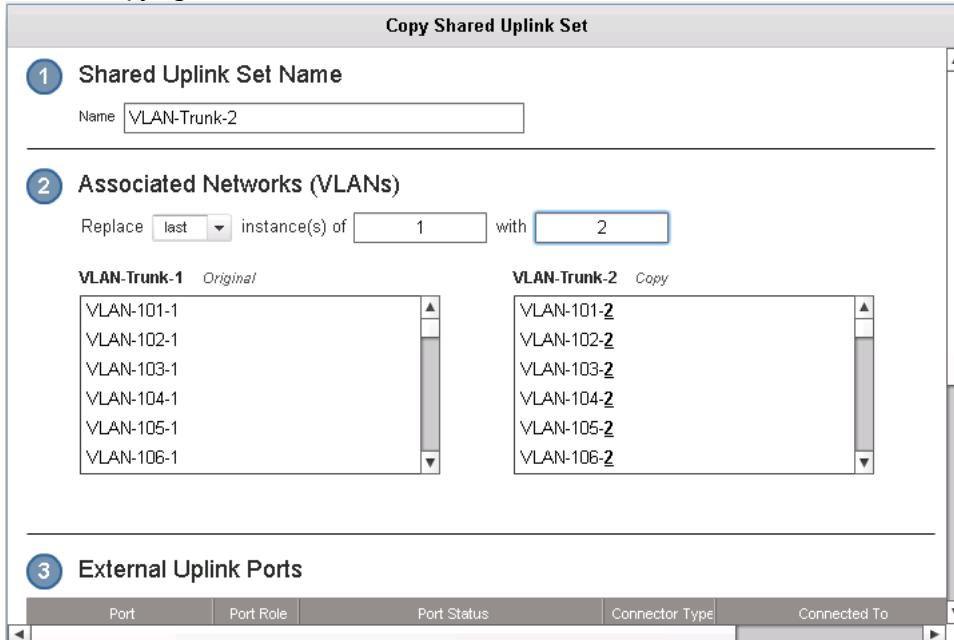
**Note:** That both of the network connections are shown as “Linked/Standby”, this state will NOT change until the network has been assigned to a server profile. This behavior is new within VC 4.30 and is provided to accommodate the new 4096 VLAN feature.

### Defining a new Shared Uplink Set (VLAN-Trunk-2)(Copying a Shared Uplink Set)

The second Shared Uplink Set could be created in the same manner as VLAN-Trunk-1 however; VC now provides the ability to COPY a VC Network or Shared Uplink Set.

- Connect Ports Q2 and Q3 of FlexFabric-20/40 F8 module in Bay 2 to Ports 1 and 2 on switch 2
- In the VC GUI screen, select Shared Uplink Sets in the left pane, in the right pane VLAN-Trunk-1 will be displayed, left click VLAN-Trunk-1, it will appear as blue, right click and select COPY
- Edit the Settings as shown below, the new SUS name will be VLAN-Trunk-2 and ALL the associated VLANs with have a suffix of 2
- In step 3, ADD uplinks Q2 and Q3 from Bay 2
- Click OK
- The SUS and ALL VLANs will be created

**Figure 283 - Copying a SUS and ALL VLANs**



## Defining a new Shared Uplink Set via CLI

The following script can be used to create the first Shared Uplink Set (VLAN-Trunk-1)

*The following command(s) can be copied and pasted into an SSH based CLI session with Virtual Connect*

```
# Create Shared Uplink Set VLAN-Trunk-1 and configure uplinks
```

```
add uplinkset VLAN-Trunk-1
add uplinkport enc0:1:Q2 Uplinkset=VLAN-Trunk-1 speed=auto
add uplinkport enc0:1:Q3 Uplinkset=VLAN-Trunk-1 speed=auto
```

```
# Create Networks VLAN-1001-1 through VLAN-1000-1 and VLAN-2001-1 through VLAN-3000-1 for Shared Uplink Set VLAN-Trunk-1
add network-range -quiet UplinkSet=VLAN-Trunk-1 NamePrefix=VLAN- NameSuffix=-1
VLANIds=101-1000,2101-3000 State=enabled PrefSpeedType=Custom PrefSpeed=11000
MaxSpeedType=Custom MaxSpeed=20000 SmartLink=enabled
```

The following script can be used to create the Second Shared Uplink Set (VLAN-Trunk-2)

```
# Create Shared Uplink Set VLAN-Trunk-2 and configure uplinks
add uplinkset VLAN-Trunk-2
add uplinkport enc0:2:Q2 Uplinkset=VLAN-Trunk-2 speed=auto
add uplinkport enc0:2:Q3 Uplinkset=VLAN-Trunk-2 speed=auto
```

```
# Create Networks VLAN101-2 through VLAN1000-2 and VLAN-2001-2 through VLAN-3000-2 for Shared Uplink Set VLAN-Trunk-2
add network-range -quiet UplinkSet=VLAN-Trunk-2 NamePrefix=VLAN- NameSuffix=-2
VLANIds=101-1000,2101-3000 State=enabled PrefSpeedType=Custom PrefSpeed=11000
MaxSpeedType=Custom MaxSpeed=20000 SmartLink=enabled
```

Please refer to Appendix D; "Scripting the Native VLAN" for scripting examples.

**Note:** In this scenario we have created two independent Share Uplink Sets (SUS), each originating from the opposite FlexFabric-20/40 F8 Modules, by doing so we provide the ability to create separate and redundant connections out of the Virtual Connect domain. When we create the server profiles, you will see how the NICs will connect to VLANs accessed through the opposite VC module, which provides the ability to create an Active / Active uplink scenario. Alternatively, we could have created a single SUS and assigned both sets of these uplink ports to the same SUS, however, this would have provided an Active/Standby uplink scenario, as shown in Scenario 5.

## Defining a new (FCoE) SAN Fabric via GUI

Create a Fabric and name it “FCoE\_A”

- On the Virtual Connect Manager screen, click Define, SAN Fabric to create the first Fabric
- Enter the Network Name of “FCoE\_A”
- Select Add Port, then add the following ports:
  - Enclosure 1, Bay 1, Port X5
  - Enclosure 1, Bay 1, Port X6
- Ensure Fabric Type is set to “FabricAttach”
- Select Show Advanced Settings
  - Select Automatic Login Re-Distribution (FlexFabric Only)
  - Select Set Preferred FCoE Connect Speed
    - Configure for 8Gb
  - Select Set Maximum FCoE Connect Speed
    - Configure for 8Gb
- Select Apply

Create a second Fabric and name it “FCoE\_B”

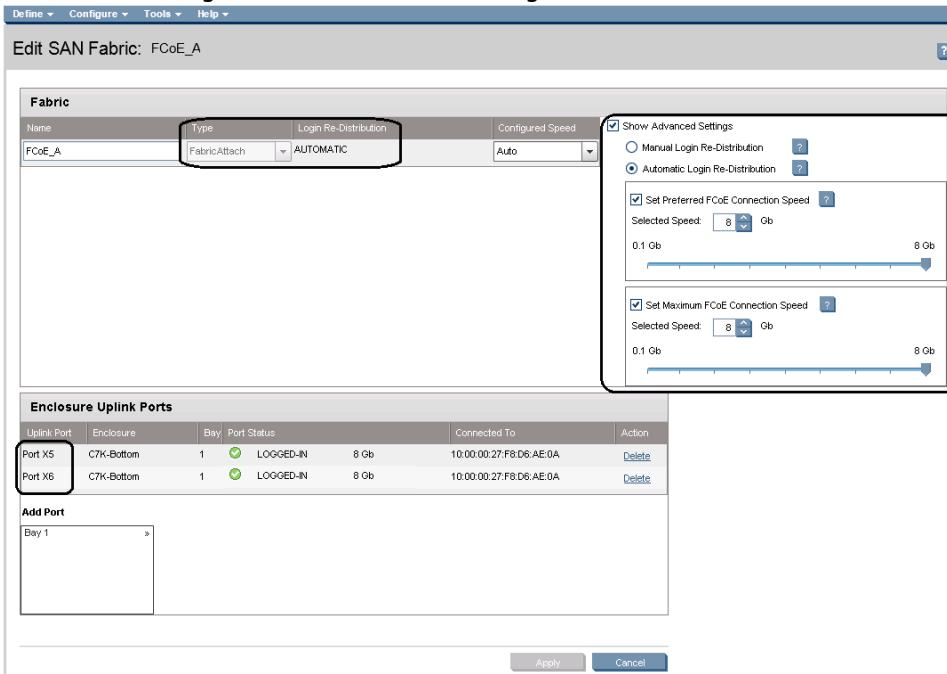
- On the Virtual Connect Manager screen, click Define, SAN Fabric to create the second Fabric
- Enter the Network Name of “FCoE\_B”
- Select Add Port, then add the following ports:
  - Enclosure 1, Bay 2, Port X5
  - Enclosure 1, Bay 2, Port X6
- Ensure Fabric Type is set to “FabricAttach”
- Select Show Advanced Settings
  - Select Automatic Login Re-Distribution (FlexFabric Only)
  - Select Set Preferred FCoE Connect Speed
    - Configure for 8Gb
  - Select Set Maximum FCoE Connect Speed
    - Configure for 8Gb
- Select Apply

## Defining SAN Fabrics via CLI

The following command(s) can be copied and pasted into an SSH based CLI session with Virtual Connect

```
#Create the SAN Fabrics FCoE_A and FCoE_B and configure uplinks as discussed above
add fabric FCoE_A Type=FabricAttach Bay=1 Ports=5,6 Speed=Auto LinkDist=Auto
PrefSpeedType=Custom PrefSpeed=8000 MaxSpeedType=Custom MaxSpeed=8000
add fabric FCoE_B Type=FabricAttach Bay=2 Ports=5,6 Speed=Auto LinkDist=Auto
PrefSpeedType=Custom PrefSpeed=8000 MaxSpeedType=Custom MaxSpeed=8000
```

**Figure 284 - SAN Configuration and Advanced Settings**



**Figure 285 - FCoE SAN fabrics configured with 8Gb uplinks per fabric. Note the bay and port numbers on the right**

SAN Fabrics										
External Connections		Server Connections								
Status	SAN Fabric	Type	Login Re-Distribution	Port Status	Connected To	Enclosure	Bay	Port	Action	
✓	FCoE_A	FabricAttach	AUTOMATIC	✓ LOGGED-IN	8 Gb	10:00:00:27:f8:d6:ae:0a	C7K-Bottom	1 X5	Edit	
✓	FCoE_A	FabricAttach	AUTOMATIC	✓ LOGGED-IN	8 Gb	10:00:00:27:f8:d6:ae:0a	C7K-Bottom	1 X6	Edit	
✓	FCoE_B	FabricAttach	AUTOMATIC	✓ LOGGED-IN	8 Gb	10:00:00:27:f8:d6:8b:9c	C7K-Bottom	2 X5	Edit	
✓	FCoE_B	FabricAttach	AUTOMATIC	✓ LOGGED-IN	8 Gb	10:00:00:27:f8:d6:8b:9c	C7K-Bottom	2 X6	Edit	

## Defining a Server Profile

We will create a server profile with two server NICs.

Each server NIC will connect to a specific network.

- On the main menu, select Define, then Server Profile
- Create a server profile called “App-1”
- Select to “Hide Unused FlexNICs”
- In the Network Port 1 drop down box, select VLAN101-1
- Set the port speed to Custom at 1Gb
- In the Network Port 2 drop down box, select VLAN101-2
- Set the port speed to Custom at 1Gb
- Select ADD network (add two additional network connections)
- In the Network Port 3 drop down box, select Multiple Networks
- Configure for networks VLAN-102-1 through VLAN-105-1 and VLAN-2100-1 through VLAN-2150-1
- Leave the network speed as Auto
- In the Network Port 4 drop down box, select Multiple Networks
- Configure for networks VLAN-102-2 through VLAN-105-2 and VLAN-2100-2 through VLAN-2150-2
- Leave the network speed as Auto
- Expand the FCoE Connections box, for Bay 1, select FCoE\_A for Bay 2, select FCoE\_B
- Set a Port Speed of 8Gb for each FCoE Connection
- Do not configure FC SAN or iSCSI Connection
- In the Assign Profile to Server Bay box, locate the Select Location drop down and select Bay 1, then apply

Prior to applying the profile, ensure that the server in Bay 1 is currently OFF

**Note:** You should now have a server profile assigned to Bay 1, with 4 Server NIC connections. NICs 1&2 should be connected to networks VLAN-101-x, NICs 3&4 should be connected to networks VLAN102-x through VLAN105-x and VLAN-2100-x through VLAN-2150-x. FCoE SAN fabrics are connected to, Port 1 - FCoE\_A and Port 2 - FCoE\_B.

## Defining a Server Profile via CLI

The following command(s) can be copied and pasted into an SSH based CLI session with Virtual Connect

```
# Create Server Profile App-1
add profile App-1 -nodefaultfcconn -nodefaultfcoeconn
set enet-connection App-1 1 pxe=Enabled Network=VLAN-101-1 SpeedType=Custom
Speed=1000
set enet-connection App-1 2 pxe=Disabled Network=VLAN-101-2 SpeedType=Custom
Speed=1000
add enet-connection App-1 3 pxe=Disabled
add server-port-map-range App-1:3 UplinkSet=VLAN-Trunk-1 VLanIds=102-105,2100-2150
add enet-connection App-1 4 pxe=Disabled
add server-port-map-range App-1:4 UplinkSet=VLAN-Trunk-1 VLanIds=102-105,2100-2150
set enet-connection App-1 3 SpeedType=Preferred
set enet-connection App-1 4 SpeedType=Preferred
add fcoe-connection App-1 Fabric=FCoE_A SpeedType=8Gb
add fcoe-connection App-1 Fabric=FCoE_B SpeedType=8Gb
poweroff server 1
assign profile App-1 enc0:1
```

**Note:** The “add server-port-map-range” command is new to VC firmware release 3.30 and can be used to map many VLANs to a server NIC, in a single command. Prior releases would have required one command to create the NIC and one additional command per VLAN mapping added

**Note:** The speed of the NIC and SAN connections, as well as the MAC and WWN. Also, note that the FCoE connections are assigned to the two SAN fabrics created earlier and use ports LOM:1-b and LOM:2-b.

**Figure 286 - Define a Server Profile (App-1) Hyper-V Host**

The screenshot shows the 'Edit Server Profile: App-1' window. At the top, there's a 'Profile' section with a 'Profile Name' dropdown set to 'App-1'. Below it is the 'Ethernet Adapter Connections' table:

Port	Network Name	Status	Port Speed Type	Allocated Port Sp...	PXE	Multicast Filter	MAC	Mapping	Action
1	VLAN-101-1	<input checked="" type="checkbox"/>	CUSTOM...	1 Gb - 20 Gb	ENABLED	None	00-17-A4-77-4C-00	LOM1:1-a => Bay 1:d1:v1	<a href="#">Delete</a>
2	VLAN-101-2	<input checked="" type="checkbox"/>	CUSTOM...	1 Gb - 20 Gb	DISABLED	None	00-17-A4-77-4C-02	LOM1:2-a => Bay 2:d1:v1	<a href="#">Delete</a>
3	Multiple Networks...	<input checked="" type="checkbox"/>	PREFERRED	11 Gb - 20 Gb	DISABLED	None	00-17-A4-77-4C-04	LOM1:1-c => Bay 1:d1:v3	<a href="#">Delete</a>
4	Multiple Networks...	<input checked="" type="checkbox"/>	PREFERRED	11 Gb - 20 Gb	DISABLED	None	00-17-A4-77-4C-06	LOM1:2-c => Bay 2:d1:v3	<a href="#">Delete</a>

Below this is the 'iSCSI HBA Connections' section, which is currently empty. Then comes the 'FCoE HBA Connections' section:

Port	Connected To	FC SAN / FCoE Network Nr	Type	Status	Port Speed Type	Allocated Port Sp...	VWN/N	MAC	Mapping	Action
1	Bay 1	FCoE_A	SAN	<input checked="" type="checkbox"/>	8	8 Gb - 8 Gb	50:06:0B:00:00:C2:AE:00	00-17-A4-77-4C-08	LOM1:1-b => Bay 1:d1:v2	<a href="#">Delete</a>
2	Bay 2	FCoE_B	SAN	<input checked="" type="checkbox"/>	8	8 Gb - 8 Gb	50:06:0B:00:00:C2:AE:02	00-17-A4-77-4C-09	LOM1:2-b => Bay 2:d1:v2	<a href="#">Delete</a>

At the bottom, there's an 'Assign Profile to Server Bay' section:

Enclosure	Server	Model	SN	Status	Power	LID
CTK-Bottom	Bay 1	Proliant BL460c Gen8	MXQ42401GO	<input checked="" type="checkbox"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>

Buttons at the bottom right include 'Apply', 'Apply & Close', and 'Cancel'.

**Figure 287 - Configure NICs 3 and 4 for multiple Networks and select the appropriate VLANs**

The screenshot shows the 'Edit Server Profile: App-1' window with the 'Ethernet Adapter Connections' tab selected. In the 'Server VLAN Tag to vNet Mappings' section, there's a table of networks not mapped:

vNet Name	Status	Uplink VLAN Id	Server VLAN Id	Untagged
VLAN-100-1	<input checked="" type="checkbox"/>	102	102	<input type="checkbox"/>
VLAN-100-2	<input checked="" type="checkbox"/>	103	103	<input type="checkbox"/>
VLAN-101-1	<input checked="" type="checkbox"/>	104	104	<input type="checkbox"/>
VLAN-101-2	<input checked="" type="checkbox"/>	105	105	<input type="checkbox"/>
VLAN-102-2	<input checked="" type="checkbox"/>	2100	2100	<input type="checkbox"/>
VLAN-103-2	<input checked="" type="checkbox"/>	2101	2101	<input type="checkbox"/>
VLAN-104-2	<input checked="" type="checkbox"/>	2102	2102	<input type="checkbox"/>
VLAN-105-2	<input checked="" type="checkbox"/>	2103	2103	<input type="checkbox"/>

On the right, there's a larger table titled 'Networks in mapping (55 mapped; limit is 162)' with columns: vNet Name, Status, Uplink VLAN Id, Server VLAN Id, and Untagged. Several rows are highlighted with a red box, including:

vNet Name	Status	Uplink VLAN Id	Server VLAN Id	Untagged
VLAN-102-1	<input checked="" type="checkbox"/>	102	102	<input type="checkbox"/>
VLAN-103-1	<input checked="" type="checkbox"/>	103	103	<input type="checkbox"/>
VLAN-104-1	<input checked="" type="checkbox"/>	104	104	<input type="checkbox"/>
VLAN-105-1	<input checked="" type="checkbox"/>	105	105	<input type="checkbox"/>
VLAN-2100-1	<input checked="" type="checkbox"/>	2100	2100	<input type="checkbox"/>
VLAN-2101-1	<input checked="" type="checkbox"/>	2101	2101	<input type="checkbox"/>
VLAN-2102-1	<input checked="" type="checkbox"/>	2102	2102	<input type="checkbox"/>
VLAN-2103-1	<input checked="" type="checkbox"/>	2103	2103	<input type="checkbox"/>
VLAN-2104-1	<input checked="" type="checkbox"/>	2104	2104	<input type="checkbox"/>

**Note:** "Server VLAN ID" and "Untagged" boxes can be edited. One network per port could be marked as "Untagged", in which case the server would not be configured for tagging on that VLAN. It is also possible to change the VLAN ID that is presented to the server (VLAN translation), in which case the communications between Virtual Connect and the network would be the VLAN ID in grey, if the Server VLAN ID box to the right were changed, VC would communicate with the server on the new VLAN ID, providing a VLAN translation function. VLAN translation could be a very useful feature, in the event that VLAN renumbering is required within the datacenter. The network VLAN numbers and Shared Uplink Set configurations could be changed to reflect the new VLAN IDs used, however, the old VLAN IDs could still be presented to the server providing the ability to delay or eliminate the need to change the VLAN ID used within the server/vSwitch.

**Figure 288 - Server Profile View Bay 1**

The screenshot shows the 'Server Profile View Bay 1' interface with the following sections:

- Device Bay Status - Bay # 1:**

Overall Status:	OK
Hardware Status:	Normal
VC Status:	OK
Assigned Server Profile:	App-1
Enclosure Name:	C7K-Bottom
UID:	[button]
Power Status/Control:	Off

**Momentary Press** button is visible.
- Blade Server Information - Bay # 1:**

Serial Number:	MXQ42401QG
Serial Number (Logical):	
UUID:	30343237-3638-584D-5134-323430315147
UUID (Logical):	
Product Name:	ProLiant BL460c Gen8
Server Name:	APP-1
Part Number:	724086-B21
Asset Tag:	[Unknown]
- Server Ethernet Adapter Information:**

Ethernet Adapter	Flex NIC	Location	Module Port	Model	MAC Address	Network	WWN	SAN Fabric
<b>Port 1</b>								
LOM1:1- a	FLB1	Bay 1:d1:v1	HP FlexFabric 20Gb 2-port 630FLB Adapter	00-17-A4-77-4C-00	VLAN-101-1			
LOM1:1- b	FLB1	Bay 1:d1:v2	HP FlexFabric 20Gb 2-port 630FLB Adapter	00-17-A4-77-4C-08		50:06:0B:00:00:C2:AE:00	FCoE_A	
LOM1:1- c	FLB1	Bay 1:d1:v3	HP FlexFabric 20Gb 2-port 630FLB Adapter	00-17-A4-77-4C-04	Multiple Networks			
LOM1:1- d	FLB1	Bay 1:d1:v4	HP FlexFabric 20Gb 2-port 630FLB Adapter	B4-B5-2F-39-85-0B				
<b>Port 2</b>								
LOM1:2- a	FLB1	Bay 2:d1:v1	HP FlexFabric 20Gb 2-port 630FLB Adapter	00-17-A4-77-4C-02	VLAN-101-2			
LOM1:2- b	FLB1	Bay 2:d1:v2	HP FlexFabric 20Gb 2-port 630FLB Adapter	00-17-A4-77-4C-09		50:06:0B:00:00:C2:AE:02	FCoE_B	
LOM1:2- c	FLB1	Bay 2:d1:v3	HP FlexFabric 20Gb 2-port 630FLB Adapter	00-17-A4-77-4C-06	Multiple Networks			
LOM1:2- d	FLB1	Bay 2:d1:v4	HP FlexFabric 20Gb 2-port 630FLB Adapter	B4-B5-2F-39-85-0F				

**Figure 289** - By clicking on the “Multiple Networks” statement for each LOM, the following page is displayed, which lists the VLAN connections for this port.

The screenshot shows a Microsoft Internet Explorer window titled "Multiple Networks - Internet Explorer". The main title bar of the window says "HP Virtual Connect Manager". The content area displays a table titled "Multiple Networks" with two columns: "No." and "Network Name". The "No." column contains numbers from 1 to 30, and the "Network Name" column contains entries such as "VLAN-102-1", "VLAN-103-1", up to "VLAN-2125-1". The "VLAN ID" column is on the far right, showing values corresponding to the network names. A vertical scroll bar is visible on the right side of the table.

No.	Network Name	VLAN ID
1	VLAN-102-1	102
2	VLAN-103-1	103
3	VLAN-104-1	104
4	VLAN-105-1	105
5	VLAN-2100-1	2100
6	VLAN-2101-1	2101
7	VLAN-2102-1	2102
8	VLAN-2103-1	2103
9	VLAN-2104-1	2104
10	VLAN-2105-1	2105
11	VLAN-2106-1	2106
12	VLAN-2107-1	2107
13	VLAN-2108-1	2108
14	VLAN-2109-1	2109
15	VLAN-2110-1	2110
16	VLAN-2111-1	2111
17	VLAN-2112-1	2112
18	VLAN-2113-1	2113
19	VLAN-2114-1	2114
20	VLAN-2115-1	2115
21	VLAN-2116-1	2116
22	VLAN-2117-1	2117
23	VLAN-2118-1	2118
24	VLAN-2119-1	2119
25	VLAN-2120-1	2120
26	VLAN-2121-1	2121
27	VLAN-2122-1	2122
28	VLAN-2123-1	2123
29	VLAN-2124-1	2124
30	VLAN-2125-1	2125

## Verify Network Link State

As discussed earlier in this document, in Virtual connect 4.30 there was a change to the link state behavior when a network as no connections to a server profile. Once a connection is made to the server profile, the uplinks will become Active, as previously expected.

**Figure 290 - All Links now appear in a Linked/Active state.**

The screenshot shows the 'Shared Uplink Sets' interface in HP Virtual Connect. It displays two entries: 'VLAN-Trunk-1' and 'VLAN-Trunk-2'. Each entry has four ports listed under 'Port Status', all of which are marked as 'Linked-Active'. The columns include 'Shared Uplink Set', 'Has FCoE', 'Port Status', 'Connector Type', 'Uplink Port', and 'Action'. The 'Port Status' column for both entries shows four green checkmarks next to 'Linked-Active'.

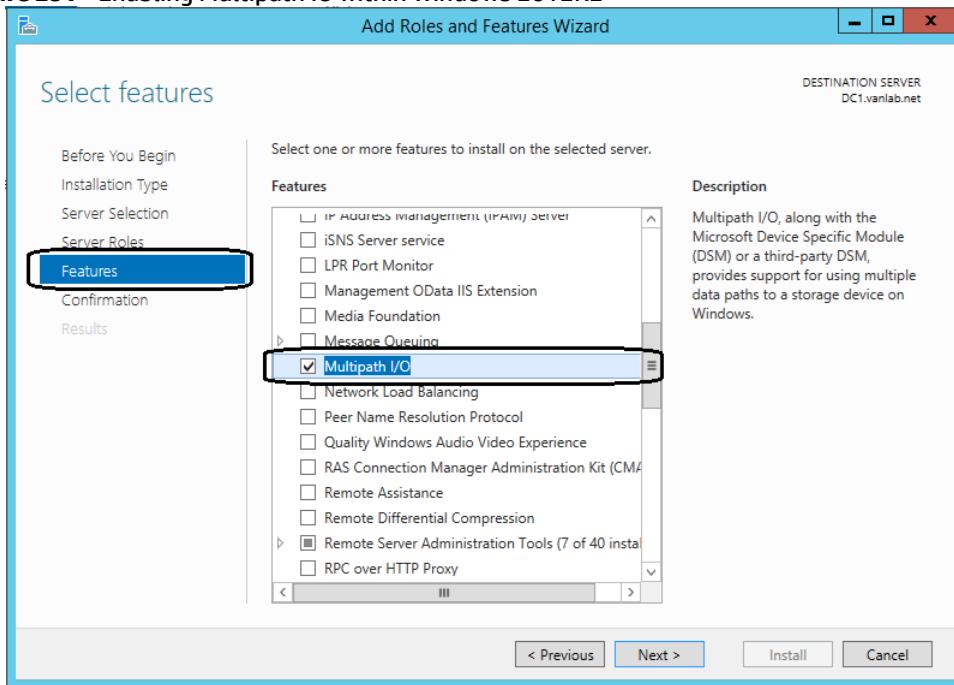
## Enabling MPIO on Windows 2012 R2

Once the OS is installed, you will be required to enable the Multi-Path IO (MPIO) feature within Windows 2012 R2 and install the MPIO software for your SAN, you can then enable the additional SAN paths to the server/storage.

**Note:** Please refer to the FC Cookbook for HP Virtual Connect for additional details on Fibre Channel Connectivity.

<http://bizsupport1.austin.hp.com/bc/docs/support/SupportManual/c01702940/c01702940.pdf>

**Figure 291 - Enabling Multipath IO within Windows 2012R2**



# Review

In this scenario we have created Two Shared Uplink Sets (SUS), providing support for many VLANs. Uplinks originating from each FlexFabric-20/40 F8 Module connect to each SUS, by doing so we provide redundant connections out of the Virtual Connect domain. As multiple uplinks are used for each SUS, we have also leveraged LACP to improve uplink performance. In this scenario, all uplinks will be active. We also create two FCoE SAN Fabrics.

We created a server profile, with FOUR NICs. Two connected to the same VLAN (101), Port 1 connects to VLAN-101-1 and Port 2 connects to VLAN-101-2, which provides the ability to sustain a link or module failure and not lose connection to the network. VLAN-101-1 and VLAN-101-2 are configured to support VLAN 101, frames will be presented to the NIC(s) without VLAN tags (untagged), these two NICs are connected to the same VLAN, but taking a different path out of the enclosure.

Network Ports 3 and 4 were added, these NICs will be connected to “Multiple Networks” and each NIC will then be configured for networks VLAN-102-x through VLAN-105-x and networks VLAN-2100-x through VLAN-2150-x. As these networks are tagging, frames will be presented to the server with VLAN tags. NICs 3 and 4 will be teamed and connected to a Hyper-V virtual switch. VLAN tagged frames for these networks will be forwarded to the Virtual switch and then passed on to the appropriate Virtual Machine, VLAN tags will be removed as the frames are passed to the virtual machine. NICs 3 and 4 had their speed set to Auto, as NICs 1 and 2 were set to 1Gb, NICs 3 and 4 received 11Gb of bandwidth. As the networks had a maximum speed configured for 20Gb, the maximum speed for all NICs is 20Gb.

Additionally, FCoE port 1 is connected to SAN fabric FCoE\_A and FCoE SAN port 2 is connected to SAN Fabric FCoE\_B, providing a multi-pathed connection to the SAN. FCoE SAN speed is configured to 8Gb.

The FCoE SAN fabric connects to each SAN fabric over a pair of uplinks per module. SAN logins are distributed across the multiple paths.

## Results – Windows 2012 R2 Networking Examples

We have successfully configured FlexFabric with a shared uplink set and redundant SAN fabrics. We have created a server profile to connect the TWO NICs to VLAN 101 and the SAN fabrics using the FCoE connections created within the profile.

Although both Ethernet and Fibre channel connectivity is provided by the FlexFabric Adapter used in the G7 through Gen 9 servers; each capability (LAN and SAN) is provided by a different component of the adapter, they appear in the server as individual network and SAN adapters.

The following graphics show a Windows 2012 R2 server with FOUR FlexNICs two configured at 1Gb and two configured at 11Gb, with a maximum configured speed of 20Gb. You will also notice that Windows believes there are only 4 NICs within this server as we have configured the profile to hide the unused FlexNICs, the extra NICs are offline and could later be added to the profile, if needed. If we did not require SAN connectivity on this server, the FCoE connections could be deleted and the server would then have 8 NIC ports available to the OS.

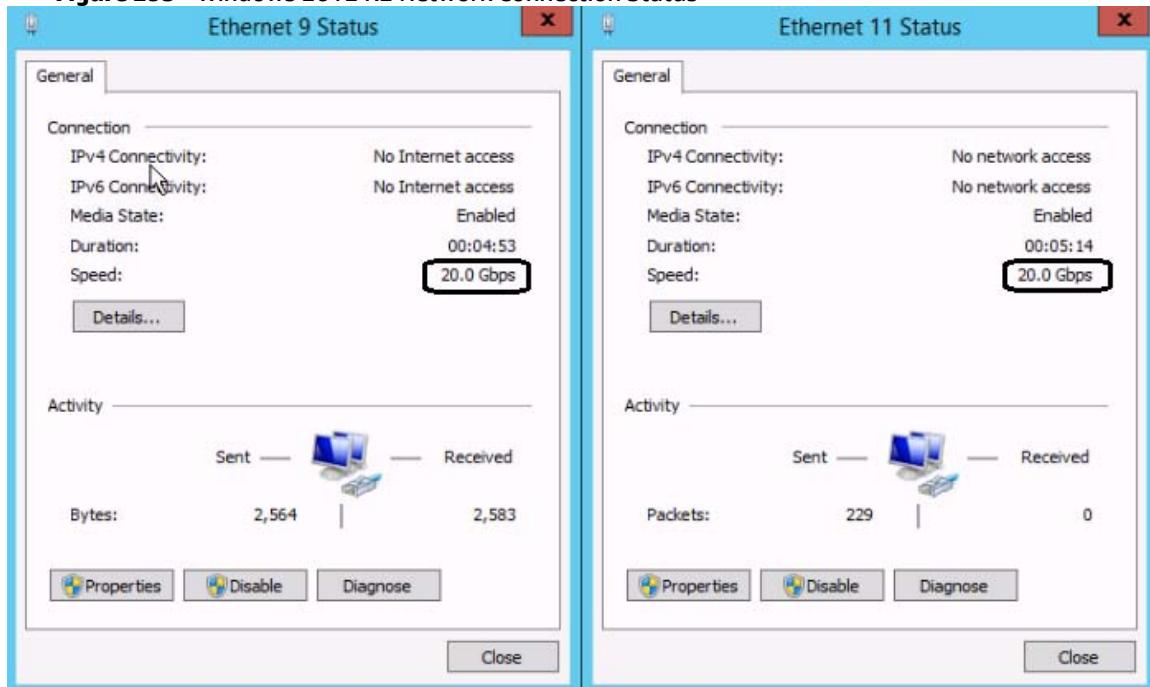
**Note:** The BL465c G7 and BL685c G7 utilize an NC551i chipset (BE2), whereas the BL460c G7, BL620c G7 and BL680c G7 utilize an NC553i chipset (BE3) and the Gen 8 blades typically have a NC554 adapter which also utilizes the BE3 chipset. Both the BE2 and BE3 chipsets share common drivers and firmware. Gen 8 Blade servers are provided with a “FlexLOM” which is a removal integrated Network adapter. This provides flexibility in NIC choice. The 554FLB is a B3 based chipset NIC, the 534FLB is a Broadcom based 10Gb NIC or the newer 20Gb adapters, such as the 630FLB shown below.

**Figure 292 - Windows 2012 R2 Network Connections (4 Connections Active)**

Name	Status	Device Name	Network Category	Connectivity
Ethernet 10	Identifying...	HP FlexFabric 20Gb 2-port 630FLB Adapter #114	Public network	No network access
Ethernet 11	Identifying...	HP FlexFabric 20Gb 2-port 630FLB Adapter #115	Public network	No network access
Ethernet 8	vanlab.net	HP FlexFabric 20Gb 2-port 630FLB Adapter #110	Public network	No Internet access
Ethernet 9	vanlab.net	HP FlexFabric 20Gb 2-port 630FLB Adapter #113	Public network	No Internet access

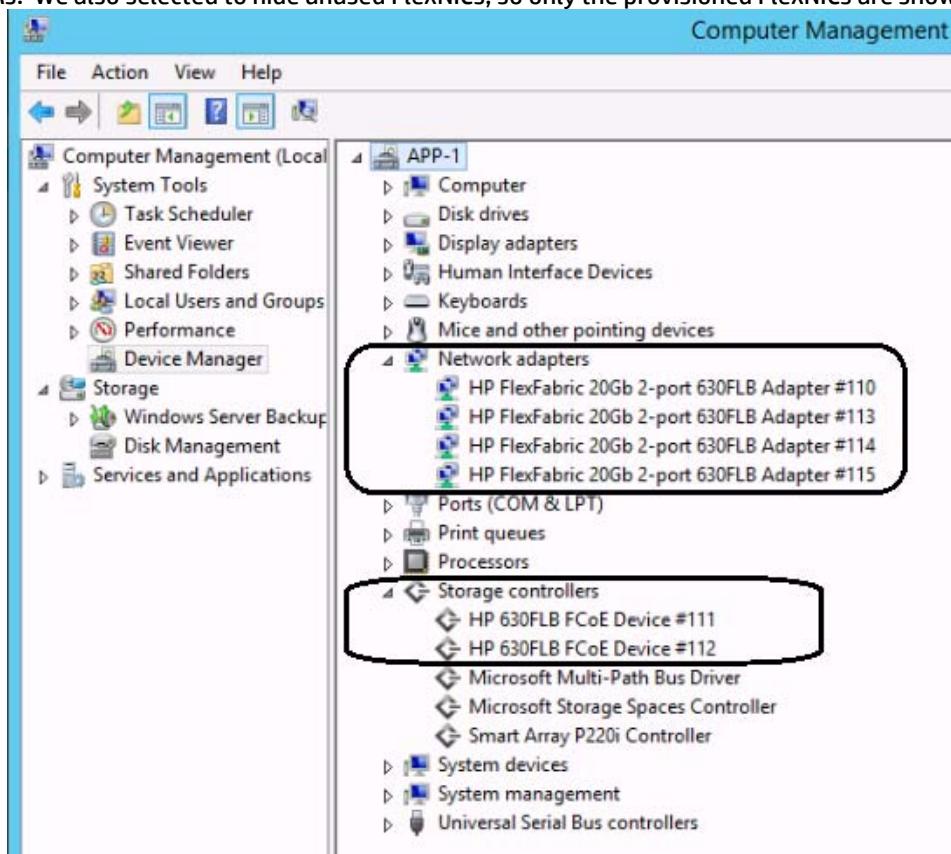
**Note:** If you are familiar with Virtual Connect Flex-10 technology, you will notice not all NICs were presented, and only the configured NICs are displayed. This is because we selected the new feature to hide unused FlexNICs.

**Figure 293 - Windows 2012 R2 Network Connection Status**



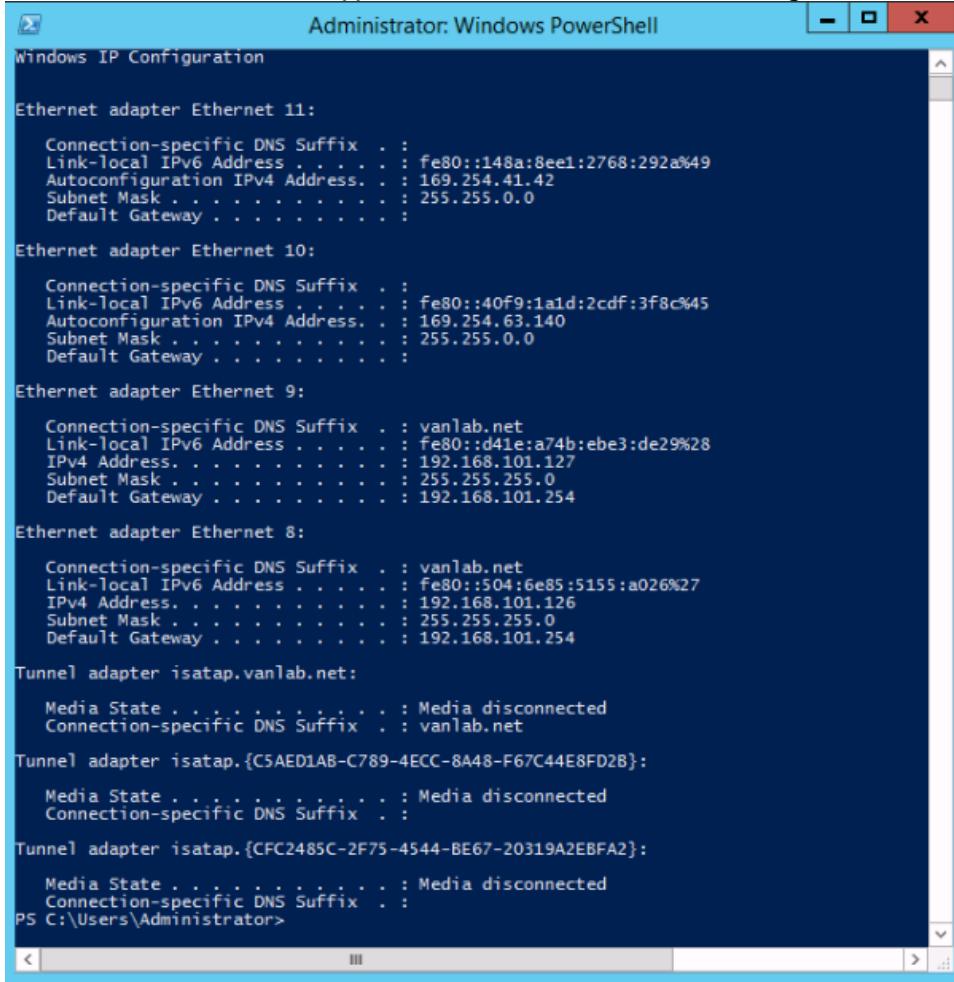
**Note:** As of Windows 2008 and later the actual NIC speed is displayed as configured in server Profile. Also, note that the speed displayed is the maximum speed setting, not the minimum setting.

**Figure 294 - Windows 2012 R2, Device Manager**, we have only configured two of the NICs and two FCoE HBAs. We also selected to hide unused FlexNICs, so only the provisioned FlexNICs are shown



The following graphics provides an example of a Windows 2012 R2 server with FOUR NICs connected to the network, initially each NIC has its own TCP/IP address, alternatively, both NICs could be teamed to provide NIC fail-over redundancy. If an active uplink, network switch or Virtual Connect FlexFabric module were to fail, the server's NIC teaming software would see one of the NICs go offline, assuming it was the active NIC, NIC teaming would fail-over to the standby NIC.

**Figure 295 - Both NICs for Profile App-1 are connected to the network through VLAN-101-x**



```

Administrator: Windows PowerShell
Windows IP Configuration

Ethernet adapter Ethernet 11:
  Connection-specific DNS Suffix . . . . . fe80::148a:8ee1:2768:292a%49
  Link-local IPv6 Address . . . . . fe80::148a:8ee1:2768:292a%49
  Autoconfiguration IPv4 Address . . . . . 169.254.41.42
  Subnet Mask . . . . . 255.255.0.0
  Default Gateway . . . . .

Ethernet adapter Ethernet 10:
  Connection-specific DNS Suffix . . . . . fe80::40f9:1a1d:2cdf:3f8c%45
  Link-local IPv6 Address . . . . . fe80::40f9:1a1d:2cdf:3f8c%45
  Autoconfiguration IPv4 Address . . . . . 169.254.63.140
  Subnet Mask . . . . . 255.255.0.0
  Default Gateway . . . . .

Ethernet adapter Ethernet 9:
  Connection-specific DNS Suffix . . . . . vanlab.net
  Link-local IPv6 Address . . . . . fe80::d41e:a74b:eb3:de29%28
  IPv4 Address . . . . . 192.168.101.127
  Subnet Mask . . . . . 255.255.255.0
  Default Gateway . . . . . 192.168.101.254

Ethernet adapter Ethernet 8:
  Connection-specific DNS Suffix . . . . . vanlab.net
  Link-local IPv6 Address . . . . . fe80::504:6e85:5155:a026%27
  IPv4 Address . . . . . 192.168.101.126
  Subnet Mask . . . . . 255.255.255.0
  Default Gateway . . . . . 192.168.101.254

Tunnel adapter isatap.vanlab.net:
  Media State . . . . . : Media disconnected
  Connection-specific DNS Suffix . . . . . vanlab.net

Tunnel adapter isatap.{C5AED1AB-C789-4ECC-8A48-F67C44E8FD2B}:
  Media State . . . . . : Media disconnected
  Connection-specific DNS Suffix . . . . .

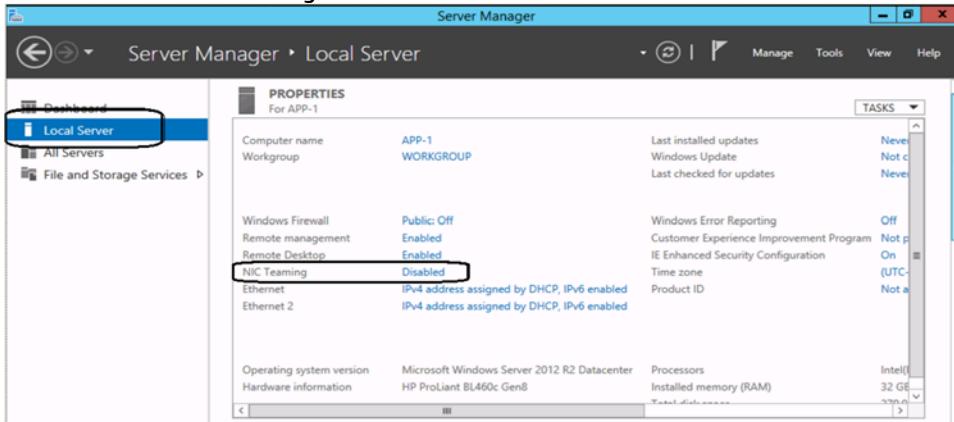
Tunnel adapter isatap.{CFC2485C-2F75-4544-BE67-20319A2EBFA2}:
  Media State . . . . . : Media disconnected
  Connection-specific DNS Suffix . . . . .
PS C:\Users\Administrator>

```

## NIC Teaming

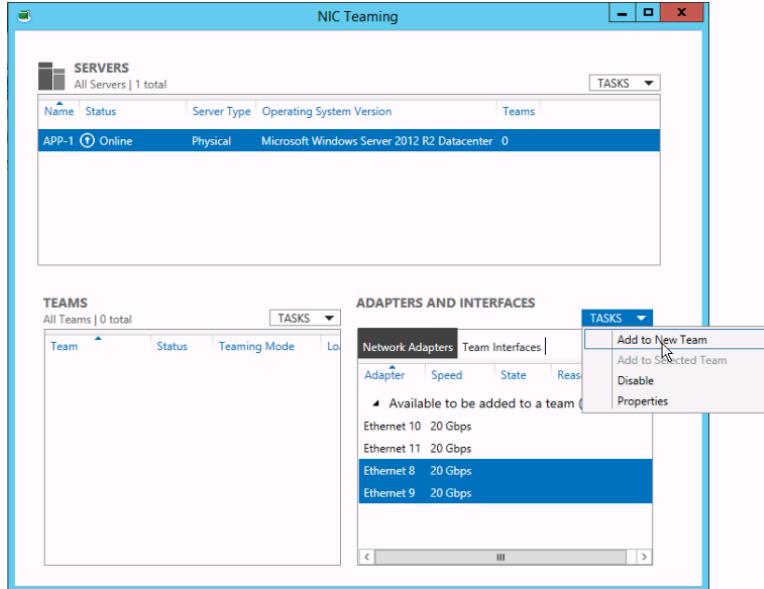
If higher availability is desired, NIC teaming in Virtual Connect works the same way as in standard network configurations. NIC Teaming is now provided as part of the Windows 2012 R2 OS. To configure NIC Teaming in windows 2012 R2, open Server Manager, select Local Server and click on “Disabled” to the right of NIC Teaming.

**Figure 296 - Enable NIC Teaming**



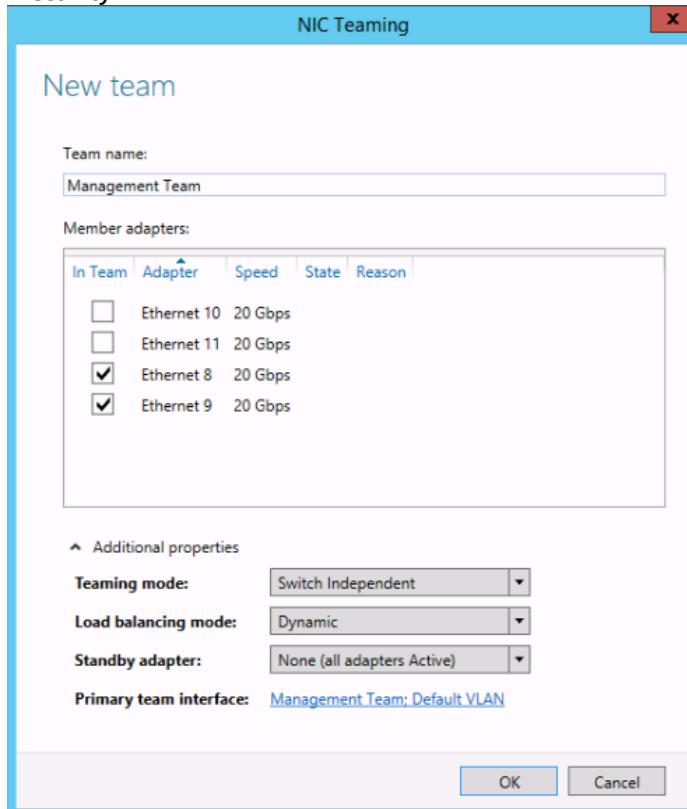
In the bottom right pane of the NIC teaming utility, highlight the two NICs you want to team and Click Tasks, then select “Add to team”.

**Figure 297 - Create the NIC Team**

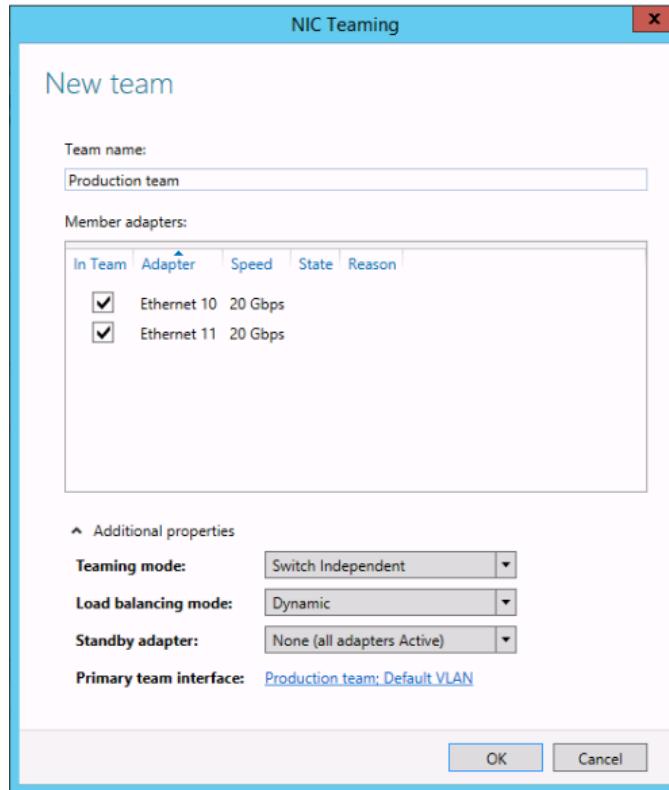


In the bottom right pane of the NIC teaming utility, highlight the two NICs you want to team and Click Tasks, then select “Add to team”. In the New Team configuration Box, provide a name for the Team and Click OK.

**Figure 298 - Provide a name for the Team and Click OK – This Team will connect to VLAN-101 to provide management connectivity**

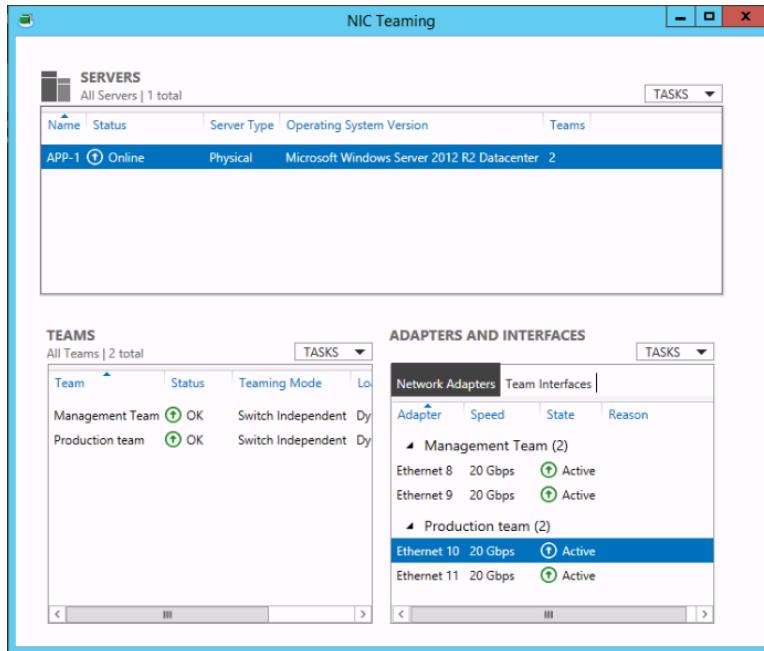


**Figure 299** - Provide a name for the Team and click OK - This Team is connected to Multiple Networks, which will support the Virtual Machines



**Note:** You can select the Additional properties drop down and alter the Teaming Mode, the default mode of "Switch Independent" is supported with Virtual Connect, however, Static Teaming and LACP modes are not supported. You can also select Load Balancing and adapter standby modes.

**Figure 300** - NIC Team has been established and both links show as active



**Figure 301** – Two NICs are teamed for Production and two NICs are teamed for Management. The Management Team was able to obtain an IP address, however, the production Team has only tagged VLANs, it will not obtain an IP from DHCP

```

Administrator: Windows PowerShell
PS C:\Users\Administrator> ipconfig

Windows IP Configuration

Ethernet adapter Production team:
  Connection-specific DNS Suffix . . . . . : fe80::852c:99b:f4c9:d8%48
  Link-local IPv6 Address . . . . . : fe80::88a7:7ad7:5574:33c6%38
  Autoconfiguration IPv4 Address . . . . . : 169.254.13.137
  Subnet Mask . . . . . : 255.255.0.0
  Default Gateway . . . . . :

Ethernet adapter Management Team:
  Connection-specific DNS Suffix . . . . . : vanlab.net
  Link-local IPv6 Address . . . . . : fe80::88a7:7ad7:5574:33c6%38
  IPv4 Address . . . . . : 192.168.101.127
  Subnet Mask . . . . . : 255.255.255.0
  Default Gateway . . . . . : 192.168.101.254

Tunnel adapter isatap.vanlab.net:
  Media State . . . . . : Media disconnected
  Connection-specific DNS Suffix . . . . . : vanlab.net

Tunnel adapter isatap.{10F25A04-87C0-4B05-BE4D-9F705CE7B612}:
  Media State . . . . . : Media disconnected
  Connection-specific DNS Suffix . . . . . : vanlab.net
PS C:\Users\Administrator>

```

## Configuring Hyper-V Virtual Network

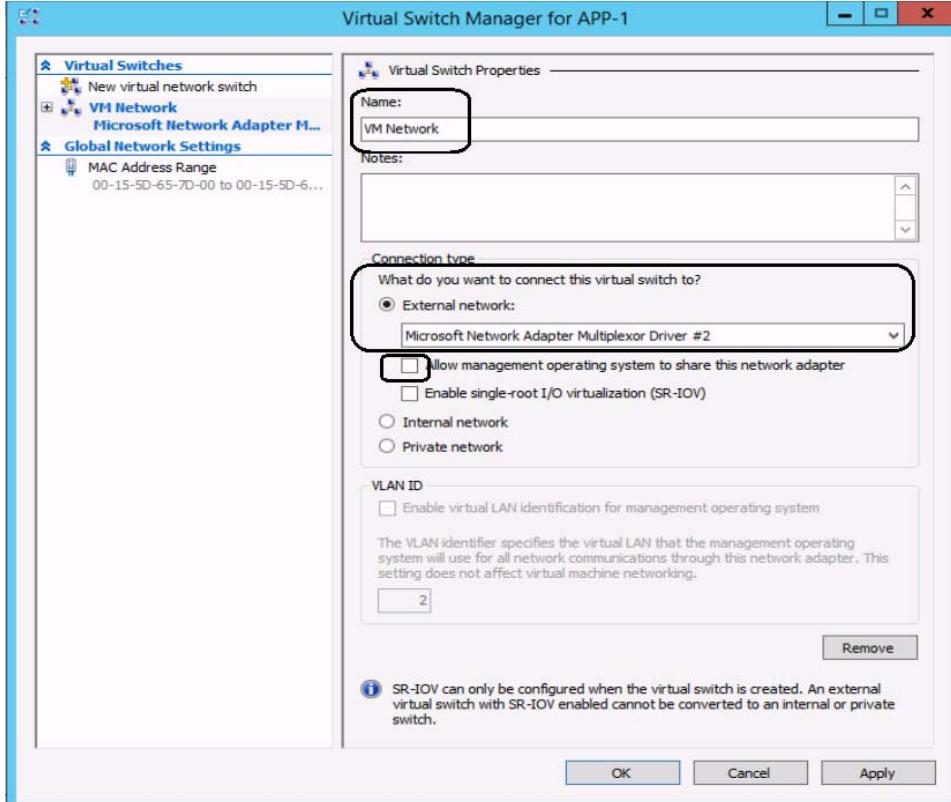
On the Windows 2012 R2 server, verify that the Hyper-V role has been added. Open the Hyper-V manager console in Window 2012 R2 and click on Virtual Network Manager. Select New Virtual Network, in the create Virtual Network box, select “External” and click ADD.

**Figure 302** – Create a new virtual network (step 1)



Create the Virtual network for the guest Virtual Machines. Name the virtual network as “VM Network”, select (in this instant) Multiplexor Driver #2, which is the Team we created early that will support the Product VLANs (which Virtual Connect is configured for VLAN tagging on VLANs 102-105 and 2100-2150). Optionally, if this network will not be used to manage the host, de-select Allow management operating system to share this network adapter. Click apply to create the virtual network, a warning box will appear and the network adapter may reset as the virtual network is created.

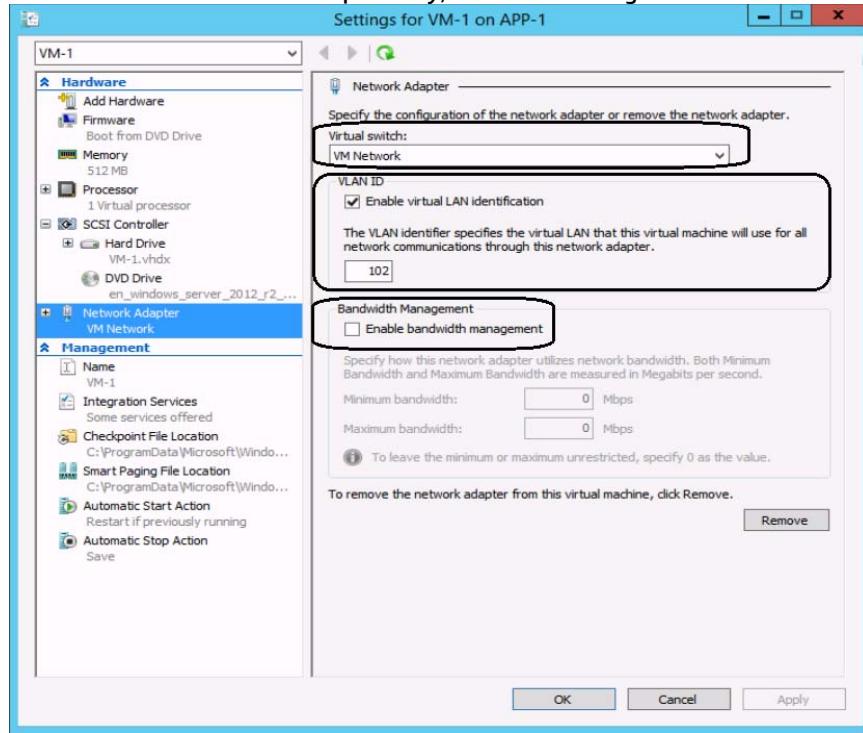
**Figure 303 - Create the virtual network (step 2)**



## Creating a Virtual Machine and connecting to the virtual network

Click “NEW” in the Hyper-V manager and select Virtual Machine to create a new virtual machine. In the Virtual Machine settings box, click on the network adapter and configure it to use the VM Network created earlier, click on “enable virtual LAN identification” and input the VLAN ID 102. This system will then be connected to VLAN 102, click OK to apply the settings. The next step will be to install an operating system in the virtual machine and then test network connectivity.

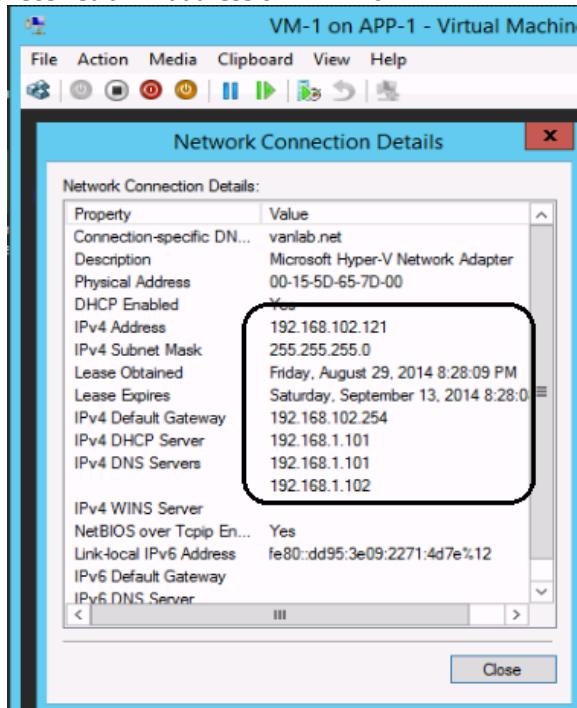
**Figure 304 - Configure the virtual machine to use the new vSwitch that was created earlier, also, select VLAN ID and enter 102 for VLAN 102. Optionally, select and configure Bandwidth Management**



## Testing VM connectivity

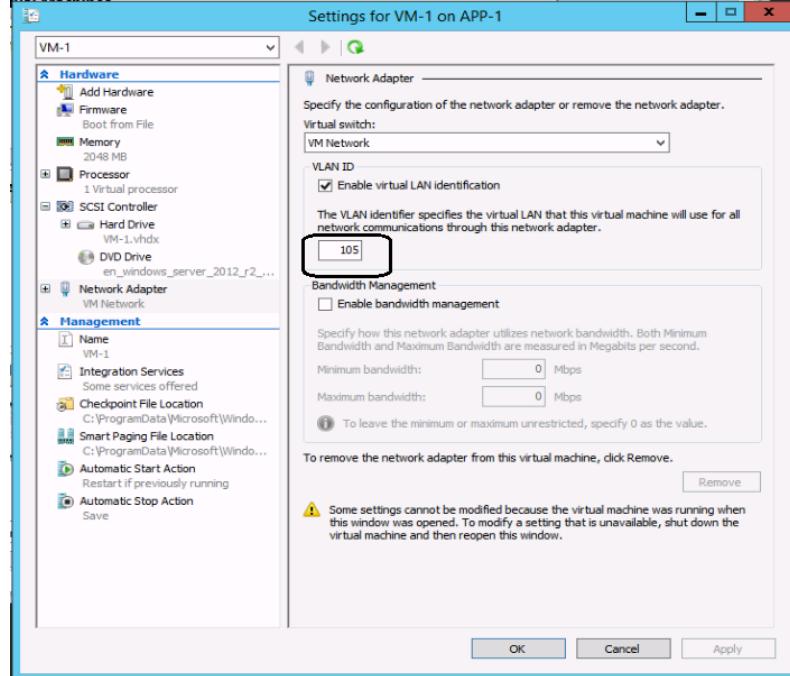
After installing Windows 2012 R2 onto the VM, we can move the VM from VLAN 102 to any other VLAN that is presented to the server via Team #2, by simply changing the VM ID that is configured on the Network Adapter within the VM Settings page.

**Figure 305 – VM1 has received an IP address on VLAN 102**

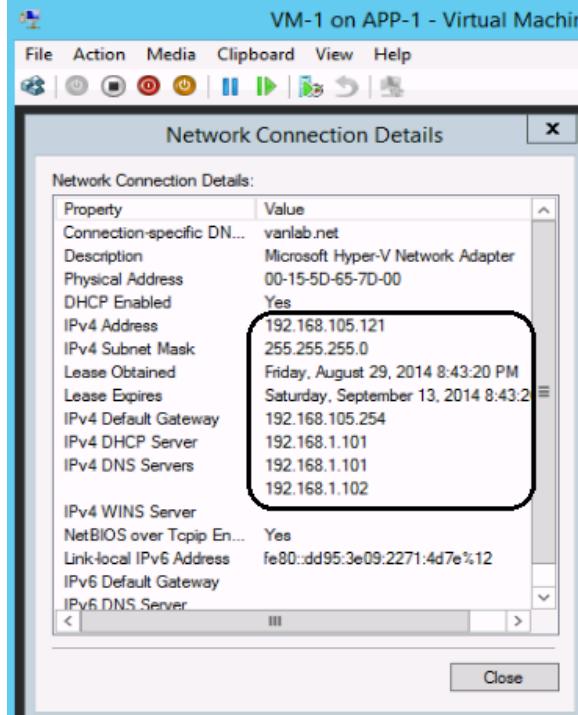


By simply changing the VLAN ID indicated in the Settings of the Network Adapter for this VM, we can change the VLAN that this VM connects to.

**Figure 306** – Move VM1 to VLAN 105 by changing the VLAN ID used for this VM.



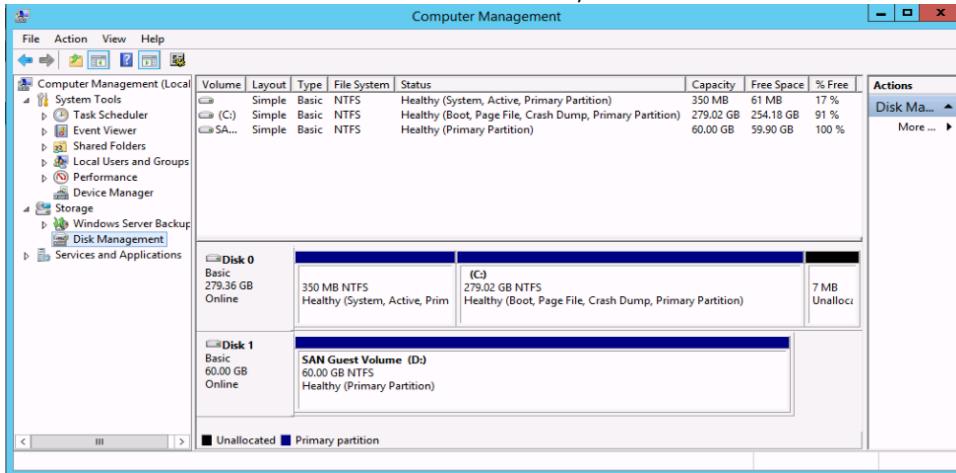
**Figure 307** – VM1 has now received an IP address on VLAN 105.



## Results – Windows 2012 R2 SAN Connectivity

Before attaching the storage LUNs to the server profile, make sure the MPIO feature is installed and configured with the windows operating system and the MPIO software for your SAN is also installed. Also make sure that you have enabled ALL the SAN fabric Zones for this server, to ensure proper SAN connectivity fail-over.

**Figure 308 - Windows 2012 R2 Disk Administrator.** Note; that D: is the SAN attached volume



## Summary

We presented a Virtual Connect Network and SAN scenario by creating two shared uplink sets (SUS), each SUS is connected with TWO active uplinks; both SUS' can actively pass traffic. We included a dual path SAN fabric for storage connectivity.

When VC profile App-1 is applied to the server in bay1 and the server is powered up, it has one NIC connected through the FlexFabric-20/40 F8 module 1 in Bay 1 (connected to VLAN-101-1), the second NIC is connected through the FlexFabric-20/40 F8 module in Bay 2 (connected to VLAN-101-2). Each NIC is configured at 1Gb with a Maximum of 20Gb. These NICs are teamed (Team #1) and will be used to manage the Hyper-v host. Either NIC or path could be active. The second pair of NICs is also teamed (Team #2) and the team is configured in promiscuous mode to support multiple tagged VLANs (102-105 and 2100-2150). Each of these NICs is configured for 11Gb with a maximum of 20Gb. Either NIC could be active. As a result, this server could access the network through either NIC or either uplink, depending on which NIC is active at the time. This host is also configured for FCoE based SAN access and connects to a SAN LUN to store the Guest VMs. Each FCoE port is configured for 8Gb of SAN bandwidth. We also enabled the new "Hide Unused FlexNICs" feature, so these unused NICs would not appear in the server OS.

Additional NICs could be added within FlexFabric, by simply powering the server off and adding up to a total of 6 NICs, the NIC speed can then be adjusted accordingly to suit the needs of each NIC. If additional or less SAN bandwidth is required, the speed of the SAN connection can also be adjusted. If the FCoE SAN connections are not required, these could be deleted, in which two additional NIC ports would then be made available to the host.

We then added the Hyper-V role to the server and created a VM guest. The guest was configured for VLAN 102, and then was later moved to VLAN 105, by simply changing the VLAN id as configured in the VM settings tab. Additional VLANs can be configured within the Shared Uplink Set and presented to the NIC team supporting the guests; those VLANs would then be made available to Hyper-V manager and any VM guests.

As additional servers are added to the enclosure, simply create additional profiles, or copy existing profiles, configure the NICs for LAN and SAN fabrics as required and apply them to the appropriate server bays and power the server on.

# Scenario 11 – Shared Uplink Set with Active/Active Uplinks, 802.3ad (LACP) – FlexFabric-20/40 F8 – vSphere

## Overview

This scenario will implement the Shared Uplink Set (SUS) to provide support for multiple VLANs. The upstream network switches connect a shared uplink set to two ports on each FlexFabric-20/40 F8 modules, LACP will be used to aggregate those links.

As multiple VLANs will be supported in this configuration, the upstream switch ports connecting to the FlexFabric-20/40 F8 modules will be configured to properly present those VLANs. In this scenario, the upstream switch ports will be configured for VLAN trunking/VLAN tagging.

When configuring Virtual Connect, we can provide several ways to implement network fail-over or redundancy. One option would be to connect TWO uplinks to a single Virtual Connect network; those two uplinks would connect from different Virtual Connect modules within the enclosure and could then connect to the same upstream switch or two different upstream switches, depending on your redundancy needs. An alternative would be to configure TWO separate Virtual Connect networks, each with a single, or multiple, uplinks configured. Each option has its advantages and disadvantages. For example; an Active/Standby configuration places the redundancy at the VC level, where Active/Active places it at the OS NIC teaming or bonding level. We will review the second option in this scenario.

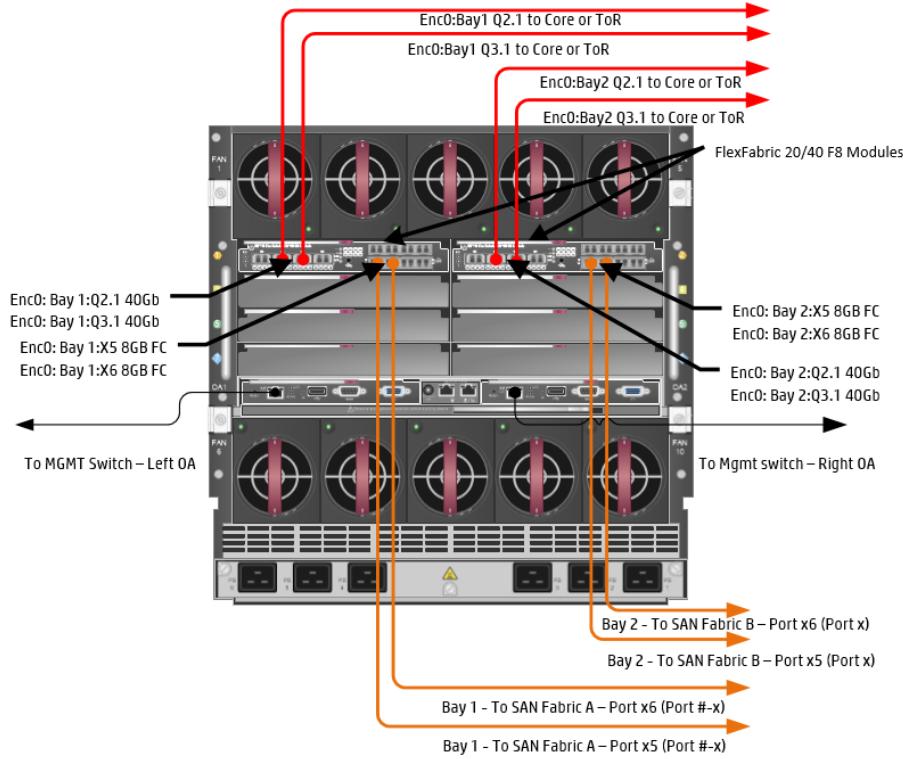
In addition, several Virtual Connect Networks can be configured to support the required networks to the servers within the BladeSystem enclosure. These networks could be used to separate the various network traffic types, such as iSCSI, backup and VMotion from production network traffic.

This scenario will also leverage the Fibre Channel over Ethernet (FCoE) capabilities of the FlexFabric-20/40 F8 modules. Each fibre channel fabric will have two uplinks connected at 8Gb to each of the FlexFabric-20/40 F8 modules.

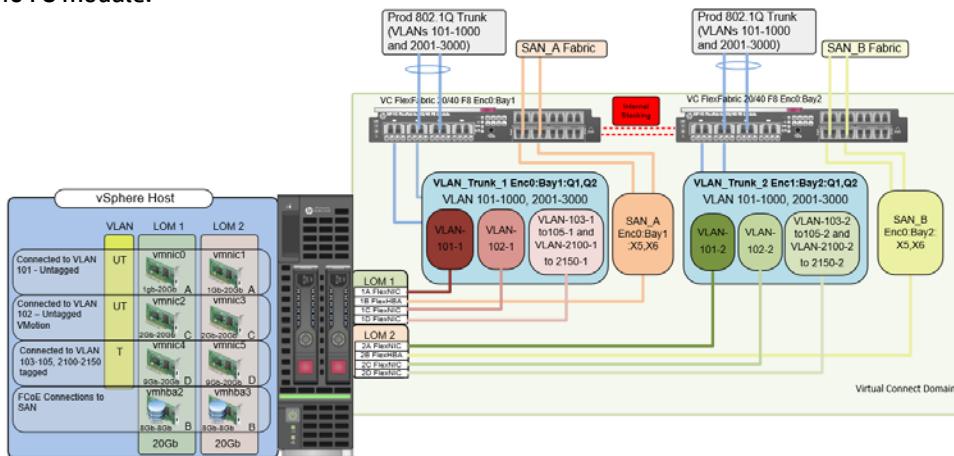
## Requirements

This scenario will support both Ethernet and fibre channel connectivity. In order to implement this scenario, an HP BladeSystem c7000 enclosure with one or more server blades and TWO Virtual Connect FlexFabric-20/40 F8 modules, installed in I/O Bays 1& 2 are required. In addition, we will require ONE or TWO external Network switches. As Virtual Connect does not appear to the network as a switch and is transparent to the network, any standard managed switch will work with Virtual Connect. The Fibre Channel uplinks will connect to the existing FC SAN fabrics. The SAN switch ports will need to be configured to support NPIV logins. Two uplinks from each FlexFabric-20/40 F8 module will be connected to the existing SAN fabrics.

**Figure 309 - Physical View:** Shows two Ethernet uplinks from Ports Q2 and Q3 on Module 1 to Ports on the first network switch and two Ethernet uplinks from Ports Q2 and Q3 on Module 2 to Ports on the second network switch. The SAN fabrics are also connected redundantly, with TWO uplinks per fabric, from ports X5 and X6 on module 1 to Fabric A and ports X5 and X6 to Fabric B.



**Figure 310 - Logical View:** The server blade profile is configured with SIX FlexNICs and 2 FlexHBAs. NICs 1 and 2 are connected to VLAN-101-x, NICs 3 and 4 are connected to VLAN-102-x and NICs 4 and 5 are connected to VLAN-103-x through VLAN-105-x and VLAN-2100x through VLAN-2150-x, which are part of the Shared Uplink Sets, VLAN-Trunk-1 and VLAN-Trunk-2 respectively. The VLAN-Trunks are connected, at 40Gb, to a network switch, through Ports Q2 and Q3 on each FlexFabric-20/40 F8 Module in Bays 1 and 2. The FCoE SAN connections are connected through ports X5 and X6 on each FlexFabric-20/40 F8 module.



# Installation and configuration

## Switch configuration

Appendices A and B provide a summary of the commands required to configure the switch in either a Cisco or HP Networking (with both ProCurve and Comware examples). The configuration information provided in the appendices assumes the following information:

- The switch ports are configured as VLAN TRUNK ports (tagging) to support several VLANs. All frames will be forwarded to Virtual Connect with VLAN tags. Optionally, one VLAN could be configured as (Default) untagged, if so, then a corresponding vNet within the Shared Uplink Set would be configured and set as “Default”.

**Note:** When adding additional uplinks to the SUS, if the additional uplinks are connecting from the same FlexFabric-20/40 F8 module to the same switch, in order to ensure all The uplinks are active, the switch ports will need to be configured for LACP within the same Link Aggregation Group.

The network switch port should be configured for Spanning Tree Edge as Virtual Connect appears to the switch as an access device and not another switch. By configuring the port as Spanning Tree Edge, it allows the switch to place the port into a forwarding state much quicker than otherwise, this allows a newly connected port to come online and begin forwarding much quicker.

The SAN connection will be made with redundant connections to each Fabric. SAN switch ports connecting to the FlexFabric-20/40 F8 module must be configured to accept NPIV logins.

## Configuring the VC module

- Physically connect Port 1 of network switch 1 to Port Q2 of the VC module in Bay 1
- Physically connect Port 2 of network switch 1 to Port Q3 of the VC module in Bay 1
- Physically connect Port 1 of network switch 2 to Port Q2 of the VC module in Bay 2
- Physically connect Port 2 of network switch 2 to Port Q3 of the VC module in Bay 2

**Note:** If you have only one network switch, connect VC ports Q2 and Q3 (Bay 2) to an alternate port on the same switch. This will NOT create a network loop and Spanning Tree is not required.

**Note:** If you currently do not have access to 40Gb switch ports, you can still utilize the QSFP ports on the FlexFabric-20/40 F8 module, through the user of the QSFP+ to 4x 10G SFP+ Splitter cable. This splitter cable is provided in lengths up to 5m, and splits the QSFP+ port in to 4x 10Gb SFP+ connections. These connections can be managed as independent 10Gb connections, or configured in an LACP group to aggregate the connect to 40Gb, see Appendix F: for further examples.

- Physically connect Ports X5/X6 on the FlexFabric in module Bay 1 to switch ports in SAN Fabric A
- Physically connect Ports X5/X6 on the FlexFabric in module Bay 2 to switch ports in SAN Fabric B

## VC CLI commands

Many of the configuration settings within VC can also be accomplished via a CLI command set. In order to connect to VC via a CLI, open an SSH connection to the IP address of the active VCM. Once logged in, VC provides a CLI with help menus. Through this scenario the CLI commands to configure VC for each setting will also be provided.

## Configuring Expanded VLAN Capacity via GUI

Virtual Connect release 3.30 provided an expanded VLAN capacity mode when using Shared Uplink Sets, this mode can be enabled through the Ethernet Settings tab or the VC CLI. The default configuration for a new Domain install is “Expanded VLAN Capacity” mode, Legacy mode is no longer available and the Domain cannot be downgraded.

Virtual Connect 4.30 now provides the ability to define up to 4096 VLANs then consume only the VLANs you need, when you need them. There is nothing to change or enable to take advantage of the 4096 VLAN feature.

## To verify the VLAN Capacity mode

- On the Virtual Connect Manager screen, Left pane, click Ethernet Settings, Advanced Settings
- Select Expanded VLAN capacity
- Verify Expanded VLAN Capacity is configured and Legacy VLAN Capacity is greyed out.

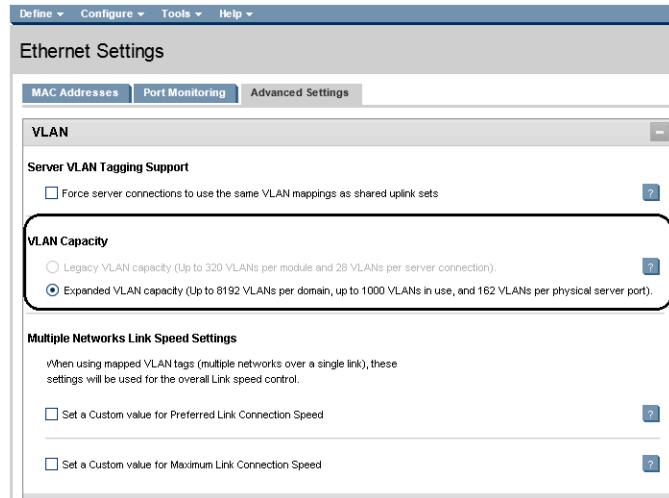
**Note:** Legacy VLAN mode will only be presented if 1Gb Virtual Connect Modules are present, in which case the domain would be limited to Firmware version 3.6x.

## Configuring Expanded VLAN Capacity via CLI

The following command can be copied and pasted into an SSH based CLI session with Virtual Connect;

```
# Set Expanded VLAN Capacity  
set enet-vlan -quiet VlanCapacity=Expanded
```

**Figure 311 - Enabling Expanded VLAN Capacity**



**Note:** If a 1Gb VC Ethernet module is present in the Domain, Expanded VLAN capacity will be greyed out, this is only supported with 10Gb and 20Gb based Virtual Connect modules. Also, once Expanded VLAN capacity is selected, moving back to Legacy VLAN capacity mode will require a domain deletion and rebuild.

## Defining a new Shared Uplink Set (VLAN-Trunk-1)

Connect Ports X5 and X6 of FlexFabric-20/40 F8 module in Bay 1 to Ports 1 and 2 on switch 1

Create a SUS named VLAN-Trunk-1 and connect it to FlexFabric-20/40 F8 Ports Q2 and Q3 on Module 1

- On the Virtual Connect Home page, select Define, Shared Uplink Set
- Insert Uplink Set Name as VLAN-Trunk-1
- Select Add Port, then add the following port;
  - Enclosure 1, Bay 1, Port Q2
  - Enclosure 1, Bay 1, Port Q3

**Figure 312 - Shared Uplink Set (VLAN-Trunk-1) Uplinks Assigned**

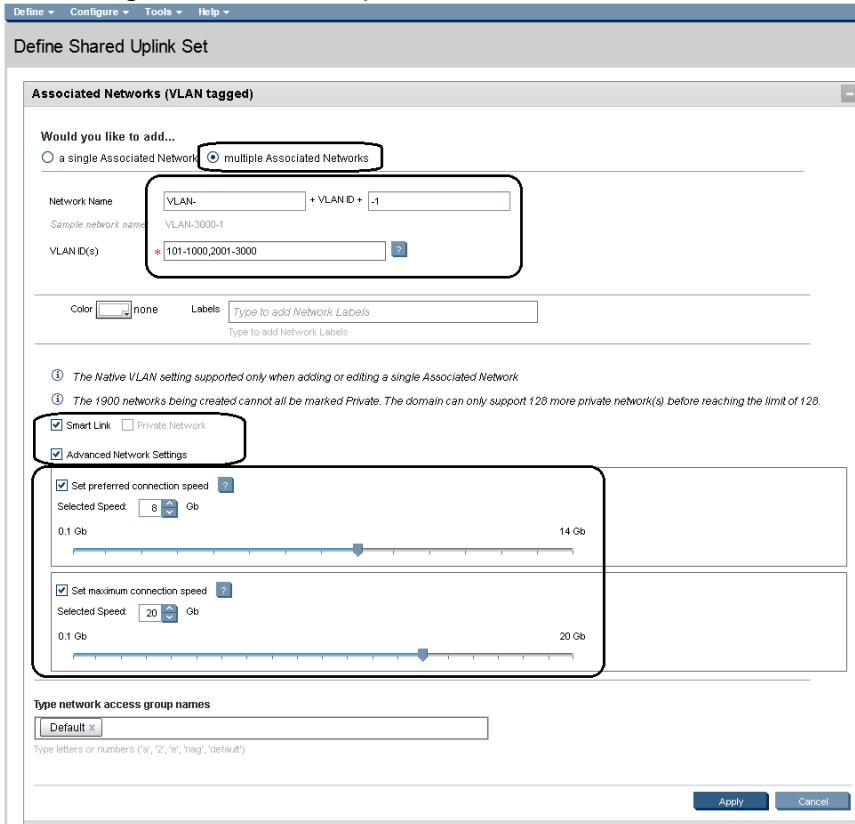
The screenshot shows the 'Define Shared Uplink Set' interface. In the 'Ethernet Shared External Uplink Set' section, 'Uplink Set Name' is set to 'VLAN-Trunk-1'. The 'External Uplink Ports' table lists two ports: 'C7K-Bottom Bay 1: Port Q2.1' and 'C7K-Bottom Bay 1: Port Q3.1', both in 'Linked' status. Below the table, 'Connection Mode' is set to 'Auto' and 'LACP Timer' is set to 'Domain Default, Short (1 sec)'. An 'Add Port' button is available. In the 'Associated FCoE Networks (VLAN tagged)' and 'Associated Networks (VLAN tagged)' sections, there are 'Add' and 'Delete' buttons. At the bottom are 'Apply' and 'Cancel' buttons.

Port	Port Role	Port Status	Connector Type	Connected To	PID	Speed/Duplex	Action
C7K-Bottom Bay 1: Port Q2.1	NA	Linked	40 Gb	QSFP+CR4	vanlab (FortyGigE1/0/49)	Auto	Delete
C7K-Bottom Bay 1: Port Q3.1	NA	Linked	40 Gb	QSFP+CR4	vanlab (FortyGigE1/0/50)	Auto	Delete

- Click Add Networks and select the Multiple Networks radio button and add the following VLANs;
  - Enter Name as VLAN-
  - Enter Suffix as -1
  - Enter VLAN IDs as follows (and shown in the following graphic);
  - 101-1000,2001-3000
- Enable SmartLink on ALL networks
- Click Advanced
  - Configure Preferred speed to 8Gb
  - Configure Maximum speed to 20Gb
- Click Apply

**Note:** You can optionally specify a network “color” or “Label” when creating a shared Uplinkset and its networks. In the example above we have not set either color or label. Also notice the new configurable LACP Timer setting.

**Figure 313 - Creating VLANs in a Shared Uplink Set**



**Note:** If the VC domain is not in Expanded VLAN capacity mode, you will receive an error when attempting to create more than 128 VLANs in a SUS. If that occurs, go to Advanced Ethernet Settings and select Expanded VLAN capacity mode and apply.

After clicking apply, a list of VLANs will be presented as shown below. If one VLAN in the trunk is untagged/native, see note below.

- Click Apply at the bottom of the page to create the Shared Uplink Set

**Figure 314 - Associated VLANs for Shared Uplink Set VLAN-Trunk-1**

Associated Networks (VLAN tagged)					
Network Name	VLAN ID	Native	Smart Link	Private Network	Action
VLAN-101-1	101	false	true	false	Edit
VLAN-102-1	102	false	true	false	Edit
VLAN-103-1	103	false	true	false	Edit
VLAN-104-1	104	false	true	false	Edit
VLAN-105-1	105	false	true	false	Edit
VLAN-106-1	106	false	true	false	Edit
VLAN-107-1	107	false	true	false	Edit
VLAN-108-1	108	false	true	false	Edit
VLAN-109-1	109	false	true	false	Edit
VLAN-110-1	110	false	true	false	Edit
VLAN-111-1	111	false	true	false	Edit
VLAN-112-1	112	false	true	false	Edit
VLAN-113-1	113	false	true	false	Edit
VLAN-114-1	114	false	true	false	Edit
VLAN-115-1	115	false	true	false	Edit
VLAN-116-1	116	false	true	false	Edit
VLAN-117-1	117	false	true	false	Edit
VLAN-118-1	118	false	true	false	Edit
VLAN-119-1	119	false	true	false	Edit
VLAN-120-1	120	false	true	false	Edit
VLAN-121-1	121	false	true	false	Edit
VLAN-122-1	122	false	true	false	Edit
VLAN-123-1	123	false	true	false	Edit
VLAN-124-1	124	false	true	false	Edit

**Note:** Optionally, if one of the VLANs in the trunk to this shared uplink set were configured as Native or Untagged, you would be required to “edit” that VLAN in the screen above, and configure Native as TRUE. This would need to be set for BOTH VLAN-Trunk-1 and VLAN-Trunk-2.

**Figure 315 – You will see that ALL Uplinks are still in a Linked/Standy state**

Shared Uplink Set	Has FCoE	Port Status	Connector Type	Uplink Port	Action
VLAN-Trunk-1	false	Linked-Standy Linked-Standy	40 Gb QSFP+CR4 40 Gb QSFP+CR4	C7K-Bottom: Bay 1: Port Q2.1 C7K-Bottom: Bay 1: Port Q3.1	Edit

**Note:** That both of the network connections are shown as “Linked/Standy”, this state will NOT change until the network has been assigned to a server profile. This behavior is new within VC 4.30 and is provided to accommodate the new 4096 VLAN feature.

### Defining a new Shared Uplink Set (VLAN-Trunk-2)(Copying a Shared Uplink Set)

The second Shared Uplink Set could be created in the same manner as VLAN-Trunk-1 however; VC now provides the ability to COPY a VC Network or Shared Uplink Set.

- Connect Ports Q2 and Q3 of FlexFabric-20/40 F8 module in Bay 2 to Ports 1 and 2 on switch 2
- In the VC GUI screen, select Shared Uplink Sets in the left pane, in the right pane VLAN-Trunk-1 will be displayed, left click VLAN-Trunk-1, it will appear as blue, right click and select COPY
- Edit the Settings as shown below, the new SUS name will be VLAN-Trunk-2 and ALL the associated VLANs will have a suffix of 2
- In step 3, ADD uplinks Q2 and Q3 from Bay 2
- Click OK
- The SUS and ALL VLANs will be created

**Figure 316 - Copying a SUS and ALL VLANs**

Copy Shared Uplink Set

1 Shared Uplink Set Name

Name: VLAN-Trunk-2

2 Associated Networks (VLANs)

Replace last instance(s) of 1 with 2

VLAN-Trunk-1 Original	VLAN-Trunk-2 Copy
VLAN-101-1	VLAN-101-2
VLAN-102-1	VLAN-102-2
VLAN-103-1	VLAN-103-2
VLAN-104-1	VLAN-104-2
VLAN-105-1	VLAN-105-2
VLAN-106-1	VLAN-106-2

3 External Uplink Ports

Port	Port Role	Port Status	Connector Type	Connected To

## Defining a new Shared Uplink Set via CLI

The following script can be used to create the first Shared Uplink Set (VLAN-Trunk-1)

*The following command(s) can be copied and pasted into an SSH based CLI session with Virtual Connect*

```
# Create Shared Uplink Set VLAN-Trunk-1 and configure uplinks
```

```
add uplinkset VLAN-Trunk-1
add uplinkport enc0:1:Q2 Uplinkset=VLAN-Trunk-1 speed=auto
add uplinkport enc0:1:Q3 Uplinkset=VLAN-Trunk-1 speed=auto

# Create Networks VLAN-101-1 through VLAN-105-1 and 2100-2400 for Shared Uplink Set
# VLAN-Trunk-1
add network-range -quiet UplinkSet=VLAN-Trunk-1 NamePrefix=VLAN- NameSuffix=-1
VLANIds=101-1000,2101-3000 State=enabled PrefSpeedType=Custom PrefSpeed=11000
MaxSpeedType=Custom MaxSpeed=20000 SmartLink=enabled
```

The following script can be used to create the Second Shared Uplink Set (VLAN-Trunk-2)

```
# Create Shared Uplink Set VLAN-Trunk-2 and configure uplinks
```

```
add uplinkset VLAN-Trunk-2
add uplinkport enc0:2:Q2 Uplinkset=VLAN-Trunk-2 speed=auto
add uplinkport enc0:2:Q3 Uplinkset=VLAN-Trunk-2 speed=auto
```

```
# Create Networks VLAN101-2 through VLAN105-2 and VLAN-2100-2 through VLAN-2400-2 for
# Shared Uplink Set VLAN-Trunk-2
```

```
add network-range -quiet UplinkSet=VLAN-Trunk-2 NamePrefix=VLAN- NameSuffix=-2
VLANIds=101-1000,2101-3000 State=enabled PrefSpeedType=Custom PrefSpeed=11000
MaxSpeedType=Custom MaxSpeed=20000 SmartLink=enabled
```

Please refer to Appendix D; “Scripting the Native VLAN” for scripting examples.

**Note:** In this scenario we have created two independent Share Uplink Sets (SUS), each originating from the opposite FlexFabric-20/40 F8 Modules, by doing so we provide the ability to create separate and redundant connections out of the Virtual Connect domain. When we create the server profiles, you will see how the NICs will connect to VLANs accessed through the opposite VC module, which provides the ability to create an Active / Active uplink scenario. Alternatively, we could have created a single SUS and assigned both sets of these uplink ports to the same SUS, however, this would have provided an Active/Standby uplink scenario, as shown in Scenario 5.

## Defining a new (FCoE) SAN Fabric via GUI

Create a Fabric and name it “FCoE\_A”

- On the Virtual Connect Manager screen, click Define, SAN Fabric to create the first Fabric
- Enter the Network Name of “FCoE\_A”
- Select Add Port, then add the following ports:
  - Enclosure 1, Bay 1, Port X5
  - Enclosure 1, Bay 1, Port X6
- Ensure Fabric Type is set to “FabricAttach”
- Select Show Advanced Settings
  - Select Automatic Login Re-Distribution (FlexFabric Only)
  - Select Set Preferred FCoE Connect Speed
    - Configure for 8Gb
  - Select Set Maximum FCoE Connect Speed
    - Configure for 8Gb
- Select Apply

Create a second Fabric and name it "FCoE\_B"

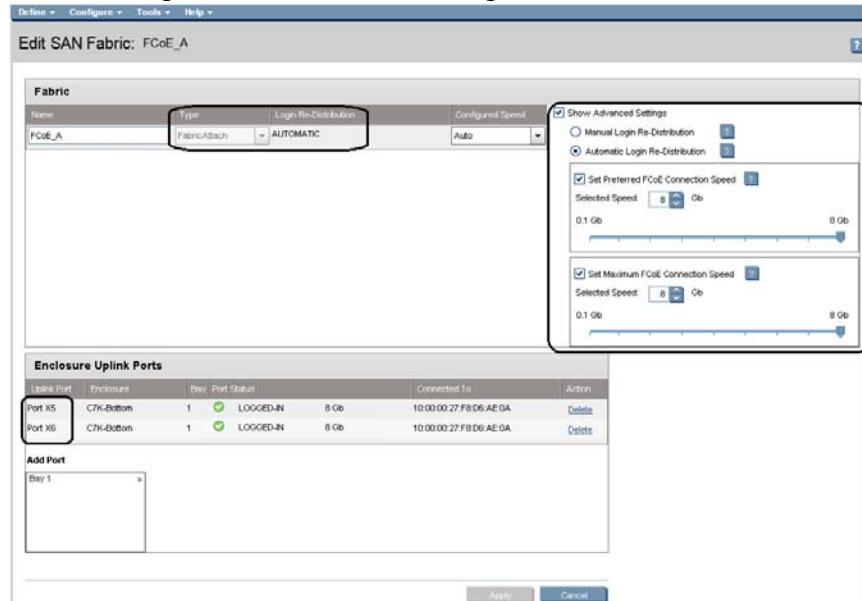
- On the Virtual Connect Manager screen, click Define, SAN Fabric to create the second Fabric
- Enter the Network Name of "FCoE\_B"
- Select Add Port, then add the following ports:
  - Enclosure 1, Bay 2, Port X5
  - Enclosure 1, Bay 2, Port X6
- Ensure Fabric Type is set to "FabricAttach"
- Select Show Advanced Settings
  - Select Automatic Login Re-Distribution (FlexFabric Only)
  - Select Set Preferred FCoE Connect Speed
    - Configure for 8Gb
  - Select Set Maximum FCoE Connect Speed
    - Configure for 8Gb
- Select Apply

## Defining SAN Fabrics via CLI

The following command(s) can be copied and pasted into an SSH based CLI session with Virtual Connect

```
#Create the SAN Fabrics FCoE_A and FCoE_B and configure uplinks as discussed above
add fabric FCoE_A Type=FabricAttach Bay=1 Ports=5,6 Speed=Auto LinkDist=Auto
PrefSpeedType=Custom PrefSpeed=8000 MaxSpeedType=Custom MaxSpeed=8000
add fabric FCoE_B Type=FabricAttach Bay=2 Ports=5,6 Speed=Auto LinkDist=Auto
PrefSpeedType=Custom PrefSpeed=8000 MaxSpeedType=Custom MaxSpeed=8000
```

**Figure 317 - SAN Configuration and Advanced Settings**



**Figure 318 - FCoE SAN fabrics configured with to 8Gb uplinks per fabric. Note the bay and port numbers on the right**

SAN Fabrics										
External Connections		Server Connections								
Status	SAN Fabric	Type	Login Re-Distribution	Port Status	Connected To	Enclosure	Bay	Port	Action	
✓	FCoE_A	FabricAttach	AUTOMATIC	LOGGED-IN	8 Gb	10:00:00:27:f8:d6:ae:0a	C7K-Bottom	1	X5	Edit
✓				LOGGED-IN	8 Gb	10:00:00:27:f8:d6:ae:0a	C7K-Bottom	1	X6	
✓	FCoE_B	FabricAttach	AUTOMATIC	LOGGED-IN	8 Gb	10:00:00:27:f8:d8:b8:9c	C7K-Bottom	2	X5	Edit
✓				LOGGED-IN	8 Gb	10:00:00:27:f8:d8:b8:9c	C7K-Bottom	2	X6	

## Defining a Server Profile

We will create a server profile with SIX server NICs and TWO SAN adapters.

Each server NIC will connect to a specific network.

- On the main menu, select Define, then Server Profile
- Create a server profile called “ESX-1”
- Select to “Hide Unused FlexNICs”
- In the Network Port 1 drop down box, select a Network, then chose VLAN101-1
- Set the port speed to Custom at 1000Gb
- In the Network Port 2 drop down box, select a Network, then chose VLAN101-2
- Set the port speed to Custom at 1000Gb
- Select ADD network (add four additional network connections)
- In the Network Port 3 drop down box, select a Network, then chose VLAN-102-1
- Set the port speed to Custom at 2Gb
- In the Network Port 4 drop down box, select a Network, then chose VLAN-102-2
- Set the port speed to Custom at 2Gb
- In the Network Port 5 drop down box, select Multiple Networks
- Configure for networks VLAN-103-1 through VLAN-105-1 and VLAN-2100-1 through VLAN-2150-1
- Leave the network speed as Auto
- In the Network Port 6 drop down box, select Multiple Networks
- Configure for networks VLAN-103-2 through VLAN-105-2 and VLAN-2100-2 through VLAN-2150-2
- Leave the network speed as Auto
- Expand the FCoE Connections box, for Bay 1, select FCoE\_A for Bay 2, select FCoE\_B
- Do not configure FC SAN or iSCSI Connection
- In the Assign Profile to Server Bay box, locate the Select Location drop down and select Bay 2, then apply

Prior to applying the profile, ensure that the server in Bay 2 is currently OFF

**Note:** You should now have a server profile assigned to Bay 2, with 6 Server NIC connections. NICs 1&2 should be connected to networks VLAN-101-x (MGMT), NICs 3&4 should be connected VLAN-102-x (VMotion), NICs 5&6 connect to networks VLAN103-x through VLAN105-x and VLAN-2100-x through VLAN-2150-x. FCoE SAN fabrics are connected to, Port 1 - FCoE\_A and Port 2 - FCoE\_B.

## Defining a Server Profile via CLI

The following command(s) can be copied and pasted into an SSH based CLI session with Virtual Connect

```
# Create Server Profile ESX-1
add profile ESX-1 -nodefaultfcconn -nodefaultfcoeconn NAG=Default HideUnusedFlexNICs=true
set enet-connection ESX-1 1 pxe=Enabled Network=VLAN-101-1 SpeedType=Custom Speed=1000
set enet-connection ESX-1 2 pxe=Disabled Network=VLAN-101-2 SpeedType=Custom Speed=1000
add enet-connection ESX-1 pxe=Disabled Network=VLAN-102-1 SpeedType=Custom Speed=2000
add enet-connection ESX-1 pxe=Disabled Network=VLAN-102-2 SpeedType=Custom Speed=2000
add enet-connection ESX-1 pxe=Disabled
add server-port-map-range ESX-1:5 UplinkSet=VLAN-Trunk-1 VLanIds=103-105,2100-2150
add enet-connection ESX-1 pxe=Disabled
add server-port-map-range ESX-1:6 UplinkSet=VLAN-Trunk-2 VLanIds=103-105,2100-2150
add fcoe-connection ESX-1 Fabric=FCoE_A SpeedType=8Gb
add fcoe-connection ESX-1 Fabric=FCoE_B SpeedType=8Gb
poweroff server 2
assign profile ESX-1 enc0:2
```

**Note:** The “add server-port-map-range” command is new to VC firmware release 3.30 and can be used to map many VLANs to a server NIC, in a single command. Prior releases would have required one command to create the NIC and one additional command per VLAN mapping added.

**Note:** The speed of the NIC and SAN connections, as well as the MAC and WWN. Also, note that the FCoE connections are assigned to the two SAN fabrics created earlier and use ports LOM:1-b and LOM:2-b.

**Figure 319 - Define a Server Profile ESX-1, assigned to Bay 2**

The screenshot shows the 'Edit Server Profile: ESX-1' interface. The top navigation bar includes 'Define', 'Configure', 'Tools', and 'Help'. The main window displays the 'Ethernet Adapter Connections' section, which lists six network interfaces (VLAN 101-1 to 102-2, and two 'Multiple Networks...' entries). Each entry includes columns for Port, Network Name, Status, Port Speed Type, Allocated Port Speed, PXE, Multicast Filter, MAC, Mapping, and Action. The 'Mapping' column contains entries like 'LOM1:1-a => Bay 1:d1:v1' and 'LOM1:2-d => Bay 2:d1:v4'. Below this is the 'iSCSI HBA Connections' section, followed by the 'FCoE HBA Connections' section, which lists two connections: 'FCoE\_A' and 'FCoE\_B' connected to Bay 1 and Bay 2 respectively. At the bottom, there's an 'Assign Profile to Server Bay' section and a footer with 'Apply', 'Apply & Close', and 'Cancel' buttons.

**Figure 320 - Configure NICs 5 and 6 for multiple Networks and select the appropriate VLANs**

This screenshot shows the 'Edit Server Profile: ESX-1' interface with the 'Ethernet Adapter Connections' section selected. It includes a 'Server VLAN Tag to vNet Mappings' section with a checkbox for 'Force the same VLAN mappings as in the Shared Uplink Set' and a dropdown menu set to 'None'. Below this is a 'Networks not in mapping' table with tabs for 'Alphabetical' and 'Filtered'. The table lists various VLANs such as VLAN-1000-1 through 104-2. To the right is a 'Networks in mapping (54 mapped; limit is 162)' table with columns for vNet Name, Status, Uplink VLAN Id, Server VLAN Id, and Untagged. This table lists numerous VLANs from 103-1 to 2105-1. The interface also features 'List' and 'Detail' buttons at the bottom.

**Note:** “Server VLAN ID” and “Untagged” boxes can be edited. One network per port could be marked as “Untagged”, in which case the server would not be configured for tagging on that VLAN. It is also possible to change the VLAN ID that is presented to the server (VLAN translation), in which case the communications between Virtual Connect and the network would be the VLAN ID in grey, if the Server VLAN ID box to the right were changed, VC would communicate with the server on the new VLAN ID, providing a VLAN translation function. VLAN translation could be a very useful feature, in the event that VLAN renumbering is required within the datacenter. The network VLAN numbers and Shared Uplink Set configurations could be changed to reflect the new VLAN IDs used, however, the old VLAN IDs could still be presented to the server providing the ability to delay or eliminate the need to change the VLAN ID used within the server/vSwitch.

**Figure 321 – Server Profile View Bay 2**

Device Bay Status - Bay # 2

Overall Status:	✓
Hardware Status:	✓
VC Status:	✓
Assigned Server Profile:	ESX-1
Enclosure Name:	C7K-Bottom
UID:	■
Power Status/Control:	On

Momentary Press      Press and Hold

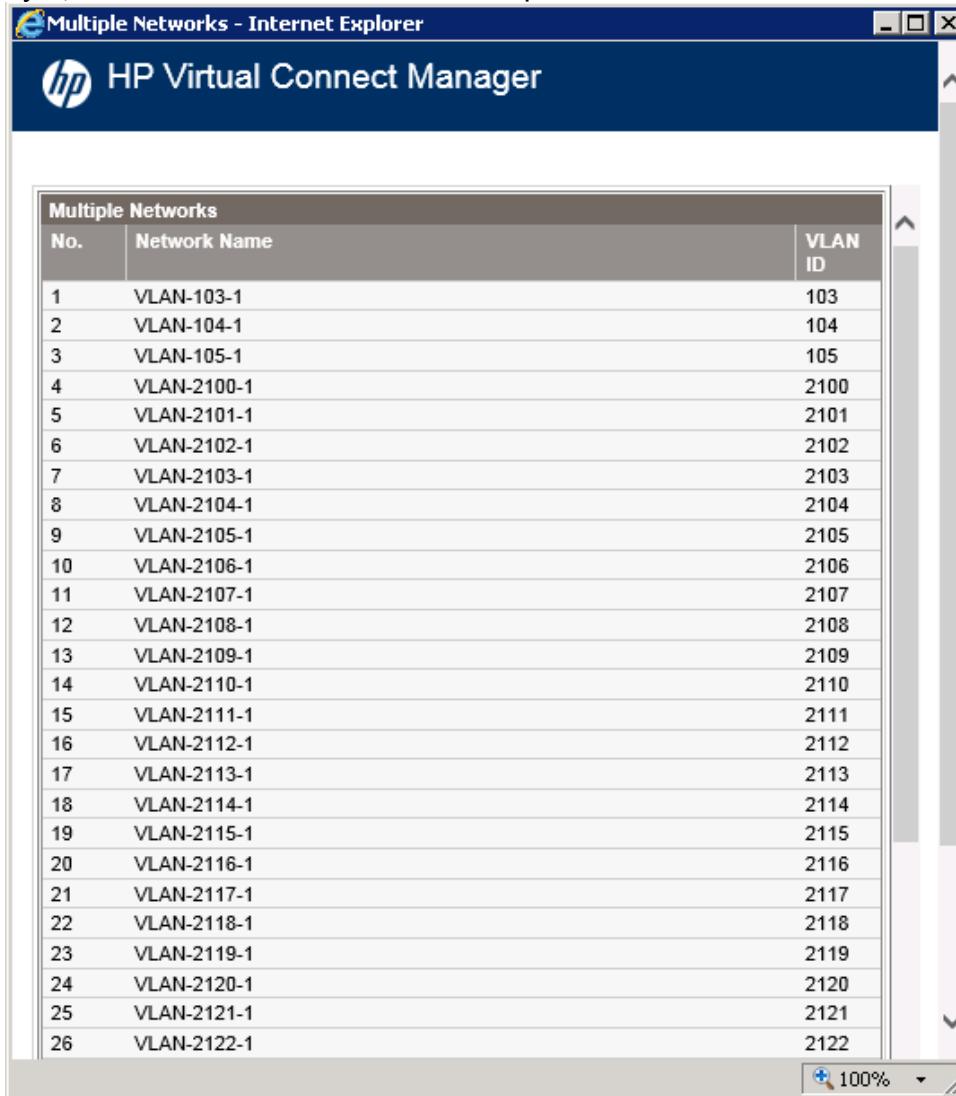
Blade Server Information - Bay # 2

Serial Number:	MXQ42401QJ
Serial Number (Logical):	VCX0000V01
UUID:	30343237-3638-584D-5134-32343031514A
UUID (Logical):	f9bdd6e0-bd79-46f1-8905-3be21b1ebfea
Product Name:	ProLiant BL460c Gen8
Server Name:	esx-1.vnlab.net
Part Number:	724086-B21
Asset Tag:	[Unknown]
UEFI Capable:	false
Boot Mode:	Legacy

Server Ethernet Adapter Information

Ethernet Adapter	Flex NIC	Location	Module Port	Model	MAC Address	Network	WWN	SAN Fabric
Port 1								
LOM1:1- FLB1	Bay 1:d1:v1	HP FlexFabric 20Gb 2-port 630FLB Adapter	00-17-A4-77-4C-0A	VLAN-101-1	50:06:0B:00:00:C2:AE:04	FCoE_A		
LOM1:1- FLB1	Bay 1:d1:v2	HP FlexFabric 20Gb 2-port 630FLB Adapter	00-17-A4-77-4C-16	VLAN-102-1				
LOM1:1- FLB1	Bay 1:d1:v3	HP FlexFabric 20Gb 2-port 630FLB Adapter	00-17-A4-77-4C-0E	Multiple Networks				
LOM1:1- FLB1	Bay 1:d1:v4	HP FlexFabric 20Gb 2-port 630FLB Adapter	00-17-A4-77-4C-12					
Port 2								
LOM1:2- FLB1	Bay 2:d1:v1	HP FlexFabric 20Gb 2-port 630FLB Adapter	00-17-A4-77-4C-0C	VLAN-101-2	50:06:0B:00:00:C2:AE:06	FCoE_B		
LOM1:2- FLB1	Bay 2:d1:v2	HP FlexFabric 20Gb 2-port 630FLB Adapter	00-17-A4-77-4C-17	VLAN-102-2				
LOM1:2- FLB1	Bay 2:d1:v3	HP FlexFabric 20Gb 2-port 630FLB Adapter	00-17-A4-77-4C-10	Multiple Networks				
LOM1:2- FLB1	Bay 2:d1:v4	HP FlexFabric 20Gb 2-port 630FLB Adapter	00-17-A4-77-4C-14					

**Figure 322** - By clicking on the “Multiple Networks” statement for each LOM, the following page is displayed, which lists the VLAN connections for this port.



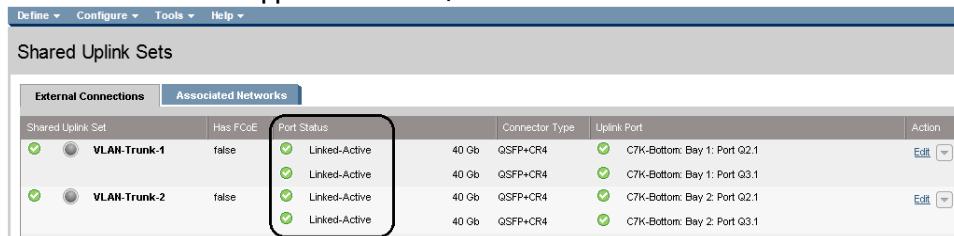
The screenshot shows a Microsoft Internet Explorer window titled "Multiple Networks - Internet Explorer". The main content area is titled "HP Virtual Connect Manager". Below this, there is a table with the following data:

No.	Network Name	VLAN ID
1	VLAN-103-1	103
2	VLAN-104-1	104
3	VLAN-105-1	105
4	VLAN-2100-1	2100
5	VLAN-2101-1	2101
6	VLAN-2102-1	2102
7	VLAN-2103-1	2103
8	VLAN-2104-1	2104
9	VLAN-2105-1	2105
10	VLAN-2106-1	2106
11	VLAN-2107-1	2107
12	VLAN-2108-1	2108
13	VLAN-2109-1	2109
14	VLAN-2110-1	2110
15	VLAN-2111-1	2111
16	VLAN-2112-1	2112
17	VLAN-2113-1	2113
18	VLAN-2114-1	2114
19	VLAN-2115-1	2115
20	VLAN-2116-1	2116
21	VLAN-2117-1	2117
22	VLAN-2118-1	2118
23	VLAN-2119-1	2119
24	VLAN-2120-1	2120
25	VLAN-2121-1	2121
26	VLAN-2122-1	2122

## Verify Network Link State

As discussed earlier in this document, in Virtual connect 4.30 there was a change to the link state behavior when a network has no connections to a server profile. Once a connection is made to the server profile, the uplinks will become Active, as previously expected.

**Figure 323** - All Links now appear in a Linked/Active state.



The screenshot shows a Microsoft Internet Explorer window with a menu bar: Define ▾, Configure ▾, Tools ▾, Help ▾. The main content area is titled "Shared Uplink Sets". Below this, there is a table with the following data:

External Connections		Associated Networks		Port Status	Connector Type	Uplink Port	Action
Shared Uplink Set	Has FCoE	Link	Link				
<input checked="" type="checkbox"/> VLAN-Trunk-1	false	Linked-Active		40 Gb	QSFP+CR4	C7K-Bottom: Bay 1: Port Q2.1	<input type="button" value="Edit"/>
		Linked-Active		40 Gb	QSFP+CR4	C7K-Bottom: Bay 1: Port Q3.1	<input type="button" value="Edit"/>
<input checked="" type="checkbox"/> VLAN-Trunk-2	false	Linked-Active		40 Gb	QSFP+CR4	C7K-Bottom: Bay 2: Port Q2.1	<input type="button" value="Edit"/>
		Linked-Active		40 Gb	QSFP+CR4	C7K-Bottom: Bay 2: Port Q3.1	<input type="button" value="Edit"/>

# Review

In this scenario we have created Two Shared Uplink Sets (SUS), providing support for many VLANs. Uplinks originating from each FlexFabric-20/40 F8 Module connect to each SUS, by doing so we provide redundant connections out of the Virtual Connect domain. As multiple uplinks are used for each SUS, we have also leveraged LACP to improve uplink performance. In this scenario, all uplinks will be active. We also create two FCoE SAN Fabrics.

We created a server profile, with SIX NICs. Two connected to the same VLAN (101), Port 1 connects to VLAN-101-1 and Port 2 connects to VLAN-101-2, which provides the ability to sustain a link or module failure and not lose connection to the network, these NICs were set to 1Gb/Sec with the Maximum speed set to 20Gb. VLAN-101-1 and VLAN-101-2 are configured to support VLAN 101, frames will be presented to the NIC(s) without VLAN tags (untagged), these two NICs are connected to the same VLAN, but taking a different path out of the enclosure. VLAN 101 is used for Management connections to the ESX host.

Network Ports 3 and 4 connect to the same VLAN (102), Port 3 connects to VLAN-102-1 and Port 4 connects to VLAN-102-2, which provides the ability to sustain a link or module failure and not lose connection to the network, these NICs were set to 2Gb/Sec with the Maximum speed set to 20Gb. VLAN-102-1 and VLAN-102-2 are configured to support VLAN 102, frames will be presented to the NIC(s) without VLAN tags (untagged), these two NICs are connected to the same VLAN, but taking a different path out of the enclosure. VLAN 102 is used for VMotion.

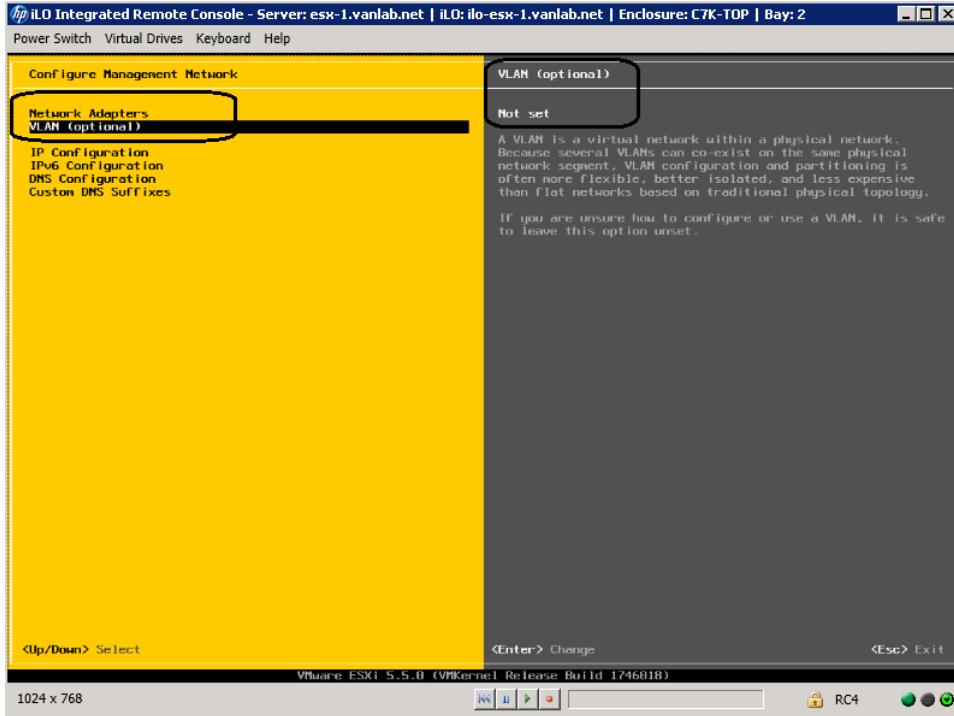
Network Ports 5 and 6 were added, these NICs will be connected to “Multiple Networks” and each NIC will then be configured for networks VLAN103-x through VLAN105-x and networks VLAN-2100-x through VLAN-2150-x. As these networks are tagging, frames will be presented to the server with VLAN tags. NICs 5 and 6 will be connected to the same vSwitch to support VM connections. VLAN tagged frames for these networks will be forwarded to the Virtual switch and then passed on to the appropriate Virtual Machine, VLAN tags will be removed as the frames are passed to the virtual machine. These NICs will use the remaining available bandwidth of 9Gb/Sec with the Maximum speed set to 20Gb.

Additionally, FCoE port 1 is connected to SAN fabric FCoE\_A and FCoE SAN port 2 is connected to SAN Fabric FCoE\_B, providing a multi-pathed connection to the SAN. The SAN fabric connections are set to 8Gb/Sec.

The FCoE SAN fabric connects to each SAN fabric over a pair of uplinks per module. SAN logins are distributed across the multiple paths.

The following graphic provides an example of an ESX server with TWO NICs connected to the same console vSwitch configured for VLAN 101, which was the Default (untagged) VLAN. Additional vSwitches have been configured for VMotion and product VLANs.

**Figure 324** - As NICs 1 and 2 are connected directly to VLAN-101, the connection acts as an Access or Untagged switch port, you need to ensure that the Hypervisor is NOT configured for VLAN tagging. However, if you want to put this server onto a VLAN that is tagged, this setting will need to be configured for that VLAN.



## Results – vSphere Networking Examples

We successfully configured FlexFabric with Share Uplink Sets, supporting several VLANs and redundant SAN fabrics. We created a server profile to connect to the various vNet with SIX NICs and the SAN fabrics using the FCoE connections created within the profile.

Although both Ethernet and Fibre channel connectivity is provided by the FlexFabric Adapter used in the G7 through Gen 9 servers; each capability (LAN and SAN) is provided by a different component of the adapter, they appear in the server as individual network and SAN adapters.

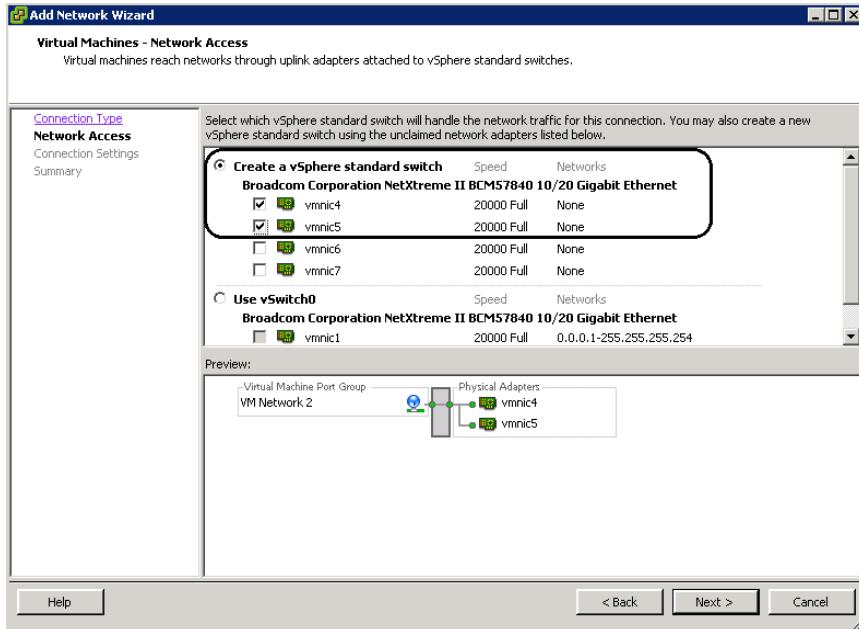
The following graphics show an ESXi 5.5 server with SIX FlexNICs configured, FOUR presented at 8Gb (two on the console network and two on the VMotion network) and two at 10Gb (Guest VLAN port groups). If we did not require SAN connectivity on this server, the FCoE connections could be deleted and the server would then have 8 NIC ports available to the OS. In addition, if we did not want FCoE connectivity and instead wanted to leverage iSCSI, we could delete the FCoE connected and re-create those connects as iSCSI connections, with offload and optionally iSCSI boot.

**Note:** The BL465c G7 and BL685c G7 utilize an NC551i chipset (BE2), whereas the BL460c G7, BL620c G7 and BL680c G7 utilize an NC553i chipset (BE3) and the Gen 8 blades typically have a NC554 adapter which also utilizes the BE3 chipset. Both the BE2 and BE3 chipsets share common drivers and firmware.

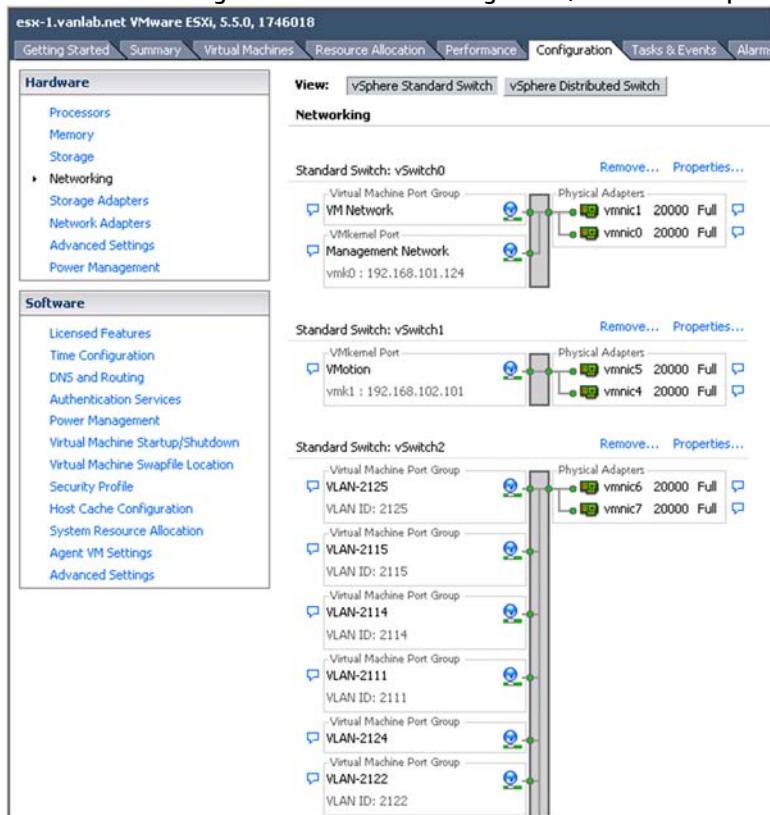
Virtual Connect supports the use of either Standard or Distributed vSwitches, examples of both are provided below.

## vSphere Standard vSwitch

**Figure 325 – ESXi 5.5 Network Connections**

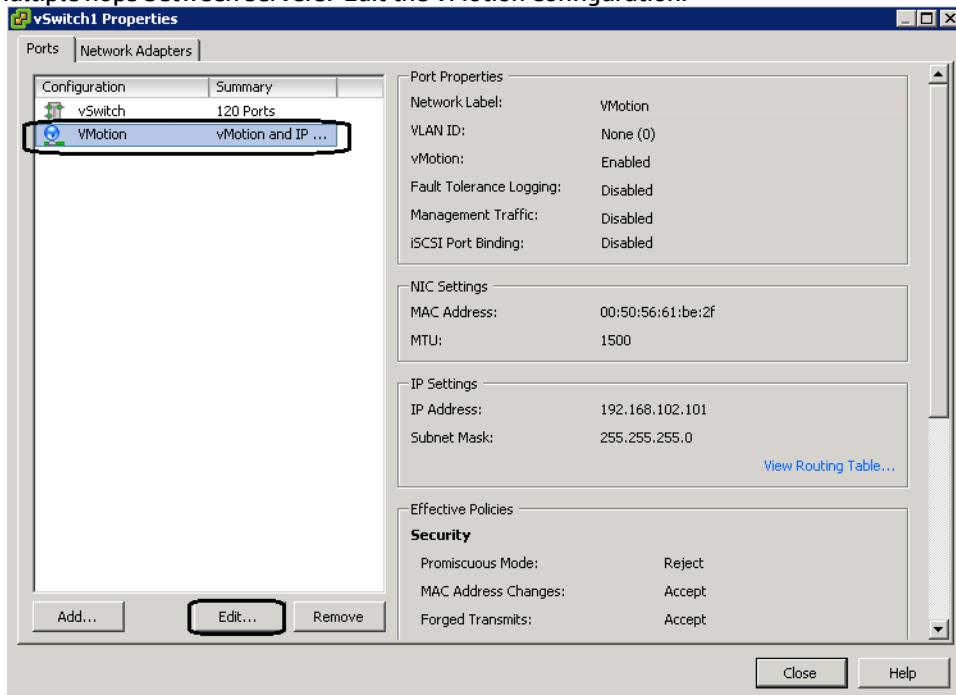


**Figure 326 – ESXi 5.5 networking – three vSwitches configured. (Note the NIC speeds)**

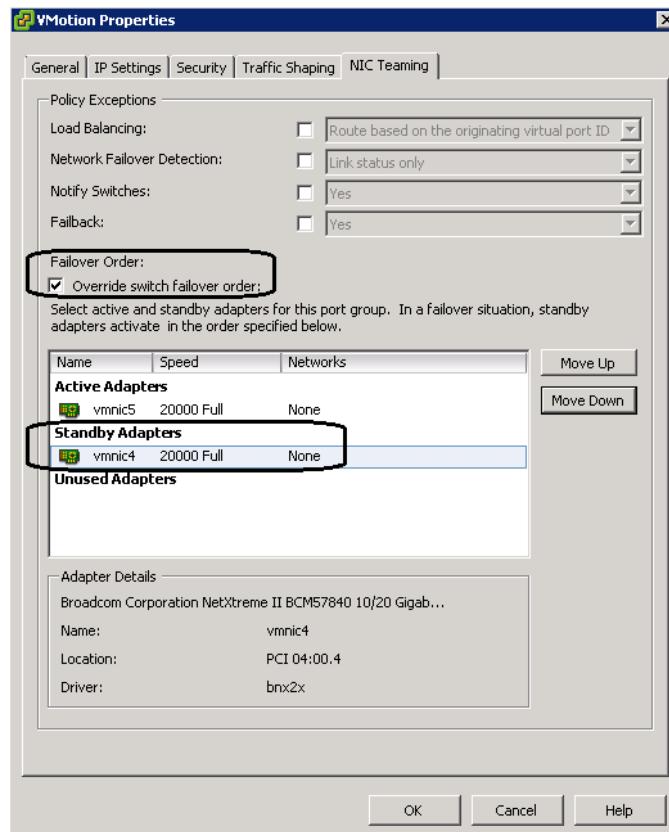


**Note:** As VLAN 101 is set as untagged at the upstream switch port, the management network port group should be defined as untagged. This will allow the server to be deployed, without having to set a VLAN ID for the management network.

**Figure 327** - You may want to specify a specific NIC for VMotion traffic. This will ensure that all VMotion traffic between servers within the enclosure will remain on the same VC module, reducing the likelihood of multiple hops between servers. Edit the VMotion Configuration.

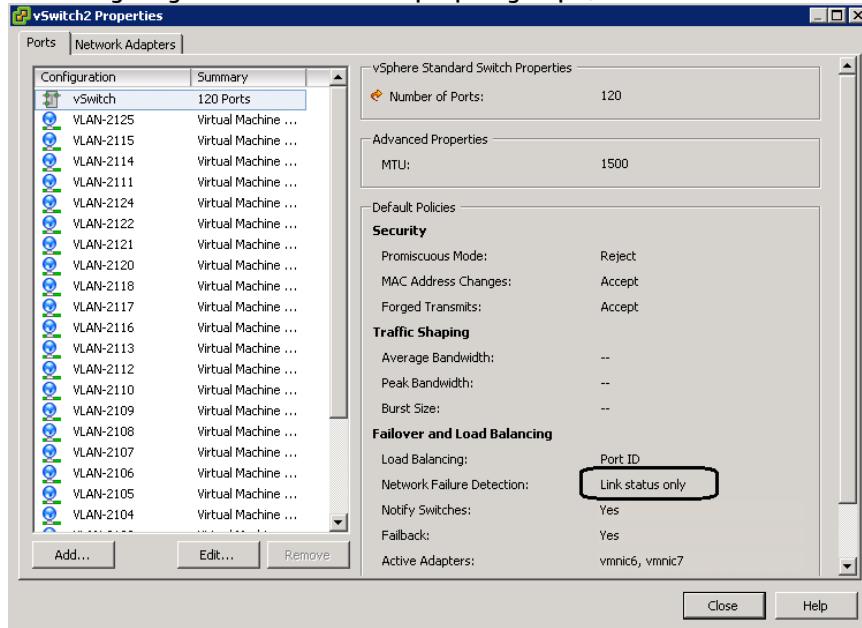


**Figure 328** - Edit the NIC Team for VMotion and set one of the Adapters in Standby, this will ensure that ALL VMotion traffic remains on the SAME VC module. ESX NIC vmnic5 is connected to the VC module in bay 1.

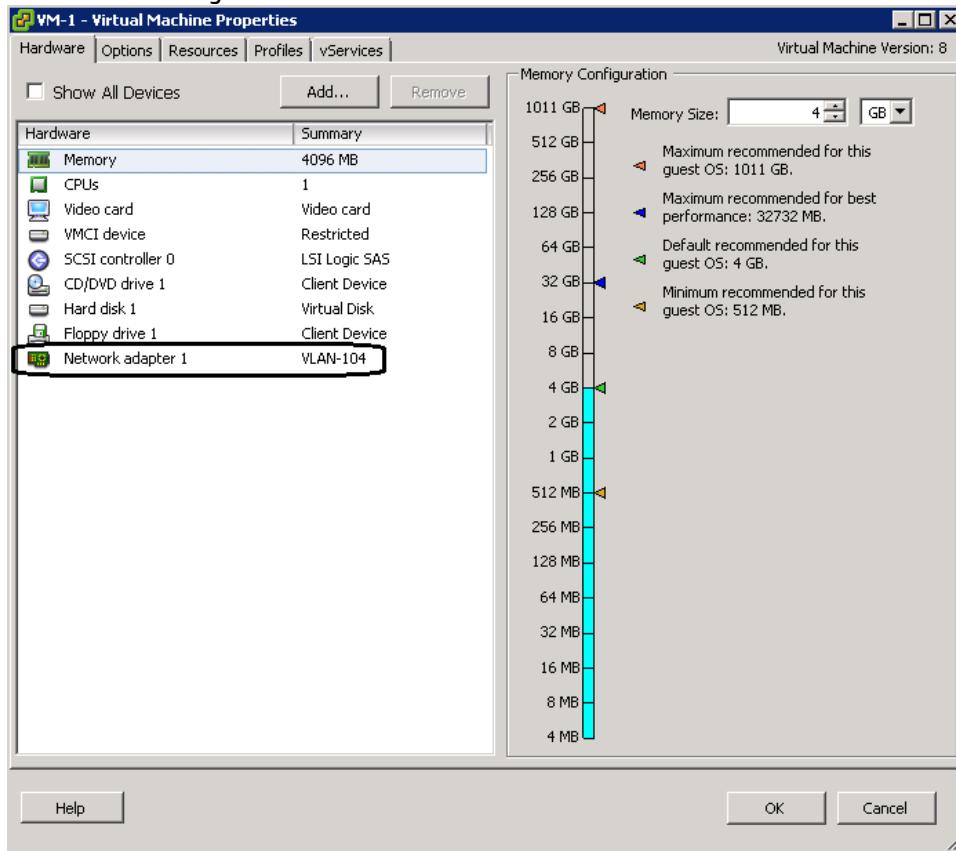


**Note:** As this Scenario is based on an Active/Active configuration, to ensure that ALL VMotion traffic between servers within the enclosure is contained to the same module, on each server edit the VMotion vSwitch properties and move one of the Adapters to Standby. This will ensure that ALL VMotion traffic will occur on the same Virtual Connect module.

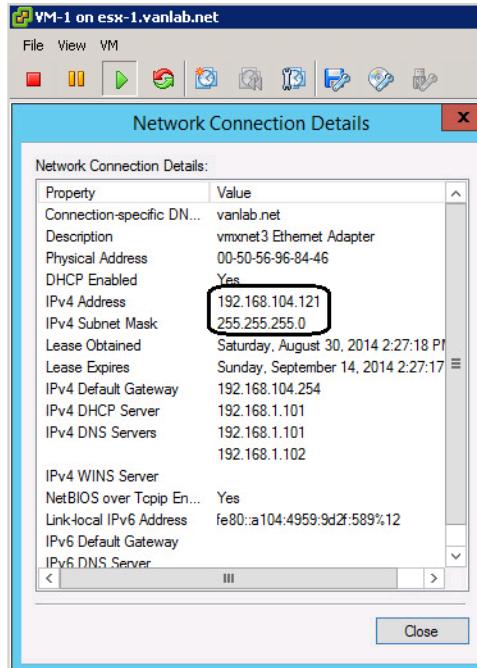
**Figure 329 - Configuring the vSwitch for multiple port groups / VLANs**



**Figure 330 - VM1 configured for VLAN 104**



**Figure 331 - VM1 on VLAN 104**



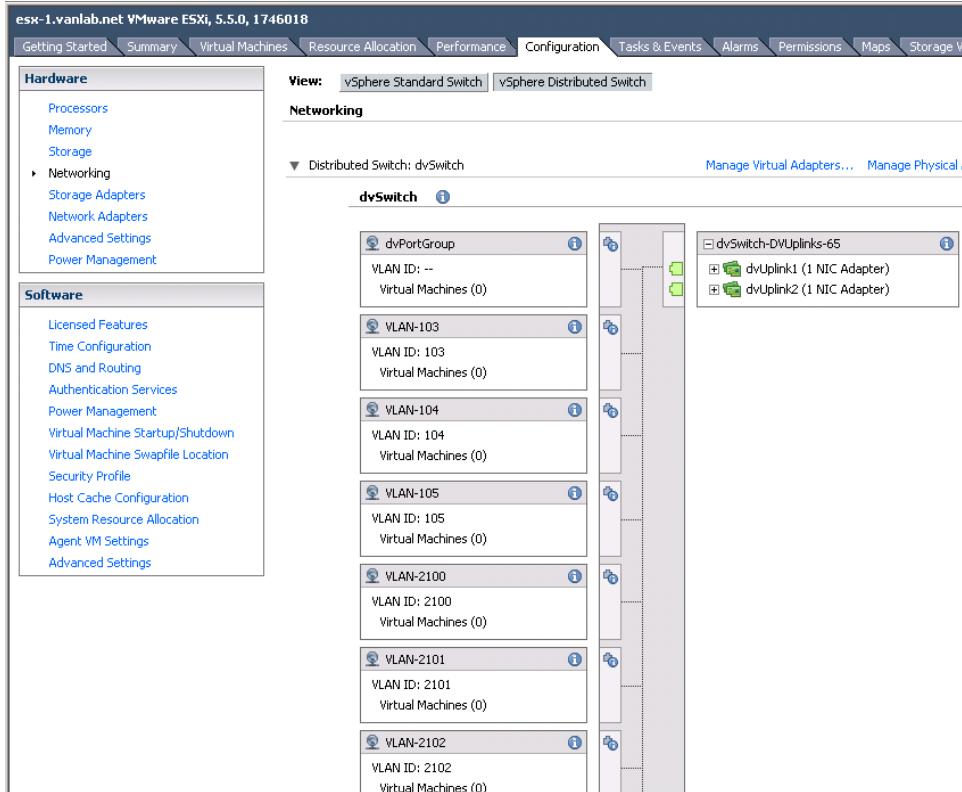
## vSphere Distributed vSwitch

**Figure 332 - Management and VMotion NICs are connected to Standard vSwitches**

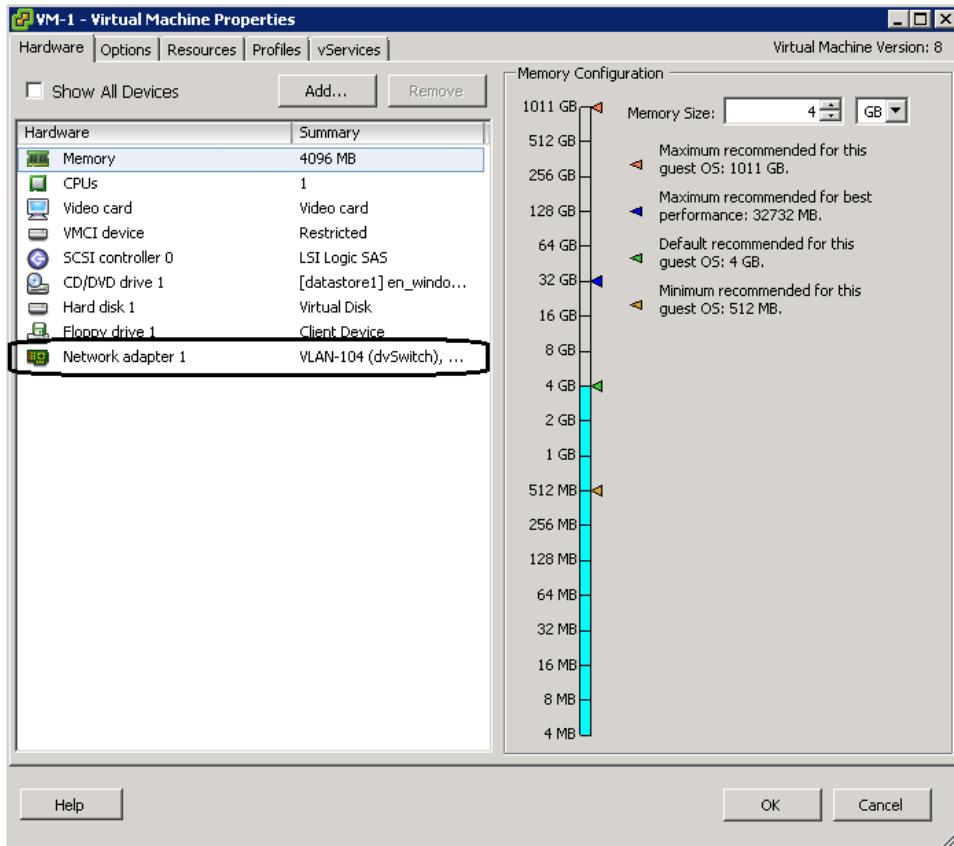
The screenshot shows the VMware ESXi 5.5.0 Configuration interface. The left sidebar lists hardware components like Processors, Memory, Storage, Networking, and Software settings. The main area displays two standard vSwitches:

- vSwitch0:** Has two port groups: "VM Network" and "Management Network". The "VM Network" is connected to two physical adapters: "vmnic1" and "vmnic0", both with bandwidth limits of 20000 and status "Full".
- vSwitch1:** Has one port group: "VMotion". It is connected to two physical adapters: "vmnic5" and "vmnic4", both with bandwidth limits of 20000 and status "Full".

**Figure 333 - VM Networks are connected to a Distributed vSwitch**



**Figure 334 - VM Connected to VLAN 104 on Distributed vSwitch**



# Results – vSphere SAN Connectivity

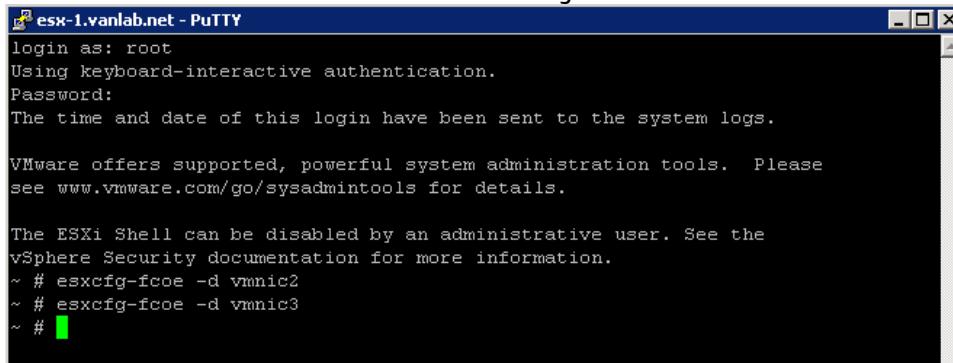
## Broadcom Adapters (534 and 630)

The Broadcom adapters (534 and 650) provide an FCoE capability, however, it presents a little differently than the Emulex discussed above. These adapters use a Broadcom BCM578xOS-Based chipset. When installed with VMWare 5.x, you will need to enable the FCoE capabilities of the adapter if you plan to connect to a Fibre Channel based SAN.

**Note:** This is not required if using the Emulex 55x or 650 network adapters.

**Note:** Additional information on enabling the FCoE function in ESXi is provided in the Introduction section, under VMWare ESXi 5.5.

**Figure 335 – SSH to the ESX host and execute the esxcfg-fcoe command as shown below**

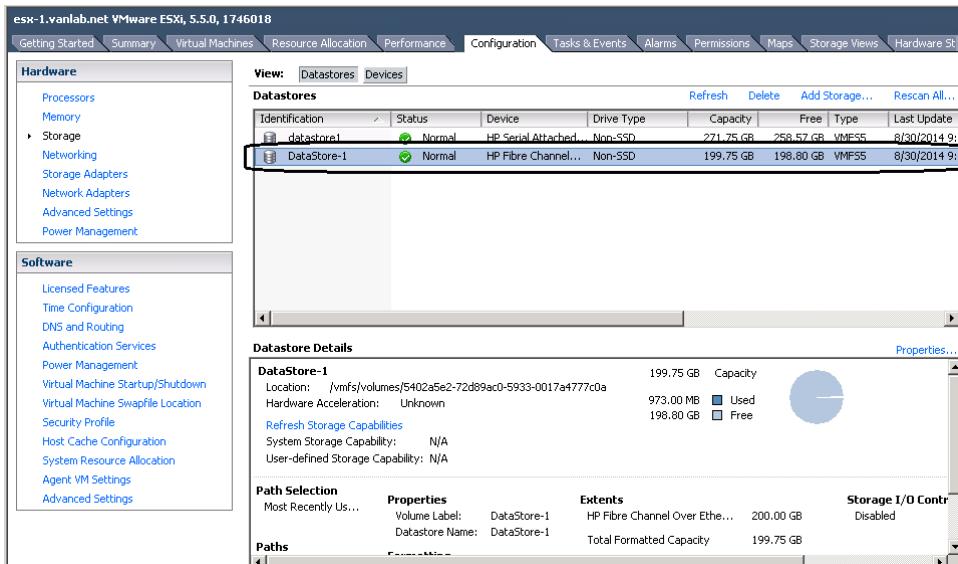


```
esx-1.vanlab.net - PuTTY
login as: root
Using keyboard-interactive authentication.
Password:
The time and date of this login have been sent to the system logs.

VMware offers supported, powerful system administration tools. Please
see www.vmware.com/go/sysadmintools for details.

The ESXi Shell can be disabled by an administrative user. See the
vSphere Security documentation for more information.
~ # esxcfg-fcoe -d vmnic2
~ # esxcfg-fcoe -d vmnic3
~ #
```

**Figure 336 – ESXi 5.5 storage configuration, the Shared Storage LUN is provided through the FCoE connections to the SAN.**



# Summary

We presented a Virtual Connect Network scenario by creating two shared uplink sets (SUS), each SUS is connected with TWO active uplinks; both SUS' can actively pass traffic. We included a dual path SAN fabric for storage connectivity.

When VC profile ESX-1 is applied to the server in bay 2 and the server is powered up, it has one NIC connected through FlexFabric-20/40 F8 module 1 (connected to VLAN-101-1), the second NIC is connected through FlexFabric-20/40 F8 module 2 (connected to VLAN-101-2). Each NIC is configured at 1Gb. These NICs are connected to the management vSwitch. The second pair of NICs are connected to the second vSwitch, which is configured for VMotion and is connected to VLAN102-x through NICs 3 and 4 which are configured at 2Gb. The last pair of NICs 5 and 6, are connected to the third vSwitch, which is configured to support VLANs 103 through 105 and 2100 through 2150 which is configured for 9Gb, all NICs could burst to 20Gb, if required. This host is also configured for FCoE based SAN access and connects to a SAN LUN to store the Guest VMs. Each FCoE port is configured for 8Gb of SAN bandwidth.

As additional servers are added to the enclosure, simply create additional profiles, or copy existing profiles, configure the NICs for LAN and SAN fabrics as required and apply them to the appropriate server bays and power the server on.

# Appendix A1 – Scenario-based CISCO IOS Command Line Reference

All of the following commands in this appendix assume an unaltered factory default configuration before execution of the switch commands.

## Scenario 1– Cisco IOS command line configuration (Simple vNet with Active/Standby Uplinks)

Connect to the Cisco switch servicing the VC Ethernet uplink ports and enter the following IOS commands.

**NOTE: If two switches are being used, issue the same commands on the second switch.**

**Table 1** Cisco IOS command line configuration  
Configure Port 1 of each switch, connected to Port X5

Command	Shortcut	Description
>enable	>en	Privilege mode
#configure terminal	#config t	Configure via terminal
#interface gigabitethernet0/1	#int gi1/0/1	Focus on Port 1
#switchport mode access	#sw mo ac	Set port 1 for Single VLAN mode
#switchport access vlan 1	#sw ac vl 1	Allow Port 1 access to VLAN 1
#spanning-tree portfast trunk	#sp portf tr	Enable portfast on Port 1
#exit	#exit	Remove focus from Port 1
#show vlan brief	#sh vl br	Display all VLANs
#show interface gigabitethernet0/1 status	#sh int gi0/1 status	Display the status of Port 1
#copy running-config startup-config (For permanent changes only)	#cop ru st	Save the running configuration to NVRAM. Otherwise, the changes will be lost on the next reboot.

## Scenarios 2 through 6, 8 and9 - Cisco IOS command line configuration (Shared Uplink Set with VLAN tagging and 802.3ad (LACP) Active/Active Uplinks)

Connect to the Cisco switch servicing the VC Ethernet uplink ports and enter the following IOS commands.

**NOTE: If two switches are being used, issue the same commands on the second switch.**

**Table 2** Cisco IOS command line configuration (802.1Q, 802.3ad)  
Configure Port 1 and 2 of each switch, connected to Port X5 and X6

Command	Shortcut	Description
>enable	>en	Privilege mode
#configure terminal	#config t	Configure via terminal
#interface TenGigabitethernet0/1	#int Ten0/1	Focus on Port 1
#switchport trunk allowed vlan 101- 105,2100-2400	#sw tr ac vl 101- 105,2100-2400	Configure port for VLANs 101 through 105, 2100-2400
#switchport mode trunk	#sw mo tr	Enable trunking on Port 1
#channel-protocol lacp	#channel-p l	Configure port 1 for 802.3ad LACP
#channel-group 10 mode active	#channel-g 10 mo ac	Enable channel group 10
#spanning-tree portfast trunk	#sp portf tr	Enable portfast on Port 1
#exit	#ex	Remove focus from Port 1
#interface TenGigabitethernet0/2	#int Ten0/2	Focus on Port 2
#switchport trunk allowed vlan 101- 105,2100-2400	#sw tr ac vl 101- 105,2100-2400	Configure port for VLANs 101 through 105, 2100-2400
#switchport mode trunk	#sw mo tr	Enable trunking on Port 2
#channel-protocol lacp	#channel-p l	Configure Port 2 for 802.3ad LACP
#channel-group 10 mode active	#channel-g 10 mo ac	Enable channel group 10
#spanning-tree portfast trunk	#sp portf tr	Enable portfast on Port 2
#exit	#ex	Remove focus from Port 2

**Table 2** Cisco IOS command line configuration (802.1Q, 802.3ad)  
Configure Port 1 and 2 of each switch, connected to Port X5 and X6

Command	Shortcut	Description
#show lacp 10 internal	#sh la 10 i	Show the LACP group 10 configuration
#show etherchannel summary	#sh eth sum	Show the etherchannel configuration
#show interface port-channel10 trunk	#sh int port-channel 10 tr	Show the port channel 10 trunk configuration
#copy running-config startup-config (For permanent changes only)	#cop ru st	Save the running configuration to NVRAM. Otherwise, the changes will be lost on the next reboot.

## Scenarios 7 - Cisco IOS command line configuration (Shared Uplink Set with VLAN tagging and 802.3ad (LACP) Active/Active Uplinks and Tunneled VLANs)

Connect to the Cisco switch servicing the VC Ethernet uplink ports and enter the following IOS commands.

**NOTE: If two switches are being used, issue the same commands on the second switch.**

**Table 3** Cisco IOS command line configuration (802.1Q, 802.3ad)  
Configure Port s 2 and 3 of each switch for vNet Tunnel (Port X5 and X6)

Command	Shortcut	Description
>enable	>en	Privilege mode
#configure terminal	#config t	Configure via terminal
#interface TenGigabitEthernet 0/2	#int ten0/2	Focus on Port 2
#switchport trunk allowed vlan 101- 105,2100-2400	#sw tr ac vl 101- 105,2100-2400	Configure port for VLANs 101 through 105,2100-2400
#switchport mode trunk	#sw mo tr	Enable trunking on Port 2
#channel-protocol lacp	#channel-p l	Configure port 1 for 802.3ad LACP
#channel-group 10 mode active	#channel-g 10 mo ac	Enable channel group 10
#spanning-tree portfast trunk	#sp portf tr	Enable portfast on Port 2
#exit	#ex	Remove focus from Port 2
#interface TenGigabitEthernet 0/3	#int ten0/3	Focus on Port 3
#switchport trunk allowed vlan 101- 105,2100-2400	#sw tr ac vl 101- 105,2100-2400	Configure port for VLANs 101 through 105,2100-2400
#switchport mode trunk	#sw mo tr	Enable trunking on Port 3
#channel-protocol lacp	#channel-p l	Configure Port 3 for 802.3ad LACP
#channel-group 10 mode active	#channel-g 10 mo ac	Enable channel group 10
#switchport trunk native vlan 500	#sw tr na vl 500	Configure Vlan 500 as the native Vlan
#spanning-tree portfast trunk	#sp portf tr	Enable portfast on Port 3

**Table 3** Cisco IOS command line configuration (802.1Q, 802.3ad)  
Configure Ports 2 and 3 of each switch for vNet Tunnel (Port X5 and X6)

Command	Shortcut	Description
#exit	#ex	Remove focus from Port 3
#show lacp 10 internal	#sh la 10 i	Show the LACP group 10 configuration
#show etherchannel summary	#sh eth sum	Show the etherchannel configuration
#show interface port-channel10 trunk	#sh int port-channel 10 tr	Show the port channel 10 trunk configuration
#copy running-config startup-config (For permanent changes only)	#cop ru st	Save the running configuration to NVRAM. Otherwise, the changes will be lost on the next reboot.

**Table 4** Cisco IOS command line configuration (802.1Q)  
Configure Ports 2 and 3 of each switch for vNet Tunnel (Port X4)

Command	Shortcut	Description
>enable	>en	Privilege mode
#configure terminal	#config t	Configure via terminal
#interface TenGigabitEthernet 0/1	#int ten 0/1	Focus on Port 1
#switchport trunk allowed vlan 101-102	#sw tr ac vl 101-102	Configure port for VLANs 101 through 102
#switchport mode trunk	#sw mo tr	Enable trunking on Port 1
#spanning-tree portfast trunk	#sp portf tr	Enable portfast on Port 1
#exit	#ex	Remove focus from Port 1
#copy running-config startup-config (For permanent changes only)	#cop ru st	Save the running configuration to NVRAM. Otherwise, the changes will be lost on the next reboot.

# Appendix A2 – Scenario-based CISCO NX-OS Command Line Reference

All of the following commands in this appendix assume an unaltered factory default configuration before execution of the switch commands.

## Scenario 1– Cisco NX-OS command line configuration (Simple vNet with Active/Standby Uplinks)

Connect to the Cisco switch servicing the VC Ethernet uplink ports and enter the following NX-OS commands.

**NOTE: If two switches are being used, issue the same commands on the second switch.**

**Table 5** Cisco NX-OS command line configuration  
Configure Port 1 of each switch, connected to Port X5

Command	Shortcut	Description
>enable	>en	Privilege mode
#configure terminal	#config t	Configure via terminal
#interface gigabitethernet0/1	#int gi1/0/1	Focus on Port 1
#switchport mode access	#sw mod a	Set port 1 for Single VLAN mode
#switchport access vlan 4	#sw ac vl 4	Allow Port 1 access to VLAN 4
#spanning-tree portfast trunk	#sp portf tr	Enable portfast on Port 1
#exit	#exit	Remove focus from Port 1
#show vlan brief	#sh vl br	Display all VLANs
#show interface Ethernet 1/1 status	#sh int et1/1 st	Display the status of Port 1
#copy running-config startup-config (For permanent changes only)	#cop ru st	Save the running configuration to NVRAM. Otherwise, the changes will be lost on the next reboot.

## Scenarios 2 through 6,8 and 9 - Cisco NX-OS command line configuration (Shared Uplink Set with VLAN tagging and 802.3ad (LACP) Active/Active Uplinks)

Connect to the Cisco switch servicing the VC Ethernet uplink ports and enter the following NX-OS commands.

**NOTE: If two switches are being used, issue the same commands on the second switch.**

**Table 6** Cisco NX-OS command line configuration (802.1Q, 802.3ad)  
Configure Port 1 and 2 of each switch, connected to Port X5 and X6

Command	Shortcut	Description
>enable	>en	Privilege mode
#configure terminal	#config t	Configure via terminal
#feature LACP	#feature l	Enable LACP on the switch
#interface Ethernet 1/1	#int eth1/1	Focus on Port 1
#switchport mode trunk	#sw mod t	Enable trunking on Port 1
#switchport trunk allowed vlan 101-105,2100-2400	#sw tr a v 101-105,2100-2400	Configure port for VLANs 101 through 105, 2100-2400
#switchport trunk native vlan 101	#sw t n v 101	Set the native VLAN for the 802.1Q trunk
#channel-group 10 mode active	#ch 10 mo ac	Enable channel group 10
#exit	#ex	Remove focus from Port-channel10
#interface Ethernet 1/2	#int eth1/2	Focus on Port 2
#switchport mode trunk	#sw mod t	Enable trunking on Port 2
#switchport trunk allowed vlan 101-105,2100-2400	#sw tr a v 101-105,2100-2400	Configure port for VLANs 101 through 105, 2100-2400
#switchport trunk native vlan 101	#sw t n v 101	Set the native VLAN for the 802.1Q trunk
#channel-group 10 mode active	#ch 10 mo ac	Enable channel group 10
#exit	#ex	Remove focus from Port-channel10
#interface port-channel 10	#int po 10	Create a port channel 10
#spanning-tree port type edge trunk	#spa port t e t	Enable PortFast on Port-channel 10
#exit	#ex	Remove focus from Port 1

**Table 6** Cisco NX-OS command line configuration (802.1Q, 802.3ad)  
 Configure Port 1 and 2 of each switch, connected to Port X5 and X6

Command	Shortcut	Description
#show interface port-channel 10	#sh int po 10	Displays the status of a port-channel interface.
#copy running-config startup-config (For permanent changes only)	#cop ru st	Save the running configuration to NVRAM. Otherwise, the changes will be lost on the next reboot.

## Scenarios 7 - Cisco NX-OS command line configuration (Shared Uplink Set with VLAN tagging and 802.3ad (LACP) Active/Active Uplinks and Tunneled VLANs)

Connect to the Cisco switch servicing the VC Ethernet uplink ports and enter the following NX-OS commands.

**NOTE: If two switches are being used, issue the same commands on the second switch.**

**Table 7** Cisco NX-OS command line configuration (802.1Q, 802.3ad)  
Configure Port s 2 and 3 of each switch for vNet Tunnel (Port X5 and X6)

Command	Shortcut	Description
>enable	>en	Privilege mode
#configure terminal	#config t	Configure via terminal
#feature LACP	#feature l	Enable LACP on the switch
#interface Ethernet 1/2	#int eth1/2	Focus on Port 2
#switchport mode trunk	#sw mod t	Enable trunking on Port 2
#switchport trunk allowed vlan 101-105,2100-2400	#sw tr a v 101-105,2100-2400	Configure port for VLANs 101 through 105, 2100-2400
#switchport trunk native vlan 101	#sw t n v 101	Set the native VLAN for the 802.1Q trunk
#channel-group 10 mode active	#ch 10 mo ac	Enable channel group 10
#exit	#ex	Remove focus from Port-channel10
#interface Ethernet 1/3	#int eth1/3	Focus on Port 3
#switchport mode trunk	#sw mod t	Enable trunking on Port 3
#switchport trunk allowed vlan 101-105,2100-2400	#sw tr a v 101-105,2100-2400	Configure port for VLANs 101 through 105, 2100-2400
#switchport trunk native vlan 101	#sw t n v 101	Set the native VLAN for the 802.1Q trunk
#channel-group 10 mode active	#ch 10 mo ac	Enable channel group 10
#exit	#ex	Remove focus from Port-channel10
#interface port-channel 10	#int po 10	Create a port channel 10
#spanning-tree port type edge trunk	#spa port t e t	Enable PortFast on Port-channel 10
#exit	#ex	Remove focus from Port 3

**Table 7** Cisco NX-OS command line configuration (802.1Q, 802.3ad)  
Configure Port s 2 and 3 of each switch for vNet Tunnel (Port X5 and X6)

Command	Shortcut	Description
#show interface port-channel 10	#sh int po 10	Displays the status of a port-channel interface.
#copy running-config startup-config (For permanent changes only)	#cop ru st	Save the running configuration to NVRAM. Otherwise, the changes will be lost on the next reboot.

**Table 8** Cisco NX-OS command line configuration (802.1Q)  
Configure Port s 2 and 3 of each switch for vNet Tunnel (Port X4)

Command	Shortcut	Description
>enable	>en	Privilege mode
#configure terminal	#config t	Configure via terminal
#feature LACP	#feature l	Enable LACP on the switch
#interface Ethernet 1/1	#int eth1/1	Focus on Port 1
#switchport mode trunk	#sw mod t	Enable trunking on Port 1
#switchport trunk allowed vlan 101-105,2100-2400	#sw tr a v 101-105,2100-2400	Configure port for VLANs 101 through 105, 2100-2400
#exit	#ex	Remove focus from Port
#copy running-config startup-config (For permanent changes only)	#cop ru st	Save the running configuration to NVRAM. Otherwise, the changes will be lost on the next reboot.

# Appendix B1 – Scenario-based ProCurve Command Line Reference

## Scenario 1 – ProCurve command line configuration (Simple vNet with Active/Standby Uplinks)

Connect to the ProCurve switch servicing the VC Ethernet uplink ports and enter the following commands.

**NOTE: If two switches are being used, issue the same commands on the second switch.**

**Table 9** ProCurve command line configuration  
Configure Port 1 of each switch, connected to Port X5

Command	Shortcut	Description
>enable	>en	Privilege mode
#configure terminal	#conf	Configure in global mode
#span	#span	Enables spanning-tree (MSTP mode by default)
#vlan 1 untagged [Ethernet] 1	#vlan 1 untag 1	Allow VLAN 1 on Port 1 , and set Port 1 to untagged mode
#spanning-tree 1 admin-edge-port	#span 1 admin-edge	Set Port 1 to be an edge port (non-bridging port). Note: port is set by default in “auto-edge” mode which automatically sets port to Edge if no BPDU are received after 3 sec.
#show interface brief 1	#sh int br 1	Display the status of Port 1
#show vlan ports 1 detail	# show vlan ports 1 detail	Displays the VLAN detail for Port 1
#show vlan 1	#sh vlan 1	Display VLAN 1 port information
#write memory  (For permanent changes only)	#write mem	Save the running configuration to NVRAM. Otherwise, the changes will be lost on the next reboot.

## Scenarios 2 through 6, 8 and 9 - ProCurve command line configuration (Shared Uplink Set with VLAN tagging and 802.3ad (LACP) Active/Active Uplinks)

Connect to the ProCurve switch servicing the VC Ethernet uplink ports and enter the following commands.

**NOTE: If two switches are being used, issue the same commands on the second switch.**

**Table 10** ProCurve command line configuration (802.1Q, 802.3ad)

Configure Port 1 and 2 of each switch, connected to Port X5 and X6

Command	Shortcut	Description
>enable	>en	Privilege mode
#configure terminal	#conf	Configure in global mode
#span	#span	Enables spanning-tree (MSTP mode by default)
#trunk 1-2 trk1 lacp	#trunk 1-2 trk1 lacp	Configure LACP port-trunk 1 to include Ports 1 & 2
#vlan 101 tagged trk1	#vlan 101 tag trk1	Allow VLAN 101 on Ports 1 and 2. Trk1 (tagged)
#vlan 102 tagged trk1	#vlan 102 tag trk1	Allow VLAN 102 on Ports 1 and 2. Trk1 (tagged)
#vlan 103 tagged trk1	#vlan 103 tag trk1	Allow VLAN 103 on Ports 1 and 2. Trk1 (tagged)
#vlan 104 tagged trk1	#vlan 104 tag trk1	Allow VLAN 104 on Ports 1 and 2. Trk1 (tagged)
.....	...	Configure all other VLANs
#vlan 2400 tagged trk1	#vlan 2400 tag trk1	Allow VLAN 2400 on Ports 1 and 2. Trk1 (tagged)
#spanning-tree ethernet trk1 admin-edge-port	#span e trk1 admin-edge	Set trk1 as an edge port (non bridging port). Note: default is “auto-edge” mode which automatically sets port to Edge if no BPDU are received after 3 sec.
#show vlan 101	#sh vlan 101	Display VLAN 101
#show vlan 102	#sh vlan 102	Display VLAN 102
#show vlan 103	#sh vlan 103	Display VLAN 103
#show vlan 104	#sh vlan 104	Display VLAN 104
#show vlan ports trk1 detail	# show vlan ports trk1 detail	Displays the VLAN detail for Trunk 1
#show interface brief1-2	#sh int br1-2	Show Port 1-2 status
#write memory	#wr mem	Save Running Config

## Scenarios 7 - ProCurve command line configuration (Shared Uplink Set with VLAN tagging and 802.3ad (LACP) Active/Active Uplinks and Tunneled VLANs)

Connect to the ProCurve switch servicing the VC Ethernet uplink ports and enter the following commands.

**NOTE: If two switches are being used, issue the same commands on the second switch.**

**Table 11** ProCurve command line configuration (802.1Q, 802.3ad)  
Configure Port s 2 and 3 of each switch for vNet Tunnel (Port X5 and X6)

Command	Shortcut	Description
>enable	>en	Privilege mode
#configure terminal	#conf	Configure in global mode
#span	#span	Enables spanning-tree (MSTP mode by default)
#trunk 1-2 trk1 lacp	#trunk 1-2 trk1 lacp	Configure LACP port-trunk 1 to include Ports 1 & 2
#vlan 101 tagged trk1	#vlan 101 tag trk1	Allow VLAN 101 on Ports 2 and 3. Trk1 (tagged)
#vlan 102 tagged trk1	#vlan 102 tag trk1	Allow VLAN 102 on Ports 2 and 3. Trk1 (tagged)
#vlan 103 tagged trk1	#vlan 103 tag trk1	Allow VLAN 103 on Ports 2 and 32. Trk1 (tagged)
#vlan 104 tagged trk1	#vlan 104 tag trk1	Allow VLAN 104 on Ports 2 and 3. Trk1 (tagged)
.....	...	Configure all other VLANs
#vlan 2400 tagged trk1	#vlan 2400 tag trk1	Allow VLAN 2400 on Ports 2 and 32. Trk1 (tagged)
#spanning-tree ethernet trk1 admin-edge-port	#span e trk1 admin-edge	Set trk1 as an edge port (non bridging port). Note: default is “auto-edge” mode which automatically sets port to Edge if no BPDU are received after 3 sec.
#show vlan 101	#sh vlan 101	Display VLAN 101
#show vlan 102	#sh vlan 102	Display VLAN 102
#show vlan 103	#sh vlan 103	Display VLAN 103
#show vlan 104	#sh vlan 104	Display VLAN 104
#show vlan ports trk1 detail	# show vlan ports trk1 detail	Displays the VLAN detail for Trunk 1
#show interface brief1-3	#sh int br1-3	Show Port 2-3 status
#write memory	#wr mem	Save running configuration

**NOTE: If two switches are being used, issue the same commands on the second switch.**

**Table 12** ProCurve command line configuration (802.1Q)  
Configure Ports 2 and 3 of each switch for vNet Tunnel (Port X4)

Command	Shortcut	Description
>enable	>en	Privilege mode
#configure terminal	#conf	Configure in global mode
#span	#span	Enables spanning-tree (MSTP mode by default)
#vlan 101 tagged 2	#vlan 101 tag 2	Allow VLAN 101 on Port 1 and set to tagged mode
#vlan 102 tagged 2	#vlan 102 tag 2	Add VLAN 102 on Port 1 and set to tagged mode
#exit	#exit	Exit VLAN 102
#show vlan ports 1 detail	# show vlan ports 1 deta	Displays the VLAN detail for Port 1
#show vlan ports 2 detail	# show vlan ports 2 deta	Displays the VLAN detail for Port 1
#write memory (For permanent changes only)	#write mem	Save the running configuration to NVRAM. Otherwise, the changes will be lost on the next reboot.

# Appendix B2 – Scenario-based Comware Command Line Reference

## Scenario 1– NPN Comware command line configuration (Simple vNet with Active/Standby Uplinks)

Connect to the HPN switch servicing the VC Ethernet uplink ports and enter the following Comware commands.

**NOTE:** Assumes that the two switches have been configured for IRF.

**Table 13** Comware command line configuration  
Configure Port 1 of each switch, connected to Port X5

Command	Shortcut	Description
#system	#sys	System View
#stp bpdu-protection	#stp bpdu	Enable Spanning Tree
#vlan 101	#vlan 101	Create VLAN 101
#interface Ten-Gigabitethernet 1/0/1	#int ten 1/0/1	Focus on Port 1/0/1
#port access vlan 101	#port ac v 101	Set port 1/0/1 access to VLAN 101
#interface Ten-Gigabitethernet 2/0/1	#int ten 2/0/1	Focus on Port 2/0/1
#port access vlan 101	#port ac v 101	Set port 2/0/1 access to VLAN 101
#quit	#quit	Remove focus from Port 2/0/1
#save	#sa	Save the running configuration

## Scenarios 2 through 6, 8 and 9 – HPN Comware command line configuration (Shared Uplink Set with VLAN tagging and 802.3ad (LACP) Active/Active Uplinks)

Connect to the HPN switch servicing the VC Ethernet uplink ports and enter the following IOS commands.

**NOTE:** Assumes that the two switches have been configured for IRF.

**Table 14** Comware command line configuration (802.1Q, 802.3ad)  
Configure Port 1 and 2 of each switch, connected to Port X5 and X6

Command	Shortcut	Description
>system	>sys	System View
#stp bpdu-protection	#stp bpdu	Enable Spanning Tree
#vlan 101 to 105 2100 to 2400	#vl 101 to 105 2100 to 2400	Create VLANs 101 to 105 and 2100 to 2400
#interface Bridge-Aggregation 1	#int br 1	Create bridge Aggregate 1
#port link-type trunk	#port-l t	Enable Port Trunk on Bridge Aggregate 1
#port trunk permit vlan 101 to 105 2100 to 2400	#port tr pe v 101 to 105 2100 to 2400	Configure bridge aggregate for VLANs 101 through 105, 2100-2400
#link-aggregation mode dynamic	#link m d	Set Link Aggregation mode to dynamic
#interface Ten-GigabitEthernet 1/0/1	#int ten 1/0/1	Set focus on Interface Ten 1/0/1
#port link-type trunk	#port link-t t	Enable trunking on port
#port trunk permit vlan 101 to 105 2100 to 2400	#port tr pe v 101 to 105 2100 to 2400	Configure port for VLANs 101 through 105, 2100-2400
# port link-aggregation group 1	#port link-a 1	Place port in Bridge Aggregate 1
#interface Ten-GigabitEthernet 1/0/2	#int ten 1/0/2	Set focus on Interface Ten 1/0/2
#port link-type trunk	#port link-t t	Enable trunking on port
#port trunk permit vlan 101 to 105 2100 to 2400	#port tr pe v 101 to 105 2100 to 2400	Configure port for VLANs 101 through 105, 2100-2400
# port link-aggregation group 1	#port link-a 1	Place port in Bridge Aggregate 1
#interface Bridge-Aggregation 2	#int br 2	Create Bridge Aggregate 2
#port link-type trunk	#port-l t	Enable Port Trunk on Bridge Aggregate 2

**Table 14** Comware command line configuration (802.1Q, 802.3ad)  
Configure Port 1 and 2 of each switch, connected to Port X5 and X6

Command	Shortcut	Description
#port trunk permit vlan 101 to 105 2100 to 2400	#port tr pe v 101 to 105 2100 to 2400	Configure bridge aggregate for VLANs 101 through 105, 2100-2400
#link-aggregation mode dynamic	#link m d	Set Link Aggregation mode to dynamic
#interface Ten-GigabitEthernet 2/0/1	#int ten 2/0/1	Set focus on Interface Ten 2/0/1
#port link-type trunk	#port link-t t	Enable trunking on port
#port trunk permit vlan 101 to 105 2100 to 2400	#port tr pe v 101 to 105 2100 to 2400	Configure port for VLANs 101 through 105, 2100-2400
# port link-aggregation group 1	#port link-a 1	Place port in Bridge Aggregate 2
#interface Ten-GigabitEthernet 2/0/2	#int ten 2/0/2	Set focus on Interface Ten 2/0/2
#port link-type trunk	#port link-t t	Enable trunking on port
#port trunk permit vlan 101 to 105 2100 to 2400	#port tr pe v 101 to 105 2100 to 2400	Configure port for VLANs 101 through 105, 2100-2400
# port link-aggregation group 1	#port link-a 1	Place port in Bridge Aggregate 2
#save	#save	Save running config

**Note:** As an alternative, ports could be configured for ALL VLANs as follows “port trunk permit vlan all”

## Scenarios 7 - Comware command line configuration (Shared Uplink Set with VLAN tagging and 802.3ad (LACP) Active/Active Uplinks and Tunneled VLANs)

Connect to the HPN switch servicing the VC Ethernet uplink ports and enter the following IOS commands.

**NOTE:** Assumes that the two switches have been configured for IRF.

**Table 15** Comware command line configuration (802.1Q, 802.3ad)  
Configure Port 1 of each switch for Shared Uplink Set (Port X4)

Command	Shortcut	Description
>system	>sys	System View
#stp bpdu-protection	#stp bpdu	Enable Spanning Tree
#vlan 101 to 105	#vl 101 to 105	Create VLANs 101 to 105
#interface Ten-GigabitEthernet 1/0/1	#int ten 1/0/1	Set focus on Interface Ten 1/0/1
#port link-type trunk	#port link-t t	Enable trunking on port
#port trunk permit vlan 101 to 102	#port tr pe v 101 to 102	Configure port for VLANs 101 to 102
#interface Ten-GigabitEthernet 1/0/2	#int ten 2/0/1	Set focus on Interface Ten 2/0/1
#port link-type trunk	#port link-t t	Enable trunking on port
#port trunk permit vlan 101 to 102	#port tr pe v 101 to 102	Configure port for VLANs 101 to 102
#save	#save	Save running config

**Note:** As an alternative, ports could be configured for ALL VLANs as follows “port trunk permit vlan all”

**Table 16** Comware command line configuration (802.1Q)  
Configure Ports 2 & 3 of each switch for the vNet Tunnel (Ports X5 & X6)

Command	Shortcut	Description
>system	>sys	System View
#stp bpdu-protection	#stp bpdu	Enable Spanning Tree
#vlan 101 to 105 2100 to 2400	#vl 101 to 105 2100 to 2400	Create VLANs 101 to 105 and 2100 to 2400
#interface Bridge-Aggregation 1	#int br 1	Create bridge Aggregate 1
#port link-type trunk	#port-l t	Enable Port Trunk on Bridge Aggregate 1
#port trunk permit vlan 101 to 105 2100 to 2400	#port tr pe v 101 to 105 2100 to 2400	Configure bridge aggregate for VLANs 101 through 105, 2100-2400
#link-aggregation mode dynamic	#link m d	Set Link Aggregation mode to dynamic
#interface Ten-GigabitEthernet 1/0/1	#int ten 1/0/1	Set focus on Interface Ten 1/0/1
#port link-type trunk	#port link-t t	Enable trunking on port
#port trunk permit vlan 101 to 105 2100 to 2400	#port tr pe v 101 to 105 2100 to 2400	Configure port for VLANs 101 through 105, 2100-2400
# port link-aggregation group 1	#port link-a 1	Place port in Bridge Aggregate 1
#interface Ten-GigabitEthernet 1/0/2	#int ten 1/0/2	Set focus on Interface Ten 1/0/2
#port link-type trunk	#port link-t t	Enable trunking on port
#port trunk permit vlan 101 to 105 2100 to 2400	#port tr pe v 101 to 105 2100 to 2400	Configure port for VLANs 101 through 105, 2100-2400
# port link-aggregation group 1	#port link-a 1	Place port in Bridge Aggregate 1
#interface Bridge-Aggregation 2	#int br 2	Create Bridge Aggregate 2
#port link-type trunk	#port-l t	Enable Port Trunk on Bridge Aggregate 2
#port trunk permit vlan 101 to 105 2100 to 2400	#port tr pe v 101 to 105 2100 to 2400	Configure bridge aggregate for VLANs 101 through 105, 2100-2400
#link-aggregation mode dynamic	#link m d	Set Link Aggregation mode to dynamic
#interface Ten-GigabitEthernet 1/0/1	#int ten 2/0/1	Set focus on Interface Ten 2/0/1

**Table 16** Comware command line configuration (802.1Q)  
 Configure Ports 2 & 3 of each switch for the vNet Tunnel (Ports X5 & X6)

Command	Shortcut	Description
#port link-type trunk	#port link-t t	Enable trunking on port
#port trunk permit vlan 101 to 105 2100 to 2400	#port tr pe v 101 to 105 2100 to 2400	Configure port for VLANs 101 through 105, 2100-2400
# port link-aggregation group 1	#port link-a 1	Place port in Bridge Aggregate 2
#interface Ten-GigabitEthernet 1/0/2	#int ten 2/0/3	Set focus on Interface Ten 2/0/3
#port link-type trunk	#port link-t t	Enable trunking on port
#port trunk permit vlan 101 to 105 2100 to 2400	#port tr pe v 101 to 105 2100 to 2400	Configure port for VLANs 101 through 105, 2100-2400
# port link-aggregation group 1	#port link-a 1	Place port in Bridge Aggregate 2
#save	#save	Save running config

**Note:** As an alternative, ports could be configured for ALL VLANs as follows “port trunk permit vlan all”

## Scenarios 10 and 11 – HPN Comware command line configuration (Shared Uplink Set with VLAN tagging and 802.3ad (LACP) Active/Active Uplinks)

Connect to the HPN switch servicing the VC Ethernet uplink ports and enter the following IOS commands.

**NOTE:** Assumes that the two switches have been configured for IRF.

**Table 14** Comware command line configuration (802.1Q, 802.3ad)  
Configure Port 1 and 2 of each switch, connected to Port Q2 and Q3

Command	Shortcut	Description
>system	>sys	System View
#stp bpdu-protection	#stp bpdu	Enable Spanning Tree
#vlan 101 to 105 2100 to 2400	#vl 101 to 105 2100 to 2400	Create VLANs 101 to 105 and 2100 to 2400
#interface Bridge-Aggregation 1	#int br 1	Create bridge Aggregate 1
#description VLAN-Trunk-1	#description VLAN-Trunk-1	Sets port Description
#port link-type trunk	#port-l t	Enable Port Trunk on Bridge Aggregate 1
#port trunk permit vlan 101 to 105 2100 to 2400	#port tr pe v 101 to 105 2100 to 2400	Configure bridge aggregate for VLANs 101 through 105, 2100-2400
#link-aggregation mode dynamic	#link m d	Set Link Aggregation mode to dynamic
#stp edged-port	#stp edg	Sets port in spanning tree edge mode
#interface Bridge-Aggregation 2	#int br 2	Create bridge Aggregate 2
#description VLAN-Trunk-1	#description VLAN-Trunk-1	Sets port Description
#port link-type trunk	#port-l t	Enable Port Trunk on Bridge Aggregate 1
#port trunk permit vlan 101 to 105 2100 to 2400	#port tr pe v 101 to 105 2100 to 2400	Configure bridge aggregate for VLANs 101 through 105, 2100-2400
#link-aggregation mode dynamic	#link m d	Set Link Aggregation mode to dynamic
#stp edged-port	#stp edg	Sets port in spanning tree edge mode
#interface FortyGigE1/0/49	#int for 1/0/49	Set focus on Interface FortyGig 1/0/49

**Table 14** Comware command line configuration (802.1Q, 802.3ad)  
Configure Port 1 and 2 of each switch, connected to Port Q2 and Q3

Command	Shortcut	Description
#description VLAN-Trunk-1 FlexFabric 20/40 Bay 1 Port Q2	#description VLAN-Trunk-1 FlexFabric 20/40 Bay 1 Port Q2	Sets Port description
#port link-type trunk	#port link-t t	Enable trunking on port
#port trunk permit vlan 101 to 105 2100 to 2400	#port tr pe v 101 to 105 2100 to 2400	Configure port for VLANs 101 through 105, 2100-2400
#stp edged-port	#stp edg	Sets port in spanning tree edge mode
# port link-aggregation group 1	#port link-a 1	Place port in Bridge Aggregate 1
#interface FortyGigE1/0/50	#int for 1/0/50	Set focus on Interface FortyGig 1/0/50
#description VLAN-Trunk-1 FlexFabric 20/40 Bay 1 Port Q3	#description VLAN-Trunk-1 FlexFabric 20/40 Bay 1 Port Q3	Sets Port description
#port link-type trunk	#port link-t t	Enable trunking on port
#port trunk permit vlan 101 to 105 2100 to 2400	#port tr pe v 101 to 105 2100 to 2400	Configure port for VLANs 101 through 105, 2100-2400
#stp edged-port	#stp edg	Sets port in spanning tree edge mode
# port link-aggregation group 1	#port link-a 1	Place port in Bridge Aggregate 1
#interface FortyGigE2/0/49	#int for 2/0/49	Set focus on Interface FortyGig 2/0/49
#description VLAN-Trunk-1 FlexFabric 20/40 Bay 2 Port Q2	#description VLAN-Trunk-1 FlexFabric 20/40 Bay 2 Port Q2	Sets Port description
#port link-type trunk	#port link-t t	Enable trunking on port
#port trunk permit vlan 101 to 105 2100 to 2400	#port tr pe v 101 to 105 2100 to 2400	Configure port for VLANs 101 through 105, 2100-2400
#stp edged-port	#stp edg	Sets port in spanning tree edge mode
# port link-aggregation group 2	#port link-a 2	Place port in Bridge Aggregate 2
#interface FortyGigE2/0/50	#int for 2/0/50	Set focus on Interface FortyGig 2/0/50

**Table 14** Comware command line configuration (802.1Q, 802.3ad)  
Configure Port 1 and 2 of each switch, connected to Port Q2 and Q3

Command	Shortcut	Description
#description VLAN-Trunk-2 FlexFabric 20/40 Bay 2 Port Q3	#description VLAN-Trunk-2 FlexFabric 20/40 Bay 2 Port Q3	Sets Port description
#stp edged-port	#stp edg	Sets port in spanning tree edge mode
# port link-aggregation group 2	#port link-a 2	Place port in Bridge Aggregate 2
#save	#save	Save running config

**Note:** As an alternative, ports could be configured for ALL VLANs as follows “port trunk permit vlan all”

# Appendix C – Acronyms and abbreviations

Term	Definition
<b>Auto Port Speed**</b>	Let VC automatically determine best Flex NIC speed
<b>CLP String</b>	Flex-10 NIC settings written to the server hardware by VC/0A when the server is power off. Read by the server hardware upon power in.
<b>Custom Port Speed**</b>	Manually set Flex NIC speed (up to Maximum value defined)
<b>DCC**</b>	Dynamic Control Channel. Future method for VC to change Flex-10 NIC port settings on the fly (without power no/off)
<b>EtherChannel*</b>	A Cisco proprietary technology that combines multiple NIC or switch ports for greater bandwidth, load balancing, and redundancy. The technology allows for bi-directional aggregated network traffic flow.
<b>Flex NIC**</b>	One of four virtual NIC partitions available per Flex-10 NIC port. Each capable of being tuned from 100Mb to 10Gb
<b>Flex-10 Nic Port**</b>	A physical 10Gb port that is capable of being partitioned into 4 Flex NICs
<b>Flex-20 Nic Port**</b>	A physical 20Gb port that is capable of being partitioned into 4 Flex NICs
<b>Flex HBA***</b>	Physical function 2 or a FlexFabric Adapter can act as either an Ethernet NIC, FCoE connection or iSCSI NIC with boot and iSCSI offload capabilities.
<b>IEEE 802.1Q</b>	An industry standard protocol that enables multiple virtual networks to run on a single link/port in a secure fashion through the use of VLAN tagging.
<b>IEEE 802.3ad</b>	An industry standard protocol that allows multiple links/ports to run in parallel, providing a virtual single link/port. The protocol provides greater bandwidth, load balancing, and redundancy.
<b>LACP</b>	Link Aggregation Control Protocol (see IEEE802.3ad)
<b>LOM</b>	LAN-on-Motherboard. Embedded network adapter on the system board
<b>Maximum Link Connection Speed**</b>	Maximum Flex NIC speed value assigned to vNet by the network administrator. Can NOT be manually overridden on the server profile.
<b>Multiple Networks Link Speed Settings**</b>	Global Preferred and Maximum Flex NIC speed values that override defined vNet values when multiple vNets are assigned to the same Flex NIC
<b>MZ1 or MEZZ1; LOM</b>	Mezzanine Slot 1; (LOM) Lan Motherboard/systemboard NIC
<b>Network Teaming Software</b>	A software that runs on a host, allowing multiple network interface ports to be combined to act as a single virtual port. The software provides greater bandwidth, load balancing, and redundancy.
<b>pNIC**</b>	Physical NIC port. A Flex NIC is seen by VMware as a pNIC
<b>Port Aggregation</b>	Combining ports to provide one or more of the following benefits: greater bandwidth, load balancing, and redundancy.
<b>Port Bonding</b>	A term typically used in the Unix/Linux world that is synonymous to NIC teaming in the Windows world.
<b>Preferred Link Connection Speed**</b>	Preferred Flex NIC speed value assigned to a vNet by the network administrator.
<b>Share Uplink Set (SUS)</b>	A set of Ethernet uplinks that are used together to provide improved throughput and availability to a group of associated Virtual Connect networks. Each associated Virtual Connect network is mapped to a specific VLAN on the external connection and appropriate VLAN tags are removed or added as Ethernet packets enter or leave the Virtual Connect domain.
<b>SmartLink</b>	A feature that, when enabled, configures a Virtual Connect network so that if all external uplinks lose link to external switches, Virtual Connect will drop the Ethernet link on all local server blade Ethernet ports connected to that network.
<b>Trunking (Cisco)</b>	802.1Q VLAN tagging
<b>Trunking (Industry)</b>	Combining ports to provide one or more of the following benefits: greater bandwidth, load balancing, and redundancy.
<b>Trunking (Industry)</b>	Combining ports to provide one or more of the following benefits: greater bandwidth, load balancing, and redundancy.
<b>VLAN</b>	A virtual network within a physical network.
<b>VLAN Tagging</b>	Tagging/marketing an Ethernet frame with an identity number representing a virtual network.
<b>VLAN Trunking Protocol (VTP)*</b>	A Cisco proprietary protocol used for configuring and administering VLANs on Cisco network devices.
<b>vNIC</b>	Virtual NIC port. A software-based NIC used by Virtualization Managers
<b>vNet</b>	Virtual Connect Network used to connect server NICs to the external Network

\*The feature is not supported by Virtual Connect

\*\*This feature was added for Virtual Connect Flex-10

\*\*\*This feature was added for Virtual Connect FlexFabric

# Appendix D – Useful VC CLI Command sets

The following are a collection of useful VC CLI commands. These CLI commands and many more are documented in detail in Virtual Connect Command Line Interface Version Guide. The following CLI commands can be copied and pasted into an SSH session with the VCM and will apply immediately upon paste.

In addition to the following CLI commands and scripting examples, there have been several telemetry and troubleshooting commands added to the VC CLI. Please refer to the VC CLI guide for more details on how to use these commands.

## VC Domain Configuration

#Enclosure Setup

#Import Enclosure and Set Domain Name

#Ensure password matches the OA password

*import enclosure username=Administrator password=Administrator*

*set domain name=VC\_Domain\_1*

#Importing additional or multiple Enclosures to an existing VC Domain

# Importing an Enclosure into an existing VC Domain (Note: As of this writing (VC firmware 2.30) the following commands must be executed individually and cannot be part of a larger script).

#The IP address, login and password information used in this command are from the OA of the enclosure being imported.

*Import enclosure 10.0.0.60 UserName=Administrator Password=password*

*Import enclosure 10.0.0.30 UserName=Administrator Password=password*

*Import enclosure 10.0.0.40 UserName=Administrator Password=password*

#Configure MAC and WWN to VC Defined and select pool #1

*set domain mactype=vc-defined macpool=1*

*set domain wwntype=vc-defined wwnpool=1*

*set serverid type=vc-defined poolid=1*

#Set default domain settings

*set mac-cache Enabled=true Refresh=5*

*set igmp Enabled=false*

*set enet-vlan -quiet VlanCapacity=Expanded*

*set statistics-throughput -quiet Enabled=true SampleRate=5m*

*set port-protect networkLoop=Enabled*

*set port-protect pauseFlood=Enabled*

*set lacp-timer Default=Short*

#Changing the Flow Control setting

*set advanced-networking -quiet PacketBufferOverallocationRatio=1 FlowControl=auto*

#Setting Flow Control to off

*set advanced-networking FlowControl=off*

# Set CLI/GUI time-out value – default is 15 minutes

*set session Timeout=0*

#Set snmp community string, trap destination and contact

*set snmp enet ReadCommunity=public SystemContact="System Admin"*

*set snmp fc ReadCommunity=public SystemContact="System Admin"*

*add snmp-trap SIM Address=192.168.1.185 Community=public Format=SNMPv2 Severity="Critical, Minor"*

*DomainCategories="ServerStatus, FabricStatus, EnetStatus, Legacy, DomainStatus, NetworkStatus, ProfileStatus, FcStatus" EnetCategories="PortThreshold, PortStatus, Other" FcCategories="Other, PortStatus"*

```
#Change Administrator default password
set user Administrator password=password

#Add additional User to VCM, creates User steve
add user steve password=password privileges=domain,network,server,storage

# Set Advanced Ethernet Settings to a Preferred speed of 2Gb and a Max Speed of 6Gb
set enet-vlan PrefSpeedType=Custom PrefSpeed=2000 MaxSpeedType=Custom MaxSpeed=6000
```

## Simple Network (vNet)

Creating vNets

```
#Create vNet "Prod-Net" and configure uplinks
add Network Prod-Net
add uplinkport enc0:1:X3 Network=Prod-Net speed=auto
#Optionally enable the vNet as a Private Network
set network Prod-Net Private=Enabled
```

## Shared Uplink Set (with 10Gb Uplinks)

Creating Shared Uplink Sets

```
#Create Shared Uplink Set "Prod-Net" and configure one uplink VC module 1, port X1
add uplinkport enc0:1:X1 Uplinkset=Prod-Net speed=auto
```

```
#Create Shared Uplink Set "Prod-Net" and configure multiple uplinks on VC Module 1, Ports X1 – X3
add uplinkset Prod-Net
add uplinkport enc0:1:X1 Uplinkset=Prod-Net speed=auto
add uplinkport enc0:1:X2 Uplinkset=Prod-Net speed=auto
add uplinkport enc0:1:X3 Uplinkset=Prod-Net speed=auto
```

```
# Create Networks VLAN_101 through VLAN_104, supporting VLANs 101 through 104 on Shared Uplink Set "Prod-Net"
add network VLAN_101 uplinkset=Prod-Net VLanID=101
add network VLAN_102 uplinkset=Prod-Net VLanID=102
add network VLAN_103 uplinkset=Prod-Net VLanID=103
add network VLAN_104 uplinkset=Prod-Net VLanID=104
# (optionally) Set network VLAN_104 as a "Private Network"
set network VLAN_104 Private=Enabled
```

## Shared Uplink Set (with 40Gb Uplinks – FlexFabric 20/40 F8)

Creating Shared Uplink Sets

```
#Create Shared Uplink Set "Prod-Net" and configure one uplink VC module 1, port Q1
add uplinkport enc0:1:Q1 Uplinkset=Prod-Net speed=auto
```

```
#Create Shared Uplink Set "Prod-Net" and configure multiple uplinks on VC Module 1, Ports Q1 – Q3
add uplinkset Prod-Net
add uplinkport enc0:1:Q1 Uplinkset=Prod-Net speed=auto
add uplinkport enc0:1:Q2 Uplinkset=Prod-Net speed=auto
add uplinkport enc0:1:Q3 Uplinkset=Prod-Net speed=auto
```

```
# Create Networks VLAN_101 through VLAN_104, supporting VLANs 101 through 104 on Shared Uplink Set "Prod-Net"
add network VLAN_101 uplinkset=Prod-Net VLanID=101
add network VLAN_102 uplinkset=Prod-Net VLanID=102
add network VLAN_103 uplinkset=Prod-Net VLanID=103
add network VLAN_104 uplinkset=Prod-Net VLanID=104
# (optionally) Set network VLAN_104 as a "Private Network"
set network VLAN_104 Private=Enabled
```

## SAN Fabric (VC-FC)

Creating FC SAN Fabrics

#Create SAN Fabrics A and B on VC-FC modules in Bays 3 and 4

Add fabric SAN\_A Bay=3 Ports=1,2

Add fabric SAN\_B Bay=4 Ports=1,2

## Server Profiles

#Create Server Profile App-1, apply this profile to Server Slot 1 and configure NIC 1 to Multiple Networks

VLAN\_101 and VLAN\_102

add profile App-1 -nodefaultenetconn

add enet-connection App-1 pxe=Enabled

add enet-connection App-1 pxe=Disabled

add server-port-map App-1:1 VLAN\_101 VLanId=101

add server-port-map App-1:1 VLAN\_102 VLanId=102

assign profile App-1 enc0:1

# As an alternative when connection to Multiple Networks, if you want ALL networks

# configured on a specific Shared Uplink Set to be presented to a server NIC, ensure that

# the “Force VLAN mappings as Shared Uplink Set” check box is enabled.

# Shared Uplink Set, use the following commands to do so

# This will set the Force same VLAN mappings as Shared Uplink Sets check box to enabled

# Result is that only VLANs from this shared uplink will be available to this NIC

add server-port-map App-1:1 VLAN\_101 Uplinkset=Prod-Net

add server-port-map App-1:1 VLAN\_102 Uplinkset=Prod-Net

# Create Server Profile App-1 – Both NICs are configured on network VLAN\_102

add profile App-1 -nodefaultenetconn

add enet-connection App-1 pxe=Enabled

add enet-connection App-1 pxe=Disabled

set enet-connection App-1 1 Network=VLAN\_102

set enet-connection App-1 2 Network=VLAN\_102

assign profile App-1 enc0:2

# Create Server Profile ESX-1 – Both NICs are configured on both networks VLAN\_102 and VLAN\_102

add profile ESX-1 -nodefaultenetconn

add enet-connection ESX-1 pxe=Enabled

add enet-connection ESX-1 pxe=Disabled

add server-port-map ESX-1:1 VLAN\_101 VLanId=101

add server-port-map ESX-1:1 VLAN\_102 VLanId=102

add server-port-map ESX-1:2 VLAN\_101 VLanId=101

add server-port-map ESX-1:2 VLAN\_102 VLanId=102

assign profile ESX-1 enc0:1

# Create Server Profile Server-1 with 8 Flex-10 NICs configured for specific speeds

add profile Server-1 -nodefaultenetconn -nodefaultfcconn -nodefaultcoecconn

add enet-connection Server-1 pxe=Enabled Network=Console-101-1 SpeedType=Custom Speed=500

add enet-connection Server-1 pxe=Disabled Network=Console-101-2 SpeedType=Custom Speed=500

add enet-connection Server-1 pxe=Disabled Network=VMotion-102-1 SpeedType=Custom Speed=2500

add enet-connection Server-1 pxe=Disabled Network=VMotion-102-2 SpeedType=Custom Speed=2500

add enet-connection Server-1 pxe=Disabled Network=Prod-103-1 SpeedType=Custom Speed=2000

add enet-connection Server-1 pxe=Disabled Network=Prod-103-2 SpeedType=Custom Speed=2000

add enet-connection Server-1 pxe=Disabled

add server-port-map Server-1:7 Prod-104-1 VLanId=104

add server-port-map Server-1:7 Prod-105-1 VLanId=105

add enet-connection Server-1 pxe=Disabled

add server-port-map Server-1:8 Prod-104-2 VLanId=104

```

add server-port-map Server-1:8 Prod-105-2 VLanId=105
Assign profile Server-1 enc0:1

# Add TWO fc connections to Profile ESX-1 with a specific WWN
add fc-connection ESX-1 Fabric=SAN_3 AddressType=User-Defined PortWWN=50:06:0B:00:00:C2:ff:00
NodeWWN=50:06:0B:00:00:c2:ff:01
add fc-connection ESX-1 Fabric=SAN_4 AddressType=User-Defined PortWWN=50:06:0B:00:00:C2:ff:02
NodeWWN=50:06:0B:00:00:C2:ff:03

# Add TWO NIC connections to Profile ESX-1 with a specific MAC and iSCSI MAC address
add enet-connection ESX-1 AddressType=User-Defined EthernetMac=00-17-00-00-AA-AA IScsiMac=00-17-00-00-
BB-BB pxe=Enabled
add enet-connection ESX-1 AddressType=User-Defined EthernetMac=00-17-00-00-AA-CC IScsiMac=00-17-00-00-
BB-CC pxe=Disabled

```

## FlexFabric Scripting Additions

#Create the **FCoE SAN Fabrics** FCoE\_A and FCoE\_B and configure uplinks as discussed above  
Add fabric FCoE\_A Bay=1 Ports=1,2 LinkDist=Auto  
Add fabric FCoE\_B Bay=2 Ports=1,2 LinkDist=Auto

## Release 3.30 Scripting Additions

### Scripting a Shared Uplink Set

When creating a Shared Uplink Set, you can now bulk create the VLAN entries for the Shared Uplink Set through the use of the “add Network-range” command.

```

# Create Shared Uplink Set VLAN-Trunk-1 and configure uplinks
add uplinkset VLAN-Trunk-1
add uplinkport enc0:1:X5 Uplinkset=VLAN-Trunk-1 speed=auto
add uplinkport enc0:1:X6 Uplinkset=VLAN-Trunk-1 speed=auto
# Create Networks VLAN-1-1 through VLAN-3-1, VLAN-101-1 through VLAN-105-1, VLAN-201-1 through VLAN-
205-1, VLAN-301-1 through VLAN-305-1 for Shared Uplink Set VLAN-Trunk-1
add network-range -quiet UplinkSet=VLAN-Trunk-1 NamePrefix=VLAN- NameSuffix=-1 VLANIds=101-105,201-
205,301-305 State=enabled PrefSpeedType=auto SmartLink=enabled

```

### Scripting a Shared Uplink Set – with a Native VLAN and SmartLink

When creating a Shared Uplink Set, you can now bulk create the VLAN entries for the Shared Uplink Set through the use of the “add Network-range” command.

```

# Create Shared Uplink Set VLAN-Trunk-1 and configure uplinks
add uplinkset VLAN-Trunk-1
add uplinkport enc0:1:X5 Uplinkset=VLAN-Trunk-1 speed=auto
add uplinkport enc0:1:X6 Uplinkset=VLAN-Trunk-1 speed=auto
# Create Network VLAN-1-1 for Shared Uplink Set VLAN-Trunk-1, enable SmartLink and NativeVLAN
add network VLAN-1-1 uplinkset=VLAN-Trunk-1 VLanID=1 NativeVLAN=Enabled
Set Network VLAN-1-1 SmartLink=Enabled
# Create Networks VLAN-2-1 through VLAN-3-1, VLAN-101-1 through VLAN-105-1, VLAN-2100 through 2400 for
Shared Uplink Set VLAN-Trunk-1
add network-range -quiet UplinkSet=VLAN-Trunk-1 NamePrefix=VLAN- NameSuffix=-1 VLANIds=2,3,101-
105,2100-2400 State=enabled PrefSpeedType=auto SmartLink=enabled

```

## **Copying a Shared Uplink Sets – with a Native VLAN and SmartLink**

Virtual Connect provides the ability to copy a Shared Uplink Set. This can be very handy when defining an Active/Active Shared Uplink Set design. You simply create the first SUS, then copy it.

For example, after creating Shared Uplink Set VLAN-Trunk-1 you can copy it to VLAN-Trunk-2. You will then need to add uplinks to the new SUS and ensure all networks have SmartLink enabled. This can be accomplished as follows;

```
copy uplinkset VLAN-Trunk-1 VLAN-Trunk-2 fromVlanStr=1 toVlanStr=2 replace=last  
add uplinkport enc0:2:X5 Uplinkset=VLAN-Trunk-2 speed=auto  
add uplinkport enc0:2:X6 Uplinkset=VLAN-Trunk-2 speed=auto  
set network-range -quiet UplinkSet=VLAN-Trunk-1 VLANIds=1,2,3,101-105,2100-2400 SmartLink=enabled
```

## **Scripting a Server Profile**

When creating a server profile, mapping multiple VLANs to a server NIC is further simplified through the use of the “add server-port-map-range” command

```
# Create Server Profile ESX-1  
add profile ESX-1 -nodefaultfcconn -nodefaultfcoeconn  
set enet-connection ESX-1 1 pxe=Enabled Network=VLAN-101-1 SpeedType=Custom Speed=100  
set enet-connection ESX-1 2 pxe=Disabled Network=VLAN-101-2 SpeedType=Custom Speed=100  
add enet-connection ESX-1 pxe=Disabled Network=VLAN-102-1 SpeedType=Custom Speed=2000  
add enet-connection ESX-1 pxe=Disabled Network=VLAN-102-2 SpeedType=Custom Speed=2000  
add enet-connection ESX-1 pxe=Disabled  
add server-port-map-range ESX-1:5 UplinkSet=VLAN-Trunk-1 VLanIds=103-105,2100-2150  
add enet-connection ESX-1 pxe=Disabled  
add server-port-map-range ESX-1:6 UplinkSet=VLAN-Trunk-2 VLanIds=103-105,2100-2150  
add fcoe-connection ESX-1 Fabric=FCoE_A SpeedType=4Gb  
add fcoe-connection ESX-1 Fabric=FCoE_B SpeedType=4Gb  
assign profile ESX-1 enc0:1
```

## **Copying a Server Profile**

Virtual Connect CLI provides the ability to COPY a profile. The example below will copy an existing profile (ESX-1), then apply it to a vacant server bay (bay 2-4), and optionally power it on.

```
copy profile ESX-1 ESX-2  
assign profile ESX-2 enc0:2  
Poweron server enc0:2  
copy profile ESX-1 ESX-3  
assign profile ESX-2 enc0:3  
Poweron server enc0:3  
copy profile ESX-1 ESX-4  
assign profile ESX-2 enc0:4  
Poweron server enc0:4
```

# Appendix E – Configuring QoS

This appendices will provide an overview and configuration to enable QoS on an existing Virtual Connect Domain. QoS can be configured within a Domain at any time after the Domain have been created.

## Virtual Connect QoS

With Virtual Connect 4.01 QoS features have been add to provide the ability to enable and configure QoS services to align with the QoS implementation as configured within your network.

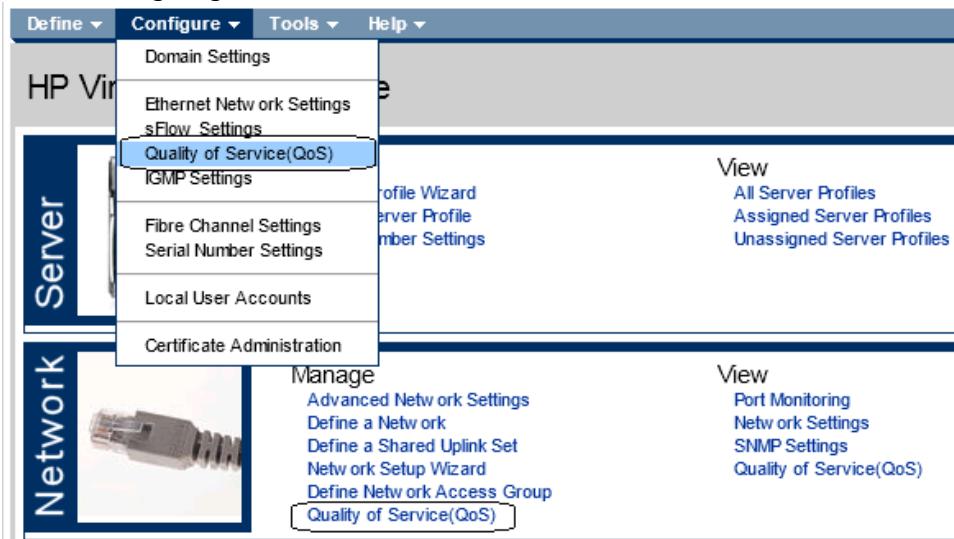
There are 3 QoS modes available within Virtual Connect:

- Passthrough (Default)
- Custom (with FCoE Lossless), Selected when FlexFabric and/or when Dual Hop FCoE is implemented within the Domain
- Custom (without FCoE Lossless), Selected when FCoE is not implemented within the Domain

## Configuring the QoS type via GUI

To configure QoS through the GUI, log into VCM and Select “Quality of Service (QoS”, from the Configure Menu drop down, or from the Network box on the Virtual Connect Home page.

**Figure 337 - Configuring QoS**



The default Virtual Connect QoS configuration mode is Passthrough. In this mode, two classes of service are provided, one for FCoE with lossless service and one for Ethernet without any form of Quality of Service (FIFO).

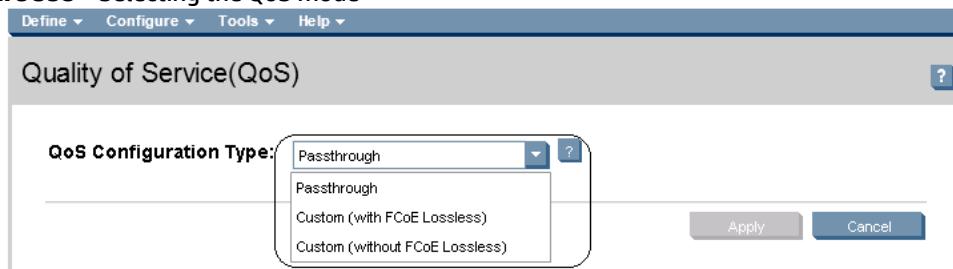
To improve the Ethernet traffic service level control and have Virtual Connect take a specific action on a specified classified traffic, the Virtual Connect QoS settings can be changed to **Custom (with FCoE Lossless)** or **Custom (without FCoE Lossless)**. In these modes, Virtual Connect monitors the Ethernet traffic for Layer 2 802.1p Priority bits, or Layer 3 DSCP or ToS markings and places packets on the pre-defined egress queues. The Ethernet traffic is then prioritized based on the traffic classification.

When configured for **Custom (with FCoE Lossless)** or **Custom (without FCoE Lossless)**, Virtual Connect provides up to eight (8) configurable QoS queues. In either mode one queue is assigned to “Best Effort”, and in **Custom (with FCoE Lossless)** one queue is assigned to FCoE traffic classes.

**Note:** FCoE Lossless applies to both FlexFabric in a Single Hop FCoE configuration, this would be considered a traditional FlexFabric configuration, or when using the new Dual Hop FCoE feature provided in Virtual Connect 4.01.

**Note:** You can change between any QoS modes as long as No Dual Hop FCoE SAN Fabrics exist. Once a DUAL HOP FCoE SAN fabric has been created, you will be limited to selecting “Passthrough” or “Custom with FCoE Lossless” QoS modes. This only applies when FCoE is configured within a Shared Uplink Set and does not apply to a traditional FlexFabric FCoE SAN Fabric connection.

**Figure 338 – Selecting the QoS mode**



## Configuring the QoS Type via CLI

The following command can be copied and pasted into an SSH based CLI session with Virtual Connect:

```
# Set QoS Config Type to Passthrough  
set qos Passthrough
```

```
# Set QoS Config Type to Custom with FCoE Lossless class  
set qos CustomWithFCoE
```

```
# Set QoS Config Type to Custom no FCoE Lossless class  
set qos CustomNoFCoE
```

## Configuring the QoS Traffic Class via GUI

The next section is only available when you have not chosen the “Passthrough” QoS configuration type. If selected accordingly, you will see the following menu option where you have the possibility to enable specific queues, define the minimum and maximum bandwidth per queue and the associated 802.1p (COS) priority.

In the **Custom (with FCoE Lossless)** mode, Virtual Connect supports up to 8 configurable traffic classes.

- 1 predefined system class for Best Effort.
- 1 predefined system class for FCoE Lossless.
- 6 user defined classes.

**Figure 339 - Configure the remaining Queues when with FCoE Lossless is selected**

Name	Real Time	Share	Max Share	Egress DOT1P Priority	Enabled
FCoE_Lossless		65	100	3	<input checked="" type="checkbox"/>
Best_Effort		0	0	0	<input type="checkbox"/>
Medium	<input type="checkbox"/>	25	100	2	<input checked="" type="checkbox"/>
Class1	<input type="checkbox"/>	0	100	0	<input type="checkbox"/>
Class2	<input type="checkbox"/>	0	100	0	<input type="checkbox"/>
Class3	<input type="checkbox"/>	0	100	0	<input type="checkbox"/>
Class4	<input type="checkbox"/>	0	100	0	<input type="checkbox"/>
Real_Time	<input checked="" type="checkbox"/>	10	10	5	<input checked="" type="checkbox"/>

\* For the FCoE\_Lossless traffic class, the Share is based on the profile connection configuration and the Max Share is based on the fabric configuration.

The “Share” parameter defines the available bandwidth per output queue. The sum of all individual Share values must be 100. If you add more bandwidth to a specific queue the requested bandwidth is deducted from the “Best\_Effort” traffic class. The “Best\_Effort” Share is therefore not changeable because it gets automatically the remaining unallocated bandwidth.

In the **Custom (without FCoE Lossless)** mode, Virtual Connect supports up to 8 configurable traffic classes.

- 1 predefined system class for Best Effort.
- 7 user defined classes.

**Figure 340 - Configure the remaining Queues when without FCoE Lossless is selected**

Name	Real Time	Share	Max Share	Egress DOT1P Priority	Enabled
Best_Effort		65	100	0	<input checked="" type="checkbox"/>
Medium	<input type="checkbox"/>	25	100	2	<input checked="" type="checkbox"/>
Class1	<input type="checkbox"/>	0	100	0	<input type="checkbox"/>
Class2	<input type="checkbox"/>	0	100	0	<input type="checkbox"/>
Class3	<input type="checkbox"/>	0	100	0	<input type="checkbox"/>
Class4	<input type="checkbox"/>	0	100	0	<input type="checkbox"/>
Class5	<input type="checkbox"/>	0	100	0	<input type="checkbox"/>
Real_Time	<input checked="" type="checkbox"/>	10	10	5	<input checked="" type="checkbox"/>

**Note:** The default unchangeable 802.1p priority for the Lossless FCoE traffic class is 3.

## Configuring the QoS Traffic Class via CLI

```
# Set QoS Config Traffic classes
set qos-class Medium Enabled=true RealTime=false Share=25 EgressDOT1P=2 MaxShare=100
set qos-class Real_Time Enabled=true RealTime=true Share=10 EgressDOT1P=5 MaxShare=10
set qos-class Class1 Enabled=false RealTime=false MaxShare=100
set qos-class Class2 Enabled=false RealTime=false MaxShare=100
set qos-class Class3 Enabled=false RealTime=false MaxShare=100
set qos-class Class4 Enabled=false RealTime=false MaxShare=100
set qos-class Best_Effort MaxShare=100
```

The FCoE Lossless traffic share is based on the Virtual Connect server profile configuration. The MAX Share is based on the FCoE Fabric configuration.

**Figure 341 – FCoE Bandwidth definition**

FCoE HBA Connections									
Port	Connectd FC SAN / FCoE Network Name	Type	Status	Port Speed Type	Allocated Port S	VWN/HN	MAC	Mapping	Action
1	Bay 1 FCoE_A	SAN	<span style="color: green;">PREFERRED</span>	4 Gb - 8 Gb	50:06:0B:00:00:C2:DE:00	00-17-A4-77-7C-14	LOM1:1-b => Bay 1:d1:v2		<span style="color: blue;">Delete</span>
2	Bay 2 FCoE_B	SAN	<span style="color: green;">PREFERRED</span>	4 Gb - 8 Gb	50:06:0B:00:00:C2:DE:02	00-17-A4-77-7C-15	LOM1:2-b => Bay 2:d1:v2		
<a href="#">+ Add</a>									
<input type="checkbox"/> Fibre Channel Boot Parameters									

For each user defined class you want to use, check the **Enabled** box and enter the appropriate Share/Max share and matching 802.1p priority. The total share value must equal 100, as changes in share value are made the Best\_Effort value will adjust automatically. Only ONE queue can be active as Real Time.

**Figure 342 – Configure Share Values and DOT1P Priority**

The screenshot shows the Quality of Service (QoS) configuration interface. At the top, there's a dropdown menu for 'QoS Configuration Type' set to 'Custom (with FCoE Lossless)'. Below it are two tabs: 'Traffic Classes' (selected) and 'Ingress Traffic Classifiers'. The 'Traffic Classes' tab displays a table with columns: Name, Real Time, Share, Max Share, Egress DOT1P Priority, and Enabled. The table contains the following data:

Name	Real Time	Share	Max Share	Egress DOT1P Priority	Enabled
FCoE_Lossless		Per Connection*	Per Fabric*	3	<input checked="" type="checkbox"/>
Best_Effort		65	100	0	<input type="checkbox"/>
Medium		25	100	2	<input type="checkbox"/>
Class1		0	100	0	<input type="checkbox"/>
Class2		0	100	0	<input type="checkbox"/>
Class3		0	100	0	<input type="checkbox"/>
Class4		0	100	0	<input type="checkbox"/>
Real_Time		10	10	5	<input checked="" type="checkbox"/>

A note at the bottom states: \*For the FCoE\_Lossless traffic class, the Share is based on the profile connection configuration and the Max Share is based on the fabric configuration.

At the bottom right are 'Apply' and 'Cancel' buttons.

**Note:** When configured for Dual Hop FCoE, FCoE Ethernet Bandwidth allocation on Virtual Connect uplinks is always fixed (Min=50% - Max=100%). This means that FCoE network will use 100% of bandwidth if no other networks are configured or if other networks are not using their bandwidth

Within the Ingress Traffic Classifiers tab in the **classification for uplinks** and **classification for downlinks** drop-down windows you can define which frame marking you trust when it arrives; the choices include DOT1P, DCSP or DCSP/DOT1P.

In addition you can do a re-marking for IEEE 802.1p or DSCP marked frames.

## Configuring the QoS Ingress Traffic Classifier on Uplinks and Downlinks via GUI

In this section you can define what QoS marking will be trusted when packets are received and how the 802.1p and DSCP mapping is handled.

**Figure 343 – Configuring Ingress Traffic Classes**

The screenshot shows the 'Quality of Service (QoS)' configuration interface. At the top, there's a dropdown menu for 'QoS Configuration Type' set to 'Custom (with FCoE Lossless)'. Below it, tabs for 'Traffic Classes' and 'Ingress Traffic Classifiers' are visible, with 'Ingress Traffic Classifiers' being the active tab. Under 'Classification for uplinks', 'DOT1P' is selected. Under 'Classification for downlinks', 'DSCP/DOT1P' is selected. A note states: '\* When DSCP and DOT1P are both in use, DSCP will be used to classify IP traffic and DOT1P will be used for non-IP traffic.' The 'DOT1P Mapping' table lists ingress DOT1P values from 0 to 7 and their corresponding traffic classes and egress priorities:

Ingress DOT1P Value	Traffic Classes	Egress DOT1P Priority
0	Best_Effort	0
1	Best_Effort	0
2	Medium	2
3 (Non-FCoE traffic)	Medium	2
3 (FCoE traffic)	FCoE_Lossless	3
4	Medium	2
5	Real_Time	5
6	Real_Time	5
7	Real_Time	5

The 'DSCP Mapping' table lists ingress DSCP values and their corresponding traffic classes and egress priorities:

Ingress DSCP Value	Traffic Classes	Egress DOT1P Priority
DSCP 10, AF11	Best_Effort	0
DSCP 12, AF12	Best_Effort	0
DSCP 14, AF13	Best_Effort	0
DSCP 18, AF21	Medium	2
DSCP 20, AF22	Medium	2
DSCP 22, AF23	Medium	2
DSCP 26, AF31	Medium	2
DSCP 28, AF32	Medium	2
DSCP 30, AF33	Medium	2
DSCP 34, AF41	Medium	2
DSCP 36, AF42	Medium	2
DSCP 38, AF43	Medium	2
DSCP 46, EF	Real_Time	5

**Note:** You are forced to re-mark traffic with CoS=3 to a different CoS value. This is done to protect the FCoE traffic which uses the default value of CoS=3.

First you specify what priority values you trust when packets are received from the up- or downlinks (server-links).

You have the choice to select between:

- 802.1p (COS value inside the Layer2 VLAN tag)
- DSCP (Differentiated services code point inside a Layer 3 IPv4 header)
- DSCP/802.1p (When DSCP and DOT1P are both in use, DSCP will be used to classify IP traffic and DOT1P will be used for non-IP traffic)

**Figure 344 - QoS Ingress Classification**



### Configuring the QoS Ingress Traffic Classifier on Uplinks and Downlinks via CLI

```
# Set QoS Ingress Traffic Classifier
set qos-classifier Downlinks Classifiers=DOT1P,DSCP
set qos-classifier Uplinks Classifiers=DOT1P
```

### Configuring the QoS Dot1P and DSCP Traffic Mappings via GUI

You can overwrite the egress 802.1q field based on the ingress 802.1p or DSCP values. In the next two screenshots you can see how to map the marked ingress traffic to a specific VC Traffic Class. The system will then automatically apply the corresponding egress 802.1p value to this traffic.

**Figure 345 – GUI QoS 802.1p mapping**

DOT1P Mapping		
Ingress DOT1P Value	Traffic Classes	Egress DOT1P Priority
0	Best_Effort	0
1	Best_Effort	0
2	Medium	2
3 (Non-FCoE traffic)	Real_Time	2
3 (FCoE traffic)	Class1	3
4	Class2 (Disabled)	2
5	Real_Time	5
6	Real_Time	5
7	Real_Time	5

**Note:** Non FCoE traffic with an 802.1p value of 3 is enforced to use a different value. This is done to protect FCoE against other traffic.

## Configuring the QoS Dot1P and DSCP Traffic Mappings via CLI

```
# Set QoS Ingress Traffic Classifier
set qos-map DOT1P Class=Best_Effort Values="0-7"
set qos-map DSCP Class=Best_Effort Values="AF11-CS7"
set qos-class Medium Enabled=true RealTime=false Share=25 EgressDOT1P=2 MaxShare=100
set qos-class Real_Time Enabled=true RealTime=true Share=10 EgressDOT1P=5 MaxShare=10
set qos-class Class1 Enabled=false RealTime=false MaxShare=100
set qos-class Class2 Enabled=false RealTime=false MaxShare=100
set qos-class Class3 Enabled=false RealTime=false MaxShare=100
set qos-class Class4 Enabled=false RealTime=false MaxShare=100
set qos-class Best_Effort MaxShare=100
set qos-classifier Downlinks Classifiers=DOT1P,DSCP
set qos-classifier Uplinks Classifiers=DOT1P
set qos-map DOT1P Class=Best_Effort Values="0,1"
set qos-map DOT1P Class=Medium Values="2,3,4"
set qos-map DOT1P Class=Real_Time Values="5,6,7"
set qos-map DSCP Class=Best_Effort Values="AF11,AF12,AF13,CS0,CS1"
set qos-map DSCP Class=Medium Values="AF21,AF22,AF23,AF31,AF32,AF33,AF41,AF42,AF43,CS2,CS3,CS4"
set qos-map DSCP Class=Real_Time Values="CS5,CS6,CS7,EF"
set qos CustomWithFCoE
```

# Appendix F – Using QSFP+ for 10Gb Connectivity with the FlexFabric-20/40 F8 Module

As discussed in Scenarios 10 and 11, HP has recently released a FlexFabric-20/40 F8 module that supports 20Gb connections to the server and 40Gb connection to the network infrastructure; however, if you don't yet have 40Gb networking available in your environment, you can still take advantage of the FlexFabric-20/40 F8 20/40 F8 module by leveraging 10Gb, or aggregates of 10Gb SFP+ connections. This appendices describes how the QSFP+ ports can be used with a 10Gb splitter cable to connect to existing 10Gb switched.

In addition to the QSFP+ splitter cable, there are 8 SFP+ 10Gb ports (X1-X8) that can be used for 10Gb connectivity over either copper or fiber connections. These ports could also be configured for 8Gb Fibre Channel connectivity.

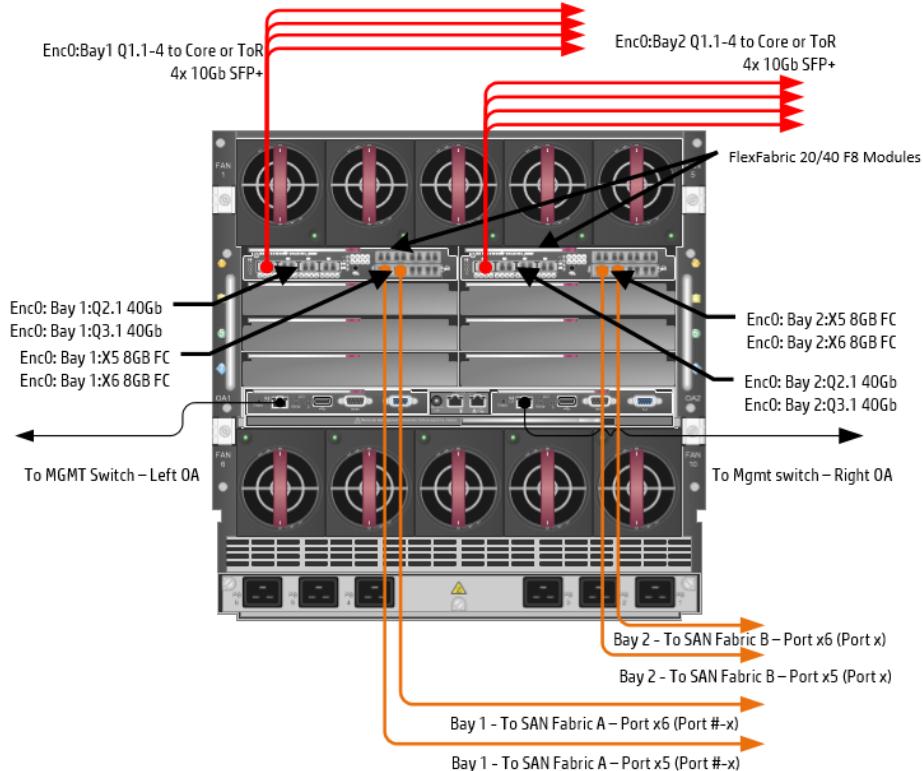
The example in this appendices, and the previous Scenarios could also be implemented using the SFP+ ports.

Although this appendices was written to align with Scenarios 10 and 11, it could be implemented with only of the scenarios, simply adjust your networks and profiles to match your specific needs.

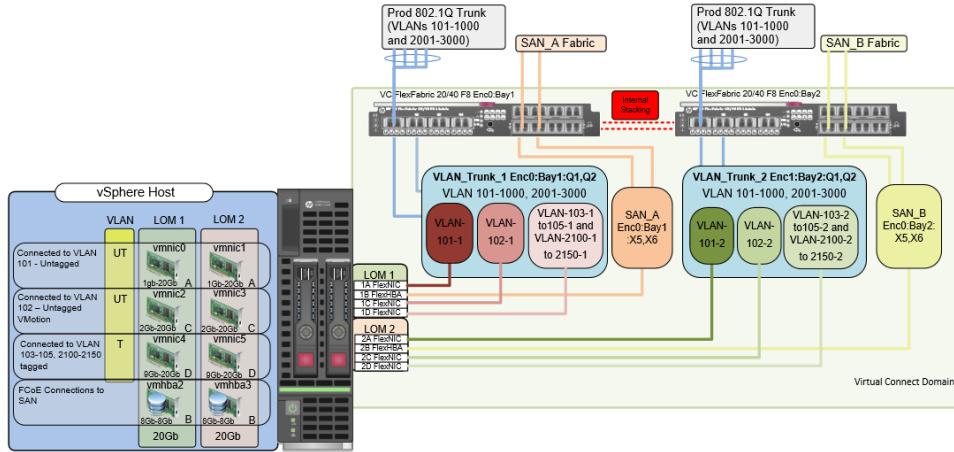
## Requirements

This example will focus specifically on the Ethernet connectivity to the LAN switches, the profiles used in Scenarios 10 and 11 align to these networks.

**Figure 346 - Physical View:** Shows four Ethernet uplinks from Port Q1 on Module 1 to Ports on the first network switch and four Ethernet uplinks from Port Q1 on Module 2 to Ports on the second network switch. The SAN fabrics are also connected redundantly, with TWO uplinks per fabric, from ports X1 and X2 on module 1 to Fabric A and ports X1 and X2 to Fabric B.



**Figure 347 - Logical View;** The server blade profile is configured with SIX FlexNICs and 2 FlexHBAs. NICs 1 and 2 are connected to VLAN-101-x, NICs 3 and 4 are connected to VLAN-102-x and NICs 4 and 5 are connected to VLAN-103-x through VLAN-105-x and VLAN-2100x through VLAN-2150-x, which are part of the Shared Uplink Sets, VLAN-Trunk-1 and VLAN-Trunk-2 respectively. The VLAN-Trunks are connected to the network switch using the QSFP+ Splitter cable through Port Q1.1 through Q1.4 on each FlexFabric-20/40 F8 Module in Bays 1 and 2. The FCoE SAN connections are connected through ports X5 and X6 on each FlexFabric-20/40 F8 module.



## Installation and configuration

### Switch configuration

Appendices A and B provide a summary of the commands required to configure the switch in either a Cisco or HP Networking (with both ProCurve and Comware examples). The configuration information provided in the appendices assumes the following information:

- The switch ports are configured as VLAN TRUNK ports (tagging) to support several VLANs. All frames will be forwarded to Virtual Connect with VLAN tags. Optionally, one VLAN could be configured as (Default) untagged, if so, then a corresponding vNet within the Shared Uplink Set would be configured and set as “Default”.

**Note:** When adding additional uplinks to the SUS, if the additional uplinks are connecting from the same FlexFabric-20/40 F8 module to the same switch, in order to ensure all The uplinks are active, the switch ports will need to be configured for LACP within the same Link Aggregation Group.

The network switch port should be configured for Spanning Tree Edge as Virtual Connect appears to the switch as an access device and not another switch. By configuring the port as Spanning Tree Edge, it allows the switch to place the port into a forwarding state much quicker than otherwise, this allows a newly connected port to come online and begin forwarding much quicker.

The SAN connection will be made with redundant connections to each Fabric. SAN switch ports connecting to the FlexFabric-20/40 F8 module must be configured to accept NPIV logins.

### Configuring the VC module

- Physically connect the QSFP+ splitter cable between Q1 on the VC module in Bay 1 to 4 Switch Ports
- Physically connect the QSFP+ splitter cable between Q1 on the VC module in Bay 2 to 4 Switch Ports

**Note:** The QSFP+ to 4x 10G SFP+ Splitter cable provides the ability to configured each 10Gb connection as an independent connection, or can be used in the same Virtual Connect Network, Tunnel of Shared Uplink Set and aggregated through LACP, or spread across multiple switches in an Active/Standby configuration.

## Defining a new Shared Uplink Set (VLAN-Trunk-1)

Connect Ports X5 and X6 of FlexFabric-20/40 F8 module in Bay 1 to Ports 1 through 4 switch 1

Create a SUS named VLAN-Trunk-1 and connect it to FlexFabric-20/40 F8 Ports Q1.1 through Q1.4 on Module 1

- On the Virtual Connect Home page, select Define, Shared Uplink Set
- Insert Uplink Set Name as VLAN-Trunk-1
- Select Add Port, then add the following port;
  - Enclosure 1, Bay 1, Port Q1.1
  - Enclosure 1, Bay 1, Port Q1.2
  - Enclosure 1, Bay 1, Port Q1.3
  - Enclosure 1, Bay 1, Port Q1.4

**Figure 348 - Shared Uplink Set (VLAN-Trunk-1) Uplinks Assigned**

Port	Port Role	Port Status	Connector Type	Connected To	PID	Speed/Duplex	Action
C7K-Bottom Bay 1: Port Q1.1	NA	Linked	10 Gb	QSFP+CR	vanlab (Ten-GigabitEthernet1/0/1)	Auto	<a href="#">Delete</a>
C7K-Bottom Bay 1: Port Q1.2	NA	Linked	10 Gb	QSFP+CR	vanlab (Ten-GigabitEthernet1/0/2)	Auto	<a href="#">Delete</a>
C7K-Bottom Bay 1: Port Q1.3	NA	Linked	10 Gb	QSFP+CR	vanlab (Ten-GigabitEthernet1/0/3)	Auto	<a href="#">Delete</a>
C7K-Bottom Bay 1: Port Q1.4	NA	Linked	10 Gb	QSFP+CR	vanlab (Ten-GigabitEthernet1/0/4)	Auto	<a href="#">Delete</a>

Connection Mode:  Auto    LACP Timer:  Domain Default, Short (1 sec)  
 Fallback     Short (1 sec)     Long (30 sec)

Add Port

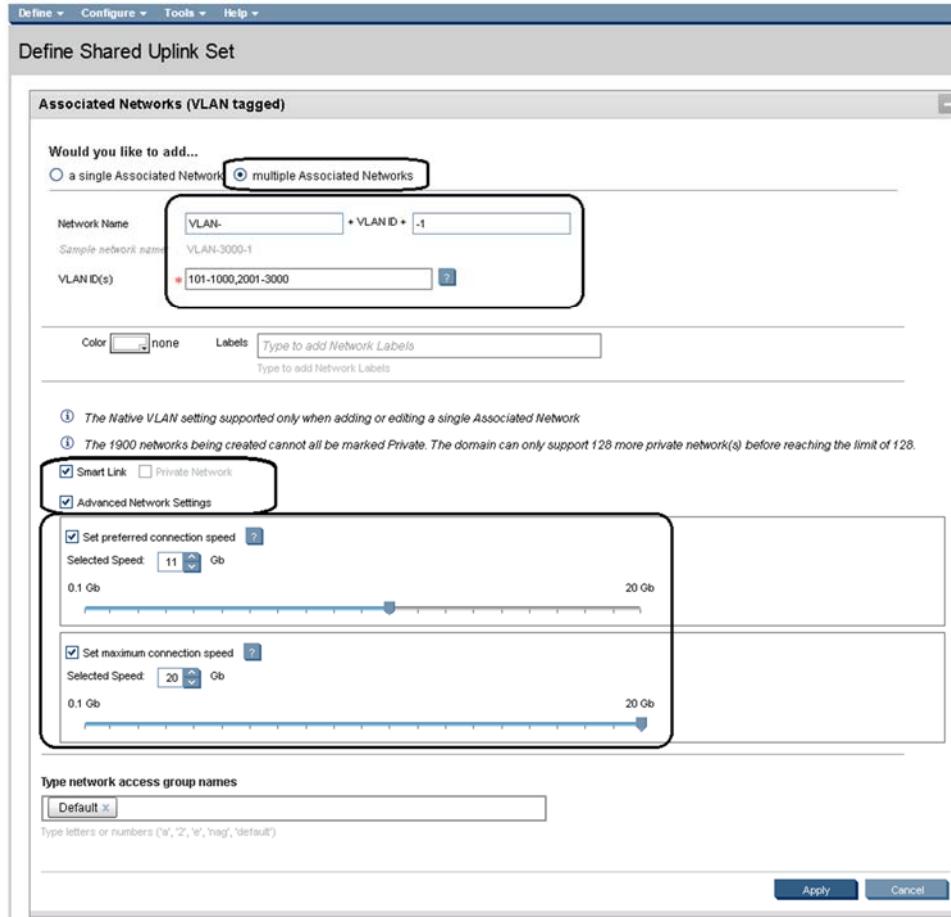
Associated FCoE Networks (VLAN tagged)

Associated Networks (VLAN tagged)

- Click Add Networks and select the Multiple Networks radio button and add the following VLANs;
  - Enter Name as VLAN-
  - Enter Suffix as -1
  - Enter VLAN IDs as follows (and shown in the following graphic);
  - 101-1000,2001-3000
- Enable SmartLink on ALL networks
- Click Advanced
  - Configure Preferred speed to 8Gb
  - Configure Maximum speed to 20Gb
- Click Apply

**Note:** You can optionally specify a network “color” or “Label” when creating a shared Uplinkset and its networks. In the example above we have not set either color or label. Also notice the new configurable LACP Timer setting.

**Figure 349 - Creating VLANs in a Shared Uplink Set**



**Note:** If the VC domain is not in Expanded VLAN capacity mode, you will receive an error when attempting to create more than 128 VLANs in a SUS. If that occurs, go to Advanced Ethernet Settings and select Expanded VLAN capacity mode and apply.

After clicking apply, a list of VLANs will be presented as shown below. If one VLAN in the trunk is untagged/native, see note below.

- Click Apply at the bottom of the page to create the Shared Uplink Set

**Figure 350 - Associated VLANs for Shared Uplink Set VLAN-Trunk-1**

Network Name	VLAN ID	Native	Smart Link	Private Network	Action
VLAN-101-1	101	false	true	false	Edit
VLAN-102-1	102	false	true	false	Edit
VLAN-103-1	103	false	true	false	Edit
VLAN-104-1	104	false	true	false	Edit
VLAN-105-1	105	false	true	false	Edit
VLAN-106-1	106	false	true	false	Edit
VLAN-107-1	107	false	true	false	Edit
VLAN-108-1	108	false	true	false	Edit
VLAN-109-1	109	false	true	false	Edit
VLAN-110-1	110	false	true	false	Edit
VLAN-111-1	111	false	true	false	Edit
VLAN-112-1	112	false	true	false	Edit
VLAN-113-1	113	false	true	false	Edit
VLAN-114-1	114	false	true	false	Edit
VLAN-115-1	115	false	true	false	Edit
VLAN-116-1	116	false	true	false	Edit
VLAN-117-1	117	false	true	false	Edit
VLAN-118-1	118	false	true	false	Edit
VLAN-119-1	119	false	true	false	Edit
VLAN-120-1	120	false	true	false	Edit
VLAN-121-1	121	false	true	false	Edit
VLAN-122-1	122	false	true	false	Edit
VLAN-123-1	123	false	true	false	Edit
VLAN-124-1	124	false	true	false	Edit

Apply      Cancel

**Note:** Optionally, if one of the VLANs in the trunk to this shared uplink set were configured as Native or Untagged, you would be required to “edit” that VLAN in the screen above, and configure Native as TRUE. This would need to be set for BOTH VLAN-Trunk-1 and VLAN-Trunk-2.

**Figure 351 - You will see that ALL Uplinks are still in a Linked/Standby state**

Shared Uplink Sets					
External Connections		Associated Networks			
Shared Uplink Set	Has FCoE	Port Status	Connector Type	Uplink Port	Action
VLAN-Trunk-1	false	<input checked="" type="checkbox"/> Linked-Standby <input checked="" type="checkbox"/> Linked-Standby <input checked="" type="checkbox"/> Linked-Standby <input checked="" type="checkbox"/> Linked-Standby	10 Gb QSFP+CR 10 Gb QSFP+CR 10 Gb QSFP+CR 10 Gb QSFP+CR	<input checked="" type="checkbox"/> C7K-Bottom: Bay 1: Port Q1.1 <input checked="" type="checkbox"/> C7K-Bottom: Bay 1: Port Q1.2 <input checked="" type="checkbox"/> C7K-Bottom: Bay 1: Port Q1.3 <input checked="" type="checkbox"/> C7K-Bottom: Bay 1: Port Q1.4	<a href="#">Edit</a>

[Add](#)

**Note:** That both of the network connections are shown as “Linked/Standby”, this state will NOT change until the network has been assigned to a server profile. This behavior is new within VC 4.30 and is provided to accommodate the new 4096 VLAN feature.

## Defining a new Shared Uplink Set (VLAN-Trunk-2)(Copying a Shared Uplink Set)

Copy the Shared Uplink Set “VLAN-Trunk-1” as shown in earlier scenarios and utilize uplinks from Bay 2. Also, if the switches you are connecting to are stacked or clusters, you could split the individual connections across switch.

## Defining a new Shared Uplink Set via CLI

The following script can be used to create the first Shared Uplink Set (VLAN-Trunk-1)

*The following command(s) can be copied and pasted into an SSH based CLI session with Virtual Connect*

```
# Create Shared Uplink Set VLAN-Trunk-1 and configure uplinks
```

```
add uplinkset VLAN-Trunk-1
add uplinkset VLAN-Trunk-1 ConnectionMode=Auto LacpTimer=Domain-Default
add uplinkport enc0:1:Q1.1 UplinkSet=VLAN-Trunk-1 Speed=Auto
add uplinkport enc0:1:Q1.2 UplinkSet=VLAN-Trunk-1 Speed=Auto
add uplinkport enc0:1:Q1.3 UplinkSet=VLAN-Trunk-1 Speed=Auto
add uplinkport enc0:1:Q1.4 UplinkSet=VLAN-Trunk-1 Speed=Auto
```

```
# Create Networks VLAN-101-1 through VLAN-105-1 and 2100-2400 for Shared Uplink Set  
VLAN-Trunk-1  
add network-range -quiet UplinkSet=VLAN-Trunk-1 NamePrefix=VLAN- NameSuffix=-1  
VLANIds=101-1000,2101-3000 State=enabled PrefSpeedType=Custom PrefSpeed=12000  
MaxSpeedType=Custom MaxSpeed=20000 SmartLink=enabled
```

The following script can be used to create the Second Shared Uplink Set (VLAN-Trunk-2)

```
# Create Shared Uplink Set VLAN-Trunk-2 and configure uplinks  
add uplinkset VLAN-Trunk-2  
add uplinkset VLAN-Trunk-1 ConnectionMode=Auto LacpTimer=Domain-Default  
add uplinkport enc0:2:Q1.1 UplinkSet=VLAN-Trunk-1 Speed=Auto  
add uplinkport enc0:2:Q1.2 UplinkSet=VLAN-Trunk-1 Speed=Auto  
add uplinkport enc0:2:Q1.3 UplinkSet=VLAN-Trunk-1 Speed=Auto  
add uplinkport enc0:2:Q1.4 UplinkSet=VLAN-Trunk-1 Speed=Auto  
  
# Create Networks VLAN101-2 through VLAN105-2 and VLAN-2100-2 through VLAN-2400-2 for  
Shared Uplink Set VLAN-Trunk-2  
add network-range -quiet UplinkSet=VLAN-Trunk-2 NamePrefix=VLAN- NameSuffix=-2  
VLANIds=101-1000,2101-3000 State=enabled PrefSpeedType=Custom PrefSpeed=11000  
MaxSpeedType=Custom MaxSpeed=20000 SmartLink=enabled
```

## Review

In this Appendix with leveraged a previously documented Share Uplink Set and utilizes a QSFP+ splitter cable to connect to an existing 10Gb infrastructure.

## **For more information**

To read more about Virtual Connect, go to: **hp.com/go/virtualconnect**

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