# HP Virtual Connect Ethernet Cookbook: Single and Multi Enclosure Domain (Stacked) Scenarios

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## Intended audience

This document is for the person who installs, administers, and troubleshoots HP BladeSystem servers with Virtual Connect. HP assumes you are qualified in the servicing of computer equipment and trained in recognizing hazards in products with hazardous energy levels.

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# Purpose

The purpose of this Virtual Connect Cookbook is to provide new users to Virtual Connect with a better understanding of the concepts and steps required when integrating HP BladeSystem and Virtual Connect 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 solutions. Although these scenarios are shown individually, some scenarios could be combined to create a more complex and versatile Virtual Connect environment, however, keeping in mind the difference between mapped and tunneled VLANs, discussed later in this paper are mutually exclusive.

This is not meant to be a complete or detailed guide to Virtual Connect, but is intended to provide the reader with some valid examples of how Virtual Connect could be deployed. Many additional configurations or scenarios could also be implemented.

# Introduction to Virtual Connect

Virtual Connect is an industry standard-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 (Figure 1). Once the LAN and SAN connections are physically made to the pool of servers, the server administrator uses Virtual Connect management tools (Virtual Connect Enterprise Manager or Virtual Connect Manager) to create an Interconnect modules connection profile for each server.

## Additional Virtual Connect Reference Material

Link to *HP Virtual Connect technology for the HP BladeSystem c-Class*, 2nd edition when available

http://h20000.www2.hp.com/bc/docs/support/SupportManual/c00814156/c00814156.pdf

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

http://bizsupport1.austin.hp.com/bc/docs/support/SupportManual/c01732252/c01732252.pdf

Link to *HP Flex-10 technology*

http://bizsupport2.austin.hp.com/bc/docs/support/SupportManual/c01608922/c01608922.pdf

## Virtual Connect Fibre Channel Cookbook

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 *Virtual Connect Fibre Channel Cookbook*
http://bizsupport1.austin.hp.com/bc/docs/support/SupportManual/c01702940/c01702940.pdf

(**www.hp.com/go/blades**)

## Virtual Connect 2.30 Firmware Release

Shared Uplink Sets provide administrators 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.)

Virtual Connect firmware 2.30 was released in September 2009 and provided a number of new features. Among those feature enhancements are a couple which are relevant to this paper;

- DCC (Device Control Channel), which adds support for link state, notification and dynamic bandwidth allocation for Flex-10 NICs.
- DCC provides the ability to dynamically edit or modify a Flex-10 profile, renaming the Flex-10 profile, editing NIC connections within a profile and/or adjusting link speed without the need for a server power down or reboot

  Note: in order to obtain the full functionality of DCC, NC532i/m NIC firmware level must be 2.2.3 or later.

The following Shared Uplink Set rules apply per domain:

- 320 Unique VLANs per Virtual Connect Ethernet module
- 128 Unique VLANs per Shared Uplink Set
- 28 Unique Server Mapped VLANs per Server Profile Network Connection

Please see the Virtual Connect 2.30 Release Notes for future details on these and other new features.

# Tunneled VLAN and Mapped VLANS

Virtual Connect provides two Ethernet networks connection methods. Both of these connection types are discussed within the following scenarios.

## vNet

A vNet is a term used to describe a network within Virtual Connect. A vNet could represent a dedicated network within Virtual Connect, in which case it would operate in one of two modes, the first is a simple vNet that will pass untagged frames. The second is a vNet tunnel which will pass tagged frames for one or many VLANs. An individual "Network" as configured within a Shared Uplink Set, which would define a specific VLAN, is also vNet.

The vNet is a network connection between one or many server NICs to one or many uplink ports. A vNet could also exist without uplink ports, to provide connectivity between server NICs within an enclosure to for local only communications such as, cluster a heartbeat network.

A vNet could be used to connect a single VLAN, no tagging, to one or many server NICs. If this network is part of 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. 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 has no limit to the number of VLANs it can support.

## Benefits of a vNet

If no VLAN support is required, support for a single specific VLAN being presented as untagged or many VLANs need to be presented to the server a vNet is a very simple network to configure and manage within Virtual Connect.

A vNet can be utilized in one of two ways, a simple vNet, used to pass untagged frames and a tunneled vNet. A tunneled vNet can be used to pass many VLANs without modifying the VLAN tags, functioning as a transparent VLAN Pass-Thru module.

## 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;

1. Select 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 VC, those frames will not be tagged, however; Virtual Connect will add the VLAN tag and forward the frame onto the correct VLAN.

2. Select multiple networks – which would provide connectivity to several VLANs.

   The Map VLAN Tags 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 VC 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).

   With Mapped VLAN Tags, 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 we want the server NIC in) 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 and present them to the guests. Using Mapped VLAN Tags minimizes the number of uplinks required.

   In order to utilize the Multiple Networks feature of Virtual Connect, the Map VLAN Tags feature, needs to be turned on under the Ethernet Settings/Advanced tab within the Virtual Connect manager or the Virtual Connect CLI.

## SUS - Restrictions and limitations

When configuring a Shared Uplink Set the following limitations apply;

- 64 VLANs per uplink (128 VLAN Support is provided in VC firmware 2.30 and later)
- 320 VLANs per module
- 28 VLANs to a server down link
- Every VLAN on every uplink counts towards the 320-VLAN limit. If a Shared Uplink Set is comprised of multiple uplinks, each VLAN on that Shared Uplink Set is counted multiple times

## Benefits of a SUS

A Shared Uplink Set can be configure to support both tagged and un-tagged network traffic to a server NIC, which simplifies the overall configuration and minimizes the number of uplink cables required to support the network connections.

## Tunnel vs. Map VLAN tags setting

It is important to note that the behavior of both vNets and Shared Uplink Sets is dependent on whether VLAN Tunnel or Map VLAN Tags is set. Server VLAN Tagging Support, as configured in the "Advanced Ethernet Settings" tab of Virtual Connect is a Domain wide configuration.

If Virtual Connect is set to Tunnel Mode, you can do the following;

- Create a Shared Uplink Set – which can support several VLANs up to the publish limits
- These VLANs can be presented to a Server NIC, one at a time – No multiple VLANS supported, frames are presented to the NIC untagged
- Create a vNet – which can support both TAGGED or UNTAGGED frames, if tagged the host system will need to interpret those tags

If Virtual Connect is set to Map VLAN Tags Mode, you can do the following;

- Create a Shared Uplink Set – (the behavior of a SUS changes and now provides the ability to connect multiple networks to a NIC) which can support several VLANs up to the publish limits.
- These VLANs can be presented to a Server NIC, as either a single Network (where VC will remove the tags and present an untagged frame to the NIC), or as multiple Networks, where VC will present all frames with their VLAN tags, in which case the host system will need to interpret the tags (one network could be configured as untagged)
- Create a vNet – (the behavior of a vNet also changes) a vNet can now only support UNTAGGED frames, which means a vNet could then only support ONE VLAN/network

# Chapter 1: Single Domain/Enclosure Scenarios

## Overview

This chapter will provide several simple configuration scenarios of Virtual Connect, using a Single HP BladeSystem c7000 enclosure with two Virtual Connect Ethernet modules installed in Bays 1 and 2. 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 will also be provided.

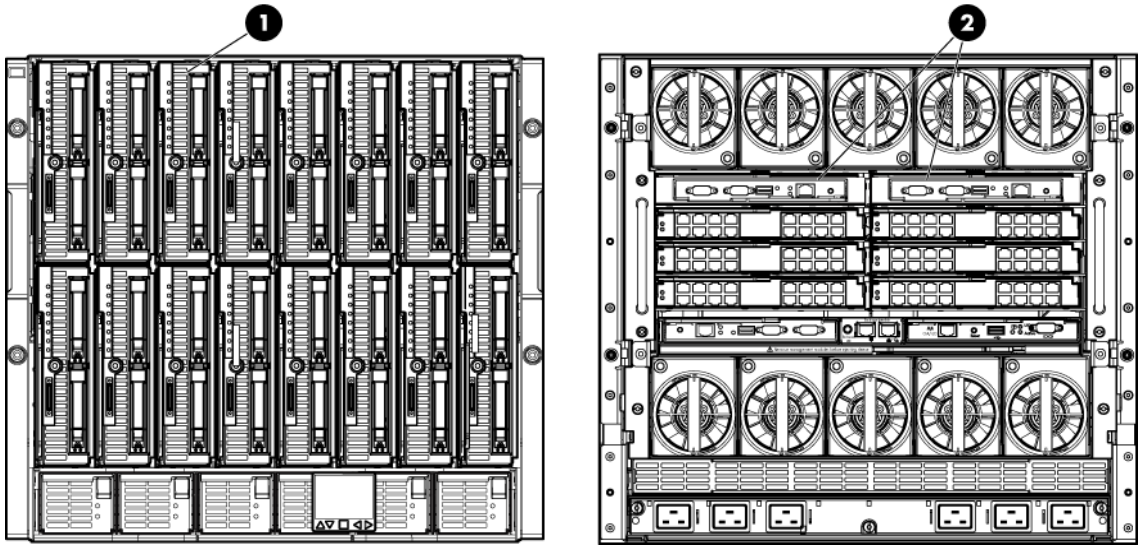
## Requirements

This chapter will utilize a single HP BladeSystem c7000 enclosure with TWO Virtual Connect Ethernet modules and a half height BladeSystem Server. The server will connect to the Virtual Connect models with two 1Gb NICs. NIC 1 will connect to the VC module in Bay 1 and NIC 2 will connect to the VC module in Bay 2.

A pair of managed network switches should also be provided, the switches should also be trunked together.

It is assumed that a Virtual Connect Domain has been created either through the GUI or a CLI script and no VC Networks, uplink sets or Server Profiles have been created.

**Figure 1-1** c7000 enclosure with four Half Height G6 BladeSystem servers and two Virtual Connect 1:10 Ethernet modules in Interconnect module bays 1& 2.




| Item | Description |
|---|---|
| 1 | Half Height blades |
| 2 | VC Ethernet modules |

# Scenario 1:1 – Simple vNet with Active/Standby Uplinks and Optional Link Aggregation 802.3ad (LACP) - Windows

## Overview

This simple configuration uses the Virtual Connect vNet. 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 VC module.

No special upstream switch configuration is required as the switch is in the factory default configuration, typically configured as an Access ports.

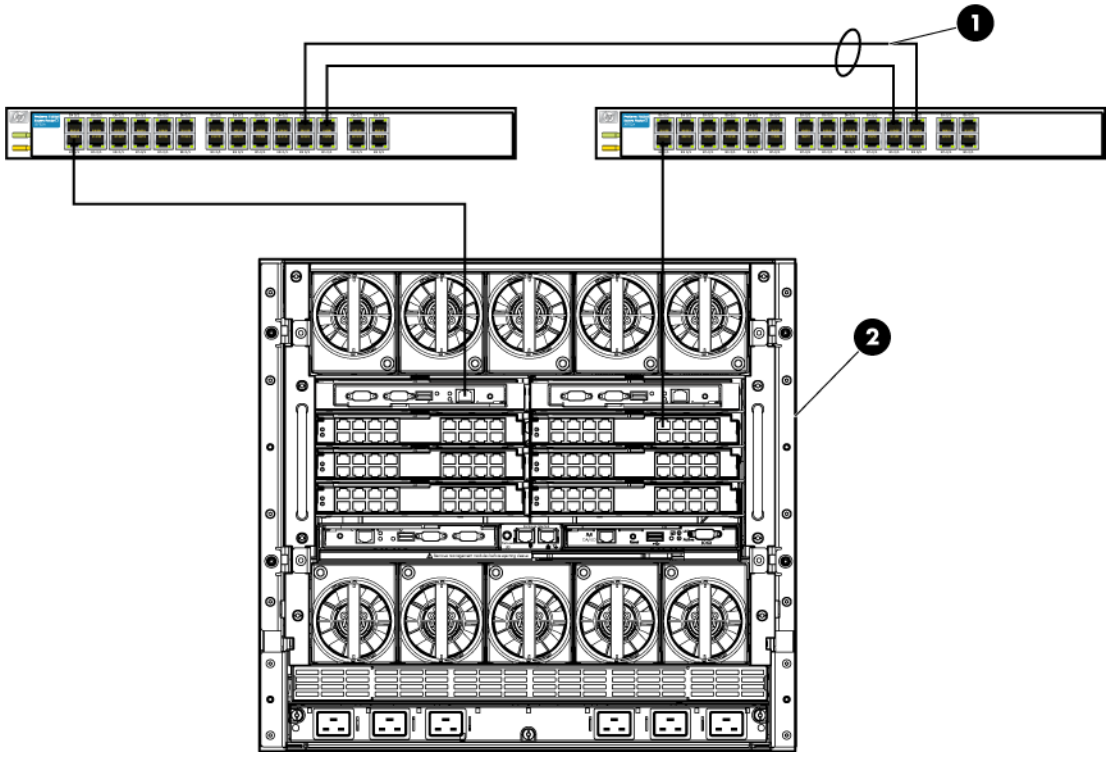
When configuring Virtual Connect, we can provide several ways to implement network fail-over or redundancy. One option would be to connect TWO uplinks to a single vNet; those two uplinks would connect from different Virtual Connect modules within the enclosure and could then connect to the same upstream switch or two different upstream switches, depending on your redundancy needs. An alternative would be to configure TWO separate vNets, each with a single uplink configured. Each option has its advantages and disadvantages. 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, such as iSCSI, backup, VMotion from production network traffic.

## Requirements

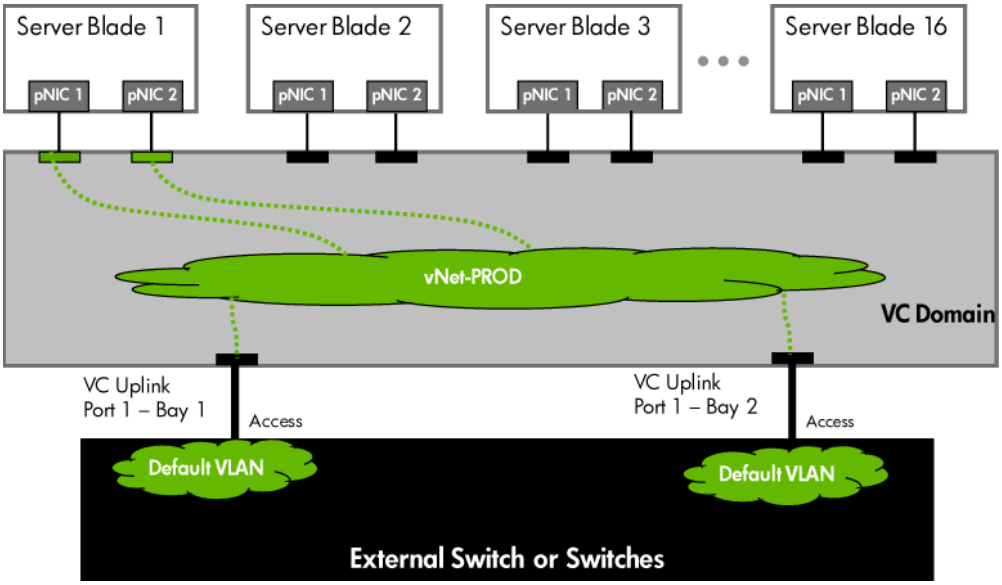
In order to implement this scenario, an HP BladeSystem c7000 enclosure with one or more server blades and TWO Virtual Connect Ethernet modules, installed in Bays 1& 2 are required. In addition, we will require ONE or TWO external Network switches. As Virtual Connect does not appear to the network as a switch and is transparent to the network, any standard managed switch will work with Virtual Connect.

**Figure 1-2** Physical View; Shows a single Ethernet uplink from Port 1 on Module 1 to Port 1 on the first network switch and a single uplink from Port 1 on Module 2 to Port 1 on the second network switch.




| Item | Description |
|---|---|
| 1 | Switch Cross Connect |
| 2 | c7000 Enclosure, rear view |

**Figure 1-3** Logical View; Shows a single Ethernet uplink from Port 1 on Module 1 on the first network switch and a single uplink from Port 1 on Module 2 to Port 1 on the second network switch.




# Installation and configuration

## Switch configuration

Appendices A and B provide a summary of the commands required to configure the switch in either a Cisco IOS or a ProCurve network infrastructure. The configuration information provided in the appendices assumes the following information:

- The switch ports are configured as ACCESS ports, either presenting the Default VLAN or a specific VLAN and will for 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. The connected host would then need to be configured to interpret those VLAN tags.

This scenario assumes the switch port is configured as an Access port and the frames are presented to Virtual Connect as untagged

### VC CLI commands

In addition to the GUI many of the configuration settings within VC can be 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. Throughout this scenario the CLI commands to configure VC for each setting will also be provided.

### Configuring the VC module

- Physically connect Port 1 of Network switch 1 to Port 1 on the VC module in Bay 1.

- Physically connect Port 1 of the second Network switch to Port 1 of the VC module in Bay 2, if you have only one network switch, connect VC port 1 (Bay 2) to an alternate port on the same switch. This will NOT create a network loop and does not require Spanning Tree to be configured.

## 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 can 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 (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 VLAN Tunneling via GUI (Ethernet settings)

Enable Tunnel VLAN Tags within Virtual Connect

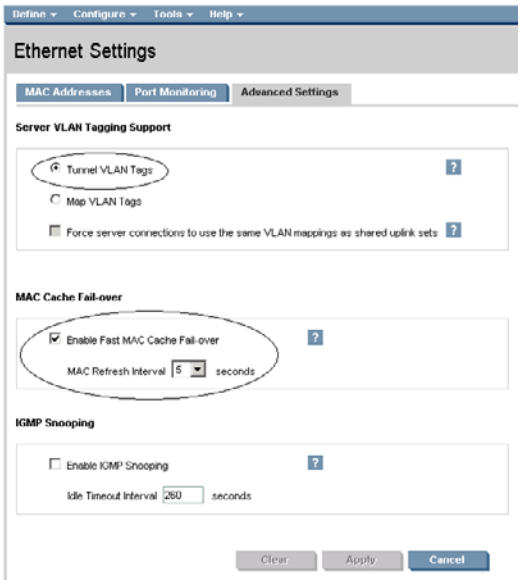
- On the Virtual Connect Manager screen, Left pane, click Ethernet Settings, Advanced Settings
- Select Tunnel VLAN Tags
- Select Fast MAC Cache Fail-over with a refresh of 5
- Select Apply

## Configuring the VC Module for VLAN Tunneling 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 "Tunnel VLAN Tags" and Enable Fast MAC cache fail-over
- set enet-vlan vlantagcontrol=Tunnel
- set mac-cache Enabled=True Refresh=5

**Figure 1-4** Ethernet 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 network and profile wizards.
- On the Virtual Connect Manager screen, click Define, Ethernet Network to create a vNet
- Ether the Network Name of "vNet-PROD"
    a. Note; Do NOT select any of the options (ie; Smart Link, Private Networks etc.)
- Select Add Port, then add the following ports;
    a. Enclosure 1, Bay 1, Port 1
    b. Enclosure 1, Bay 2, Port 1
- Leave Connection Mode as Auto
- 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.

Note: Smart Link – 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 or SUS are down. We will use Smartlink in a later scenario.

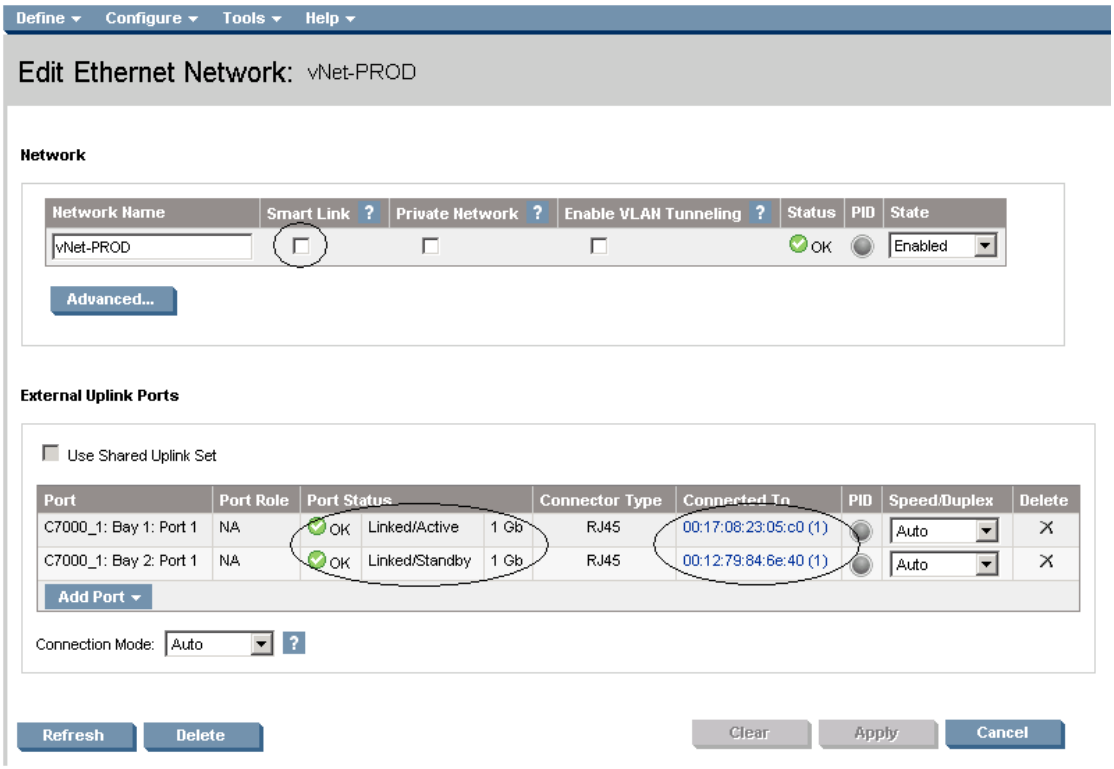
## Defining a new vNet via CLI

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 enc0:1:1 Network=vNet-PROD speed=auto
add uplinkport enc0:2:1 Network=vNet-PROD speed=auto
set network vNet-PROD SmartLink=Disabled
```

**Figure 1-5** Define Ethernet Network (vNet-PROD).

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




## Defining a Server Profile with NIC 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"
- In the Network Port 1 drop down box, select "vNet-PROD"
- In the Network Port 2 drop down box, select "vNet-PROD"
- In the Assign the Profile to a Server Bay, select Bay 1 and apply

## Defining a Server Profile with NIC 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 –nodefaultenetconn
add enet-connection App-1 pxe=Enabled
add enet-connection App-1 pxe=Disabled
set enet-connection App-1 1 Network=vNet-PROD
set enet-connection App-1 2 Network=vNet-PROD
assign profile App-1 enc0:1
```

**Figure 1-6** Define Server Profile (App- 1)

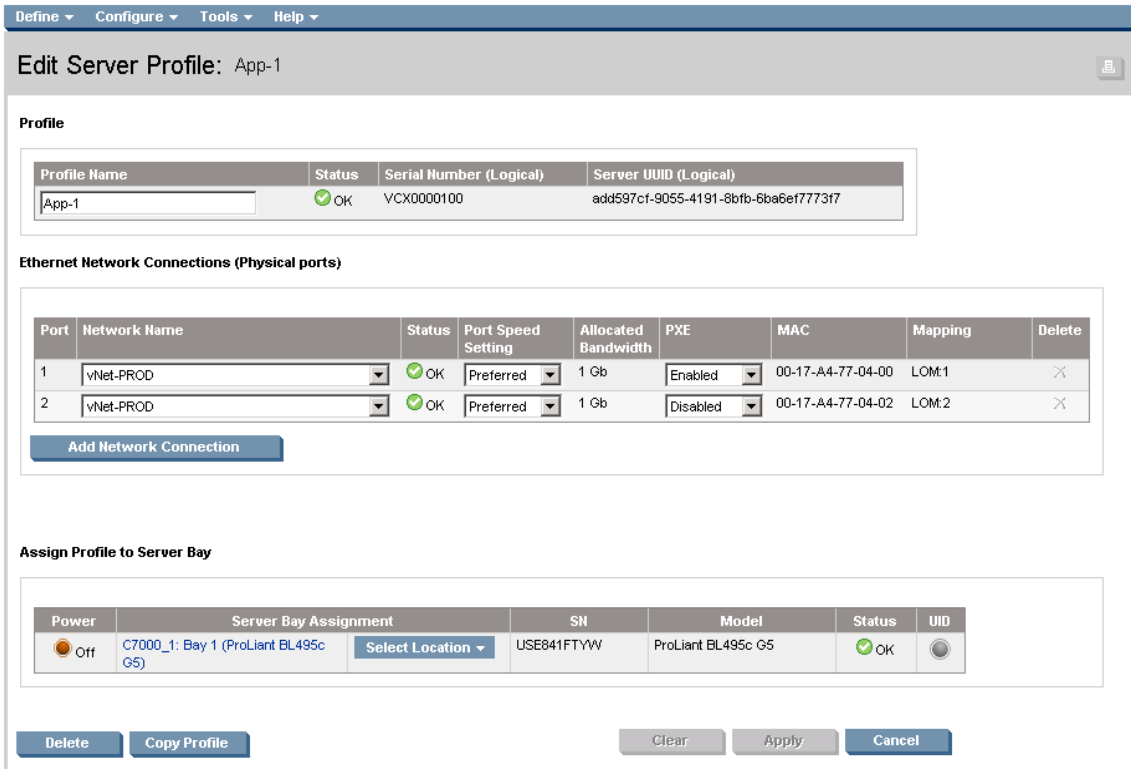
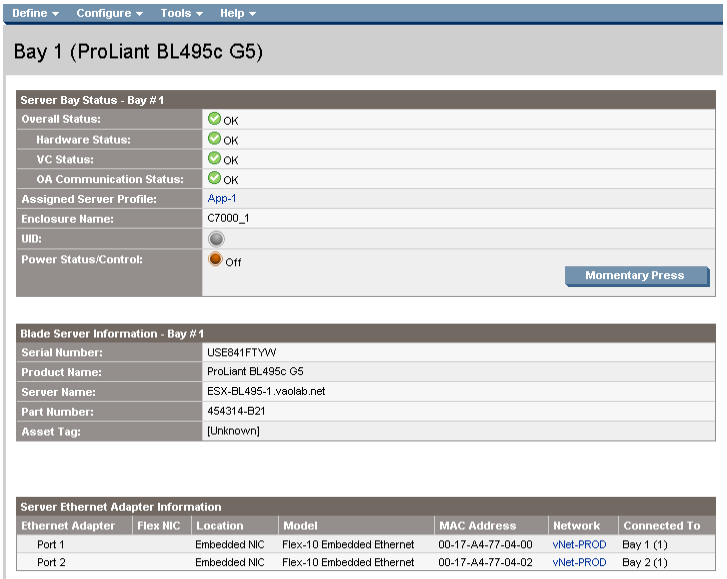


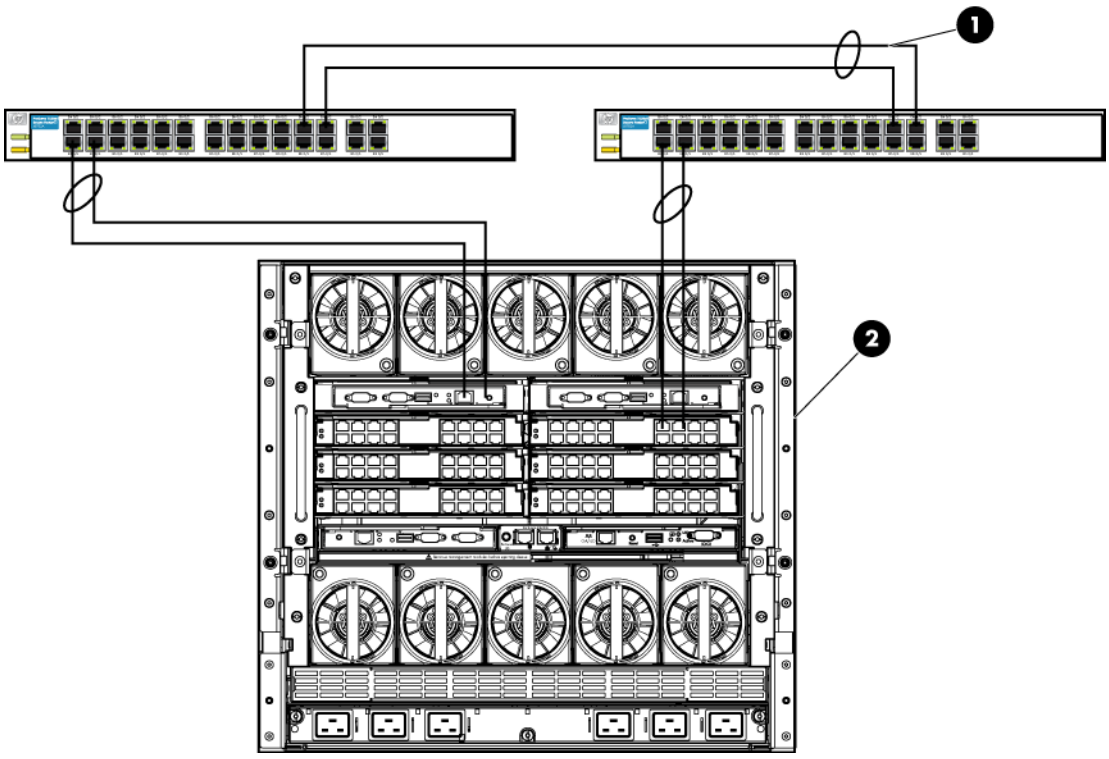

**Figure 1-7** Server Profile View Bay 1.



# Optionally Configuring Additional Uplinks to a vNet (LACP)

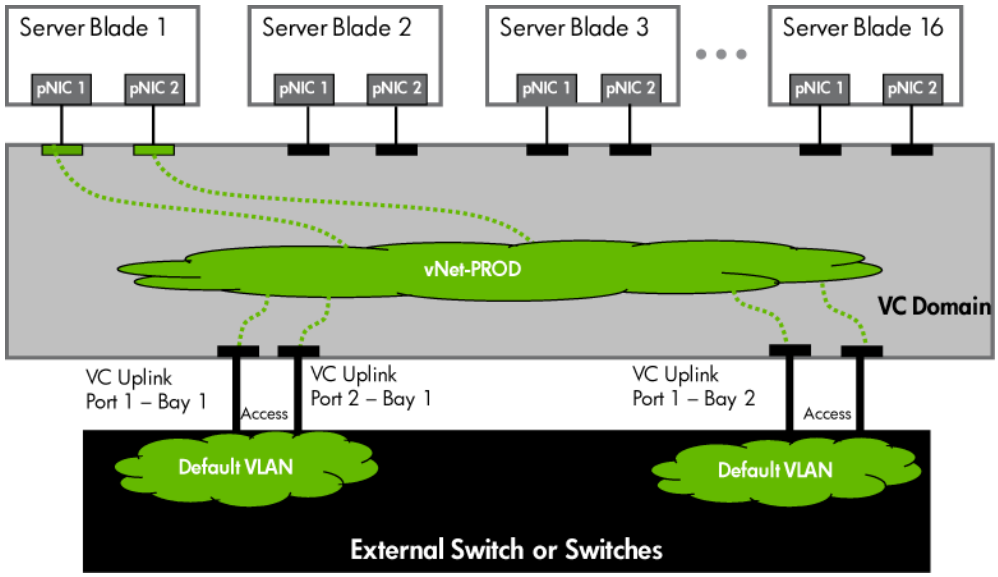
If additional uplink bandwidth or redundancy is required, additional uplinks can be configured for an existing vNet. There are two options available when configuring additional uplinks, when all uplinks configured within a vNet connect a single VC module to a single upstream switch, ALL links will be active, providing additional bandwidth, using Link Aggregation Protocol (LACP 802.3ad), this requires the upstream switch to be configured, on these ports, for link aggregation control protocol (LACP) and be configured in the same link aggregation group. When some of the uplinks configured within a vNet connect a VC module to different upstream switches, or from multiple VC modules to a single or multiple switches, some links will be active and the remaining will be Standby, potentially providing additional bandwidth as well as increase availability, using Link Aggregation Protocol (LACP 802.3.ad).

**Figure 1-8** Shows two Ethernet uplinks from Port 1 and 2 on Module 1 to Port 1 and 2 on the first network switch and two uplinks from ports 1 and 2 on Module 2 to Ports 1 and 2 on the second network switch.




| Item | Description |
|---|---|
| 1 | Switch Cross Connect |
| 2 | c7000 Enclosure, rear view |

**Figure 1-9** Logical View; Shows two Ethernet uplinks from Ports 1& 2 of each VC module to the network switch.




# Switch configuration

Appendices A and B provide a summary of the commands required to configure the switch in either a Cisco IOS or a ProCurve network infrastructure. The configuration information provided in the appendices assumes the following information:

Note: when adding the additional uplinks, the switch ports connected to Virtual Connect will need to be configured for LACP and in the same Link Aggregation Group.

## Adding uplinks to an existing vNet via GUI

Edit the vNet named "vNet-PROD"

- In the left pane of the Virtual Connect Manager screen, click on the Network "vNet-Prod"
- Select Add Port, then add the following ports;
    a. Enclosure 1, Bay 1, Port 2
    b. Enclosure 1, Bay 2, Port 2
- Leave Connection Mode as Auto
- Select Apply

Note: By connecting FOUR Uplinks from this vNet we have provided additional bandwidth and a redundant path to the network as two uplinks will be active and two will be in standby.

## Adding uplinks to an existing vNet via CLI

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

```
# Edit the vNet "vNet-PROD" and configure uplinks as discussed above

add uplinkport enc0:1:2 Network=vNet-PROD speed=auto
add uplinkport enc0:2:2 Network=vNet-PROD speed=auto

set network vNet-PROD SmartLink=Disabled
```

**Figure 1-10** Adding uplinks to an existing vNet (vNet-PROD).

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

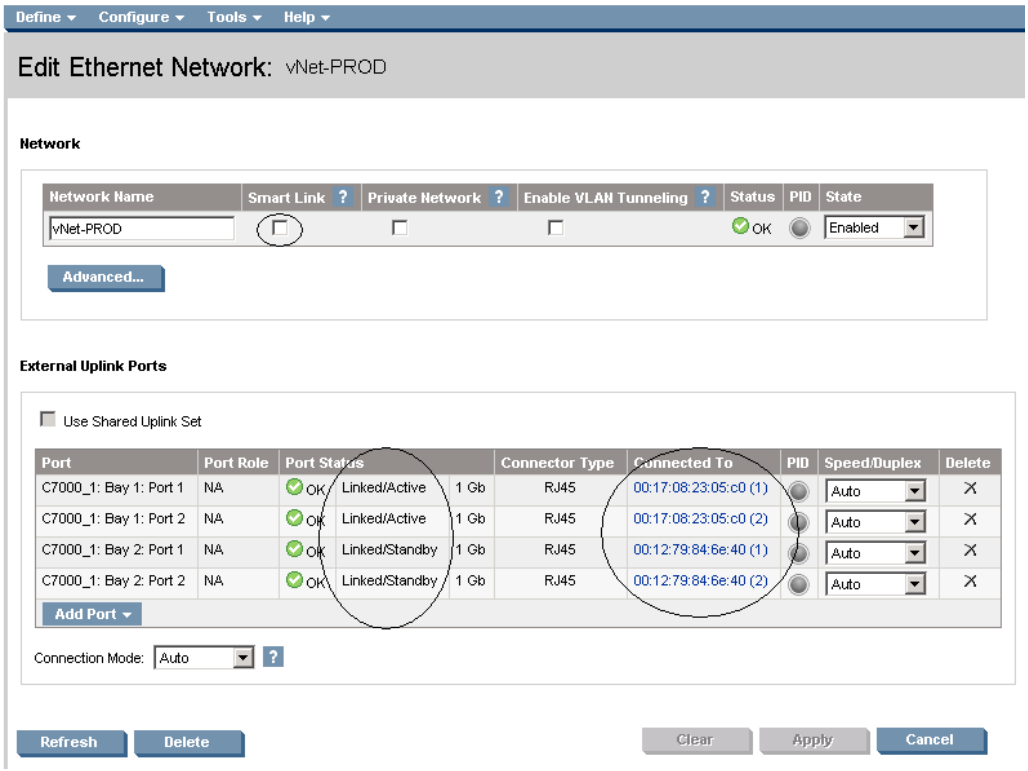



**Figure 1-11** Link aggregation confirmed – Bay 1.

Note: All connections within an active/active LACP group will have the same LAG ID. To view this, go to the Interconnect bay and view Uplink Port Information. If you are having trouble establishing an active/active connection, confirm the LAG ID.

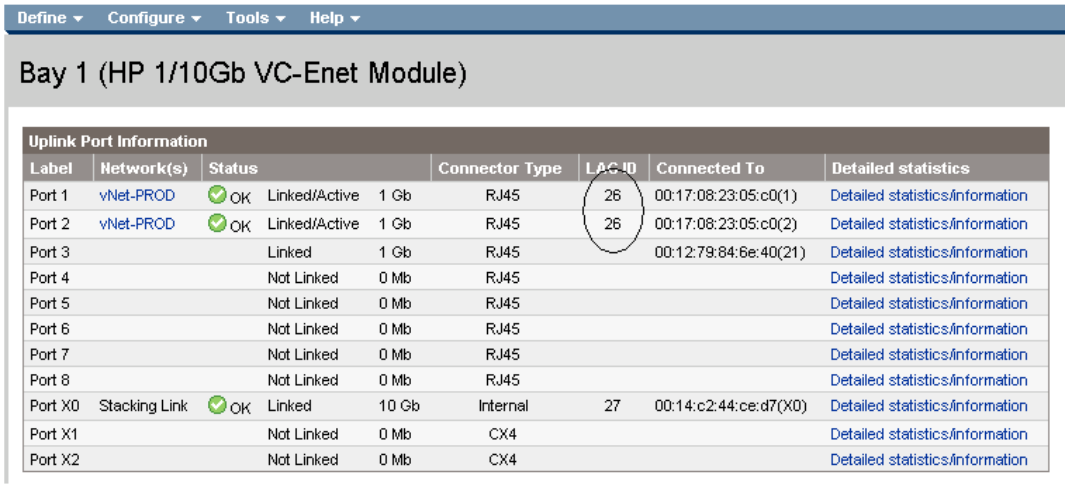
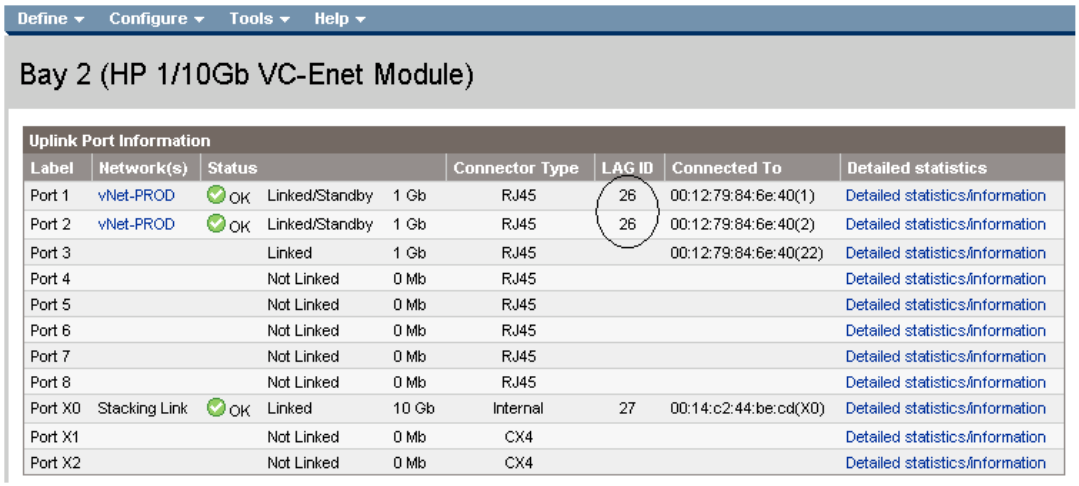


**Figure 1-12** Link aggregation confirmed - Bay 2.




# Summary

We created a couple different Virtual Connect Network solutions; base initially for availability, one link was active while the second was in standby mode. We later added two additional links; this increased the network bandwidth to the Virtual Connect network, while still maintaining availability.

When VC profile App-1 is applied to the server in bay1 and is powered up, it has one NIC through each module connected to "vNet-PROD", which connects to the network infrastructure through a pair of 1Gb uplinks. These NICs could now be configured as individual NICs (Figure 1-8) with their own IP address or as a pair of TEAMED NICs (Figure 1-9). 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.

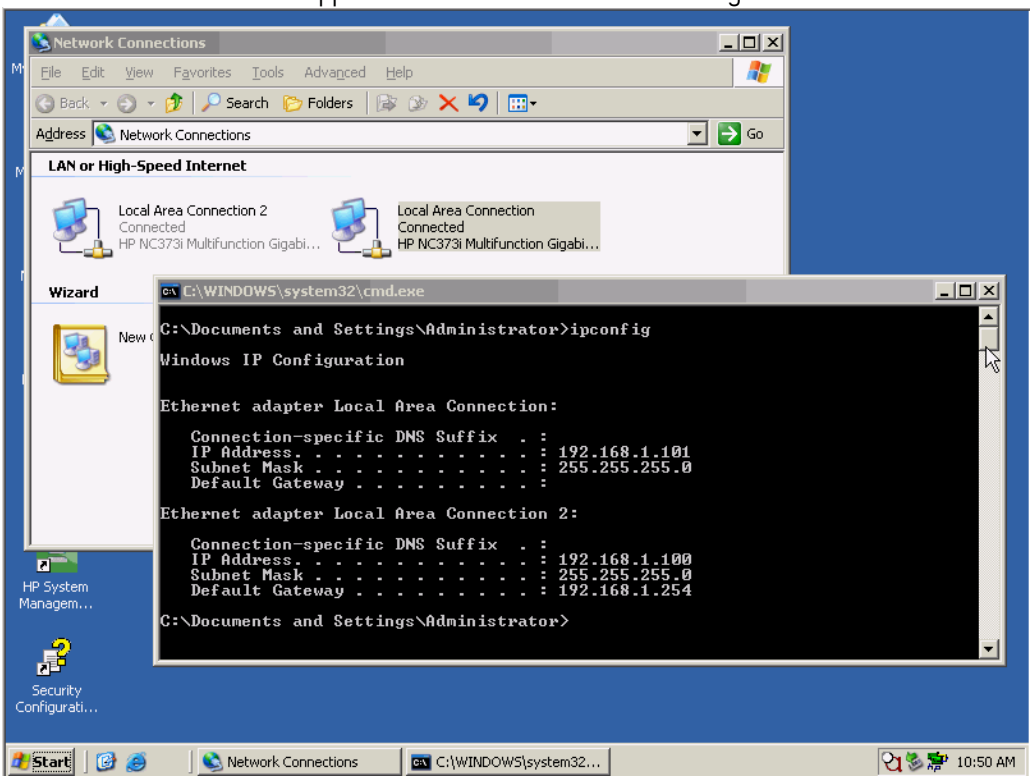
When additional bandwidth was required, additional uplinks were added to the existing vNet, this process had no effect on the server profile.

As additional servers are added to the enclosure, simply create additional profiles, or copy existing profiles, configure the NICs for vNet-PROD and apply them to the appropriate server bays.

# Results

The following graphic provides an example of a Windows 2003 server with TWO NICs connected to the network, each NIC has its own TCP/IP address, either or both NICs could be actively working on the network.

**Figure 1-13** Both NICs for Profile App-1are connected to the network through vNet-PROD.




The following graphics provide an example of a Windows 2003 server with TWO NICs teamed and connected to the network. One NIC will be active while the other is in standby. In the event of an Uplink or switch failure, VC will fail-over to the standby uplinks.

**Figure 1-14** Both NICs, using the HP Network Configuration Utility.

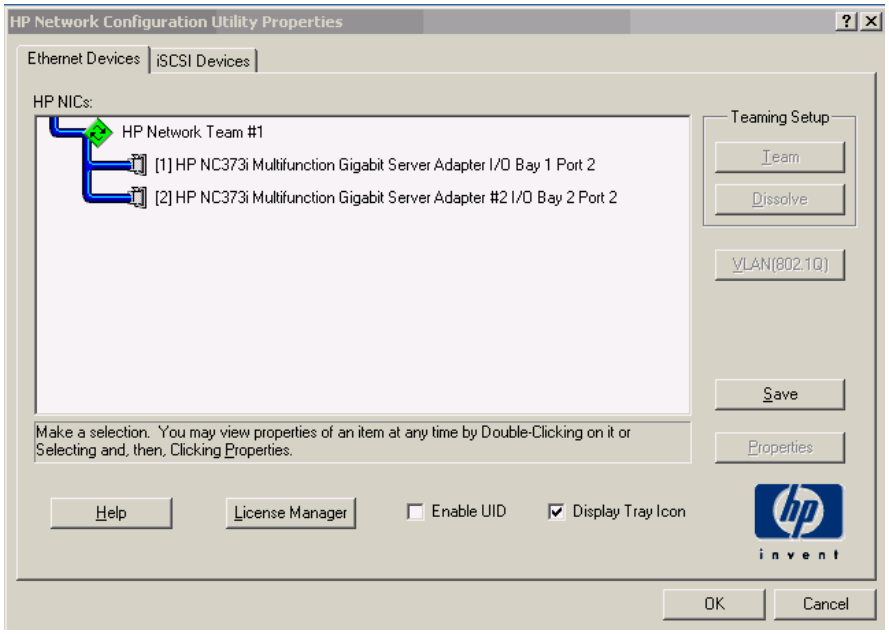
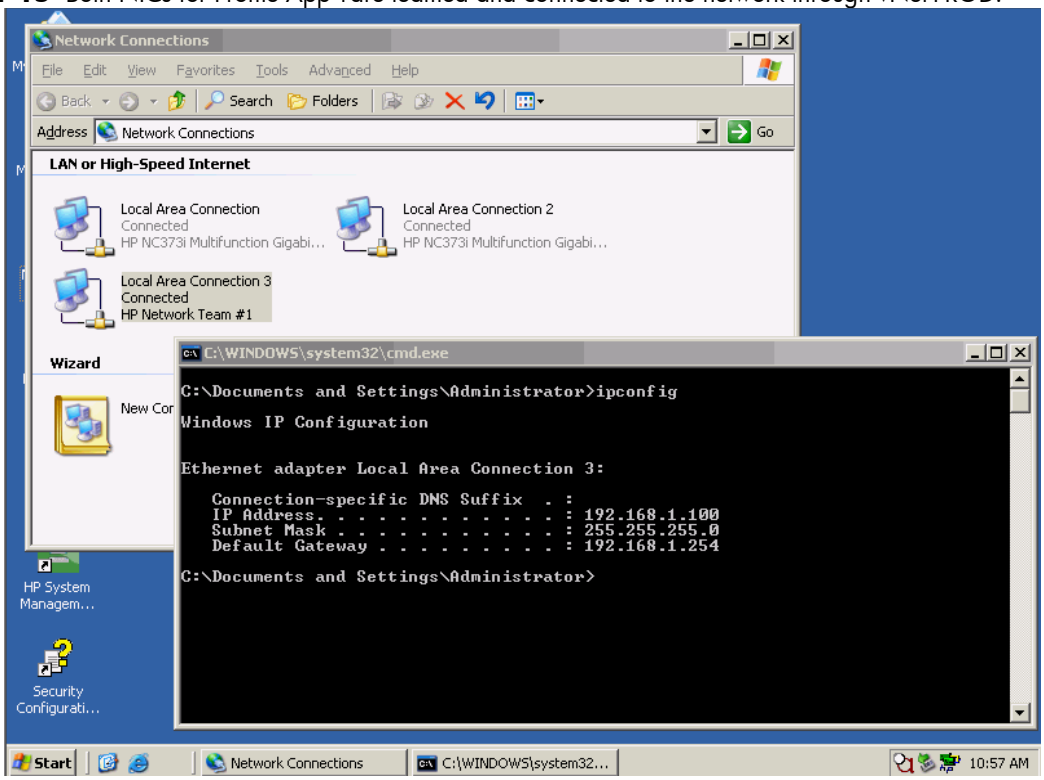


**Figure 1-15** Both NICs for Profile App-1are teamed and connected to the network through vNet-PROD.



# Scenario 1:2 – Multiple Simple Networks with Active\Active Uplinks and Optional Link Aggregation 802.3ad (LACP) - Windows

## Overview

This simple configuration uses the Virtual Connect vNet. 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 VC module.

No special upstream switch configuration is required as the switch is in the factory default configuration.

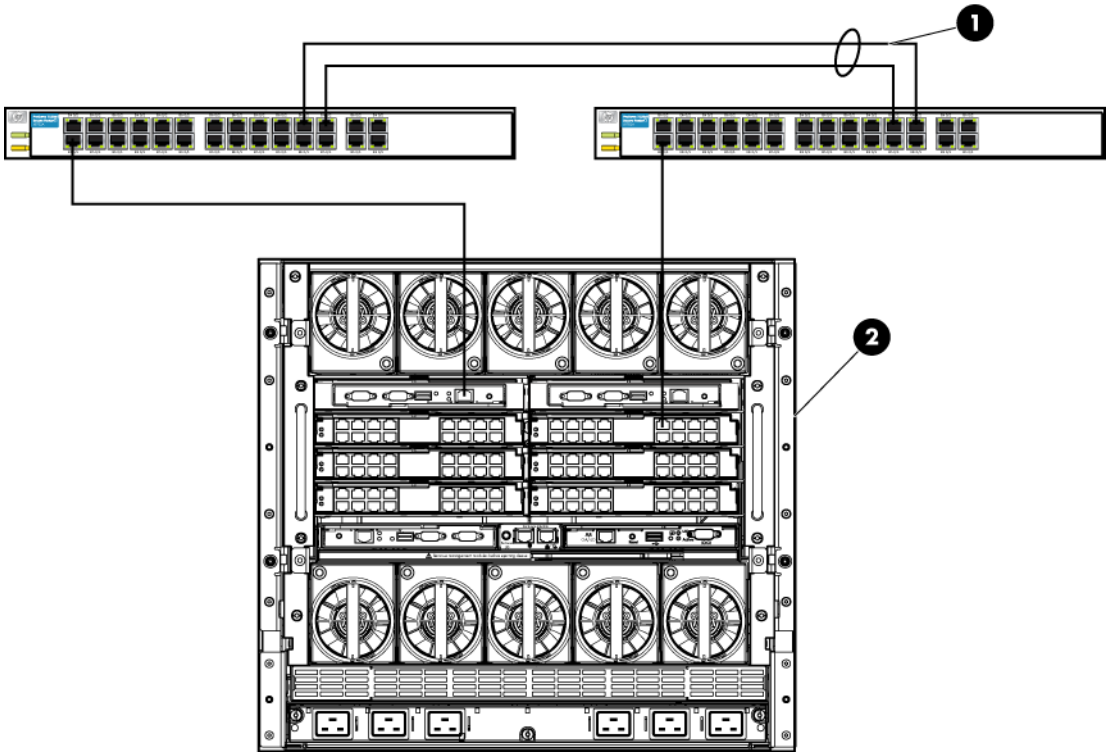
As discussed in scenario 1:1, when configuring Virtual Connect, we can provide several ways to implement network fail-over or redundancy. In this scenario we will configure TWO separate vNets, each with a single uplink configured from each VC module. We will later connect additional uplinks, to provide additional bandwidth.

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, such as iSCSI, backup, VMotion from production network traffic.

## Requirements

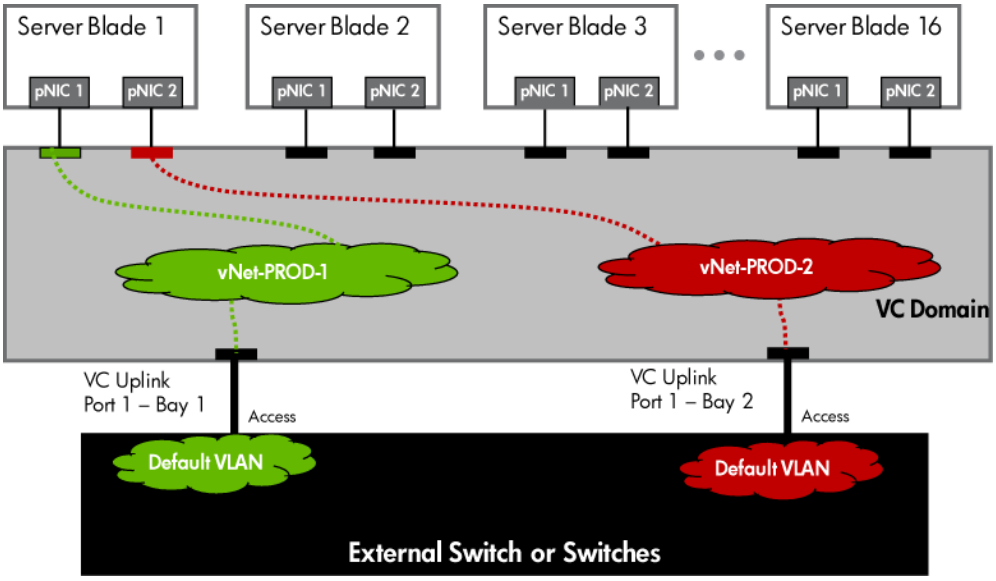
In order to implement this scenario, an HP BladeSystem c7000 enclosure with one or more server blades and TWO Virtual Connect Ethernet modules, installed in Bays 1& 2 are required. In addition, we will require ONE or TWO external Network switches. As Virtual Connect does not appear to the network as a switch and is transparent to the network, any standard managed switch will work with Virtual Connect.

**Figure 1-16** Physical View; Shows a single Ethernet uplink from Port 1 on Module 1 to Port 1 on the first network switch and a single uplink from Port 1 on Module 2 to Port 1 on the second network switch.




| Item | Description |
|---|---|
| 1 | Switch Cross Connect |
| 2 | c7000 Enclosure, rear view |

**Figure 1-17** Logical View; Shows a single Ethernet uplink from Port 1 on Module 1 to Port 1 on the first network switch and a single uplink from Port 1 on Module 2 to Port 1 on the second network switch. The Uplink from Module 1 is associated with vNet-PROD-1 and the Uplink from Module 2 is associated with vNet-PROD-2. Both of these connections, in this example, connect to the same network.




# Installation and configuration

## Switch configuration

Appendices A and B provide a summary of the commands required to configure the switch in either a Cisco IOS or a ProCurve network infrastructure. The configuration information provided in the appendices assumes the following information:

- The switch ports are configured as ACCESS ports, either presenting the Default VLAN or a specific VLAN and will for 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. The connected host would then need to be configured to interpret those VLAN tags.

This scenario assumes the switch port is configured as an Access port and the frames are presented to Virtual Connect as untagged

## VC CLI commands

In addition to the GUI many of the configuration settings within VC can be 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. Throughout this scenario the CLI commands to configure VC for each setting will also be provided.

## Configuring the VC module

- Physically connect port 1 of the Network switch to port 1 on the VC module in Bay 1.

- Connect Port 1 of the second Network switch to Port 1 of the VC module in Bay 2, if you have only one network switch, connect the second VC module, port 1 to an alternate port on the same switch. This will NOT create a network loop and does not require Spanning Tree to be configured.

## 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 can 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 (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 VLAN Tunneling via GUI (Ethernet settings)

Enable Tunnel VLAN Tags within Virtual Connect

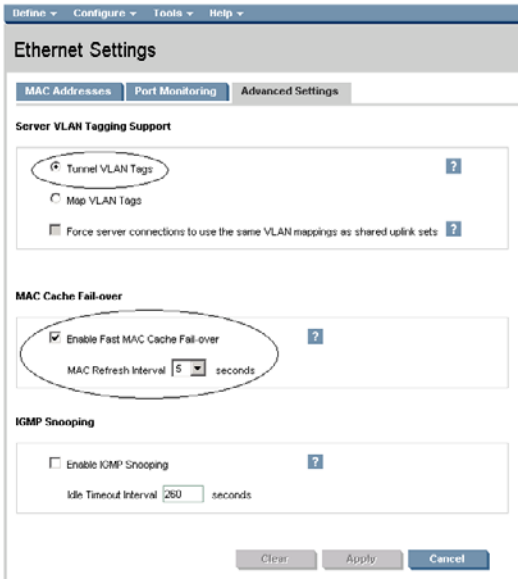
- On the Virtual Connect Manager screen, Left pane, click Ethernet Settings, Advanced Settings
- Select Tunnel VLAN Tags
- Select Fast MAC Cache Fail-over with a refresh of 5
- Select Apply

## Configuring the VC Module VLAN Tunneling 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 "Tunnel VLAN Tags" and Enable Fast MAC cache fail-over
set enet-vlan vlantagcontrol=Tunnel
set mac-cache Enabled=True Refresh=5
```

**Figure 1-18** Ethernet Settings.



## Defining two new vNet via GUI

Create a vNet and name it "vNet-PROD-1"

- On the Virtual Connect Manager screen, click Define, Ethernet Network to create a vNet
- Ether the Network Name of "vNet-PROD-1"
    a. Optionally select Smart Link, but, do NOT select any of the other options (ie; Private Networks etc.)
- Select Add Port, then add the following ports;
    a. Enclosure 1, Bay 1, Port 1
- Leave Connection Mode as Auto
- Select Apply

Create a vNet and name it "vNet-PROD-2"

- On the Virtual Connect Manager screen, click Define, Ethernet Network to create a vNet
- Ether the Network Name of "vNet-PROD-2"
    a. Select Smart Link, but, do NOT select any of the other options (ie; Private Networks etc.)
- Select Add Port, then add the following ports;
    a. Enclosure 1, Bay 2, Port 1
- Leave Connection Mode as Auto
- Select Apply

Note: By creating TWO vNets we have provided a redundant path to the network. As each uplink originates from a different VC module and vNet both, uplinks will be active. 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.

Note: Smart Link – In this configuration Smartlink SHOULD be enabled. Smartlink is used to turn off downlink ports within Virtual Connect if ALL available uplinks to a vNet or SUS are down. In this scenario if an upstream switch or all cables to a vNet were to fail on a specific vNet, VC would turn off the downlink ports connect to that vNet, which would then force the NIC Teaming software to fail-over to the alternate NIC.

## 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-1
add uplinkport enc0:1:1 Network=vNet-PROD-1 speed=auto
set network vNet-PROD-1 SmartLink=Enabled
add Network vNet-PROD-2
add uplinkport enc0:2:1 Network=vNet-PROD-2 speed=auto
set network vNet-PROD-2 SmartLink=Enabled
```

**Figure 1-19** Define Ethernet Network (vNet-PROD-1).

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

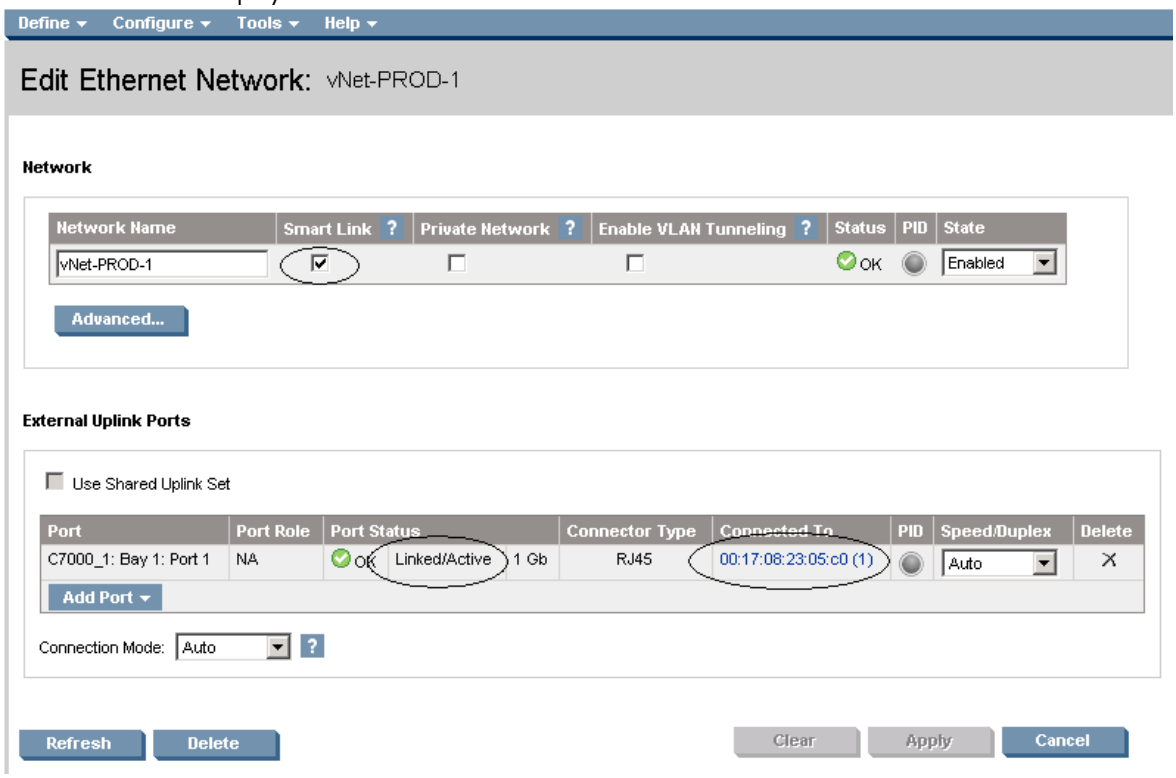
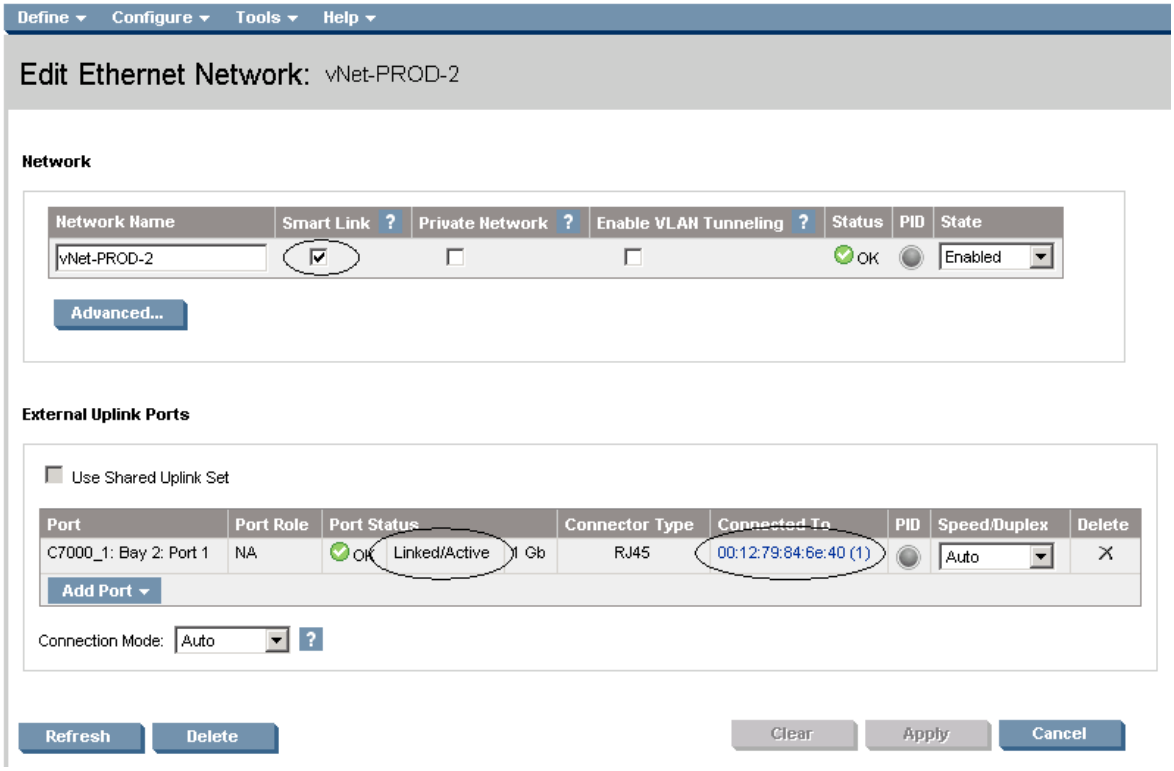



**Figure 1-20** Define Ethernet Network (vNet-PROD-2).

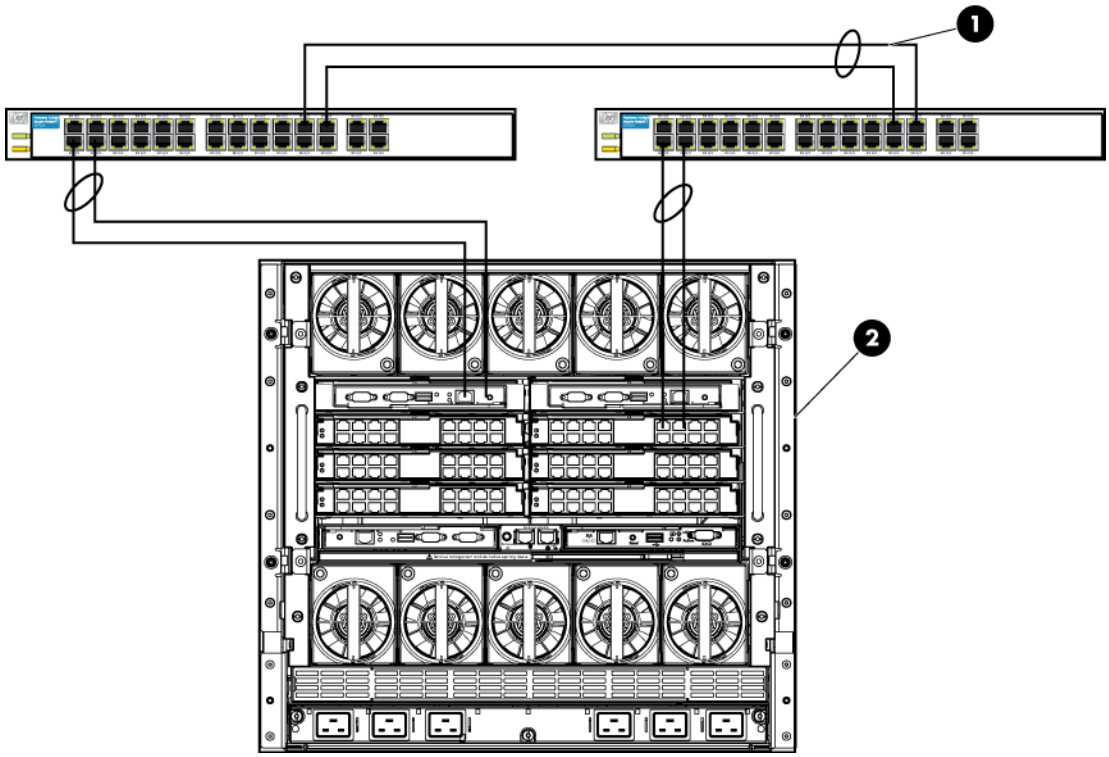
Note: The Port Status and Connected to information. If the connected switch supports LLDP, the connected to information should be displayed as below



# Optionally Configuring Additional Uplinks to a vNet (LACP)

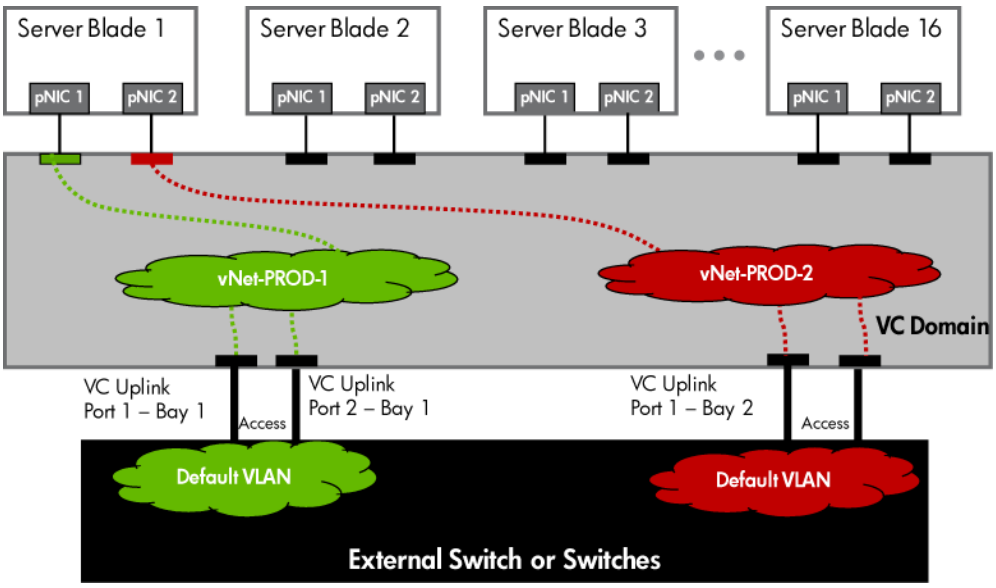
If additional uplink bandwidth or redundancy is required, additional uplinks can be configured for an existing vNet. There are two options available when configuring additional uplinks, when all uplinks configured within a vNet connect a single VC module to a single upstream switch, ALL links will be active, providing additional bandwidth, using Link Aggregation Protocol (LACP 802.3ad), this requires the upstream switch to be configured, on these ports, for link aggregation control protocol (LACP) and be configured in the same link aggregation group. When some of the uplinks configured within a vNet connect a VC module to different upstream switches, or from multiple VC modules to a single or multiple switches, some links will be active and the remaining will be Standby, potentially providing additional bandwidth as well as increase availability, using Link Aggregation Protocol (LACP 802.3.ad).

**Figure 1-21** Physical View; Shows two Ethernet uplinks from Ports 1 & 2 on Module 1 to Ports 1 & 2 on the first network switch and two uplinks from Ports 1 and 2 on Module 2 to Ports 1 & 2 on the second network switch.




| Item | Description |
|---|---|
| 1 | Switch Cross Connect |
| 2 | c7000 Enclosure, rear view |

**Figure 1-22** Logical View; Shows two Ethernet uplinks from Ports 1&2 of each VC module to the network switch.




## Switch configuration

Appendices A and B provide a summary of the commands required to configure the switch in either a Cisco IOS or a ProCurve network infrastructure. The configuration information provided in the appendices assumes the following information:

- The switch ports are configured as ACCESS ports, either presenting the Default VLAN or a specific VLAN and will for 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. The connected host would then need to be configured to interpret those VLAN tags.
- When adding the additional uplinks to the vNet, the switch ports connected to Virtual Connect will need to be configured for LACP and configured for the same Link Aggregation Group.

## Adding uplinks to an existing vNet via GUI

Edit the vNet named "vNet-PROD-1"

- In the left pane of the Virtual Connect Manager screen, click on the vNet
- Select Add Port, then add the following ports;
    a. Enclosure 1, Bay 1, Port 2
- Leave Connection Mode as Auto
- Select Apply
- Edit the vNet named "vNet-PROD-2"
- In the left pane of the Virtual Connect Manager screen, click on the vNet
- Select Add Port, then add the following ports;
    a. Enclosure 1, Bay 2, Port 1
- Leave Connection Mode as Auto
- Select Apply

Note: By connecting two Uplinks from each vNet we have provided additional bandwidth and redundant paths to the network.

## Adding uplinks to an existing vNet via CLI

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

```
# Edit the vNet "vNet-PROD-1" and configure uplinks as discussed above
add uplinkport enc0:1:2 Network=vNet-PROD-1 speed=auto
# Edit the vNet "vNet-PROD-2" and configure uplinks as discussed above
add uplinkport enc0:2:2 Network=vNet-PROD-2 speed=auto
```

**Figure 1-23** Adding uplinks to an existing vNet (vNet-PROD-1).

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

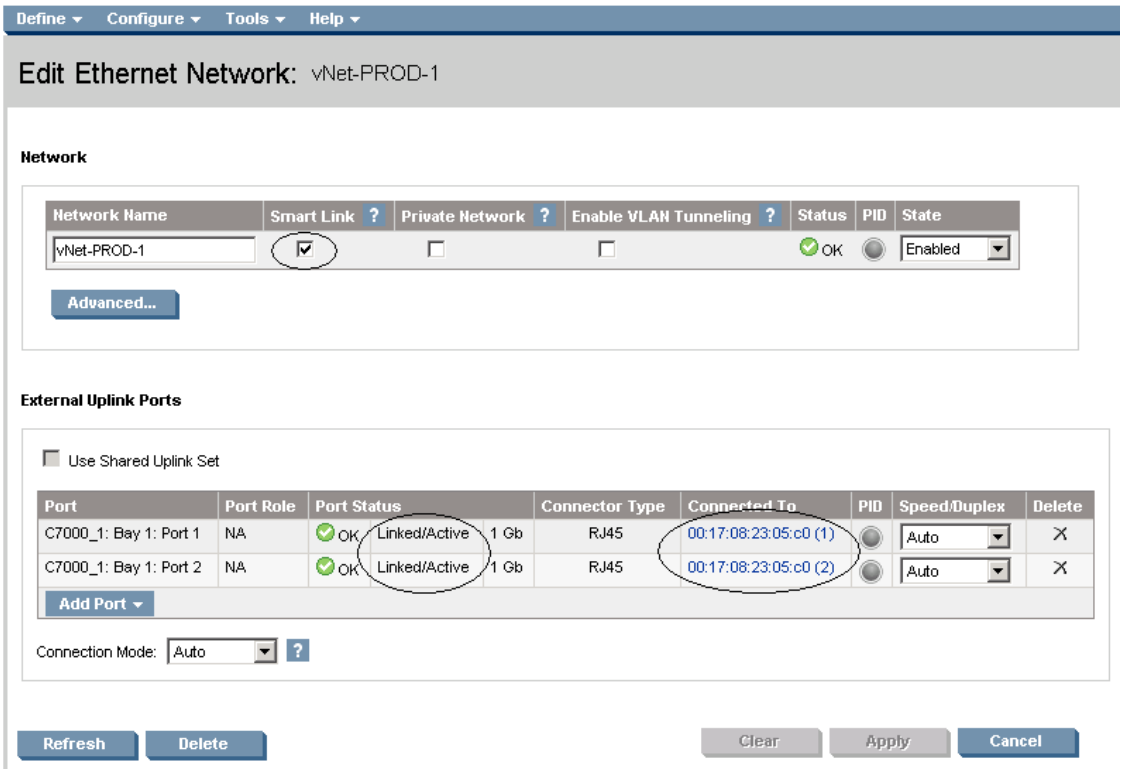


**Figure 1-24** Adding uplinks to an existing vNet (vNet-PROD-2).

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

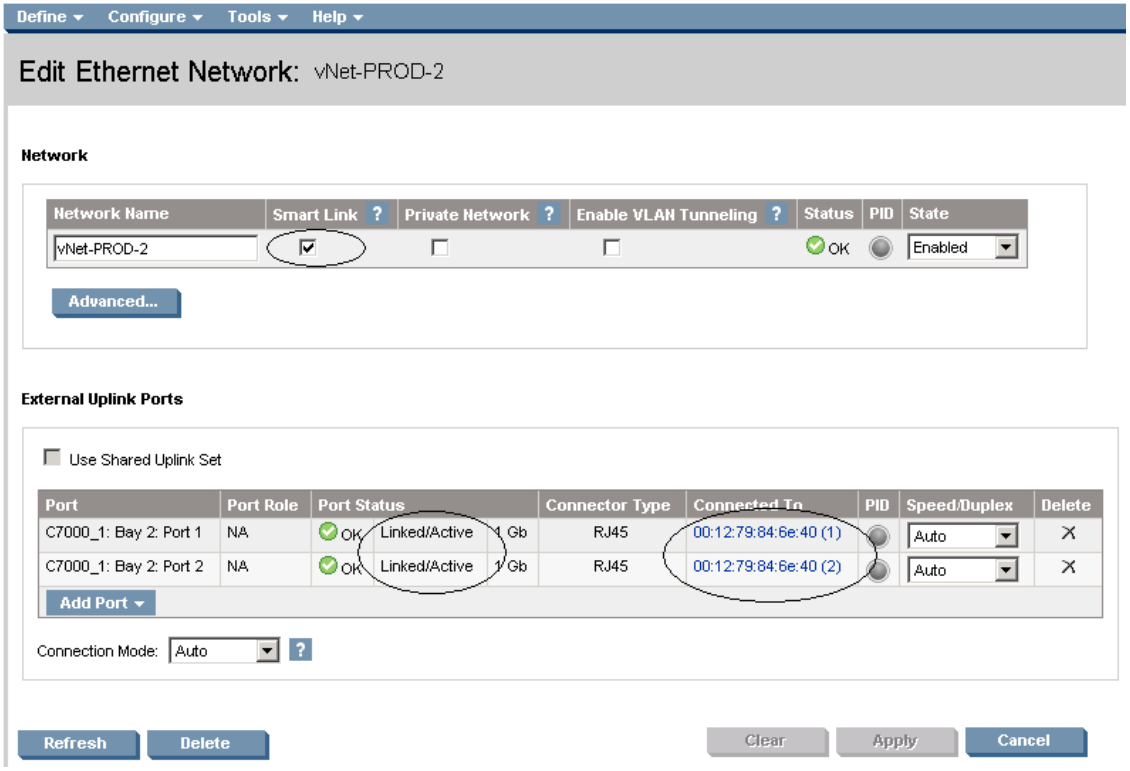



**Figure 1-25** Link aggregation confirmed – Bay 1.

Note: All connections within an active/active LACP group will have the same LAG ID. To view this, go to the Interconnect bay and view Uplink Port Information. If you are having troubles establishing an active/active connection, confirm the LAG ID.

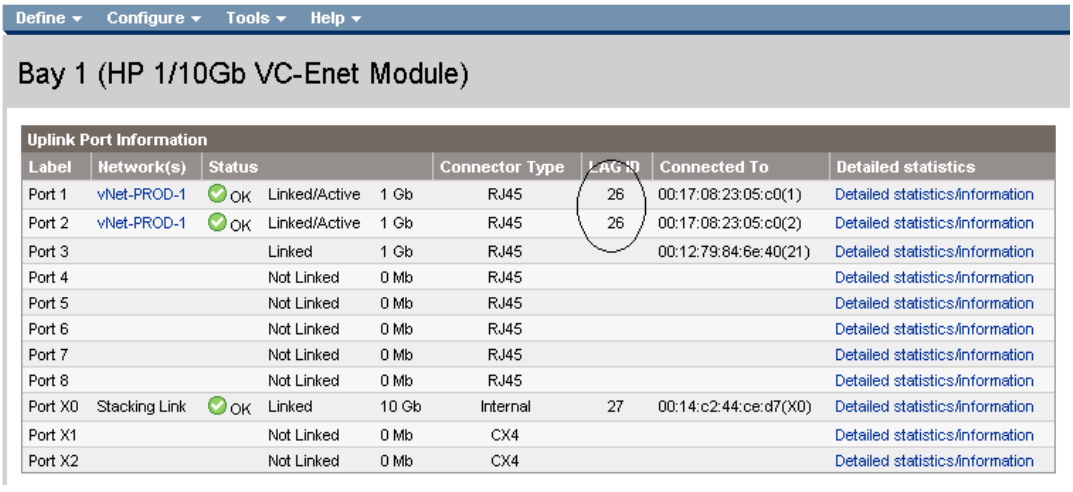
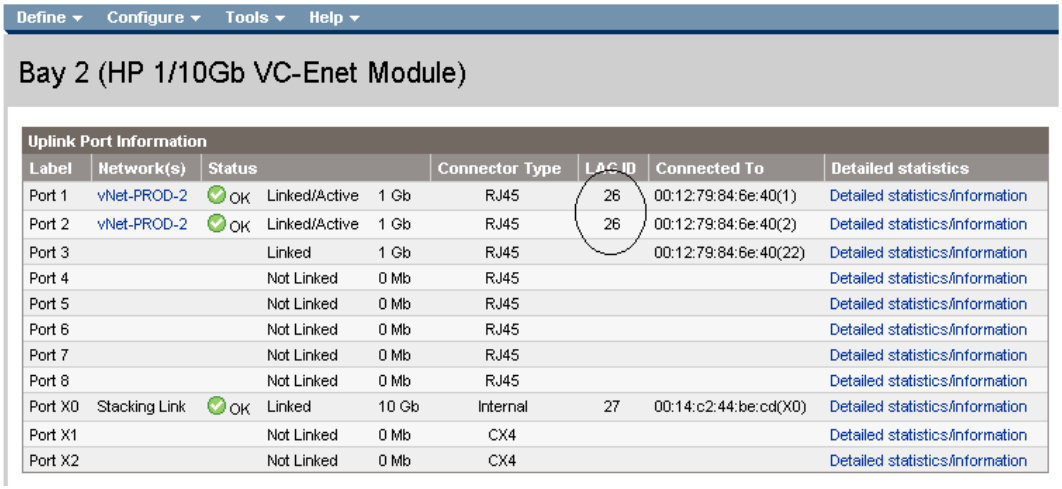


**Figure 1-26** Link aggregation confirmed - Bay 2.




## Defining a Server Profile with NIC 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”
- In the Network Port 1 drop down box, select “vNet-PROD-1”
- In the Network Port 2 drop down box, select “vNet-PROD-2”
- In the Assign the Profile to a Server Bays, select Bay 1 and apply

## Defining a Server Profile with NIC 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
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=vNet-PROD-1
set enet-connection App-1 2 Network=vNet-PROD-2
assign profile App-1 enc0:1
```

**Figure 1-27** Define Server Profile (App-1).

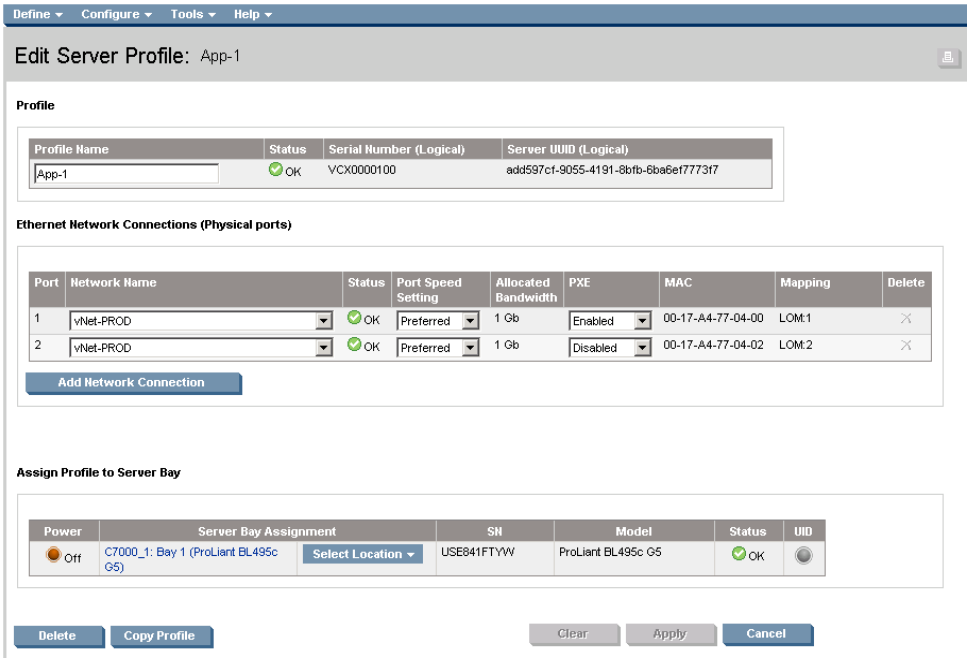
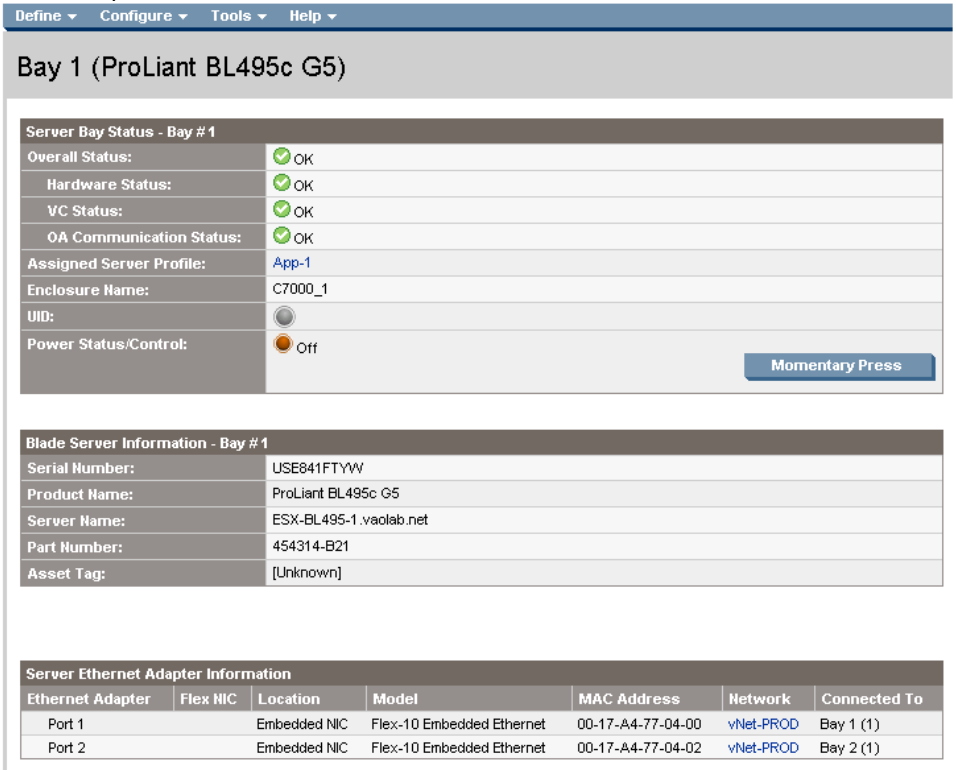



**Figure 1-28** View Bay 1.



# Summary

We created a couple different Virtual Connect Network solutions; base initially for bandwidth, which also provided additional availability. Two VC networks were created, both with a single active uplink. We later added two additional links; this increased the network bandwidth to the Virtual Connect networks, while still maintaining availability.

When VC profile App-1 is applied to the server in bay1 and is powered up, it has two NICs connected to "vNet-PROD-1" and "vNet-PROD-2", which connects to the network infrastructure through a two 1Gb 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 NIC is active at the time.

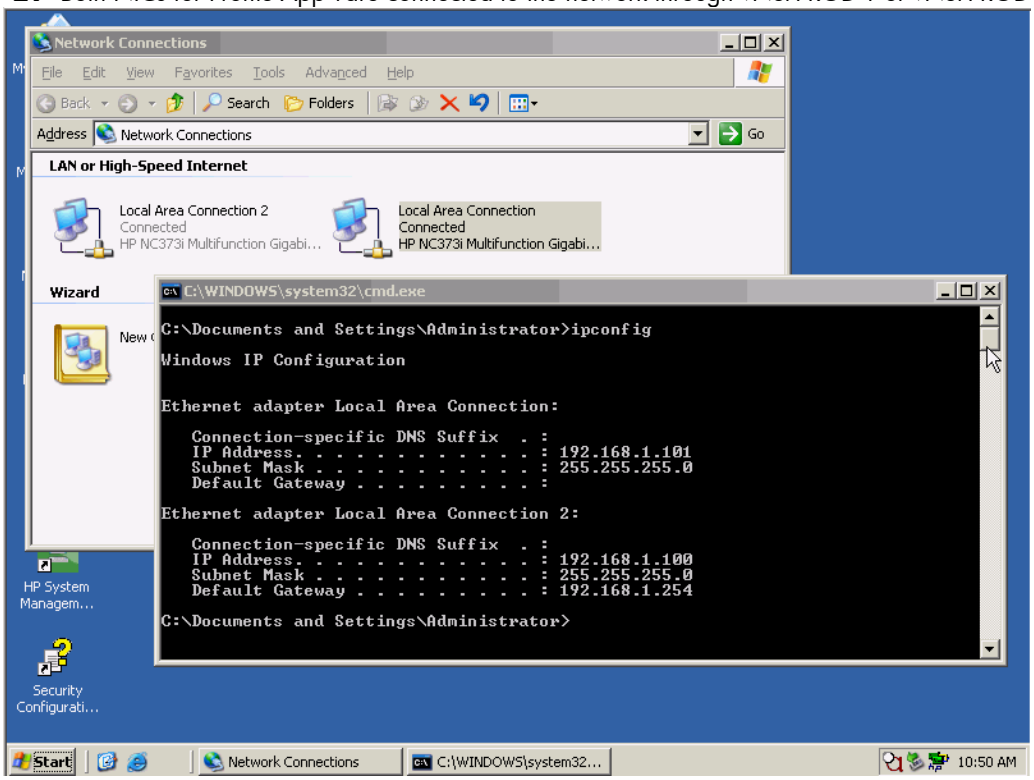
When additional bandwidth was required, additional uplinks were added to each vNet.

As additional servers are added to the enclosure, simply create additional profiles, configure the NICs for vNet-PROD-1 and vNet-PROD-2 and apply them to the appropriate server bays.

# Results

The following graphic provides an example of a Windows 2003 server with TWO NICs connected to the network, each NIC has its own TCP/IP address, either or both NICs could be actively working on the network.

**Figure 1-29** Both NICs for Profile App-1are connected to the network through vNet-PROD-1 or vNet-PROD-2.



The following graphics provide an example of a Windows 2003 server with TWO NICs teamed and connected to the network. One NIC will be active, the other NIC will be in standby, in the event of an Uplink, switch or VC module failure; the teaming software will fail the NIC over to the alternate path, as required.

**Figure 1-30** Team both NICs, using the HP Network Configuration Utility.

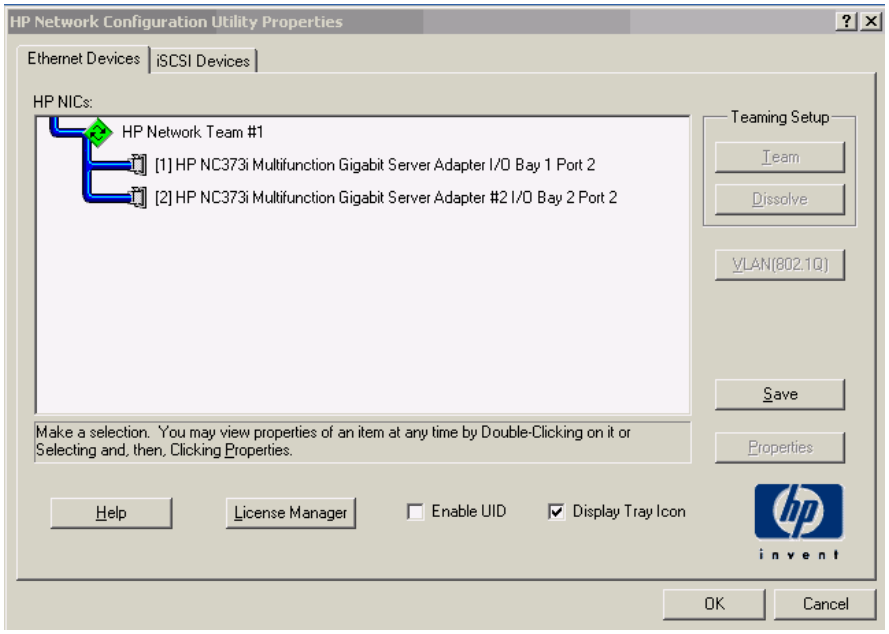
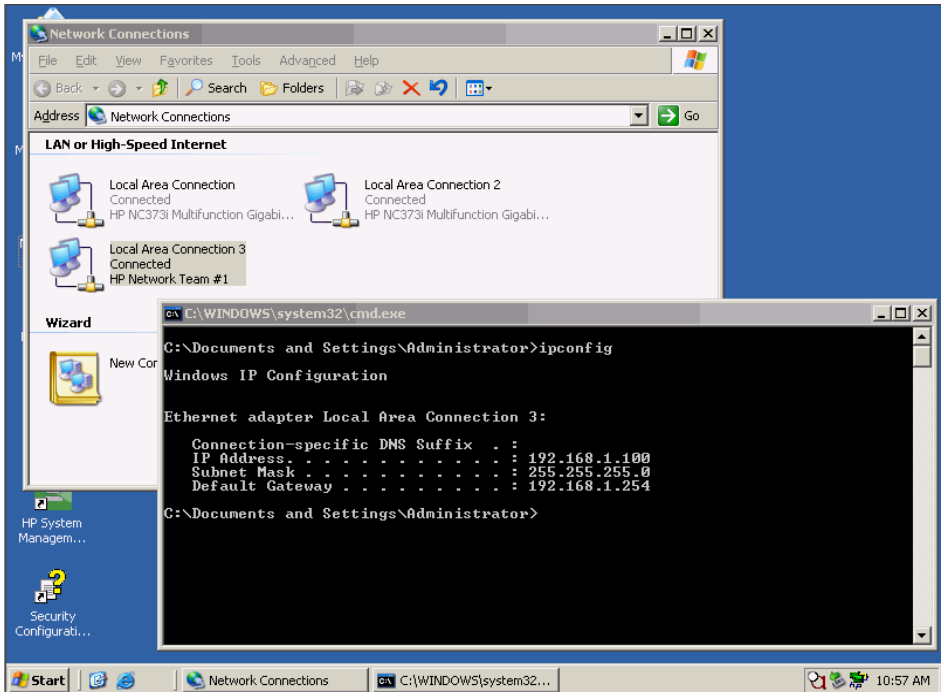



**Figure 1-31** Both NICs for Profile App-1are teamed and could connect connected to the network through either vNet-PROD-1 or vNet-PROD-2, depending on which NIC is active.



# Scenario 1:3 – Multiple Simple Networks Providing Redundancy and Link Aggregation 802.3ad (LACP) with VLAN Tunneling – VMware ESX

## Overview

This configuration uses the Virtual Connect vNet. The vNet is the simplest way to connect Virtual Connect to a network and server. In this scenario, the upstream network switch is configured to pass multiple VLANs to two ports on each VC module.

The upstream switch ports will be configured as "trunk" ports for several VLANs, VLAN 101 will be configured as untagged as this VLAN will be used for console or management access.

## Requirements

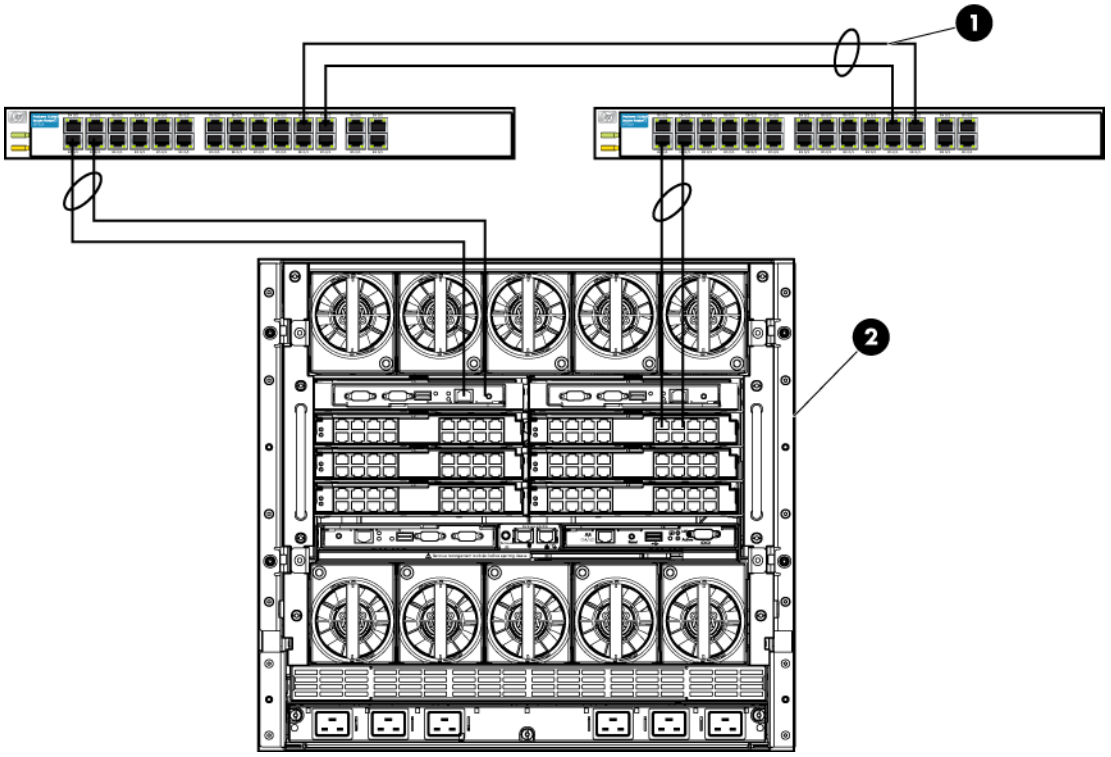
In order to implement this scenario, an HP BladeSystem c7000 enclosure with one of more server blades and TWO Virtual Connect Ethernet modules, installed in Bays 1& 2 are required. In addition, we will require ONE or TWO external Network switches. As Virtual Connect does not appear to the network as a switch and is transparent to the network, any standard managed switch will work with Virtual Connect.

## Configuring Uplinks to a vNet (LACP)

When all uplinks configured within a vNet connect a VC module to an upstream switch, ALL links could be active, providing additional bandwidth, using Link Aggregation Protocol (LACP 802.3ad), this requires the upstream switch to be configured, on these ports, for link aggregation control protocol (LACP).

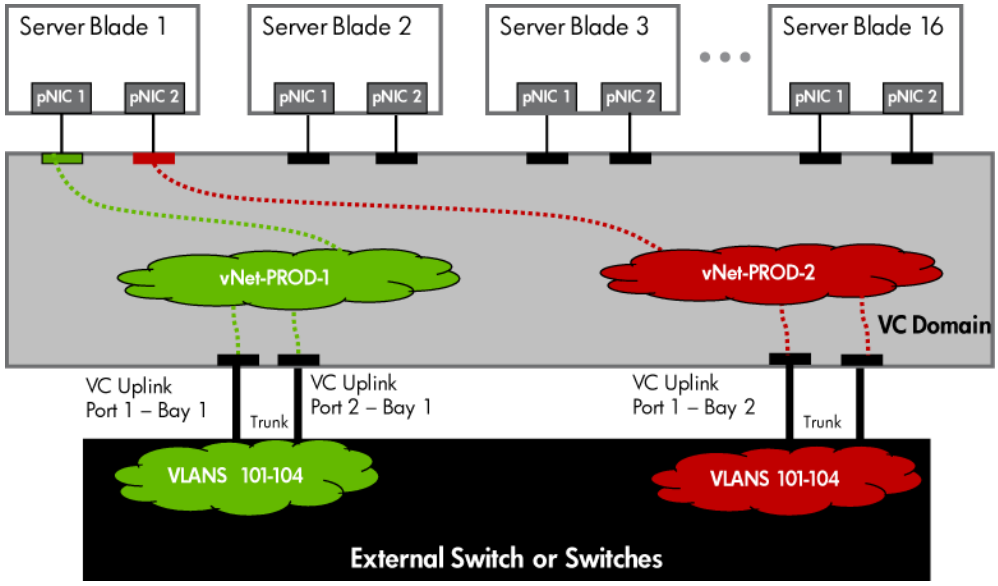
When some of the uplinks configured within a vNet connect a VC module to different upstream switches, some links will be active and the remaining will be Standby, providing additional bandwidth and/or availability, using Link Aggregation Protocol (LACP 802.3.ad).

**Figure 1-32** Physical View; Shows two Ethernet uplinks from Ports 1 & 2 on Module 1 to Ports 1 & 2 on the first network switch and two uplinks from Ports 1 and 2 on Module 2 to Ports 1 & 2 on the second network switch.




| Item | Description |
|---|---|
| 1 | Switch Cross Connect |
| 2 | c7000 Enclosure, rear view |

**Figure 1-33** Logical View; Shows two Ethernet uplinks from Ports 1&2 of each VC module to the network switch.




# Installation and configuration

## Switch configuration

Appendices A and B provide a summary of the commands required to configure the switch in either a Cisco IOS or a ProCurve network infrastructure. The configuration information provided in the appendices assumes the following information:

- The upstream switch ports are configured as TRUNK ports, presenting VLANs 101-104 (VLAN 101 is set to default (untagged)).
- The upstream switch ports are configured within the same Link Aggregation Group
- When adding the additional uplinks to the vNet, the switch ports connected to Virtual Connect will need to be configured for LACP and configured for the same Link Aggregation Group.

## VC CLI commands

Many of the configuration settings within VC can be 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 the VC module

- Physically connect Ports 1 and 2 of the first network switch to Ports 1 and 2 on the VC module in Bay 1.
- Physically connect Ports 1 and 2 of the second network switch to Ports 1 and 2 of the VC module in Bay 2, if you have only one network switch, connect the second VC module cables to alternates port on the same switch. This will NOT create a network loop and does not require Spanning Tree to be configured.

## 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 can 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 (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.

  Note: Fast MAC Cache Fail-over is less critical with this scenario, as no uplinks are configured in standby mode, all uplinks are active.

## Configuring the VC Module for VLAN Tunneling via GUI (Ethernet settings)

Enable Tunnel VLAN Tags within Virtual Connect

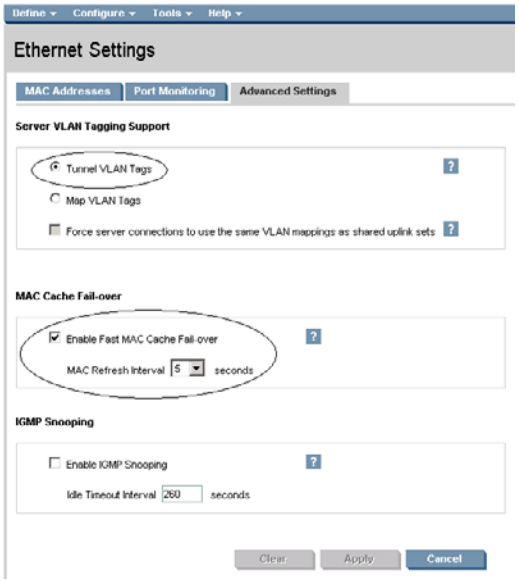
- On the Virtual Connect Manager screen, Left pane, click Ethernet Settings, Advanced Settings
- Select Tunnel VLAN Tags
- Select Fast MAC Cache Fail-over with a refresh of 5
- Select Apply

## Configuring the VC Module for VLAN Tunneling 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 "Tunnel VLAN Tags" and Enable Fast MAC cache fail-over
set enet-vlan vlantagcontrol=Tunnel
set mac-cache Enabled=True Refresh=5
```

**Figure 1-34** Ethernet Settings.



## Defining two new vNets via GUI

1. Create a vNet and name it “vNet-PROD-1”

- On the Virtual Connect Manager screen, click Define, Ethernet Network to create a vNet
- Ether the Network Name of “vNet-PROD-1”
    a. Select Enable VLAN Tunneling
    b. Optionally select Smart Link, but, do NOT select Private Networks
- Select Add Port, then add the following ports;
    a. Enclosure 1, Bay 1, Ports1 & 2
- Leave Connection Mode as Auto
- Select Apply

2. Create a vNet and name it “vNet-PROD-2”

- On the Virtual Connect Manager screen, click Define, Ethernet Network to create a vNet
- Ether the Network Name of “vNet-PROD-2”
    a. Select Enable VLAN Tunneling
    b. Optionally select Smart Link, but, do NOT select Private Networks
- Select Add Port, then add the following ports;
    a. Enclosure 1, Bay 2, Ports 1 & 2
- Leave Connection Mode as Auto
- Select Apply

Note: By creating TWO vNets we have provided a redundant path to the network. As each uplink pair originates from a different VC module within each vNet, both uplinks pairs will be active. This configuration provides the ability to lose an uplink cable/pair, network switch or depending on how the NICs are configured at the server (teamed or un-teamed), even a VC module.

Note: Smart Link – In this configuration Smartlink SHOULD be enabled. Smartlink is used to turn off downlink ports within Virtual Connect if ALL available uplinks to a vNet or SUS are down. In this scenario if an upstream switch or all cables to a vNet were to fail, VC would turn off the downlink ports connect to that vNet, which would then force the NIC Teaming software to fail-over to the alternate NIC.

## 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-1
add uplinkport enc0:1:1 Network=vNet-PROD-1 speed=auto
add uplinkport enc0:1:2 Network=vNet-PROD-1 speed=auto
set network vNet-PROD-1 SmartLink=Enabled VLanTunnel=Enabled
add Network vNet-PROD-2
add uplinkport enc0:2:1 Network=vNet-PROD-2 speed=auto
add uplinkport enc0:2:2 Network=vNet-PROD-2 speed=auto
set network vNet-PROD-2 SmartLink=Enabled VLanTunnel=Enabled
```

**Figure 1-35** Adding uplinks to an existing vNet (vNet-PROD-1).

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

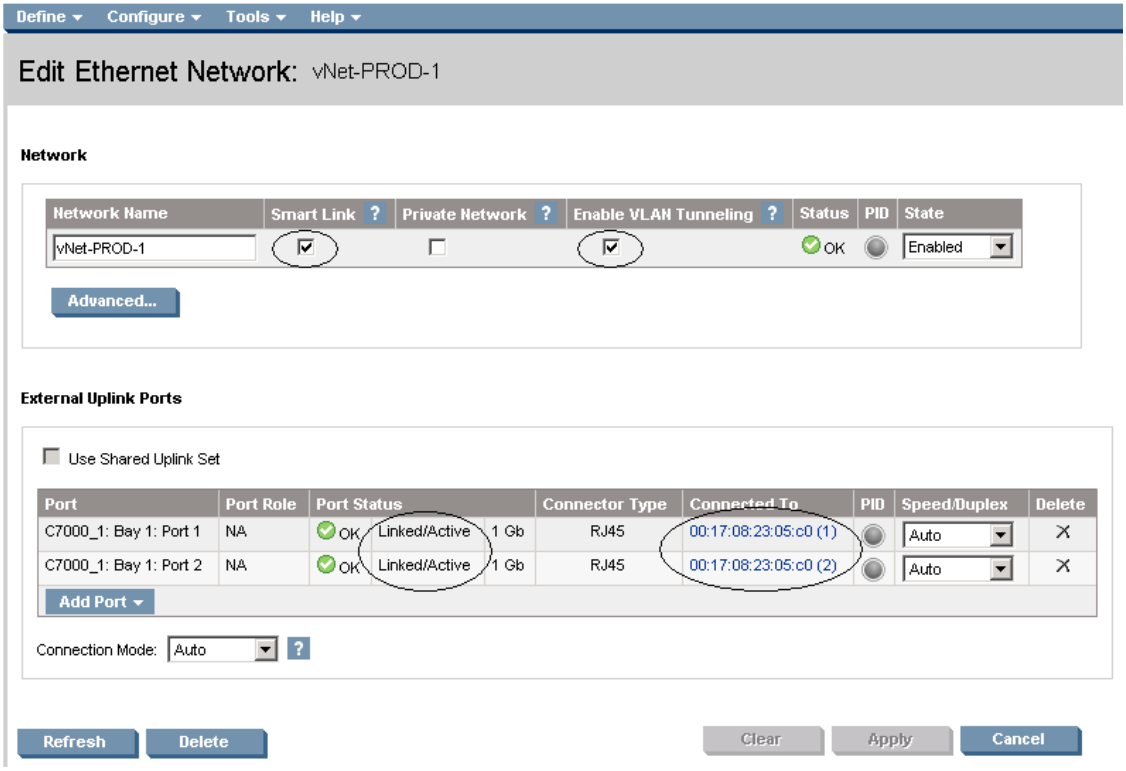


**Figure 1-36** Adding uplinks to an existing vNet (vNet-PROD-2).

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

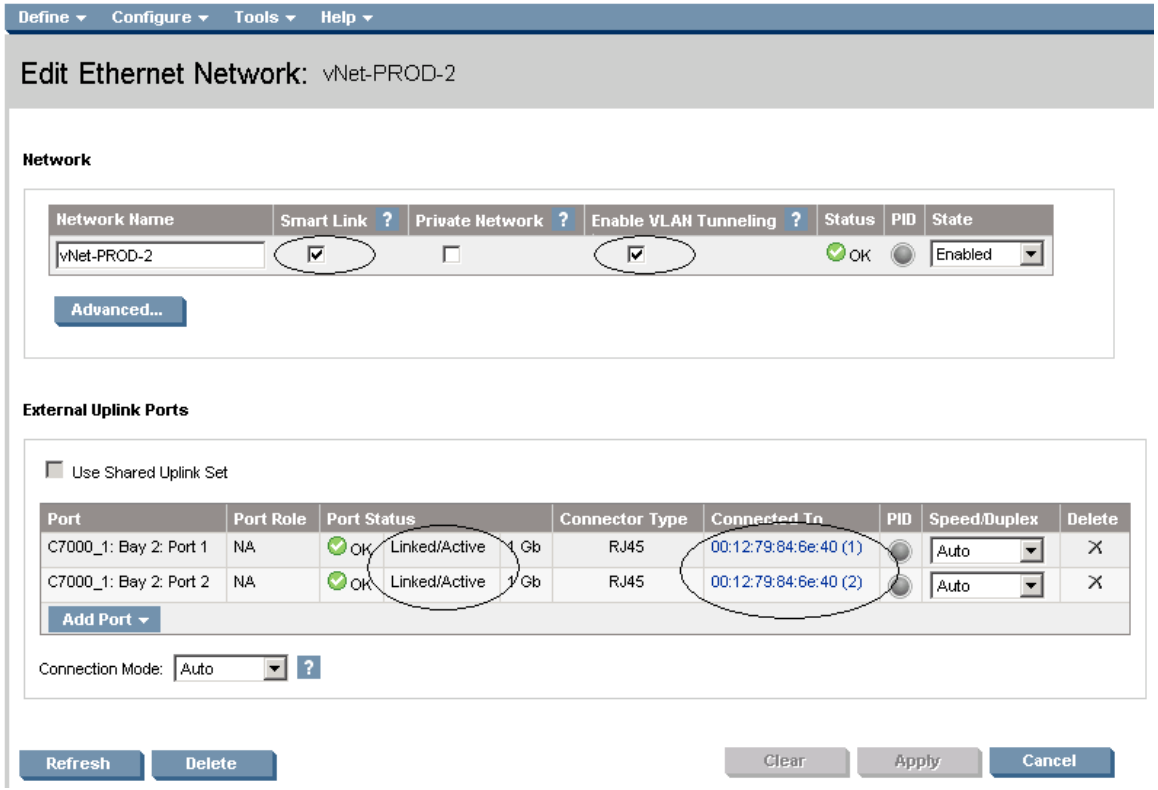



**Figure 1-37** Link aggregation confirmed – Bay 1.

Note: All connections within an active/active LACP group will have the same LAG ID. To view this, go to the Interconnect bay and view Uplink Port Information. If you are having troubles establishing an active/active connection, confirm the LAG ID

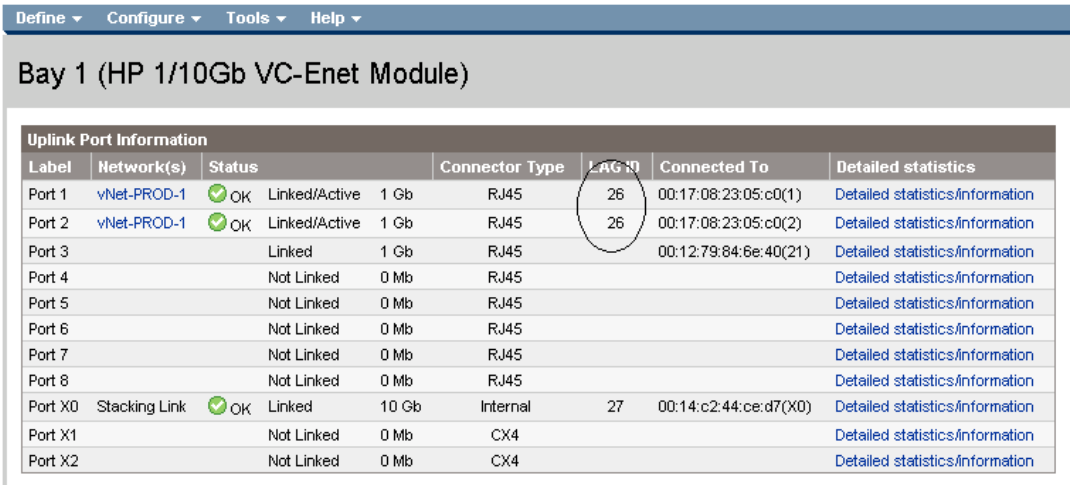
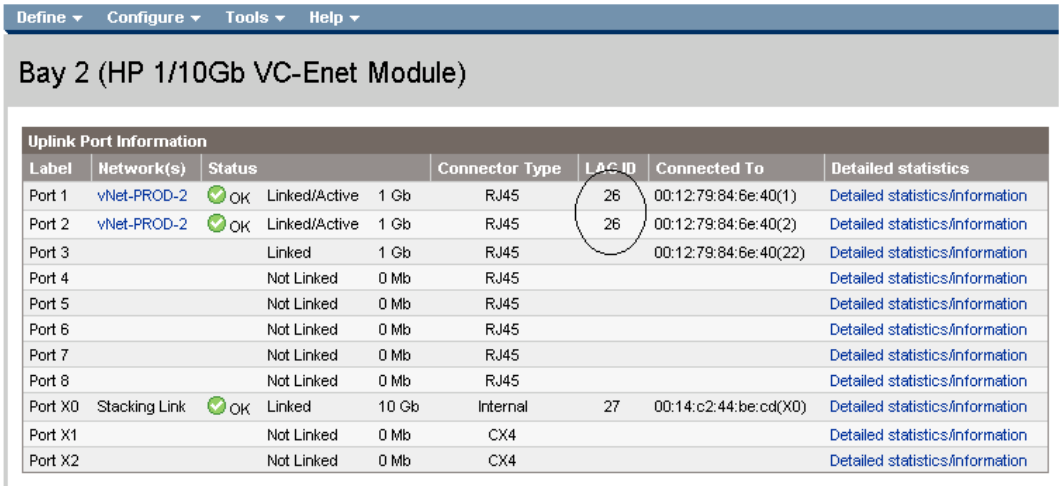


**Figure 1-38** Link aggregation confirmed - Bay 2.




## Defining a Server Profile with NIC 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 “ESX-1”
- In the Network Port 1 drop down box, select “vNet-PROD-1”
- In the Network Port 2 drop down box, select “vNet-PROD-2”
- In the Assign the Profile to a Server Bays, select Bay 1 and apply

## Defining a Server Profile with NIC 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 ESX-1
add profile ESX-1 –nodefaultenetconn
add enet-connection ESX-1 pxe=Enabled
add enet-connection ESX-1 pxe=Disabled
set enet-connection ESX-1 1 Network=vNet-PROD-1
set enet-connection ESX-1 2 Network=vNet-PROD-2
assign profile ESX-1 enc0:1
```

**Figure 1-39** Define a Server Profile (ESX-1).

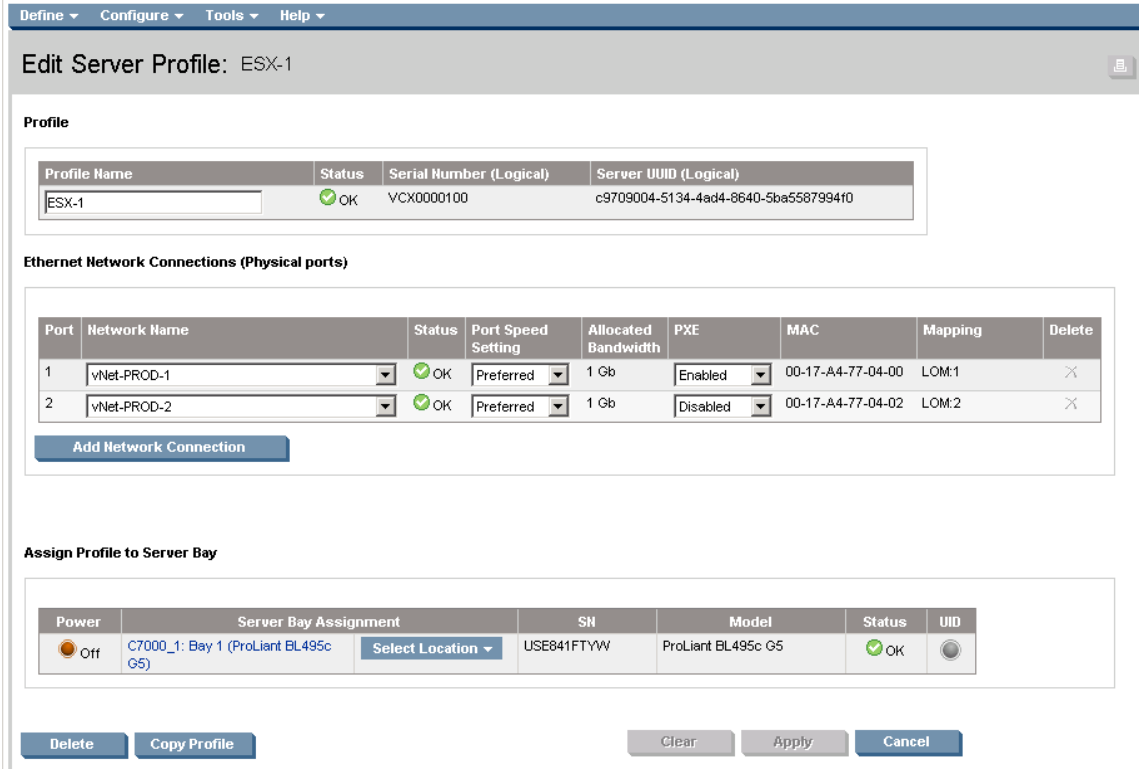
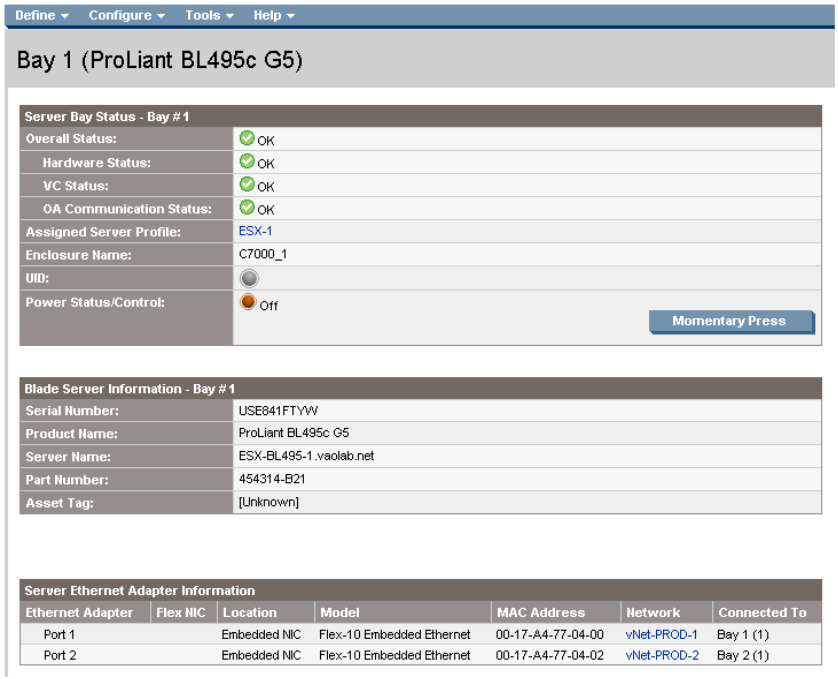



**Figure 1-40** View Bay 1.



# Summary

We created two VC networks, both with TWO active uplinks. Both VC Networks will pass several VLANs as configured/defined by the connected switch, without modification or interpreting the VLAN tags.

When VC profile ESX-1 is applied to the server in bay1 and is powered up, it has two NICs, these NICs are connected to "vNet-PROD-1" and "vNet-PROD-2" respectively, which connects to the network infrastructure through uplinks. These NICs could be configured within the OS as individual NICs with their own IP address or as a pair of TEAMED NICs connected to the same vSwitch. Either NIC could be active. As a result, this server could access the network through either NIC or either set of uplink cables, depending on which NIC is active at the time.

When additional bandwidth is required, additional uplinks could be added to each vNet.

If additional VLANs needed to be supported by these vNets, simply configure the upstream switch ports for the new VLANs, then configure the ESX vSwitch with additional port groups to support these VLANs, no additional Virtual Connect configuration is required.

As additional servers are added to the enclosure, simply create additional profiles, configure the NICs for vNet-PROD-1 and vNet-PROD-2 and apply them to the appropriate server bays.

# Results

The following graphic provides an example of an ESX server with TWO NICs connected to the same vSwitch, the console is configured for VLAN 101, which was the Default (untagged) VLAN. Additional port groups were configured to support each additional VLAN.

**Figure 1-41** Both NICs for Profile ESX-1are connected to the network through vNet=PROD-1 and vNet-PROD-2, VLANs are configured as Port Groups within the virtual switch.

Note: if the management/console VLAN was not set to Default within the server Profile, then the console would need to be configured for the appropriate VLAN

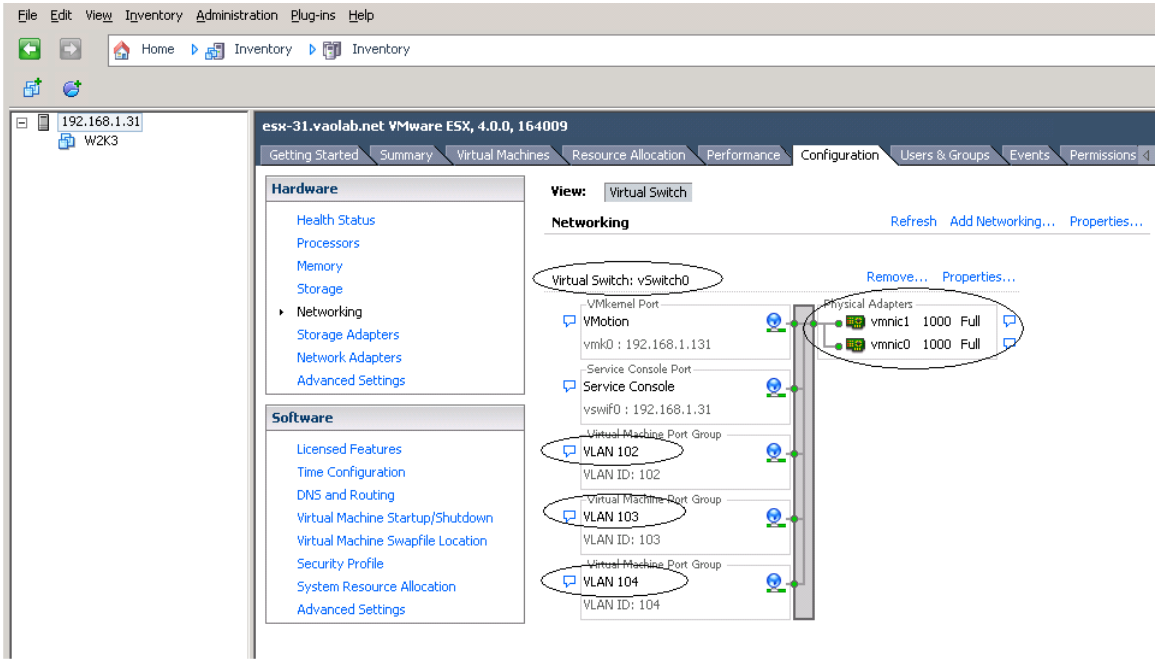
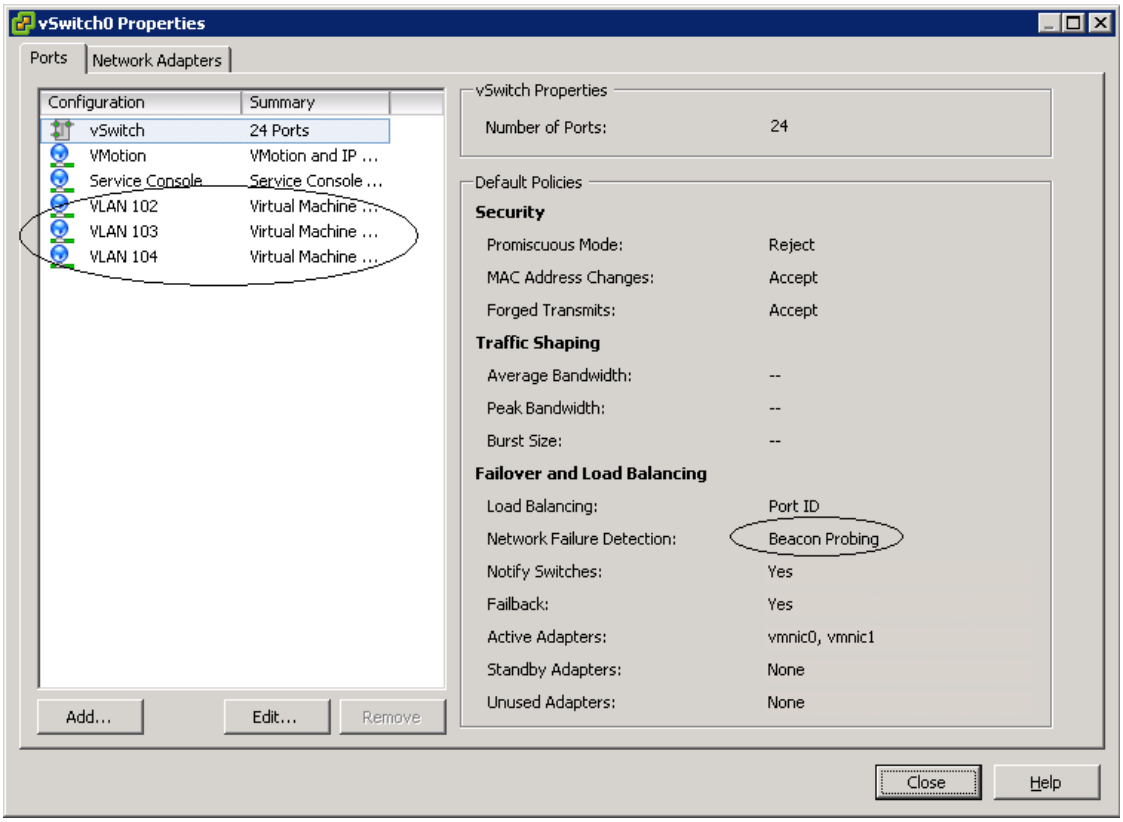
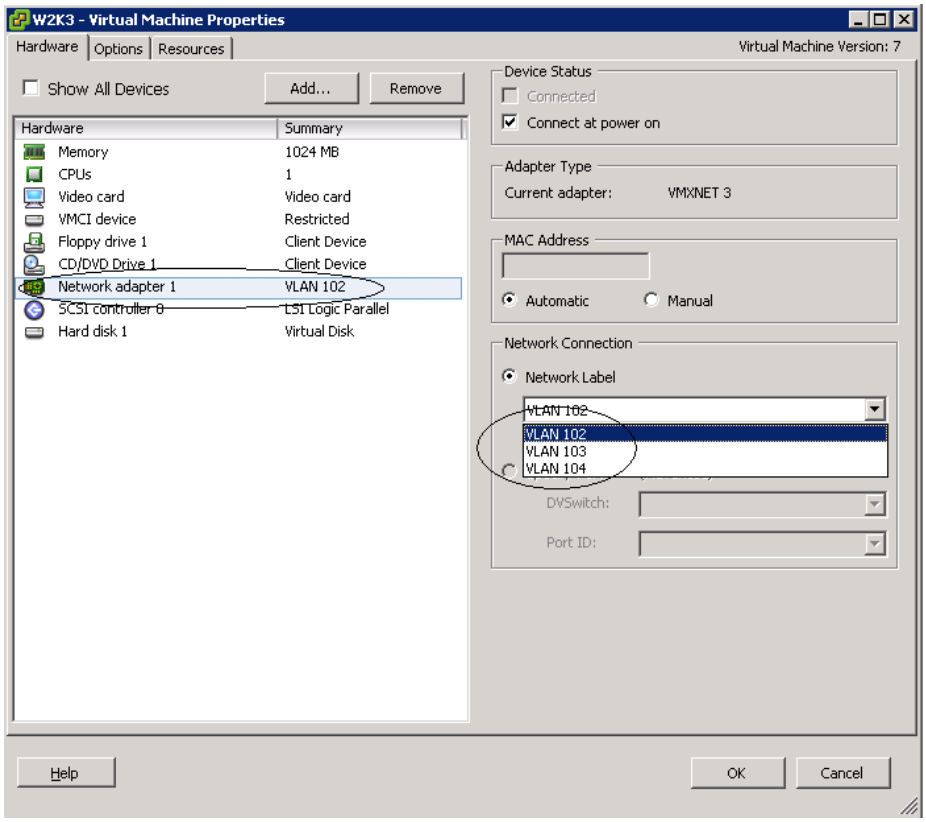


**Figure 1-42** Configuring the ESX vSwitch for Multiple Networks / VLANs. If additional VLANs need to be supported, simply configure the upstream switch ports for those VLANs, then configure the vSwitch as below to support those additional VLANs.




When configuring the virtual guest, edit the Network Adapter configuration and select which VLAN this guest will connect to.

**Figure 1-43** The guest Virtualization Manager's network adapter is then configured for the appropriate VLAN.



# Scenario 1:4 – VLAN Tagging (802.1Q) with a Shared Uplink Set (SUS) with Link Aggregation using LACP (802.3ad) – Windows

## Overview

This configuration uses the Virtual Connect Shared Uplink Set (SUS). The SUS provides the ability to present a single or multiple VLANs to a server NIC. In this scenario, the upstream network switch connects multiple VLANs to two ports on each VC module.

## Requirements

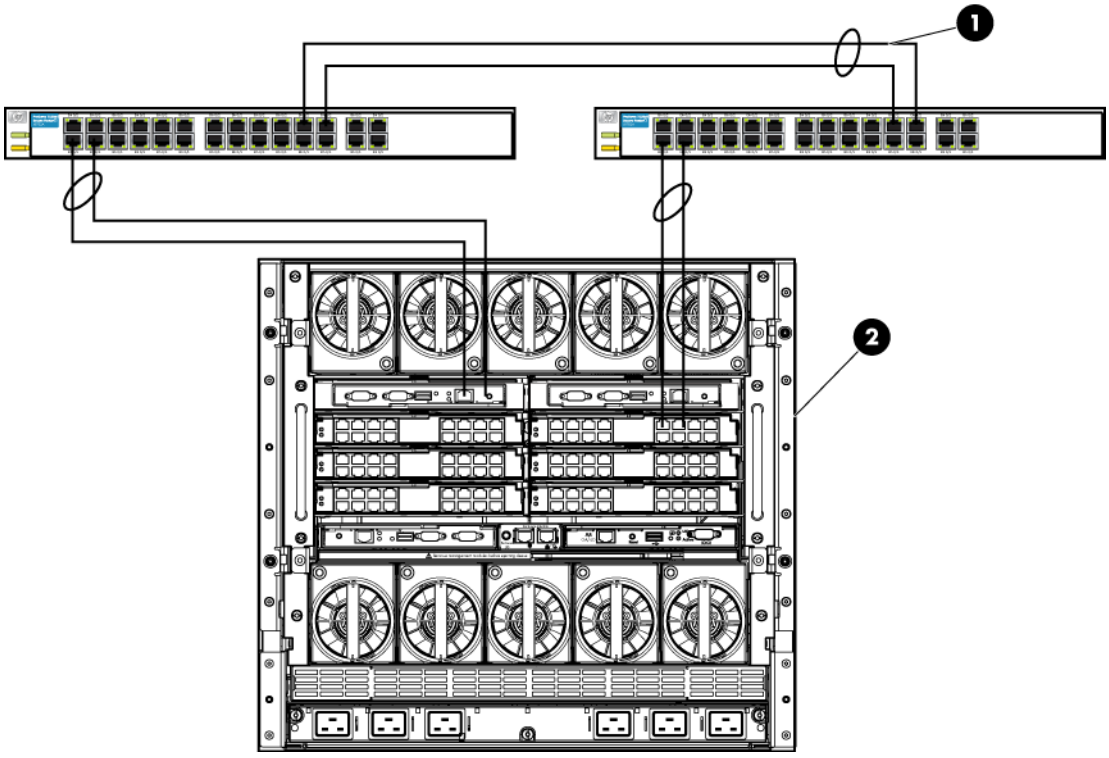
In order to implement this scenario, an HP BladeSystem c7000 enclosure with one of more server blades and TWO Virtual Connect Ethernet modules, installed in Bays 1& 2 are required. In addition, we will require ONE or TWO external Network switches. As Virtual Connect does not appear to the network as a switch and is transparent to the network, any standard managed switch will work with Virtual Connect.

## Configuring Uplinks to a vNet (LACP)

When all uplinks configured within a vNet connect a VC module to an upstream switch, ALL links could be active, providing additional bandwidth, using Link Aggregation Protocol (LACP 802.3ad), this requires the upstream switch to be configured, on these ports, for link aggregation control protocol (LACP).

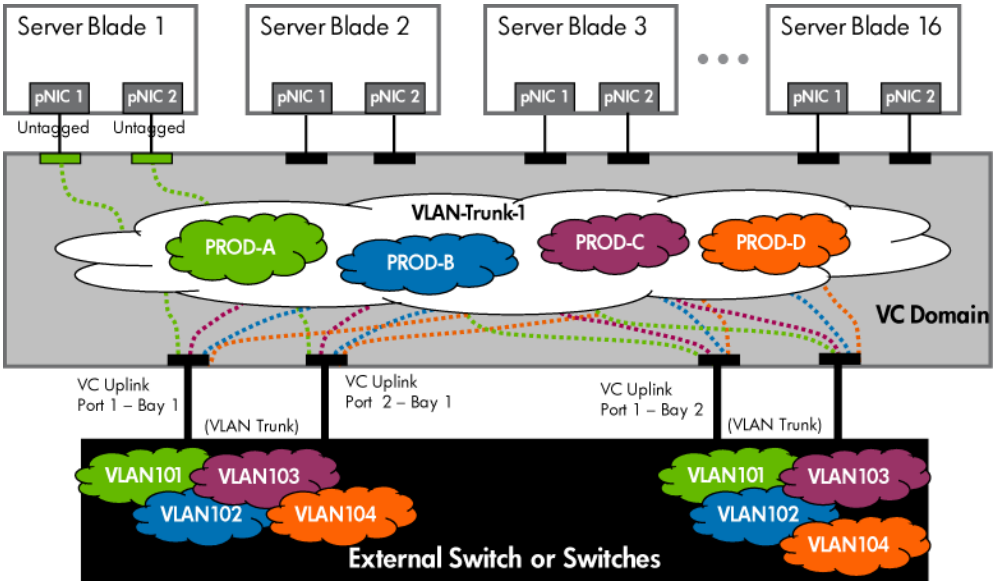
When some of the uplinks configured within a vNet connect a VC module to different upstream switches, some links will be active and the remaining will be Standby, providing additional bandwidth and/or availability, using Link Aggregation Protocol (LACP 802.3.ad).

**Figure 1-44** Physical View; Shows two Ethernet uplinks from Ports 1 and 2 on Module 1 to Ports 1 and 2 on the first network switch and two uplinks from Ports 1 and 2 on Module 2 to Ports 1 and 2 on the second network switch.




| Item | Description |
|---|---|
| 1 | Switch Cross Connect |
| 2 | c7000 Enclosure, rear view |

**Figure 1-45** Logical View; Shows two Ethernet uplinks from each VC module to the network switches. The Uplinks from both Modules are associated with the Shared Uplink Set "VLAN-Trunk-1. Both NICs for blade App-1 are connected to PROD-A, all frames are received untagged.




# Installation and configuration

## Switch configuration

Appendices A and B provide a summary of the commands required to configure the switch in either a Cisco IOS or a ProCurve network infrastructure. The configuration information provided in the appendices assumes the following information:

- The switch ports are configured as TRUNK ports to support VLANs 101, 102, 103 and 104. All frames will be forwarding to VC with VLAN tags.
- When adding the additional uplinks to the SUS, the switch ports connected to Virtual Connect will need to be configured for LACP and configured for the same Link Aggregation Group.

## 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 the VC module

- Physically connect Ports 1 and 2 of the first network switch to Ports 1 and 2 on the VC module in Bay 1.
- Physically connect Ports 1 and 2 of the second network switch to Ports 1 and 2 of the VC module in Bay 2, if you have only one network switch, connect the second VC module cables to alternates port on the same switch. This will NOT create a network loop and does not require Spanning Tree to be configured.

## 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 can 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 (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 Map VLAN Tags via GUI (Ethernet settings)

Enable Map VLAN Tags within Virtual Connect

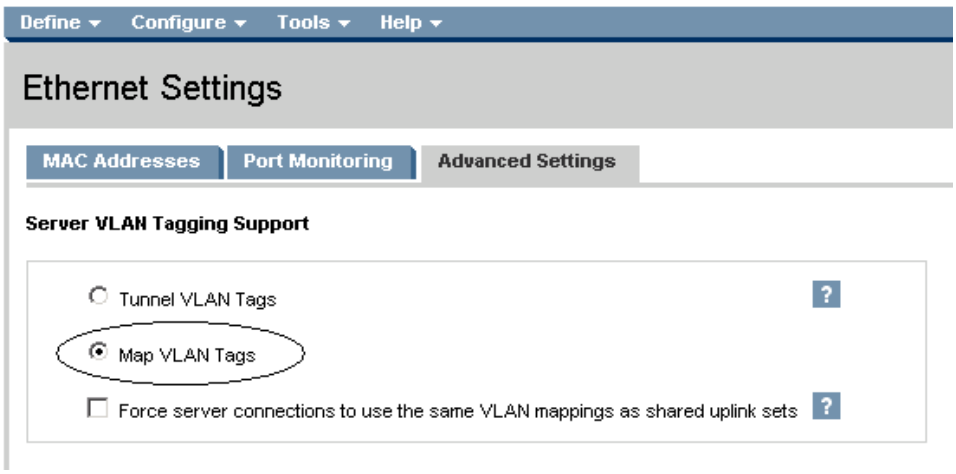
- On the Virtual Connect Manager screen, Left pane, click Ethernet Settings, Advanced Settings
- Select Map VLAN Tags
- Select Fast MAC Cache Fail-over with a refresh of 5
- Select Apply

## Configuring the VC Module for Map VLAN Tags 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 "Map VLAN Tags" and Enable Fast MAC cache fail-over
set enet-vlan vlantagcontrol=map sharedservervlanid=false
set mac-cache Enabled=True Refresh=5
```

**Figure 1-46** Ethernet Settings.




## Defining a new Shared Uplink Set via GUI

Create a SUS and name it “VLAN-Trunk-1”

- On the Virtual Connect Manager screen, click Define, Shared Uplink Set to create a SUS
- Ether the Network Name of “VLAN-Trunk-1”
- Select Add Port, then add the following ports;

a. Enclosure 1, Bay 1, Port 1
b. Enclosure 1, Bay 1, Port 2
c. Enclosure 1, Bay 2, Port 1
d. Enclosure 1, Bay 2, Port 2

- Add Networks as follows;
  a. PROD-A = VLAN ID=101
  b. PROD-B = VLAN ID=102
  c. PROD-B = VLAN ID=103
  d. PROD-B = VLAN ID=104
- Leave Connection Mode as Auto

Note: By creating a SUS we have provided the ability to present one or many VLANs to a server NIC. As two uplinks are configure from each VC module and the SAME SUS we have provided an active/standby configuration with Link Aggregation (802.3ad, LACP). This configuration provides additional bandwidth and the ability to lose an uplink cable, network switch or depending on how the NICs are configured at the server (teamed or untamed), even a VC module. However, only one uplink pair will be active at a time.

Note: Smart Link – 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 or SUS are down.

## Defining a new Shared Uplink Set via CLI

```
#Create Shared Uplink Set "VLAN-Trunk-1" and configure an uplink on VC Module 1, Port 1 and VC Module 2, Port 1
add uplinkset VLAN-Trunk-1
add uplinkport enc0:1:1 Uplinkset=VLAN-Trunk-1 speed=auto
add uplinkport enc0:1:2 Uplinkset=VLAN-Trunk-1 speed=auto
add uplinkport enc0:2:1 Uplinkset=VLAN-Trunk-1 speed=auto
add uplinkport enc0:2:2 Uplinkset=VLAN-Trunk-1 speed=auto

# Create Networks VLAN_101 and VLAN_104 for Shared Uplink Set "VLAN-TRUNK-1"
add network PROD-A uplinkset=VLAN-Trunk-1 VLanID=101
add network PROD-B uplinkset=VLAN-Trunk-1 VLanID=102
add network PROD-C uplinkset=VLAN-Trunk-1 VLanID=103
add network PROD-D uplinkset=VLAN-Trunk-1 VLanID=104
```

**Figure 1-47** Define Shared Uplink Set (VLAN-Trunk-1).

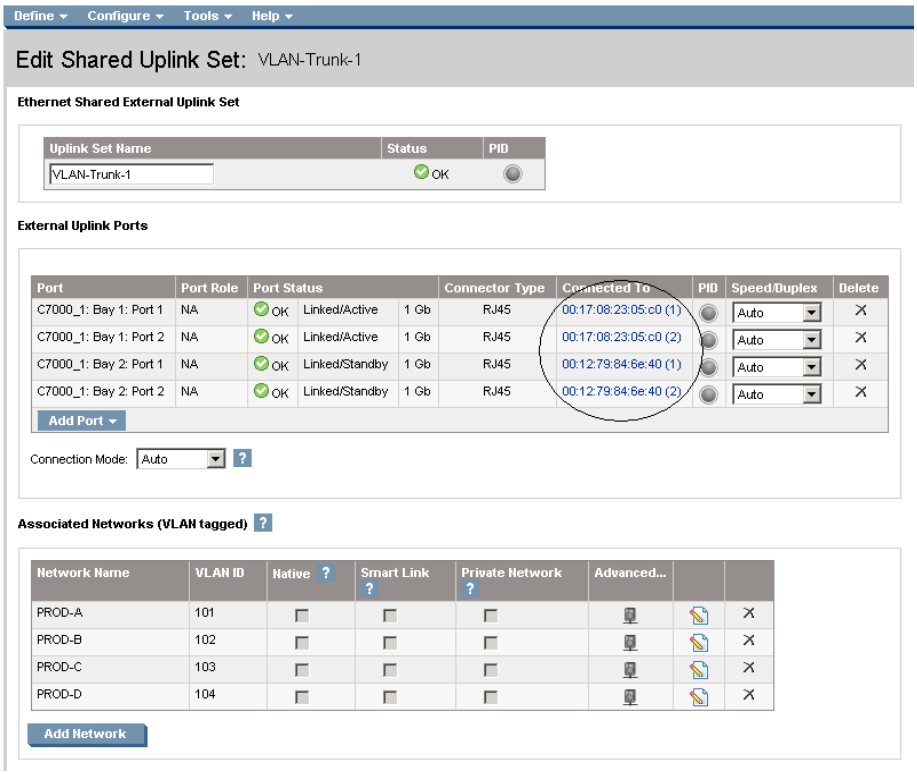



**Figure 1-48** Link aggregation confirmed – Bay 1.

Note: All connections within an active/active LACP group will have the same LAG ID. To view this, go to the Interconnect bay and view Uplink Port Information. If you are having troubles establishing an active/active connection, confirm the LAG ID

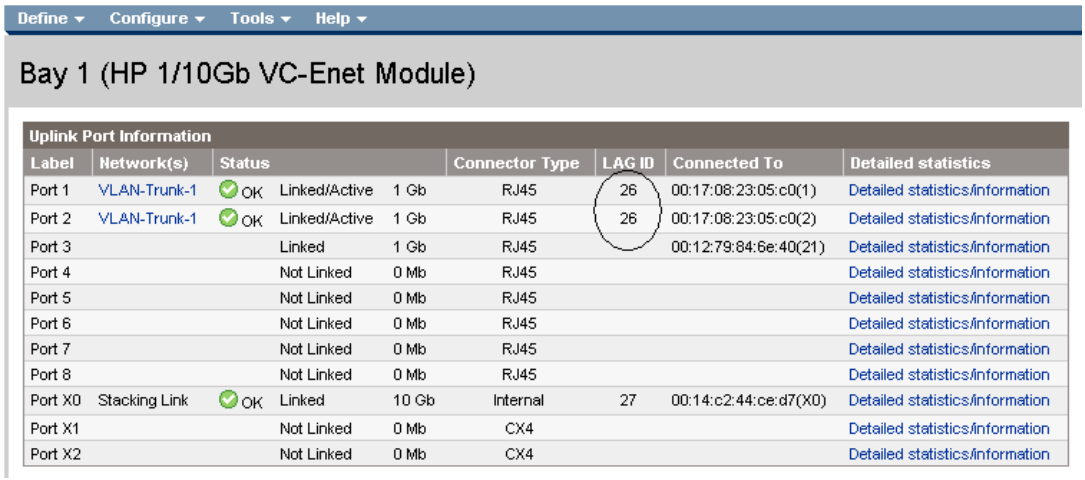
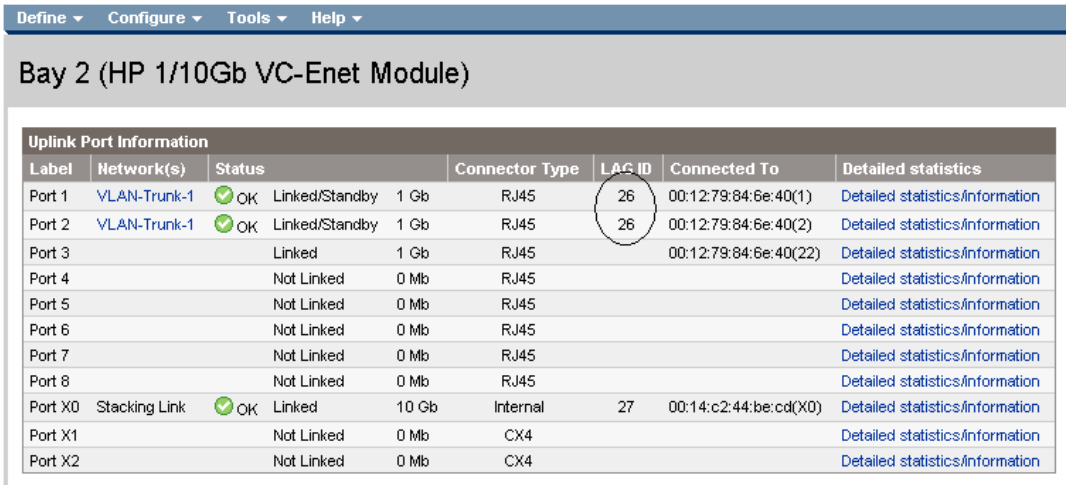


**Figure 1-49** Link aggregation confirmed - Bay 2.




## Defining a Server Profile with NICs Connections to a single VLAN, via GUI

Each server NIC will connect to a network.

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

- Create a server profile called "App-1"
- In the Network Port 1 drop down box, select "PROD-A"
- In the Network Port 2 drop down box, select "PROD-A"
- In the Assign the Profile to a Server Bays, select Bay 1 and apply

## Defining a Server Profile with NICs Connections to a single VLAN, 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
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=PROD-A
set enet-connection App-1 2 Network=PROD-A
assign profile App-1 enc0:1
```

Note: the graphic below is an example of a how a Windows or Linux server might be configured for a specific VLAN. In this case both NICs are configured for network PROD-A, which is mapped to VLAN 101. Any frames received by Virtual Connect for this server will have their VLAN tags intact, Virtual Connect will remove the tags and present the frames to the server NICs, and therefore, the VC port is acting as an ACCESS port.

**Figure 1-50** Define a Server Profile (App-1).

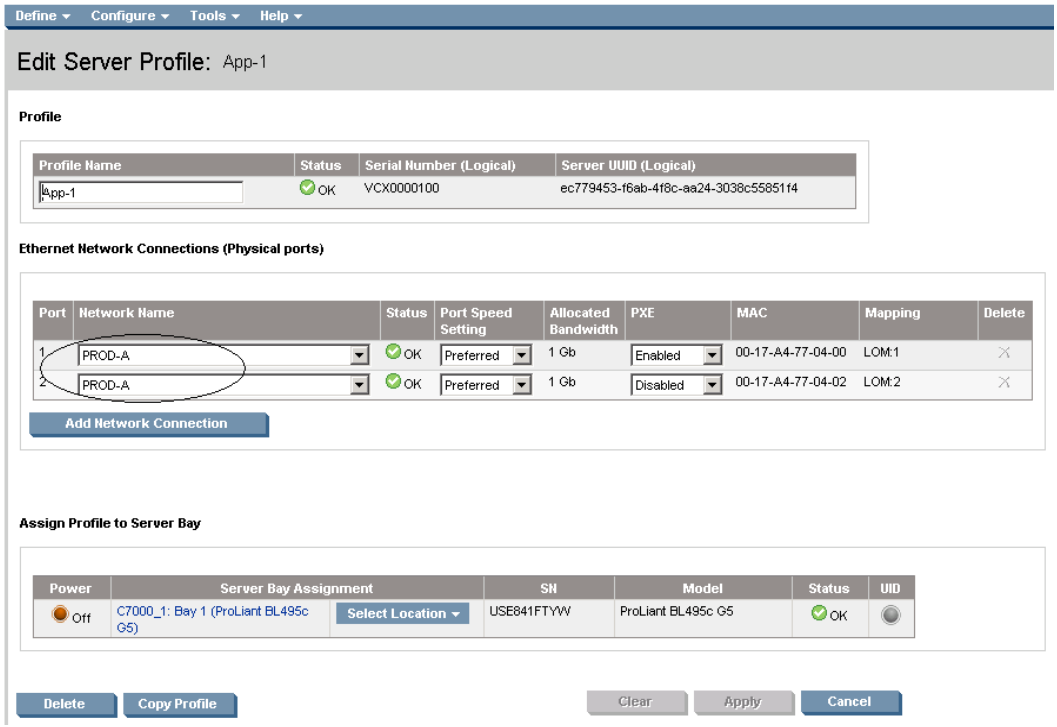
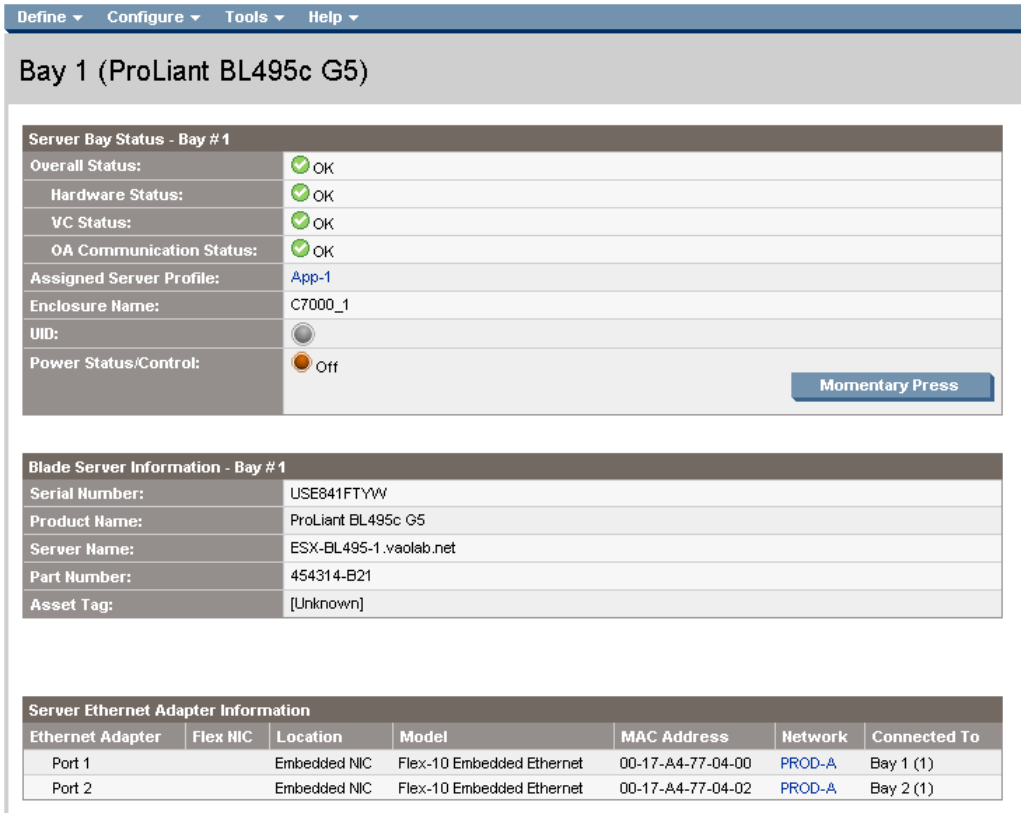



**Figure 1-51** View Bay 1.



# Summary

We created a Virtual Connect Shared Uplink Set (SUS), to support 4 VLANs (101-104). The SUS was created with both Active and standby uplinks, to provide both additional bandwidth and availability.

When VC profile App-1 is applied to the server in bay1 and is powered up, it has two NICs connected to "PROD-A", which connects to the network infrastructure through a two (active) 1Gb uplinks. These NICs are configured in VLAN 104, however, Virtual Connect is removing the VLAN tags and presenting the frames as untagged, so the operating system does not need to understand which VLAN it is on.

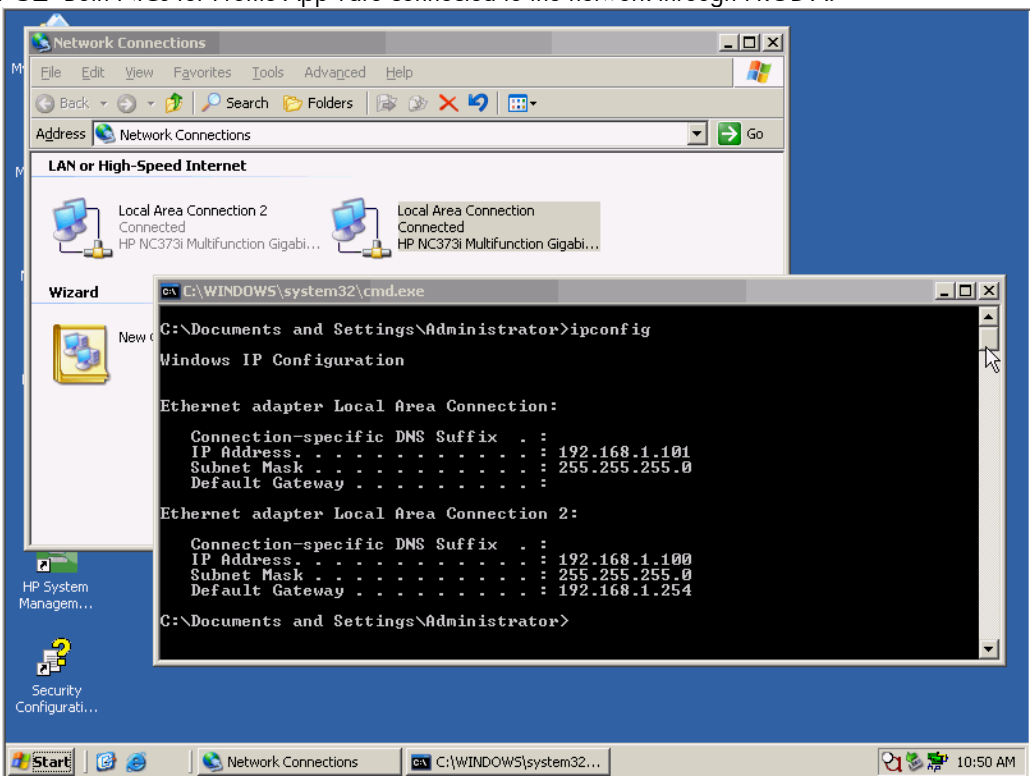
These NICs could now be configured as individual NICs with their own IP address or as a pair of TEAMED NICs. Either NIC could be active. As a result, this server could access the network through either NIC or either uplink cable, depending on which NIC is active at the time.

As additional servers are added to the enclosure, simply create additional profiles, configure the NICs for the appropriate network and apply them to the appropriate server bays.

# Results

The following graphic provides an example of a Windows 2003 server with TWO NICs connected to the network, each NIC has its own TCP/IP address, either or both NICs could be actively working on the network.

**Figure 1-52** Both NICs for Profile App-1are connected to the network through PROD-A.




The following graphics provide an example of a Windows 2003 server with TWO NICs teamed and connected to the network. One NIC will be active, the other in standby, in the event of an Uplink, switch or VC module failure; the teaming software will fail the NIC over to the alternate path, as required.

**Figure 1-53** Team both NICs, using the HP Network Configuration Utility.

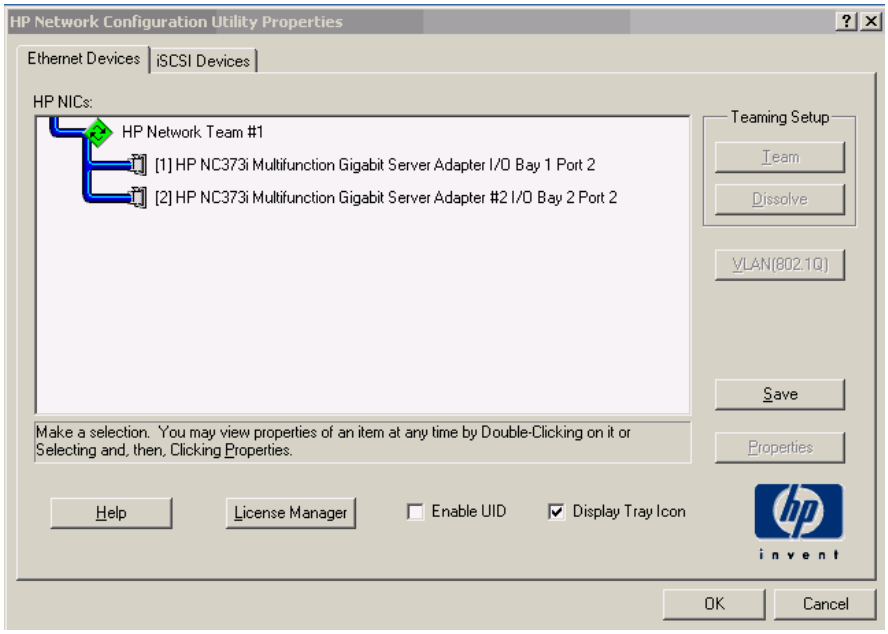
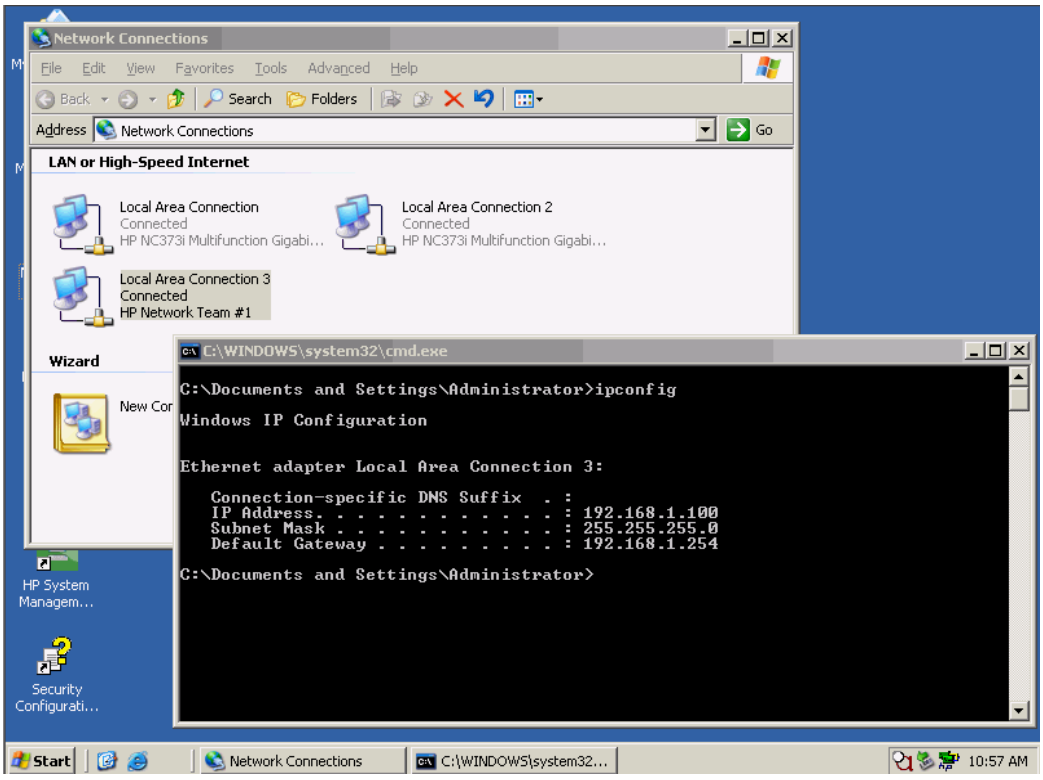



**Figure 1-54** Both NICs for Profile App-1are teamed and connected to the network through PROD-A.



# Scenario 1:5 – VLAN Tagging (802.1Q) with a Shared Uplink Set (SUS) with Link Aggregation using LACP (802.3ad) – VMware ESX

## Overview

This configuration uses the Virtual Connect Shared Uplink Set (SUS). The SUS provides the ability to present a single or multiple VLANs to a server NIC. In this scenario, the upstream network switch connects multiple VLANs to two ports on each VC module.

## Requirements

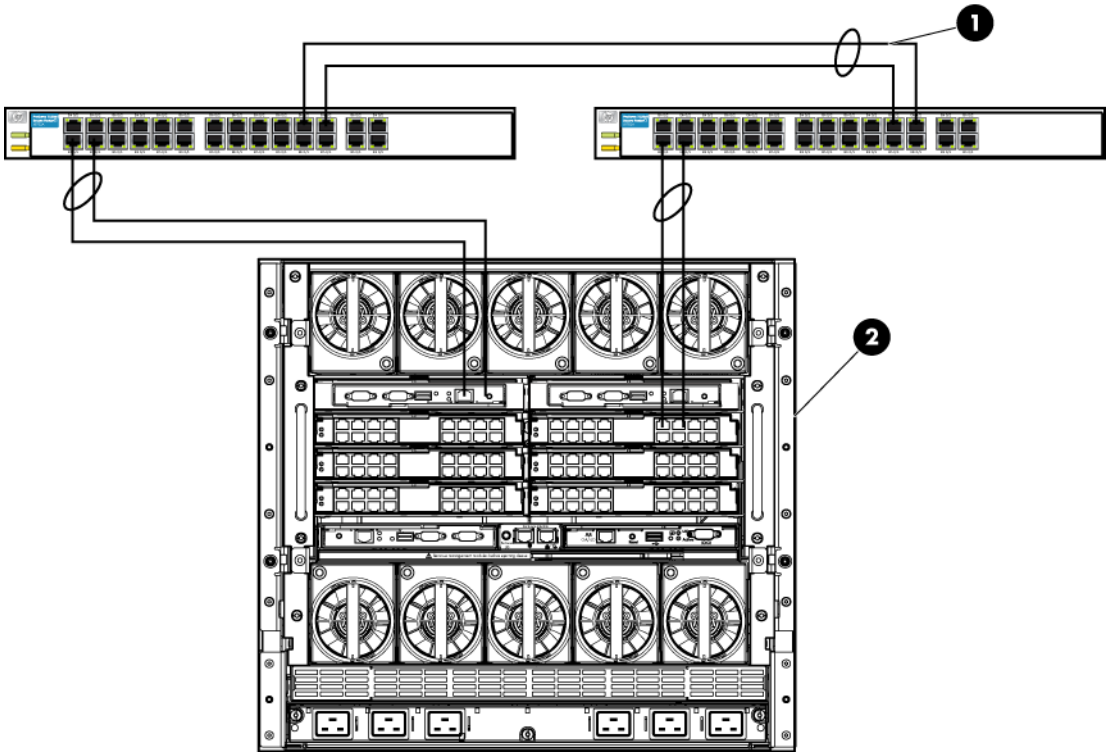
In order to implement this scenario, an HP BladeSystem c7000 enclosure with one of more server blades and TWO Virtual Connect Ethernet modules, installed in Bays 1& 2 are required. In addition, we will require ONE or TWO external Network switches. As Virtual Connect does not appear to the network as a switch and is transparent to the network, any standard managed switch will work with Virtual Connect.

## Configuring Uplinks to a vNet (LACP)

When all uplinks configured within a vNet connect a VC module to an upstream switch, ALL links could be active, providing additional bandwidth, using Link Aggregation Protocol (LACP 802.3ad), this requires the upstream switch to be configured, on these ports, for link aggregation control protocol (LACP).

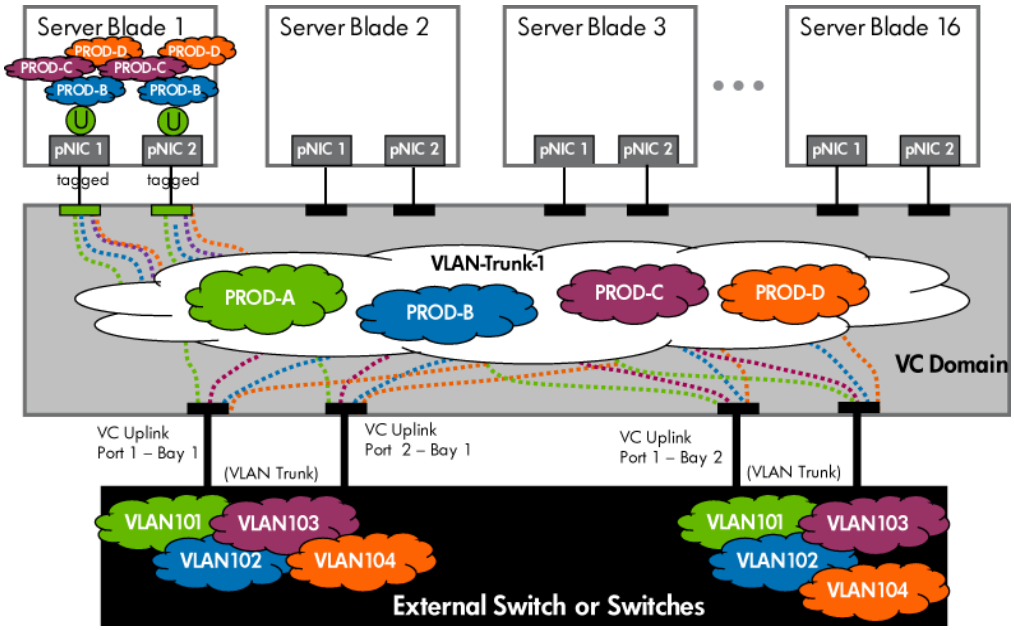
When some of the uplinks configured within a vNet connect a VC module to different upstream switches, some links will be active and the remaining will be Standby, providing additional bandwidth and/or availability, using Link Aggregation Protocol (LACP 802.3.ad).

**Figure 1-55** Physical View; Shows two Ethernet uplinks from Ports 1 and 2 on Module 1 to Ports 1 and 2 on the first network switch and two uplinks from Ports 1 and 2 on Module 2 to Ports 1 and 2 on the second network switch.




| Item | Description |
|---|---|
| 1 | Switch Cross Connect |
| 2 | c7000 Enclosure, rear view |

**Figure 1-56** Server Profile ESX-1 configured with Multiple Networks on NICs 1&2 with PROD-A configured as the Default VLAN (untagged). All additional networks will be presented with tags.




# Installation and configuration

## Switch configuration

Appendices A and B provide a summary of the commands required to configure the switch in either a Cisco IOS or a ProCurve network infrastructure. The configuration information provided in the appendices assumes the following information:

- The switch ports are configured as TRUNK ports to support VLANs 101, 102, 103 and 104. All frames will be forwarding to VC with VLAN tags.
- When adding the additional uplinks to the SUS, the switch ports connected to Virtual Connect will need to be configured for LACP and configured for the same Link Aggregation Group.

## 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 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 can 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 (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 Map VLAN Tags via GUI (Ethernet settings)

Enable Tunnel VLAN Tags within Virtual Connect

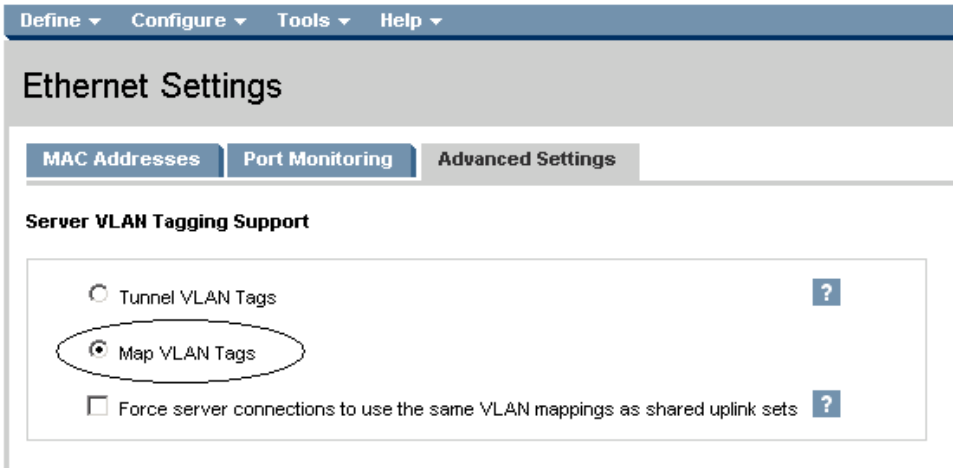
- On the Virtual Connect Manager screen, Left pane, click Ethernet Settings, Advanced Settings
- Select Map VLAN Tags
- Select Fast MAC Cache Fail-over with a refresh of 5
- Select Apply

## Configuring the VC Module for Map VLAN Tags 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 "Map VLAN Tags" and Enable Fast MAC cache fail-over
set enet-vlan vlantagcontrol=map sharedservervlanid=false
set mac-cache Enabled=True Refresh=5
```

**Figure 1-57** Ethernet Settings.



## Defining a new Shared Uplink Set via GUI

Create a SUS and name it "VLAN-Trunk-1"

- On the Virtual Connect Manager screen, click Define, Shared Uplink Set to create a SUS
- Ether the Network Name of "VLAN-Trunk-1"
- Select Add Port, then add the following ports;
    a. Enclosure 1, Bay 1, Port 1
    b. Enclosure 1, Bay 1, Port 2
    c. Enclosure 1, Bay 2, Port 1
    d. Enclosure 1, Bay 2, Port 2
- Add Networks as follows;
    a. PROD-A = VLAN ID=101
    b. PROD-B = VLAN ID=102
    c. PROD-B = VLAN ID=103
    d. PROD-B = VLAN ID=104
- Leave Connection Mode as Auto

Note: By creating a SUS we have provided the ability to present one or many VLANs to a server NIC. As two uplinks are configure from each VC module and the SAME SUS we have provided an active/standby configuration with Link Aggregation (LACP). This configuration provides additional bandwidth and the ability to lose an uplink cable, network switch or depending on how the NICs are configured at the server (teamed or untamed), even a VC module. However, only one uplink pair will be active at a time.

Note: Smart Link – 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 or SUS are down.

## Defining a new Shared Uplink Set via CLI

#Create Shared Uplink Set "VLAN-Trunk-1" and configure an uplink on VC Module 1, Port 1 and VC Module 2, Port 1

```
add uplinkset VLAN-Trunk-1
add uplinkport enc0:1:1 Uplinkset=VLAN-Trunk-1 speed=auto
add uplinkport enc0:1:2 Uplinkset=VLAN-Trunk-1 speed=auto
add uplinkport enc0:2:1 Uplinkset=VLAN-Trunk-1 speed=auto
add uplinkport enc0:2:2 Uplinkset=VLAN-Trunk-1 speed=auto

# Create Networks VLAN_101 and VLAN_104 for Shared Uplink Set "VLAN-TRUNK-1"
add network PROD-A uplinkset=VLAN-Trunk-1 VLanID=101
add network PROD-B uplinkset=VLAN-Trunk-1 VLanID=102
add network PROD-C uplinkset=VLAN-Trunk-1 VLanID=103
add network PROD-D uplinkset=VLAN-Trunk-1 VLanID=104
```

**Figure 1-58** Define Shared Uplink Set (VLAN-Trunk-1).

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

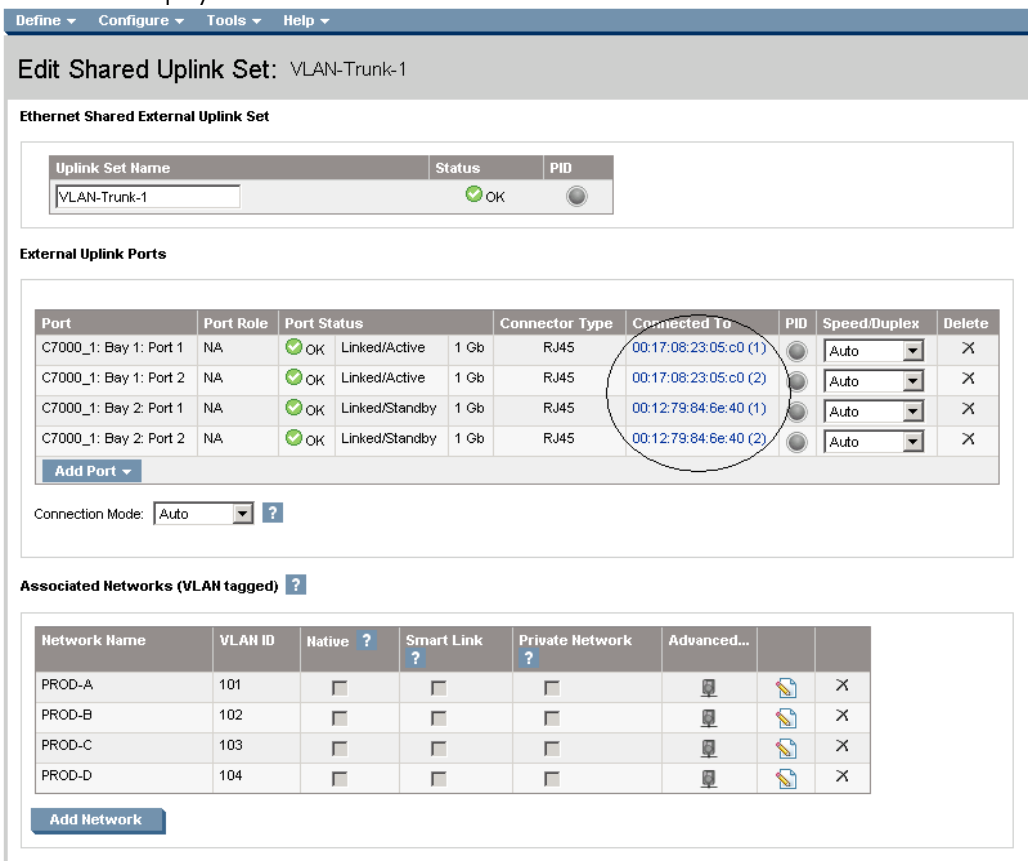



**Figure 1-59** Link aggregation confirmed – Bay 1.

Note: All connections within an active/active LACP group will have the same LAG ID. To view this, go to the Interconnect bay and view Uplink Port Information. If you are having troubles establishing an active/active connection, confirm the LAG ID

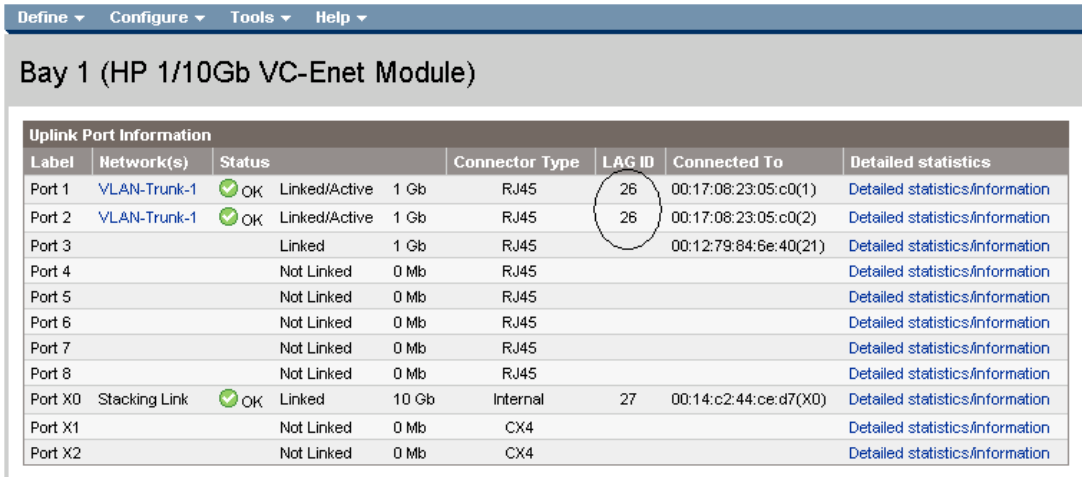
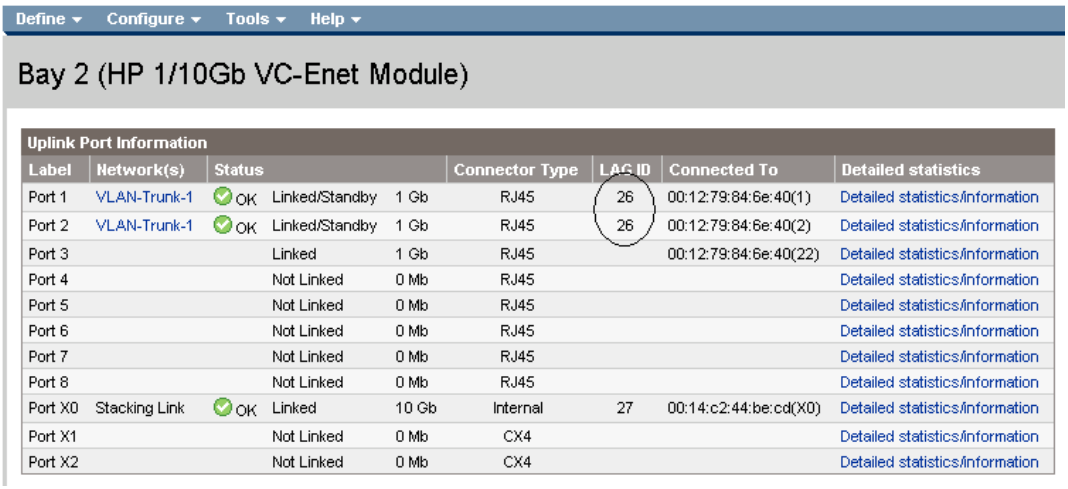


**Figure 1-60** Link aggregation confirmed - Bay 2.




## Defining a Server Profile with NICs Connections to Multiple VLANs, 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"
- In the Network Port 1 drop down box, select "Multiple Networks"
  - When the Server VLAN Tag to vNet Mappings popup appears, configure as follows;
    - In the vNet Name drop down, select PROD-A and check Untagged
    - Click Add Mapping
      - Select PROD-B
    - Click Add Mapping
      - Select PROD-C
    - Click Add Mapping
      - Select PROD-D
    - Click OK
- In the Network Port 2 drop down box, Do the same as configured for Port 1
- In the Assign the Profile to a Server Bays, select Bay 1 and apply

## Defining a Server Profile with NICs Connections to Multiple VLANs, 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
add profile ESX-1 –nodefaultenetconn -nodefaultfcconn
add enet-connection ESX-1 pxe=Enabled
add enet-connection ESX-1 pxe=Disabled
add server-port-map ESX-1:1 PROD-A VLanId=101 Untagged=True
add server-port-map ESX-1:1 PROD-B VLanId=102
add server-port-map ESX-1:1 PROD-C VLanId=103
add server-port-map ESX-1:1 PROD-D VLanId=104
add server-port-map ESX-1:2 PROD-A VLanId=101 Untagged=True
add server-port-map ESX-1:2 PROD-B VLanId=102
add server-port-map ESX-1:2 PROD-C VLanId=103
add server-port-map ESX-1:2 PROD-D VLanId=104
assign profile ESX-1 enc0:1
```

**Figure 1-61** Server Profile (App-1) with Multiple Networks configured.

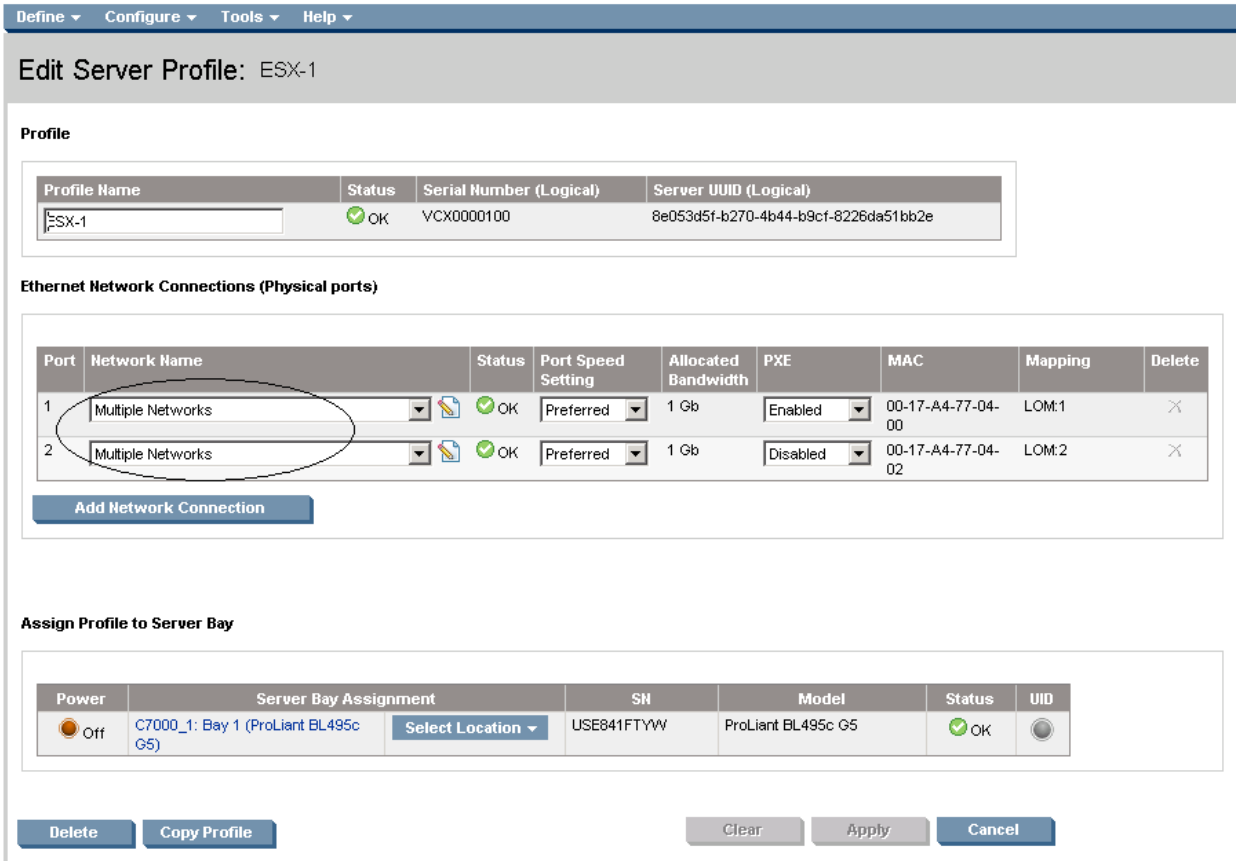
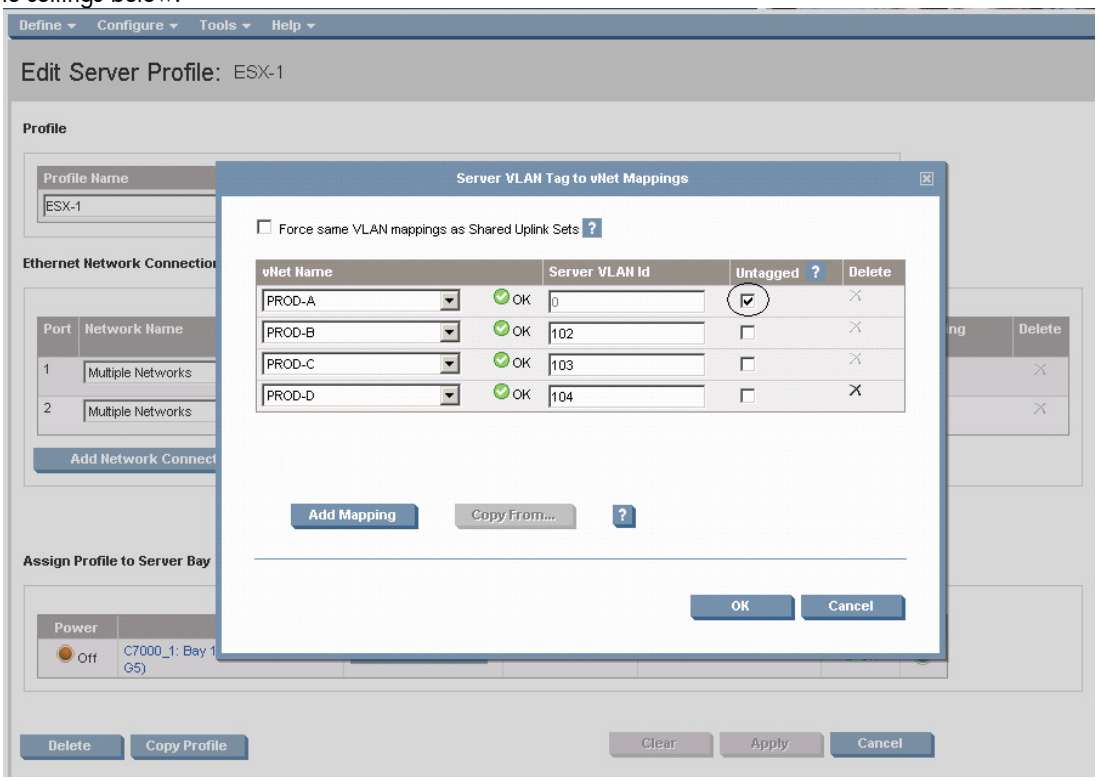


**Figure 1-62** Configuring NIC Port 1 with Multiple Networks, note PROD-A is not tagged, Note; that both NICs are configured with the same settings below.




Note: the above graphic is an example of a how an ESX hypervisor might be configured for multiple VLANs. In this case both NICs are configured for networks PROD-A though PROD-D which are mapped to VLANs 101-104. Any frames received by Virtual Connect for this server will have their tags intact and forward to the server NICs, therefore acting as a TRUNK port. This works well for a hypervisor host/vSwitch that can be configured to interpret the tag. In addition, PROD-A is defined as the default VLAN, therefore any frames received by VC for VLAN 101 will be forwarded to the server NIC, with the tags removed. This would work well for the console NICs, so that the console does not need to be configured to understand the VLAN tags. It we did not un-tag VLAN 101, then the ESX console would need to be configured for this VLAN.

# Summary

We created a Virtual Connect Shared Uplink Set (SUS) to support 4 VLANs (101-104). The SUS was created with Active and standby uplinks, to provide both additional bandwidth and availability.

When VC profile ESX-1 is applied to the server in bay1 and is powered up, it has two NICs configured for "Multiple Networks" which connects to the network infrastructure through two (active) 1Gb uplinks. These NICs are configured to support LANs 101 through 104 with VLAN 101 configured as Default (untagged), so the operating system does not need to understand which VLAN it is on.

As additional servers are added to the enclosure, simply create additional profiles, configure the NICs for Multiple Networks and apply them to the appropriate server bays.

# Results

The following graphic provides an example of an ESX Server with TWO NICs connected to the network. Both NICs are configured to support VLANs 101-104. VLAN 101 is the default VLAN and is not tagged. Port Groups are added to support each VLAN.

**Figure 1-63** Both NICs for Profile ESX-1 are connected to the network through Multiple Networks; VLANs are configured as Port Groups within the virtual switch.

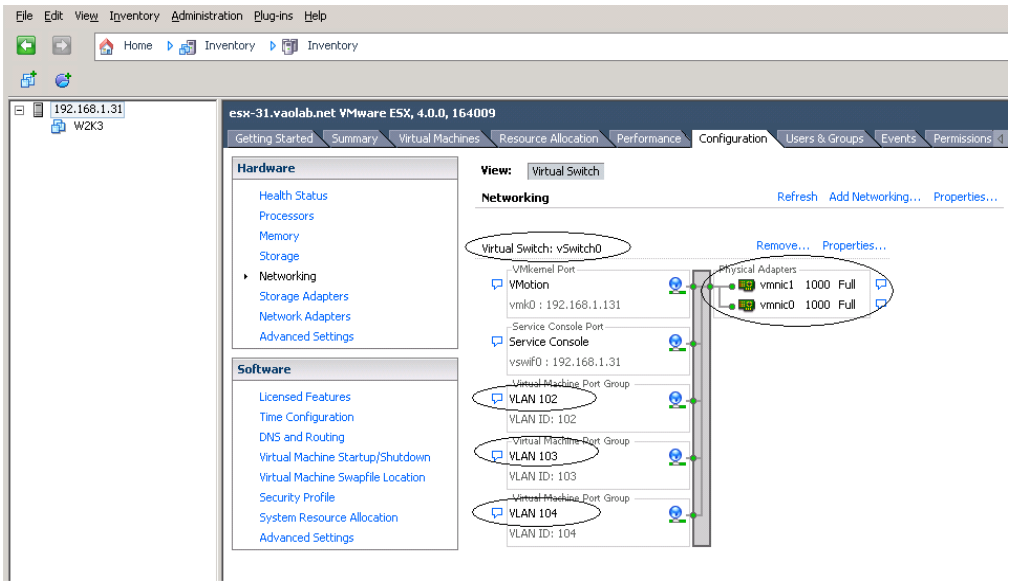
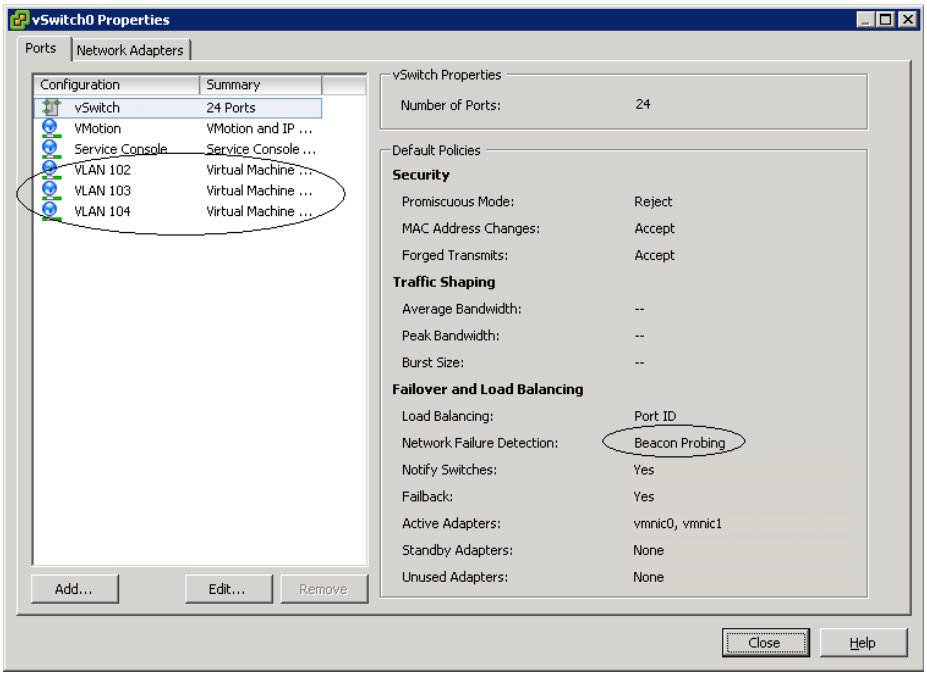
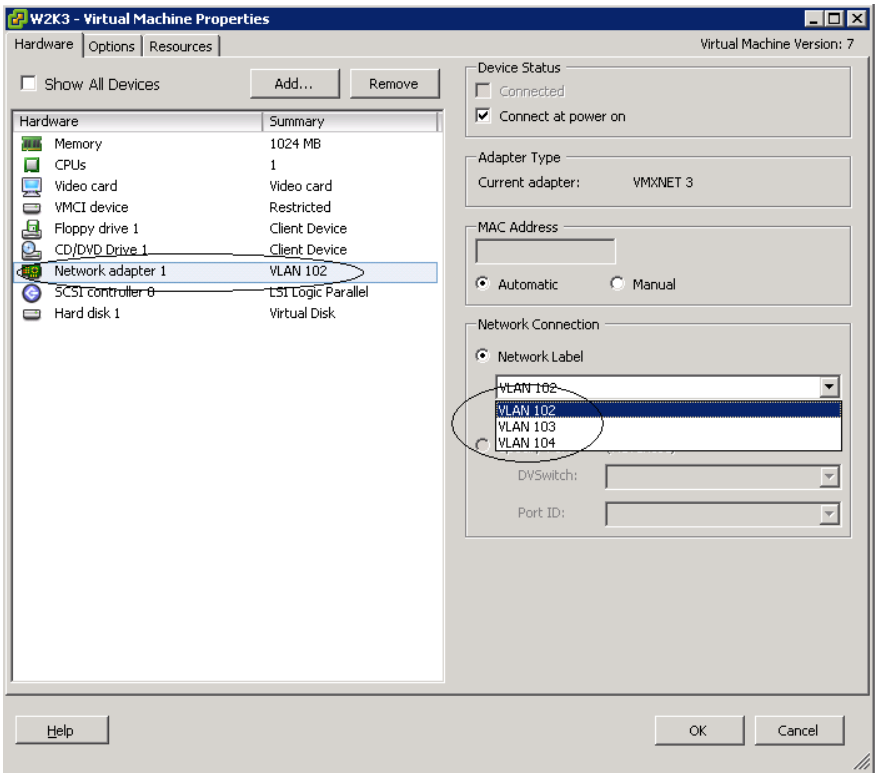



**Figure 1-64** Configuring the ESX vSwitch for Multiple Networks / VLANs.



When configuring the virtual guest, edit the Network Adapter configuration and select which VLAN this guest will connect to.

**Figure 1-65** Edit the configuration of the Guest network adapter and configure it for the appropriate VLAN.



# Scenario 1:6 – VLAN Tagging (802.1Q) with Multiple Shared Uplink Sets (SUS) and Link Aggregation using LACP (802.3ad) – VMware ESX

## Overview

This configuration uses the Virtual Connect Shared Uplink Set (SUS). The SUS provides the ability to present a single or multiple VLANs to a server NIC. In this scenario, the upstream network switches present several VLANs to two ports on each VC module.

## Requirements

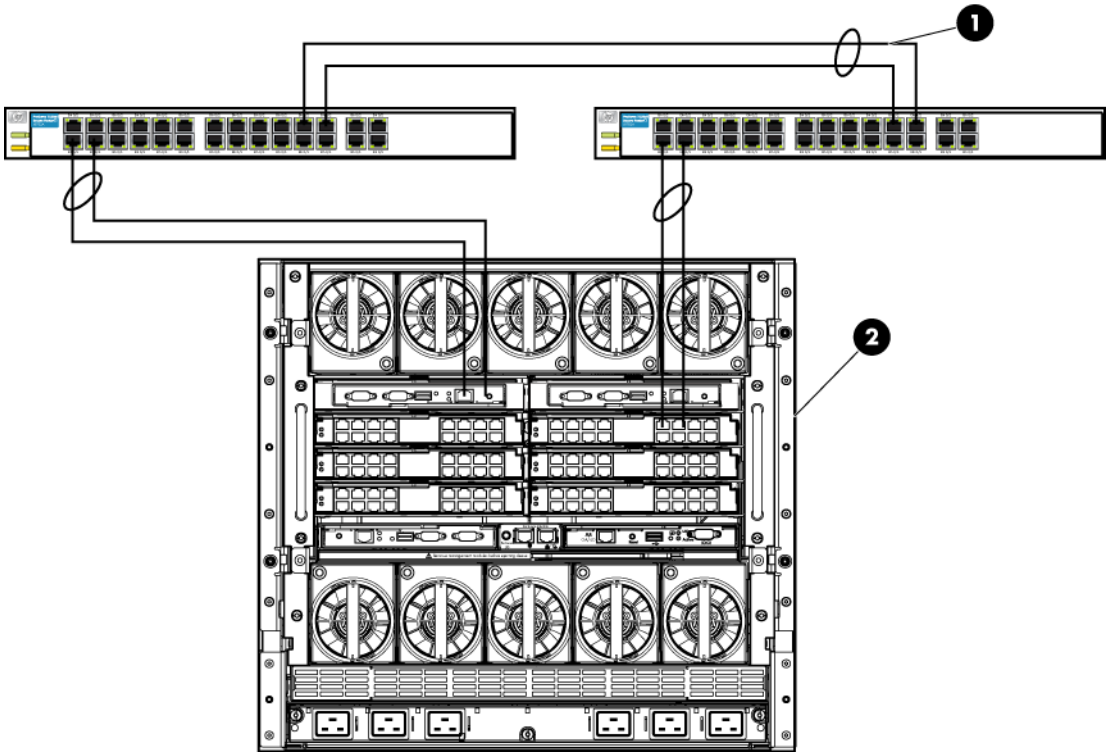
In order to implement this scenario, an HP BladeSystem c7000 enclosure with one of more server blades and TWO Virtual Connect Ethernet modules, installed in Bays 1& 2 are required. In addition, we will require ONE or TWO external Network switches. As Virtual Connect does not appear to the network as a switch and is transparent to the network, any standard managed switch will work with Virtual Connect.

## Configuring Uplinks to a vNet (LACP)

When all uplinks configured within a vNet connect a VC module to an upstream switch, ALL links could be active, providing additional bandwidth, using Link Aggregation Protocol (LACP 802.3ad), this requires the upstream switch to be configured, on these ports, for link aggregation control protocol (LACP).

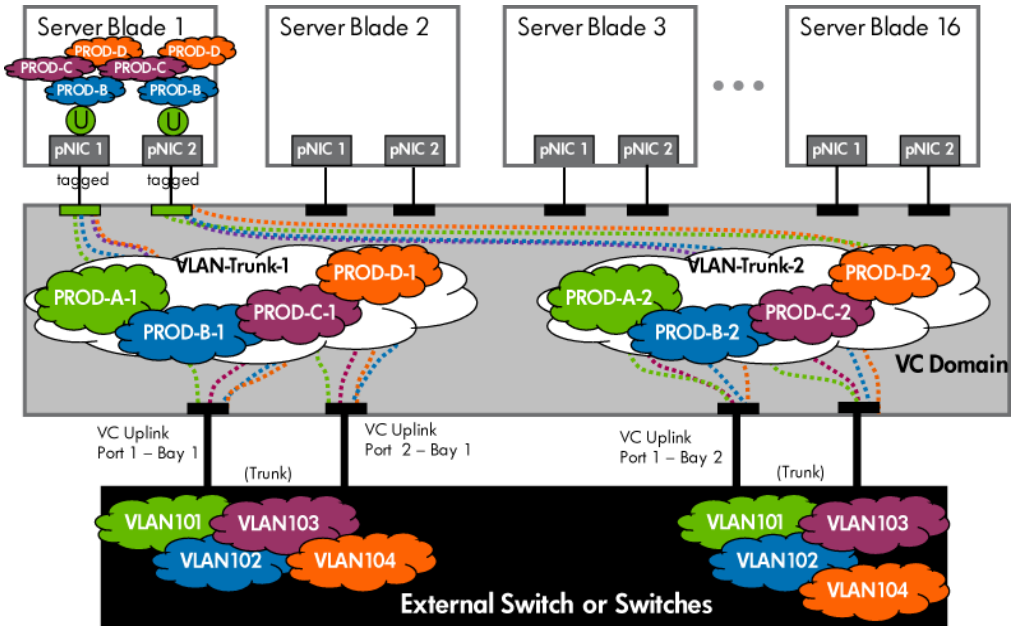
When some of the uplinks configured within a vNet connect a VC module to different upstream switches, some links will be active and the remaining will be Standby, providing additional bandwidth and/or availability, using Link Aggregation Protocol (LACP 802.3.ad).

**Figure 1-66** Physical View; Shows two Ethernet uplinks from Ports 1 and 2 on Module 1 to Ports 1 and 2 on the first network switch and two uplinks from Ports 1 and 2 on Module 2 to Ports 1 and 2 on the second network switch.




| Item | Description |
|---|---|
| 1 | Switch Cross Connect |
| 2 | c7000, rear view |

**Figure 1-67** Server Profile ESX-1 configured with Multiple Networks on NICs 1&2 with PROD-A-1 and PROD-A-2 configured as the Default VLAN (untagged) at the server profile. All additional networks will be presented with tags.




# Installation and configuration

## Switch configuration

Appendices A and B provide a summary of the commands required to configure the switch in either a Cisco IOS or a ProCurve network infrastructure. The configuration information provided in the appendices assumes the following information:

- The switch ports are configured as TRUNK ports to support VLANs 101, 102, 103 and 104. All frames will be forwarding to VC with VLAN tags.
- When adding the additional uplinks to the SUS, the switch ports connected to Virtual Connect will need to be configured for LACP and configured for the same Link Aggregation Group.

## 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 the VC module

- Physically connect Ports 1 and 2 of the first network switch to Ports 1 and 2 on the VC module in Bay 1.
- Physically connect Ports 1 and 2 of the second network switch to Ports 1 and 2 of the VC module in Bay 2, if you have only one network switch, connect the second VC module cables to alternates port on the same switch. This will NOT create a network loop and does not require Spanning Tree to be configured.

## 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 can 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 (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 Map VLAN Tags via GUI (Ethernet settings)

Enable Map VLAN Tags within Virtual Connect

- On the Virtual Connect Manager screen, Left pane, click Ethernet Settings, Advanced Settings
- Select Map VLAN Tags
- Select Fast MAC Cache Fail-over with a refresh of 5
- Select Apply

## Configuring the VC Module for Map VLAN Tags via CLI (Ethernet settings)

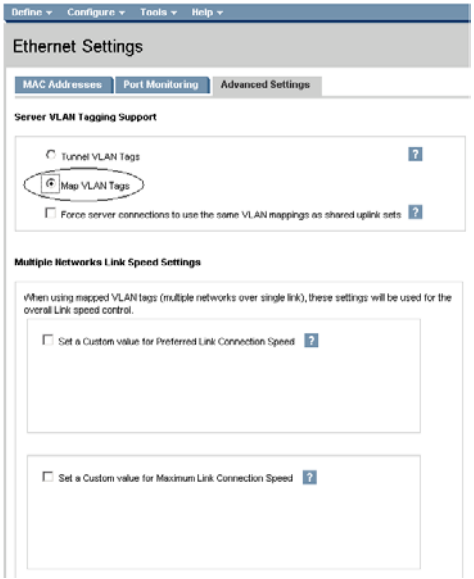
The following command(s) can be copied and pasted into an SSH based CLI session with Virtual Connect

# Set Advanced Ethernet Settings to "Map VLAN Tags" and set "Force server connections" to disabled

set enet-vlan vlantagcontrol=map sharedservervlanid=false

set mac-cache Enabled=True Refresh=5

**Figure 1-68** Ethernet Settings.



## Defining a new Shared Uplink Sets via the GUI

Create a SUS and name it "VLAN-Trunk-1"

- On the Virtual Connect Manager screen, click Define, Shared Uplink Set to create a SUS
- Ether the Network Name of "VLAN-Trunk-1"
- Select Add Port, then add the following ports;
    a. Enclosure 1, Bay 1, Port 1
    b. Enclosure 1, Bay 1, Port 2
- Add Networks as follows;
    a. PROD-A-1 = VLAN ID=101
    b. PROD-B-1 = VLAN ID=102
    c. PROD-C-1 = VLAN ID=103
    d. PROD-D-1 = VLAN ID=104
- Enable Smart Link for All networks
- Leave Connection Mode as Auto

1. Create a SUS and name it "VLAN-Trunk-2"

- On the Virtual Connect Manager screen, click Define, Shared Uplink Set to create a SUS
- Ether the Network Name of "VLAN-Trunk-2"
- Select Add Port, then add the following ports;
    a. Enclosure 1, Bay 2, Port 1
    b. Enclosure 1, Bay 2, Port 2

Add Networks as follows;

a. PROD-A-2 = VLAN ID=101
b. PROD-B-2 = VLAN ID=102
c. PROD-C-2 = VLAN ID=103
d. PROD-D-2 = VLAN ID=104

Enable Smart Link for All networks

Leave Connection Mode as Auto

Note: By creating a SUS we have provided the ability to present one or many VLANs to a server NIC. As two uplinks are configure from each VC module within different SUS' we have provided an active/active configuration with Link Aggregation (LACP). This configuration provides additional bandwidth through LACP and independent SUS, providing the ability to lose an uplink cable, network switch or depending on how the NICs are configured at the server (teamed or untamed), even a VC module. Both pairs of uplinks will be active at any time

Note: Smart Link – In this configuration Smartlink should be enabled. Smartlink is used to turn off downlink ports within Virtual Connect, if ALL available uplinks to a vNet or SUS are down.

## Defining a new Shared Uplink Set via the CLI

```
  #Create Shared Uplink Set "VLAN-Trunk-1" and configure an uplink on VC Module 1, Ports 1 and 2
add uplinkset VLAN-Trunk-1
add uplinkport enc0:1:1 Uplinkset=VLAN-Trunk-1 speed=auto
add uplinkport enc0:1:2 Uplinkset=VLAN-Trunk-1 speed=auto

# Create Networks VLAN_101 and VLAN_104 for Shared Uplink Set "VLAN-TRUNK-1"
add network PROD-A-1 uplinkset=VLAN-Trunk-1 VLanID=101
Set Network PROD-A-1 SmartLink=Enabled
add network PROD-B-1 uplinkset=VLAN-Trunk-1 VLanID=102
Set Network PROD-B-1 SmartLink=Enabled
add network PROD-C-1 uplinkset=VLAN-Trunk-1 VLanID=103
Set Network PROD-C-1 SmartLink=Enabled
add network PROD-D-1 uplinkset=VLAN-Trunk-1 VLanID=104
Set Network PROD-D-1 SmartLink=Enabled

  #Create Shared Uplink Set "VLAN-Trunk-2" and configure an uplink on VC Module 2, Ports 1 and 2
add uplinkset VLAN-Trunk-2
add uplinkport enc0:2:1 Uplinkset=VLAN-Trunk-2 speed=auto
add uplinkport enc0:2:2 Uplinkset=VLAN-Trunk-2 speed=auto


# Create Networks VLAN_101 and VLAN_104 for Shared Uplink Set "VLAN-TRUNK-2"
add network PROD-A-2 uplinkset=VLAN-Trunk-2 VLanID=101
Set Network PROD-A-2 SmartLink=Enabled
add network PROD-B-2 uplinkset=VLAN-Trunk-2 VLanID=102
Set Network PROD-B-2 SmartLink=Enabled
add network PROD-C-2 uplinkset=VLAN-Trunk-2 VLanID=103
Set Network PROD-C-2 SmartLink=Enabled
add network PROD-D-2 uplinkset=VLAN-Trunk-2 VLanID=104
Set Network PROD-D-2 SmartLink=Enabled
```

**Figure 1-69** Define Shared Uplink Set (VLAN-Trunk-1).

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

Note: Smart Link is enabled, if ALL uplinks to this SUS fail, then server downlinks will be turned off, initiating a NIC teaming fail-over.

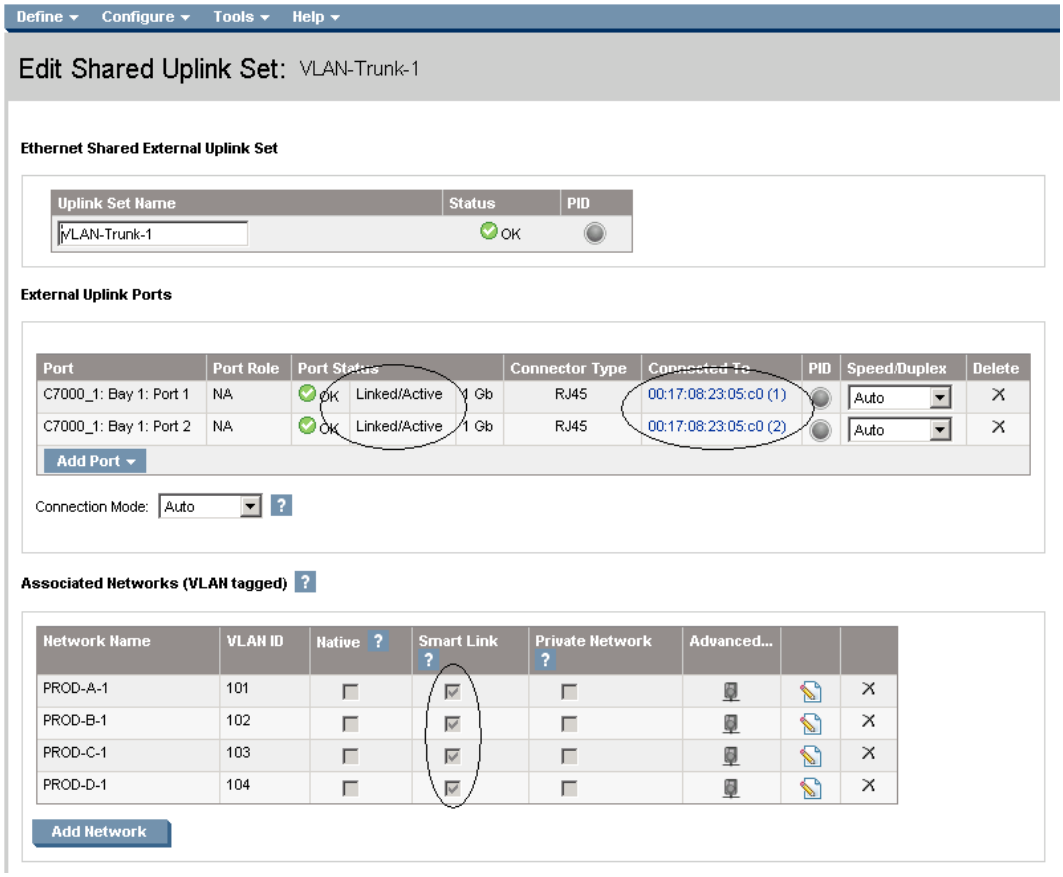


**Figure 1-70** Define Shared Uplink Set (VLAN-Trunk-2).

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

Note: Smart Link is enabled, if ALL uplinks to this SUS fail, then server downlinks will be turned off, initiating a NIC teaming fail-over.

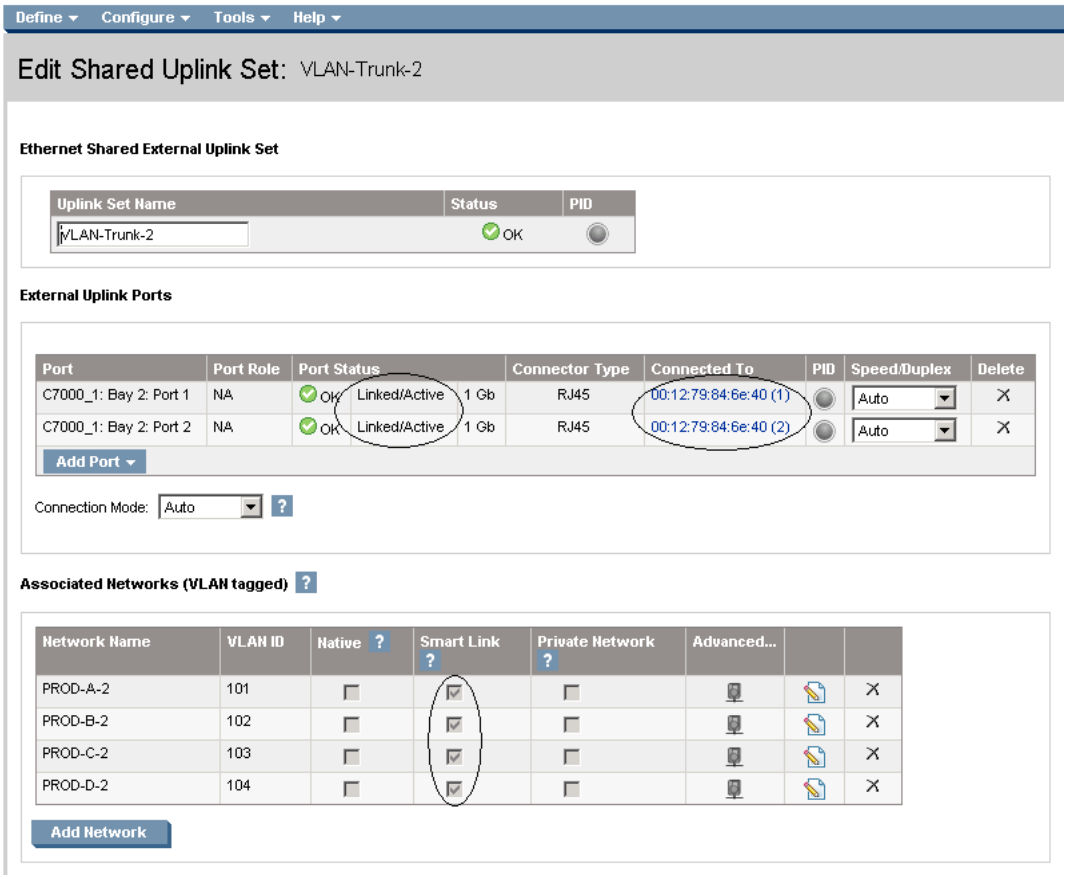
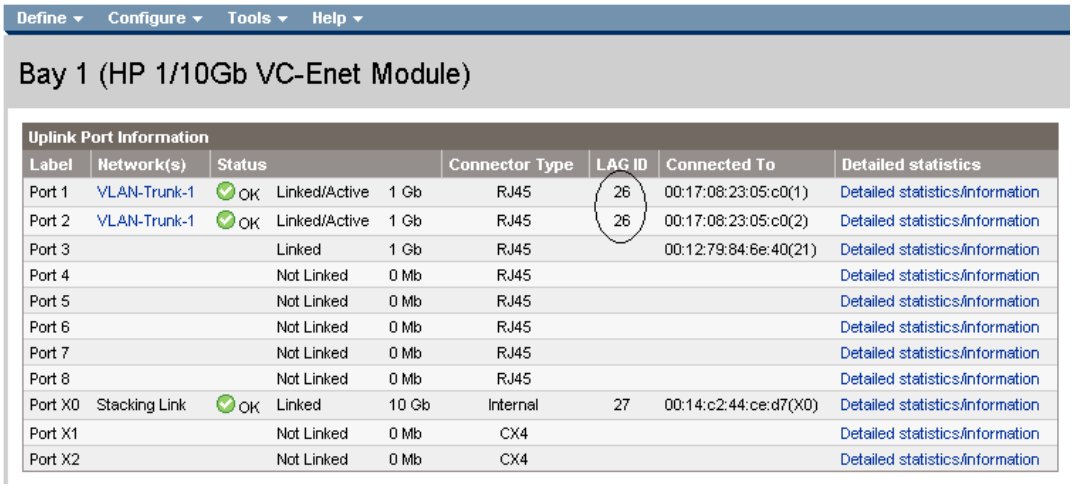


**Figure 1-71** Link aggregation confirmed – Bay 1.

Note: All connections within an active/active LACP group will have the same LAG ID. To view this, go to the Interconnect bay and view Uplink Port Information. If you are having troubles establishing an active/active connection, confirm the LAG ID



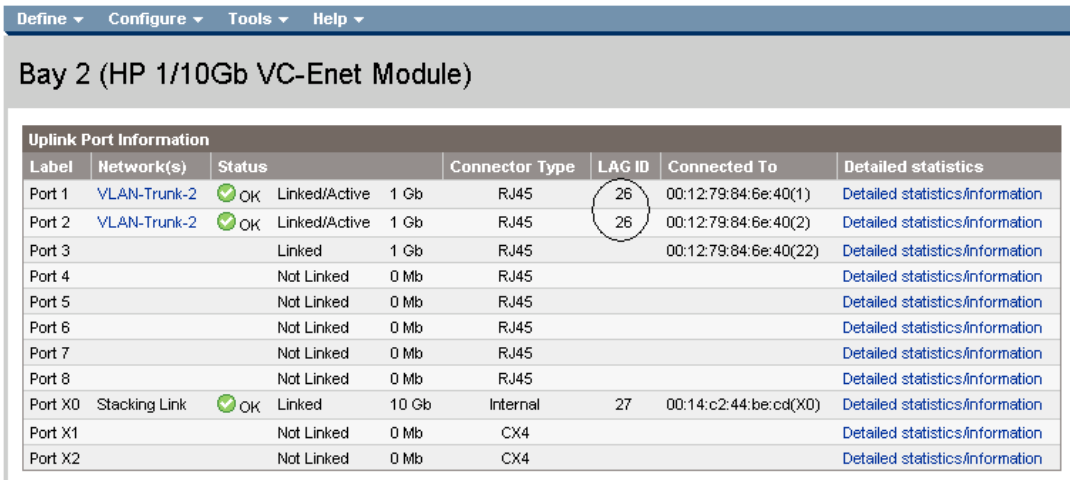
Define ▾ Configure ▾ Tools ▾ Help ▾

Bay 1 (HP 1/10Gb VC-Enet Module)

Uplink Port Information

| Label | Network(s) | Status | | | Connector Type | LAG ID | Connected To | Detailed statistics |
|---|---|---|---|---|---|---|---|---|
| Port 1 | VLAN-Trunk-1 | OK | Linked/Active | 1 Gb | RJ45 | 26 | 00:17:08:23:05:c0(1) | Detailed statistics/information |
| Port 2 | VLAN-Trunk-1 | OK | Linked/Active | 1 Gb | RJ45 | 26 | 00:17:08:23:05:c0(2) | Detailed statistics/information |
| Port 3 | | | Linked | 1 Gb | RJ45 | | 00:12:79:84:6e:40(21) | Detailed statistics/information |
| Port 4 | | | Not Linked | 0 Mb | RJ45 | | | Detailed statistics/information |
| Port 5 | | | Not Linked | 0 Mb | RJ45 | | | Detailed statistics/information |
| Port 6 | | | Not Linked | 0 Mb | RJ45 | | | Detailed statistics/information |
| Port 7 | | | Not Linked | 0 Mb | RJ45 | | | Detailed statistics/information |
| Port 8 | | | Not Linked | 0 Mb | RJ45 | | | Detailed statistics/information |
| Port X0 | Stacking Link | OK | Linked | 10 Gb | Internal | 27 | 00:14:c2:44:ce:d7(X0) | Detailed statistics/information |
| Port X1 | | | Not Linked | 0 Mb | CX4 | | | Detailed statistics/information |
| Port X2 | | | Not Linked | 0 Mb | CX4 | | | Detailed statistics/information |

**Figure 1-72** Link aggregation confirmed - Bay 2.



Define ▾ Configure ▾ Tools ▾ Help ▾

Bay 2 (HP 1/10Gb VC-Enet Module)

Uplink Port Information

| Label | Network(s) | Status | | | Connector Type | LAG ID | Connected To | Detailed statistics |
|---|---|---|---|---|---|---|---|---|
| Port 1 | VLAN-Trunk-2 | OK | Linked/Active | 1 Gb | RJ45 | 26 | 00:12:79:84:6e:40(1) | Detailed statistics/information |
| Port 2 | VLAN-Trunk-2 | OK | Linked/Active | 1 Gb | RJ45 | 26 | 00:12:79:84:6e:40(2) | Detailed statistics/information |
| Port 3 | | | Linked | 1 Gb | RJ45 | | 00:12:79:84:6e:40(22) | Detailed statistics/information |
| Port 4 | | | Not Linked | 0 Mb | RJ45 | | | Detailed statistics/information |
| Port 5 | | | Not Linked | 0 Mb | RJ45 | | | Detailed statistics/information |
| Port 6 | | | Not Linked | 0 Mb | RJ45 | | | Detailed statistics/information |
| Port 7 | | | Not Linked | 0 Mb | RJ45 | | | Detailed statistics/information |
| Port 8 | | | Not Linked | 0 Mb | RJ45 | | | Detailed statistics/information |
| Port X0 | Stacking Link | OK | Linked | 10 Gb | Internal | 27 | 00:14:c2:44:be:cd(X0) | Detailed statistics/information |
| Port X1 | | | Not Linked | 0 Mb | CX4 | | | Detailed statistics/information |
| Port X2 | | | Not Linked | 0 Mb | CX4 | | | Detailed statistics/information |

## Defining a Server Profile with NICs Connections to Multiple VLANs, 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 "ESX-1"
- In the Network Port 1 drop down box, select "Multiple Networks"
  - When the Server VLAN Tag to vNet Mappings popup appears, configure as follows;
    - In the vNet Name drop down, select PROD-A-1 and check Untagged
    - Click Add Mapping
      - Select PROD-B-1
    - Click Add Mapping
      - Select PROD-C-1
    - Click Add Mapping
      - Select PROD-D-1
    - Click OK
- In the Network Port 2 drop down box, select "Multiple Networks"
  - When the Server VLAN Tag to vNet Mappings popup appears, configure as follows;
    - In the vNet Name drop down, select PROD-A-2 and check Untagged
    - Click Add Mapping
      - Select PROD-B-2
    - Click Add Mapping
      - Select PROD-C-2
    - Click Add Mapping
      - Select PROD-D-2
    - Click OK
- In the Assign the Profile to a Server Bays, select Bay 1 and apply

## Defining a Server Profile with NICs Connections to Multiple VLANs, 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
add profile ESX-1 –nodefaultenetconn -nodefaultfcconn
add enet-connection ESX-1 pxe=Enabled
add enet-connection ESX-1 pxe=Disabled
add server-port-map ESX-1:1 PROD-A-1 VLanId=101 Untagged=True
add server-port-map ESX-1:1 PROD-B-1 VLanId=102
add server-port-map ESX-1:1 PROD-C-1 VLanId=103
add server-port-map ESX-1:1 PROD-D-1 VLanId=104
add server-port-map ESX-1:2 PROD-A-2 VLanId=101 Untagged=True
add server-port-map ESX-1:2 PROD-B-2 VLanId=102
add server-port-map ESX-1:2 PROD-C-2 VLanId=103
add server-port-map ESX-1:2 PROD-D-2 VLanId=104
assign profile ESX-1 enc0:1
```

**Figure 1-73** Server Profile (ESX-1) with Multiple Networks configured.

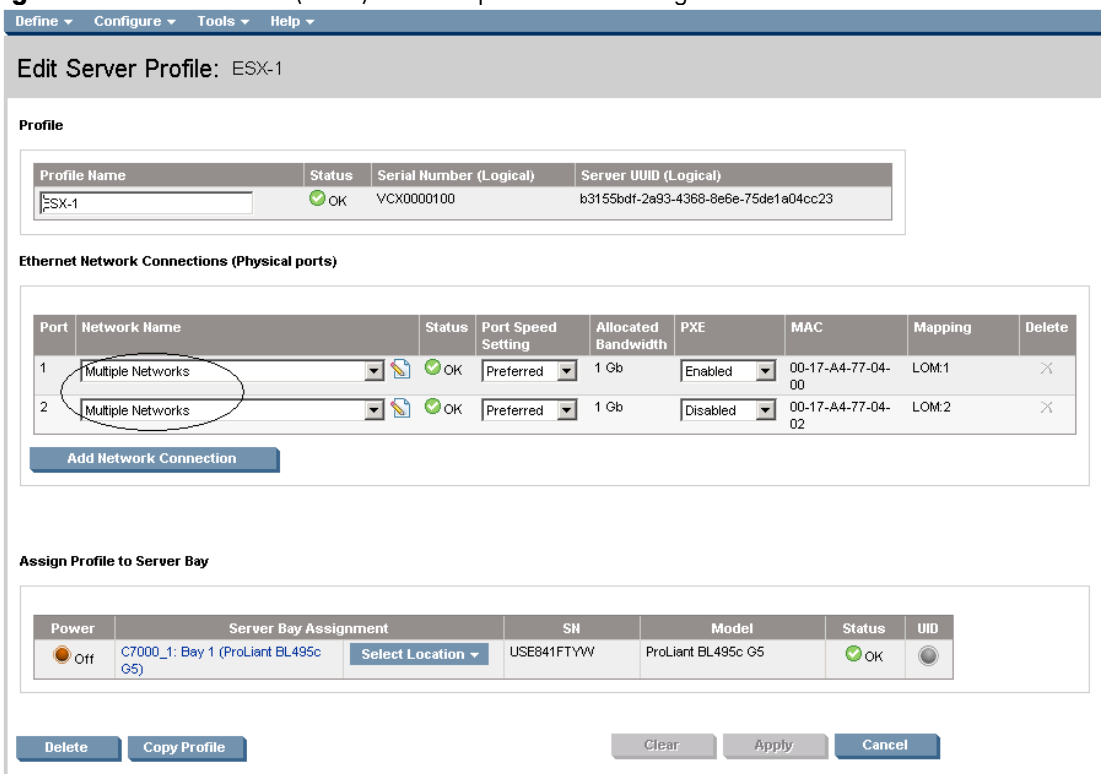



**Figure 1-74** Configuring NIC Port 1 with Multiple Networks, PROD-A-1 is not tagged, Note; that both NICs are configured with the same settings below, except NIC 2 is connected to PROD-x-2.

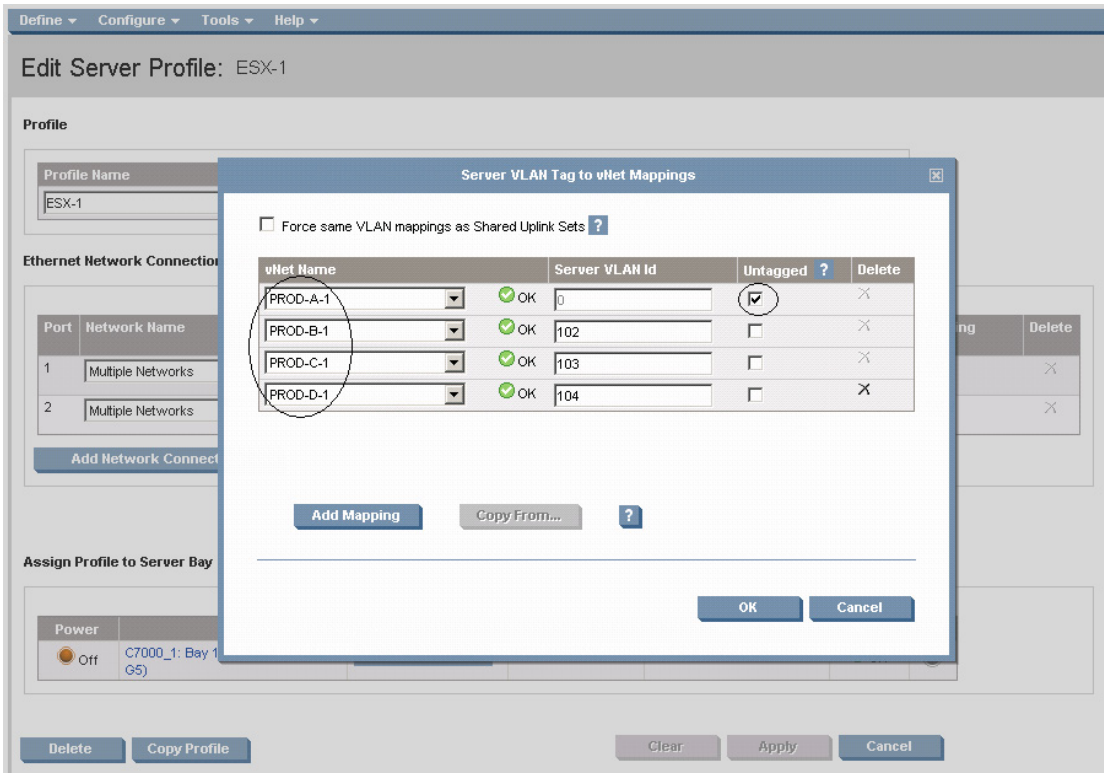
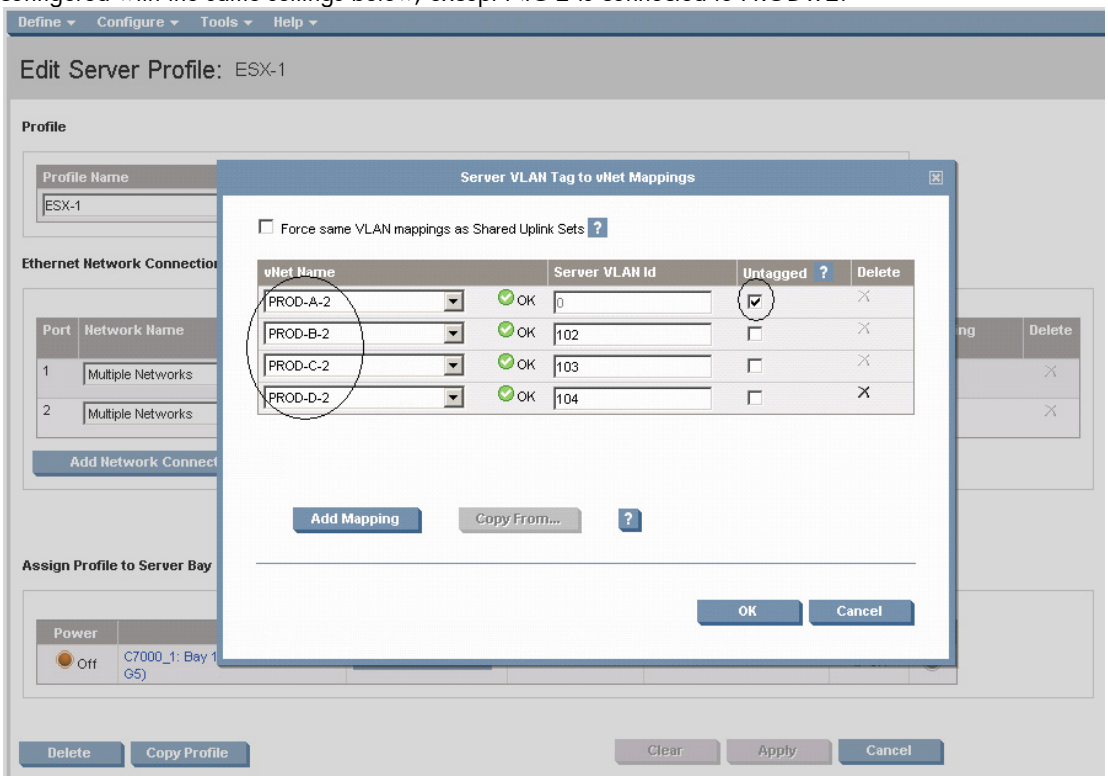


**Figure 1-75** Configuring NIC Port 2 with Multiple Networks, PROD-A-2 is not tagged, Note; that both NICs are configured with the same settings below, except NIC 2 is connected to PROD-x-2.




Note: the above graphic is an example of a how an ESX hypervisor might be configured for multiple VLANs. In this case both NICs are configured for networks VLAN-Trunk-1 and VLAN-Trunk-2, supporting PROD-A-1&2 though PROD-D-1&2 which are mapped to VLANs 101-104. Any frames received by Virtual Connect for this server will have their tags intact and forward to the server NICs, therefore acting as a TRUNK port. This works well for a hypervisor host/vSwitch that can be configured to interpret the tag. In addition, PROD-A is defined as the default VLAN, therefore any frames received by VC for VLAN 101 will be forwarded to the server NIC, with the tags removed. This would work well for the console NICs, so that the console does not need to be configured to understand the VLAN tags. It we did not un-tag VLAN 101, then the ESX console would need to be configured for this VLAN.

# Summary

We created a Virtual Connect Shared Uplink Set (SUS) to support 4 VLANs (101-104). The SUS was created with Active and standby uplinks, to provide both additional bandwidth and availability.

When VC profile ESX-1 is applied to the server in bay1 and is powered up, it has two NICs configured for "Multiple Networks" which connects to the network infrastructure through two (active) 1Gb uplinks. These NICs are configured to support LANs 101 through 104 with VLAN 101 configured as Default (untagged), so the operating system does not need to understand which VLAN it is on.

As this is an ESX environment, both NICs would be connected to a vSwitch with port groups configured for VLANs 102 through 104. VLAN 101 would be configured as the console network.

As additional servers are added to the enclosure, simply create additional profiles, configure the NICs for Multiple Networks and apply them to the appropriate server bays.

# Results

The following graphic provides an example of an ESX Server with TWO NICs connected to the network. Both NICs are configured to support VLANs 101-104. VLAN 101 is the default VLAN and is not tagged. Port Groups are added to support each VLAN.

**Figure 1-76** Both NICs for Profile ESX-1are connected to the network through Multiple Networks, VLANs are configured as Port Groups within the virtual switch.

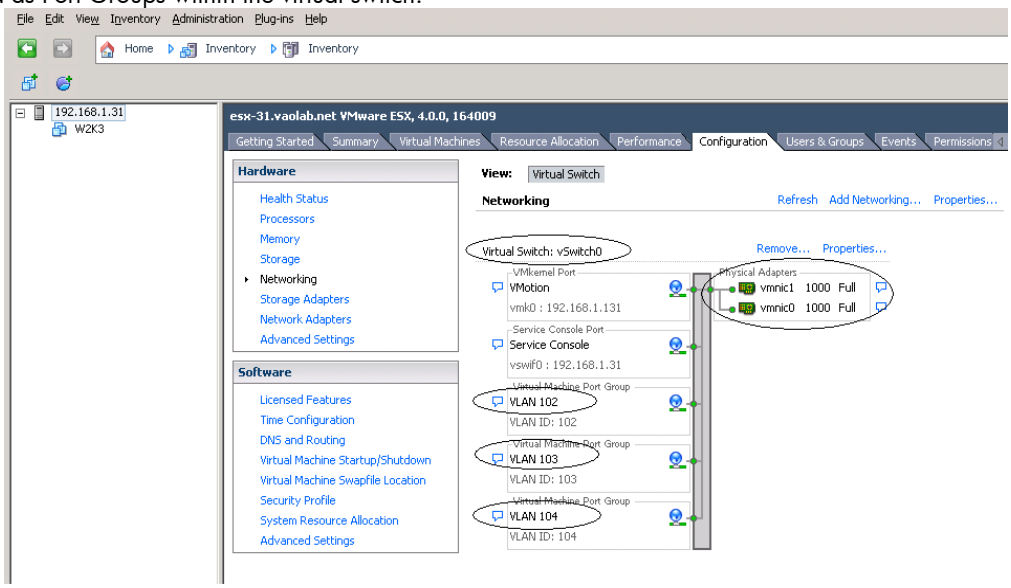
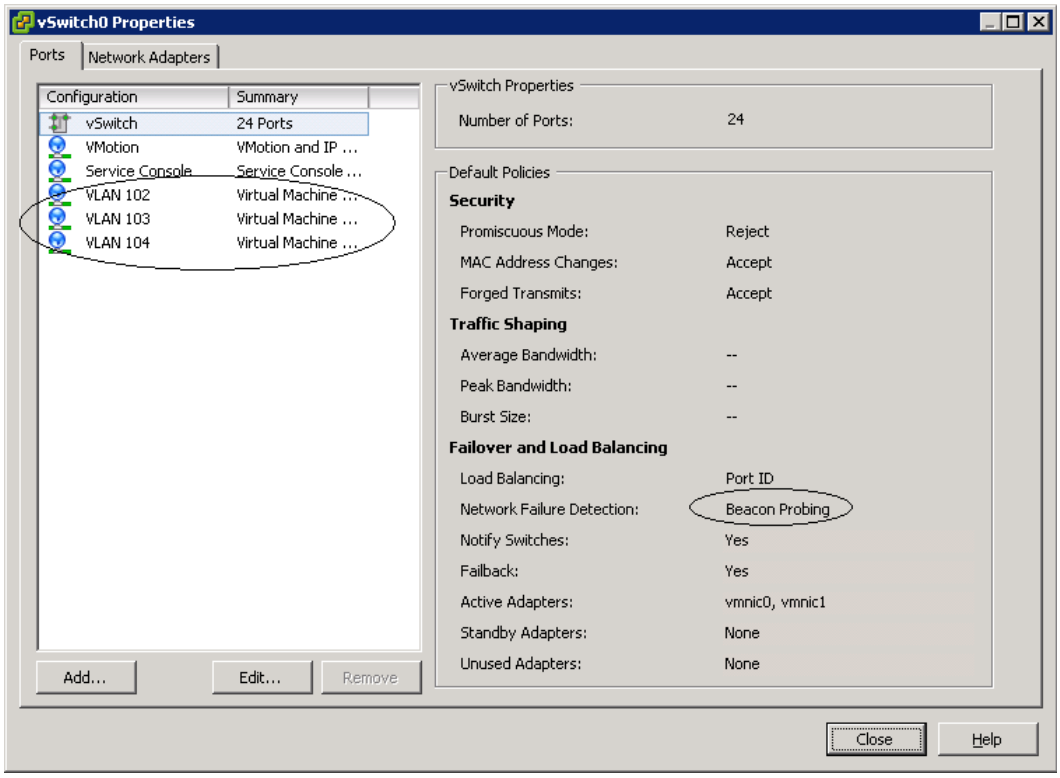
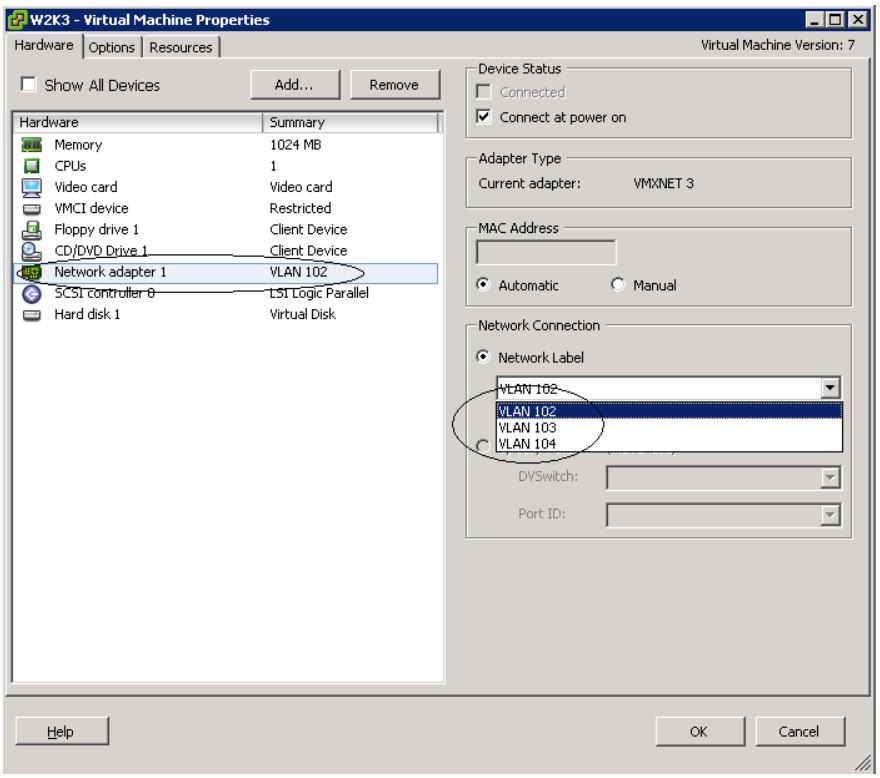


**Figure 1-77** Configuring the ESX vSwitch for Multiple Networks / VLANs.




When configuring the virtual guest, edit the Network Adapter configuration and select which VLAN this guest will connect to.

**Figure 1-78** Edit the configuration of the Guest network adapter and configure it for the appropriate VLAN.



# Scenario 1:7 – Private Networks (Simple vNet)

## Overview

This scenario uses the private Networks feature to restrict communications between hosts within a Virtual Connect Network. In this scenario, a single uplink port from the VC module will be used to carry a single or multiple VLANs to a simple vNet. The vNet is configured with the Private Networks feature enabled. The adjacent hosts within the vNet will not be able to talk to other servers within the VC Domain, even if on the same VLAN, and an external router would be required.

This configuration uses the Virtual Connect vNet. 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 VC module.

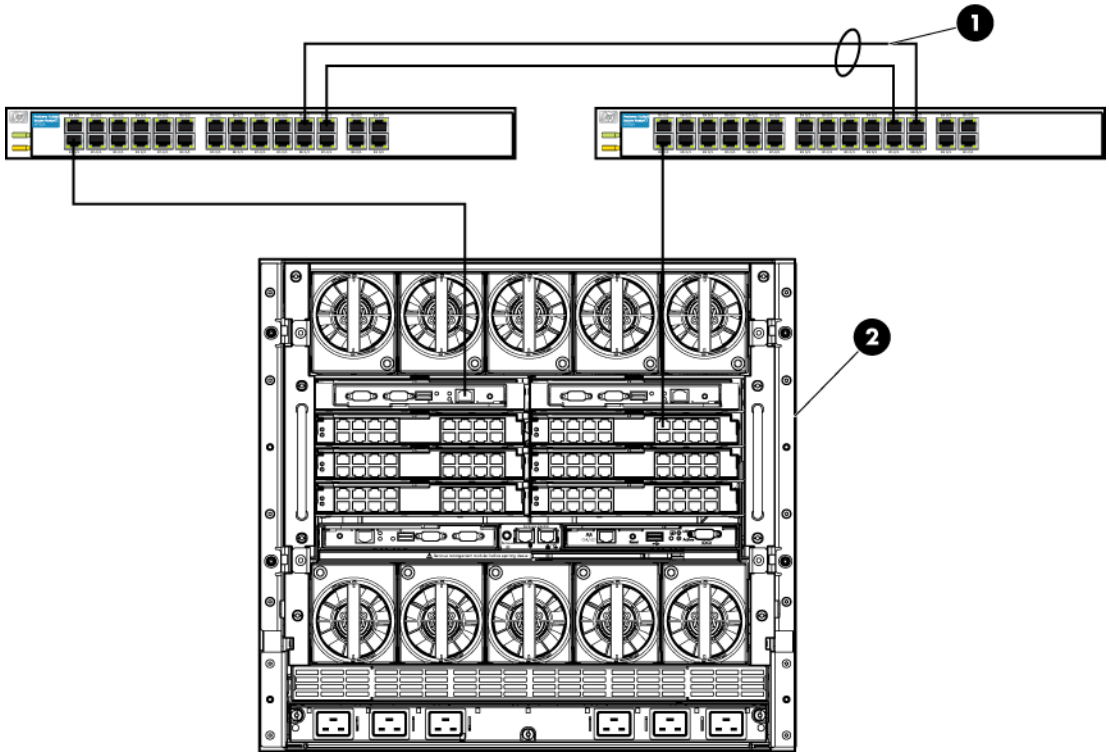
No special upstream switch configuration is required as the switch is in the factory default configuration.

## Requirements

In order to implement this scenario, an HP BladeSystem c7000 enclosure with one of more server blades and TWO Virtual Connect Ethernet modules, installed in 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.

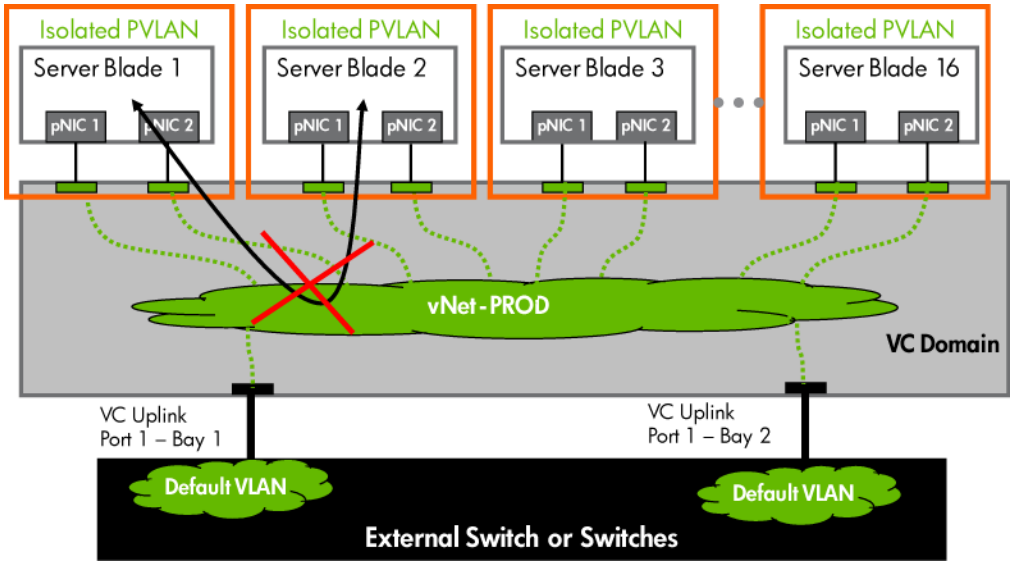
Depending how we assign the VC networks to the servers, will determine whether the VC-Enet module will simply pass these VLANs through and not interpret the VLAN tag, in which case the VLAN tag will be interpreted by the OS on the assigned blade. Or an individual VLAN could be assigned to a server NIC, in which case, VC could interpret the VLAN tag and then forward the untagged frame to the server NIC.

**Figure 1-79** Physical View; Shows a single Ethernet uplink from Port 1 on Module 1 to Port 1 on the first network switch and a single uplink from Port 1 on Module 2 to Port 1 on the second network switch.




| Item | Description |
|---|---|
| 1 | Switch Cross Connect |
| 2 | C7000 Enclosure, rear view |

**Figure 1-80** Private VLANs - Simple Network Connection showing a single Ethernet uplink to a single VC-Enet port (Port 1). VC-Enet Port 1 is configured as part of the VC Network Prod-Net. As the Private Network feature is enabled on Prod-Net, servers that are connected to Prod-Net will not be able to talk directly to each other within VC, an external router would be required. "Prod-Net" is presented to Server Profiles Web-1 through Web-4. Each profile is applied to bays 1-4 respectively.




# Installation and configuration

## Switch Configuration

Appendices A and B provide a summary of the commands required to configure the switch in either a Cisco IOS or a ProCurve network infrastructure. The configuration information provided in the appendices assumes the following information:

- The switch ports are configured as ACCESS ports, either presenting the Default VLAN or a specific VLAN and will for forwarding untagged frames.

## 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 the VC module

- Physically connect Ports 1 and 2 of the first network switch to Ports 1 and 2 on the VC module in Bay 1.
- Physically connect Ports 1 and 2 of the second network switch to Ports 1 and 2 of the VC module in Bay 2, if you have only one network switch, connect the second VC module cables to alternates port on the same switch. This will NOT create a network loop and does not require Spanning Tree to be configured.

## Configuring Fast MAC Cache Failover

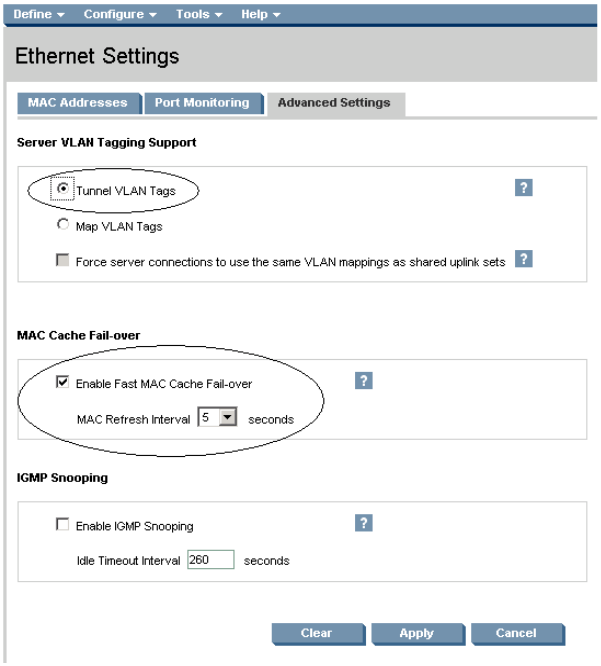
- When an uplink on a VC Ethernet Module that was previously in standby mode becomes active, it can take several minutes for external Ethernet switches to recognize that the c-Class server blades can now be reached on this newly active connection.

- 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 (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 (Ethernet settings)

- Private Networks is supported on both Tunnel VLAN tags AND Map VLAN tags, so either setting could be used here
- On the Virtual Connect Manager screen, Left pane, click Ethernet Settings, Advanced Settings
- Select either Tunnel or Map VLAN Tags
- Select Fast MAC Cache Fail-over with a refresh of 5
- Select Apply

**Figure 1-81** Ethernet Settings.



## Defining a new vNet via GUI

Create a vNet and name it “vNet-PROD”

- On the Virtual Connect Manager screen, click Define, Ethernet Network to create a vNet
- Ether the Network Name of “vNet-PROD”
    a. Select Private Networks
- Select Add Port, then add the following ports;
    a. Enclosure 1, Bay 1, Port 1
    b. Enclosure 1, Bay 2, Port 1
- Leave Connection Mode as Auto
- 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.

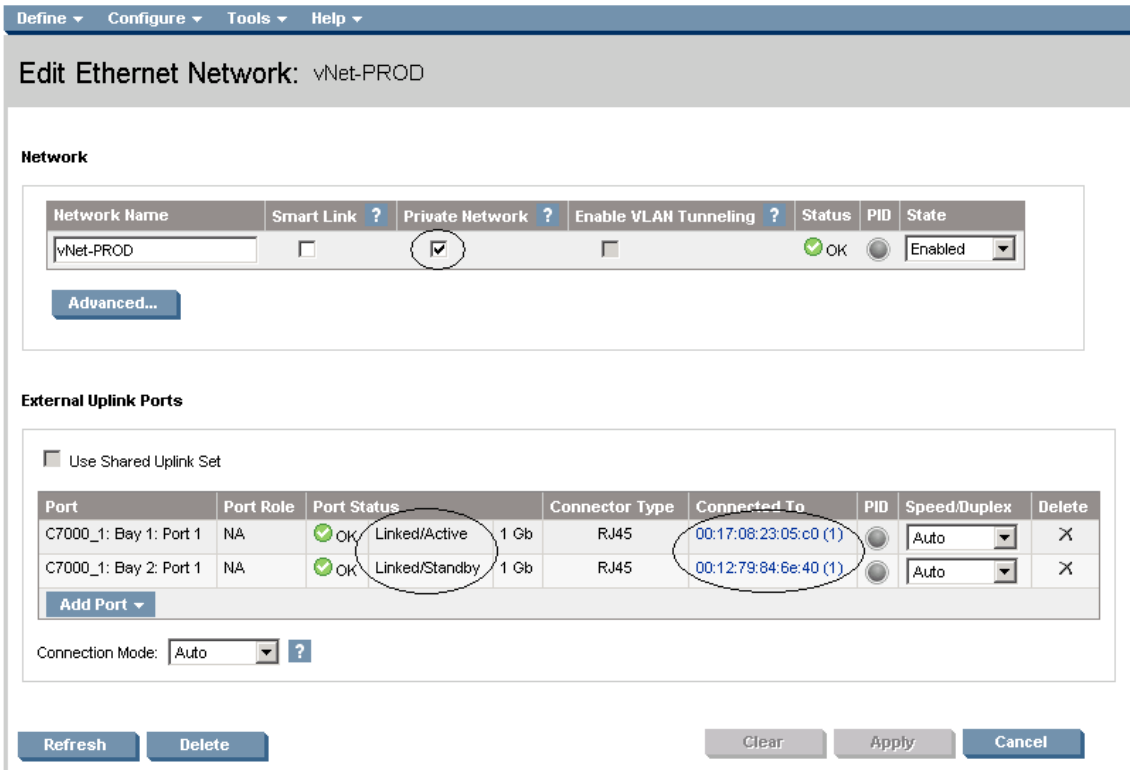
Note: Smart Link – In this configuration Smartlink should NOT be enabled. Smartlink is used to turn if downlink ports within Virtual Connect, if ALL available uplinks to a vNet or SUS are down.

## 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 SmartLink=Disabled
add uplinkport enc0:1:1 Network=vNet-PROD speed=auto
add uplinkport enc0:2:1 Network=vNet-PROD speed=auto
set network vNet-PROD Private=Enabled
```

**Figure 1-82** Define a new vNet (vNet-Prod) and enable Private Networks.




## Defining a Server Profile

Four server profiles will be required; both Network ports will be connected to vNet-PROD

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

- Create a server profile called "Web-1"
- In the Network Port 1 drop down box, select "vNet-PROD"
- In the Network Port 2 drop down box, select "vNet-PROD"
- In the Assign the Profile to a Server Bays, select Bay 1 and apply

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

- Create a server profile called "Web-2"
- In the Network Port 1 drop down box, select "vNet-PROD"
- In the Network Port 2 drop down box, select "vNet-PROD"
- In the Assign the Profile to a Server Bays, select Bay 2 and apply

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

- Create a server profile called "Web-3"
- In the Network Port 1 drop down box, select "vNet-PROD"
- In the Network Port 2 drop down box, select "vNet-PROD"
- In the Assign the Profile to a Server Bays, select Bay 3 and apply

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

- Create a server profile called “Web-4”
- In the Network Port 1 drop down box, select “vNet-PROD”
- In the Network Port 2 drop down box, select “vNet-PROD”
- In the Assign the Profile to a Server Bays, select Bay 4 and apply

## 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 Web-1 – Web-4
add profile Web-1 -nodefaultenetconn
add enet-connection Web-1 pxe=Enabled Network=vNet-PROD
add enet-connection Web-1 pxe=Disabled Network=vNet-PROD
assign profile Web-1 enc0:1
add profile Web-2 -nodefaultenetconn
add enet-connection Web-2 pxe=Enabled Network=vNet-PROD
add enet-connection Web-2 pxe=Disabled Network=vNet-PROD
assign profile Web-2 enc0:2
add profile Web-3 -nodefaultenetconn
add enet-connection Web-3 pxe=Enabled Network=vNet-PROD
add enet-connection Web-3 pxe=Disabled Network=vNet-PROD
assign profile Web-3 enc0:3
add profile Web-4 -nodefaultenetconn
add enet-connection Web-4 pxe=Enabled Network=vNet-PROD
add enet-connection Web-4 pxe=Disabled Network=vNet-PROD
assign profile Web-4 enc0:4
```

**Figure 1-83** Define a Server Profile (Web-1 to Web-4).

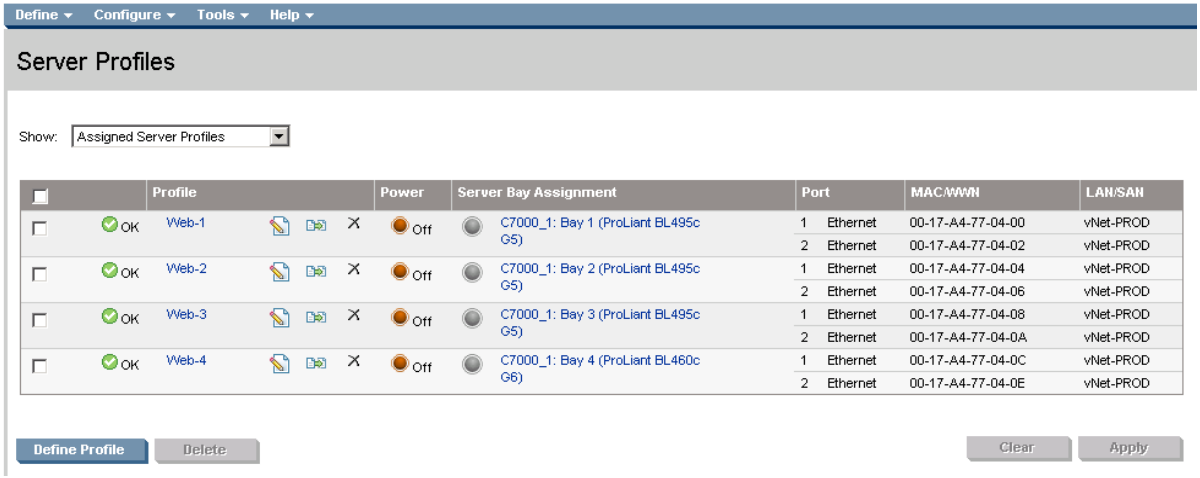
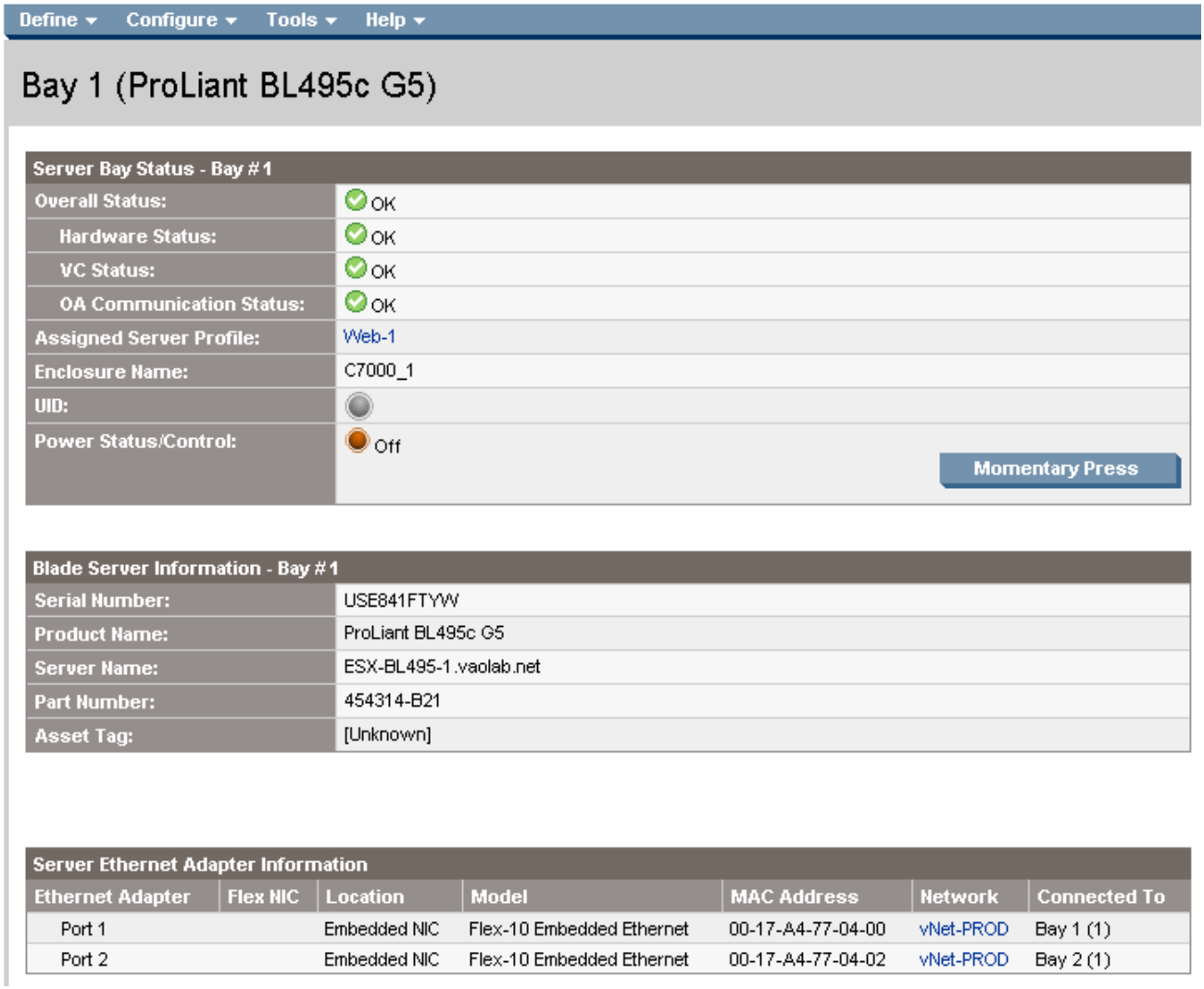


**Figure 1-84** View Server Bay 1.



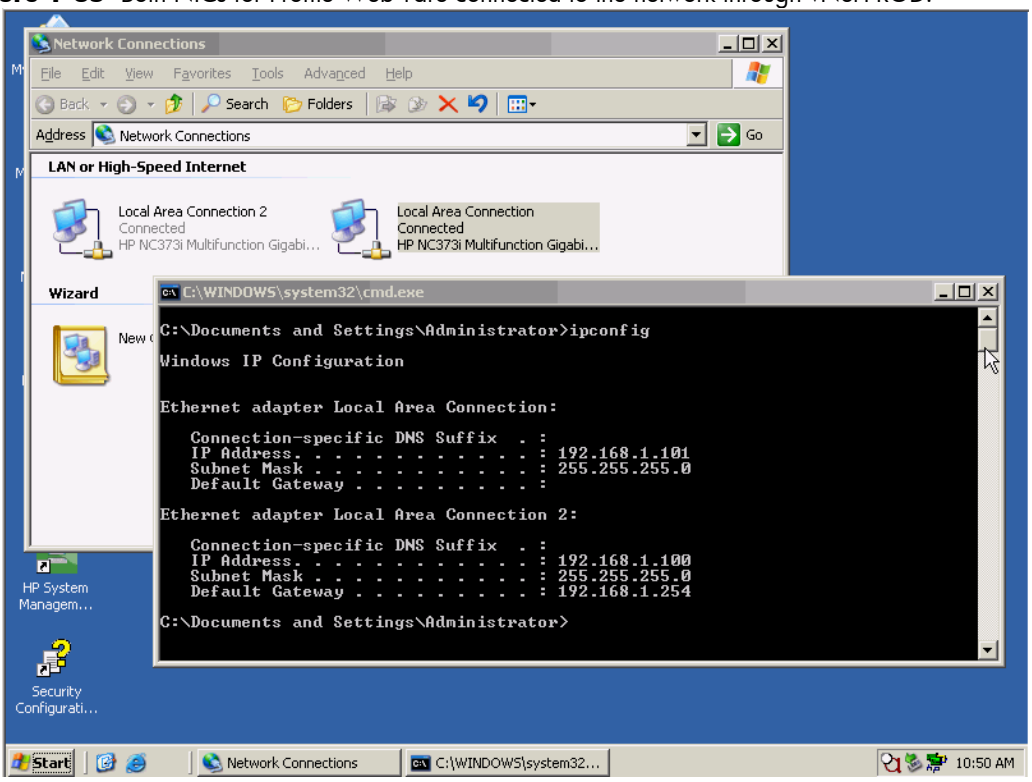

# Summary

All server blades are assigned a Server Profile which is configured with a single NIC on vNet PROD_NET. When the blades are powered up and their profiles are applied, the blades in bays 1 through 4 will have both NICs connected to the vNet-PROD network. Even though these servers are connect to the same vNet, as the Private VLANs check box is enabled on this network, these servers will not be able to talk directly to each other within this VC Network. To do so an external router would be required.

# Results

The following graphic provides an example of a Windows 2003 server with TWO NICs connected to the network, each NIC has its own TCP/IP address, either or both NICs could be actively working on the network.

**Figure 1-85** Both NICs for Profile Web-1are connected to the network through vNet-PROD.



The following graphics provides an example of a Windows 2003 server with TWO NICs teamed and connected to the network. One NIC will be active, in the event of an Uplink, switch or VC module failure; the teaming software will fail the NIC over to the alternate path, if required.

**Figure 1-86** Team both NICs, using the HP Network Configuration Utility.

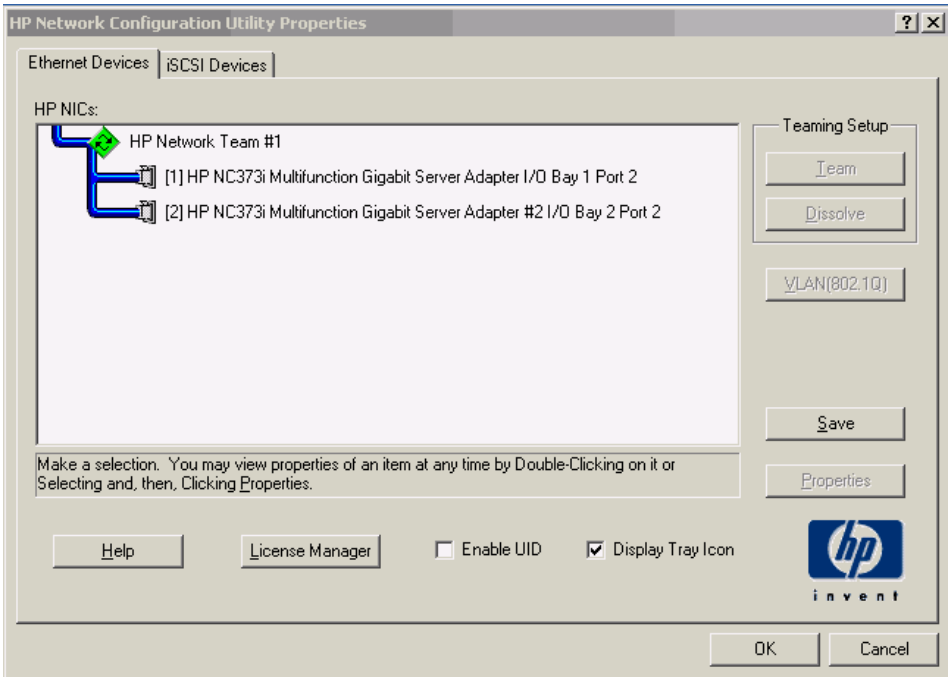
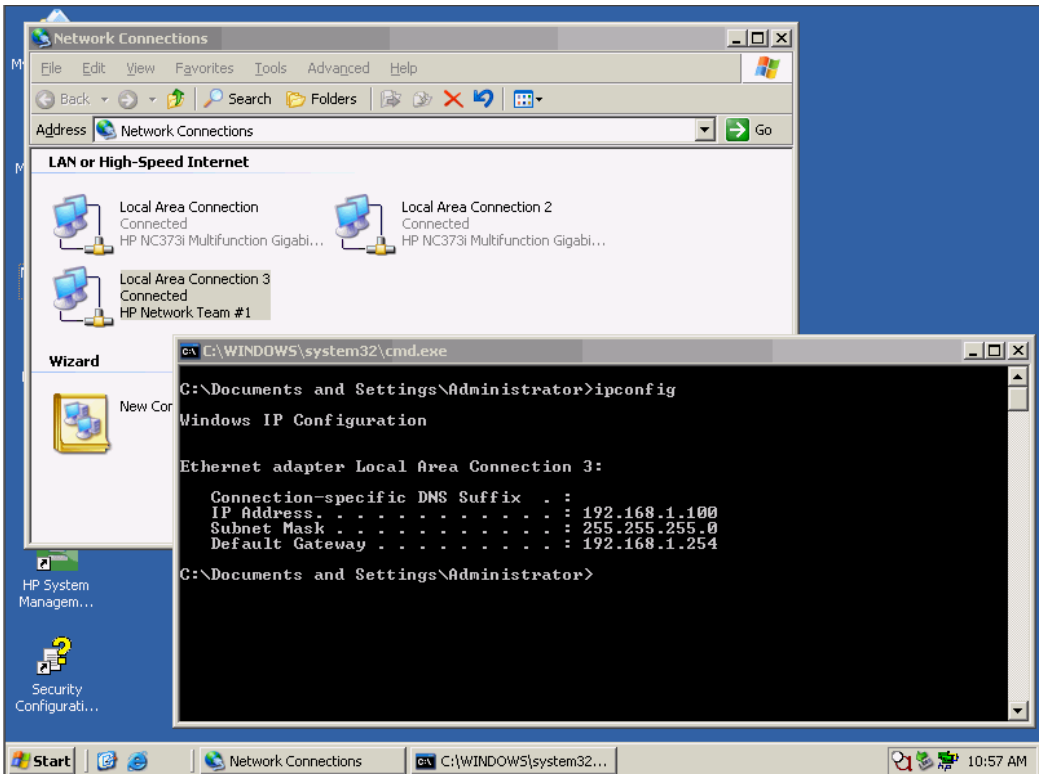



**Figure 1-87** Both NICs for Profile Web-1are teamed and connected to the network through vNet-PROD.



# Chapter 2: Flex-10 Scenario

## Overview

This chapter will provide configuration scenarios of Virtual Connect Flex-10, using a single HP BladeSystem c7000 enclosure with two Virtual Connect Flex-10 Ethernet modules installed in Bays 1 and 2. If additional Network ports are required, over what TWO Flex-10 NICs will provide, additional network ports can be added along with additional VC or VC Flex-10 modules, switches or Pass-Thru modules.

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, Windows Hyper-V and/or VMware will also be provided.

CISCO and ProCurve CLI commands used to configure the upstream switches are also provided in the appendices.

Flex-10 technology can be provided in two ways;

3. Through the use the10Gb (LOM) NICs integrated on the main PCB, or;
4. Through the installation of a DUAL PORT 10Gb-KR mezzanine card (NC532m) in an HP BladeSystem server. The first server to provide 10Gb LOM NICs is the BL495c, which is what is being used in the following example.

The key benefit of Flex-10 is that; we now have 10Gb of network bandwidth available per NIC port with the ability to partition or divide that bandwidth into as many as four (4) independent configurable physical NICs per port. These NICs can be configured at speeds of between 100Mb and 10Gb providing the ability to tune bandwidth to the specific need, such as, management, VMotion or production networks. With current technology, all networks would be provided with the same 1Gb speed and would require independent discrete NICs. With Flex-10, we can now provide each network with the desired speed as shown in the following table.

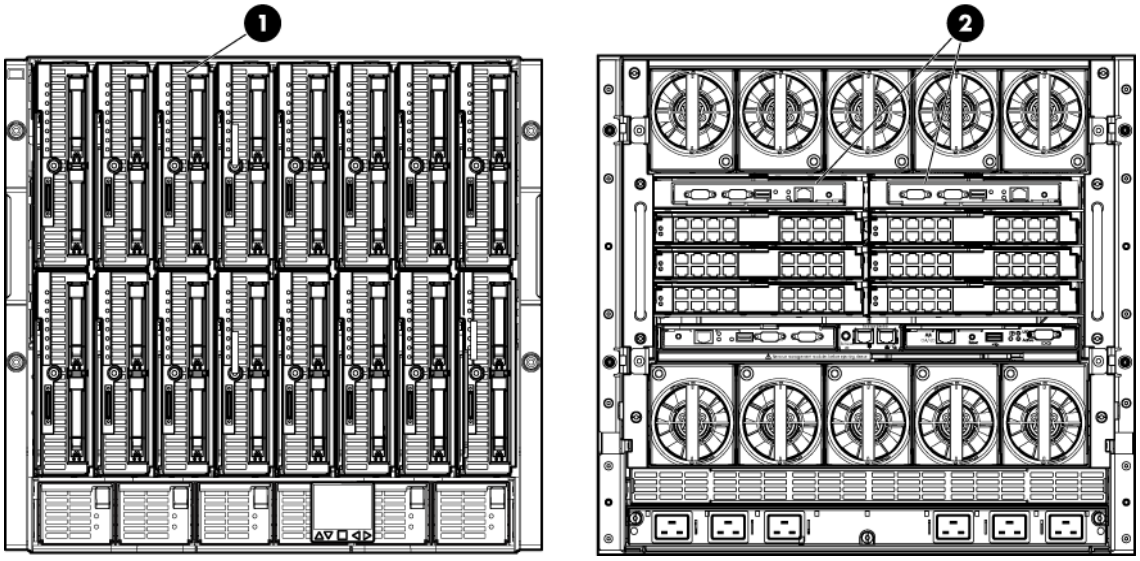
Flex-10 provides significant investment protections as both 1Gb and 10Gb uplink connections are supported. If 10Gb ports are not currently available within the datacenter, Flex-10 could be deployed initially with 1Gb uplinks and then later upgraded to 10Gb uplink connections once those ports become available.

## Requirements

This chapter will utilize a single HP BladeSystem c7000 enclosure with TWO Virtual Connect Flex-10 Ethernet modules and a half height BladeSystem server installed in Bay 1. The server will connect to the Virtual Connect models with two 10Gb NICs. Network adapter Port 1 connects to the VC Flex-10 module in Bay 1 and Network adapter Port 2 connects to the VC Flex-10 module in Bay 2.

It is assumed that a Virtual Connect Domain has been created either through the GUI or a CLI script and no VC Networks or Server Profiles have been created.

**Figure 2-1** c7000 enclosure with four Half Height G6 BladeSystem servers and two Virtual Connect Flex-10 Ethernet modules in Interconnect modules Bays 1 & 2.




| Item | Description |
|---|---|
| 1 | Half Height BladeSystem Server |
| 2 | VC Ethernet Modules |

# Scenario 2:1 - Flex-10 - VLAN Tagging (802.1Q) with Multiple Shared Uplink Sets (SUS) and Mapped VLANs - Windows 2003/2008

## Overview

This scenario discusses the Flex-10 features provided in Virtual Connect. For an overview of Flex-10, please refer to the following technology brief. HP Flex-10 technology brief:

http://h20000.www2.hp.com/bc/docs/support/SupportManual/c01608922/c01608922.pdf

Virtual Connect Flex-10 provides the ability to either present the 10Gb server NICs as single 10Gb NICs, or divide each NIC into as many as 4 "physical function" NICs per NIC port. These physical function NICs look to the server hardware and OS as physical NICs, have their own MAC address and can be configured at speeds from 100Mb to 10Gb.

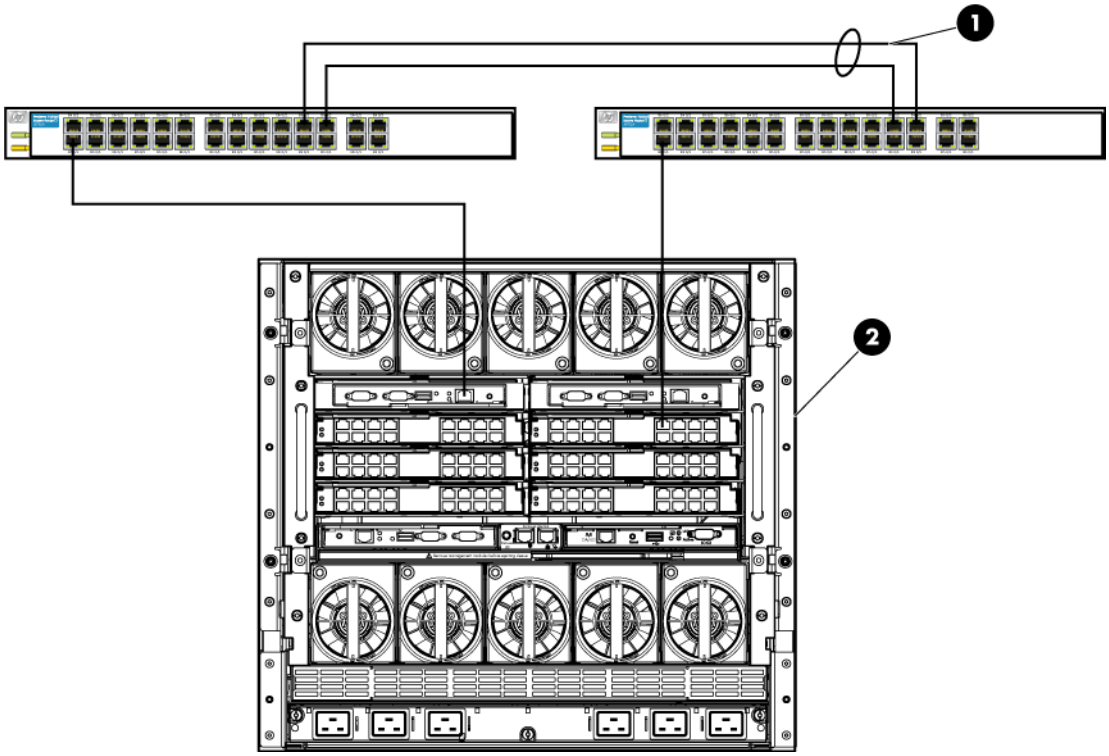
As shown in earlier scenarios, VLAN access can be handled in two different ways. Virtual Connect can either pass VLAN/Non-VLAN traffic untouched to the host (Tunneling Mode) or Virtual Connect can handle all VLAN tagging (Server Mapped VLANs). Each has their advantages as discussed in the Introduction to Virtual Connect section, earlier in this document.

This scenario, using Map VLAN Tags, will focus more on the Virtual Connect Flex-10 technology. In this scenario we have two10Gb uplinks configured with multiple VLANs. We will configure a Windows 2003 and Windows 2008 server initially with two 10Gb NICs. We will then show how Flex-10 can be used to provide additional NICs to the server, without adding additional hardware. We will also show how the speed of each NIC can be varied from speeds ranging between 100Mb to 10Gb.

## Requirements

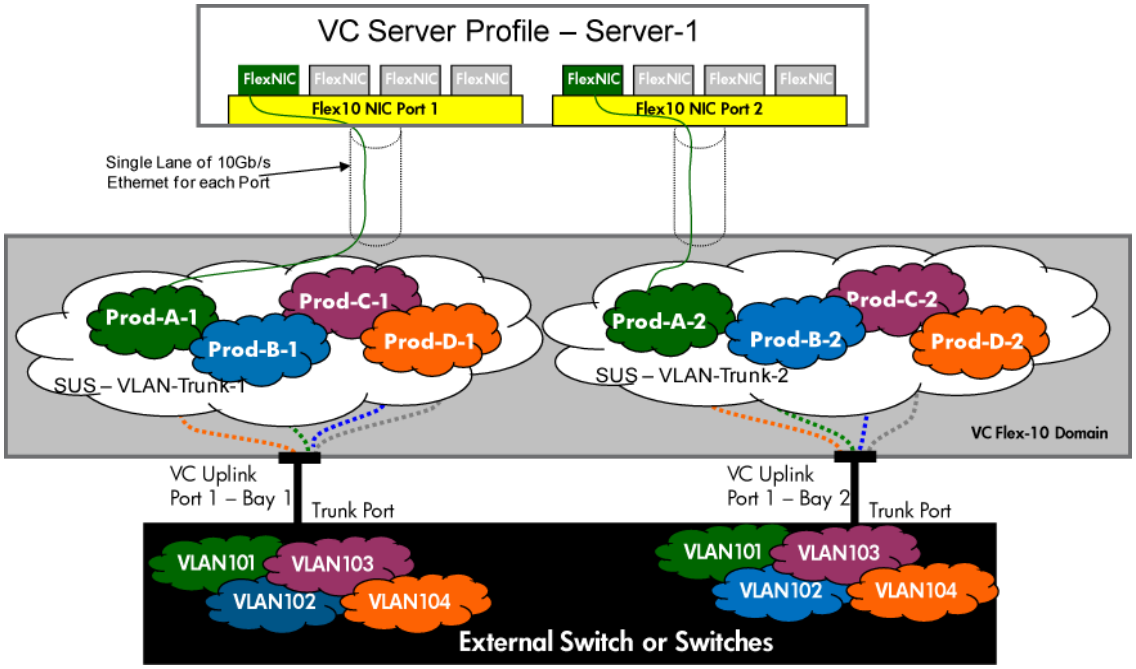
In order to implement this scenario, an HP BladeSystem c7000 enclosure with one of more Blade G6 servers with 10Gb NICs and TWO Virtual Connect Flex-10 Ethernet modules, installed in Bays 1& 2 are required. In addition, we will require ONE or TWO external Network switches. As Virtual Connect does not appear to the network as a switch and is transparent to the network, any standard managed switch will work with Virtual Connect.

**Figure 2-2** Physical View; Shows one 10Gb Ethernet uplink from Ports 1 on Module 1 to Port 1 on the first network switch and one 10Gb uplink from Port 1 on Module 2 to Port 1 on the second network switch.




| Item | Description |
|---|---|
| 1 | Switch Cross Connect |
| 2 | c7000 Enclosure, rear view |

**Figure 2-3** Server blade profile with TWO Flex-10 NICs configured. Each NIC is connected to a vNet (Prod-101-1 and Prod-101-2), 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 X1 on VC module 1 and Port X1 on VC module 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 IOS or a ProCurve network infrastructure. The configuration information provided in the appendices assumes the following information:

- The switch ports are configured as TRUNK ports to support VLANs 101, 102, 103 and 104. All frames will be forwarding to VC with VLAN tags.

Note: when adding the additional uplinks to the SUS, the switch ports connected to Virtual Connect will need to be configured for LACP and configured for the same Link Aggregation Group.

## 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 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 can 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 (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 Map VLAN Tags via GUI (Ethernet settings)

Note: Flex-10 has also provided additional controls when configuring VC for mapped VLAN tags (Multiple Networks over a single link) support. These features provide the ability to set a Custom or Preferred network speed value for each NIC. These are VC domain settings and when configured will limit the maximum configurable speed of a NIC.

Enable Map VLAN Tags within Virtual Connect

- On the Virtual Connect Manager screen, Left pane, click Ethernet Settings, Advanced Settings
- Select Map VLAN Tags
- Select Fast MAC Cache Fail-over with a refresh of 5
- Optionally, select a preferred/Maximum link speed
- Select Apply

## Configuring the VC Module for Map VLAN Tags via CLI (Ethernet settings)

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

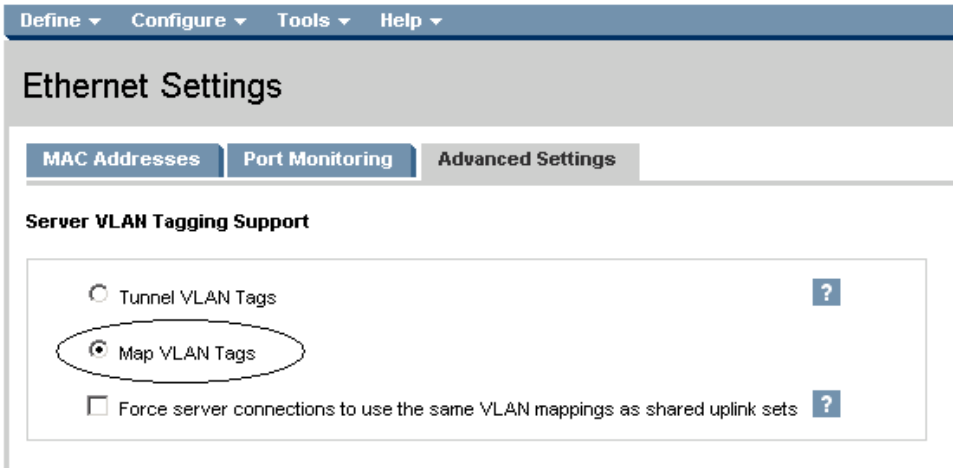
```
# Set Advanced Ethernet Settings to "Map VLAN Tags" and set "Force server connections" to disabled
set enet-vlan vlantagcontrol=map sharedservervlanid=false
set mac-cache Enabled=True Refresh=5
```

**Note:** Do not set a Preferred or Max speed for this scenario. This example is provided for reference only. For the purpose of this scenario, we will not be configuring the custom values for Preferred Link or Maximum Connection speeds. However, the CLI commands are provided below for reference.

Selecting the Set a Custom value for Preferred Link Connection Speed and/or Set a Customer value for Maximum Link Connection Speed, Sets the respective speed for all connections using multiple networks to 500Mb and maximum connection speed to 2.5Gb.

```
# Set Advanced Ethernet Settings to a Preferred speed of 500Mb and a Max Speed of 2500Mb
set enet-vlan PrefSpeedType=Custom PrefSpeed=500 MaxSpeedType=Custom MaxSpeed=2500
```

**Figure 2-4** Ethernet Settings.




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

Connect Port X1 of VC module 1 to Port 1 on switch 1

Create a SUS named "VLAN-Trunk-1" and connect it to Flex-10 Port X1 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;
    a. Enclosure 1, Bay 1, Port X1
- Add Networks as follows;
    a. PROD-A-1 = VLAN ID=101
    b. PROD-B-1 = VLAN ID=102
    c. PROD-C-1 = VLAN ID=103
    d. PROD-D-1 = VLAN ID=104
- Enable SmartLink on ALL networks
- Click Apply

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

Connect Port X1 of VC module 2 to Port 1 on switch 2

Create a SUS named "VLAN-Trunk-2" and connect it to Flex-10 Port X1 on Module 2

- On the Virtual Connect Home page, select Define, Shared Uplink Set
- Insert Uplink Set Name as VLAN-Trunk-2
- Select Add Port, then add the following port;
    a. Enclosure 1, Bay 2, Port X1
- Add Networks as follows;
    a. PROD-A-2 = VLAN ID=101
    b. PROD-B-2 = VLAN ID=102
    c. PROD-C-2 = VLAN ID=103
    d. PROD-D-2 = VLAN ID=104
- Enable SmartLink on ALL networks
- Click Apply

## 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:X1 Uplinkset=VLAN-Trunk-1 speed=auto

# Create Networks Prod-A-1 through Prod-D-1 for Shared Uplink Set "VLAN-Trunk-1"
add network PROD-A-1 uplinkset=VLAN-Trunk-1 VLanID=101
Set Network PROD-A-1 SmartLink=Enabled
add network PROD-B-1 uplinkset=VLAN-Trunk-1 VLanID=102
Set Network PROD-B-1 SmartLink=Enabled
add network PROD-C-1 uplinkset=VLAN-Trunk-1 VLanID=103
Set Network PROD-C-1 SmartLink=Enabled
add network PROD-D-1 uplinkset=VLAN-Trunk-1 VLanID=104
Set Network PROD-D-1 SmartLink=Enabled
```

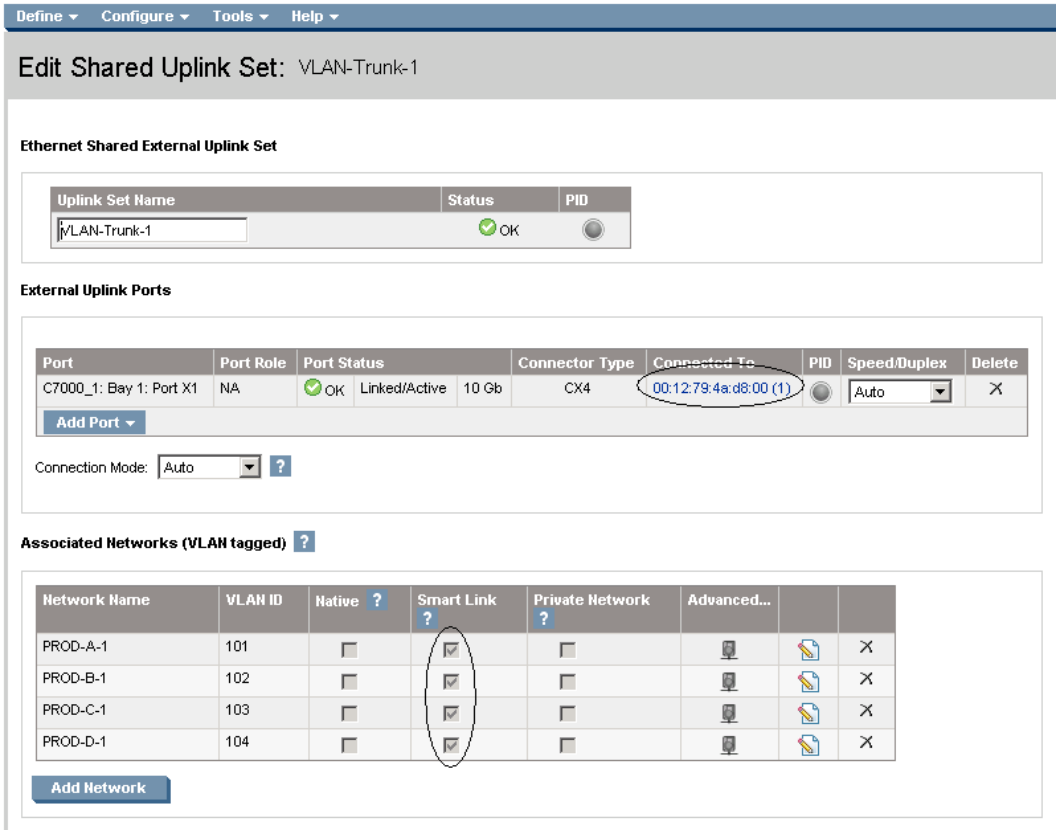
The following script can be used to create the Second Shared Uplink Set (VLAN-Trunk-2)

```
# Create Shared Uplink Set "VLAN-Trunk-2" and configure uplinks
add uplinkset VLAN-Trunk-2
add uplinkport enc0:2:X1 Uplinkset=VLAN-Trunk-2 speed=auto

# Create Networks Prod-A-2 through Prod-D-2 for Shared Uplink Set "VLAN-Trunk-2"
add network PROD-A-2 uplinkset=VLAN-Trunk-2 VLanID=101
Set Network PROD-A-2 SmartLink=Enabled
add network PROD-B-2 uplinkset=VLAN-Trunk-2 VLanID=102
Set Network PROD-B-2 SmartLink=Enabled
add network PROD-C-2 uplinkset=VLAN-Trunk-2 VLanID=103
Set Network PROD-C-2 SmartLink=Enabled
add network PROD-D-2 uplinkset=VLAN-Trunk-2 VLanID=104
Set Network PROD-D-2 SmartLink=Enabled
```

**Note:** It is important to point out at this time, if you are familiar with VC scripting, or have existing VC scripts that you had used on Virtual Connect 1:10 modules, and may want to use with Flex-10, the numbering of the Flex-10 external ports is different than with early modules of VC. VC-E and VC-F uplinks ports are numbered as Ports 1, 2, 3 etc., however; Flex-10 ports are referenced as X1, X2, X3 etc., plus some of the ports are shared, IE the CX4 is shared with SFP+ Port X1, both are configured as X1, but only one is usable at a time. If a CX-4 cable is connected the SFP+ port will become disable, the same is true for Ports X7 & X8, which are the internal cross connect ports, the cross connects will disconnect, if an SFP+ module is plugged in Ports X7 or X8.

**Figure 2-5** Define a Shared Uplink Set (VLAN-Trunk-1) and add VLANs.




**Note:** The "*Connected to*" field in the graphic above displays the MAC address and port number of the switch this uplink is connected to. This information is provided through LLDP discover and is not available in all switch products. This information can be very helpful when determining which switches and ports VC is connected to.

**Figure 2-6** Active / Active SUS.

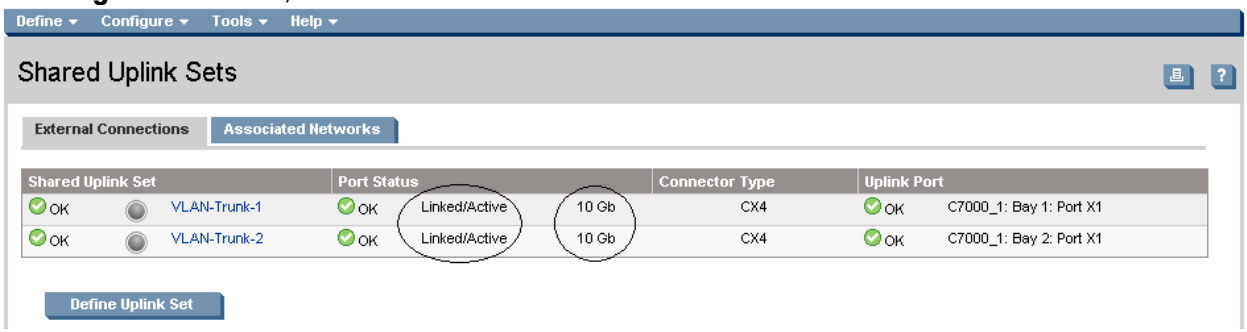
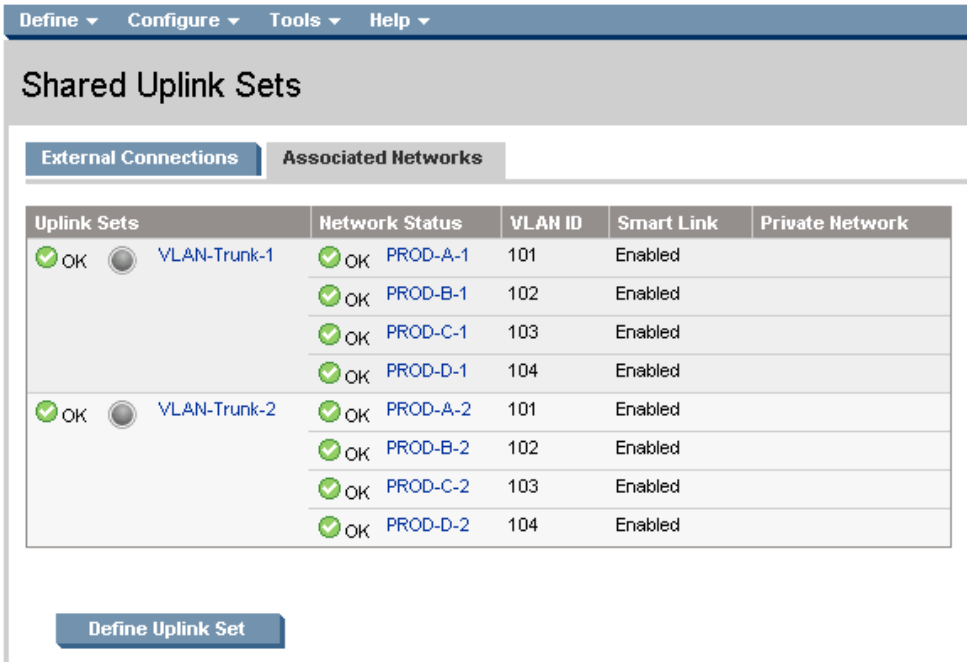
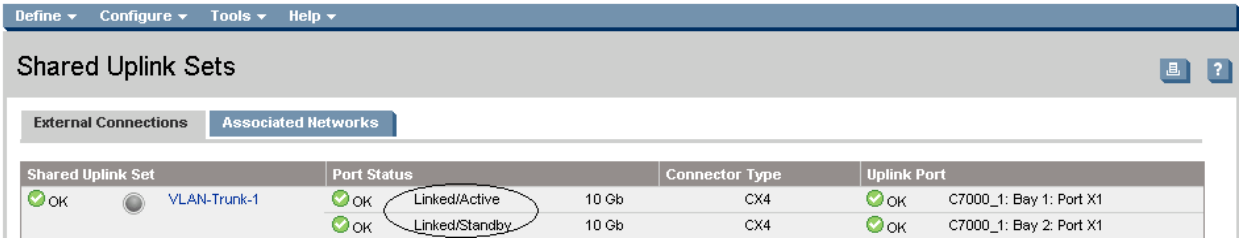


**Figure 2-7** Associated Networks.




**Summary Note:** In this scenario we have created two independent Share Uplink Sets (SUS), each originating from the opposite VC-Modules, by doing so we provide the ability to create separate and redundant connections out of VC. 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 of these uplink ports to the same SUS, however, this would have provided an Active/ Standby uplink scenario, example below.

**Figure 2-8** Example of an Active / Standby SUS.




## 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 "Server-1"
- In the Network Port 1 drop down box, select PROD-A-1
- In the Network Port 2 drop down box, select PROD-A-2
- Do not select a FC SAN connection

- In the Assign Profile to Server Bay box, locate the Select Location drop down and select Bay 1, they apply

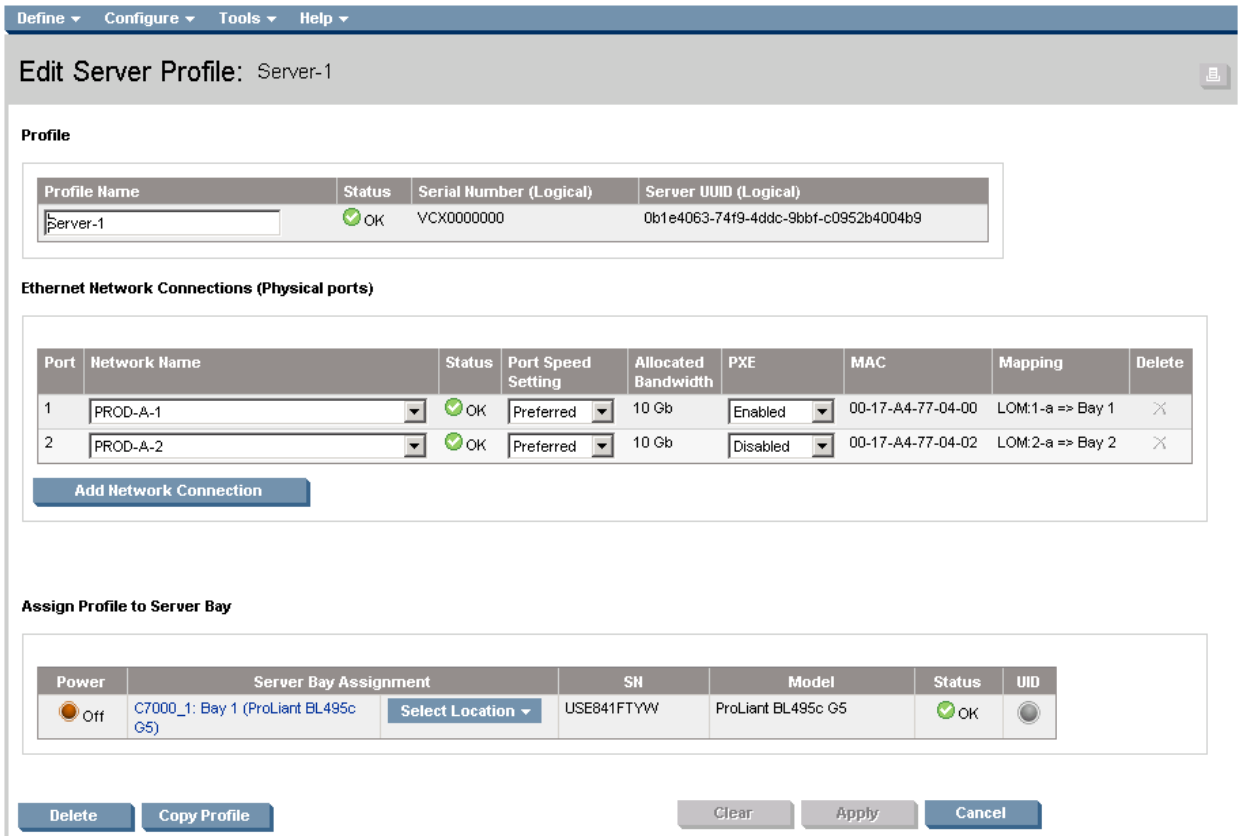
**Note:** you should now have a server profile assigned to Bay 1, with 2 Server NIC connections. NICs 1&2 should be connected to networks PROD-A-1 and PROD-A-2.

## 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 Server-1
add profile Server-1 –nodefaultenetconn -nodefaultfcconn
add enet-connection Server-1 pxe=Enabled Network=PROD-A-1
add enet-connection Server-1 pxe=Disabled Network=PROD-A-2
assign profile Server-1 enc0:1
```

**Figure 2-9** Define a Server Profile.




## Server NIC Speed and LOM Mappings

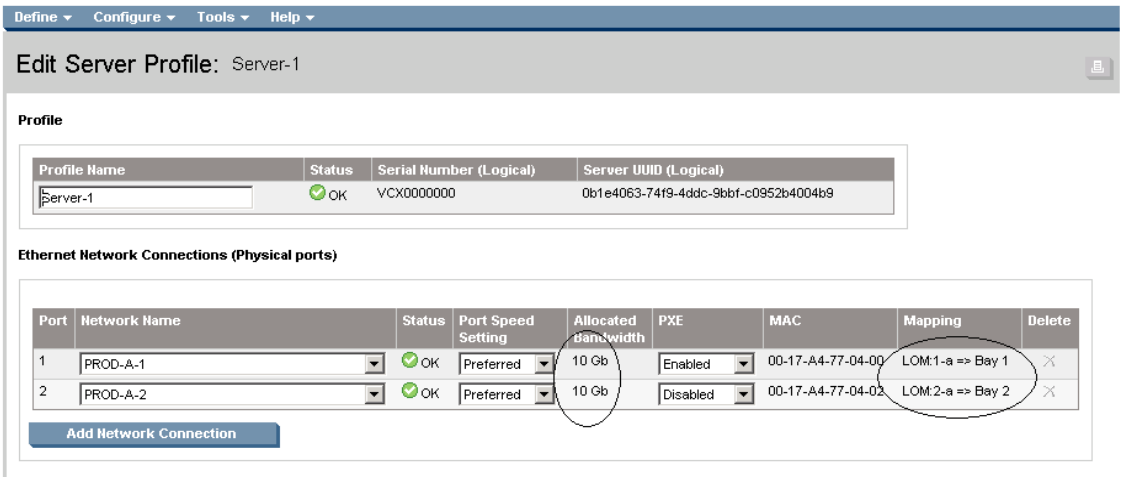
What has been shown and discussed to this point is standard Virtual Connect functionality. We will now focus more of the specific Flex-10 features.

Note the "Allocated Bandwidth" and the LOM "Mapping" settings in the following graphic. Flex-10 based NICs have the ability of being configured as a Single 10Gb NIC or divided into as many as FOUR (4) physical NICs. It is important to note the LOM mappings when configuring which NIC will be connected to which network as a NIC on a specific LOM can connect to a network only once. (IE, NIC

LOM:1-a can be assigned to Prod-101-1, no other NIC on LOM:1 can be assigned to Prod-101-1) This is discussed in further details in the Flex-10 technology brief mentioned earlier in this scenario.

As additional NICs are added to a server profile that is assigned to a server with a 10Gb Flex-NIC, the assignment will alternate between LOM:1 and LOM:2. The first NIC will be LOM:1-a, the second will be LOM:2-a, then LOM:1-b, LOM:2-b etc. to a max of 4 NICs per LOM.

**Figure 2-10** Server NIC speed and LOM Mappings.




# Summary

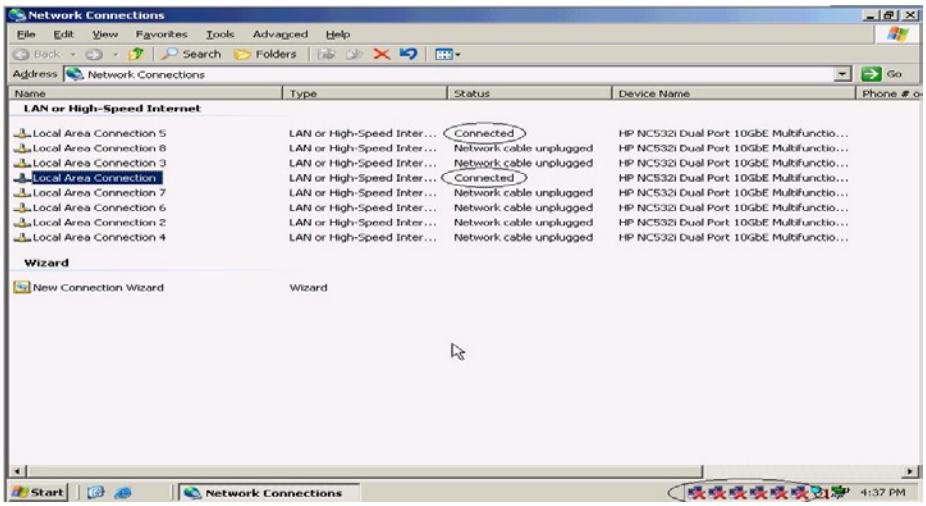
This profile will present Network Port 1 to "PROD-A-1" which is configured on VC Flex-10 module 1, and Network Port 1, with Network Port 2 to "PROD-A-2", which is configured on VC Flex-10 module 2. Both PROD-A-1 and PROD-A-2 are configured to support VLAN 101, so these two NICs are connected to the same VLAN, but taking a different path out of the enclosure. These two NICs could now be teamed within the OS.

# Result

## Windows 2003 Networking Configuration Example

The following graphics show a Windows 2003 server with TWO Flex-10 NICs configured as single NICs, at FULL 10Gb speed. You will also notice that Windows currently believes there are 8 NICs within this server. However, only TWO NICs are currently configured within Virtual Connect Flex-10, so the additional NICs show as disconnected.

**Figure 2-11** Windows 2003 Network Connections (2 Connections Active).




The NICs that are not configured within VC will appear with a red x as not connected. You can go into Network Connections for the Windows 2003 server and Disable any NICs that are not currently in use. Windows assigns the NICs as NIC 1-8, whereas four of the NICs will reside on LOM:1 and four on LOM:2. You may need to refer to the VC server profile for the NIC MAC addresses to verify which NIC is which.

**Figure 2-12** Windows 2003 Extra Network Connections – Disabled.

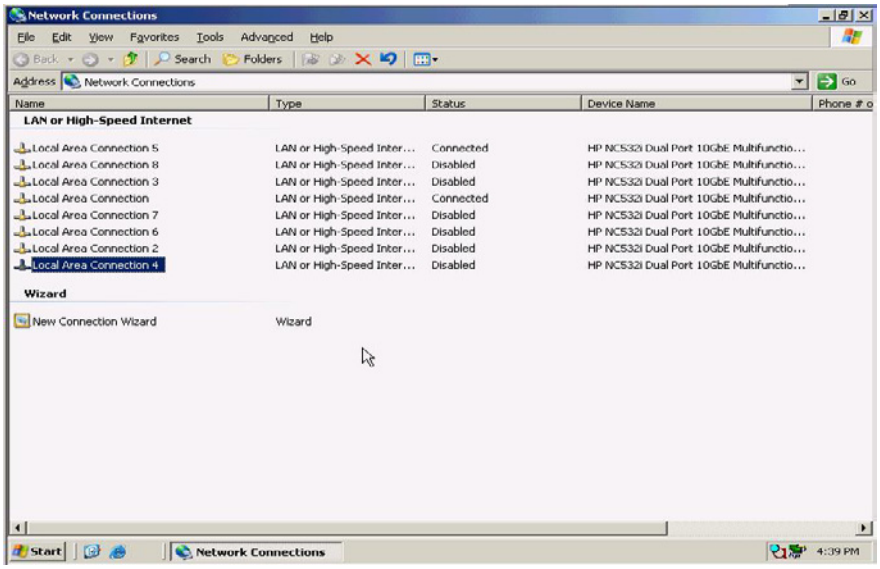
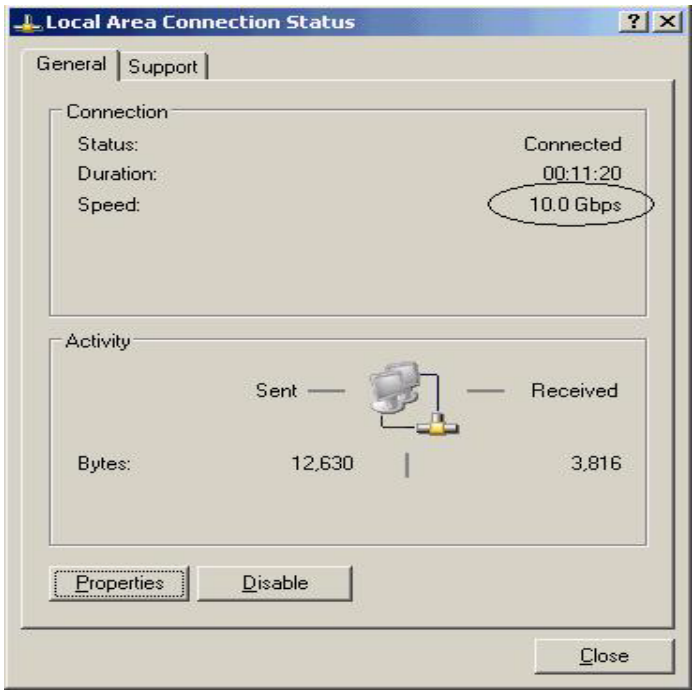


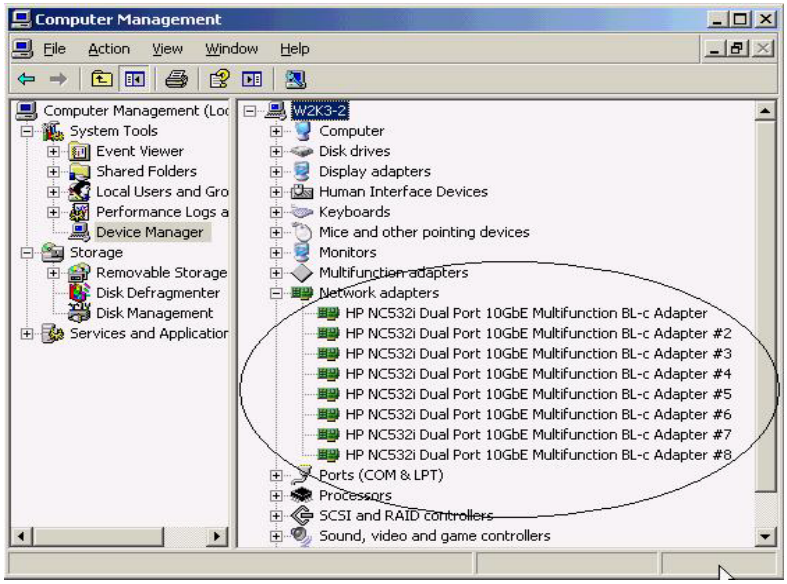
**Figure 2-13** Windows 2003 Network Connections (2 Connections).




Note: In windows 2003 the NIC speeds may not be shown accurately when speeds are configured in 100MB increments above 1Gb. IE: if a NIC is configured for 2.5Gb within Flex-10, it will be displayed in Windows 2003 as a 2Gb NIC. Windows 2008 does not have this limitation.

**Figure 2-14** Windows 2003 Device Manager shows all 8 NICs.

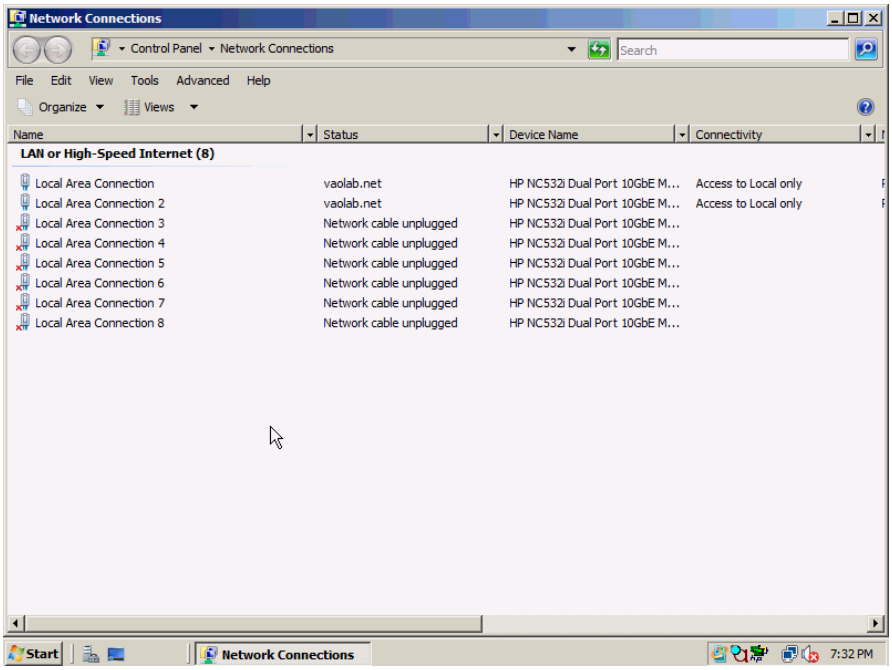
Note: This is the case no matter how many NICs are actually configured and in use.




## Windows 2008 Networking Configuration Example

The following graphics show a Windows 2008 server with TWO Flex-10 NICs configured as single NICs, at FULL 10Gb speed. You will also notice that he server currently believes there are 8 NICs within this server. However, only TWO NICs are currently configured within Virtual Connect Flex-10.

**Figure 2-15** Windows 2008 Network Connections (2 Connections Active).



The NICs that are not configured within VC will appear with a red x as not connected. You can go into Network Connections for the Windows 2008 server and Disable any NICs that are not currently in use. Windows assigns the NICs as NIC 1-8, whereas four of the NICs will reside on LOM:1 and four on LOM:2. You may need to refer to the VC server profile for the NIC MAC addresses to verify which NIC is which.

**Figure 2-16** Windows 2008 Extra Network Connections – Disabled.

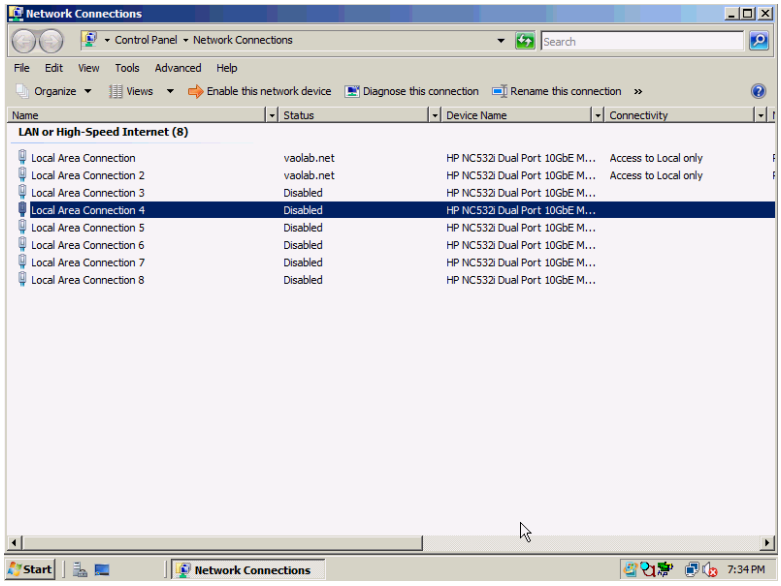
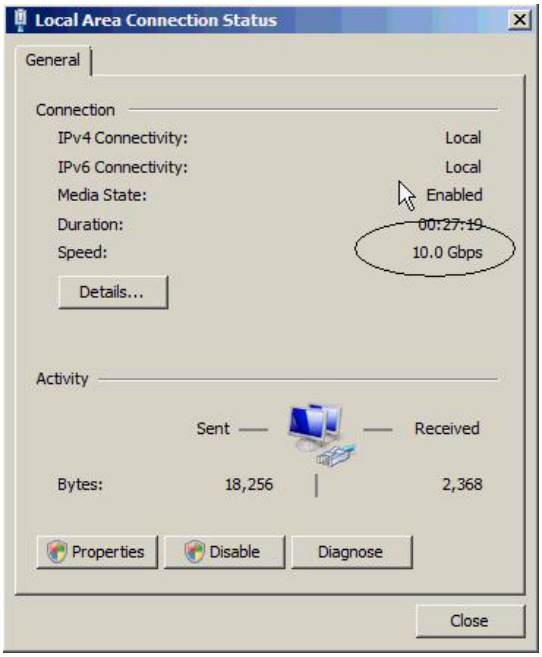



**Figure 2-17** Windows 2003 Network Connections (2 Connections).



## NIC Teaming

If higher availability is desired, NIC teaming in Flex-10 works the same way as in standard network configurations. Simply, open the NIC teaming Utility and configure the available NICs for teaming. In this example, we have only TWO NICs available, so selecting NICs for teaming will be quite simple. However, if multiple NICs are available, ensure that the correct pair of NICs is teamed. You will note the BAY#-Port# indication within each NIC. You would typically TEAM a NIC from Bay 1 to Bay 2 for example.

NIC teaming functions the same in both Windows 2003 and Windows 2008. The graphics below are from Windows 2003.

Highlight both NICs and then select Team, then click OK, the team will be created.

**Figure 2-18** View – Teaming GUI.

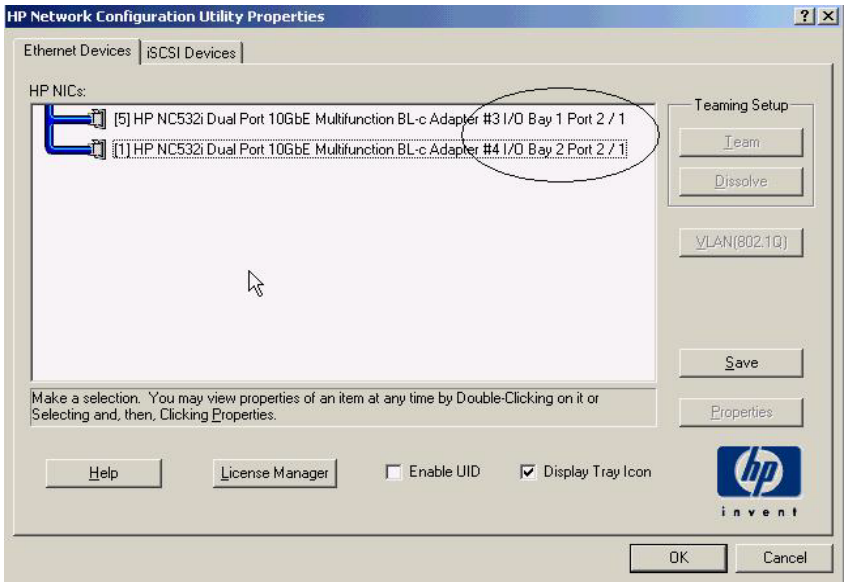


**Figure 2-19** View – Network Connections – NIC Team #1.

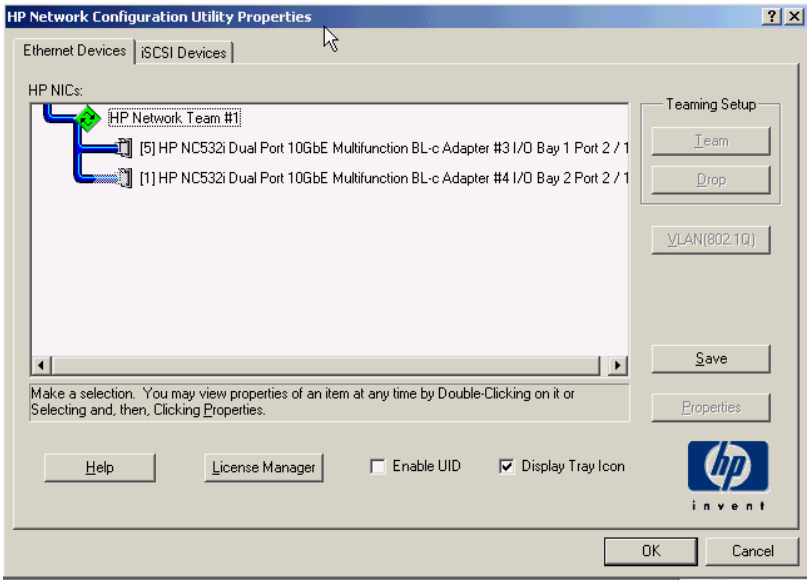
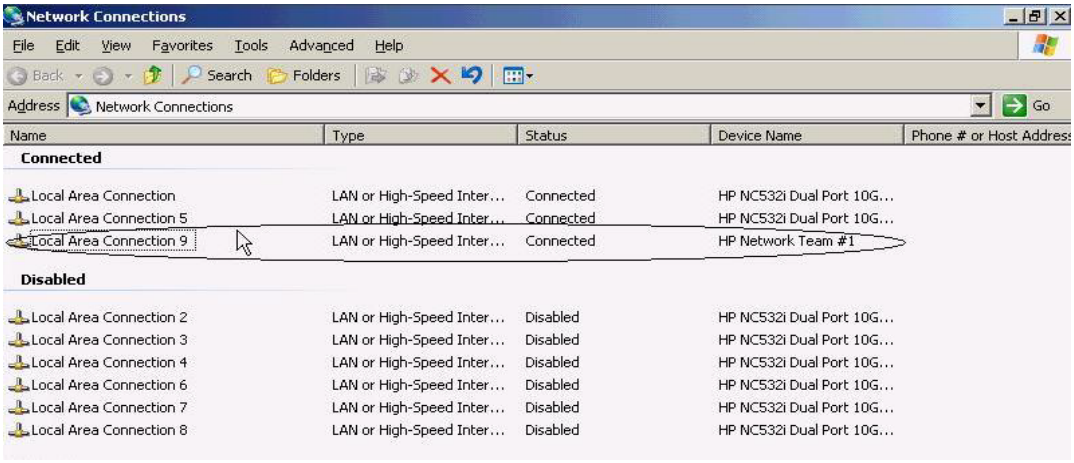



**Figure 2-20** View – Network Connections – NIC Team #1 – Windows.



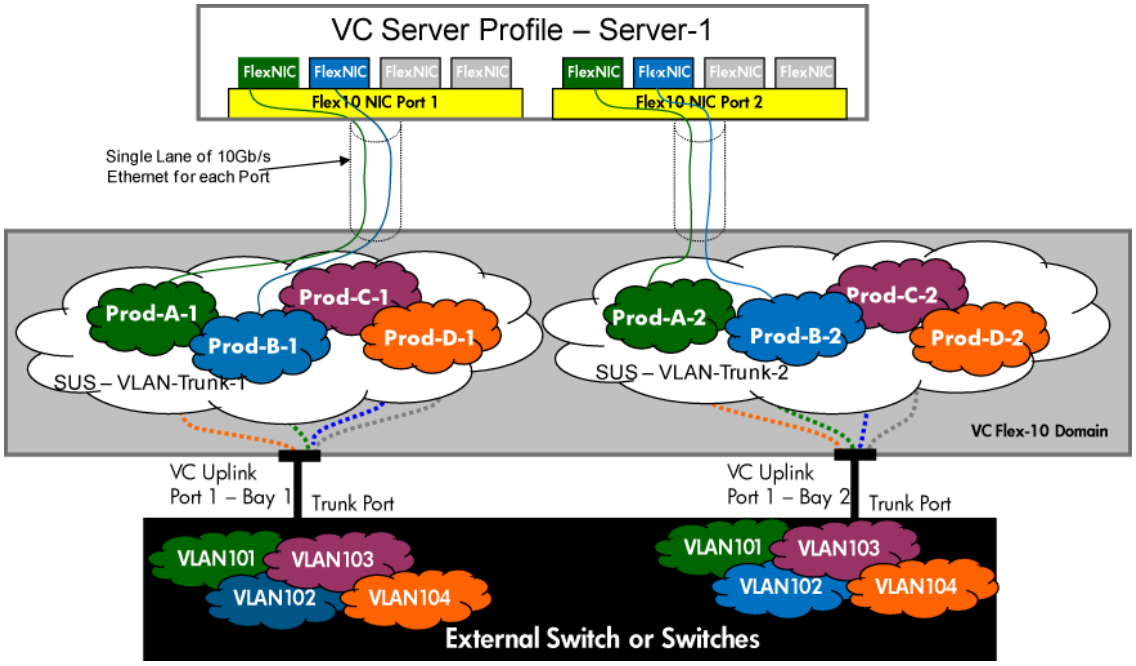

\

# Adding additional NICs to an existing server Profile

What has been shown and discussed to this point is standard Virtual Connect functionality. We will now go into more of the specific Flex-10 features by providing additional NICs to the Windows server, without adding additional server hardware.

The server must be powered off in order to add NICs to the profile, however; editing of the profile, changing network connections, link speed etc., can be done with the server running.

**Figure 2-21** Server Blade profile was initially configured with only TWO NICs. We have now added TWO additional Flex-10 NICs and connected them to PROD-B-1 and PROD-B-2 respectively.



## Editing a Server Profile

We will edit server profile Server-1 and add TWO additional NICs to the server.

Each server NIC will connect to a specific network.

- On the main VC menu, select Server Profile Server-1
- Under Ethernet Network Connections, click the Add Network Connection button twice
- Two additional Network connections will appear
- Under the Network Name column, select PROD-B-1and RROD-B-2
- Under the Port Speed Settings column, select a speed for each NIC
- Set the NIC speeds as follows;
  - NIC1 (port LOM1:a) Auto or Preferred
  - NIC2 (port LOM2:a) Auto or Preferred
  - NIC3 (port LOM1:b) Set to Custom – 7.5Gb
  - NIC4 (port LOM2:b) Set to Custom – 7.5Gb
- By setting NICs 3 & 4 to 7.5Gb, and leaving NICs 1 & 2 as Auto/Preferred, they will be assigned the remaining 2.5Gb of bandwidth each
- Optionally, you can add up to a total of 8 NIC ports and then assigned the speeds accordingly
- Scroll to the bottom of the profile, Click Apply
- If the server is off, power it back on, the view the server from the iLO or OA consoles and not the additional NICs

## Defining a Server Profile via CLI

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

```
# Provision and configure TWO additional NICs for Profile Server-1, Set speed to custom, 7.5Gb
add enet-connection Server-1 pxe=Disabled Network=PROD-B-1 SpeedType=Custom Speed=7500
add enet-connection Server-1 pxe=Disabled Network=PROD-B-2 SpeedType=Custom Speed=7500
```

Alternatively, not setting a Custom speed on the additional NICs would result in ALL NICs being configured for 5Gb per NIC.

```
# Provision and configure TWO additional NICs for Profile Server-1 and leave the speeds set to the default, all configured NICs would get an equal speed
add enet-connection Server-1 pxe=Disabled Network=PROD-B-1
add enet-connection Server-1 pxe=Disabled Network=PROD-B-2
```

Note: the script may run faster if the profile is not assigned to a server bay. Optionally, you could un-assign the profile, make the changes, and then reassign the profile.

**Figure 2-22** Setting the Network connection Port Speed.

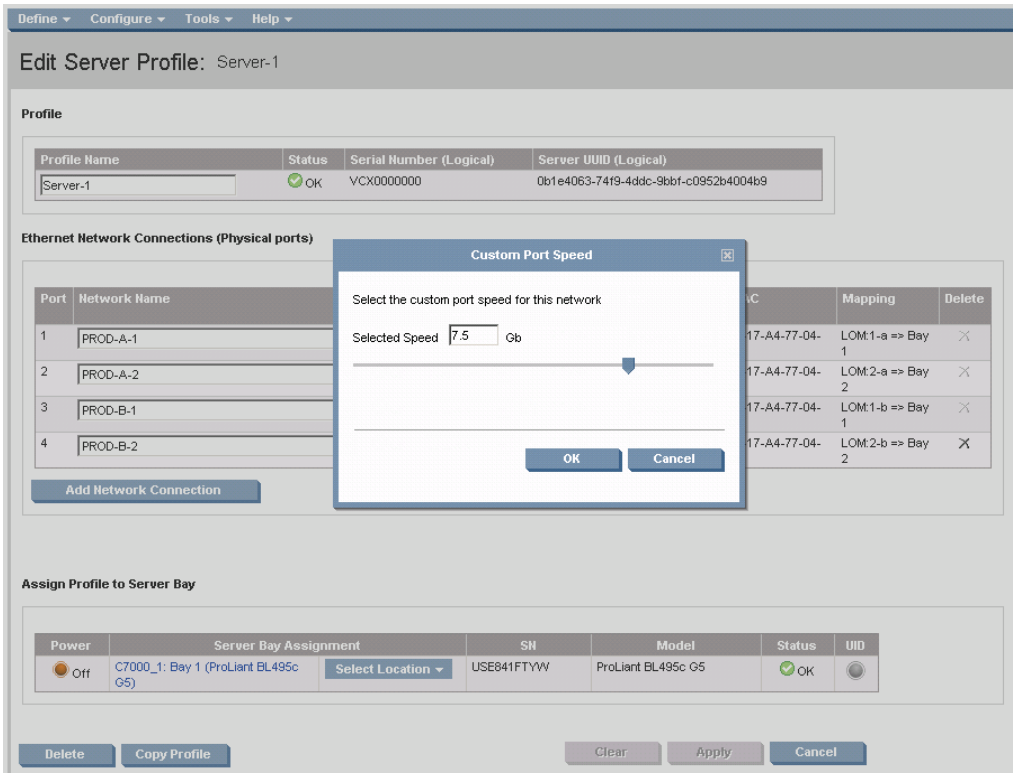
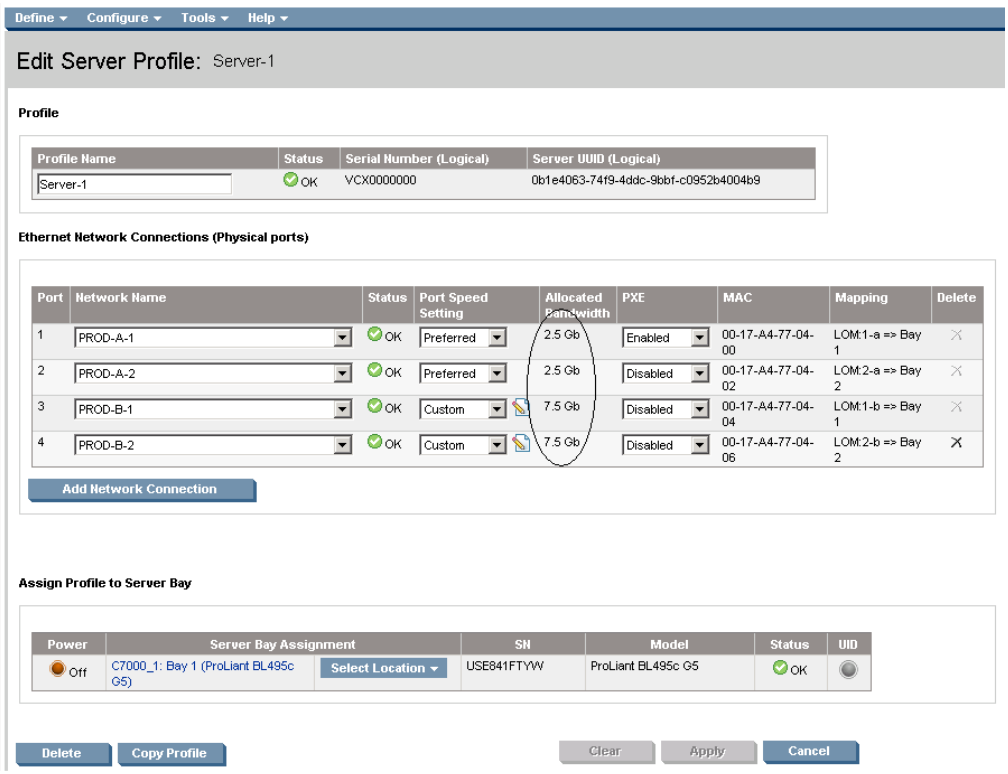



**Figure 2-23** Server NIC speed and LOM Mappings.



# Summary

Initially the Virtual Connect server profile was created with only TWO 10Gb NICs configured and applied to Enclosure Bay 1. Without installing any additional hardware, the profile was later edited and two additional NICs were added, the initial NICs had their speed set down to 2.5Gb each and the newly added NICs were set with a link speed of 7.5Gb.

It was shown how those NICs could be created within both the GUI and VC CLI. We also discussed how those additional NICs could be configured for specific link speeds, between 100Mb and 10Gb per NIC.

When the blade occupying enclosure Bay 1 is powered up, it will have 4 physical NICs connected to networks, PROD-A-1, PROD-A-2, PROD-B-1 and PROD-B-2. If additional NICs are required, simply go to the Virtual Connect profile and add the required number of NICs, configure them for the appropriate networks, speed and apply the profile. Verify the configuration change through the OA, HP Virtual Connect Enterprise Manager (VCEM) and/or ILO.

# Result

The following graphics provide an example of a Windows 2003/2008 server with 4 NICs configured and connected to the VC Networks as discussed earlier. NIC Teaming examples are also provided.

**Figure 2-24** Windows 2003 Network Connections (4 Active Connections).

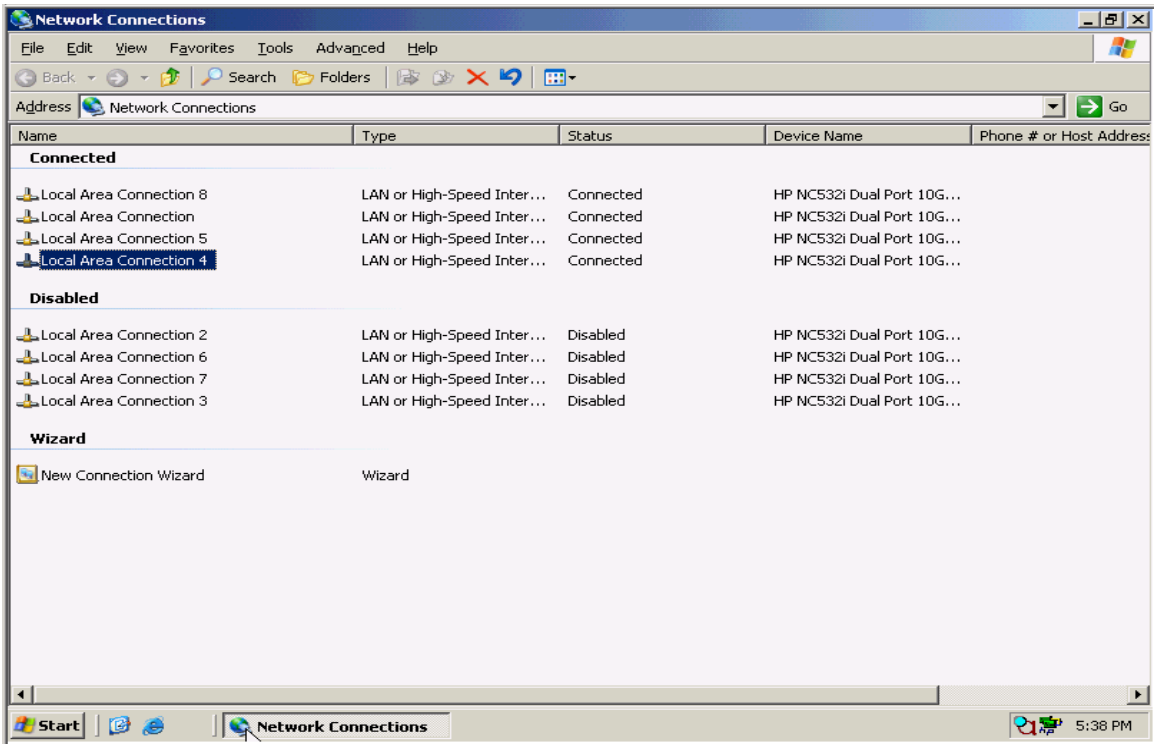
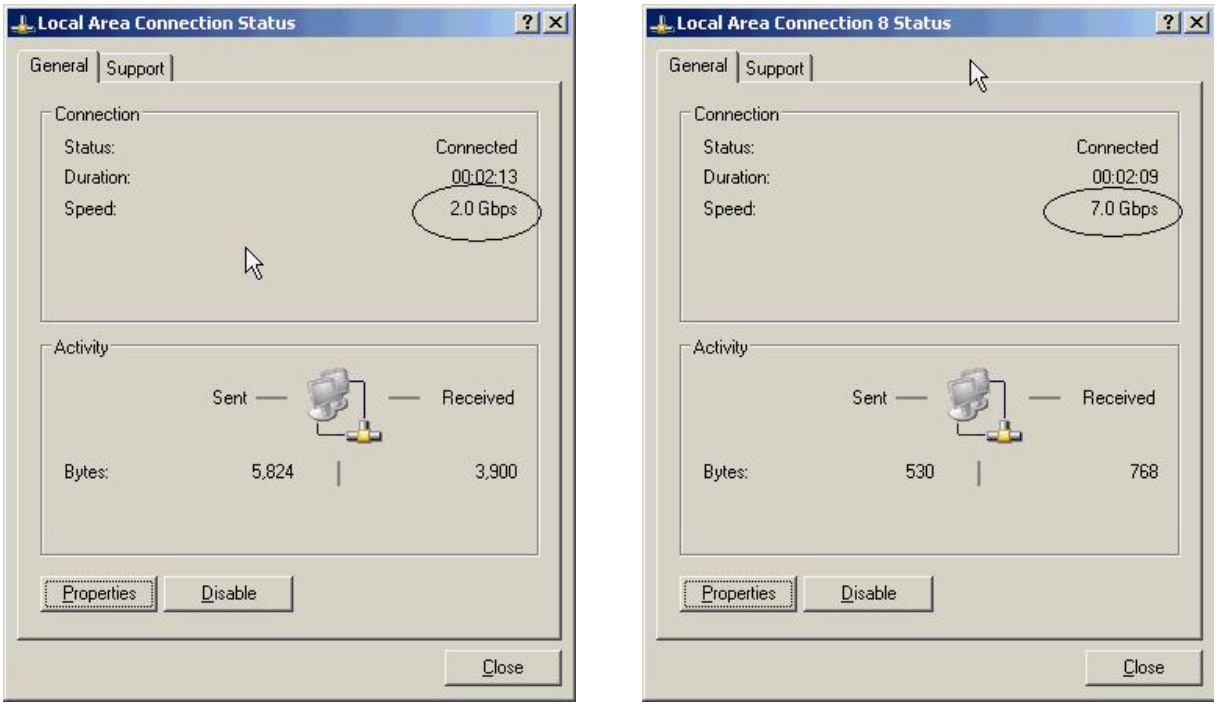


**Figure 2-25** Windows 2003 Network Connections NIC Speed.




Note: Even though the Profile is set to 2.5Gb and 7.5Gb respectively, Windows 2003 does not display values correctly. Windows 2008 displays the correct values.

**Figure 2-26** Windows 2008 Network Connections (4 Active Connections).

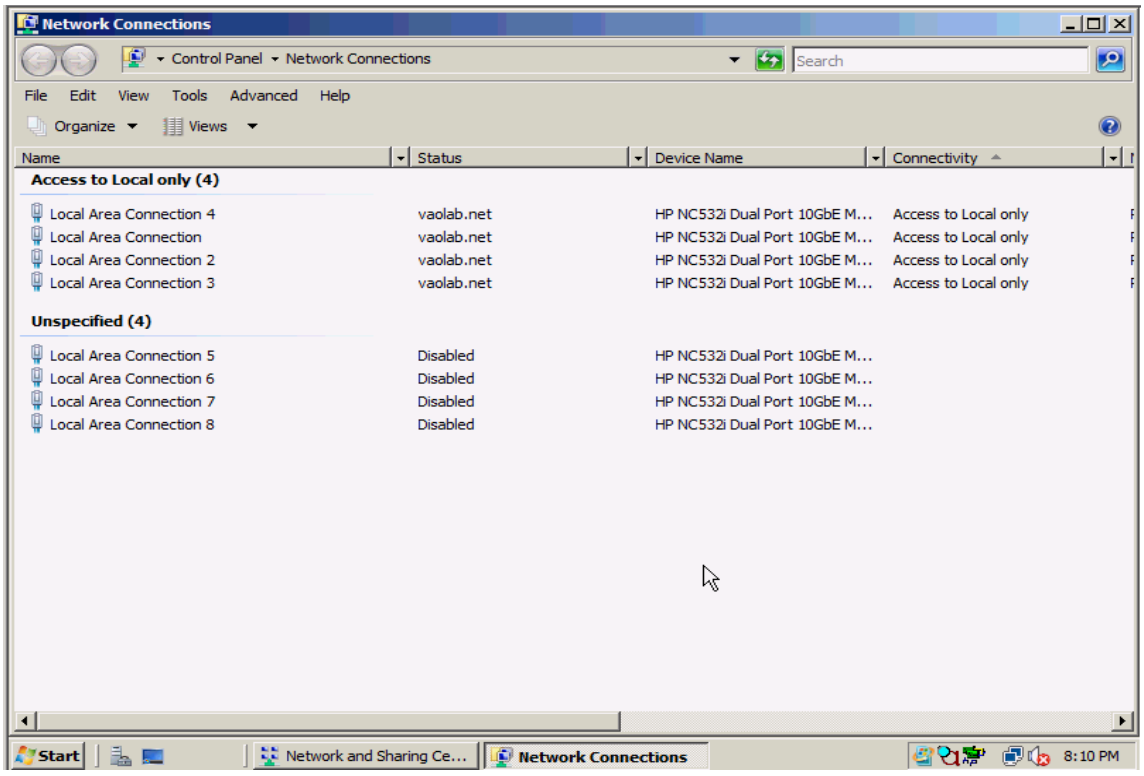
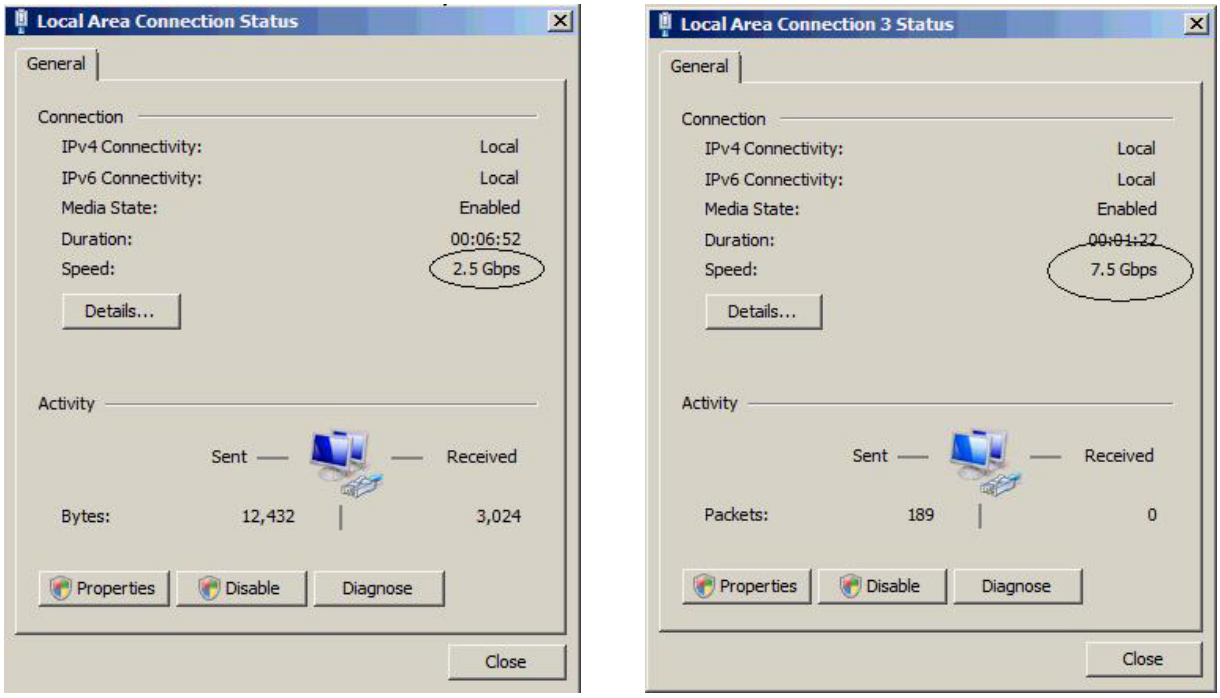



**Figure 2-27** Windows 2008 Network Connections NIC Speed.




**Note:** Windows 2008 displays the correct link speed values

# Scenario 2:2 - Flex-10 - VLAN Tagging (802.1Q) with Multiple Shared Uplink Sets (SUS) and Mapped VLANs - Windows 2008 Hyper-V

## Overview

This scenario discusses the Flex-10 features provided in Virtual Connect. For an overview of Flex-10, please refer to the following technology brief. HP Flex-10 technology brief;

http://h20000.www2.hp.com/bc/docs/support/SupportManual/c01608922/c01608922.pdf

Virtual Connect Flex-10 provides the ability to either present the 10Gb server NICs as single 10Gb NICs, or divide each NIC into as many as 4 "physical function" NICs per NIC port. These physical function NICs look to the server hardware and OS as physical NICs, have their own MAC address and can be configured at speeds from 100Mb to 10Gb.

As shown in earlier scenarios, VLAN access can be handled in two different ways. Virtual Connect can either pass VLAN/Non-VLAN traffic untouched to the host (Tunneling Mode) or Virtual Connect can handle all VLAN tagging (Server Mapped VLANs). Each has their advantages as discussed in the Introduction to Virtual Connect section, earlier in this document.

This scenario, using Map VLAN Tags, will focus on the Virtual Connect Flex-10 technology. In this scenario we have two 10Gb uplinks configured with multiple VLANs. We will configure a Windows 2008R2 Hyper-V server with 4 NICs, 2 per NIC port, configured at various speeds. Some NICs will be connected to a specific VLAN, so frames will be presented without tags, the other will be configured with multiple networks/VLANs, were frames will be presented with tags. We will also show how the speed of each NIC can be varied from speeds ranging between 100Mb to 10Gb.

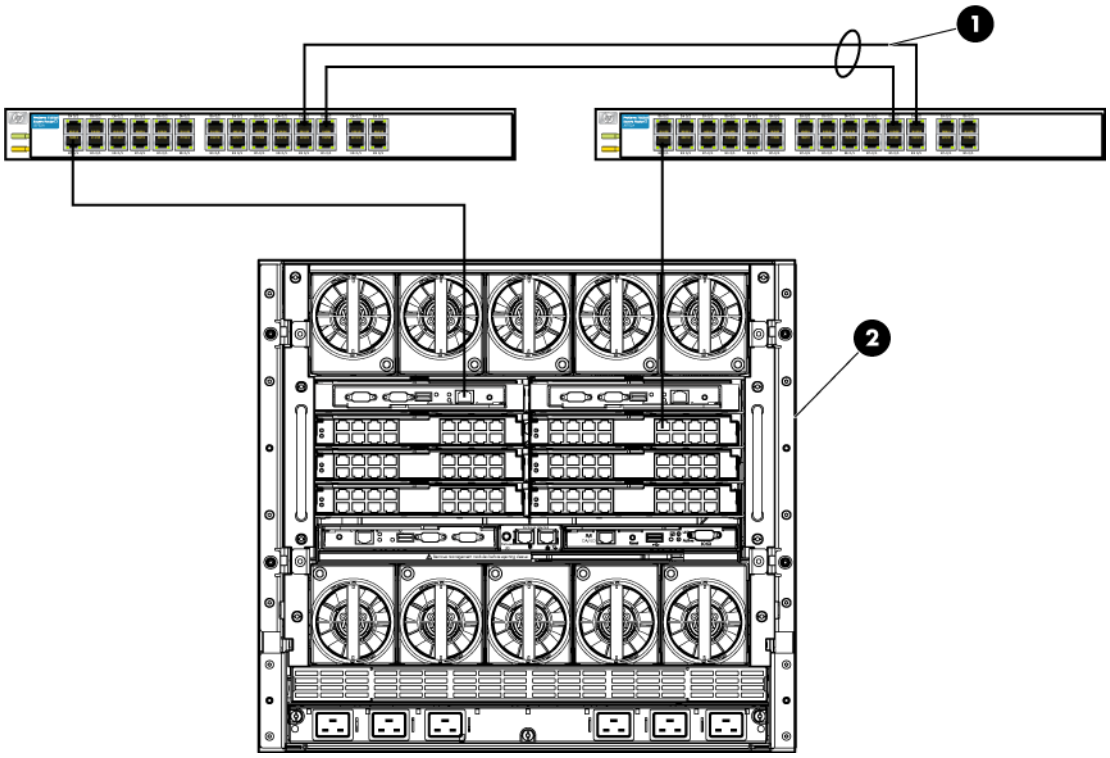
**Table 2-1** Flex-10 NIC – Optimized for a Virtualization

| | Management NIC #1 | Production NIC #2 | Management NIC #3 | Production NIC #4 |
|---|---|---|---|---|
| Traditional 1Gb technology | 1Gb | 1Gb | 1Gb | 1Gb |
| Virtual Connect Flex-10 | 2.5Gb | 7.5Gb | 2.5Gb | 7.5Gb |

# Requirements

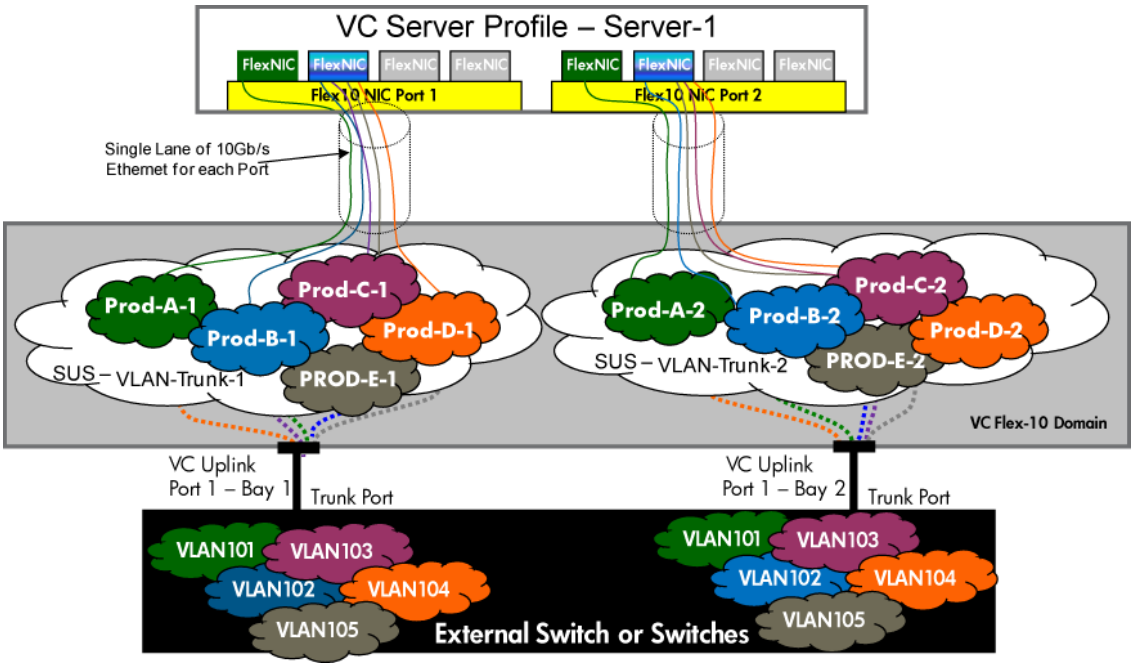
In order to implement this scenario, an HP BladeSystem c7000 enclosure with one of more Blade G6 servers with 10Gb NICs and TWO Virtual Connect Flex-10 Ethernet modules, installed in Bays 1 & 2 are required. In addition, we will require ONE or TWO external Network switches. As Virtual Connect does not appear to the network as a switch and is transparent to the network, any standard managed switch will work with Virtual Connect.

**Figure 2-28** Physical View; Shows one 10Gb Ethernet uplink from Ports 1 on Module 1 to Port 1 on the first network switch and one 10Gb uplink from Port 1 on Module 2 to Port 1 on the second network switch.




| Item | Description |
|---|---|
| 1 | Switch Cross Connect |
| 2 | c7000 Enclosure, rear view |

**Figure 2-29** Server Blade profile with TWO Flex-10 NICs configured. Each NIC is connected to a vNet (PROD-A-1 and PROD-A-2), the additional NICs are connected to other networks, which are also 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 X1 on VC module 1 and Port X1 on VC module 2, creating an Active/Active uplink.




# Installation and configuration

## Switch configuration

Appendices A and B provide a summary of the commands required to configure the switch in either a Cisco IOS or a ProCurve network infrastructure. The configuration information provided in the appendices assumes the following information:

- The switch ports are configured as TRUNK ports to support VLANs 101, 102, 103, 104 and 105. All frames will be forwarding to VC with VLAN tags.

Note: when adding the additional uplinks to the SUS, the switch ports connected to Virtual Connect will need to be configured for LACP and configured for the same Link Aggregation Group.

## 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 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 can 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 (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 Map VLAN Tags via GUI (Ethernet settings)

Note: Flex-10 has also provided additional controls when configuring VC for mapped VLAN tags (Multiple Networks over a single link) support. These features provide the ability to set a Custom or Preferred network speed value for each NIC. These are VC domain settings and when configured will limit the maximum configurable speed of a NIC.

Enable Map VLAN Tags within Virtual Connect

- On the Virtual Connect Manager screen, Left pane, click Ethernet Settings, Advanced Settings
- Select Map VLAN Tags
- Select Fast MAC Cache Fail-over with a refresh of 5
- Optionally, select a preferred/Maximum link speed
- Select Apply

## Configuring the VC Module for Map VLAN Tags via CLI (Ethernet settings)

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

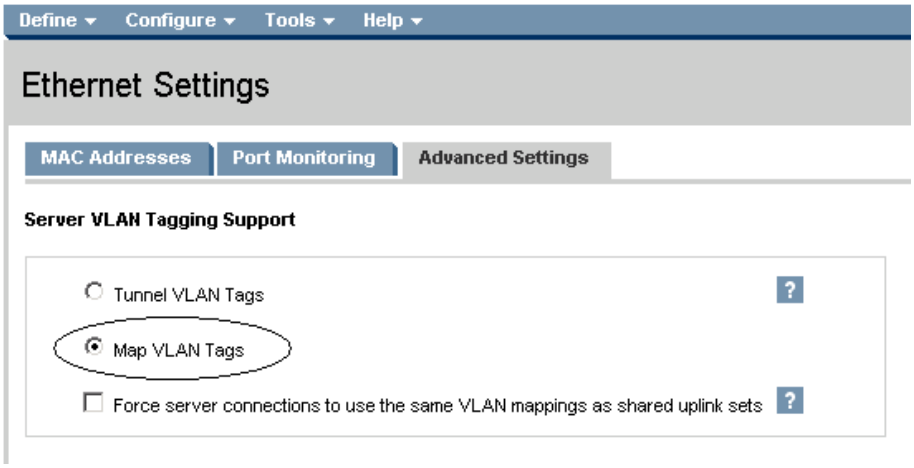
```
# Set Advanced Ethernet Settings to "Map VLAN Tags" and set "Force server connections" to disabled
set enet-vlan vlantagcontrol=map sharedservervlanid=false
set mac-cache Enabled=True Refresh=5
```

**Note:** Do not set a Preferred or Max speed for this scenario. This example is provided for reference only. For the purpose of this scenario, we will not be configuring the custom values for Preferred Link or Maximum Connection speeds. However, the CLI commands are provided below for reference.

Selecting the Set a Customer value for Preferred Link Connection Speed and/or Set a Customer value for Maximum Link Connection Speed, Sets the respective speed for all connections using multiple networks to 500Mb and maximum connection speed to 2.5Gb.

```
# Set Advanced Ethernet Settings to a Preferred speed of 500Mb and a Max Speed of 2500Mb
set enet-vlan PrefSpeedType=Custom PrefSpeed=500 MaxSpeedType=Custom MaxSpeed=2500
```

**Figure 2-30** Ethernet Settings.




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

Connect Port X1 of VC module 1 to Port 1 on switch 1

Create a SUS named "VLAN-Trunk-1" and connect it to Flex-10 Port X1 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;
  a. Enclosure 1, Bay 1, Port X1
- Add Networks as follows;
  a. PROD-A-1 = VLAN ID=101
  b. PROD-B-1 = VLAN ID=102
  c. PROD-C-1 = VLAN ID=103
  d. PROD-D-1 = VLAN ID=104
  e. PROD-E-1 = VLAN ID=105
- Enable Smartlink on ALL Networks
- Click Apply

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

Connect Port X1 of VC module 2 to Port 1 on switch 2

Create a SUS named "VLAN-Trunk-2" and connect it to Flex-10 Port X1 on Module 2

- On the Virtual Connect Home page, select Define, Shared Uplink Set
- Insert Uplink Set Name as VLAN-Trunk-2
- Select Add Port, then add the following port;
  a. Enclosure 1, Bay 2, Port X1
- Add Networks as follows;
  a. PROD-A-2 = VLAN ID=101
  b. PROD-B-2 = VLAN ID=102
  c. PROD-C-2 = VLAN ID=103
  d. PROD-D-2 = VLAN ID=104

e. PROD-E-2 = VLAN ID=105

- Enable Smartlink on ALL Networks
- Click Apply

## 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:X1 Uplinkset=VLAN-Trunk-1 speed=auto

# Create Networks Prod-A-1 through Prod-D-1 for Shared Uplink Set "VLAN-Trunk-1"
add network PROD-A-1 uplinkset=VLAN-Trunk-1 VLanID=101
Set Network PROD-A-1 SmartLink=Enabled
add network PROD-B-1 uplinkset=VLAN-Trunk-1 VLanID=102
Set Network PROD-B-1 SmartLink=Enabled
add network PROD-C-1 uplinkset=VLAN-Trunk-1 VLanID=103
Set Network PROD-C-1 SmartLink=Enabled
add network PROD-D-1 uplinkset=VLAN-Trunk-1 VLanID=104
Set Network PROD-D-1 SmartLink=Enabled
add network PROD-E-1 uplinkset=VLAN-Trunk-1 VLanID=105
Set Network PROD-E-1 SmartLink=Enabled
```

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

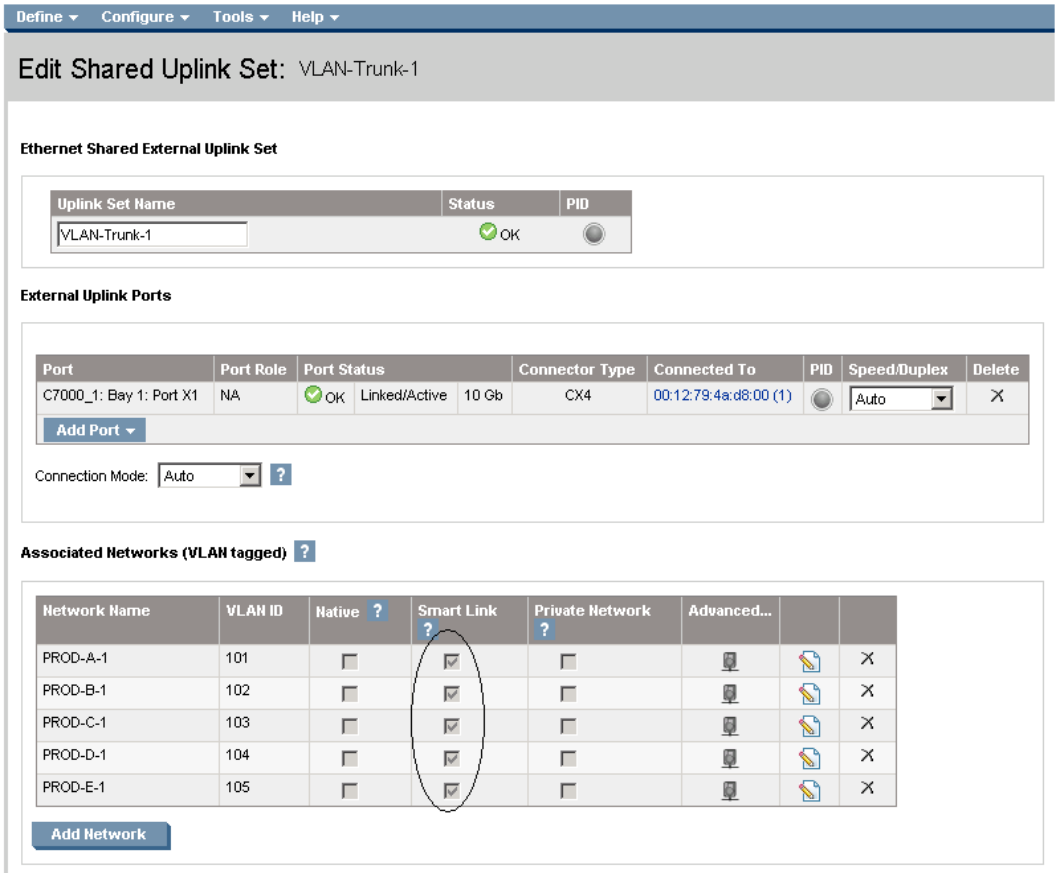
```
# Create Shared Uplink Set "VLAN-Trunk-2" and configure uplinks
add uplinkset VLAN-Trunk-2
add uplinkport enc0:2:X1 Uplinkset=VLAN-Trunk-2 speed=auto

# Create Networks Prod-A-2 through Prod-D-2 for Shared Uplink Set "VLAN-Trunk-2"
add network PROD-A-2 uplinkset=VLAN-Trunk-2 VLanID=101
Set Network PROD-A-2 SmartLink=Enabled
add network PROD-B-2 uplinkset=VLAN-Trunk-2 VLanID=102
Set Network PROD-B-2 SmartLink=Enabled
add network PROD-C-2 uplinkset=VLAN-Trunk-2 VLanID=103
Set Network PROD-C-2 SmartLink=Enabled
add network PROD-D-2 uplinkset=VLAN-Trunk-2 VLanID=104
Set Network PROD-D-2 SmartLink=Enabled
add network PROD-E-2 uplinkset=VLAN-Trunk-2 VLanID=105
Set Network PROD-E-2 SmartLink=Enabled
```

**Note:** It is important to point out at this time, if you are familiar with VC scripting, or have existing VC scripts that you had used on Virtual Connect 1:10 modules, and may want to use with Flex-10, the numbering of the Flex-10 external ports is different than with early modules of VC. VC-E and VC-F uplinks ports are numbered as Ports 1, 2, 3 etc., however; Flex-10 ports are referenced as X1, X2, X3 etc., plus some of the ports are shared, IE the CX4 is shared with SFP+ port X1, both are configured as X1, but only one is usable at a time. If a CX-4 cable is connected the SFP+ port will become disable, the same is true

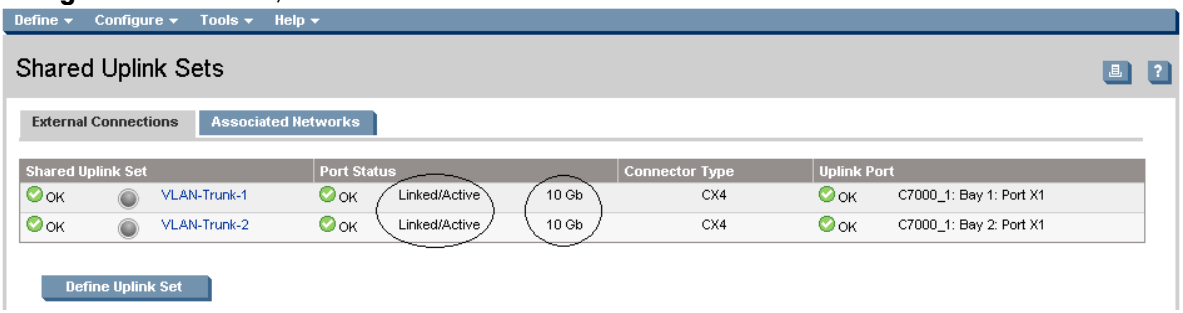
for Ports X7 & X8, which are the internal cross connect ports, the cross connects will disconnect, if an SFP+ module is plugged in Ports X7 or X8.

**Figure 2-31** Define a Shared Uplink Set (VLAN-Trunk-1) and add VLANs.



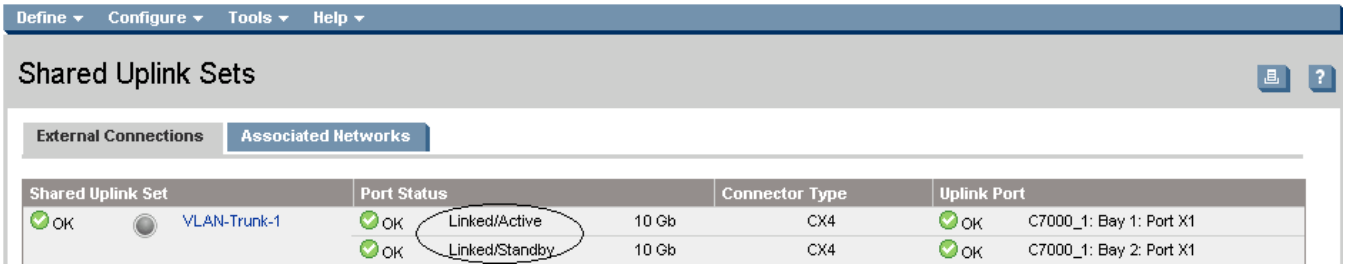

**Note:** The *"Connected to"* field in the graphic above displays the MAC address and port number of the switch this uplink is connected to. This information is provided through LLDP discover and is not available in all switch products. This information can be very helpful when determining which switches and ports VC is connected to.

**Figure 2-32** Active / Active SUS.




**Summary Note:** In this scenario we have created two independent Share Uplink Sets (SUS), each originating from the opposite VC-Modules, by doing so we provide the ability to create separate and redundant connections out of VC. 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 of these uplink ports to the same SUS, however, this would have provided an Active/ Standby uplink scenario, example below.

**Figure 2-32** Example of an Active / Standby SUS.




## 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 "Server-1"
- In the Network Port 1 drop down box, select PROD-A-1, configure the speed as custom at 2.5Gb
- In the Network Port 2 drop down box, select PROD-A-2, configure the speed as custom at 2.5Gb
- In the Network Port 3 drop down box, select Multiple Networks, configure the speed as Auto
  - Configure Multiple Networks for PROD-C-1, PROD-D-1 and PROD-E-1
- In the Network Port 4 drop down box, select Multiple Networks, configure the speed as Auto
  - Configure Multiple Networks for PROD-C-2, PROD-D-2 and PROD-E-2
- In the Assign Profile to Server Bay box, locate the Select Location drop down and select Bay 1, then apply

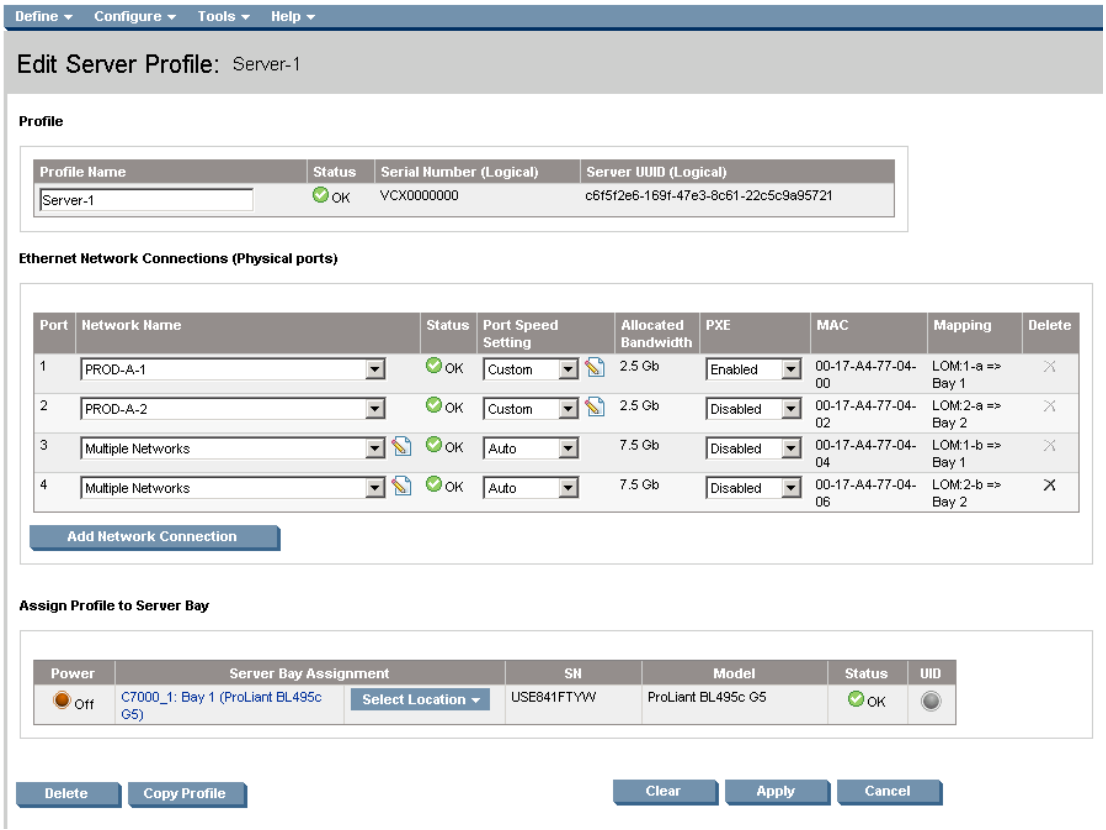
**Note:** you should now have a server profile assigned to Bay 1, with 4 Server NICs connected to the various networks. NICs 3&4 should have a link speed of 7.5Gb

## 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 Server-1
add profile Server-1 –nodefaultenetconn
add enet-connection Server-1 pxe=Enabled Network=PROD-A-1 SpeedType=Custom Speed=2500
add enet-connection Server-1 pxe=Disabled Network=PROD-A-2 SpeedType=Custom Speed=2500
add enet-connection Server-1 pxe=Disabled
add server-port-map Server-1:3 PROD-C-1 VLanId=102
add server-port-map Server-1:3 PROD-C-1 VLanId=103
add server-port-map Server-1:3 PROD-D-1 VLanId=104
add server-port-map Server-1:3 PROD-E-1 VLanId=105
add enet-connection Server-1 pxe=Disabled
add server-port-map Server-1:4 PROD-C-2 VLanId=102
add server-port-map Server-1:4 PROD-C-2 VLanId=103
add server-port-map Server-1:4 PROD-D-2 VLanId=104
add server-port-map Server-1:4 PROD-E-2 VLanId=105
Assign profile Server-1 enc0:1
```

**Figure 2-33** Define a Server Profile with 4 NICs.



## Server NIC Speed and LOM Mappings

We will now focus more of the specific Flex-10 features.

Note the "Allocated Bandwidth" and the LOM "Mapping" settings in the following graphic. Flex-10 based NICs have the ability of being configured as a Single 10Gb NIC or divided into as many as FOUR (4) physical NICs. It is important to note the LOM mappings when configuring which NIC will be connected to which network, as a NIC on a specific LOM can connect to a network only once. (IE, NIC LOM:1-a can be assigned to Prod-101-1, no other NIC on LOM:1 can be assigned to Prod-101-1) This is discussed in further details in the Flex-10 technology brief mentioned earlier in this document.

As additional NICs are added to a profile that is assigned to a server with a 10Gb Flex-NIC, the assignment will alternate between LOM:1-x and LOM:2-x. The first NIC will be LOM:1-a, the second will be LOM:2-a, then LOM:1-b, LOM:2-b etc. to a max of 4 NICs per LOM.

Also, note that if additional NICs are required, this server has only 6 NICs configured, we could ADD two more NICs to this server without adding additional hardware. As of Virtual Connect firmware 2.30, Virtual Connect will provide the ability to add/remove or reconfigure the server NICs, including NIC speed, while the server is running.

**Figure 2-34** Server NIC speed and LOM Mappings.

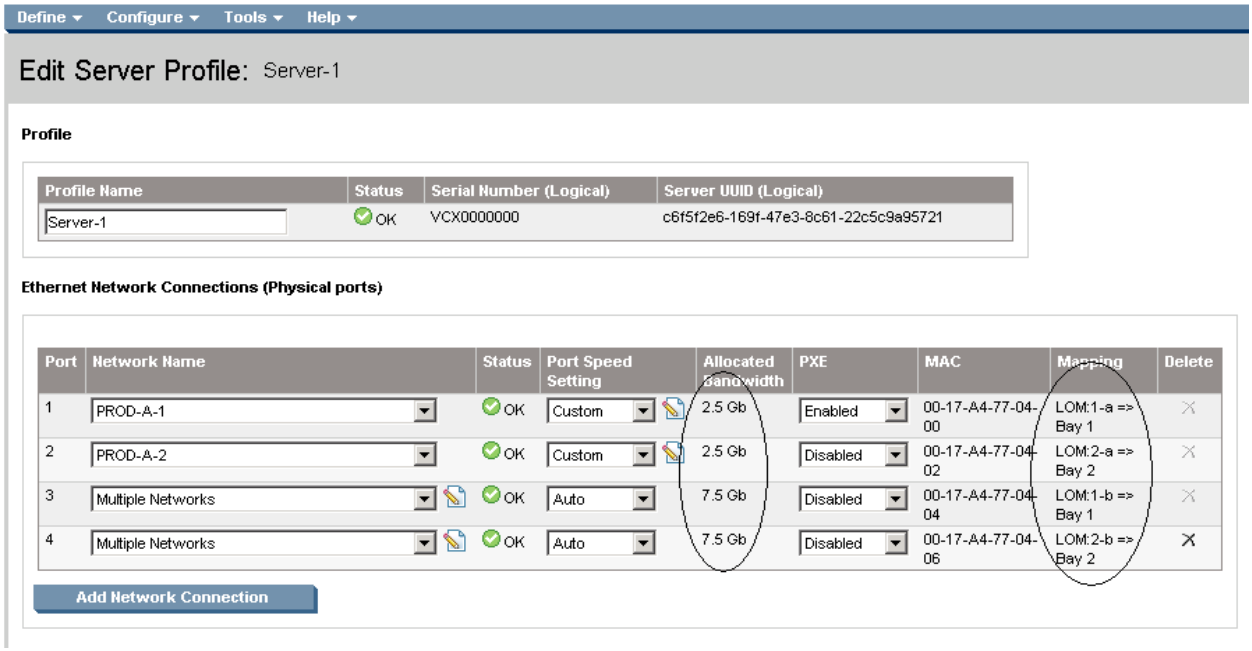


**Figure 2-35** Adjusting the NIC speed.

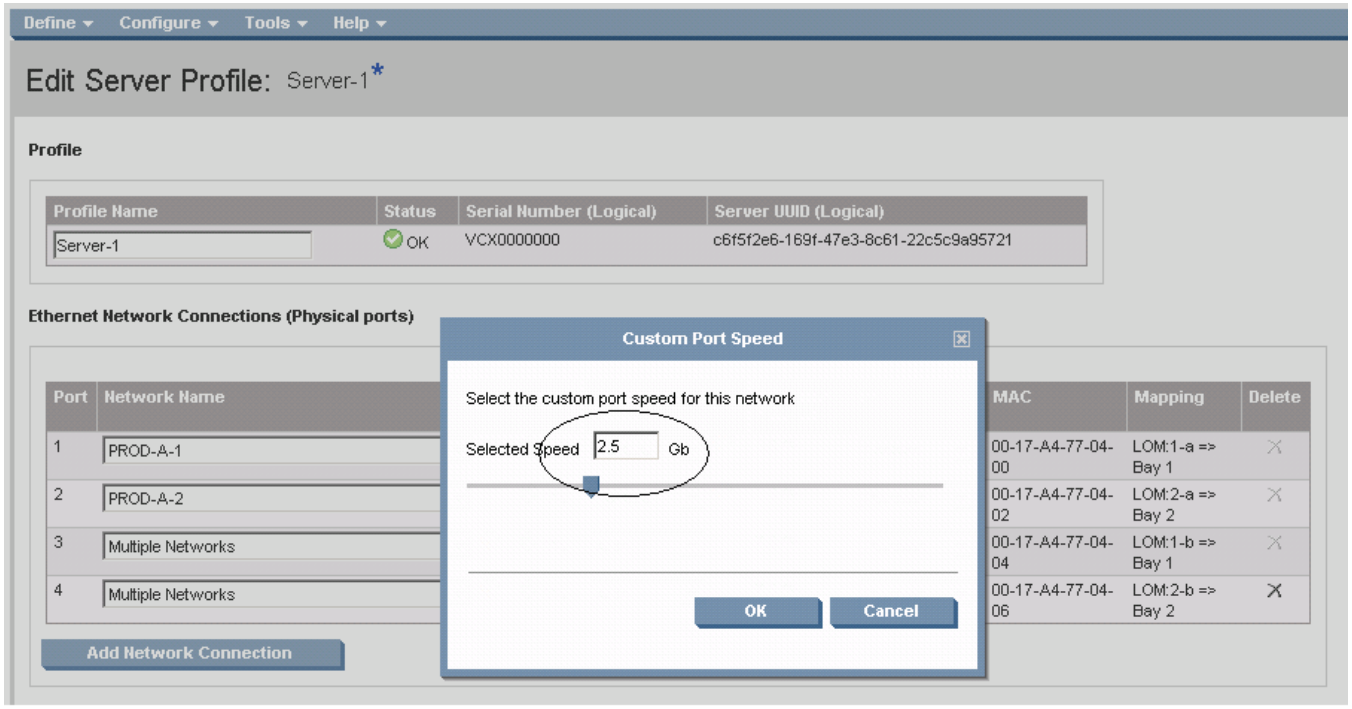
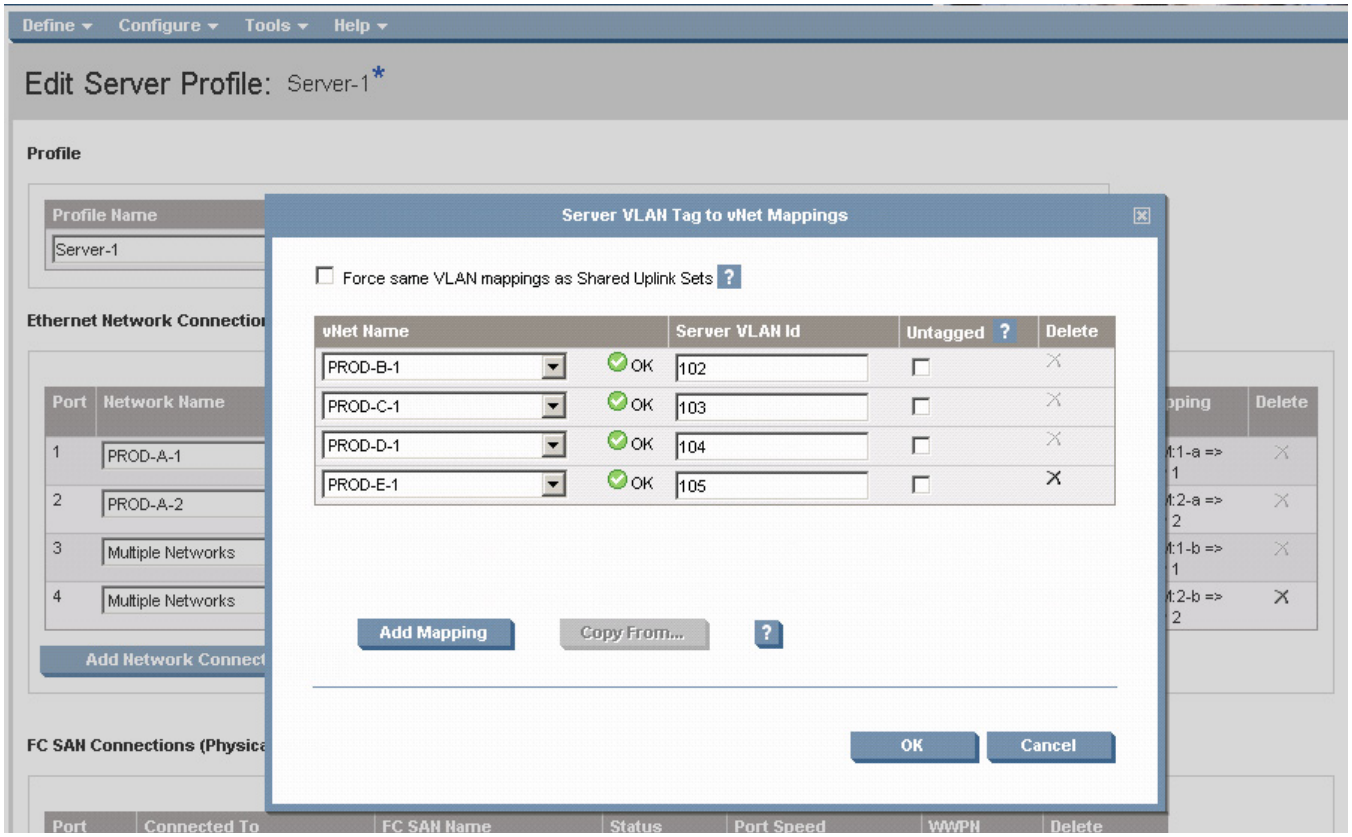



**Figure 2-36** Configuring Multiple Networks.



# Summary

This profile will present NIC 1 to network "PROD-A-1" & NIC 2 to network PROD-A-2 which are mapped to VLAN 101 (management network); frames for VLAN 101 will be passed to NICs 1&2 untagged. NICs 3&4 are connected to "Multiple Networks" (Production VLANs), PROD-B-1 – PROD-E-1 and PROD-B-2 – PROD-E-2, which are mapped to VLANs 102 – 105; frames will be passed to NICs 3&4 will be tagged.

If additional NICs are required, simply add the NICs to the server profile, this configuration will support up to 8 NICs without adding additional hardware. If the performance demands of a NIC change, the speed of a NIC could be adjusted up or down

When the blade occupying enclosure Bay 1 is powered up, it will have 4 physical NICs connected to networks, PROD-A-1, PROD-A-2, PROD-B-1 and PROD-B-2. If additional NICs are required, simply go to the virtual connect profile and add the required number of NICs, configure them for the appropriate networks, speed and apply the profile. Verify the configuration change through the OA, VCEM and/or ILO.

In order for Hyper-v to provide network redundancy Windows NIC teaming will be utilized. It is important to note that the Hyper-V role should be installed BEFORE the HP ProLiant Network teaming Software is installed.

# Result

The following graphics provide an example of a Windows 2008R2 server with 4 NICs configured and connected to the VC Networks as discussed earlier. The Disabled network connections are the 4 remaining and un-configured FlexNICs.

This configuration has provided us with 4 NICs total. Two of the NICs are configured for a 2.5Gb link, this will be connected to the management network. The last two NICs are configured for 7.5Gb link and will be used to support several VLANs.

In order to provide network redundancy each of these NIC pairs will be teamed using the HP ProLiant Network Teaming Software.

As Windows 2008R2 network adapter enumeration order is not clear, will need to determine with NIC is connected to which VC module/port. In order to provide NIC teaming redundancy, we want to team NIC a NIC connect to the VC module in Bay 1 with a NIC connected to the VC module in Bay 2. The simplest way to determine which NIC is which, is by locating the MAC address of each NIC.

Open the Network Connections screen in Windows 2008R2, as in the following graphic. You can see that four of the NICs are disconnected, this can be disabled in this interface as they are unused FlexNICs.

The remaining NICs should be identified by their MAC address. Rename each Connection with a name that can be referred to later when building the NIC teams.

**Figure 2-37** Windows 2008 Network Connections (4 Active Connections).

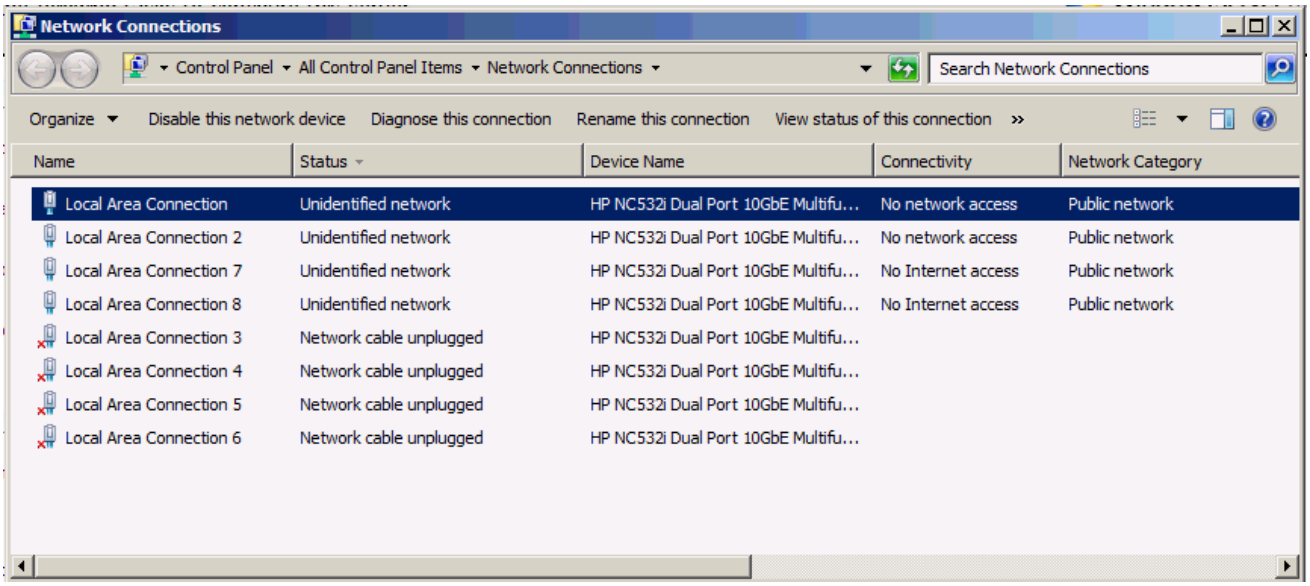
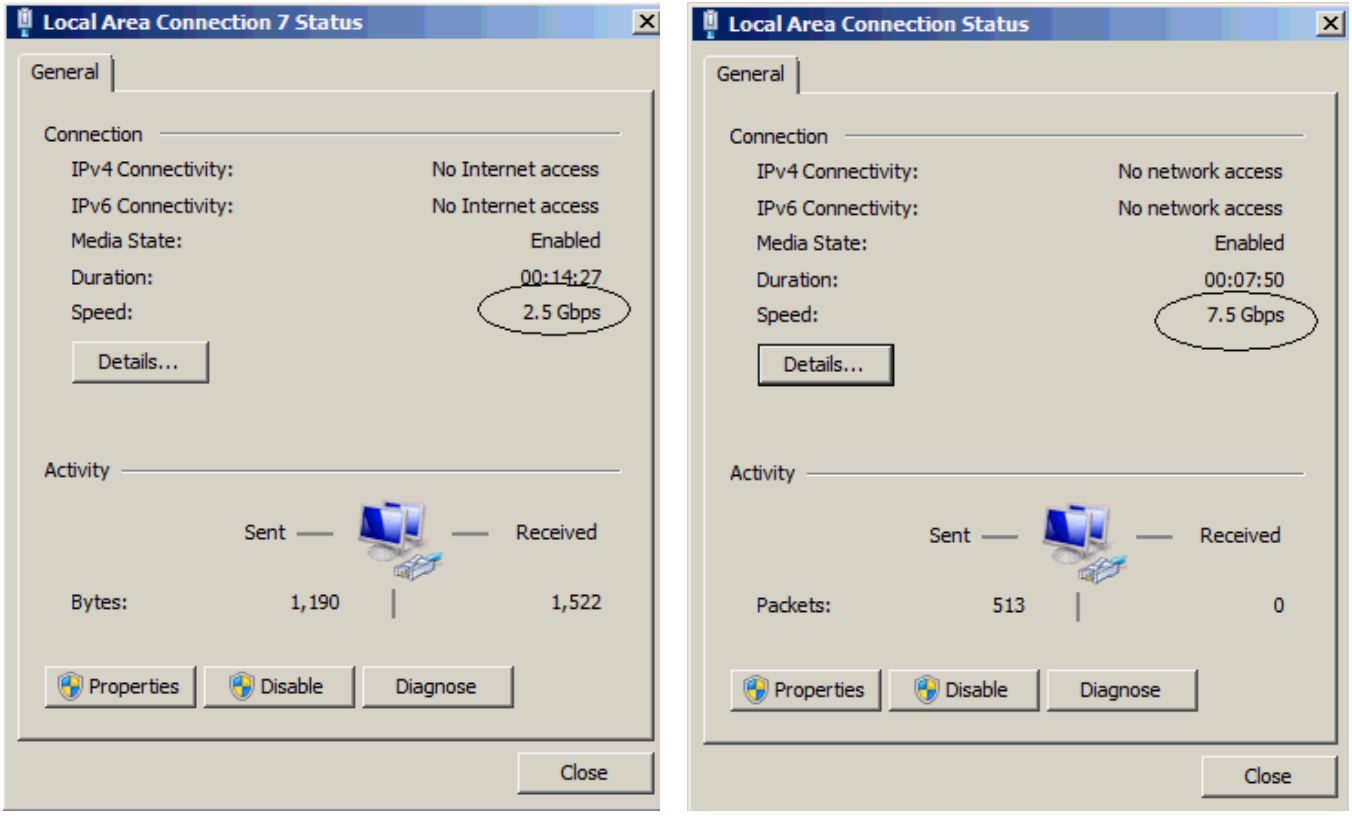
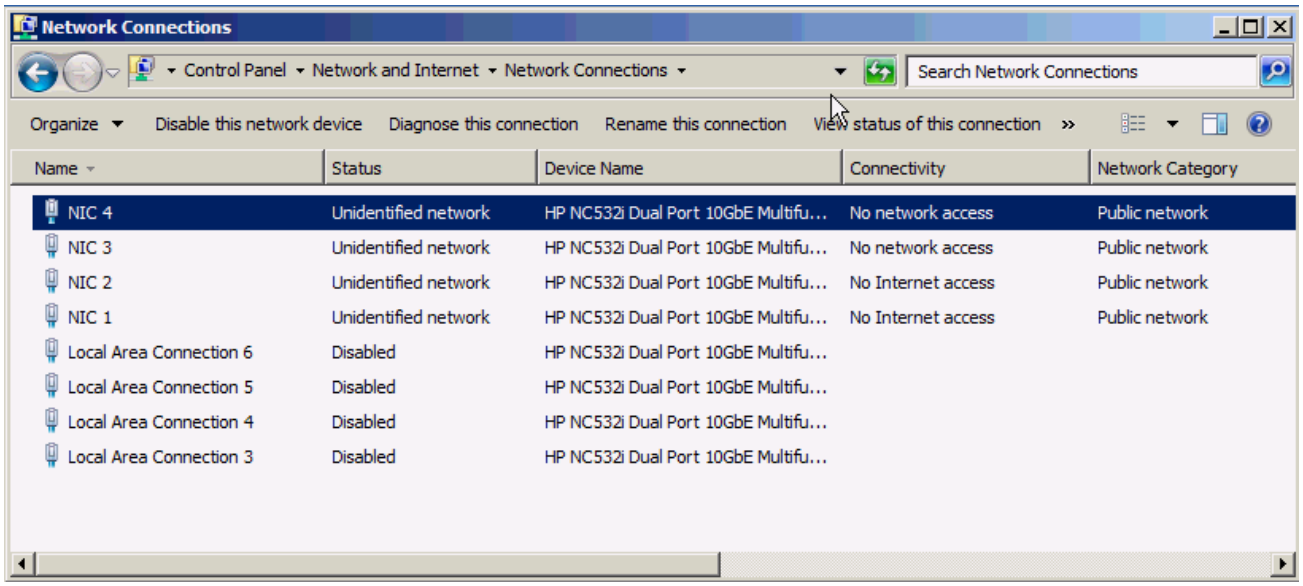



**Figure 2-38** Windows 2008R2 Network Connections NIC Speed.




**Note:** Windows 2008R2 displays the correct link speed values

**Figure 2-39** Windows 2008 Network Connections (4 Active Connections – Renamed).




Ensure that the Hyper-V role has been installed and configured, then install the latest version of the HP ProLiant Network Teaming Software and run the utility. Notice the NIC Names that were set earlier. You can also highlight each NIC and select properties to verify the MAC address of the NIC before creating the team.

## Configuring NIC teaming

To create the NIC team for the Management network, Select NIC 1 and NIC 2, click TEAM, Click on the TEAM name and rename it to Management, then save the TEAM. Click on the remaining two NICs and team these separately and rename this team to Production. Click OK.

**Figure 2-40** HP ProLiant Network Configuration Utility.

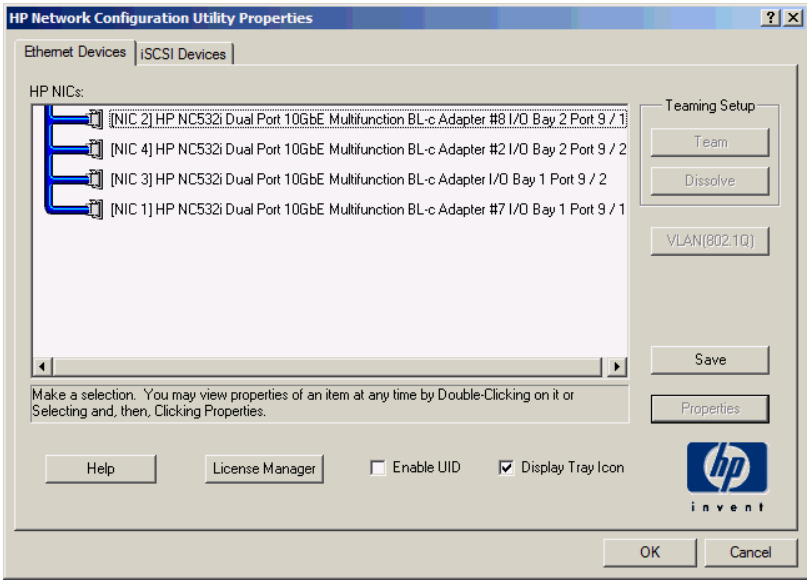
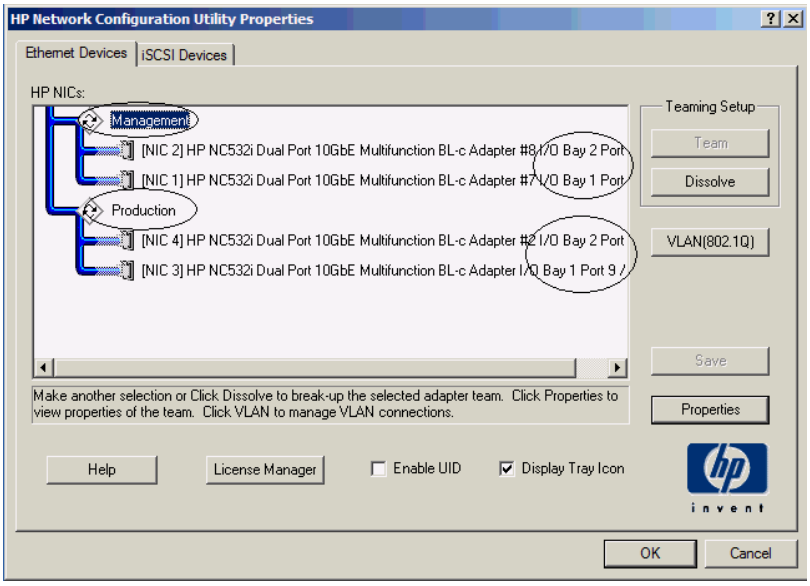


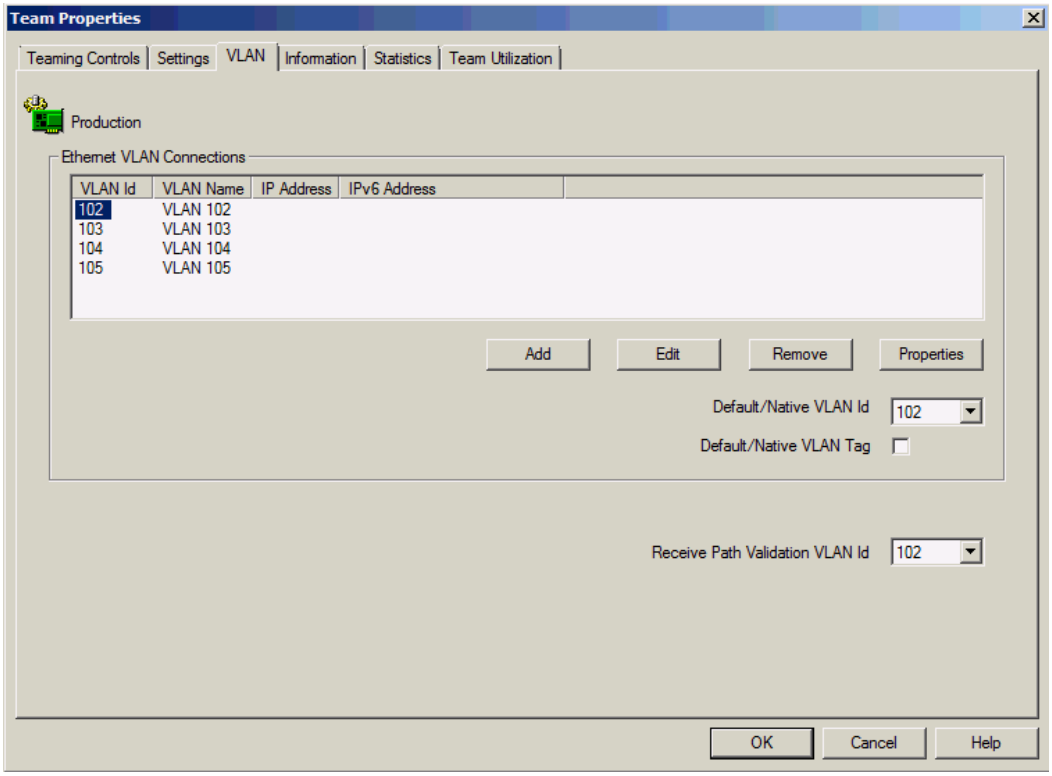
**Figure 2-41** HP ProLiant Network Configuration Utility with both teams created.




## Creating the VLANs within NIC Teaming

Highlight the Production NIC team and click the VLAN (802.1Q) button on the right and create a VLAN for each VLAN that this NIC team will support.

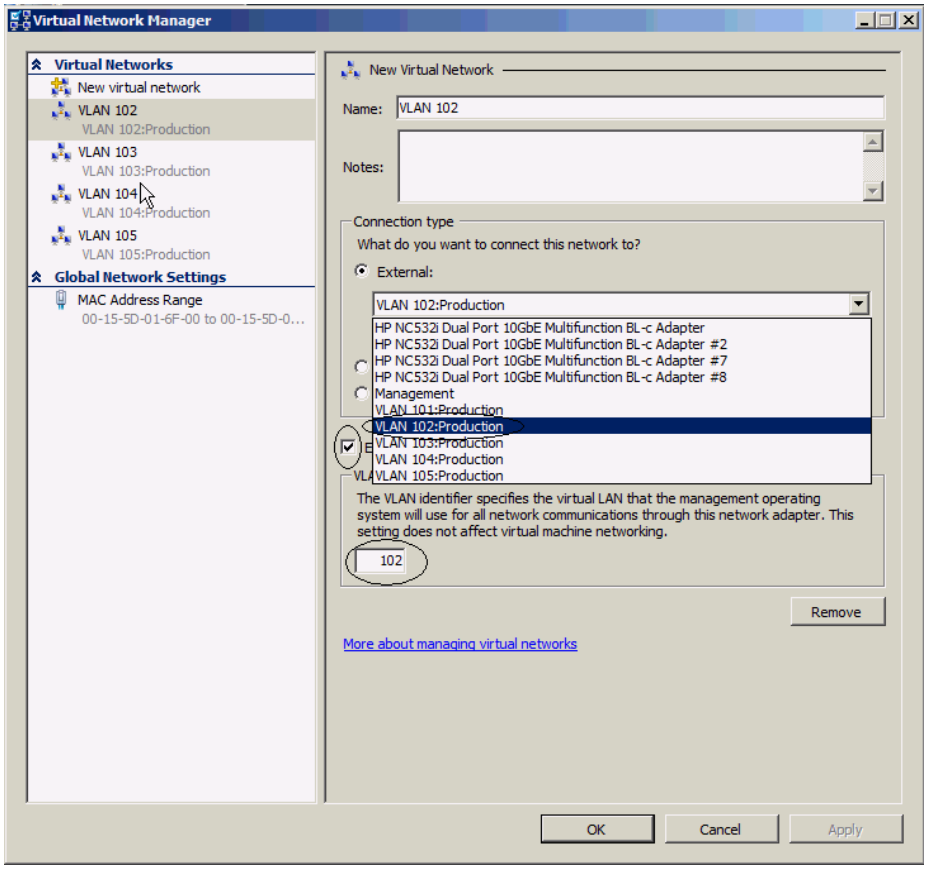
**Figure 2-42** HP ProLiant Network Configuration Utility VLAN configurations for Production Team.



## Creating the Hyper-V Virtual Network

Run the Hyper-V Manager, open the Virtual Network Manager and create a new External Virtual Network for each VLAN that was created within the NIC team, enable the VLAN ID check box and enter the VLAN ID for this VLAN. Click Apply.

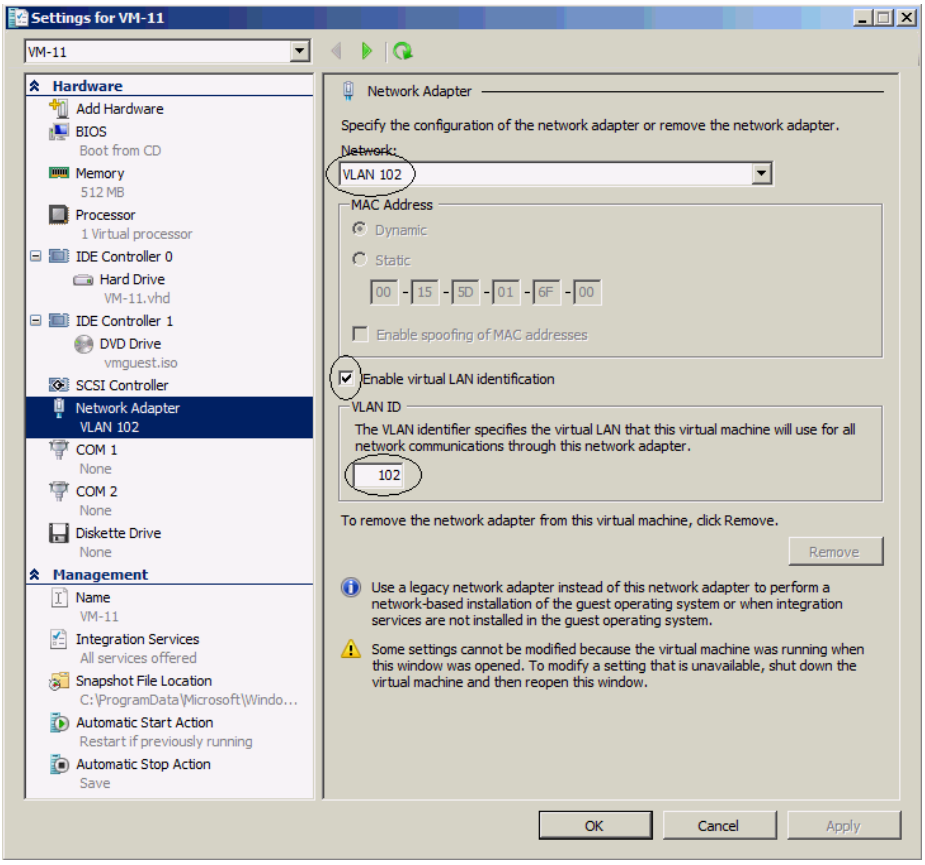
**Figure 2-43** Hyper-V Virtual Network Manager.



## Assigning a Virtualization Manager to a Network/VLAN

Run the Hyper-V Manager and select HP Insight Virtualization Manager software that requires a network connection to be made. Select Setting for that Virtualization Manager, click the Network Adapter, under the Network drop down box, select the appropriate VLAN (VLAN 102), enable virtual LAN identification and enter the appropriate VLAN ID for this system and apply the settings.

**Figure 2-44** Configure Virtualization Manager network settings.

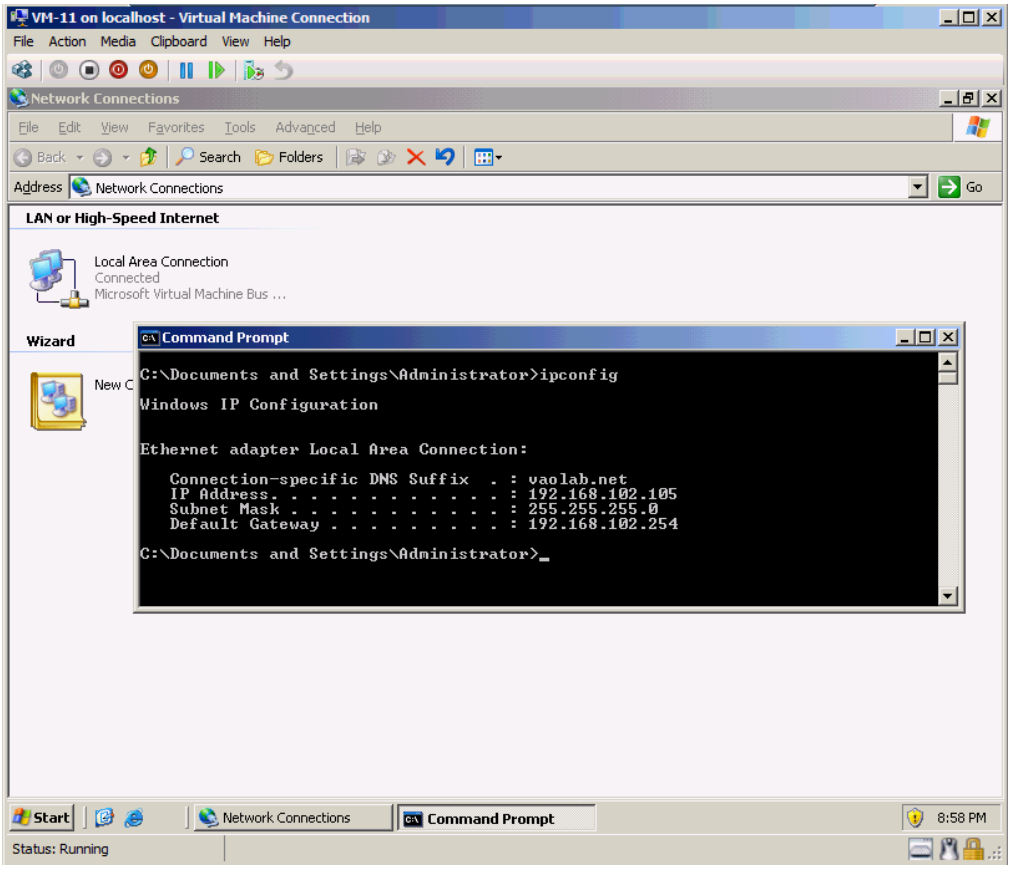



Once this Virtualization Manager is powered on, the management NIC team would be connected to the management network through NIC 1 & 2. The Production VLANs network will present the Virtualization Manager with a connection that the VLAN as configured. Frames will be handed to the Virtualization Manager without tags. As the Production VLANs network is based on a NIC team, as is the management connection to this server, in the event of a module or uplink failure, the NIC team would manage path fail-over to the alternate NIC.

## Verify that the Guest is connected to the correct VLAN

Open a console to the Virtualization Manager and verify that it is in the correct VLAN.

**Figure 2-45** Verify guest VM received an IP address for the correct VLAN.



# Scenario 2:3 - Flex-10 - VLAN Tagging (802.1Q) with Multiple Shared Uplink Sets (SUS) and Mapped VLANs - ESX 4

## Overview

This scenario discusses the Flex-10 features provided in Virtual Connect. For an overview of Flex-10, please refer to the following technology brief. HP Flex-10 technology brief;

http://h20000.www2.hp.com/bc/docs/support/SupportManual/c01608922/c01608922.pdf

Virtual Connect Flex-10 provides the ability to either present the 10Gb server NICs as single 10Gb NICs, or divide each NIC into as many as 4 "physical function" NICs per NIC port. These physical function NICs look to the server hardware and OS as physical NICs, have their own MAC address and can be configured at speeds from 100Mb to 10Gb.

As shown in earlier scenarios, VLAN access can be handled in two different ways. Virtual Connect can either pass VLAN/Non-VLAN traffic untouched to the host (Tunneling Mode) or Virtual Connect can handle all VLAN tagging (Server Mapped VLANs). Each has their advantages as discussed in the Introduction to Virtual Connect section, earlier in this document.

This scenario, using Map VLAN Tags, will focus more on the Virtual Connect Flex-10 technology. In this scenario we have two10Gb uplinks configured with multiple VLANs. We will configure a VMware ESX server with SIX NICs, 3 per NIC port, configured at various speed. Some NICs will be connected to specific VLANs, so frames will be presented without tags, others will be configured with multiple networks, were frames will be presented with tags. We will also show how the speed of each NIC can be varied from speeds ranging between 100Mb to 10Gb.

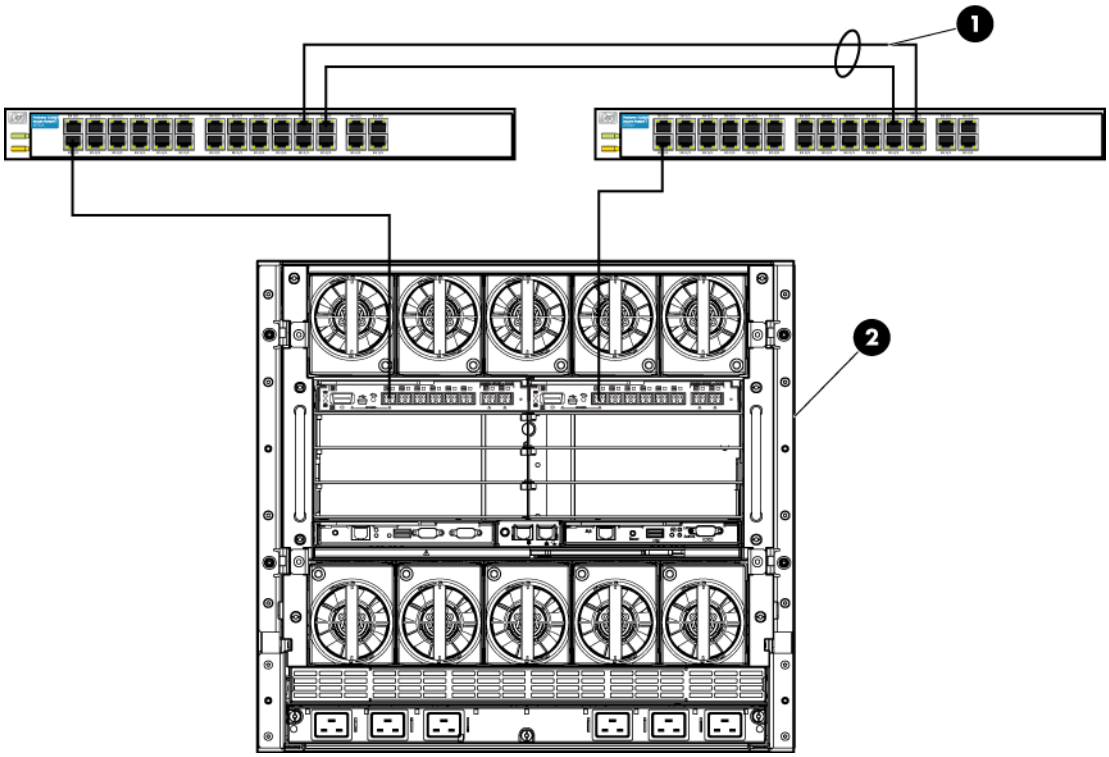
**Table 2-2** Flex-10 NIC – Optimization for a VMWARE ESX implementation

| | Console NIC #1 | VMotion NIC #2 | Production NIC #3 | Console NIC #4 | VMotion NIC #5 | Production NIC #6 |
|---|---|---|---|---|---|---|
| Traditional 1Gb technology | 1Gb | 1Gb | 1Gb | 1Gb | 1Gb | 1Gb |
| Virtual Connect Flex-10 | 500Mb | 2.5Gb | 7Gb | 500Mb | 2.5Gb | 7Gb |

# Requirements

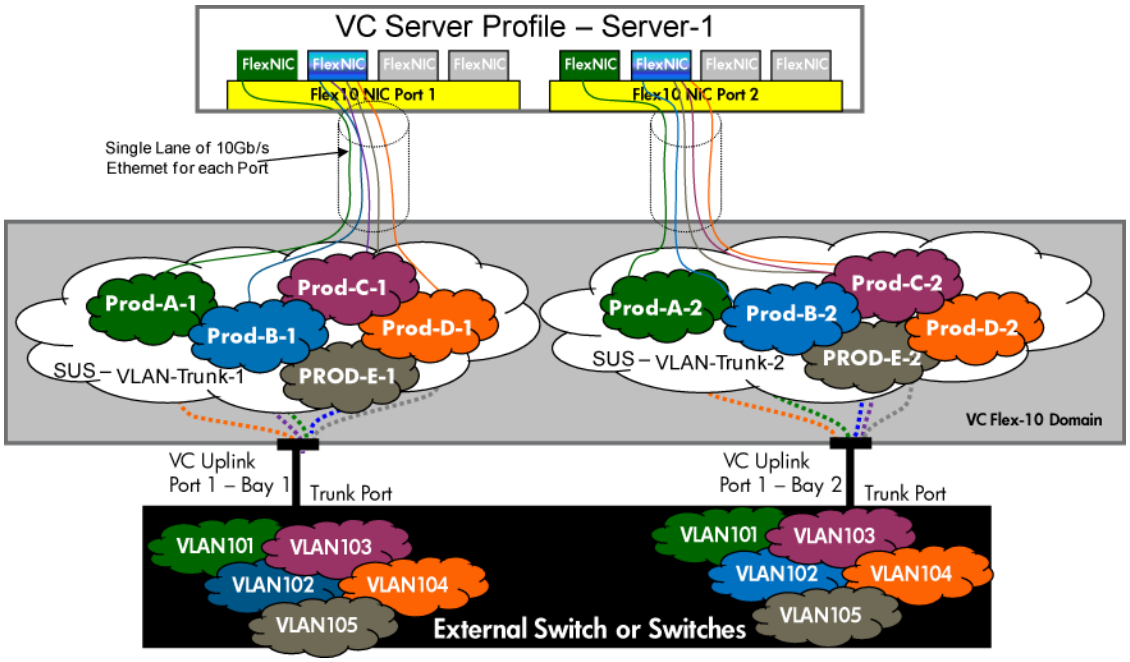
In order to implement this scenario, an HP BladeSystem c7000 enclosure with one of more Blade G6 servers with 10Gb NICs and TWO Virtual Connect Flex-10 Ethernet modules, installed in Bays 1& 2 are required. In addition, we will require ONE or TWO external Network switches. As Virtual Connect does not appear to the network as a switch and is transparent to the network, any standard managed switch will work with Virtual Connect.

**Figure 2-46** Physical View; Shows one 10Gb Ethernet uplink from Ports 1 on Module 1 to Port 1 on the first network switch and one 10Gb uplink from Port 1 on Module 2 to Port 1 on the second network switch.




| Item | Description |
|---|---|
| 1 | Switch Cross Connect |
| 2 | c7000 Enclosure, rear view |

**Figure 2-47** Server Blade profile with TWO Flex-10 NICs configured. Each NIC is connected to a vNet (PROD-A-1 and PROD-A-2), the additional NICs are connected to other networks, which are also 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 X1 on VC module 1 and Port X1 on VC module 2, creating an Active/Active uplink.




# Installation and configuration

## Switch configuration

Appendices A and B provide a summary of the commands required to configure the switch in either a Cisco IOS or a ProCurve network infrastructure. The configuration information provided in the appendices assumes the following information:

- The switch ports are configured as TRUNK ports to support VLANs 101, 102, 103, 104 and 105. All frames will be forwarding to VC with VLAN tags.
- When adding the additional uplinks to the SUS, the switch ports connected to Virtual Connect will need to be configured for LACP and configured for the same Link Aggregation Group.

## 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 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 can 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 (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 Map VLAN Tags via GUI (Ethernet settings)

Note: Flex-10 has also provided additional controls when configuring VC for mapped VLAN tags (Multiple Networks over a single link) support. These features provide the ability to set a Custom or Preferred network speed value for each NIC. These are VC domain settings and when configured will limit the maximum configurable speed of a NIC.

Enable Map VLAN Tags within Virtual Connect

- On the Virtual Connect Manager screen, Left pane, click Ethernet Settings, Advanced Settings
- Select Map VLAN Tags
- Select Fast MAC Cache Fail-over with a refresh of 5
- Optionally, select a preferred/Maximum link speed
- Select Apply

## Configuring the VC Module for Map VLAN Tags via CLI (Ethernet settings)

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

# Set Advanced Ethernet Settings to "Map VLAN Tags" and set "Force server connections" to disabled

set enet-vlan vlantagcontrol=map sharedservervlanid=false

set mac-cache Enabled=True Refresh=5

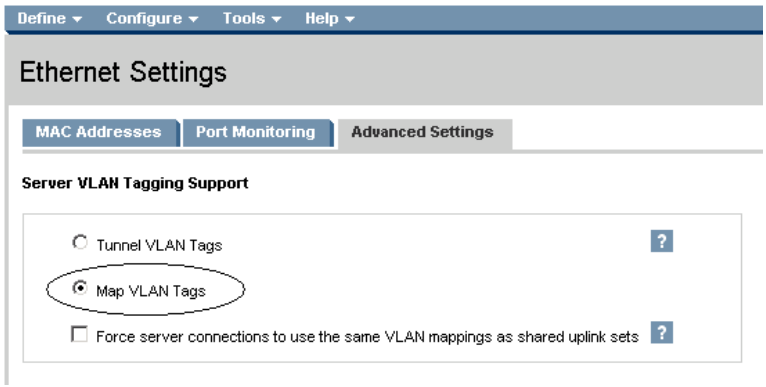
**Note:** Do not set a Preferred or Max speed for this scenario. This example is provided for reference only. For the purpose of this scenario, we will not be configuring the custom values for Preferred Link or Maximum Connection speeds. However, the CLI commands are provided below for reference.

Selecting the Set a Customer value for Preferred Link Connection Speed and/or Set a Customer value for Maximum Link Connection Speed, Sets the respective speed for all connections using multiple networks to 500Mb and maximum connection speed to 2.5Gb.

# Set Advanced Ethernet Settings to a Preferred speed of 500Mb and a Max Speed of 2500Mb

set enet-vlan PrefSpeedType=Custom PrefSpeed=500 MaxSpeedType=Custom MaxSpeed=2500

**Figure 2-48** Ethernet Settings.



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

Connect Port X1 of VC module 1 to Port 1 on switch 1

Create a SUS named “VLAN-Trunk-1” and connect it to Flex-10 Port X1 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;
  a. Enclosure 1, Bay 1, Port X1
- Add Networks as follows;
  a. PROD-A-1 = VLAN ID=101
  b. PROD-B-1 = VLAN ID=102
  c. PROD-C-1 = VLAN ID=103
  d. PROD-D-1 = VLAN ID=104
  e. PROD-E-1 = VLAN ID=105
- Enable SmartLink on ALL Networks
- Click Apply

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

Connect Port X1 of VC module 2 to Port 1 on switch 2

Create a SUS named “VLAN-Trunk-2” and connect it to Flex-10 port X1 on Module 2

- On the Virtual Connect Home page, select Define, Shared Uplink Set
- Insert Uplink Set Name as VLAN-Trunk-2
- Select Add Port, then add the following port;
  a. Enclosure 1, Bay 2, Port X1
- Add Networks as follows;
  a. PROD-A-2 = VLAN ID=101
  b. PROD-B-2 = VLAN ID=102
  c. PROD-C-2 = VLAN ID=103
  d. PROD-D-2 = VLAN ID=104
  e. PROD-E-2 = VLAN ID=105
- Enable SmartLink on ALL Networks
- Click Apply

## 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:X1 Uplinkset=VLAN-Trunk-1 speed=auto

# Create Networks Prod-A-1 through Prod-D-1 for Shared Uplink Set "VLAN-Trunk-1"
add network PROD-A-1 uplinkset=VLAN-Trunk-1 VLanID=101
Set Network PROD-A-1 SmartLink=Enabled
add network PROD-B-1 uplinkset=VLAN-Trunk-1 VLanID=102
Set Network PROD-B-1 SmartLink=Enabled
add network PROD-C-1 uplinkset=VLAN-Trunk-1 VLanID=103
Set Network PROD-C-1 SmartLink=Enabled
add network PROD-D-1 uplinkset=VLAN-Trunk-1 VLanID=104
Set Network PROD-D-1 SmartLink=Enabled
add network PROD-E-1 uplinkset=VLAN-Trunk-1 VLanID=105
Set Network PROD-E-1 SmartLink=Enabled
```

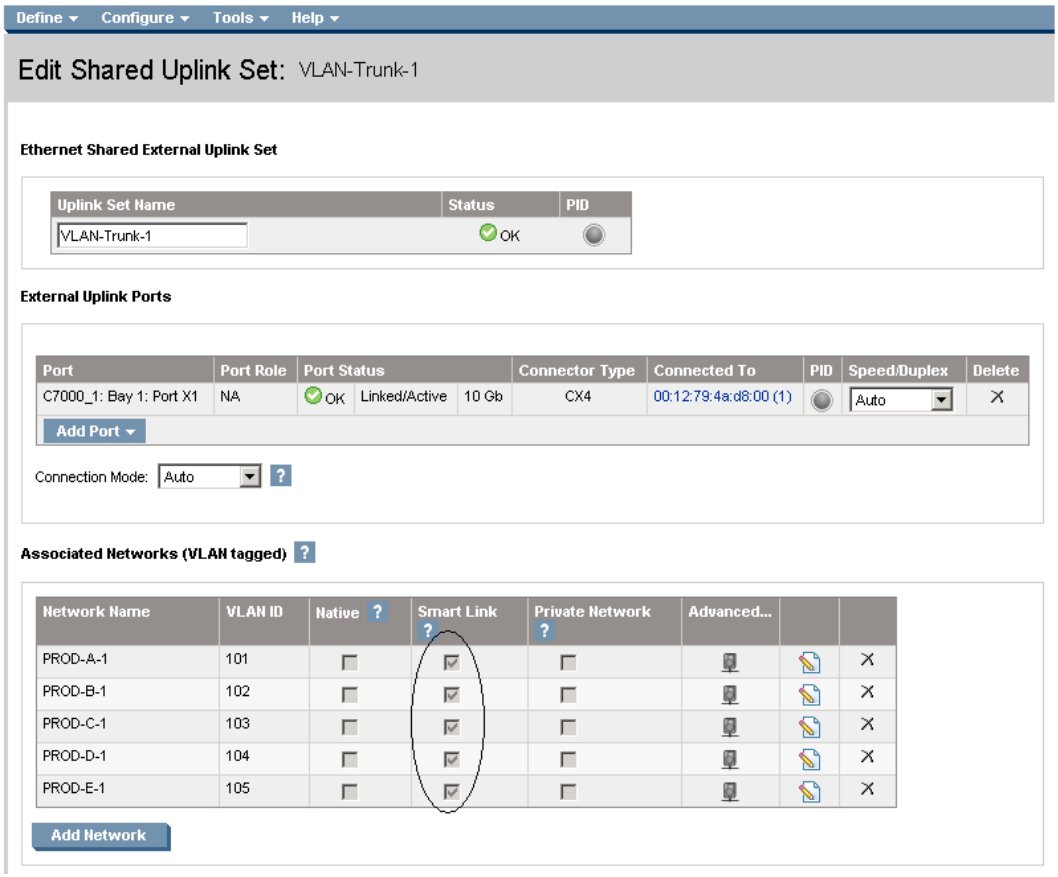
The following script can be used to create the Second Shared Uplink Set (VLAN-Trunk-2)

```
# Create Shared Uplink Set "VLAN-Trunk-2" and configure uplinks
add uplinkset VLAN-Trunk-2
add uplinkport enc0:2:X1 Uplinkset=VLAN-Trunk-2 speed=auto

# Create Networks Prod-A-2 through Prod-D-2 for Shared Uplink Set "VLAN-Trunk-2"
add network PROD-A-2 uplinkset=VLAN-Trunk-2 VLanID=101
Set Network PROD-A-2 SmartLink=Enabled
add network PROD-B-2 uplinkset=VLAN-Trunk-2 VLanID=102
Set Network PROD-B-2 SmartLink=Enabled
add network PROD-C-2 uplinkset=VLAN-Trunk-2 VLanID=103
Set Network PROD-C-2 SmartLink=Enabled
add network PROD-D-2 uplinkset=VLAN-Trunk-2 VLanID=104
Set Network PROD-D-2 SmartLink=Enabled
add network PROD-E-2 uplinkset=VLAN-Trunk-2 VLanID=105
Set Network PROD-E-2 SmartLink=Enabled
```

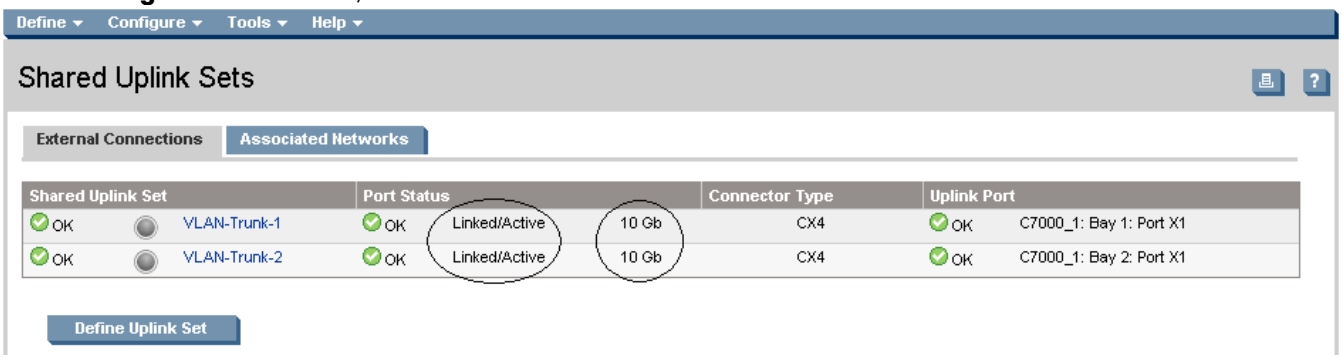
**Note:** It is important to point out at this time, if you are familiar with VC scripting, or have existing VC scripts that you had used on Virtual Connect 1:10 modules, and may want to use with Flex-10, the numbering of the Flex-10 external ports is different than with early modules of VC. VC-E and VC-F uplinks ports are numbered as Ports 1, 2, 3 etc., however; Flex-10 ports are referenced as X1, X2, X3 etc., plus some of the ports are shared, IE the CX4 is shared with SFP+ Port X1, both are configured as X1, but only one is usable at a time. If a CX-4 cable is connected the SFP+ port will become disable, the same is true for Ports X7 & X8, which are the internal cross connect ports, the cross connects will disconnect, if an SFP+ module is plugged in Ports X7 or X8.

**Figure 2-49** Define a Shared Uplink Set (VLAN-Trunk-1) and add VLANs.



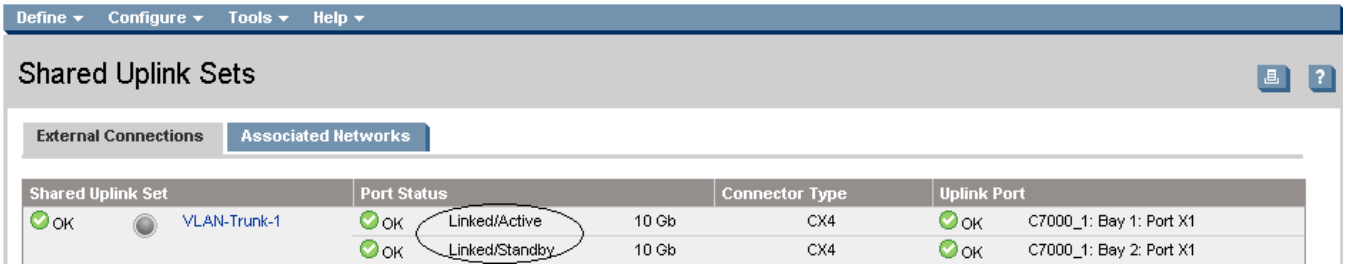

**Note:** The "*Connected to*" field in the graphic above displays the MAC address and port number of the switch this uplink is connected to. This information is provided through LLDP discover and is not available in all switch products. This information can be very helpful when determining which switches and ports VC is connected to.

**Figure 2-50** Active / Active SUS.




**Summary Note:** In this scenario we have created two independent Share Uplink Sets (SUS), each originating from the opposite VC-Modules, by doing so we provide the ability to create separate and redundant connections out of VC. 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 of these uplink ports to the same SUS, however, this would have provided an Active/ Standby uplink scenario.

**Figure 2-51** Example of an Active / Standby SUS.




## 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 "Server-1"
- In the Network Port 1 drop down box, select PROD-A-1, configure the speed as custom at 500Mb
- In the Network Port 2 drop down box, select PROD-A-2, configure the speed as custom at 500Mb
- In the Network Port 3 drop down box, select PROD-B-1, configure the speed as custom at 2.5Gb
- In the Network Port 4 drop down box, select PROD-B-2, configure the speed as custom at 2.5Gb
- In the Network Port 5 drop down box, select Multiple Networks, configure the speed as Auto
  - Configure Multiple Networks for PROD-C-1, PROD-D-1 and PROD-E-1
- In the Network Port 6 drop down box, select Multiple Networks, configure the speed as Auto
  - Configure Multiple Networks for PROD-C-2, PROD-D-2 and PROD-E-2
- In the Assign Profile to Server Bay box, locate the Select Location drop down and select Bay 1, then apply

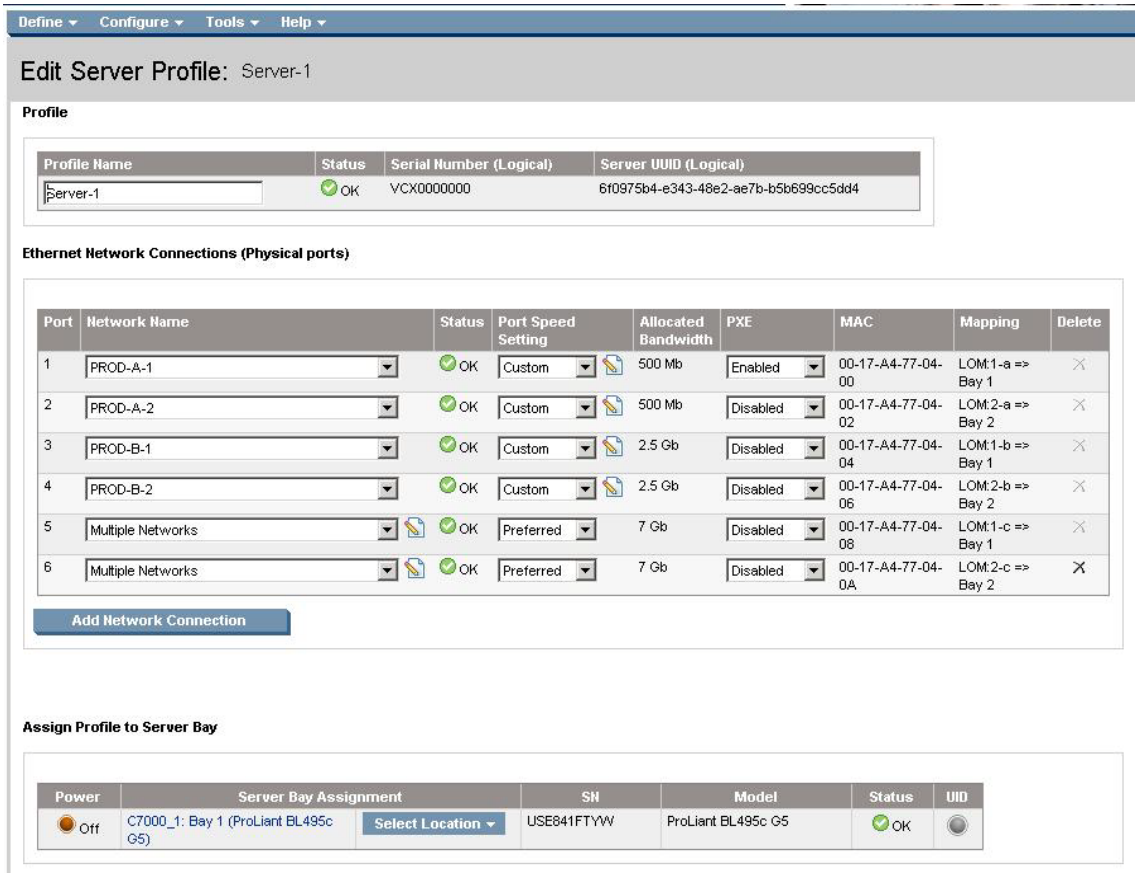
**Note:** you should now have a server profile assigned to Bay 1, with 6 Server NICs connected to the various networks. NICs 5&6 should have a link speed of 7.5Gb

## 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 Server-1
add profile Server-1 –nodefaultenetconn
add enet-connection Server-1 pxe=Enabled Network=PROD-A-1 SpeedType=Custom Speed=500
add enet-connection Server-1 pxe=Disabled Network=PROD-A-2 SpeedType=Custom Speed=500
add enet-connection Server-1 pxe=Disabled Network=PROD-B-1 SpeedType=Custom
Speed=2500
add enet-connection Server-1 pxe=Disabled Network=PROD-B-2 SpeedType=Custom
Speed=2500
add enet-connection Server-1 pxe=Disabled
add server-port-map Server-1:5 PROD-C-1 VLanId=103
add server-port-map Server-1:5 PROD-D-1 VLanId=104
add server-port-map Server-1:5 PROD-E-1 VLanId=105
add enet-connection Server-1 pxe=Disabled
add server-port-map Server-1:6 PROD-C-2 VLanId=103
add server-port-map Server-1:6 PROD-D-2 VLanId=104
add server-port-map Server-1:6 PROD-E-2 VLanId=105
Assign profile Server-1 enc0:1
```

**Figure 2-52** Define a Server Profile with 6 NICs.



## Server NIC Speed and LOM Mappings

We will now focus more of the specific Flex-10 features.

Note the "Allocated Bandwidth" and the LOM "Mapping" settings in the following graphic. Flex-10 based NICs have the ability of being configured as a Single 10Gb NIC or divided into as many as FOUR (4) physical NICs. It is important to note the LOM mappings when configuring which NIC will be connected to which network, as a NIC on a specific LOM can connect to a network only once. (IE, NIC LOM:1-a can be assigned to Prod-101-1, no other NIC on LOM:1 can be assigned to Prod-101-1) This is discussed in further details in the Flex-10 technology brief mentioned earlier in this document.

As additional NICs are added to a profile that is assigned to a server with a 10Gb Flex-NIC, the assignment will alternate between LOM:1-x and LOM:2-x. The first NIC will be LOM:1-a, the second will be LOM:2-a, then LOM:1-b, LOM:2-b etc. to a max of 4 NICs per LOM.

Also, note that if additional NICs are required, this server has only 6 NICs configured, we could ADD two more NICs to this server without adding additional hardware. As of Virtual Connect firmware 2.30, Virtual Connect will provide the ability to add/remove or reconfigure the server NICs, including NIC speed, while the server is running.

**Figure 2-53** Server NIC speed and LOM Mappings.

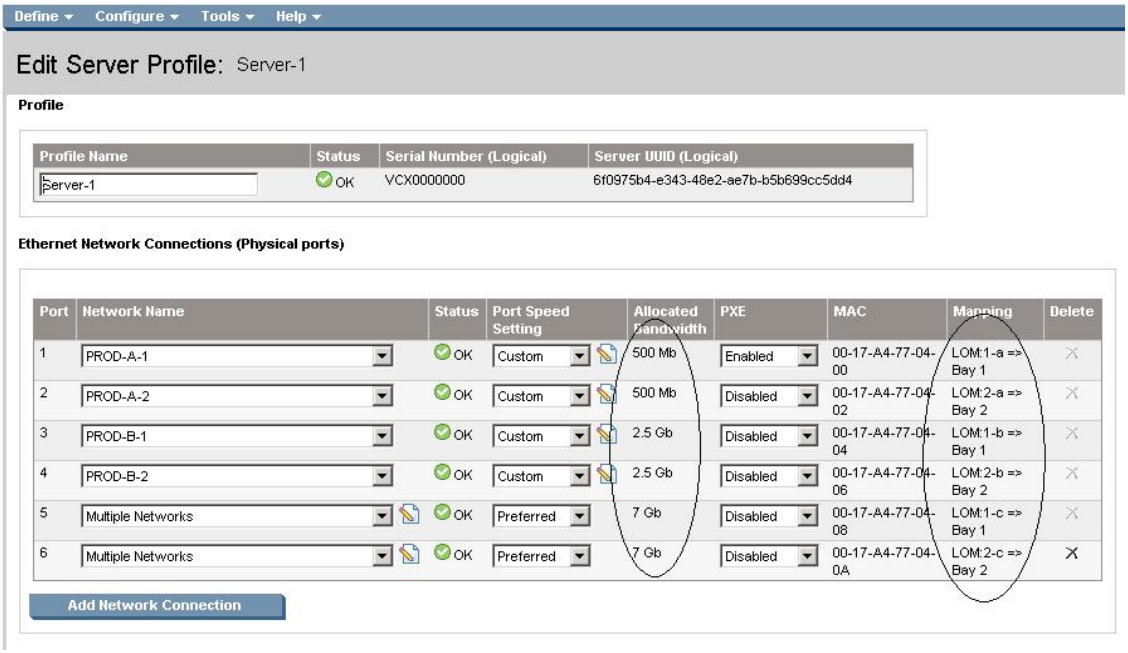


**Figure 2-54** Adjusting the NIC speed.

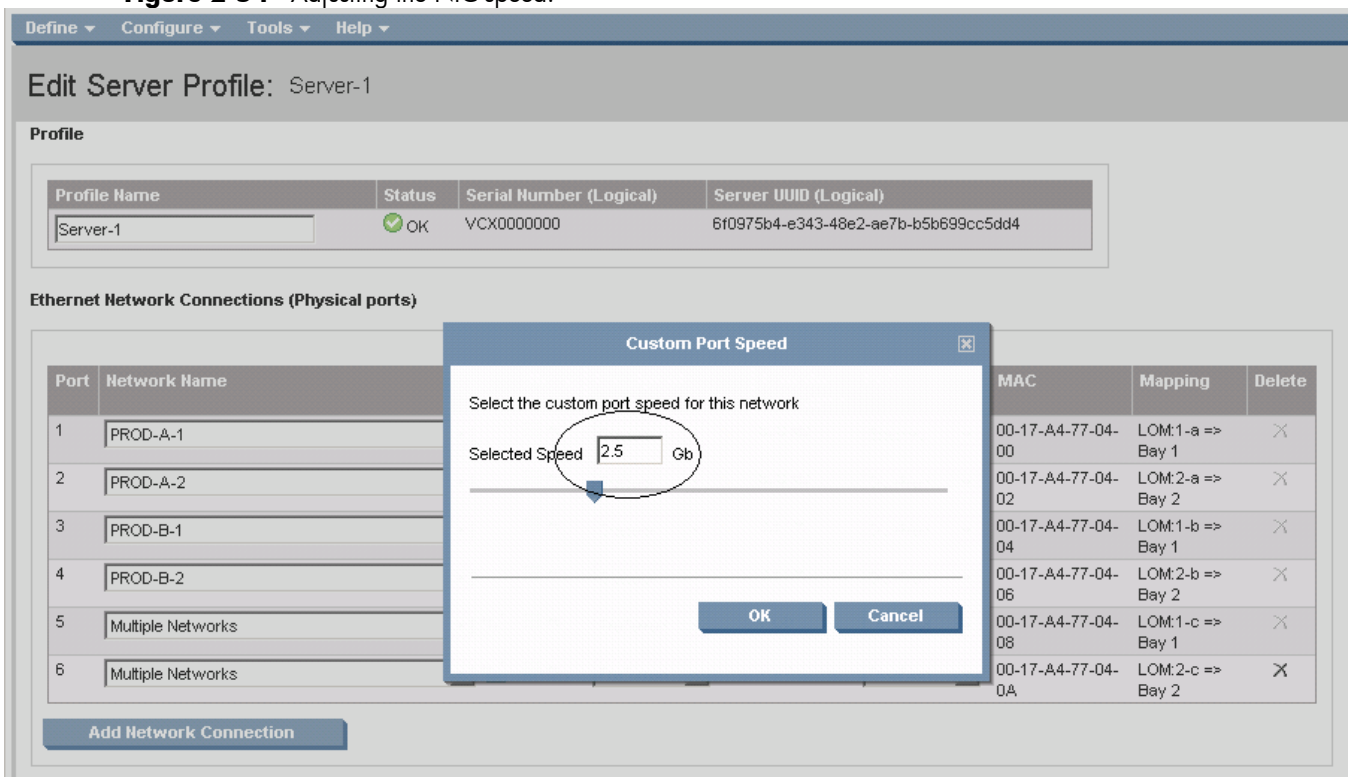
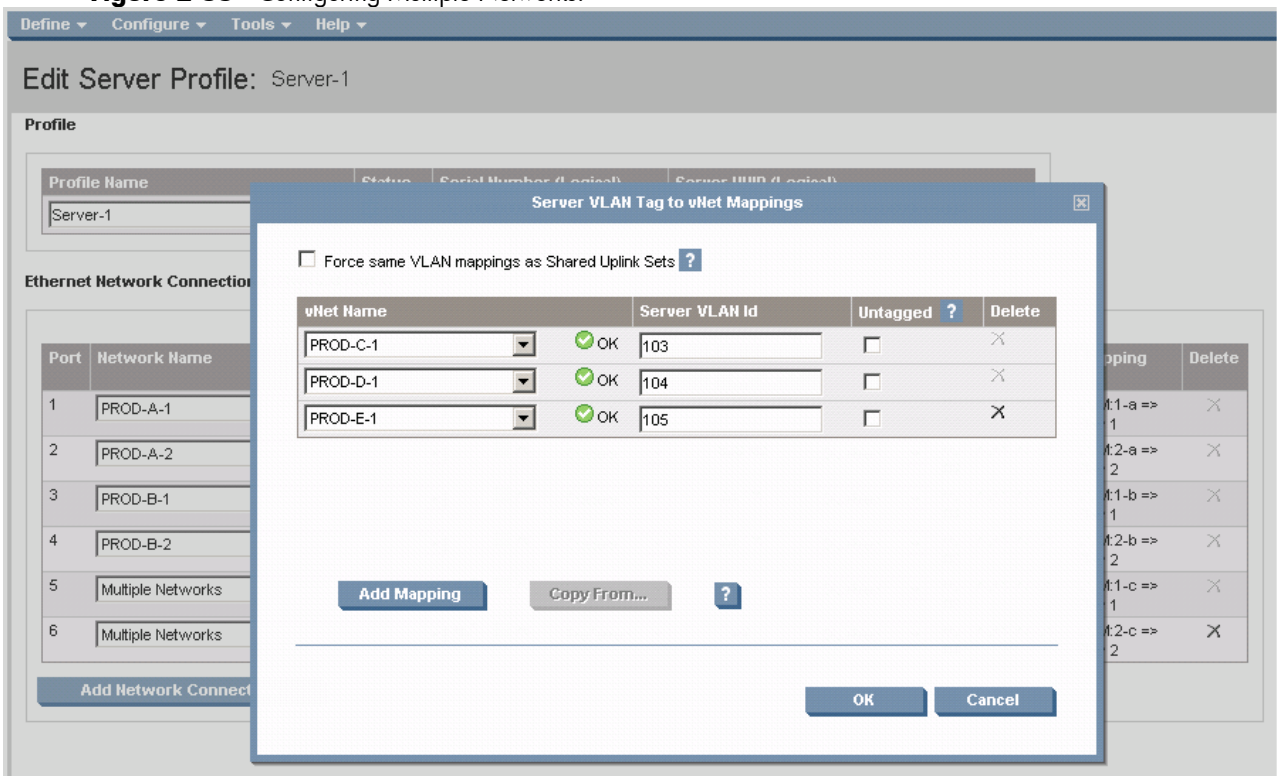



**Figure 2-55** Configuring Multiple Networks.



# Summary

This profile will present NIC 1 to network “PROD-A-1” & NIC 2 to network PROD-A-2 which are mapped to VLAN 101; frames for VLAN 101 will be passed to NICs 1&2 untagged. NICs 3&4 are connected to PROD-B-1 & PROD-B-2, which are mapped to VLAN 102; frames for VLAN 102 will be passed to NICs 3&4 untagged.

NICs 5&6 are connected to “Multiple Networks”, PROD-C-1 – PROD-E-1 and PROD-C-2 – PROD-E-2, which are mapped to VLANs 103 – 104; frames will be passed to NICs 5&6 will be tagged.

If additional NICs are required, simply add the NICs to the server profile, this configuration will support up to 8 NICs without adding additional hardware. If the performance demands of a NIC change, the speed of a NIC could be adjusted up or down.

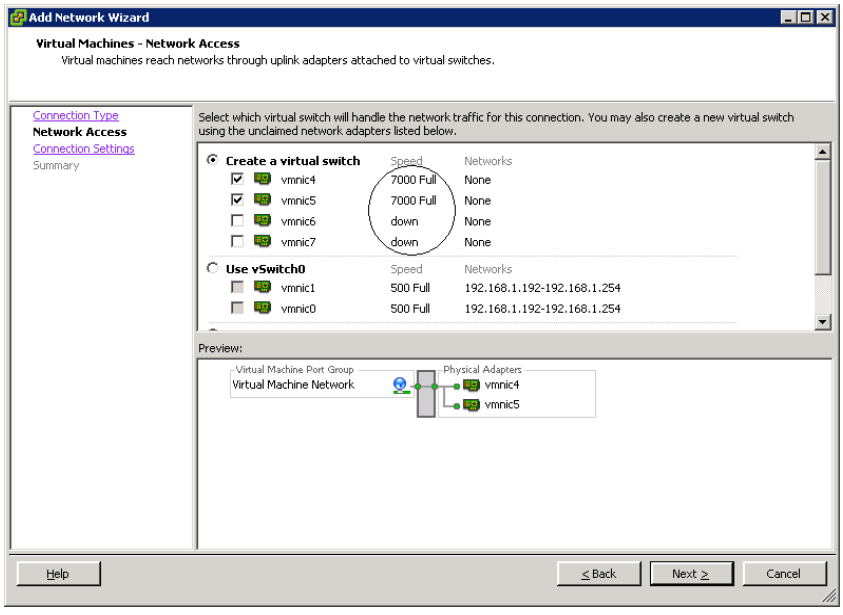
# Result

## VMware ESX Configuration Example

The following graphics show an ESX server with two Flex-10 NICs configured as 6 NICs. NICs speeds are also configured accordingly and connected to vSwitches, with port groups to present the VLANs accordingly.

When configuring the vSwitches for ESX, you will notice that 8 NICs actually already exist, however, NICs 7&8 (vmnic6 & vmnic7) are shown as down, as they were not configured within the VC profile. If we need an additional NIC, we simply add it within the Profile, set the speed and apply the profile, the server will need to be powered down to add or remove NICs. However, if the NICs were pre-provisioned within the profile, VC firmware 2.30 added the ability to dynamically, change network connections and link speed, without first powering the server off. Once added/connected to a network, the NICs will be available to be assigned to a vSwitch. Also, note vmnics 6&7 which were not provisioned within the profile and show link down.

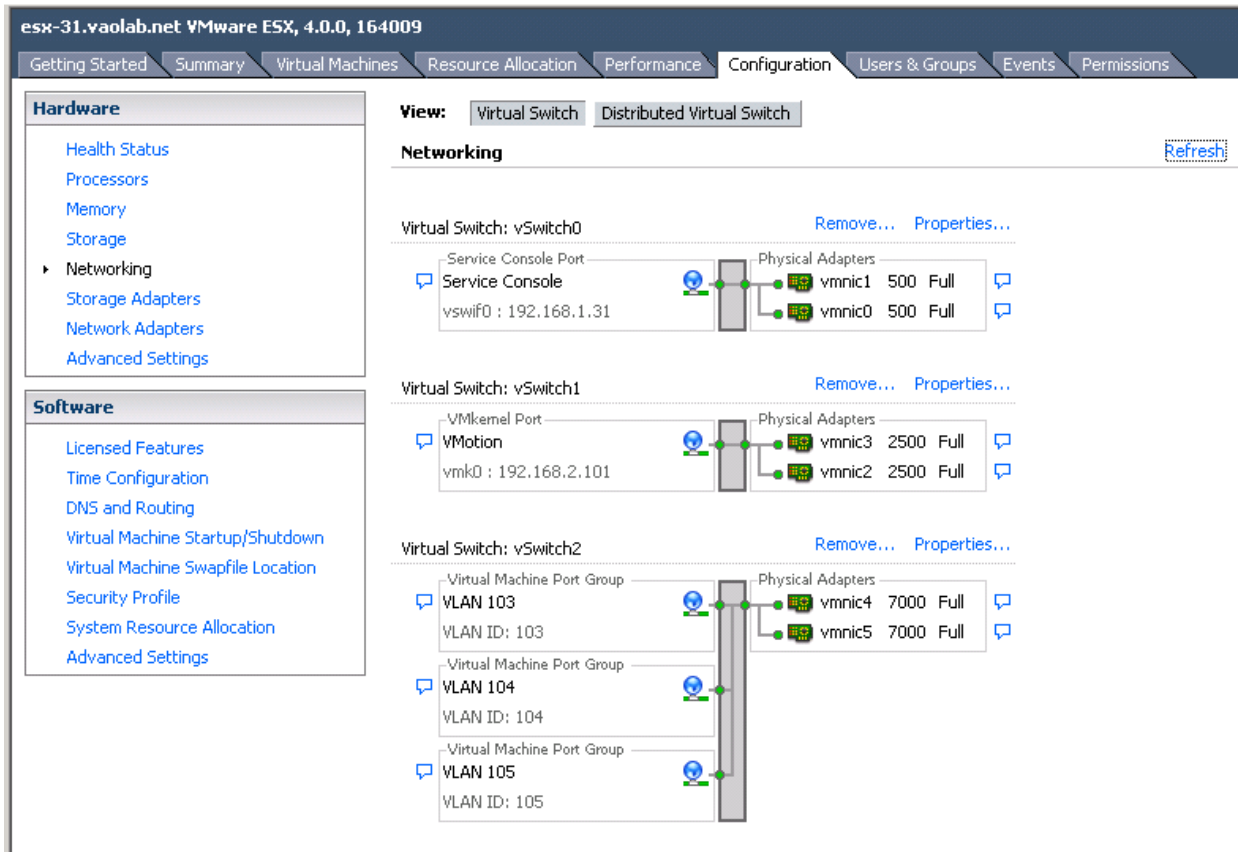
**Figure 2-56** Configuring ESX 4 vSwitch.



# ESX 4 Networking Configuration Example

The following graphics show an ESX 4 server with two Flex-10 NICs configured as six NICs.

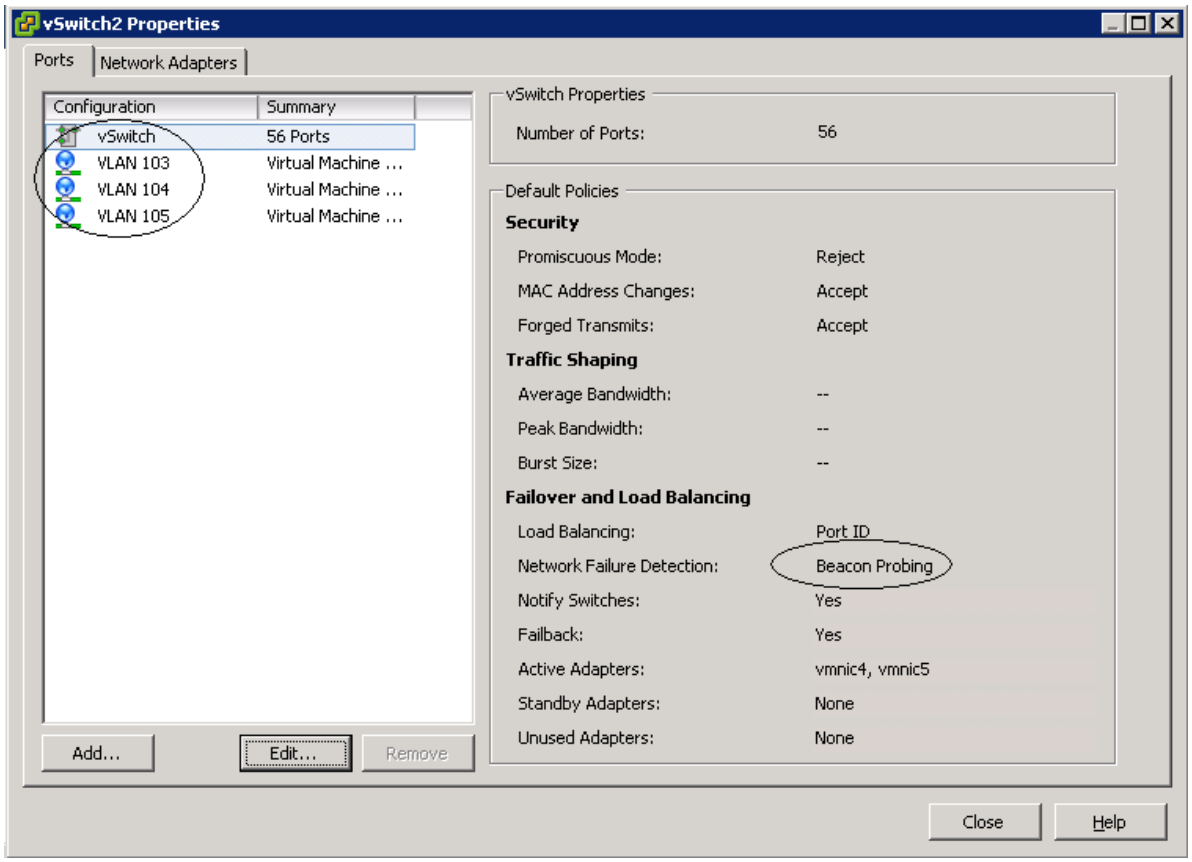
**Figure 2-57** vSwitch Configuration the ESX Host with 6 NICs.



## VMWARE ESX Host Networking configuration Example

When configuring the ESX virtual switch, add virtual networks for each VLAN this ESX host will support.

**Figure 2-58** Configuring the ESX vSwitch for Multiple Networks / VLANs.



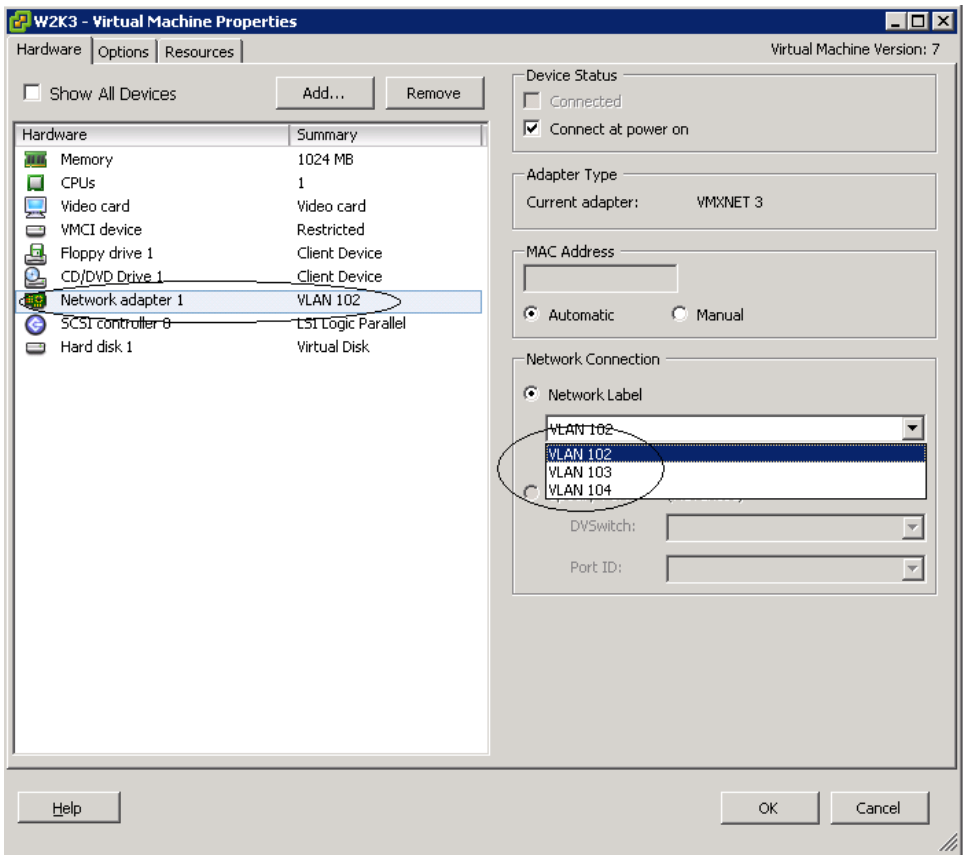

**Note:** That vSwitch2 has two NICs configured to redundantly, support VLANs 103, 104 and 105.

**Note:** If implementing ESX 3.5 on Flex-10, first review VMWARE KB 1007982 and ensure Network Failure Detection is set to Beacon Probing.

When configuring the guest NIC simply chose which VLAN this guest will reside on.

**Note:** If implementing ESX 4.0 on Flex-10 ensure that ESX driver version 1.52 is installed, also ensure that NIC firmware 5.2.7 is also installed.

**Figure 2-59** Selection of the Virtual Network (VLAN) as required.



# Scenario 2:4 - Flex-10 - VLAN Tagging (802.1Q) with Multiple Shared Uplink Sets (SUS) and Tunneled VLANs - ESX 4

## Overview

This scenario discusses the Flex-10 features provided in Virtual Connect. For an overview of Flex-10, please refer to the following technology brief. HP Flex-10 technology brief; http://h20000.www2.hp.com/bc/docs/support/SupportManual/c01608922/c01608922.pdf

Virtual Connect Flex-10 provides the ability to either present the 10Gb server NICs as single 10Gb NICs, or divide each NIC into as many as 4 "physical function" NICs per NIC port. These physical function NICs look to the server hardware and OS as physical NICs, have their own MAC address and can be configured at speeds from 100Mb to 10Gb.

As shown in earlier scenarios, VLAN access can be handled in two different ways. Virtual Connect can either pass VLAN/Non-VLAN traffic untouched to the host (Tunneling Mode) or Virtual Connect can handle all VLAN tagging (Server Mapped VLANs). Each has their advantages as discussed in the Introduction to Virtual Connect section, earlier in this document.

This scenario, using Tunneled VLAN Tags, will focus on how Virtual Connect can be sued to manage hundreds of VLANs. In this scenario we have two10Gb uplinks configured with a mix of VLAN connection types. We will configure a VMware ESX server with EIGHT NICs, 4 per NIC port, configured at various speed. Some NICs will be connected to specific VLANs, so frames will be presented without tags, others will be connected to a vNet where hundreds of VLANs are presented with tags. We will also show how the speed of each NIC can be varied from speeds ranging between 100Mb to 10Gb.

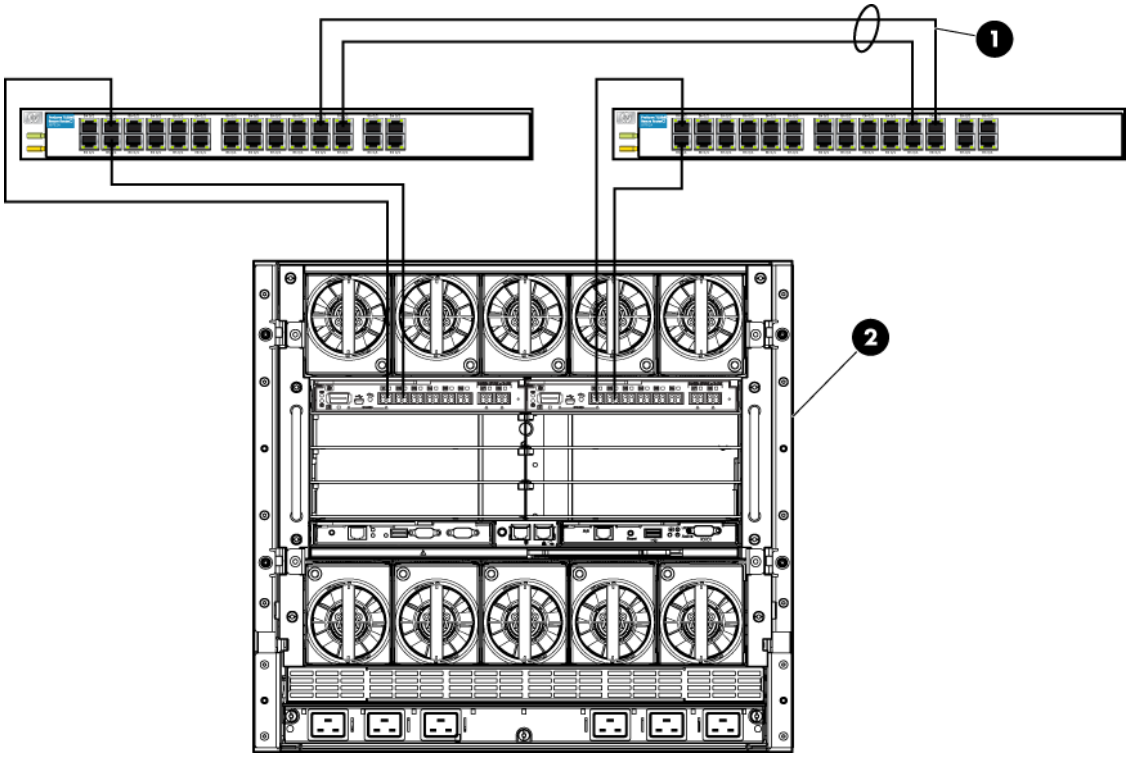
**Table 2-3** Flex-10 NIC – Optimization for a VMWARE ESX implementation

| | Console NIC #1 | VMotion NIC #2 | iSCSI NIC #3 | Production NIC #4 | Console NIC #5 | VMotion NIC #6 | Production NIC #7 | iSCSI NIC #8 |
|---|---|---|---|---|---|---|---|---|
| Traditional 1Gb technology | 1Gb | 1Gb | 1Gb | 1Gb | 1Gb | 1Gb | 1Gb | 1Gb |
| Virtual Connect Flex-10 | 100Mb | 2Gb | 4Gb | 3.9Gb | 100Mb | 2Gb | 4Gb | 3.9Gb |

# Requirements

In order to implement this scenario, an HP BladeSystem c7000 enclosure with one of more Blade G6 servers with 10Gb NICs and TWO Virtual Connect Flex-10 Ethernet modules, installed in 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.

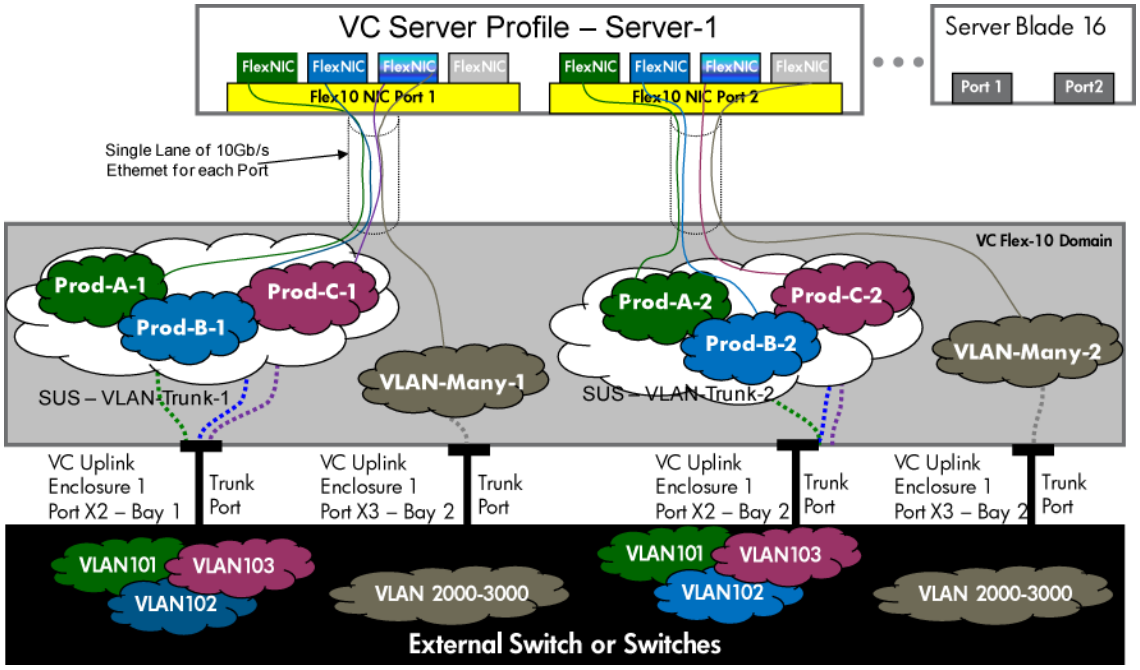
**Figure 2-60** Physical View; Shows one 10Gb Ethernet uplink from Ports 1 on Module 1 to Port 1 on the first network switch and one 10Gb uplink from Port 1 on Module 2 to Port 1 on the second network switch.




| Item | Description |
|---|---|
| 1 | Switch Cross Connect |
| 2 | c7000 Enclosure, rear view |

**Figure 2-61** Server Blade profile with TWO Flex-10 NICs configured. Each FlexNIC will connect to a different network. Both Shared Uplinks Sets and vNets are used.

VLAN-Trunk-1 and VLAN-Trunk-2 respectively connect to Port X1 on Bays 1&2, were VLAN-Many-1 and VLAN-Many-2 are connected to Port X2 on Bays 1&2 of the Flex-10 modules.




# Installation and configuration

## Switch configuration

Appendices A and B provide a summary of the commands required to configure the switch in either a Cisco IOS or a ProCurve network infrastructure. The configuration information provided in the appendices assumes the following information:

- The switch ports are configured as TRUNK ports. Part1 of each network switch is configured to support VLANs 101, 102, and 103. Port 2 of each network switch is configured to support VLANs 2000 through 3000. All frames will be forwarding to VC with VLAN tags.
- If adding additional uplinks to the SUS or vnet, the switch ports connected to Virtual Connect will need to be configured for LACP and configured for the same Link Aggregation Group.

## 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 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 can 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 (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 Tunnel VLAN Tags via GUI (Ethernet settings)

Note: Flex-10 has also provided additional controls when configuring VC for mapped VLAN tags (Multiple Networks over a single link) support. These features provide the ability to set a Custom or Preferred network speed value for each NIC. These are VC domain settings and when configured will limit the maximum configurable speed of a NIC.

Enable Tunnel VLAN Tags within Virtual Connect

- On the Virtual Connect Manager screen, Left pane, click Ethernet Settings, Advanced Settings
- Select Tunnel VLAN Tags
- Select Fast MAC Cache Fail-over with a refresh of 5
- Optionally, select a preferred/Maximum link speed
- Select Apply

## Configuring the VC Module for VLAN Tunneling via CLI (Ethernet settings)

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

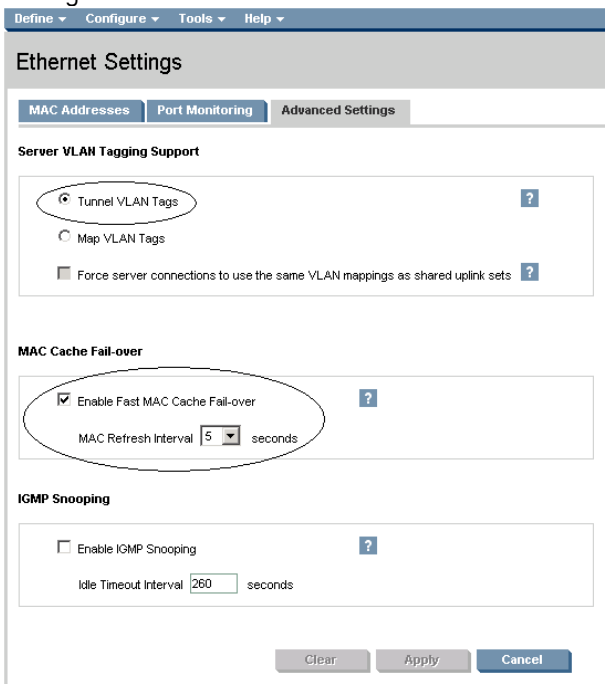
```
# Set Advanced Ethernet Settings to "Tunnel VLAN Tags" and Enable Fast MAC cache fail-over
set enet-vlan vlantagcontrol=Tunnel
set mac-cacheEnabled=True Refresh=5
```

**Note:** Do not set a Preferred or Max speed for this scenario. This example is provided for reference only. For the purpose of this scenario, we will not be configuring the custom values for Preferred Link or Maximum Connection speeds. However, the CLI commands are provided below for reference.

Selecting the Set a Customer value for Preferred Link Connection Speed and/or Set a Customer value for Maximum Link Connection Speed, Sets the respective speed for all connections using multiple networks to 500Mb and maximum connection speed to 2.5Gb.

```
# Set Advanced Ethernet Settings to a Preferred speed of 500Mb and a Max Speed of 2500Mb
set enet-vlan PrefSpeedType=Custom PrefSpeed=500 MaxSpeedType=Custom MaxSpeed=2500
```

**Figure 2-62** Ethernet Settings.




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

Connect Port X1 of VC module 1 to Port 1 on switch 1

Create a SUS named "VLAN-Trunk-1" and connect it to Flex-10 port X1 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;
    a. Enclosure 1, Bay 1, Port X1
- Add Networks as follows;
    a. PROD-A-1 = VLAN ID=101
    b. PROD-B-1 = VLAN ID=102
    c. PROD-C-1 = VLAN ID=103
- Enable SmartLink on ALL Networks
- Click Apply

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

Connect Port X1 of VC module 2 to Port 1 on switch 2

Create a SUS named "VLAN-Trunk-2" and connect it to Flex-10 Port X1 on Module 2

- On the Virtual Connect Home page, select Define, Shared Uplink Set
- Insert Uplink Set Name as VLAN-Trunk-2
- Select Add Port, then add the following port;
    a. Enclosure 1, Bay 2, Port X1

- Add Networks as follows;
    a. PROD-A-2 = VLAN ID=101
    b. PROD-B-2 = VLAN ID=102
    c. PROD-C-2 = VLAN ID=103
- Enable SmartLink on ALL Networks
- Click Apply

## Defining two new vNets via GUI

Create a vNet and name it "VLAN-Many-1"

- On the Virtual Connect Manager screen, click Define, Ethernet Network to create a vNet
- Enter the Network Name of "VLAN-Many-1"
    d. Select Smart Link
    e. Select Enable VLAN Tunneling
- Select Add Port, then add the following ports;
    a. Enclosure 1, Bay 1, Port X2
- Leave Connection Mode as Auto
- Select Apply

Create a vNet and name it "VLAN-Many-2"

- On the Virtual Connect Manager screen, click Define, Ethernet Network to create a vNet
- Enter the Network Name of "VLAN-Many-2"
    a. Select Smart Link
    b. Select Enable VLAN Tunneling
- Select Add Port, then add the following ports;
    a. Enclosure 1, Bay 2, Port X2
- Leave Connection Mode as Auto
- Select Apply

Note: By creating TWO vNets we have provided a redundant path to the network. As each uplink originates from a different VC module within each vNet, both uplinks will be active. This configuration provides the ability to lose an uplink cable, network switch or even a VC module.

Note: Smart Link – In this configuration Smartlink SHOULD be enabled. Smartlink is used to turn off downlink ports within Virtual Connect if ALL available uplinks to a vNet or SUS are down. In this scenario if an upstream switch or all cables to a vNet were to fail, VC would turn off the downlink ports connect to that vNet, which would then force the NIC Teaming software to fail-over to the alternate NIC.

## 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:X1 Uplinkset=VLAN-Trunk-1 speed=auto

# Create Networks Prod-A-1 through Prod-D-1 for Shared Uplink Set "VLAN-Trunk-1"
add network PROD-A-1 uplinkset=VLAN-Trunk-1 VLanID=101
Set Network PROD-A-1 SmartLink=Enabled
add network PROD-B-1 uplinkset=VLAN-Trunk-1 VLanID=102
Set Network PROD-B-1 SmartLink=Enabled
add network PROD-C-1 uplinkset=VLAN-Trunk-1 VLanID=103
Set Network PROD-C-1 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:X1 Uplinkset=VLAN-Trunk-2 speed=auto

# Create Networks Prod-A-2 through Prod-D-2 for Shared Uplink Set "VLAN-Trunk-2"
add network PROD-A-2 uplinkset=VLAN-Trunk-2 VLanID=101
Set Network PROD-A-2 SmartLink=Enabled
add network PROD-B-2 uplinkset=VLAN-Trunk-2 VLanID=102
Set Network PROD-B-2 SmartLink=Enabled
add network PROD-C-2 uplinkset=VLAN-Trunk-2 VLanID=103
Set Network PROD-C-2 SmartLink=Enabled
```

## Defining a new vNet via CLI

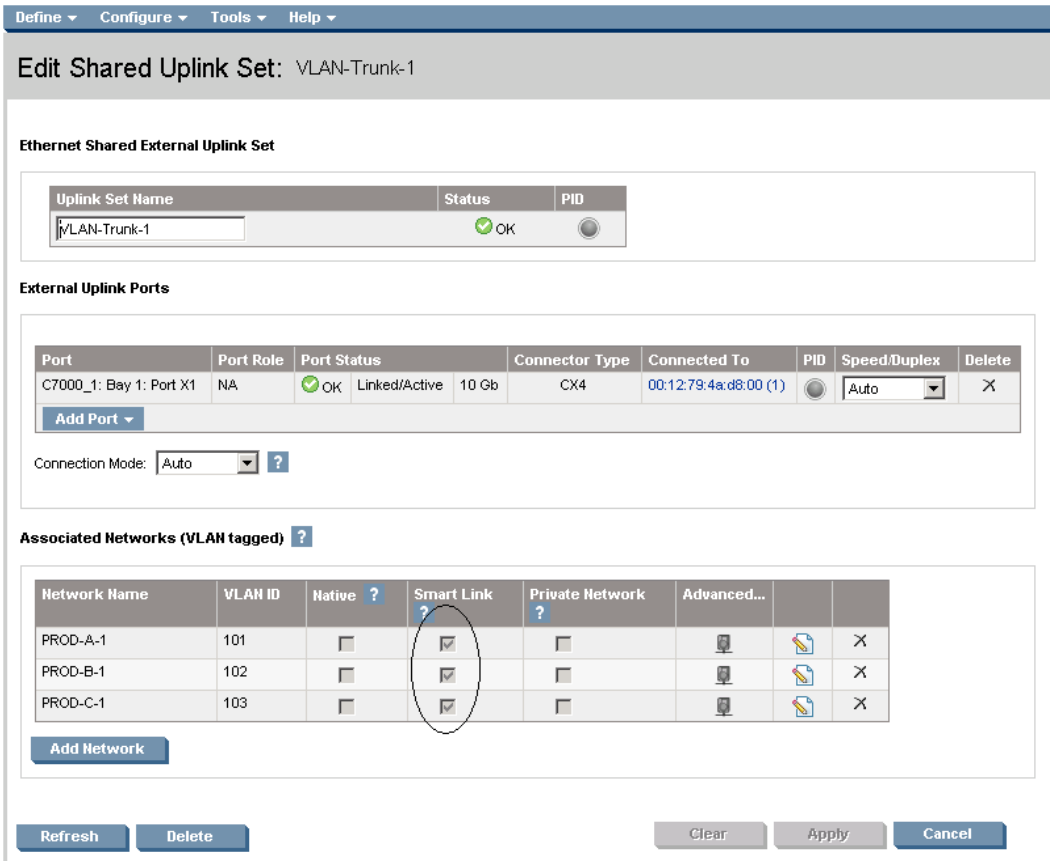
The following command(s) can be copied and pasted into an SSH based CLI session with Virtual Connect

```
# Create the vNet "VLAN-Many" and configure uplinks as discussed above
add Network VLAN-Many-1
add uplinkport enc0:1:X2 Network=VLAN-Many-1 speed=auto
set network VLAN-Many-1 SmartLink=Enabled VLanTunnel=Enabled

add Network VLAN-Many-2
add uplinkport enc0:2:X2 Network=VLAN-Many-2 speed=auto
set network VLAN-Many-2 SmartLink=Enabled VLanTunnel=Enabled
```

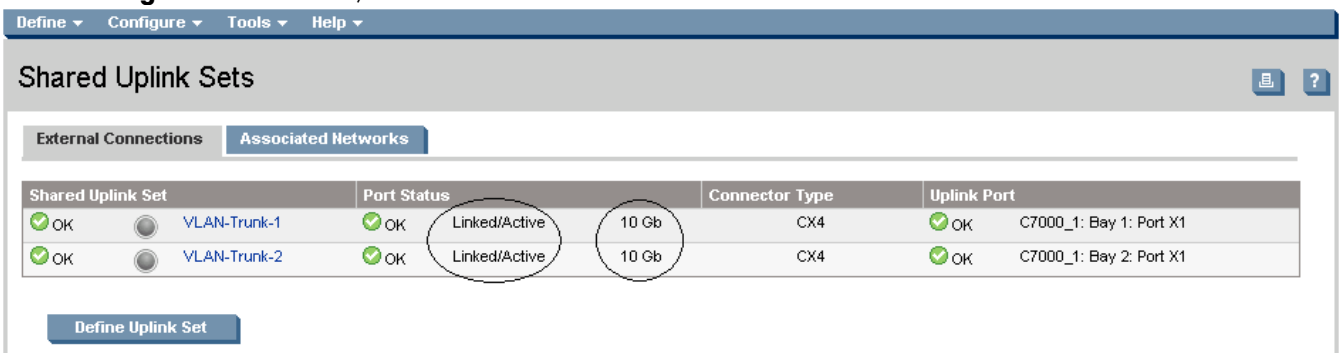
**Note:** It is important to point out at this time, if you are familiar with VC scripting, or have existing VC scripts that you had used on Virtual Connect 1:10 modules, and may want to use with Flex-10, the numbering of the Flex-10 external ports is different than with early modules of VC. VC-E and VC-F uplinks ports are numbered as Ports 1, 2, 3 etc., however; Flex-10 ports are referenced as X1, X2, X3 etc., plus some of the ports are shared, IE the CX4 is shared with SFP+ Port X1, both are configured as X1, but only one is usable at a time. If a CX-4 cable is connected the SFP+ port will become disable, the same is true for Ports X7 & X8, which are the internal cross connect ports, the cross connects will disconnect, if an SFP+ module is plugged in Ports X7 or X8.

**Figure 2-63** Define a Shared Uplink Set (VLAN-Trunk-1) and add VLANs.




**Note:** The "*Connected to*" field in the graphic above displays the MAC address and port number of the switch this uplink is connected to. This information is provided through LLDP discover and is not available in all switch products. This information can be very helpful when determining which switches and ports VC is connected to.

**Figure 2-64** Active / Active SUS.



**Summary Note:** In this scenario we have created two independent Share Uplink Sets (SUS), each originating from the opposite VC-Modules, by doing so we provide the ability to create separate and redundant connections out of VC. 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 of these uplink ports to the same SUS, however, this would have provided an Active/ Standby uplink scenario.

**Figure 2-65** Example of a Active / Standby SUS.

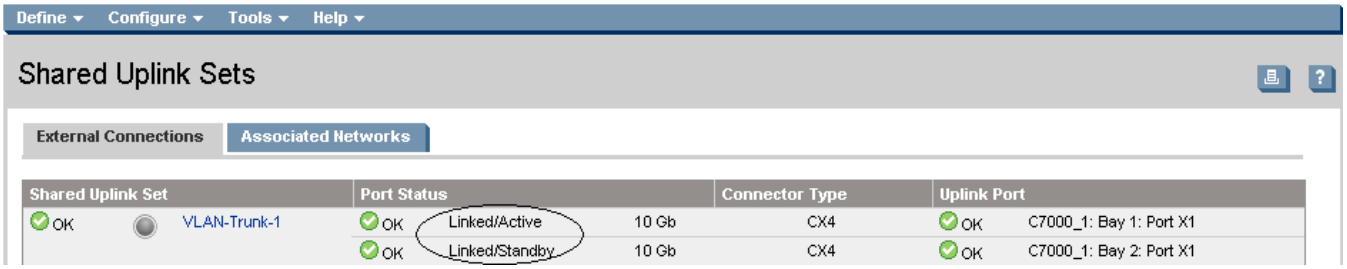
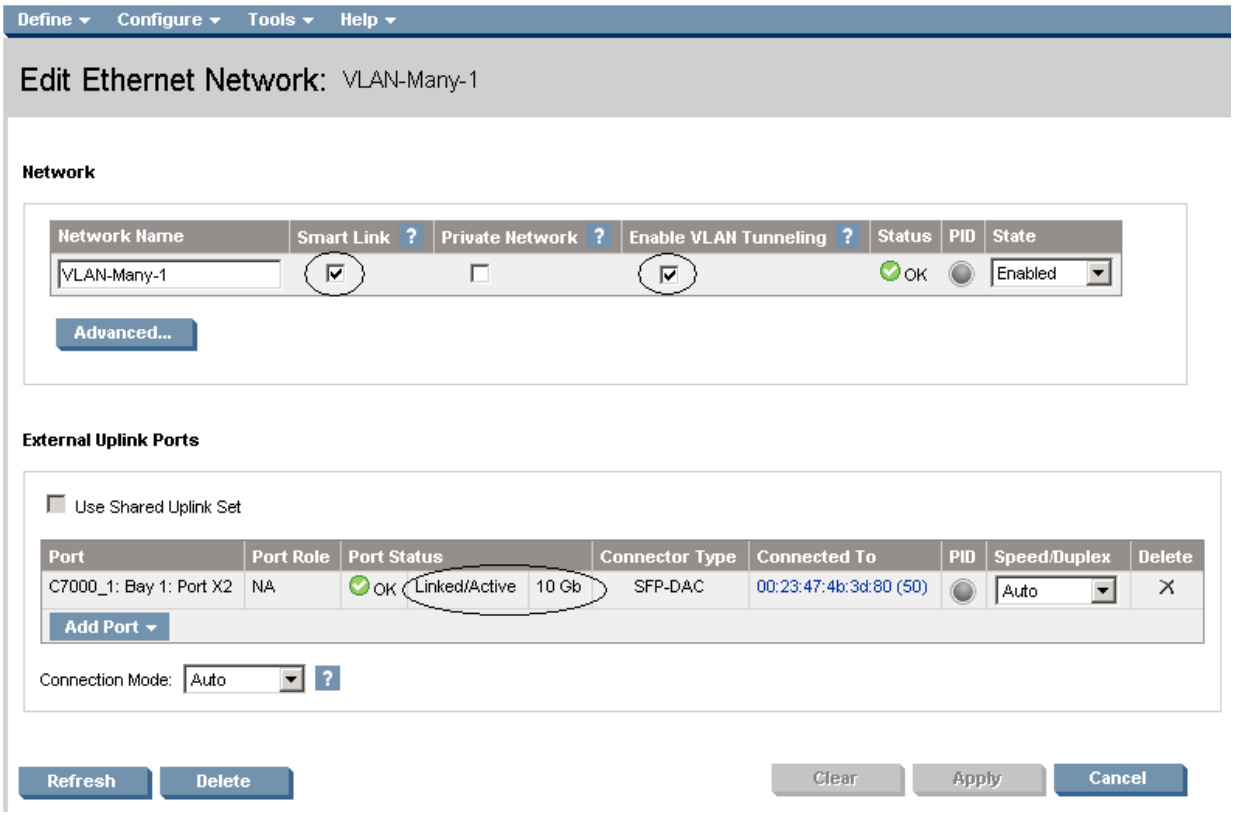



**Figure 2-66** VLAN-Many-1 – Linked at 10Gb with both Smart Link and VLAN Tunneling Enabled.



## 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 "Server-1"
- In the Network Port 1 drop down box, select PROD-A-1, configure the speed as custom at 100Mb
- In the Network Port 2 drop down box, select PROD-A-2, configure the speed as custom at 100Mb
- In the Network Port 3 drop down box, select PROD-B-1, configure the speed as custom at 2Gb
- In the Network Port 4 drop down box, select PROD-B-2, configure the speed as custom at 2Gb
- In the Network Port 5 drop down box, select PROD-C-1, configure the speed as custom at 4Gb
- In the Network Port 6 drop down box, select PROD-C-2, configure the speed as custom at 4Gb
- In the Network Port 7 drop down box, select VNET-Many-1, configure the speed as custom at 3.9Gb
- In the Network Port 8 drop down box, select VNET-Many-2, configure the speed as custom at 3.9Gb
- In the Assign Profile to Server Bay box, locate the Select Location drop down and select Bay 1, then apply

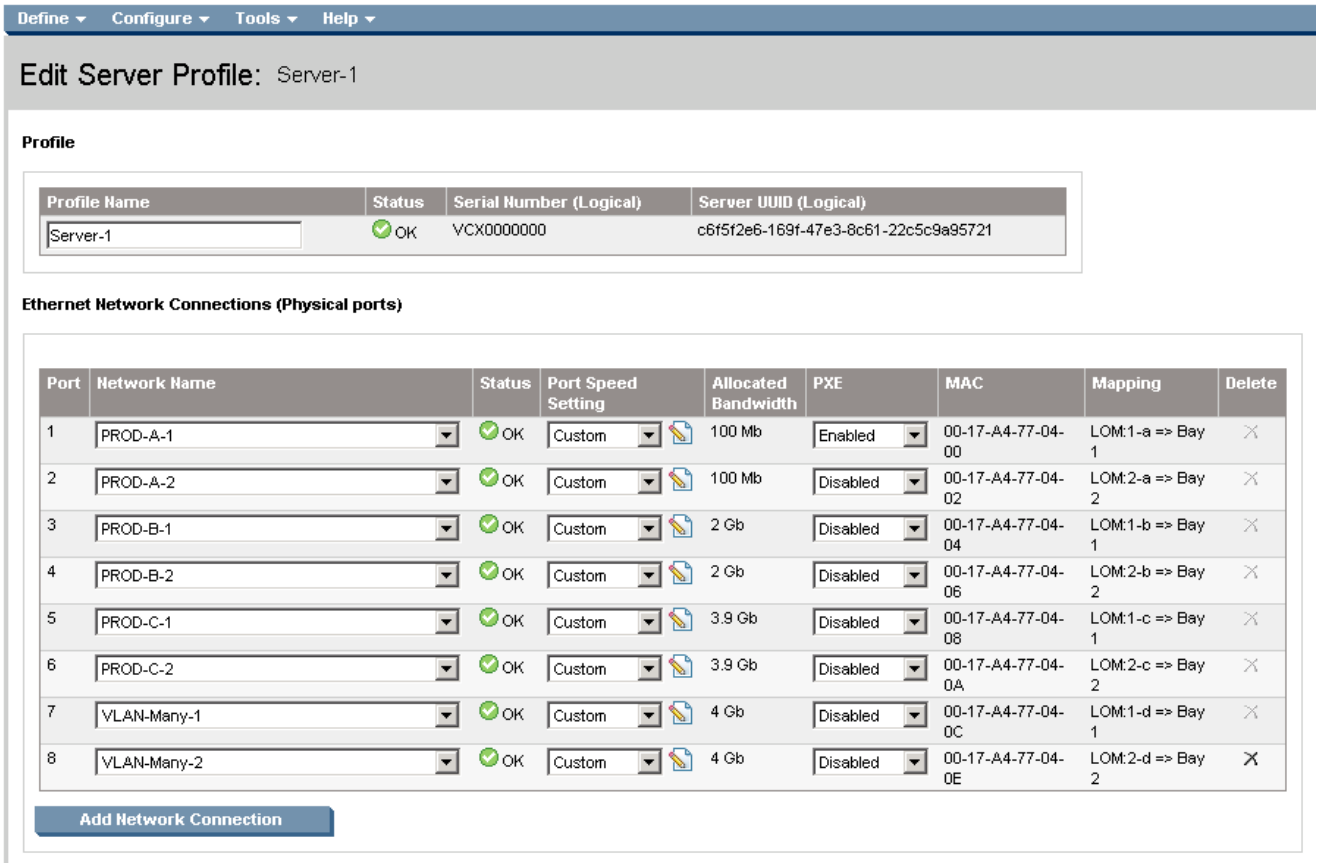
**Note:** you should now have a server profile assigned to Bay 1, with 8 Server NICs connected to the various networks.

## 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 Server-1
add profile Server-1 –nodefaultenetconn
add enet-connection Server-1 pxe=Enabled Network=PROD-A-1 SpeedType=Custom Speed=100
add enet-connection Server-1 pxe=Disabled Network=PROD-A-2 SpeedType=Custom Speed=100
add enet-connection Server-1 pxe=Disabled Network=PROD-B-1 SpeedType=Custom Speed=2000
add enet-connection Server-1 pxe=Disabled Network=PROD-B-2 SpeedType=Custom Speed=2000
add enet-connection Server-1 pxe=Disabled Network=PROD-C-1 SpeedType=Custom Speed=3900
add enet-connection Server-1 pxe=Disabled Network=PROD-C-2 SpeedType=Custom Speed=3900
add enet-connection Server-1 pxe=Disabled Network=VLAN-Many-1 SpeedType=Custom Speed=4000
add enet-connection Server-1 pxe=Disabled Network=VLAN-Many-2 SpeedType=Custom Speed=4000
Assign profile Server-1 enc0:1
```

**Figure 2-67** Define a Server Profile with 8 NICs.




# Summary

This profile is configured as follows;

- NICs 1&2 are connected to “PROD-A-1” & “PROD-A-2” (Console Network), which are mapped to VLAN 101
- NICs 3&4 are connected to “PROD-B-1” & “PROD-B-2” (VMotion Network), which are mapped to VLAN 102
- NICs 5&6 are connected to “PROD-C-1” & “PROD-C-2” (iSCSI or NFS Network), which are mapped to VLAN 103

Note: Frames for VLANs 101 through 103 will be passed to the server NICs “untagged”, so the host will not be required to interpret the VLAN tag.

- NICs 7&8 are connected to “VLAN-Many-1” & “VLAN-Many-2” (Product VLANs), which are mapped to VLANs 2000 through 3000

Note: Frames for VLANs 2000 through 3000 will be passed to the server NICs “tagged”, so the host will be required to interpret the VLAN tags. This is perfectly fine when connecting to a vSwitch within a virtual host, such as VMware ESX.

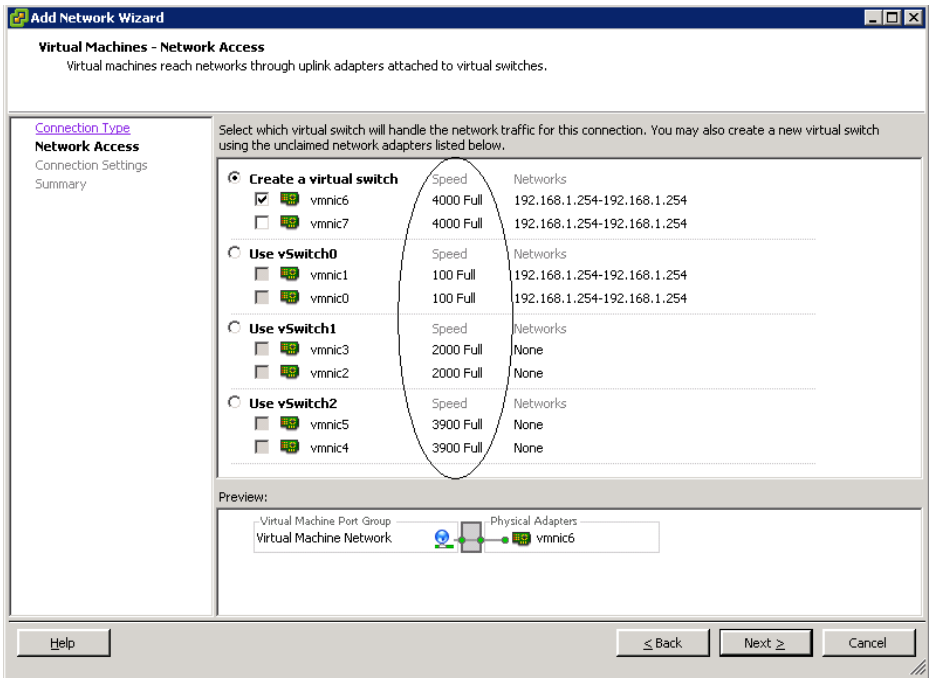
# Result

## VMware ESX Configuration Example

The following graphics show an ESX server with two Flex-10 NICs configured as 8 NICs. NICs speeds are also configured accordingly and connected to vSwitches, with port groups to present the VLANs accordingly.

When configuring the vSwitches for ESX, you will notice that 8 NICs actually already exist, as per the Virtual Connect server Profile.

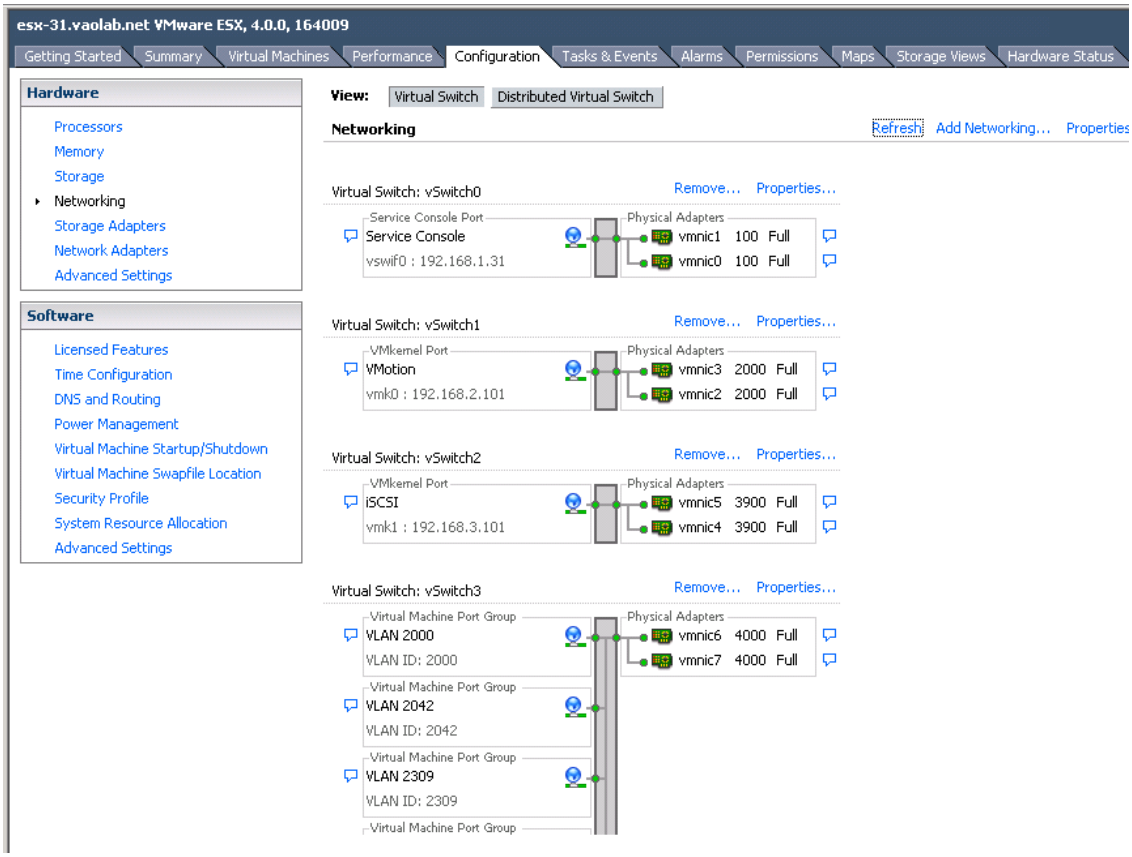
**Figure 2-68** Configuring ESX 4 vSwitch.



# ESX 4 Networking Configuration Example

The following graphics show an ESX 4 server with two Flex-10 NICs configured as six NICs.

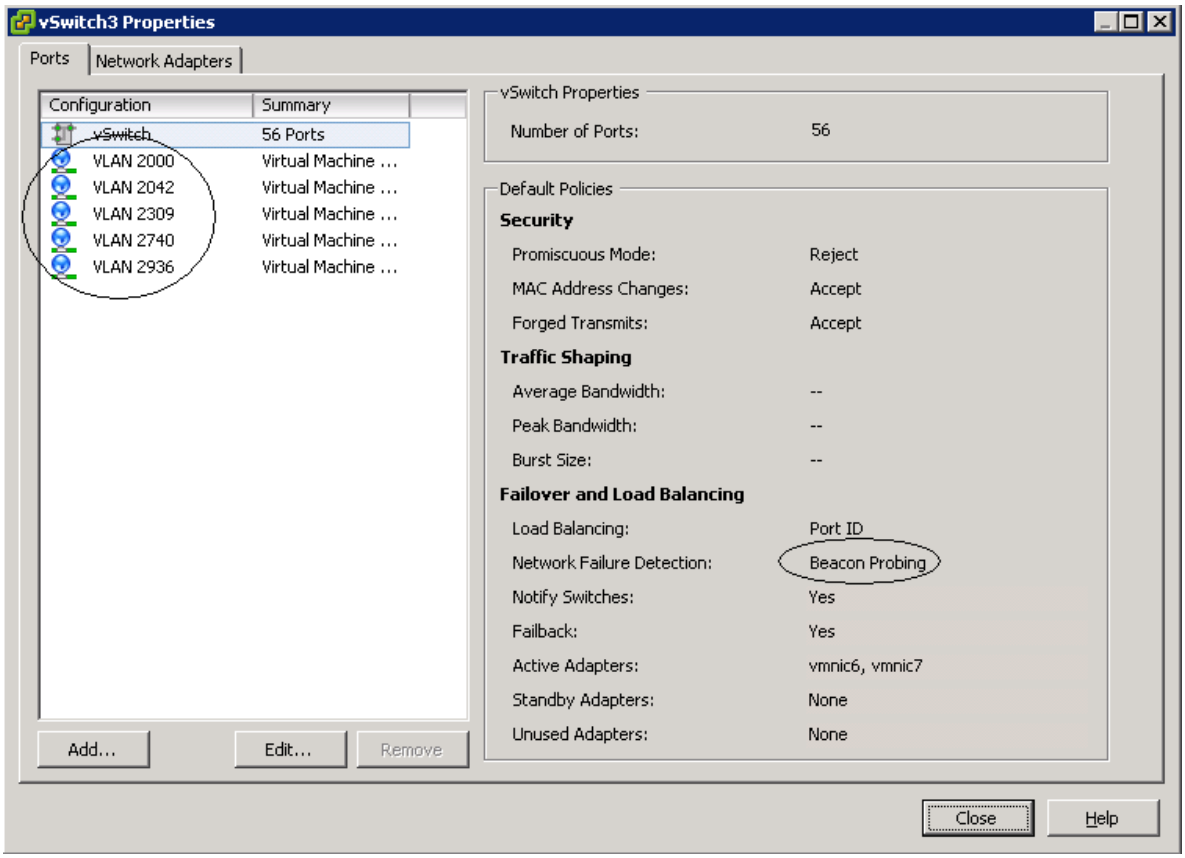
**Figure 2-69** vSwitch Configuration the ESX Host with 8 NICs.



## VMWARE ESX Host Networking configuration Example

When configuring the ESX virtual switch, add virtual networks for each VLAN this ESX host will support.

**Figure 2-70** Configuring the ESX vSwitch for Multiple Networks / VLANs.



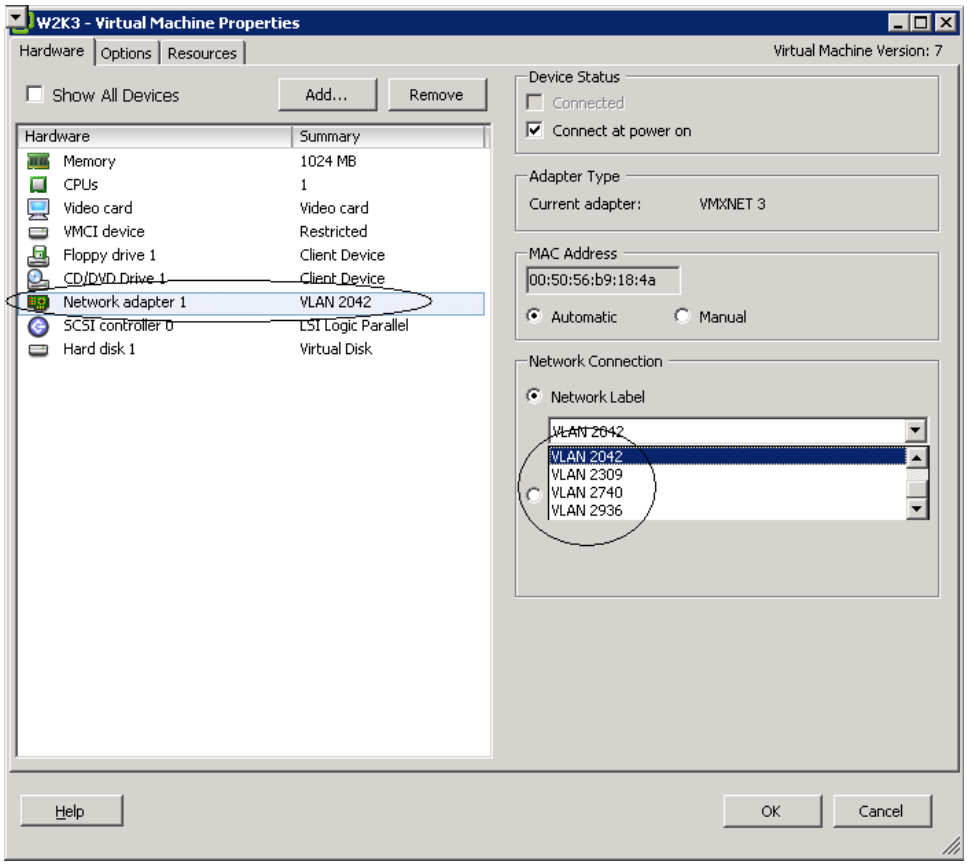

**Note:** That vSwitch 3 has two NICs configured to, redundantly, support VLANs 103, 104 and 105.

**Note:** If implementing ESX 3.5 on Flex-10, first review VMWARE KB 1007982 and ensure Network Failure Detection is set to Beacon Probing.

**Note:** If implementing ESX 4.0 on Flex-10 ensure that ESX driver version 1.52 is installed, also ensure that NIC firmware 5.2.7 is also installed.

When configuring the guest NIC simply chose which VLAN this guest will reside on.

**Figure 2-71** Selection of the Virtual Network (VLAN) as required.



# Chapter 3: Multi-Enclosure (Stacking) Scenarios

## Overview

This chapter will provide sample configuration scenarios of Virtual Connect and/or Virtual Connect with Flex-10, using multiple (Stacked) HP BladeSystem c7000 enclosures, which is referred to a Multi-enclosure stacking (ME), each with two Virtual Connect Ethernet modules installed in Bays 1 and 2. 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 will also be provided.

## Requirements

This chapter will utilize multiple HP BladeSystem c7000 enclosures in a Virtual Connect stacked domain configuration. The initial scenarios will each enclosure will have TWO Virtual Connect Ethernet (VC-F) modules and a half height BladeSystem server. The server will connect to the Virtual Connect models with two 1Gb NICs. NIC 1 will connect to the VC module in Bay 1 and NIC 2 will connect to the VC module in Bay 2. Enclosure 1 is externally connected to enclosure two using 10Gb CX-4 cables. The later scenario will utilize Virtual Connect Flex-10 modules in each of four enclosures, these enclosures will be externally connected using 10Gb CX-4 cables, although stacking could be implanted using the newer SFP+ twinax cables.

A pair of managed network switches should also be provided, the switches should also be trunked together.

It is assumed that a Virtual Connect Domain has been created either through the GUI or a CLI script and no VC Networks, uplink sets or Server Profiles have been created.

# Scenario 3:1 – Multi-Enclosure stacking, with Multiple Simple vNets, Redundant Uplinks and LACP (2 Enclosures)

## Overview

This simple configuration uses the Virtual Connect vNet using uplinks from TWO different enclosures within the stacked Virtual Connect domain, which is referred to a Multi-enclosure stacking (ME). The vNet is the simplest way to connect Virtual Connect to a network and server. In this scenario, the upstream network switches connect the vNet to a pair of ports on two of the VC modules, positioned in Bay1 of enclosure 1 and Bay 2 of enclosure 2.

As there will be a pair of uplinks from each VC module to their respective switches, LACP would need to be configured on the upstream switch ports. It is also assumed these switch ports are configured as Access ports. However, if the switch ports were configured as trunk ports, presenting multiple VLANs to the vNet, Virtual Connect would simply pass the tagged frames on to the server, unchanged with tags intact, however, the VC Domain would need to be configured in Tunneled mode and VLAN tunneling would need to be enabled for thses vNets.

When configuring Virtual Connect, we can provide several ways to implement network fail-over or redundancy. One option would be to connect uplinks for a vNet from multiple VC modules; those uplinks would connect from different Virtual Connect modules within the enclosure stack 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 vNets, each with a set of uplinks configured. Each option has its advantages and disadvantages. This scenario will review use TWO separate vNets, which will provide two active paths to the network.

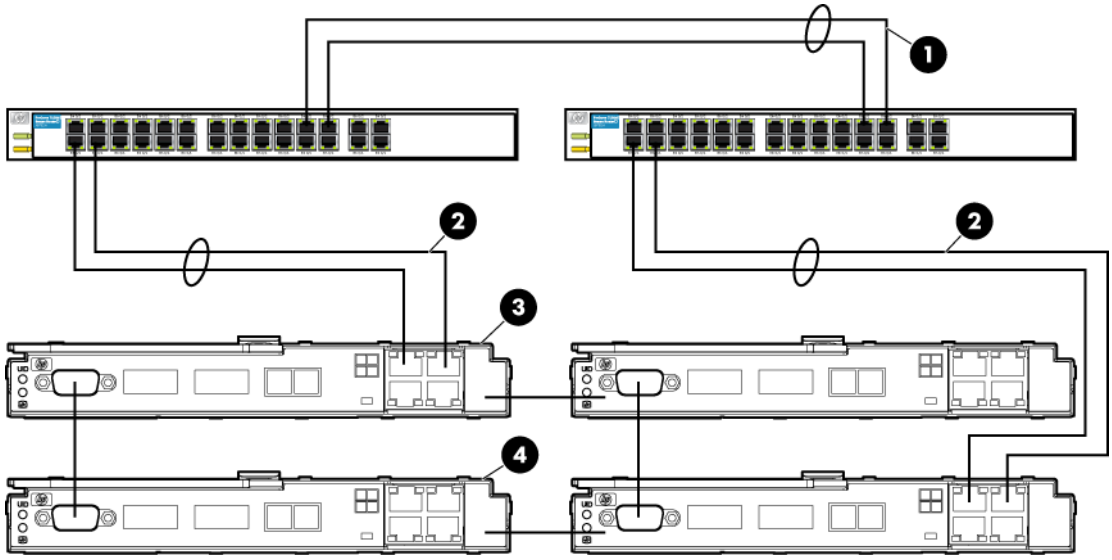
In addition, several vNets can be configured to support the required networks to the servers within the BladeSystem enclosure. These networks could be used to separate the various network traffic, such as iSCSI, backup, VMotion from production network traffic.

## Requirements

In order to implement this scenario, two HP BladeSystem c7000 enclosures with one or more server blade and TWO Virtual Connect Ethernet modules, installed in 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.

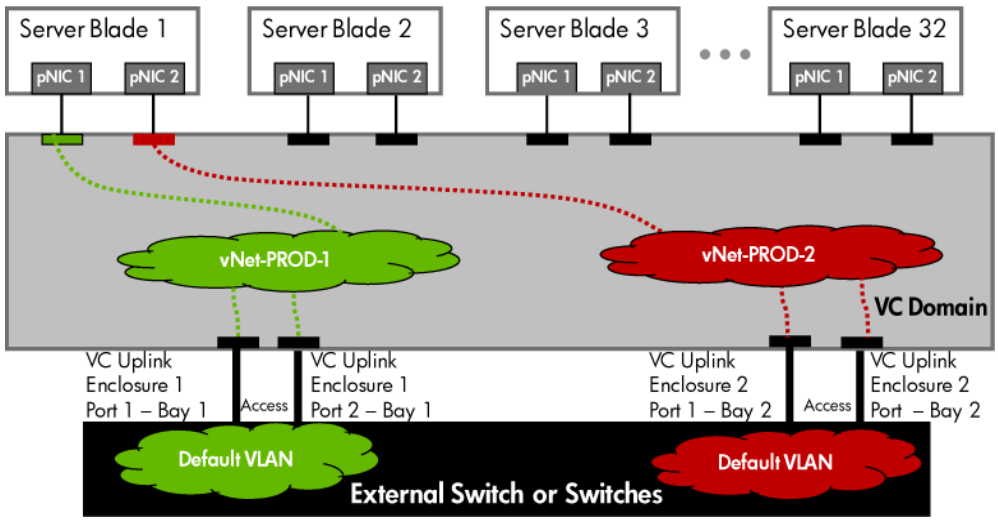
Note: In order to implement Virtual Connect enclosure stacking, the enclosure that will form the primary or initial VC Domain must be configured with either VC-F or VC Flex-10 modules in Bays 1 and 2; VC-E modules are not supported in Bays 1 and 2 of the primary VC enclosure, but VC-E modules could be used in other bays, or Bays 1&2 in other enclosures in the stack, just not the primary enclosure.

**Figure 3-1** Physical View; Shows TWO Ethernet uplinks from Ports 1 and 2 on Module 1 in Enclosure 1 to Ports 1 and 2 on the first network switch and TWO uplinks from Ports 1 and 2 on Module 2 in Enclosure 2 to Ports 1 and 2 on the second network switch.




| Item | Description |
|---|---|
| 1 | Switch Cross Connect |
| 2 | 1Gb uplinks (10Gb Uplinks could also be used) |
| 3 | Enclosure 1, rear view |
| 4 | Enclosure 2, rear view |

**Figure 3-2** Logical View; Shows TWO Ethernet uplinks from Ports 1 and 2 on Module 1 in Enclosure 1 to Ports 1 and 2 on the first network switch and TWO uplinks from Ports 1 and 2 on Module 2 in Enclosure 2 to Ports 1 and 2 on the second network switch, which connect to vNets vNet-PROD-1 and vNet-PROD-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 IOS or a ProCurve network infrastructure. The configuration information provided in the appendices assumes the following information:

- The switch ports are configured as ACCESS ports, either presenting the Default VLAN or a specific VLAN and will for 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. The connected host would then need to be configured to interpret those VLAN tags
- As LACP will be implemented, the ports that connect the uplinks from module 1 and module 2 will need to be configured for LACP (not Ether-channel) and be configured in their respective Ling Aggregation Groups (LAG)

This scenario assumes the switch ports are configured as an Access ports and the frames are presented to Virtual Connect as untagged.

## VC CLI commands

In addition to the GUI many of the configuration settings within VC can be 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. Throughout this scenario the CLI commands to configure VC for each setting will also be provided.

## Configuring the VC module

- Physically connect Port 1 of Network switch 1 to Port 1 on the VC module in Bay 1.
- Physically connect Port 1 of the second Network switch to Port 1 of the VC module in Bay 2, if you have only one network switch, connect VC Port 1 (Bay 2) to an alternate port on the same switch. This will NOT create a network loop and does not require Spanning Tree to be configured.
- Physically connect a CX-4 cable from the CX-4 port or the module in enclosure 1, Bay 1 to the CX-4 connector on enclosure 2 Bay 1
- Physically connect a CX-4 cable from the CX-4 port or the module in enclosure 1, Bay 2 to the CX-4 connector on enclosure 2 Bay 2

## Configuring the VC Module for VLAN Tunneling via GUI (Ethernet settings)

Enable Tunnel VLAN Tags within Virtual Connect

- On the Virtual Connect Manager screen, Left pane, click Ethernet Settings, Advanced Settings
- Select Tunnel VLAN Tags
- Select Fast MAC Cache Fail-over with a refresh of 5
- Select Apply

## Configuring the VC Module for VLAN Tunneling via CLI (Ethernet settings)

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

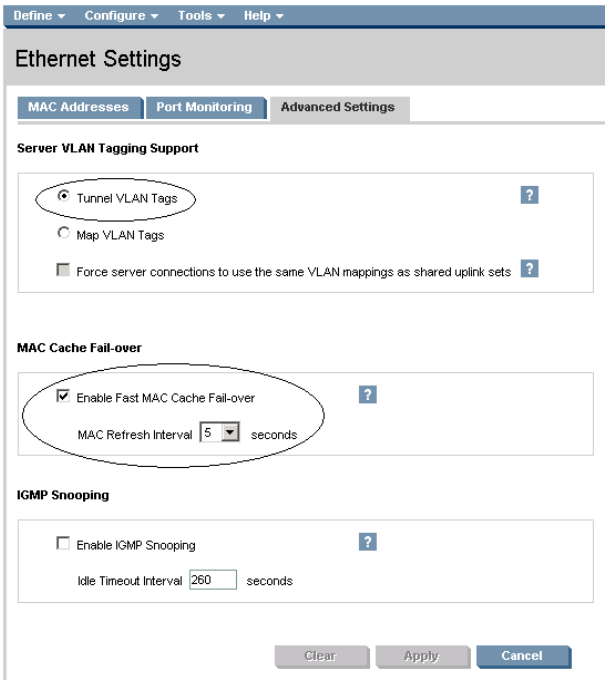
# Set Advanced Ethernet Settings to "Tunnel VLAN Tags" and, as no links are configured in standby, optionally enable Fast MAC cache fail-over

set enet-vlan vlantagcontrol=Tunnel

set mac-cache Enabled=True Refresh=5

**Figure 3-3** Ethernet Settings.

2.




## Importing the Second Enclosure via GUI

In order to stack Virtual Connect we need to first implement Virtual Connect, configure a Virtual Connect Domain within a HP BladeSystem c7000 enclosure, cable the enclosure together and then "import" the additional enclosures into the existing VC Domain. Up to three additional HP BladeSystem c7000 enclosures can be imported. The enclosures being imported must have no Virtual Connect domain configured, and should be considered as "bare metal". However, the Onboard Administrator (OA) must be configured and the VC modules within the enclosure must have TCP/IP addresses configured.

To import the second enclosure;

- Login to the existing Virtual Connect domain of the first enclosure and select Domain Enclosures in the left pane
- Press the "Find" button
- Enter the IP address and credentials for the OA of the enclosure you wish to import
- Select the enclosure, then press the "Import" button, this may take a few minutes to complete
- From the left pane, select Stacking Links and verify there are no stacking link errors

## Importing the Second Enclosure via CLI

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

# Importing an Enclosure into an existing VC Domain

Import enclosure 10.0.0.50 UserName=Administrator Password=password

Note: Type "YES" when prompted

Note: the IP Address (User name and password) is for the OA of the enclosure being imported. The Double Dense statement is can be sued if BL2x220c (Double Dense) Blades are used.

IE; Import enclosure 10.0.0.50 UserName=Administrator Password=password DoubleDense=Enable

**Figure 3-4** Importing an enclosure into an existing VC Domain.

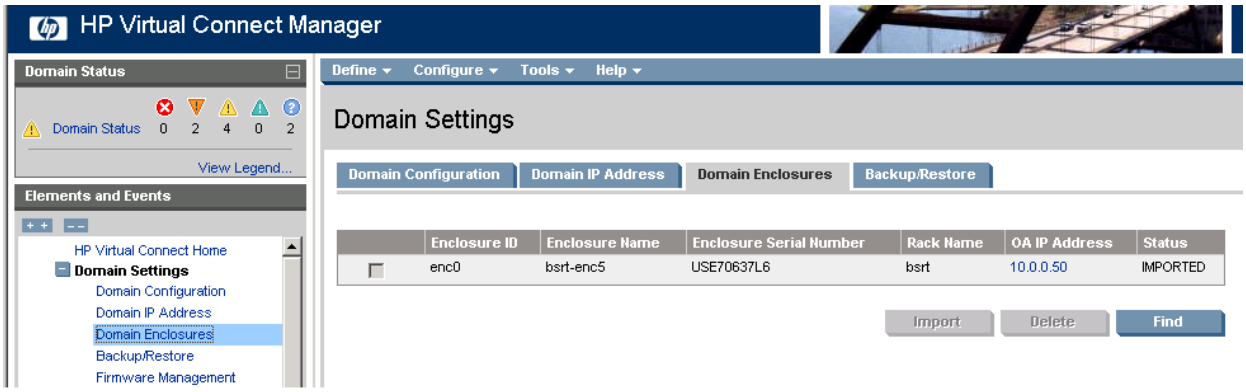



**Figure 3-5** Enter the IP address and credentials of for the OA of the enclosure being imported.

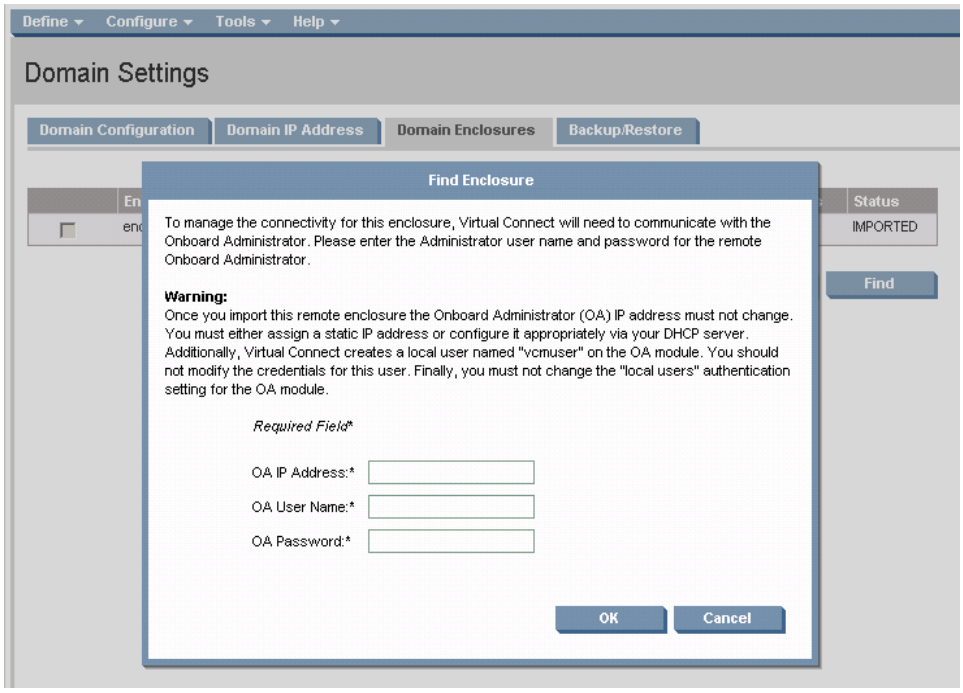


**Figure 3-6** The figure below shows importing the enclosure.

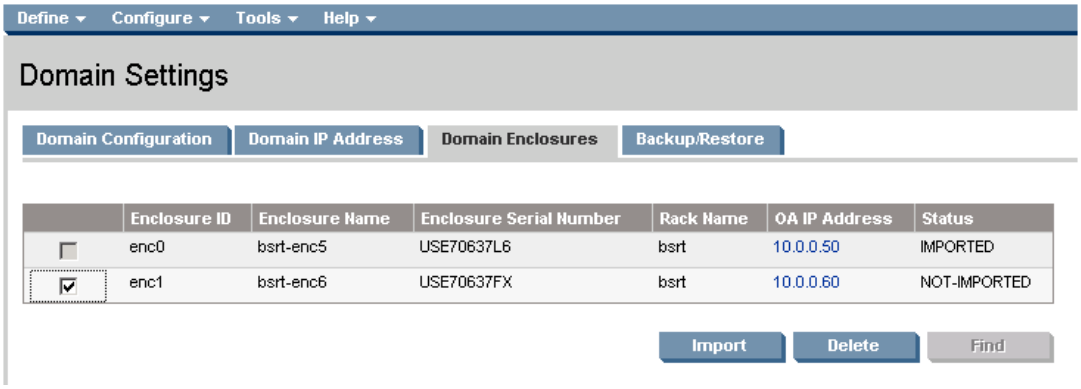



**Figure 3-7** The enclosure is imported.

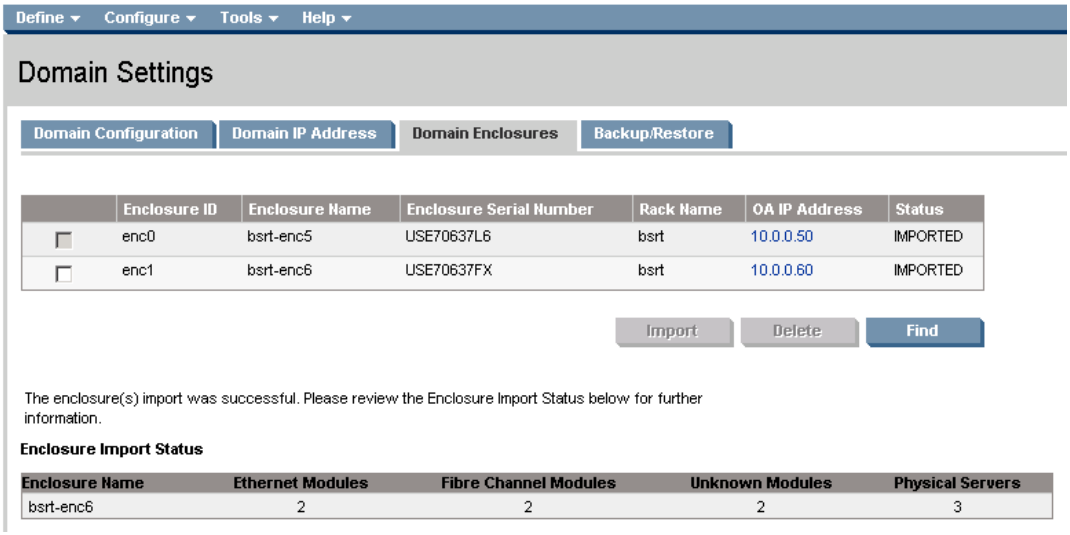
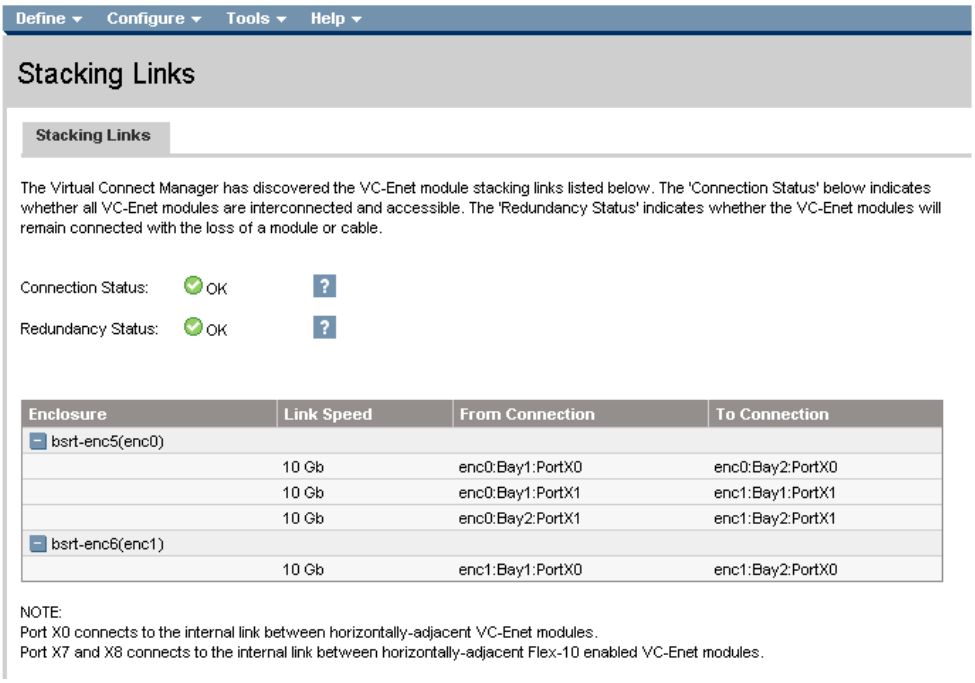


**Figure 3-8** VC Domain Stacking Links.




## Defining a new vNet via GUI

Create a vNet and name it "vNet-PROD-1"

- Login to Virtual Connect
- On the Virtual Connect Manager screen, click Define, Ethernet Network to create a vNet
- Enter the Network Name of "vNet-PROD-1"
    a. Note; select Smart Link, but do not select Private Networks
- Select Add Port, then add the following ports;
    a. Enclosure 1, Bay 1, Port 1
    b. Enclosure 1, Bay 1, Port 2
- Leave Connection Mode as Auto
- Select Apply

Create a vNet and name it "vNet-PROD-2"

- Enter the Network Name of "vNet-PROD-1"
    a. Note; select Smart Link, but do not select Private Networks
- Select Add Port, then add the following ports;
    a. Enclosure 2, Bay 2, Port 1
    b. Enclosure 2, Bay 2, Port 2
- Leave Connection Mode as Auto
- Select Apply

Note: By connecting TWO Uplinks from each vNet we are leveraging LACP to provide additional bandwidth. By creating TWO separate vNets, we are also providing the ability to have ALL uplinks active and then provide fail-over through the server's NICs with NIC teaming or two NICs connected to a vSwitch if a hypervisor is used. 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.

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

add Network vNet-PROD-2
add uplinkport enc1:2:1 Network=vNet-PROD-2 speed=auto
add uplinkport enc1:2:2 Network=vNet-PROD-2 speed=auto
set network vNet-PROD-2 SmartLink=Enabled
```

**Figure 3-9** Define Ethernet Network (vNet-PROD-1).

Note: The that the uplinks are connected to different enclosures, (enc0 and enc1)

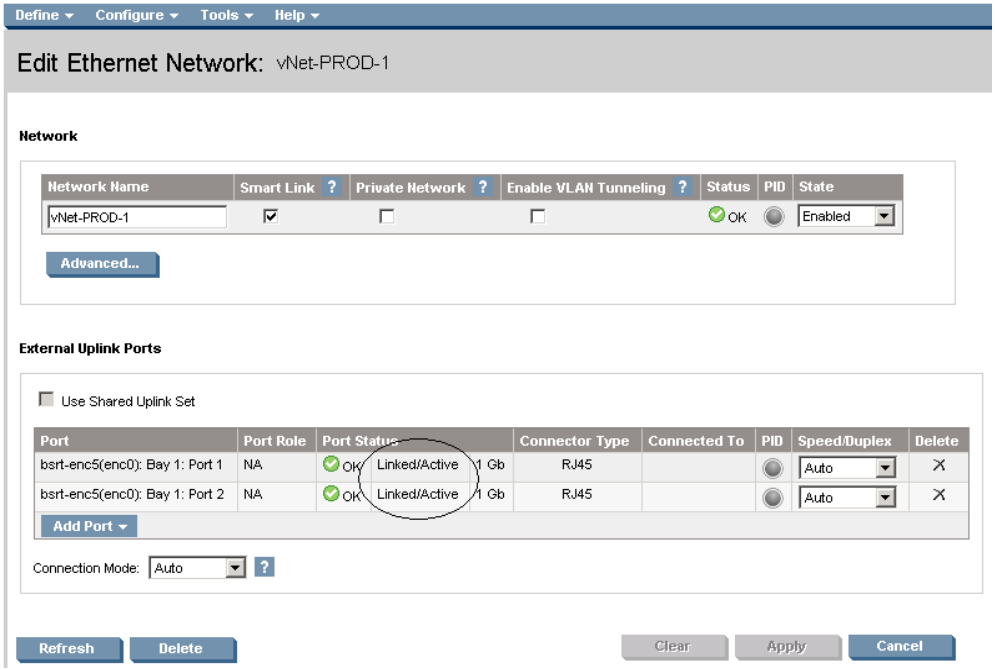
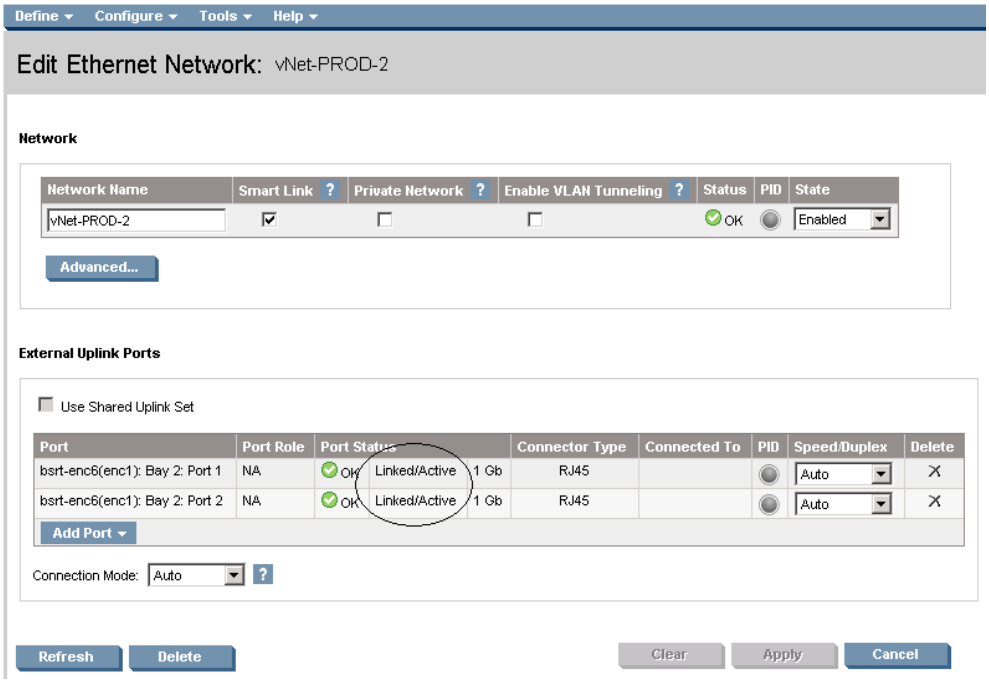


**Figure 3-10** Define Ethernet Network (vNet-PROD-2).

Note: The uplinks are connected to different enclosures, (enc0 and enc1).




## Defining a Server Profile with NIC 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"

## Defining a Server Profile with NIC 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

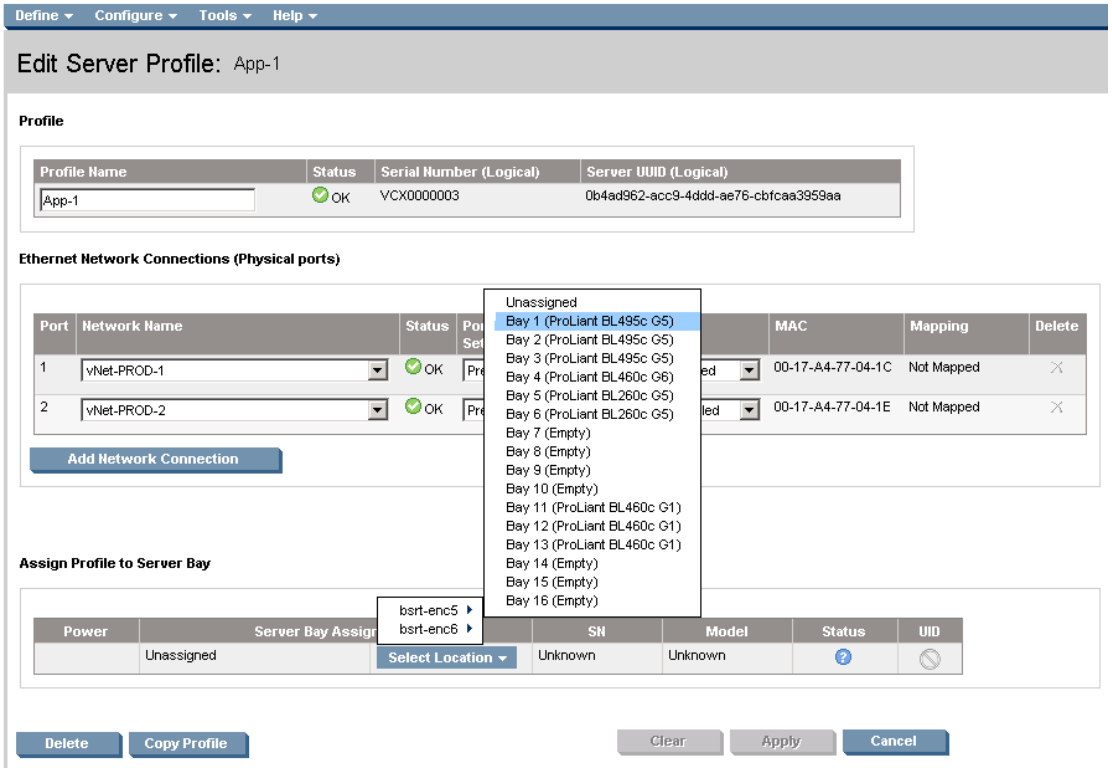
- Create a server profile called "App-1"
- In the Network Port 1 drop down box, select "vNet-PROD"
- In the Network Port 2 drop down box, select "vNet-PROD"
- In the Assign the Profile to a Server Bay, select Bay 1 and apply

## Defining a Server Profile with NIC 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 –nodefaultenetconn
add enet-connection App-1 pxe=Enabled
add enet-connection App-1 pxe=Disabled
set enet-connection App-1 1 Network=vNet-PROD-1
set enet-connection App-1 2 Network=vNet-PROD-2
assign profile App-1 enc0:1
```

**Figure 3-11** Define a Server Profile (App-1) and Assigns it to a Bay in either enclosure.




# Summary

We created a Virtual Connect Domain within a BladeSystem c7000 enclosure, using 10Gb Ethernet cables, we then connected the VC modules from a second enclosure to this enclosure. We then extended the Virtual Connect domain (stacked) to include the second enclosure.

We created a Virtual Connect network (vNet) which provided additional bandwidth through LACP with fail-over capabilities to uplinks on a from the second enclosure. One set of uplinks are will provide active network connections while the second set of uplinks will be in standby mode to prevent any network loops.

When VC profile App-1 is applied to the server in bay1 and is powered up, it has one NIC through each module connected to "vNet-PROD", which connects to the network infrastructure through the 1Gb uplinks. These NICs could now be configured as individual NICs (figure 1-8) with their own IP address or as a pair of TEAMED NICs (figure 1-9). 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. This server profile could then be assigned to any valid server bay within the Virtual Connect stack.

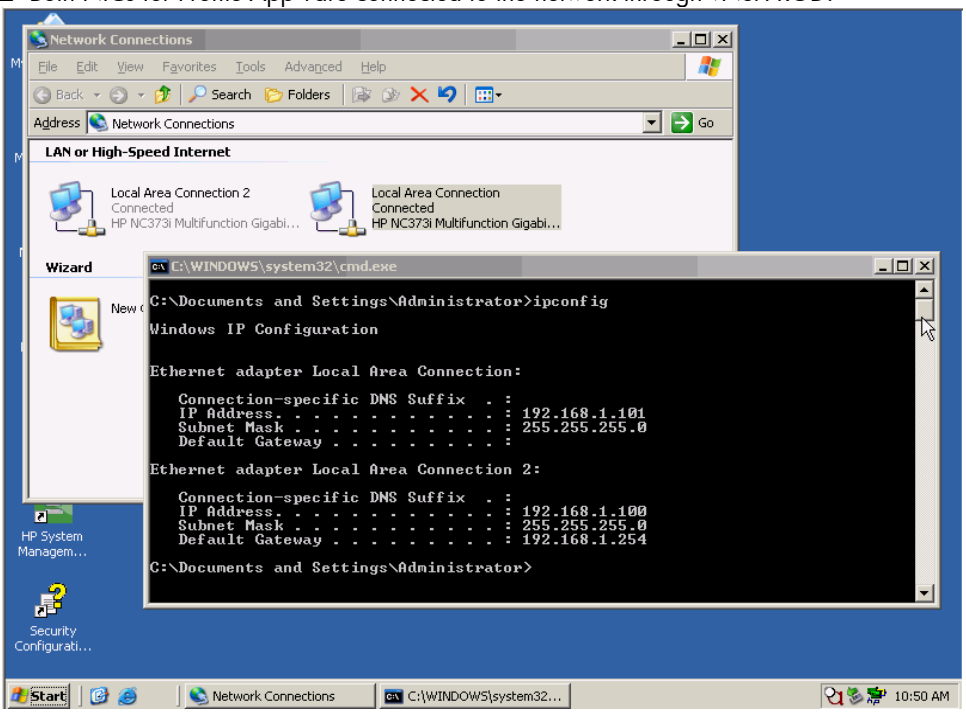
As additional servers are added to the enclosure, simply create additional profiles, or copy existing profiles, configure the NICs for vNet-PROD and apply them to the appropriate server bays.

Additional enclosures could be added to the stack by following the same instructions used to add the second enclosure; up to four (4) enclosures can be stacked.

# Results

The following graphic provides an example of a Windows 2003 server with TWO NICs connected to the network, each NIC has its own TCP/IP address, either or both NICs could be actively working on the network.

**Figure 3-12** Both NICs for Profile App-1are connected to the network through vNet-PROD.




The following graphics provide an example of a Windows 2003 server with TWO NICs teamed and connected to the network. One NIC will be active while the other is in standby. In the event of an Uplink or switch failure, VC will fail-over to the standby uplinks. IF VC were to fail, the NIC teaming software would fail-over to the standby NIC.

**Figure 3-13** Team both NICs, using the HP Network Configuration Utility.

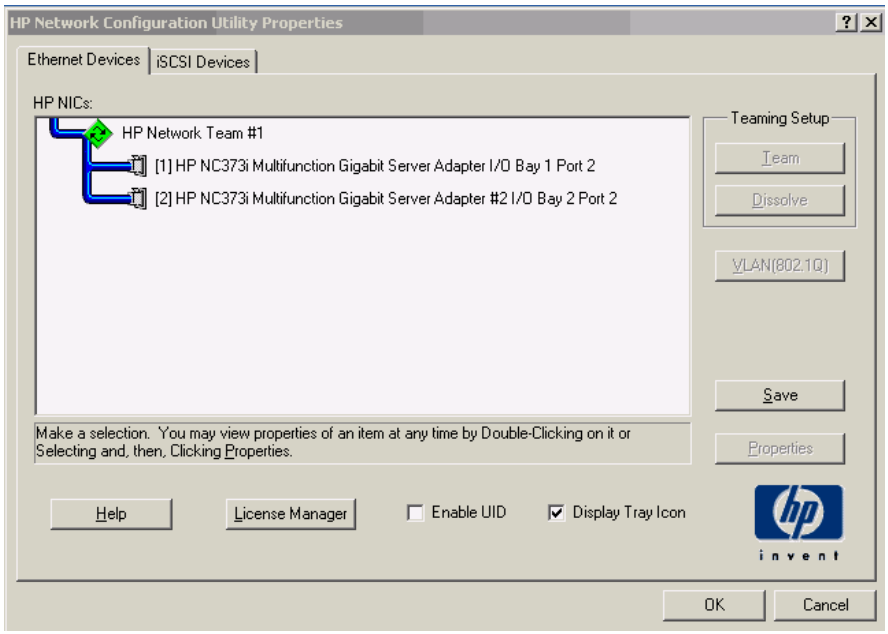
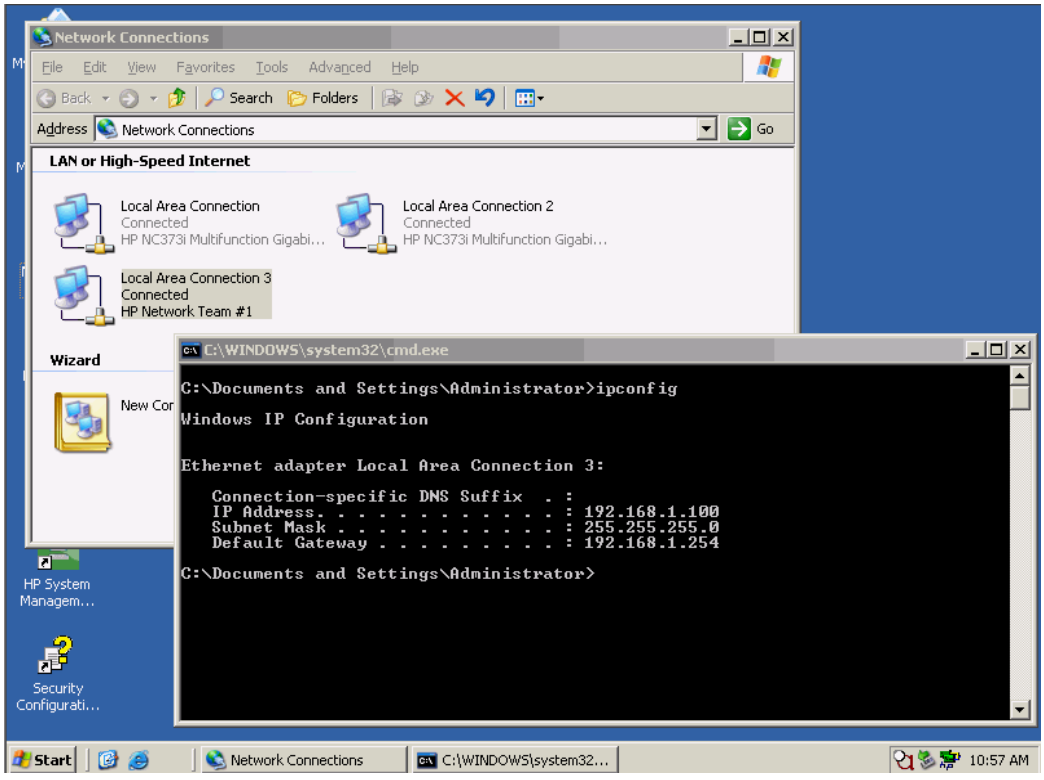



**Figure 3-14** Both NICs for Profile App-1are teamed and connected to the network through vNet-PROD.



# Scenario 3:2 - Flex-10 with Multi-Enclosure stacking - VLAN Tagging (802.1Q) with Multiple Shared Uplink Sets (SUS) - VMware ESX - (4 Enclosures)

## Overview

This scenario discusses the Flex-10 features provided in Virtual Connect. For an overview of Flex-10, please refer to the following technology brief. HP Flex-10 technology brief;

http://h20000.www2.hp.com/bc/docs/support/SupportManual/c01608922/c01608922.pdf

Virtual Connect Flex-10 provides the ability to either present the 10Gb server NICs as single 10Gb NICs, or divide each NIC into as many as 4 "physical function" NICs per NIC port. These physical function NICs look to the server hardware and OS as physical NICs, have their own MAC address and can be configured at speeds from 100Mb to 10Gb.

As shown in earlier scenarios, VLAN access can be handled in two different ways. Virtual Connect can either pass VLAN/Non-VLAN traffic untouched to the host (Tunneling Mode) or Virtual Connect can handle all VLAN tagging (Server Mapped VLANs). Each has their advantages as discussed in the Introduction to Virtual Connect section, earlier in this document.

This scenario, using Map VLAN Tags, will focus more on Enclosure stacking, which is referred to a Multi-enclosure stacking (ME), while leveraging Virtual Connect Flex-10 technology. In this scenario we have two10Gb uplinks configured with multiple VLANs. We will configure a VMware ESX server with SIX NICs, 3 per NIC port, configured at various speed. Some NICs will be connected to specific VLANs, so frames will be presented without tags, others will be configured with multiple networks, were frames will be presented with tags. We will also show how the speed of each NIC can be varied from speeds ranging between 100Mb to 10Gb.

Flex-10 technology can be provided in two ways;

1. Through the use the10Gb (LOM) NICs integrated on the main PCB, or;
2. Through the installation of a DUAL PORT 10Gb-KR mezzanine card (NC532m) in an HP BladeSystem server. The first server to provide 10Gb LOM NICs is the BL495c, which is what is being used in the following example.

The key benefit of Flex-10 is that; we now have 10Gb of network bandwidth available per NIC port with the ability to partition or divide that bandwidth into as many as four (4) independent configurable physical NICs per port. These NICs can be configured at speeds of between 100Mb and 10Gb providing the ability to tune bandwidth to the specific need, such as, management, VMotion or production networks. With current technology, all networks would be provided with the same 1Gb speed and would require independent discrete NICs. With Flex-10, we can now provide each network with the desired speed as shown in the following table.

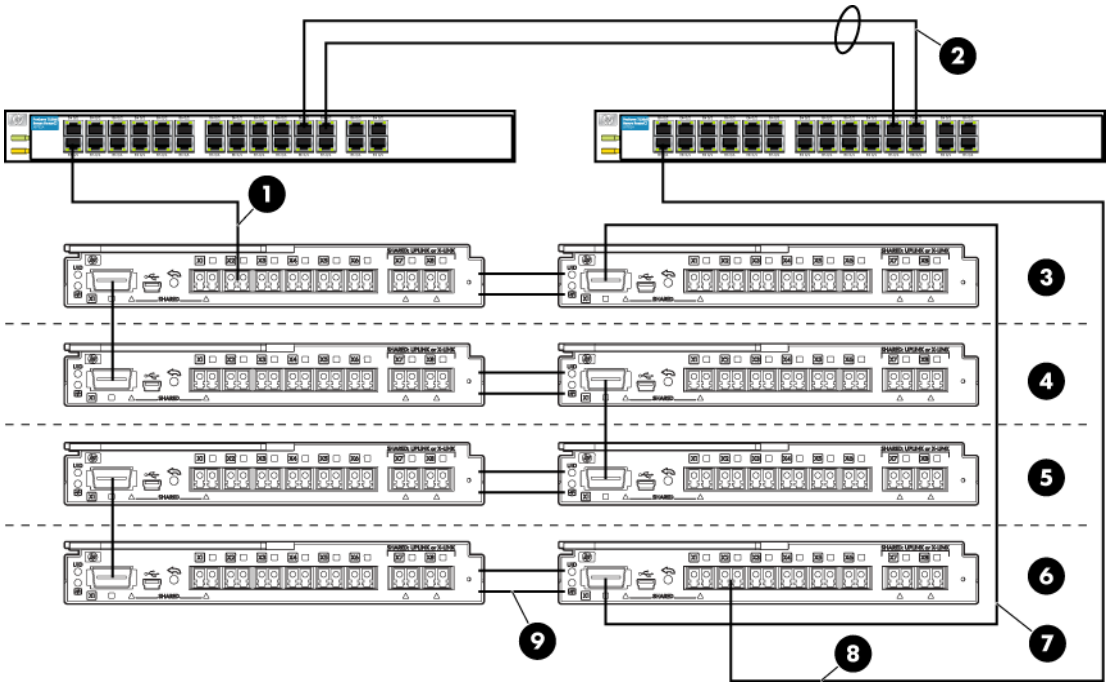
**Table 3-1** Flex-10 NIC – Optimization for a VMWARE ESX implementation

| | Console NIC #1 | VMotion NIC #2 | Production NIC #3 | Console NIC #4 | VMotion NIC #5 | Production NIC #6 |
|---|---|---|---|---|---|---|
| Traditional 1Gb technology | 1Gb | 1Gb | 1Gb | 1Gb | 1Gb | 1Gb |
| Virtual Connect Flex-10 | 500Mb | 2.5Gb | 7Gb | 500Mb | 2.5Gb | 7Gb |

# Requirements

In order to implement this scenario, four HP BladeSystem c7000 enclosure with one of more Blade G6 servers with 10Gb NICs and TWO Virtual Connect Flex-10 Ethernet modules, installed in 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.

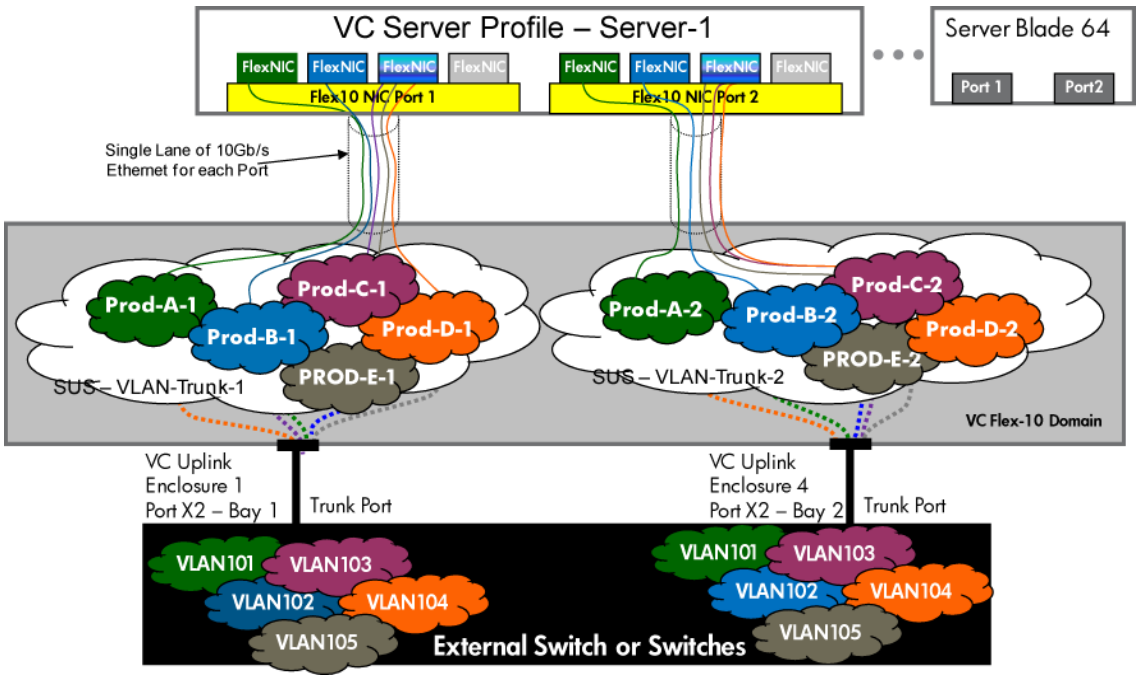
**Figure 3-15** Physical View; Shows one 10Gb Ethernet uplink from Port X2 on Module 1, enclosure 1 to Port 1 on the first network switch and one 10Gb uplink from Port X2 on Module 2, enclosure 2 to Port 1 on the second network switch.




| Item | Description |
|---|---|

| Item | Description |
|---|---|
| 1 | 10 Gb Uplink |
| 2 | Switch Cross Connect |
| 3 | Enclosure 1 |
| 4 | Enclosure 2 |
| 5 | Enclosure 3 |
| 6 | Enclosure 4 |
| 7 | External 10Gb Stacking link |
| 8 | 10 Gb Uplink |
| 9 | Internal Dual 10Gb Stacking links |

**Figure 3-16** Server Blade profile with TWO Flex-10 NICs configured. Each NIC is connected to a Shared Uplink Set (VLAN-Trunk-1 and VLAN-Trunk-2), the additional NICs are connected to other networks, which are also part of the Shared Uplink Sets. The VLAN-Trunks are connected, at 10Gb, to a network switch, through Port X2 on VC module 1, enclosure 1 and Port X2 on VC module 2, enclosure 4, creating an Active/Active uplink.



# Installation and configuration

## Switch configuration

Appendices A and B provide a summary of the commands required to configure the switch in either a Cisco IOS or a ProCurve network infrastructure. The configuration information provided in the appendices assumes the following information:

- The switch ports are configured as TRUNK ports to support VLANs 101, 102, 103, 104 and 105. All frames will be forwarding to VC with VLAN tags.
- When adding the additional uplinks to the SUS, the switch ports connected to Virtual Connect will need to be configured for LACP and configured for the same Link Aggregation Group.

## 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 the VC Module for Map VLAN Tags via GUI (Ethernet settings)

Flex-10 has also provided additional controls when configuring VC for mapped VLAN tags (Multiple Networks over a single link) support. These features provide the ability to set a Custom or Preferred network speed value for each NIC. These are VC domain wide settings and when configured will limit the maximum configurable speed of a NIC.

Enable Map VLAN Tags within Virtual Connect

- On the Virtual Connect Manager screen, Left pane, click Ethernet Settings, Advanced Settings
- Select Map VLAN Tags
- Optionally, select a preferred/Maximum link speed
- Select Apply

## Configuring the VC Module for Map VLAN Tags 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 "Map VLAN Tags" and Enable Fast MAC cache fail-over
set enet-vlan vlantagcontrol=Map
```

**Note:** Do not set a Preferred or Max speed for this scenario. This example is provided for reference only. For the purpose of this scenario, we will not be configuring the custom values for Preferred Link or Maximum Connection speeds. However, the CLI commands are provided below for reference.

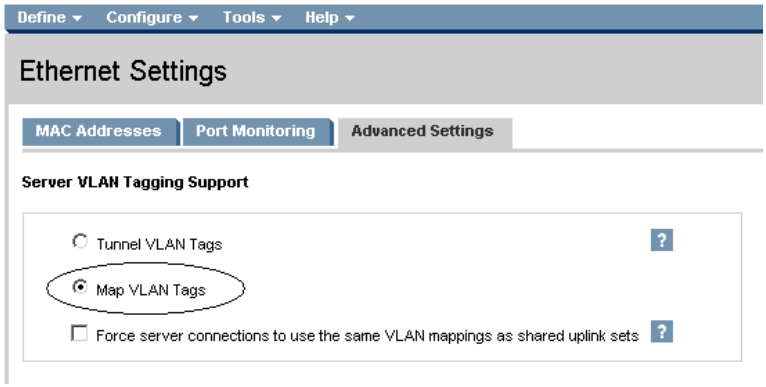
Selecting the Set a Customer value for Preferred Link Connection Speed and/or Set a Customer value for Maximum Link Connection Speed, Sets the respective speed for all connections using multiple networks to 500Mb and maximum connection speed to 2.5Gb.

*Optionally*

```
# Set Advanced Ethernet Settings to a Preferred speed of 500Mb and a Max Speed of 2500Mb
```

set enet-vlan PrefSpeedType=Custom PrefSpeed=500 MaxSpeedType=Custom MaxSpeed=2500

**Figure 3-17** Ethernet Settings.




## Importing the Second (and additional) Enclosure(s) via GUI

In order to stack Virtual Connect we need to first implement Virtual Connect, configure a Virtual Connect Domain within a HP BladeSystem c7000 enclosure, cable the enclosure together and then "import" the additional enclosures into the existing VC Domain. Up to three additional HP BladeSystem c7000 enclosures can be imported. The enclosures being imported must have no Virtual Connect domain configured, and should be considered as "bare metal". However, the Onboard Administrator (OA) must be configured and the VC modules within the enclosure must have TCP/IP addresses configured.

To import the second enclosure;

- Login to the existing Virtual Connect domain of the first enclosure and select Domain Enclosures in the left pane
- Press the "Find" button
- Enter the IP address and credentials for the OA of the enclosure you wish to import
- Select the enclosure, then press the "Import" button, this may take a few minutes to complete
- From the left pane, select Stacking Links and verify there are no stacking link errors

If additional enclosures need to be imported, press the Find button again and follow the steps above for each additional enclosure.

## Importing the Second Enclosure via CLI

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

```
# Importing an Enclosure into an existing VC Domain
Import enclosure 10.0.0.50 UserName=Administrator Password=password DoubleDense=False
```

Note: the IP Address (User name and password) is for the OA of the enclosure being imported. The Double Dense statement is optional if double dense blades are not used.

## Importing multiple Enclosures via CLI

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

```
# Importing an Enclosure into an existing VC Domain (See note below)
```

Note: when importing additional enclosures through the CLI, each of the import Enclosure statements below must be executed individually and cannot be part of a larger script. When run, each command will ask for a "yes" to confirm the enclosure importation, once the enclosure has been found.

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

**Figure 3-18** Importing an enclosure into an existing VC Domain.

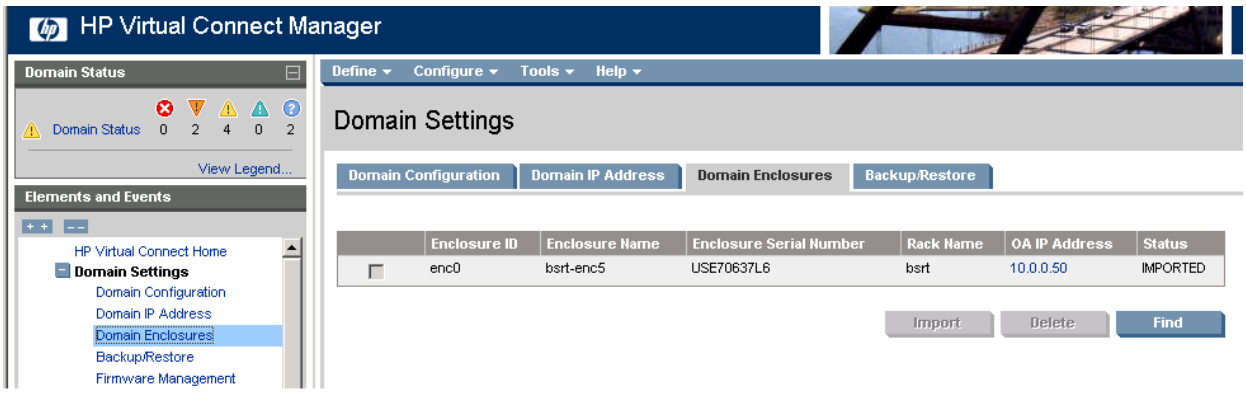



**Figure 3-19** Enter the IP address and credentials of for the OA of the enclosure being imported.

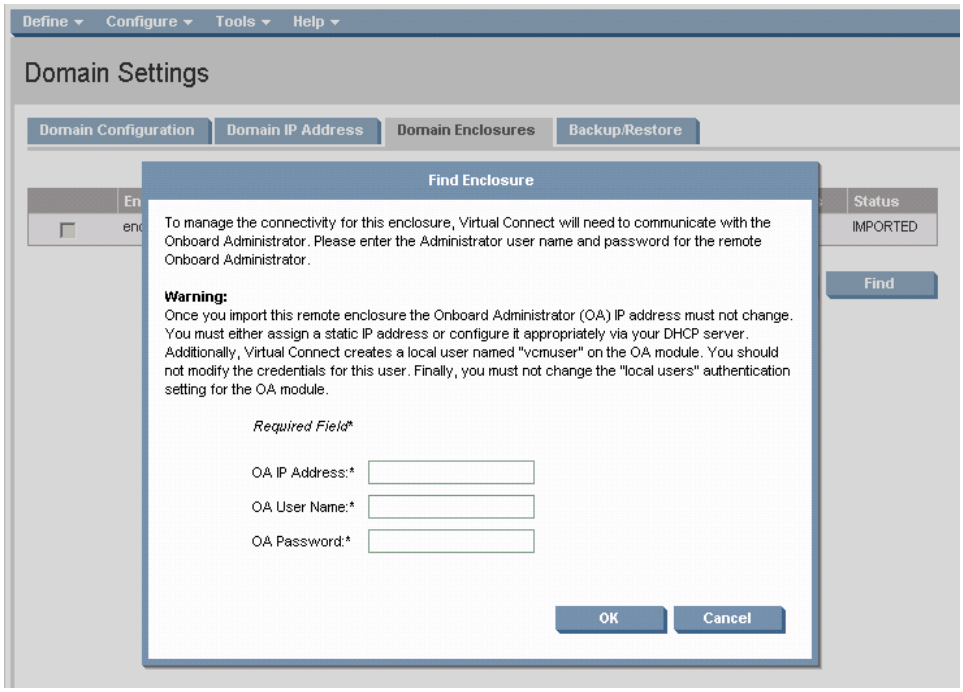


**Figure 3-20** Importing the enclosure.

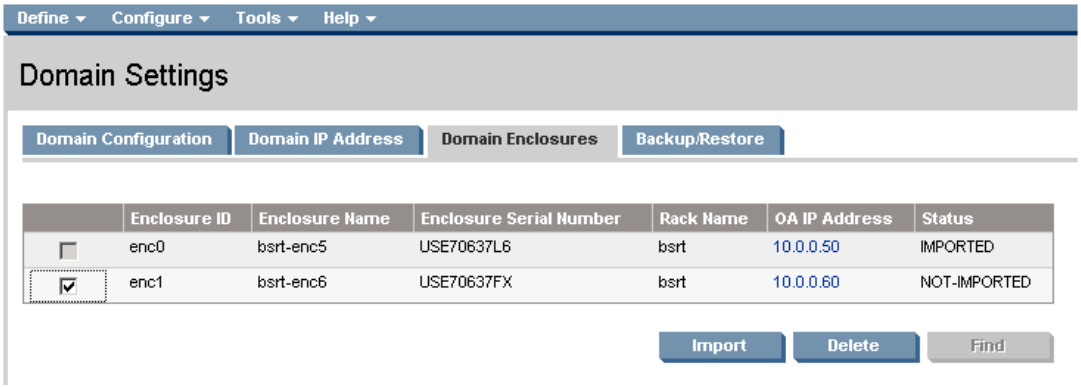



**Figure 3-21** Importing additional enclosures.

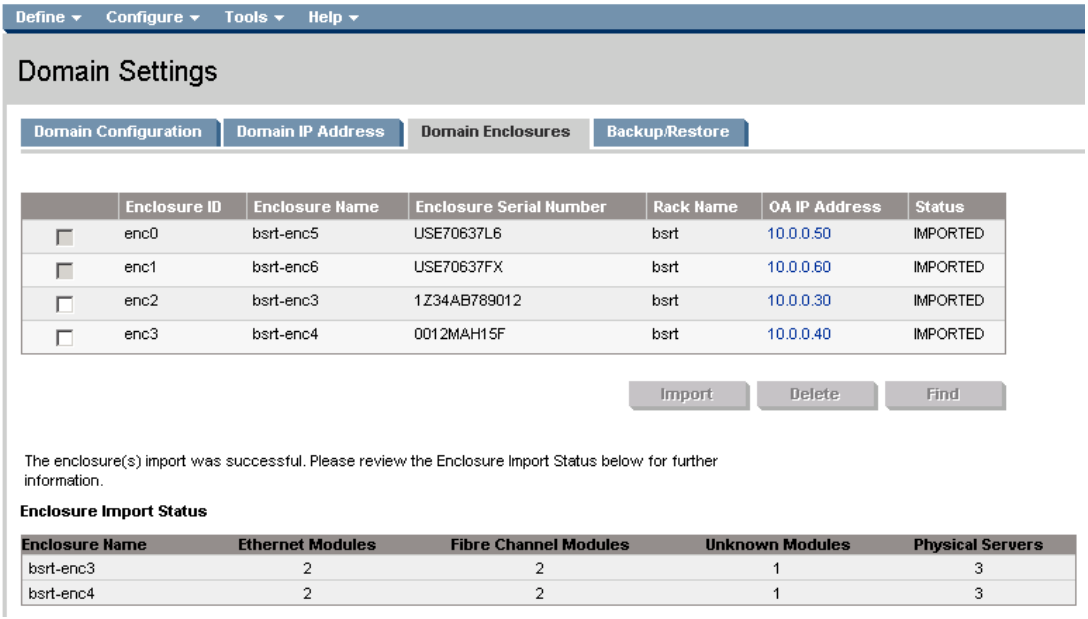
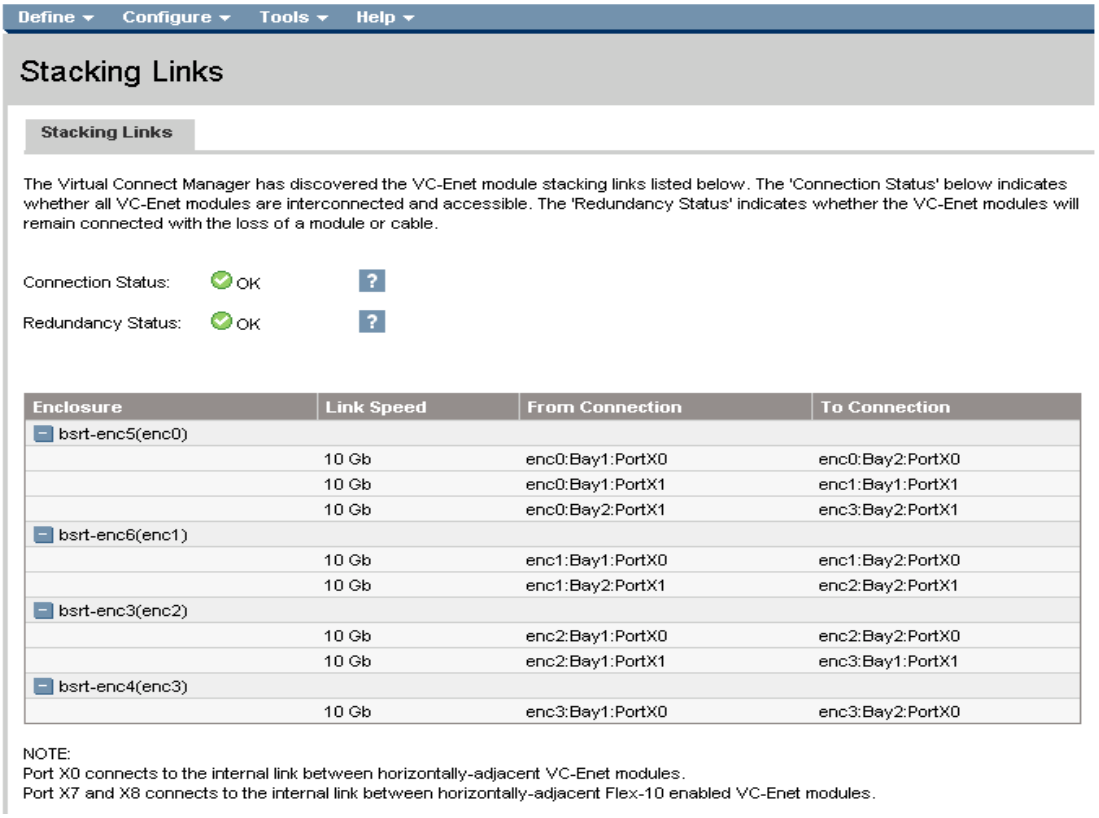


**Figure 3-22** VC Domain Stacking Links.




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

Connect Port X2 of VC module 1, enclosure 1 to Port 1 on switch 1

Create a SUS named “VLAN-Trunk-1” and connect it to Flex-10 Port X2 on Module 1, enclosure 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;
  a. Enclosure 1, Bay 1, Port X2
- Add Networks as follows;
  a. PROD-A-1 = VLAN ID=101
  b. PROD-B-1 = VLAN ID=102
  c. PROD-C-1 = VLAN ID=103
  d. PROD-D-1 = VLAN ID=104
  e. PROD-E-1 = VLAN ID=105
- Enable Smart Link on each network
- Click Apply

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

Connect Port X2 of VC module 2m enclosure 4 to Port 1 on switch 2

Create a SUS named “VLAN-Trunk-2” and connect it to Flex-10 Port X2 on Module 2, enclosure 4

- On the Virtual Connect Home page, select Define, Shared Uplink Set
- Insert Uplink Set Name as VLAN-Trunk-2
- Select Add Port, then add the following port;
  a. Enclosure 4, Bay 2, Port X2
- Add Networks as follows;
  a. PROD-A-2 = VLAN ID=101
  b. PROD-B-2 = VLAN ID=102
  c. PROD-C-2 = VLAN ID=103
  d. PROD-D-2 = VLAN ID=104
  e. PROD-E-2 = VLAN ID=105
- Enable Smart Link on each network
- Click Apply

## 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*

*Note: This uplink will connect from Enclosure 1, Bay 1*

```
# Create Shared Uplink Set "VLAN-Trunk-1" and configure uplinks
add uplinkset VLAN-Trunk-1
add uplinkport enc0:1:X2 Uplinkset=VLAN-Trunk-1 speed=auto

# Create Networks Prod-A-1 through Prod-D-1 for Shared Uplink Set "VLAN-Trunk-1"
add network PROD-A-1 uplinkset=VLAN-Trunk-1 VLanID=101
set network PROD-A-1 SmartLink=Enabled
add network PROD-B-1 uplinkset=VLAN-Trunk-1 VLanID=102
set network PROD-B-1 SmartLink=Enabled
add network PROD-C-1 uplinkset=VLAN-Trunk-1 VLanID=103
set network PROD-C-1 SmartLink=Enabled
add network PROD-D-1 uplinkset=VLAN-Trunk-1 VLanID=104
set network PROD-D-1 SmartLink=Enabled
add network PROD-E-1 uplinkset=VLAN-Trunk-1 VLanID=105
set network PROD-E-1 SmartLink=Enabled
```

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

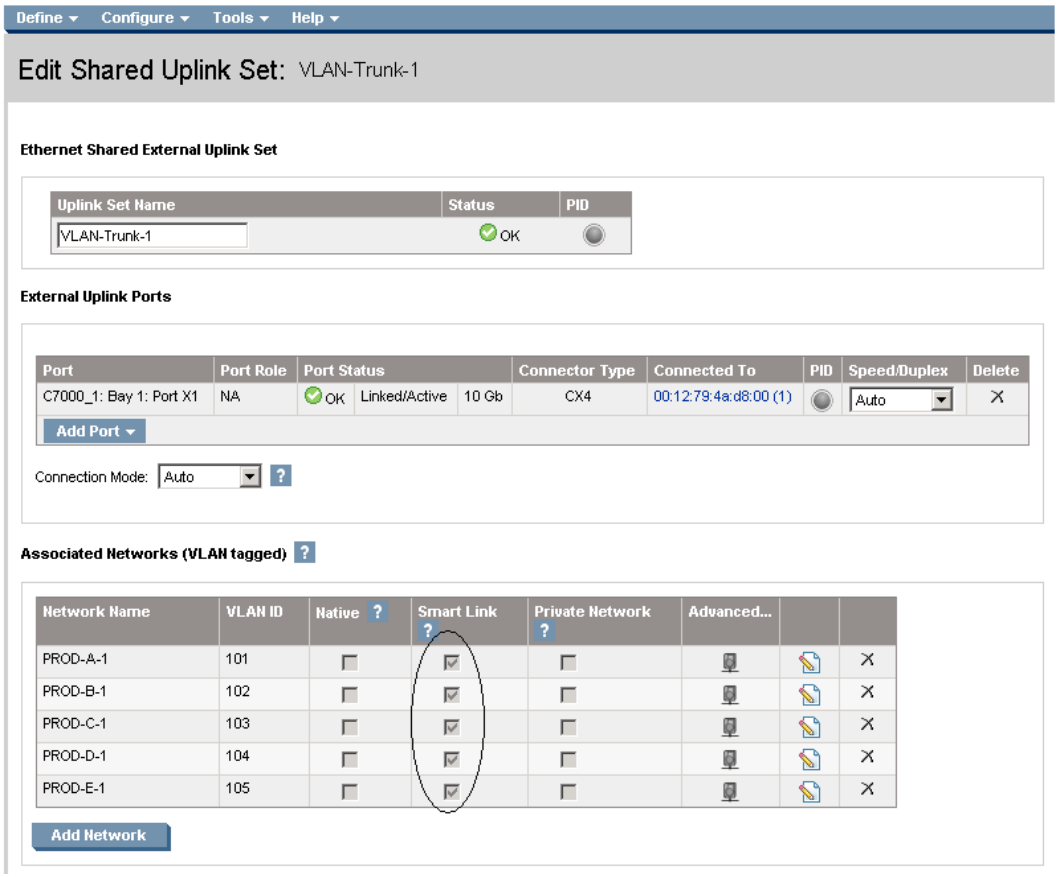
*Note: This uplink will connect from Enclosure 3, Bay 2*

```
# Create Shared Uplink Set "VLAN-Trunk-2" and configure uplinks
add uplinkset VLAN-Trunk-2
add uplinkport enc3:2:X2 Uplinkset=VLAN-Trunk-2 speed=auto

# Create Networks Prod-A-2 through Prod-D-2 for Shared Uplink Set "VLAN-Trunk-2"
add network PROD-A-2 uplinkset=VLAN-Trunk-2 VLanID=101
set network PROD-A-2 SmartLink=Enabled
add network PROD-B-2 uplinkset=VLAN-Trunk-2 VLanID=102
set network PROD-B-2 SmartLink=Enabled
add network PROD-C-2 uplinkset=VLAN-Trunk-2 VLanID=103
set network PROD-C-2 SmartLink=Enabled
add network PROD-D-2 uplinkset=VLAN-Trunk-2 VLanID=104
set network PROD-D-2 SmartLink=Enabled
add network PROD-E-2 uplinkset=VLAN-Trunk-2 VLanID=105
set network PROD-E-2 SmartLink=Enabled
```

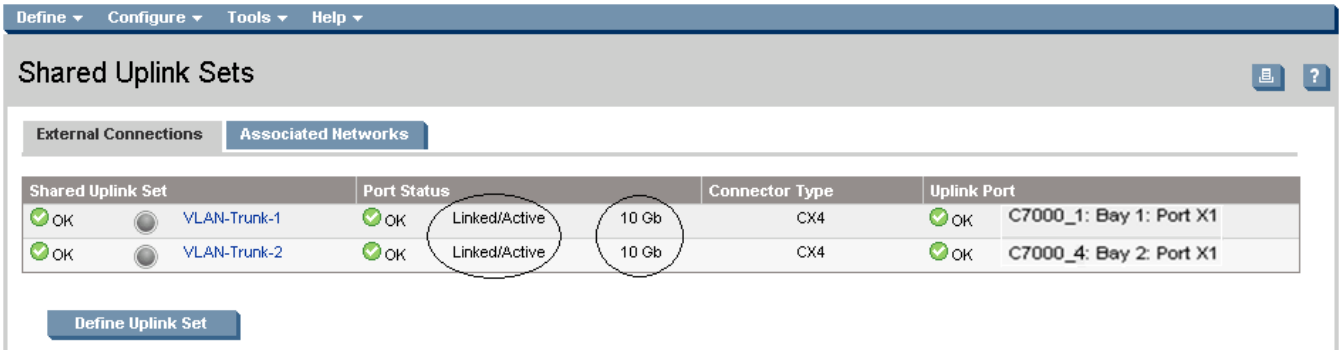
**Note:** It is important to point out at this time, if you are familiar with VC scripting, or have existing VC scripts that you had used on Virtual Connect 1:10 modules, and may want to use with Flex-10, the numbering of the Flex-10 external ports is different than with early modules of VC. VC-E and VC-F uplinks ports are numbered as Ports 1, 2, 3 etc., however; Flex-10 ports are referenced as X1, X2, X3 etc., plus some of the ports are shared, IE the CX4 is shared with SFP+ Port X1, both are configured as X1, but only one is usable at a time. If a CX-4 cable is connected the SFP+ port will become disable, the same is true for Ports X7 & X8, which are the internal cross connect ports, the cross connects will disconnect, if an SFP+ module is plugged in Ports X7 or X8.

**Figure 3-23** Define a Shared Uplink Set (VLAN-Trunk-1) and add VLANs.



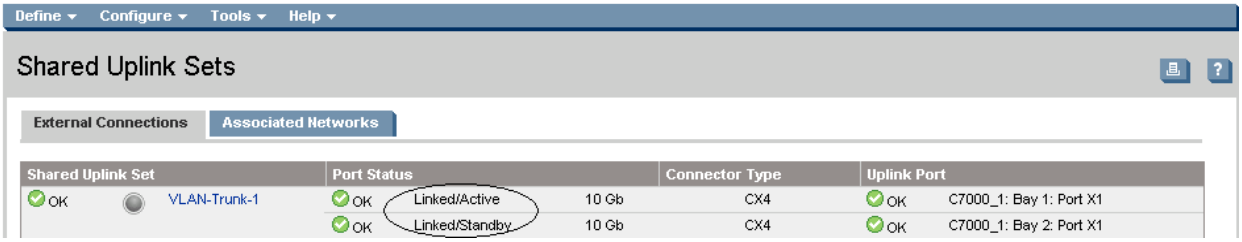

**Note:** The "*Connected to*" field in the graphic above displays the MAC address and port number of the switch this uplink is connected to. This information is provided through LLDP discover and is not available in all switch products. This information can be very helpful when determining which switches and ports VC is connected to.

**Figure 3-24** Active / Active SUS.




**Note:** In this scenario we have created two independent Share Uplink Sets (SUS), each originating from the opposite VC-Modules, by doing so we provide the ability to create separate and redundant connections out of VC. 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 of these uplink ports to the same SUS, however, this would have provided an Active/ Standby uplink scenario.

**Figure 3-25** Example of a Active / Standby SUS.




## 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 "Server-1"
- In the Network Port 1 drop down box, select PROD-A-1, configure the speed as custom at 500Mb
- In the Network Port 2 drop down box, select PROD-A-2, configure the speed as custom at 500Mb
- In the Network Port 3 drop down box, select PROD-B-1, configure the speed as custom at 2.5Gb
- In the Network Port 4 drop down box, select PROD-B-2, configure the speed as custom at 2.5Gb
- In the Network Port 5 drop down box, select Multiple Networks, configure the speed as Auto
  - Configure Multiple Networks for PROD-C-1, PROD-D-1 and PROD-E-1
- In the Network Port 6 drop down box, select Multiple Networks, configure the speed as Auto
  - Configure Multiple Networks for PROD-C-2, PROD-D-2 and PROD-E-2
- In the Assign Profile to Server Bay box, locate the Select Location drop down and select Bay 1, then apply

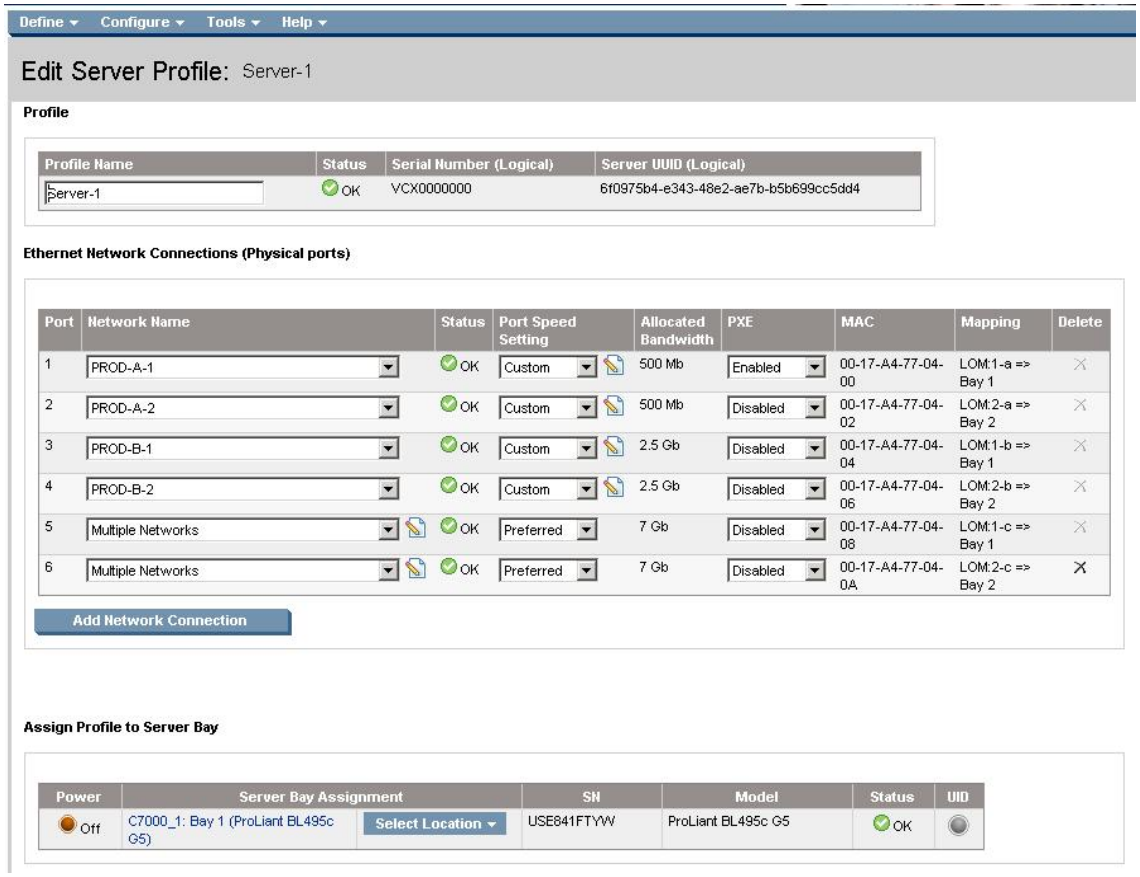
**Note:** you should now have a server profile assigned to Bay 1, with 6 Server NICs connected to the various networks. NICs 5&6 should have a link speed of 7.5Gb

## 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 Server-1
add profile Server-1 –nodefaultenetconn
add enet-connection Server-1 pxe=Enabled Network=PROD-A-1 SpeedType=Custom Speed=500
add enet-connection Server-1 pxe=Disabled Network=PROD-A-2 SpeedType=Custom Speed=500
add enet-connection Server-1 pxe=Disabled Network=PROD-B-1 SpeedType=Custom
Speed=2500
add enet-connection Server-1 pxe=Disabled Network=PROD-B-2 SpeedType=Custom
Speed=2500
add enet-connection Server-1 pxe=Disabled
add server-port-map Server-1:5 PROD-C-1 VLanId=103
add server-port-map Server-1:5 PROD-D-1 VLanId=104
add server-port-map Server-1:5 PROD-E-1 VLanId=105
add enet-connection Server-1 pxe=Disabled
add server-port-map Server-1:6 PROD-C-2 VLanId=103
add server-port-map Server-1:6 PROD-D-2 VLanId=104
add server-port-map Server-1:6 PROD-E-2 VLanId=105
Assign profile Server-1 enc0:1
```

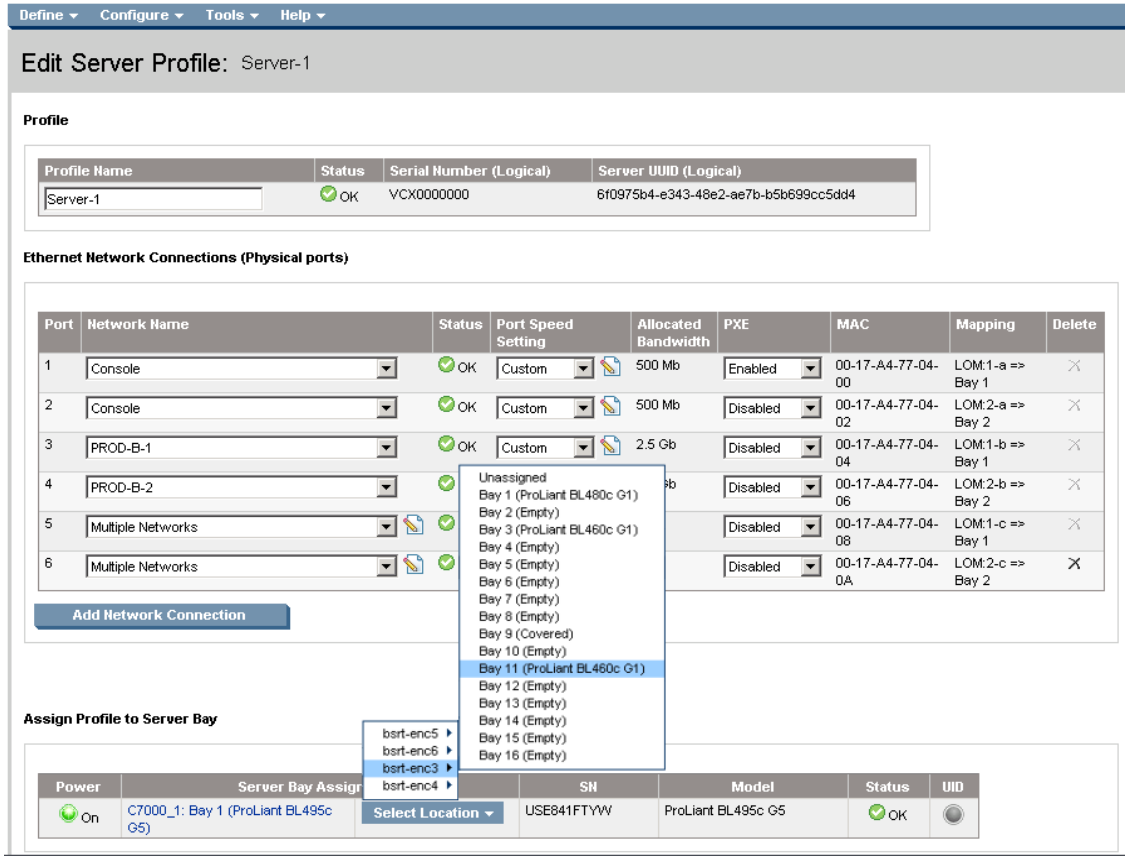
**Figure 3-26** Define a Server Profile with 6 NICs.



Alternatively, the profile could be assigned to any server bay within the enclosure stack.

# Create Server Profile Server-1 to the 4th enclosure, bay 11

**Figure 3-27** Assign the server Profile to Enclosure 3, slot 11.



## Server NIC Speed and LOM Mappings

We will now focus more of the specific Flex-10 features.

Note the "Allocated Bandwidth" and the LOM "Mapping" settings in the following graphic. Flex-10 based NICs have the ability of being configured as a Single 10Gb NIC or divided into as many as FOUR (4) physical NICs. It is important to note the LOM mappings when configuring which NIC will be connected to which network, as a NIC on a specific LOM can connect to a network only once. (IE, NIC LOM:1-a can be assigned to Prod-101-1, no other NIC on LOM:1 can be assigned to Prod-101-1) This is discussed in further details in the Flex-10 technology brief mentioned earlier in this document.

As additional NICs are added to a profile that is assigned to a server with a 10Gb Flex-NIC, the assignment will alternate between LOM:1-x and LOM:2-x. The first NIC will be LOM:1-a, the second will be LOM:2-a, then LOM:1-b, LOM:2-b etc. to a max of 4 NICs per LOM.

Also, note that if additional NICs are required, this server has only 6 NICs configured, we could ADD two more NICs to this server without adding additional hardware. As of Virtual Connect firmware 2.30, Virtual Connect will provide the ability to add/remove or reconfigure the server NICs, including NIC speed, while the server is running.

**Figure 3-28** Server NIC speed and LOM Mappings.

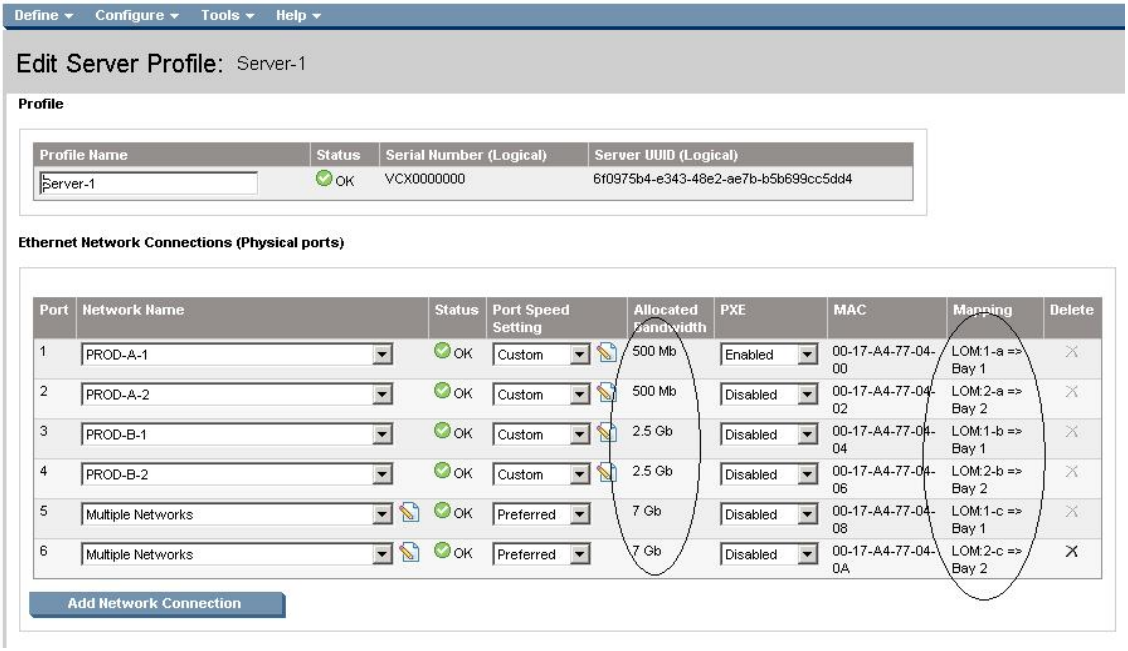


**Figure 3-29** Adjusting the NIC speed.

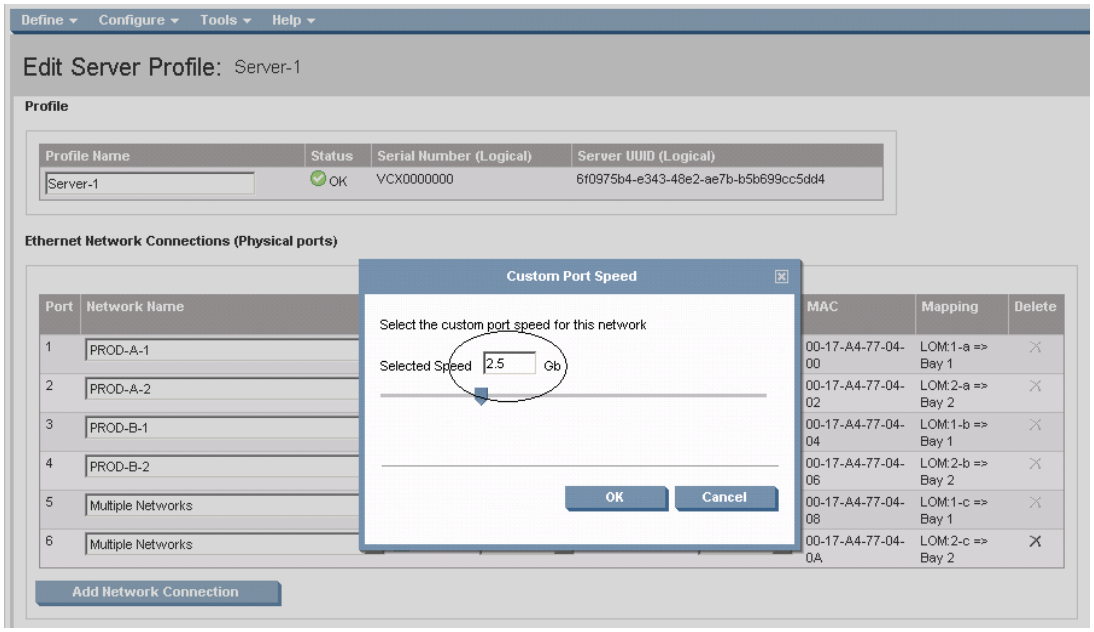
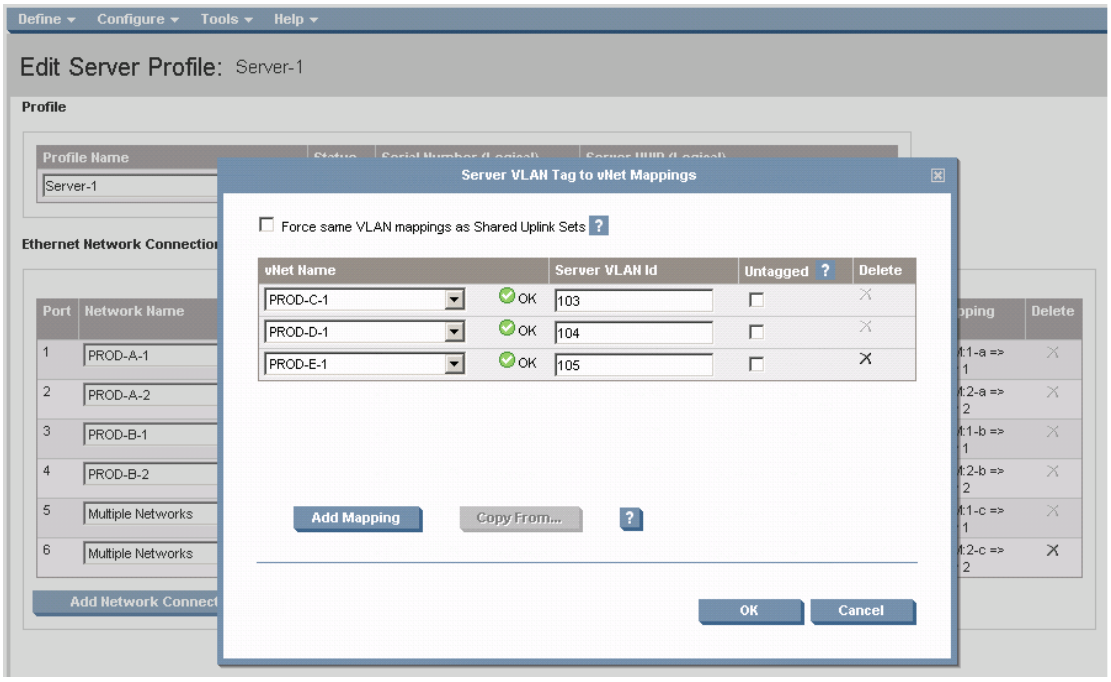



**Figure 3-30** Configuring Multiple Networks.



# Summary

This profile will present NIC 1 to network “PROD-A-1” & NIC 2 to network PROD-A-2 which are mapped to VLAN 101; frames for VLAN 101 will be passed to NICs 1&2 untagged. NICs 3&4 are connected to PROD-B-1 & PROD-B-2, which are mapped to VLAN 102; frames for VLAN 102 will be passed to NICs 3&4 untagged.

NICs 5&6 are connected to “Multiple Networks”, PROD-C-1 – PROD-E-1 and PROD-C-2 – PROD-E-2, which are mapped to VLANs 103 – 104; frames will be passed to NICs 5&6 will be tagged.

If additional NICs are required, simply add the NICs to the server profile, this configuration will support up to 8 NICs without adding additional hardware. If the performance demands of a NIC change, the speed of a NIC could be adjusted up or down.

# Result

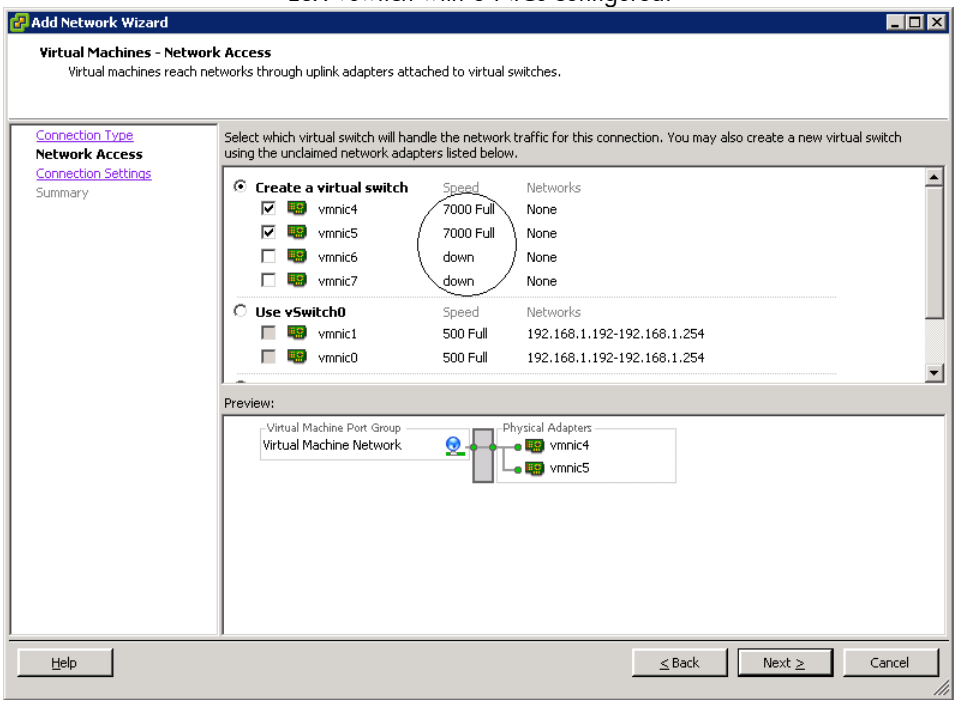
## VMware ESX Configuration Example

The following graphics show an ESX server with two Flex-10 NICs configured as 6 NICs. NICs speeds are also configured accordingly and connected to vSwitches, with port groups to present the VLANs accordingly.

When configuring the vSwitches for ESX, you will notice that 8 NICs actually already exist, however, NICs 7&8 (vmnic6 & vmnic7) are shown as down, as they were not configured within the VC profile. If we need an additional NIC, we simply add it within the Profile, set the speed and apply the profile, the server will need to be powered down to add or remove NICs. However, if the NICs were pre-provisioned within the profile, VC firmware 2.30 added the ability to dynamically, change network connections and link speed, without first powering the server off. Once added/connected to a network, the NICs will be available to be assigned to a vSwitch.

**Figure 3-31** Configuring ESX 4 vSwitch.

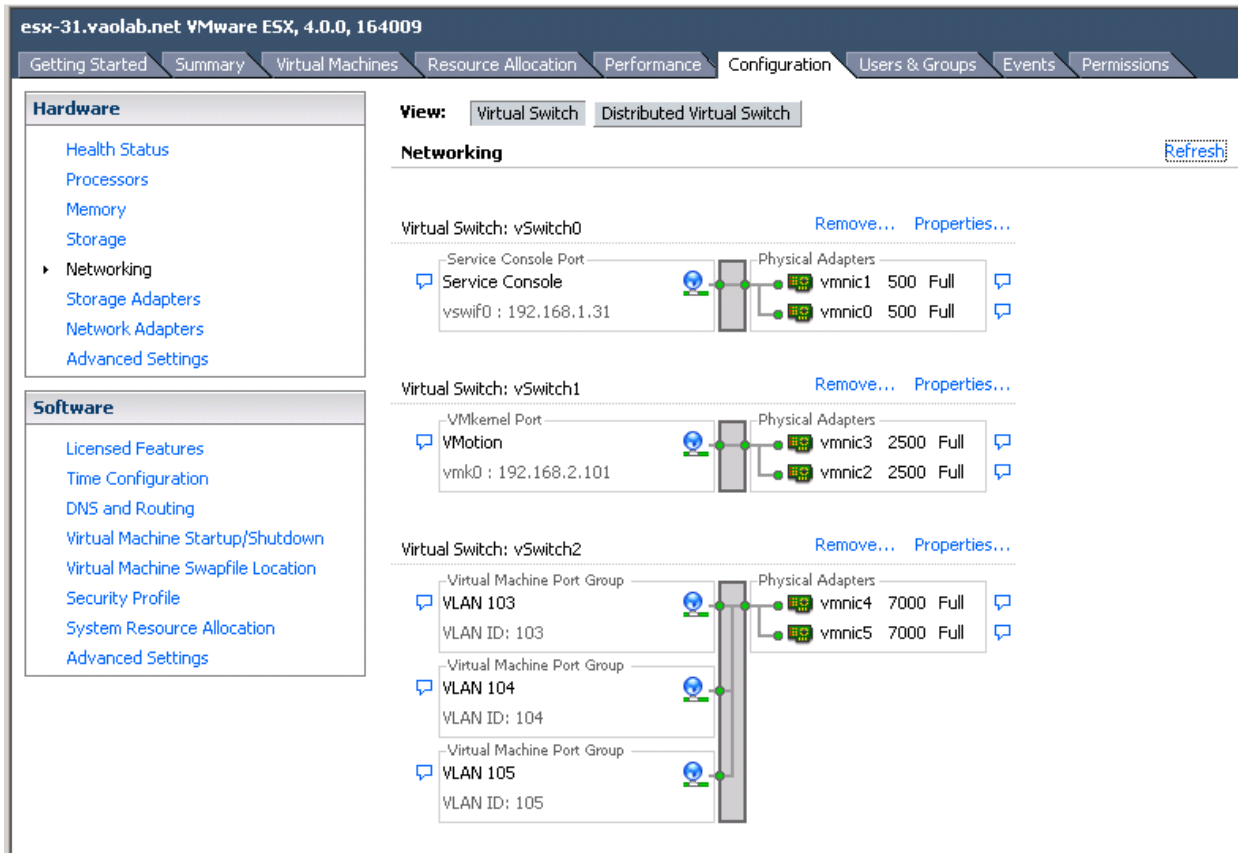
ESX Vswitch with 6 NICs configured.



## ESX 4 Networking Configuration Example

The following graphics show an ESX 4 server with two Flex-10 NICs configured as six NICs.

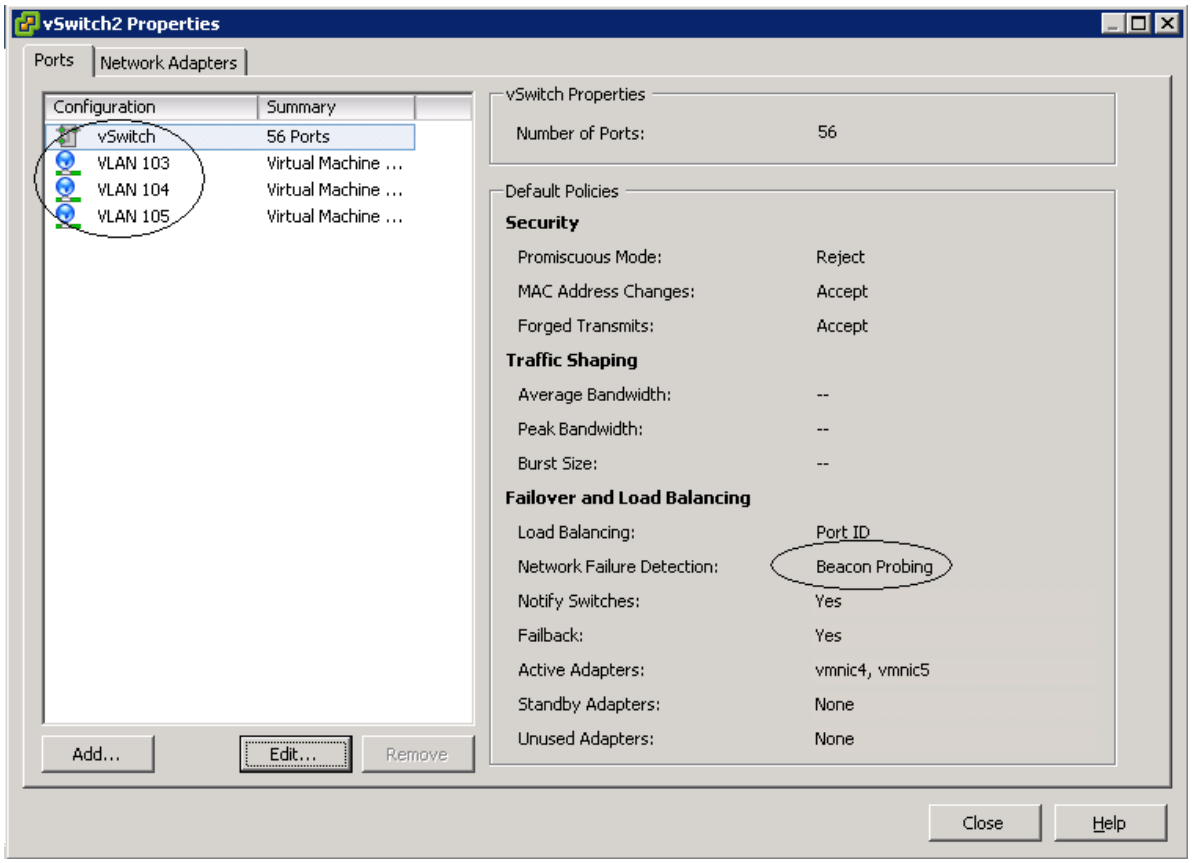
**Figure 3-32** vSwitch Configuration the ESX Host with 6 NICs.



## VMWARE ESX Host Networking configuration Example

When configuring the ESX virtual switch, add virtual networks for each VLAN this ESX host will support.

**Figure 3-33** Configuring the ESX vSwitch for Multiple Networks / VLANs.



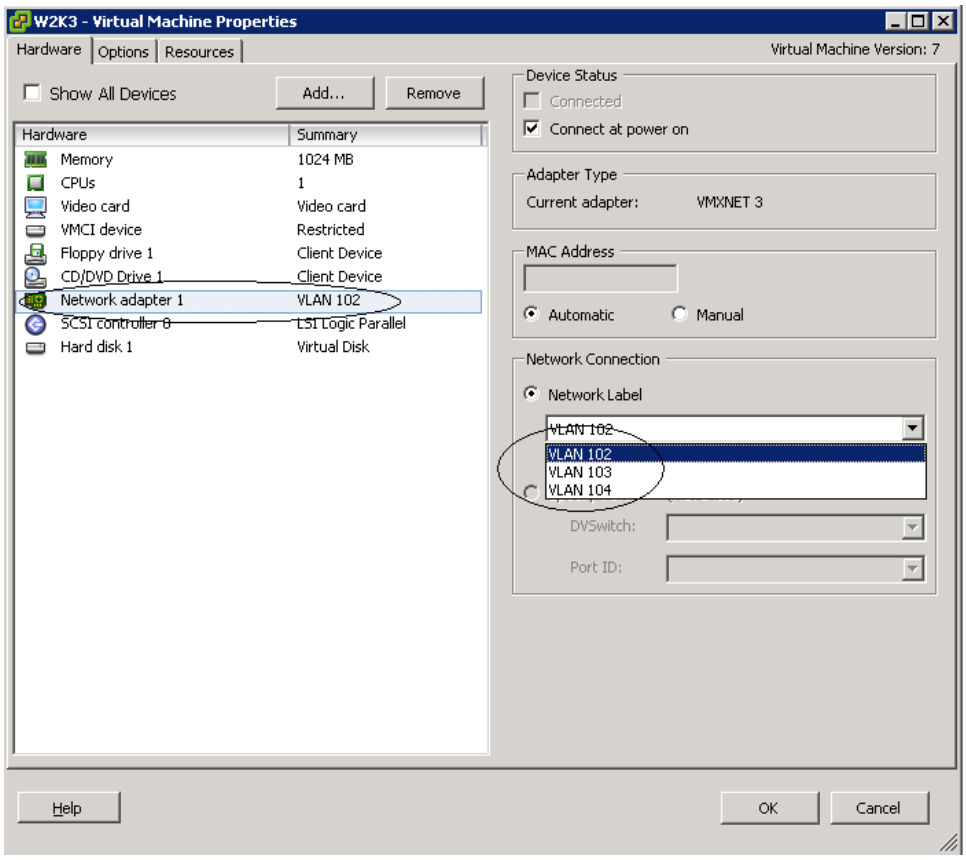

**Note:** That vSwitch 3 has two NICs configured to, redundantly, support VLANs 103, 104 and 105.

**Note:** If implementing ESX 3.5 on Flex-10, first review VMWARE KB 1007982 and ensure Network Failure Detection is set to Beacon Probing.

**Note:** If implementing ESX 4.0 on Flex-10 ensure that ESX driver version 1.52 is installed, also ensure that NIC firmware 5.2.7 is also installed.

When configuring the guest NIC simply chose which VLAN this guest will reside on.

**Figure 3-34** Selection of the Virtual Network (VLAN) as required.



# Appendix A: Scenario-based Cisco command line reference

All of the following commands in this appendix assume an unaltered factory default configuration before execution of the switch commands.

## Scenario 1-1 & 1-2 – Cisco IOS command line configuration (Simple vNet with Active/Standby Uplinks)

Connect to the Cisco switch servicing the VC-Enet uplink ports and enter the following IOS commands.

***NOTE: If two switches are being used, issue the same commands on the second switch.***

**Table 1a** Scenario 1 (Part 1) - Cisco IOS command line configuration

| 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<br># this is an access port, is this required? | #sp portf tr | Enable portfast on Port 1 |
| #exit | #exit | Remove focus from 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<br>(For permanent changes only) | #cop ru st | Save the running configuration to NVRAM. Otherwise, the changes will be lost on the next reboot. |

## Simple vNet with Active/Standby Uplinks and Link Aggregation 802.3ad (LACP) - Windows

Connect to the Cisco switch servicing the VC-Enet uplink ports and enter the following IOS commands.

***NOTE: If two switches are being used, issue the same commands on the second switch.***

**Table 1b** Scenario 1 (Part 2) - Cisco IOS command line configuration

| 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 |
| #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<br># this is an access port, is this required? | #sp portf tr | Enable portfast on Port 1 |
| #exit | #ex | Remove focus from Port 1 |
| #interface gigabitethernet0/2 | #int gi0/2 | Focus on Port 2 |
| #switchport mode access | #sw mo ac | Set port 2 for Single VLAN mode |
| #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 |
| #switchport access vlan 1 | #sw ac vl 1 | Allow Port 2 access to VLAN 1 |
| #spanning-tree portfast trunk<br># this is an access port, is this required? | #sp portf tr | Enable portfast on Port 2 |
| #exit | #exit | Remove focus from Port 2 |
| #exit | #exit | Exit config mode |
| #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 |
| #show vlan brief | #sh vl br | Display all VLANs |
| #show interface gigabitethernet0/2 status | #sh int gi1/0/2 status | Display the status of Port 2 |

**Table 1b** Scenario 1 (Part 2) - Cisco IOS command line configuration

| Command | Shortcut | Description |
|---|---|---|
| #copy running-config startup-config<br>(For permanent changes only) | #cop ru st | Save the running configuration to NVRAM. Otherwise, the changes will be lost on the next reboot. |

# Scenario 1-3 – Cisco IOS command line configuration (Multiple Simple Networks Providing Redundancy and Link Aggregation 802.3ad (LACP))

Connect to the Cisco switch servicing the VC-Enet uplink ports and enter the following IOS commands.

*NOTE: If two switches are being used, issue the same commands on the second switch.*

**Table 4** Scenario 1-3 - Cisco IOS command line configuration (802.1Q, 802.3ad)

| Command | Shortcut | Description |
|---|---|---|
| >enable | >en | Privilege mode |
| #configure terminal | #config t | Configure via terminal |
| #interface gigabitethernet0/1 | #int gi0/1 | Focus on Port 1 |
| #switchport trunk allowed vlan 101-104 | #sw tr ac vl 101-104 | Configure port for VLANs 101 through 104 |
| #switchport mode trunk | #sw mo tr | Enable trunking on Port 1 |
| #channel-protocol lacp | #channel-p l | Configure port 20 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 gigabitethernet0/2 | #int gi0/2 | Focus on Port 2 |
| #switchport trunk allowed vlan 101-104 | #sw tr ac vl 101-104 | Configure Port 2 for VLANs 101 through 104 |
| #switchport mode trunk | #sw mo tr | Enable trunking on Port 2 |
| #channel-protocol lacp | #channel-p l | Configure Port 21 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 |
| #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. |

# Scenario 1-4 through 1-6 – Cisco IOS command line configuration (Multiple Simple Networks Providing Redundancy and Link Aggregation 802.3ad (LACP))

Connect to the Cisco switch servicing the VC-Enet uplink ports and enter the following IOS commands.

*NOTE: If two switches are being used, issue the same commands on the second switch.*

**Table 4** Scenario 1-4 – 1-6 - Cisco IOS command line configuration (802.1Q, 802.3ad)

| Command | Shortcut | Description |
|---|---|---|
| >enable | >en | Privilege mode |
| #configure terminal | #config t | Configure via terminal |
| #interface gigabitethernet0/1 | #int gi0/1 | Focus on Port 1 |
| #switchport trunk allowed vlan 101-104 | #sw tr al vl 101-104 | Configure port for VLANs 101 through 104 |
| #switchport mode trunk | #sw mo tr | Enable trunking on Port 1 |
| #channel-protocol lacp | #channel-p l | Configure port 20 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 gigabitethernet0/2 | #int gi0/2 | Focus on Port 2 |
| #switchport trunk allowed vlan 101-104 | #sw tr al vl 101-104 | Configure port 2 for VLANs 101 through 104 |
| #switchport mode trunk | #sw mo tr | Enable trunking on Port 2 |
| #channel-protocol lacp | #channel-p l | Configure port 21 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 |
| #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. |

# Scenario 1-7 – Cisco IOS command line configuration (Private Networks (Simple vNet))

Connect to the Cisco switch servicing the VC-Enet uplink ports and enter the following IOS commands.

***NOTE: If two switches are being used, issue the same commands on the second switch.***

**Table 7** Scenario 7 - Cisco IOS command line configuration

| 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<br># this is an access port, is this required? | #sp portf tr | Enable portfast on Port 1 |
| #exit | #exit | Remove focus from Port 1 |
| #exit | #exit | Exit config mode |
| #show vlan brief | #sh vl br | Display all VLANs |
| #show interface gigabitethernet0/1 status | #sh int gi1/0/1 status | Display the status of Port 1 |
| #copy running-config startup-config<br>(For permanent changes only) | #cop ru st | Save the running configuration to NVRAM. Otherwise, the changes will be lost on the next reboot. |

# Scenario 2-1– Cisco IOS command line configuration (VLAN Tagging (802.1Q) with Multiple Shared Uplink Sets (SUS))

Connect to the Cisco switch servicing the VC-Enet uplink ports and enter the following IOS commands.

*NOTE: If two switches are being used, issue the same commands on the second switch.*

**Table 4** Scenario 1-4 – 1-6 - Cisco IOS command line configuration (802.1Q)

| 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 trunk allowed vlan 101-104 | #sw tr al vl 101-104 | Configure port for VLANs 101 through 104 |
| #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 |
| #exit | #ex | Exit config mode |
| #show vlan brief | #sh vl br | Display all VLANs |
| #show interface gigabitethernet0/1 status | #sh int gi1/0/1 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. |

# Scenario 2-2 & 2-3 – Cisco IOS command line configuration (VLAN Tagging (802.1Q) with Multiple Shared Uplink Sets (SUS))

Connect to the Cisco switch servicing the VC-Enet uplink ports and enter the following IOS commands.

*NOTE: If two switches are being used, issue the same commands on the second switch.*

**Table 4** Scenario 1-4 – 1-6 - Cisco IOS command line configuration (802.1Q)

| 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 trunk allowed vlan 101-105 | #sw tr al vl 101-105 | Configure port for VLANs 101 through 105 |
| #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 |
| #exit | #ex | Exit config mode |
| #show vlan brief | #sh vl br | Display all VLANs |
| #show interface gigabitethernet0/1 status | #sh int gi1/0/1 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. |

# Scenario 2-4 – Cisco IOS command line configuration (VLAN Tagging (802.1Q) with Multiple Shared Uplink Sets (SUS) and vNets)

Connect to the Cisco switch servicing the VC-Enet uplink ports and enter the following IOS commands.

*NOTE: If two switches are being used, issue the same commands on the second switch.*

**Table 9** Scenario 2-3 & 2-3 Cisco IOS command line configuration (802.1Q, 802.3ad)

| 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 trunk allowed vlan 101-103 | #sw tr al vl 101-103 | Configure port for VLANs 101 through 103 |
| #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 |
| #interface gigabitethernet0/2 | #int gi1/0/2 | Focus on Port 2 |
| #switchport trunk allowed vlan 2000-3000 | #sw tr ac vl 2000-3000 | Configure port for VLANs 2000 through 3000 |
| #switchport mode trunk | #sw mo tr | Enable trunking on Port 2 |
| #spanning-tree portfast trunk | #sp portf tr | Enable portfast on Port 2 |
| #exit | #ex | Remove focus from Port 2 |
| #exit | #ex | Exit config mode |
| #show vlan brief | #sh vl br | Display all VLANs |
| #show interface gigabitethernet0/1 status | #sh int gi1/0/1 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. |

# Scenario 3-1– Cisco IOS command line configuration (Multiple Simple Networks Providing Redundancy and Link Aggregation 802.3ad (LACP))

Connect to the Cisco switch servicing the VC-Enet uplink ports and enter the following IOS commands.

*NOTE: If two switches are being used, issue the same commands on the second switch.*

**Table 10** Scenario 3-1 - Cisco IOS command line configuration

| Command | Shortcut | Description |
|---|---|---|
| >enable | >en | Privilege mode |
| #configure terminal | #config t | Configure via terminal |
| #interface gigabitethernet0/1 | #int gi0/1 | Focus on Port 1 |
| #switchport mode access | #sw mo ac | Set Port 1 for Single VLAN mode |
| #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 |
| #switchport access vlan 1 | #sw ac vl 1 | Allow Port 1 access to VLAN 1 |
| #spanning-tree portfast trunk<br># this is an access port, is this required? | #sp portf tr | Enable portfast on Port 1 |
| #exit | #ex | Remove focus from Port 1 |
| >enable | >en | Privilege mode |
| #configure terminal | #config t | Configure via terminal |
| #interface gigabitethernet0/2 | #int gi0/2 | Focus on Port 2 |
| #switchport mode access | #sw mo ac | Set Port 2 for Single VLAN mode |
| #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 |
| #switchport access vlan 1 | #sw ac vl 1 | Allow Port 2 access to VLAN 1 |
| #spanning-tree portfast trunk<br># this is an access port, is this required? | #sp portf tr | Enable portfast on Port 2 |
| #exit | #ex | Remove focus from Port 2 |
| #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<br>(For permanent changes only) | #cop ru st | Save the running configuration to NVRAM. Otherwise, the changes will be lost on the next reboot. |

# Scenario 3-2 – Cisco IOS command line configuration (VLAN Tagging (802.1Q) with Multiple Shared Uplink Sets (SUS))

Connect to the Cisco switch servicing the VC-Enet uplink ports and enter the following IOS commands.

*NOTE: If two switches are being used, issue the same commands on the second switch.*

**Table 10** Scenario 3-2 Cisco IOS command line configuration (802.1Q)

| Command | Shortcut | Description |
|---|---|---|
| >enable | >en | Privilege mode |
| #configure terminal | #config t | Configure via terminal |
| #interface gigabitethernet0/1 | #int gi0/1 | Focus on Port 1 |
| #switchport trunk encapsulation dot1q | #sw tr enc dot | Configure Port 1 for tagged VLANs |
| #switchport trunk allowed vlan 101-105 | #sw tr ac vl 101-105 | Configure port for VLANs 101 through 105 |
| #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 |
| #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. |

# Appendix B: Scenario-based ProCurve command line reference

## Scenario 1-1 & 1-2 – ProCurve command line configuration (Simple vNet with Active/Standby Uplinks)

Connect to the ProCurve switch servicing the VC-Enet uplink ports and enter the following commands.

***NOTE: If two switches are being used, issue the same commands on the second switch.***

**Table 1a** Scenario 1-1 and 1-2 (Part 1) - ProCurve command line configuration (simple network)

| 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<br><br>(For permanent changes only) | #write mem | Save the running configuration to NVRAM. Otherwise, the changes will be lost on the next reboot. |

## Simple vNet with Active/Standby Uplinks and Link Aggregation 802.3ad (LACP)

Connect to the ProCurve switch servicing the VC-Enet uplink ports and enter the following commands.

***NOTE: If two switches are being used, issue the same commands on the second switch.***

**Table 1b** Scenario 1-1 and 1-2 (Part 2) - ProCurve command line configuration (simple network)

| 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 1 untagged [Ethernet] trk1 | #vlan 1 untag trk1 | Allow VLAN 1 on Port 1 & 2 , and set to untagged mode |
| #spanning-tree ethernet trk1 admin-edge-port | #span e trk1 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 vlan ports trk1 detail | # show vlan ports trk1 detail | Displays the VLAN detail for Trunk1 |
| #show vlan 1 | #sh vlan 1 | Display VLAN 1 port information |
| #write memory<br><br>(For permanent changes only) | #write mem | Save the running configuration to NVRAM. Otherwise, the changes will be lost on the next reboot. |

# Scenario 1-3 – ProCurve command line configuration (Multiple Simple Networks Providing Redundancy and Link Aggregation 802.3ad (LACP))

Connect to the ProCurve switch servicing the VC-Enet uplink ports and enter the following commands.

*NOTE: If two switches are being used, issue the same commands on the second switch.*

**Table 3** Scenario 1-3 - ProCurve command line configuration (untagged VLANs)

| 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 untagged trk1 | #vlan 101 untag trk1 | Allow VLAN 101 on Ports 1 and 2 and configure Ports 1 and 2 for untagged VLAN mode |
| #vlan 102 tagged trk1 | #vlan 102 tag trk1 | Allow VLAN 101 on Ports 1 and 2 and configure Ports 1 and 2 for untagged VLAN mode |
| #vlan 103 tagged trk1 | #vlan 103 tag trk1 | Allow VLAN 101 on Ports 1 and 2 and configure Ports 1 and 2 for untagged VLAN mode |
| #vlan 104 tagged trk1 | #vlan 104 tag trk1 | Allow VLAN 101 on Ports 1 and 2 and configure Ports 1 and 2 for untagged VLAN mode |
| #spanning-tree ethernet trk1 admin-edge-port | #span e trk1 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 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<br><br>(For permanent changes only) | #write mem | Save the running configuration to NVRAM. Otherwise, the changes will be lost on the next reboot. |

# Scenario 1-4 through 1-6 – ProCurve command line configuration (Multiple Simple Networks Providing Redundancy and Link Aggregation 802.3ad (LACP))

Connect to the ProCurve switch servicing the VC-Enet uplink ports and enter the following commands.

*NOTE: If two switches are being used, issue the same commands on the second switch.*

**Table 3** Scenario 1-3 - ProCurve command line configuration (untagged VLANs)

| 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 and configure Ports 1 and 2 for untagged VLAN mode |
| #vlan 102 tagged trk1 | #vlan 102 tag trk1 | Allow VLAN 101 on Ports 1 and 2 and configure Ports 1 and 2 for untagged VLAN mode |
| #vlan 103 tagged trk1 | #vlan 103 tag trk1 | Allow VLAN 101 on Ports 1 and 2 and configure Ports 1 and 2 for untagged VLAN mode |
| #vlan 104 tagged trk1 | #vlan 104 tag trk1 | Allow VLAN 101 on Ports 1 and 2 and configure Ports 1 and 2 for untagged VLAN mode |
| #spanning-tree ethernet trk1 admin-edge-port | #span e trk1 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 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<br><br>(For permanent changes only) | #write mem | Save the running configuration to NVRAM. Otherwise, the changes will be lost on the next reboot. |

# Scenario 1-7 – ProCurve command line configuration (Simple vNet with Active/Standby Uplinks)

Connect to the ProCurve switch servicing the VC-Enet uplink ports and enter the following commands..

***NOTE: If two switches are being used, issue the same commands on the second switch.***

**Table 5** Scenario 1-7 - ProCurve command line configuration (simple network)

| 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<br><br>(For permanent changes only) | #write mem | Save the running configuration to NVRAM. Otherwise, the changes will be lost on the next reboot. |

# Scenario 2-1– ProCurve command line configuration (VLAN Tagging (802.1Q) with Multiple Shared Uplink Sets (SUS))

Connect to the ProCurve switch servicing the VC-Enet uplink ports and enter the following commands.

*NOTE: If two switches are being used, issue the same commands on the second switch.*

**Table 6** Scenarios 2-1 - ProCurve command line configuration (802.1Q)

| 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 1 | #vlan 101 tag 1 | Allow VLAN 101 on Port 1 and set Port 1 to tagged mode |
| #vlan 102 tagged 1 | #vlan 102 tag 1 | Add VLAN 102 on Port 1 and set Port 1 to tagged mode |
| #vlan 103 tagged 1 | #vlan 103 tag 1 | Allow VLAN 103 on Port 1 and set Port 1 to tagged mode |
| #vlan 104 tagged 1 | #vlan 104 tag 1 | Add VLAN 104 on Port 1 and set Port 1 to tagged mode |
| #vlan 1 | #vlan 1 | Set focus to VLAN 1 |
| #no untagged 1 | #no untagged 1 | Disables VLAN 1 on Ports 1 |
| #exit | #exit | Exit VLAN 1 |
| #show vlan ports 1 detail | # show vlan ports 1 detail | Displays the VLAN detail for Port 1 |
| #show interface brief 1 | #sh int br 1 | Display the status of Ports 1 |
| #write memory<br><br>(For permanent changes only) | #write mem | Save the running configuration to NVRAM. Otherwise, the changes will be lost on the next reboot. |

# Scenario 2-2 & 2-3 – ProCurve command line configuration (VLAN Tagging (802.1Q) with Multiple Shared Uplink Sets (SUS))

Connect to the ProCurve switch servicing the VC-Enet uplink ports and enter the following commands.

*NOTE: If two switches are being used, issue the same commands on the second switch.*

**Table 7** Scenarios 2-2 through 2-3 - ProCurve command line configuration (802.1Q)

| 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 1 | #vlan 101 tag 1 | Allow VLAN 101 on Port 1 and set Port 1 to tagged mode |
| #vlan 102 tagged 1 | #vlan 102 tag 1 | Add VLAN 102 on Port 1 and set Port 1 to tagged mode |
| #vlan 103 tagged 1 | #vlan 103 tag 1 | Allow VLAN 103 on Port 1 and set Port 1 to tagged mode |
| #vlan 104 tagged 1 | #vlan 104 tag 1 | Add VLAN 104 on Port 1 and set Port 1 to tagged mode |
| #vlan 105 tagged 1 | #vlan 105 tag 1 | Add VLAN 105 on Port 1 and set Port 1 to tagged mode |
| #vlan 1 | #vlan 1 | Set focus to VLAN 1 |
| #no untagged 1 | #no untagged 1 | Disables VLAN 1 on Ports 1 |
| #exit | #exit | Exit VLAN 1 |
| #show vlan ports 1 detail | # show vlan ports 1 detail | Displays the VLAN detail for Port 1 |
| #show interface brief 1 | #sh int br 1 | Display the status of Ports 1 |
| #write memory<br><br>(For permanent changes only) | #write mem | Save the running configuration to NVRAM. Otherwise, the changes will be lost on the next reboot. |

# Scenario 2-4 – ProCurve command line configuration (VLAN Tagging (802.1Q) with Multiple Shared Uplink Sets (SUS) and vNets)

Connect to the ProCurve switch servicing the VC-Enet uplink ports and enter the following commands.

*NOTE: If two switches are being used, issue the same commands on the second switch.*

**Table 8** Scenario 2-4 ProCurve command line configuration (802.1Q)

| 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 1 | #vlan 101 tag 1 | Allow VLAN 101 on Port 1 and set Port 1 to tagged mode |
| #vlan 102 tagged 1 | #vlan 102 tag 1 | Add VLAN 102 on Port 1 and set Port 1 to tagged mode |
| #vlan 103 tagged 1 | #vlan 103 tag 1 | Allow VLAN 103 on Port 1 and set Port 1 to tagged mode |
| **Command** | **Shortcut** | **Description** |
| #vlan 2042 tagged 2 | #vlan 2000 tag 2 | Add VLAN 2042 on Port 2 and set Port 1 to tagged mode |
| #vlan 2042 tagged 2 | #vlan 2042 tag 2 | Add VLAN 2042 on Port 2 and set Port 1 to tagged mode |
| #vlan 2309 tagged 2 | #vlan 2309 tag 2 | Allow VLAN 2309 on Port 2 and set Port 2 to tagged mode |
| #vlan 2740 tagged 2 | #vlan 2740 tag 2 | Add VLAN 2740 on Port 2 and set Port 2 to tagged mode |
| #vlan 2936 tagged 2 | #vlan 2936 tag 2 | Allow VLAN 2936 on Port 2 and set Port 2 to tagged mode |
| #vlan 1 | #vlan 1 | Set focus to VLAN 1 |
| #no untagged 1-2 | #no untagged 1-2 | Disables VLAN 1 on Ports 1 & 2 |
| #exit | #exit | Exit VLAN 1 |
| #show vlan ports 1 detail | # show vlan ports 1 detail | Displays the VLAN detail for Port 1 |
| #show vlan ports 2 detail | # show vlan ports 2 detail | Displays the VLAN detail for Port 2 |
| #show interface brief 1-2 | #sh int br 1-2 | Display the status of Ports 1 & 2 |
| #write memory<br><br>(For permanent changes only) | #write mem | Save the running configuration to NVRAM. Otherwise, the changes will be lost on the next reboot. |

# Scenario 3-1– ProCurve command line configuration (Multiple Simple Networks Providing Redundancy and Link Aggregation 802.3ad (LACP))

Connect to the ProCurve switch servicing the VC-Enet uplink ports and enter the following commands.

***NOTE: If two switches are being used, issue the same commands on the second switch.***

**Table 9** Scenario 3-1 - ProCurve command line configuration (untagged VLANs)

| 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 1 untagged [Ethernet] trk1 | #vlan 1 untag trk1 | Allow VLAN 1 on Port 1 & 2 , and set to untagged mode |
| #spanning-tree ethernet trk1 admin-edge-port | #span e trk1 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 vlan ports trk1 detail | # show vlan ports trk1 detail | Displays the VLAN detail for Trunk 1 |
| #show vlan 1 | #sh vlan 1 | Display VLAN 1 port information |
| #write memory<br><br>(For permanent changes only) | #write mem | Save the running configuration to NVRAM. Otherwise, the changes will be lost on the next reboot. |

# Scenario 3-2 – ProCurve command line configuration (VLAN Tagging (802.1Q) with Multiple Shared Uplink Sets (SUS))

Connect to the ProCurve switch servicing the VC-Enet uplink ports and enter the following commands.

*NOTE: If two switches are being used, issue the same commands on the second switch.*

**Table 9** Scenarios 3-2 - ProCurve command line configuration (802.1Q)

| 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 1 | #vlan 101 tag 1 | Allow VLAN 101 on Port 1 and set Port 1 to tagged mode |
| #vlan 102 tagged 1 | #vlan 102 tag 1 | Add VLAN 102 on Port 1 and set Port 1 to tagged mode |
| #vlan 103 tagged 1 | #vlan 103 tag 1 | Allow VLAN 103 on Port 1 and set Port 1 to tagged mode |
| #vlan 104 tagged 1 | #vlan 104 tag 1 | Add VLAN 104 on Port 1 and set Port 1 to tagged mode |
| #vlan 105 tagged 1 | #vlan 105 tag 1 | Add VLAN 105 on Port 1 and set Port 1 to tagged mode |
| #vlan 1 | #vlan 1 | Set focus to VLAN 1 |
| #no untagged 1 | #no untagged 1 | Disables VLAN 1 on Ports 1 |
| #exit | #exit | Exit VLAN 1 |
| #show vlan ports 1 detail | # show vlan ports 1 detail | Displays the VLAN detail for Port 1 |
| #show interface brief 1 | #sh int br 1 | Display the status of Ports 1 |
| #write memory<br><br>(For permanent changes only) | #write mem | Save the running configuration to NVRAM. Otherwise, the changes will be lost on the next reboot. |

# Appendix C: Acronyms and abbreviations

| Term | Definition |
|---|---|
| **Auto Port Speed**** | Let VC automatically determine best Flex NIC speed |
| **CLP String** | Flex-10 NIC settings written to the server hardware by VC/OA when the server is power oof. Read by the server hardware upon power in. |
| **Custom Port Speed**** | Manually set Flex NIC speed (up to Maximum value defined) |
| **DCC**** | Dynamic Control Channel. Future method for VC to change Flex-10 NIC port settings on the fly (without power no/off) |
| **EtherChannel*** | 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. |
| **Flex NIC**** | One of four virtual NIC partitions available per Flex-10 Nic port. Each capable of being tuned from 100Mb to 10Gb |
| **Flex-10 Nic Port**** | A physical 10Gb port that is capable of being partitioned into 4 Flex NICs |
| **IEEE802.1Q** | 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. |
| **IEEE802.3ad** | 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. |
| **LACP** | Link Aggregation Control Protocol (see IEEE802.3ad) |
| **LOM** | LAN-on-Motherboard. Embedded network adapter on the system board |
| **Maximum Link Connection Speed**** | Maximum Flex NIC speed value assigned to vNet by the network administrator. Can NOT be manually overridden on the server profile. |
| **Multiple Networks Link Speed Settings**** | Global Preferred and Maximum Flex NIC speed values that override defined vNet values when multiple vNets are assigned to the same Flex NIC |
| **MZ1 or MEZZ1; LOM** | Mezzanine Slot 1; LAM on Motherbard/systemboard NIC |
| **Network Teaming Software** | 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. |
| **pNIC**** | Physical NIC port. A Flex NIC is seen by VMware as a pNIC |
| **Port Aggregation** | Combining ports to provide one or more of the following benefits: greater bandwidth, load balancing, and redundancy. |
| **Port Aggregation Protocol (PAgP)*** | A Cisco proprietary protocol aids in the automatic creation of Fast EtherChannel links. PAgP packets are sent between Fast EtherChannel-capable ports to negotiate the forming of a channel. |
| **Port Bonding** | A term typically used in the Unix/Linux world that is synonymous to NIC teaming in the Windows world. |
| | |
| **Preferred Link Connection Speed**** | Preferred Flex NIC speed value assigned to a vNet by the network administrator. |
| **Share Uplink Set (SUS)** | 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. |

| | |
|---|---|
| **Smart Link** | 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. |
| **Trunking (Cisco)** | 802.1Q VLAN tagging |
| **Trunking (Industry)** | Combining ports to provide one or more of the following benefits: greater bandwidth, load balancing, and redundancy. |
| **Trunking (Industry)** | Combining ports to provide one or more of the following benefits: greater bandwidth, load balancing, and redundancy. |
| **VLAN** | A virtual network within a physical network. |
| **VLAN Tagging** | Tagging/marking an Ethernet frame with an identity number representing a virtual network. |
| **VLAN Trunking Protocol (VTP)*** | A Cisco proprietary protocol used for configuring and administering VLANs on Cisco network devices. |
| **vNIC** | Virtual NIC port. A software-based NIC used by Virtualization Managers |
| **vNet** | 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.

# 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 Manager Command Line Interface Version 1.31 (or later) User Guide. The following CLI commands can be copied and pasted into an SSH session with the VCM and will apply immediately upon paste.

## 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

#Change Administrator

set user Administrator password=Administrator

# Set Advanced Ethernet Settings to "Map VLAN Tags" and set "Force server connections" to disabled

set enet-vlan vlantagcontrol=map sharedservervlanid=false

# Set Advanced Ethernet Settings to "Tunnel VLAN Tags"

set enet-vlan vlantagcontrol=tunnel

# Set Advanced Ethernet Settings to a Preferred speed of 500Mb and a Max Speed of 2500Mb

```
set enet-vlan PrefSpeedType=Custom PrefSpeed=500 MaxSpeedType=Custom MaxSpeed=2500
#Add additional User to VCM, creates User jimbo
add user jimbo password=password privileges=domain,network,server,storage
```

Creating Shared Uplink Sets

```
#Create Shared Uplink Set "Prod-Net" and configure a single uplink on VC module 1, port 2
add uplinkset Prod-Net
add uplinkport enc0:1:2 Uplinkset=Prod-Net speed=auto
#Add an additional uplink on port 3 to Prod-Net
add uplinkport enc0:1:3 Uplinkset=Prod-Net speed=auto

#Create Shared Uplink Set "Prod-Net" and configure multiple uplinks on VC Module 1, Ports 1, 2 and 3
add uplinkset Prod-Net
add uplinkport enc0:1:1 Uplinkset=Prod-Net speed=auto
add uplinkport enc0:1:2 Uplinkset=Prod-Net speed=auto
add uplinkport enc0:1:3 Uplinkset=Prod-Net speed=auto

# Create Networks PROD-A through PROD-D, supporting VLANs 101 through 104 on Shared Uplink Set "Prod-Net"
add network VLAN_10 uplinkset=Prod-Net VLanID=10
add network VLAN_20 uplinkset=Prod-Net VLanID=20
# (optionally) Set network VLAN_20 as a “Private Network”
set network VLAN20 Private=Enabled
```

Creating vNets

```
#Create vNet "Prod-Net" and configure uplinks
add Network Prod-Net
add uplinkport enc0:1:3 Network=Prod-Net speed=auto
#Optionally enable the vNet as a Private Network
set network Prod-Net Private=Enabled
```

Server Profiles

```
#Create Server Profile App-1, apply this profile to Server Slot 1 and configure NIC 1 to Multiple Networks VLAN_10 and VLAN_20
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_10 VLanId=10
add server-port-map App-1:1 VLAN_20 VLanId=20
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_10 Uplinkset=Prod-Net
add server-port-map App-1:1 VLAN_20 Uplinkset=Prod-Net

# Create Server Profile App-1 – Both NICs are configured on network VLAN_20
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_20
set enet-connection App-1 2 Network=VLAN_20
assign profile App-1 enc0:2

# Create Server Profile ESX-1 – Both NICs are configured on Both networks VLAN_10 and VLAN_20
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_10 VLanId=10
add server-port-map ESX-1:1 VLAN_20 VLanId=20
add server-port-map ESX-1:2 VLAN_10 VLanId=10
add server-port-map ESX-1:2 VLAN_20 VLanId=20
assign profile ESX-1 enc0:1
```

```
# Create Server Profile Server-1 with Flex-10 NICs configured for specific speeds
add profile Server-1 -nodefaultenetconn
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
```