



# Cisco Nexus 1000V Series

## Layer 3 Troubleshooting

### Troubleshooting Guide

June 2013

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## What You Will Learn

This document provides Layer 3 troubleshooting guideline on Nexus 1000v running in VMware ESXi environment. For detailed configuration documentation, refer to the respective Cisco® and VMware product configuration guides. Links to the product configuration guides can be found in the “[For More Information](#)” section of this document.

## Audience

This document is intended for network architects, network engineers, virtualization administrators, and server administrators interested in L3 troubleshooting the Cisco Nexus 1000V Series Switches in VMware vSphere environments.

## Introduction

Cisco Nexus 1000V Series Switches are virtual machine access switches that are an intelligent software switch implementation for VMware vSphere environments running Cisco NX-OS Software. Operating inside the VMware ESX hypervisor, the Cisco Nexus 1000V Series supports Cisco VN-Link server virtualization technology to provide:

- Policy-based virtual machine connectivity
- Mobile virtual machine security and network policy
- Nondisruptive operation model for your server virtualization and networking teams

When server virtualization is deployed in the data center, virtual servers are not managed the same way as physical servers. Server virtualization is treated as a special deployment, leading to longer deployment time, with a greater degree of coordination among server, network, storage, and security administrators. With the Cisco Nexus 1000V Series, you have a consistent networking feature set and provisioning process from the virtual machine access layer to the core of the data center network infrastructure. Virtual servers can use the same network configuration, security policy, diagnostic tools, and operation models as their physical server counterparts attached to dedicated physical network ports. Virtualization administrators can access predefined network policy that follows mobile virtual machines to help ensure proper connectivity, saving valuable time for focusing on virtual machine administration. This comprehensive set of capabilities helps you deploy server virtualization faster and take advantage of the benefits.

Developed in close collaboration with VMware, the Cisco Nexus 1000V Series is certified by VMware and is compatible with VMware vSphere, vCenter, ESX, and ESXi and with many other VMware vSphere features. You can use the Cisco Nexus 1000V Series to manage your virtual machine connectivity with confidence in the integrity of the server virtualization infrastructure.

## Cisco Nexus 1000V Series Components

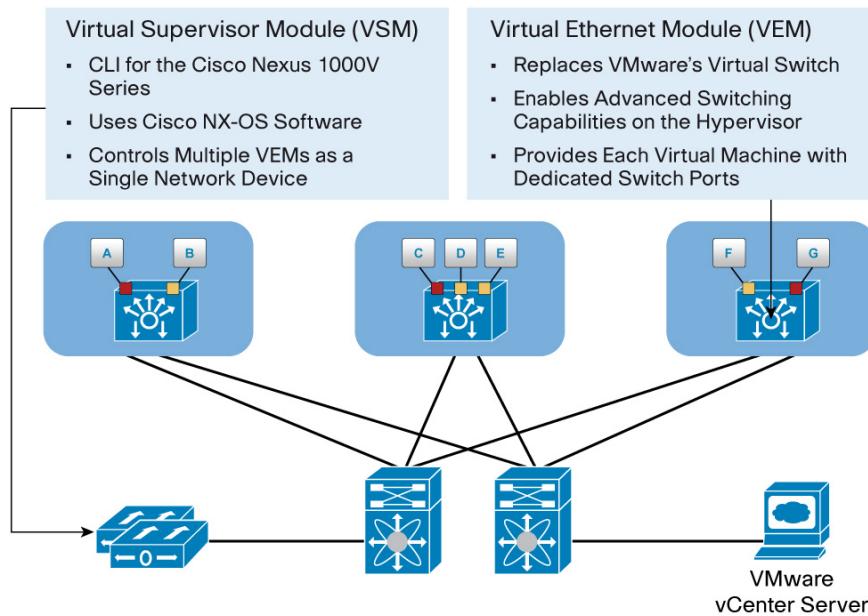
The Cisco Nexus 1000V Series provides Layer 2 switching, advanced networking functions, and a common network management model in a virtualized server environment by replacing the virtual switch in VMware vSphere. The Cisco Nexus 1000V Series manages a data center as defined in VMware vCenter Server. Each server in the data center is represented as a line card in the Cisco Nexus 1000V Series Switch and can be managed as if it were a line card in a physical Cisco switch.

The Cisco Nexus 1000V Series implementation has two main components:

- Virtual Supervisor Module (VSM)
- Virtual Ethernet Module (VEM)

These two components together make up the Cisco Nexus 1000V Series Switch, with the VSM providing the management plane and the VEM providing the data plane (Figure 2).

**Figure 1.** Cisco Nexus 1000V Series Components



## VSM Overview

VSM is a Virtual Machine, where it can be resided on an ESXi Host Machine or Nexus 1010/1110. It is the control plane for the Nexus 1000V solution, responsible for VMware vCenter communication, plus programming and managing Virtual Ethernet Modules (VEM). Each VSM HA pair can manage 64 VEMs. 2 GB of memory is required per VSM.

There are 3 network interfaces in a VSM:

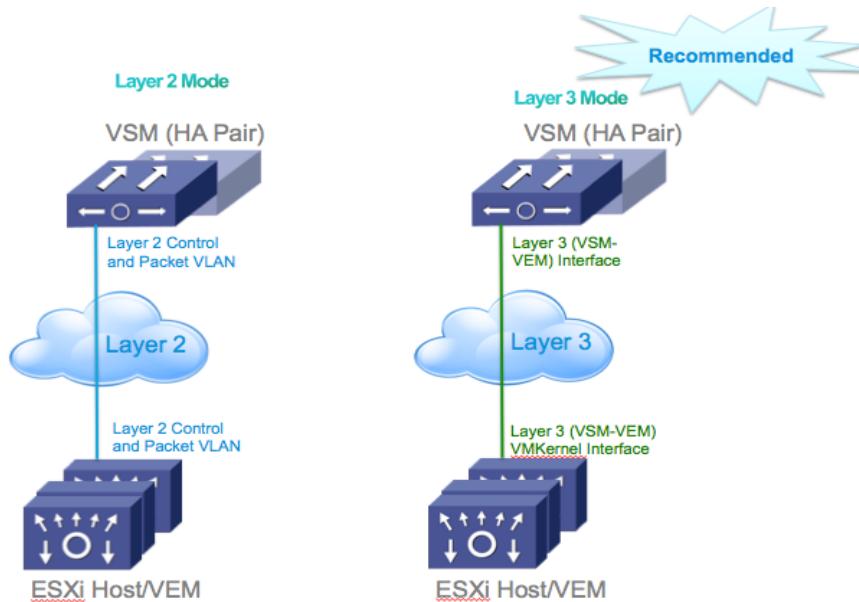
- 1) Adapter 1 is the Control interface, responsible for the heartbeats between VSMs and VEM (in L2 mode), plus AIPC communications. Naming is Control 0.
- 2) Adapter 2 is the Management interface, it provides connectivity to VSM terminal and VMware vCenter; also serve as backup heartbeat between VSMs. Naming is Mgmt 0.
- 3) Adapter 3 is the Packet interface, it is responsible for protocol control info, like CDP and IGMP.

## VSM Control Mode (VEM-to-VSM Communication)

The VSM can communicate with the VEM over the Layer 2 or Layer 3 network. Layer 3 is the recommended mode for control and packet communication between the VSM and the VEM. The VEM uses vSwitch data provided by VMware vCenter Server to configure the control interfaces for VSM-to-VEM control and packet communication. The VEM then

applies the correct uplink port profile to the control interfaces to establish communication with the VSM. There are two ways of connecting the VSM and the VEM (Figure 2):

**Figure 2.** VEM-to-VSM Network Communication



- **Layer 2 mode:** Layer 2 mode is supported for VSM and VEM control communication, in this case, the VSM and the VEM must be in the same Layer 2 domain. Communication occurs using the control and packet VLAN. Layer 2 mode is configured as follows:  

```
Nexus1000V(config-svs-domain)# svs mode L2
```
- **Layer 3 mode (default):** Layer 3 mode for VSM-to-VEM communication is recommended and it is now default. When you configure Layer 3 mode, you can specify whether to use the VSM management interface for VSM-to-VEM control traffic or to use the dedicated Control0 interface for VSM-to-VEM control traffic.  

```
Nexus1000V(config-svs-domain)# svs mode L3 interface[Mgmt0|Control0]
```

Layer 3 mode encapsulates the control and packet frames through User Datagram Protocol (UDP) port 4785. The port profile configured for Layer 3 (VSM-to-VEM) communication on the VSM needs to have **capability l3control** enabled. This process requires configuration of a VMware vmkernel interface on each VMware ESX host. L2 connectivity thru Control Interface still requires between primary VSM and secondary VSM for high availability.

\* This article provides troubleshooting guideline when configure VSM in L3 control mode.

## Why does Cisco recommend L3 mode?

### Using L2 mode

- With L2, control VLAN needs to be created on every hop, including on vSwitch
  - More operational hurdles with 3<sup>rd</sup> party Blade Server environments
  - No visibility for troubleshooting 3<sup>rd</sup> party networking technologies (i.e. Virtual Connect)

- L2 troubleshooting more difficult with requirements of ESXi CLI
  - Cumbersome to provide root access
  - CLI is not intuitive for server admin (more network-centric)

### Using L3 mode

- Only requires vmkernel interface managed by N1KV
  - Recommended to be management interface of ESXi server (doesn't have to be but will require another interface, which then requires another IP Address on the same subnet)
  - Utilizes same VLAN as management interface (no longer requiring control VLAN to be created)
  - Easy to troubleshoot
  - After the ESXi vmkernel added to the correct veth port-profile and can ping management interface of VSM management interface, communication between VSM/VEM is formed
  - Server admin only needs to do a vmking ping via CLI, no need to run N1KV specific vemcmd for network troubleshooting
  - If server can't ping, network admin can move through the hops in the network to resolve the issue

## L3 Mode Setup on Cisco Nexus 1000V

With L3 control, a VSM and VEM can reside in different Layer 3 networks. L3 also simplifies troubleshooting as if the VSM can ping the L3 control VMK, then it should be able to add as a module.

There are two options in setting up L3 control: (1) VSM mgmt0 interface and (2) VSM control0 interface. In this example, we will use VSM mgmt0 interface.

L3 control mode configuration steps:

**Step 1:** Configure VLAN that will be used for L3 connectivity. In this example, we will use VLAN 10 as "Management-VMotion" VLAN.

```
Nexus1000V# configure terminal
Nexus1000V(config)# vlan 10
Nexus1000V(config-vlan)# name Management-VMotion
```

**Step 2:** Create uplink port-profile for management

```
Nexus1000V# configure terminal
Nexus1000V(config)# port-profile type ethernet mgmt-uplink
Nexus1000V(config-port-prof)# vmware port-group
Nexus1000V(config-port-prof)# switchport mode access
Nexus1000V(config-port-prof)# switchport access vlan 10
Nexus1000V(config-port-prof)# no shutdown
Nexus1000V(config-port-prof)# system vlan 10
Nexus1000V(config-port-prof)# state enabled
Nexus1000V(config-port-prof)# end
```

**Step 3:** Create port-profile for L3 Control with a system VLAN. CLI “capability l3control” allows the VEM to use the VMK in this port-profile to send L3 traffic. Make sure to add the VLAN to uplink port-profile. A separate L3 port-profile is required for each different ESCi host subnet.

```
Nexus1000V# configure terminal
Nexus1000V(config)# port-profile type vethernet n1kv-L3
Nexus1000V(config-port-prof)# vmware port-group
Nexus1000V(config-port-prof)# capability l3control
Nexus1000V(config-port-prof)# switchport mode access
Nexus1000V(config-port-prof)# switchport access vlan 10
Nexus1000V(config-port-prof)# no shutdown
Nexus1000V(config-port-prof)# system vlan 10
Nexus1000V(config-port-prof)# state enabled
Nexus1000V(config-port-prof)# end
```

NOTE: Port-profile with “capability l3control” configured can ONLY be used by vmk interfaces. Never add a VM to this port-profile.

**Step 4:** Create port-profile for VSM management

```
Nexus1000V# configure terminal
Nexus1000V(config)# port-profile vsm-mgmt0
Nexus1000V(config-port-prof)# vmware port-group
Nexus1000V(config-port-prof)# switchport mode access
Nexus1000V(config-port-prof)# switchport access vlan 10
Nexus1000V(config-port-prof)# no shutdown
Nexus1000V(config-port-prof)# system vlan 10
Nexus1000V(config-port-prof)# state enabled
Nexus1000V(config-port-prof)# end
```

**Step 5:** Configure the VSM domain transport as Layer 3. You can use mgmt0 or control0 for L3 connectivity, in this example, we will use mgmt 0

```
Nexus1000V# configure terminal
Nexus1000V(config)# svs-domain
Nexus1000V(config-svs-domain)# domain id 1
Nexus1000V(config-svs-domain)# svs mode L3 interface mgmt0
Nexus1000V(config-svs-domain)# end
```

NOTE: Make sure the domain ID is unique in the environment. A pair of HA VSMs use the same domain ID; if there are more than one domain, ensure there is no overlap in domain IDs.

```
Nexus1000V# show svs domain
SVS domain config:
  Domain id: 1
  Control vlan: NA
  Packet vlan: NA
  L2/L3 Control mode: L3
  L3 control interface: mgmt0
  Status: Config push to VC successful.
```

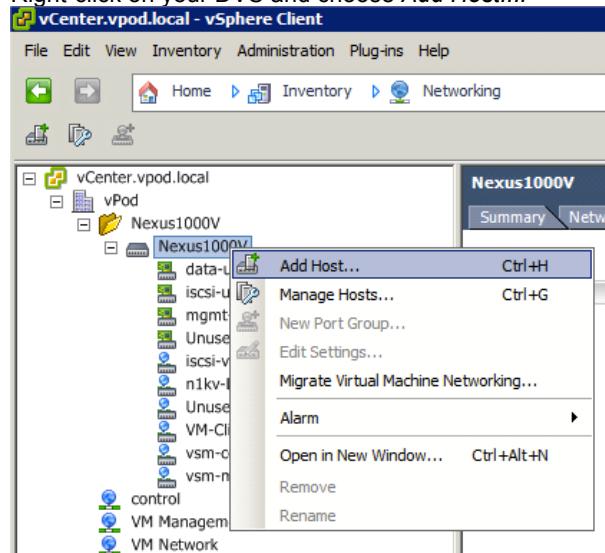
Note: Control VLAN and Packet VLAN are not used in L3 mode  
Nexus1000V#

**Step 6:** Add ESXi hosts to N1Kv DVS.

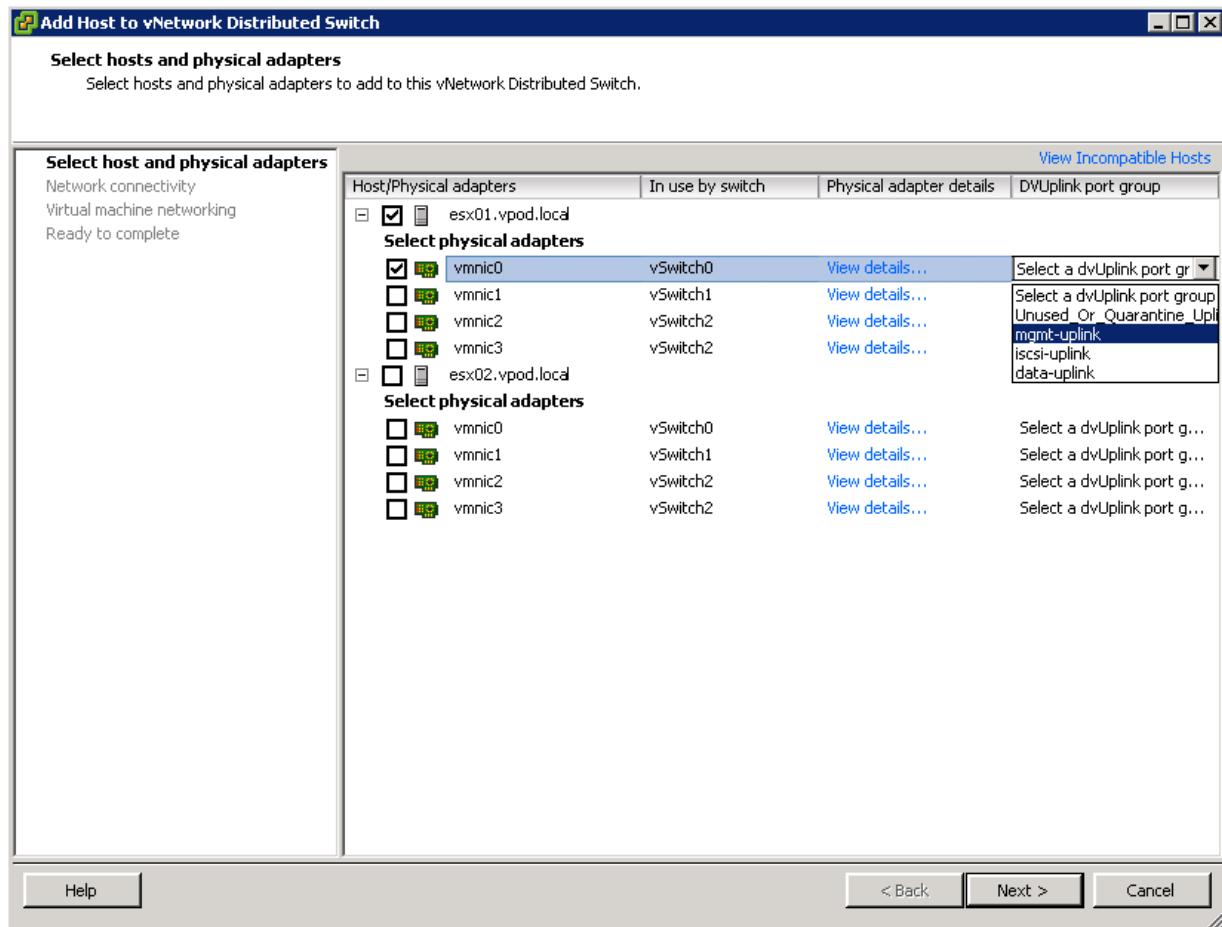
Assuming that the VEM module is already installed to your ESXi host. Open your **vCenter->Networking** then select your Nexus 1000V.



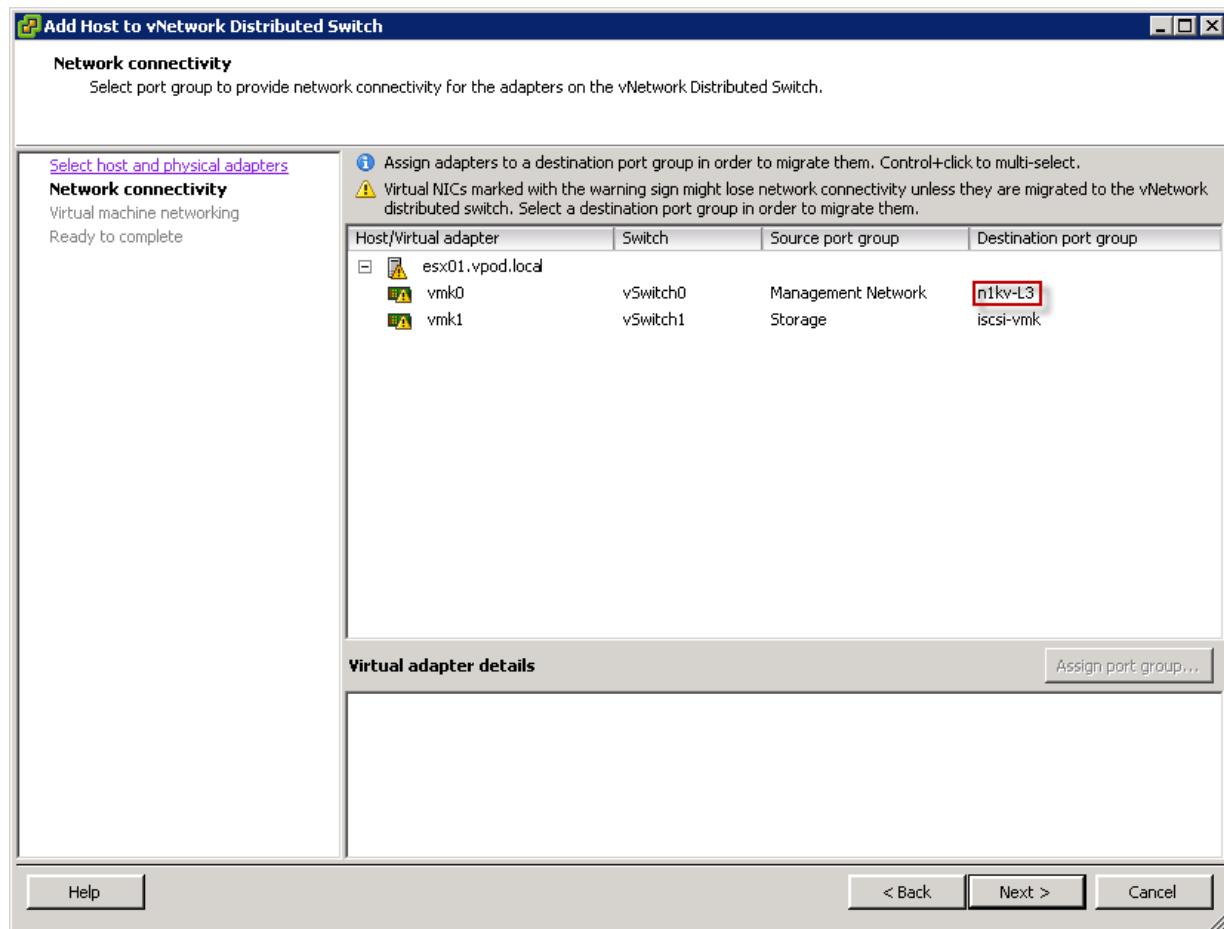
Right-click on your DVS and choose *Add Host....*



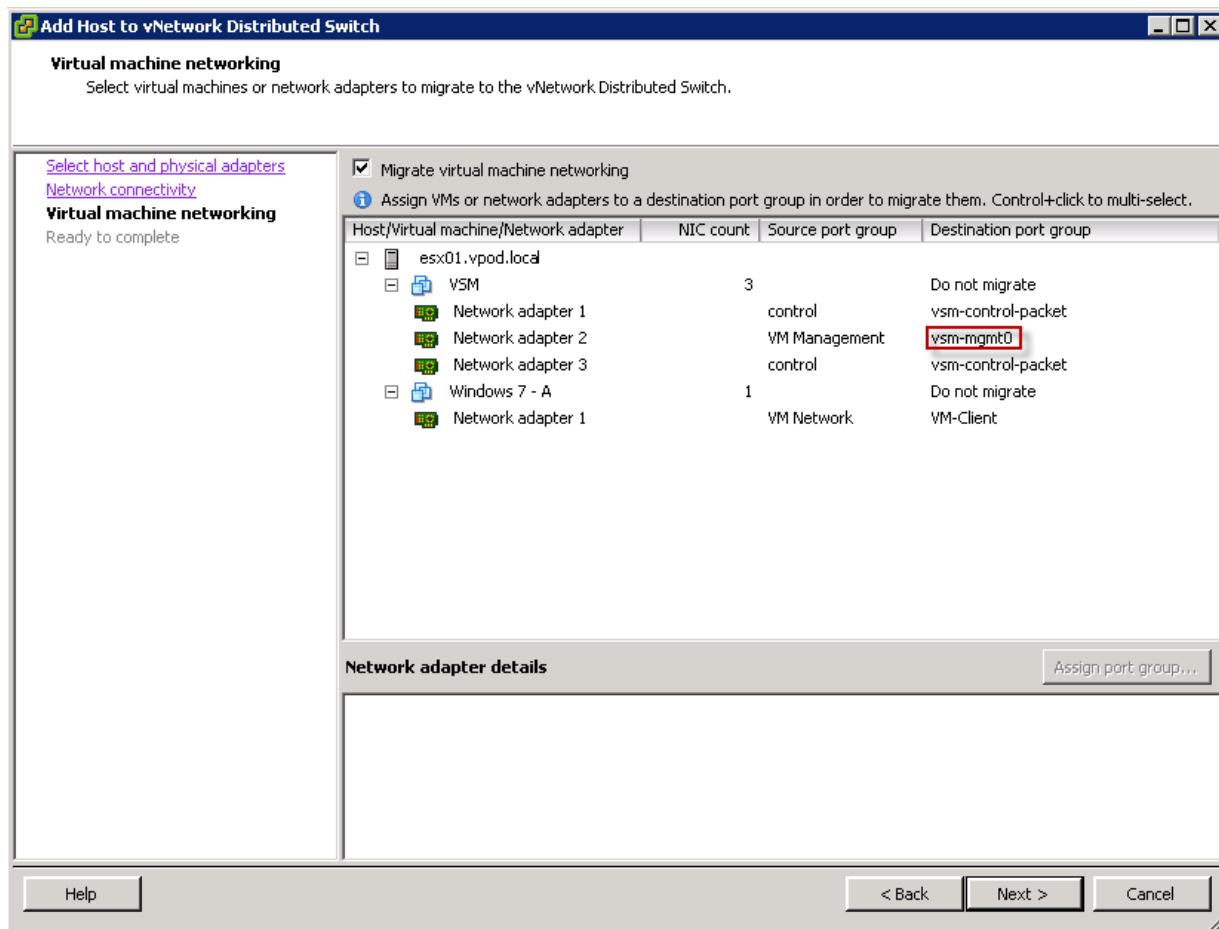
Migrate vmnic0 on the selected ESX host, then select mgmt.-uplink as port-group



Migrate vmk0 with destination port group "n1kv-L3" for layer 3 communication



Migrate Virtual Machine Networking by assigning the L3 capable port-profile to the vmk interface.



If migration is successful, you will see ESX host appear in the Hosts view of the Distributed Virtual Switch. Please note that the migrated vmnic must be in the same subnet as the host's default gateway.

Name	State	vDS Status	Status	% CPU	% Memory
esx01.vpod.local	Connected	Up	War...	8	85

Verify the module has registered to the VSM by running '**show module**'. The difference between L2 and L3 modes is that in L2 mode, as soon as the vNIC is moved, the VEM module will register to the VSM and see the VEM on "show module"; while in L3 mode, VMK also has to be moved to the L3 port profile in order to register the VEM module to the VSM.

Mod	Ports	Module-Type	Model	Status
---	-----	-----	-----	-----

```

1   0      Virtual Supervisor Module      Nexus1000V      active *
3   248    Virtual Ethernet Module       NA             ok

Mod  Sw                  Hw
--- -----
1   4.2(1)SV2(1.1)        0.0
3   4.2(1)SV2(1.1)        VMware ESXi 4.1.0 Releasebuild-260247 (2.0)

Mod  MAC-Address(es)          Serial-Num
--- -----
1   00-19-07-6c-5a-a8 to 00-19-07-6c-62-a8 NA
3   02-00-0c-00-03-00 to 02-00-0c-00-03-80 NA

Mod  Server-IP            Server-UUID          Server-Name
--- -----
1   10.2.11.10           NA                  NA
3   10.2.11.11           422c9ae2-9381-e104-6a91-2f2815f5028d esx01.vpod.local

* this terminal session
Nexus1000V#

```

*Now you can see the VEM module on VSM.*

Please note that in L3 mode the VSMs still use the control interface to form a HA pair, so the VSMs must be L2 adjacent. The control VLAN will be whichever VLAN the first NIC on the VSM is assigned in the vSphere client.

### L3 Mode Troubleshooting on Cisco Nexus 1000v

Configuring with L3 control mode, in the event where the VEM is not registering under the VSM, the following steps can help you troubleshoot the issue:

#### 1. Is L3 control mode properly configured?

- VSM: “show svs domain”

```

Nexus1000V# show svs domain
SVS domain config:
  Domain id:    1
  Control vlan:  NA
  Packet vlan:  NA
  L2/L3 Control mode: L3
  L3 control interface: mgmt0
  Status: Config push to VC successful.
  Control type multicast: No

Note: Control VLAN and Packet VLAN are not used in L3 mode
Nexus1000V#

```

- VEM: “vemcmd show card” by ssh to the ESX host

```
~ # vemcmd show card
Card UUID type 2: 422c9ae2-9381-e104-6a91-2f2815f5028d
Card name: esx01
Switch name: Nexus1000V
Switch alias: DvsPortset-0
Switch uuid: 98 1b 09 50 47 b9 a6 64-a0 ae 3c 09 f6 62 40 8e
Card domain: 1
Card slot: 3
VEM Tunnel Mode: L3 Mode
L3 Ctrl Index: 49
L3 Ctrl VLAN: 10
VEM Control (AIPC) MAC: 00:02:3d:10:01:02
VEM Packet (Inband) MAC: 00:02:3d:20:01:02
VEM Control Agent (DPA) MAC: 00:02:3d:40:01:02
VEM SPAN MAC: 00:02:3d:30:01:02
Primary VSM MAC : 00:50:56:89:00:02
Primary VSM PKT MAC : 00:50:56:89:00:04
Primary VSM MGMT MAC : 00:50:56:89:00:03
Standby VSM CTRL MAC : ff:ff:ff:ff:ff:ff
Management IPv4 address: 10.2.11.11
Management IPv6 address: 0000:0000:0000:0000:0000:0000:0000:0000
Primary L3 Control IPv4 address: 10.2.11.10
Secondary VSM MAC : 00:00:00:00:00:00
Secondary L3 Control IPv4 address: 0.0.0.0
Upgrade : Default
Max physical ports: 32
Max virtual ports: 216
Card control VLAN: 1
Card packet VLAN: 1
Control type multicast: No
Card Headless Mode : No
    Processors: 2
    Processor Cores: 2
Processor Sockets: 2
    Kernel Memory: 3378508
Port link-up delay: 5s
Global UUFB: DISABLED
Heartbeat Set: True
PC LB Algo: source-mac
Datapath portset event in progress : no
Licensed: Yes
~ #
```

2. Is the port-profile with “capability l3control” configured?

```
Nexus1000V# show port-profile name n1kv-L3

port-profile n1kv-L3
  type: Vethernet
  description:
  status: enabled
  max-ports: 32
  min-ports: 1
  inherit:
  config attributes:
    switchport mode access
    switchport access vlan 10
    no shutdown
  evaluated config attributes:
    switchport mode access
    switchport access vlan 10
    no shutdown
  assigned interfaces:
    Vethernet1
    Vethernet7
  port-group: n1kv-L3
  system vlans: 10
  capability l3control: yes
  capability iscsi-multipath: no
  capability vxlan: no
  capability l3-vservice: no
  port-profile role: none
  port-binding: static
```

3. Make sure system vlan is configured properly and being used as management

```
Nexus1000V# show port-profile name n1kv-L3

port-profile n1kv-L3
  type: Vethernet
  description:
  status: enabled
  max-ports: 32
  min-ports: 1
  inherit:
  config attributes:
    switchport mode access
    switchport access vlan 10
    no shutdown
  evaluated config attributes:
    switchport mode access
    switchport access vlan 10
    no shutdown
  assigned interfaces:
    Vethernet1
    Vethernet7
  port-group: n1kv-L3
    system vlans: 10
    capability l3control: yes
    capability iscsi-multipath: no
    capability vxlan: no
    capability l3-vservice: no
    port-profile role: none
    port-binding: static
```

```

Nexus1000V# show port-profile name mgmt-uplink

port-profile mgmt-uplink
  type: Ethernet
  description:
  status: enabled
  max-ports: 32
  min-ports: 1
  inherit:
  config attributes:
    switchport mode access
    switchport access vlan 10
    no shutdown
  evaluated config attributes:
    switchport mode access
    switchport access vlan 10
    no shutdown
  assigned interfaces:
    Ethernet3/1
    Ethernet4/1
  port-group: mgmt-uplink
  system vlans: 10
  capability l3control: no
  capability iscsi-multipath: no
  capability vxlan: no
  capability l3-vservice: no
  port-profile role: none
  port-binding: static

```

4. Which vmk is using the port-profile? Is it the correct vmk? Remember, the vmk must reside in the Nexus 1000v, and NOT the vSwitch or DVS.

```

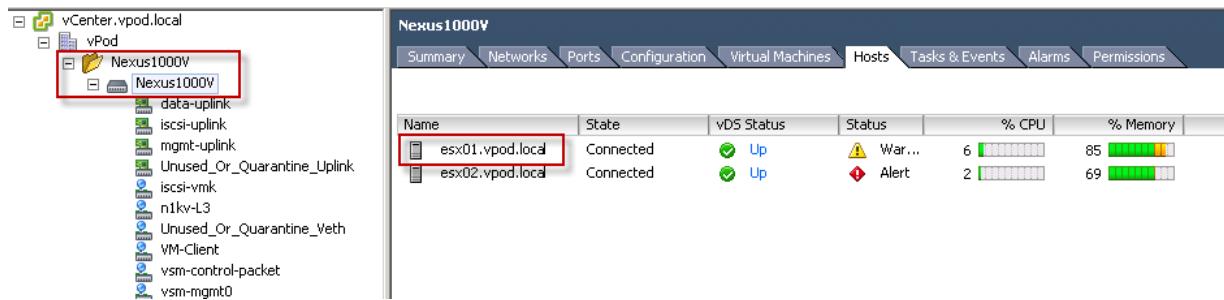
Nexus1000V# show port-profile usage name n1kv-L3

port-profile n1kv-L3
  Vethernet1
  Vethernet7

Nexus1000V# sh interface virtual

-----
```

Port	Adapter	Owner	Mod	Host
Veth1	vmk0	VMware VMkernel	3	esx01.vpod.local
Veth2	vmk1	VMware VMkernel	3	esx01.vpod.local
Veth3	Net Adapter 1	Windows 7 - A	3	esx01.vpod.local
Veth4	Net Adapter 1	VSM	3	esx01.vpod.local
Veth5	Net Adapter 2	VSM	3	esx01.vpod.local
Veth6	Net Adapter 3	VSM	3	esx01.vpod.local
Veth7	vmk0	VMware VMkernel	4	esx02.vpod.local
Veth8	vmk1	VMware VMkernel	4	esx02.vpod.local
Veth9	Net Adapter 1	Windows 7 - B	4	esx02.vpod.local
Veth10	Net Adapter 1	WebServer	4	esx02.vpod.local



**Manage Hosts**

**Network connectivity**  
Select port group to provide network connectivity for the adapters on the vNetwork Distributed Switch.

Host/Virtual adapter	Switch	Source port group	Destination port group
esx01.vpod.local	Nexus1000V	n1kv-L3	Do not migrate
vmk0	Nexus1000V	iscsi-vmk	Do not migrate
vmk1			

##### 5. Is there more than one interface per host using that port-profile?

```
Nexus1000V# show port-profile usage name n1kv-L3
port-profile n1kv-L3
  Vethernet1
  Vethernet7
```

2 different hosts

```
Nexus1000V# sh interface virtual
-----
Port      Adapter      Owner          Mod Host
Veth1     vmk0        VMware VMkernel  3   esx01.vpod.local
Veth2     vmk1        VMware VMkernel  3   esx01.vpod.local
Veth3     Net Adapter 1 Windows 7 - A  3   esx01.vpod.local
Veth4     Net Adapter 1 VSM            3   esx01.vpod.local
Veth5     Net Adapter 2 VSM            3   esx01.vpod.local
Veth6     Net Adapter 3 VSM            3   esx01.vpod.local
Veth7     vmk0        VMware VMkernel  4   esx02.vpod.local
Veth8     vmk1        VMware VMkernel  4   esx02.vpod.local
Veth9     Net Adapter 1 Windows 7 - B  4   esx02.vpod.local
Veth10    Net Adapter 1 WebServer     4   esx02.vpod.local
```

##### 6. Which interface, control0 or mgmt0, is being used? Is it properly configured?

- VSM: "show svs domain"

```

Nexus1000V# show svs domain
SVS domain config:
  Domain id:    1
  Control vlan: NA
  Packet vlan:  NA
  L2/L3 Control mode: L3
  L3 control interface: mgmt0
  Status: Config push to VC successful.
  Control type multicast: No

Note: Control VLAN and Packet VLAN are not used in L3 mode

```

7. Can the vmk ping the VSM using the correct interface?

```

~ # ping 10.2.11.10 ← VSM IP
PING 10.2.11.10 (10.2.11.10): 56 data bytes
64 bytes from 10.2.11.10: icmp_seq=0 ttl=255 time=1.502 ms
64 bytes from 10.2.11.10: icmp_seq=1 ttl=255 time=0.765 ms
64 bytes from 10.2.11.10: icmp_seq=2 ttl=255 time=0.816 ms

--- 10.2.11.10 ping statistics ---
3 packets transmitted, 3 packets received, 0% packet loss
round-trip min/avg/max = 0.765/1.028/1.502 ms
~ #

```

8. Is the UDP port 4785 allowed to pass through? If there is a Firewall configured, check configuration to ensure the port is not blocked.

## Conclusion

Cisco Nexus 1000V Series Switches integrate into the expanding virtualized data center, providing secure, nondisruptive, policy-based enhanced networking features and visibility for the networking team into the server virtualization environment. The comprehensive feature set of the Cisco Nexus 1000V Series allows the networking team to troubleshoot more rapidly any problems in the server virtualization environment, increasing the uptime of virtual machines and protecting the applications that propel the data center.

## For More Information

For more information about the Cisco Nexus 1000V Series, please refer to the following:

- Cisco Nexus 1000V Series product information: <http://www.cisco.com/go/1000v>.
- Cisco Nexus 1000V Series technical documentation: [http://www.cisco.com/en/US/products/ps9902/prod\\_white\\_papers\\_list.html](http://www.cisco.com/en/US/products/ps9902/prod_white_papers_list.html).
- Cisco Nexus 1000V Series community: <https://communities.cisco.com/community/technology/datacenter/nexus1000v>.



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