

Chelsio Native Network Driver with SR-IOV support for VMware ESXi 6.X

Installation and User's Guide



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Version History

Version	Revision Date
1.0.0	03/24/2016
1.0.1	10/31/2016
1.0.2	11/11/2016
1.0.3	12/05/2016
1.0.4	12/30/2016
1.0.5	01/27/2017
1.0.6	02/24/2017

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1. Introduction

Thank you for choosing Chelsio Unified Wire adapters. These high speed, single chip, single firmware cards provide enterprises and datacenters with high performance solutions for various Network and Storage related requirements.

The **Terminator** series of adapters is Chelsio's next generation of highly integrated, hypervirtualized 1/10/25/40/50/100GbE controllers. The adapters are built around a programmable protocol-processing engine, with full offload of a complete Unified Wire solution comprising NIC, TOE, iWARP RDMA, iSCSI, FCoE and NAT support. It scales to true 100Gb line-rate operation from a single TCP connection to thousands of connections, and allows simultaneous low latency and high bandwidth operation thanks to multiple physical channels through the ASIC.

Ideal for all data, storage and high performance clustering applications, Chelsio adapters enable a unified fabric over a single wire by simultaneously running all unmodified IP sockets, Fibre Channel and InfiniBand applications over Ethernet at line rate.

Designed for deployment in virtualized datacenters, cloud service installations and high performance computing environments, Chelsio adapters bring a new level of performance metrics and functional capabilities to the computer networking industry.

This document describes the installation, use and maintenance of Native Network driver for VMware ESXi and its various components.

1.1. Features

Chelsio's Native Network driver for VMware is developed for Chelsio's Unified Wire family of adapters.

1.2. Hardware Requirements

1.2.1. Supported Adapters

The following are the currently shipping Chelsio adapters that are compatible with Chelsio Native Network driver:

- T62100-CR
- T62100-LP-CR
- T62100-SO-CR
- T6225-CR
- T6225-SO-CR
- T580-SO-CR
- T580-LP-CR
- T580-CR

- T540-CR
- T520-SO-CR
- T520-CR
- T520-LL-CR
- T520-BT

1.2.2. SR-IOV Requirements

- SR-IOV should be enabled in the BIOS.
- Intel Virtualization Technology for Directed I/O (VT-d) should be enabled in the BIOS.
- PCI Express Slot should be ARI capable.

1.3. Software Requirements

1.3.1. ESXi Requirements

The Chelsio Native Network driver has been developed to run on ESXi platforms. Currently the driver is available for the following versions:

- Host:
 - ESXi 6.5a
 - ESXi 6.5
 - ESXi 6.0
 - ESXi 6.0 U1
 - ESXi 6.0 U2

• Virtual Machine (with VFs):

- RHEL 7.3, 3.10.0-514.el7
- RHEL 7.2, 3.10.0-327.el7
- RHEL 6.8, 2.6.32-642.el6
- RHEL 6.7, 2.6.32-573.el6
- SLES 12 SP2, 4.4.21-69-default
- SLES 12 SP1, 3.12.49-11-default
- SLES 11 SP4, 3.0.101-63-default
- Ubuntu 16.04.1, 4.4.0-31-generic
- Ubuntu 14.04.4, 4.2.0-27-generic
- Kernel.org linux-4.9
- Kernel.org linux-4.8

Windows Guest is not supported with SR-IOV.

1.4. Package Contents

The Chelsio Native Network driver package consists of the following files/directories:

- **cxl-*.vib**: Driver VIB file required for installation.
- **docs:** This directory contains support documents README, Release Notes and User's Guide (this document) for the software.
- **EULA:** Chelsio's End User License Agreement.

2. Hardware Installation

Follow these steps to install Chelsio Adapter in your system:

- i. Shutdown/power off your system.
- ii. Power off all remaining peripherals attached to your system.
- iii. Unpack the Chelsio adapter and place it on an anti-static surface.
- iv. Remove the system case cover according to the system manufacturer's instructions.
- v. Remove the PCI filler plate from the slot where you will install the Ethernet adapter.
- vi. For maximum performance, it is highly recommended to install the adapter into a PCIe x8/x16 slot.
- vii. Holding the Chelsio adapter by the edges, align the edge connector with the PCI connector on the motherboard. Apply even pressure on both edges until the card is firmly seated. It may be necessary to remove the transceiver modules prior to inserting the adapter.
- viii. Secure the Chelsio adapter with a screw, or other securing mechanism, as described by the system manufacturer's instructions. Replace the case cover.
- ix. After securing the card, ensure that the card is still fully seated in the PCIE x8/x16 slot as sometimes the process of securing the card causes the card to become unseated.
- x. Connect a fiber/twinax cable, multi-mode for short range (SR) optics or single-mode for long range (LR) optics, to the Ethernet adapter or regular Ethernet cable for the 1Gb Ethernet adapter.
- xi. Power on your system.
- xii. Verify if the adapter was installed successfully by using the Ispci command

[root@wa	avne ~1# 1	Lspci grep	-i Chels	BIO						
06:00.0	Ethernet	controller:	Chelsio	Communications	Inc	T6225-CR	Unified	Wire	Ethernet	Controller
06:00.1	Ethernet	controller:	Chelsio	Communications	Inc	T6225-CR	Unified	Wire	Ethernet	Controller
06:00.2	Ethernet	controller:	Chelsio	Communications	Inc	T6225-CR	Unified	Wire	Ethernet	Controller
06:00.3	Ethernet	controller:	Chelsio	Communications	Inc	T6225-CR	Unified	Wire	Ethernet	Controller
06:00.4	Ethernet	controller:	Chelsio	Communications	Inc	T6225-CR	Unified	Wire	Ethernet	Controller
06:00.5	SCSI stor	rage controll	ler: Chel	lsio Communicati	ions	Inc T622	5-CR Unit	fied N	Wire Store	age Controller
06:00.6	Fibre Cha	annel: Chelsi	io Commur	nications Inc T	6225	-CR Unifie	ed Wire S	Stora	ge Control	ller

For Chelsio adapters, the physical functions are currently assigned as:

- Physical functions 0 3: for the SR-IOV functions of the adapter
- Physical function 4: for all NIC functions of the adapter
- Physical function 5: for iSCSI
- Physical function 6: for FCoE
- Physical function 7: Currently not assigned

```
Note
```

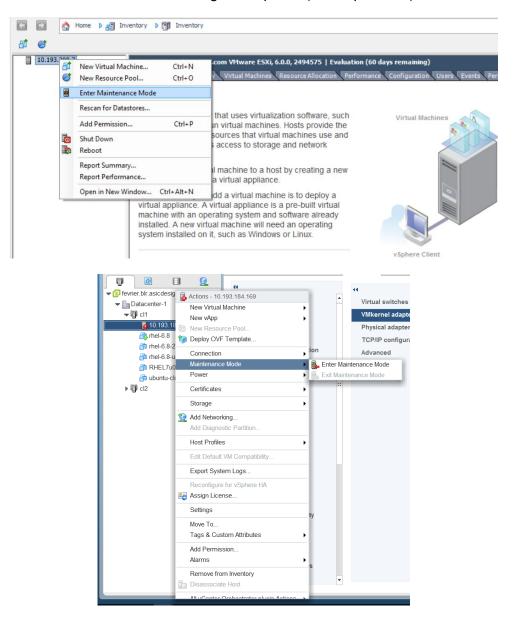
Network device names for Chelsio's physical ports are assigned using the following convention: the port farthest from the motherboard will appear as the first network interface. However, for T5 40G adapters, the association of physical Ethernet ports and their corresponding network device names is opposite. For these adapters, the port nearest to the motherboard will appear as the first network interface.

3. Software/Driver Installation

- i. Download the driver package from Chelsio Download Center, http://service.chelsio.com.
- ii. Unzip the driver package:

```
[root@host:~] unzip <driver_package>.zip
```

iii. Put the host in maintenance mode using the vSphere (desktop or web) Client.



iv. Install the Native Network driver (cxl):

```
[root@host:~] cp cxl-*.vib /productLocker/
[root@host:~] cp cxl-*.vib /var/log/vmware/
[root@host:~] esxcli software vib install -v /productLocker/cxl-*.vib --no-
sig-check
```

v. After installation completes successfully, exit from maintenance mode and reboot the host.

4. Software/Driver Loading

After rebooting the ESXi Host, the driver will load automatically. However, it is possible to manually load the driver by using the command below:

```
[root@host:~] vmkload_mod cxl
```

Execute the below command so that device manager performs a rescan:

[root@host:~] kill -SIGHUP \$(cat /var/run/vmware/vmkdevmgr.pid)

5. Software/Driver Configuration and Fine-tuning

5.1. cxgbtool

The *cxgbtool* command queries or sets various aspects of Chelsio network interface cards. It complements standard tools used to configure network settings and provides functionality not available through such tools. Some of the commands provided can be used to query running statistics to aid in debugging. The tool will be installed by default on installing the driver VIB.

Syntax & Usage

To use cxgbtool, use the syntax:

[root@host:~] /opt/chelsio/bin/cxgbtool <options>



For information on available parameters and their usage, refer to cxgbtool help by running the /opt/chelsio/bin/cxgbtool -h command.

5.2. Adapter Configuration

The adapter's configuration should be updated for optimal performance in ESXi environment. Follow the steps mentioned below:

i. Run the following *cxgbtool* command:

[root@host:~] /opt/chelsio/bin/cxgbtool -c esxcfg -set



te Not supported on T6 adapters.

ii. Reboot the system for changes to take effect.

5.3. Firmware update

The driver will auto-load the firmware if an update is required. The version can be verified using:

```
[root@host:~] /opt/chelsio/bin/cxgbtool -c version
```

5.4. Connecting a Virtual Machine

Follow the steps mentioned below to connect Chelsio adapter to a virtual machine:

i. Create a new virtual switch:

```
[root@host:~] esxcfg-vswitch -a vSwitchN
```

ii. Link a Chelsio adapter to the newly created virtual switch:

```
[root@host:~] esxcfg-vswitch -L vmnicN vSwitchN
```

iii. Create a new port group on the vSwitch:

```
[root@host:~] esxcfg-vswitch -A <port group name> vSwitchN
```

iv. From the vSphere client, right-click on the virtual machine, select the virtual network adapter to be used, and attach the newly created port group.

5.5. Tuning vMotion for vSAN

While creating a vSAN you may encounter out of memory issues, resulting in vMotion timing out. To avoid this, follow the steps mentioned below on all ESXi hosts in the vSAN:

i. Set the low-memory packet heap value to the maximum supported value of 512:

```
[root@host:~] esxcli system settings kernel set -s netPktHeapMaxMBPerGB -v
512
```

ii. Set the networking packet buffer pool size to the maximum supported value of 200:

```
[root@host:~] esxcli system settings kernel set -s netPktPoolMaxMBPerGB -v
200
```

iii. Reboot the host.

iv. Enable maximum RSS queues:

```
[root@host:~] vmkload mod cxl rss q=1
```

5.6. Virtual Functions (SR-IOV)

5.6.1. Instantiate VFs

Follow the steps mentioned below to instantiate virtual functions:

i. *max_vfs* is a comma separated module parameter that specifies the maximum number of VFs per port. Load the Native Network driver (cxl) with *max_vfs* parameter and set it to a non-zero value. In case of multiple adapters, use ',,' to separate the number of VFs per adapter:

[root@host:~] esxcfg-module cxl -s max vfs=W,X,,Y,Z

Where,

W: Number of VFs per port 0 of adapter 0.

X: Number of VFs per port 1 of adapter 0.

Y: Number of VFs per port 0 of adapter 1.

Z: Number of VFs per port 1 of adapter 1.

1 Note A maximum of 16 VFs can be instantiated per port.

E.g. - To instantiate 3 VFs for port 1 of adapter 0 & 4 VFs for port 0 of adapter 1:

[root@host:~] esxcfg-module cxl -s max_vfs=0,3,,4,0

ii. Verify *max_vfs* setting using the *-g* option:

[root@host:~] esxcfg-module -g cxl

E.g. :

```
[root@host:~] esxcfg-module -g cxl
cxl enabled = 1 options = 'max_vfs=2,2'
```

- iii. Reboot the ESXi host for changes to take effect.
- iv. Check if VFs were instantiated successfully on the PCI bus by either using the shell prompt (using *lspci*) or vSphere GUI (under *Host* > *Configuration*>*Advanced setting*)

[root@austen:~] lspci grep Chelsio
0000:05:00.0 Network controller: Chelsio Communications Inc. T580-LP-CR Unified Wire Ethernet Controller [vmnic4]
0000:05:00.1 Network controller: Chelsio Communications Inc. T580-LP-CR Unified Wire Ethernet Controller [vmnic5]
0000:05:00.2 Network controller: Chelsio Communications Inc. T580-LP-CR Unified Wire Ethernet Controller [vmnic6]
0000:05:00.3 Network controller: Chelsio Communications Inc. T580-LP-CR Unified Wire Ethernet Controller [vmnic7]
0000:05:00.4 Network controller: Chelsio Communications Inc T580-LP-CR Unified Wire Ethernet Controller
0000:05:00.5 Mass storage controller: Chelsio Communications Inc T580-LP-CR Unified Wire Storage Controller
10000-05-00 6 Serial bus controller. Chelsio Communications Inc T580-LP-CR Unified Wire Storage Controller
0000.05.00 6 Serial bus controller: Chelsio Communications Inc T580-LP-CR Unified Wire Storage Controller 0000:05:01.0 Network controller: Chelsio Communications Inc T580-LP-CR Unified Wire Ethernet Controller [PF_0.5.0_VF_0]
0000:05:00 6 Serial bus controller: Chelsio Communications Inc T580-LP-CR Unified Wire Storage Controller 0000:05:01.0 Network controller: Chelsio Communications Inc T580-LP-CR Unified Wire Ethernet Controller [PF_0.5.0_VF_0] 0000:05:01.1 Network controller: Chelsio Communications Inc T580-LP-CR Unified Wire Ethernet Controller [PF_0.5.1_VF_0]
0000.05.00 6 Serial bus controller: Chelsio Communications Inc T580-LP-CR Unified Wire Storage Controller 0000:05:01.0 Network controller: Chelsio Communications Inc T580-LP-CR Unified Wire Ethernet Controller [PF_0.5.0_VF_0]

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Hardware	DirectPath I/O Co	nfiguration					
Heidt Status Processors Memory Storage Networking Storage Adapters Network Adapters Advanced Settings Power Management Software Licensed Features Time Configuration	a device needed for normal host boot or operation can make normal host boot impossible and may require significant effort to undo. See the online hep for more information. Each listed device is available for direct access by the virtual machines on this host. Each listed device is available for direct access by the virtual machines on this host. Each listed device is available for direct access by the virtual machines on this host. Each listed device is available for direct access by the virtual machines on this host. Each listed device is available for direct access by the virtual machines on this host. Each listed device is available for direct access by the virtual machines on this host. Each listed device is available for direct access by the virtual machines on this host. Each listed device is available for direct access by the virtual machines on this host. Each listed device is available for direct access by the virtual machines on this host. Each listed device is available for direct access by the virtual machines on this host. Each listed device is available for direct access by the virtual machines on this host. Each listed device is available for direct access by the virtual machines on this host. Each listed device is available for direct access by the virtual machines on this host. Each listed device is available for direct access by the virtual machines on this host. Each listed device is available for direct access by the virtual machines on this host. Each listed device is available for direct access by the virtual machines on this host. Each listed device is available for direct access by the virtual machines on this host. Each listed device is available for direct access by the virtual machines on this host. Each listed device is available for direct access by the virtual machines on this host. Each listed device is available for direct access by the virtual machines on this host. Each listed device is available for direct access by the virtual machines on this host. Each listed device is avai		xcept via dedicating it to a single virtual machine. In particu online help for more information. Hide Details Re				
DNS and Routing Authentication Services							
Virtual Machine Startup/Shutdown	Device Details						
Vetual Machine Swapfile Location Security Profile Host Cache Configuration System Resource Reservation Agent VM Settings Advanced Settings	Device Name ID Device ID Vendor ID Function Bus	-	Vendor Name Class ID Subdevice ID Subvendor ID Slot				
1					Name, Target or Status contains: -	Clear	×

- **1** Note Unloading driver when VFs are attached to VMs is not supported by VMware.
 - VMs with SRIOV interface might not power on with "out of MSI-X vectors" message in vmkernel.log. To resolve this issue, you need to add "pciPassthru<VF_ID>.maxMSIXvectors" parameter to VMs configuration file. Maximum value allowed for this param is 31. It is recommended to set the value according to the following equation:

pciPassthru<VF_ID>.maxMSIXvectors = <Number of CPUs in Win VM> + 2

For more information refer to VMware documentation.

• Windows Guest is not supported with SR-IOV.

5.6.2. Assigning VFs to VMs

Once the VFs are instantiated successfully, it's time to attach them to the virtual machine. For instructions on how to assign virtual functions to a virtual machine, please refer to VMware's official documentation.

5.6.3. Using VFs in Linux VM

To use the newly attached VFs in a virtual machine, follow the steps mentioned below:

- i. Power-on the Virtual Machine with VF attached to it.
- ii. Verify that the Chelsio VF shows up in the VM using the *lspci* command. You should see a similar output:

```
[root@host~]# lspci | grep Chelsio
00:08:0 Ethernet controller: Chelsio Communications Inc T580-LP-CR Unified
Wire Ethernet Controller [VF]
```

- iii. Download the latest Chelsio Unified Wire for Linux driver package, from Chelsio Download Center, http://service.chelsio.com/
- iv. Untar the tarball using the following command:

[root@host~]# tar zxvfm ChelsioUwire-x.xx.x.tar.gz

v. Change you current working directory to ChelsioUwire-x.xx.x.x directory and install the VF driver using the following command:

[root@host~]# make vnic install

vi. Load the VF driver in the VM using the below command:

[root@host~] # modprobe cxgb4vf



10 Note To know more about Chelsio Virtual Function driver, please refer Chelsio Unified Wire for Linux User's Guide.

5.6.4. Example

i. In this example, 2 VFs are instantiated per port, hence a total of 4 VFs instantiated on the host. The host is then rebooted.

```
[root@host:~] esxcfg-module cxl -s max_vfs=2,2
[root@host:~] reboot
```

- ii. 4 VMs are setup in the following combination:
 - VF0 of PF0 (VF marked with the bus-id <PCIslot.01.0>) is assigned to VM1
 - VF1 of PF0 (VF marked with the bus-id <PCIslot.01.4>) is assigned to VM2
 - VF0 of PF1 (VF marked with the bus-id <PCIslot.01.1>) is assigned to VM3
 - VF1 of PF1 (VF marked with the bus-id <PCIslot.01.5>) is assigned to VM4
- iii. VMs are powered up one after another.
- iv. VF driver (cxgb4vf) is installed and loaded in all the VMs.

The above configuration will result in the following connectivity:

- VFs of the same port can communicate with each other. i.e. VM1 can communicate with VM2, and VM3 can communicate with VM4.
- VFs of port 0 (VM1 and VM2) will be able to communicate with any peer connected to port 0 of the network adapter.
- VFs of port 1 (VM3 and VM4) will be able to communicate with any peer connected to port 1 of the network adapter.

5.7. VXLAN

Virtual Extensible LAN (VXLAN) is a network virtualization technique that uses overlay encapsulation protocol to provide Ethernet Layer 2 network services with extended scalability and flexibility. VXLAN extends the virtual LAN (VLAN) address space by adding a 24-bit segment ID and increasing the number of available logical networks from 4096 to 16 million, thereby addressing the scalability and network segmentation issues associated with large cloud computing deployments. Furthermore, VXLAN provides a cost effective software-defined networking (SDN) solution for migration of a large number of VMs over large distances using existing hardware and software resources.

The following sections describe the method to setup a VXLAN using Chelsio adapter:

5.7.1. ESXi 6.5a

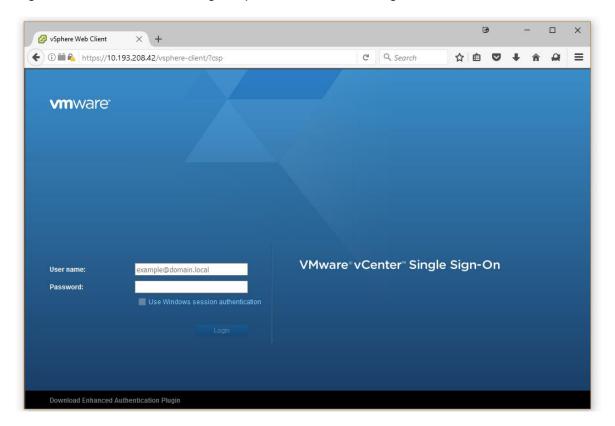
Configuring Adapters

For T6 adapters, VXLAN offload is enabled by default on loading the driver. In case of T5 adapters, this feature is enabled for Tx but disabled for Rx. To enable it, load the driver with $vxlan_rx_offload=1$ option:

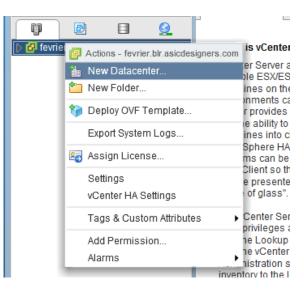
```
[root@host:~] vmkload mod cxl vxlan rx offload=1
```

• Creating Cluster

i. Log in to vCenter Server through vSphere Web Client using a web browser.



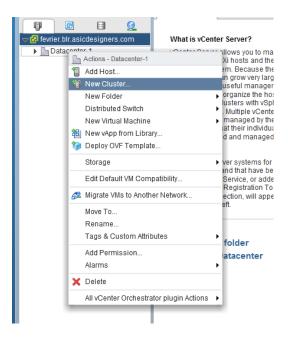
ii. Click on **Hosts and Clusters** tab in the **Object Navigator**. Right-click on your vCenter server and select **New Datacenter**.



iii. Provide a name for the new datacenter and click **OK**.

🚹 New Datacenter	€ €
Datacenter name: Location:	Datacenter-1 P fevrier.blr.asicdesign
	OK Cancel

iv. Right-click on the newly created datacenter and select New Cluster.



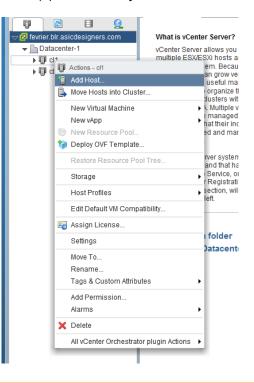
v. Enter a name for the new cluster and select options for cluster features. Click OK.

New Cluster		? >>
Name	cl1	
Location	Datacenter-1	
▶ DRS	Turn ON	
▶ vSphere HA	Turn ON	
► EVC	Disable	•
 Virtual SAN 	Turn ON	
		OK Cancel

vi. The newly created cluster will appear in the inventory. Repeat the above step to add more clusters to the datacenter.



vii. Right-click on the newly created cluster and select **Add Host**. This will invoke the **Add Host Wizard** allowing you to add host(s) to the newly created cluster.



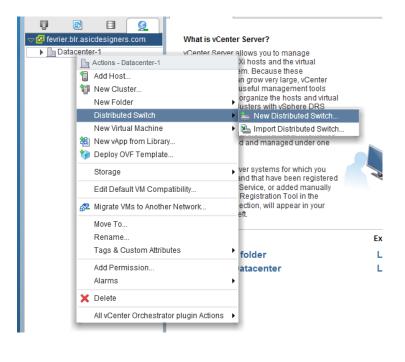
viii. Provide name or IP address of the host, username and password, and other configuration details. Click **Next**.

Add Host		9	*
 Name and location Connection settings Host summary Ready to complete 	Enter the name or IP address Host name or IP address: Location: Type:	ss of the host to add to vCenter Server. 10.193.184.69 I add I add I add I add I add I add I add I add I add I add I add	
		Back Next Finish Cancel]_

ix. Review the information provided and click Finish.

Creating Distributed Switch

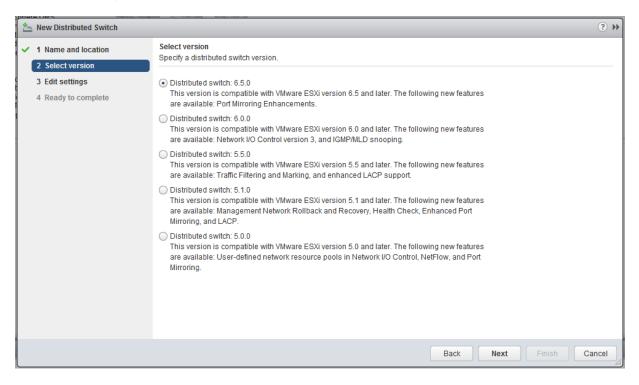
- i. Log in to vCenter Server through vSphere Web Client using a web browser.
- ii. Click on Networking tab.
- iii. Right-click on your datacenter and select **Distributed Switch > New Distributed Switch**.



iv. Enter a name for the switch and click next.

Let New Distributed Switch		0	**
1 Name and location 2 Select version	Name and Specify dist	location ributed switch name and location.	
 2 Select version 3 Edit settings 4 Ready to complete 	Name: Location:	DSwitch Datacenter-1	
		Back Next Finish Cancel	

v. Select the required switch version and click Next.



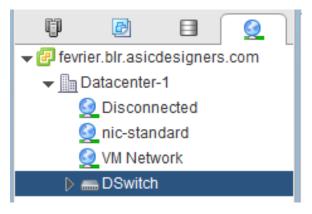
vi. Select the required number of uplinks for your setup. Please note that the number of uplinks must be equal or less than the number of adapters to be used for each host. Click **Next**.

La New Distributed Switch			**
 1 Name and location 2 Select version 	Edit settings Specify number of uplin	k ports, resource allocation and default port group.	_
3 Edit settings 4 Ready to complete	Number of uplinks: Network I/O Control: Default port group: Port group name:	Imable Imable	
		Back Next Finish Cancel),

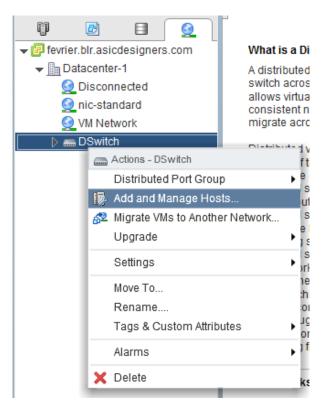
vii. Review the settings and click **Finish**.

En New Distributed Switch				? ₩
 1 Name and location 2 Select version 	Ready to complete Review your settings selections be	fore finishing the wizard.		
 2 Select version 3 Edit settings 4 Ready to complete 	Name: Version: Number of uplinks: Network I/O Control: Suggested next actions Wew Distributed Port Group Mew Distributed Port Group Add and Manage Hosts	DSwitch2 6.5.0 2 Enabled	uted switch.	
			Back Next Finis	h Cancel

viii. The newly created switch will appear in the inventory.



ix. Right-click on the switch and select Add and Manage Hosts.



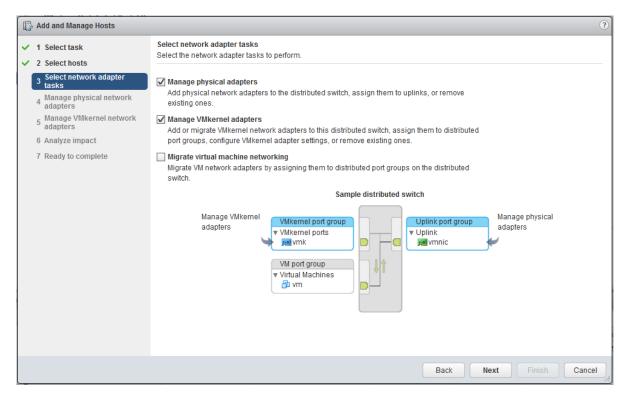
x. Select Manage host networking and click Next.

Add and Manage Hosts	(?
Add and Manage Hosts 1 Select task 2 Select hosts 3 Select network adapter 1 tasks 4 Manage physical network 4 adapters 5 Manage VMkernel network adapters 6 6 Analyze impact 7 Ready to complete	Select task Select a task to perform on this distributed switch. Add new hosts to this distributed switch. Add new hosts to this distributed switch. C Manage networking Manage networking of hosts attached to this distributed switch. Remove hosts Remove hosts from this distributed switch. Add new hosts and manage host networking (advanced) Add new hosts and manage networking of hosts atready attached to this distributed switch. Use this option to unify the network configuration of new and existing hosts.
	Back Next Finish Cancel

xi. Click + Attached hosts. Select member hosts to add and click OK.

Select member hosts			×
			Q Filter
✓ Host	Host State	VDS Status	Cluster
10.193.184.169	Connected	🥑 Up	🗊 cl1
✓	Connected	🥑 Up	🗊 cl2
A Find	•		2 items 🛛 🗎 Copy 🗸
			OK Cancel

xii. Click Next and select the appropriate network adapters tasks to perform. Click Next.



xiii. Here you can add physical network adapters to the switch. Select the adapter and click **Assign uplink**.

1 Select task 2 Select hosts	Manage physical network adapters Add or remove physical network adap	ters to this distributed switch.		
3 Select network adapter tasks	📷 Assign uplink 💢 Unassign ada	pter 🖃 Reset changes 🚯 View	v settings	
4 Manage physical network adapters	Host/Physical Network Adapters	1 🛦 In Use by Switch	Uplink	Uplink Port Group
5 Manage VMkernel network adapters				
	✓ On this switch			
6 Analyze impact	vmnic3 (Assigned)		Uplink 1	DSwitch-qa-2-DVUplink
7 Ready to complete	 On other switches/unclaimed 			
	vmnic0	vSwitch0	-	-
	vmnic1		-	-
	对 vmnic2	-	-	-
	📷 vmnic6	vSwitch1	-	-
	📷 vmnic7			-
	On this switch			
	 On other switches/unclaimed 			
	vmnic0	vSwitch0	-	-
	wnic1			
	vmnic2		-	-
	vmnic3	-		-
	vmnic4		-	-
	vmpic5	_	_	

	xiv.	Select an u	plink for the	adapter ar	nd click OK	and then Next
--	------	-------------	---------------	------------	--------------------	---------------

Select an Uplink for vmnic2	×
Uplink	Assigned Adapter
Uplink 1	vmnic3
Uplink 2	-
(Auto-assign)	
	OK Cancel

xv. In this step, you can view the VMkernel adapters automatically added to the hosts. If VXLAN modules are already installed using NSX Manager, you can also view the VXLAN Port group associated to the respective host in distributed switch. Click **Next**.

1 Select task 2 Select hosts		Manage VMkernel network adapters Manage and assign VMkernel network adapters to the distributed switch.			
³ Select network adapter tasks	🚨 Assign port group 斗 New adaj	pter 🥒 Edit adapter 🗙 Remove	🝙 Reset changes 🚯 View settir	Igs	
4 Manage physical network adapters	Host/VMkernel Network Adapters	1 A In Use by Switch	Source Port Group	Destination Port Group	
5 Manage VMkernel network adapters	- 10.193.184.169				
³ adapters					
6 Analyze impact	vmk1	DSwitch	vxw-vmknicPg-dvs-41-0	Do not migrate	
7 Ready to complete					
	vmk0	vSwitch0	Management Network	Do not migrate	
	On this switch				
	pm vmk0	vSwitch0	Management Network	Do not migrate	

xvi. Review the impact status of the configuration. Click Next.

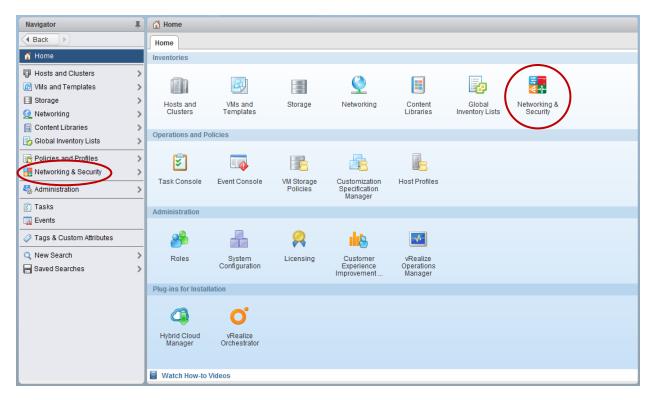
Add and Manage Hosts		(?)				
 1 Select task 2 Select hosts 	Analyze impact Review the impact this configuration change might have on some network dependent services.					
 Select network adapter tasks 	Overall impact status: 🥑 No impact					
 4 Manage physical network adapters 	Host / Impact Analysis per Service 1	Status				
 Manage VMkernel network adapters 	✓ ☐ 10.193.184.169 iSCSI	No impact				
6 Analyze impact						
7 Ready to complete	iSCSI	No impact				
	No items	selected				
		Back Next Finish Cancel				

xvii. Review the settings and click **Finish**.

Add and Manage Hosts		?
1 Select task	Ready to complete Review your settings selections before finishing the wizard.	
2 Select hosts 3 Select network adapter tasks	Number of managed hosts	
✓ 4 Manage physical network adapters	Hosts to update: 2 Number of network adapters for update	
 5 Manage VMkernel network adapters 4 Anathene immediate 	Physical network adapters: 2	
 6 Analyze impact 7 Ready to complete 		
		Þ
	Back Next Finish Cancel	
	Back Next Finish Cancer	

Setting up VXLAN

- i. Follow the steps mentioned in VMware's NSX installation guide to install and configure NSX Manager.
- Make certain that vCenter Server is registered with NSX manager successfully. Networking & Security link should appear in both Home and Navigator panes. Click on the link in any of the two panes.



iii. In the **Navigator** pane, click on **Installation** and then **Host Preparation** tab. Select the IP of the required NSX manager from the drop-down menu.

Navigator I	Installation
Back	Management Host Preparation Logical Network Preparation
Networking & Security	
tome NSX Home	NSX Manager: 10.193.187.113 💌
🚱 Dashboard	# 10.193.187.113
🔅 Installation	NSX Component instantation on Hosts
(the second Outlinks a	

iv. In the *Installation Status* column for the required cluster, click on options (^(®)) and select **Install**.

Installation				
Management Host Prepar	ration Logical Network Preparation	Service Deployments		
NSX Manager: 10.193.187.				
Actions	UI NUSIS			
Clusters & Hosts	Installation Status	Firewall	VXLAN	
▶ ∰uci1	Not Installed	🔯 - Not Configured	Not Configured	
▶ 🛍 ci2	Not Installed	Install igured	Not Configured	
				2 items

v. Click Yes to confirm. Installation progress will be shown in the Recent Tasks pane.

cl1 - Install				
Are you su	ure you want to	continue with the install?		
	Yes	No		

vi. In the *VXLAN* column for the required cluster, click on options () and select **Configure VXLAN**.

🄯 Actions				
Clusters & Hosts	Installation Status	Firewall	VXLAN	
▶ ∰ici1	✓ 6.3.0.5007049	Enabled	Not Configured	@-
▶ ∰ cl2	Not installed	Not Configured	Not Configured	Force Sync Services Change IP Detection Type Change Locale ID Disable Firewall Configure VXLAN Uninstall
				Communication Channel Health

vii. Select the distributed switch created previously from the drop-down menu. Provide details like VLAN ID, IP addressing and Teaming policy and click **OK**.

cl1 - Configure VXLAN Net	working	?	*
Switch:	* DSwitch	•	
VLAN:	* 0		
MTU:	* 1600		
VMKNic IP Addressing:	* 🔘 Use DHCP		
	• Use IP Pool vxlan-ip-pool	•	
VMKNic Teaming Policy:	* Fail Over	•	
VTEP:	* 1		
	ОК Са	ncel	0

viii. Click on the Logical Network Preparation tab and then Segment ID. Set the range for Segment ID pool and Multicast addresses. Click OK.

Edit Segment IDs and Mu	Iticast Address Allocation	?			
Provide a Segment ID p	ool and Multicast range unique to this NSX Manager.				
Segment ID pool: *	t ID pool: * 5000-5900				
	(In the range of 5000-16777215)	_			
🗹 Enable Multicast add	ressing				
Multicast addresses are	required only for Hybrid and Multicast control plane modes.				
Multicast addresses: * 239.0.0.0-239.255.255.255					
	(Recommended range - 239.0.0.0-239.255.255.255)				
		_			
	OK Cance	<u>ا</u>			

ix. Click on **Transport Zones** and then **+** link.

Installation					
Management Host I	Preparation Logical Network Prepa	ration Service Deployme	ents		
NSX Manager: 10.19	3.187.113				
VXLAN Transport Se	egment ID Transport Zones				
÷				1 Q F	ilter -
Name	1 Description	Scope	Control Plane Mode	CDO Mode	Logical Switches
		This list is e	mpty.		
4					
M				0 Objects	Export Copy

x. Provide a name for the transport zone. Select the replication mode and clusters that will be part of the transport zone. Click **OK**.

Rew Transport Zone				? •		
Name:	transport1					
Description:						
Replication mode:	 Multicast 					
	Multicast on Physica	al network used for VXLAN cor	ntrol plane.			
	 Unicast 					
	VXLAN control plan	e handled by NSX Controller	Cluster.			
	 Hybrid 					
	Optimized Unicast I	mode. Offloads local traffic rep	lication to physical network	¢.		
Salact clusters that will	be part of the Transpor	t 7000				
	be part of the franspor					
Name		NSX vSwitch	Status			
🗹 🗊 cl1		BSwitch	📀 Normal			
			OK Can	cel		

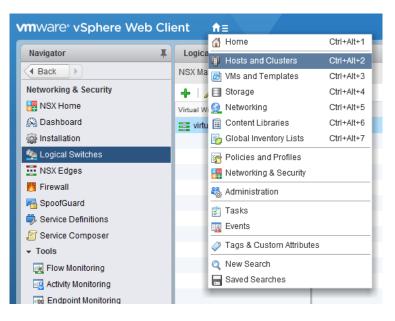
xi. In the **Navigator** pane, select **Logical Switches** under **Networking & Security** and then + link.

Navigator I	Logical Switches					
Back	NSX Manager: 10.193.18	7.113				
Networking & Security	+					
🚟 NSX Home	Virtual Wire ID	Segment ID	Name	1 A Status	Transport Zone	Hard
🚱 Dashboard			This list is empty.			
🙀 Installation						
🛬 Logical Switches						
NSX Edges						
📙 Firewall						
n SpoofGuard						
Service Definitions						
Service Composer						
- Tools						
碱 Flow Monitoring						
🖳 Activity Monitoring						
🙀 Endpoint Monitoring						
💱 Traceflow						
 Networking & Security Inventory 						
👭 NSX Managers >						
	4					
	M				a abiasta	Export 👔 Coj

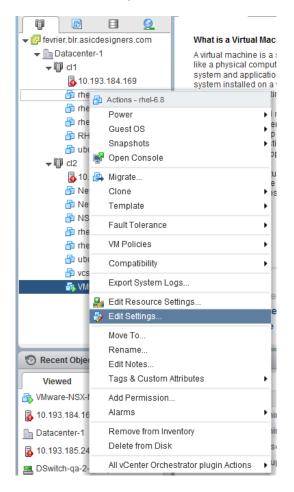
xii. Provide a name for the logical switch and select the transport zone that was previously created. Change the replication mode if required and Click **OK**.

强 New Logical Switch	1	(?)»
Name: *	wire1	
Description:		
Transport Zone: *	transport1 Change F	Remove
Replication mode:	 Multicast 	
	Multicast on Physical network used for VXLAN control plane.	
	 Unicast 	
	VXLAN control plane handled by NSX Controller Cluster.	
	O Hybrid	
	Optimized Unicast mode. Offloads local traffic replication to physical r	network.
Enable IP Discov	ery	
Enable MAC Lear	ning	
	ОК	Cancel

xiii. Using the main menu (or shortcut Ctrl+Alt+2), access the Hosts and Clusters section.



xiv. Select VM under Datacenter > Cluster, right-click and select Edit Settings.



xv. In the **New device** drop-down menu, select **Network** and then click **Add**. This will add a **New Network** entry under **Virtual Hardware** tab.

🖻 🗗 rhel-6.8 - Edit Settin	igs	- ? >
Virtual Hardware VM Virtual Hardware VM CPU Memory Hard disk 1 GSCSI controller 0 Memory CD/DVD drive 1	Options SDRS Rules vApp Options	
k y ► 🗖 CPU		
r ▶ 🎹 Memory	2048 v MB v	
o v → 🛄 Hard disk 1	20 GB 💌	
e at ▶ 🛃 SCSI controller 0	VMware Paravirtual	8
ト i CD/DVD drive 1	Datastore ISO File	
n 🕨 🔚 Floppy drive 1	Client Device	
▶ 🛄 Video card	Specify custom settings	
▶ ∰ VMCI device		
▶ Other Devices		
▶ Upgrade	Schedule VM Compatibility Upgrade	
r		
New device	e: 🛛 🙀 Network 🔽 Add	
Compatibility: ESXi 6.0 a	and later (VM version 11) OK	Cancel

xvi. In the **New Network** drop-down menu, select *Show more networks*. Add the logical switch created previously. Click **OK** and then **OK** again.

🗗 rhel-6.8 - Edit Settin	gs	? ₩
Virtual Hardware VM	Options SDRS Rules vApp Options	
	1 .	
	2048 • MB •	
 ▶ ■ Memory ▶ ■ Hard disk 1 ▶ ④ SCSI controller 0 	20 GB V	
▶ 🛃 SCSI controller 0	VMware Paravirtual	
► CD/DVD drive 1	Datastore ISO File	
▶ 📻 Floppy drive 1	Client Device	
▶ 🛄 Video card	Specify custom settings	
▶ i VMCI device		
Other Devices		
▶ Upgrade	Schedule VM Compatibility Upgrade	
▶ Mew Network	VM Network	
r	VM Network	
t	nic-standard	
	DSwitch	
1	Show more networks	
New device	e: Network 🗸 Add	
Compatibility: ESXi 6.0 a	and later (VM version 11) OK C	ancel
enques		

Select Network		×
h Show all columns		
C		Q Filter -
Name	Distributed Switch	
DPortGroup	DSwitch	
e 🎎 vxw-vmknicPg-dvs-41-0-34c	DSwitch	
d 🔔 vxw-dvs-41-virtualwire-4-sid	DSwitch	
Q VM Network	-	
r 🧕 nic-standard	-	
n		
a		
2		
4		
t		
A C Find		5 items 🖺 Copy 🗸
e		OK Cancel

xvii. Repeat the above step for all the VMs in the cluster. All the VMs added to the VXLAN will now be able to communicate successfully.

5.7.2. ESXi 6.0

Configuring Adapters

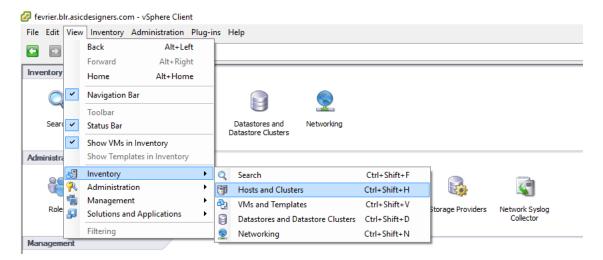
Please see Configuring Adapters sub-section for ESXi 6.5a.

• Creating Cluster

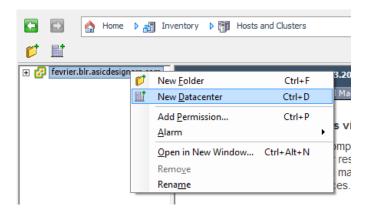


Instructions provided here are for desktop client. Steps for web client are similar with minor variations.

- i. Open a vSphere Client session to a vCenter Server.
- ii. Select View > Inventory > Hosts and Clusters.



iii. Right-click on your vCenter Server and select **New Datacenter**. Provide a name for the new datacenter and hit [Enter].



iv. Right-click on your datacenter and select New Cluster.

		designers.com Data1				
+ Dat-	ø	New <u>F</u> older	Ctrl+F			
	el 🕴	New Cluster	Ctrl+L			
1	C.	New Datastore Cluster				
		Add <u>H</u> ost	Ctrl+H			
	E.	New Virtual Machine	Ctrl+N			
1	<u></u>	New vSphere Distributed Switch	Ctrl+K			
		Add Data <u>s</u> tore				
		Rescan for Datastores				
1	F8	Migrate Virtual Machine Networking				
		Add Permission	Ctrl+P			
		<u>A</u> larm	•			
		Open in New <u>W</u> indow Ct	trl+Alt+N			
		Remo <u>v</u> e				
		Rena <u>m</u> e				

v. Enter a name for the new cluster and select options for cluster features, Enhanced vMotion Compatibility (EVC) and swap file policy in the subsequent screens.

🕜 New Cluster Wizard			đ	_		Х
Cluster Features What features do you wan	to enable for this cluster?					
Cluster Features VMware EVC VM Swapfile Location Ready to Complete	 Turn On vSphere HA detec running within a d monitoring to minir vSphere HA must Turn On vSphere DI vSphere DRS enab resources. Cluster and virtual machin vSphere DRS also 	ts failures and provides rapid n uster. Core functionality includ mize downtime when heartbeat be turned on to use Fault Toler RS ples vCenter Server to manage resources can be divided into	ecovery for th es host and vii s cannot be de ance. hosts as an ai smaller resourd	rtual machine atected. ggregate poo ce pools for u nment of virt	e ol of Jisers, gro Jual machi	nes
	policies. vSphere DRS and	virtual machines to balance load VMware EVC should be enabled with Fault Tolerance turned or	l in the cluster	in order to p		ing
		< 8	Back 1	Next >	Can	cel

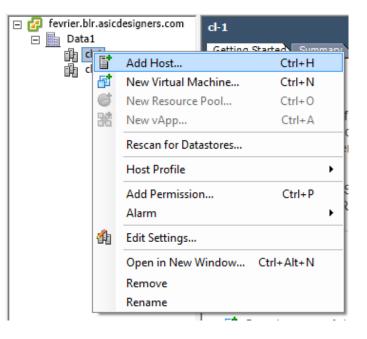
vi. Review the options selected and click **Finish**.

🕗 New Cluster Wizard		U	-		×
Ready to Complete Review the selected options for this	duster and dick Finish.				
Cluster Features	The cluster will be created with the	following options:			
VMware EVC VM Swapfile Location	Cluster Name:	d-1			
Ready to Complete	VMware EVC Mode:	AMD Opteron™ Generation 1			
	Virtual Machine Swapfile Location:	Same directory as the virtual machine			
		<u><</u> Back <u>F</u> inis	h	Cano	el

vii. The newly created cluster will appear in the inventory. Repeat the above step to add more clusters in the datacenter.

🖃 🛃 fevrier.blr.asicdesigners.com	n
🖃 🌆 Data1	
in cl-1	
i d-2	

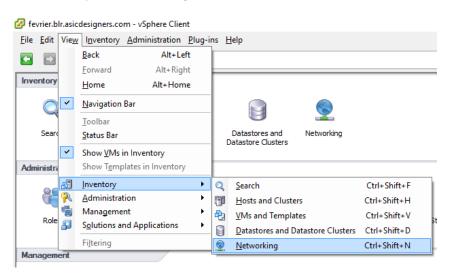
viii. Right-click on the newly created cluster and select **Add Host**. This will invoke the **Add Host Wizard** allowing you to add host(s) to the newly created cluster.



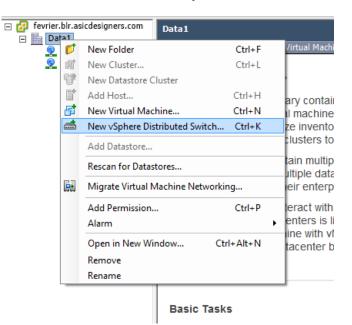
• Creating Distributed Switch

Note Instructions provided here are for desktop client. Steps for web client are similar with minor variations.

- i. Open a vSphere Client session to a vCenter Server.
- ii. Select View > Inventory > Networking



iii. Right-click on your datacenter and select New vSphere Distributed Switch.



iv. In the setup wizard, select the required switch version and click Next.

🕝 Create vSphere Distributed Switch		ē	-		×
Select vSphere Distributed Switch Specify vSphere distributed switch		vSphere Distri	buted Switc	h Version:	6.0.0
Select VDS Version General Properties Add Hosts and Physical Adapters Ready to Complete	vSphere Distributed Switch Version vSphere Distributed Switch Version: 5.0.0 This version is compatible with VMware ESX version 5.0 and lat User-defined network resource pools in Network I/O Control, N vSphere Distributed Switch Version: 5.1.0 See the VMware documentation for a list of compatible VMware version of the vSphere distributed switch.	letFlow and Port Mirr	oring.		
	 vSphere Distributed Switch Version: 5.5.0 See the VMware documentation for a list of compatible VMware version of the vSphere distributed switch. vSphere Distributed Switch Version: 6.0.0 See the VMware documentation for a list of compatible VMware version of the vSphere distributed switch. 				
		< Back	ext >	Canc	:el

v. Select the required number of uplinks for your setup. Please note that the number of uplinks must be equal or less than the number of adapters to be used for each host. Click **Next**.

🕜 Create vSphere Distributed Switch					۱.	-		×
General Properties Specify the vSphere distributed swi	itch properties.			vS	phere Distribu	ted Switch	Version:	6.0.0
Select VDS Version General Properties Add Hosts and Physical Adapters Ready to Complete	General Name: Name: Number of uplink ports:	dvSwitch 2 Maximum	number of physical a	dapters per ho	st			
	dvSwitch Your port groups will	l go here.			ıts plink1 (0 Host plink2 (0 Host			
	н			< Back	. Nex	t>	Cano	el

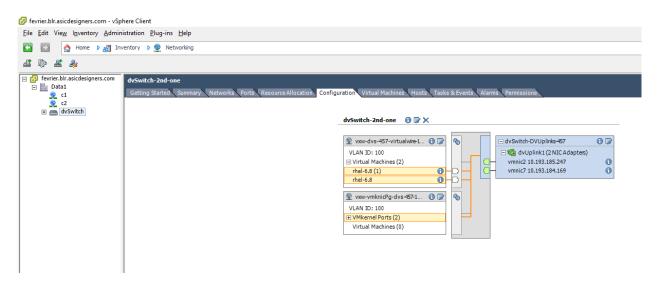
vi. Select the hosts and VMNICs for each host, to be added to the VXLAN network. Click Next.

🚱 Create vSphere Distributed Switch			•	_		×
Add Hosts and Physical Adapters Select hosts and physical adapters	to add to the new vSphere distributed s	witch.	vSphere Dist	ributed Switch	Version:	6.0.0
Select VDS Version General Properties Add Hosts and Physical Adapters Ready to Complete	When do you want to add hosts and t Add now Add later	heir physical adapters to		switch? View Incom	ipatible F	losts
	Host/Physical adapters	In use by switch	Settings			
	□ □ 10.193.184.169		View Details			
	Select physical adapters		Competensia			
	vmnic2		View Details			
	vmnic3		View Details			
	vmnic6		View Details	-		
			View Details			
	1		≤ Back 1	Next≥	Cano	el

vii. Review the options selected and click Finish.

Create vSphere Distributed Switch Ready to Complete Verify the settings for the new v		G vSphere Distri	buted Swite	h Version:	× : 6.0.0
Select VDS Version General Properties Add Hosts and Physical Adapters Ready to Complete	Automatically create a default port group dvSwitch VLAN ID: Virtual Machines (0)	□ Uplink ports □ 10,000 0,0000 0,000 0,000 0,000 0,000 0,000 0,000 0,000 0,000 0,000 0,000 0	169 ost)		
		< Back F	inish	Cano	:el

viii. The newly created switch will appear in the inventory.



• Setting up VXLAN

- i. Before proceeding, please follow the steps mentioned in VMware's vShield installation guide to install and configure vShield Manager.
- ii. Using a web browser, login to vShield Manager and select your datacenter in the left pane.

		logged in as a	System A	dministrator	Logged in as:admin	Change Password	Logout <u>Hel</u>	<u>p About</u>
View: Host & Clusters V	-							
Q	General	App Firew	/all	Endpoint	SpoofGuard	Network Virtualiza	ition	
	Hosts Port Groups	Grouping	Services					Refresh
E Settings & Reports								
Data Security	Host Informatio	n						
- 👘 Service Insertion						Last updated or	n Nov 30, 2016 7	26:34 PM
Object Library			User	Service	Арр	Endpoint	Data Security	
⊡· 💋 Datacenters	Name	Cluster	VMs	VMs	Enabled	Enabled	Enabled	
	10.193.184.169	cl-1	7	0	No	No	No	
	10.193.185.247	cl-2	9	1	No	No	No	

iii. Select the **Network Virtualization** tab on the right pane, then click on the **Preparation** link and then **Edit**. Select the clusters you want to add to the VXLAN. For each of the cluster added, select the designated distributed switch to transport the VXLAN traffic, and specify the VLANID. Click **Next**.

Select participating clusters	Select		clusters t	clusters o participate in VXL ributed switch to tra		
Specify transport attributes	Use	Cluster	*	Distributed Switch		VLAN
	\checkmark	🔒 cl-1		dvSwitch	-	100
		🔂 cl-2		dvSwitch		100

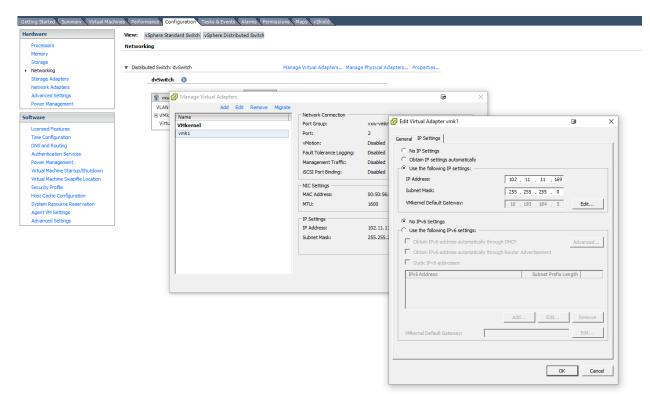
iv. For the distributed switch, select the desired teaming policy and set the MTU to 1600 (to accommodate VXLAN header). Click **Finish**.

Prepare Infrastructure For VXLAN Networking						
Select participating clusters Specify transport	Specify transport attributes The following switches were designated for transporting VXLAN traffic. Please specify a VLAN preferred MTU setting for each switch.					
attributes	Distributed Switch	Teaming Policy	MTU (bytes)			
	🛲 dvSwitch	Static EtherChannel	1600			
		Previous Next Finis	sh Cancel			

v. The newly added clusters will be initialized now.

Data1								
General Ar	p Firewall	Endpoint	SpoofGuard	Network Virtualization				
reparation Network Scopes Networks Edges Refre								
	Connectivity Segment ID letwork Connectivity for VXLAN Traffic Resolve Edit							
All hosts in a cluster must	All hosts in a cluster must be connected to a distributed switch to enable VXLAN networking							
Hosts & Clusters	Status	Vn	nknic IP Addresses	Distributed Switch	VLAN	Teaming Policy	MTU	
▶ @ cl-2	🔅 Starting	DH	CP	dvSwitch	100	Static EtherChannel	1600	
▶ 🏥 cl-1	🔅 Starting	DH	СР	dvSwitch	100	Static EtherChannel	1600	

vi. In case DHCP server is not available for clusters, use vSphere client to configure static IPs for the hosts.



vii. While still in the **Preparation** section, click the **Segment ID** button and then **Edit**. Set the range for *Segment ID pool* and *Multicast addresses*. Click **OK**.

Edit Settings	×
Provide a segmentID pool and multicast range unique to this vShield manager.	
Segment ID pool: * 5000-5900	
Multicast addresses: * 224.0.0.0-224.1.8.255	
Ok Cance	

viii. Click the **Network Scopes** link and then **+**. Provide a name and description (optional) for the new network scope. Select the clusters you want to add in this network scope. Click **Ok**.

Add Network Scope		8
Name * vxlan-scope		
Description		
Select One or More Clusters to Ac	d to this Network Scope	
Clusters	Distributed Switch	Readiness
☑ ∰ cl-2	dvSwitch	🗸 Ready
☑ ឿ d-1	dvSwitch	🗸 Ready
		Ok Cancel
Data 1		
General App Firewall	Endpoint S	SpoofGuard Network Virtualization
Preparation Network Scopes Netw		
♦ ×		
Name		Description
JJ vxlan-scope		

ix. Click the **Networks** link and press the **+**. Provide a name and description (optional) for the new VXLAN. Click on *Network Scope and s*elect the network scope created in the previous step from the drop-down. Click **Ok**.

Create VXLAN	Network 🛞
Name	* vxlan-virtual-wire
Description	
Network Sco	pe vxlan-scope
Scope Details	
Name	vxlan-scope
Description	
 Clusters 	
▶ Available Se	rvices
	Ok Cancel

)ata1						
General App Firewall	Endpoint	SpoofGuard	Network Virtualization			
Preparation Network Scopes Netw	vorks Edges					Refresh
🕂 🗙 🎯						
Name	Status	9	Segment ID	Multicast IP Address	Edge	
🛬 vxlan-virtual-wire	ок	5	5000	224.0.0.0		

x. In vSphere client, right-click on the VM you want to add to the VXLAN and select *Edit Settings*.

🗗 rhel-6	3.185.247 5.8 (1) 5.8-1 (1)	environment, you can use workstation environments, consolidate server applica	, as testing en
Thele Thele RHEL RHEL RHEL Wn-w Shie	.8 Po 7u Gu 7u Gu 7u Sr 7u Po 10 10 10 10 10 10 10 10 10 10	In vCenter Server virtual over ver vest lapshot pen Console it Settings igrate one mplate ult Tolerance dd Permission eport Performance mame pen in New Window Ctrl+ Alt+N emove from Inventory elete from Disk	<pre>machines run un many achine achine ttings </pre>

🔗 rhel-6.8-2 - Virtual Machine	Properties		_			
Hardware Options Resources	vServices		Virtual Machine	e Version: 11 🛕 🖻		[
□ Show All Devices Hardware ■ ■ Memory □ CPUs □ Video card □ VMCI device SCSI controller 0 ● CD/DVD drive 1 □ Hard disk 1 ₽ Floppy drive 1	Add Remove	Memory C 2 TB 1 TB 512 GB 256 GB 128 GB 64 GB 32 GB 16 GB 4 GB 2 GB 1 GB 2 GB 1 GB 2 GB 1 GB 1 GB 2 S6 MB 1 GB 2 S6 MB 1 28 MB 64 MB 32 MB 64 MB 32 MB 64 MB	onfiguration 2 ≟ Memory Size: 2 ≟ Maximum recommended for 2 Add Hardware 2 Device Type What sort of device do you with sort of device do you with sort of device do you with sort of device type Device Type Network connection Ready to Complete 2	B▼ ab X	sh to add. Information This device can be added to this Virtual Machine.	
		_			< Back Next > Cancel	

xi. Click Add, select *Ethernet Adapter* and then click Next.

xii. Select the VXLAN created previously from the Network label drop-down. Click Next.

🕜 Add Hardware			ē	×
Network Type What type of network do	you want to add?			
Device Type Network connection Ready to Complete	Adapter Type Type: VMXNET 3 Adapter choice can affect both netw Consult the VMware KnowledgeBas network adapters supported for var Network Connection Network label: VM Network intel -debug t5-vmnic3-vmnetwork VM Network VM Network	J rorking performance and m e for more information on ious guest operating syste	choosing amon ams and hosts.	ig the
		< Back	Next >	Cancel

xiii. Review the options selected and click $\ensuremath{\textit{Finish}}.$

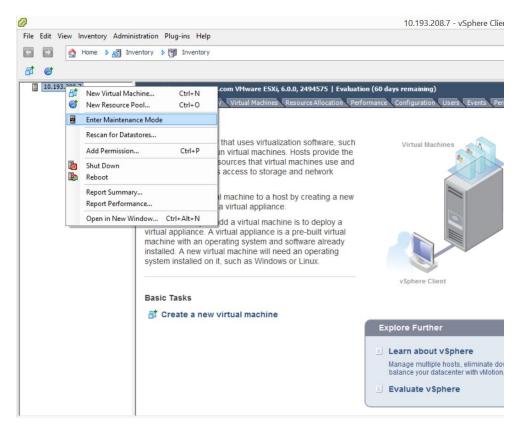
🔗 Add Hardware		ē	×
Ready to Complete Review the selected op	tions and click Finish to add t	he hardware.	
Device Type Network connection	Options:		
Ready to Complete	Hardware type: Adapter type: Network Connection: Connect at power on:	Ethernet Adapter VMXNET 3 vxw-dvs-493-virtualwire-19-sid-5000-vxlan-virtual-wire Yes	
<u> </u>		< Back Finish	Cancel

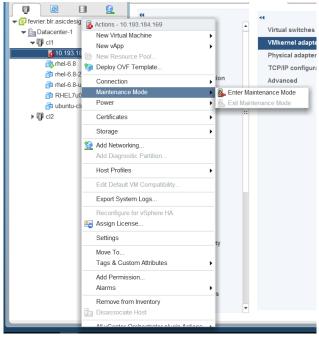
xiv. All the VMs added to the VXLAN will now be able to communicate successfully.

6. Software/Driver Uninstallation

Follow the steps mentioned below to uninstall the driver:

i. Put the host in maintenance mode using the vSphere (desktop or web) Client:





ii. Uninstall the driver:

```
[root@host:~] esxcli software vib remove -n cxl
```

iii. Reboot the host:

[root@host:~] reboot

7. Software/Driver Update

For any distribution specific problems, please check README and Release Notes included in the release for possible workaround.

Please visit Chelsio support web site http://service.chelsio.com/ for regular updates on various software/drivers. You can also subscribe to our newsletter for the latest software updates.

8. Appendix

8.1. Chelsio End-User License Agreement (EULA)

Installation and use of the driver/software implies acceptance of the terms in the Chelsio End-User License Agreement (EULA).

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Chelsio Communications, Inc. 209 North Fair Oaks Avenue, Sunnyvale, CA 94085 U.S.A