



Backup Solution Testing on Cisco UCS C240 M5 with HP Tape Library and VEEAM Availability Suite

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CHAPTER 1

Backup Solution Testing

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Overview

This program Backup Testing - Backup to Disk/De-duplication Disk and Replicate to HP LTO-6 Ultrium 6250/6650 and HP LTO-5 Ultrium 3280 SAS external tape library validates data backup from the Windows and Linux OS on the Cisco UCS environment. Backup data stored in the Backup server Cisco UCS C240 M5 will be replicated to the attached HP LTO-6 Ultrium 6250/6650 and HP LTO-5 Ultrium 3280 SAS external tape library using defined Storage policy. The objective of Backup Testing is to verify the Backup and Restore of Data files, entire disks of Windows and Linux OS from VM's and Baremetal Server OS, Full VM, P2V and MS SQL by the backup software (VEEAM Backup and Replication 9.5 U3a) with the data repository models, which are covered in the features tested section.

Acronyms

Acronym	Description
10GbE	10 Gigabit Ethernet
BDR	Baremetal Disaster Recovery
CNA	Converged Network Adapter
FI	Fabric interconnect
FC	Fabric Channel
HBA	Host Bus Adapter
HDD	Hard Disk Drive
HXDP	HyperFlex Data Platform
JOS	Japanese Operating System
MDS	Multilayer Director Switch
MS	Microsoft
OS	Operating System
P2V	Physical to Virtual

Acronym	Description
RHEL	RedHat Enterprise Linux
SLES	SUSE Linux Enterprise Server
SP	Service Pack
SQL	Structured Query Language
SAN	Storage Area Network
SAS	Serial Attached SCSI
UCS	Unified Computing System
UCSM	Unified Computing System Manager
UP	Unified Port
VIC	Virtual Interface Card
VM	Virtual Machine

Backup Test Strategy and Implementation

The requirements gathered for Backup Testing (Backup to Disk/De-duplication Disk and Replicate to HP Tape Library) are specific to the Japanese usage and market. The following requirements are derived based on the inputs and prioritization given by Cisco Japan Solution Engineers:

- UCS C240 M5 is deployed as Backup server in Standalone mode and Backup software is installed on top of Windows Server 2016 OS in the Local HDD of the server.
- Backup data is stored in C240 M5 Server Local HDD/De-duplication disk and then replicated to HP LTO-6 Ultrium 6250/6650 and HP LTO-5 Ultrium 3280 SAS external tape library using Backup software.
- HP LTO-6 Ultrium 6250/6650 and HP LTO-5 Ultrium 3280 SAS external tape library is attached to the Backup server using SAS Connectivity.
- Windows and Linux Server OS are installed on Local HDD/ LUN of the Cisco UCS B Series Bare metal Server (B200M5, B200 M4) for Similar/ Dissimilar Hardware Disaster Recovery.
- P2V Conversion is executed using BDR Backup Job for Windows and Linux Server OS.
- Backup Clients for Files & Folders are deployed as VMs in Local HDD/LUN of the UCS B-Series and HyperFlex Servers.
- Data files of size 500MB includes Microsoft Excel, Microsoft Word and PDF for full backup and additional 100MB files used for incremental backup.
- Data backup is done from the Windows, RHEL and SLES OS which are deployed as VMs and Baremetal Servers.
- VMware Esxi and Hyper-V Host are integrated with Backup server for Agentless backup and recovery of VMs.
- MS SQL Server is deployed in Windows Server OS for Database backup.



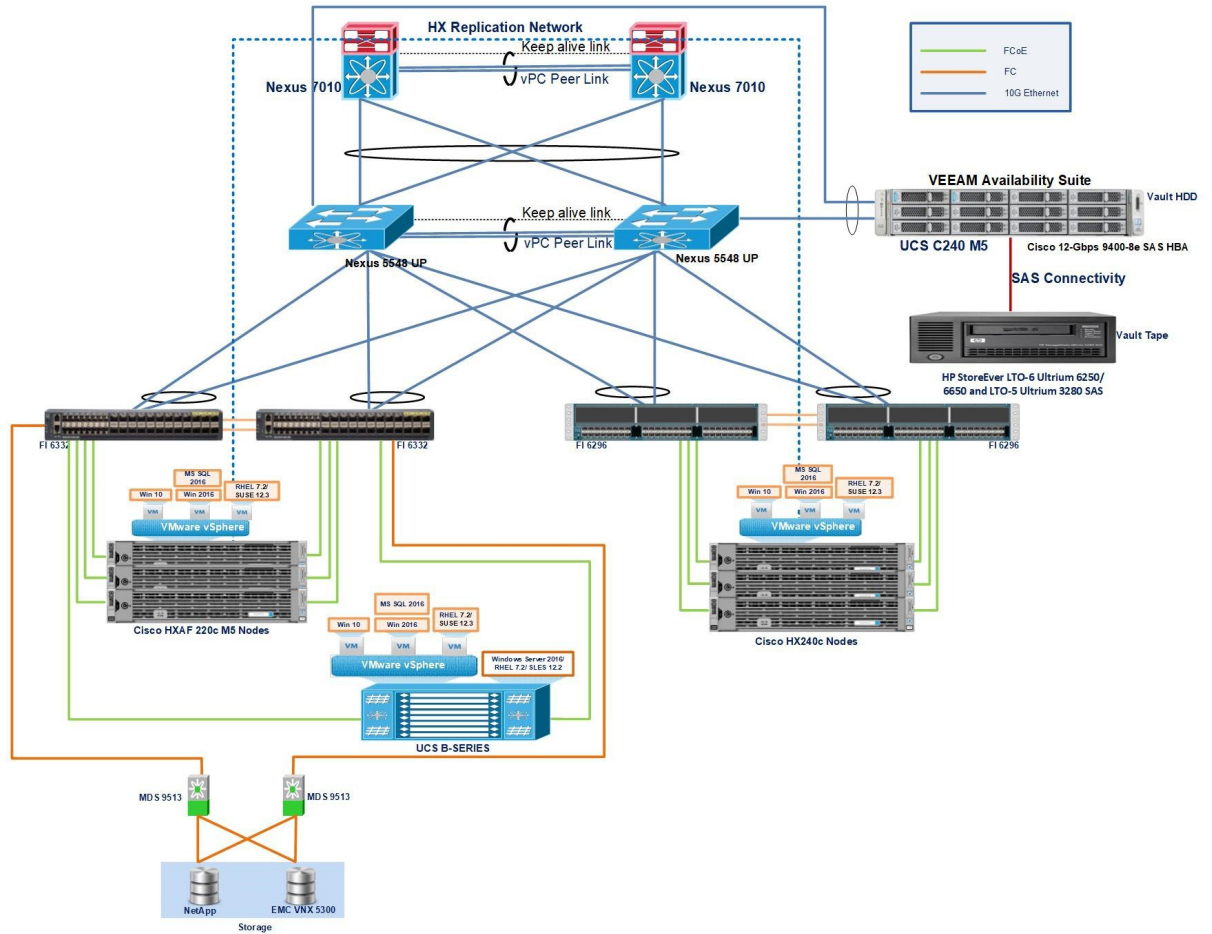
CHAPTER 2

Test Topology and Environment Matrix

- [Test Topology, on page 4](#)
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Test Topology

Figure 1: Topology in use



Environment Matrix

Component	Version
UCS	
Blade Servers	UCS B200M5, B200 M4
Rack Server	UCS C240M5
HyperFlex	HXAF220c M5, HXAF 240c M4
UCSM	4.0(1b)
FI	6332UP, 6296

Component	Version
Cisco HXDP Installer	3.5(1a)
Adapters	
VIC 1385	4.3(1b)
VIC 1387	4.3(1b)
VIC 1340/1380	4.3(1b)
Infra	
Nexus 7010	7.2(1)D1(1)
Nexus 5548 UP	7.2(1)N1(1)
MDS 9513	7.3(0)D1(1)
Backup Software	
VEEAM Backup and Replication	9.5 U3a
VEEAM Agent for Windows	2.2.0.589
VEEAM Agent for Linux	2.0.0.400-1
OS	
Windows	Windows 10 x64 JOS Windows Server 2012 R2 x64 JOS Windows Server 2016 x64 JOS
Linux	Redhat Enterprise Linux 7.2 x64 JOS SUSE Linux Enterprise Server 12.3 JOS
Database	
MS SQL Server	Microsoft SQL Server 2016 (Japanese)
Hypervisor	
ESXi	ESXi-6.5.0-5969303-Custom-Cisco-image HX-ESXi-6.5U2-8935087-Cisco-Custom-6.5.2.2
Hyper-V	Hyper-V 2012 R2
Tape Library	
HP LTO-6 Ultrium 6250 SAS Tape Library	
HP LTO-6 Ultrium 6650 SAS Tape Library	
HP LTO-5 Ultrium 3280 SAS Tape Library	
Storage	
NetApp FAS 2554	8.3.2 CMode
EMC VNX 5300	05.32.000.5.218



CHAPTER 3

Features Tested

- [Features Tested, on page 7](#)

Features Tested

Data Backup was tested with the following backup methods:

Full Backup

Full backup is the starting point for all other types of backup and contains all the data in the folders and files that are selected to be backed up. Because full backup stores all files and folders, frequent full backups resulting faster and simpler restore operations.

Reverse Incremental Backup

With this Backup, Veeam Backup & Replication copies only VM data blocks that have changed since the last backup job session. Veeam Backup & Replication "injects" copied data blocks into the full backup file to rebuild it to the most recent state of the VM. Additionally, Veeam Backup & Replication creates a reverse incremental backup file containing data blocks that are replaced when the full backup file is rebuilt, and adds this reverse incremental backup file before the full backup file in the backup chain.

Forward Incremental Backup

With this Backup, Veeam Backup & Replication copies only VM data blocks that have changed since the last backup job session (full or incremental) and saves these blocks as an incremental backup file in the backup chain.

Synthetic full backup

With this backup, Veeam Backup & Replication does not retrieve VM data from the source datastore. Instead, it synthesizes a full backup from data you already have on the backup repository. The Backup Software accesses the previous full backup and a chain of subsequent incremental backup files from the backup repository. It consolidates the VM data from these files and writes it into a new full backup file.

De-Duplication

De-Duplication is the process of minimizing Storage space taken by the data by detecting data repetition and storing the identical data only once. De-Duplication may also reduce network load: if, during a backup, a data is found to be a duplicate of an already stored one, its content is not transferred over the network.

Volume Level Backup

Volume Level Backup is to create a backup image of specific computer volume. When restoring data from such backup, able to recover data on these volumes only files, folders, application data and so on. With this option selected, you will pass to the Items step of the Wizard .

File Level Backup

Backup individual files and Folders. This mode produces an image-based backup with only selected files included in the image .

Compression

Compression reduces the size of a backup by reducing the size of files in the backup. In turn, the smaller backup size decreases the number of media that is required for Storage. Compression also decreases the amount of data that travels over the network as well as the network load.

Encryption

The Encryption attribute determines whether the backup should be encrypted. When the server initiates the backup, it passes on the Encryption policy attribute to the client in the backup request. If the Encryption option is enabled, the Backup server encrypts with the backup with the password provided while creating the backup policy.

Application Aware Processing

Application-aware processing is Veeam's proprietary technology based on Microsoft VSS. Microsoft VSS is responsible for quiescing applications on the VM and creating a consistent view of application data on the VM guest OS. Use of Microsoft VSS ensures that there are no unfinished database transactions or incomplete application files when Veeam Backup & Replication triggers the VM snapshot and starts copying VM data to the target.



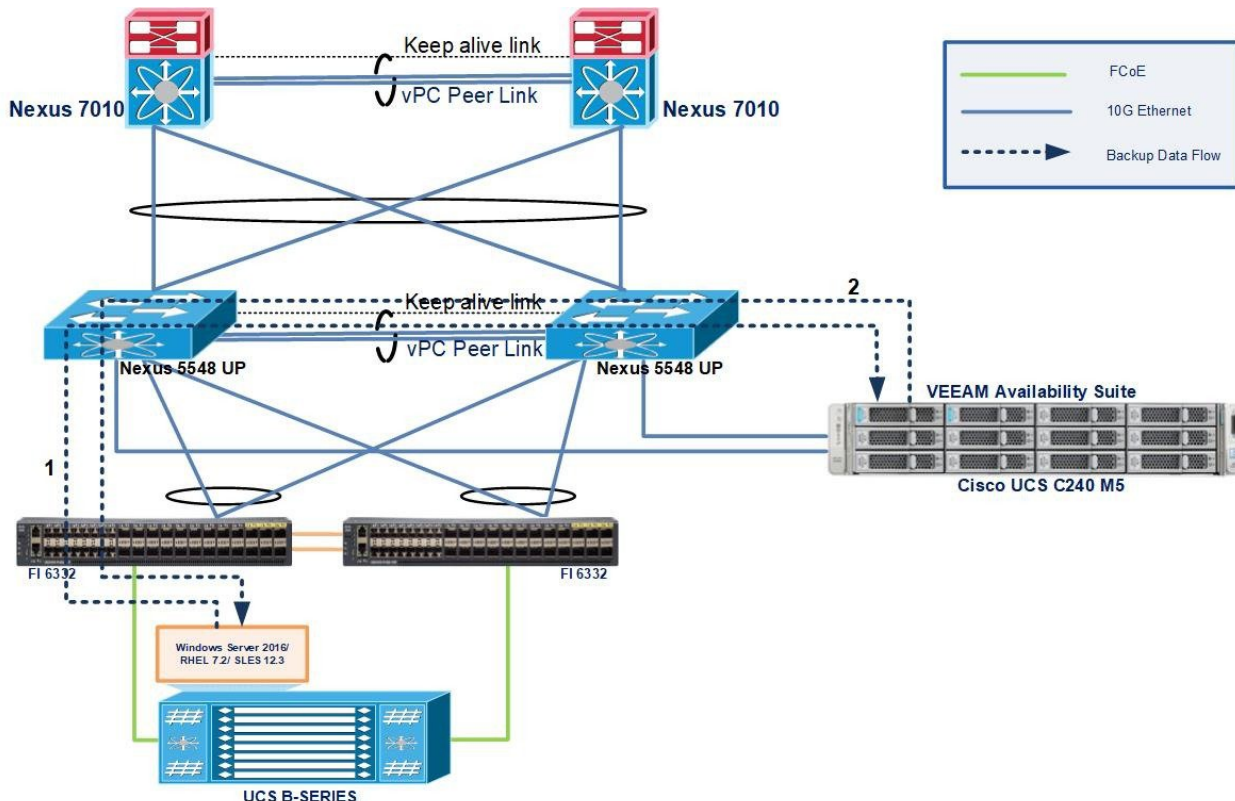
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Test Scenarios for UCS with VEEAM Backup and Replication 9.5.3

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Disaster Recovery for Similar Hardware (Local Boot)

Figure 2: BDR-Similar Hardware (Local HDD to Local HDD)

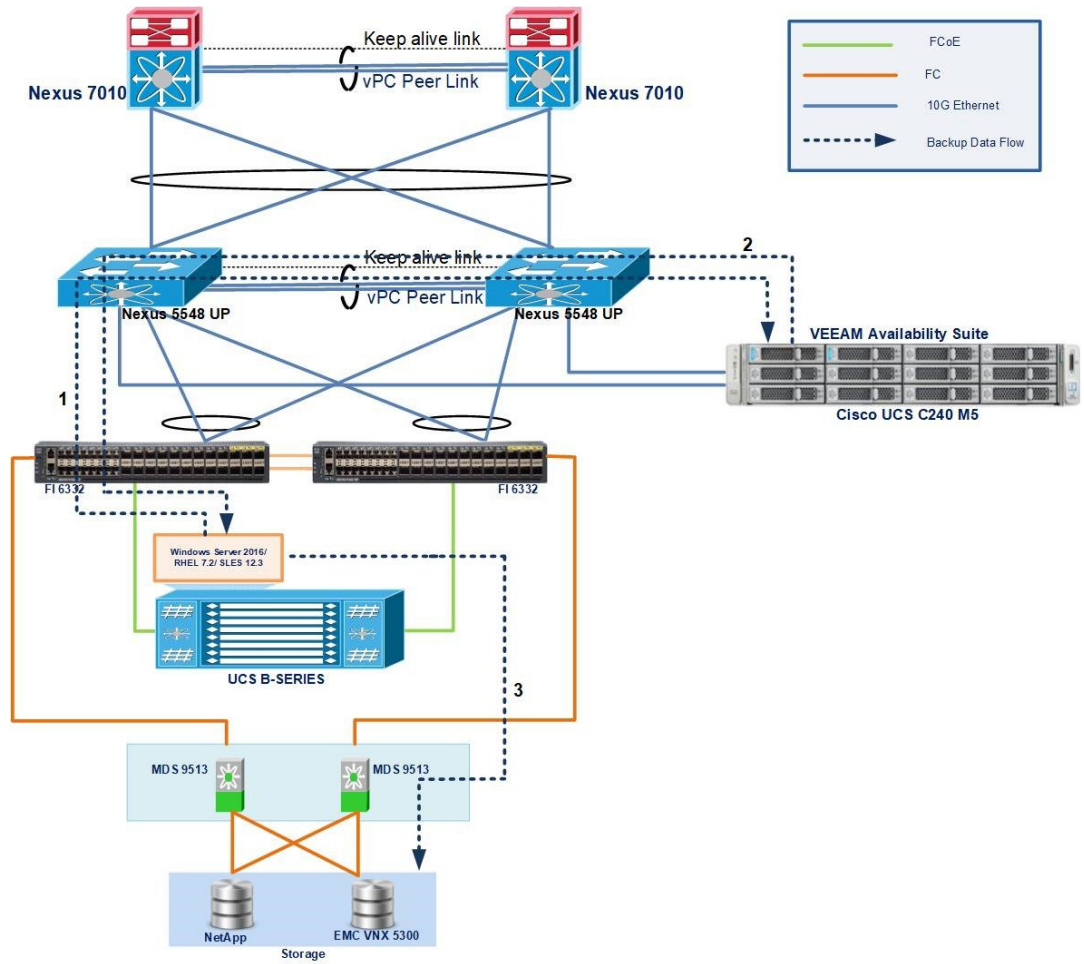


Backup Data flows		
Step	From	To
1	Backup of B Series Server (entire Disk)	Local Disk of Backup Server
2	Local Disk of Backup Server	B Series Server (Local HDD)

Description:

- Backup of Entire Disks from Japanese Windows, RHEL and SLES OS to Local HDD of Backup Server.
- Restore the Entire Disks from Local HDD of Backup Server to the Similar hardware (Local HDD) using Backup Software.

Figure 3: BDR-Similar Hardware (Local HDD to SAN LUN)



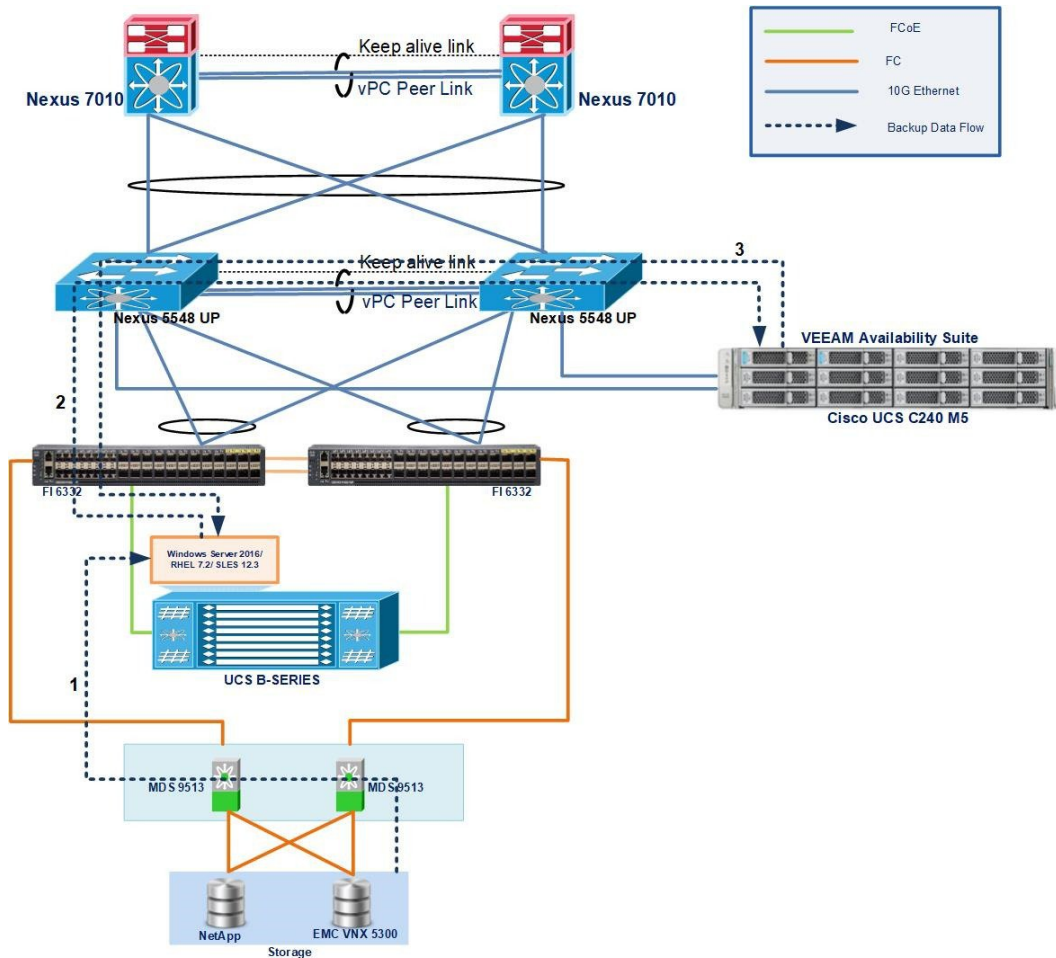
Backup Data flows		
Step	From	To
1	Backup of B Series Server (entire Disk)	Local Disk of Backup Server
2-3	Local Disk of Backup Server	B Series Server (SAN)

Description:

- Backup of Entire Disks from Japanese Windows, RHEL and SLES OS to Local HDD of Backup Server.
- Restore the Entire Disks from Local HDD of Backup Server to the Similar hardware (SAN) using Backup Software.

Disaster Recovery for Similar Hardware (SAN Boot)

Figure 4: BDR-Similar Hardware (SAN to Local HDD)

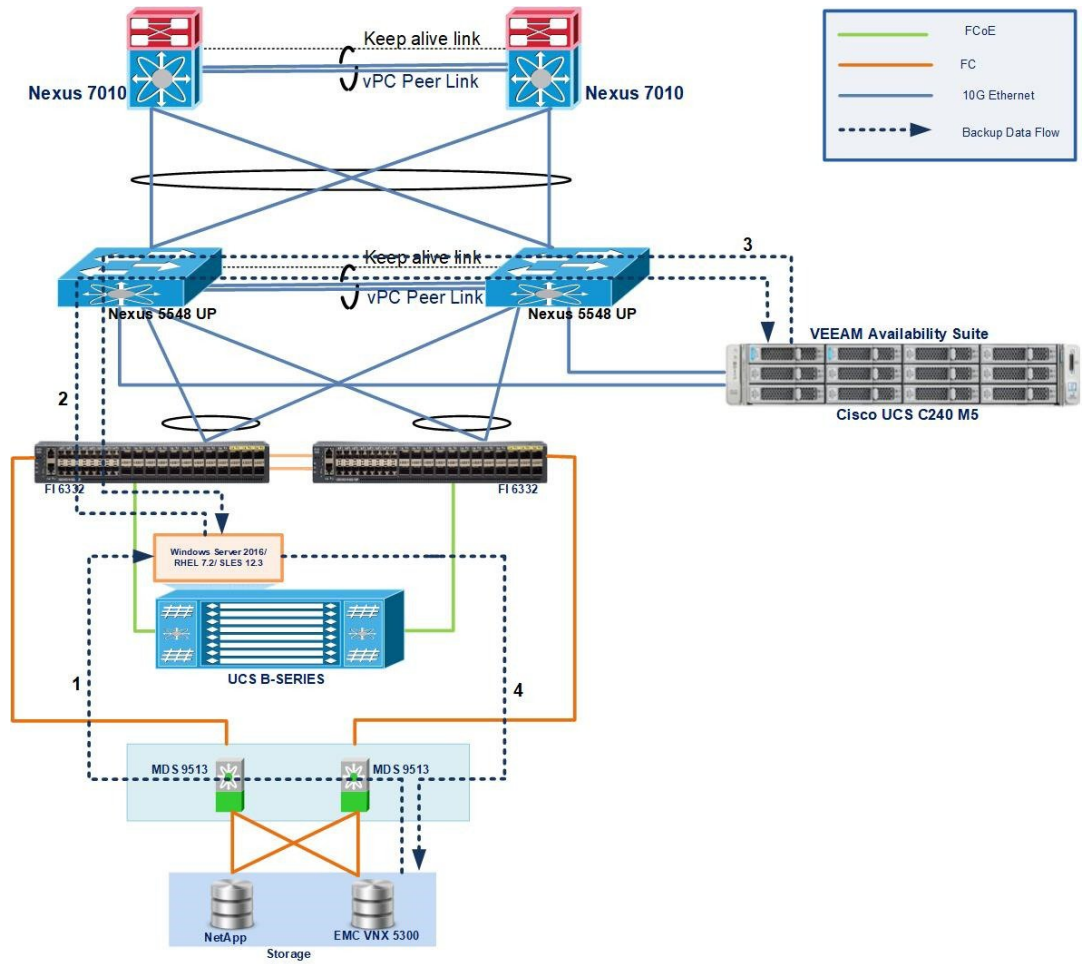


Backup Data flows		
Step	From	To
1	DiskArray (NetApp FAS&EMCVNX)	B Series SAN based Server
2	Backup of B Series Server (entire Disk)	Local Disk of Backup Server
3	Local Disk of Backup Server	B Series Server (Local HDD)

Description:

- Backup of Entire Disks from Japanese Windows, RHEL and SLES OS to Local HDD of Backup Server.
- Restore the Entire Disks from Local HDD of Backup Server to the Similar hardware (Local HDD) using Backup Software.

Figure 5: BDR-Similar Hardware (SAN to SAN)



Backup Data flows

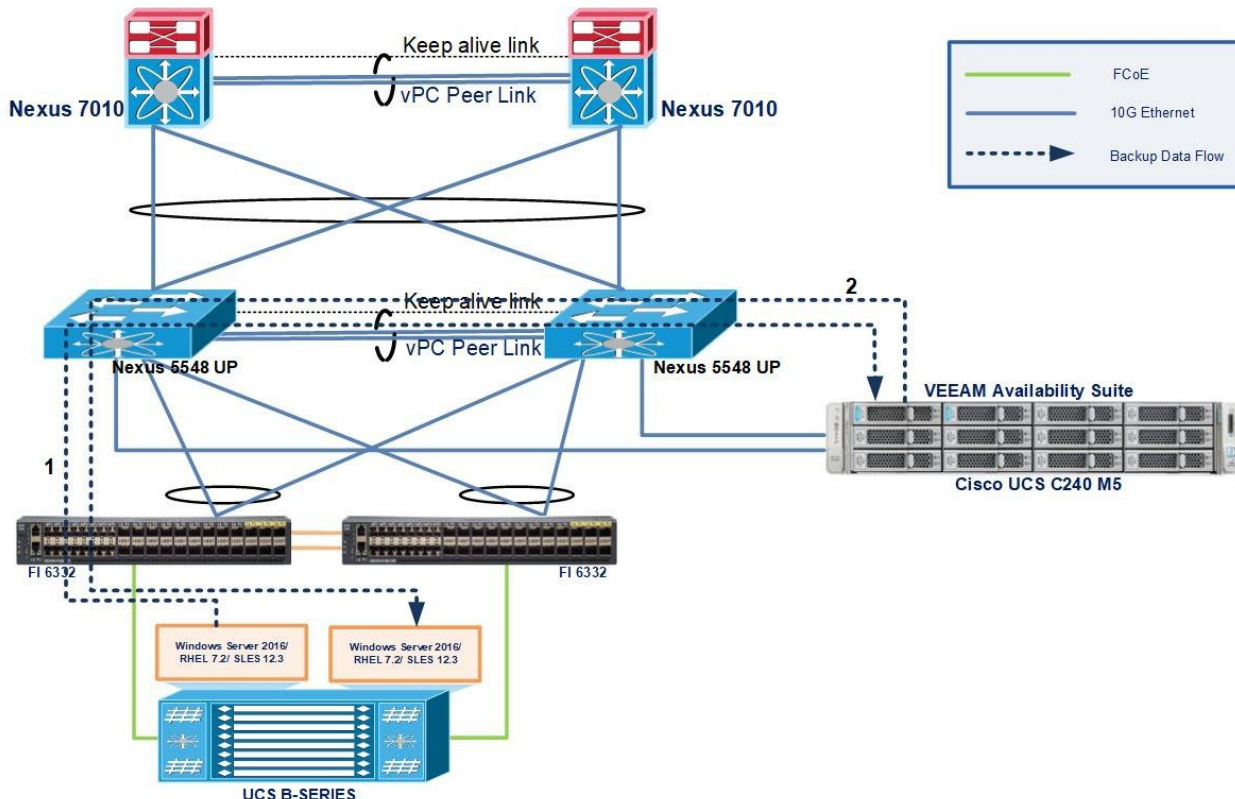
Step	From	To
1	DiskArray (NetApp FAS&EMCVNX)	B Series SAN based Server
2	Backup of B Series Server (entire Disk)	Local Disk of Backup Server
3-4	Local Disk of Backup Server	B Series Server (SAN)

Description:

- Backup of Entire Disks from Japanese Windows, RHEL and SLES OS to Local HDD of Backup Server.
- Restore the Entire Disks from Local HDD of Backup Server to the Similar hardware (SAN) using Backup Software.

Disaster Recovery for Dissimilar Hardware (Local Boot)

Figure 6: BDR-Dis-similar Harware (Local HDD to Local HDD)

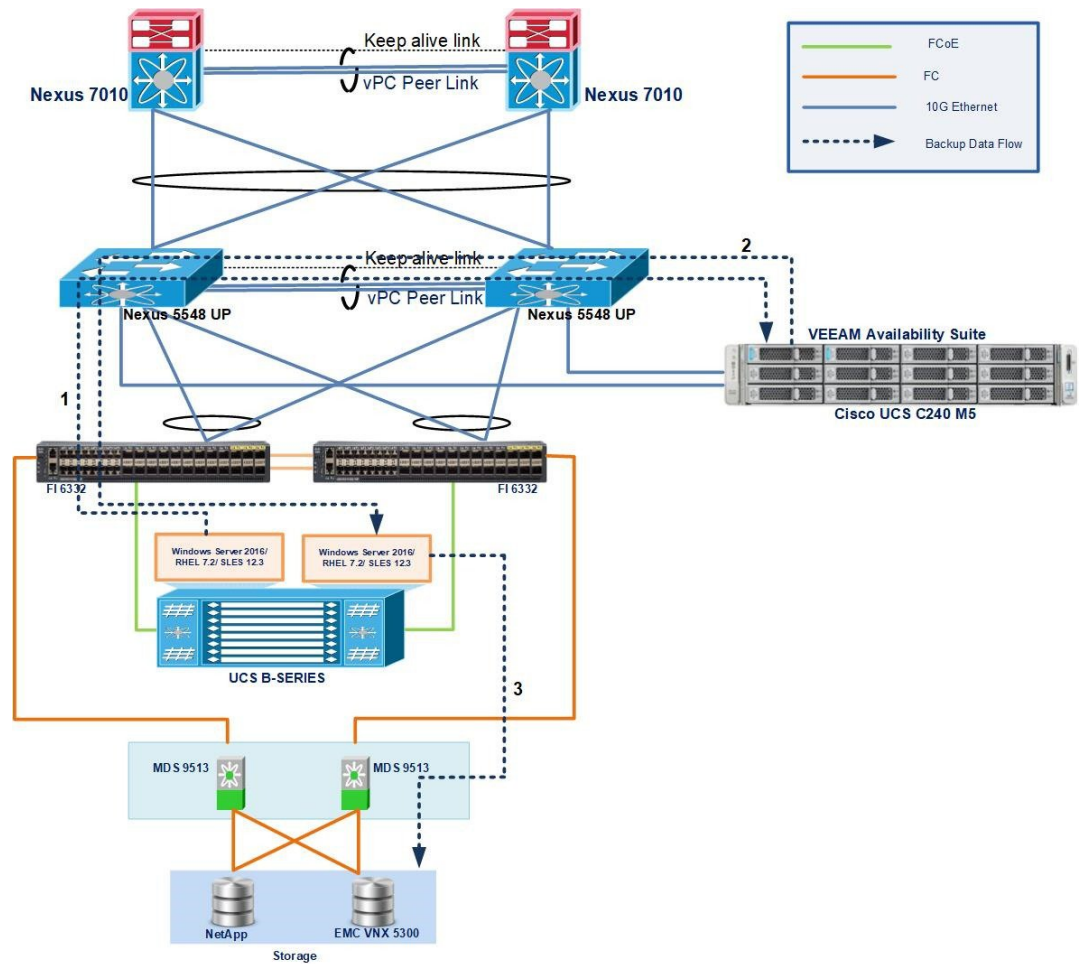


Backup Data flows		
Step	From	To
1	Backup of B Series Server (entire Disk)	Local Disk of Backup Server
2	Local Disk of Backup Server	C Series Server (Local HDD)

Description:

- Backup of Entire Disks from Japanese Windows, RHEL and SLES OS to Local HDD of Backup Server.
- Restore the Entire Disks from Local HDD of Backup Server to the Dis-similar hardware (Local HDD) using Backup Software.

Figure 7: BDR-Dis-similar Hardware (Local HDD to SAN)



Backup Data flows

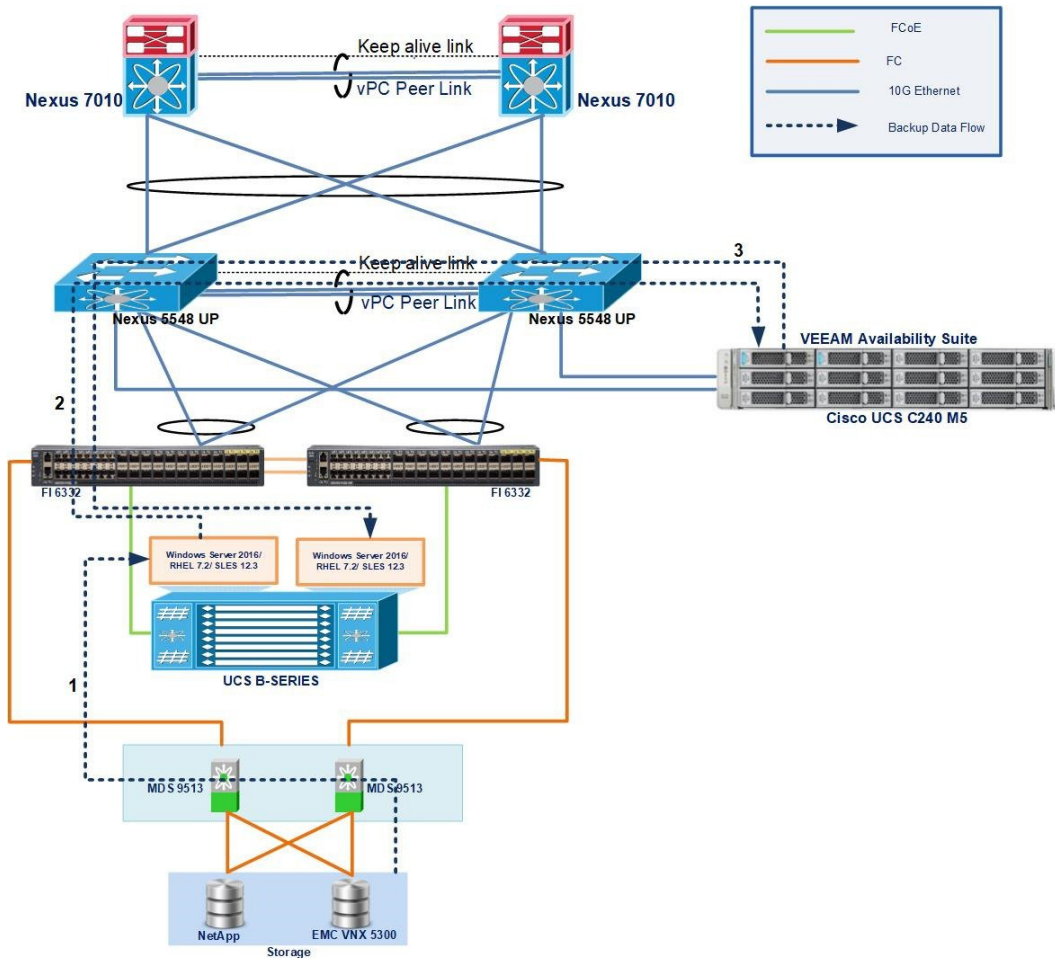
Step	From	To
1	Backup of B Series Server (entire Disk)	Local Disk of Backup Server
2-3	Local Disk of Backup Server	C Series Server (SAN)

Description:

- Backup of Entire Disks from Japanese Windows, RHEL and SLES OS to Local HDD of Backup Server.
- Restore the Entire Disks from Local HDD of Backup Server to the Dis-similar hardware (SAN) using Backup Software.

Disaster Recovery for Dissimilar Hardware (SAN Boot)

Figure 8: BDR-Dis-similar Harware (SAN to Local HDD)

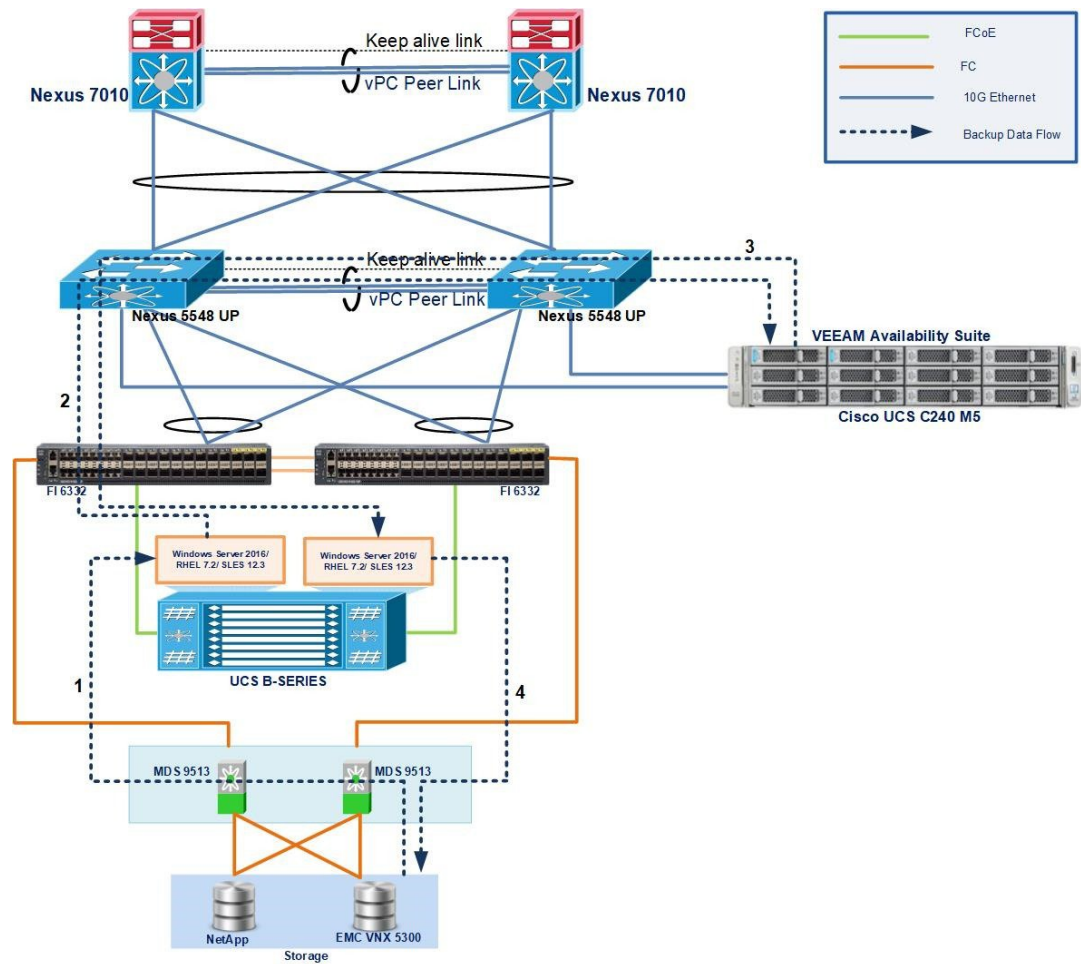


Backup Data flows		
Step	From	To
1	DiskArray (NetApp FAS&EMCVNX)	B Series SAN based Server
2	Backup of B Series Server (entire Disk)	Local Disk of Backup Server
3	Local Disk of Backup Server	C Series Server (Local HDD)

Description:

- Backup of Entire Disks from Japanese Windows, RHEL and SLES OS to Local HDD of Backup Server.
- Restore the Entire Disks from Local HDD of Backup Server to the Dis-similar hardware (Local HDD) using Backup Software.

Figure 9: BDR-Dis-similar Hardware (SAN to SAN)



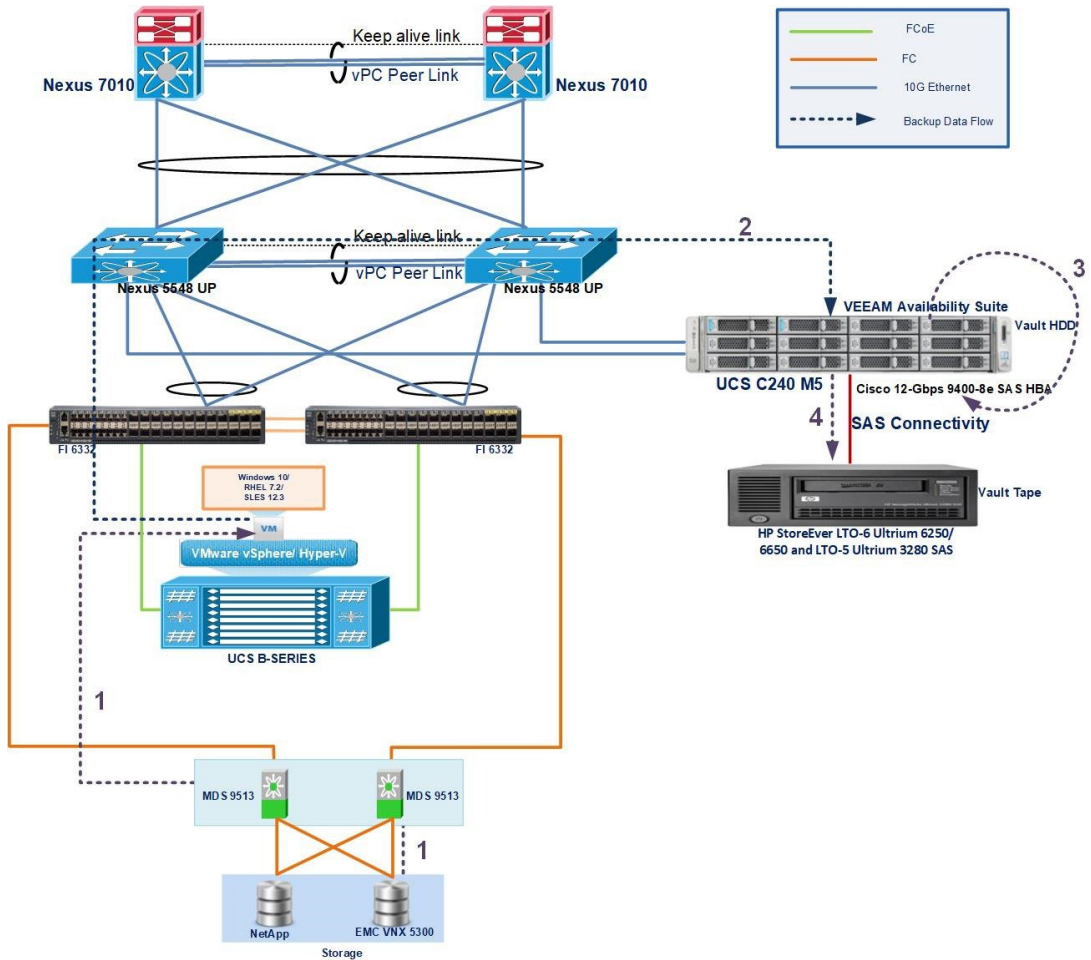
Backup Data flows		
Step	From	To
1	DiskArray (NetApp FAS&EMCVNX)	B Series SAN based Server
2	Backup of B Series Server (entire Disk)	Local Disk of Backup Server
3-4	Local Disk of Backup Server	C Series Server (SAN)

Description:

- Backup of Entire Disks from Japanese Windows, RHEL and SLES OS to Local HDD of Backup Server.
- Restore the Entire Disks from Local HDD of Backup Server to the Dis-similar hardware (SAN) using Backup Software.

Full VM

Figure 10: Full VM Backup



Backup Data flows		
Step	From	To
1	Disk Array (NetApp FAS & EMC VNX)	VM in B series SAN based server
2	VM in B series SAN based server	Backup Server
3	Backup Server	Backup Server Disk
4	Backup Server Disk	HP LTO-6 Ultrium 6250/6650 and HP LTO-5 Ultrium 3280 SAS external tape library

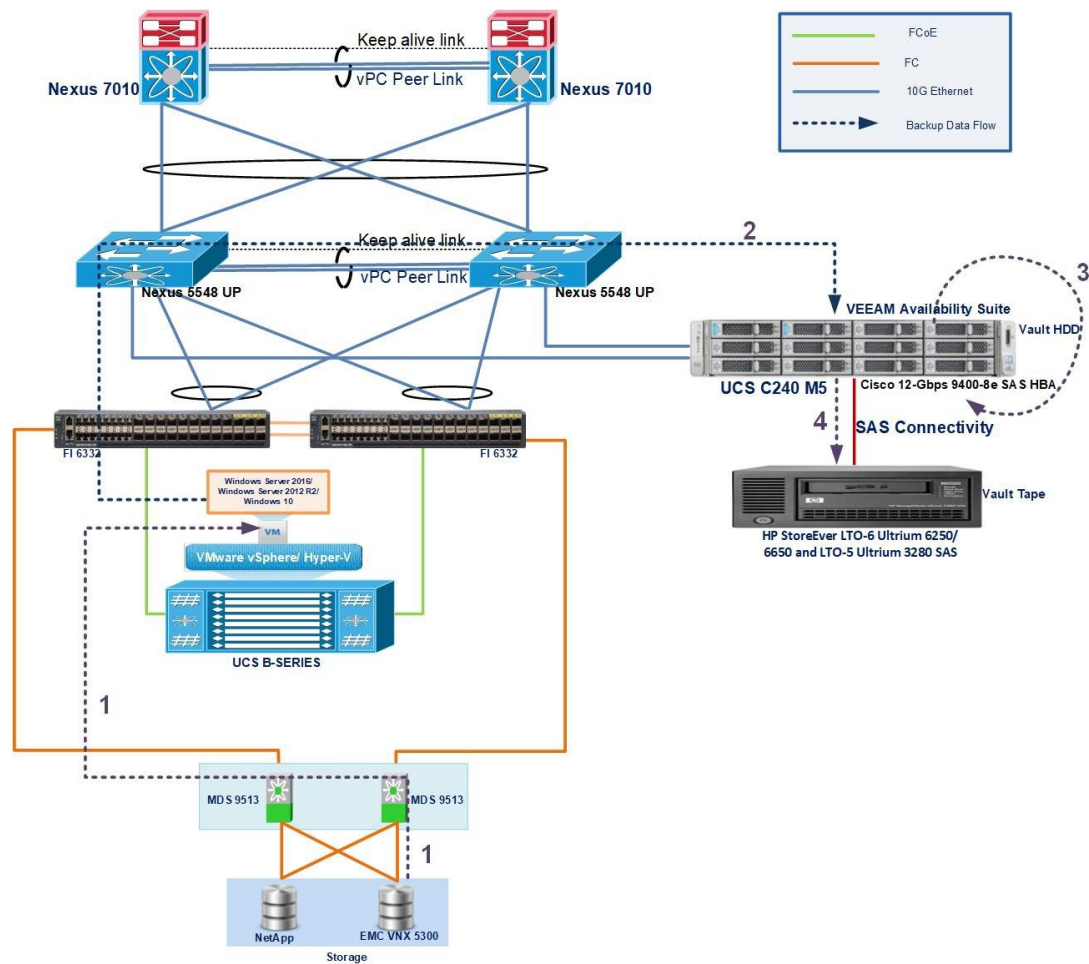
Description

- Select the VM to be backed up using Backup Software.

- Run the Backup Job and Backup of VM is Successful.
- Select the Restore option and specify where to recover the virtual machine (existing VM or as a New VM)
- Run the Restore Job and the Restore of VM is successful.

Windows Files/Folders- VM

Figure 11: Windows Files/Folders-VM on B200 M5



Backup Data flows		
Step	From	To
1	Disk Array (NetApp FAS & EMC VNX)	VM in B series SAN based server
2	VM in B series SAN based server	Backup Server
3	Backup Server	Backup Server Disk

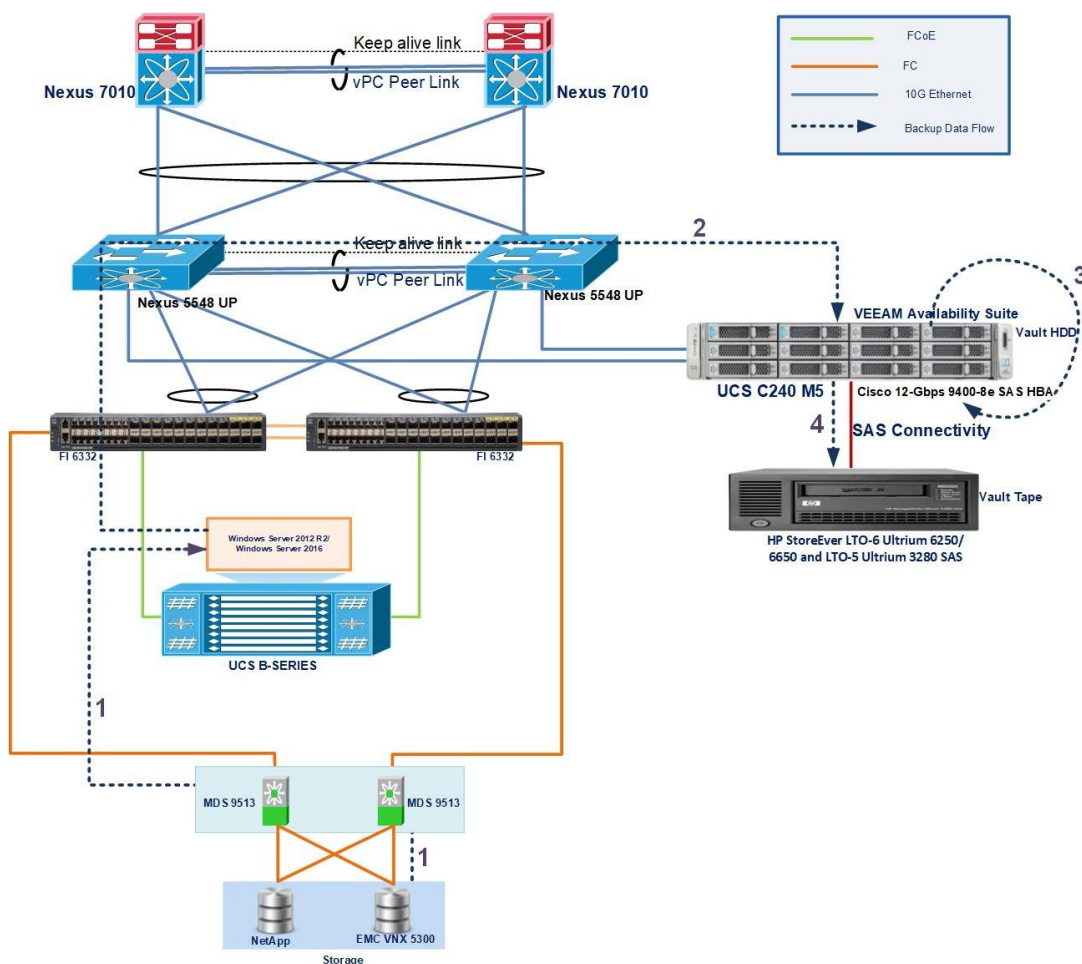
Backup Data flows		
4	Backup Server Disk	HP LTO-6 Ultrium 6250/6650 and HP LTO-5 Ultrium 3280 SAS external tape library

Description:

- Backup of data files (Word, PDF and Excel) from Windows OS to Backup Server Local HDD/De-duplication and then replicate the same to HP LTO-6 Ultrium 6250/6650 and HP LTO-5 Ultrium 3280 SAS external tape library using Backup software.
- Restore the Files either from Local HDD or De-duplication disk or HP LTO-6 Ultrium 6250/6650 and HP LTO-5 Ultrium 3280 SAS external tape library by using the Restore Option available on the Backup Software.

Windows Files/Folders- Baremetal

Figure 12: Windows Files/Folders-B200 M5 Baremetal Server



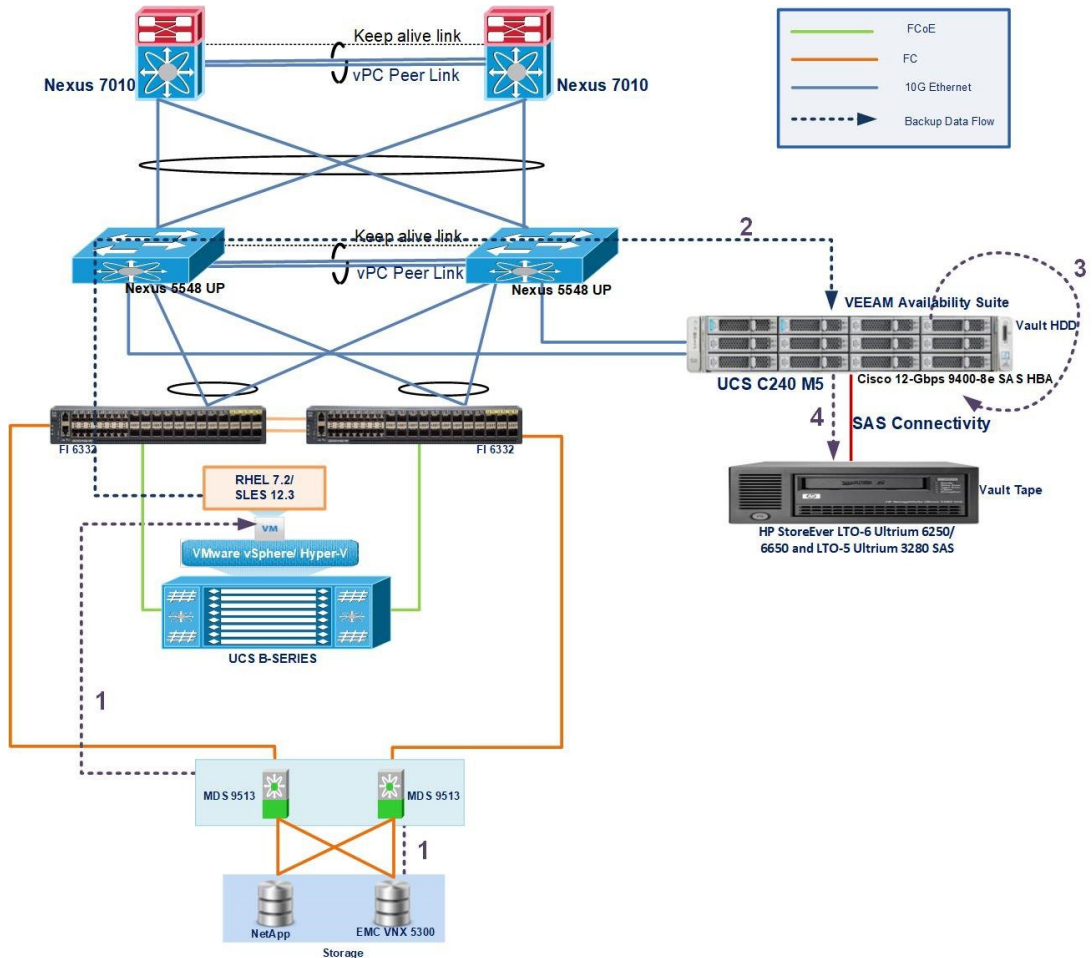
Backup Data flows		
Step	From	To
1	Disk Array (NetApp FAS & EMC VNX)	B/C series SAN based server
2	B/C series SAN based server	Backup Server
3	Backup Server	Backup Server Disk
4	Backup Server Disk	HP LTO-6 Ultrium 6250/6650 and HP LTO-5 Ultrium 3280 SAS external tape library

Description

- Backup of data files (Word, PDF and Excel) from Windows OS to Backup Server Local HDD/De-duplication and then replicate the same to HP LTO-6 Ultrium 6250/6650 and HP LTO-5 Ultrium 3280 SAS external tape library using Backup software.
- Restore the Files either from Local HDD or De-duplication disk or HP LTO-6 Ultrium 6250/6650 and HP LTO-5 Ultrium 3280 SAS external tape library by using the Restore Option available on the Backup Software.

Linux Files/Folders- VM

Figure 13: Linux Files/Folders-VM on B200 M5



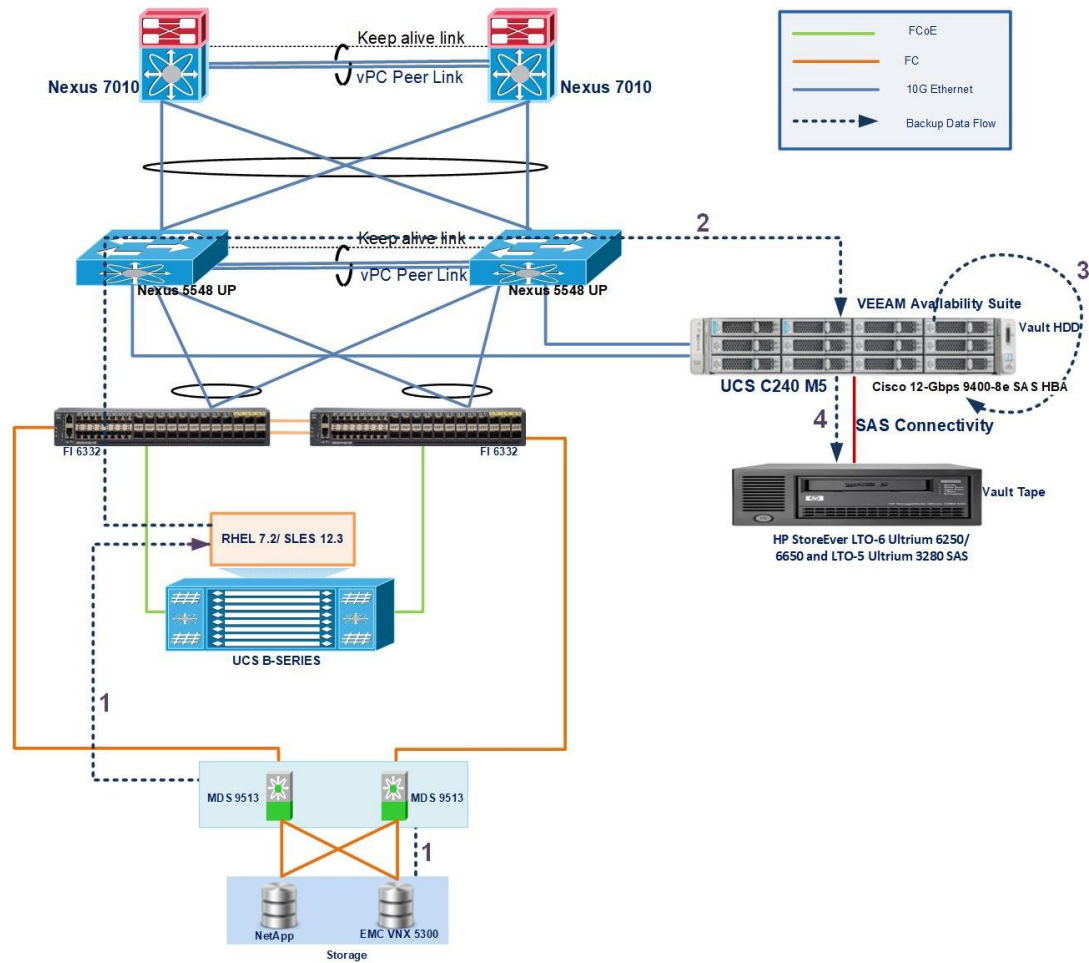
Backup Data flows		
Step	From	To
1	Disk Array (NetApp FAS & EMC VNX)	VM in B series SAN based server
2	VM in B series SAN based server	Backup Server
3	Backup Server	Backup Server Disk
4	Backup Server Disk	HP LTO-6 Ultrium 6250/6650 and HP LTO-5 Ultrium 3280 SAS external tape library

Description:

- Backup of data files (Word, PDF and Excel) from RHEL and SLES to Backup Server Local HDD/De-duplication and then replicate the same to HP LTO-6 Ultrium 6250/6650 and HP LTO-5 Ultrium 3280 SAS external tape library using Backup software.
- Restore the Files either from Local HDD or De-duplication disk or HP LTO-6 Ultrium 6250/6650 and HP LTO-5 Ultrium 3280 SAS external tape library by using the Restore Option available on the Backup Software.

Linux Files/Folders- Baremetal

Figure 14: Linux Files/Folders-B200 M5 Baremetal Server



Backup Data flows		
Step	From	To
1	Disk Array (NetApp FAS & EMC VNX)	B/C series SAN based server
2	B/C series SAN based server	Backup Server
3	Backup Server	Backup Server Disk

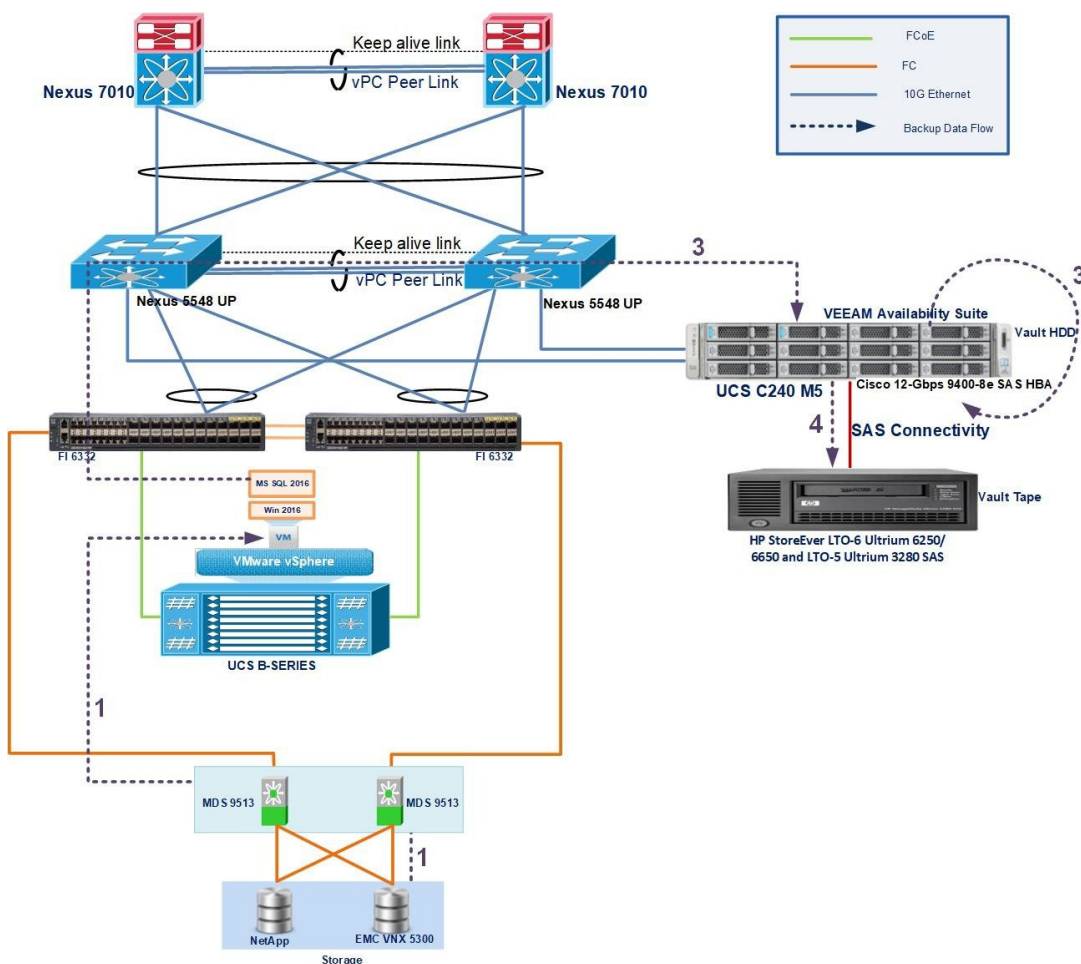
Backup Data flows		
4	Backup Server Disk	HP LTO-6 Ultrium 6250/6650 and HP LTO-5 Ultrium 3280 SAS external tape library

Description

- Backup of data files (Word, PDF and Excel) from RHEL and SLES to Backup Server Local HDD/De-duplication and then replicate the same to HP LTO-6 Ultrium 6250/6650 and HP LTO-5 Ultrium 3280 SAS external tape library using Backup software.
- Restore the Files either from Local HDD or De-duplication disk or HP LTO-6 Ultrium 6250/6650 and HP LTO-5 Ultrium 3280 SAS external tape library by using the Restore Option available on the Backup Software.

SQL Backup

Figure 15: MS SQL Database Backup- SQL Server as VM on B200 M5 Server



Backup Data flows		
Step	From	To
1	Disk Array (NetApp FAS & EMC VNX)	VM in B series SAN based server
2	VM in B series SAN based server (Backup client)	Backup Server
3	Backup Server	Backup Server Disk
4	Backup Server Disk	HP LTO-6 Ultrium 6250/6650 and HP LTO-5 Ultrium 3280 SAS external tape library

Description:

- Backup of database from SQL Server to Backup Server Local HDD/De-duplication disk and then replicate the same to HP LTO-6 Ultrium 6250/6650 and HP LTO-5 Ultrium 3280 SAS external tape library using the Backup software.
- Restore the Database either from Local HDD/De-duplication disk/HP LTO-6 Ultrium 6250/6650 and HP LTO-5 Ultrium 3280 SAS external tape library using the Restore option available on the Backup Software.

P2V - Local

Figure 16: P2V-Local to ESXi Host

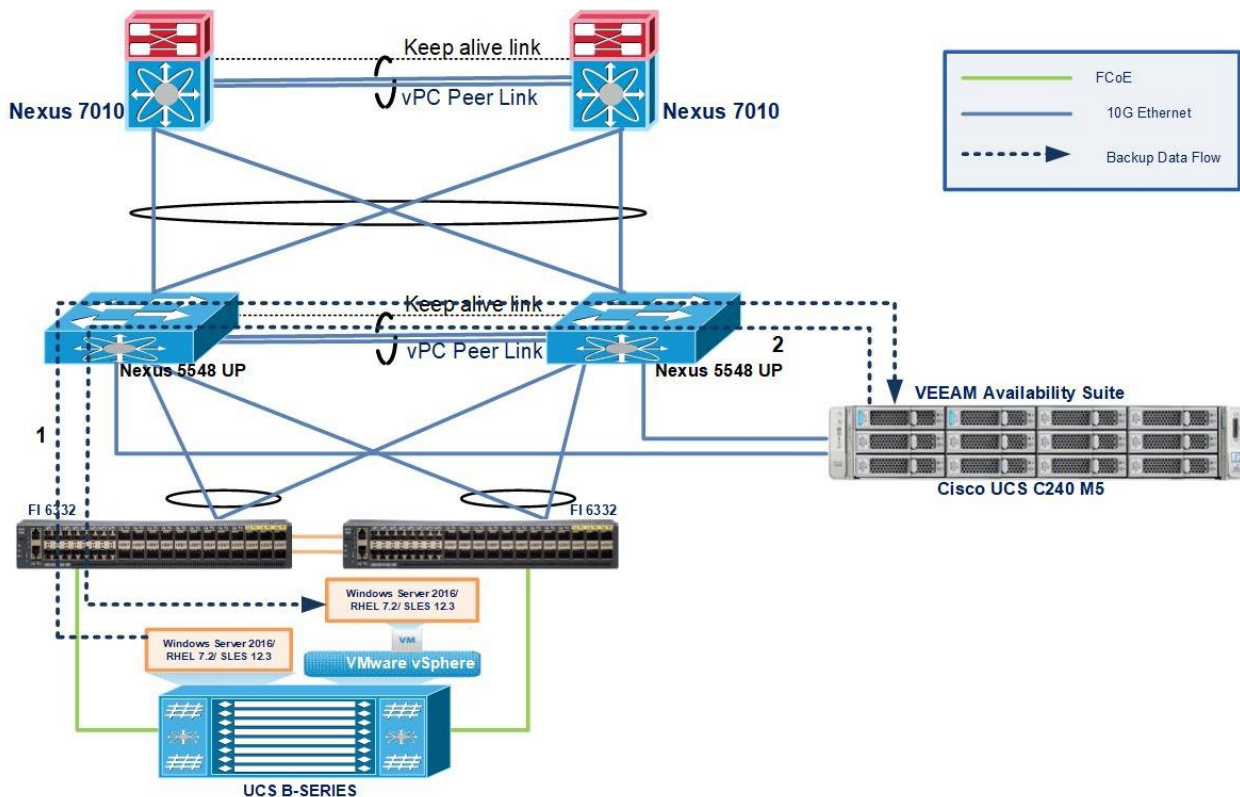
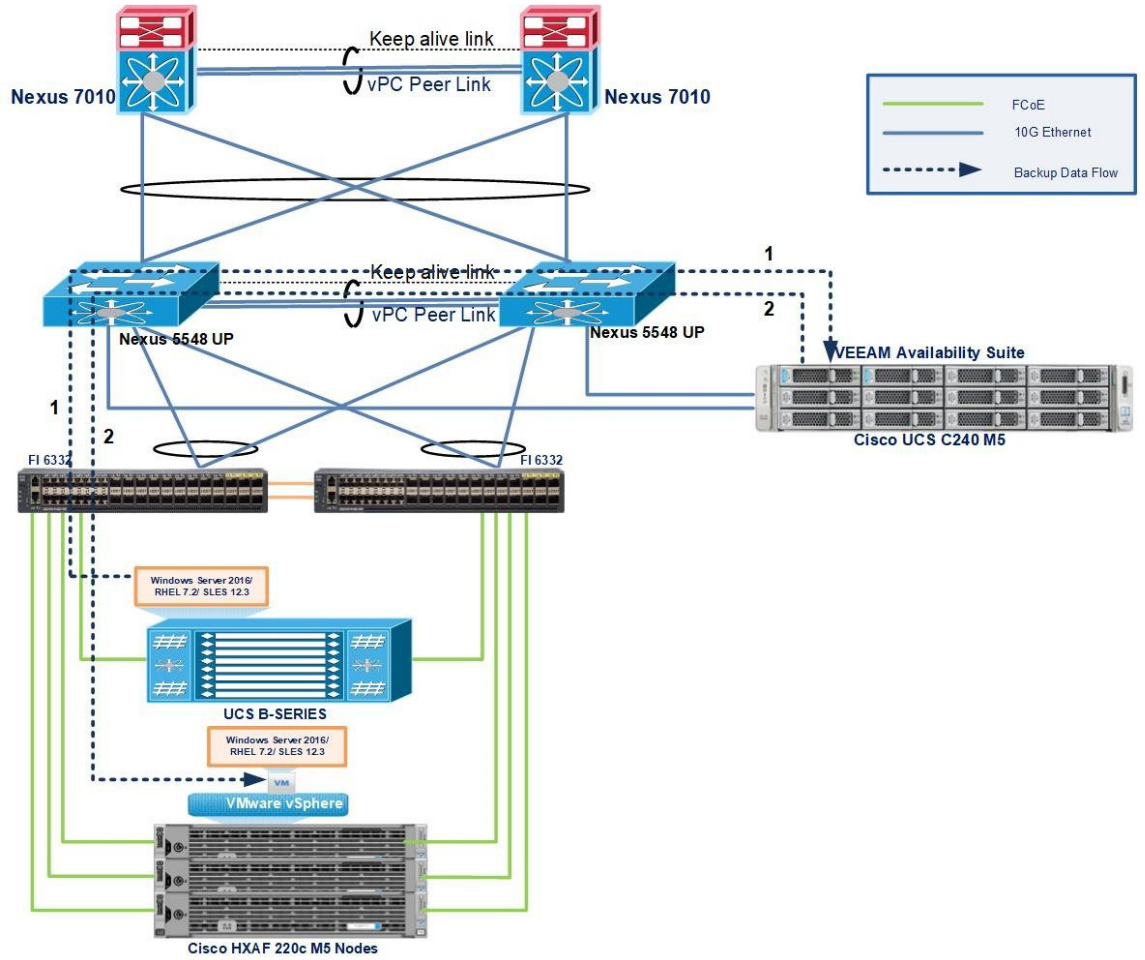


Figure 17: P2V- Local to HyperFlex Server



Backup Data flows		
Step	From	To
1	Backup of B Series Bare metal Server (entire Disk) (Local HDD)	Local Disk of Backup Server
2	Local Disk of Backup Server	VM on ESXi of another B Series Server/ HyperFlex Server

Description

- Backup of Entire Disks from Windows, RHEL and SLES OS to Local HDD of Backup Server.
- Restore the Entire Disks from Local HDD of Backup Server as a VM on ESXi of another B series Server/HyperFlex Server using Backup Software.

P2V - SAN

Figure 18: P2V-SAN to ESXi Host

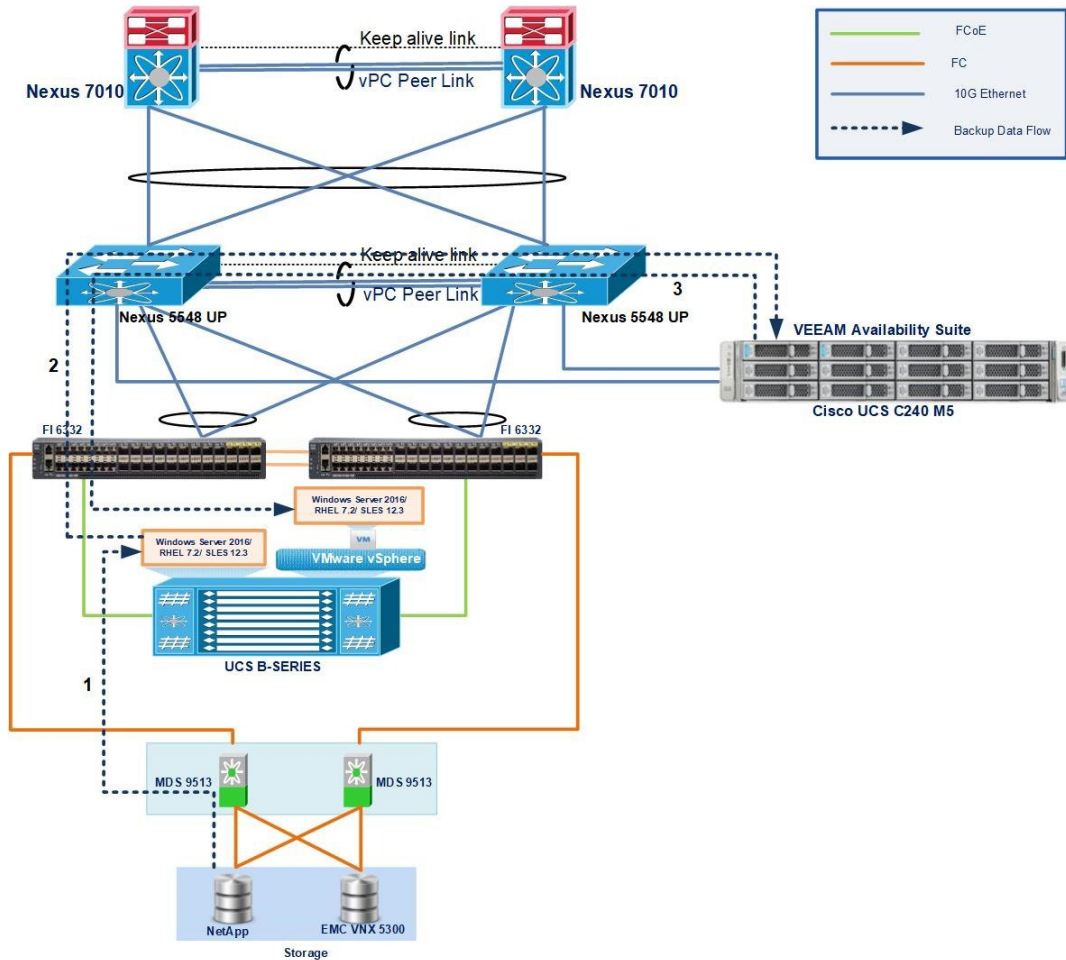
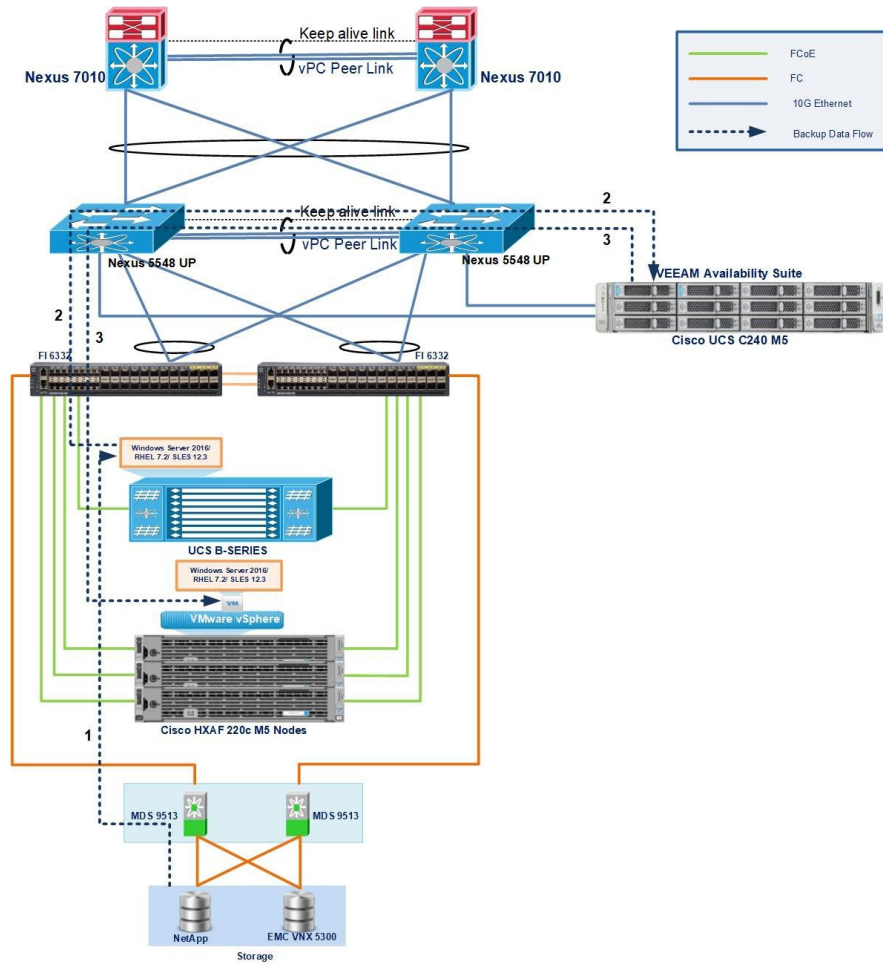


Figure 19: P2V-SAN to HyperFlex Server



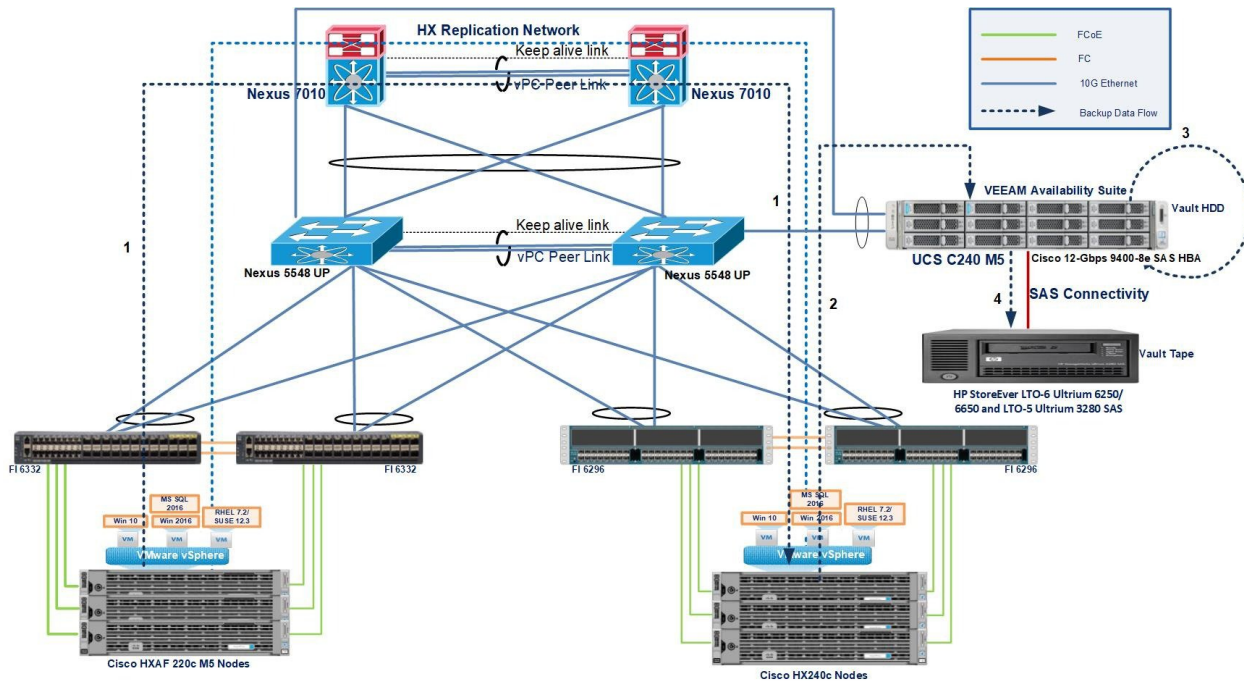
Backup Data flows		
Step	From	To
1	DiskArray (NetApp FAS&EMCVNX)	B Series SAN based Baremetal Server
2	Backup of B Series Baremetal Server (entire Disk) (SAN)	Local Disk of Backup Server
3	Local Disk of Backup Server	VM on ESXi of another B Series Server/ HyperFlex Server

Description

- Backup of Entire Disks from Windows, RHEL and SLES OS to Local HDD of Backup Server.
- Restore the Entire Disks from Local HDD of Backup Server as a VM on ESXi of another B series Server/HyperFlex Server using Backup Software.

HyperFlex Replication

Figure 20: HyperFlex Replication



Backup Data flows		
Steps	From	To
1	VM in HXAF 220c M5 node cluster(Replication Network)	HXAF 240c M4 node cluster
2	VM in HXAF 240c M4 node cluster	Backup Server
3	Backup Server	Backup Server Disk
4	Backup Server Disk	HP LTO-6 Ultrium 6250/6650 and HP LTO-5 Ultrium 3280 SAS external tape library

Description

- Select the VM in HXAF 220c M5 node cluster to be protected using replication network.
- Run the Backup Job and Backup of protected VM from HXAF 240c M4 node cluster is Successful.
- Select the Restore option and specify where to recover the virtual machine (existing VM or as a New VM)
- Run the Restore Job and the Restore of VM is successful.



CHAPTER 5

Issues

- [Issues, on page 31](#)
- [Related Documentation, on page 32](#)

Issues

Issue 1: FC LUN is not discovered in BDR restore for Windows server 2016 OS

Workaround:

- Boot into recovery media
- Go to Tools - Command Prompt
- Type regedit to open a registry editor
- Navigate to HKLM\SOFTWARE\Veeam\Veeam Endpoint Backup\
- create a registry value (DWORD) ProcessSharedDisks and set it to 1 (decimal)
- Close registry editor
- Run the recovery wizard (if it was running previously - close it and open once again)
- Check the disk presence

Issue 2: Linux Baremetal Recovery - Boot from Recovery media hangs at "Setting up Network"

Workaround:

- Create /tmp/template/etc/modprobe.d/ directory
- Within the directory, create blacklist.conf file
- Add the content `install ib_srpt /bin/false` into the blacklist.conf file
- Create new custom recovery media using the following command:

```
veeamconfig config patchiso --input veeam-recovery-media-2.0.1.665_x86_64.iso --output <your recovery media name>.iso --efi --copy /tmp/template
```

Related Documentation

Cisco Servers - Unified Computing

<https://www.cisco.com/c/en/us/products/servers-unified-computing/index.html>

Cisco HyperFlex Servers

https://www.cisco.com/c/en_in/products/hyperconverged-infrastructure/hyperflex-hx-series/index.html

VEEAM Backup and Replication

<https://www.veeam.com/vm-backup-recovery-replication-software.html>

https://www.cisco.com/c/en/us/td/docs/unified_computing/ucs/UCS_CVDs/dataprotection_hx_veeam_multisite.html