NIST SPECIAL PUBLICATION 1800-19C

Trusted Cloud

Security Practice Guide for VMware Hybrid Cloud Infrastructure as a Service (IaaS) Environments

Volume C:
How-to Guides

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PRELIMINARY DRAFT

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https://www.nccoe.nist.gov/projects/building-blocks/trusted-cloud

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FEEDBACK

You can improve this guide by contributing feedback. As you review and adopt this solution for your own organization, we ask you and your colleagues to share your experience and advice with us.

Comments on this publication may be submitted to: trusted-cloud-nccoe@nist.gov.

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NATIONAL CYBERSECURITY CENTER OF EXCELLENCE

The National Cybersecurity Center of Excellence (NCCoE), a part of the National Institute of Standards and Technology (NIST), is a collaborative hub where industry organizations, government agencies, and academic institutions work together to address businesses' most pressing cybersecurity issues. This public-private partnership enables the creation of practical cybersecurity solutions for specific industries, as well as for broad, cross-sector technology challenges. Through consortia under Cooperative Research and Development Agreements (CRADAs), including technology partners—from Fortune 50 market leaders to smaller companies specializing in information technology security—the NCCoE applies standards and best practices to develop modular, easily adaptable example cybersecurity solutions using commercially available technology. The NCCoE documents these example solutions in the NIST Special Publication 1800 series, which maps capabilities to the NIST Cybersecurity Framework and details the steps needed for another entity to re-create the example solution. The NCCoE was established in 2012 by NIST in partnership with the State of Maryland and Montgomery County, Maryland.

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NIST CYBERSECURITY PRACTICE GUIDES

NIST Cybersecurity Practice Guides (Special Publication 1800 series) target specific cybersecurity challenges in the public and private sectors. They are practical, user-friendly guides that facilitate the adoption of standards-based approaches to cybersecurity. They show members of the information security community how to implement example solutions that help them align more easily with relevant standards and best practices, and provide users with the materials lists, configuration files, and other information they need to implement a similar approach.

The documents in this series describe example implementations of cybersecurity practices that businesses and other organizations may voluntarily adopt. These documents do not describe regulations or mandatory practices, nor do they carry statutory authority.

ABSTRACT

A *cloud workload* is an abstraction of the actual instance of a functional application that is virtualized or containerized to include compute, storage, and network resources. Organizations need to be able to monitor, track, apply, and enforce their security and privacy policies on their cloud workloads, based on business requirements, in a consistent, repeatable, and automated way. The goal of this project is to develop a trusted cloud solution that will demonstrate how trusted compute pools leveraging hardware roots of trust can provide the necessary security capabilities. These capabilities not only provide assurance that cloud workloads are running on trusted hardware and in a trusted geolocation or logical boundary, but also improve the protections for the data in the workloads and in the data flows between

workloads. When complete, the example solution will leverage modern commercial off-the-shelf technology and cloud services to address a particular use case scenario: lifting and shifting a typical multi-tier application between an organization-controlled private cloud and a hybrid/public cloud over the internet.

KEYWORDS

cloud technology; compliance; cybersecurity; privacy; trusted compute pools

ACKNOWLEDGMENTS

The Technology Partners/Collaborators who are participating in this build submitted their capabilities in response to a notice in the Federal Register. Respondents with relevant capabilities or product components were invited to sign a Cooperative Research and Development Agreement (CRADA) with NIST, allowing them to participate in a consortium to build this example solution. We are working with:

Technology Partner/Collaborator	Build Involvement
Dell EMC	Server, storage, and networking hardware
Gemalto (A Thales Company)	Hardware security module (HSM) for storing keys
HyTrust	Asset tagging and policy enforcement, workload and storage encryption, and data scanning
IBM	Public cloud environment with IBM provisioned servers
Intel	Intel processors in the Dell EMC servers
RSA	Multifactor authentication, network traffic monitoring, and dashboard and reporting
VMware	Compute, storage, and network virtualization capabilities

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1 Introduction

The following volumes of this guide show information technology (IT) professionals and security engineers how we implemented this example solution. We cover all of the products employed in this reference design. We do not re-create the product manufacturers' documentation, which is presumed to be widely available. Rather, these volumes show how we incorporated the products together in our environment.

Note: These are not comprehensive tutorials. There are many possible service and security configurations for these products that are out of scope for this reference design.

1.1 Practice Guide Structure

This is a preliminary draft of Volume C of a NIST Cybersecurity Practice Guide currently under development. This draft is not yet complete because the build of the trusted cloud example implementation at the NCCoE is ongoing. This draft is provided to reviewers who would like to follow the ongoing work and stay informed on the progress of the project. **Organizations should not attempt to implement this preliminary draft.**

When completed, this National Institute of Standards and Technology (NIST) Cybersecurity Practice Guide will demonstrate a standards-based reference design and provide users with the information they need to replicate a trusted cloud solution using trusted compute pools leveraging hardware roots of trust to provide the necessary security capabilities. This reference design will be modular and can be deployed in whole or in part.

This guide contains three volumes:

- NIST SP 1800-19A: *Executive Summary*
- NIST SP 1800-19B: *Approach, Architecture, and Security Characteristics* – what we built and why
- NIST SP 1800-19C: *How-To Guides* – instructions for building the example solution **(you are here)**

Depending on your role in your organization, you might use this guide in different ways:

Business decision makers, including chief security and technology officers, will be interested in the *Executive Summary, NIST SP 1800-19A*, which describes the following topics:

- challenges that enterprises face in protecting cloud workloads in hybrid cloud models
- example solution built at the NCCoE
- benefits of adopting the example solution

Technology or security program managers who are concerned with how to identify, understand, assess, and mitigate risk will be interested in *NIST SP 1800-19B,* which describes what we did and why. The following sections will be of particular interest:

- Section 3.4.3, Risk, describes the risk analysis we performed.
- Appendix A, Mappings, maps the security characteristics of this example solution to cybersecurity standards and best practices.

You might share the *Executive Summary, NIST SP 1800-19A,* with your leadership team members to help them understand the importance of adopting standards-based trusted compute pools in a hybrid cloud model that provide expanded security capabilities.

IT professionals who want to implement an approach like this will find the whole practice guide useful. You will be able to use this How-To portion of the guide, *NIST SP 1800-19C*, to replicate all or parts of the build being created in our lab. This How-To portion of the guide provides specific product installation, configuration, and integration instructions for implementing the example solution.

This guide assumes that IT professionals have experience implementing security products within the enterprise. While we are using a suite of commercial products to address this challenge, this guide does not endorse these particular products. Your organization can adopt this solution or one that adheres to these guidelines in whole, or you can use this guide as a starting point for tailoring and implementing parts of a trusted cloud implementation leveraging commercial off-the-shelf technology. Your organization's security experts should identify the products that will best integrate with your existing tools and IT system infrastructure. We hope that you will seek products that are congruent with applicable standards and best practices. Section 4.2, Technologies, in *NIST SP 1800-19B* lists the products we are using and maps them to the cybersecurity controls provided by this reference solution.

A NIST Cybersecurity Practice Guide does not describe "the" solution, but a possible solution. This is a draft guide. We seek feedback on its contents and welcome your input. Comments, suggestions, and success stories will improve subsequent versions of this guide. Please contribute your thoughts to trusted-cloud-nccoe@nist.gov.

1.2 Build Overview

The NCCoE has been working with its build team partners to create a lab demonstration environment that will include all of the architectural components and functionality described in Section 4 of *NIST SP 1800-19B*. This will include a private on-premises cloud hosted at the NCCoE, an instance of the public IBM Cloud Secure Virtualization (ICSV), and an Internet Protocol Security (IPsec) virtual private network (VPN) that connects the two clouds to form a hybrid cloud. The private on-premises cloud at the NCCoE consists of components from Dell EMC, Gemalto, HyTrust, Intel, RSA, and VMware, and the ICSV instance consists of components from HyTrust, IBM, Intel, and VMware.

Information about the usage scenarios for the build will be included in the next draft of this guide.

1.3 Typographic Conventions

The following table presents typographic conventions used in this volume.

Typeface/Symbol	Meaning	Example
Italics	file names and path names; references to documents that are not hyperlinks; new terms; and placeholders	For language use and style guidance, see the *NCCoE Style Guide*.
Bold	names of menus, options, command buttons, and fields	Choose **File > Edit.**
`Monospace`	command-line input, onscreen computer output, sample code examples, and status codes	`mkdir`
`Monospace Bold`	command-line user input contrasted with computer output	**`service sshd start`**
blue text	link to other parts of the document, a web URL, or an email address	All publications from NIST's NCCoE are available at https://www.nccoe.nist.gov.

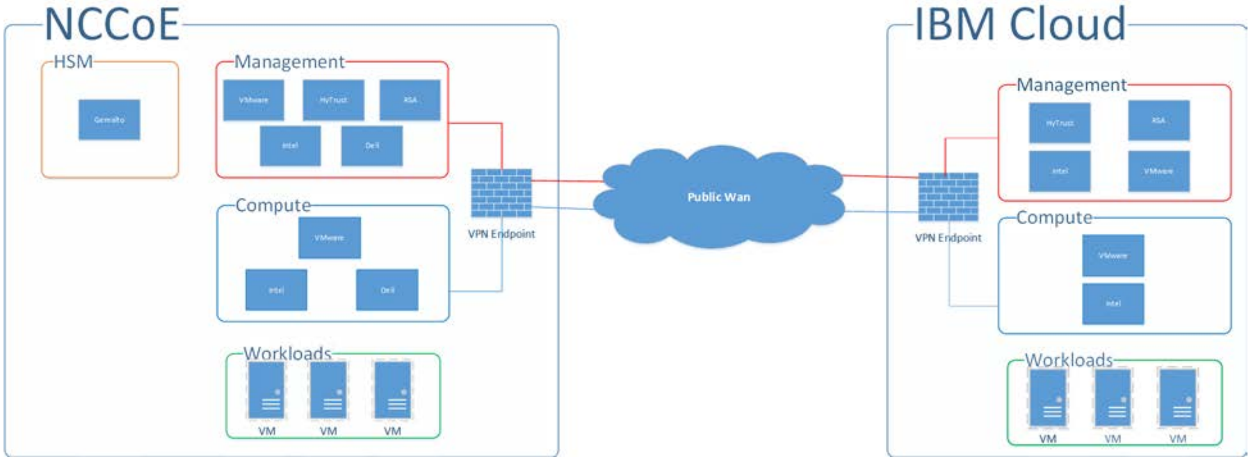
1.4 Logical Architecture Summary

Figure 1-1 shows the high-level architecture. It depicts the four main components that comprise the build:

- **HSM component**: This build utilizes HSMs to store sensitive keys within the environment.
- **Management component**: Identical functional management components are instantiated within each cloud instance. At a minimum, each management component includes VMware running the virtualization stack, HyTrust providing the asset tagging policy enforcement aspect, and RSA providing network-visibility, dashboard, and reporting capabilities. The management components are connected through the VPN to represent one logical management element.
- **Compute component**: The compute components host the tenant workload virtual machines (VMs). Asset tagging is provisioned on the compute servers so that policy can be assigned and enforced to ensure that tenant workloads reside on servers that meet specific regulatory compliance requirements.
- **Workload component**: The workload components include VMs, data storage, and networks owned and operated by the tenant and data owner. Policies are applied to the workloads to

ensure that they can run only on servers that meet specific requirements, such as asset tag policies.

Figure 1-1: High-Level Solution Architecture



2 Dell/EMC Product Installation and Configuration Guide

The aspects of installing and configuring the Dell/EMC products used to build the example solution have not yet been fully documented. The completed documentation is planned for inclusion in the next draft of this guide.

3 Gemalto Product Installation and Configuration Guide

The aspects of installing and configuring the Gemalto products used to build the example solution have not yet been fully documented. The completed documentation is planned for inclusion in the next draft of this guide.

4 HyTrust Product Installation and Configuration Guide

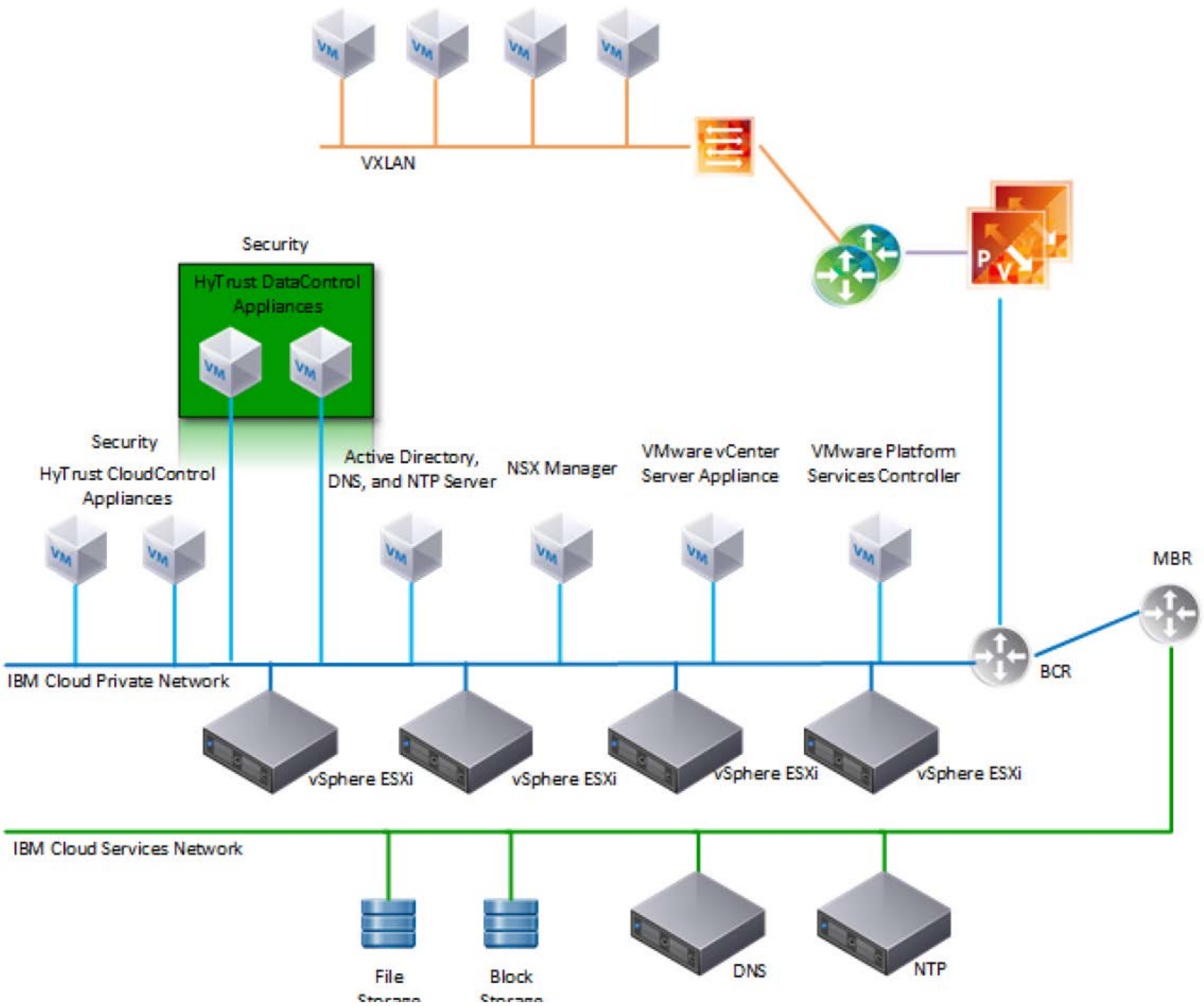
The aspects of installing and configuring the HyTrust products used to build the example solution have not yet been fully documented. The completed documentation is planned for inclusion in the next draft of this guide.

5 IBM Product Installation and Configuration Guide

This section covers all the aspects of installing and configuring the IBM products used to build the example solution. For more information, see the IBM Cloud Secure Virtualization (ICSV) site at https://www.ibm.com/cloud/secure-virtualization.

5.1 ICSV Deployment

IBM Cloud Secure Virtualization combines the power of IBM Cloud, VMware Cloud Foundation, HyTrust security software, and Intel TXT-enabled hardware to protect virtualized workloads. ICSV is deployed on the IBM Cloud infrastructure according to a VMware, HyTrust, IBM, and Intel validated design reference architecture. IBM Cloud Secure Virtualization is initially deployed as a four-node cluster within the choice of clients of available IBM Cloud Data Centers worldwide. Below is a Reference Architecture for ICSV that shows the separation between IBM Cloud services, ICSV provisioned infrastructure, and tenant virtual machines (VMs). ICSV utilizes the IBM Cloud Services Network to enable provisioning the IBM Cloud Private Network to a customer, which in turn protects the virtualized workloads.


VM
VXLAN
Security
HyTrust DataControl Appliances
P
V
Security
HyTrust CloudControl Appliances
Active Directory, DNS, and NTP Server
NSX Manager
VMware vCenter Server Appliance
VMware Platform Services Controller
MBR
IBM Cloud Private Network
BCR
vSphere ESXi
vSphere ESXi
vSphere ESXi
vSphere ESXi
IBM Cloud Services Network
File Storage
Block Storage
DNS
NTP

To deploy the ICSV reference architecture stack, IBM has streamlined the process in three phases for the customer.

5.1.1 Pre-Deployment

This phase starts after the customer has agreed to purchase the ICSV stack in the IBM cloud and has identified the use cases using a workshop or IBM Garage methodology. For the NCCoE project, we had a good understanding of the use case and the capabilities provided by ICSV. To achieve success in all three phases, the IBM Services team filled out Table 5-1 and Table 5-2. The information provided in each table helped us with decisions in later steps.

Table 5-1: Example of IBM Cloud Contact Information Template

	Name	**Email Address**	**Phone Number**
Client Sponsor			
Client Technical Lead			
Client Oversight			
Client Sales Engineer			
IBM Account Exec			
IBM Sales Contact			
IBM OM Contact			
IBM Program Manager (PM)			
IBM Consultant			
Other IBMers			
Vendors info (if applicable)			

Table 5-2: ICSV Requirement & Deployment Template

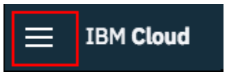
Client Input Variables	**Choices**	**Example Values**
SoftLayer user id		<user_name> from IAAS
SoftLayer API key		<user_key> from IAAS
Deployment - VMware Cloud Foundation (VCF) or vCenter Server (VCS)	VCF or VCS	VCS
VCS deployment details		

Client Input Variables	**Choices**	**Example Values**
Instance name	-	TrustedCld
# of hosts (min. 3)	3 to 20	4
Instance	Primary or Secondary	Primary
Host configuration	Small, Medium, Large, Custom	Custom
Cores	16, 24, 28, 36	24
Intel core base	2.1, 2.2, 2.3 GHz	2.2 GHz
RAM	(64-1.5 TB)	256 GB
Data center location	Dallas,DC,Boulder,etc	Dallas
Data Storage	NFS or VSAN	VSAN
Size of each Data Storage	(1, 2, 4, 8, 12 TB)	2 TB
Performance of file shares	(2, 4, 10 IOPS/GB)	NA
NFS version - v3.0 or v4.1 for shared drives		NA
Windows AD	VSI OR VM	VM
Host Prefix	-	Esxi0
Domain name (used in Windows AD)	-	nccoe.lab
Sub Domain (used by VM)	-	icsv
VM License	BYO or Purchase	Purchase
VM Vcenter Server License	-	Standard
VM vSphere License	-	Enterprise Plus
VM NSX License	-	Enterprise
Services to be added		
Veeam	Yes / No	NO
F5	Yes / No	NO
Fortinet Security Appliance	Yes / No	NO
Fortinet Virtual Appliance	Yes / No	NO
Zerto version 5.0	Yes / No	NO
HyTrust DataControl	Yes / No	YES
HyTrust CloudControl	Yes / No	YES
IBM Spectrum Protect Plus	Yes / No	NO

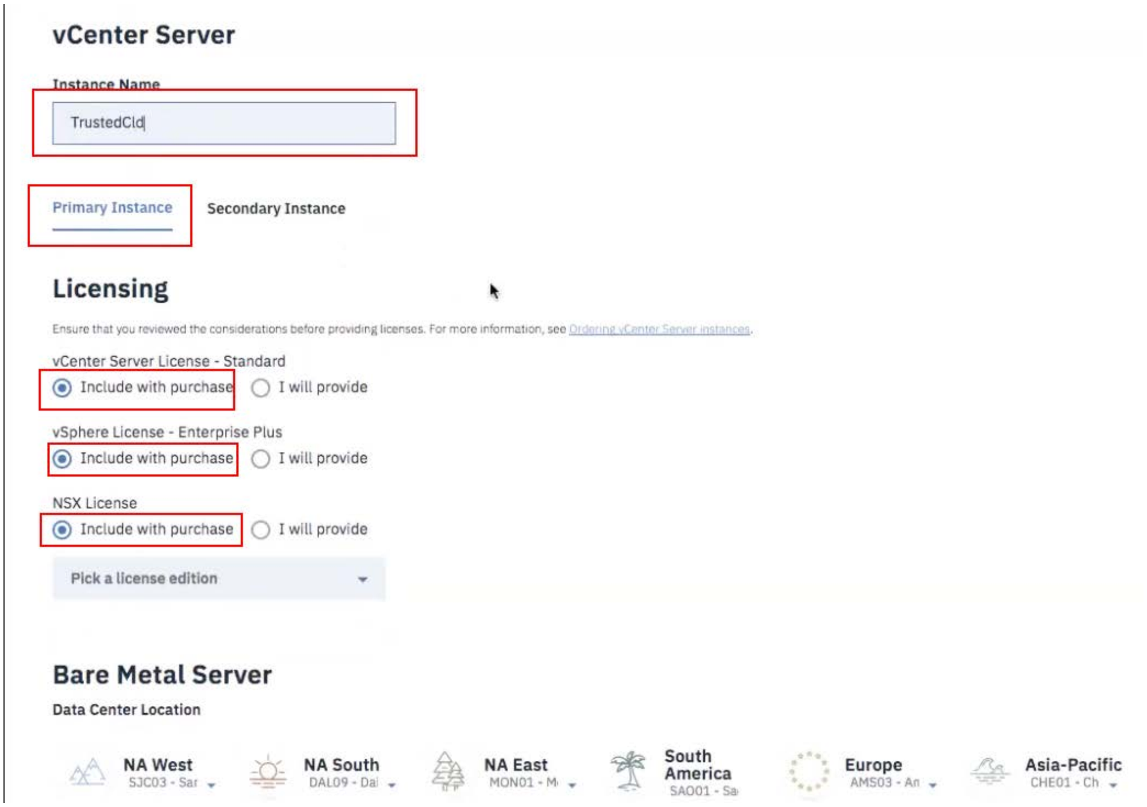
5.1.2 Automation Deployment

The following are steps for ordering an ICSV instance through the IBM portal.

1. Log into the IBM Cloud infrastructure customer portal at https://console.ng.bluemix.net/catalog/.
2. From the top left corner, select the 'Hamburger' menu:



3. Select **VMware** from the drop-down menu on the left side.
4. Click on **Settings** and make sure the correct API key is entered before provisioning the solution.
5. On the **IBM Cloud for VMware Solutions** screen, select **VMware vCenter Server on IBM Cloud**.
6. On the next screen, select **vCenter Server** and click the **Create** button.
7. In the next window, type in the **Instance Name** and make sure **Primary Instance** is highlighted for Instance type. For the **Licensing** options, select **Include with purchase** for all of them. For the **NSX License**, select **Enterprise** from the drop-down menu.



vCenter Server

Instance Name: TrustedCld

Primary Instance | Secondary Instance

Licensing

Ensure that you reviewed the considerations before providing licenses. For more information, see Ordering vCenter Server instances.

vCenter Server License - Standard
● Include with purchase ○ I will provide

vSphere License - Enterprise Plus
● Include with purchase ○ I will provide

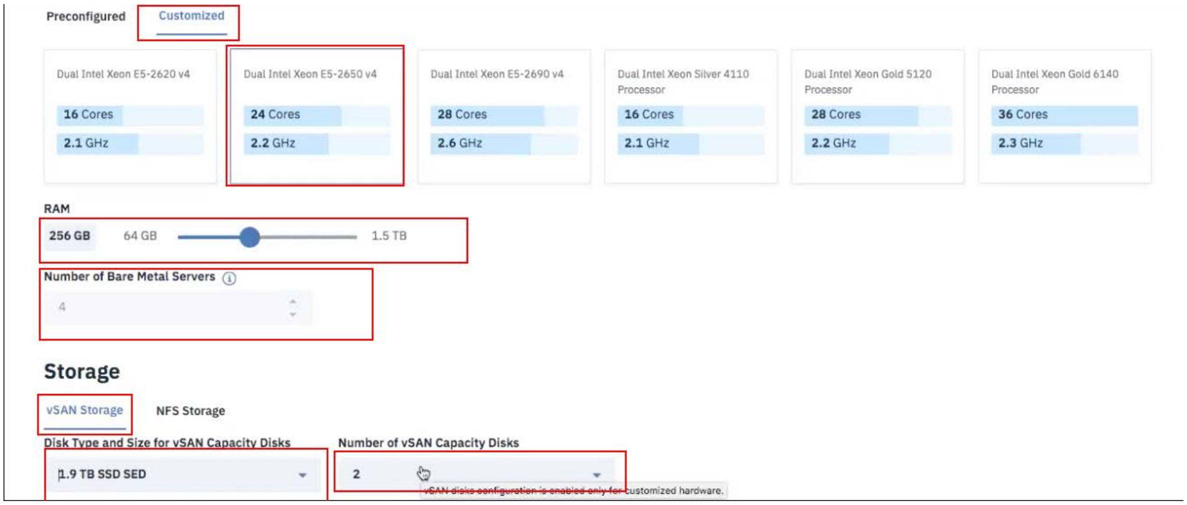
NSX License
● Include with purchase ○ I will provide

Pick a license edition

Bare Metal Server

Data Center Location

8. Under **Bare Metal Server**:
    a. For the **Data Center Location**, open the drop-down menu for **NA South** and select **DAL09**.
    b. Select **Customized** since our workload needs a VSAN, which requires a minimum of a four-node cluster.
9. Under **Storage**:
    a. Select **vSan Storage.**
    b. Set the **Disk Type and Size for vSAN Capacity Disks** to **1.9 TB SSD SED**.
    c. Select **2** from the drop-down menu for the **Number of vSAN Capacity Disks**.
    d. For **vSAN License**, select **Include with purchase** and then choose **Enterprise** from the drop-down menu.



Preconfigured | Customized

Dual Intel Xeon E5-2620 v4	Dual Intel Xeon E5-2650 v4	Dual Intel Xeon E5-2690 v4	Dual Intel Xeon Silver 4110 Processor	Dual Intel Xeon Gold 5120 Processor	Dual Intel Xeon Gold 6140 Processor
16 Cores	24 Cores	28 Cores	16 Cores	28 Cores	36 Cores
2.1 GHz	2.2 GHz	2.6 GHz	2.1 GHz	2.2 GHz	2.3 GHz

RAM
256 GB 64 GB 1.5 TB

Number of Bare Metal Servers: 4

Storage

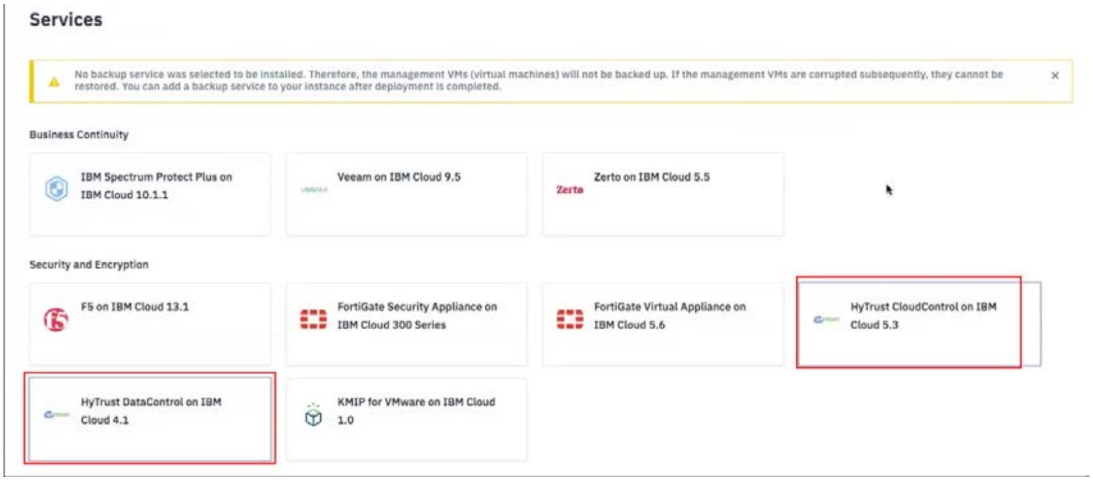
vSAN Storage | NFS Storage

Disk Type and Size for vSAN Capacity Disks: 1.9 TB SSD SED

Number of vSAN Capacity Disks: 2

vSAN disks configuration is enabled only for customized hardware.

10. For the **Network Interface**, enter the following:
    a. Hostname Prefix: `esxi`
    b. Subdomain Label: `icsv`
    c. Domain Name: `nccoe.lab`
11. Select **Order New VLANs**.
12. Under **DNS Configuration**, select **Two highly available dedicated Windows Server VMs on the management cluster**.
13. Under Services, remove **Veeam on IBM Cloud 9.5** and select **HyTrust CloudControl on IBM Cloud 5.3** and **HyTrust DataControl on IBM Cloud 4.1**.



Services

No backup service was selected to be installed. Therefore, the management VMs (virtual machines) will not be backed up. If the management VMs are corrupted subsequently, they cannot be restored. You can add a backup service to your instance after deployment is completed.

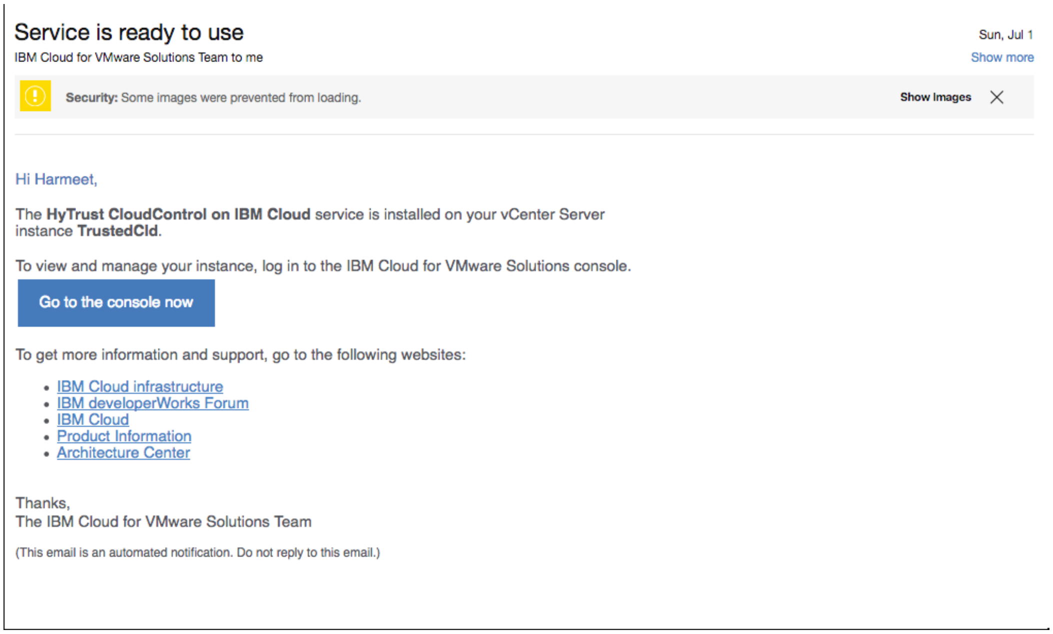
Business Continuity

- IBM Spectrum Protect Plus on IBM Cloud 10.1.1
- Veeam on IBM Cloud 9.5
- Zerto on IBM Cloud 5.5

Security and Encryption

- F5 on IBM Cloud 13.1
- FortiGate Security Appliance on IBM Cloud 300 Series
- FortiGate Virtual Appliance on IBM Cloud 5.6
- HyTrust CloudControl on IBM Cloud 5.3
- HyTrust DataControl on IBM Cloud 4.1
- KMIP for VMware on IBM Cloud 1.0

14. Click on the **Provision** button in the bottom right-hand corner. This will begin the provisioning process for the selected topology. It can take roughly 24 hours to complete the automation deployment. Once deployment has completed, you should receive an email notification.



Service is ready to use

IBM Cloud for VMware Solutions Team to me

Sun, Jul 1

Show more

Security: Some images were prevented from loading.

Hi Harmeet,

The **HyTrust CloudControl on IBM Cloud** service is installed on your vCenter Server instance **TrustedCld**.

To view and manage your instance, log in to the IBM Cloud for VMware Solutions console.

To get more information and support, go to the following websites:

- IBM Cloud infrastructure
- IBM developerWorks Forum
- IBM Cloud
- Product Information
- Architecture Center

Thanks,
The IBM Cloud for VMware Solutions Team

(This email is an automated notification. Do not reply to this email.)

5.1.3 Post-Deployment

This information is needed to set up HTCC to interact with Windows AD and vCenter. The IBM Service team will set up HTCC so it is ready for HyTrust configuration based on the use cases required by the client. Table 5-3 shows examples of HTCC configuration parameters.

294 Table 5-3: Examples of HTCC Configuration Parameters

Client Input Variables	**Choices**	**Example Values**
SMTP Server - for email notifications	Point to company or enable third party sendgrid	sendgrid
SNMP Server	?	?
NTP Server (provided by SL)	Use default (10.0.77.54), unless specified	10.0.77.54 (time.service.networklayer.com)
Windows AD Groups and Users		
Group / Users		
HTCC Super Admin group	ht_superadmin_users	ht_superadmin_users
User in : ht_superadmin_users (Full Admin)	Administrator	Administrator
User: ht_ldap_svc HTCC to AD login user	ht_ldap_svc , unless specified by client	ht_ldap_svc
User: ht_vcenter_svc HTCC to vCenter login user	ht_vcenter_svc unless specified by client	ht_vcenter_svc
H/W Policy tags		
Country (from BMXI portal, as displayed)	Country Name	USA
State/Province	State or Province Name	DAL
Physical Data Center (PDC)	Location (IBM Cloud Data Center name as displayed)	DAL09
Region	Region where data center is located	South West
Classification (User ID-Client name)	Custom	

The IBM services team gathers information from the client, such as the examples in Table 5-4, after understanding the use cases. The information will be used to configure HyTrust, VMware, and Intel TPM/TXT to enforce workload rules and policy. Once post-deployment is completed, the IBM services team will perform a verification test and deliver the asset to the client.

Table 5-4: Examples of Additional HTCC Configuration Parameters

Client Input Variables	**Choices**	**Example Values**
SMTP Server - for email notifications	Point to company or enable third party sendgrid	sendgrid
SNMP Server	?	?
HyTrust H/W TPM Policy Tags		
HTCC Compliance Templates - Custom		
Name		Based on PCI, NIST, …
HTCC Scheduled Events		
Name		Template or Label
HTCC Policy Labels		
Name		Template
HTCC Roles		
Default Roles		
Users		
ASC_ARCAdmin	default	ASC_ARCAdmin
ASC_ARCAssessor	default	ASC_ARCAssessor
ASC_ApplAdmin	default	ASC_ApplAdmin

Client Input Variables	**Choices**	**Example Values**
ASC_BackupAdmin	default	ASC_BackupAdmin
ASC_BasicLogin	default	ASC_BasicLogin
ASC_CoreApplAdmin	default	ASC_CoreApplAdmin
ASC_DCAdmin	default	ASC_DCAdmin
ASC_ESXMAdmin	default	ASC_ESXMAdmin
ASC_NetworkAdmin	default	ASC_NetworkAdmin
ASC_PolicyAdmin	default	ASC_PolicyAdmin
ASC_RoleAdmin	default	ASC_RoleAdmin
ASC_StorageAdmin	default	ASC_StorageAdmin
ASC_SuperAdmin	default	ASC_SuperAdmin
ASC_ThirdParty	default	ASC_ThirdParty
ASC_UCSLogin	default	ASC_UCSLogin
ASC_VIAdmin	default	ASC_VIAdmin
ASC_VMPowerUser	default	ASC_VMPowerUser
ASC_VMUser	default	ASC_VMUser
Groups		
ASC_ARCAdmin	default	ASC_ARCAdmin
ASC_ARCAssessor	default	ASC_ARCAssessor
ASC_ApplAdmin	default	ASC_ApplAdmin
ASC_BackupAdmin	default	ASC_BackupAdmin
ASC_BasicLogin	default	ASC_BasicLogin
ASC_CoreApplAdmin	default	ASC_CoreApplAdmin
ASC_DCAdmin	default	ASC_DCAdmin

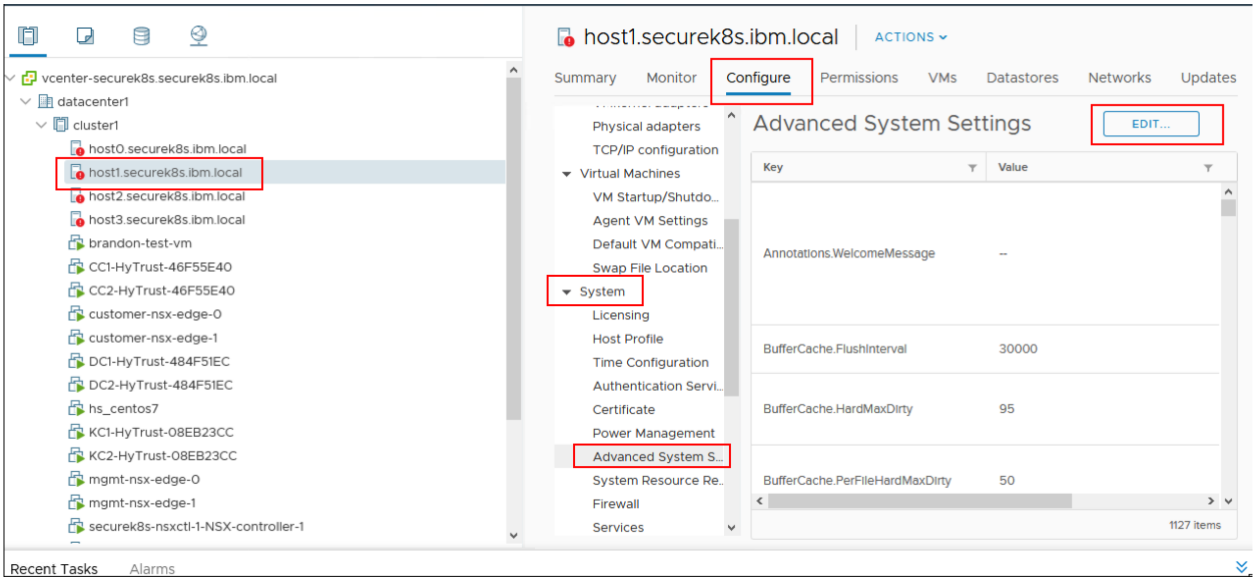
Client Input Variables	Choices	Example Values
ASC_ESXMAdmin	default	ASC_ESXMAdmin
ASC_NetworkAdmin	default	ASC_NetworkAdmin
ASC_PolicyAdmin	default	ASC_PolicyAdmin
ASC_RoleAdmin	default	ASC_RoleAdmin
ASC_StorageAdmin	default	ASC_StorageAdmin
ASC_SuperAdmin	default	ASC_SuperAdmin
ASC_ThirdParty	default	ASC_ThirdParty
ASC_UCSLogin	default	ASC_UCSLogin
ASC_VIAdmin	default	ASC_VIAdmin
ASC_VMPowerUser	default	ASC_VMPowerUser
ASC_VMUser	default	ASC_VMUser

5.2 Enable Hardware Root of Trust on ICSV Servers

In order to leverage the ICSV instance for hardware roots of trust, steps must be taken to enable these features within the server BIOS, as well as ensuring features in the VMware products are enabled to access and leverage these measurements.

5.2.1 Enable Managed Object Browser (MOB) for each ESXi Server

1. Open the vSphere Client and navigate to the relevant host.
2. Click on the **Configure** tab.
3. On the left-hand side under **Software**, click on **System**, then **Advanced System Settings**.
4. Click on the **Edit** button.



Key	Value
Annotations.WelcomeMessage	--
BufferCache.FlushInterval	30000
BufferCache.HardMaxDirty	95
BufferCache.PerFileHardMaxDirty	50

5. Modify or add the configuration to enable MOB: **Config.HostAgent.plugins.solo.enableMob** (set value to **True**).

6. To confirm that MOB has been enabled on the host, open `http://x.x.x.x/mob`, where x.x.x.x is the IP address of the ESX Server.

5.2.2 Enable TPM/TXT on SuperMicro hosts

1. From the vCenter console, enter the ESX host(s) in maintenance mode.
2. Log into your IBM Cloud console and open a support ticket. In the ticket, specify the following:
   a. ESX host(s) you want them to work on. You can have support work on multiple hosts as long as you have the minimum running as required by your instance—minimum of three hosts for instances that have VSAN, otherwise two hosts.

   b. Enter ticket description as follows:

   < Start of ticket description >

   We need your assistance to enable TPM/TXT in the BIOS for this IBM Cloud Secure Virtualization (ICSV) instance.

   Please enable the TPM/TXT flags in the BIOS, following the steps in the exact order specified:

   1. Reboot the following host(s) specified below and enter into BIOS – <provide the list of hosts again here for clarity.>

            2. Go to Advanced ‘Trusted Computing’. *If TPM cannot be cleared in the* ***Pending Operations*** *option, then reboot to BIOS and* ***enable TPM only.*** *You will need this to clear TPM in the next reboot.* ***Press F4 to save and exit.***
            3. *On reboot, again go to BIOS and* go to Advanced ‘Trusted Computing’. ***Clear TXT***. *This will clear TPM and TXT.* ***Press F4 to save and exit.***
            4. *On reboot go to BIOS and* ***enable TPM only. Press F4 to save and exit. Do not enable TPM and TXT in the same reboot. They have to be enabled in sequence.***
            5. *On reboot, again go to BIOS and now* ***enable TXT.*** *The TPM should have been enabled from last step.* ***Press F4 to save and exit.***
            6. *Let the reboot continue to boot to ESX.*

        Please let me know when you have done this successfully.

        < End of ticket description >

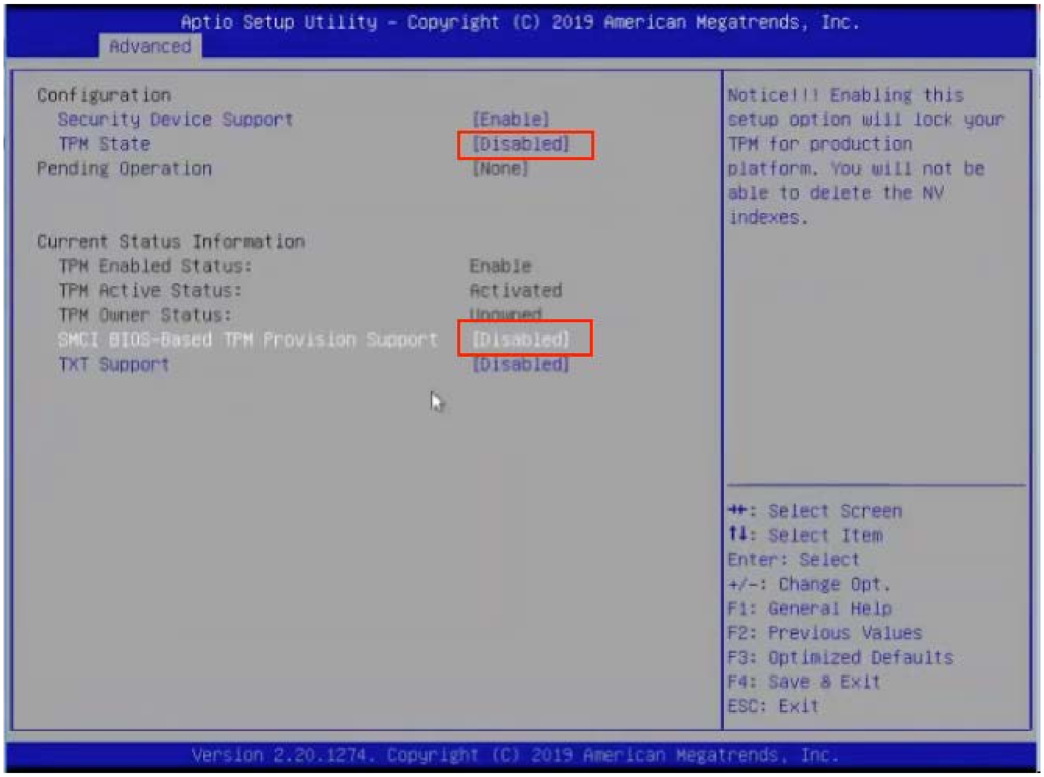
    c. Once the support person returns the ticket with the task completed, continue with the tasks below.

3. From the vCenter console, exit maintenance mode. You may need to connect the ESX hosts again if the host got disconnected.
4. From the vSphere web client or vSphere client, disconnect the host and then connect the host back. This is needed to have the ESXi host re-read the TPM settings.
5. Check the vCenter MOB to check if TPM/TXT is enabled.

At a minimum, there must be three hosts up in instances that have VSAN. So make sure you only work on hosts that will ensure this requirement is met. Ideally, work on one host at a time.

5.2.3 Enable TPM/TXT in IBM Cloud

1. Through vCenter, place the ESXi host in maintenance mode.
2. Reboot the ESXi server by pressing the **F12** key in the iKVM viewer.
3. Once the server reboots, access the BIOS. Disable the **TPM Provision Support,** the **TXT Support**, and the **TPM State**, then **Save & Exit**.



Aptio Setup Utility – Copyright (C) 2019 American Megatrends, Inc.

Advanced

Configuration
Security Device Support [Enable]
TPM State [Disabled]
Pending Operation [None]

Current Status Information
TPM Enabled Status: Enable
TPM Active Status: Activated
TPM Owner Status: Unowned
SMCI BIOS-Based TPM Provision Support [Disabled]
TXT Support [Disabled]

Notice!!! Enabling this setup option will lock your TPM for production platform. You will not be able to delete the NV indexes.

4. Reboot the server all the way to the ESXi OS level.

5. Reboot the server again using the **F12** key.

6. Make sure the OS is not loaded, and access the BIOS. Set the **TPM State** to **Enabled**, then **Save & Exit**.

7. Let the system boot up, but access the BIOS before the OS is loaded and after IPM-CPU initialization. If the system boots the OS, you will have to do the above steps again.

8. Enable **TXT Support** in the BIOS, then **Save & Exit**.

9. Boot the server to OS hypervisor level.

5.2.4 Validate the TPM/TXT is enabled

1. SSH into the ESX host as root and run the following command:

```
zcat  /var/log/boot.gz  |  grep -I  tpm
```

   This should show if the TPM library was loaded.

2. Other commands to check are:

```
vmkload_mod -l  | grep tpm
```

```
grep -i  tpm  /var/log/hostd.log | less -S
```

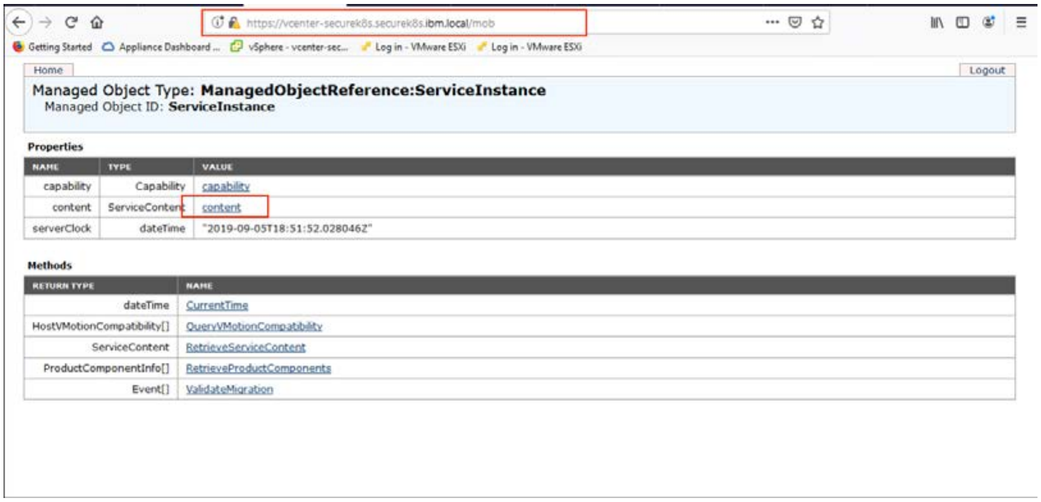
3. As a root user, run the following command:

```
esxcli hardware trustedboot get
```

It should show two answers, and both should be **true**.

5.2.5 Check the vCenter MOB to see if the TPM/TXT is enabled

1. Open a browser with **https://<vCenter-console-IP address>/mob** to bring the vCenter MOB (do not use the individual ESXi host MOB). Authenticate using the vCenter credential.
2. Click on different resources of the MOB in the steps shown below:
   a. Click on **content.**



Managed Object Type: **ManagedObjectReference:ServiceInstance**
Managed Object ID: **ServiceInstance**

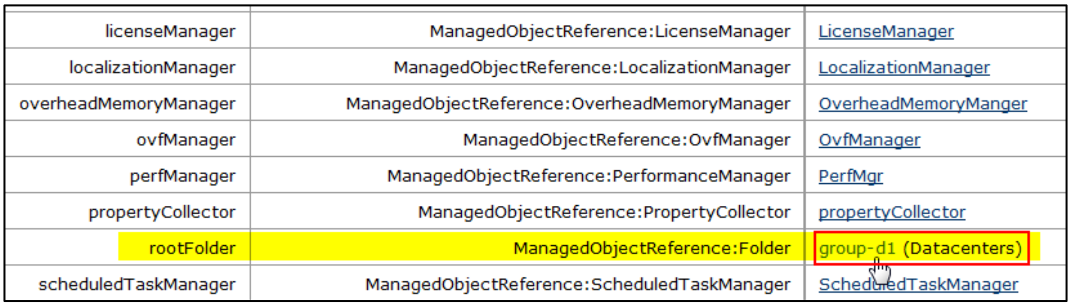
Properties

NAME	TYPE	VALUE
capability	Capability	capability
content	ServiceContent	content
serverClock	dateTime	"2019-09-05T18:51:52.028046Z"

Methods

RETURN TYPE	NAME
dateTime	CurrentTime
HostVMotionCompatibility[]	QueryVMotionCompatibility
ServiceContent	RetrieveServiceContent
ProductComponentInfo[]	RetrieveProductComponents
Event[]	ValidateMigration

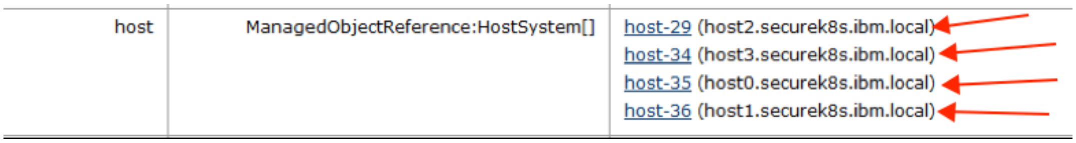
   b. Search for **group-d1 (Datacenters)** and click on it.



licenseManager	ManagedObjectReference:LicenseManager	LicenseManager
localizationManager	ManagedObjectReference:LocalizationManager	LocalizationManager
overheadMemoryManager	ManagedObjectReference:OverheadMemoryManager	OverheadMemoryManger
ovfManager	ManagedObjectReference:OvfManager	OvfManager
perfManager	ManagedObjectReference:PerformanceManager	PerfMgr
propertyCollector	ManagedObjectReference:PropertyCollector	propertyCollector
rootFolder	ManagedObjectReference:Folder	group-d1 (Datacenters)
scheduledTaskManager	ManagedObjectReference:ScheduledTaskManager	ScheduledTaskManager

   c. Find **datacenter-2 (SDDC-Datacenter)** and click on it.
   d. Search for **group-h4 (host)** and click on it.
   e. Search for **domain-c7 (SDDC-Cluster)** and click on it.

f. Search for **host,** and you will see all the hosts listed with their host names.

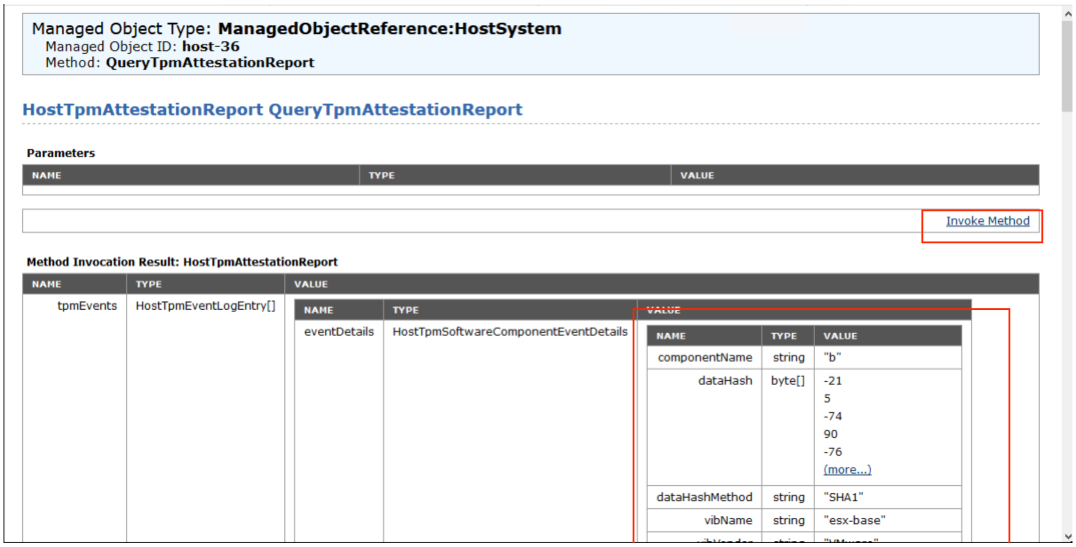


host	ManagedObjectReference:HostSystem[]	host-29 (host2.securek8s.ibm.local) host-34 (host3.securek8s.ibm.local) host-35 (host0.securek8s.ibm.local) host-36 (host1.securek8s.ibm.local)

g. Click on the host that you need to validate. In our demo, we are checking **host1.securek8s.ibm.local**

h. Search for method **QueryTpmAttestationReport** and click on it to invoke the method.

i. Click on **Invoke Method**.



Managed Object Type: **ManagedObjectReference:HostSystem**
Managed Object ID: **host-36**
Method: **QueryTpmAttestationReport**

HostTpmAttestationReport QueryTpmAttestationReport

Parameters

NAME	TYPE	VALUE

Method Invocation Result: HostTpmAttestationReport

NAME	TYPE	VALUE
tpmEvents	HostTpmEventLogEntry[]	

NAME	TYPE	VALUE
eventDetails	HostTpmSoftwareComponentEventDetails	

NAME	TYPE	VALUE
componentName	string	"b"
dataHash	byte[]	-21 5 -74 90 -76 (more...)
dataHashMethod	string	"SHA1"
vibName	string	"esx-base"
vibVendor	string	"VMware"

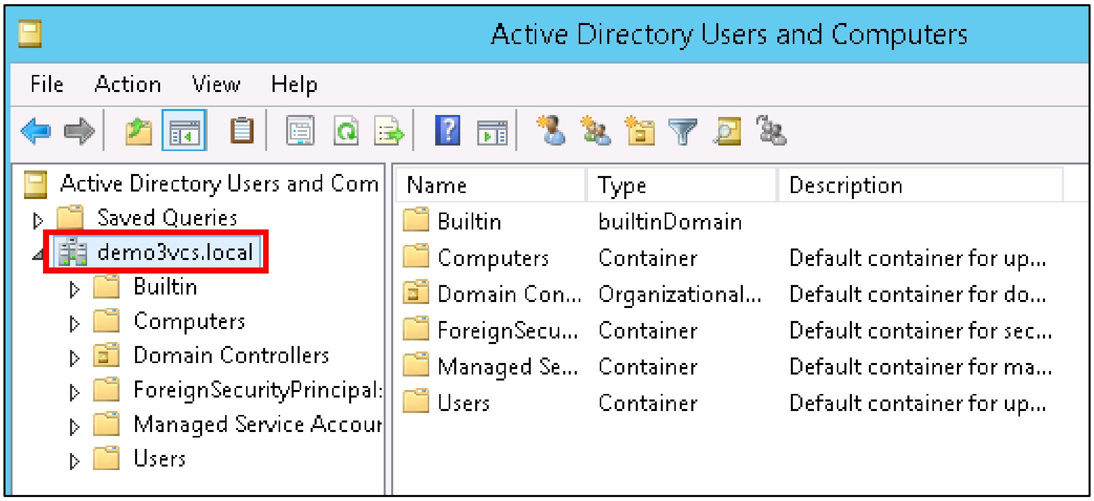
5.2.6 Set up Active Directory users and groups

In this part of the setup, you will create several new organizational units. Remember that this procedure uses a Windows 2012 server and Microsoft AD to illustrate the steps. Your environment and your specific steps might be different. This section assumes actions are being performed from the ICSV Microsoft AD server.

Alternatively, you can follow these steps to set up AD. Note that the values in the screen shots will be different than your values.

1. In Windows Server, start the Server Manager, if not already started.
2. From the **Server Manager** window, select **Tools** -> **Active Directory Users and Computers**.

3. Right-click on your domain that has been created based on the instance name you provided by Windows AD deployment (for VCS) or during VCF deployment creation. For our demo, it is **demo3VCS.local**. Select **New -> Organizational Unit.** You should create the new **OU.**

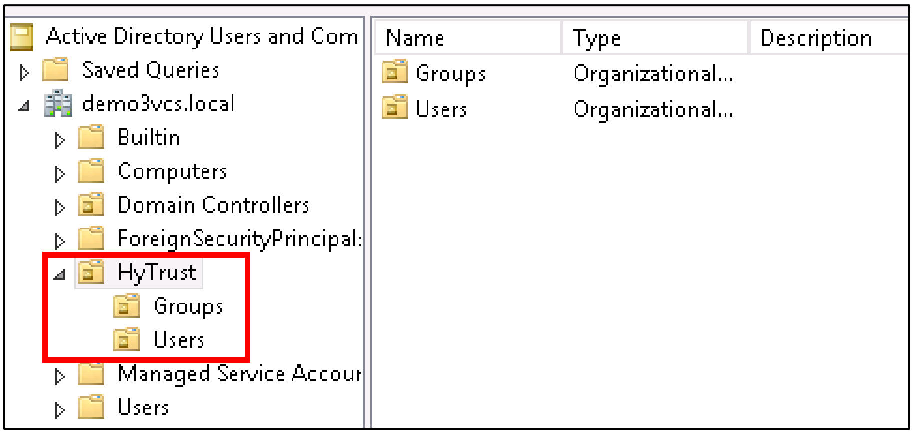


Active Directory Users and Com
- Saved Queries
- demo3vcs.local
  - Builtin
  - Computers
  - Domain Controllers
  - ForeignSecurityPrincipal:
  - Managed Service Accour
  - Users

Name	Type	Description
Builtin	builtinDomain	
Computers	Container	Default container for up...
Domain Con...	Organizational...	Default container for do...
ForeignSecu...	Container	Default container for sec...
Managed Se...	Container	Default container for ma...
Users	Container	Default container for up...

4. Enter **HyTrust** as the name of the new unit. Right-click on the **HyTrust** organizational unit, select **New -> Organizational Unit**, and give the name of **Groups**.

5. Right-click again on the **HyTrust** organizational unit, select **New -> Organizational Unit**, and give the name of **Users**. This group will be used to allow a user to communicate between HTCC and AD. The directory hierarchy should now look similar to this:



Active Directory Users and Com
- Saved Queries
- demo3vcs.local
  - Builtin
  - Computers
  - Domain Controllers
  - ForeignSecurityPrincipal:
  - HyTrust
    - Groups
    - Users
  - Managed Service Accour
  - Users

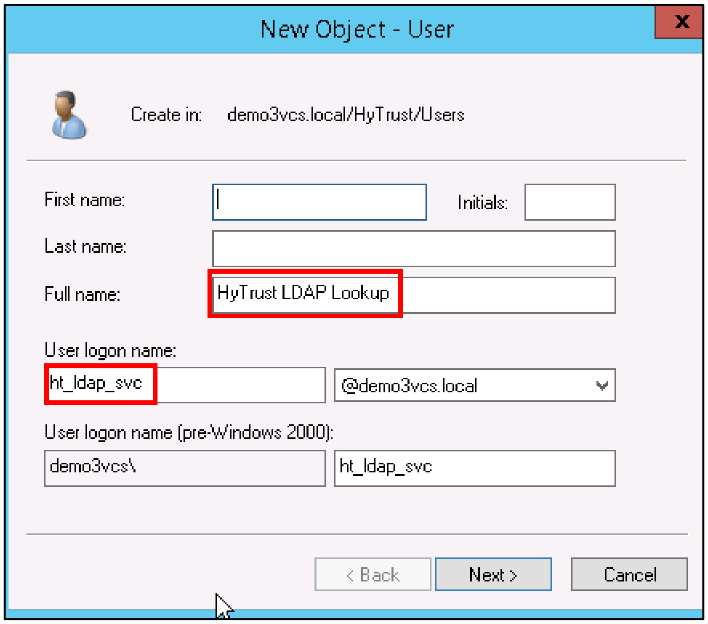
Name	Type	Description
Groups	Organizational...	
Users	Organizational...	

6. Add two users to the **Users** group. To do this, right-click on the **HyTrust/Users** organizational unit and select **New -> User**.

7. The first user is the primary user account that will be used to communicate between HTCC and AD. In the pop-up screen for users, enter user information as appropriate. The screen might look like this:

   Full name: **HyTrust LDAP Lookup**

   User logon name: **ht_ldap_svc**



New Object - User

Create in: demo3vcs.local/HyTrust/Users

First name:

Initials:

Last name:

Full name: HyTrust LDAP Lookup

User logon name: ht_ldap_svc @demo3vcs.local

User logon name (pre-Windows 2000): demo3vcs\ ht_ldap_svc

8. Click **Next** to go to the user password screen. It asks you to establish a password and some password options for the user. Enter or verify these fields:

   a. Enter and confirm a password for the user. The password needs to have at least one upper case letter, otherwise the user will not be created. Note the password in the deployment spreadsheet.

   b. Uncheck this option: **User must change password at next logon**.

   c. Check this option: **Password never expires**.

   d. Click **Next**.

   e. Verify the information and finish.

9. The second user will be used as the service account when HTCC interacts with vCenter. You could use the **Administrator@vsphere.local** account, but best practice is to create a specific service account in AD and use that. Create the second user (in the same way as the first user) with the following values:

Full name: **HyTrust VCenter svc account**

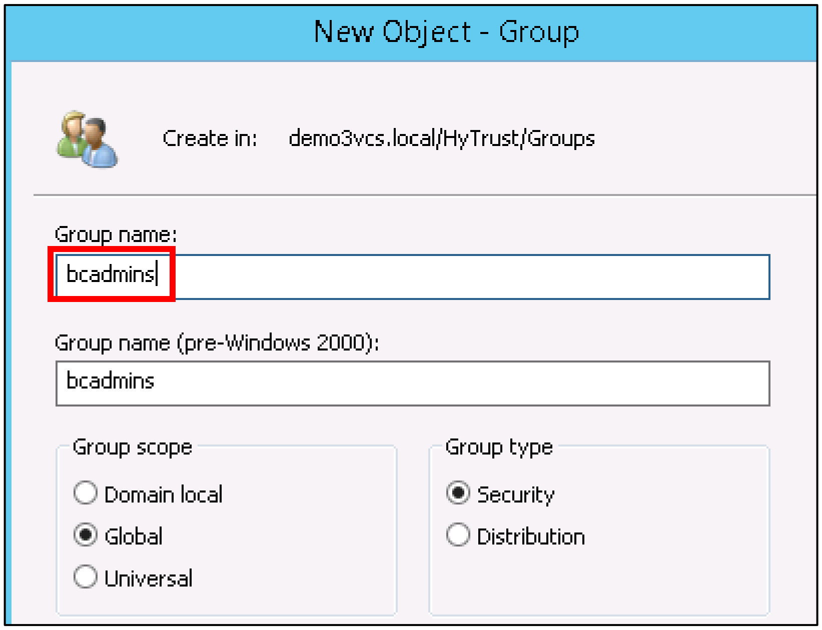
User logon name: **ht_vcenter_svc**

Ensure that the password never expires.

10. You will now create two subgroups under **Groups**.

    a. First, right-click on the **Groups** organizational unit and select **New -> Group**.

    b. When prompted, enter a name for the new group: **bcadmins**. Later, you will tell HTDC to use this group when communicating with HTCC to verify boundary checks. Keep the rest of the options (Group scope and type) the default values as shown below. Press **OK** to create the group.



New Object - Group

Create in: demo3vcs.local/HyTrust/Groups

Group name: bcadmins

Group name (pre-Windows 2000): bcadmins

Group scope
○ Domain local
● Global
○ Universal

Group type
● Security
○ Distribution

    c. Right-click again on the **Groups** organizational unit and select **New -> Group**.

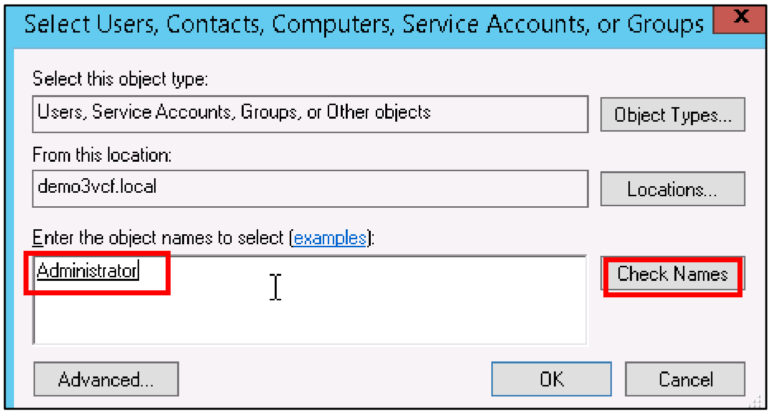
    d. When prompted, enter a name for this group: **ht_superadmin_users** and press **OK**. Later, you will tell HTCC to use this group to specify administrative users of HTCC.

11. You will now add members to the superadmin group.

    a. To do this, right-click on the **ht_superadmin_users** group, and select **Properties**.

    b. In the pop-up window, select the **Members** tab, then click **Add**.

c. In the next pop-up screen, enter an object name **Administrator**, and click on **Check Names**. If no error is returned, click **OK**.



Select Users, Contacts, Computers, Service Accounts, or Groups

Select this object type:
Users, Service Accounts, Groups, or Other objects

From this location:
demo3vcf.local

Enter the object names to select (examples):
Administrator

12. Close the AD control panel.

You are now ready to set up HTCC authentication to work with AD, as described in the next procedure.

5.2.7 Join vCenter to the AD domain

We need to integrate the AD domain into vCenter so that we can later give the AD HyTrust service account vCenter permissions. You first have to join the vCenter to the AD domain, and then add the AD user to vCenter. Note that this is already done for VCS and VCF. However, you may want to check using the instructions below.

1. To check if vCenter is already joined to the AD Domain, SSH into PSC.
2. Run the following command:

```
/opt/likewise/bin/domainjoin-cli  query
```

   If the output indicates it's already joined, you can skip the rest of this section (5.2.7).

3. If it's not already joined, run the following command to join it:

```
/opt/likewise/bin/domainjoin-cli  join  <domain-name>  <AD
Administrator user>  <password>
```

   Example:

   /opt/likewise/bin/domainjoin-cli   join   demo3vcs.local   Administrator Passw0rd

   Output:

```
Joining to AD Domain:     demo3vcs.local
```

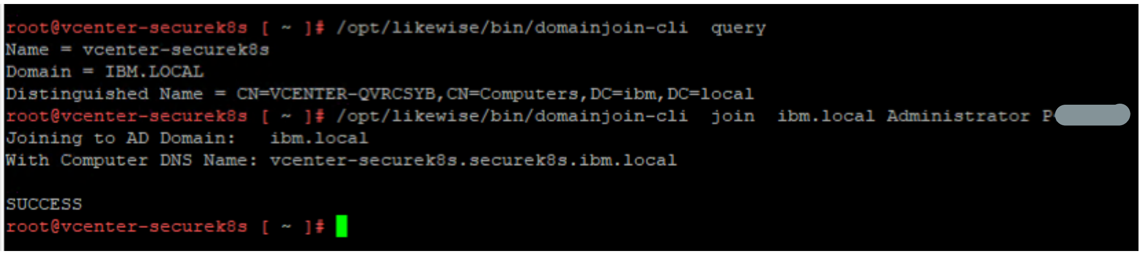
With Computer DNS Name: psc.demo3vcs.local

SUCCESS

Then reboot.

4. SSH into PSC again and verify that the join has succeeded by issuing the following command:

```
/opt/likewise/bin/domainjoin-cli  query
```



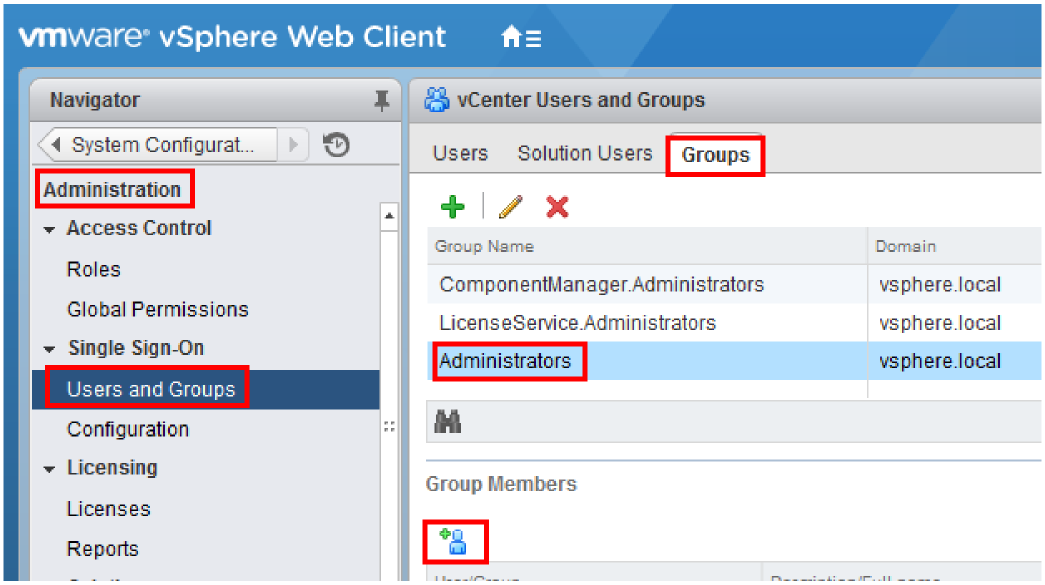
```
root@vcenter-securek8s [ ~ ]# /opt/likewise/bin/domainjoin-cli  query
Name = vcenter-securek8s
Domain = IBM.LOCAL
Distinguished Name = CN=VCENTER-QVRCSYB,CN=Computers,DC=ibm,DC=local
root@vcenter-securek8s [ ~ ]# /opt/likewise/bin/domainjoin-cli  join  ibm.local Administrator P[redacted]
Joining to AD Domain:   ibm.local
With Computer DNS Name: vcenter-securek8s.securek8s.ibm.local

SUCCESS
root@vcenter-securek8s [ ~ ]# 
```

5.2.8 Add AD HyTrust-vCenter service user to vCenter as Administrator

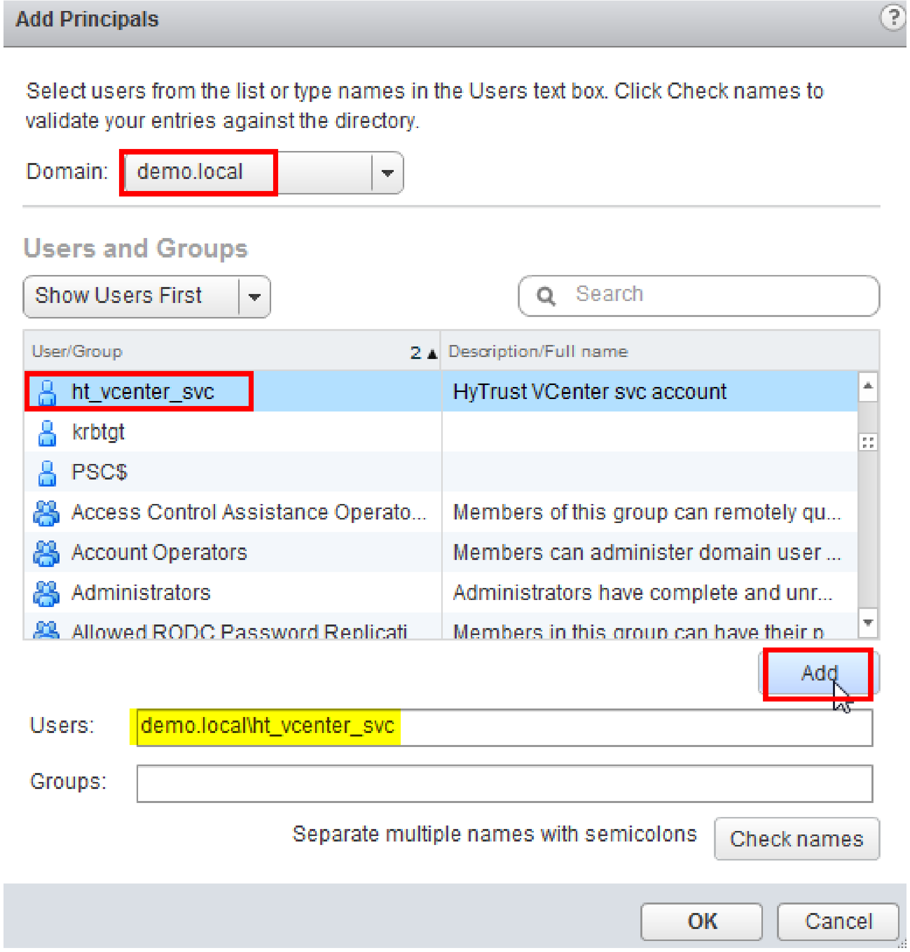
This is for both the VCS and VCF instances.

1. In the vSphere Web Client, go to **Administration** and then **Users and Groups**. Click on **Groups,** then **Administrators**, and select the Group Members **Add** icon.



Group Name	Domain
ComponentManager.Administrators	vsphere.local
LicenseService.Administrators	vsphere.local
Administrators	vsphere.local

2. In the **Add Principals** panel, select the Windows AD Domain (**demo.local** in our example), scroll down and select the user **ht_vcenter_svc** user (that was created in Windows AD), and click on the **Add** button. That user should appear in the Users list. Then press the **OK** button.



Select users from the list or type names in the Users text box. Click Check names to validate your entries against the directory.

Domain: demo.local

User/Group	Description/Full name
ht_vcenter_svc	HyTrust VCenter svc account
krbtgt	
PSC$	
Access Control Assistance Operato...	Members of this group can remotely qu...
Account Operators	Members can administer domain user ...
Administrators	Administrators have complete and unr...
Allowed RODC Password Replicati	Members in this group can have their p

Users: demo.local\ht_vcenter_svc

Groups:

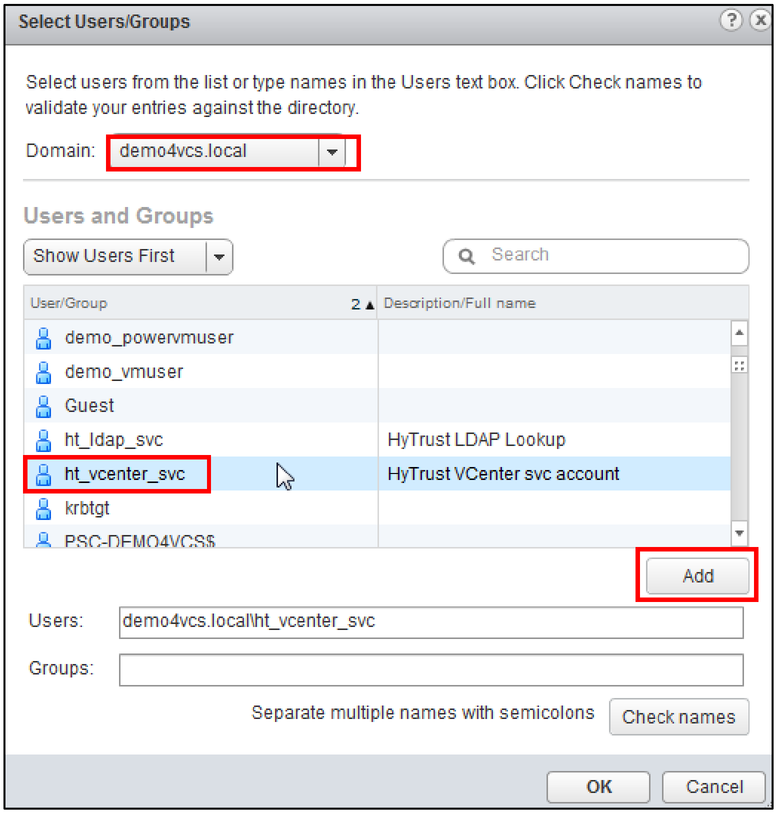
Separate multiple names with semicolons

You have successfully added the Windows AD HyTrust vCenter LDAP id as part of the Administrator group. This id will be used for all interaction between HTCC and vCenter, when the vCenter is added to HTCC.

5.2.9 Add AD HyTrust-vCenter service user to vCenter Global Permissions

1. Go to the vCenter web client. Under **Administration**, click on **Global Permissions**.

2. Add the AD user for the HyTrust-vCenter service, **ht_vcenter_svc**, and give it Administration permission.



Select Users/Groups

Select users from the list or type names in the Users text box. Click Check names to validate your entries against the directory.

Domain: demo4vcs.local

Users and Groups

User/Group	Description/Full name
demo_powervmuser	
demo_vmuser	
Guest	
ht_ldap_svc	HyTrust LDAP Lookup
ht_vcenter_svc	HyTrust VCenter svc account
krbtgt	
PSC-DEMO4VCS$	

Users: demo4vcs.local\ht_vcenter_svc

Groups:

Separate multiple names with semicolons

5.2.10 Configure HTCC for AD authentication

HTCC requires a directory services solution. In this deployment solution, HTCC authentication will be set up to work with Microsoft AD. Before you configure HTCC to use AD, you must define two groups and one user. You can do this via existing AD entries or create entries just for HTCC (as is the case in our implementation).

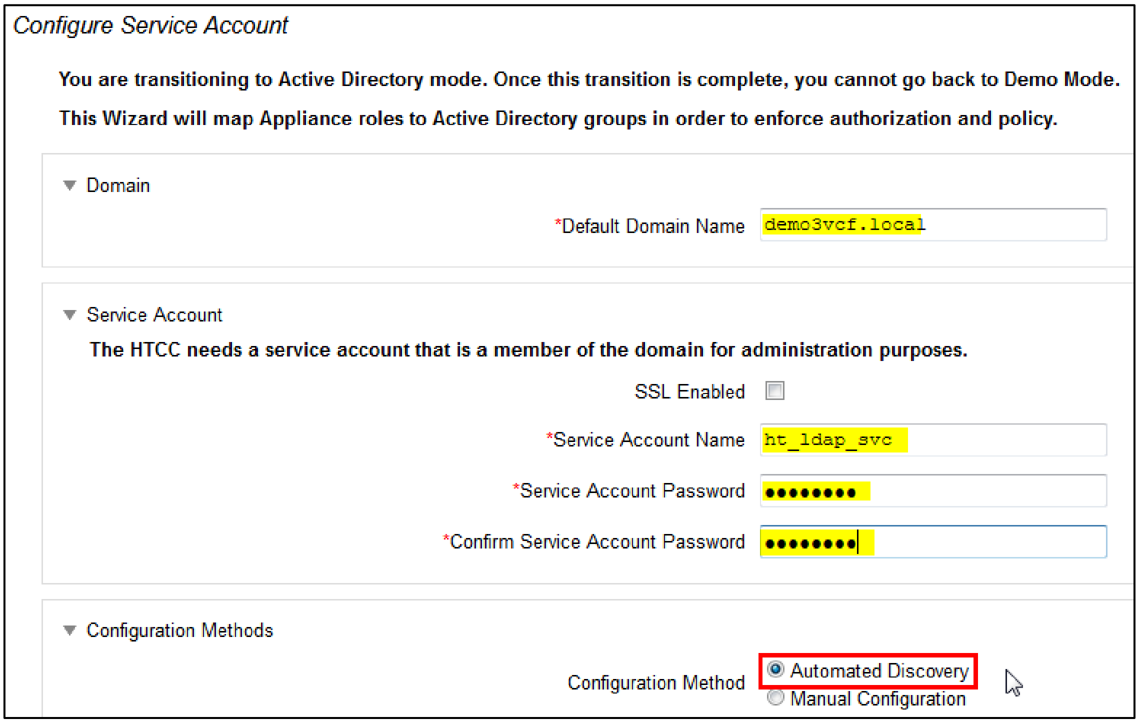
By default, HTCC is set to use a demo userid/password authentication. Once you change to AD authentication, you cannot revert back to the demo authentication.

If AD is configured with SSL, the AD server’s SSL certificate must be imported into HTCC. To configure HTCC with an AD server with SSL configuration, refer to the HTCC Administration Guide for the following steps:

1. Import AD Server certificate into HTCC. Refer to the HTCC Administration Guide section titled “Installing a Third-party Root Certificate.”
2. Configure AD with SSL in HTCC. Refer to the HTCC Administration Guide section titled “Integrating the Appliance with Active Directory.”

To set up HTCC authentication, follow these steps:

1. Log onto the HTCC web console, using URL ***https://<HTCC-Virtual-IP>/asc*** with the default username of **superadminuser** and the password **Pa$$w0rd123!**
2. From the HTCC dashboard, select the **Configuration** menu, and then **Authentication**.
3. Change the **Authentication Server Type** to **Directory Service** and accept your changes.
4. You should see a screen for configuring the service account. In the service account name field, enter the username and password that was created earlier in the setup steps for AD. Make sure that the Default domain name is the one you used to deploy the instance. In our demo, it's **demo3vcf.local**. Use the password for user **ht_ldap_svc** that you used in Windows AD configuration. The screen might look like this:



Configure Service Account

You are transitioning to Active Directory mode. Once this transition is complete, you cannot go back to Demo Mode.

This Wizard will map Appliance roles to Active Directory groups in order to enforce authorization and policy.

▼ Domain

*Default Domain Name: demo3vcf.local

▼ Service Account

The HTCC needs a service account that is a member of the domain for administration purposes.

SSL Enabled □

*Service Account Name: ht_ldap_svc

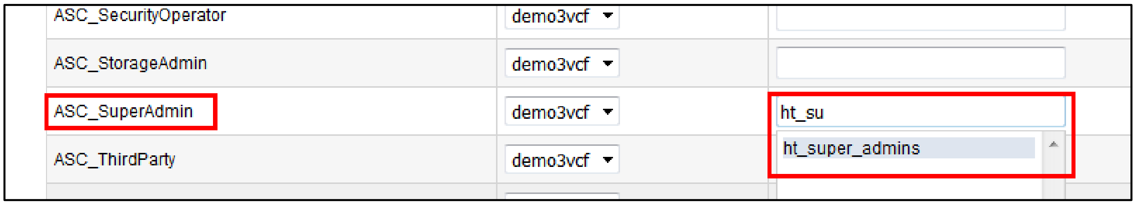
*Service Account Password: ••••••••

*Confirm Service Account Password: ••••••••

▼ Configuration Methods

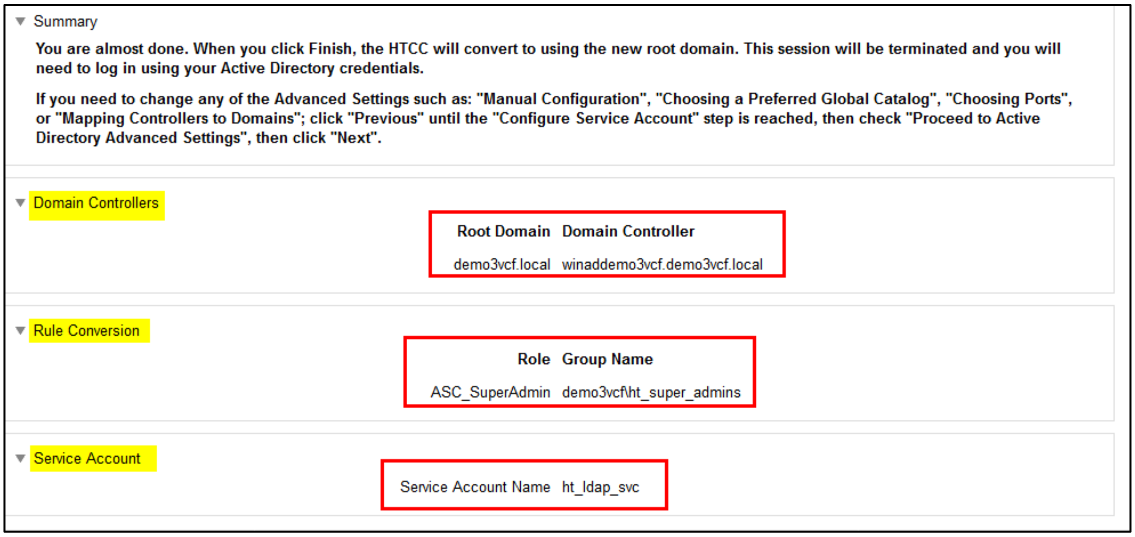
Configuration Method: ● Automated Discovery ○ Manual Configuration

5. Click **Next,** and you will see the domain listed. Click **Next** again.
6. You should now see the **Role-Group Mapping** page. Look under the **ASC_SuperAdmin** section entry. Confirm that your AD domain is listed in the selected pull-down entry. In the group name field, enter the admin group name, **ht_superadmin_users,** that you created earlier in the initial AD setup. HTCC will attempt to perform predictive searches to allow for name completion.



ASC_SecurityOperator	demo3vcf ▾	
ASC_StorageAdmin	demo3vcf ▾	
ASC_SuperAdmin	demo3vcf ▾	ht_su ht_super_admins
ASC_ThirdParty	demo3vcf ▾	

7. Click **Next** and review the summary. If it is correct, finish. If AD is working correctly, the web interface will automatically log you out.



▾ Summary

You are almost done. When you click Finish, the HTCC will convert to using the new root domain. This session will be terminated and you will need to log in using your Active Directory credentials.

If you need to change any of the Advanced Settings such as: "Manual Configuration", "Choosing a Preferred Global Catalog", "Choosing Ports", or "Mapping Controllers to Domains"; click "Previous" until the "Configure Service Account" step is reached, then check "Proceed to Active Directory Advanced Settings", then click "Next".

▾ Domain Controllers

Root Domain	Domain Controller
demo3vcf.local	winaddemo3vcf.demo3vcf.local

▾ Rule Conversion

Role	Group Name
ASC_SuperAdmin	demo3vcf\ht_super_admins

▾ Service Account

Service Account Name ht_ldap_svc

8. Log back in using the **Administrator** user and password of your Windows AD/DNS Server (which is the domain controller). Recall that we had added '**Administrator'** to the **ht_superadmin_users** group in Windows AD.

At this point, AD should be correctly set up for deployment. You are ready to set up the trust attestation service.

5.3 Add Hosts to HTCC and Enable Good Known Host (GKH)

You will first add hosts in vCenter and then enable the Good Known Host (GKH) values to make them Trusted.

5.3.1 Add vCenter to HTCC

In this step, you will add the hosts to HTCC. Since all the hosts are managed by vCenter (as compared to standalone ESX hosts), you will add vCenter as the host—that will automatically detect the NSX server and the ESX hosts, and add them to HTCC. The high-level steps are:

1. In HTCC, add vCenter as the host. For vCenter, use the same AD LDAP used for the HTCC vCenter AD id, **ht_vcenter_svc@ibm.local** (change the domain name based on what you have). While you can use **Administrator@vsphere.local**, best practice suggests you use the AD id.
2. For all the ESX hosts that are detected, add their user ids/passwords and **Publish IPs**.
3. If the vCenter and ESX host patch levels are not one of the valid patches supported by HTCC, add the patch level to HTCC so it recognizes them as valid hosts.

5.3.2 Enable a Good Known Host

Enabling a Good Known Host indicates that you know and trust the host, and allows CloudControl to use this host as a source for measurements when assessing other hosts with the same BIOS and hypervisor versions for trust.

1. Select **Compliance** > **Hosts**.
2. On the **Hosts** page, select the host that you want to modify and click **Edit**.
3. On the **Edit Host** page, click the **Trust Attestation** tab. Note: The tab appears only after the TAS server has been setup and configured.
4. Check the **Good Known Host (BIOS and VMM)** checkbox. Important: Do not enable more than one Good Known Host with the same BIOS and hypervisor versions.
5. Optionally, click the **Trusted** button for the **View Host Trust Attestation Report**.
6. A dump file of the Trust report opens in a separate page.
7. Click **OK** to confirm your selection.
8. Click **OK**.
9. The Good Known Host icon (green) displays next to the host name. You can mouse over the icon to see the host BIOS and hypervisor versions.

Once a Good Known Host is enabled, all other hosts under the same vCenter with the same BIOS and hypervisor versions are automatically marked as trusted if their measurements match. A Good Known Host must be enabled for each different BIOS and hypervisor version of your hosts.

5.3.3 Verify and update host trust

CloudControl enables you to verify and update the host trust information by performing a complete attestation cycle consisting of registering, creating whitelists, and updating Trust status. You can use one of the following methods:

- Manually select the hosts and click the **Update Trust** button.
- Enable the **Refresh Trust Status** scheduled event. For more information on scheduled events, see the Administration Guide for HyTrust CloudControl.

Important: Because CloudControl requires all Good Known Hosts to be verified by both BIOS and VMM, you must run the **Refresh Trust Status** scheduled event when upgrading to ensure that all qualifications are met. Good Known Hosts from previous versions will not display the Good Known Host icon until verified.

CloudControl automatically detects and updates the Trust Status of all Intel TXT ESXi hosts on boot. To manually verify and update host trust:

1. Select **Compliance** > **Hosts**.
2. On the **Hosts** page, select the ESXi or KVM host(s) that you want to validate and click **Update Trust**.

Trusted hosts display the Trusted Host icon, and the TRUSTED policy label appears in the resource tree for the host. If a host is not trusted, the Untrusted Host icon is displayed.

5.3.4 Define PolicyTags in CloudControl

Use HyTrust CloudControl to define PolicyTags and assign them to hosts.

1. Select **Policy** > **PolicyTags**.
2. On the **PolicyTags** page, click **Add**.
3. On the **Add PolicyTag** page, choose the **PolicyTag Type** and enter the appropriate value.
   a. **Country:** Assign Country Names
   b. **State/Province:** Assign State/Province
   c. **Physical Data Center (PDC):** Assign Physical Data Center name or region
   d. **Region (Logical):** Assign a geographical region
   e. **Classification:** Assign custom PolicyTags value
4. Click **OK**.
5. The **PolicyTags** page displays the PolicyTag that you added. Click **Add** to add another PolicyTag.

5.3.5 Assign PolicyTags to hosts

Important: We recommend that you put your host in maintenance mode before assigning PolicyTags, especially if you are modifying existing PolicyTag assignments which may be in use by your existing compliance rules. Do not remove the host from maintenance mode until you have verified that the new PolicyTag assignment has been correctly provisioned.

1. Select **Compliance** > **Hosts**.
2. On the **Hosts** page, check the checkbox for the Intel TXT-enabled host and click **Edit**.

3. On the **Edit Hosts** page, select the **PolicyTag** tab.
4. Select the appropriate **PolicyTag** value for one or more of the fields listed in Section 5.3.4.
5. Click **OK**.
6. CloudControl displays a JGrowl error message that prompts users to PXE boot the host(s) to activate the PolicyTag assignment.

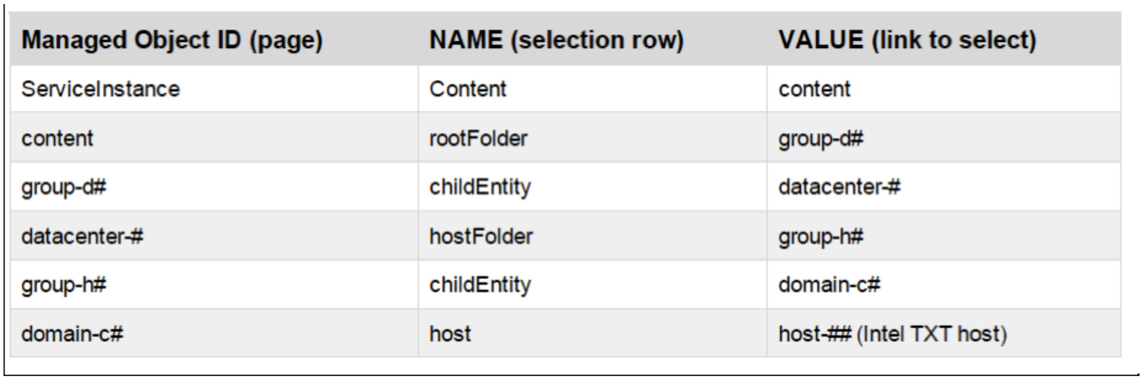
5.3.6 Provision PolicyTags

1. Collect the UUID information for each Trusted host. See Section 5.3.6.1.
2. Generate and run the esxcli commands for hardware provisioning for each Trusted host. See Section 5.3.6.2 and Section 5.3.6.3.
3. Verify that the PolicyTags are provisioned. See Section 5.3.6.4.

5.3.6.1 Collect UUIDs of GKH and Trusted hosts

The UUID information for the GKH and Trusted hosts can be collected from the vCenter MOB. You will need to obtain the UUID for each GKH and Trusted host.

1. Log into the vCenter MOB at ***https://<VSPHERE_URL>/mob***
2. Perform the following series of page selections to reach the host page for each of your Intel TXT-enabled hosts:



Managed Object ID (page)	NAME (selection row)	VALUE (link to select)
ServiceInstance	Content	content
content	rootFolder	group-d#
group-d#	childEntity	datacenter-#
datacenter-#	hostFolder	group-h#
group-h#	childEntity	domain-c#
domain-c#	host	host-## (Intel TXT host)

3. On the **Hosts** page, click **Summary**.
4. On the **Summary** page, click **Hardware**. The hardware page contains the UUID information.
5. Repeat this for each Trusted host.

5.3.6.2 Generate esxcli commands

Use the CloudControl cli to generate esxcli commands that can be used for hardware provisioning.

1. Log into CloudControl as the **ascadminuser,** and run the following command:

   ```
   asc tas --export-certs
   ```

   This generates a file in /tmp in the following format: `export--xxxx-xx-xxx.tgz`

2. Navigate to the /tmp folder and extract the file using the following command:

   ```
   tar -xvf export--xxxx-xx-xxx.tgz
   ```

   The extraction process lists several files, including the sha1.bin for each Trusted ESXi host.

   Example:

   export--2018-08-27T23-44-43Z/6aa6af76/14f6/42e8/b452/6aa6af76-14f6-42e8-b452-dc27fe259e1a/system--6aa6af76-14f6-42e8-b452-dc27fe259e1a.der

   export--2018-08-27T23-44-43Z/6aa6af76/14f6/42e8/b452/6aa6af76-14f6-42e8-b452-dc27fe259e1a/system--6aa6af76-14f6-42e8-b452-dc27fe259e1a.sha1.bin

   export--2018-08-27T23-44-43Z/6aa6af76/14f6/42e8/b452/6aa6af76-14f6-42e8-b452-dc27fe259e1a/system--6aa6af76-14f6-42e8-b452-dc27fe259e1a.sha256.bin

   export--2018-08-27T23-44-43Z/6aa6af76/14f6/42e8/b452/6aa6af76-14f6-42e8-b452-dc27fe259e1a/system--6aa6af76-14f6-42e8-b452-dc27fe259e1a.metadata.txt

   export--2018-08-27T23-44-43Z/dddfda66/314e/4378/8f4d/dddfda66-314e-4378-8f4d-060b5d885038/system--dddfda66-314e-4378-8f4d-060b5d885038.der

   export--2018-08-27T23-44-43Z/dddfda66/314e/4378/8f4d/dddfda66-314e-4378-8f4d-060b5d885038/system--dddfda66-314e-4378-8f4d-060b5d885038.sha1.bin

   export--2018-08-27T23-44-43Z/dddfda66/314e/4378/8f4d/dddfda66-314e-4378-8f4d-060b5d885038/system--dddfda66-314e-4378-8f4d-060b5d885038.sha256.bin

   export--2018-08-27T23-44-43Z/dddfda66/314e/4378/8f4d/dddfda66-314e-4378-8f4d-060b5d885038/system--dddfda66-314e-4378-8f4d-060b5d885038.metadata.txt

3. Navigate to the extracted directory, for example: `cd /tmp/export--xxxx-xx-xxx`

4. At the prompt, type the following command:

   ```
   grep -E -- '"(id|subject)" : ' json.dump | grep -A1 '<Trusted-
   Host-UUID> '
   ```

This command returns the “subject” and the “id”.

Example:

"subject" : "4c4c4544-0032-3010-8035-b5c04f333832",

"id" : "6aa6af76-14f6-42e8-b452-dc27fe259e1a"

5. Run the following command for each Trusted host:

```
hexdump -e '"esxcli hardware tpm tag set --data=" 20/1 "%1.2x"
";\n"' <sha1.bin file path>
```

where `<sha1.bin file path>` matches the “id” for the specific host

This returns the esxcli command.

Example:

hexdump -e '"esxcli hardware tpm tag set --data=" 20/1 "%1.2x" ";\n"'

6aa6af76/14f6/42e8/b452/6aa6af76-14f6-42e8-b452-dc27fe259e1a/system--6aa6af76-14f6-42e8-b452-dc27fe259e1a.sha1.bin

esxcli hardware tpm tag set --data=46f048ce41afdfa686e4c00f9fd67a2b71d1c749;

5.3.6.3 Run esxcli commands

Run the esxcli commands for each Trusted host to provision the hardware tags.

1. Put the Trusted host into maintenance mode.
2. Log in to the ESXi host as root.
3. Run the specific esxcli command for the Trusted host. The command is part of the hexdump output.

   Example:

   esxcli hardware tpm tag set --data=46f048ce41afdfa686e4c00f9fd67a2b71d1c749;

4. Restart the ESXi host. The host should still be in maintenance mode.

5.3.6.4 Verify PolicyTags on provisioned hosts

1. Open CloudControl and select **Compliance > Hosts**.
2. Select the host that you just updated and click **Update Trust**.
3. Select **Policy > Resources**.

4. Verify that the PolicyTags have been provisioned. If the tag icon next to the host being provisioned is blue, then the PolicyTags assigned to the host are provisioned. If the tag icon is yellow, then the PolicyTags assigned to the host are not provisioned.

   Note: If the provisioning process was not successful, you may have to clear the TPM once again and repeat the process.

After the PolicyTag provisioning is successful, you can remove the hosts from maintenance mode.

6 Intel Product Installation and Configuration Guide

The aspects of installing and configuring the Intel products used to build the example solution have not yet been fully documented. The completed documentation is planned for inclusion in the next draft of this guide.

7 RSA Product Installation and Configuration Guide

The aspects of installing and configuring the RSA products used to build the example solution have not yet been fully documented. The completed documentation is planned for inclusion in the next draft of this guide.

8 VMware Product Installation and Configuration Guide

This section covers all the aspects of installing and configuring the VMware products used to build the example solution.

8.1 Prerequisites

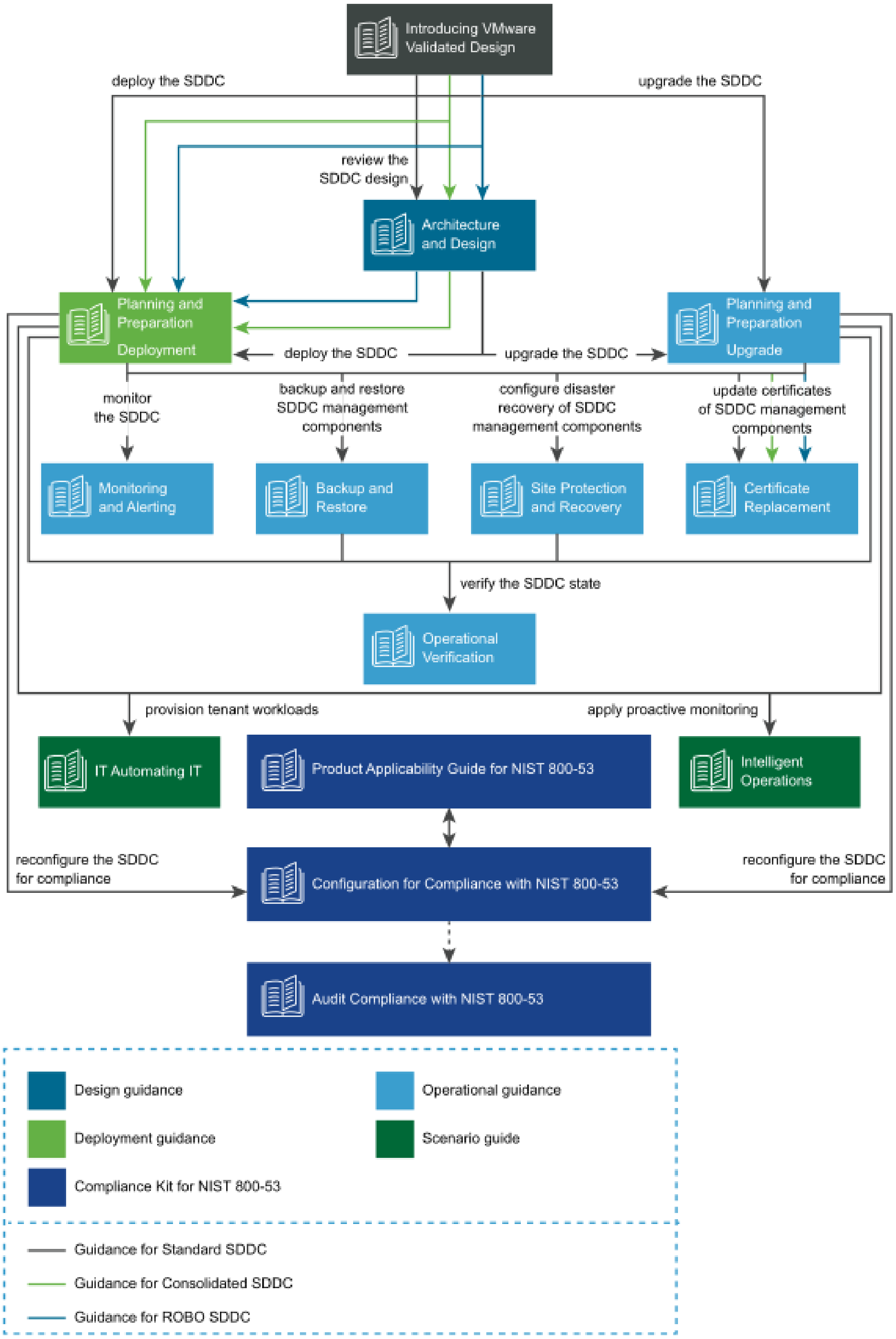
The VMware Validated Design (VVD) is a blueprint for a Software Defined Data Center (SDDC). A Standard deployment model was used. In order to prepare for the implementation of the VVD, review the following documentation. It outlines the preparation and planning phases, contains logical design architectures and design decisions related to the implementation, and assists with the end-to-end process of deploying a VVD:

- *VMware Validated Design Documentation*
- *Documentation Structure and Audience* (VVD 4.3, VVD 5.0.1), see Figure 8-1
  - *Architecture and Design*
  - *Planning and Preparation Deployment*
  - *Planning and Preparation Upgrade*
  - *Monitoring and Alerting*

    - *Backup and Restore*
    - *Site Protection and Recovery*
    - *Certificate Replacement*
    - *Operational Verification*
    - *IT Automating IT*
    - *Intelligent Operations*
    - *Security and Compliance Configuration for NIST 800-53:*
        - *Introduction to Security and Compliance*
        - *Product Applicability Guide for NIST 800-53*
        - *Configuration for Compliance with NIST 800-53*
        - *Audit Compliance with NIST 800-53*
- *Introducing VMware Validated Design for Software-Defined Data Center* (VVD 4.3, VVD 5.0.1)
- *Design Objectives of VMware Validated Designs* (VVD 4.3, VVD 5.0.1)
- *Overview of Standard SDDC* (VVD 4.3, VVD 5.0.1)
- *VMware Validated Design Architecture and Design* (VVD 4.3, VVD 5.0.1)
- *VMware Validated Design Planning and Preparation* (VVD 4.3, VVD 5.0.1)
- *VMware Validated Design for Software-Defined Data Center Release Notes* (VVD 4.3, VVD 5.0, VVD 5.0.1)

To visualize how the VVD works in conjunction with the Compliance Kit for NIST 800-53, Figure 8-1 provides an overview of the documentation structure. The VMware Validated Design Compliance Kit enhances the documentation of the VVD for SDDC and must be applied after the SDDC is deployed.

706 **Figure 8-1: Map of VVD Documentation**


Introducing VMware Validated Design
deploy the SDDC
upgrade the SDDC
review the SDDC design
Architecture and Design
Planning and Preparation Deployment
Planning and Preparation Upgrade
deploy the SDDC
upgrade the SDDC
monitor the SDDC
backup and restore SDDC management components
configure disaster recovery of SDDC management components
update certificates of SDDC management components
Monitoring and Alerting
Backup and Restore
Site Protection and Recovery
Certificate Replacement
verify the SDDC state
Operational Verification
provision tenant workloads
apply proactive monitoring
IT Automating IT
Product Applicability Guide for NIST 800-53
Intelligent Operations
reconfigure the SDDC for compliance
Configuration for Compliance with NIST 800-53
reconfigure the SDDC for compliance
Audit Compliance with NIST 800-53
Design guidance
Operational guidance
Deployment guidance
Scenario guide
Compliance Kit for NIST 800-53
Guidance for Standard SDDC
Guidance for Consolidated SDDC
Guidance for ROBO SDDC

To reconfigure your SDDC for compliance with NIST SP 800-53 [1], you must download and license additional VMware and third-party software.

The VVD coupled with *Security and Compliance Configuration for NIST 800-53* uses scripts and commands based on VMware PowerCLI to reconfigure the SDDC. You must prepare a host with a supported operating system (OS) for running Microsoft PowerShell, set up Microsoft PowerShell, and install the latest version of VMware PowerCLI. The host must have connectivity to the ESXi management network in the management cluster.

8.2 Installation and Configuration

Review the following documentation for the complete guide concerning the installation and configuration for the VVD for an SDDC for a Standard Deployment:

- Deployment for Region A (VVD 4.3, VVD 5.0.1)
- Deployment for Region B (VVD 4.3, VVD 5.0.1)

8.3 Configuration Customization Supporting the Use Cases and Security Capabilities

After deployment of a Standard VVD, the enhancements outlined in this publication should be applied. The security configurations and controls outlined in this section were implemented on a number of VVD versions, beginning with VVD 4.2 and then VVD 4.3. In addition to this lab, a separate project to publish the security configurations as a Compliance Kit that works as an enhancement to the VVD was published to VVD version 5.0.1. Changes between VVD 4.2, 4.3, 5.0.1, and even the most current version, 5.1, are unlikely to have a significant impact to the configuration guidance.

Although this document outlines a specific version of the VVD, the Compliance Kit has been developed to support VVD 4.3, 5.0.1, 5.1, and future VVD releases. This section discusses the *VMware Validated Design 5.0.1 Compliance Kit for NIST 800-53* and provides supplemental information detailing the resources that are included within the kit because the kit was not formally published for VVD 4.2 or 4.3, even though it was tested based on these versions. The VVD 5.0.1 Compliance Kit contains a number of files, including:

- *Introduction to Security and Compliance*
- *Product Applicability Guide*
- *Configuration Guide*
- *Audit Guide*
- *Audit Guide Appendix*

The configuration procedures included within the kit are in two groups:

- **Built-In Controls**: Security controls based on compliance requirements are included in the VVD for SDDC. These may require configuration and adjustment, but by design the capabilities are included in the VVD for SDDC.
- **Enhanced Controls**: Additional guidance on a per regulation or standard basis includes a set of capabilities that can be added to the VVD for SDDC.

Over time, we expect a significant number of enhancement VVD controls to be incorporated into the VVD for SDDC. The enhancement guide always contains some number of NIST controls that are applicable to NIST SP 800-53 but are not included in the VVD for SDDC implementation. Each procedure documented in the *Configuration Guide* includes the NIST SP 800-53 control(s) that are associated with each. Two examples sampled from the *Configuration Guide* are included in Sections 8.3.1 and 8.3.2.

Although the compliance kit was designed under VVD 5.0.1, the procedures and information included within the following sections are applicable to future releases of VVD, including VVD 5.1 and 5.1.1. Please note that while future iterations of the compliance kit will include configurations across all products, version 5.0.1 only corresponds to the following products: vCenter, ESXi, NSX for vSphere (NSX-V), and vSAN.

The following products are part of the VVD Bill of Materials, but not included in the current iteration of the Compliance Kit: vRealize, vRealize Automation (vRA), vRealize Operations Manager (vROPS), and vRealize Log Insight (vRLI). The documentation surrounding the configuration of these products does exist and is sourced from their respective *DISA Security Technical Implementation Guides*, which can be reviewed at https://public.cyber.mil/stigs/downloads. There are two examples for these configurations sampled from the *Configuration Guide* (Sections 8.3.3 and 8.3.4).

8.3.1 Example VVD 5.0.1 Configuration: Configure the Password and Policy Lockout Setting in vCenter Server in Region A

1. In a web browser, log into vCenter by using the vSphere Web Client.
2. Configure the password policies.
    a. From the **Home** menu of the vSphere Web Client, click **Administration**.
    b. In the Navigator, under **Single Sign-On**, click **Configuration**.
    c. On the **Policies** tab, under **Password Policy**, click **Edit**.
    d. In the **Edit Password Policies** dialog box, configure the password policies and click **OK**.
        i. **Maximum Lifetime** should be set to `60`.
        ii. **Restrict Reuse** should be set to `5`.
        iii. **Minimum Length** should be set to `15`.

   iv. **Upper-case Characters** should be set to `1`.
   v. **Lower-case Characters** should be set to `1`.
   vi. **Numeric Characters** should be set to `1`.
   vii. **Special Characters** should be set to `1`.

3. Configure the lockout policies.
   a. On the **Policies** tab, click **Lockout Policy** and click **Edit**.
   b. In the **Edit Lockout Policy** dialog box, for **Maximum Number of Failed Login Attempts**, enter `3`.
   c. For **Interval Between Failures**, enter `900`.
   d. For **Unlock Time**, enter `0` and then click **OK**.

8.3.2 Example VVD 5.0.1 Configuration: Configure Encryption Management in Region A

1. In a web browser, log in to vCenter Server by using the vSphere Web Client.
2. Enable **Host Encryption Mode** on the **sfo01m01esx01.sfo01.rainpole.local** host.
   a. From the **Home** menu of the vSphere Web Client, select **Hosts and Clusters**.
   b. Under the **sfo01-m01dc data center**, select the **sfo01m01esx01.sfo01.rainpole.local** host and click the **Configure** tab.
   c. Under **System**, click **Security profile**.
   d. Under **Host Encryption Mode**, click **Edit**.
   e. In the **Set Encryption Mode** dialog box, from the **Encryption Mode** drop-down menu, select **Enabled** and click **OK**.
   f. Repeat the procedure for all remaining hosts in Region A.
3. Enable VM encryption on all the VMs and virtual disks.
   a. From the **Home** menu of the vSphere Web Client, select **VMs and Templates**.
   b. Under the **sfo01-m01dc data center**, expand the **sfo01-m01fd-bcdr** folder, right-click the **sfo01m01vc01 VM** and select **VM Policies**, then **Edit VM Storage Policies**.
   c. From the **VM Storage Policy** drop-down menu, select **VM Encryption Policy**, click **Apply to all**, and click **OK**.
   d. Repeat the procedure to reconfigure the remaining VMs in Region A.

8.3.3 Example vRealize Automation DISA STIG Configuration: Configure SLES for vRealize to protect the confidentiality and integrity of transmitted information

1. Update the "Ciphers" directive with the following command:

   ```
   sed -i "/^[^#]*Ciphers/ c\Ciphers aes256-ctr,aes128-ctr"
   /etc/ssh/sshd_config
   ```

2. Save and close the file.
3. Restart the sshd process:

   ```
   service sshd restart
   ```

8.3.4 Example vRealize Operations Manager DISA STIG Configuration: Configure the vRealize Operations server session timeout

1. Logon to the admin UI as the administrator.
2. Navigate to **Global Settings**.
3. Select **Edit Global Settings**.
4. Set the **Session Timeout:** setting to **15** minutes.
5. Select **OK.**

8.4 Operation, Monitoring, and Maintenance

This section explains how to operate, monitor, and maintain various VMware products. It points to existing documentation whenever possible, so this document only includes supplemental information, such as backup and recovery processes, and specific monitoring practices recommended for the example solution.

8.4.1 Operation

This section discusses the basic operation of the VVD 5.0.1 for an SDDC, in addition to any relevant products associated with such operations.

vSphere vCenter Server (vCS) Appliance is a management application that allows for the management of VMs and ESXi hosts centrally. The vSphere Web Client is used to access the vCS.

vRealize Operations Manager (vROPS) tracks and analyzes the operation of multiple data sources in the SDDC by using specialized analytic algorithms. The algorithms help vROPS learn and predict the behavior of every object that it monitors. Users access this information by views, reports, and dashboards.

vRealize Automation (vRA) provides a secure web portal where authorized administrators, developers, and business owners can request new IT services and manage specific cloud and IT resources, while ensuring compliance with business policies.

Please review the following for further information and discussion pertaining to the operational standards of the VVD 5.0.1 for an SDDC: *VMware Validated Design Documentation*, *VMware Validated Design 5.0.1 Compliance Kit for NIST 800-53*, and *NIST SP 1800-19B*.

8.4.2 Monitoring

This section outlines monitoring and alerting functionalities and best practices pertaining to VVD.

Use the vRealize Log Insight (vRLI) event signature engine to monitor key events and to send filtered or tagged events to one or more remote destinations. You can use a set of alerts to send to vROPS and through SMTP for operations team notification. The use of vRLI allows you to monitor the SDDC and provide troubleshooting and cause analysis, which can reduce operating costs.

With the integration between vRLI and vROPS, you can implement the following cross-product event tracking:

- Send alerts from vRLI to vROPS, which maps them to the target objects.
- Launch in context from a vROPS object to the objects logs in vRLI.
- Launch in context from a vRLI event to the objects in vROPS.

Use applications in vROPS to group monitoring data about the virtual machines of the SDDC management components.

vROPS builds an application to determine how your environment is affected when one or more components experience problems. You can also monitor the overall health and performance of the application.

vROPS collects data from the components in the application and displays the results in a summary dashboard with a real-time analysis for any or all the components.

Ensuring that your backup solution is configured to trigger an email alert generation showing the status of your backup jobs is a recommended practice within the SDDC. This should be included in daily monitoring activities to ensure that all management objects within the SDDC have successful backup images. The following can be done to enable broad monitoring using vROPS:

1. Create applications in vROPS to group the monitoring data
    a. about the VMs of vRealize Suite Lifecycle Manager
    b. about the VMs of vRLI

   c. about the VMs of VMware Site Recovery Manager
   d. about the VMs of VMware vSphere Replication (vR)
   e. for the VMs of vROPS
   f. collected from your vSphere Storage APIs for Data Protection (VADP)-based backup solution VMs
   g. about the VMs of VMware vSphere Update Manager Download Service (UMDS)
2. Create email notifications in vROPS so it informs the SDDC operators of issues in the main monitoring parameters of the environment.
3. Configure vROPS to send email notifications about important alerts in the SDDC.

Please review the *Monitoring and Alerting* documentation for more information regarding the monitoring of the VVD 4.3 deployment, and the VVD for SDDC 5.0.1 release notes for more information on monitoring for VVD 5.0.1 deployments.

8.4.3 Maintenance

This section outlines the steps to perform an SDDC upgrade that follows a defined upgrade path. The NCCoE project started with VVD version 4.3 and upgraded to 5.0.1. Table 8-1 provides a summary of the system requirements and upgrade sequence associated with the Bill of Materials (BOM) or product versions associated with each VVD version. This upgrade path is functional and defined by layers in which the components are upgraded or updated. It is important to note that functional and scalability tests for individual patches and express patches are not required for an environment.

Table 8-1: Summary of VVD Version and Associated Bill of Materials (Product Versions)

SDDC Layer	Product Name	Product Version in VVD 4.3	Product Version in VVD 5.0.1	Operation Type
Operations Management	vRealize Suite Lifecycle Manager	1.2	2.0.0 Patch 2	Upgrade
	vRealize Log Insight	4.6	4.7	Upgrade
	vRealize Log Insight Agent	4.6	4.7	Upgrade
	vRealize Operations Manager	6.7	7.0	Upgrade
Cloud Management	vRealize Business for Cloud	7.4	7.5	Upgrade
	vRealize Automation with Embedded vRealize Orchestrator	7.4	7.5	Upgrade

SDDC Layer	Product Name	Product Version in VVD 4.3	Product Version in VVD 5.0.1	Operation Type
Business Continuity	Site Recovery Manager	6.5.1.1	8.1.1	Upgrade
	vSphere Replication	6.5.1.3	8.1.1	Upgrade
	Backup solution based on VMware vSphere Storage APIs for Data Protection	Compatible Version	Compatible Version	Vendor Specific
Virtual Infrastructure	NSX Data Center for vSphere	6.4.1	6.4.4	Update
	Platform Services Controller	6.5 Update 2	6.7 Update 1	Upgrade
	vCenter Server	6.5 Update 2	6.7 Update 1	Upgrade
	vSphere Update Manager Download Service	6.5 Update 2	6.7 Update 1	Upgrade
	ESXi	6.5 Update 2	6.7 Update 1	Upgrade
	vSAN	6.6.1 Update 2	6.7 Update 1	Upgrade

The following are tips for upgrading the SDDC:

- Before you begin any upgrade process, review all the release notes.
- Consider that the SDDC design and implementation may be affected by security features that are enabled. Ensure interoperability testing is performed before and after making security changes, as well as when introducing new features, functionality, and bug fixes.
- The environment within the NCCoE lab varies from the traditional VVD deployment because for the NCCoE, additional integration with vendors is included, e.g., integration between HyTrust components and Key Management Server (KMS) and the VVD.
- Note that if a distributed environment is used, ensure there is replication by using the *vdcrepadmin* command line interface between the platform services controller (PSC) and the vCenter environments. This can be checked by following the instructions in VMware Knowledge Base article 2127057.
- Perform a backup copy of your current certificates before you start the upgrade process. If you need to request a new certificate, ensure you follow the procedures in this document for VVD 4.3 and this document for VVD 5.1.

The following is a tip for updating the SDDC:

- Before performing an update, ensure an operational verification test is performed before and after the update. In most cases, updates should not impact the SDDC design and implementation (updates could include patches and bug fixes).

Updates that are not validated by VVD should be approached with caution.

- Scalability and functionality tests for individual patches, express patches, and hot fixes are not typically performed using the VVD. If a patch must be applied to your environment, follow the VMware published practices and VMware Knowledge Base articles for the specific patch. If an issue occurs during or after the process of applying a patch, contact VMware Technical Support.
- For further information and instruction regarding an update, please see the following documentation for VVD 4.3 or VVD 5.0.

8.5 Product Configuration Overview

This section contains Table 8-2, which details all configurations for each product, their corresponding enhanced or built-in label, and their mapped NIST SP 800-53 Revision 4 control(s). The labels are derived from the compliance kit with the exception of the vRA and vROPS items, which are sourced directly from their corresponding DISA STIGs.

There are only a small number of vROPS and vRA DISA STIGs included in the following table, which means it does not include all available configurations. For the entire compilation of vROPS and vRA DISA STIGs, please review the following links:

- VMware vRealize Automation 7.x Lighttpd
- VMware vRealize Automation 7.x SLES
- VMware vRealize Automation 7.x tc Server
- VMware vRealize Operations Manager 6.x Application
- VMware vRealize Operations Manager 6.x SLES
- VMware vRealize Operations Manager 6.x tc Server
- VMware vRealize – Cassandra

There are a few notable items for which there are no NIST control mappings; rather, they are identified as “VMware Best Practices”. These items are not sourced from any existing DISA STIGs, hardening guides, or other compliance frameworks. As such, they are only defined as “VMware Best Practices” and their implementation is strongly recommended.

925 **Table 8-2: Configuration Items Without Control Mappings**

Product Name	Configuration Label	Enhanced or Built-in	NIST SP 800-53 Rev. 4 Controls
ESXi	NIST80053-VI-ESXI-CFG-00048	Enhanced	AC-12
ESXi	NIST80053-VI-ESXI-CFG-00146	Built-In	AC-14a, AC-14b
ESXi	NIST80053-VI-ESXI-CFG-00031	Enhanced	AC-17
ESXi	NIST80053-VI-ESXI-CFG-00165	Built-In	AC-7
ESXi	NIST80053-VI-ESXI-CFG-00002	Enhanced	AC-8
NSX	NIST80053-VI-NET-CFG-00343	Built-In	CM-7
NSX	NIST80053-VI-NET-CFG-00344	Built-In	CM-7
NSX	NIST80053-VI-NET-CFG-00372	Enhanced	CP-9
NSX	NIST80053-VI-NET-CFG-00374	Enhanced	CP-9
NSX	NIST80053-VI-NET-CFG-00312	Built-In	IA-5
vCenter	NIST80053-VI-VC-CFG-00453	Built-In	VMware Best Practice only. No specific UCF_NIST_800_53_R4_High control is associated with this capability.
vCenter	NIST80053-VI-VC-CFG-00465	Built-In	VMware Best Practice only. No specific UCF_NIST_800_53_R4_High control is associated with this capability.
vCenter	NIST80053-VI-VC-CFG-00442	Enhanced	AU-5(2)
vCenter	NIST80053-VI-VC-CFG-00461	Built-In	AU-9, AU-6a, AU-2d, AC-6(9)
vCenter	NIST80053-VI-VC-CFG-00460	Built-In	AU-9, AU-7b, AU-7a, AU-7(1), AU-6a, AU-12c, AU-12a, AC-6(9)
vRA	VRAU-TC-000710	Enhanced	AC-17 (1)
vRA	VRAU-VA-000010	Enhanced	AC-17 (2)
vRA	VRAU-HA-000140	Enhanced	CM-7a
vRA	VRAU-LI-000215	Enhanced	CM-7a
vRA	VRAU-SL-000360	Enhanced	IA-5 (1) (b)
vRA	VRAU-VI-000240	Enhanced	IA-5 (1) (c)
vRA	VRAU-AP-000265	Enhanced	IA-7
vRA	VRAU-PG-000470	Enhanced	SC-13
vROPS	VROM-CS-000005	Enhanced	AC-3
vROPS	VROM-PG-000220	Enhanced	IA-7

Product Name	Configuration Label	Enhanced or Built-in	NIST SP 800-53 Rev. 4 Controls
vROPS	VROM-SL-001240	Enhanced	SC-13
vROPS	VROM-TC-000505	Enhanced	SC-2
vSAN	NIST80053-VI-Storage-SDS-CFG-00182	Built-In	AC-11a
vSAN	NIST80053-VI-Storage-SDS-CFG-00186	Enhanced	AU-4
vSAN	NIST80053-VI-Storage-SDS-CFG-00180	Built-In	AU-8b, AU-8a, AU-8(1)(b), AU-8(1)(a)
vSAN	NIST80053-VI-Storage-SDS-CFG-00181	Built-In	AU-9, AU-7b, AU-7a, AU-7(1), AU-6a, AU-12c, AU-12a, AC-6(9)
vSAN	NIST80053-VI-Storage-SDS-CFG-00183	Enhanced	SC-13, MP-5(4), AU-9(3)
vSphere	NIST80053-VI-VSPHERE-CFG-00571	Enhanced	CM-6
vSphere	NIST80053-VI-VSPHERE-CFG-00563	Enhanced	IA-2

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Appendix A Security Configuration Setting Mappings

This appendix captures the security configuration settings (Common Configuration Enumerations [CCEs]), which are mapped to the associated NIST SP 800-53 [1] controls and NIST Cybersecurity Framework [2] subcategories. The settings have not yet been fully inventoried. The completed mappings are planned for inclusion in the next draft of this guide.

The following table lists the VMware products and their associated security configurations.

CCE ID	Configuration(s)	Built-In/Enhanced	Product	Audit Procedure	Recommended Parameter Value
CCE-84401-9	NIST80053-VI-ESXi-CFG-00001	Enhanced	ESXi	Connect via SSH and run the following command: # grep -i "^Ciphers" /etc/ssh/sshd_config If there is no output or the output is not “Ciphers aes128-ctr,aes192-ctr,aes256-ctr,aes128-cbc,aes192-cbc,aes256-cbc” or a subset of this list, ciphers that are not FIPS-approved are in use, so this is a finding.	aes128-ctr,aes192-ctr,aes256-ctr,aes128-cbc,aes192-cbc,aes256-cbc
CCE-84402-7	NIST80053-VI-ESXi-CFG-00002	Enhanced	ESXi	Connect via SSH and run the following command: # grep -i "^Protocol" /etc/ssh/sshd_config If there is no output or the output is not exactly “Protocol 2”, this is a finding.	2
CCE-84403-5	NIST80053-VI-ESXi-CFG-00003	Enhanced	ESXi	Connect via SSH and run the following command: # grep -i "^IgnoreRhosts" /etc/ssh/sshd_config If there is no output or the output is not exactly “IgnoreRhosts yes”, this is a finding.	yes
CCE-84404-3	NIST80053-VI-ESXi-	Enhanced	ESXi	Connect via SSH and run the following command: # grep -i "^HostbasedAuthentication" /etc/ssh/sshd_config	no

CCE ID	Configuration(s)	Built-In/Enhanced	Product	Audit Procedure	Recommended Parameter Value
	CFG-00004			If there is no output or the output is not exactly “HostbasedAuthentication no”, this is a finding.	
CCE-84405-0	NIST80053-VI-ESXi-CFG-00005	Enhanced	ESXi	Connect via SSH and run the following command: # grep -i "^PermitRootLogin" /etc/ssh/sshd_config If there is no output or the output is not exactly “PermitRootLogin no”, this is a finding.	no
CCE-84406-8	NIST80053-VI-ESXi-CFG-00006	Enhanced	ESXi	Connect via SSH and run the following command: # grep -i "^PermitEmptyPasswords" /etc/ssh/sshd_config If there is no output or the output is not exactly “PermitEmptyPasswords no”, this is a finding.	no
CCE-84407-6	NIST80053-VI-ESXi-CFG-00007	Enhanced	ESXi	Connect via SSH and run the following command: # grep -i "^PermitUserEnvironment" /etc/ssh/sshd_config If there is no output or the output is not exactly “PermitUserEnvironment no”, this is a finding.	no
CCE-84408-4	NIST80053-VI-ESXi-CFG-00008	Enhanced	ESXi	Connect via SSH and run the following command: # grep -i "^MACs" /etc/ssh/sshd_config If there is no output or the output is not exactly “MACs hmac-sha1,hmac-sha2-256,hmac-sha2-512”, this is a finding.	hmac-sha1,hmac-sha2-256,hmac-sha2-512
CCE-84409-2	NIST80053-VI-ESXi-	Enhanced	ESXi	Connect via SSH and run the following command: # grep -i "^GSSAPIAuthentication" /etc/ssh/sshd_config	no

CCE ID	Configuration(s)	Built-In/Enhanced	Product	Audit Procedure	Recommended Parameter Value
	CFG-00009			If there is no output or the output is not exactly “GSSAPIAuthentication no”, this is a finding.	
CCE-84410-0	NIST80053-VI-ESXi-CFG-00010	Enhanced	ESXi	Connect via SSH and run the following command: # grep -i "^KerberosAuthentication" /etc/ssh/sshd_config If there is no output or the output is not exactly “KerberosAuthentication no”, this is a finding.	no
CCE-84411-8	NIST80053-VI-ESXi-CFG-00011	Enhanced	ESXi	Connect via SSH and run the following command: # grep -i "^StrictModes" /etc/ssh/sshd_config If there is no output or the output is not exactly “StrictModes yes”, this is a finding.	yes
CCE-84412-6	NIST80053-VI-ESXi-CFG-00012	Enhanced	ESXi	Connect via SSH and run the following command: # grep -i "^Compression" /etc/ssh/sshd_config If there is no output or the output is not exactly “Compression no”, this is a finding.	no
CCE-84413-4	NIST80053-VI-ESXi-CFG-00013	Enhanced	ESXi	Connect via SSH and run the following command: # grep -i "^GatewayPorts" /etc/ssh/sshd_config If there is no output or the output is not exactly “GatewayPorts no”, this is a finding.	no
CCE-84414-2	NIST80053-VI-ESXi-CFG-00014	Enhanced	ESXi	Connect via SSH and run the following command: # grep -i "^X11Forwarding" /etc/ssh/sshd_config	no

CCE ID	Configuration(s)	Built-In/Enhanced	Product	Audit Procedure	Recommended Parameter Value
				If there is no output or the output is not exactly “X11Forwarding no”, this is a finding.	
CCE-84415-9	NIST80053-VI-ESXi-CFG-00015	Enhanced	ESXi	Connect via SSH and run the following command: # grep -i "^AcceptEnv" /etc/ssh/sshd_config If there is no output or the output is not exactly “AcceptEnv”, this is a finding.	AcceptEnv
CCE-84416-7	NIST80053-VI-ESXi-CFG-00016	Enhanced	ESXi	Connect via SSH and run the following command: # grep -i "^PermitTunnel" /etc/ssh/sshd_config If there is no output or the output is not exactly “PermitTunnel no”, this is a finding.	no
CCE-84417-5	NIST80053-VI-ESXi-CFG-00017	Enhanced	ESXi	Connect via SSH and run the following command: # grep -i "^ClientAliveCountMax" /etc/ssh/sshd_config If there is no output or the output is not exactly “ClientAliveCountMax 3”, this is a finding.	3
CCE-84418-3	NIST80053-VI-ESXi-CFG-00018	Enhanced	ESXi	Connect via SSH and run the following command: # grep -i "^ClientAliveInterval" /etc/ssh/sshd_config If there is no output or the output is not exactly “ClientAliveInterval 200”, this is a finding.	200
CCE-84419-1	NIST80053-VI-ESXi-CFG-00019	Enhanced	ESXi	Connect via SSH and run the following command: # grep -i "^MaxSessions" /etc/ssh/sshd_config	1

CCE ID	Configuration(s)	Built-In/Enhanced	Product	Audit Procedure	Recommended Parameter Value
				If there is no output or the output is not exactly "MaxSessions 1", this is a finding.	
CCE-84420-9	NIST80053-VI-ESXi-CFG-00020	Enhanced	ESXi	Connect via SSH and run the following command: # grep -i "^Ciphers" /etc/ssh/sshd_config If there is no output or the output is not exactly "Ciphers aes128-ctr,aes192-ctr,aes256-ctr,aes128-cbc,aes192-cbc,aes256-cbc", ciphers that are not FIPS-approved may be used, so this is a finding.	aes128-ctr,aes192-ctr,aes256-ctr,aes128-cbc,aes192-cbc, aes256-cbc
CCE-84421-7	NIST80053-VI-ESXi-CFG-00022	Enhanced	ESXi	From a PowerCLI command prompt, while connected to the ESXi host run the following command: Get-VMHost | Get-AdvancedSetting -Name Security.PasswordQualityControl If Security.PasswordQualityControl is not set to "similar=deny retry=3 min=disabled,disabled,disabled,disabled,15", this is a finding.	similar=deny retry=3 min=disabled,disabled,disabled,disabled,15
CCE-84422-5	NIST80053-VI-ESXi-CFG-00028	Enhanced	ESXi	From a PowerCLI command prompt, while connected to the ESXi host run the following command: Get-VMHost | Get-VMHostFirewallException | Where {$_.Name -eq 'SSH Server' -and $_.Enabled -eq $true} \| Select Name,Enabled,@{N="AllIPEnabled";E={$_.ExtensionData.AllowedHosts.AllIP}} If for an enabled service "Allow connections from any IP address" is selected, this is a finding.	AllIPEnabled: False

CCE ID	Configuration(s)	Built-In/Enhanced	Product	Audit Procedure	Recommended Parameter Value
CCE-84423-3	NIST80053-VI-ESXi-CFG-00030	Enhanced	ESXi	From a PowerCLI command prompt, while connected to the ESXi host run the following command: Get-VMHost | Get-AdvancedSetting -Name UserVars.SuppressShellWarning If UserVars.SuppressShellWarning is not set to 0, this is a finding.	0
CCE-84424-1	NIST80053-VI-ESXi-CFG-00031	Enhanced	ESXi	From a PowerCLI command prompt, while connected to the ESXi host run the following command: Get-VMHost | Select Name,@{N="Lockdown";E={$_.Extensiondata.Config.LockdownMode}} If Lockdown Mode is disabled, this is a finding. For environments that do not use vCenter server to manage ESXi, this is not applicable.	lockdownNormal
CCE-84425-8	NIST80053-VI-ESXi-CFG-00034	Enhanced	ESXi	From a PowerCLI command prompt, while connected to the ESXi host run the following command: Get-VMHost | Get-AdvancedSetting -Name Security.AccountLockFailures If Security.AccountLockFailures is not set to 3, this is a finding.	3
CCE-84426-6	NIST80053-VI-ESXi-CFG-00038	Enhanced	ESXi	From a PowerCLI command prompt, while connected to the ESXi host run the following command: Get-VMHost | Get-AdvancedSetting -Name UserVars.ESXiShellInteractiveTimeOut	600

CCE ID	Configuration(s)	Built-In/Enhanced	Product	Audit Procedure	Recommended Parameter Value
				If UserVars.ESXiShellInteractiveTimeOut is not set to 600, this is a finding.	
CCE-84427-4	NIST80053-VI-ESXi-CFG-00039	Enhanced	ESXi	From a PowerCLI command prompt, while connected to the ESXi host run the following command: Get-VMHost | Get-AdvancedSetting -Name UserVars.ESXiShellTimeOut If UserVars.ESXiShellTimeOut is not set to 600, this is a finding.	600
CCE-84428-2	NIST80053-VI-ESXi-CFG-00043	Enhanced	ESXi	From a PowerCLI command prompt, while connected to the ESXi host run the following command: Get-VMHost | Get-AdvancedSetting -Name Net.BlockGuestBPDU If Net.BlockGuestBPDU is not set to 1, this is a finding.	1
CCE-84429-0	NIST80053-VI-ESXi-CFG-00056	Enhanced	ESXi	From a PowerCLI command prompt, while connected to the ESXi host run the following commands: $esxcli = Get-EsxCli $esxcli.system.coredump.network.get() If there is no active core dump partition or the network core dump collector is not configured and enabled, this is a finding.	TRUE
CCE-84430-8	NIST80053-VI-ESXi-CFG-00106	Built-in	ESXi	From a PowerCLI command prompt, while connected to the ESXi host run the following command: Get-VMHostFirewallDefaultPolicy If the Incoming or Outgoing policies are True, this is a finding.	FALSE

CCE ID	Configuration(s)	Built-In/Enhanced	Product	Audit Procedure	Recommended Parameter Value
CCE-84431-6	NIST80053-VI-ESXi-CFG-00107	Enhanced	ESXi	Log in to the host and run the following command: # ls -la /etc/ssh/keys-root/authorized_keys If the authorized_keys file exists, this is a finding.	File should not exist
CCE-84432-4	NIST80053-VI-ESXi-CFG-00108	Built-in	ESXi	From a PowerCLI command prompt, while connected to the ESXi host run the following command: Get-VMHostSnmp | Select * or From a console or ssh session run the following command: esxcli system snmp get If SNMP is not in use and is enabled, this is a finding. If SNMP is enabled and “read only communities” is set to public, this is a finding. If SNMP is enabled and is not using v3 targets, this is a finding. Note: SNMP v3 targets can only be viewed and configured from the esxcli command.	FALSE
CCE-84433-2	NIST80053-VI-ESXi-CFG-00109	Enhanced	ESXi	Connect via SSH and run the following command: # grep -i "^password" /etc/pam.d/passwd | grep sufficient If the remember setting is not set or is not “remember=5”, this is a finding.	remember=5

CCE ID	Configuration(s)	Built-In/Enhanced	Product	Audit Procedure	Recommended Parameter Value
CCE-84434-0	NIST80053-VI-ESXi-CFG-00110	Built-in	ESXi	Run the following command: # grep -i "^password" /etc/pam.d/passwd | grep sufficient If sha512 is not listed, this is a finding.	sha512
CCE-84435-7	NIST80053-VI-ESXi-CFG-00111	Enhanced	ESXi	From a PowerCLI command prompt, while connected to the ESXi host run the following command: Get-VMHost | Get-VMHostService | Where {$_.Label -eq "SSH"} If the ESXi SSH service is running, this is a finding.	Policy: Off and Running: False
CCE-84436-5	NIST80053-VI-ESXi-CFG-00112	Enhanced	ESXi	From a PowerCLI command prompt, while connected to the ESXi host run the following command: Get-VMHost | Get-VMHostService | Where {$_.Label -eq "ESXi Shell"} If the ESXi Shell service is running, this is a finding.	Policy: Off and Running: False
CCE-84437-3	NIST80053-VI-ESXi-CFG-00113	Enhanced	ESXi	From a PowerCLI command prompt, while connected to the ESXi host run the following command: Get-VMHost | Get-VMHostService | Where {$_.Label -eq "SSH"} If the ESXi SSH service is running, this is a finding.	Policy: Off and Running: False
CCE-84438-1	NIST80053-VI-ESXi-CFG-00114	Built-in	ESXi	From a PowerCLI command prompt, while connected to the ESXi host run the following command: Get-VMHost | Get-VMHostAuthentication For systems that do not use Active Directory and have no local user accounts, other than root, dcui, and/or vpxuser, this is not	sfo01.rainpole.local

CCE ID	Configuration(s)	Built-In/Enhanced	Product	Audit Procedure	Recommended Parameter Value
				applicable. For systems that do not use Active Directory and do have local user accounts, other than root, dcui, and/or vpxuser, this is a finding. If Directory Services Type is not set to “Active Directory”, this is a finding.	
CCE-84439-9	NIST80053-VI-ESXi-CFG-00115	Built-in	ESXi	From a PowerCLI command prompt, while connected to vCenter run the following command: Get-VMHost | Select Name, ` @{N="HostProfile";E={$_ \| Get-VMHostProfile}}, ` @{N="JoinADEnabled";E={($_ | Get-VmHostProfile).ExtensionData.Config.ApplyProfile.Authentication.ActiveDirectory.Enabled}}, ` @{N="JoinDomainMethod";E={(($_ \| Get-VMHostProfile).ExtensionData.Config.ApplyProfile.Authentication.ActiveDirectory \| Select -ExpandProperty Policy \| Where {$_.Id -eq "JoinDomainMethodPolicy"}).Policyoption.Id}} Verify if "JoinADEnabled" is "True" then "JoinDomainMethod" should be "FixedCAMConfigOption". For systems that do not use Active Directory and have no local user accounts, other than root, dcui, and/or vpxuser, this is not applicable. For systems that do not use Active Directory and do have local user accounts, other than root, dcui, and/or vpxuser, this is a finding.	JoinADEnabled: True, JoinDomainMethod: FixedCAMConfigOption

CCE ID	Configuration(s)	Built-In/Enhanced	Product	Audit Procedure	Recommended Parameter Value
				If vSphere Authentication Proxy is not used to join hosts to an Active Directory domain, this is a finding.	
CCE-84440-7	NIST80053-VI-ESXi-CFG-00116	Built-in	ESXi	From a PowerCLI command prompt, while connected to the ESXi host run the following command: Get-VMHost | Get-VMHostAuthentication For systems that do not use Active Directory and have no local user accounts, other than root, dcui, and/or vpxuser, this is not applicable. For systems that do not use Active Directory and do have local user accounts, other than root, dcui, and/or vpxuser, this is a finding. If the Directory Services Type is not set to “Active Directory”, this is a finding.	sfo01.rainpole.local
CCE-84441-5	NIST80053-VI-ESXi-CFG-00117	Built-in	ESXi	From a PowerCLI command prompt, while connected to vCenter run the following command: Get-VMHost | Select Name, ` @{N="HostProfile";E={$_ \| Get-VMHostProfile}}, ` @{N="JoinADEnabled";E={($_ | Get-VmHostProfile).ExtensionData.Config.ApplyProfile.Authentication.ActiveDirectory.Enabled}}, ` @{N="JoinDomainMethod";E={(($_ \| Get-VMHostProfile).ExtensionData.Config.ApplyProfile.Authentication.ActiveDirectory \| Select -ExpandProperty Policy \| Where {$_.Id -eq "JoinDomainMethodPolicy"}).Policyoption.Id}} Verify if "JoinADEnabled" is "True" then "JoinDomainMethod" should be "FixedCAMConfigOption".	sfo01.rainpole.local

CCE ID	Configuration(s)	Built-In/Enhanced	Product	Audit Procedure	Recommended Parameter Value
				For systems that do not use Active Directory and have no local user accounts, other than root, dcui, and/or vpxuser, this is not applicable. For systems that do not use Active Directory and do have local user accounts, other than root, dcui, and/or vpxuser, this is a finding. If vSphere Authentication Proxy is not used to join hosts to an Active Directory domain, this is a finding.	
CCE-84442-3	NIST80053-VI-ESXi-CFG-00118	Built-in	ESXi	From a PowerCLI command prompt, while connected to the ESXi host run the following command: Get-VMHost | Get-VMHostAuthentication For systems that do not use Active Directory and have no local user accounts, other than root, dcui, and/or vpxuser, this is not applicable. For systems that do not use Active Directory and do have local user accounts, other than root, dcui, and/or vpxuser, this is a finding. If Directory Services Type is not set to “Active Directory”, this is a finding.	sfo01.rainpole.local
CCE-84443-1	NIST80053-VI-ESXi-CFG-00119	Built-in	ESXi	From a PowerCLI command prompt, while connected to vCenter run the following command: Get-VMHost | Select Name, ` @{N="HostProfile";E={$_ \| Get-VMHostProfile}}, ` @{N="JoinADEnabled";E={($_ | Get-	sfo01.rainpole.local

CCE ID	Configuration(s)	Built-In/Enhanced	Product	Audit Procedure	Recommended Parameter Value
				VmHostProfile).ExtensionData.Config.ApplyProfile.Authentication.ActiveDirectory.Enabled}}, ` @{N="JoinDomainMethod";E={(($_ \| Get-VMHostProfile).ExtensionData.Config.ApplyProfile.Authentication.ActiveDirectory \| Select -ExpandProperty Policy \| Where {$_.Id -eq "JoinDomainMethodPolicy"}).Policyoption.Id}} Verify if "JoinADEnabled" is "True" then "JoinDomainMethod" should be "FixedCAMConfigOption". For systems that do not use Active Directory and have no local user accounts, other than root, dcui, and/or vpxuser, this is not applicable. For systems that do not use Active Directory and do have local user accounts, other than root, dcui, and/or vpxuser, this is a finding. If vSphere Authentication Proxy is not used to join hosts to an Active Directory domain, this is a finding.	
CCE-84444-9	NIST80053-VI-ESXi-CFG-00120	Built-in	ESXi	From a PowerCLI command prompt, while connected to the ESXi host run the following command: Get-VMHost | Get-VMHostAuthentication For systems that do not use Active Directory and have no local user accounts, other than root, dcui, and/or vpxuser, this is not applicable. For systems that do not use Active Directory and do have local user accounts, other than root, dcui, and/or vpxuser, this is a	sfo01.rainpole.local

CCE ID	Configuration(s)	Built-In/Enhanced	Product	Audit Procedure	Recommended Parameter Value
				finding. If Directory Services Type is not set to “Active Directory”, this is a finding.	
CCE-84445-6	NIST80053-VI-ESXi-CFG-00121	Built-in	ESXi	From a PowerCLI command prompt, while connected to vCenter run the following command: Get-VMHost | Select Name, ` @{N="HostProfile";E={$_ \| Get-VMHostProfile}}, ` @{N="JoinADEnabled";E={($_ | Get-VmHostProfile).ExtensionData.Config.ApplyProfile.Authentication.ActiveDirectory.Enabled}}, ` @{N="JoinDomainMethod";E={(($_ \| Get-VMHostProfile).ExtensionData.Config.ApplyProfile.Authentication.ActiveDirectory \| Select -ExpandProperty Policy \| Where {$_.Id -eq "JoinDomainMethodPolicy"}).Policyoption.Id}} Verify if "JoinADEnabled" is "True" then "JoinDomainMethod" should be "FixedCAMConfigOption". For systems that do not use Active Directory and have no local user accounts, other than root, dcui, and/or vpxuser, this is not applicable. For systems that do not use Active Directory and do have local user accounts, other than root, dcui, and/or vpxuser, this is a finding. If vSphere Authentication Proxy is not used to join hosts to an Active Directory domain, this is a finding.	sfo01.rainpole.local

CCE ID	Configuration(s)	Built-In/Enhanced	Product	Audit Procedure	Recommended Parameter Value
CCE-84446-4	NIST80053-VI-ESXi-CFG-00122	Enhanced	ESXi	From a PowerCLI command prompt, while connected to the ESXi host run the following command: Get-VMHost | Get-AdvancedSetting -Name Annotations.WelcomeMessage Check for the login banner text (mentioned in the parameter value) based on the character limitations imposed by the system. An exact match of the text is required. If this banner is not displayed, this is a finding.	This system is for the use of authorized users only. Individuals using this computer system without authority or in excess of their authority are subject to having all their activities on this system monitored and recorded by system personnel. Anyone using this system expressly consents to such monitoring and is advised that if such monitoring reveals possible evidence of criminal activity system personal may provide the evidence of such monitoring to law enforcement officials.
CCE-84447-2	NIST80053-VI-ESXi-CFG-00123	Enhanced	ESXi	From a PowerCLI command prompt, while connected to the ESXi host run the following command: Get-VMHost | Get-AdvancedSetting -Name Config.Etc.issue	This system is for the use of authorized users only. Individuals using this computer system

CCE ID	Configuration(s)	Built-In/Enhanced	Product	Audit Procedure	Recommended Parameter Value
				If the Config.Etc.issue setting (/etc/issue file) does not contain the logon banner exactly as shown in the parameter value, this is a finding.	without authority or in excess of their authority are subject to having all their activities on this system monitored and recorded by system personnel. Anyone using this system expressly consents to such monitoring and is advised that if such monitoring reveals possible evidence of criminal activity system personal may provide the evidence of such monitoring to law enforcement officials.
CCE-84448-0	NIST80053-VI-ESXi-CFG-00124	Enhanced	ESXi	Connect via SSH and run the following command: # grep -i "^Banner" /etc/ssh/sshd_config If there is no output or the output is not exactly "Banner /etc/issue", this is a finding.	This system is for the use of authorized users only. Individuals using this computer system without authority or in excess of their authority are subject to having all their

CCE ID	Configuration(s)	Built-In/Enhanced	Product	Audit Procedure	Recommended Parameter Value
					activities on this system monitored and recorded by system personnel. Anyone using this system expressly consents to such monitoring and is advised that if such monitoring reveals possible evidence of criminal activity system personal may provide the evidence of such monitoring to law enforcement officials.
CCE-84449-8	NIST80053-VI-ESXi-CFG-00125	Enhanced	ESXi	From a PowerCLI command prompt, while connected to the ESXi host run the following script: $vmhost = Get-VMHost | Get-View $lockdown = Get-View $vmhost.ConfigManager.HostAccessManager $lockdown.QueryLockdownExceptions() If the exception users list contains accounts that do not require special permissions, this is a finding. Note: This list is not intended for system administrator accounts but for special circumstances such as a service account.	Remove unnecessary users from the exception user list

CCE ID	Configuration(s)	Built-In/Enhanced	Product	Audit Procedure	Recommended Parameter Value
CCE-84450-6	NIST80053-VI-ESXi-CFG-00127	Enhanced	ESXi	From a PowerCLI command prompt, while connected to the ESXi host run the following command: Get-VMHost | Get-AdvancedSetting -Name Annotations.WelcomeMessage Check for the login banner text (mentioned in the parameter value) based on the character limitations imposed by the system. An exact match of the text is required. If this banner is not displayed, this is a finding.	This system is for the use of authorized users only. Individuals using this computer system without authority or in excess of their authority are subject to having all their activities on this system monitored and recorded by system personnel. Anyone using this system expressly consents to such monitoring and is advised that if such monitoring reveals possible evidence of criminal activity system personal may provide the evidence of such monitoring to law enforcement officials.
CCE-84451-4	NIST80053-VI-ESXi-CFG-00129	Enhanced	ESXi	If vCenter Update Manager is used on the network, it can scan all hosts for missing patches. From the vSphere Client, go to Hosts and Clusters >> Update Manager tab, and select Scan to view all hosts’ compliance status.	Apply latest patches and updates

CCE ID	Configuration(s)	Built-In/Enhanced	Product	Audit Procedure	Recommended Parameter Value
				If vCenter Update Manager is not used, a host's compliance status must be manually determined by the build number. The following VMware KB 1014508 can be used to correlate patches with build numbers. If the ESXi host does not have the latest patches, this is a finding. If the ESXi host is not on a supported release, this is a finding.	
CCE-84452-2	NIST80053-VI-ESXi-CFG-00134	Enhanced	ESXi	The downloaded ISO, offline bundle, or patch hash must be verified against the vendor's checksum to ensure the integrity and authenticity of the files. See typical command line examples for both the md5 and sha1 hash checks: # md5sum <filename>.iso # sha1sum <filename>.iso If any of the system's downloaded ISO, offline bundle, or system patch hashes cannot be verified against the vendor's checksum, this is a finding.	Compare the MD5 sum output with the value posted on the VMware Web site. SHA1 or MD5 hash should match.
CCE-84453-0	NIST80053-VI-ESXi-CFG-00135	Built-in	ESXi	From a PowerCLI command prompt, while connected to the ESXi host run the following command: Get-VMHost | Get-AdvancedSetting -Name Syslog.global.logHost If Syslog.global.logHost is not set to a site-specific syslog server, this is a finding.	udp://sfo01vrli01.sfo01.rainpole.local:514
CCE-84454-8	NIST80053-VI-ESXi-CFG-00136	Built-in	ESXi	From a PowerCLI command prompt, while connected to the ESXi host run the following command: Get-VMHost | Get-AdvancedSetting -Name Syslog.global.logDir	[] /scratch/log

CCE ID	Configuration(s)	Built-In/Enhanced	Product	Audit Procedure	Recommended Parameter Value
				If LocalLogOutputIsPersistent is not set to true, this is a finding.	
CCE-84455-5	NIST80053-VI-ESXi-CFG-00137	Built-in	ESXi	From a PowerCLI command prompt, while connected to the ESXi host run the following command: Get-VMHost | Get-AdvancedSetting -Name Config.HostAgent.plugins.hostsvc.esxAdminsGroup For systems that do not use Active Directory and have no local user accounts, other than root, dcui, and/or vpxuser, this is not applicable. For systems that do not use Active Directory and do have local user accounts, other than root, dcui, and/or vpxuser, this is a finding. If Config.HostAgent.plugins.hostsvc.esxAdminsGroup is set to “ESX Admins”, this is a finding.	ug-SDDC-Admins
CCE-84456-3	NIST80053-VI-ESXi-CFG-00138	Built-in	ESXi	From a PowerCLI command prompt, while connected to the ESXi host run the following command: Get-VMHost | Get-AdvancedSetting -Name Mem.ShareForceSalting If Mem.ShareForceSalting is not set to 2, this is a finding.	2
CCE-84457-1	NIST80053-VI-ESXi-CFG-00139	Built-in	ESXi	From a PowerCLI command prompt, while connected to the ESXi host run the following command: Get-VMHostFirewallDefaultPolicy If the Incoming or Outgoing policies are True, this is a finding.	N/A

CCE ID	Configuration(s)	Built-In/Enhanced	Product	Audit Procedure	Recommended Parameter Value
CCE-84458-9	NIST80053-VI-ESXi-CFG-00141	Built-in	ESXi	From a PowerCLI command prompt, while connected to the ESXi host run the following command: Get-VMHost | Get-AdvancedSetting -Name Syslog.global.logHost If Syslog.global.logHost is not set to a site-specific syslog server, this is a finding.	udp://sfo01vrli01.sfo01.rainpole.local:514
CCE-84459-7	NIST80053-VI-ESXi-CFG-00142	Enhanced	ESXi	From a PowerCLI command prompt, while connected to the ESXi host run the following command: Get-VMHost | Get-AdvancedSetting -Name Config.HostAgent.plugins.hostsvc.esxAdminsGroup For systems that do not use Active Directory and have no local user accounts, other than root, dcui, and/or vpxuser, this is not applicable. For systems that do not use Active Directory and do have local user accounts, other than root, dcui, and/or vpxuser, this is a finding. If Config.HostAgent.plugins.hostsvc.esxAdminsGroup is set to “ESX Admins”, this is a finding.	ug-SDDC-Admins
CCE-84460-5	NIST80053-VI-ESXi-CFG-00143	Built-in	ESXi	From a PowerCLI command prompt, while connected to the ESXi host run the following command: Get-VMHost | Get-AdvancedSetting -Name Syslog.global.logHost If Syslog.global.logHost is not set to a site-specific syslog server, this is a finding.	udp://sfo01vrli01.sfo01.rainpole.local:514

CCE ID	Configuration(s)	Built-In/Enhanced	Product	Audit Procedure	Recommended Parameter Value
CCE-84461-3	NIST80053-VI-ESXi-CFG-00145	Built-in	ESXi	From a PowerCLI command prompt, while connected to the ESXi host run the following command: Get-VMHost | Get-VMHostNTPServer Get-VMHost | Get-VMHostService | Where {$_.Label -eq "NTP Daemon"} If the NTP service is not configured with authoritative DoD time sources and the service is not configured to start and stop with the host and is running, this is a finding.	ntp.lax01.rainpole.local, ntp.sfo01.rainpole.local
CCE-84462-1	NIST80053-VI-ESXi-CFG-00157	Built-in	ESXi	From a PowerCLI command prompt, while connected to the ESXi host run the following commands: $esxcli = Get-EsxCli $esxcli.software.acceptance.get() If the acceptance level is CommunitySupported, this is a finding.	PartnerSupported
CCE-84463-9	NIST80053-VI-ESXi-CFG-00158	Built-in	ESXi	From a PowerCLI command prompt, while connected to the ESXi host run the following commands: $esxcli = Get-EsxCli $esxcli.software.acceptance.get() If the acceptance level is CommunitySupported, this is a finding.	PartnerSupported
CCE-84464-7	NIST80053-VI-ESXi-CFG-00159	Built-in	ESXi	From a PowerCLI command prompt, while connected to the ESXi host run the following commands: $esxcli = Get-EsxCli $esxcli.software.acceptance.get() If the acceptance level is CommunitySupported, this is a finding.	PartnerSupported

CCE ID	Configuration(s)	Built-In/Enhanced	Product	Audit Procedure	Recommended Parameter Value
CCE-84465-4	NIST80053-VI-ESXi-CFG-00160	Built-in	ESXi	From a PowerCLI command prompt, while connected to the ESXi host run the following commands: $esxcli = Get-EsxCli $esxcli.software.acceptance.get() If the acceptance level is CommunitySupported, this is a finding.	PartnerSupported
CCE-84466-2	NIST80053-VI-ESXi-CFG-00161	Built-in	ESXi	From a PowerCLI command prompt, while connected to the ESXi host run the following commands: Get-VDSwitch | Get-VDSecurityPolicy Get-VDPortGroup | Get-VDSecurityPolicy If Forged Transmits is set to accept, this is a finding.	FALSE
CCE-84467-0	NIST80053-VI-ESXi-CFG-00162	Built-in	ESXi	From a PowerCLI command prompt, while connected to the ESXi host run the following commands: Get-VDSwitch | Get-VDSecurityPolicy Get-VDPortGroup | Get-VDSecurityPolicy If MAC Address Changes is set to accept, this is a finding.	FALSE
CCE-84468-8	NIST80053-VI-ESXi-CFG-00163	Built-in	ESXi	From a PowerCLI command prompt, while connected to the ESXi host run the following command: Get-VMHost | Get-AdvancedSetting -Name DCUI.Access If DCUI.Access is not restricted to root, this is a finding. Note: This list is only for local user accounts and should only contain the root user.	root

CCE ID	Configuration(s)	Built-In/Enhanced	Product	Audit Procedure	Recommended Parameter Value
CCE-84469-6	NIST80053-VI-ESXi-CFG-00164	Built-in	ESXi	From a PowerCLI command prompt, while connected to the ESXi host run the following command: Get-VMHost | Get-AdvancedSetting -Name Syslog.global.logHost If Syslog.global.logHost is not set to a site-specific syslog server, this is a finding.	udp://sfo01vrli01.sfo01.rainpole.local:514
CCE-84470-4	NIST80053-VI-ESXi-CFG-00165	Built-in	ESXi	From a PowerCLI command prompt, while connected to the ESXi host run the following command: Get-VMHost | Get-AdvancedSetting -Name Security.AccountUnlockTime If Security.AccountUnlockTime is not set to 900, this is a finding.	900
CCE-84471-2	NIST80053-VI-ESXi-CFG-00166	Built-in	ESXi	From a PowerCLI command prompt, while connected to the ESXi host run the following command: Get-VMHost | Get-AdvancedSetting -Name Config.HostAgent.plugins.solo.enableMob If Config.HostAgent.plugins.solo.enableMob is not set to false, this is a finding.	FALSE
CCE-84472-0	NIST80053-VI-ESXi-CFG-00167	Built-in	ESXi	From a PowerCLI command prompt, while connected to the ESXi host run the following command: Get-VMHost | Get-AdvancedSetting -Name Config.HostAgent.plugins.hostsvc.esxAdminsGroup For systems that do not use Active Directory and have no local user accounts, other than root, dcui, and/or vpxuser, this is not applicable.	ug-SDDC-Admins

CCE ID	Configuration(s)	Built-In/Enhanced	Product	Audit Procedure	Recommended Parameter Value
				For systems that do not use Active Directory and do have local user accounts, other than root, dcui, and/or vpxuser, this is a finding. If Config.HostAgent.plugins.hostsvc.esxAdminsGroup is set to "ESX Admins", this is a finding.	
CCE-84473-8	NIST80053-VI-ESXi-CFG-00168	Built-in	ESXi	From a PowerCLI command prompt, while connected to the ESXi host run the following command: Get-VMHost | Get-AdvancedSetting -Name UserVars.Dcui-TimeOut If UserVars.DcuiTimeOut is not set to 600, this is a finding.	600
CCE-84474-6	NIST80053-VI-ESXi-CFG-00169	Built-in	ESXi	From a PowerCLI command prompt, while connected to the ESXi host run the following command: Get-VMHost | Get-AdvancedSetting -Name Net.DVFilterBindIpAddress If Net.DVFilterBindIpAddress is not blank and security appliances are not in use on the host, this is a finding.	""
CCE-84475-3	NIST80053-VI-ESXi-CFG-00170	Built-in	ESXi	From a PowerCLI command prompt, while connected to the ESXi host run the following command: Get-VMHost | Get-AdvancedSetting -Name Syslog.global.logHost If Syslog.global.logHost is not set to a site-specific syslog server, this is a finding.	udp://sfo01vrli01.sfo01.rainpole.local:514

CCE ID	Configuration(s)	Built-In/Enhanced	Product	Audit Procedure	Recommended Parameter Value
CCE-84476-1	NIST80053-VI-ESXi-CFG-00171	Built-in	ESXi	From a PowerCLI command prompt, while connected to the ESXi host run the following command: Get-VMHost | Get-AdvancedSetting -Name UserVars.Dcui-TimeOut If UserVars.DcuiTimeOut is not set to 600, this is a finding.	600
CCE-84477-9	NIST80053-VI-ESXi-CFG-00172	Built-in	ESXi	From a PowerCLI command prompt, while connected to the ESXi host run the following command: Get-VMHost | Get-AdvancedSetting -Name Syslog.global.logHost If Syslog.global.logHost is not set to a site-specific syslog server, this is a finding.	udp://sfo01vrli01.sfo01.rainpole.local:514
CCE-84478-7	NIST80053-VI-ESXi-CFG-00173	Built-in	ESXi	From a PowerCLI command prompt, while connected to the ESXi host run the following command: Get-VMHost | Get-AdvancedSetting -Name Config.HostAgent.plugins.hostsvc.esxAdminsGroup For systems that do not use Active Directory and have no local user accounts, other than root, dcui, and/or vpxuser, this is not applicable. For systems that do not use Active Directory and do have local user accounts, other than root, dcui, and/or vpxuser, this is a finding. If the Config.HostAgent.plugins.hostsvc.esxAdminsGroup keyword is set to “ESX Admins”, this is a finding.	ug-SDDC-Admins

CCE ID	Configuration(s)	Built-In/Enhanced	Product	Audit Procedure	Recommended Parameter Value
CCE-84479-5	NIST80053-VI-ESXi-CFG-00174	Built-in	ESXi	From a PowerCLI command prompt, while connected to the ESXi host run the following command: Get-VMHost | Get-AdvancedSetting -Name Syslog.global.logHost If Syslog.global.logHost is not set to a site-specific syslog server, this is a finding.	udp://sfo01vrli01.sfo01.rainpole.local:514
CCE-84480-3	NIST80053-VI-ESXi-CFG-00175	Built-in	ESXi	From a PowerCLI command prompt, while connected to the ESXi host run the following command: Get-VMHost | Get-AdvancedSetting -Name Config.HostAgent.plugins.hostsvc.esxAdminsGroup For systems that do not use Active Directory and have no local user accounts, other than root, dcui, and/or vpxuser, this is not applicable. For systems that do not use Active Directory and do have local user accounts, other than root, dcui, and/or vpxuser, this is a finding. If Config.HostAgent.plugins.hostsvc.esxAdminsGroup is set to “ESX Admins”, this is a finding.	ug-SDDC-Admins
CCE-84481-1	NIST80053-VI-ESXi-CFG-00176	Built-in	ESXi	From a PowerCLI command prompt, while connected to the ESXi host run the following command: Get-VMHost | Get-AdvancedSetting -Name Syslog.global.logHost If Syslog.global.logHost is not set to a site-specific syslog server, this is a finding.	udp://sfo01vrli01.sfo01.rainpole.local:514

CCE ID	Configuration(s)	Built-In/Enhanced	Product	Audit Procedure	Recommended Parameter Value
CCE-84482-9	NIST80053-VI-ESXi-CFG-00177	Built-in	ESXi	The vMotion VMkernel port group should be in a dedicated VLAN that can be on a common standard or distributed virtual switch as long as the vMotion VLAN is not shared by any other function and it is not routed to anything but ESXi hosts. The check for this will be unique per environment. From the vSphere Client, select the ESXi host and go to Configure > Networking > VMKernel adapters. Review the VLANs associated with the vMotion VMkernel(s) and verify they are dedicated for that purpose and logically separated from other functions. If long distance or cross vCenter vMotion is used, the vMotion network can be routable but must be accessible to only the intended ESXi hosts. If the vMotion port group is not on an isolated VLAN and/or is routable to systems other than ESXi hosts, this is a finding. For environments that do not use vCenter Server to manage ESXi, this is not applicable.	vMotion VMKernel Port group should be in a dedicated VLAN. The check for this will be unique per environment.
CCE-84483-7	NIST80053-VI-ESXi-CFG-00178	Built-in	ESXi	The Management VMkernel port group should be in a dedicated VLAN that can be on a common standard or distributed virtual switch as long as the Management VLAN is not shared by any other function and it is not routed to anything other than management related functions such as vCenter. The check for this will be unique per environment. From the vSphere Client, select the ESXi host and go to Configure > Networking > VMKernel adapters. Review the VLANs associated with the Management VMkernel and verify they are dedicated for that purpose and logically separated from other functions.	Management VMKernel Port group should be in a dedicated VLAN. The check for this will be unique per environment

CCE ID	Configuration(s)	Built-In/Enhanced	Product	Audit Procedure	Recommended Parameter Value
				If the network segment is routed, except to networks where other management-related entities are located such as vCenter, this is a finding. If production virtual machine traffic is routed to this network, this is a finding.	
CCE-84484-5	NIST80053-VI-ESXi-CFG-00179	Built-in	ESXi	From a PowerCLI command prompt, while connected to the ESXi host run the following command: Get-VMHost | Get-AdvancedSetting -Name Config.HostAgent.log.level If Config.HostAgent.log.level is not set to info, this is a finding. Note: Verbose logging level is acceptable for troubleshooting purposes.	info
CCE-84485-2	NIST80053-VI-ESXi-CFG-00180	Built-in	ESXi	From a PowerCLI command prompt, while connected to the ESXi host run the following command: Get-VMHost | Get-AdvancedSetting -Name Config.HostAgent.log.level If Config.HostAgent.log.level is not set to info, this is a finding. Note: Verbose logging level is acceptable for troubleshooting purposes.	info
CCE-84486-0	NIST80053-VI-ESXi-	Built-in	ESXi	From the vSphere Client, select the ESXi Host and go to Configure >> Networking >> VMKernel adapters. Review each VMkernel adapter that is defined and ensure it is enabled for only one type of management traffic.	N/A

CCE ID	Configuration(s)	Built-In/Enhanced	Product	Audit Procedure	Recommended Parameter Value
	CFG-00181			If any VMkernel is used for more than one type of management traffic, this is a finding.	
CCE-84487-8	NIST80053-VI-ESXi-CFG-00182	Built-in	ESXi	From the vSphere Client, select the ESXi Host and go to Configure >> Networking >> TCP/IP Configuration. Review the default system TCP/IP stacks and verify they are configured with the appropriate IP address information. If any system TCP/IP stack is configured and not in use by a VMkernel adapter, this is a finding.	N/A
CCE-84488-6	NIST80053-VI-ESXi-CFG-00192	Built-in	ESXi	From a PowerCLI command prompt, while connected to the ESXi host run the following command: Get-VMHost | Get-VMHostNTPServer Get-VMHost | Get-VMHostService | Where {$_.Label -eq "NTP Daemon"} If the NTP service is not configured with authoritative DoD time sources and the service is not configured to start and stop with the host and is running, this is a finding.	Policy :On and Running: True
CCE-84489-4	NIST80053-VI-ESXi-CFG-00184	Built-in	ESXi	This check refers to an entity outside the physical scope of the ESXi server system. The configuration of upstream physical switches must be documented to ensure that spanning tree protocol is disabled and/or portfast is configured for all physical ports connected to ESXi hosts. Inspect the documentation and verify that the documentation is updated on a regular basis and/or whenever modifications are made to either ESXi hosts or the upstream physical switches. Alternatively, log in to the physical switch and verify that spanning tree protocol is disabled and/or portfast is configured for all physical ports connected to ESXi hosts.	N/A

CCE ID	Configuration(s)	Built-In/Enhanced	Product	Audit Procedure	Recommended Parameter Value
				If the physical switch's spanning tree protocol is not disabled or portfast is not configured for all physical ports connected to ESXi hosts, this is a finding.	
CCE-84501-6	NIST80053-VI-NET-CFG-00251	Built-in	NSX	From the vSphere Web Client, go to Administration >> Single Sign-On >> Policies >> Password Policy.	NSX Manager Appliance - NSX Domain Service Account - Password (Dependent on Customer Configurations)
CCE-84502-4	NIST80053-VI-NET-CFG-00252	Built-in	NSX	From the vSphere Web Client, go to Administration >> Single Sign-On >> Policies >> Password Policy.	Border Gateway Protocol Password (Dependent on Customer Configurations)
CCE-84503-2	NIST80053-VI-NET-CFG-00253	Built-in	NSX	From the vSphere Web Client, go to Administration >> Single Sign-On >> Policies >> Password Policy.	Universal Distributed Logical Router Password (Dependent on Customer Configurations)
CCE-84504-0	NIST80053-VI-NET-CFG-00281	Built-in	NSX	Log on to NSX Manager Virtual Appliance, then go to Backup & Restore. If “Audit Logs” or “System Events” are excluded (by default they are NOT excluded), this is a finding.	Audit logs and System events are not excluded
CCE-84505-7	NIST80053-VI-NET-CFG-00282	Built-in	NSX	Log on to NSX Manager Virtual Appliance, then go to Manage Appliance Settings and look under General Network Settings. If IPv6 is configured, this is a finding.	IPv6 should be disabled

CCE ID	Configuration(s)	Built-In/Enhanced	Product	Audit Procedure	Recommended Parameter Value
CCE-84506-5	NIST80053-VI-NET-CFG-00283	Built-in	NSX	Log on to NSX Manager Virtual Appliance, then go to Manage Appliance Settings and look under DNS Servers. If IPv6 DNS is configured, this is a finding.	IPv6 DNS should be disabled
CCE-84507-3	NIST80053-VI-NET-CFG-00285	Built-in	NSX	Log on to NSX Manager Virtual Appliance, then go to Manage Appliance Settings and look under Time Settings. If any the NTP Servers are not authorized or trusted, this is a finding.	1) Use at least three NTP servers from outside time sources -OR- 2) Configure a few local NTP servers on a trusted network that in turn obtain their time from at least three outside time sources
CCE-84508-1	NIST80053-VI-NET-CFG-00286	Built-in	NSX	Log on to NSX Manager Virtual Appliance and go to Manage Appliance Settings. Verify syslog server configuration.	Remote syslog server is configured.
CCE-84509-9	NIST80053-VI-NET-CFG-00287	Built-in	NSX	Log on to NSX Manager Virtual Appliance, then go to Manage Appliance Settings --> SSL Certificates. Click on the certificate and verify certificate details.	1) Appropriate Issuer 2) Correct certificate Type 3) RSA Algorithm 4) 2048 bits keys or higher
CCE-84510-7	NIST80053-VI-NET-	Built-in	NSX	Assess the deployment and try to reach NSX manager being on standard network. The NSX manager should only be reachable using isolation mechanisms.	No read or write permissions on backup directory

CCE ID	Configuration(s)	Built-In/Enhanced	Product	Audit Procedure	Recommended Parameter Value
	CFG-00288				
CCE-84511-5	NIST80053-VI-NET-CFG-00289	Built-in	NSX	Log in to the VMware vSphere environment and inspect which users have access permissions to NSX manager VA. If any user other than the intended administrator has access to the VA or is able to carry out any administrative actions on that VA, this is a finding.	Procedural
CCE-84512-3	NIST80053-VI-NET-CFG-00290	Built-in	NSX	Log in to the SFTP server and navigate to backup directory. If the backup directory can be read or written to by users other than the backup user, this is a finding.	No read or write permissions on backup directory
CCE-84513-1	NIST80053-VI-NET-CFG-00291	Built-in	NSX	Log on to NSX Manager Virtual Appliance, then go to Manage Appliance Settings and look under General network settings. If IPv4 DNS is not authorized or secure, this is a finding.	IPv4 DNS is authorized and secure
CCE-84514-9	NIST80053-VI-NET-CFG-00294	Built-in	NSX	Log on to NSX Manager Virtual Appliance, then look under Backup & Restore. Verify “FTP Server settings”.	FTP Server settings (Dependent on Customer Configurations)
CCE-84515-6	NIST80053-VI-NET-CFG-00295	Built-in	NSX	After downloading the media, use the MD5/SHA1 sum value to verify the integrity of the download. Compare the MD5/SHA1 hash output with the value posted on the VMware secure website. If the hash output does not match the website value, this is a finding.	SHA1 or MD5 hash should match

CCE ID	Configuration(s)	Built-In/Enhanced	Product	Audit Procedure	Recommended Parameter Value
CCE-84516-4	NIST80053-VI-NET-CFG-00296	Built-in	NSX	If the controller network is not deployed on a network that is not configured for or connected to other types of traffic, this is a finding.	Procedural (Dependent on Customer Configurations)
CCE-84517-2	NIST80053-VI-NET-CFG-00297	Built-in	NSX	Run this Rest API call to get the properties of the controller node: https://<nsxmgr>/api/2.0/vdn/controller/node Response: <controllerNodeConfig> <ipSecEnabled>true</ipSecEnabled > </controllerNodeConfig> If ipSecEnabled is not true, this is a finding.	<ipSecEnabled>true</ipSecEnabled >
CCE-84518-0	NIST80053-VI-NET-CFG-00300	Built-in	NSX	Thoroughly review the deployment. If the virtual network is not isolated, this is a finding.	Procedural (Dependent on Customer Configurations)
CCE-84519-8	NIST80053-VI-NET-CFG-00301	Built-in	NSX	Do a thorough check on the infrastructure design and deployment network diagram. If there are any non-hypervisors on the logical network data plane or if any untrusted hypervisors are used, this is a finding.	Procedural (Dependent on Customer Configurations)
CCE-84520-6	NIST80053-VI-NET-CFG-00302	Built-in	NSX	Use the vSphere Web Client to connect to the vCenter Server. As administrator, go to Home > Inventory > Networking. Select “DSwitch” for distributed portgroups. Select each dvPortgroup connected to active VMs requiring securing. Go to tab “Summary > Edit Settings > Policies > Security”.	Reject

CCE ID	Configuration(s)	Built-In/Enhanced	Product	Audit Procedure	Recommended Parameter Value
				If Forged Transmits is not set to Reject, this is a finding.	
CCE-84521-4	NIST80053-VI-NET-CFG-00303	Built-in	NSX	Use the vSphere Web Client to connect to the vCenter Server. As administrator, go to Home > Inventory > Networking. Select “DSwitch” for distributed portgroups. Select each dvPortgroup connected to active VMs requiring securing. Go to tab “Summary > Edit Settings > Policies > Security”. If Mac Address Changes is not set to Reject, this is a finding.	Reject
CCE-84522-2	NIST80053-VI-NET-CFG-00304	Built-in	NSX	Use the vSphere Web Client to connect to the vCenter Server. As administrator, go to Home > Inventory > Networking. Select “DSwitch” for distributed portgroups. Select each dvPortgroup connected to active VMs requiring securing. Go to tab “Summary > Edit Settings > Policies > Security”. If Promiscuous Mode is not set to Reject, this is a finding.	Reject
CCE-84523-0	NIST80053-VI-NET-CFG-00306	Built-in	NSX	Log in to VMware vSphere Web Client. Navigate to Networking and Security --> Installation and Upgrade. Go to the “Host Preparation” tab. Under the “VXLAN” column, select “View Configuration”. If VMKNic Teaming Policy is not set to “Load Balance - SRCID”, this is a finding.	Load Balance - SRCID
CCE-84524-8	NIST80053-VI-NET-CFG-00308	Built-in	NSX	Log into the vCenter web interface with credentials authorized for administration. Navigate to Networking and Security >> Firewall. Expand “Default Section Layer 3” in Configuration. If the action for the Default Rule is “Allow”, this is a finding.	Denied
CCE-84525-5	NIST80053-VI-NET-	Built-in	NSX	Log on to vSphere Web Client with credentials authorized for administration. Navigate and select Networking and Security >> Users and Domains.	Procedural

CCE ID	Configuration(s)	Built-In/Enhanced	Product	Audit Procedure	Recommended Parameter Value
	CFG-00311			View each role and verify the users and/or groups assigned to it.	
CCE-84526-3	NIST80053-VI-NET-CFG-00312	Built-in	NSX	From the vSphere Web Client, go to Administration >> Single Sign-On >> Configuration >> Policies >> Password Policy. View the values of the password format requirements. If Numeric Characters is not set to at least 1, this is a finding.	1
CCE-84527-1	NIST80053-VI-NET-CFG-00313	Built-in	NSX	From the vSphere Web Client, go to Administration >> Single Sign-On >> Configuration >> Policies >> Password Policy. View the values of the password format requirements. If Special Characters is not set to at least 1, this is a finding.	1
CCE-84528-9	NIST80053-VI-NET-CFG-00316	Built-in	NSX	Log on to vSphere Web Client with credentials authorized for administration. Navigate and select Networking and Security >> Users and Domains. View each role and verify the users and/or groups assigned to it. If any user or service account has more privileges than required, this is a finding.	Procedural
CCE-84529-7	NIST80053-VI-NET-CFG-00317	Built-in	NSX	Log into NSX Manager with built-in administrator account “admin” and default manufacturer password “default”. If the NSX Manager accepts the default password, this is a finding.	Non-default password
CCE-84530-5	NIST80053-VI-NET-CFG-00318	Built-in	NSX	Log into vSphere Web Client with credentials authorized for administration. Navigate to Networking and Security >> Firewall. Expand rule sections as necessary to view rules. If there are no rules configured to enforce authorizations, this is a finding.	Procedural

CCE ID	Configuration(s)	Built-In/Enhanced	Product	Audit Procedure	Recommended Parameter Value
CCE-84531-3	NIST80053-VI-NET-CFG-00321	Built-in	NSX	From the vSphere Web Client, go to Administration >> Single Sign-On >> Configuration >> Policies >> Password Policy. View the values of the password format requirements. If Lower-Case Characters is not set to at least 1, this is a finding.	1
CCE-84532-1	NIST80053-VI-NET-CFG-00322	Built-in	NSX	From the vSphere Web Client, go to Administration >> Single Sign-On >> Configuration >> Policies >> Password Policy. If Upper-Case Characters is not set to at least 1, this is a finding.	1
CCE-84533-9	NIST80053-VI-NET-CFG-00323	Enhanced	NSX	Log into vSphere Web Client with credentials authorized for administration. Navigate and select Networking and Security >> Firewall tab to display a list of firewall rules deployed across the NSX environment. Click on the dropdown arrow to expand each firewall rule's section. For each rule, select the pencil icon in the "Action" column. If the "Log" option has not been enabled for all rules, this is a finding.	Log
CCE-84534-7	NIST80053-VI-NET-CFG-00324	Enhanced	NSX	Log into vSphere Web Client with credentials authorized for administration. Navigate and select Networking and Security >> SpoofGuard. Check the Default policy of each NSX Manager. If the mode is disabled, this is a finding.	Enabled
CCE-84535-4	NIST80053-VI-NET-CFG-00328	Built-in	NSX	Log onto vSphere Web Client with credentials authorized for administration. Navigate and select Networking and Security >> select the "NSX Edges" tab on the left-side menu. Double-click the Edge ID. Navigate to Manage >> Verify the configurations under "Settings, Firewall, Routing, Bridging, and DHCP Relay" are enabled only as	Enabled

CCE ID	Configuration(s)	Built-In/Enhanced	Product	Audit Procedure	Recommended Parameter Value
				necessary to the deployment. If unnecessary services are enabled, this is a finding.	
CCE-84536-2	NIST80053-VI-NET-CFG-00329	Built-in	NSX	If the built-in SSO administrator account is used for daily operations or there is no policy restricting its use, this is a finding.	Procedural (Dependent on Customer Configurations)
CCE-84537-0	NIST80053-VI-NET-CFG-00330	Built-in	NSX	From the vSphere Web Client, go to Administration >> Single Sign-On >> Configuration >> Policies >> Password Policy. If Restrict Reuse is not set to “5” or more, this is a finding.	5
CCE-84538-8	NIST80053-VI-NET-CFG-00340	Built-in	NSX	Go to the vSphere Web Client URL https://client-host-name/vsphere-client and verify the CA certificate is signed by an approved service provider. If a public key certificate from an appropriate certificate policy through an approved service provider is not used, this is a finding.	Procedural
CCE-84539-6	NIST80053-VI-NET-CFG-00343	Built-in	NSX	Log into vSphere Web Client with credentials authorized for administration. Navigate and select Networking and Security >> Firewall. If there are services enabled that should not be, this is a finding.	Procedural
CCE-84540-4	NIST80053-VI-NET-CFG-00344	Built-in	NSX	Log into vSphere Web Client with credentials authorized for administration. Navigate and select Networking and Security >> Firewall. If ports, protocols, and/or services are not disabled or restricted as required by the PPSM, this is a finding.	Procedural

CCE ID	Configuration(s)	Built-In/Enhanced	Product	Audit Procedure	Recommended Parameter Value
CCE-84541-2	NIST80053-VI-NET-CFG-00360	Built-in	NSX	Log onto vSphere Web Client with credentials authorized for administration. Navigate and select Networking and Security >> “NSX Edges” tab on the left-side menu. Double-click the EdgeID. Click on the “Configure” tab on the top of the new screen, then Interfaces >> Check the “Connection Status” column for the associated interface. If any inactive router interfaces are not disabled, this is a finding.	Procedural
CCE-84542-0	NIST80053-VI-NET-CFG-00372	Built-in	NSX	Log on to NSX Manager with credentials authorized for administration. Navigate and select Backup and Restore >> Backup History. If backups are not being sent to a centralized location when changes occur or weekly, whichever is sooner, this is a finding.	Procedural
CCE-84301-1	NIST80053-VI-VC-CFG-00060	Enhanced	vCenter	Ask the SA if hardened, patched templates are used for VM creation, properly configured OS deployments, including applications both dependent and non-dependent on VM-specific configurations. If hardened, patched templates are not used for VM creation, this is a finding. The system must use templates to deploy VMs whenever possible.	Hardened virtual machine templates to use for OS deployments.
CCE-84302-9	NIST80053-VI-ESXI-CFG-00061	Enhanced	vCenter	On the Home page of the vSphere Client, select Menu > Administration and click Roles. Select the VC from the Roles provider drop-down menu. Select the Virtual machine user (sample) role and click Privileges. If the Console Interaction privilege is assigned to the role, this is a finding. If SSH and/or terminal management services are exclusively used to perform management tasks, this is not a finding.	Disable Console interaction privilege

CCE ID	Configuration(s)	Built-In/Enhanced	Product	Audit Procedure	Recommended Parameter Value
CCE-84303-7	NIST80053-VI-ESXI-CFG-00065	Built-in	vCenter	From a PowerCLI command prompt, while connected to the ESXi host or vCenter server run the following command: Get-VM | Where {$_.ExtensionData.Config.Hardware.Device.DeviceInfo.Label -match ""parallel""} If a virtual machine has a parallel device present, this is a finding.	Disconnect unauthorized parallel devices
CCE-84304-5	NIST80053-VI-ESXI-CFG-00066	Built-in	vCenter	From a PowerCLI command prompt, while connected to the ESXi host or vCenter server run the following command: Get-VM | Where {$_.ExtensionData.Config.Hardware.Device.DeviceInfo.Label -match ""serial""} If a virtual machine has a serial device present, this is a finding.	Disconnect unauthorized serial devices
CCE-84305-2	NIST80053-VI-ESXI-CFG-00067	Built-in	vCenter	From a PowerCLI command prompt, while connected to the ESXi host or vCenter server run the following command: Get-VM | Get-UsbDevice If a virtual machine has any USB devices or USB controllers present, this is a finding.	No USB device present
CCE-84306-0	NIST80053-VI-ESXI-CFG-00068	Built-in	vCenter	From a PowerCLI command prompt, while connected to the ESXi host or vCenter server run the following command: Get-VM "VM Name" | Get-AdvancedSetting -Name sched.mem.pshare.salt If sched.mem.pshare.salt exists, this is a finding.	Remove the advanced setting sched.mem.pshare.salt
CCE-84307-8	NIST80053-VI-ESXI-	Enhanced	vCenter	From a PowerCLI command prompt, while connected to the ESXi host or vCenter server run the following command:	TRUE

CCE ID	Configuration(s)	Built-In/Enhanced	Product	Audit Procedure	Recommended Parameter Value
	CFG-00070			Get-VM "VM Name" | Get-AdvancedSetting -Name isolation.tools.copy.disable If isolation.tools.copy.disable does not exist or is not set to true, this is a finding.	
CCE-84308-6	NIST80053-VI-ESXI-CFG-00071	Enhanced	vCenter	From a PowerCLI command prompt, while connected to the ESXi host or vCenter server run the following command: Get-VM "VM Name" | Get-AdvancedSetting -Name isolation.tools.dnd.disable If isolation.tools.dnd.disable does not exist or is not set to true, this is a finding.	TRUE
CCE-84309-4	NIST80053-VI-ESXI-CFG-00072	Enhanced	vCenter	From a PowerCLI command prompt, while connected to the ESXi host or vCenter server run the following command: Get-VM "VM Name" | Get-AdvancedSetting -Name isolation.tools.setGUIOptions.enable If isolation.tools.setGUIOptions.enable does not exist or is not set to false, this is a finding.	FALSE
CCE-84310-2	NIST80053-VI-ESXI-CFG-00073	Enhanced	vCenter	From a PowerCLI command prompt, while connected to the ESXi host or vCenter server run the following command: Get-VM "VM Name" | Get-AdvancedSetting -Name isolation.tools.paste.disable If isolation.tools.paste.disable does not exist or is not set to true, this is a finding.	TRUE

CCE ID	Configuration(s)	Built-In/Enhanced	Product	Audit Procedure	Recommended Parameter Value
CCE-84311-0	NIST80053-VI-ESXI-CFG-00074	Enhanced	vCenter	From a PowerCLI command prompt, while connected to the ESXi host or vCenter server run the following command: Get-VM "VM Name" | Get-AdvancedSetting -Name isolation.tools.diskShrink.disable If isolation.tools.diskShrink.disable does not exist or is not set to true, this is a finding.	TRUE
CCE-84312-8	NIST80053-VI-ESXI-CFG-00075	Enhanced	vCenter	From a PowerCLI command prompt, while connected to the ESXi host or vCenter server run the following command: Get-VM "VM Name" | Get-AdvancedSetting -Name isolation.tools.diskWiper.disable If isolation.tools.diskWiper.disable does not exist or is not set to true, this is a finding.	TRUE
CCE-84313-6	NIST80053-VI-ESXI-CFG-00076	Enhanced	vCenter	From a PowerCLI command prompt, while connected to the ESXi host or vCenter server run the following command: Get-VM "VM Name" | Get-AdvancedSetting -Name isolation.tools.hgfsServerSet.disable If isolation.tools.hgfsServerSet.disable does not exist or is not set to true, this is a finding.	TRUE
CCE-84314-4	NIST80053-VI-ESXI-CFG-00077	Enhanced	vCenter	From a PowerCLI command prompt, while connected to the ESXi host or vCenter server run the following command: Get-VM "VM Name" | Get-AdvancedSetting -Name isolation.tools.ghi.autologon.disable	TRUE

CCE ID	Configuration(s)	Built-In/Enhanced	Product	Audit Procedure	Recommended Parameter Value
				If isolation.tools.ghi.autologon.disable does not exist or is not set to true, this is a finding.	
CCE-84315-1	NIST80053-VI-ESXI-CFG-00078	Enhanced	vCenter	From a PowerCLI command prompt, while connected to the ESXi host or vCenter server run the following command: Get-VM "VM Name" | Get-AdvancedSetting -Name isolation.bios.bbs.disable If isolation.bios.bbs.disable does not exist or is not set to true, this is a finding.	TRUE
CCE-84316-9	NIST80053-VI-ESXI-CFG-00079	Enhanced	vCenter	From a PowerCLI command prompt, while connected to the ESXi host or vCenter server run the following command: Get-VM "VM Name" | Get-AdvancedSetting -Name isolation.tools.getCreds.disable If isolation.tools.getCreds.disable does not exist or is not set to true, this is a finding.	TRUE
CCE-84317-7	NIST80053-VI-ESXI-CFG-00080	Enhanced	vCenter	From a PowerCLI command prompt, while connected to the ESXi host or vCenter server run the following command: Get-VM "VM Name" | Get-AdvancedSetting -Name isolation.tools.ghi.launchmenu.change If isolation.tools.ghi.launchmenu.change does not exist or is not set to true, this is a finding.	TRUE
CCE-84318-5	NIST80053-VI-ESXI-CFG-00081	Enhanced	vCenter	From a PowerCLI command prompt, while connected to the ESXi host or vCenter server run the following command: Get-VM "VM Name" | Get-AdvancedSetting -Name isolation.tools.memSchedFakeSampleStats.disable	TRUE

CCE ID	Configuration(s)	Built-In/Enhanced	Product	Audit Procedure	Recommended Parameter Value
				If isolation.tools.memSchedFakeSampleStats.disable does not exist or is not set to true, this is a finding.	
CCE-84319-3	NIST80053-VI-ESXI-CFG-00082	Enhanced	vCenter	From a PowerCLI command prompt, while connected to the ESXi host or vCenter server run the following command: Get-VM "VM Name" | Get-AdvancedSetting -Name isolation.tools.ghi.protocolhandler.info.disable If isolation.tools.ghi.protocolhandler.info.disable does not exist or is not set to true, this is a finding.	TRUE
CCE-84320-1	NIST80053-VI-ESXI-CFG-00083	Enhanced	vCenter	From a PowerCLI command prompt, while connected to the ESXi host or vCenter server run the following command: Get-VM "VM Name" | Get-AdvancedSetting -Name isolation.ghi.host.shellAction.disable If isolation.ghi.host.shellAction.disable does not exist or is not set to true, this is a finding.	TRUE
CCE-84321-9	NIST80053-VI-ESXI-CFG-00084	Enhanced	vCenter	From a PowerCLI command prompt, while connected to the ESXi host or vCenter server run the following command: Get-VM "VM Name" | Get-AdvancedSetting -Name isolation.tools.dispTopoRequest.disable If isolation.tools.dispTopoRequest.disable does not exist or is not set to true, this is a finding.	TRUE
CCE-84322-7	NIST80053-VI-ESXI-	Enhanced	vCenter	From a PowerCLI command prompt, while connected to the ESXi host or vCenter server run the following command: Get-VM "VM Name" | Get-AdvancedSetting -Name	TRUE

CCE ID	Configuration(s)	Built-In/Enhanced	Product	Audit Procedure	Recommended Parameter Value
	CFG-00085			isolation.tools.trashFolderState.disable If isolation.tools.trashFolderState.disable does not exist or is not set to true, this is a finding.	
CCE-84323-5	NIST80053-VI-ESXI-CFG-00086	Enhanced	vCenter	From a PowerCLI command prompt, while connected to the ESXi host or vCenter server run the following command: Get-VM "VM Name" | Get-AdvancedSetting -Name isolation.tools.ghi.trayicon.disable If isolation.tools.ghi.trayicon.disable does not exist or is not set to true, this is a finding.	TRUE
CCE-84324-3	NIST80053-VI-ESXI-CFG-00087	Enhanced	vCenter	From a PowerCLI command prompt, while connected to the ESXi host or vCenter server run the following command: Get-VM "VM Name" | Get-AdvancedSetting -Name isolation.tools.unity.disable If isolation.tools.unity.disable does not exist or is not set to true, this is a finding.	TRUE
CCE-84325-0	NIST80053-VI-ESXI-CFG-00088	Enhanced	vCenter	From a PowerCLI command prompt, while connected to the ESXi host or vCenter server run the following command: Get-VM "VM Name" | Get-AdvancedSetting -Name isolation.tools.unityInterlockOperation.disable If isolation.tools.unityInterlockOperation.disable does not exist or is not set to true, this is a finding.	TRUE
CCE-84326-8	NIST80053-VI-ESXI-	Enhanced	vCenter	From a PowerCLI command prompt, while connected to the ESXi host or vCenter server run the following command:	TRUE

CCE ID	Configuration(s)	Built-In/Enhanced	Product	Audit Procedure	Recommended Parameter Value
	CFG-00089			Get-VM "VM Name" | Get-AdvancedSetting -Name isolation.tools.unity.push.update.disable If isolation.tools.unity.push.update.disable does not exist or is not set to true, this is a finding.	
CCE-84327-6	NIST80053-VI-ESXI-CFG-00090	Enhanced	vCenter	From a PowerCLI command prompt, while connected to the ESXi host or vCenter server run the following command: Get-VM "VM Name" | Get-AdvancedSetting -Name isolation.tools.unity.taskbar.disable If isolation.tools.unity.taskbar.disable does not exist or is not set to true, this is a finding.	TRUE
CCE-84328-4	NIST80053-VI-ESXI-CFG-00091	Enhanced	vCenter	From a PowerCLI command prompt, while connected to the ESXi host or vCenter server run the following command: Get-VM "VM Name" | Get-AdvancedSetting -Name isolation.tools.unityActive.disable If isolation.tools.unityActive.disable does not exist or is not set to true, this is a finding.	TRUE
CCE-84329-2	NIST80053-VI-ESXI-CFG-00092	Enhanced	vCenter	From a PowerCLI command prompt, while connected to the ESXi host or vCenter server run the following command: Get-VM "VM Name" | Get-AdvancedSetting -Name isolation.tools.unity.windowContents.disable If isolation.tools.unity.windowContents.disable does not exist or is not set to true, this is a finding.	TRUE

CCE ID	Configuration(s)	Built-In/Enhanced	Product	Audit Procedure	Recommended Parameter Value
CCE-84330-0	NIST80053-VI-ESXI-CFG-00093	Enhanced	vCenter	From a PowerCLI command prompt, while connected to the ESXi host or vCenter server run the following command: Get-VM "VM Name" | Get-AdvancedSetting -Name isolation.tools.vmxDnDVersionGet.disable If isolation.tools.vmxDnDVersionGet.disable does not exist or is not set to true, this is a finding.	TRUE
CCE-84331-8	NIST80053-VI-ESXI-CFG-00094	Enhanced	vCenter	From a PowerCLI command prompt, while connected to the ESXi host or vCenter server run the following command: Get-VM "VM Name" | Get-AdvancedSetting -Name isolation.tools.guestDnDVersionSet.disable If isolation.tools.guestDnDVersionSet.disable does not exist or is not set to true, this is a finding.	TRUE
CCE-84332-6	NIST80053-VI-ESXI-CFG-00095	Enhanced	vCenter	From a PowerCLI command prompt, while connected to the ESXi host or vCenter server run the following command: Get-VM "VM Name" | Get-AdvancedSetting -Name isolation.tools.vixMessage.disable If isolation.tools.vixMessage.disable does not exist or is not set to true, this is a finding.	TRUE
CCE-84333-4	NIST80053-VI-ESXI-CFG-00096	Enhanced	vCenter	From a PowerCLI command prompt, while connected to the ESXi host or vCenter server run the following command: Get-VM "VM Name" | Get-AdvancedSetting -Name RemoteDisplay.maxConnections	1

CCE ID	Configuration(s)	Built-In/Enhanced	Product	Audit Procedure	Recommended Parameter Value
				If RemoteDisplay.maxConnections does not exist or is not set to 1, this is a finding.	
CCE-84334-2	NIST80053-VI-ESXI-CFG-00097	Enhanced	vCenter	From a PowerCLI command prompt, while connected to the ESXi host or vCenter server run the following command: Get-VM "VM Name" | Get-AdvancedSetting -Name RemoteDisplay.vnc.enabled If RemoteDisplay.vnc.enabled does not exist or is not set to false, this is a finding.	FALSE
CCE-84335-9	NIST80053-VI-ESXI-CFG-00098	Enhanced	vCenter	From a PowerCLI command prompt, while connected to the ESXi host or vCenter server run the following command: Get-VM "VM Name" | Get-AdvancedSetting -Name isolation.tools.autoInstall.disable If isolation.tools.autoInstall.disable does not exist or is not set to true, this is a finding.	TRUE
CCE-84336-7	NIST80053-VI-ESXI-CFG-00099	Enhanced	vCenter	From a PowerCLI command prompt, while connected to the ESXi host or vCenter server run the following command: Get-VM "VM Name" | Get-AdvancedSetting -Name tools.setinfo.sizeLimit If tools.setinfo.sizeLimit does not exist or is not set to 1048576, this is a finding.	1048576
CCE-84337-5	NIST80053-VI-ESXI-CFG-00100	Enhanced	vCenter	From a PowerCLI command prompt, while connected to the ESXi host or vCenter server run the following command: Get-VM "VM Name" | Get-AdvancedSetting -Name isolation.device.edit.disable	TRUE

CCE ID	Configuration(s)	Built-In/Enhanced	Product	Audit Procedure	Recommended Parameter Value
				If isolation.device.edit.disable does not exist or is not set to true, this is a finding.	
CCE-84338-3	NIST80053-VI-ESXI-CFG-00101	Enhanced	vCenter	From a PowerCLI command prompt, while connected to the ESXi host or vCenter server run the following command: Get-VM "VM Name" | Get-AdvancedSetting -Name isolation.device.connectable.disable If isolation.device.connectable.disable does not exist or is not set to true, this is a finding.	TRUE
CCE-84339-1	NIST80053-VI-ESXI-CFG-00102	Enhanced	vCenter	From a PowerCLI command prompt, while connected to the ESXi host or vCenter server run the following command: Get-VM "VM Name" | Get-AdvancedSetting -Name tools.guestlib.enableHostInfo If tools.guestlib.enableHostInfo does not exist or is not set to false, this is a finding.	FALSE
CCE-84340-9	NIST80053-VI-ESXI-CFG-00154	Built-in	vCenter	From a PowerCLI command prompt, while connected to the ESXi host or vCenter server run the following command: Get-VM "VM Name" | Get-HardDisk | Select Parent, Name, Filename, DiskType, Persistence | FT -AutoSize If the virtual machine has attached disks that are in independent nonpersistent mode, this is a finding.	Persistent
CCE-84341-7	NIST80053-VI-ESXI-	Built-in	vCenter	From a PowerCLI command prompt, while connected to the ESXi host or vCenter server run the following command:	Disconnect unauthorized floppy devices

CCE ID	Configuration(s)	Built-In/Enhanced	Product	Audit Procedure	Recommended Parameter Value
	CFG-00155			Get-VM | Get-FloppyDrive | Select Parent, Name, ConnectionState If a virtual machine has a floppy drive present, this is a finding.	
CCE-84342-5	NIST80053-VI-ESXI-CFG-00156	Built-in	vCenter	From a PowerCLI command prompt, while connected to the ESXi host or vCenter server run the following command: Get-VM | Get-CDDrive | Where {$_.extensiondata.connectable.connected -eq $true} | Select Parent,Name If a virtual machine has a CD/DVD drive connected other than temporarily, this is a finding.	Disconnect unauthorized CD/DVD drives
CCE-84343-3	NIST80053-VI-ESXI-CFG-00185	Built-in	vCenter	From a PowerCLI command prompt, while connected to the ESXi host run the following command: Get-VirtualPortGroup | Select Name, VLanID If any port group is configured with VLAN 4095 and is not documented as a needed exception, this is a finding.	Not 4095
CCE-84344-1	NIST80053-VI-NET-CFG-00341	Built-in	vCenter	If the vCenter server is not joined to an Active Directory domain and not configured for Single Sign-On Identity Source of the Active Directory domain, and Active Directory/CAC/PIV certificate-based accounts are not used for daily operations of the vCenter server, this is a finding.	Procedural (Dependent on Customer Configurations)
CCE-84345-8	NIST80053-VI-NET-CFG-00341	Built-in	vCenter	If the vCenter server is not joined to an Active Directory domain and not configured for Single Sign-On Identity Source of the Active Directory domain, and Active Directory/CAC/PIV certificate-based accounts are not used for daily operations of the vCenter server, this is a finding.	Procedural (Dependent on Customer Configurations)

CCE ID	Configuration(s)	Built-In/Enhanced	Product	Audit Procedure	Recommended Parameter Value
CCE-84346-6	NIST80053-VI-VC-CFG-00401	Built-in	vCenter	For applications sharing service accounts, create a new service account to assign to the application so that no application shares a service account with another. When standing up a new application that requires access to vCenter always create a new service account prior to installation and grant only the permissions needed for that application.	Procedural (Dependent on Customer Configurations)
CCE-84347-4	NIST80053-VI-VC-CFG-00402	Built-in	vCenter	From a PowerCLI command prompt, while connected to the vCenter server run the following command: Get-VDPortgroup | select Name, VlanConfiguration If any port group is configured with VLAN 4095 and is not documented as a needed exception, this is a finding.	Not 4095
CCE-84348-2	NIST80053-VI-VC-CFG-00403	Built-in	vCenter	From the vSphere Web Client go to Administration >> Single Sign-On >> Configuration >> Policies >> Password Policy. If Restrict Reuse is not set to 5 or more, this is a finding.	5
CCE-84349-0	NIST80053-VI-VC-CFG-00404	Built-in	vCenter	From a PowerCLI command prompt, while connected to the vCenter server run the following command: Get-AdvancedSetting -Entity <vcenter server name> -Name config.log.level If the level is not set to info, this is a finding.	info
CCE-84350-8	NIST80053-VI-VC-CFG-00405	Built-in	vCenter	From a PowerCLI command prompt, while connected to the vCenter server run the following commands: Get-VDSwitch | Get-VDSecurityPolicy Get-VDPortgroup | Get-VDSecurityPolicy	reject

CCE ID	Configuration(s)	Built-In/Enhanced	Product	Audit Procedure	Recommended Parameter Value
				If the Promiscuous Mode policy is set to accept, this is a finding.	
CCE-84351-6	NIST80053-VI-VC-CFG-00406	Built-in	vCenter	From the vSphere Web Client go to Administration >> Client Plug-Ins. View the Installed/Available Plug-ins list and verify they are all identified as authorized VMware, 3rd party (Partner) and/or site-specific (locally developed and site) approved plug-ins. If any Installed/Available plug-ins in the viewable list cannot be verified as vSphere Client plug-ins and/or authorized extensions from trusted sources, this is a finding.	N/A
CCE-84352-4	NIST80053-VI-VC-CFG-00407	Built-in	vCenter	From a PowerCLI command prompt, while connected to the vCenter server run the following commands: Get-VDSwitch | Get-VDSecurityPolicy Get-VDPortgroup | Get-VDSecurityPolicy If the MAC Address Changes policy is set to accept, this is a finding.	Authorized extensions from Trusted Sources
CCE-84353-2	NIST80053-VI-VC-CFG-00408	Built-in	vCenter	From the vSphere Web Client go to Administration >> Single Sign-On >> Configuration >> Policies >> Password Policy. If Upper-Case Characters is not set to at least 1, this is a finding.	1
CCE-84354-0	NIST80053-VI-VC-CFG-00409	Built-in	vCenter	From a PowerCLI command prompt, while connected to the vCenter server run the following command: Get-VDSwitch | select Name,@{N="NIOC Enabled";E={$_.ExtensionData.config.NetworkResourceManagementEnabled}} If Network I/O Control is disabled, this is a finding.	enabled

CCE ID	Configuration(s)	Built-In/Enhanced	Product	Audit Procedure	Recommended Parameter Value
CCE-84355-7	NIST80053-VI-VC-CFG-00410	Enhanced	vCenter	From the vSphere Web Client go to Administration >> Single Sign-On >> Configuration >> Policies >> Password Policy. If the Minimum Length is not set to at least 15, this is a finding.	15
CCE-84356-5	NIST80053-VI-VC-CFG-00411	Enhanced	vCenter	From a PowerCLI command prompt, while connected to the vCenter server run the following commands: $vds = Get-VDSwitch $vds.ExtensionData.Config.HealthCheckConfig If the health check feature is enabled on distributed switches and is not on temporarily for troubleshooting purposes, this is a finding.	FALSE
CCE-84357-3	NIST80053-VI-VC-CFG-00412	Enhanced	vCenter	From the vSphere Client, select the vCenter server at the top of the hierarchy and go to Alarms >> Definitions. or From a PowerCLI command prompt, while connected to the vCenter server run the following command: Get-AlarmDefinition | Where {$_.ExtensionData.Info.Expression.Expression.EventTypeId -eq "vim.event.PermissionUpdatedEvent"} \| Select Name,Enabled,@{N="EventTypeId";E={$_.ExtensionData.Info.Expression.Expression.EventTypeId}} If there is not an alarm created to alert on permission update events, this is a finding.	Procedural

CCE ID	Configuration(s)	Built-In/Enhanced	Product	Audit Procedure	Recommended Parameter Value
CCE-84358-1	NIST80053-VI-VC-CFG-00413	Built-in	vCenter	From the vSphere Web Client go to Administration >> Single Sign-On >> Configuration >> Policies >> Password Policy. If Lower-Case Characters is not set to at least 1, this is a finding.	1
CCE-84359-9	NIST80053-VI-VC-CFG-00414	Enhanced	vCenter	From the vSphere Client, select the vCenter server at the top of the hierarchy and go to Alarms >> Definitions. or From a PowerCLI command prompt, while connected to the vCenter server run the following command: Get-AlarmDefinition | Where {$_.ExtensionData.Info.Expression.Expression.EventTypeId -eq "vim.event.PermissionAddedEvent"} \| Select Name,Enabled,@{N="EventTypeId";E={$_.ExtensionData.Info.Expression.Expression.EventTypeId}} If there is not an alarm created to alert on permission addition events, this is a finding.	Procedural
CCE-84360-7	NIST80053-VI-VC-CFG-00415	Built-in	vCenter	From the vSphere Web Client, go to Administration >> Access Control >> Roles. or From a PowerCLI command prompt, while connected to the vCenter server run the following command: Get-VIPermission | Sort Role | Select Role,Principal,Entity,Propagate,IsGroup | FT -Auto	Procedural (Dependent on Customer Configurations)

CCE ID	Configuration(s)	Built-In/Enhanced	Product	Audit Procedure	Recommended Parameter Value
				Application service account and user required privileges should be documented. If any user or service account has more privileges than required, this is a finding.	
CCE-84361-5	NIST80053-VI-VC-CFG-00416	Enhanced	vCenter	From the vSphere Client, select the vCenter server at the top of the hierarchy and go to Alarms >> Definitions. or From a PowerCLI command prompt, while connected to the vCenter server run the following command: Get-AlarmDefinition | Where {$_.ExtensionData.Info.Expression.Expression.EventTypeId -eq "vim.event.PermissionRemovedEvent"} \| Select Name,Enabled,@{N="EventTypeId";E={$_.ExtensionData.Info.Expression.Expression.EventTypeId}} If there is not an alarm to alert on permission deletion events, this is a finding.	Procedural
CCE-84362-3	NIST80053-VI-VC-CFG-00417	Built-in	vCenter	From a PowerCLI command prompt, while connected to the vCenter server run the following command: Get-VDPortgroup | Select Name,VirtualSwitch,@{N="NetFlowEnabled";E={$_.Extensiondata.Config.defaultPortConfig.ipfixEnabled.Value}} If NetFlow is configured and the collector IP is not known and is not enabled temporarily for troubleshooting purposes, this is a finding.	Known Ips

CCE ID	Configuration(s)	Built-In/Enhanced	Product	Audit Procedure	Recommended Parameter Value
CCE-84363-1	NIST80053-VI-VC-CFG-00418	Enhanced	vCenter	If no clusters are enabled for VSAN, this is not applicable. From the vSphere Web Client go to Host and Clusters >> Select a vCenter Server >> Configure >> vSAN >> Internet Connectivity >> Status. If a proxy is not configured, this is a finding.	Procedural
CCE-84364-9	NIST80053-VI-VC-CFG-00419	Built-in	vCenter	From a PowerCLI command prompt, while connected to the vCenter server run the following command: Get-VIPermission | Sort Role | Select Role,Principal,Entity,Propagate,IsGroup | FT -Auto Application service account and user required privileges should be documented. If any user or service account has more privileges than required, this is a finding.	Procedural (Dependent on Customer Configurations)
CCE-84365-6	NIST80053-VI-VC-CFG-00420	Built-in	vCenter	From the vSphere Web Client, go to Host and Clusters >> Select a Cluster >> Related Objects >> Datastores. Review the datastores. Identify any datastores with “vsan” as the datastore type. or From a PowerCLI command prompt, while connected to the vCenter server run the following command: If($(Get-Cluster \| where {$_.VsanEnabled} | Measure).Count -gt 0){ Write-Host "VSAN Enabled Cluster found" Get-Cluster | where {$_.VsanEnabled} | Get-Datastore | where	No name with “vsanDatastore”

CCE ID	Configuration(s)	Built-In/Enhanced	Product	Audit Procedure	Recommended Parameter Value

				{$_.type -match "vsan"}
				}
				else{
				Write-Host "VSAN is not enabled, this finding is not applicable"
				}
				
				If VSAN is enabled and the datastore is named "vsanDatastore", this is a finding.	

CCE-84366-4	NIST80053-VI-VC-CFG-00421	Enhanced	vCenter	From the vSphere Web Client, go to Administration >> Single Sign-On >> Configuration >> Policies >> Password Policy. If Maximum Lifetime is not set to 60, this is a finding.	60
CCE-84367-2	NIST80053-VI-VC-CFG-00422	Enhanced	vCenter	On the system where vCenter is installed, locate the webclient.properties file. /etc/vmware/vsphere-client/ and /etc/vmware/vsphere-ui/ If session.timeout is not set to 10 (minutes), this is a finding.	10
CCE-84368-0	NIST80053-VI-VC-CFG-00427	Enhanced	vCenter	Get-AdvancedSetting -Entity <vcenter server name> -Name config.vpxd.hostPasswordLength	32
CCE-84369-8	NIST80053-VI-VC-CFG-00428	Built-in	vCenter	From the vSphere Web Client, go to vCenter Inventory Lists >> vCenter Servers >> Select your vCenter Server >> Settings >> Advanced System Settings. or From a PowerCLI command prompt, while connected to the vCenter server run the following command:	FALSE

CCE ID	Configuration(s)	Built-In/Enhanced	Product	Audit Procedure	Recommended Parameter Value
				Get-AdvancedSetting -Entity <vcenter server name> -Name VirtualCenter.VimPasswordExpirationInDays If VirtualCenter.VimPasswordExpirationInDays is set to a value other than 30 or does not exist, this is a finding.	
CCE-84370-6	NIST80053-VI-VC-CFG-00429	Built-in	vCenter	Check the following conditions: 1. The Update Manager must be configured to use the Update Manager Download Server. 2. The use of physical media to transfer update files to the Update Manager server (air-gap model example: separate Update Manager Download Server which may source vendor patches externally via the Internet versus an internal source) must be enforced with site policies. To verify download settings, from the vSphere Client/vCenter Server system, click Update Manager. Select a Host and then click the Settings tab. In the Download Settings tab, find “Direct connection to Internet”. If “Direct connection to Internet” is configured, this is a finding. If all of the above conditions are not met, this is a finding.	Procedural
CCE-84371-4	NIST80053-VI-VC-CFG-00432	Built-in	vCenter	From the vSphere Web Client, go to Administration >> Single Sign-On >> Configuration >> Policies >> Password Policy. If Special Characters is not set to at least 1, this is a finding.	1
CCE-84372-2	NIST80053-VI-VC-CFG-00433	Built-in	vCenter	From the vSphere Web Client, go to Administration >> Single Sign-On >> Configuration >> Policies >> Password Policy. If Numeric Characters is not set to at least 1, this is a finding.	1

CCE ID	Configuration(s)	Built-In/Enhanced	Product	Audit Procedure	Recommended Parameter Value
CCE-84373-0	NIST80053-VI-VC-CFG-00434	Enhanced	vCenter	From the vSphere Web Client, go to Administration >> Single Sign-On >> Configuration >> Policies >> Lockout Policy. If the Time interval between failures is not set to at least 900, this is a finding.	900
CCE-84374-8	NIST80053-VI-VC-CFG-00435	Enhanced	vCenter	From the vSphere Web Client, go to Administration >> Single Sign-On >> Configuration >> Policies >> Lockout Policy. If the Unlock time is not set to 0, this is a finding.	0
CCE-84375-5	NIST80053-VI-VC-CFG-00436	Enhanced	vCenter	From the vSphere Web Client, go to Administration >> Single Sign-On >> Configuration >> Policies >> Lockout Policy. If the Maximum number of failed login attempts is not set to 3, this is a finding.	3
CCE-84376-3	NIST80053-VI-VC-CFG-00437	Enhanced	vCenter	From the vSphere Web Client go to vCenter Inventory Lists >> vCenter Servers >> Select your vCenter Server >> Settings >> Advanced Settings. or From a PowerCLI command prompt, while connected to the vCenter server run the following command: Get-AdvancedSetting -Entity <vcenter server name> -Name config.nfc.useSSL If config.nfc.useSSL is not set to true, this is a finding.	TRUE
CCE-84377-1	NIST80053-VI-VC-CFG-00439	Built-in	vCenter	If the built-in SSO administrator account is used for daily operations or there is no policy restricting its use, this is a finding.	Procedural

CCE ID	Configuration(s)	Built-In/Enhanced	Product	Audit Procedure	Recommended Parameter Value
CCE-84378-9	NIST80053-VI-VC-CFG-00440	Enhanced	vCenter	From the vSphere Web Client, go to Networking >> Select a distributed port group >> Manage >> Settings >> Properties. View the Override port policies. or From a PowerCLI command prompt, while connected to the vCenter server run the following command: Get-VDPortgroup | Get-View | Select Name, @{N="VlanOverrideAllowed";E={$_.Config.Policy.VlanOverrideAllowed}}, @{N="UplinkTeamingOverrideAllowed";E={$_.Config.Policy.UplinkTeamingOverrideAllowed}}, @{N="SecurityPolicyOverrideAllowed";E={$_.Config.Policy.SecurityPolicyOverrideAllowed}}, @{N="IpfixOverrideAllowed";E={$_.Config.Policy.IpfixOverrideAllowed}}, @{N="BlockOverrideAllowed";E={$_.Config.Policy.BlockOverrideAllowed}}, @{N="ShapingOverrideAllowed";E={$_.Config.Policy.ShapingOverrideAllowed}}, @{N="VendorConfigOverrideAllowed";E={$_.Config.Policy.VendorConfigOverrideAllowed}}, @{N="TrafficFilterOverrideAllowed";E={$_.Config.Policy.TrafficFilterOverrideAllowed}}, @{N="PortConfigResetAtDisconnect";E={$_.Config.Policy.PortConfigResetAtDisconnect}} | Sort Name	disabled

CCE ID	Configuration(s)	Built-In/Enhanced	Product	Audit Procedure	Recommended Parameter Value
				Note: This was broken up into multiple lines for readability. Either paste as is into a PowerShell script or combine into one line and run. This does not apply to the reset port configuration on disconnect policy. If any port level overrides are enabled and not documented, this is a finding.	
CCE-84379-7	NIST80053-VI-VC-CFG-00442	Enhanced	vCenter	From the vSphere Client, select the vCenter server at the top of the hierarchy and go to Alarms >> Definitions. or From a PowerCLI command prompt, while connected to the vCenter server run the following command: Get-AlarmDefinition | Where {$_.ExtensionData.Info.Expression.Expression.EventTypeId -eq "esx.problem.vmsyslogd.remote.failure"} \| Select Name,Enabled,@{N="EventTypeId";E={$_.ExtensionData.Info.Expression.Expression.EventTypeId}} If there is no alarm created to alert if an ESXi host can no longer reach its syslog server, this is a finding.	Enabled
CCE-84380-5	NIST80053-VI-VC-CFG-00445	Built-in	vCenter	If IP-based storage is not used, this is not applicable. IP-based storage (iSCSI, NFS, VSAN) VMkernel port groups must be in a dedicated VLAN that can be on a common standard or distributed virtual switch that is logically separated from other traffic types. The check for this will be unique per environment.	Unique IP Addresses

CCE ID	Configuration(s)	Built-In/Enhanced	Product	Audit Procedure	Recommended Parameter Value
				From the vSphere Client, select Networks >> Distributed Port Groups and review the VLANs associated with any IP-based storage VMkernels. If any IP-based storage networks are not isolated from other traffic types, this is a finding.	
CCE-84381-3	NIST80053-VI-VC-CFG-00447	Built-in	vCenter	Log in to the vCenter server and view the local administrators group membership. If the local administrators group contains users and/or groups that are not vCenter Administrators such as “Domain Admins”, this is a finding.	Only necessary users and groups
CCE-84382-1	NIST80053-VI-VC-CFG-00450	Built-in	vCenter	From the vSphere Client, go to Home >> Networking. Select a distributed port group, click Edit, then go to Security. or From a PowerCLI command prompt, while connected to the vCenter server run the following commands: Get-VDSwitch | Get-VDSecurityPolicy Get-VDPortgroup | ?{$_.IsUplink -eq $false} | Get-VDSecurityPolicy If the Forged Transmits policy is set to accept for a non-uplink port, this is a finding.	reject
CCE-84383-9	NIST80053-VI-VC-CFG-00455	Enhanced	vCenter	If the vSphere Storage API - Data Protection (VADP) solution is not configured for performing backup and restore of the management components, this is a finding.	vSphere Storage API - Data Protection (VADP)

CCE ID	Configuration(s)	Built-In/Enhanced	Product	Audit Procedure	Recommended Parameter Value
CCE-84384-7	NIST80053-VI-VC-CFG-00497	Built-in	vCenter	On the Edit port group - VM Network window, check for input 1611 for VLAN ID. If the vlan is 1611, this is a finding.	Not 1611
CCE-84385-4	NIST80053-VI-VC-CFG-00555	Enhanced	vCenter	From a PowerCLI command prompt, while connected to the ESXi host or vCenter server run the following command: Get-VM "VM Name" | Get-AdvancedSetting -Name svga.vgaonly If svga.vgaonly does not exist or is not set to false, this is a finding.	TRUE
CCE-84386-2	NIST80053-VI-VC-CFG-00561	Enhanced	vCenter	From a PowerCLI command prompt, while connected to the ESXi host or vCenter server run the following command: Get-VM "VM Name" | Get-AdvancedSetting -Name pciPassthru*.present If pciPassthru*.present does not exist or is not set to false, this is a finding.	FALSE
CCE-84601-4	NIST80053-VI-Storage-SDS-CFG-00178	Enhanced	vSAN	From a PowerCLI command prompt, while connected to the vCenter server run the following command: Get-VIPermission | Where {$_.Role -eq "Admin"} | Select Role,Principal,Entity,Propagate,IsGroup | FT -Auto If there are any users other than Solution Users with the Administrator role that are not explicitly designated for cryptographic operations, this is a finding.	No Cryptography Administrator
CCE-84602-2	NIST80053-VI-	Built-in	vSAN	From a PowerCLI command prompt, while connected to the ESXi host run the following commands:	Correct date and timestamp

CCE ID	Configuration(s)	Built-In/Enhanced	Product	Audit Procedure	Recommended Parameter Value
	Storage-SDS-CFG-00180			Get-VMHost | Get-VMHostNTPServer Get-VMHost | Get-VMHostService | Where {$_.Label -eq "NTP Daemon"} If the NTP service is not configured with authoritative DoD time sources and the service is not configured to start and stop with the host and is running, this is a finding.	
CCE-84603-0	NIST80053-VI-Storage-SDS-CFG-00181	Built-in	vSAN	Log in to the vRealize Log Insight user interface. Click the configuration drop-down menu icon and select Content Packs. Under Content Pack Marketplace, select Marketplace. If the VMware - vSAN content pack does not appear in the Installed Content Packs list, this is a finding.	VMware - vSAN
CCE-84604-8	NIST80053-VI-Storage-SDS-CFG-00182	Built-in	vSAN	From a PowerCLI command prompt, while connected to the ESXi host run the following command: Get-VMHost | Get-AdvancedSetting -Name UserVars.HostClientSessionTimeout If UserVars.HostClientSessionTimeout is not set to 900, this is a finding.	900
CCE-84605-5	NIST80053-VI-Storage-SDS-CFG-00183	Enhanced	vSAN	From the vSphere client, select the cluster. Click the Configure tab and under vSAN, click Services. If Encryption is not enabled or the KMS cluster is not configured, this is a finding.	Enabled

CCE ID	Configuration(s)	Built-In/Enhanced	Product	Audit Procedure	Recommended Parameter Value
CCE-84606-3	NIST80053-VI-Storage-SDS-CFG-00184	Built-in	vSAN	Perform a compliance check on the inventory objects to make sure that you have all the latest security patches and updates applied. Use the vSphere Client to log in to a vCenter Server Appliance, or to a vCenter Server system with which Update Manager is registered. If all the latest security patches and updates are not applied, this is a finding.	Up-to-Date Patches and Upgrades
CCE-84607-1	NIST80053-VI-Storage-SDS-CFG-00185	Built-in	vSAN	From a PowerCLI command prompt, while connected to the ESXi host run the following command: Get-VMHost | Get-AdvancedSetting -Name Syslog.global.logHost If Syslog.global.logHost is not set to a site-specific syslog server, this is a finding.	udp://sfo01vrli01.sfo01.rainpole.local:514
CCE-84608-9	NIST80053-VI-Storage-SDS-CFG-00204	Enhanced	vSAN	From a PowerCLI command prompt, while connected to the vCenter server run the following command: Get-VIPermission | Where {$_.Role -eq "Admin"} | Select Role,Principal,Entity,Propagate,IsGroup | FT -Auto If there are any users other than Solution Users with the Administrator role that are not explicitly designated for cryptographic operations, this is a finding.	No Cryptography Administrator
CCE-84609-7	NIST80053-VI-Storage-SDS-CFG-00207	Enhanced	vSAN	If VSAN Health Check is installed: From the vSphere Client, go to Host and Clusters. Select a VC and go to Configure > vSAN > Internet Connectivity > Status. If “Enable Internet access for this cluster” is enabled and a proxy is not configured, this is a finding.	Proxy should be configured

CCE ID	Configuration(s)	Built-In/Enhanced	Product	Audit Procedure	Recommended Parameter Value

CCE-84610-5	NIST80053-VI-Storage-SDS-CFG-00208	Built-in	vSAN	From a PowerCLI command prompt, while connected to the vCenter server run the following command:
				
				If($(Get-Cluster \| where {$_.VsanEnabled} | Measure).Count -gt 0){
				Write-Host "VSAN Enabled Cluster found"
				Get-Cluster | where {$_.VsanEnabled} \| Get-Datastore \| where {$_.type -match "vsan"}
				}
				else{
				Write-Host "VSAN is not enabled, this finding is not applicable"
				}
				
				If VSAN is enabled and the datastore is named “vsanDatastore”, this is a finding.
					Datastore name is unique

CCE-84611-3	NIST80053-VI-Storage-SDS-CFG-00179	Enhanced	vSAN	From a PowerCLI command prompt, while connected to the ESXi host run the following commands: $esxcli = Get-EsxCli $esxcli.system.coredump.network.get() If there is no active core dump partition or the network core dump collector is not configured and enabled, this is a finding.	TRUE
CCE-84612-1	NIST80053-VI-Storage-SDS-CFG-00186	Enhanced	vSAN	Make sure you have sufficient capacity in the management vSAN cluster for the management virtual machines. If you do not have sufficient capacity, this is a finding.	Procedural

933 Appendix B List of Acronyms

API	Application Programming Interface
BOM	Bill of Materials
CCE	Common Configuration Enumeration
DISA	Defense Information Systems Agency
HSM	Hardware Security Module
IaaS	Infrastructure as a Service
IT	Information Technology
KMS	Key Management System
NCCoE	National Cybersecurity Center of Excellence
NIST	National Institute of Standards and Technology
NISTIR	National Institute of Standards and Technology Interagency Report
NSX-V	NSX for vSphere
OS	Operating System
PSC	Platform Services Controller
SDDC	Software Defined Data Center
SLES	SUSE Linux Enterprise Server
SMTP	Simple Mail Transfer Protocol
SP	Special Publication
STIG	Security Technical Implementation Guide
UI	User Interface
UMDS	Update Manager Download Service
VADP	vSphere Storage APIs for Data Protection
vCS	vSphere vCenter Server
VM	Virtual Machine
vR	vSphere Replication
vRA	vRealize Automation
vRLI	vRealize Log Insight
vROPS	vRealize Operations Manager
VVD	VMware Validated Design

Appendix C Glossary

All significant technical terms used within this document are defined in other key documents, particularly National Institute of Standards and Technology Interagency Report (NISTIR) 7904, *Trusted Geolocation in the Cloud: Proof of Concept Implementation*. As a convenience to the reader, terms critical to understanding this volume are provided in this glossary.

Cloud workload A logical bundle of software and data that is present in, and processed by, a cloud computing technology.

Geolocation Determining the approximate physical location of an object, such as a cloud computing server.

Hardware root of trust An inherently trusted combination of hardware and firmware that maintains the integrity of information.

Trusted compute pool A physical or logical grouping of computing hardware in a data center that is tagged with specific and varying security policies. Within a trusted compute pool, the access and execution of applications and workloads are monitored, controlled, audited, etc. Also known as a *trusted pool*.

Appendix D References

[1] Joint Task Force Transformation Initiative, “Security and privacy controls for federal information systems and organizations,” NIST, Gaithersburg, MD, NIST SP 800-53 Revision 4, Apr. 2013. Available: https://dx.doi.org/10.6028/NIST.SP.800-53r4.

[2] NIST, “Framework for improving critical infrastructure cybersecurity,” NIST, Gaithersburg, MD, Apr. 16, 2018, Version 1.1. Available: https://doi.org/10.6028/NIST.CSWP.04162018.