vRA Hardening

vRealize Automation 6.2

You can find the most up-to-date technical documentation on the VMware website at:

https://docs.vmware.com/

If you have comments about this documentation, submit your feedback to

docfeedback@vmware.com

VMware, Inc.
3401 Hillview Ave.
Palo Alto, CA 94304
www.vmware.com

Contents

1 vRealize Automation Secure Baseline Overview 6

2 Install and Configure the vRealize Hardening Tool 7

3 Run the vRealize Hardening Tool in UI Mode 9

4 Run the vRealize Hardening Tool in Command Line Interface Mode 10

5 vRealize Automation Hardening Activity Options 11

6 Verifying the Integrity of Installation Media 12

7 Hardening VMware System Software Infrastructure 13

Hardening the VMware vSphere® Environment 13

Hardening the Infrastructure as a Service Host 13

Hardening Microsoft SQL Server 14

Hardening Microsoft .NET 14

Hardening Microsoft Internet Information Services (IIS) 14

Hardening the vRealize Automation Server PostgreSQL Database 15

8 Reviewing Installed Software 16

9 VMware Security Advisories and Patches 17

10 Secure Configuration 18

Securing the vRealize Automation appliance 18

Change the Root Password 18

Verify Root Password Hash and Complexity 19

Manage Password Expiry 19

Managing Secure Shell and Administrative Accounts 20

Set Boot Loader Authentication 25

Configure NTP 26

Configuring TLS for vRealize Automation appliance Data In-transit 27

Configure vRealize Automation Application Resources 35

Change the PostgreSQL User Password 37

Configure PostgreSQL Client Authentication 38

Customizing Console Proxy Configuration 39

Set vRealize Automation appliance Session Timeout 40

Managing Nonessential Software 40
Securing the Infrastructure as a Service Component 44
Disabling Windows Time Service 45
Disable SSLv3 in Internet Information Services 45
Configuring TLS Cipher Suites 46
Customizing Configuration Modes 46
Verifying Host Server Security 46
Protecting Application Resources 47
Secure the Infrastructure as a Service Host Machine 48

11 Configuring Server Response Headers 49
Configure the Lighttpd Server Response Header 49
Configure the Apache Server Response Header 49
Configure the TCServer Response Header for the vRealize Automation appliance 50
Configure the tcServer Response Server Header for the Identity Appliance 50
Configure the Internet Information Services Server Response Header 51

12 Configuring Host Network Security 52
Configuring Network Settings for VMware Appliances 52
Prevent User Control of Network Interfaces 52
Set TCP Backlog Queue Size 53
Deny ICMPv4 Echoes to Broadcast Address 53
Disable IPv4 Proxy ARP 53
Deny IPv4 ICMP Redirect Messages 54
Deny IPv6 ICMP Redirect Messages 55
Log IPv4 Martian Packets 55
Use IPv4 Reverse Path Filtering 56
Deny IPv4 Forwarding 57
Deny IPv6 Forwarding 57
Use IPv4 TCP Syncookies 58
Deny IPv6 Router Advertisements 58
Deny IPv6 Router Solicitations 59
Deny IPv6 Router Preference in Router Solicitations 60
Deny IPv6 Router Prefix 60
Deny IPv6 Router Advertisement Hop Limit Settings 61
Deny IPv6 Router Advertisement Autoconf Settings 62
Deny IPv6 Neighbor Solicitations 62
Restrict IPv6 Max Addresses 63
Configuring Network Settings for the Infrastructure as a Service Host 64
Configuring Ports and Protocols 64
User Required Ports 64
Administrator Required Ports 64

13 Auditing and Logging 69

vRealize Automation Secure Baseline Overview

1

VMware provides comprehensive recommendations to help you verify and configure a secure baseline for your vRealize Automation system.

Use the appropriate tools and procedures as specified by VMware to verify and maintain a secure, hardened baseline configuration for your vRealize Automation system. Some vRealize Automation components are installed in a hardened or partially-hardened state, but you should review and verify configuration of each component in light of VMware security recommendations, company security policies, and known threats. While you must verify or configure some hardening activities manually, in many cases, you can complete hardening activities either manually.

vRealize Automation Security Posture

The security posture of vRealize Automation assumes a holistically secure environment based on system and network configuration, organizational security policies, and security best practices.

When verifying and configuring hardening of a vRealize Automation system, consider each of the following areas as addressed by VMware hardening recommendations.

- Secure Deployment
- Secure Configuration
- Network Security

To ensure that your system is securely hardened, consider VMware recommendations and your local security policies as they relate to each of these conceptual areas.

System Components

When considering hardening and the secure configuration of your vRealize Automation system, ensure that you understand all components and how they work together to support system functionality.

Consider the following components when planning and implementing a secure system.

- vRealize Automation appliance
- IaaS Component

Install and Configure the vRealize Hardening Tool

2

You can set up the vRealize Hardening Tool to help maintain and verify a secure baseline for your vRealize Automation installation.

Set up the vRealize Hardening Tool to work with your VMware installation. The Hardening Tool is based on and requires Ansible, which is an open-source software platform for configuring and managing computers.

The vRealize Hardening Tool is available on the VMware vRealize Automation Drivers & Tools download page.

Prerequisites

Install and configure yourvRealize Automation system in accordance with VMware guidelines in *Installation and Configuration*.

Procedure

1 Install the Ansible software by downloading it and following the instructions on the Ansible Web site.

2 Verify the Ansible installation.

   a Run the `ansible --version` command.

   b If any errors appear, see the`<vrhtool>/Readme.txt` file for instructions about how to install missing modules required to run Ansible.

3 Download the vRealize Hardening Tool.

4 Run the `tar -zxvf vrhtool.tar.gz` command to install the Hardening Tool.

5 Modify the list of appliances to update.

a Open the `<vrhtool>/baseline/v1.0/roles/inventory.yaml` file in a text editor.

b Replace *abc1.xyxz.com* with the fully qualified domain name (FQDN) of your vRealize Automation appliance.

You can include multiple instances of vRealize Automation appliance, as shown in the following example.

```
# Usage:
# Fully_Qualified_Hostname root_username root_password

# List of Cafe appliances
[cafe]
<abc1.xyxz.com> ansible_ssh_user=username ansible_ssh_pass=password
<abc2.xyxz.com> ansible_ssh_user=username ansible_ssh_pass=password
[cafe:vars]
# Provide the username of the admin account you want to create on all the Cafe servers
# This user can be used for admin activities when root user is disabled
username=cafeuser1
```

c Replace *username* and *password* with the required SSH credentials that enable the vRealize Hardening Tool to modify the vRealize Automation appliance.

Run the vRealize Hardening Tool in UI Mode

3

You can run the vRealize Hardening Tool in UI mode to complete some hardening activities.

For information about specific hardening activities you can complete with the Hardening Tool, see Chapter 5 vRealize Automation Hardening Activity Options.

Procedure

1 Change to the directory where the tool resides by running the following command.

```
cd vrhtool
```

2 Run the `python script`.

```
python script/vRHT.py
```

3 In Categories, select the hardening activities to run.

4 (Optional) Select **Dry Run**, and click **Execute** to verify the changes before they are implemented.

5 Click **Execute** to run the vRealize Hardening Tool based on your selections.

Run the vRealize Hardening Tool in Command Line Interface Mode

4

Users can run the vRealize Hardening Tool in command-line interface (CLI) mode to complete some hardening activities.

For information about specific hardening activities that you can complete with the Hardening Tool, see Chapter 5 vRealize Automation Hardening Activity Options.

Procedure

1 Change to the directory where the vRealize Hardening Tool resides.

```
cd vrhtool
```

2 (Optional) To verify that the vRealize Hardening Tool was installed without making changes, run the `ansible-playbook` command.

```
ansible-playbook -i baseline/v1.0/roles/inventory.yaml
baseline/v1.0/roles/start.yaml -check
```

No changes are made to the system.

3 To run the vRealize Hardening Tool and make changes to the system, run the `ansible-playbook` command.

```
ansible-playbook -i baseline/my_inventory.yaml baseline/vRA.yaml --tags
apache2,create_admin_user,lighttpd,ntp,pwd_expiry,rabbitmq,tcserver
```

Each comma-separated tag, such as *create_admin_user* is associated with a hardening activity that the vRealize Hardening Tool supports. If you do not want to run a hardening activity, you can omit it from the command.

vRealize Automation Hardening Activity Options

5

Harden the vRealize Automation system either manually or by using the vRealize Hardening Tool. You can complete many hardening activities with the vRealize Hardening Tool UI or the command-line interface (CLI), or you can complete them by manually editing or setting configuration options. You must complete some hardening activities manually.

Because many of the hardening settings that the Hardening Tool configures are set by default, you can use the Hardening Tool to restore a system to its default hardened state.

Table 5-1. Hardening Activity Options

Manual Hardening Activity	Hardening Tool UI Option	Hardening Tool Command-Line Tag Option
Configure the Apache Server Response Header	Apache2 Configuration	apache2
Create Local Administrator Account for Secure Shell	Linux Admin User	create_admin_user
Configure the Lighttpd Server Response Header	Lighttpd Configuration	lighttpd
Configure NTP	Network Time Protocol	ntp
Manage Password Expiry	Root Password Expiry	pwd_expiry
Disable Weak Ciphers in the vRealize Automation appliance RabbitMQ Service	RabbitMQ Configuration	rabbitmq
Configure the TCServer Response Header for the vRealize Automation appliance	TcServer Configuration	tcserver
Configuring Network Settings for VMware Appliances	Network Settings	Network_cfg
Verifying Secure Shell Key File Permissions	Secure Shell	ssh
Harden the Secure Shell Server Configuration	Secure Shell	ssh
Harden the Secure Shell Client Configuration	Secure Shell	ssh

Verifying the Integrity of Installation Media 6

Users should always verify the integrity of the installation media before installing a VMware product.

Always verify the SHA1 hash after you download an ISO, offline bundle, or patch to ensure integrity and authenticity of the downloaded files. If you obtain physical media from VMware and the security seal is broken, return the software to VMware for a replacement.

After you download 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 Web site. SHA1 or MD5 hash should match.

For more information about verifying the integrity of the installation media, see http://kb.vmware.com/kb/1537.

Hardening VMware System Software Infrastructure

7

As part of your hardening process, assess the deployed software infrastructure that supports your VMware system and verify that it meets VMware hardening guidelines.

Before hardening your VMware system, review and address security deficiencies in your supporting software infrastructure to create a completely hardened and secure environment. Software infrastructure elements to consider include operating system components, supporting software, and database software. Address security concerns in these and other components according to the manufacturer's recommendations and other relevant security protocols.

This chapter includes the following topics:

- Hardening the VMware vSphere ® Environment
- Hardening the Infrastructure as a Service Host
- Hardening Microsoft SQL Server
- Hardening Microsoft .NET
- Hardening Microsoft Internet Information Services (IIS)
- Hardening the vRealize Automation Server PostgreSQL Database

Hardening the VMware vSphere ® Environment

Assess the VMware vSphere ® environment and verify that the appropriate level of vSphere hardening guidance is enforced and maintained.

For more guidance about hardening, see http://www.vmware.com/security/hardening-guides.html .

As part of a comprehensively hardened environment, VMware vSphere ® infrastructure must meet security guidelines as defined by VMware.

Hardening the Infrastructure as a Service Host

Verify that your Infrastructure as a Service Microsoft Windows host machine is hardened according to VMware guidelines.

Review the recommendations in the appropriate Microsoft Windows hardening and secure best practice guidelines, and ensure that your Windows Server host is appropriately hardened. Not following the hardening recommendations might result in exposure to known security vulnerabilities from insecure components on Windows releases.

To verify that your version is supported, see the vRealize Automation Support Matrix.

Contact your Microsoft vendor about the correct guidance for hardening practices of Microsoft products.

Hardening Microsoft SQL Server

Verify that the Microsoft SQL Server database meets security guidelines as established by Microsoft and VMware.

Review the recommendations in the appropriate Microsoft SQL Server hardening and secure best practice guidelines. Review all Microsoft security bulletins regarding the installed version of Microsoft SQL Server. Not following the hardening recommendations might result in exposure to known security vulnerabilities from insecure components on Microsoft SQL Server versions.

To verify that your version Microsoft SQL Server is supported, see the vRealize Automation Support Matrix.

Contact your Microsoft vendor for guidance about hardening practices for Microsoft products.

Hardening Microsoft .NET

As part of a comprehensively hardened environment, Microsoft .NET must meet security guidelines as laid out by Microsoft and VMware.

Review the recommendations set out in the appropriate .NET hardening and secure best practice guidelines. Also, review all Microsoft security bulletins regarding the version of Microsoft SQL Server you are using. Failure to follow the hardening recommendations might result in exposure to known security vulnerabilities from insecure Microsoft.NET components.

To verify that your version of Microsoft.NET is supported, see the vRealize Automation Support Matrix.

Contact your Microsoft vendor for guidance on hardening practices for Microsoft products.

Hardening Microsoft Internet Information Services (IIS)

Verify that your Microsoft Internet Information Services (IIS) meet all Microsoft and VMware security guidelines.

Review the recommendations set out in the appropriate Microsoft IIS hardening and secure best practice guidelines. Also, review all Microsoft security bulletins regarding the version of IIS you are using. Not following the hardening recommendations might result in exposure to known security vulnerabilities.

To verify that your version is supported, see the vRealize Automation Support Matrix.

Contact your Microsoft vendor for guidance on hardening practices for Microsoft products.

Hardening the vRealize Automation Server PostgreSQL Database

Verify that your VMware or user-supplied PostgreSQL database meets applicable hardening guidelines.

For most customers, VMware distributes vRealize Automation with a hardened PostgreSQL database. In addition, VMware releases occasional product security advisories. To maintain PostgreSQL security, assess your vRealize Automation installation, patching, and upgrade history regularly, then follow and enforce all relevant VMware security advisories.

For more information about the current VMware security advisories, see http://www.vmware.com/security/advisories/. Also, review applicable recommendations in the PostgreSQL hardening guides and best practices that are available online.

Caution Failure to follow hardening recommendations might result in exposure to known security vulnerabilities.

User Supplied PostgreSQL Database

In some cases, users supply their own PostgreSQL databases. If you have a user supplied PostgreSQL database, review applicable recommendations in the PostgreSQL hardening and secure best practice guidelines that are available online. Also, review all PostgreSQL security bulletins regarding your version of PostgreSQL.

To verify that your version is supported, see the vRealize Automation Support Matrix. For more information about PostgreSQL security alerts, see the security section of the PostgreSQL Web site.

Caution Failure to follow hardening recommendations might result in exposure to known security vulnerabilities.

Reviewing Installed Software 8

Because vulnerabilities in third party and unused software increase the risk of unauthorized system access and disruption of availability, it is important to review all software installed on VMware host machines and evaluate its use.

Do not install software that is not required for the secure operation of the system on the VMware host machines. Uninstall unused or extraneous software.

Inventory Installed Unsupported Software

Assess your VMware deployment and inventory of installed products to verify that no extraneous unsupported software is installed.

For more information about the support policies for third-party products, see the VMware support article at https://www.vmware.com/support/policies/thirdparty.html.

Verify Third-Party Software

VMware does not support or recommend installation of third party software that has not been tested and verified. Insecure, unpatched, or unauthenticated third-party software installed on VMware host machines might put the system at risk of unauthorized access and disruption of availability. If you must use unsupported third-party software, consult the third-party vendor for secure configuration and patching requirements.

VMware Security Advisories and Patches

9

To maintain maximum security for your system, follow VMware security advisories and apply all relevant patches.

VMware releases security advisories for products. Monitor these advisories to ensure that your product is protected against known threats.

Assess the vRealize Automation installation, patching, and upgrade history and verify that the released VMware Security Advisories are followed and enforced.

For more information about the current VMware security advisories, see http://www.vmware.com/security/advisories/.

Secure Configuration

10

Verify and update security settings for vRealize Automation virtual appliances and the Infrastructure as a Service component as appropriate for your system configuration. In addition, verify and update configuration of other components and applications.

Securely configuring a vRealize Automation installation involves addressing the configuration of each component individually and as they work together. Consider the configuration of all systems components in concert to achieve a reasonably secure baseline.

This chapter includes the following topics:

- Securing the vRealize Automation appliance
- Securing the Infrastructure as a Service Component

Securing the vRealize Automation appliance

Verify and update security settings for the vRealize Automation appliance as necessary for your system configuration.

Configure security settings for your virtual appliances and their host operating systems. In addition, set or verify configuration of other related components and applications. In some cases, you need to verify existing settings, while in others you must change or add settings to achieve an appropriate configuration.

Change the Root Password

You can change the root password for the vRealize Automation appliance to meet applicable security requirements.

Change the root password on the vRealize Automation appliance using the Virtual Appliance Management Interface. Verify that the root password meets your organization's corporate password complexity requirements.

Procedure

1 Open the Virtual Appliance Management Interface for your vRealize Automation appliance.

   https://*vRealizeAppliance-url*:5480

2 Select the **Admin** tab on the Virtual Appliance Management Interface.

3 Select the **Admin** submenu.

4 Enter the existing password in the **Current administrator password** text box.

5 Enter the new password in the **New administrator password** text box.

6 Enter the new password in the **Retype new administrator password** text box.

7 Click **Save Settings** to save your changes.

Verify Root Password Hash and Complexity

Verify that the root password meets your organization’s corporate password complexity requirements.

Validating the root password complexity is required as the root user bypasses the pam_cracklib module password complexity check that is applied to user accounts.

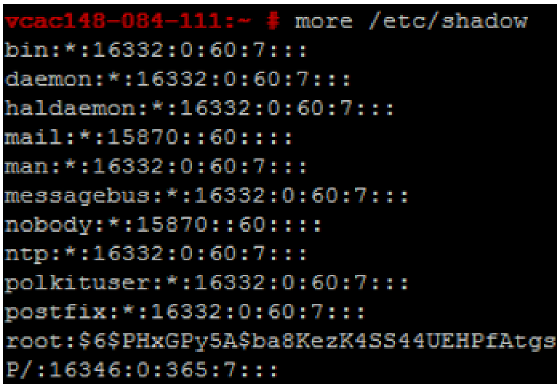
The account password must start with `$6$`, which indicates a sha512 hash. This is the standard hash for all hardened appliances.

Procedure

1 To verify the hash of the root password, log in as root and run the `# more /etc/shadow` command.

The hash information is displayed.

Figure 10-1. Password Hash Results



```
vcac148-084-111:~ # more /etc/shadow
bin:*:16332:0:60:7:::
daemon:*:16332:0:60:7:::
haldaemon:*:16332:0:60:7:::
mail:*:15870::60::::
man:*:16332:0:60:7:::
messagebus:*:16332:0:60:7:::
nobody:*:15870::60::::
ntp:*:16332:0:60:7:::
polkituser:*:16332:0:60:7:::
postfix:*:16332:0:60:7:::
root:$6$PHxGPy5A$ba8KezK4SS44UEHPfAtgs
P/:16346:0:365:7:::
```

2 If the root password does not contain a sha512 hash, run the `passwd` command to change it.

All hardened appliances enable `enforce_for_root` for the `pw_history` module, found in the `etc/pam.d/common-password` file. The system remembers the last five passwords by default. Old passwords are stored for each user in the `/etc/security/opasswd` file.

Manage Password Expiry

Configure all account password expirations in accordance with your organization's security policies.

By default, all hardened VMware virtual appliance accounts use a 60-day password expiration. On most hardened appliances, the root account is set to a 365-day password expiration. As a best practice, verify that the expiration on all accounts meets both security and operation requirements standards.

If the root password expires, you cannot reinstate it. You must implement site-specific policies to prevent administrative and root passwords from expiring.

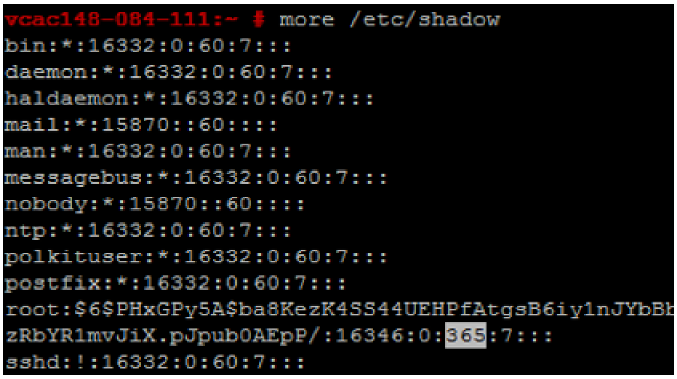
Procedure

1. Log in to your virtual appliance machines as root and run the following command to verify the password expiration on all accounts.

   ```
   # cat /etc/shadow
   ```

   The password expiration is the fifth field (fields are separated by colons) of the shadow file. The root expiration is set in days.

   Figure 10-2. Password Expiry Field

   ```
   vcac148-084-111:~ # more /etc/shadow
   bin:*:16332:0:60:7:::
   daemon:*:16332:0:60:7:::
   haldaemon:*:16332:0:60:7:::
   mail:*:15870::60::::
   man:*:16332:0:60:7:::
   messagebus:*:16332:0:60:7:::
   nobody:*:15870::60::::
   ntp:*:16332:0:60:7:::
   polkituser:*:16332:0:60:7:::
   postfix:*:16332:0:60:7:::
   root:$6$PHxGPy5A$ba8KezK4SS44UEHPfAtgsB6iy1nJYbBb
   zRbYR1mvJiX.pJpub0AEpP/:16346:0:365:7:::
   sshd:!:16332:0:60:7:::
   ```

2. To modify the expiry of the root account, run a command of the following form.

   ```
   # passwd –x 365 root
   ```

   In this command, 365 specifies the number of days until password expiry. Use the same command to modify any user, substituting the specific account for 'root', and replacing the number of days to meet the expiry standards of the organization.

Managing Secure Shell and Administrative Accounts

For remote connections, all hardened appliances include the Secure Shell (SSH) protocol. Use SSH only when necessary and manage it appropriately to preserve system security.

SSH is an interactive command-line environment that supports remote connections to VMware virtual appliances. By default, SSH access requires high-privileged user account credentials. Root user SSH activities generally bypass the role-based access control (RBAC) and audit controls of the virtual appliances.

As a best practice, disable SSH in a production environment, and activate it only to troubleshoot problems that you cannot resolve by other means. Leave it enabled only while needed for a specific purpose and in accordance with your organization's security policies. SSH is disabled by default on the vRealize Automation appliance. Depending on your vSphere configuration, you might enable or disable SSH when you deploy your Open Virtualization Format (OVF) template.

As a simple test to determine whether SSH is enabled on a machine, try opening a connection by using SSH. If the connection opens and requests credentials, then SSH is enabled and available for connections.

Secure Shell root User Account

Because VMware appliances do not include pre-configured user accounts, the root account can use SSH to directly log in by default. Disable SSH as root as soon as possible.

To meet the compliance standards for non repudiation, the SSH server on all hardened appliances is pre-configured with the AllowGroups wheel entry to restrict SSH access to the secondary group wheel. For separation of duties, you can modify the AllowGroups wheel entry in the `/etc/ssh/sshd_config` file to use another group such as sshd.

The wheel group is enabled with the `pam_wheel` module for superuser access, so members of the wheel group can su-root, where the root password is required. Group separation enables users to SSH to the appliance, but not to su to root. Do not remove or modify other entries in the AllowGroups field, which ensures proper appliance functionality. After making a change, you must restart the SSH daemon by running the command: `# service sshd restart`.

Enable or Disable Secure Shell on the vRealize Automation Appliances

Enable Secure Shell (SSH) on the vRealize Automation appliance only for troubleshooting. Disable SSH on these components during normal production operation.

You can enable or disable SSH on the vRealize Automation appliance using the Virtual Appliance Management console.

Procedure

1 Navigate to the Virtual Appliance Management Console (VAMI) for your vRealize Automation appliance.

   : https://*vRealizeAppliance url*:5480

2 Click the **Admin** tab.

3 Click the **Admin** sub-menu.

4 Select the **SSH service enable** check box to enable SSH or deselect it to disable SSH.

5 Click **Save Settings** to save your changes.

Create Local Administrator Account for Secure Shell

As a security best practice, create and configure local administrative accounts for Secure Shell (SSH) on your virtual appliance host machines. Also, remove root SSH access after you create the appropriate accounts.

Create local administrative accounts for SSH, or members of the secondary wheel group, or both. Before you disable direct root access, test that authorized administrators can access SSH by using AllowGroups, and that they can su to root using the wheel group.

Procedure

1 Log in to the virtual appliance as root and run the following commands with the appropriate username.

```
# useradd –g users <username> –G wheel –m –d /home/username
            # passwd username
```

Wheel is the group specified in AllowGroups for ssh access. To add multiple secondary groups, use `–G wheel,sshd`.

2 Switch to the user and provide a new password to enforce password complexity checking.

```
# su -username
    # username@hostname:~>passwd
```

If the password complexity is met, the password updates. If the password complexity is not met, the password reverts to the original password, and you must rerun the password command.

3 To remove direct login to SSH, modify the`/etc/ssh/sshd_config` file by replacing `(#)PermitRootLogin yes` with `PermitRootLogin no`.

Alternatively, you can enable/disable SSH in the Virtual Appliance Management Interface (VAMI) by selecting or deselecting the **Administrator SSH login enabled** check box on the **Admin** tab.

What to do next

Disable direct logins as root. By default, the hardened appliances allow direct login to root through the console. After you create administrative accounts for non-repudiation and test them for su-root wheel access, disable direct root logins by editing the `/etc/security` file as root and replacing the `tty1` entry with `console`.

Restrict Secure Shell Access

As part of your system hardening process, restrict Secure Shell (SSH) access by configuring the tcp_wrappers package appropriately on all VMware virtual appliance host machines. Also maintain required SSH key file permissions on these appliances.

All VMware virtual appliances include the tcp_wrappers package to allow tcp-supported daemons to control the network subnets that can access the libwrapped daemons. By default, the `/etc/hosts.allow` file contains a generic entry, `Sshd: ALL : ALLOW`, that allows all access to the secure shell. Restrict this access as appropriate for your organization.

Procedure

1 Open the `/etc/hosts.allow` file on your virtual appliance host machine in a text editor.

2. Change the generic entry in your production environment to include only the local host entries and the management network subnet for secure operations.

   ```
   sshd:127.0.0.1 : ALLOW
   sshd: [::1] : ALLOW
   sshd: 10.0.0.0 :ALLOW
   ```

   In this example, all local host connections and connections that the clients make on the 10.0.0.0 subnet are allowed.

3. Add all appropriate machine identification, for example, host name, IP address, fully qualified domain name (FQDN), and loopback.

4. Save the file and close it.

Maintain Secure Shell Key File Permissions

To maintain an appropriate level of security, configure Secure Shell (SSH) key file permissions on VMware virtual appliance host machines.

Limit SSH public host key file and group permissions to root on virtual appliance host machines. These permissions are set by default, but you should review them to ensure that they are set correctly.

Procedure

1. View the public host key files, located in `/etc/ssh/*key.pub`.

2. Verify that these files are owned by root, that the group is owned by root, and that the files have permissions set to 0644.

   The permissions are (-rw-r--r--).

3. Close all files.

4. View the public host key files, located in `/etc/ssh/*key`.

5. Verify that these file are owned by root, that the group is owned by root, and that the files have permissions set to 0600.

   The permissions are (-rw-------).

6. Close all files.

Configure Secure Shell Port

By default, the SSHD service listens on port 22. Consider changing this port assignment on virtual appliance host machines, because potential attackers often target the most commonly used ports, such as 22.

🧱	Not set by default	Complete this hardening activity manually or by using the companion hardening tool. Some hardening activities might depend on your organization's security policies.

Changing the port number considerably reduces the number of automated attacks performed by systematic attackers or zombie computers. Conversely, changing the port number forces the configuration of this alternative port for all clients that connect to the system.

Procedure

1 Log in to your virtual appliance as root and edit the `/etc/ssh/sshd_config` file.

2 Change # Port 22 to Port *preferred port number*.

3 Restart the SSHD service by running the `service sshd restart` command.

What to do next

Update your firewall settings accordingly to support the new port.

Harden the Secure Shell Server Configuration

Where possible, all VMware appliances have a default hardened configuration. Users can verify that their configuration is appropriately hardened by examining the server and client service settings in the global options section of the configuration file.

If possible, restrict use of the SSH server to a management subnet in the `/etc/hosts.allow` file.

Procedure

1 Open the `/etc/ssh/sshd_config` server configuration file on the VMware appliance, and verify that the settings are correct.

Setting	Status
Server Daemon Protocol	Protocol 2
CBC Ciphers	aes256-ctr and aes128-ctr
TCP Forwarding	AllowTCPForwarding no
Server Gateway Ports	Gateway Ports no
X11 Forwarding	X11Forwarding no
SSH Service	Use the AllowGroups field and specify a group permitted access. Add appropriate members to this group.
GSSAPI Authentication	GSSAPIAuthentication no, if unused
Keberos Authentication	KeberosAuthentication no, if unused
Local Variables (AcceptEnv global option)	Set to `disabled by commenting out` or `enabled for LC_* or LANG variables`
Tunnel Configuration	PermitTunnel no
Network Sessions	MaxSessions 1
User Concurrent Connections	Set to 1 for root and any other user. The `/etc/security/limits.conf` file also needs to be configured with the same setting.
Strict Mode Checking	Strict Modes yes
Privilege Separation	UsePrivilegeSeparation yes

Setting	Status
rhosts RSA Authentication	RhostsESAAuthentication no
Compression	Compression delayed or Compression no
Message Authentication code	MACs hmac-sha1
User Access Restriction	PermitUserEnvironment no

2 Save your changes and close the file.

Harden the Secure Shell Client Configuration

As part of your system hardening process, verify hardening of the SSH client by examining the SSH client configuration file on virtual appliance host machines to ensure that it is configured according toVMware guidelines.

Procedure

1 Open the SSH client configuration file, `/etc/ssh/ssh_config`, and verify that settings in the global options section are correct.

Setting	Status
Client Protocol	Protocol 2
Client Gateway Ports	Gateway Ports no
GSSAPI Authentication	GSSAPIAuthentication no
Local Variables (SendEnv global option)	Provide only LC_* or LANG variables
CBC Ciphers	aes256-ctr and aes128-ctr only
Message Authentication Codes	Used in the `MACs hmac-sha1` entry only

2 Save your changes and close the file.

Verifying Secure Shell Key File Permissions

To minimize the possibility of malicious attacks, maintain critical SSH key file permissions on your virtual appliance host machines.

After configuring or updating your SSH configuration, always verify that the following SSH key file permissions do not change.

- The public host key files located in `/etc/ssh/*key.pub` are owned by the root user and have permissions set to 0644 (-rw-r--r--).
- The private host key files located in `/etc/ssh/*key` are owned by the root user and have permissions set to 0600 (-rw------).

Set Boot Loader Authentication

To provide an appropriate level of security, configure boot loader authentication on your VMware virtual appliances.

If the system's boot loader requires no authentication, users with system console access can alter the system boot configuration or boot the system into single user or maintenance mode, which can result in denial of service or unauthorized system access. Because boot loader authentication is not set by default on the VMware virtual appliances, you must create a GRUB password to configure it.

Procedure

1. Verify whether a boot password exists by locating the `password --md5 <password-hash>` line in the `/boot/grub/menu.lst` file on your virtual appliances.
2. If no password exists, run the `# /usr/sbin/grub-md5-crypt` command on your virtual appliance.

   An MD5 password is generated, and the command supplies the md5 hash output.
3. Append the password to the `menu.lst` file by running the `# password --md5 <hash from grub-md5-crypt>` command.

Configure NTP

For critical time sourcing, disable host time synchronization and use the Network Time Protocol (NTP) on the vRealize Automation appliance.

The NTP daemon on vRealize Automation appliance provides synchronized time services. NTP is disabled by default, so you need to configure it manually. If possible, use NTP in production environments to track user actions and to detect potential malicious attacks and intrusions through accurate audit and log keeping. For information about NTP security notices, see the NTP Web site.

The NTP configuration file is located in the `/etc/` folder on each appliance. You can enable the NTP service for the vRealize Automation appliance and add time servers on the **Admin** tab of the Virtual Appliance Management Interface.

Procedure

1. Navigate to the `/etc/ntp.conf` configuration file on your virtual appliance host machine.
2. Set the file ownership to **`root:root`**.
3. Set the permissions to **`0640`**.
4. To mitigate the risk of a denial-of-service amplification attack on the NTP service, open the `/etc/ntp.conf` file and ensure that the restrict lines appear in the file.

   ```
   restrict default kod nomodify notrap nopeer noquery
   restrict -6 default kod nomodify notrap nopeer noquery
   restrict 127.0.0.1
   restrict -6 ::1
   ```
5. Save any changes and close the files.

Configuring TLS for vRealize Automation appliance Data In-transit

Ensure that your vRealize Automation deployment uses strong TLS protocols to secure transmission channels for vRealize Automation appliance components.

For performance considerations, TLS is not enabled for localhost connections between some application services. Where defence in depth is of concern, enable TLS on all localhost communications.

Important If you are terminating TLS on the load balancer, disable insecure protocols such as SSLv2, SSLv3, and TLS 1.0 on all load balancers.

Verify that SSLv3 is Disabled

As part of your hardening process, ensure that the deployed vRealize Automation appliance uses secure transmission channels.

Procedure

1 Verify that SSLv3 is disabled in the HAProxy https handlers on the vRealize Automation appliance.

Review this file	Ensure the following is present	In the appropriate line as shown
`/etc/haproxy/conf.d/20-vcac.cfg`	no-sslv3	`bind 0.0.0.0:443 ssl crt /etc/apache2/server.pem ciphers TLSv1+HIGH:!aNULL:!eNULL:!3DES:!RC4:!CAMELLIA:!DH:!kECDHE:@STRENGTH no-sslv3`
`/etc/haproxy/conf.d/30-vro-config.cfg`	no-sslv3	`bind :8283 ssl crt /opt/vmware/etc/lighttpd/server.pem ciphers TLSv1+HIGH:!aNULL:!eNULL:!3DES:!RC4:!CAMELLIA:!DH:!kECDHE:@STRENGTH no-sslv3`

2 Open the `/etc/apache2/vhosts.d/vcac.conf` file and verify that the `SSLProtocol all -SSLv2 -SSLv3` entry appears.

3 Open the `/opt/vmware/etc/lighttpd/lighttpd.conf` file, and verify that the correct disable entries appear.

```
ssl.use-sslv2 = "disable"
ssl.use-sslv3 = "disable"
```

4 Verify that SSLv2 and SSLv3 are disabled for the Console Proxy on the vRealize Automation appliance.

a Edit the `/etc/vcac/security.properties` file by adding or modifying the following line:

```
consoleproxy.ssl.server.protocols = TLSv1.2, TLSv1.1, TLSv1
```

b Restart the server by running the following command:

```
service vcac-server restart
```

5 Verify that SSLv3 is disabled for the vCO service.

a Locate the `<Connector>` tag in the `/etc/vco/app-server/server.xml` file and add the following attribute:

```
sslEnabledProtocols = "TLSv1.1,TLSv1.2,TLSv1"
```

b Restart the vCO service by running the following command.

```
service vco-server restart
```

6 Verify that SSLv3 us disabled for the vRealize Automation service.

a Add the following attributes to the `<Connector>` tag in the `/etc/vcac/server.xml` file

```
sslEnabledProtocols = "TLSv1.1,TLSv1.2,TLSv1"
```

b Restart the vRealize Automation service by running the following command:

```
service vcac-server restart
```

7 Verify that SSLv3 is disabled for RabbitMQ.

Open the `/etc/rabbitmq/rabbitmq.config` file and verify that `{versions, ['tlsv1.2', 'tlsv1.1']}` are present in the ssl and ssl_options sections.

```
[
  {ssl, [
      {versions, ['tlsv1.2', 'tlsv1.1']},
      {ciphers, ["AES256-SHA", "AES128-SHA"]}
  ]},
   {rabbit, [
      {tcp_listeners, [{"127.0.0.1", 5672}]},
      {frame_max, 262144},
      {ssl_listeners, [5671]},
      {ssl_options, [
         {cacertfile, "/etc/rabbitmq/certs/ca/cacert.pem"},
         {certfile, "/etc/rabbitmq/certs/server/cert.pem"},
         {keyfile, "/etc/rabbitmq/certs/server/key.pem"},
         {versions, ['tlsv1.2', 'tlsv1.1']},
         {ciphers, ["AES256-SHA", "AES128-SHA"]},
         {verify, verify_peer},
         {fail_if_no_peer_cert, false}
      ]},
      {mnesia_table_loading_timeout,600000},
      {cluster_partition_handling, autoheal},
      {heartbeat, 600}
   ]},
   {kernel, [{net_ticktime,  120}]}
].
```

8 Restart the RabbitMQ server by running the following command:

```
# service rabbitmq-server restart
```

9 Verify that SSLv3 is disabled for the vIDM service.

Open the `/opt/vmware/horizon/workspace/config/server.xml` file for each instance of the connector containing `SSLEnabled="true"` and ensure that the following line is present.

```
sslEnabledProtocols="TLSv1.1,TLSv1.2"
```

Configure Strong Protocols for the Identity Appliance

You must ensure that the deployed Identity Appliance uses secure transmission channels.

The Identity Appliance disables SSLv2 and SSLv3 by default. Prior to production, verify protocol configuration on the Identity Appliance tomcat http handler and lighttpd https handler.

The Identity Appliance supports the TLSv1.0, TLSv1.1, TLSv1.2 protocols by default.

Prerequisites

The Identity Appliance disables SSLv2 and SSLv3 by default. Before production, verify protocol configuration on the Identity Appliance tomcat HTTP handler and lighttpd HTTPS handler.

The Identity Appliance supports the TLSv1.0, TLSv1.1, TLSv1.2 protocols by default.

Procedure

1 Open the `/usr/lib/vmware-sts/conf/server.xml` file, find the connector configuration for the HTTPS port, and verify that the `sslEnabledProtocols = "TLSv1,TLSv1.1,TLSv1.2"` attribute appears.

🟩	Set by default	Used only when this activity was previously not a default setting. Indicates that a state changed from the previous release.

2 Open the `/opt/vmware/etc/lighttpd/conf.d/10-common.conf` file and verify that the correct disable entries appear .

```
ssl.use-sslv2 = "disable"
```

```
ssl.use-sslv3 = "disable"
```

These settings are imported to the`/opt/vmware/etc/lighttpd/lighttpd.conf` file.

3 Save the changes you made and close the file.

Configure Strong Protocols for the Application Services Appliance

You must ensure that the deployed Application Services Appliance uses secure transmission channels.

Prerequisites

The Application Services Appliance disables SSLv2 and SSLv3 by default. Before production, verify protocol configuration on the Application Services Appliance tomcat http handler.

The Application Services Appliance supports the TLSv1.0 protocol by default.

Procedure

1 Open the `/home/darwin/tcserver/darwin/conf/server.xml` file in a text editor.

2 Find the connector configuration for https port 8443, and verify that the following attribute appears.

```
sslEnabledProtocols = "TLSv1,TLSv1.1,TLSv1.2"
```

3 Save the changes you made and close it.

Configuring TLS Cipher Suites for vRealize Automation Components

For maximum security, you must configure vRealize Automation components to use strong ciphers.

The encryption cipher negotiated between the server and the browser determines the encryption strength that is used in a TLS session.

To ensure that only strong ciphers are selected, disable weak ciphers in vRealize Automation components. Configure the server to support only strong ciphers and to use sufficiently large key sizes. Also, configure all ciphers in a suitable order.

Disable cipher suites that do not offer authentication such as NULL cipher suites, aNULL, or eNULL. Also disable anonymous Diffie-Hellman key exchange (ADH), export level ciphers (EXP, ciphers containing DES), key sizes smaller than 128 bits for encrypting payload traffic, the use of MD5 as a hashing mechanism for payload traffic, IDEA Cipher Suites, and RC4 cipher suites. Also ensure that cipher suites using Diffie-Hellman (DHE) key exchange are disabled

Using Strong Ciphers

The encryption cipher negotiated between the server and the browser determines the encryption strength used in a TLS session.

vRealize Automation appliance

The following TLS ciphers are acceptable and enabled by default on the vRealize Automation appliance.

- TLS_DHE_RSA_WITH_AES_128_CBC_SHA
- TLS_DHE_RSA_WITH_AES_256_CBC_SHA
- TLS_RSA_WITH_AES_128_CBC_SHA
- TLS_RSA_WITH_AES_256_CBC_SHA

The preferred server cipher is TLS_DHE_RSA_WITH_AES_256_CBC_SHA.

Identity Appliance

For lighttpd, the following TLS ciphers are acceptable and enabled by default on the Identity Appliance.

- TLS_DHE_RSA_WITH_AES_128_CBC_SHA
- TLS_DHE_RSA_WITH_AES_256_CBC_SHA
- TLS_RSA_WITH_AES_128_CBC_SHA
- TLS_RSA_WITH_AES_256_CBC_SHA

The preferred server cipher is TLS_DHE_RSA_WITH_AES_256_CBC_SHA.

For the tomcat HTTP handler, the following TLS ciphers are acceptable and enabled by default on the Identity Appliance.

- TLS_RSA_WITH_AES_128_CBC_SHA
- TLS_RSA_WITH_AES_256_CBC_SHA

The preferred server cipher is TLS _RSA_WITH_AES_256_CBC_SHA.

Application Services Appliance

The following TLS ciphers are acceptable and enabled by default on the Application Services Appliance.

- TLS_DHE_RSA_WITH_AES_128_CBC_SHA
- TLS_DHE_RSA_WITH_AES_256_CBC_SHA
- TLS_RSA_WITH_AES_128_CBC_SHA
- TLS_RSA_WITH_AES_256_CBC_SHA

The preferred server cipher is TLS_DHE_RSA_WITH_AES_256_CBC_SHA.

Disable Weak Ciphers in the vRealize Automation appliance Apache HTTPS Handler

Review apache2 HTTPS handler ciphers on the vRealize Automation appliance against the list of acceptable ciphers and disable all ciphers that are considered weak.

	Not set by default	Complete this hardening activity manually or using the companion hardening tool. Some hardening activities might depend on your organization's security policies.

Disable cipher suites that do not offer authentication such as NULL cipher suites, aNULL, or eNULL. Also disable anonymous Diffie-Hellman key exchange (ADH), export level ciphers (EXP, ciphers containing DES), key sizes smaller than 128 bits for encrypting payload traffic, the use of MD5 as a hashing mechanism for payload traffic, IDEA Cipher Suites, and RC4 cipher suites.

For a list of recommended strong ciphers, see Using Strong Ciphers.

Procedure

1. Open the `/etc/apache2/vhosts.d/vcac.conf` file in a text editor.
2. Verify that the file contains the line `SSLCipherSuite HIGH:!aNULL!ADH:!EXP:!MD5:!3DES:!CAMELLIA:!PSK:!SRP:@STRENGTH`.
3. Save the changes you made and close the file.

Disable Weak Ciphers in Lighttpd

Review lighttpd https handler ciphers on the vRealize Automation appliance against the list of acceptable ciphers and disable all of those considered weak.

Disable cipher suites that do not offer authentication such as NULL cipher suites, aNULL, or eNULL. Also disable anonymous Diffie-Hellman key exchange (ADH), export level ciphers (EXP, ciphers containing DES), key sizes smaller than 128 bits for encrypting payload traffic, the use of MD5 as a hashing mechanism for payload traffic, IDEA Cipher Suites, and RC4 cipher suites.

For a list of recommended strong ciphers, see Using Strong Ciphers.

Procedure

1 Open the `/opt/vmware/etc/lighttpd/lighttpd.conf` file in a text editor.

2 Ensure that the following entry appears in the file.

```
ssl.cipher-list = "TLSv1+HIGH: !SSLv2: !aNULL: !eNULL: !3DES: @STRENGTH"
```

3 Save any changes you made and close the file.

Disable Weak Ciphers in the vRealize Automation appliance Console Proxy Service

Review the vRealize Automation appliance Console Proxy Service ciphers against the list of acceptable ciphers and disable all of those considered weak.

Disable cipher suites that do not offer authentication such as NULL cipher suites, aNULL, or eNULL. Also disable anonymous Diffie-Hellman key exchange (ADH), export level ciphers (EXP, ciphers containing DES), key sizes smaller than 128 bits for encrypting payload traffic, the use of MD5 as a hashing mechanism for payload traffic, IDEA Cipher Suites, and RC4 cipher suites.

Procedure

1 Open the `/etc/vcac/security.properties` file in a text editor.

2 Add a line to the file to disable the unwanted cipher suites.

Use a variation of the following line:

```
consoleproxy.ssl.ciphers.disallowed=cipher_suite_1, cipher_suite_2,etc
```

For example, to disable the AES 128 cipher suites, add the following line:

```
consoleproxy.ssl.ciphers.disallowed=TLS_DH_DSS_WITH_AES_128_CBC_SHA,
TLS_DH_DSS_WITH_AES_256_CBC_SHA, TLS_DH_RSA_WITH_AES_256_CBC_SHA,
TLS_DHE_DSS_WITH_AES_128_CBC_SHA, TLS_DHE_DSS_WITH_AES_256_CBC_SHA,
TLS_DHE_RSA_WITH_AES_128_CBC_SHA, TLS_DHE_RSA_WITH_AES_256_CBC_SHA
```

3 Restart the server using the following command.

```
servicce vcac-server restart
```

Disable Weak Ciphers in vRealize Automation appliance vCO Service

Review vRealize Automation appliance vCO Service ciphers against the list of acceptable ciphers and disable all of those considered weak.

Disable cipher suites that do not offer authentication such as NULL cipher suites, aNULL, or eNULL. Also disable anonymous Diffie-Hellman key exchange (ADH), export level ciphers (EXP, ciphers containing DES), key sizes smaller than 128 bits for encrypting payload traffic, the use of MD5 as a hashing mechanism for payload traffic, IDEA Cipher Suites, and RC4 cipher suites.

Procedure

1. Locate the `<Connector>` tag in `/etc/vco/app/server/server.xml` file.
2. Edit or add the cipher attribute to use the desired cipher suites.

   Refer to the following example:

   ```
   ciphers="TLS_ECDHE_ECDSA_WITH_AES_128_GCM_SHA256,TLS_ECDHE_RSA_WITH_AES_128_GCM_SHA256,TLS_ECDHE_EC
   DSA_WITH_AES_128_CBC_SHA256,TLS_ECDHE_RSA_WITH_AES_128_CBC_SHA256,TLS_ECDHE_ECDSA_WITH_AES_256_GCM_
   SHA384,TLS_ECDHE_RSA_WITH_AES_256_GCM_SHA384,TLS_ECDHE_ECDSA_WITH_AES_256_CBC_SHA384,TLS_ECDHE_RSA_
   WITH_AES_256_CBC_SHA384”
   ```

Disable Weak Ciphers in Identity Appliance Tomcat Service

Review Identity Appliance Tomcat Service ciphers against the list of acceptable ciphers and disable all of those considered weak.

Disable cipher suites that do not offer authentication such as NULL cipher suites, aNULL, or eNULL. Also disable anonymous Diffie-Hellman key exchange (ADH), export level ciphers (EXP, ciphers containing DES), key sizes smaller than 128 bits for encrypting payload traffic, the use of MD5 as a hashing mechanism for payload traffic, IDEA Cipher Suites, and RC4 cipher suites.

For a list of recommended strong ciphers, see Using Strong Ciphers.

Procedure

1. Open the `/usr/lib/vmware-sts/conf/server.xml` file in a text editor.
2. Locate the connector configuration for the http port and review the ciphers listed in the following attribute.

   ```
   ciphers="TLS_RSA_WITH_AES_128_CBC_SHA,TLS_RSA_WITH_AES_256_CBC_SHA"
   ```

3. Save any changes you made and close the file.

Disable Weak Ciphers in the vRealize Automation appliance RabbitMQ Service

Review vRealize Automation appliance RabbitMQ Service ciphers against the list of acceptable ciphers and disable all of those that are considered weak.

Disable cipher suites that do not offer authentication such as NULL cipher suites, aNULL, or eNULL. Also disable anonymous Diffie-Hellman key exchange (ADH), export level ciphers (EXP, ciphers containing DES), key sizes smaller than 128 bits for encrypting payload traffic, the use of MD5 as a hashing mechanism for payload traffic, IDEA Cipher Suites, and RC4 cipher suites.

Procedure

1 Evaluate the supported cipher suites. by running the `# /usr/sbin/rabbitmqctl eval 'ssl:cipher_suites().'` command.

The ciphers returned in the following example represent only the supported ciphers. The RabbitMQ server does not use or advertise these ciphers unless configured to do so in the `rabbitmq.config` file.

```
["ECDHE-ECDSA-AES256-GCM-SHA384","ECDHE-RSA-AES256-GCM-SHA384",
 "ECDHE-ECDSA-AES256-SHA384","ECDHE-RSA-AES256-SHA384",
 "ECDH-ECDSA-AES256-GCM-SHA384","ECDH-RSA-AES256-GCM-SHA384",
 "ECDH-ECDSA-AES256-SHA384","ECDH-RSA-AES256-SHA384",
 "DHE-RSA-AES256-GCM-SHA384","DHE-DSS-AES256-GCM-SHA384",
 "DHE-RSA-AES256-SHA256","DHE-DSS-AES256-SHA256","AES256-GCM-SHA384",
 "AES256-SHA256","ECDHE-ECDSA-AES128-GCM-SHA256",
 "ECDHE-RSA-AES128-GCM-SHA256","ECDHE-ECDSA-AES128-SHA256",
 "ECDHE-RSA-AES128-SHA256","ECDH-ECDSA-AES128-GCM-SHA256",
 "ECDH-RSA-AES128-GCM-SHA256","ECDH-ECDSA-AES128-SHA256",
 "ECDH-RSA-AES128-SHA256","DHE-RSA-AES128-GCM-SHA256",
 "DHE-DSS-AES128-GCM-SHA256","DHE-RSA-AES128-SHA256","DHE-DSS-AES128-SHA256",
 "AES128-GCM-SHA256","AES128-SHA256","ECDHE-ECDSA-AES256-SHA",
 "ECDHE-RSA-AES256-SHA","DHE-RSA-AES256-SHA","DHE-DSS-AES256-SHA",
 "ECDH-ECDSA-AES256-SHA","ECDH-RSA-AES256-SHA","AES256-SHA",
 "ECDHE-ECDSA-DES-CBC3-SHA","ECDHE-RSA-DES-CBC3-SHA","EDH-RSA-DES-CBC3-SHA",
 "EDH-DSS-DES-CBC3-SHA","ECDH-ECDSA-DES-CBC3-SHA","ECDH-RSA-DES-CBC3-SHA",
 "DES-CBC3-SHA","ECDHE-ECDSA-AES128-SHA","ECDHE-RSA-AES128-SHA",
 "DHE-RSA-AES128-SHA","DHE-DSS-AES128-SHA","ECDH-ECDSA-AES128-SHA",
 "ECDH-RSA-AES128-SHA","AES128-SHA"]
```

2 Select supported ciphers that meet the security requirements for your organization.

For example, to allow only `ECDHE-ECDSA-AES128-GCM-SHA256 & ECDHE-ECDSA-AES256-GCM-SHA384`, review the`/etc/rabbitmq/rabbitmq.config` file and add the following line to ssl and ssl_options.

```
{ciphers, [“ECDHE-ECDSA-AES128-GCM-SHA256”, “ECDHE-ECDSA-AES256-GCM-SHA384”]}
```

3 Restart the RabbitMQ server using the following command.

```
service rabbitmq-server restart
```

Disable Weak Ciphers in the Application Services Appliance

Review Application Services Appliance ciphers against the list of acceptable ciphers and disable all of those considered weak.

For a list of recommended strong ciphers, see Using Strong Ciphers.

Procedure

1 Open the `/home/darwin/tcserver/darwin/conf/server.xml` file in a text editor.

2 Find the connector configuration for https port 8443, and verify that the cipher suites listed in the `ciphers="…."` attribute are not weak.

3 Save any changes you made and close the file.

Insecure Renegotiation

vRealize Automation components use session renegotiation to maintain security during SSL communication.

Apache (vRealize Automation appliance)

Secure renegotiation is supported by default. Client-initiated renegotiation is rejected by default.

Lighttpd (vRealize Automation appliance , Identity Appliance)

Secure renegotiation is supported by default.

Client-initiated renegotiation is honored by default. The currently used version of lighttpd does not support disabling client-initiated renegotiation. The VAMI on port 5480 should be accessible only on an internal secure network to avoid some forms of denial-of-service attack that use client-initiated renegotiation.

RabbitMQ (vRealize Automation appliance)

Client-initiated renegotiation is honored and secure renegotiation is not supported in the version of RabbitMQ that the vRealize Automation appliance uses. To mitigate this inherent risk, do not allow ports that RabbitMQ uses to be externally exposed. As a best practice when clustering vRealize Automation appliance servers, implement firewall rules to allow RabbitMQ to communicate between the vRealize Automation appliance servers.

Configure vRealize Automation Application Resources

Review vRealize Automation application resources and restrict file permissions.

Procedure

1 Run the following command to verify that files with SUID and GUID bits set are well-defined.

```
find / -path /proc -prune -o -type f -perm +6000 -ls
```

The following list should appear.

```
2197357   24 -rwsr-xr-x   1 polkituser root       23176 Mar 31  2015 /usr/lib/PolicyKit/polkit-
set-default-helper
2197354   16 -rwxr-sr-x   1 root     polkituser    14856 Mar 31  2015 /usr/lib/PolicyKit/polkit-
read-auth-helper
2197353   12 -rwsr-x---   1 root     polkituser    10744 Mar 31  2015 /usr/lib/PolicyKit/polkit-
grant-helper-pam
2197352   20 -rwxr-sr-x   1 root     polkituser    19208 Mar 31  2015 /usr/lib/PolicyKit/polkit-
grant-helper
2197351   20 -rwxr-sr-x   1 root     polkituser    19008 Mar 31  2015 /usr/lib/PolicyKit/polkit-
explicit-grant-helper
2197356   24 -rwxr-sr-x   1 root     polkituser    23160 Mar 31  2015 /usr/lib/PolicyKit/polkit-
revoke-helper
2188203  460 -rws--x--x   1 root     root       465364 Apr 21 22:38 /usr/lib64/ssh/ssh-keysign
2138858   12 -rwxr-sr-x   1 root     tty         10680 May 10  2010 /usr/sbin/utempter
2142482  144 -rwsr-xr-x   1 root     root       142890 Sep 15  2015 /usr/bin/passwd
```

```
2142477  164 -rwsr-xr-x   1 root     shadow     161782 Sep 15  2015 /usr/bin/chage
2142467  156 -rwsr-xr-x   1 root     shadow     152850 Sep 15  2015 /usr/bin/chfn
1458298  364 -rwsr-xr-x   1 root     root       365787 Jul 22  2015 /usr/bin/sudo
2142481   64 -rwsr-xr-x   1 root     root        57776 Sep 15  2015 /usr/bin/newgrp
1458249   40 -rwsr-x---   1 root     trusted     40432 Mar 18  2015 /usr/bin/crontab
2142478  148 -rwsr-xr-x   1 root     shadow     146459 Sep 15  2015 /usr/bin/chsh
2142480  156 -rwsr-xr-x   1 root     shadow     152387 Sep 15  2015 /usr/bin/gpasswd
2142479   48 -rwsr-xr-x   1 root     shadow      46967 Sep 15  2015 /usr/bin/expiry
311484   48 -rwsr-x---   1 root     messagebus    47912 Sep 16  2014 /lib64/dbus-1/dbus-daemon-
launch-helper
876574   36 -rwsr-xr-x   1 root     shadow      35688 Apr 10  2014 /sbin/unix_chkpwd
876648   12 -rwsr-xr-x   1 root     shadow      10736 Dec 16  2011 /sbin/unix2_chkpwd
 49308   68 -rwsr-xr-x   1 root     root        63376 May 27  2015 /opt/likewise/bin/ksu
1130552   40 -rwsr-xr-x   1 root     root        40016 Apr 16  2015 /bin/su
1130511   40 -rwsr-xr-x   1 root     root        40048 Apr 15  2011 /bin/ping
1130600  100 -rwsr-xr-x   1 root     root        94808 Mar 11  2015 /bin/mount
1130601   72 -rwsr-xr-x   1 root     root        69240 Mar 11  2015 /bin/umount
1130512   36 -rwsr-xr-x   1 root     root        35792 Apr 15  2011 /bin/ping6
2012 /lib64/dbus-1/dbus-daemon-launch-helper
```

2 Run the following command to verify that all files on the virtual appliance have an owner.

```
find / -path /proc -prune -o -nouser -o -nogroup
```

3 Review permissions for all files to the virtual appliance to verify that none of them are world writable by running the following command.

```
find / -name "*.*" -type f -perm -a+w | xargs ls -ldb
```

4 Run the following command to verify that only the vcac user owns the correct files.

```
find / -name "proc" -prune -o -user vcac -print | egrep -v -e "*/vcac/*" | egrep
-v -e "*/vmware-vcac/*"
```

If no results appear, then all correct files are owned only by the vcac user.

5 Verify that the following files are writeable only by the vcac user.

```
/etc/vcac/vcac/security.properties
```

```
/etc/vcac/vcac/solution-users.properties
```

```
/etc/vcac/vcac/sso-admin.properties
```

```
/etc/vcac/vcac/vcac.keystore
```

```
/etc/vcac/vcac/vcac.properties
```

Also verify the following files and their sub-directories

```
/var/log/vcac/*
```

```
/var/lib/vcac/*
```

```
/var/cache/vcac/*
```

6 Verify that only the vcac or root user can read the correct files in the following directories and their sub-directories.

```
/etc/vcac/*
```

```
/var/log/vcac/*
```

```
/var/lib/vcac/*
```

```
/var/cache/vcac/*
```

7 Verify that the correct files are owned only by the vco or root user, as shown in in the following directories and their sub-directories.

```
/etc/vco/*
```

```
/var/log/vco/*
```

```
/var/lib/vco/*
```

```
/var/cache/vco/*
```

8 Verify that the correct files are writeable only by the vco or root user, as shown in in the following directories and their sub-directories.

```
/etc/vco/*
```

```
/var/log/vco/*
```

```
/var/lib/vco/*
```

```
/var/cache/vco/*
```

9 Verify that the correct files are readable only by the vco or root user, as shown in in the following directories and their sub-directories.

```
/etc/vco/*
```

```
/var/log/vco/*
```

```
/var/lib/vco/*
```

```
/var/cache/vco/*
```

Change the PostgreSQL User Password

The vRealize Automation embedded PostgreSQL database includes a default Postgres user account named vcac. Change the vcac account password when you use the embedded vRealize Automation PostgreSQL database.

Configure the vRealize Automation system before you change the Postgres vcac user password.

Procedure

1 Run the `ssh root@IP` *`address or URL`* command on the vRealize Automation appliance designated for the PostgreSQL database.

2 Run the `su Postgres /opt/vmware/vpostgres/9.2/bin/psql` command to start the psql prompt.

3 Change the vcac user password with the a command of the form `ALTER ROLE vcac with PASSWORD 'your-complex-password';`.

   In this command, replace `'your-complex-password'` with an appropriate password.

4 Type \q to close the psql prompt.

5 Log in to the virtual appliance host machine at https://*vRealizeApplianceurl*:5480.

6 Select the **Database** menu option from the vRA Settings tab, and enter the new password.

Configure PostgreSQL Client Authentication

Ensure that local trust authentication, is not configured the vRealize Automation appliance PostgreSQL database. This configuration allows any local user, including the database super user, to connect as any PostgreSQL user without a password.

Note The Postgres super user account should remain as local trust.

The md5 authentication method is recommended because it sends encrypted passwords.

The client authentication configuration settings reside in the `/storage/db/pgdata/pg_hba.conf` file.

```
# TYPE  DATABASE        USER               ADDRESS          METHOD

# "local" is for Unix domain socket connections only
local      all              postgres                            trust
# IPv4 local connections:
#host    all              all                127.0.0.1/32     md5
hostssl    all              all                127.0.0.1/32     md5
# IPv6 local connections:
#host    all              all                ::1/128          md5
hostssl    all              all                ::1/128          md5

# Allow remote connections for VCAC user.
#host    vcac             vcac               0.0.0.0/0        md5
hostssl    vcac             vcac               0.0.0.0/0        md5
hostssl    vcac             vcac               ::0/0        md5
# Allow remote connections for VCAC replication user.
#host    vcac             vcac_replication   0.0.0.0/0        md5
hostssl    vcac          vcac_replication   0.0.0.0/0        md5
hostssl    vcac          vcac_replication   ::0/0        md5
# Allow replication connections by a user with the replication privilege.
#host    replication      vcac_replication   0.0.0.0/0        md5
hostssl    replication      vcac_replication   0.0.0.0/0        md5
hostssl    replication      vcac_replication   ::0/0        md5
```

If you edit the `pg_hba.conf` file, you must restart the Postgres server by running the following commands before changes can take effect.

```
# cd /opt/vmware/vpostgres/9.2/bin
# su postgres
# ./pg_ctl restart -D /storage/db/pgdata/ -m fast
```

Customizing Console Proxy Configuration

You can customize the remote console configuration for vRealize Automation to facilitate troubleshooting and organizational practices.

When you install, configure, or maintain vRealize Automation, you can change some settings to enable troubleshooting and debugging of your installation. Catalog and audit each of the changes you make to ensure that applicable components are properly secured according to their required use. Do not proceed to production if you are not sure that your configuration changes are correctly secured.

Customize VMware Remote Console Ticket Expiry

You can customize the validity period for remote console tickets used in establishing VMware Remote Console connections.

When a user makes VMware Remote Console connections, the system creates and returns a one-time credential that establishes a specific connection to a virtual machine. You can set the ticket expiry for a specified time frame in minutes.

Procedure

1 Open the `/etc/vcac/security.properties` file in a text editor.

2 Add a line to the file of the form `consoleproxy.ticket.validitySec=30`.

In this line the numerical value specifies the number of minutes before the ticket expires.

3 Save the file and close it.

4 Restart the vcac-server using the command `/etc/init.d/vcac–server restart`.

The ticket expiry value is reset to the specified time frame in minutes.

Customize Console Proxy Server Port

You can customize the port on which the VMware Remote Console console proxy listens for messages.

Procedure

1 Open the `/etc/vcac/security.properties` file in a text editor.

2 Add a line to the file of the form `consoleproxy.service.port=8445`.

The numerical value specifies the console proxy service port number, in this case 8445.

3 Save the file and close it.

4 Restart the vcac-server using the command `/etc/init.d/vcac–server restart`.

The proxy service port changes to the specified port number.

Set vRealize Automation appliance Session Timeout

Configure the session timeout setting on the vRealize Automation appliance in accordance with your company security policy.

The vRealize Automation appliance default session timeout on user inactivity is 30 minutes. To adjust this time out value to conform to your organization's security policy, edit the `web.xml` file on your vRealize Automation appliance host machine.

Procedure

1 Open the`/usr/lib/vcac/server/webapps/vcac/WEB-INF/web.xml` file in a text editor.

2 Find `session-config` and set the session-timeout value. See the following code sample.

```
<!-- 30 minutes session expiration time -->
  <session-config>
         <session-timeout>30</session-timeout>
         <tracking-mode>COOKIE</tracking-mode>
         <cookie-config>
                <path>/</path>
         </cookie-config>
  </session-config>
```

3 Restart the Apache server by running the following commands.

```
/etc/init.d/apache2 stop
```

```
/etc/init.d/apache2 start
```

Managing Nonessential Software

To minimize security risks, remove or configure nonessential software from your vRealize Automation host machines.

Configure all software that you do not remove in accordance with manufacturer recommendations and security best practices to minimize its potential to create security breaches.

Securing Application Services Example Content

Secure Software example content to prevent potential attackers from exploiting it.

The Software appliance contains a content server that uses unpatched example content. To prevent misuse, secure this content server before you use it in a production environment. See *Using Application Services* in the VMware vRealize Automation 6.2 Documentation Center.

Secure the USB Mass Storage Handler

Secure the USB mass storage handler to prevent its use as the USB device handler with the VMware virtual appliance host machines. Potential attackers can exploit this handler to compromise your system.

Procedure

1 Open the/etc/modprobe.conf.local file in a text editor.

2 Ensure that the `install usb-storage /bin/true` line appears in the file.

3 Save the file and close it.

Secure the Bluetooth Protocol Handler

Secure the Bluetooth Protocol Handler on your virtual appliance host machines to prevent potential attackers from exploiting it.

Binding the Bluetooth protocol to the network stack is unnecessary and can increase the attack surface of the host.

Procedure

1 Open the /etc/modprobe.conf.local file in a text editor.

2 Ensure that the following line appears in this file.

```
install bluetooth /bin/true
```

3 Save the file and close it.

Secure the Stream Control Transmission Protocol

Prevent the Stream Control Transmission Protocol (SCTP) from loading on your system by default. Potential attackers could exploit this protocol to compromise your system.

Configure your system to prevent the Stream Control Transmission Protocol (SCTP) module from loading unless it is absolutely necessary. SCTP is an unused IETF-standardized transport layer protocol. Binding this protocol to the network stack increases the attack surface of the host. Unprivileged local processes could cause the kernel to dynamically load a protocol handler by opening a socket using the protocol.

Procedure

1 Open the /etc/modprobe.conf.local file in a text editor.

2 Ensure that the following line appears in this file.

```
install sctp /bin/true
```

3 Save the file and close it.

Secure the Datagram Congestion Protocol

As part of your system hardening activities, prevent the Datagram Congestion Protocol (DCCP) from loading on your virtual appliance host machines by default. Potential attackers can exploit this protocol to compromise your system.

Avoid loading the Datagram Congestion Control Protocol (DCCP) module, unless it is absolutely necessary. DCCP is a proposed transport layer protocol, which is not used. Binding this protocol to the network stack increases the attack surface of the host. Unprivileged local processes can cause the kernel to dynamically load a protocol handler by using the protocol to open a socket.

Procedure

1. Open the `/etc/modprobe.conf.local` file in a text editor.
2. Ensure that the DCCP lines appear in the file.

```
install dccp/bin/true
 install dccp_ipv4/bin/true
 install dccp_ipv6/bin/true
```

3. Save the file and close it.

Secure Network Bridging

Prevent the network bridging module from loading on your system by default. Potential attackers could exploit it to compromise your system.

Configure your system to prevent the network from loading, unless it is absolutely necessary. Potential attackers could exploit it to bypass network partitioning and security.

Procedure

1. Run the following command on all VMware virtual appliance host machines.

```
# rmmod bridge
```

2. Open the `/etc/modprobe.conf.local` file in a text editor.
3. Ensure that the following line appears in this file.

```
install bridge /bin/false
```

4. Save the file and close it.

Secure Reliable Datagram Sockets Protocol

As part of your system hardening activities, prevent the Reliable Datagram Sockets Protocol (RDS) from loading on your virtual appliance host machines by default. Potential attackers can exploit this protocol to compromise your system.

Binding the Reliable Datagram Sockets (RDS) Protocol to the network stack increases the attack surface of the host. Unprivileged local processes can cause the system to dynamically load a protocol handler by using the protocol to open a socket.

Procedure

1. Open the `/etc/modprobe.conf.local` file in a text editor.
2. Ensure that the `install rds /bin/true` line appears in this file.

3 Save the file and close it.

Secure Transparent Inter-Process Communication Protocol

As part of your system hardening activities, prevent the Transparent Inter-Process Communication Protocol (TIPC) from loading on your virtual appliance host machines by default. Potential attackers can exploit this protocol to compromise your system.

Binding the Transparent Inter-Process Communications (TIPC) Protocol to the network stack increases the attack surface of the host. Unprivileged local processes can cause the kernel to dynamically load a protocol handler by using the protocol to open a socket.

Procedure

1 Open the `/etc/modprobe.conf.local` file in a text editor.

2 Ensure that the `install tipc /bin/true` line appears in this file.

3 Save the file and close it.

Secure Internetwork Packet Exchange Protocol

Prevent the Internetwork Packet Exchange Protocol (IPX) from loading on your system by default. Potential attackers could exploit this protocol to compromise your system.

Avoid loading the Internetwork Packet Exchange (IPX) Protocol module unless it is absolutely necessary. IPX protocol is an obsolete network-layer protocol. Binding this protocol to the network stack increases the attack surface of the host. Unprivileged local processes could cause the system to dynamically load a protocol handler by using the protocol to open a socket.

Procedure

1 Open the `/etc/modprobe.conf.local` file in a text editor.

2 Ensure that the following line appears in this file.

```
install ipx /bin/true
```

3 Save the file and close it.

Secure Appletalk Protocol

Prevent the Appletalk Protocol from loading on your system by default. Potential attackers could exploit this protocol to compromise your system.

Avoid loading the Appletalk Protocol module unless it is absolutely necessary. Binding this protocol to the network stack increases the attack surface of the host. Unprivileged local processes could cause the system to dynamically load a protocol handler by using the protocol to open a socket.

Procedure

1 Open the `/etc/modprobe.conf.local` file in a text editor.

2 Ensure that the following line appears in this file.

```
install appletalk /bin/true
```

3 Save the file and close it.

Secure DECnet Protocol

Prevent the DECnet Protocol from loading on your system by default. Potential attackers could exploit this protocol to compromise your system.

Avoid loading the DECnet Protocol module unless it is absolutely necessary. Binding this protocol to the network stack increases the attack surface of the host. Unprivileged local processes could cause the system to dynamically load a protocol handler by using the protocol to open a socket.

Procedure

1 Open the DECnet Protocol `/etc/modprobe.conf.local` file in a text editor.

2 Ensure that the following line appears in this file.

```
install decnet /bin/true
```

3 Save the file and close it.

Secure Firewire Module

Prevent the Firewire module from loading on your system by default. Potential attackers could exploit this protocol to compromise your system.

Avoid loading the Firewire module unless it is absolutely necessary.

Procedure

1 Open the `/etc/modprobe.conf.local` file in a text editor.

2 Ensure that the following line appears in this file.

```
install ieee1394 /bin/true
```

3 Save the file and close it.

Securing the Infrastructure as a Service Component

When you harden your system, secure the vRealize Automation Infrastructure as a Service (IaaS) component and its host machine to prevent potential attackers from exploiting it.

You must configure security setting for the vRealize Automation Infrastructure as a Service (IaaS) component and the host on which it resides. You must set or verify the configuration of other related components and applications. In some cases, you can verify existing settings, in others you must change or add settings for an appropriate configuration.

Disabling Windows Time Service

As a security best practice, use authorized time servers rather than host time synchronization in a vRealize Automation production environment.

In a production environment, disable host time synchronization and use authorized time servers to support accurate tracking of user actions, and identification of potential malicious attacks and intrusion through auditing and logging.

Disable SSLv3 in Internet Information Services

As a security best practice, disable SSLv3 in Internet Information Services (IIS) on the Infrastructure as a Service (IaaS) host server machine.

Procedure

1. Run the Windows registry editor as an administrator.
2. Navigate to `HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Control\SecurityProviders\Schannel\Protocols\` in the registry window.
3. Right-click on **Protocols**, and select **New > Key**.
4. Enter **`SSL 3.0`**.
5. In the navigation tree, right-click the newly created **SSL 3.0** key, and in the pop-up menu select **New > Key** and enter **`Client`**.
6. In the navigation tree, right-click on the newly created **SSL 3.0** key, and in the pop-up menu select **New > Key** and enter **`Server`**.
7. In the navigation tree, under SSL 3.0, right-click **Client**, and select **New > DWORD (32-bit) Value** and enter **`DisabledByDefault`**.
8. In the navigation tree, under SSL 3.0, select **Client**, and in the right pane, double-click **DisabledByDefault** and enter **`1`**.
9. In the navigation tree, under SSL 3.0, right-click **Server**, and select **New > DWORD (32-bit) Value** and enter **`Enabled`**.
10. In the navigation tree, under SSL 3.0, select **Server**, and in the right pane, double-click the enabled **DWORD** and enter **`0`**.
11. Restart the Windows Server.

Configuring TLS Cipher Suites

For maximum security, you must configure vRealize Automation components to use strong ciphers. The encryption cipher negotiated between the server and the browser determines the encryption strength that is used in a TLS session. To ensure that only strong ciphers are selected, disable weak ciphers in vRealize Automation components. Configure the server to support only strong ciphers and to use sufficiently large key sizes. Also, configure all ciphers in a suitable order.

Cipher Suites that are not Acceptable

Disable cipher suites that do not offer authentication such as NULL cipher suites, aNULL, or eNULL. Also disable anonymous Diffie-Hellman key exchange (ADH), export level ciphers (EXP, ciphers containing DES), key sizes smaller than 128 bits for encrypting payload traffic, the use of MD5 as a hashing mechanism for payload traffic, IDEA Cipher Suites, and RC4 cipher suites. Also ensure that cipher suites using Diffie-Hellman (DHE) key exchange are disabled.

Customizing Configuration Modes

You can customize settings on your vRealize® system if your changes conform to security requirements.

When you are installing, configuring, or maintaining vRealize Automation® you might want to change some configurations and settings to facilitate troubleshooting and debugging of your installation. Catalog and audit each of the changes you make to ensure that they are properly secured according to their required use. Do not proceed to production if you are not certain that your configuration changes are correctly secured.

Verifying Host Server Security

As a security best practice, verify the security configuration of your Infrastructure as a Service (IaaS) host server machines.

Microsoft supplies several tools to help you verify security on host server machines. Contact your Microsoft vendor for guidance on the most appropriate use of these tools.

Verify Host Server Secure Baseline

Run the Microsoft Baseline Security Analyzer (MBSA) to quickly confirm that your server has the latest updates or hot fixes. You can use the MBSA to install missing security patches from Microsoft to keep your server up-to-date with Microsoft security recommendations.

Download the latest version of the MBSA tool from the Microsoft website.

Verify Host Server Security Configuration

Use the Windows Security Configuration Wizard (SCW) and the Microsoft Security Compliance Manager (SCM) toolkit to verify that the host server is securely configured.

Run the SCW from the administrative tools from your Windows server. This tool can identify the roles of your server and the installed features including networking, Windows firewalls, and registry settings. Compare the report with the latest hardening guidance from the relevant SCM for your Windows server. Based on the results, you can fine tune security settings for each feature such as network services, account settings, and Windows firewalls, and apply the settings to your server.

You can find more information about the SCW tool on the Microsoft Technet Web site.

Protecting Application Resources

As a security best practice, ensure that all relevant Infrastructure as a Service files have the appropriate permissions.

Review Infrastructure as a Service files against your Infrastructure as a Service installation. In most cases, subfolders and files for every folder should have the same settings as the folder.

Directory or File	Group or Users	Full Control	Modify	Read & Execute	Read	Write
VMware\vCAC\Agents \<agent_name> \logs	SYSTEM	X	X	X	X	X
	Administrator	X	X	X	X	X
	Administrators	X	X	X	X	X
VMware\vCAC\Agents\ <agent_name> \temp	SYSTEM	X	X	X	X	X
	Administrator	X	X	X	X	X
	Administrators	X	X	X	X	X
VMware\vCAC\Agents\	SYSTEM	X	X	X	X	X
	Administrators	X	X	X	X	X
	Users			X	X	
VMware\vCAC\Distributed Execution Manager\	SYSTEM	X	X	X	X	X
	Administrators	X	X	X	X	X
	Users			X	X	
VMware\vCAC\Distributed Execution Manager\DEM\Logs	SYSTEM	X	X	X	X	X
	Administrator	X	X	X	X	X
	Administrators	X	X	X	X	X
VMware\vCAC\Distributed Execution Manager\DEO\Logs	SYSTEM	X	X	X	X	X
	Administrator	X	X	X	X	X
	Administrators	X	X	X	X	X
VMware\vCAC\Management Agent\	SYSTEM	X	X	X	X	X
	Administrators	X	X	X	X	X
	Users			X	X	
VMware\vCAC\Server\	SYSTEM	X	X	X	X	X
	Administrators	X	X	X	X	X

Directory or File	Group or Users	Full Control	Modify	Read & Execute	Read	Write
	Users			X	X	
VMware\vCAC\Web API	SYSTEM	X	X	X	X	X
	Administrators	X	X	X	X	X
	Users			X	X	

Secure the Infrastructure as a Service Host Machine

As a security best practice, review basic settings on your Infrastructure as a Service (IaaS) host machine to ensure that it conforms to security guidelines.

Secure miscellaneous accounts, applications, ports, and services on the Infrastructure as a Service (IaaS) host machine.

Verify Server User Account Settings

Verify that no unnecessary local and domain user accounts and settings exist. Restrict any user account that is not related to the application functions to those required for administration, maintenance, and troubleshooting. Restrict remote access from domain user accounts to the minimum required to maintain the server. Strictly control and audit these accounts.

Delete Unnecessary Applications

Delete all unnecessary applications from the host servers. Unnecessary applications increase the risk of exposure because of their unknown or unpatched vulnerabilities.

Disable Unnecessary Ports and Services

Review the host server's firewall for the list of open ports. Block all ports that are not required for the IaaS component or critical system operation. See Configuring Ports and Protocols. Audit the services running against your host server, and disable those that are not required.

Configuring Server Response Headers

11

As a security best practice, configure your vRealize Automation system to limit information available to potential attackers.

To the extent possible, minimize the amount of information that your system shares about its identity and version. Hackers and malicious actors can use this information to craft targeted attacks against your Web server or version.

This chapter includes the following topics:

- Configure the Lighttpd Server Response Header
- Configure the Apache Server Response Header
- Configure the TCServer Response Header for the vRealize Automation appliance
- Configure the tcServer Response Server Header for the Identity Appliance
- Configure the Internet Information Services Server Response Header

Configure the Lighttpd Server Response Header

As a best practice, create a blank server header for the vRealize Automation appliance lighttpd server.

Procedure

1 Open the `/opt/vmware/etc/lighttpd/lighttpd.conf` file in a text editor.

2 Add the `server.tag = " "` to the file.

3 Save your changes and close the file.

4 Restart the lighttpd server by running the `# /opt/vmware/etc/init.d/vami-lighttp restart` command.

Configure the Apache Server Response Header

As a best practice, create a custom server header for the Apache server used with the vRealize Automation appliance to limit the possibility of a malicious attacker obtaining valuable information.

You cannot disable the Apache HTTP Server response header, because Apache considers the server header a feature. You can suppress sending information about software version, OS, and so on. The vRealize Hardening tool supports this hardening activity with the "Apache2 Configuration" option, or you can alter the configuration file manually.

Procedure

1 Open the `/etc/sysconsfig/apache2` file in a text editor.

2 Edit the `APACHE_SERVERTOKENS` line.

```
APACHE_SERVERTOKENS="ProductOnly"
```

3 Save your changes and close the file.

4 Restart the Apache server.

```
/etc/init.d/apache2 stop
/etc/init.d/apache2 start
```

Configure the TCServer Response Header for the vRealize Automation appliance

As a best practice, create a custom blank server header for the TCServer response header used with the vRealize Automation appliance to limit the possibility of a malicious attacker obtaining valuable information.

Procedure

1 Open the `/etc/vco/app-server/server.xml` file in a text editor.

2 In each `<Connector>` element add `server=" ".`

For example: `<Connector protocol="HTTP/1.1" server="" ........ />`

3 Save your changes and close the file.

4 Restart the server using the following command.

```
service vco-server restart
```

Configure the tcServer Response Server Header for the Identity Appliance

As a best practice, create a custom blank server header for the tcServer Response server used with the Identity Appliance to limit the possibility of a malicious attacker obtaining valuable information.

Create a blank server header for the Identity Appliance tcServer Response server so that malicious attackers cannot obtain sensitive information from the configuration file. The vRealize Hardening Tool supports this hardening activity with the Tcserver Configuration option, or you can alter the tcServer Response server configuration file manually.

Procedure

1 Open the `/usr/lib/vmware-sts/conf/server.xml` file in a text editor.

2 In each `<Connector>` element add `server=" ".`

For example: `<Connector protocol="HTTP/1.1" server="" ........ />`

3 Save your changes and close the file.

4 Restart the Apache server

```
/etc/init.d/vmware-stsd stop

                    /etc/init.d/vmware-stsd start
```

Configure the Internet Information Services Server Response Header

As a best practice, create a custom blank server header for the Internet Information Services (IIS) server used with the Identity Appliance to limit the possibility of malicious attackers obtaining valuable information.

Procedure

1 Open the `C:\Windows\System32\inetsrv\urlscan\UrlScan.ini` file in a text editor.

2 Search for `RemoveServerHeader=0` and change it to `RemoveServerHeader=1.`

3 Save your changes and close the file.

4 Restart the server by running the `iisreset` command.

What to do next

Disable the IIS X-Powered By header by removing HTTP Response headers from the list in the IIS Manager Console.

1 Open the IIS Manager console.

2 Open the HTTP Response Header and remove it from the list.

3 Restart the server by running the `iisreset` command.

Configuring Host Network Security

12

To provide maximum protection against known security threats, configure network interface and communication settings on all VMware host machines.

As part of a comprehensive security plan, configure network interface security settings for the VMware virtual appliances and the Infrastructure as a Service components in accordance with established security guidelines.

This chapter includes the following topics:

- Configuring Network Settings for VMware Appliances
- Configuring Network Settings for the Infrastructure as a Service Host
- Configuring Ports and Protocols

Configuring Network Settings for VMware Appliances

To ensure that your VMware virtual appliance host machines support only safe and essential communications, review and edit their network communication settings.

Examine the network IP protocol configuration of your VMware host machines, and configure network settings in accordance with security guidelines. Disable all nonessential communication protocols.

Prevent User Control of Network Interfaces

As a security best practice, allow users only the system privileges that they need to do their jobs on VMware appliance host machines.

Permitting user accounts with privileges to manipulate network interfaces can result in bypassing network security mechanisms or denial of service. Restrict the ability to change network interface settings to privileged users.

Procedure

1 Run the following command on each VMware appliance host machine.

```
# grep -i '^USERCONTROL=' /etc/sysconfig/network/ifcfg*
```

2 Make sure that each interface is set to `NO`.

Set TCP Backlog Queue Size

To provide some level of defense against malicious attacks, configure a default TCP backlog queue size on VMware appliance host machines.

Set the TCP backlog queue sizes to an appropriate default size to provide mitigation for TCP denial or service attacks. The recommended default setting is 1280.

Procedure

1 Run the following command on each VMware appliance host machine.

```
# cat /proc/sys/net/ipv4/tcp_max_syn_backlog
```

2 Open the `/etc/sysctl.conf` file in a text editor.

3 Set the default TCP backlog queue size by adding the following entry to the file.

```
net.ipv4.tcp_max_syn_backlog=1280
```

4 Save your changes and close the file.

Deny ICMPv4 Echoes to Broadcast Address

As a security best practice, verify that your VMware appliance host machines ignore ICMP broadcast address echo requests.

Responses to broadcast Internet Control Message Protocol (ICMP) echoes provide an attack vector for amplification attacks and can facilitate network mapping by malicious agents. Configuring your appliance host machines to ignore ICMPv4 echoes provides protection against such attacks.

Procedure

1 Run the `# cat /proc/sys/net/ipv4/icmp_echo_ignore_broadcasts` command on the VMware virtual appliance host machines to confirm that they deny IPv4 broadcast address echo requests.

   If the host machines are configured to deny IPv4 redirects, this command will return a value of 0 for `/proc/sys/net/ipv4/icmp_echo_ignore_broadcasts`.

2 To configure a virtual appliance host machine to deny ICMPv4 broadcast address echo requests, open the `/etc/sysctl.conf` file on Windows host machines in a text editor.

3 Locate the entry that reads `net.ipv4.icmp_echo_ignore_broadcasts=0` . If the value for this entry is not set to zero or if the entry does not exist, add it or update the existing entry accordingly.

4 Save the changes and close the file.

Disable IPv4 Proxy ARP

Verify that IPv4 Proxy ARP is disabled if not otherwise required on your VMware appliance host machines to prevent unauthorized information sharing.

IPv4 Proxy ARP allows a system to send responses to ARP requests on one interface on behalf of hosts connected to another interface. Disable it if not needed to prevent leakage of addressing information between the attached network segments.

Procedure

1 Run the `# grep [01] /proc/sys/net/ipv4/conf/*/proxy_arp|egrep "default|all"` command on the VMware virtual appliance host machines to verify that IPv4 Proxy ARP is disabled.

   If IPv6 Proxy ARP is disabled on the host machines, this command will return values of 0.

   ```
   /proc/sys/net/ipv4/conf/all/proxy_arp:0
   /proc/sys/net/ipv4/conf/default/proxy_arp:0
   ```

   If the host machines are configured correctly, no further action is necessary.

2 If you need to configure IPv6 Proxy ARP on host machines, open the `/etc/sysctl.conf` file in a text editor.

3 Check for the following entries.

   ```
   net.ipv4.conf.default.proxy_arp=0
   net.ipv4.conf.all.proxy_arp=0
   ```

   If the entries do not exist or if their values are not set to zero, add the entries or update the existing entries accordingly.

4 Save any changes you made and close the file.

Deny IPv4 ICMP Redirect Messages

As a security best practice, verify that your VMware virtual appliance host machines deny IPv4 ICMP redirect messages.

Routers use ICMP redirect messages to tell hosts that a more direct route exists for a destination. A malicious ICMP redirect message can facilitate a man-in-the-middle attack. These messages modify the host's route table and are unauthenticated. Ensure that your system is configured to ignore them if they are not otherwise needed.

Procedure

1 Run the `# grep [01] /proc/sys/net/ipv4/conf/*/accept_redirects|egrep "default|all"` command on the VMware appliance host machines to confirm that they deny IPv4 redirect messages.

   If the host machines are configured to deny IPv4 redirects, this command returns the following:

   `/proc/sys/net/ipv4/conf/all/accept_reidrects:0`

   `/proc/sys/net/ipv4/conf/default/accept_redirects:0`

2 If you need to configure a virtual appliance host machine to deny IPv4 redirect messages, open the `/etc/sysctl.conf` file in a text editor.

3 Check the values of the lines that begin with `net.ipv4.conf`.

If the values for the following entries are not set to zero or if the entries do not exist, add them to the file or update the existing entries accordingly.

```
net.ipv4.conf.all.accept_redirects=0
net.ipv4.conf.default.accept_redirects=0
```

4 Save the changes you made and close the file.

Deny IPv6 ICMP Redirect Messages

As a security best practice, verify that your VMware virtual appliance host machines deny IPv6 ICMP redirect messages.

Routers use ICMP redirect messages to tell hosts that a more direct route exists for a destination. A malicious ICMP redirect message can facilitate a man-in-the-middle attack. These messages modify the host's route table and are unauthenticated. Ensure your system is configured to ignore them if they not otherwise needed.

Procedure

1 Run the `# grep [01] /proc/sys/net/ipv6/conf/*/accept_redirects|egrep "default|all"` command on the VMwarevirtual appliance host machines to confirm that they deny IPv6 redirect messages.

If the host machines are configured to deny IPv6 redirects, this command returns the following:

`/proc/sys/net/ipv6/conf/all/accept_redirects:0`

`/proc/sys/net/ipv6/conf/default/accept_redirects:0`

2 To configure a virtual appliance host machine to deny IPv4 redirect messages, open the `/etc/sysctl.conf` file in a text editor.

3 Check the values of the lines that begin with `net.ipv6.conf`.

If the values for the following entries in the are not set to zero or if the entries do not exist, add them to the file or update the existing entries accordingly.

```
net.ipv6.conf.all.accept_redirects=0
net.ipv6.conf.default.accept_redirects=0
```

4 Save the changes and close the file.

Log IPv4 Martian Packets

As a security best practice, verify that your VMware virtual appliance host machines log IPv4 Martian packets.

Martian packets contain addresses that the system knows to be invalid. Configure your host machines to log these messages so that you can identify misconfigurations or attacks in progress.

Procedure

1 Run the `# grep [01] /proc/sys/net/ipv4/conf/*/log_martians|egrep "default|all"` command on the VMware appliance host machines to verify that they log IPv4 Martian packets.

If the virtual machines are configured to log Martian packers, they return the following:

```
/proc/sys/net/ipv4/conf/all/log_martians:1
/proc/sys/net/ipv4/default/log_martians:1
```

If the host machines are configured correctly, no further action is necessary.

2 If you need to configure virtual machines to log IPv4 martian packets, open the `/etc/sysctl.conf` file in a text editor.

3 Check the values of the lines that start with `net.ipv4.conf`.

If the value for the following entries are not set to 1or if they do not exist, add them to the file or update the existing entries accordingly.

```
net.ipv4.conf.all.log_martians=1
net.ipv4.conf.default.log_martians=1
```

4 Save your changes and close the file.

Use IPv4 Reverse Path Filtering

As a security best practice, verify that your VMware virtual appliance host machines use IPv4 reverse path filtering.

Reverse-path filtering protects against spoofed source addresses by causing the system to discard packets with source addresses that have no route or a route that does not point towards the originating interface. Configure your host machines to use reverse-path filtering whenever possible. In some cases, depending on the system role, reverse-path filtering can cause the system to discard legitimate traffic. If you encounter such problems, you might need to use a more permissive mode or disable reverse-path filtering altogether.

Procedure

1 Run the `# grep [01] /proc/sys/net/ipv4/conf/*/rp_filter|egrep "default|all"` command on the VMware virtual appliance host machines to verify that they use IPv4 reverse path filtering.

If the virtual machines use IPv4 reverse path filtering, this command returns the following:

```
/proc/sys/net/ipv4/conf/all/rp_filter:1
/proc/sys/net/ipv4/conf/default/re_filter:1
```

If your virtual machines are configured correctly, no further action is required.

2 If you need to configure IPv4 reverse path filtering on host machines, open the `/etc/sysctl.conf` file in a text editor.

3 Check the values of the lines that begin with `net.ipv4.conf`.

   If the values for the following entries are not set to 1 or if they do not exist, add them to the file or update the existing entries accordingly.

   ```
   net.ipv4.conf.all.rp_filter=1
   net.ipv4.conf.default.rp_filter=1
   ```

4 Save the changes and close the file.

Deny IPv4 Forwarding

Verify that your VMware appliance host machines deny IPv4 forwarding.

If the system is configured for IP forwarding and is not a designated router, attackers could use it to bypass network security by providing a path for communication not filtered by network devices. Configure your virtual appliance host machines to deny IPv4 forwarding to avoid this risk.

Procedure

1 Run the `# cat /proc/sys/net/ipv4/ip_forward` command on the VMware appliance host machines to confirm that they deny IPv4 forwarding.

   If the host machines are configured to deny IPv4 forwarding, this command will return a value of 0 for `/proc/sys/net/ipv4/ip_forward`. If the virtual machines are configured correctly, no further action is necessary.

2 To configure a virtual appliance host machine to deny IPv4 forwarding, open the `/etc/sysctl.conf` file in a text editor.

3 Locate the entry that reads `net.ipv4.ip_forward=0`. If the value for this entry is not currently set to zero or if the entry does not exist, add it or update the existing entry accordingly.

4 Save any changes and close the file.

Deny IPv6 Forwarding

As a security best practice, verify that your VMware appliance host systems deny IPv6 forwarding.

If the system is configured for IP forwarding and is not a designated router, attackers could use it to bypass network security by providing a path for communication not filtered by network devices. Configure your virtual appliance host machines to deny IPv6 forwarding to avoid this risk.

Procedure

1 Run the `# grep [01] /proc/sys/net/ipv6/conf/*/forwarding|egrep "default|all"` command on the VMware appliance host machines to verify that they deny IPv6 forwarding.

   If the host machines are configured to deny IPv6 forwarding, this command will return the following:

   ```
   /proc/sys/net/ipv6/conf/all/forwarding:0
   /proc/sys/net/ipv6/conf/default/forwarding:0
   ```

If the host machines are configured correctly, no further action is necessary.

2 If you need to configure a host machine to deny IPv6 forwarding, open the `/etc/sysctl.conf` file in a text editor.

3 Check the values of the lines that begin with `net.ipv6.conf`.

If the values for the following entries are not set to zero or if the entries do not exist, add the entries or update the existing entries accordingly.

```
                net.ipv6.conf.all.accept_redirects=0
net.ipv6.conf.default.accept_redirects=0
```

4 Save any changes you made and close the file.

Use IPv4 TCP Syncookies

Verify that your VMware appliance host machines use IPv4 TCP Syncookies.

A TCP SYN flood attack might cause a denial of service by filling a system's TCP connection table with connections in the SYN_RCVD state. Syncookies prevent tracking a connection until receipt of a subsequent ACK, verifying that the initiator is attempting a valid connection and is not a flood source. This technique does not operate in a fully standards-compliant manner, but is only activated during a flood condition, and allows defence of the system while continuing to service valid requests.

Procedure

1 Run the `# cat /proc/sys/net/ipv4/tcp_syncookies` command on the VMware appliance host machines to verify that they use IPv4 TCP Syncookies.

If the host machines are configured to deny IPv4 forwarding, this command will return a value of 1 for `/proc/sys/net/ipv4/tcp_syncookies`. If the virtual machines are configured correctly, no further action is necessary.

2 If you need to configure a virtual appliance to use IPv4 TCP Syncookies, open the `/etc/sysctl.conf` in a text editor.

3 Locate the entry that reads `net.ipv4.tcp_syncookies=1`.

If the value for this entry is not currently set to one or if it does not exist, add the entry or update the existing entry accordingly.

4 Save any changes you made and close the file.

Deny IPv6 Router Advertisements

Verify that VMware host machines deny the acceptance of router advertisements and ICMP redirects unless otherwise required for system operation.

IPv6 enables systems to configure their networking devices by automatically using information from the network. From a security perspective, manually configuring important configuration information is preferable to accepting it from the network in an unauthenticated way.

Procedure

1 Run the `# grep [01] /proc/sys/net/ipv6/conf/*/accept_ra|egrep "default|all"` command on the VMware appliance host machines to verify that they deny router advertisements.

If the host machines are configured to deny IPv6 router advertisements, this command will return values of 0:

```
/proc/sys/net/ipv6/conf/all/accept_ra:0
/proc/sys/net/ipv6/conf/default/accept_ra:0
```

If the host machines are configured correctly, no further action is necessary.

2 If you need to configure a host machine to deny IPv6 router advertisements, open the `/etc/sysctl.conf` file in a text editor.

3 Check for the following entries.

```
net.ipv6.conf.all.accept_ra=0
net.ipv6.conf.default.accept_ra=0
```

If these entries do not exist, or if their values are not set to zero, add the entries or update the existing entries accordingly.

4 Save any changes you made and close the file.

Deny IPv6 Router Solicitations

As a security best practice, verify that your VMware appliance host machines deny IPv6 router solicitations unless otherwise required for system operation.

The router solicitations setting determines how many router solicitations are sent when bringing up the interface. If addresses are statically assigned, there is no need to send any solicitations.

Procedure

1 Run the `# grep [01] /proc/sys/net/ipv6/conf/*/router_solicitations|egrep "default|all"` command on the VMware appliance host machines to verify that they deny IPv6 router solicitations.

If the host machines are configured to deny IPv6 router advertisements, this command will return the following:

```
/proc/sys/net/ipv6/conf/all/router_solicitations:0
/proc/sys/net/ipv6/conf/default/router_solicitations:0
```

If the host machines are configured correctly, no further action is necessary.

2 If you need to configure host machines to deny IPv6 router solicitations, open the `/etc/sysctl.conf` file in a text editor.

3 Check for the following entries.

```
net.ipv6.conf.all.router_solicitations=0
net.ipv6.conf.default.router_solicitations=0
```

If the entries do not exist or if their values are not set to zero, add the entries or update the existing entries accordingly.

4 Save any changes and close the file.

Deny IPv6 Router Preference in Router Solicitations

Verify that your VMware appliance host machines to deny IPv6 router solicitations unless otherwise needed for system operation.

The router preference in the solicitations setting determines router preferences. If addresses are statically assigned, there is no need to receive any router preference for solicitations.

Procedure

1 Run the `# grep [01] /proc/sys/net/ipv6/conf/*/accept_ra_rtr_pref|egrep "default|all"` command on the VMware appliance host machines to verify that they deny IPv6 router solicitations.

   If the host machines are configured to deny IPv6 router advertisements, this command will return the following:

   ```
   /proc/sys/net/ipv6/conf/all/accept_ra_rtr_pref:0
   /proc/sys/net/ipv6/conf/default/accept_ra_rtr_pref:0
   ```

   If the host machines are configured correctly, no further action is necessary.

2 If you need to configure host machines to deny IPv6 route solicitations, open the `/etc/sysctl.conf` file in a text editor.

3 Check for the following entries.

   ```
   net.ipv6.conf.all.accept_ra_rtr_pref=0
   net.ipv6.conf.default.accept_ra_rtr_pref=0
   ```

   If the entries do not exist or if their values not set to zero, add the entries or update the existing entries accordingly.

4 Save any changes you made and close the file.

Deny IPv6 Router Prefix

Verify that your VMware appliance host machines deny IPv6 router prefix information unless otherwise required for system operation.

The `accept_ra_pinfo` setting controls whether the system accepts prefix info from the router. If addresses are statically assigned, there is no need to receive any router prefix information.

Procedure

1 Run the `# grep [01] /proc/sys/net/ipv6/conf/*/accept_ra_pinfo|egrep "default|all"` command on the VMware appliance host machines to verify that they deny IPv6 router prefix information.

If the host machines are configured to deny IPv6 router advertisements, this command will return the following.

```
/proc/sys/net/ipv6/conf/all/accept_ra_pinfo:0
/proc/sys/net/ipv6/conf/default/accept_ra_pinfo:0
```

If the host machines are configured correctly, no further action is necessary.

2 If you need to configure host machines to deny IPv6 router prefix information, open the `/etc/sysctl.conf` file in a text editor.

3 Check for the following entries.

```
net.ipv6.conf.all.accept_ra_pinfo=0
net.ipv6.conf.default.accept_ra_pinfo=0
```

If the entries do not exist or if their values are not set to zero, add the entries or update the existing entries accordingly.

4 Save any changes and close the file.

Deny IPv6 Router Advertisement Hop Limit Settings

Verify that your VMware appliance host machines deny IPv6 router hop limit settings unless necessary.

The `accept_ra_defrtr` setting controls whether the system will accept Hop Limit settings from a router advertisement. Setting it to zero prevents a router from changing your default IPv6 Hop Limit for outgoing packets.

Procedure

1 Run the `# grep [01] /proc/sys/net/ipv6/conf/*/accept_ra_defrtr|egrep "default|all"` command on the VMware appliance host machines to verify that they deny IPv6 router hop limit settings.

If the host machines are configured to deny IPv6 router hop limit settings, this command will return values of 0.

```
/proc/sys/net/ipv6/conf/all/accept_ra_defrtr:0
/proc/sys/net/ipv6/conf/default/accept_ra_defrtr:0
```

If the host machines are configured correctly, no further action is necessary.

2 If you need to configure a host machine to deny IPv6 router hop limit settings, open the `/etc/sysctl.conf` file in a text editor.

3 Check for the following entries.

```
net.ipv6.conf.all.autoconf=0
net.ipv6.conf.default.autoconf=0
```

If the entries do not exist or if their values are not set to zero, add the entries or update the existing entries accordingly.

4 Save any changes you made and close the file.

Deny IPv6 Router Advertisement Autoconf Settings

Verify that your VMware appliance host machines deny IPv6 router autoconf settings unless necessary.

The `autoconf` setting controls whether router advertisements can cause the system to assign a global unicast address to an interface.

Procedure

1 Run the `# grep [01] /proc/sys/net/ipv6/conf/*/autoconf|egrep "default|all"` command on the VMware appliance host machines to verify that they deny IPv6 router autoconf settings.

If the host machines are configured to deny IPv6 router autoconf settings, this command will return values of 0.

```
/proc/sys/net/ipv6/conf/all/autoconf:0
/proc/sys/net/ipv6/conf/default/autoconf:0
```

If the host machines are configured correctly, no further action is necessary.

2 If you need to configure a host machine to deny IPv6 router autoconf settings, open the `/etc/sysctl.conf` file in a text editor.

3 Check for the following entries.

```
net.ipv6.conf.all.autoconf=0
net.ipv6.conf.default.autoconf=0
```

If the entries do not exist or if their values are not set to zero, add the entries or update the existing entries accordingly.

4 Save any changes you made and close the file.

Deny IPv6 Neighbor Solicitations

Verify that your VMware appliance host machines to deny IPv6 neighbor solicitations unless necessary.

The `dad_transmits` setting determines how many neighbor solicitations to send out per address (global and link-local) when bringing up an interface to ensure the desired address is unique on the network.

Procedure

1 Run the `# grep [01] /proc/sys/net/ipv6/conf/*/dad_transmits|egrep "default|all"` command on the VMware appliance host machines to confirm that they deny IPv6 neighbor solicitations.

If the host machines are configured to deny IPv6 neighbor solicitations, this command will return values of 0.

```
/proc/sys/net/ipv6/conf/all/dad_transmits:0
/proc/sys/net/ipv6/conf/default/dad_transmits:0
```

If the host machines are configured correctly, no further action is necessary.

2 If you need to configure a host machine to deny IPv6 neighbor solicitations, open the `/etc/sysctl.conf` file in a text editor.

3 Check for the following entries.

```
net.ipv6.conf.all.dad_transmits=0
net.ipv6.conf.default.dad_transmits=0
```

If the entries do not exist or if their values are not set to zero, add the entries or update the existing entries accordingly.

4 Save any changes you made and close the file.

Restrict IPv6 Max Addresses

Verify that your VMware appliance host machines to restrict IPv6 max address settings to the minimum required for system operation.

The max addresses setting determines how many global unicast IPv6 addresses are available to each interface. The default is 16, but you should set to exactly the number of statically configured global addresses required for your system.

Procedure

1 Run the `# grep [1] /proc/sys/net/ipv6/conf/*/max_addresses|egrep "default|all"` command on the VMware appliance host machines to verify that they restrict IPv6 max addresses appropriately.

If the host machines are configured to restrict IPv6 max addresses, this command will return values of 1.

```
/proc/sys/net/ipv6/conf/all/max_addresses:1
/proc/sys/net/ipv6/conf/default/max_addresses:1
```

If the host machines are configured correctly, no further action is necessary.

2 If you need to configure IPv6 max addresses on host machines, open the `/etc/sysctl.conf` file in a text editor.

3 Check for the following entries.

```
net.ipv6.conf.all.max_addresses=1
net.ipv6.conf.default.max_addresses=1
```

If the entries do not exist or if their values are not set to 1, add the entries or update the existing entries accordingly.

4 Save any changes you made and close the file.

Configuring Network Settings for the Infrastructure as a Service Host

As a security best practice, configure network communication settings on your VMware Infrastructure as a Service (IaaS) component host machine according to VMware requirements and guidelines.

Configure the Infrastructure as a Service (IaaS) host machine's network configuration to support full vRealize Automation functions with appropriate security.

See Securing the Infrastructure as a Service Component.

Configuring Ports and Protocols

As a security best practice, configure ports and protocols for all vRealize Automation appliances and components in accordance with VMware guidelines.

Configure incoming and outgoing ports for vRealize Automation components as required for critical system components to operate in production. Disable all unneeded ports and protocols. See the *vRealize Automation 6x Reference Architecture Guide*.

User Required Ports

As a security best practice, configure vRealize Automation user ports according to VMware guidelines.

Expose required ports only over a secure network.

SERVER	PORTS
vRealize Automation Appliance	443, 8443

Administrator Required Ports

As a security best practice, configure vRealize Automation administrator ports according to VMware guidelines.

Expose required ports only over a secure network.

SERVER	PORTS
vRealize Application Services Server	5480

vRealize Automation Appliance Ports

As a security best practice, configure incoming and outgoing ports for the vRealize Automation appliance according to VMware recommendations.

Incoming Ports

Configure the minimum required incoming ports for the vRealize Automation appliance. Configure optional ports if needed for your system configuration.

Table 12-1. Minimum Required Incoming Ports

PORT	PROTOCOL	COMMENTS
443	TCP	Access to the vRealize Automation console and API calls.
8443	TCP	Console Proxy (VMRC).
5480	TCP	Access to the virtual appliance Web Management Console.
5488, 5489	TCP	Internal. Used by the vRealize Automation appliance for updates.
5672	TCP	RabbitMQ messaging. **Note** When you cluster vRealize Automation appliance instances, you might need to configure the open ports 4369 and 25672.
40002	TCP	Required for vIDM service. This is firewalled to all external traffic with the exception of traffic from other vRealize Automation appliance nodes when added in HA configuration.

If necessary, configure optional incoming ports.

Table 12-2. Optional Incoming Ports

PORT	PROTOCOL	COMMENTS
22	TCP	(Optional) SSH. In a production environment, disable the SSH service listening on port 22, and close port 22 .
80	TCP	(Optional) Redirects to 443.

Outgoing Ports

Configure the required outgoing ports.

Table 12-3. Minimum Required Outgoing Ports

PORT	PROTOCOL	COMMENTS
25,587	TCP, UDP	SMTP for sending outbound notification emails.
53	TCP, UDP	DNS.
67, 68, 546, 547	TCP, UDP	DHCP.
110, 995	TCP, UDP	POP for receiving inbound notification emails.
143, 993	TCP, UDP	IMAP for receiving inbound notification emails.
443	TCP	Infrastructure as a Service Manager Service over HTTPS.

If necessary, configure optional outgoing ports.

Table 12-4. Optional Outgoing Ports

PORT	PROTOCOL	COMMENTS
80	TCP	(Optional) For fetching software updates. You can download and apply updates separately.
123	TCP, UDP	(Optional) For connecting directly to NTP instead of using host time.

Identity Appliance Ports

As a security best practice, configure incoming ports for the Identity Appliance according to VMware guidelines.

Incoming Ports

Configure the minimum required incoming ports for the Identity Appliance. Configure optional ports if needed for your system configuration.

Table 12-5. Minimum Required Incoming Ports

PORT	PROTOCOL	COMMENTS
5480	TCP	Access to the virtual appliance Web Management Console.
7444	TCP	SSO service over HTTPS.

If needed, configure optional incoming ports.

Table 12-6. Optional Incoming Ports

PORT	PROTOCOL	COMMENTS
22	TCP	(Optional) SSH. In a production environment, disable the SSH service listening on port 22, or any other port, and close port 22.

Application Services Appliance Ports

As a security best practice, configure incoming ports for the Application Services Appliance according to VMware guidelines.

Incoming Ports

Configure the minimum required incoming ports for the Application Services Appliance. Configure optional ports if needed for your system configuration.

Table 12-7. Minimum Required Incoming Ports

PORT	PROTOCOL	COMMENTS
8443	TCP	HTTPS for Application Services user interface.
5671		AMQP over SSL for RabbitMQ.
80	TCP	HTTP. Used to host preprepared demo content, agent binary, and CLI binary. Do not use preprepared content in production environments.

If needed configure the following incoming ports.

Table 12-8. Optional Incoming Ports

PORT	PROTOCOL	COMMENTS
22	TCP	(Optional) SSH. In a production environment, disable the SSH service listening on port 22, or any other port, and close port 22.

Infrastructure as a Service Ports

As a security best practice, configure incoming and outgoing ports for the Infrastructure as a Service (IaaS) components according to VMware guidelines.

Incoming Ports

Configure the minimum required incoming ports for the IaaS components.

Table 12-9. Minimum Required Incoming Ports

COMPONENT	PORT	PROTOCOL	COMMENTS
Manager Service	443	TCP	Communication with IaaS components and vRealize Automation Appliance over HTTPS. Any virtualization hosts that proxy agents manage must also have TCP port 443 open for incoming traffic

Outgoing Ports

Configure the minimum required outgoing ports for the IaaS components.

Table 12-10. Minimum Required Outgoing Ports

COMPONENT	PORT	PROTOCOL	COMMENTS
All	53	TCP, UDP	DNS.
All		TCP, UDP	DHCP.
Manager Service	443	TCP	Communication with vRealize Automation Appliance over HTTPS.
Web site	443	TCP	Communication with Manager Service over HTTPS.
Distributed Execution Managers	443	TCP	Communication with Manager Service over HTTPS.
Proxy Agents	443	TCP	Communication with Manager Service and virtualization hosts over HTTPS.

Table 12-10. Minimum Required Outgoing Ports (Continued)

COMPONENT	PORT	PROTOCOL	COMMENTS
Guest Agent	443	TCP	Communication with Manager Service over HTTPS.
Manager Service, Web site	1433	TCP	MSSQL.

If needed, configure optional outgoing ports.

Table 12-11. Optional Outgoing Ports

COMPONENT	PORT	PROTOCOL	COMMENTS
All	123	TCP, UDP	NTP is optional.

13

Auditing and Logging

As a security best practice, set up auditing and logging on your vRealize Automation system in accordance with VMware recommendations.

Remote logging to a central log host provides a secure store for log files. By gathering log files to a central host, you can monitor the environment with a single tool. Also, you can perform aggregate analysis and search for evidence of threats such as coordinated attacks on multiple entities within the infrastructure. Logging to a secure, centralized log server can help prevent log tampering, and also provides a long-term audit record.

Ensure That the Remote Logging Server Is Secure

Often, after attackers breach the security of your host machine, they attempt to search for and tamper with log files to cover their tracks and maintain control without being discovered. Securing the remote logging server appropriately helps to discourage log tampering.

Use an Authorized NTP Server

Ensure that all host machines use the same relative time source, including the relevant localization offset, and that you can correlate the relative time source to an agreed-upon time standard such as Coordinated Universal Time (UTC). A disciplined approach to time sources enables you to quickly track and correlate an intruder's actions when you review the relevant log files. Incorrect time settings can make it difficult to inspect and correlate log files to detect attacks and can make auditing inaccurate.

Use at least three NTP servers from outside time sources or configure a few local NTP servers on a trusted network that in turn obtain their time from at least three outside time sources.