CIS Red Hat Enterprise Linux 7 Benchmark

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Overview

This document, CIS Red Hat Enterprise Linux 7 Benchmark, provides prescriptive guidance for establishing a secure configuration posture for Red Hat Enterprise Linux (RHEL) version 7.0 running on x86 and x64 platforms. To obtain the latest version of this guide, please visit http://benchmarks.cisecurity.org. If you have questions, comments, or have identified ways to improve this guide, please write us at feedback@cisecurity.org.

Intended Audience

This benchmark is intended for system and application administrators, security specialists, auditors, help desk, and platform deployment personnel who plan to develop, deploy, assess, or secure solutions that incorporate Red Hat Enterprise Linux 7.

Consensus Guidance

This benchmark was created using a consensus review process comprised subject matter experts. Consensus participants provide perspective from a diverse set of backgrounds including consulting, software development, audit and compliance, security research, operations, government, and legal.

Each CIS benchmark undergoes two phases of consensus review. The first phase occurs during initial benchmark development. During this phase, subject matter experts convene to discuss, create, and test working drafts of the benchmark. This discussion occurs until consensus has been reached on benchmark recommendations. The second phase begins after the benchmark has been published. During this phase, all feedback provided by the Internet community is reviewed by the consensus team for incorporation in the benchmark. If you are interested in participating in the consensus process, please visit https://community.cisecurity.org.

Typographical Conventions

The following typographical conventions are used throughout this guide:

Convention	Meaning
`Stylized Monospace font`	Used for blocks of code, command, and script examples. Text should be interpreted exactly as presented.
`Monospace font`	Used for inline code, commands, or examples. Text should be interpreted exactly as presented.
<italic font in brackets>	Italic texts set in angle brackets denote a variable requiring substitution for a real value.
Italic font	Used to denote the title of a book, article, or other publication.
Note	Additional information or caveats

Scoring Information

A scoring status indicates whether compliance with the given recommendation impacts the assessed target's benchmark score. The following scoring statuses are used in this benchmark:

Scored

Failure to comply with "Scored" recommendations will decrease the final benchmark score. Compliance with "Scored" recommendations will increase the final benchmark score.

Not Scored

Failure to comply with "Not Scored" recommendations will not decrease the final benchmark score. Compliance with "Not Scored" recommendations will not increase the final benchmark score.

Profile Definitions

The following configuration profiles are defined by this Benchmark:

- **Level 1**

  Items in this profile intend to:

  - be practical and prudent;
  - provide a clear security benefit; and
  - not inhibit the utility of the technology beyond acceptable means.

- **Level 2**

  This profile extends the "Level 1" profile. Items in this profile exhibit one or more of the following characteristics:

  - are intended for environments or use cases where security is paramount.
  - acts as defense in depth measure.
  - may negatively inhibit the utility or performance of the technology.

Acknowledgements

This benchmark exemplifies the great things a community of users, vendors, and subject matter experts can accomplish through consensus collaboration. The CIS community thanks the entire consensus team with special recognition to the following individuals who contributed greatly to the creation of this guide:

Recommendations

1 Install Updates, Patches and Additional Security Software

1.1 Filesystem Configuration

Directories that are used for system-wide functions can be further protected by placing them on separate partitions. This provides protection for resource exhaustion and enables the use of mounting options that are applicable to the directory's intended use. User's data can be stored on separate partitions and have stricter mount options. A user partition is a filesystem that has been established for use by the users and does not contain software for system operations. The directives in this section are easier to perform during initial system installation. If the system is already installed, it is recommended that a full backup be performed before repartitioning the system.

Note: If you are repartitioning a system that has already been installed, make sure the data has been copied over to the new partition, unmount it and then remove the data from the directory that was in the old partition. Otherwise it will still consume space in the old partition that will be masked when the new filesystem is mounted. For example, if a system is in single-user mode with no filesystems mounted and the administrator adds a lot of data to the `/tmp` directory, this data will still consume space in `/` once the `/tmp` filesystem is mounted unless it is removed first.

1.1.1 Create Separate Partition for /tmp (Scored)

Profile Applicability:

- Level 1

Description:

The `/tmp` directory is a world-writable directory used for temporary storage by all users and some applications.

Rationale:

Since the `/tmp` directory is intended to be world-writable, there is a risk of resource exhaustion if it is not bound to a separate partition. In addition, making `/tmp` its own file system allows an administrator to set the `noexec` option on the mount, making `/tmp`

useless for an attacker to install executable code. It would also prevent an attacker from establishing a hardlink to a system `setuid` program and wait for it to be updated. Once the program was updated, the hardlink would be broken and the attacker would have his own copy of the program. If the program happened to have a security vulnerability, the attacker could continue to exploit the known flaw.

Audit:

Verify that there is a `/tmp` file partition in the `/etc/fstab` file.

```
# grep "[[:space:]]/tmp[[:space:]]" /etc/fstab
```

Remediation:

For new installations, check the box to "Review and modify partitioning" and create a separate partition for `/tmp`.

For systems that were previously installed, use the Logical Volume Manager (LVM) to create partitions.

References:

1. AJ Lewis, "LVM HOWTO", http://tldp.org/HOWTO/LVM-HOWTO/

1.1.2 Set nodev option for /tmp Partition (Scored)

Profile Applicability:

• Level 1

Description:

The `nodev` mount option specifies that the filesystem cannot contain special devices.

Rationale:

Since the `/tmp` filesystem is not intended to support devices, set this option to ensure that users cannot attempt to create block or character special devices in `/tmp`.

Audit:

Run the following commands to determine if the system is configured as recommended.

```
# grep "[[:space:]]/tmp[[:space:]]" /etc/fstab | grep nodev
# mount | grep "[[:space:]]/tmp[[:space:]]" | grep nodev
```

If either command emits no output then the system is not configured as recommended.

Remediation:

Edit the `/etc/fstab` file and add `nodev` to the fourth field (mounting options). See the `fstab(5)` manual page for more information.

```
# mount -o remount,nodev /tmp
```

1.1.3 Set nosuid option for /tmp Partition (Scored)

Profile Applicability:

• Level 1

Description:

The `nosuid` mount option specifies that the filesystem cannot contain set userid files.

Rationale:

Since the `/tmp` filesystem is only intended for temporary file storage, set this option to ensure that users cannot create set userid files in `/tmp`.

```
# mount -o remount,nosuid /tmp
```

Audit:

Run the following commands to determine if the system is configured as recommended.

```
# grep "[[:space:]]/tmp[[:space:]]" /etc/fstab | grep nosuid
# mount | grep "[[:space:]]/tmp[[:space:]]" | grep nosuid
```
If either command emits no output then the system is not configured as recommended.

Remediation:

Edit the `/etc/fstab` file and add `nosuid` to the fourth field (mounting options). See the `fstab(5)` manual page for more information.

1.1.4 Set noexec option for /tmp Partition (Scored)

Profile Applicability:

• Level 1

Description:

The `noexec` mount option specifies that the filesystem cannot contain executable binaries.

Rationale:

Since the `/tmp` filesystem is only intended for temporary file storage, set this option to ensure that users cannot run executable binaries from `/tmp`.

Audit:

Run the following commands to determine if the system is configured as recommended.

```
# grep "[[:space:]]/tmp[[:space:]]" /etc/fstab | grep noexec
# mount | grep "[[:space:]]/tmp[[:space:]]" | grep noexec
```
If either command emits no output then the system is not configured as recommended.

Remediation:

Edit the `/etc/fstab` file and add `noexec` to the fourth field (mounting options). See the `fstab(5)` manual page for more information.

```
# mount -o remount,noexec /tmp
```

1.1.5 Create Separate Partition for /var (Scored)

Profile Applicability:

- Level 1

Description:

The `/var` directory is used by daemons and other system services to temporarily store dynamic data. Some directories created by these processes may be world-writable.

Rationale:

Since the `/var` directory may contain world-writable files and directories, there is a risk of resource exhaustion if it is not bound to a separate partition.

Audit:

```
# grep "[[:space:]]/var[[:space:]]" /etc/fstab
<volume> /var <fstype> <options>
```

Remediation:

For new installations, check the box to "Review and modify partitioning" and create a separate partition for `/var`.

For systems that were previously installed, use the Logical Volume Manager (LVM) to create partitions.

References:

1. AJ Lewis, "LVM HOWTO", http://tldp.org/HOWTO/LVM-HOWTO/

1.1.6 Bind Mount the /var/tmp directory to /tmp (Scored)

Profile Applicability:

- Level 1

Description:

The `/var/tmp` directory is normally a standalone directory in the `/var` file system. Binding `/var/tmp` to `/tmp` establishes an unbreakable link to `/tmp` that cannot be removed (even by the root user). It also allows `/var/tmp` to inherit the same mount options that `/tmp` owns, allowing `/var/tmp` to be protected in the same `/tmp` is protected. It will also prevent `/var` from filling up with temporary files as the contents of `/var/tmp` will actually reside in the file system containing `/tmp`.

Rationale:

All programs that use `/var/tmp` and `/tmp` to read/write temporary files will always be written to the `/tmp` file system, preventing a user from running the `/var` file system out of space or trying to perform operations that have been blocked in the `/tmp` filesystem.

Audit:

Perform the following to determine if the system is configured as recommended:

```
# grep -e "^/tmp[[:space:]]" /etc/fstab | grep /var/tmp
/tmp /var/tmp none none 0 0
# mount | grep -e "^/tmp[[:space:]]" | grep /var/tmp
/tmp on /var/tmp type none (rw,bind)
```

If the above commands emit no output then the system is not configured as recommended.

Remediation:

```
# mount --bind /tmp /var/tmp
```

and edit the `/etc/fstab` file to contain the following line:

```
/tmp /var/tmp none bind 0 0
```

1.1.7 Create Separate Partition for /var/log (Scored)

Profile Applicability:

- Level 1

Description:

The `/var/log` directory is used by system services to store log data .

Rationale:

There are two important reasons to ensure that system logs are stored on a separate partition: protection against resource exhaustion (since logs can grow quite large) and protection of audit data.

Audit:

```
# grep "[[:space:]]/var/log[[:space:]]" /etc/fstab
<volume> /var/log <fstype> <options>
```

Remediation:

For new installations, check the box to "Review and modify partitioning" and create a separate partition for `/var/log`.

For systems that were previously installed, use the Logical Volume Manager (LVM) to create partitions.

References:

1. AJ Lewis, "LVM HOWTO", http://tldp.org/HOWTO/LVM-HOWTO/

1.1.8 Create Separate Partition for /var/log/audit (Scored)

Profile Applicability:

- Level 1

Description:

The auditing daemon, `auditd`, stores log data in the `/var/log/audit` directory.

Rationale:

There are two important reasons to ensure that data gathered by `auditd` is stored on a separate partition: protection against resource exhaustion (since the `audit.log` file can grow quite large) and protection of audit data. The audit daemon calculates how much free

space is left and performs actions based on the results. If other processes (such as `syslog`) consume space in the same partition as `auditd`, it may not perform as desired.

Audit:

```
# grep "[[:space:]]/var/log/audit[[:space:]]" /etc/fstab
<volume> /var/log/audit <fstype> <options>
```

Remediation:

For new installations, check the box to "Review and modify partitioning" and create a separate partition for `/var/log/audit`. For systems that were previously installed, use the Logical Volume Manager (LVM) to create partitions.

References:

1. AJ Lewis, "LVM HOWTO", http://tldp.org/HOWTO/LVM-HOWTO/

1.1.9 Create Separate Partition for /home (Scored)

Profile Applicability:

- Level 1

Description:

The `/home` directory is used to support disk storage needs of local users.

Rationale:

If the system is intended to support local users, create a separate partition for the `/home` directory to protect against resource exhaustion and restrict the type of files that can be stored under `/home`.

Audit:

```
# grep "[[:space:]]/home[[:space:]]" /etc/fstab
<volume> /home <fstype> <options>
```

Remediation:

For new installations, check the box to "Review and modify partitioning" and create a separate partition for `/home`.

For systems that were previously installed, use the Logical Volume Manager (LVM) to create partitions.

References:

1. AJ Lewis, "LVM HOWTO", http://tldp.org/HOWTO/LVM-HOWTO/

1.1.10 Add nodev Option to /home (Scored)

Profile Applicability:

- Level 1

Description:

When set on a file system, this option prevents character and block special devices from being defined, or if they exist, from being used as character and block special devices.

Rationale:

Since the user partitions are not intended to support devices, set this option to ensure that users cannot attempt to create block or character special devices.

Note: The actions in the item refer to the `/home` partition, which is the default user partition that is defined in RHEL7. If you have created other user partitions, it is recommended that the Remediation and Audit steps be applied to these partitions as well.

Audit:

```
# grep "[[:space:]]/home[[:space:]]" /etc/fstab
Verify that nodev is an option
# mount | grep /home
<each user partition> on <mount point> type <fstype> (nodev)
```

Note: There may be other options listed for this filesystem

Remediation:

Edit the `/etc/fstab` file and add `nodev` to the fourth field (mounting options). See the `fstab(5)` manual page for more information.

```
# mount -o remount,nodev /home
```

1.1.11 Add nodev Option to Removable Media Partitions (Not Scored)

Profile Applicability:

- Level 1

Description:

Set `nodev` on removable media to prevent character and block special devices that are present on the removable be treated as these device files.

Rationale:

Removable media containing character and block special devices could be used to circumvent security controls by allowing non-root users to access sensitive device files such as `/dev/kmem` or the raw disk partitions.

Audit:

```
# grep <each removable media mountpoint> /etc/fstab
Verify that nodev is an option
```

Remediation:

Edit the `/etc/fstab` file and add "`nodev`" to the fourth field (mounting options). Look for entries that have mount points that contain words such as floppy or cdrom. See the `fstab(5)` manual page for more information.

1.1.12 Add noexec Option to Removable Media Partitions (Not Scored)

Profile Applicability:

- Level 1

Description:

Set `noexec` on removable media to prevent programs from executing from the removable media.

Rationale:

Setting this option on a file system prevents users from executing programs from the removable. This deters users from being to introduce potentially malicious software on the system.

Audit:

```
# grep <each removable media mountpoint> /etc/fstab
```
Note: Verify that `noexec` is an option

Remediation:

Edit the `/etc/fstab` file and add `noexec` to the fourth field (mounting options). Look for entries that have mount points that contain words such as floppy or cdrom. See the `fstab(5)` manual page for more information.

1.1.13 Add nosuid Option to Removable Media Partitions (Not Scored)

Profile Applicability:

- Level 1

Description:

Set `nosuid` on removable media to prevent `setuid` and `setgid` executable files that are on that media from being executed as `setuid` and `setgid`.

Rationale:

Setting this option on a file system prevents users from introducing privileged programs onto the system and allowing non-root users to execute them.

Audit:

```
# grep <each removable media mountpoint> /etc/fstab
Verify that nosuid is an option
```

Remediation:

Edit the `/etc/fstab` file and add `nosuid` to the fourth field (mounting options). Look for entries that have mount points that contain words such as floppy or cdrom. See the `fstab(5)` manual page for more information.

1.1.14 Add nodev Option to /dev/shm Partition (Scored)

Profile Applicability:

- Level 1

Description:

The `nodev` mount option specifies that the `/dev/shm` (temporary filesystem stored in memory) cannot contain block or character special devices.

Rationale:

Since the `/dev/shm` filesystem is not intended to support devices, set this option to ensure that users cannot attempt to create special devices in `/dev/shm` partitions.

Audit:

Run the following commands to determine if the system is in configured as recommended:

```
# grep /dev/shm /etc/fstab | grep nodev
# mount | grep /dev/shm | grep nodev
```
If either command emits no output then the system is not configured as recommended.

Remediation:

Edit the `/etc/fstab` file and add `nodev` to the fourth field (mounting options of entries that have mount points that contain `/dev/shm`. See the `fstab(5)` manual page for more information.

```
# mount -o remount,nodev /dev/shm
```

1.1.15 Add nosuid Option to /dev/shm Partition (Scored)

Profile Applicability:

- Level 1

Description:

The `nosuid` mount option specifies that the `/dev/shm` (temporary filesystem stored in memory) will not execute `setuid` and `setgid` on executable programs as such, but rather execute them with the uid and gid of the user executing the program.

Rationale:

Setting this option on a file system prevents users from introducing privileged programs onto the system and allowing non-root users to execute them.

Audit:

Run the following commands to determine if the system is in configured as recommended:

```
# grep /dev/shm /etc/fstab | grep nosuid
# mount | grep /dev/shm | grep nosuid
```
If either command emits no output then the system is not configured as recommended.

Remediation:

Edit the `/etc/fstab` file and add `nosuid` to the fourth field (mounting options). Look for entries that have mount points that contain `/dev/shm`. See the `fstab(5)` manual page for more information.

```
# mount -o remount,nosuid /dev/shm
```

1.1.16 Add noexec Option to /dev/shm Partition (Scored)

Profile Applicability:

• Level 1

Description:

Set `noexec` on the shared memory partition to prevent programs from executing from there.

Rationale:

Setting this option on a file system prevents users from executing programs from shared memory. This deters users from introducing potentially malicious software on the system.

Audit:

Run the following commands to determine if the system is in configured as recommended:

```
# grep /dev/shm /etc/fstab | grep noexec
# mount | grep /dev/shm | grep noexec
```
If either command emits no output then the system is not configured as recommended.

Remediation:

Edit the `/etc/fstab` file and add `noexec` to the fourth field (mounting options). Look for entries that have mount points that contain `/dev/shm`. See the `fstab(5)` manual page for more information.

```
# mount -o remount,noexec /dev/shm
```

1.1.17 Set Sticky Bit on All World-Writable Directories (Scored)

Profile Applicability:

• Level 1

Description:

Setting the sticky bit on world writable directories prevents users from deleting or renaming files in that directory that are not owned by them.

Rationale:

This feature prevents the ability to delete or rename files in world writable directories (such as `/tmp`) that are owned by another user.

Audit:

```
# df --local -P | awk {'if (NR!=1) print $6'} | xargs -I '{}' find '{}' -xdev -type d
\( -perm -0002 -a ! -perm -1000 \) 2>/dev/null
```

Remediation:

```
# df --local -P | awk {'if (NR!=1) print $6'} | xargs -I '{}' find '{}' -xdev -type d
\( -perm -0002 -a ! -perm -1000 \) 2>/dev/null | xargs chmod a+t
```

1.1.18 Disable Mounting of cramfs Filesystems (Not Scored)

Profile Applicability:

- Level 2

Description:

The `cramfs` filesystem type is a compressed read-only Linux filesystem embedded in small footprint systems. A `cramfs` image can be used without having to first decompress the image.

Rationale:

Removing support for unneeded filesystem types reduces the local attack surface of the server. If this filesystem type is not needed, disable it.

Audit:

```
# /sbin/modprobe -n -v cramfs
install /bin/true
# /sbin/lsmod | grep cramfs
<No output>
```

Remediation:

Edit or create the file `/etc/modprobe.d/CIS.conf` and add the following line:

```
install cramfs /bin/true
```

1.1.19 Disable Mounting of freevxfs Filesystems (Not Scored)

Profile Applicability:

• Level 2

Description:

The `freevxfs` filesystem type is a free version of the Veritas type filesystem. This is the primary filesystem type for HP-UX operating systems.

Rationale:

Removing support for unneeded filesystem types reduces the local attack surface of the server. If this filesystem type is not needed, disable it.

Audit:

```
# /sbin/modprobe -n -v freevxfs
install /bin/true
# /sbin/lsmod | grep freevxfs
<No output>
```

Remediation:

Edit or create the file `/etc/modprobe.d/CIS.conf` and add the following line:

```
install freevxfs /bin/true
```

1.1.20 Disable Mounting of jffs2 Filesystems (Not Scored)

Profile Applicability:

• Level 2

Description:

The `jffs2` (journaling flash filesystem 2) filesystem type is a log-structured filesystem used in flash memory devices.

Rationale:

Removing support for unneeded filesystem types reduces the local attack surface of the server. If this filesystem type is not needed, disable it.

Audit:

```
# /sbin/modprobe -n -v jffs2
install /bin/true
# /sbin/lsmod | grep jffs2
<No output>
```

Remediation:

Edit or create the file `/etc/modprobe.d/CIS.conf` and add the following line:

```
install jffs2 /bin/true
```

1.1.21 Disable Mounting of hfs Filesystems (Not Scored)

Profile Applicability:

- Level 2

Description:

The `hfs` filesystem type is a hierarchical filesystem that allows you to mount Mac OS filesystems.

Rationale:

Removing support for unneeded filesystem types reduces the local attack surface of the server. If this filesystem type is not needed, disable it.

Audit:

```
# /sbin/modprobe -n -v hfs
install /bin/true
# /sbin/lsmod | grep hfs
<No output>
```

Remediation:

Edit or create the file `/etc/modprobe.d/CIS.conf` and add the following line:

```
install hfs /bin/true
```

1.1.22 Disable Mounting of hfsplus Filesystems (Not Scored)

Profile Applicability:

- Level 2

Description:

The `hfsplus` filesystem type is a hierarchical filesystem designed to replace `hfs` that allows you to mount Mac OS filesystems.

Rationale:

Removing support for unneeded filesystem types reduces the local attack surface of the server. If this filesystem type is not needed, disable it.

Audit:

```
# /sbin/modprobe -n -v hfsplus
install /bin/true
# /sbin/lsmod | grep hfsplus
<No output>
```

Remediation:

Edit or create the file `/etc/modprobe.d/CIS.conf` and add the following line:

```
install hfsplus /bin/true
```

1.1.23 Disable Mounting of squashfs Filesystems (Not Scored)

Profile Applicability:

- Level 2

Description:

The `squashfs` filesystem type is a compressed read-only Linux filesystem embedded in small footprint systems (similar to `cramfs`). A `squashfs` image can be used without having to first decompress the image.

Rationale:

Removing support for unneeded filesystem types reduces the local attack surface of the server. If this filesystem type is not needed, disable it.

Audit:

```
# /sbin/modprobe -n -v squashfs
install /bin/true
# /sbin/lsmod | grep squashfs
<No output>
```

Remediation:

Edit or create the file `/etc/modprobe.d/CIS.conf` and add the following line:

```
install squashfs /bin/true
```

1.1.24 Disable Mounting of udf Filesystems (Not Scored)

Profile Applicability:

- Level 2

Description:

The `udf` filesystem type is the universal disk format used to implement ISO/IEC 13346 and ECMA-167 specifications. This is an open vendor filesystem type for data storage on a broad range of media. This filesystem type is necessary to support writing DVDs and newer optical disc formats.

Rationale:

Removing support for unneeded filesystem types reduces the local attack surface of the server. If this filesystem type is not needed, disable it.

Audit:

```
# /sbin/modprobe -n -v udf
install /bin/true
# /sbin/lsmod | grep udf
<No output>
```

Remediation:

Edit or create the file `/etc/modprobe.d/CIS.conf` and add the following line:

```
install udf /bin/true
```

1.2 Configure Software Updates

Red Hat uses the `yum` command line tool to install and update software packages. Updating the RHEL7 software via the Internet requires a valid Red Hat subscription. Patch management procedures may vary widely between enterprises. Large enterprises may choose to install a Red Hat Satellite Update server that can be used in place of Red Hat's servers, whereas a single deployment of a Red Hat system may prefer to get updates from Red Hat's servers. Updates can be performed automatically or manually, depending on the site's policy for patch management. Many large enterprises prefer to test patches on a non-production system before rolling out to production.

For the purpose of this benchmark, the requirement is to ensure that a patch management system is configured and maintained. The specifics on patch update procedures are left to the organization.

1.2.1 Configure Connection to the RHN RPM Repositories (Not Scored)

Profile Applicability:

- Level 1

Description:

Systems need to be registered with the Red Hat Network (RHN) to receive patch updates. This is usually configured during initial installation.

Rationale:

It is important to register with the Red Hat Network to make sure that patches are updated on a regular basis. This helps to reduce the exposure time as new vulnerabilities are discovered.

Audit:

Verify that the system is registered by executing the following command:

```
# yum check-update
```

Remediation:

If your system is not listed on the RHN site as a registered system, run the Red Hat Network Registration tool as follows:

```
# rhn_register
```

Follow the prompts on the screen. If successful, the system will appear on the RHN web site and be subscribed to one or more software update channels. Additionally, a new daemon, `rhnsd`, will be enabled.

1.2.2 Verify Red Hat GPG Key is Installed (Scored)

Profile Applicability:

- Level 1

Description:

Red Hat cryptographically signs updates with a GPG key to verify that they are valid.

Rationale:

It is important to ensure that updates are obtained from a valid source to protect against spoofing that could lead to the inadvertent installation of malware on the system.

Audit:

Run the following command to ensure that the system has the Red Hat GPG key properly installed:

```
# rpm -q --queryformat "%{SUMMARY}\n" gpg-pubkey
```

Remediation:

Compare the GPG fingerprint with the one from Red Hat's web site at http://www.redhat.com/security/team/key. The following command can be used to print the installed release key's fingerprint, which is actually contained in the file referenced below:

```
# gpg --quiet --with-fingerprint /etc/pki/rpm-gpg/RPM-GPG-KEY-redhat-release
```

More information on package signing is also available at https://access.redhat.com/security/team/key.

References:

1. More information on package signing is also available at https://access.redhat.com/security/team/key

1.2.3 Verify that gpgcheck is Globally Activated (Scored)

Profile Applicability:

- Level 1

Description:

The `gpgcheck` option, found in the main section of the `/etc/yum.conf` file determines if an RPM package's signature is always checked prior to its installation.

Rationale:

It is important to ensure that an RPM's package signature is always checked prior to installation to ensure that the software is obtained from a trusted source.

Audit:

Run the following command to verify that `gpgcheck` is set to `1` in all occurrences of the `/etc/yum.conf` file:

```
# grep gpgcheck /etc/yum.conf
gpgcheck=1
```

Remediation:

Edit the `/etc/yum.conf` file and set the `gpgcheck` to 1 as follows:

```
gpgcheck=1
```

1.2.4 Disable the rhnsd Daemon (Not Scored)

Profile Applicability:

- Level 2

Description:

The `rhnsd` daemon polls the Red Hat Network web site for scheduled actions and, if there are, executes those actions.

Rationale:

Patch management policies may require that organizations test the impact of a patch before it is deployed in a production environment. Having patches automatically deployed could have a negative impact on the environment. It is best to not allow an action by default but only after appropriate consideration has been made. It is recommended that the service be disabled unless the risk is understood and accepted or you are running your own satellite . This item is not scored because organizations may have addressed the risk.

Audit:

```
# systemctl is-enabled rhnsd
```

Ensure result is not enabled.

Remediation:

Disable the `rhnsd` daemon by running the following command:

```
# systemctl disable rhnsd
```

1.2.5 Obtain Software Package Updates with yum (Not Scored)

Profile Applicability:

- Level 1

Description:

The `yum` update utility performs software updates, including dependency analysis, based on repository metadata and can be run manually from the command line, invoked from one of the provided front-end tools, or configured to run automatically at specified intervals.

Rationale:

The yum update utility is the preferred method to update software since it checks for dependencies and ensures that the software is installed correctly. Refer to your local patch management procedures for the method used to perform yum updates.

Audit:

Perform the following command to determine if there are any packages that need to be updated:

```
# yum check-update
```

Remediation:

```
# yum update
```

1.2.6 Verify Package Integrity Using RPM (Not Scored)

Profile Applicability:

- Level 1

Description:

RPM has the capability of verifying installed packages by comparing the installed files against the file information stored in the package.

Rationale:

Verifying packages gives a system administrator the ability to detect if package files were changed, which could indicate that a valid binary was overwritten with a trojaned binary.

Audit:

Perform the following to verify integrity of installed packages.

```
# rpm -qVa | awk '$2 != "c" { print $0}'
If any output shows up, you may have an integrity issue with that package
```

Note: Actions in other areas of the benchmark change permissions on some files to make them more secure than the default, which would cause this check to fail. It is important to validate the packages either have the permissions they were intended to have, or have been intentionally altered. It is recommended that any output generated in the audit step be investigated to justify the discrepancy.

Remediation:

Address unexpected discrepancies identified in the audit step.

1.3 Advanced Intrusion Detection Environment (AIDE)

AIDE is a file integrity checking tool, similar in nature to Tripwire. While it cannot prevent intrusions, it can detect unauthorized changes to configuration files by alerting when the files are changed. When setting up AIDE, decide internally what the site policy will be concerning integrity checking. Review the AIDE quick start guide and AIDE documentation before proceeding.

1.3.1 Install AIDE (Scored)

Profile Applicability:

- Level 2

Description:

In some installations, AIDE is not installed automatically.

Rationale:

Install AIDE to make use of the file integrity features to monitor critical files for changes that could affect the security of the system.

Audit:

```
Perform the following to determine if AIDE is installed.
# rpm -q aide
aide.<package version>.<hardware platform>
```

Remediation:

Use yum to install AIDE (-y option may be used to assume yes at all prompts):

yum install aide
<Output messages from Yum install>
aide.<hardware platform> <package version> installed

Initialize AIDE:

/usr/sbin/aide --init -B 'database_out=file:/var/lib/aide/aide.db.gz'

Note: The prelinking feature can interfere with AIDE because it alters binaries to speed up their start up times. Set `PRELINKING=no` in `/etc/sysconfig/prelink` and run `/usr/sbin/prelink -ua` to restore the binaries to their prelinked state, thus avoiding false positives from AIDE.

1.3.2 Implement Periodic Execution of File Integrity (Scored)

Profile Applicability:

- Level 2

Description:

Implement periodic file checking, in compliance with site policy.

Rationale:

Periodic file checking allows the system administrator to determine on a regular basis if critical files have been changed in an unauthorized fashion.

Audit:

Perform the following to determine if there is a `cron` job scheduled to run the aide check.

```
# crontab -u root -l | grep aide
0 5 * * * /usr/sbin/aide --check
```

Remediation:

Execute the following command:

```
# crontab -u root -e
```

Add the following line to the crontab:

```
0 5 * * * /usr/sbin/aide --check
```

Note: The checking in this instance occurs every day at 5am. Alter the frequency and time of the checks in compliance with site policy.

1.4 Configure SELinux

SELinux provides a Mandatory Access Control (MAC) system that greatly augments the default Discretionary Access Control (DAC) model. Under SELinux, every process and every object (files, sockets, pipes) on the system is assigned a security context, a label that includes detailed type information about the object. The kernel allows processes to access objects only if that access is explicitly allowed by the policy in effect. The policy defines transitions, so that a user can be allowed to run software, but the software can run under a different context than the user's default. This automatically limits the damage that the software can do to files accessible by the calling user. The user does not need to take any action to gain this benefit. For an action to occur, both the traditional DAC permissions must be satisfied as well as the SELinux MAC rules. The action will not be allowed if either one of these models does not permit the action. In this way, SELinux rules can only make a system's permissions more restrictive and secure. SELinux requires a complex policy to allow all the actions required of a system under normal operation. Three such policies have been designed for use with RHEL7 and are included with the system: `targeted`, `strict`, and `mls`. These are described as follows:

- `targeted`: consists mostly of Type Enforcement (TE) rules, and a small number of Role-Based Access Control (RBAC) rules. Targeted restricts the actions of many types of programs, but leaves interactive users largely unaffected.
- `strict`: also uses TE and RBAC rules, but on more programs and more aggressively.
- `mls`: implements Multi-Level Security (MLS), which introduces even more kinds of labels (sensitivity and category) and rules that govern access based on these.

This section provides guidance for the configuration of the `targeted` policy.

References:

1. NSA SELinux resources:
    1. http://www.nsa.gov/research/selinux
    2. http://www.nsa.gov/research/selinux/list.shtml

2. Fedora SELinux resources:
    1. FAQ: http://docs.fedoraproject.org/selinux-faq
    2. User Guide: http://docs.fedoraproject.org/selinux-user-guide
    3. Managing Services Guide: http://docs.fedoraproject.org/selinux-managing-confined-services-guide
3. SELinux Project web page and wiki:
    1. http://www.selinuxproject.org
4. Chapters 43-45 of Red Hat Enterprise Linux 5: Deployment Guide (Frank Mayer, Karl MacMillan and David Caplan),
5. SELinux by Example: Using Security Enhanced Linux (Prentice Hall, August 6, 2006)

1.4.1 Ensure SELinux is not disabled in /boot/grub2/grub.cfg (Scored)

Profile Applicability:

- Level 2

Description:

Configure SELINUX to be enabled at boot time and verify that it has not been overwritten by the grub boot parameters

Rationale:

SELinux must be enabled at boot time in `/boot/grub2/grub.cfg` to ensure that the controls it provides are not overwritten.

Audit:

Perform the following to verify that SELinux is enabled at boot time:

```
# grep selinux=0 /boot/grub2/grub.cfg
[no output produced]
# grep enforcing=0 /boot/grub2/grub.cfg
[no output produced]
```

Remediation:

Remove all instances of `selinux=0` and `enforcing=0` from `/boot/grub2/grub.cfg`.

1.4.2 Set the SELinux State (Scored)

Profile Applicability:

- Level 2

Description:

Set SELinux to enable when the system is booted.

Rationale:

SELinux must be enabled at boot time in to ensure that the controls it provides are in effect at all times.

Audit:

Perform the following to determine if SELinux is enabled at boot time.

```
# grep SELINUX=enforcing /etc/selinux/config
SELINUX=enforcing

# /usr/sbin/sestatus

SELinux status: enabled
Current mode: enforcing
Mode from config file: enforcing
Policy from config file: targeted
```

Remediation:

Edit the `/etc/selinux/config` file to set the SELINUX parameter:

```
SELINUX=enforcing
```

1.4.3 Set the SELinux Policy (Scored)

Profile Applicability:

- Level 2

Description:

Configure SELinux to meet or exceed the default targeted policy, which constrains daemons and system software only.

Rationale:

Security configuration requirements vary from site to site. Some sites may mandate a policy that is stricter than the default policy, which is perfectly acceptable. This item is intended to ensure that at least the default recommendations are met.

Audit:

Perform the following to determine if the targeted policy is selected in the
`/etc/selinux/config` file.

```
# grep SELINUXTYPE=targeted /etc/selinux/config
SELINUXTYPE=targeted

# /usr/sbin/sestatus

SELinux status: enabled
Current mode: enforcing
Mode from config file: enforcing
Policy from config file: targeted
```

Note: If your organization requires stricter policies, verify that they are selected by using
the "`grep`" command on the `/etc/selinux/config` file.

Remediation:

Edit the `/etc/selinux/config` file to set the SELINUXTYPE parameter:

```
SELINUXTYPE=targeted
```

Note: If your organization requires stricter policies, make sure they are added to the
`/etc/selinux/config` file.

1.4.4 Remove SETroubleshoot (Scored)

Profile Applicability:

- Level 2

Description:

The SETroubleshoot service notifies desktop users of SELinux denials through a user-
friendly interface. The service provides important information around configuration errors,
unauthorized intrusions, and other potential errors.

Rationale:

The SETroubleshoot service is an unnecessary daemon to have running on a server,
especially if X Windows is disabled.

Audit:

```
# rpm -q setroubleshoot
setroubleshoot.<package version>.<hardware platform>
```

Remediation:

```
# yum erase setroubleshoot
```

1.4.5 Remove MCS Translation Service (mcstrans) (Scored)

Profile Applicability:

- Level 2

Description:

The `mcstransd` daemon provides category label information to client processes requesting information. The label translations are defined in `/etc/selinux/targeted/setrans.conf`

Rationale:

Since this service is not used very often, disable it to reduce the amount of potentially vulnerable code running on the system.

Audit:

Perform the following to determine if mctrans is disabled:

```
# rpm -q mcstrans
mcstrans.<package version>.<hardware platform>
```

Remediation:

```
# yum erase mcstrans
```

1.4.6 Check for Unconfined Daemons (Scored)

Profile Applicability:

- Level 2

Description:

Daemons that are not defined in SELinux policy will inherit the security context of their parent process.

Rationale:

Since daemons are launched and descend from the `init` process, they will inherit the security context label `initrc_t`. This could cause the unintended consequence of giving the process more permission than it requires.

Audit:

Perform the following to determine if unconfined daemons are running on the system.

```
# ps -eZ | egrep "initrc" | egrep -vw "tr|ps|egrep|bash|awk" | tr ':' ' ' | awk '{
print $NF }'

[no output produced]
```

Remediation:

Investigate any unconfined daemons found during the audit action.

1.5 Secure Boot Settings

1.5.1 Set User/Group Owner on /boot/grub2/grub.cfg (Scored)

Profile Applicability:

- Level 1

Description:

Set the owner and group of `/boot/grub2/grub.cfg` to the root user.

Rationale:

Setting the owner and group to root prevents non-root users from changing the file.

Audit:

Perform the following to determine if the `/boot/grub2/grub.cfg` file has the correct ownership:

```
# stat -L -c "%u %g" /boot/grub2/grub.cfg | egrep "0 0"
```

If the above command emits no output then the system is not configured as recommended.

Remediation:

```
# chown root:root /boot/grub2/grub.cfg
```

1.5.2 Set Permissions on /boot/grub2/grub.cfg (Scored)

Profile Applicability:

- Level 1

Description:

Set permission on the `/boot/grub2/grub.cfg` file to read and write for root only.

Rationale:

Setting the permissions to read and write for root only prevents non-root users from seeing the boot parameters or changing them. Non-root users who read the boot parameters may be able to identify weaknesses in security upon boot and be able to exploit them.

Audit:

Perform the following to determine if the `/boot/grub2/grub.cfg` file permissions are correct:

```
# stat -L -c "%a" /boot/grub2/grub.cfg | egrep ".00"
```
If the above command emits no output then the system is not configured as recommended.

Remediation:

```
# chmod og-rwx /boot/grub2/grub.cfg
```

1.5.3 Set Boot Loader Password (Scored)

Profile Applicability:

- Level 1

Description:

Setting the boot loader password will require that anyone rebooting the system must enter a password before being able to set command line boot parameters

Rationale:

Requiring a boot password upon execution of the boot loader will prevent an unauthorized user from entering boot parameters or changing the boot partition. This prevents users from weakening security (e.g. turning off SELinux at boot time).

Audit:

Perform the following to determine if a password is required to set command line boot parameters:

```
# grep "^set superusers" /boot/grub2/grub.cfg
set superusers="<user-list>"
# grep "^password" /boot/grub2/grub.cfg
password_pbkdf2 <user> <encrypted password>
```

At least one user must be specified as a super user and have a password assigned.

Remediation:

Create an encrypted password with grub-md5-crypt:

```
# grub2-mkpasswd-pbkdf2
Enter password: <password>
Reenter password: <password>
Your PBKDF2 is <encrypted-password>
```

Add the following into `/etc/grub.d/00_header` or a custom `/etc/grub.d` configuration file:

cat <<EOF

set superusers="*<user-list>*"

password_pbkdf2 *<user> <encrypted-password>*

EOF

Run the following to update the grub configuration:

```
# grub2-mkconfig -o /boot/grub2/grub.cfg
```

1.6 Additional Process Hardening

1.6.1 Restrict Core Dumps (Scored)

Profile Applicability:

- Level 1

Description:

A core dump is the memory of an executable program. It is generally used to determine why a program aborted. It can also be used to glean confidential information from a core file. The system provides the ability to set a soft limit for core dumps, but this can be overridden by the user.

Rationale:

Setting a hard limit on core dumps prevents users from overriding the soft variable. If core dumps are required, consider setting limits for user groups (see `limits.conf(5)`). In

addition, setting the `fs.suid_dumpable` variable to 0 will prevent setuid programs from dumping core.

Audit:

Perform the following to determine if core dumps are restricted.

```
# grep "hard core" /etc/security/limits.conf
* hard core 0
# sysctl fs.suid_dumpable
fs.suid_dumpable = 0
```

Remediation:

Add the following line to the `/etc/security/limits.conf` file.

```
* hard core 0
```

Add the following line to the `/etc/sysctl.conf` file.

```
fs.suid_dumpable = 0
```

1.6.2 Enable Randomized Virtual Memory Region Placement (Scored)

Profile Applicability:

- Level 1

Description:

Set the system flag to force randomized virtual memory region placement.

Rationale:

Randomly placing virtual memory regions will make it difficult for to write memory page exploits as the memory placement will be consistently shifting.

Audit:

Perform the following to determine if virtual memory is randomized.

```
# sysctl kernel.randomize_va_space
kernel.randomize_va_space = 2
```

Remediation:

Add the following line to the `/etc/sysctl.conf` file.

```
kernel.randomize_va_space = 2
```

1.7 Use the Latest OS Release (Not Scored)

Profile Applicability:

- Level 1

Description:

Periodically, Red Hat releases updates to the Red Hat operating system to support new hardware platforms, deliver new functionality as well as the bundle together a set of patches that can be tested as a unit.

Rationale:

Newer updates may contain security enhancements that would not be available through the standard patching process. As a result, it is recommended that the latest update of the Red Hat software be used to take advantage of the latest functionality. As with any software installation, organizations need to determine if a given update meets their requirements and verify the compatibility and supportability of any additional software against the update revision that is selected.

Audit:

Run the following command to determine the current OS level:

```
# uname -r
```
or

```
# cat /etc/redhat-release
```

Remediation:

Use the latest update when installing new systems and upgrade to or reinstall with the latest update as appropriate for existing systems.

2 OS Services

While applying system updates and patches helps correct known vulnerabilities, one of the best ways to protect the system against as yet unreported vulnerabilities is to disable all services that are not required for normal system operation. This prevents the exploitation of vulnerabilities discovered at a later date. If a service is not enabled, it cannot be exploited. The actions in this section of the document provide guidance on what services can be safely disabled and under which circumstances, greatly reducing the number of possible threats to the resulting system.

2.1 Remove Legacy Services

The items in this section are intended to ensure that legacy services are not installed on the system. Some guidance includes directives to both disable and remove the service. There is no good reason to have these services on the system, even in a disabled state.

Note: The audit items in the section check to see if the packages are listed in the yum database and installed using rpm. It could be argued that someone may have installed them separately. However, this is also true for any other type of rogue software. It is beyond the scope of this benchmark to address software that is installed using non-standard methods and installation directories.

2.1.1 Remove telnet-server (Scored)

Profile Applicability:

- Level 1

Description:

The telnet-server package contains the `telnetd` daemon, which accepts connections from users from other systems via the `telnet` protocol.

Rationale:

The telnet protocol is insecure and unencrypted. The use of an unencrypted transmission medium could allow a user with access to sniff network traffic the ability to steal credentials. The `ssh` package provides an encrypted session and stronger security and is included in most Red Hat Linux distributions.

Audit:

Perform the following to determine if the `telnet-server` package is on the system.

```
# rpm -q telnet-server
package telnet-server is not installed
```

Remediation:

```
# yum erase telnet-server
```

2.1.2 Remove telnet Clients (Scored)

Profile Applicability:

- Level 1

Description:

The `telnet` package contains the `telnet` client, which allows users to start connections to other systems via the telnet protocol.

Rationale:

The `telnet` protocol is insecure and unencrypted. The use of an unencrypted transmission medium could allow an authorized user to steal credentials. The `ssh` package provides an encrypted session and stronger security and is included in most Red Hat Linux distributions.

Audit:

Perform the following to determine if the `telnet` package is on the system.

```
# rpm -q telnet
package telnet is not installed
```

Remediation:

```
# yum erase telnet
```

2.1.3 Remove rsh-server (Scored)

Profile Applicability:

- Level 1

Description:

The Berkeley rsh-server (`rsh`, `rlogin`, `rcp`) package contains legacy services that exchange credentials in clear-text.

Rationale:

These legacy service contain numerous security exposures and have been replaced with the more secure SSH package.

Audit:

Perform the following to determine if rsh-server is installed on the system.

```
# rpm -q rsh-server
package rsh-server is not installed
```

Remediation:

```
# yum erase rsh-server
```

2.1.4 Remove rsh (Scored)

Profile Applicability:

- Level 1

Description:

The `rsh` package contains the client commands for the rsh services.

Rationale:

These legacy clients contain numerous security exposures and have been replaced with the more secure SSH package. Even if the server is removed, it is best to ensure the clients are also removed to prevent users from inadvertently attempting to use these commands and therefore exposing their credentials. Note that removing the `rsh` package removes the clients for `rsh`, `rcp` and `rlogin`.

Audit:

Perform the following to determine if `rsh` is installed on the system.

```
# rpm -q rsh
package rsh is not installed
```

Remediation:

```
# yum erase rsh
```

2.1.5 Remove NIS Client (Scored)

Profile Applicability:

- Level 1

Description:

The Network Information Service (NIS), formerly known as Yellow Pages, is a client-server directory service protocol used to distribute system configuration files. The NIS client (`ypbind`) was used to bind a machine to an NIS server and receive the distributed configuration files.

Rationale:

The NIS service is inherently an insecure system that has been vulnerable to DOS attacks, buffer overflows and has poor authentication for querying NIS maps. NIS generally has been replaced by such protocols as Lightweight Directory Access Protocol (LDAP). It is recommended that the service be removed.

Audit:

Perform the following to determine if ypbind is installed on the system.

```
# rpm -q ypbind
package ypbind is not installed
```

Remediation:

```
# yum erase ypbind
```

2.1.6 Remove NIS Server (Scored)

Profile Applicability:

- Level 1

Description:

The Network Information Service (NIS) (formally known as Yellow Pages) is a client-server directory service protocol for distributing system configuration files. The NIS server is a collection of programs that allow for the distribution of configuration files.

Rationale:

The NIS service is inherently an insecure system that has been vulnerable to DOS attacks, buffer overflows and has poor authentication for querying NIS maps. NIS generally been replaced by such protocols as Lightweight Directory Access Protocol (LDAP). It is recommended that the service be disabled and other, more secure services be used

Audit:

Perform the following to determine if ypserv is installed on the system.

```
# rpm -q ypserv
package ypserv is not installed
```

Remediation:

```
# yum erase ypserv
```

2.1.7 Remove tftp (Scored)

Profile Applicability:

- Level 1

Description:

Trivial File Transfer Protocol (TFTP) is a simple file transfer protocol, typically used to automatically transfer configuration or boot files between machines. TFTP does not support authentication and can be easily hacked. The package `tftp` is a client program that allows for connections to a `tftp` server.

Rationale:

It is recommended that TFTP be removed, unless there is a specific need for TFTP (such as a boot server). In that case, use extreme caution when configuring the services.

Audit:

Perform the following to determine if tftp is installed on the system.

```
# rpm -q tftp
package tftp is not installed
```

Remediation:

```
# yum erase tftp
```

2.1.8 Remove tftp-server (Scored)

Profile Applicability:

- Level 1

Description:

Trivial File Transfer Protocol (TFTP) is a simple file transfer protocol, typically used to automatically transfer configuration or boot machines from a boot server. The package `tftp-server` is the server package used to define and support a TFTP server.

Rationale:

TFTP does not support authentication nor does it ensure the confidentiality of integrity of data. It is recommended that TFTP be removed, unless there is a specific need for TFTP. In that case, extreme caution must be used when configuring the services.

Audit:

Perform the following to determine if tftp-server is installed on the system.

```
# rpm -q tftp-server
package tftp-server is not installed
```

Remediation:

```
# yum erase tftp-server
```

2.1.9 Remove talk (Scored)

Profile Applicability:

- Level 1

Description:

The `talk` software makes it possible for users to send and receive messages across systems through a terminal session. The `talk` client (allows initialization of talk sessions) is installed by default.

Rationale:

The software presents a security risk as it uses unencrypted protocols for communication.

Audit:

Perform the following to determine if talk is installed on the system.

```
# rpm -q talk
package talk is not installed
```

Remediation:

```
# yum erase talk
```

2.1.10 Remove talk-server (Scored)

Profile Applicability:

- Level 1

Description:

The talk software makes it possible for users to send and receive messages across systems through a terminal session. The talk client (allows initiate of talk sessions) is installed by default.

Rationale:

The software presents a security risk as it uses unencrypted protocols for communication.

Audit:

Perform the following to determine if `talk-server` is installed on the system:

```
# rpm -q talk-server
package talk-server is not installed
```

Remediation:

```
# yum erase talk-server
```

2.1.11 Remove xinetd (Scored)

Profile Applicability:

- Level 2

Description:

The eXtended InterNET Daemon (`xinetd`) is an open source super daemon that replaced the original `inetd` daemon. The `xinetd` daemon listens for well known services and dispatches the appropriate daemon to properly respond to service requests.

Rationale:

If there are no `xinetd` services required, it is recommended that the daemon be deleted from the system.

Audit:

Perform the following to determine if `xinetd` is installed on the system.

```
# rpm -q xinetd
package xinetd is not installed
```

Remediation:

```
# yum erase xinetd
```

2.1.12 Disable chargen-dgram (Scored)

Profile Applicability:

- Level 1

Description:

`chargen-dgram` is a network service that responds with 0 to 512 ASCII characters for each datagram it receives. This service is intended for debugging and testing purposes. It is recommended that this service be disabled.

Rationale:

Disabling this service will reduce the remote attack surface of the system.

Audit:

```
# chkconfig --list chargen-dgram
chargen-dgram: off
```

Remediation:

Disable the `chargen-dgram` service by running the following command:

```
# chkconfig chargen-dgram off
```

2.1.13 Disable chargen-stream (Scored)

Profile Applicability:

- Level 1

Description:

`chargen-stream` is a network service that responds with 0 to 512 ASCII characters for each connection it receives. This service is intended for debugging and testing purposes. It is recommended that this service be disabled.

Rationale:

Disabling this service will reduce the remote attack surface of the system.

Audit:

```
# chkconfig --list chargen-stream
chargen-stream: off
```

Remediation:

Disable the `chargen-stream` service by running the following command:

```
# chkconfig chargen-stream off
```

2.1.14 Disable daytime-dgram (Scored)

Profile Applicability:

- Level 1

Description:

`daytime-dgram` is a network service that responds with the server's current date and time. This service is intended for debugging and testing purposes. It is recommended that this service be disabled.

Rationale:

Disabling this service will reduce the remote attack surface of the system.

Audit:

```
# chkconfig --list daytime-dgram
daytime-dgram: off
```

Remediation:

Disable the `daytime-dgram` service by running the following command:

```
# chkconfig daytime-dgram off
```

2.1.15 Disable daytime-stream (Scored)

Profile Applicability:

- Level 1

Description:

`daytime-stream` is a network service that responds with the server's current date and time. This service is intended for debugging and testing purposes. It is recommended that this service be disabled.

Rationale:

Disabling this service will reduce the remote attack surface of the system.

Audit:

```
# chkconfig --list daytime-stream
daytime-stream: off
```

Remediation:

Disable the `daytime-stream` service by running the following command:

```
# chkconfig daytime-stream off
```

2.1.16 Disable echo-dgram (Scored)

Profile Applicability:

- Level 1

Description:

`echo-dgram` is a network service that responds to clients with the data sent to it by the client. This service is intended for debugging and testing purposes. It is recommended that this service be disabled.

Rationale:

Disabling this service will reduce the remote attack surface of the system.

Audit:

```
# chkconfig --list echo-dgram
echo-dgram: off
```

Remediation:

Disable the echo-dgram service by running the following command:

```
# chkconfig echo-dgram off
```

2.1.17 Disable echo-stream (Scored)

Profile Applicability:

- Level 1

Description:

`echo-stream` is a network service that responds to clients with the data sent to it by the client. This service is intended for debugging and testing purposes. It is recommended that this service be disabled.

Rationale:

Disabling this service will reduce the remote attack surface of the system.

Audit:

```
# chkconfig --list echo-stream
echo-stream: off
```

Remediation:

Disable the echo-stream service by running the following command:

```
# chkconfig echo-stream off
```

2.1.18 Disable tcpmux-server (Scored)

Profile Applicability:

- Level 1

Description:

`tcpmux-server` is a network service that allows a client to access other network services running on the server. It is recommended that this service be disabled.

Rationale:

`tcpmux-server` can be abused to circumvent the server's host based firewall. Additionally, `tcpmux-server` can be leveraged by an attacker to effectively port scan the server.

Audit:

```
# chkconfig --list tcpmux-server
tcpmux-server: off
```

Remediation:

Disable the `tcpmux-server` service by running the following command:

```
# chkconfig tcpmux-server off
```

3 Special Purpose Services

This section describes services that are installed on servers that specifically need to run these services. If any of these services are not required, it is recommended that they be disabled or deleted from the system to reduce the potential attack surface.

3.1 Set Daemon umask (Scored)

Profile Applicability:

- Level 1

Description:

Set the default `umask` for all processes started at boot time. The settings in `umask` selectively turn off default permission when a file is created by a daemon process.

Rationale:

Setting the `umask` to 027 will make sure that files created by daemons will not be readable, writable or executable by any other than the group and owner of the daemon process and will not be writable by the group of the daemon process. The daemon process can manually override these settings if these files need additional permission.

Audit:

Perform the following to determine if the daemon `umask` is set.

```
# grep umask /etc/sysconfig/init
umask 027
```

Remediation:

Add the following line to the `/etc/sysconfig/init` file.

```
umask 027
```

3.2 Remove the X Window System (Scored)

Profile Applicability:

- Level 1

Description:

The X Window system provides a Graphical User Interface (GUI) where users can have multiple windows in which to run programs and various add on. The X Window system is typically used on desktops where users login, but not on servers where users typically do not login.

Rationale:

Unless your organization specifically requires graphical login access via the X Window System, remove the server to reduce the potential attack surface.

Audit:

Perform the following to ensure the system is not booting into graphical mode:

```
ls -l /etc/systemd/system/default.target | grep graphical.target
```
No results should be returned.

Perform the following to determine if the X Window server is installed on the system:

```
# rpm -q xorg-x11-server-common
package xorg-x11-server-common is not installed
```

Remediation:

Change the default runlevel to multi user without X:

```
# cd /etc/systemd/system/
# unlink default.target
# ln -s /usr/lib/systemd/system/multi-user.target default.target
```
Uninstall the X Window Server:

```
# yum remove xorg-x11-server-common
```

3.3 Disable Avahi Server (Scored)

Profile Applicability:

- Level 1

Description:

Avahi is a free zeroconf implementation, including a system for multicast DNS/DNS-SD service discovery. Avahi allows programs to publish and discover services and hosts running on a local network with no specific configuration. For example, a user can plug a computer into a network and Avahi automatically finds printers to print to, files to look at and people to talk to, as well as network services running on the machine.

Rationale:

Since servers are not normally used for printing, this service is not needed unless dependencies require it. If this is the case, disable the service to reduce the potential attack surface. If for some reason the service is required on the server, follow the recommendations in sub-sections 3.2.1 - 3.2.5 to secure it.

Audit:

Perform the following to determine if Avahi is disabled.

```
# systemctl is-enabled avahi-daemon
```
Ensure result is not enabled.

Remediation:

```
# systemctl disable avahi-daemon
```

3.4 Disable Print Server - CUPS (Not Scored)

Profile Applicability:

- Level 1

Description:

The Common Unix Print System (CUPS) provides the ability to print to both local and network printers. A system running CUPS can also accept print jobs from remote systems and print them to local printers. It also provides a web based remote administration capability.

Rationale:

If the system does not need to print jobs or accept print jobs from other systems, it is recommended that CUPS be disabled to reduce the potential attack surface.

Audit:

Perform the following to determine if CUPS is disabled.

```
# systemctl is-enabled cups
disabled
```

Remediation:

```
systemctl disabled cups
```

References:

1. More detailed documentation on CUPS is available at the project homepage at http://www.cups.org.

3.5 Remove DHCP Server (Scored)

Profile Applicability:

- Level 1

Description:

The Dynamic Host Configuration Protocol (DHCP) is a service that allows machines to be dynamically assigned IP addresses.

Rationale:

Unless a server is specifically set up to act as a DHCP server, it is recommended that this service be deleted to reduce the potential attack surface.

Audit:

Perform the following to determine if DHCP is disabled.

```
# rpm -q dhcp
package dhcp is not installed
```

Remediation:

```
# yum erase dhcp
```

References:

1. More detailed documentation on DHCP is available at
   http://www.isc.org/software/dhcp.

3.6 Configure Network Time Protocol (NTP) (Scored)

Profile Applicability:

- Level 1

Description:

The Network Time Protocol (NTP) is designed to synchronize system clocks across a variety of systems and use a source that is highly accurate. The version of NTP delivered with Red Hat can be found at http://www.ntp.org. NTP can be configured to be a client and/or a server.

Rationale:

It is recommended that physical systems and virtual guests lacking direct access to the physical host's clock be configured as NTP clients to synchronize their clocks (especially to support time sensitive security mechanisms like Kerberos). This also ensures log files have consistent time records across the enterprise, which aids in forensic investigations.

Audit:

The following script checks for the correct parameters on restrict default and restrict -6 default:

```
# grep "restrict default" /etc/ntp.conf
restrict default kod nomodify notrap nopeer noquery
# grep "restrict -6 default" /etc/ntp.conf
restrict -6 default kod nomodify notrap nopeer noquery
```

Perform the following to determine if the system is configured to use an NTP Server and that the ntp daemon is running as an unprivileged user.

```
# grep "^server" /etc/ntp.conf
server
# grep "ntp:ntp" /etc/sysconfig/ntpd
OPTIONS="-u ntp:ntp -p /var/run/ntpd.pid"
```

Remediation:

Set the following restrict parameters in `/etc/ntp.conf`:

```
restrict default kod nomodify notrap nopeer noquery
restrict -6 default kod nomodify notrap nopeer noquery
```

Also, make sure `/etc/ntp.conf` has an NTP server specified:

```
server <ntp-server>
```
Note: *<ntp-server>* is the IP address or hostname of a trusted time server. Configuring an NTP server is outside the scope of this benchmark.

Ensure `-u ntp:ntp` in options in `/etc/sysconfig/ntpd`:

```
OPTIONS="-u ntp:ntp"
```

References:

1. For more information on configuring NTP servers, go to the NTP homepage at http://www.ntp.org.

3.7 Remove LDAP (Not Scored)

Profile Applicability:

- Level 1

Description:

The Lightweight Directory Access Protocol (LDAP) was introduced as a replacement for NIS/YP. It is a service that provides a method for looking up information from a central database. The default client/server LDAP application for Red Hat is OpenLDAP.

Rationale:

If the server will not need to act as an LDAP client or server, it is recommended that the software be disabled to reduce the potential attack surface.

Audit:

Perform the following to determine if LDAP is running.

```
# rpm -q openldap-servers
package openldap-servers is not installed
# rpm -q openldap-clients
package openldap-clients is not installed
```

Remediation:

If LDAP is running on the system and is not needed, remove it as follows:

```
# yum erase openldap-servers
# yum erase openldap-clients
```

References:

1. For more detailed documentation on OpenLDAP, go to the project homepage at http://www.openldap.org.

3.8 Disable NFS and RPC (Not Scored)

Profile Applicability:

- Level 1

Description:

The Network File System (NFS) is one of the first and most widely distributed file systems in the UNIX environment. It provides the ability for systems to mount file systems of other servers through the network.

Rationale:

If the server does not export NFS shares or act as an NFS client, it is recommended that these services be disabled to reduce remote attack surface.

Audit:

Perform the following to determine if NFS is disabled.

```
# systemctl is-enabled nfslock
# systemctl is-enabled rpcgssd
# systemctl is-enabled rpcbind
# systemctl is-enabled rpcidmapd
# systemctl is-enabled rpcsvcgssd
```

Ensure no commands return enabled.

Remediation:

```
# systemctl disable nfslock
# systemctl disable rpcgssd
# systemctl disable rpcbind
# systemctl disable rpcidmapd
# systemctl disable rpcsvcgssd
```

3.9 Remove DNS Server (Not Scored)

Profile Applicability:

- Level 1

Description:

The Domain Name System (DNS) is a hierarchical naming system that maps names to IP addresses for computers, services and other resources connected to a network.

Rationale:

Unless a server is specifically designated to act as a DNS server, it is recommended that the package be deleted to reduce the potential attack surface.

Audit:

Perform the following to determine if DNS is disabled on the system.

```
# rpm -q bind
package bind is not installed
```

Remediation:

```
# yum erase bind
```

3.10 Remove FTP Server (Not Scored)

Profile Applicability:

- Level 1

Description:

The File Transfer Protocol (FTP) provides networked computers with the ability to transfer files.

Rationale:

FTP does not protect the confidentiality of data or authentication credentials. It is recommended sftp be used if file transfer is required. Unless there is a need to run the system as a FTP server (for example, to allow anonymous downloads), it is recommended that the package be deleted to reduce the potential attack surface.

Audit:

Perform the following to determine if FTP is disabled.

```
# rpm -q vsftpd
package vsftpd is not installed
```

Remediation:

```
# yum erase vsftpd
```

3.11 Remove HTTP Server (Not Scored)

Profile Applicability:

- Level 1

Description:

HTTP or web servers provide the ability to host web site content. The default HTTP server shipped with Red Hat Linux is Apache.

Rationale:

Unless there is a need to run the system as a web server, it is recommended that the package be deleted to reduce the potential attack surface.

Audit:

Perform the following to determine if apache is disabled.

```
# rpm -q httpd
package httpd is not installed
```

Remediation:

```
# yum erase httpd
```

3.12 Remove Dovecot (IMAP and POP3 services) (Not Scored)

Profile Applicability:

- Level 1

Description:

Dovecot is an open source IMAP and POP3 server for Linux based systems.

Rationale:

Unless POP3 and/or IMAP servers are to be provided to this server, it is recommended that the service be deleted to reduce the potential attack surface.

Audit:

Perform the following to determine if dovecot is installed on the system.

```
# rpm -q dovecot
package dovecot is not installed
```

Remediation:

```
# yum erase dovecot
```

References:

1. http://www.dovecot.org

3.13 Remove Samba (Not Scored)

Profile Applicability:

- Level 1

Description:

The Samba daemon allows system administrators to configure their Linux systems to share file systems and directories with Windows desktops. Samba will advertise the file systems and directories via the Small Message Block (SMB) protocol. Windows desktop users will be able to mount these directories and file systems as letter drives on their systems.

Rationale:

If there is no need to mount directories and file systems to Windows systems, then this service can be deleted to reduce the potential attack surface.

Audit:

Perform the following to determine if samba is installed on the system.

```
# rpm -q samba
package samba is not installed
```

Remediation:

```
# yum erase samba
```

3.14 Remove HTTP Proxy Server (Not Scored)

Profile Applicability:

- Level 1

Description:

The default HTTP proxy package shipped with Red Hat Linux is squid.

Rationale:

If there is no need for a proxy server, it is recommended that the squid proxy be deleted to reduce the potential attack surface.

Audit:

Perform the following to determine if squid is installed on the system.

```
# rpm -q squid
package squid is not installed
```

Remediation:

```
# yum erase squid
```

3.15 Remove SNMP Server (Not Scored)

Profile Applicability:

- Level 1

Description:

The Simple Network Management Protocol (SNMP) server is used to listen for SNMP commands from an SNMP management system, execute the commands or collect the information and then send results back to the requesting system.

Rationale:

The SNMP server communicates using SNMP v1, which transmits data in the clear and does not require authentication to execute commands. Unless absolutely necessary, it is recommended that the SNMP service not be used.

Audit:

Perform the following to determine if net-snmp is installed on the system.

```
# rpm -q net-snmp
package net-snmp is not installed
```

Remediation:

```
# yum erase net-snmp
```

3.16 Configure Mail Transfer Agent for Local-Only Mode (Scored)

Profile Applicability:

- Level 1

Description:

Mail Transfer Agents (MTA), such as sendmail and Postfix, are used to listen for incoming mail and transfer the messages to the appropriate user or mail server. If the system is not intended to be a mail server, it is recommended that the MTA be configured to only process local mail. By default, the MTA is set to loopback mode on RHEL7.

Rationale:

The software for all Mail Transfer Agents is complex and most have a long history of security issues. While it is important to ensure that the system can process local mail messages, it is not necessary to have the MTA's daemon listening on a port unless the server is intended to be a mail server that receives and processes mail from other systems.

Note: RHEL5 uses sendmail as the default MTA while RHEL6 and RHEL7 uses Postfix. The recommendation to set the default MTA to local-only mode applies regardless of the MTA that is used.

Audit:

Perform the following command and make sure that the MTA is listening on the loopback address (127.0.0.1):

```
# netstat -an | grep LIST | grep ":25[[:space:]]"
tcp 0 0 127.0.0.1:25 0.0.0.0:* LISTEN
```

Remediation:

Edit `/etc/postfix/main.cf` and add the following line to the RECEIVING MAIL section. If the line already exists, change it to look like the line below.

```
inet_interfaces = localhost

# Execute the following command to restart postfix
# service postfix restart
```

4 Network Configuration and Firewalls

This section provides guidance for secure network and firewall configuration.

4.1 Modify Network Parameters (Host Only)

The following network parameters determine if the system is to act as a *host only*. A system is considered *host only* if the system has a single interface, or has multiple interfaces but will not be configured as a router.

4.1.1 Disable IP Forwarding (Scored)

Profile Applicability:

- Level 1

Description:

The `net.ipv4.ip_forward` flag is used to tell the server whether it can forward packets or not. If the server is not to be used as a router, set the flag to 0.

Rationale:

Setting the flag to 0 ensures that a server with multiple interfaces (for example, a hard proxy), will never be able to forward packets, and therefore, never serve as a router.

Audit:

Perform the following to determine if `net.ipv4.ip_forward` is enabled on the system.

```
# /sbin/sysctl net.ipv4.ip_forward
net.ipv4.ip_forward = 0
```

Remediation:

Set the `net.ipv4.ip_forward` parameter to `0` in `/etc/sysctl.conf`:

```
net.ipv4.ip_forward=0
```

Modify active kernel parameters to match:

```
# /sbin/sysctl -w net.ipv4.ip_forward=0
# /sbin/sysctl -w net.ipv4.route.flush=1
```

4.1.2 Disable Send Packet Redirects (Scored)

Profile Applicability:

- Level 1

Description:

ICMP Redirects are used to send routing information to other hosts. As a host itself does not act as a router (in a host only configuration), there is no need to send redirects.

Rationale:

An attacker could use a compromised host to send invalid ICMP redirects to other router devices in an attempt to corrupt routing and have users access a system set up by the attacker as opposed to a valid system.

Audit:

Perform the following to determine if send packet redirects is disabled.

```
# /sbin/sysctl net.ipv4.conf.all.send_redirects
net.ipv4.conf.all.send_redirects = 0
# /sbin/sysctl net.ipv4.conf.default.send redirects
net.ipv4.conf.default.send_redirects = 0
```

Remediation:

Set the `net.ipv4.conf.all.send_redirects` and `net.ipv4.conf.default.send_redirects` parameters to `0` in `/etc/sysctl.conf`:

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

Modify active kernel parameters to match:

```
# /sbin/sysctl -w net.ipv4.conf.all.send_redirects=0
# /sbin/sysctl -w net.ipv4.conf.default.send_redirects=0
# /sbin/sysctl -w net.ipv4.route.flush=1
```

4.2 Modify Network Parameters (Host and Router)

The following network parameters determine if the system is to act as a router. A system acts as a router if it has at least two interfaces and is configured to perform routing functions.

4.2.1 Disable Source Routed Packet Acceptance (Scored)

Profile Applicability:

- Level 1

Description:

In networking, source routing allows a sender to partially or fully specify the route packets take through a network. In contrast, non-source routed packets travel a path determined by routers in the network. In some cases, systems may not be routable or reachable from some locations (e.g. private addresses vs. Internet routable), and so source routed packets would need to be used.

Rationale:

Setting `net.ipv4.conf.all.accept_source_route` and `net.ipv4.conf.default.accept_source_route` to 0 disables the system from accepting source routed packets. Assume this server was capable of routing packets to Internet routable addresses on one interface and private addresses on another interface. Assume that the private addresses were not routable to the Internet routable addresses and vice versa. Under normal routing circumstances, an attacker from the Internet routable addresses could not use the server as a way to reach the private address servers. If, however, source routed packets were allowed, they could be used to gain access to the private address systems as the route could be specified, rather than rely on routing protocols that did not allow this routing.

Audit:

Perform the following to determine if accepting source routed packets is disabled.

```
# /sbin/sysctl net.ipv4.conf.all.accept_source_route
net.ipv4.conf.all.accept_source_route = 0
# /sbin/sysctl net.ipv4.conf.default.accept_source_route
net.ipv4.conf.default.accept_source_route = 0
```

Remediation:

Set the `net.ipv4.conf.all.accept_source_route` and
`net.ipv4.conf.default.accept_source_route` parameters to `0` in `/etc/sysctl.conf`:

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

Modify active kernel parameters to match:

```
# /sbin/sysctl -w net.ipv4.conf.all.accept_source_route=0
# /sbin/sysctl -w net.ipv4.conf.default.accept_source_route=0
# /sbin/sysctl -w net.ipv4.route.flush=1
```

4.2.2 Disable ICMP Redirect Acceptance (Scored)

Profile Applicability:

- Level 1

Description:

ICMP redirect messages are packets that convey routing information and tell your host
(acting as a router) to send packets via an alternate path. It is a way of allowing an outside
routing device to update your system routing tables. By setting
`net.ipv4.conf.all.accept_redirects` to 0, the system will not accept any ICMP redirect
messages, and therefore, won't allow outsiders to update the system's routing tables.

Rationale:

Attackers could use bogus ICMP redirect messages to maliciously alter the system routing
tables and get them to send packets to incorrect networks and allow your system packets
to be captured.

Audit:

Perform the following to determine if ICMP redirect messages will be rejected.

```
# /sbin/sysctl net.ipv4.conf.all.accept_redirects
net.ipv4.conf.all.accept_redirects = 0
# /sbin/sysctl net.ipv4.conf.default.accept_redirects
net.ipv4.conf.default.accept_redirects = 0
```

Remediation:

Set the `net.ipv4.conf.all.accept_redirects` and
`net.ipv4.conf.default.accept_redirects` parameters to `0` in `/etc/sysctl.conf`:

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

Modify active kernel parameters to match:

```
# /sbin/sysctl -w net.ipv4.conf.all.accept_redirects=0
# /sbin/sysctl -w net.ipv4.conf.default.accept_redirects=0
# /sbin/sysctl -w net.ipv4.route.flush=1
```

4.2.3 Disable Secure ICMP Redirect Acceptance (Scored)

Profile Applicability:

- Level 2

Description:

Secure ICMP redirects are the same as ICMP redirects, except they come from gateways listed on the default gateway list. It is assumed that these gateways are known to your system, and that they are likely to be secure.

Rationale:

It is still possible for even known gateways to be compromised. Setting `net.ipv4.conf.all.secure_redirects` to 0 protects the system from routing table updates by possibly compromised known gateways.

Audit:

Perform the following to determine if ICMP redirect messages will be rejected from known gateways.

```
# /sbin/sysctl net.ipv4.conf.all.secure_redirects
net.ipv4.conf.all.secure_redirects = 0
# /sbin/sysctl net.ipv4.conf.default.secure_redirects
net.ipv4.conf.default.secure_redirects = 0
```

Remediation:

Set the `net.ipv4.conf.all.secure_redirects` and `net.ipv4.conf.default.secure_redirects` parameters to `0` in `/etc/sysctl.conf`:

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

Modify active kernel parameters to match:

```
# /sbin/sysctl -w net.ipv4.conf.all.secure_redirects=0
# /sbin/sysctl -w net.ipv4.conf.default.secure_redirects=0
# /sbin/sysctl -w net.ipv4.route.flush=1
```

4.2.4 Log Suspicious Packets (Scored)

Profile Applicability:

- Level 1

Description:

When enabled, this feature logs packets with un-routable source addresses to the kernel log.

Rationale:

Enabling this feature and logging these packets allows an administrator to investigate the possibility that an attacker is sending spoofed packets to their server.

Audit:

Perform the following to determine if suspicious packets are logged.

```
# /sbin/sysctl net.ipv4.conf.all.log_martians
net.ipv4.conf.all.log_martians = 1
# /sbin/sysctl net.ipv4.conf.default.log_martians
net.ipv4.conf.default.log_martians = 1
```

Remediation:

Set the `net.ipv4.conf.all.log_martians` and `net.ipv4.conf.default.log_martians` parameters to `1` in `/etc/sysctl.conf`:

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

Modify active kernel parameters to match:

```
# /sbin/sysctl -w net.ipv4.conf.all.log_martians=1
# /sbin/sysctl -w net.ipv4.conf.default.log_martians=1
# /sbin/sysctl -w net.ipv4.route.flush=1
```

4.2.5 Enable Ignore Broadcast Requests (Scored)

Profile Applicability:

- Level 1

Description:

Setting `net.ipv4.icmp_echo_ignore_broadcasts` to 1 will cause the system to ignore all ICMP echo and timestamp requests to broadcast and multicast addresses.

Rationale:

Accepting ICMP echo and timestamp requests with broadcast or multicast destinations for your network could be used to trick your host into starting (or participating) in a Smurf attack. A Smurf attack relies on an attacker sending large amounts of ICMP broadcast messages with a spoofed source address. All hosts receiving this message and responding would send echo-reply messages back to the spoofed address, which is probably not routable. If many hosts respond to the packets, the amount of traffic on the network could be significantly multiplied.

Audit:

Perform the following to determine if all ICMP echo and timestamp requests to broadcast and multicast addresses will be ignored.

```
# /sbin/sysctl net.ipv4.icmp_echo_ignore_broadcasts
net.ipv4.icmp_echo_ignore_broadcasts = 1
```

Remediation:

Set the `net.ipv4.icmp_echo_ignore_broadcasts` parameter to `1` in `/etc/sysctl.conf`:

```
net.ipv4.icmp_echo_ignore_broadcasts=1
```
Modify active kernel parameters to match:

```
# /sbin/sysctl -w net.ipv4.icmp_echo_ignore_broadcasts=1
# /sbin/sysctl -w net.ipv4.route.flush=1
```

4.2.6 Enable Bad Error Message Protection (Scored)

Profile Applicability:

• Level 1

Description:

Setting `icmp_ignore_bogus_error_responses` to 1 prevents the kernel from logging bogus responses (RFC-1122 non-compliant) from broadcast reframes, keeping file systems from filling up with useless log messages.

Rationale:

Some routers (and some attackers) will send responses that violate RFC-1122 and attempt to fill up a log file system with many useless error messages.

Audit:

Perform the following to determine if bogus messages will be ignored.

```
# /sbin/sysctl net.ipv4.icmp_ignore_bogus_error_responses
net.ipv4.icmp_ignore_bogus_error_responses = 1
```

Remediation:

Set the `net.ipv4.icmp_ignore_bogus_error_responses` parameter to `1` in `/etc/sysctl.conf`:

```
net.ipv4.icmp_ignore_bogus_error_responses=1
```

Modify active kernel parameters to match:

```
# /sbin/sysctl -w net.ipv4.icmp_ignore_bogus_error_responses=1
# /sbin/sysctl -w net.ipv4.route.flush=1
```

4.2.7 Enable RFC-recommended Source Route Validation (Scored)

Profile Applicability:

- Level 2

Description:

Setting `net.ipv4.conf.all.rp_filter` and `net.ipv4.conf.default.rp_filter` to 1 forces the Linux kernel to utilize reverse path filtering on a received packet to determine if the packet was valid. Essentially, with reverse path filtering, if the return packet does not go out the same interface that the corresponding source packet came from, the packet is dropped (and logged if `log_martians` is set).

Rationale:

Setting these flags is a good way to deter attackers from sending your server bogus packets that cannot be responded to. One instance where this feature breaks down is if asymmetrical routing is employed. This is would occur when using dynamic routing protocols (bgp, ospf, etc) on your system. If you are using asymmetrical routing on your server, you will not be able to enable this feature without breaking the routing.

Audit:

Perform the following to determine if RFC-recommended source route validation is enabled.

```
# /sbin/sysctl net.ipv4.conf.all.rp_filter
net.ipv4.conf.all.rp_filter = 1
# /sbin/sysctl net.ipv4.conf.default.rp filter
net.ipv4.conf.default.rp_filter = 1
```

Remediation:

Set the `net.ipv4.conf.all.rp_filter` and `net.ipv4.conf.default.rp_filter` parameters to `1` in `/etc/sysctl.conf`:

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

Modify active kernel parameters to match:

```
# /sbin/sysctl -w net.ipv4.conf.all.rp_filter=1
# /sbin/sysctl -w net.ipv4.conf.default.rp_filter=1
# /sbin/sysctl -w net.ipv4.route.flush=1
```

4.2.8 Enable TCP SYN Cookies (Scored)

Profile Applicability:

- Level 1

Description:

When `tcp_syncookies` is set, the kernel will handle TCP SYN packets normally until the half-open connection queue is full, at which time, the SYN cookie functionality kicks in. SYN cookies work by not using the SYN queue at all. Instead, the kernel simply replies to the SYN with a SYN|ACK, but will include a specially crafted TCP sequence number that encodes the source and destination IP address and port number and the time the packet was sent. A legitimate connection would send the ACK packet of the three way handshake with the specially crafted sequence number. This allows the server to verify that it has received a valid response to a SYN cookie and allow the connection, even though there is no corresponding SYN in the queue.

Rationale:

Attackers use SYN flood attacks to perform a denial of service attacked on a server by sending many SYN packets without completing the three way handshake. This will quickly use up slots in the kernel's half-open connection queue and prevent legitimate connections from succeeding. SYN cookies allow the server to keep accepting valid connections, even if under a denial of service attack.

Audit:

Perform the following to determine if TCP SYN Cookies is enabled.

```
# /sbin/sysctl net.ipv4.tcp_syncookies
net.ipv4.tcp_syncookies = 1
```

Remediation:

Set the `net.ipv4.tcp_syncookies` parameter to 1 in `/etc/sysctl.conf`:

net.ipv4.tcp_syncookies=1

Modify active kernel parameters to match:

```
# /sbin/sysctl -w net.ipv4.tcp_syncookies=1
# /sbin/sysctl -w net.ipv4.route.flush=1
```

4.3 Wireless Networking

4.3.1 Deactivate Wireless Interfaces (Not Scored)

Profile Applicability:

- Level 1

Description:

Wireless networking is used when wired networks are unavailable. Red Hat contains a wireless tool kit to allow system administrators to configure and use wireless networks.

Rationale:

If wireless is not to be used, wireless devices can be disabled to reduce the potential attack surface.

Audit:

Perform the following to determine if wireless interfaces are active.

```
# ip link show
```
Validate that all interfaces using wireless are down.

Remediation:

Use the following commands to list all interfaces and identify devices with wireless interfaces. Once identified, shutdown the interface and remove it.

```
# ip link show
# iw list
# ip link set <interface> down
# rm /etc/sysconfig/network-scripts/ifcfg-<interface>
```

4.4 IPv6

IPv6 is a networking protocol that supersedes IPv4. It has more routable addresses and has built in security

4.4.1 Configure IPv6

If IPv6 is to be used, follow this section of the benchmark to configure IPv6.

4.4.1.1 Disable IPv6 Router Advertisements (Not Scored)

Profile Applicability:

• Level 1

Description:

This setting disables the systems ability to accept router advertisements

Rationale:

It is recommended that systems not accept router advertisements as they could be tricked into routing traffic to compromised machines. Setting hard routes within the system (usually a single default route to a trusted router) protects the system from bad routes.

Audit:

Perform the following to determine if the system is disabled from accepting router advertisements:

```
# /sbin/sysctl net.ipv6.conf.all.accept_ra
net.ipv6.conf.all.accept_ra = 0
# /sbin/sysctl net.ipv6.conf.default.accept_ra
net.ipv6.conf.default.accept_ra = 0
```

Remediation:

Set the `net.ipv6.conf.all.accept_ra` and `net.ipv6.conf.default.accept_ra` parameter to `0` in `/etc/sysctl.conf`:

```
net.ipv6.conf.all.accept_ra=0
net.ipv6.conf.default.accept_ra=0
```
Modify active kernel parameters to match:

```
# /sbin/sysctl -w net.ipv6.conf.all.accept_ra=0
# /sbin/sysctl -w net.ipv6.conf.default.accept_ra=0
# /sbin/sysctl -w net.ipv6.route.flush=1
```

4.4.1.2 Disable IPv6 Redirect Acceptance (Not Scored)

Profile Applicability:

- Level 1

Description:

This setting prevents the system from accepting ICMP redirects. ICMP redirects tell the system about alternate routes for sending traffic.

Rationale:

It is recommended that systems not accept ICMP redirects as they could be tricked into routing traffic to compromised machines. Setting hard routes within the system (usually a single default route to a trusted router) protects the system from bad routes.

Audit:

Perform the following to determine if IPv6 redirects are disabled.

```
# /sbin/sysctl net.ipv6.conf.all.accept_redirects
net.ipv6.conf.all.accept_redirect = 0
# /sbin/sysctl net.ipv6.conf.default.accept_redirects
net.ipv6.conf.default.accept_redirect = 0
```

Remediation:

Set the `net.ipv6.conf.all.accept_redirects` and `net.ipv6.conf.default.accept_redirects` parameters to `0` in `/etc/sysctl.conf`:

```
net.ipv6.conf.all.accept_redirects=0
net.ipv6.conf.default.accept_redirects=0
```
Modify active kernel parameters to match:

```
# /sbin/sysctl -w net.ipv6.conf.all.accept_redirects=0
# /sbin/sysctl -w net.ipv6.conf.default.accept_redirects=0
# /sbin/sysctl -w net.ipv6.route.flush=1
```

4.4.2 Disable IPv6 (Not Scored)

Profile Applicability:

- Level 1

Description:

Although IPv6 has many advantages over IPv4, few organizations have implemented IPv6.

Rationale:

If IPv6 is not to be used, it is recommended that it be disabled to reduce the attack surface of the system.

Audit:

Perform the following to determine if IPv6 is enabled

```
# grep net.ipv6.conf.all.disable_ipv6 /etc/sysctl.conf
net.ipv6.conf.all.disable_ipv6=1
# sysctl net.ipv6.conf.all.disable_ipv6
net.ipv6.conf.all.disable_ipv6=1
```

Remediation:

Ensure net.ipv6.conf.all.disable_ipv6 is set to 1 in /etc/sysctl.conf:

```
net.ipv6.conf.all.disable_ipv6=1
```

Modify active kernel parameters to match:

```
# sysctl net.ipv6.conf.all.disable_ipv6=1
```

4.5 Install TCP Wrappers

4.5.1 Install TCP Wrappers (Not Scored)

Profile Applicability:

- Level 1

Description:

TCP Wrappers provides a simple access list and standardized logging method for services capable of supporting it. In the past, services that were called from `inetd` and `xinetd` supported the use of tcp wrappers. As `inetd` and `xinetd` have been falling in disuse, any service that can support tcp wrappers will have the `libwrap.so` library attached to it.

Rationale:

TCP Wrappers provide a good simple access list mechanism to services that may not have that support built in. It is recommended that all services that can support TCP Wrappers, use it.

Audit:

Perform the following to determine if TCP Wrappers is enabled.

```
# yum list tcp_wrappers
tcp_wrappers.<hardware platform>     <release>     <installed>
```

Remediation:

```
# yum install tcp_wrappers
```
To verify if a service supports TCP Wrappers, run the following command:

```
# ldd <path-to-daemon> | grep libwrap.so
```
If there is any output, then the service supports TCP Wrappers.

4.5.2 Create /etc/hosts.allow (Not Scored)

Profile Applicability:

- Level 1

Description:

The `/etc/hosts.allow` file specifies which IP addresses are permitted to connect to the host. It is intended to be used in conjunction with the `/etc/hosts.deny` file.

Rationale:

The `/etc/hosts.allow` file supports access control by IP and helps ensure that only authorized systems can connect to the server.

Audit:

Run the following command to verify the contents of the `/etc/hosts.allow` file.

```
# cat /etc/hosts.allow
[contents will vary, depending on your network configuration]
```

Remediation:

Create /etc/hosts.allow:

```
# echo "ALL: <net>/<mask>, <net>/<mask>, …" >/etc/hosts.allow
```
where each *<net>/<mask>* combination (for example, "192.168.1.0/255.255.255.0")
represents one network block in use by your organization that requires access to this
system.

4.5.3 Verify Permissions on /etc/hosts.allow (Scored)

Profile Applicability:

- Level 1

Description:

The `/etc/hosts.allow` file contains networking information that is used by many applications and therefore must be readable for these applications to operate.

Rationale:

It is critical to ensure that the `/etc/hosts.allow` file is protected from unauthorized write access. Although it is protected by default, the file permissions could be changed either inadvertently or through malicious actions.

Audit:

Run the following command to determine the permissions on the `/etc/hosts.allow` file.

```
# /bin/ls -l /etc/hosts.allow
-rw-r--r-- 1 root root 2055 Jan 30 16:30 /etc/hosts.allow
```

Remediation:

If the permissions of the `/etc/hosts.allow` file are incorrect, run the following command to correct them:

```
# /bin/chmod 644 /etc/hosts.allow
```

4.5.4 Create /etc/hosts.deny (Not Scored)

Profile Applicability:

- Level 1

Description:

The `/etc/hosts.deny` file specifies which IP addresses are **not** permitted to connect to the host. It is intended to be used in conjunction with the `/etc/hosts.allow` file.

Rationale:

The `/etc/hosts.deny` file serves as a failsafe so that any host not specified in `/etc/hosts.allow` is denied access to the server.

Audit:

Verify that `/etc/hosts.deny` exists and is configured to deny all hosts not explicitly listed in `/etc/hosts.allow`:

```
# grep "ALL: ALL" /etc/hosts.deny
ALL: ALL
```

Remediation:

Create `/etc/hosts.deny`:

```
# echo "ALL: ALL" >> /etc/hosts.deny
```

4.5.5 Verify Permissions on /etc/hosts.deny (Scored)

Profile Applicability:

- Level 1

Description:

The `/etc/hosts.deny` file contains network information that is used by many system applications and therefore must be readable for these applications to operate.

Rationale:

It is critical to ensure that the `/etc/hosts.deny` file is protected from unauthorized write access. Although it is protected by default, the file permissions could be changed either inadvertently or through malicious actions.

Audit:

Run the following command to determine the permissions on the `/etc/hosts.deny` file.

```
# /bin/ls -l /etc/hosts.deny
-rw-r--r-- 1 root root 2055 Jan 30 16:30 /etc/hosts.deny
```

Remediation:

If the permissions of the `/etc/hosts.deny` file are incorrect, run the following command to correct them:

```
# /bin/chmod 644 /etc/hosts.deny
```

4.6 Uncommon Network Protocols

Red Hat Linux supports several network protocols that are not commonly used. If these protocols are not needed, it is recommended that they be disabled in the kernel.

4.6.1 Disable DCCP (Not Scored)

Profile Applicability:

- Level 1

Description:

The Datagram Congestion Control Protocol (DCCP) is a transport layer protocol that supports streaming media and telephony. DCCP provides a way to gain access to congestion control, without having to do it at the application layer, but does not provide in-sequence delivery.

Rationale:

If the protocol is not required, it is recommended that the drivers not be installed to reduce the potential attack surface.

Audit:

Perform the following to determine if DCCP is disabled.

```
# grep "install dccp /bin/true" /etc/modprobe.d/CIS.conf
install dccp /bin/true
```

Remediation:

```
# echo "install dccp /bin/true" >> /etc/modprobe.d/CIS.conf
```

4.6.2 Disable SCTP (Not Scored)

Profile Applicability:

- Level 1

Description:

The Stream Control Transmission Protocol (SCTP) is a transport layer protocol used to support message oriented communication, with several streams of messages in one connection. It serves a similar function as TCP and UDP, incorporating features of both. It is

message-oriented like UDP, and ensures reliable in-sequence transport of messages with congestion control like TCP.

Rationale:

If the protocol is not being used, it is recommended that kernel module not be loaded, disabling the service to reduce the potential attack surface.

Audit:

Perform the following to determine if SCTP is disabled.

```
# grep "install sctp /bin/true" /etc/modprobe.d/CIS.conf
install sctp /bin/true
```

Remediation:

```
# echo "install sctp /bin/true" >> /etc/modprobe.d/CIS.conf
```

4.6.3 Disable RDS (Not Scored)

Profile Applicability:

- Level 1

Description:

The Reliable Datagram Sockets (RDS) protocol is a transport layer protocol designed to provide low-latency, high-bandwidth communications between cluster nodes. It was developed by the Oracle Corporation.

Rationale:

If the protocol is not being used, it is recommended that kernel module not be loaded, disabling the service to reduce the potential attack surface.

Audit:

Perform the following to determine if RDS is disabled.

```
# grep "install rds /bin/true" /etc/modprobe.d/CIS.conf
install rds /bin/true
```

Remediation:

```
# echo "install rds /bin/true" >> /etc/modprobe.d/CIS.conf
```

4.6.4 Disable TIPC (Not Scored)

Profile Applicability:

- Level 1

Description:

The Transparent Inter-Process Communication (TIPC) protocol is designed to provide communication between cluster nodes.

Rationale:

If the protocol is not being used, it is recommended that kernel module not be loaded, disabling the service to reduce the potential attack surface.

Audit:

Perform the following to determine if TIPC is disabled.

```
# grep "install tipc /bin/true" /etc/modprobe.d/CIS.conf
install tipc /bin/true
```

Remediation:

```
# echo "install tipc /bin/true" >> /etc/modprobe.d/CIS.conf
```

4.7 Enable firewalld (Scored)

Profile Applicability:

- Level 1

Description:

`IPtables` is an application that allows a system administrator to configure the IP tables, chains and rules provided by the Linux kernel firewall. The `firewalld` service provides a dynamic firewall allowing changes to be made at anytime without disruptions cause by reloading.

Rationale:

A firewall provides extra protection for the Linux system by limiting communications in and out of the box to specific addresses and ports.

Audit:

Perform the following to determine if `firewalld` is enabled:

```
# systemctl is-enabled firewalld
enabled
```

Remediation:

```
# systemctl enable firewalld
```

5 Logging and Auditing

The items in this section describe how to configure logging, log monitoring, and auditing, using tools included with RHEL7.

It is recommended that `rsyslog` be used for logging (with `logwatch` providing summarization) and `auditd` be used for auditing (with `aureport` providing summarization) to automatically monitor logs for intrusion attempts and other suspicious system behavior.

In addition to the local log files created by the steps in this section, it is also recommended that sites collect copies of their system logs on a secure, centralized log server via an encrypted connection. Not only does centralized logging help sites correlate events that may be occurring on multiple systems, but having a second copy of the system log information may be critical after a system compromise where the attacker has modified the local log files on the affected system(s). If a log correlation system is deployed, configure it to process the logs described in this section.

Because it is often necessary to correlate log information from many different systems (particularly after a security incident) it is recommended that the time be synchronized among systems and devices connected to the local network. The standard Internet protocol for time synchronization is the Network Time Protocol (NTP), which is supported by most network-ready devices. See the `ntpd(8)` manual page for more information on configuring NTP.

It is important that all logs described in this section be monitored on a regular basis and correlated to determine trends. A seemingly innocuous entry in one log could be more significant when compared to an entry in another log.

Note on log file permissions: There really isn't a "one size fits all" solution to the permissions on log files. Many sites utilize group permissions so that administrators who are in a defined security group, such as "wheel" do not have to elevate privileges to root in order to read log files. Also, if a third party log aggregation tool is used, it may need to have group permissions to read the log files, which is preferable to having it run setuid to root.

Therefore, there are two remediation and audit steps for log file permissions. One is for systems that do not have a secured group method implemented that only permits root to read the log files (`root:root 600`). The other is for sites that do have such a setup and are designated as `root:securegrp 640` where `securegrp` is the defined security group (in some cases `wheel`).

5.1 Configure rsyslog

The rsyslog software is recommended as a replacement for the default syslogd daemon and provides improvements over syslogd, such as connection-oriented (i.e. TCP) transmission of logs, the option to log to database formats, and the encryption of log data en route to a central logging server.

5.1.1 Install the rsyslog package (Scored)

Profile Applicability:

- Level 1

Description:

The `rsyslog` package is a third party package that provides many enhancements to syslog, such as multi-threading, TCP communication, message filtering and data base support. As of RHEL 5.2, rsyslog is available as part of the core distribution.

Rationale:

The security enhancements of rsyslog such as connection-oriented (i.e. TCP) transmission of logs, the option to log to database formats, and the encryption of log data en route to a central logging server) justify installing and configuring the package.

Audit:

Perform the following command to verify that `rsyslog` is installed.

```
# rpm -q rsyslog
rsyslog.<package version>.<hardware platform>
```

Remediation:

```
# yum install rsyslog
```

5.1.2 Activate the rsyslog Service (Scored)

Profile Applicability:

- Level 1

Description:

The `systemctl` command can be used to ensure that the `rsyslog` service is turned on.

Rationale:

If the `rsyslog` service is not activated the system will not have a syslog service running.

Audit:

Perform the following to determine if rsyslog is enabled.

```
# systemctl is-enabled rsyslog
enabled
```

Remediation:

```
# systemctl enable rsyslog
```

5.1.3 Configure /etc/rsyslog.conf (Not Scored)

Profile Applicability:

- Level 1

Description:

The `/etc/rsyslog.conf` file specifies rules for logging and which files are to be used to log certain classes of messages.

Rationale:

A great deal of important security-related information is sent via `rsyslog` (e.g., successful and failed su attempts, failed login attempts, root login attempts, etc.).

Audit:

Review the contents of the `/etc/rsyslog.conf` file to ensure appropriate logging is set. In addition, perform the following command and ensure that the log files are logging information:

```
# ls -l /var/log/
```

Remediation:

Edit the following lines in the `/etc/rsyslog.conf` file as appropriate for your environment:

```
auth,user.* /var/log/messages
kern.* /var/log/kern.log
daemon.* /var/log/daemon.log
syslog.* /var/log/syslog
lpr,news,uucp,local0,local1,local2,local3,local4,local5,local6.* /var/log/unused.log

# Execute the following command to restart rsyslogd
# pkill -HUP rsyslogd
```

References:

1. See the rsyslog.conf(5) man page for more information.

5.1.4 Create and Set Permissions on rsyslog Log Files (Scored)

Profile Applicability:

- Level 1

Description:

A log file must already exist for `rsyslog` to be able to write to it.

Rationale:

It is important to ensure that log files exist and have the correct permissions to ensure that sensitive `rsyslog` data is archived and protected.

Audit:

For each *<logfile>* listed in the `/etc/rsyslog.conf` file, perform the following command and verify that the *<owner>:<group>* is `root:root` and the permissions are `0600` (for sites that have not implemented a secure group) and `root:securegrp` with permissions of `0640` (for sites that have implemented a secure group):

```
# ls -l <logfile>
```

Remediation:

For sites that have **not** implemented a secure admin group:

Create the `/var/log/` directory and for each *<logfile>* listed in the `/etc/rsyslog.conf` file, perform the following commands:

```
# touch <logfile>
# chown root:root <logfile>
# chmod og-rwx <logfile>
```

For sites that **have** implemented a secure admin group:

Create the `/var/log/` directory and for each *<logfile>* listed in the `/etc/rsyslog.conf` file, perform the following commands (where is the name of the security group):

```
# touch <logfile>
# chown root:<securegrp> <logfile>
# chmod g-wx,o-rwx<logfile>
```

References:

1. See the rsyslog.conf(5) man page for more information.

5.1.5 Configure rsyslog to Send Logs to a Remote Log Host (Scored)

Profile Applicability:

- Level 1

Description:

The `rsyslog` utility supports the ability to send logs it gathers to a remote log host running `syslogd(8)` or to receive messages from remote hosts, reducing administrative overhead.

Rationale:

Storing log data on a remote host protects log integrity from local attacks. If an attacker gains root access on the local system, they could tamper with or remove log data that is stored on the local system

Audit:

Review the `/etc/rsyslog.conf` file and verify that logs are sent to a central host (where *logfile.example.com* is the name of your central log host).

```
# grep "^*.*[^I][^I]*@" /etc/rsyslog.conf
*.* @@loghost.example.com
```

Remediation:

Edit the `/etc/rsyslog.conf` file and add the following line (where *logfile.example.com* is the name of your central log host).

```
*.* @@loghost.example.com

# Execute the following command to restart rsyslogd
# pkill -HUP rsyslogd
```

Note: The double "at" sign (`@@`) directs `rsyslog` to use TCP to send log messages to the server, which is a more reliable transport mechanism than the default UDP protocol.

References:

1. See the rsyslog.conf(5) man page for more information.

5.1.6 Accept Remote rsyslog Messages Only on Designated Log Hosts (Not Scored)

Profile Applicability:

- Level 1

Description:

By default, `rsyslog` does not listen for log messages coming in from remote systems. The `ModLoad` tells `rsyslog` to load the `imtcp.so` module so it can listen over a network via TCP. The `InputTCPServerRun` option instructs `rsyslogd` to listen on the specified TCP port.

Rationale:

The guidance in the section ensures that remote log hosts are configured to only accept `rsyslog` data from hosts within the specified domain and that those systems that are not designed to be log hosts do not accept any remote `rsyslog` messages. This provides protection from spoofed log data and ensures that system administrators are reviewing reasonably complete syslog data in a central location.

Audit:

Run the following to determine if rsyslog is listening for remote messages:

```
# grep '$ModLoad imtcp.so' /etc/rsyslog.conf
$ModLoad imtcp.so
# grep '$InputTCPServerRun' /etc/rsyslog.conf
$InputTCPServerRun 514
```

Remediation:

On hosts that are designated as log hosts edit the `/etc/rsyslog.conf` file and un-comment the following lines:

```
$ModLoad imtcp.so
$InputTCPServerRun 514
```

Note: On hosts that are not designated log hosts these lines should be commented out instead.

Execute the following command to restart `rsyslogd`:

```
# pkill -HUP rsyslogd
```

References:

1. See the rsyslog(8) man page for more information.

5.2 Configure System Accounting (auditd)

System auditing, through `auditd`, allows system administrators to monitor their systems such that they can detect unauthorized access or modification of data. By default, auditd will audit SELinux AVC denials, system logins, account modifications, and authentication events. Events will be logged to `/var/log/audit/audit.log`. The recording of these events will use a modest amount of disk space on a system. If significantly more events are captured, additional on system or off system storage may need to be allocated.

Note: For 64 bit systems that have arch as a rule parameter, you will need two rules: one for 64 bit and one for 32 bit systems. For 32 bit systems, only one rule is needed.

5.2.1 Configure Data Retention

When auditing, it is important to carefully configure the storage requirements for audit logs. By default, auditd will max out the log files at 5MB and retain only 4 copies of them. Older versions will be deleted. It is possible on a system that the 20 MBs of audit logs may fill up the system causing loss of audit data. While the recommendations here provide guidance, check your site policy for audit storage requirements.

5.2.1.1 Configure Audit Log Storage Size (Not Scored)

Profile Applicability:

- Level 2

Description:

Configure the maximum size of the audit log file. Once the log reaches the maximum size, it will be rotated and a new log file will be started.

Rationale:

It is important that an appropriate size is determined for log files so that they do not impact the system and audit data is not lost.

Audit:

Perform the following to determine the maximum size of the audit log files.

```
# grep max_log_file /etc/audit/auditd.conf
max_log_file = <MB>
```

Remediation:

Set the `max_log_file` parameter in `/etc/audit/auditd.conf`

```
max_log_file = <MB>
```

Note: `MB` is the number of MegaBytes the file can be.

5.2.1.2 Disable System on Audit Log Full (Not Scored)

Profile Applicability:

- Level 2

Description:

The `auditd` daemon can be configured to halt the system when the audit logs are full.

Rationale:

In high security contexts, the risk of detecting unauthorized access or nonrepudiation exceeds the benefit of the system's availability.

Audit:

Perform the following to determine if `auditd` is configured to notify the administrator and halt the system when audit logs are full.

```
# grep space_left_action /etc/audit/auditd.conf
space_left_action = email
# grep action_mail_acct /etc/audit/auditd.conf
action_mail_acct = root
```

```
# grep admin space left action /etc/audit/auditd.conf
admin_space_left_action = halt
```

Remediation:

Add the following lines to the `/etc/audit/auditd.conf` file.

```
space_left_action = email
action_mail_acct = root
admin_space_left_action = halt
```

5.2.1.3 Keep All Auditing Information (Scored)

Profile Applicability:

- Level 2

Description:

Normally, `auditd` will hold 4 logs of maximum log file size before deleting older log files.

Rationale:

In high security contexts, the benefits of maintaining a long audit history exceed the cost of storing the audit history.

Audit:

Perform the following to determine if audit logs are retained.

```
# grep max_log_file_action /etc/audit/auditd.conf
max_log_file_action = keep_logs
```

Remediation:

Add the following line to the `/etc/audit/auditd.conf` file.

```
max_log_file_action = keep_logs
```

5.2.2 Enable auditd Service (Scored)

Profile Applicability:

- Level 2

Description:

Turn on the `auditd` daemon to record system events.

Rationale:

The capturing of system events provides system administrators with information to allow them to determine if unauthorized access to their system is occurring.

Audit:

Perform the following to determine if `auditd` is enabled.

```
# systemctl is-enabled auditd
enabled
```

Remediation:

```
# systemctl enable auditd
```

5.2.3 Enable Auditing for Processes That Start Prior to auditd (Scored)

Profile Applicability:

- Level 2

Description:

Configure `grub` so that processes that are capable of being audited can be audited even if they start up prior to `auditd` startup.

Rationale:

Audit events need to be captured on processes that start up prior to `auditd`, so that potential malicious activity cannot go undetected.

Audit:

Perform the following to determine if `/boot/grub2/grub.cfg` is configured to log processes that start prior to `auditd`.

```
# grep "linux" /boot/grub2/grub.cfg
```

Make sure each line that starts with linux has the audit=1 parameter set.

Remediation:

Edit `/etc/default/grub` to include `audit=1` as part of `GRUB_CMDLINE_LINUX`:

```
GRUB_CMDLINE_LINUX="audit=1"
```

And run the following command to update the grub configuration:

```
# grub2-mkconfig -o /boot/grub2/grub.cfg
```

5.2.4 Record Events That Modify Date and Time Information (Scored)

Profile Applicability:

- Level 2

Description:

Capture events where the system date and/or time has been modified. The parameters in this section are set to determine if the `adjtimex` (tune kernel clock), `settimeofday` (Set time, using `timeval` and `timezone` structures) `stime` (using seconds since 1/1/1970) or `clock_settime` (allows for the setting of several internal clocks and timers) system calls have been executed and always write an audit record to the `/var/log/audit.log` file upon exit, tagging the records with the identifier "time-change"

Rationale:

Unexpected changes in system date and/or time could be a sign of malicious activity on the system.

Audit:

Perform the following to determine if events where the system date and/or time has been modified are captured.

On a 64 bit system, perform the following command and ensure the output is as shown. Note: "`-a always,exit`" may be specified as "`-a exit,always`".

```
# grep time-change /etc/audit/audit.rules
-a always,exit -F arch=b64 -S adjtimex -S settimeofday -k time-change
-a always,exit -F arch=b32 -S adjtimex -S settimeofday -S stime -k time-change
-a always,exit -F arch=b64 -S clock_settime -k time-change
-a always,exit -F arch=b32 -S clock_settime -k time-change
-w /etc/localtime -p wa -k time-change
```

On a 32 bit system, perform the following command and ensure the output is as shown. Note: "`-a always,exit`" may be specified as "`-a exit,always`".

```
# grep time-change /etc/audit/audit.rules
-a always,exit -F arch=b32 -S adjtimex -S settimeofday -S stime -k time-change
-a always,exit -F arch=b32 -S clock_settime -k time-change
-w /etc/localtime -p wa -k time-change
```

Remediation:

For 64 bit systems, add the following lines to the `/etc/audit/audit.rules` file.

```
-a always,exit -F arch=b64 -S adjtimex -S settimeofday -k time-change
-a always,exit -F arch=b32 -S adjtimex -S settimeofday -S stime -k time-change
-a always,exit -F arch=b64 -S clock_settime -k time-change
-a always,exit -F arch=b32 -S clock_settime -k time-change
-w /etc/localtime -p wa -k time-change

# Execute the following command to restart auditd
# pkill -P 1 -HUP auditd
```

For 32 bit systems, add the following lines to the `/etc/audit/audit.rules` file.

```
-a always,exit -F arch=b32 -S adjtimex -S settimeofday -S stime -k time-change
-a always,exit -F arch=b32 -S clock_settime -k time-change
-w /etc/localtime -p wa -k time-change

# Execute the following command to restart auditd
# pkill -P 1 -HUP auditd
```

5.2.5 Record Events That Modify User/Group Information (Scored)

Profile Applicability:

• Level 2

Description:

Record events affecting the `group`, `passwd` (user IDs), `shadow` and `gshadow` (passwords) or `/etc/security/opasswd` (old passwords, based on remember parameter in the PAM configuration) files. The parameters in this section will watch the files to see if they have been opened for write or have had attribute changes (e.g. permissions) and tag them with the identifier "identity" in the audit log file.

Rationale:

Unexpected changes to these files could be an indication that the system has been compromised and that an unauthorized user is attempting to hide their activities or compromise additional accounts.

Audit:

Perform the following to determine if events that modify user/group information are recorded.

```
# grep identity /etc/audit/audit.rules
-w /etc/group -p wa -k identity
-w /etc/passwd -p wa -k identity
-w /etc/gshadow -p wa -k identity
-w /etc/shadow -p wa -k identity
-w /etc/security/opasswd -p wa -k identity
```

Remediation:

Add the following lines to the `/etc/audit/audit.rules` file.

```
-w /etc/group -p wa -k identity
-w /etc/passwd -p wa -k identity
-w /etc/gshadow -p wa -k identity
-w /etc/shadow -p wa -k identity
-w /etc/security/opasswd -p wa -k identity

# Execute the following command to restart auditd
# pkill -P 1-HUP auditd
```

5.2.6 Record Events That Modify the System's Network Environment (Scored)

Profile Applicability:

- Level 2

Description:

Record changes to network environment files or system calls. The below parameters monitor the `sethostname` (set the system's host name) or `setdomainname` (set the system's domainname) system calls, and write an audit event on system call exit. The other parameters monitor the `/etc/issue` and `/etc/issue.net` files (messages displayed pre-login), `/etc/hosts` (file containing host names and associated IP addresses) and `/etc/sysconfig/network` (directory containing network interface scripts and configurations) files.

Rationale:

Monitoring `sethostname` and `setdomainname` will identify potential unauthorized changes to host and domainname of a system. The changing of these names could potentially break security parameters that are set based on those names. The `/etc/hosts` file is monitored for changes in the file that can indicate an unauthorized intruder is trying to change machine associations with IP addresses and trick users and processes into connecting to unintended machines. Monitoring `/etc/issue` and `/etc/issue.net` is important, as intruders could put disinformation into those files and trick users into providing information to the intruder. Monitoring `/etc/sysconfig/network` is important as it can show if network interfaces or scripts are being modified in a way that can lead to the machine becoming unavailable or compromised. All audit records will be tagged with the identifier "system-locale."

Audit:

On a 64 bit system, perform the following command and ensure the output is as shown to determine if events that modify the system's environment are recorded. Note: "-a always,exit" may be specified as "-a exit,always".

```
# grep system-locale /etc/audit/audit.rules
-a always,exit -F arch=b64 -S sethostname -S setdomainname -k system-locale
-a always,exit -F arch=b32 -S sethostname -S setdomainname -k system-locale
-w /etc/issue -p wa -k system-locale
-w /etc/issue.net -p wa -k system-locale
-w /etc/hosts -p wa -k system-locale
-w /etc/sysconfig/network -p wa -k system-locale
```

For 32 bit systems, perform the following command and ensure the output is as shown to determine if events that modify the system's environment are recorded. Note: "-a always,exit" may be specified as "-a exit,always".

```
# grep system-locale /etc/audit/audit.rules
-a always,exit -F arch=b32 -S sethostname -S setdomainname -k system-locale
-w /etc/issue -p wa -k system-locale
-w /etc/issue.net -p wa -k system-locale
-w /etc/hosts -p wa -k system-locale
-w /etc/sysconfig/network -p wa -k system-locale
```

Remediation:

For 64 bit systems, add the following lines to the /etc/audit/audit.rules file.

```
-a always,exit -F arch=b64 -S sethostname -S setdomainname -k system-locale
-a always,exit -F arch=b32 -S sethostname -S setdomainname -k system-locale
-w /etc/issue -p wa -k system-locale
-w /etc/issue.net -p wa -k system-locale
-w /etc/hosts -p wa -k system-locale
-w /etc/sysconfig/network -p wa -k system-locale

# Execute the following command to restart auditd
# pkill -P 1-HUP auditd
```

For 32 bit systems, add the following lines to the /etc/audit/audit.rules file.

```
-a always,exit -F arch=b32 -S sethostname -S setdomainname -k system-locale
-w /etc/issue -p wa -k system-locale
-w /etc/issue.net -p wa -k system-locale
-w /etc/hosts -p wa -k system-locale
-w /etc/sysconfig/network -p wa -k system-locale

# Execute the following command to restart auditd
# pkill -P 1-HUP auditd
```

5.2.7 Record Events That Modify the System's Mandatory Access Controls (Scored)

Profile Applicability:

- Level 2

Description:

Monitor SELinux mandatory access controls. The parameters below monitor any write access (potential additional, deletion or modification of files in the directory) or attribute changes to the /etc/selinux directory.

Rationale:

Changes to files in this directory could indicate that an unauthorized user is attempting to modify access controls and change security contexts, leading to a compromise of the system.

Audit:

Perform the following to determine if events that modify the system's mandatory access controls are recorded

```
# grep MAC-policy /etc/audit/audit.rules
-w /etc/selinux/ -p wa -k MAC-policy
```

Remediation:

Add the following lines to the /etc/audit/audit.rules file.

```
-w /etc/selinux/ -p wa -k MAC-policy
```
Execute the following command to restart auditd:

```
# pkill -P 1 -HUP auditd
```

5.2.8 Collect Login and Logout Events (Scored)

Profile Applicability:

- Level 2

Description:

Monitor login and logout events. The parameters below track changes to files associated with login/logout events. The file `/var/log/faillog` tracks failed events from login. The file `/var/log/lastlog` maintain records of the last time a user successfully logged in. The file `/var/log/btmp` keeps track of failed login attempts and can be read by entering the command `/usr/bin/last -f /var/log/btmp`. All audit records will be tagged with the identifier "logins."

Rationale:

Monitoring login/logout events could provide a system administrator with information associated with brute force attacks against user logins.

Audit:

Perform the following to determine if login and logout events are recorded.

```
# grep logins /etc/audit/audit.rules
-w /var/log/faillog -p wa -k logins
-w /var/log/lastlog -p wa -k logins
-w /var/log/tallylog -p wa -k logins
```

Remediation:

Add the following lines to the `/etc/audit/audit.rules` file.

```
-w /var/log/faillog -p wa -k logins
-w /var/log/lastlog -p wa -k logins
-w /var/log/tallylog -p wa -k logins

# Execute the following command to restart auditd
# pkill -HUP -P 1 auditd
```

5.2.9 Collect Session Initiation Information (Scored)

Profile Applicability:

- Level 2

Description:

Monitor session initiation events. The parameters in this section track changes to the files associated with session events. The file `/var/run/utmp` file tracks all currently logged in users. The `/var/log/wtmp` file tracks logins, logouts, shutdown and reboot events. All audit records will be tagged with the identifier "session."

Rationale:

Monitoring these files for changes could alert a system administrator to logins occurring at unusual hours, which could indicate intruder activity (i.e. a user logging in at a time when they do not normally log in).

Audit:

Perform the following to determine if session initiation information is collected.

```
# grep session /etc/audit/audit.rules
-w /var/run/utmp -p wa -k session
```

```
-w /var/log/wtmp -p wa -k session
-w /var/log/btmp -p wa -k session
```

Remediation:

Add the following lines to the `/etc/audit/audit.rules` file.

```
-w /var/run/utmp -p wa -k session
-w /var/log/wtmp -p wa -k session
-w /var/log/btmp -p wa -k session

# Execute the following command to restart auditd
# pkill -HUP -P 1 auditd
```

Note: Use the last command to read /var/log/wtmp (last with no parameters) and /var/run/utmp (last -f /var/run/utmp)

5.2.10 Collect Discretionary Access Control Permission Modification Events (Scored)

Profile Applicability:

- Level 2

Description:

Monitor changes to file permissions, attributes, ownership and group. The parameters in this section track changes for system calls that affect file permissions and attributes. The `chmod`, `fchmod` and `fchmodat` system calls affect the permissions associated with a file. The `chown`, `fchown`, `fchownat` and `lchown` system calls affect owner and group attributes on a file. The `setxattr`, `lsetxattr`, `fsetxattr` (set extended file attributes) and `removexattr`, `lremovexattr`, `fremovexattr` (remove extended file attributes) control extended file attributes. In all cases, an audit record will only be written for non-system userids (auid >= 1000) and will ignore Daemon events (auid = 4294967295). All audit records will be tagged with the identifier "perm_mod."

Rationale:

Monitoring for changes in file attributes could alert a system administrator to activity that could indicate intruder activity or policy violation.

Audit:

For 64 bit systems, perform the following command and ensure the output is as shown to determine if permission modifications are being recorded. Note: "`-a always,exit`" may be specified as "`-a exit,always`".

```
# grep perm_mod /etc/audit/audit.rules
-a always,exit -F arch=b64 -S chmod -S fchmod -S fchmodat -F auid>=1000 \
-F auid!=4294967295 -k perm_mod
-a always,exit -F arch=b32 -S chmod -S fchmod -S fchmodat -F auid>=1000 \
-F auid!=4294967295 -k perm_mod
-a always,exit -F arch=b64 -S chown -S fchown -S fchownat -S lchown -F auid>=1000 \
-F auid!=4294967295 -k perm_mod
-a always,exit -F arch=b32 -S chown -S fchown -S fchownat -S lchown -F auid>=1000 \
-F auid!=4294967295 -k perm_mod
-a always,exit -F arch=b64 -S setxattr -S lsetxattr -S fsetxattr -S removexattr -S \
lremovexattr -S fremovexattr -F auid>=1000 -F auid!=4294967295 -k perm_mod
-a always,exit -F arch=b32 -S setxattr -S lsetxattr -S fsetxattr -S removexattr -S \
lremovexattr -S fremovexattr -F auid>=1000 -F auid!=4294967295 -k perm_mod
```

For 32 bit systems, perform the following command and ensure the output is as shown to determine if permission modifications are being recorded. Note: "-a always,exit" may be specified as "-a exit,always".

```
# grep perm_mod /etc/audit/audit.rules
-a always,exit -F arch=b32 -S chmod -S fchmod -S fchmodat -F auid>=1000 \
-F auid!=4294967295 -k perm_mod
-a always,exit -F arch=b32 -S chown -S fchown -S fchownat -S lchown -F auid>=1000 \
-F auid!=4294967295 -k perm_mod
-a always,exit -F arch=b32 -S setxattr -S lsetxattr -S fsetxattr -S removexattr -S \
lremovexattr -S fremovexattr -F auid>=1000 -F auid!=4294967295 -k perm_mod
```

Remediation:

For 64 bit systems, add the following lines to the /etc/audit/audit.rules file.

```
-a always,exit -F arch=b64 -S chmod -S fchmod -S fchmodat -F auid>=1000 \
-F auid!=4294967295 -k perm_mod
-a always,exit -F arch=b32 -S chmod -S fchmod -S fchmodat -F auid>=1000 \
-F auid!=4294967295 -k perm_mod
-a always,exit -F arch=b64 -S chown -S fchown -S fchownat -S lchown -F auid>=1000 \
-F auid!=4294967295 -k perm_mod
-a always,exit -F arch=b32 -S chown -S fchown -S fchownat -S lchown -F auid>=1000 \
-F auid!=4294967295 -k perm_mod
-a always,exit -F arch=b64 -S setxattr -S lsetxattr -S fsetxattr -S removexattr -S \
lremovexattr -S fremovexattr -F auid>=1000 -F auid!=4294967295 -k perm_mod
-a always,exit -F arch=b32 -S setxattr -S lsetxattr -S fsetxattr -S removexattr -S \
lremovexattr -S fremovexattr -F auid>=1000 -F auid!=4294967295 -k perm_mod

# Execute the following command to restart auditd
# pkill -HUP -P 1 auditd
```

For 32 bit systems, add the following lines to the /etc/audit/audit.rules file.

```
-a always,exit -F arch=b32 -S chmod -S fchmod -S fchmodat -F auid>=1000 \
-F auid!=4294967295 -k perm_mod
-a always,exit -F arch=b32 -S chown -S fchown -S fchownat -S lchown -F auid>=1000 \
-F auid!=4294967295 -k perm_mod
-a always,exit -F arch=b32 -S setxattr -S lsetxattr -S fsetxattr -S removexattr -S \
lremovexattr -S fremovexattr -F auid>=1000 -F auid!=4294967295 -k perm_mod

# Execute the following command to restart auditd
# pkill -HUP -P 1 auditd
```

5.2.11 Collect Unsuccessful Unauthorized Access Attempts to Files (Scored)

Profile Applicability:

- Level 2

Description:

Monitor for unsuccessful attempts to access files. The parameters below are associated with system calls that control creation (`creat`), opening (`open`, `openat`) and truncation (`truncate`, `ftruncate`) of files. An audit log record will only be written if the user is a non-privileged user (auid > = 1000), is not a Daemon event (auid=4294967295) and if the system call returned EACCES (permission denied to the file) or EPERM (some other permanent error associated with the specific system call). All audit records will be tagged with the identifier "access."

Rationale:

Failed attempts to open, create or truncate files could be an indication that an individual or process is trying to gain unauthorized access to the system.

Audit:

On 64 bit systems, perform the following command and ensure the output is as shown to determine if there are unsuccessful attempts to access files. Note: "`-a always,exit`" may be specified as "`-a exit,always`".

```
# grep access /etc/audit/audit.rules
-a always,exit -F arch=b64 -S creat -S open -S openat -S truncate -S ftruncate \
-F exit=-EACCES -F auid>=1000 -F auid!=4294967295 -k access
-a always,exit -F arch=b32 -S creat -S open -S openat -S truncate -S ftruncate \
-F exit=-EACCES -F auid>=1000 -F auid!=4294967295 -k access
-a always,exit -F arch=b64 -S creat -S open -S openat -S truncate -S ftruncate \
-F exit=-EPERM -F auid>=1000 -F auid!=4294967295 -k access
-a always,exit -F arch=b32 -S creat -S open -S openat -S truncate -S ftruncate \
-F exit=-EPERM -F auid>=1000 -F auid!=4294967295 -k access
```

On 32 bit systems, perform the following command and ensure the output is as shown to determine if there are unsuccessful attempts to access files. Note: "`-a always,exit`" may be specified as "`-a exit,always`".

```
# grep access /etc/audit/audit.rules
-a always,exit -F arch=b32 -S creat -S open -S openat -S truncate -S ftruncate \
-F exit=-EACCES -F auid>=1000 -F auid!=4294967295 -k access
-a always,exit -F arch=b32 -S creat -S open -S openat -S truncate -S ftruncate \
-F exit=-EPERM -F auid>=1000 -F auid!=4294967295 -k access
```

Remediation:

For 64 bit systems, add the following lines to the /etc/audit/audit.rules file.

```
-a always,exit -F arch=b64 -S creat -S open -S openat -S truncate -S ftruncate \
-F exit=-EACCES -F auid>=1000 -F auid!=4294967295 -k access
-a always,exit -F arch=b32 -S creat -S open -S openat -S truncate -S ftruncate \
-F exit=-EACCES -F auid>=1000 -F auid!=4294967295 -k access
-a always,exit -F arch=b64 -S creat -S open -S openat -S truncate -S ftruncate \
-F exit=-EPERM -F auid>=1000 -F auid!=4294967295 -k access
-a always,exit -F arch=b32 -S creat -S open -S openat -S truncate -S ftruncate \
-F exit=-EPERM -F auid>=1000 -F auid!=4294967295 -k access

# Execute the following command to restart auditd
# pkill -HUP -P 1 auditd
```

For 32 bit systems, add the following lines to the /etc/audit/audit.rules file.

```
-a always,exit -F arch=b32 -S creat -S open -S openat -S truncate -S ftruncate \
-F exit=-EACCES -F auid>=1000 -F auid!=4294967295 -k access
-a always,exit -F arch=b32 -S creat -S open -S openat -S truncate -S ftruncate \
-F exit=-EPERM -F auid>=1000 -F auid!=4294967295 -k access

# Execute the following command to restart auditd
# pkill -HUP -P 1 auditd
```

5.2.12 Collect Use of Privileged Commands (Scored)

Profile Applicability:

- Level 2

Description:

Monitor privileged programs (those that have the setuid and/or setgid bit set on execution) to determine if unprivileged users are running these commands.

Rationale:

Execution of privileged commands by non-privileged users could be an indication of someone trying to gain unauthorized access to the system.

Audit:

Verify that an audit line for each setuid/setgid program identified in the `find` command appears in the audit file with the above attributes.

Remediation:

To remediate this issue, the system administrator will have to execute a find command to locate all the privileged programs and then add an audit line for each one of them. The audit parameters associated with this are as follows:

`-F path=" $1 "` - will populate each file name found through the find command and processed by awk.

`-F perm=x` - will write an audit record if the file is executed.

`-F auid>=1000` - will write a record if the user executing the command is not a privileged user.

`-F auid!= 4294967295` - will ignore Daemon events

All audit records will be tagged with the identifier "privileged."

```
# find PART -xdev \( -perm -4000 -o -perm -2000 \) -type f | awk '{print \
"-a always,exit -F path=" $1 " -F perm=x -F auid>=1000 -F auid!=4294967295 \
-k privileged" }'
```

Next, add those lines to the `/etc/audit/audit.rules` file.

5.2.13 Collect Successful File System Mounts (Scored)

Profile Applicability:

- Level 2

Description:

Monitor the use of the `mount` system call. The `mount` (and `umount`) system call controls the mounting and unmounting of file systems. The parameters below configure the system to create an audit record when the mount system call is used by a non-privileged user

Rationale:

It is highly unusual for a non privileged user to `mount` file systems to the system. While tracking `mount` commands gives the system administrator evidence that external media may have been mounted (based on a review of the source of the mount and confirming it's an external media type), it does not conclusively indicate that data was exported to the media. System administrators who wish to determine if data were exported, would also have to track successful `open`, `creat` and `truncate` system calls requiring write access to a file under the mount point of the external media file system. This could give a fair indication that a write occurred. The only way to truly prove it, would be to track successful writes to the external media. Tracking write system calls could quickly fill up the audit log and is not recommended. Recommendations on configuration options to track data export to media is beyond the scope of this document.

Note: This tracks successful and unsuccessful mount commands. File system mounts do not have to come from external media and this action still does not verify write (e.g. CD ROMS)

Audit:

For 64 bit systems perform the following command and ensure the output is as shown to determine if filesystem mounts are recorded. Note: "`-a always,exit`" may be specified as "`-a exit,always`".

```
# grep mounts /etc/audit/audit.rules
-a always,exit -F arch=b64 -S mount -F auid>=1000 -F auid!=4294967295 -k mounts
-a always,exit -F arch=b32 -S mount -F auid>=1000 -F auid!=4294967295 -k mounts
```

For 32 bit systems perform the following command and ensure the output is as shown to determine if filesystem mounts are recorded. Note: "`-a always,exit`" may be specified as "`-a exit,always`".

```
# grep mounts /etc/audit/audit.rules
-a always,exit -F arch=b32 -S mount -F auid>=1000 -F auid!=4294967295 -k mounts
```

Remediation:

For 64 bit systems, add the following lines to the /etc/audit/audit.rules file.

```
-a always,exit -F arch=b64 -S mount -F auid>=1000 -F auid!=4294967295 -k mounts
-a always,exit -F arch=b32 -S mount -F auid>=1000 -F auid!=4294967295 -k mounts

# Execute the following command to restart auditd
# pkill -HUP -P 1 auditd
```

For 32 bit systems, add the following lines to the /etc/audit/audit.rules file.

```
-a always,exit -F arch=b32 -S mount -F auid>=1000 -F auid!=4294967295 -k mounts

# Execute the following command to restart auditd
# pkill -HUP -P 1 auditd
```

5.2.14 Collect File Deletion Events by User (Scored)

Profile Applicability:

- Level 2

Description:

Monitor the use of system calls associated with the deletion or renaming of files and file attributes. This configuration statement sets up monitoring for the `unlink` (remove a file), `unlinkat` (remove a file attribute), `rename` (rename a file) and `renameat` (rename a file attribute) system calls and tags them with the identifier "delete".

Rationale:

Monitoring these calls from non-privileged users could provide a system administrator with evidence that inappropriate removal of files and file attributes associated with protected files is occurring. While this audit option will look at all events, system administrators will want to look for specific privileged files that are being deleted or altered.

Audit:

For 64 bit systems, perform the following command and ensure the output is as shown to determine if file deletion events by user are recorded.

```
# grep delete /etc/audit/audit.rules
-a always,exit -F arch=b64 -S unlink -S unlinkat -S rename -S renameat -F auid>=1000 \
-F auid!=4294967295 -k delete
-a always,exit -F arch=b32 -S unlink -S unlinkat -S rename -S renameat -F auid>=1000 \
-F auid!=4294967295 -k delete
```

For 32 bit systems, perform the following command and ensure the output is as shown to determine if file deletion events by user are recorded.

```
# grep delete /etc/audit/audit.rules
-a always,exit -F arch=b32 -S unlink -S unlinkat -S rename -S renameat -F auid>=1000 \
-F auid!=4294967295 -k delete
```

Remediation:

At a minimum, configure the audit system to collect file deletion events for all users and root.

For 64 bit systems, add the following to the /etc/audit/audit.rules file.

```
-a always,exit -F arch=b64 -S unlink -S unlinkat -S rename -S renameat -F auid>=1000 \
-F auid!=4294967295 -k delete
-a always,exit -F arch=b32 -S unlink -S unlinkat -S rename -S renameat -F auid>=1000 \
-F auid!=4294967295 -k delete

# Execute the following command to restart auditd
# pkill -HUP -P 1 auditd
```

For 32 bit systems, add the following to the /etc/audit/audit.rules file.

```
-a always,exit -F arch=b32 -S unlink -S unlinkat -S rename -S renameat -F auid>=1000 \
-F auid!=4294967295 -k delete

# Execute the following command to restart auditd
# pkill -P 1-HUP auditd
```

5.2.15 Collect Changes to System Administration Scope (sudoers) (Scored)

Profile Applicability:

- Level 2

Description:

Monitor scope changes for system administrations. If the system has been properly configured to force system administrators to log in as themselves first and then use the `sudo` command to execute privileged commands, it is possible to monitor changes in scope. The file `/etc/sudoers` will be written to when the file or its attributes have changed. The audit records will be tagged with the identifier "scope."

Rationale:

Changes in the `/etc/sudoers` file can indicate that an unauthorized change has been made to scope of system administrator activity.

Audit:

Perform the following to determine if changes to `/etc/sudoers` are recorded.

```
# grep scope /etc/audit/audit.rules
-w /etc/sudoers -p wa -k scope
```

Remediation:

Add the following lines to the `/etc/audit/audit.rules` file.

```
-w /etc/sudoers -p wa -k scope

# Execute the following command to restart auditd
# pkill -HUP -P 1 auditd
```

5.2.16 Collect System Administrator Actions (sudolog) (Scored)

Profile Applicability:

- Level 2

Description:

Monitor the `sudo` log file. If the system has been properly configured to disable the use of the `su` command and force all administrators to have to log in first and then use `sudo` to execute privileged commands, then all administrator commands will be logged to `/var/log/sudo.log`. Any time a command is executed, an audit event will be triggered as

the `/var/log/sudo.log` file will be opened for write and the executed administration command will be written to the log.

Rationale:

Changes in `/var/log/sudo.log` indicate that an administrator has executed a command or the log file itself has been tampered with. Administrators will want to correlate the events written to the audit trail with the records written to `/var/log/sudo.log` to verify if unauthorized commands have been executed.

Audit:

Perform the following to determine if administrator activity is recorded.

```
# grep actions /etc/audit/audit.rules
-w /var/log/sudo.log -p wa -k actions
```

Remediation:

Add the following lines to the `/etc/audit/audit.rules` file.

```
-w /var/log/sudo.log -p wa -k actions

# Execute the following command to restart auditd
# pkill -HUP -P 1 auditd
```

Note: The system must be configured with `su` disabled (See Item 7.6 Restrict Access to the su Command) to force all command execution through `sudo`. This will not be effective on the console, as administrators can log in as root.

5.2.17 Collect Kernel Module Loading and Unloading (Scored)

Profile Applicability:

• Level 2

Description:

Monitor the loading and unloading of kernel modules. The programs `insmod` (install a kernel module), `rmmod` (remove a kernel module), and `modprobe` (a more sophisticated program to load and unload modules, as well as some other features) control loading and unloading of modules. The `init_module` (load a module) and `delete_module` (delete a module) system calls control loading and unloading of modules. Any execution of the loading and unloading module programs and system calls will trigger an audit record with an identifier of "modules".

Rationale:

Monitoring the use of `insmod`, `rmmod` and `modprobe` could provide system administrators with evidence that an unauthorized user loaded or unloaded a kernel module, possibly compromising the security of the system. Monitoring of the `init_module` and `delete_module` system calls would reflect an unauthorized user attempting to use a different program to load and unload modules.

Audit:

Perform the following to determine if kernel module loading and unloading is recorded. Note: "`-a always,exit`" may be specified as "`-a exit,always`".

```
# grep modules /etc/audit/audit.rules
-w /sbin/insmod -p x -k modules
-w /sbin/rmmod -p x -k modules
-w /sbin/modprobe -p x -k modules
For 32 bit systems
-a always,exit -F arch=b32 -S init_module -S delete_module -k modules
For 64 bit systems
-a always,exit -F arch=b64 -S init_module -S delete_module -k modules
```

Remediation:

Add the following lines to the /etc/audit/audit.rules file.

```
-w /sbin/insmod -p x -k modules
-w /sbin/rmmod -p x -k modules
-w /sbin/modprobe -p x -k modules
For 32 bit systems, add
-a always,exit -F arch=b32 -S init_module -S delete_module -k modules
For 64 bit systems, add
-a always,exit -F arch=b64 -S init_module -S delete_module -k modules
```

5.2.18 Make the Audit Configuration Immutable (Scored)

Profile Applicability:

- Level 2

Description:

Set system audit so that audit rules cannot be modified with `auditctl`. Setting the flag "-e 2" forces audit to be put in immutable mode. Audit changes can only be made on system reboot.

Rationale:

In immutable mode, unauthorized users cannot execute changes to the audit system to potential hide malicious activity and then put the audit rules back. Users would most likely

notice a system reboot and that could alert administrators of an attempt to make unauthorized audit changes.

Audit:

Perform the following to determine if the audit configuration is immutable.

```
# grep "^-e 2" /etc/audit/audit.rules
-e 2
```

Remediation:

Add the following lines to the `/etc/audit/audit.rules` file.

```
-e 2
```

Note: This must be the last entry in the `/etc/audit/audit.rules` file

5.3 Configure logrotate (Not Scored)

Profile Applicability:

- Level 1

Description:

The system includes the capability of rotating log files regularly to avoid filling up the system with logs or making the logs unmanageable large. The file `/etc/logrotate.d/syslog` is the configuration file used to rotate log files created by `syslog` or `rsyslog`. These files are rotated on a weekly basis via a cron job and the last 4 weeks are kept.

Rationale:

By keeping the log files smaller and more manageable, a system administrator can easily archive these files to another system and spend less time looking through inordinately large log files.

Audit:

Perform the following to determine if the appropriate system logs are rotated.

```
# grep '{' /etc/logrotate.d/syslog
/var/log/messages /var/log/secure /var/log/maillog /var/log/spooler /var/log/boot.log
/var/log/cron {
```

Remediation:

Edit the `/etc/logrotate.d/syslog` file to include appropriate system logs:

```
/var/log/messages /var/log/secure /var/log/maillog /var/log/spooler /var/log/boot.log
/var/log/cron {
```

6 System Access, Authentication and Authorization

6.1 Configure cron and anacron

6.1.1 Enable anacron Daemon (Scored)

Profile Applicability:

- Level 1

Description:

The `anacron` daemon is used on systems that are not up 24x7. The `anacron` daemon will execute jobs that would have normally been run had the system not been down.

Rationale:

Cron jobs may include critical security or administrative functions that need to run on a regular basis. Use this daemon on machines that are not up 24x7, or if there are jobs that need to be executed after the system has been brought back up after a maintenance window.

Audit:

Perform the following to determine if `anacron` is enabled.

```
# rpm -q cronie-anacron
cronie-anacron.<package version>.<hardware platform>
```

Remediation:

```
# yum install cronie-anacron
```

Note: NSA Guidance recommends disabling `anacron` for systems that are intended to be up 24X7, with the rationale that unnecessary software should be disabled to reduce risk. However, even systems that are designed to be up at all times can experience downtime

that could prevent important system maintenance jobs from running. Review the requirements for your site to determine your appropriate risk level.

6.1.2 Enable crond Daemon (Scored)

Profile Applicability:

- Level 1

Description:

The `crond` daemon is used to execute batch jobs on the system.

Rationale:

While there may not be user jobs that need to be run on the system, the system does have maintenance jobs that may include security monitoring that have to run and `crond` is used to execute them.

Audit:

Perform the following to determine if `cron` is enabled.

```
# systemctl is-enabled crond
enabled
```

Remediation:

```
# systemctl enable crond
```

6.1.3 Set User/Group Owner and Permission on /etc/anacrontab (Scored)

Profile Applicability:

- Level 1

Description:

The `/etc/anacrontab` file is used by `anacron` to control its own jobs. The commands in this item make sure that root is the user and group owner of the file and is the only user that can read and write the file.

Rationale:

This file contains information on what system jobs are run by `anacron`. Write access to these files could provide unprivileged users with the ability to elevate their privileges. Read

access to these files could provide users with the ability to gain insight on system jobs that run on the system and could provide them a way to gain unauthorized privileged access.

Audit:

Perform the following to determine if the `/etc/anacrontab` file has the correct permissions.

```
# stat -L -c "%a %u %g" /etc/anacrontab | egrep ".00 0 0"
```
If the above command emits no output then the system is not configured as recommended.

Remediation:

```
# chown root:root /etc/anacrontab
# chmod og-rwx /etc/anacrontab
```

6.1.4 Set User/Group Owner and Permission on /etc/crontab (Scored)

Profile Applicability:

• Level 1

Description:

The `/etc/crontab` file is used by `cron` to control its own jobs. The commands in this item make here sure that root is the user and group owner of the file and is the only user that can read and write the file.

Rationale:

This file contains information on what system jobs are run by cron. Write access to these files could provide unprivileged users with the ability to elevate their privileges. Read access to these files could provide users with the ability to gain insight on system jobs that run on the system and could provide them a way to gain unauthorized privileged access.

Audit:

Perform the following to determine if the `/etc/crontab` file has the correct permissions.

```
# stat -L -c "%a %u %g" /etc/crontab | egrep ".00 0 0"
```
If the above command emits no output then the system is not configured as recommended.

Remediation:

```
# chown root:root /etc/crontab
# chmod og-rwx /etc/crontab
```

6.1.5 Set User/Group Owner and Permission on /etc/cron.hourly (Scored)

Profile Applicability:

- Level 1

Description:

This directory contains system `cron` jobs that need to run on an hourly basis. The files in this directory cannot be manipulated by the `crontab` command, but are instead edited by system administrators using a text editor. The commands below restrict read/write and search access to user and group root, preventing regular users from accessing this directory.

Rationale:

Granting write access to this directory for non-privileged users could provide them the means for gaining unauthorized elevated privileges. Granting read access to this directory could give an unprivileged user insight in how to gain elevated privileges or circumvent auditing controls.

Audit:

Perform the following to determine if the `/etc/cron.hourly` file has the correct permissions.

```
# stat -L -c "%a %u %g" /etc/cron.hourly | egrep ".00 0 0"
```
If the above command emits no output then the system is not configured as recommended.

Remediation:

```
# chown root:root /etc/cron.hourly
# chmod og-rwx /etc/cron.hourly
```

6.1.6 Set User/Group Owner and Permission on /etc/cron.daily (Scored)

Profile Applicability:

- Level 1

Description:

The `/etc/cron.daily` directory contains system cron jobs that need to run on a daily basis. The files in this directory cannot be manipulated by the `crontab` command, but are instead edited by system administrators using a text editor. The commands below restrict

read/write and search access to user and group root, preventing regular users from accessing this directory.

Rationale:

Granting write access to this directory for non-privileged users could provide them the means for gaining unauthorized elevated privileges. Granting read access to this directory could give an unprivileged user insight in how to gain elevated privileges or circumvent auditing controls.

Audit:

Perform the following to determine if the `/etc/cron.daily` directory has the correct permissions.

```
# stat -L -c "%a %u %g" /etc/cron.daily | egrep ".00 0 0"
```
If the above command emits no output then the system is not configured as recommended.

Remediation:

```
# chown root:root /etc/cron.daily
# chmod og-rwx /etc/cron.daily
```

6.1.7 Set User/Group Owner and Permission on /etc/cron.weekly (Scored)

Profile Applicability:

- Level 1

Description:

The `/etc/cron.weekly` directory contains system cron jobs that need to run on a weekly basis. The files in this directory cannot be manipulated by the `crontab` command, but are instead edited by system administrators using a text editor. The commands below restrict read/write and search access to user and group root, preventing regular users from accessing this directory.

Rationale:

Granting write access to this directory for non-privileged users could provide them the means for gaining unauthorized elevated privileges. Granting read access to this directory could give an unprivileged user insight in how to gain elevated privileges or circumvent auditing controls.

Audit:

Perform the following to determine if the /etc/cron.weekly directory has the correct permissions.

```
# stat -L -c "%a %u %g" /etc/cron.weekly | egrep ".00 0 0"
```
If the above command emits no output then the system is not configured as recommended.

Remediation:

```
# chown root:root /etc/cron.weekly
# chmod og-rwx /etc/cron.weekly
```

6.1.8 Set User/Group Owner and Permission on /etc/cron.monthly (Scored)

Profile Applicability:

- Level 1

Description:

The /etc/cron.monthly directory contains system cron jobs that need to run on a monthly basis. The files in this directory cannot be manipulated by the crontab command, but are instead edited by system administrators using a text editor. The commands below restrict read/write and search access to user and group root, preventing regular users from accessing this directory.

Rationale:

Granting write access to this directory for non-privileged users could provide them the means for gaining unauthorized elevated privileges. Granting read access to this directory could give an unprivileged user insight in how to gain elevated privileges or circumvent auditing controls.

Audit:

Perform the following to determine if the /etc/cron.monthly directory has the correct permissions.

```
# stat -L -c "%a %u %g" /etc/cron.monthly | egrep ".00 0 0"
```
If the above command emits no output then the system is not configured as recommended.

Remediation:

```
# chown root:root /etc/cron.monthly
# chmod og-rwx /etc/cron.monthly
```

6.1.9 Set User/Group Owner and Permission on /etc/cron.d (Scored)

Profile Applicability:

- Level 1

Description:

The `/etc/cron.d` directory contains system `cron` jobs that need to run in a similar manner to the hourly, daily weekly and monthly jobs from `/etc/crontab`, but require more granular control as to when they run. The files in this directory cannot be manipulated by the `crontab` command, but are instead edited by system administrators using a text editor. The commands below restrict read/write and search access to user and group root, preventing regular users from accessing this directory.

Rationale:

Granting write access to this directory for non-privileged users could provide them the means for gaining unauthorized elevated privileges. Granting read access to this directory could give an unprivileged user insight in how to gain elevated privileges or circumvent auditing controls.

Audit:

Perform the following to determine if the /etc/cron.d directory has the correct permissions.

```
# stat -L -c "%a %u %g" /etc/cron.d | egrep ".00 0 0"
```
If the above command emits no output then the system is not configured as recommended.

Remediation:

```
# chown root:root /etc/cron.d
# chmod og-rwx /etc/cron.d
```

6.1.10 Restrict at Daemon (Scored)

Profile Applicability:

- Level 1

Description:

The `at` daemon works with the `cron` daemon to allow non-privileged users to submit one time only jobs at their convenience. There are two files that control at: `/etc/at.allow` and `/etc/at.deny`. If `/etc/at.allow` exists, then users listed in the file are the only ones that can create at jobs. If `/etc/at.allow` does not exist and `/etc/at.deny` does exist, then any user on the system, with the exception of those listed in `/etc/at.deny`, are allowed to execute at jobs. An empty `/etc/at.deny` file allows any user to create at jobs. If neither `/etc/at.allow` nor `/etc/at.deny` exist, then only superuser can create at jobs. The commands below remove the `/etc/at.deny` file and create an empty `/etc/at.allow` file that can only be read and modified by user and group root.

Rationale:

Granting write access to this directory for non-privileged users could provide them the means to gain unauthorized elevated privileges. Granting read access to this directory could give an unprivileged user insight in how to gain elevated privileges or circumvent auditing controls. In addition, it is a better practice to create a white list of users who can execute at jobs versus a blacklist of users who can't execute at jobs as a system administrator will always know who can create jobs and does not have to worry about remembering to add a user to the blacklist when a new user id is created.

Audit:

Perform the following to determine if at jobs are restricted.

```
# stat -L /etc/at.deny > /dev/null
# stat -L -c "%a %u %g" /etc/at.allow | egrep ".00 0 0"
```
If the above command emits no output then the system is not configured as recommended.

Remediation:

```
# rm /etc/at.deny
# touch /etc/at.allow
# chown root:root /etc/at.allow
# chmod og-rwx /etc/at.allow
```

6.1.11 Restrict at/cron to Authorized Users (Scored)

Profile Applicability:

- Level 1

Description:

Configure `/etc/cron.allow` and `/etc/at.allow` to allow specific users to use these services. If `/etc/cron.allow` or `/etc/at.allow` do not exist, then `/etc/at.deny` and

`/etc/cron.deny` are checked. Any user not specifically defined in those files is allowed to use at and cron. By removing the files, only users in `/etc/cron.allow` and `/etc/at.allow` are allowed to use at and cron. Note that even though a given user is not listed in `cron.allow`, cron jobs can still be run as that user. The `cron.allow` file only controls administrative access to the crontab command for scheduling and modifying cron jobs.

Rationale:

On many systems, only the system administrator is authorized to schedule `cron` jobs. Using the `cron.allow` file to control who can run `cron` jobs enforces this policy. It is easier to manage an allow list than a deny list. In a deny list, you could potentially add a user ID to the system and forget to add it to the deny files.

Audit:

Perform the following to determine if the remediation in the section has been performed:

```
# ls -l /etc/cron.deny
[no output returned]
# ls -l /etc/at.deny
[no output returned]
# ls -l /etc/cron.allow
-rw------- 1 root root /etc/cron.allow
# ls -l /etc/at.allow
-rw------- 1 root root /etc/at.allow
```

Remediation:

If `/etc/cron.allow` or `/etc/at.allow` do not exist on your system create them.

Run the following to ensure `cron.deny` and `at.deny` are removed and permissions are set correctly:

```
# /bin/rm /etc/cron.deny
# /bin/rm /etc/at.deny
# chmod og-rwx /etc/cron.allow
# chmod og-rwx /etc/at.allow
# chown root:root /etc/cron.allow
# chown root:root /etc/at.allow
```

6.2 Configure SSH

Description: SSH is a secure, encrypted replacement for common login services such as `telnet`, `ftp`, `rlogin`, `rsh`, and `rcp`.

Rationale: It is strongly recommended that sites abandon older clear-text login protocols and use SSH to prevent session hijacking and sniffing of sensitive data off the network.

6.2.1 Set SSH Protocol to 2 (Scored)

Profile Applicability:

- Level 1

Description:

SSH supports two different and incompatible protocols: SSH1 and SSH2. SSH1 was the original protocol and was subject to security issues. SSH2 is more advanced and secure.

Rationale:

SSH v1 suffers from insecurities that do not affect SSH v2.

Audit:

To verify the correct SSH setting, run the following command and verify that the output is as shown:

```
# grep "^Protocol" /etc/ssh/sshd_config
Protocol 2
```

Remediation:

Edit the `/etc/ssh/sshd_config` file to set the parameter as follows:

```
Protocol 2
```

6.2.2 Set LogLevel to INFO (Scored)

Profile Applicability:

- Level 1

Description:

The `INFO` parameter specifies that login and logout activity will be logged.

Rationale:

SSH provides several logging levels with varying amounts of verbosity. `DEBUG` is specifically *not* recommended other than strictly for debugging SSH communications since it provides so much data that it is difficult to identify important security information. `INFO` level is the basic level that only records login activity of SSH users. In many situations, such as Incident Response, it is important to determine when a particular user was active on a system. The logout record can eliminate those users who disconnected, which helps narrow the field.

Audit:

To verify the correct SSH setting, run the following command and verify that the output is as shown:

```
# grep "^LogLevel" /etc/ssh/sshd_config
LogLevel INFO
```

Remediation:

Edit the `/etc/ssh/sshd_config` file to set the parameter as follows:

```
LogLevel INFO
```

6.2.3 Set Permissions on /etc/ssh/sshd_config (Scored)

Profile Applicability:

- Level 1

Description:

The `/etc/ssh/sshd_config` file contains configuration specifications for `sshd`. The command below sets the owner and group of the file to root.

Rationale:

The `/etc/ssh/sshd_config` file needs to be protected from unauthorized changes by non-privileged users, but needs to be readable as this information is used with many non-privileged programs.

Audit:

Run the following command to determine the user and group ownership on the `/etc/ssh/sshd_config` file.

```
# /bin/ls -l /etc/ssh/sshd_config
-rw------- 1 root root 762 Sep 23 002 /etc/ssh/sshd_config
```

Remediation:

If the user and group ownership of the `/etc/ssh/sshd_config` file are incorrect, run the following command to correct them:

```
# chown root:root /etc/ssh/sshd_config
```

If the permissions are incorrect, run the following command to correct them:

```
# chmod 600 /etc/ssh/sshd_config
```

6.2.4 Disable SSH X11 Forwarding (Scored)

Profile Applicability:

- Level 1

Description:

The X11Forwarding parameter provides the ability to tunnel X11 traffic through the connection to enable remote graphic connections.

Rationale:

Disable X11 forwarding unless there is an operational requirement to use X11 applications directly. There is a small risk that the remote X11 servers of users who are logged in via SSH with X11 forwarding could be compromised by other users on the X11 server. Note that even if X11 forwarding is disabled, users can always install their own forwarders.

Audit:

To verify the correct SSH setting, run the following command and verify that the output is as shown:

```
# grep "^X11Forwarding" /etc/ssh/sshd_config
X11Forwarding no
```

Remediation:

Edit the `/etc/ssh/sshd_config` file to set the parameter as follows:

```
X11Forwarding no
```

6.2.5 Set SSH MaxAuthTries to 4 or Less (Scored)

Profile Applicability:

- Level 1

Description:

The `MaxAuthTries` parameter specifies the maximum number of authentication attempts permitted per connection. When the login failure count reaches half the number, error messages will be written to the `syslog` file detailing the login failure.

Rationale:

Setting the `MaxAuthTries` parameter to a low number will minimize the risk of successful brute force attacks to the SSH server. While the recommended setting is 4, it is set the number based on site policy.

Audit:

To verify the correct SSH setting, run the following command and verify that the output is as shown:

```
# grep "^MaxAuthTries" /etc/ssh/sshd_config
MaxAuthTries 4
```

Remediation:

Edit the `/etc/ssh/sshd_config` file to set the parameter as follows:

```
MaxAuthTries 4
```

6.2.6 Set SSH IgnoreRhosts to Yes (Scored)

Profile Applicability:

- Level 1

Description:

The `IgnoreRhosts` parameter specifies that `.rhosts` and `.shosts` files will not be used in `RhostsRSAAuthentication` or `HostbasedAuthentication`.

Rationale:

Setting this parameter forces users to enter a password when authenticating with ssh.

Audit:

To verify the correct SSH setting, run the following command and verify that the output is as shown:

```
# grep "^IgnoreRhosts" /etc/ssh/sshd_config
IgnoreRhosts yes
```

Remediation:

Edit the `/etc/ssh/sshd_config` file to set the parameter as follows:

```
IgnoreRhosts yes
```

6.2.7 Set SSH HostbasedAuthentication to No (Scored)

Profile Applicability:

- Level 1

Description:

The `HostbasedAuthentication` parameter specifies if authentication is allowed through trusted hosts via the user of `.rhosts`, or `/etc/hosts.equiv`, along with successful public key client host authentication. This option only applies to SSH Protocol Version 2.

Rationale:

Even though the `.rhosts` files are ineffective if support is disabled in `/etc/pam.conf`, disabling the ability to use `.rhosts` files in SSH provides an additional layer of protection .

Audit:

To verify the correct SSH setting, run the following command and verify that the output is as shown:

```
# grep "^HostbasedAuthentication" /etc/ssh/sshd_config
HostbasedAuthentication no
```

Remediation:

Edit the `/etc/ssh/sshd_config` file to set the parameter as follows:

```
HostbasedAuthentication no
```

6.2.8 Disable SSH Root Login (Scored)

Profile Applicability:

- Level 1

Description:

The `PermitRootLogin` parameter specifies if the root user can log in using ssh(1). The default is no.

Rationale:

Disallowing root logins over SSH requires server admins to authenticate using their own individual account, then escalating to root via `sudo` or `su`. This in turn limits opportunity for non-repudiation and provides a clear audit trail in the event of a security incident

Audit:

To verify the correct SSH setting, run the following command and verify that the output is as shown:

```
# grep "^PermitRootLogin" /etc/ssh/sshd_config
PermitRootLogin no
```

Remediation:

Edit the `/etc/ssh/sshd_config` file to set the parameter as follows:

```
PermitRootLogin no
```

6.2.9 Set SSH PermitEmptyPasswords to No (Scored)

Profile Applicability:

- Level 1

Description:

The `PermitEmptyPasswords` parameter specifies if the server allows login to accounts with empty password strings.

Rationale:

Disallowing remote shell access to accounts that have an empty password reduces the probability of unauthorized access to the system

Audit:

To verify the correct SSH setting, run the following command and verify that the output is as shown:

```
# grep "^PermitEmptyPasswords" /etc/ssh/sshd_config
PermitEmptyPasswords no
```

Remediation:

Edit the `/etc/ssh/sshd_config` file to set the parameter as follows:

```
PermitEmptyPasswords no
```

6.2.10 Do Not Allow Users to Set Environment Options (Scored)

Profile Applicability:

- Level 1

Description:

The `PermitUserEnvironment` option allows users to present environment options to the `ssh` daemon.

Rationale:

Permitting users the ability to set environment variables through the SSH daemon could potentially allow users to bypass security controls (e.g. setting an execution path that has `ssh` executing trojaned programs).

Audit:

To verify the correct SSH setting, run the following command and verify that the output is as shown:

```
# grep PermitUserEnvironment /etc/ssh/sshd_config
PermitUserEnvironment no
```

Remediation:

Edit the `/etc/ssh/sshd_config` file to set the parameter as follows:

```
PermitUserEnvironment no
```

6.2.11 Use Only Approved Cipher in Counter Mode (Scored)

Profile Applicability:

- Level 1

Description:

This variable limits the types of ciphers that SSH can use during communication.

Rationale:

Based on research conducted at various institutions, it was determined that the symmetric portion of the SSH Transport Protocol (as described in RFC 4253) has security weaknesses that allowed recovery of up to 32 bits of plaintext from a block of ciphertext that was encrypted with the Cipher Block Chaining (CBC) method. From that research, new Counter mode algorithms (as described in RFC4344) were designed that are not vulnerable to these types of attacks and these algorithms are now recommended for standard use.

Audit:

To verify the correct SSH setting, run the following command and verify that the output is as shown:

```
# grep "Ciphers" /etc/ssh/sshd_config
Ciphers aes128-ctr,aes192-ctr,aes256-ctr
```

Remediation:

Edit the `/etc/ssh/sshd_config` file to set the parameter as follows:

```
Ciphers aes128-ctr,aes192-ctr,aes256-ctr
```

References:

1. For more information on the Counter mode algorithms, read RFC4344 at http://www.ietf.org/rfc/rfc4344.txt.

6.2.12 Set Idle Timeout Interval for User Login (Scored)

Profile Applicability:

- Level 1

Description:

The two options `ClientAliveInterval` and `ClientAliveCountMax` control the timeout of ssh sessions. When the `ClientAliveInterval` variable is set, ssh sessions that have no activity for the specified length of time are terminated. When the `ClientAliveCountMax`

variable is set, `sshd` will send client alive messages at every `ClientAliveInterval` interval. When the number of consecutive client alive messages are sent with no response from the client, the `ssh` session is terminated. For example, if the `ClientAliveInterval` is set to 15 seconds and the `ClientAliveCountMax` is set to 3, the client `ssh` session will be terminated after 45 seconds of idle time.

Rationale:

Having no timeout value associated with a connection could allow an unauthorized user access to another user's `ssh` session (e.g. user walks away from their computer and doesn't lock the screen). Setting a timeout value at least reduces the risk of this happening..

While the recommended setting is 300 seconds (5 minutes), set this timeout value based on site policy. The recommended setting for `ClientAliveCountMax` is 0. In this case, the client session will be terminated after 5 minutes of idle time and no keepalive messages will be sent.

Audit:

To verify the correct SSH setting, run the following command and verify that the output is as shown:

```
# grep "^ClientAliveInterval" /etc/ssh/sshd_config
ClientAliveInterval 300
# grep "^ClientAliveCountMax" /etc/ssh/sshd_config
ClientAliveCountMax 0
```

Remediation:

Edit the `/etc/ssh/sshd_config` file to set the parameter as follows:

```
ClientAliveInterval 300
ClientAliveCountMax 0
```

6.2.13 Limit Access via SSH (Scored)

Profile Applicability:

- Level 1

Description:

There are several options available to limit which users and group can access the system via SSH. It is recommended that at least of the following options be leveraged:

```
AllowUsers
```

The `AllowUsers` variable gives the system administrator the option of allowing specific users to `ssh` into the system. The list consists of comma separated user names. Numeric userIDs are not recognized with this variable. If a system administrator wants to restrict user access further by only allowing the allowed users to log in from a particular host, the entry can be specified in the form of user@host.

AllowGroups

The `AllowGroups` variable gives the system administrator the option of allowing specific groups of users to `ssh` into the system. The list consists of comma separated user names. Numeric groupIDs are not recognized with this variable.

DenyUsers

The `DenyUsers` variable gives the system administrator the option of denying specific users to `ssh` into the system. The list consists of comma separated user names. Numeric userIDs are not recognized with this variable. If a system administrator wants to restrict user access further by specifically denying a user's access from a particular host, the entry can be specified in the form of user@host.

DenyGroups

The `DenyGroups` variable gives the system administrator the option of denying specific groups of users to `ssh` into the system. The list consists of comma separated group names. Numeric groupIDs are not recognized with this variable.

Rationale:

Restricting which users can remotely access the system via SSH will help ensure that only authorized users access the system.

Audit:

To verify the correct SSH setting, run the following command and verify that the output is as shown:

```
# grep "^AllowUsers" /etc/ssh/sshd_config
AllowUsers <userlist>

# grep "^AllowGroups" /etc/ssh/sshd_config
AllowGroups <grouplist>

# grep "^DenyUsers" /etc/ssh/sshd_config
DenyUsers <userlist>
# grep "^DenyGroups" /etc/ssh/sshd_config
DenyGroups <grouplist>
```

Remediation:

Edit the `/etc/ssh/sshd_config` file to set one or more of the parameter as follows:

```
AllowUsers <userlist>
AllowGroups <grouplist>
DenyUsers <userlist>
DenyGroups <grouplist>
```

6.2.14 Set SSH Banner (Scored)

Profile Applicability:

- Level 1

Description:

The `Banner` parameter specifies a file whose contents must be sent to the remote user before authentication is permitted. By default, no banner is displayed.

Rationale:

Banners are used to warn connecting users of the particular site's policy regarding connection. Consult with your legal department for the appropriate warning banner for your site.

Audit:

To verify the correct SSH setting, run the following command and verify that `<bannerfile>` is either `/etc/issue` or `/etc/issue.net`:

```
# grep "^Banner" /etc/ssh/sshd_config
Banner <bannerfile>
```

Remediation:

Edit the `/etc/ssh/sshd_config` file to set the parameter as follows:

```
Banner /etc/issue.net
```

6.3 Configure PAM

PAM (Pluggable Authentication Modules) is a service that implements modular authentication modules on UNIX systems. PAM is implemented as a set of shared objects that are loaded and executed when a program needs to authenticate a user. Files for PAM are typically located in the `/etc/pam.d` directory. PAM must be carefully configured to secure system authentication. While this section covers some of PAM, please consult other PAM resources to fully understand the configuration capabilities.

6.3.1 Upgrade Password Hashing Algorithm to SHA-512 (Scored)

Profile Applicability:

- Level 1

Description:

The SHA-512 encryption has been available since Red Hat release 5.2,. The commands below change password encryption from `md5` to `sha512` (a much stronger hashing algorithm). All existing accounts will need to perform a password change to upgrade the stored hashes to the new algorithm.

Rationale:

The SHA-512 algorithm provides much stronger hashing than MD5, thus providing additional protection to the system by increasing the level of effort for an attacker to successfully determine passwords.

Note that these change only apply to accounts configured on the local system.

Audit:

Perform the following to determine if the password-hashing algorithm is set to SHA-512:

```
# authconfig --test | grep hashing | grep sha512
```
If the above command emits no output then the system is not configured as recommended

Remediation:

Perform the following to configure the system as recommended:

```
# authconfig --passalgo=sha512 --update
```
Note: If it is determined that the password algorithm being used is not SHA-512, once it is changed, it is recommended that all userID's be immediately expired and forced to change

their passwords on next login. To accomplish that, the following commands can be used. Any system accounts that need to be expired should be carefully done separately by the system administrator to prevent any potential problems.

```
# cat /etc/passwd | awk -F: '( $3 >=1000 && $1 != "nfsnobody" ) { print $1 }' | xargs
-n 1 chage -d 0
```

6.3.2 Set Password Creation Requirement Parameters Using pam_pwquality (Scored)

Profile Applicability:

- Level 1

Description:

The `pam_pwquality` module checks of the strength of passwords. It performs checks such as making sure a password is not a dictionary word, it is a certain length, contains a mix of characters (e.g. alphabet, numeric, other) and more. The following are definitions of the `pam_pwquality.so` options.

- `try_first_pass` - retrieve the password from a previous stacked PAM module. If not available, then prompt the user for a password.
- `retry=3` - Allow 3 tries before sending back a failure.

The following options are set in the `/etc/security/pwquality.conf` file:

- `minlen=14` - password must be 14 characters or more
- `dcredit=-1` - provide at least 1 digit
- `ucredit=-1` - provide at least one uppercase character
- `ocredit=-1` - provide at least one special character
- `lcredit=-1` - provide at least one lowercase character

The setting shown above is one possible policy. Alter these values to conform to your own organization's password policies.

Rationale:

Strong passwords protect systems from being hacked through brute force methods.

Audit:

Perform the following to determine the current settings in the `/etc/pam.d/system-auth` file.

```
# grep pam_pwquality.so /etc/pam.d/system-auth
password requisite pam_pwquality.so try_first_pass local_users_only retry=3
authtok_type=
```

Check settings in `/etc/security/pwquality.conf`:

```
minlen=14
dcredit=-1
ucredit=-1
ocredit=-1
lcredit=-1
```

Remediation:

Set the `pam_pwquality.so` parameters as follows in `/etc/pam.d/system-auth`:

```
password requisite pam_pwquality.so try_first_pass local_users_only retry=3
authtok_type=
```

Set the following settings in `/etc/security/pwquality.conf`:

```
minlen=14
dcredit=-1
ucredit=-1
ocredit=-1
lcredit=-1
```

6.3.3 Set Lockout for Failed Password Attempts (Not Scored)

Profile Applicability:

- Level 1

Description:

Lock out userIDs after *n* unsuccessful consecutive login attempts. The first sets of changes are made to the main PAM configuration files `/etc/pam.d/system-auth` and `/etc/pam.d/password-auth`. The second set of changes are applied to the program specific PAM configuration file (in this case, the `ssh` daemon). The second set of changes must be applied to each program that will lock out userID's.

Set the lockout number to the policy in effect at your site.

Rationale:

Locking out userIDs after *n* unsuccessful consecutive login attempts mitigates brute force password attacks against your systems.

Audit:

Perform the following to determine the current settings for userID lockout.

```
# grep "pam_faillock" /etc/pam.d/password-auth
auth required pam_faillock.so preauth audit silent deny=5 unlock_time=900
auth [default=die] pam_faillock.so authfail audit deny=5 unlock_time=900
auth sufficient pam_faillock.so authsucc audit deny=5 unlock_time=900
# grep "pam_unix.so" /etc/pam.d/password-auth | grep success=1
auth [success=1 default=bad] pam_unix.so

# grep "pam_faillock" /etc/pam.d/system-auth
auth required pam_faillock.so preauth audit silent deny=5 unlock_time=900
auth [default=die] pam_faillock.so authfail audit deny=5 unlock_time=900
auth sufficient pam_faillock.so authsucc audit deny=5 unlock_time=900
# grep "pam_unix.so" /etc/pam.d/system-auth | grep success=1
auth [success=1 default=bad] pam_unix.so
```

Remediation:

Edit the `/etc/pam.d/password-auth` and `/etc/pam.d/system-auth` files and add the "auth" lines as highlighted below:

```
# cat /etc/pam.d/password-auth
#%PAM-1.0
# This file is auto-generated.
# User changes will be destroyed the next time authconfig is run.
auth required pam_env.so
auth required pam_faillock.so preauth audit silent deny=5 unlock_time=900
auth [success=1 default=bad] pam_unix.so
auth [default=die] pam_faillock.so authfail audit deny=5 unlock_time=900
auth sufficient pam_faillock.so authsucc audit deny=5 unlock_time=900
auth required pam_deny.so

# cat /etc/pam.d/system-auth
#%PAM-1.0
# This file is auto-generated.
# User changes will be destroyed the next time authconfig is run.
auth required pam_env.so
auth required pam_faillock.so preauth audit silent deny=5 unlock_time=900
auth [success=1 default=bad] pam_unix.so
auth [default=die] pam_faillock.so authfail audit deny=5 unlock_time=900
auth sufficient pam_faillock.so authsucc audit deny=5 unlock_time=900
auth required pam_deny.so
```

Note: If a user has been locked out because they have reached the maximum consecutive failure count defined by `deny=` in the `pam_faillock.so` module, the user can be unlocked by issuing the command `/usr/sbin/faillock -u --reset`. This command sets the failed count to 0, effectively unlocking the userid.

6.3.4 Limit Password Reuse (Scored)

Profile Applicability:

- Level 1

Description:

The `/etc/security/opasswd` file stores the users' old passwords and can be checked to ensure that users are not recycling recent passwords.

Rationale:

Forcing users not to reuse their past 5 passwords make it less likely that an attacker will be able to guess the password.

Note that these change only apply to accounts configured on the local system.

Audit:

Perform the following to determine the current setting for reuse of older passwords:

```
# grep "remember" /etc/pam.d/system-auth
password sufficient pam_unix.so remember=5
```

Remediation:

Set the `pam_unix.so remember` parameter to `5` in `/etc/pam.d/system-auth`:

```
password sufficient pam_unix.so remember=5
```

6.4 Restrict root Login to System Console (Not Scored)

Profile Applicability:

- Level 1

Description:

The file `/etc/securetty` contains a list of valid terminals that may be logged in directly as root.

Rationale:

Since the system console has special properties to handle emergency situations, it is important to ensure that the console is in a physically secure location and that unauthorized consoles have not been defined.

Audit:

```
# cat /etc/securetty
```

Remediation:

Remove entries for any consoles that are not in a physically secure location.

6.5 Restrict Access to the su Command (Scored)

Profile Applicability:

- Level 1

Description:

The `su` command allows a user to run a command or shell as another user. The program has been superseded by `sudo`, which allows for more granular control over privileged access. Normally, the `su` command can be executed by any user. By uncommenting the `pam_wheel.so` statement in `/etc/pam.d/su`, the `su` command will only allow users in the wheel group to execute `su`.

Rationale:

Restricting the use of `su`, and using `sudo` in its place, provides system administrators better control of the escalation of user privileges to execute privileged commands. The sudo utility also provides a better logging and audit mechanism, as it can log each command executed via `sudo`, whereas `su` can only record that a user executed the `su` program.

Audit:

```
# grep pam_wheel.so /etc/pam.d/su
auth required pam_wheel.so use_uid
# grep wheel /etc/group
wheel:x:10:root, <user list>
```

Remediation:

Set the `pam_wheel.so` parameters as follows in `/etc/pam.d/su`:

```
auth required pam_wheel.so use_uid
```

Set the proper list of users to be included in the `wheel` group in `/etc/groups`.

7 User Accounts and Environment

This section provides guidance on setting up secure defaults for system and user accounts and their environment. Guidance for monitoring these settings and others that may change over time is provided in Section 10 System Maintenance.

7.1 Set Shadow Password Suite Parameters (/etc/login.defs)

While a majority of the password control parameters have been moved to PAM, some parameters are still available through the shadow password suite. Any changes made to `/etc/login.defs` will only be applied if the `usermod` command is used. If userIDs are added a different way, use the `chage` command to effect changes to individual userIDs.

7.1.1 Set Password Expiration Days (Scored)

Profile Applicability:

- Level 1

Description:

The `PASS_MAX_DAYS` parameter in `/etc/login.defs` allows an administrator to force passwords to expire once they reach a defined age. It is recommended that the `PASS_MAX_DAYS` parameter be set to less than or equal to 90 days.

Rationale:

The window of opportunity for an attacker to leverage compromised credentials or successfully compromise credentials via an online brute force attack is limited by the age of the password. Therefore, reducing the maximum age of a password also reduces an attacker's window of opportunity.

Audit:

```
# grep PASS_MAX_DAYS /etc/login.defs
PASS_MAX_DAYS 90
# chage --list <user>
Maximum number of days between password change:    90
```

Remediation:

Set the `PASS_MAX_DAYS` parameter to `90` in `/etc/login.defs`:

```
PASS_MAX_DAYS 90
```

Modify active user parameters to match:

```
# chage --maxdays 90 <user>
```

7.1.2 Set Password Change Minimum Number of Days (Scored)

Profile Applicability:

- Level 1

Description:

The `PASS_MIN_DAYS` parameter in `/etc/login.defs` allows an administrator to prevent users from changing their password until a minimum number of days have passed since the last time the user changed their password. It is recommended that `PASS_MIN_DAYS` parameter be set to 7 or more days.

Rationale:

By restricting the frequency of password changes, an administrator can prevent users from repeatedly changing their password in an attempt to circumvent password reuse controls.

Audit:

```
# grep PASS_MIN_DAYS /etc/login.defs
PASS_MAX_DAYS 7
# chage --list <user>
Minimum number of days between password change:    7
```

Remediation:

Set the `PASS_MIN_DAYS` parameter to 7 in `/etc/login.defs`:

```
PASS_MIN_DAYS 7
```
Modify active user parameters to match:

```
# chage --mindays 7 <user>
```

7.1.3 Set Password Expiring Warning Days (Scored)

Profile Applicability:

- Level 1

Description:

The `PASS_WARN_AGE` parameter in `/etc/login.defs` allows an administrator to notify users that their password will expire in a defined number of days. It is recommended that the `PASS_WARN_AGE` parameter be set to 7 or more days.

Rationale:

Providing an advance warning that a password will be expiring gives users time to think of a secure password. Users caught unaware may choose a simple password or write it down where it may be discovered.

Audit:

```
# grep PASS_WARN_AGE /etc/login.defs
PASS_WARN_AGE 7
# chage --list <user>
Number of days of warning before password expires:    7
```

Remediation:

Set the `PASS_WARN_AGE` parameter to 7 in `/etc/login.defs`:

```
PASS_WARN_AGE 7
```

Modify active user parameters to match:

```
# chage --warndays 7 <user>
```

7.2 Disable System Accounts (Scored)

Profile Applicability:

- Level 1

Description:

There are a number of accounts provided with the Red Hat that are used to manage applications and are not intended to provide an interactive shell.

Rationale:

It is important to make sure that accounts that are not being used by regular users are locked to prevent them from being used to provide an interactive shell. By default, Red Hat sets the password field for these accounts to an invalid string, but it is also recommended that the shell field in the password file be set to `/sbin/nologin`. This prevents the account from potentially being used to run any commands.

Audit:

Run the following script to determine if any system accounts can be accessed:

```
egrep -v "^\+" /etc/passwd | awk -F: '($1!="root" && $1!="sync" && $1!="shutdown" &&
$1!="halt" && $3<1000 && $7!="/sbin/nologin") {print}'
```

There should be no results returned.

Remediation:

Accounts that have been locked are prohibited from running commands on the system. Such accounts are not able to login to the system nor are they able to use scheduled execution facilities such as cron. To make sure system accounts cannot be accessed, using the following script:

```
#!/bin/bash
for user in `awk -F: '($3 < 1000) {print $1 }' /etc/passwd`; do
   if [ $user != "root" ]
   then
      /usr/sbin/usermod -L $user
      if [ $user != "sync" ] && [ $user != "shutdown" ] && [ $user != "halt" ]
      then
         /usr/sbin/usermod -s /sbin/nologin $user
      fi
   fi
done
```

7.3 Set Default Group for root Account (Scored)

Profile Applicability:

- Level 1

Description:

The usermod command can be used to specify which group the root user belongs to. This affects permissions of files that are created by the root user.

Rationale:

Using GID 0 for the *root* account helps prevent *root*-owned files from accidentally becoming accessible to non-privileged users.

Audit:

```
# grep "^root:" /etc/passwd | cut -f4 -d:
0
```

Remediation:

```
# usermod -g 0 root
```

7.4 Set Default umask for Users (Scored)

Profile Applicability:

- Level 1

Description:

The default `umask` determines the permissions of files created by users. The user creating the file has the discretion of making their files and directories readable by others via the chmod command. Users who wish to allow their files and directories to be readable by others by default may choose a different default umask by inserting the `umask` command into the standard shell configuration files (`.profile`, `.cshrc`, etc.) in their home directories.

Rationale:

Setting a very secure default value for `umask` ensures that users make a conscious choice about their file permissions. A default `umask` setting of `077` causes files and directories created by users to not be readable by any other user on the system. A `umask` of `027` would make files and directories readable by users in the same Unix group, while a `umask` of `022` would make files readable by every user on the system.

Note: The directives in this section apply to bash and shell. If other shells are supported on the system, it is recommended that their configuration files also are checked.

Audit:

```
# grep "^umask 077" /etc/bashrc
umask 077
# grep "^umask 077" /etc/profile.d/*
umask 077
```

Remediation:

Edit the /etc/bashrc and `/etc/profile.d/cis.sh` files (and the appropriate files for any other shell supported on your system) and add the following the UMASK parameter as shown:

```
umask 77
```

7.5 Lock Inactive User Accounts (Scored)

Profile Applicability:

- Level 1

Description:

User accounts that have been inactive for over a given period of time can be automatically disabled. It is recommended that accounts that are inactive for 35 or more days be disabled.

Rationale:

Inactive accounts pose a threat to system security since the users are not logging in to notice failed login attempts or other anomalies.

Audit:

```
# useradd -D | grep INACTIVE
```

Remediation:

```
# useradd -D -f 35
```

8 Warning Banners

Presenting a warning message prior to the normal user login may assist the prosecution of trespassers on the computer system. Changing some of these login banners also has the side effect of hiding OS version information and other detailed system information from attackers attempting to target specific exploits at a system.

Guidelines published by the US Department of Defense require that warning messages include at least the name of the organization that owns the system, the fact that the system is subject to monitoring and that such monitoring is in compliance with local statutes, and that use of the system implies consent to such monitoring. It is important that the organization's legal counsel review the content of all messages before any system modifications are made, as these warning messages are inherently site-specific. More information (including citations of relevant case law) can be found at http://www.justice.gov/criminal/cybercrime/

Note: The text provided in the remediation actions for these items is intended as an example only. Please edit to include the specific text for your organization as approved by your legal department.

8.1 Set Warning Banner for Standard Login Services (Scored)

Profile Applicability:

- Level 1

Description:

The contents of the `/etc/issue` file are displayed prior to the login prompt on the system's console and serial devices, and also prior to logins via telnet. The contents of the `/etc/motd` file is generally displayed after all successful logins, no matter where the user is logging in from, but is thought to be less useful because it only provides notification to the user after the machine has been accessed.

Rationale:

Warning messages inform users who are attempting to login to the system of their legal status regarding the system and must include the name of the organization that owns the system and any monitoring policies that are in place. Consult with your organization's legal counsel for the appropriate wording for your specific organization.

Audit:

Run the following commands and ensure that the files exist and have the correct permissions.

```
# /bin/ls -l /etc/motd
-rw-r--r-- 1 root root 2055 Jan 30 16:30 /etc/motd

# ls /etc/issue
-rw-r--r-- 1 root root 2055 Jan 30 16:30 /etc/issue

# ls /etc/issue.net
-rw-r--r-- 1 root root 2055 Jan 30 16:30 /etc/issue.net
```

The commands above simply validate the presence of the `/etc/motd`, `/etc/issue` and `/etc/issue.net` files. Review the contents of these files with the "`cat`" command and ensure that it is appropriate for your organization.

Remediation:

```
# touch /etc/motd
# echo "Authorized uses only. All activity may be \
monitored and reported." > /etc/issue
# echo "Authorized uses only. All activity may be \
monitored and reported." > /etc/issue.net

# chown root:root /etc/motd
# chmod 644 /etc/motd
# chown root:root /etc/issue
# chmod 644 /etc/issue
# chown root:root /etc/issue.net
# chmod 644 /etc/issue.net
```

8.2 Remove OS Information from Login Warning Banners (Scored)

Profile Applicability:

- Level 1

Description:

Unix-based systems have typically displayed information about the OS release and patch level upon logging in to the system. This information can be useful to developers who are developing software for a particular OS platform. If `mingetty(8)` supports the following options, they display operating system information:

`\m` - machine architecture (`uname -m`)
`\r` - operating system release (`uname -r`)
`\s` - operating system name
`\v` - operating system version (`uname -v`)

Rationale:

Displaying OS and patch level information in login banners also has the side effect of providing detailed system information to attackers attempting to target specific exploits of a system. Authorized users can easily get this information by running the "`uname -a`" command once they have logged in.

Audit:

Perform the following commands to check if OS information is set to be displayed in the system login banners:

```
# egrep '(\\v|\\r|\\m|\\s)' /etc/issue
# egrep '(\\v|\\r|\\m|\\s)' /etc/motd
# egrep'(\\v|\\r|\\m|\\s)' /etc/issue.net
```

Remediation:

Edit the `/etc/motd`, `/etc/issue` and `/etc/issue.net` files and remove any lines containing `\m`, `\r`, `\s` or `\v`.

8.3 Set GNOME Warning Banner (Not Scored)

Profile Applicability:

- Level 1

Description:

The GNOME Display Manager is used for login session management. See the manual page `gdm(1)` for more information. The remediation action for this item sets a warning message for GDM users before they log in.

Rationale:

Warning messages inform users who are attempting to login to the system of their legal status regarding the system and must include the name of the organization that owns the system and any monitoring policies that are in place. Consult with your organization's legal counsel for the appropriate wording for your specific organization.

Audit:

Verify that a message is shown when logging in via the GNOME Display Manager.

Remediation:

Edit the `/etc.d/dconf/db/gdm.d/01-banner-message` file as to include the following:

```
[org/gnome/login-screen]
banner-message-enable=true
banner-message-text='Type the banner message here'
```

Run the following command to update dconf:

```
dconf update
```

Restart gdm for these settings to take effect.

9 System Maintenance

No matter how securely a system has been installed and hardened, administrator and user activity over time can introduce security exposures. The section describes tasks to be performed on a regular, ongoing basis - perhaps in an automated fashion via the cron utility.

Note: unlike other sections, the items in this section specify an Audit action followed by a Remediation action since it is necessary to determine what the current setting is before determining remediation measures, which will vary depending on the site's policy.

9.1 Verify System File Permissions

9.1.1 Verify System File Permissions (Not Scored)

Profile Applicability:

- Level 2

Description:

The RPM package manager has a number of useful options. One of these, the `-v` (or `–verify`) option, can be used to verify that system packages are correctly installed. The `-V` option can be used to verify a particular package or to verify all system packages (`-Va`). If no output is returned, the package is installed correctly. The following table describes the meaning of output from the verify option:

```
Code Meaning
S File size differs.
M File mode differs (includes permissions and file type).
5 The MD5 checksum differs.
D The major and minor version numbers differ on a device file.
L A mismatch occurs in a link.
U The file ownership differs.
G The file group owner differs.
T The file time (mtime) differs.
```

The `rpm -qf` command can be used to determine which package a particular file belongs to. For example the following command determines which package the `/etc/passwd` file belongs to:

```
# rpm -qf /etc/passwd
setup-2.5.58-7.el5
```

To verify the settings for the package that controls the `/etc/passwd` file, run the following:

```
# rpm -V setup-2.5.58-7.el5
.M...... c /etc/passwd
S.5....T c /etc/printcap
```

Note that you can feed the output of the `rpm -qf` command to the `rpm -V` command:

```
# rpm -V `rpm -qf /etc/passwd`
.M...... c /etc/passwd
S.5....T c /etc/printcap
```

Rationale:

It is important to confirm that packaged system files and directories are maintained with the permissions they were intended to have from the OS vendor.

Note: Since packages and important files may change with new updates and releases, it is recommended to verify everything, not just a finite list of files. This can be a time consuming task and is therefore not a scored benchmark item, but is provided for those interested in additional security measures.

Audit:

Run the following command to review all installed packages. Note that this may be very time consuming and may be best scheduled via the `cron` utility. It is recommended that the output of this command be redirected to a file that can be reviewed later.

```
# rpm -Va --nomtime --nosize --nomd5 --nolinkto > <filename>
```

Remediation:

Correct any discrepancies found and rerun the command until output is clean or risk is mitigated or accepted.

References:

1. http://docs.fedoraproject.org/en-US/Fedora_Draft_Documentation/0.1/html/RPM_Guide/index.html

9.1.2 Verify Permissions on /etc/passwd (Scored)

Profile Applicability:

- Level 1

Description:

The `/etc/passwd` file contains user account information that is used by many system utilities and therefore must be readable for these utilities to operate.

Rationale:

It is critical to ensure that the `/etc/passwd` file is protected from unauthorized write access. Although it is protected by default, the file permissions could be changed either inadvertently or through malicious actions.

Audit:

Run the following command to determine the permissions on the `/etc/passwd` file.

```
# /bin/ls -l /etc/passwd
-rw-r--r-- 1 root root 2055 Jan 30 16:30 /etc/passwd
```

Remediation:

If the permissions of the `/etc/passwd` file are incorrect, run the following command to correct them:

```
# /bin/chmod 644 /etc/passwd
```

9.1.3 Verify Permissions on /etc/shadow (Scored)

Profile Applicability:

- Level 1

Description:

The `/etc/shadow` file is used to store the information about user accounts that is critical to the security of those accounts, such as the hashed password and other security information.

Rationale:

If attackers can gain read access to the `/etc/shadow` file, they can easily run a password cracking program against the hashed password to break it. Other security information that is stored in the `/etc/shadow` file (such as expiration) could also be useful to subvert the user accounts.

Audit:

Run the following command to determine the permissions on the `/etc/shadow` file.

```
# /bin/ls -l /etc/shadow
---------- 1 root root 633 Sep 23 2002 /etc/shadow
```

Remediation:

If the permissions of the `/etc/shadow` file are incorrect, run the following command to correct them:

```
# /bin/chmod 000 /etc/shadow
```

9.1.4 Verify Permissions on /etc/gshadow (Scored)

Profile Applicability:

- Level 1

Description:

The `/etc/gshadow` file contains information about group accounts that is critical to the security of those accounts, such as the hashed password and other security information.

Rationale:

If attackers can gain read access to the `/etc/gshadow` file, they can easily run a password cracking program against the hashed password to break it. Other security information that is stored in the `/etc/gshadow` file (such as expiration) could also be useful to subvert the group accounts.

Audit:

Run the following command to determine the permissions on the `/etc/gshadow` file.

```
# /bin/ls -l /etc/gshadow
---------- 1 root root 633 Sep 23 2002 /etc/gshadow
```

Remediation:

If the permissions of the `/etc/gshadow` file are incorrect, run the following command to correct them:

```
# /bin/chmod 000 /etc/gshadow
```

9.1.5 Verify Permissions on /etc/group (Scored)

Profile Applicability:

- Level 1

Description:

The `/etc/group` file contains a list of all the valid groups defined in the system. The command below allows read/write access for root and read access for everyone else.

Rationale:

The `/etc/group` file needs to be protected from unauthorized changes by non-privileged users, but needs to be readable as this information is used with many non-privileged programs.

Audit:

Run the following command to determine the permissions on the `/etc/group` file.

```
# /bin/ls -l /etc/group
-rw-r--r-- 1 root root 762 Sep 23 002 /etc/group
```

Remediation:

If the permissions of the `/etc/group` file are incorrect, run the following command to correct them:

```
# /bin/chmod 644 /etc/group
```

9.1.6 Verify User/Group Ownership on /etc/passwd (Scored)

Profile Applicability:

- Level 1

Description:

The `/etc/passwd` file contains a list of all the valid userIDs defined in the system, but not the passwords. The command below sets the owner and group of the file to root.

Rationale:

The `/etc/passwd` file needs to be protected from unauthorized changes by non-privileged users, but needs to be readable as this information is used with many non-privileged programs.

Audit:

Run the following command to determine the user and group ownership on the `/etc/passwd` file.

```
# /bin/ls -l /etc/passwd
-rw-r--r-- 1 root root 762 Sep 23 002 /etc/passwd
```

Remediation:

If the user and group ownership of the `/etc/passwd` file are incorrect, run the following command to correct them:

```
# /bin/chown root:root /etc/passwd
```

9.1.7 Verify User/Group Ownership on /etc/shadow (Scored)

Profile Applicability:

- Level 1

Description:

The `/etc/shadow` file contains the one-way cipher text passwords for each user defined in the `/etc/passwd` file. The command below sets the user and group ownership of the file to root.

Rationale:

If attackers can gain read access to the `/etc/shadow` file, they can easily run a password cracking program against the hashed password to break it. Other security information that

is stored in the `/etc/shadow` file (such as expiration) could also be useful to subvert the user accounts.

Audit:

Run the following command to determine the permissions on the `/etc/shadow` file.

```
# /bin/ls -l /etc/shadow
---------- 1 root root 762 Sep 23 2002 /etc/shadow
```

Remediation:

If the ownership of the `/etc/shadow` file are incorrect, run the following command to correct them:

```
# /bin/chown root:root /etc/shadow
```

9.1.8 Verify User/Group Ownership on /etc/gshadow (Scored)

Profile Applicability:

- Level 1

Description:

The `/etc/gshadow` file contains information about group accounts that is critical to the security of those accounts, such as the hashed password and other security information.

Rationale:

If attackers can gain read access to the `/etc/gshadow` file, they can easily run a password cracking program against the hashed password to break it. Other security information that is stored in the `/etc/gshadow` file (such as expiration) could also be useful to subvert the group accounts.

Audit:

Run the following command to determine the permissions on the `/etc/gshadow` file.

```
# /bin/ls -l /etc/gshadow
---------- 1 root root 633 Sep 23 2002 /etc/gshadow
```

Remediation:

If the ownership of the `/etc/gshadow` file are incorrect, run the following command to correct them:

```
# /bin/chown root:root /etc/gshadow
```

9.1.9 Verify User/Group Ownership on /etc/group (Scored)

Profile Applicability:

• Level 1

Description:

The `/etc/group` file contains a list of all the valid groups defined in the system. The command below allows read/write access for root and read access for everyone else.

Rationale:

The `/etc/group` file needs to be protected from unauthorized changes by non-privileged users, but needs to be readable as this information is used with many non-privileged programs.

Audit:

Run the following command to determine the permissions on the `/etc/group` file.

```
# /bin/ls -l /etc/group
-rw-r--r-- 1 root root 762 Sep 23 002 /etc/group
```

Remediation:

If the ownership of the `/etc/group` file are incorrect, run the following command to correct them:

```
# /bin/chown root:root /etc/group
```

9.1.10 Find World Writable Files (Not Scored)

Profile Applicability:

• Level 1

Description:

Unix-based systems support variable settings to control access to files. World writable files are the least secure. See the `chmod(2)` man page for more information.

Rationale:

Data in world-writable files can be modified and compromised by any user on the system. World writable files may also indicate an incorrectly written script or program that could potentially be the cause of a larger compromise to the system's integrity.

Audit:

```
#!/bin/bash
df --local -P | awk {'if (NR!=1) print $6'} | xargs -I '{}' find '{}' -xdev -type f -
perm -0002
```

Remediation:

Removing write access for the "other" category (chmod o-w *<filename>)* is advisable, but always consult relevant vendor documentation to avoid breaking any application dependencies on a given file.

9.1.11 Find Un-owned Files and Directories (Scored)

Profile Applicability:

- Level 1

Description:

Sometimes when administrators delete users from the password file they neglect to remove all files owned by those users from the system.

Rationale:

A new user who is assigned the deleted user's user ID or group ID may then end up "owning" these files, and thus have more access on the system than was intended.

Audit:

```
#!/bin/bash
df --local -P | awk {'if (NR!=1) print $6'} | xargs -I '{}' find '{}' -xdev -nouser -
ls
```

Remediation:

Locate files that are owned by users or groups not listed in the system configuration files, and reset the ownership of these files to some active user on the system as appropriate.

9.1.12 Find Un-grouped Files and Directories (Scored)

Profile Applicability:

- Level 1

Description:

Sometimes when administrators delete users from the password file they neglect to remove all files owned by those users from the system.

Rationale:

A new user who is assigned the deleted user's user ID or group ID may then end up "owning" these files, and thus have more access on the system than was intended.

Audit:

```
#!/bin/bash
df --local -P | awk {'if (NR!=1) print $6'} | xargs -I '{}' find '{}' -xdev -nogroup -ls
```

Remediation:

Locate files that are owned by users or groups not listed in the system configuration files, and reset the ownership of these files to some active user on the system as appropriate.

9.1.13 Find SUID System Executables (Not Scored)

Profile Applicability:

- Level 1

Description:

The owner of a file can set the file's permissions to run with the owner's or group's permissions, even if the user running the program is not the owner or a member of the group. The most common reason for a SUID program is to enable users to perform functions (such as changing their password) that require root privileges.

Rationale:

There are valid reasons for SUID programs, but it is important to identify and review such programs to ensure they are legitimate.

Audit:

```
#!/bin/bash
df --local -P | awk {'if (NR!=1) print $6'} | xargs -I '{}' find '{}' -xdev -type f -perm -4000 -print
```

Remediation:

Ensure that no rogue set-UID programs have been introduced into the system. Review the files returned by the action in the Audit section and confirm the integrity of these binaries as described below:

```
# rpm -V `rpm -qf /usr/bin/sudo`
.......T /usr/bin/sudo
SM5....T /usr/bin/sudoedit
```

9.1.14 Find SGID System Executables (Not Scored)

Profile Applicability:

- Level 1

Description:

The owner of a file can set the file's permissions to run with the owner's or group's permissions, even if the user running the program is not the owner or a member of the group. The most common reason for a SGID program is to enable users to perform functions (such as changing their password) that require root privileges.

Rationale:

There are valid reasons for SGID programs, but it is important to identify and review such programs to ensure they are legitimate. Review the files returned by the action in the audit section and check to see if system binaries have a different md5 checksum than what from the package. This is an indication that the binary may have been replaced. The following is an example of checking the "sudo" executable:

```
# rpm -V `rpm -qf /usr/bin/sudo`
.......T /usr/bin/sudo
SM5....T /usr/bin/sudoedit
```

Audit:

```
#!/bin/bash
df --local -P | awk {'if (NR!=1) print $6'} | xargs -I '{}' find '{}' -xdev -type f -
perm -2000 -print
```

Remediation:

Ensure that no rogue set-GID programs have been introduced into the system

```
# /bin/rpm -V `/bin/rpm -qf sudo`
```

9.2 Review User and Group Settings

This section provides guidance on securing aspects of the users and groups.

9.2.1 Ensure Password Fields are Not Empty (Scored)

Profile Applicability:

- Level 1

Description:

An account with an empty password field means that anybody may log in as that user without providing a password.

Rationale:

All accounts must have passwords or be locked to prevent the account from being used by an unauthorized user.

Audit:

Run the following command and verify that no output is returned:

```
# /bin/cat /etc/shadow | /bin/awk -F: '($2 == "" ) { print $1 " does not have a
password "}'
```

Remediation:

If any accounts in the `/etc/shadow` file do not have a password, run the following command to lock the account until it can be determined why it does not have a password:

```
# /usr/bin/passwd -l <username>
```

Also, check to see if the account is logged in and investigate what it is being used for to determine if it needs to be forced off.

9.2.2 Verify No Legacy "+" Entries Exist in /etc/passwd File (Scored)

Profile Applicability:

- Level 1

Description:

The character + in various files used to be markers for systems to insert data from NIS maps at a certain point in a system configuration file. These entries are no longer required on RHEL7 systems, but may exist in files that have been imported from other platforms.

Rationale:

These entries may provide an avenue for attackers to gain privileged access on the system.

Audit:

Run the following command and verify that no output is returned:

```
# /bin/grep '^+:' /etc/passwd
```

Remediation:

Delete these entries if they exist.

9.2.3 Verify No Legacy "+" Entries Exist in /etc/shadow File (Scored)

Profile Applicability:

- Level 1

Description:

The character + in various files used to be markers for systems to insert data from NIS maps at a certain point in a system configuration file. These entries are no longer required on RHEL7 systems, but may exist in files that have been imported from other platforms.

Rationale:

These entries may provide an avenue for attackers to gain privileged access on the system.

Audit:

Run the following command and verify that no output is returned:

```
# /bin/grep '^+:' /etc/shadow
```

Remediation:

Delete these entries if they exist.

9.2.4 Verify No Legacy "+" Entries Exist in /etc/group File (Scored)

Profile Applicability:

- Level 1

Description:

The character + in various files used to be markers for systems to insert data from NIS maps at a certain point in a system configuration file. These entries are no longer required on RHEL7 systems, but may exist in files that have been imported from other platforms.

Rationale:

These entries may provide an avenue for attackers to gain privileged access on the system.

Audit:

Run the following command and verify that no output is returned:

```
# /bin/grep '^+:' /etc/group
```

Remediation:

Delete these entries if they exist.

9.2.5 Verify No UID 0 Accounts Exist Other Than root (Scored)

Profile Applicability:

- Level 1

Description:

Any account with UID 0 has superuser privileges on the system.

Rationale:

This access must be limited to only the default `root` account and only from the system console. Administrative access must be through an unprivileged account using an approved mechanism as noted in Item 7.5 Restrict root Login to System Console.

Audit:

Run the following command and verify that only the word "root" is returned:

```
# /bin/cat /etc/passwd | /bin/awk -F: '($3 == 0) { print $1 }'
root
```

Remediation:

Delete any other entries that are displayed.

9.2.6 Ensure root PATH Integrity (Scored)

Profile Applicability:

- Level 1

Description:

The `root` user can execute any command on the system and could be fooled into executing programs unintentionally if the `PATH` is not set correctly.

Rationale:

Including the current working directory (.) or other writable directory in `root`'s executable path makes it likely that an attacker can gain superuser access by forcing an administrator operating as `root` to execute a Trojan horse program.

Audit:

```
#!/bin/bash
if [ "`echo $PATH | /bin/grep :: `" != "" ]; then
    echo "Empty Directory in PATH (::)"
fi

if [ "`echo $PATH | bin/grep :$`"  != "" ]; then
    echo "Trailing : in PATH"
fi

p=`echo $PATH | /bin/sed -e 's/::/:/' -e 's/:$//' -e 's/:/ /g'`
set -- $p
while [ "$1" != "" ]; do
    if [ "$1" = "." ]; then
        echo "PATH contains ."
        shift
        continue
    fi
    if [ -d $1 ]; then
        dirperm=`/bin/ls -ldH $1 | /bin/cut -f1 -d" "`
        if [ `echo $dirperm | /bin/cut -c6 ` != "-" ]; then
            echo "Group Write permission set on directory $1"
        fi
        if [ `echo $dirperm | /bin/cut -c9 ` != "-" ]; then
            echo "Other Write permission set on directory $1"
        fi
            dirown=`ls -ldH $1 | awk '{print $3}'`
          if [ "$dirown" != "root" ] ; then
            echo $1 is not owned by root
             fi
    else
            echo $1 is not a directory
```

```
        fi
    shift
done
```

Remediation:

Correct or justify any items discovered in the Audit step.

9.2.7 Check Permissions on User Home Directories (Scored)

Profile Applicability:

- Level 1

Description:

While the system administrator can establish secure permissions for users' home directories, the users can easily override these.

Rationale:

Group or world-writable user home directories may enable malicious users to steal or modify other users' data or to gain another user's system privileges.

Audit:

```
#!/bin/bash
for dir in `/bin/cat /etc/passwd  | /bin/egrep -v '(root|halt|sync|shutdown)' |\
    /bin/awk -F: '($8 == "PS" && $7 != "/sbin/nologin") { print $6 }'`; do
        dirperm=`/bin/ls -ld $dir | /bin/cut -f1 -d" "`
        if [ `echo $dirperm | /bin/cut -c6 ` != "-" ]; then
            echo "Group Write permission set on directory $dir"
        fi
        if [ `echo $dirperm | /bin/cut -c8 ` != "-" ]; then
            echo "Other Read permission set on directory $dir"

        fi

        if [ `echo $dirperm | /bin/cut -c9 ` != "-" ]; then
            echo "Other Write permission set on directory $dir"
        fi
        if [ `echo $dirperm | /bin/cut -c10 ` != "-" ]; then
            echo "Other Execute permission set on directory $dir"
        fi
done
```

Remediation:

Making global modifications to user home directories without alerting the user community can result in unexpected outages and unhappy users. Therefore, it is recommended that a

monitoring policy be established to report user file permissions and determine the action to be taken in accordance with site policy.

9.2.8 Check User Dot File Permissions (Scored)

Profile Applicability:

- Level 1

Description:

While the system administrator can establish secure permissions for users' "dot" files, the users can easily override these.

Rationale:

Group or world-writable user configuration files may enable malicious users to steal or modify other users' data or to gain another user's system privileges.

Audit:

```
#!/bin/bash
for dir in `/bin/cat /etc/passwd | /bin/egrep -v '(root|sync|halt|shutdown)' |
/bin/awk -F: '($7 != "/sbin/nologin") { print $6 }'`; do
    for file in $dir/.[A-Za-z0-9]*; do

        if [ ! -h "$file" -a -f "$file" ]; then
            fileperm=`/bin/ls -ld $file | /bin/cut -f1 -d" "`

            if [ `echo $fileperm | /bin/cut -c6 ` != "-" ]; then
                echo "Group Write permission set on file $file"
            fi
            if [ `echo $fileperm | /bin/cut -c9 ` != "-" ]; then
                echo "Other Write permission set on file $file"
            fi
        fi

    done

done
```

Remediation:

Making global modifications to users' files without alerting the user community can result in unexpected outages and unhappy users. Therefore, it is recommended that a monitoring policy be established to report user dot file permissions and determine the action to be taken in accordance with site policy.

9.2.9 Check Permissions on User .netrc Files (Scored)

Profile Applicability:

- Level 1

Description:

While the system administrator can establish secure permissions for users' `.netrc` files, the users can easily override these.

Rationale:

`.netrc` files may contain unencrypted passwords that may be used to attack other systems.

Audit:

```
#!/bin/bash
for dir in `/bin/cat /etc/passwd | /bin/egrep -v '(root|sync|halt|shutdown)' |\
    /bin/awk -F: '($7 != "/sbin/nologin") { print $6 }'`; do
    for file in $dir/.netrc; do
        if [ ! -h "$file" -a -f "$file" ]; then
            fileperm=`/bin/ls -ld $file | /bin/cut -f1 -d" "`
            if [ `echo $fileperm | /bin/cut -c5 ` != "-" ]
            then
                echo "Group Read set on $file"
            fi
            if [ `echo $fileperm | /bin/cut -c6 ` != "-" ]
            then
                echo "Group Write set on $file"
            fi
            if [ `echo $fileperm | /bin/cut -c7 ` != "-" ]
            then
                echo "Group Execute set on $file"
            fi
            if [ `echo $fileperm | /bin/cut -c8 ` != "-" ]
            then
                echo "Other Read  set on $file"
            fi
            if [ `echo $fileperm | /bin/cut -c9 ` != "-" ]
            then
                echo "Other Write set on $file"
            fi
            if [ `echo $fileperm | /bin/cut -c10 ` != "-" ]
            then
                echo "Other Execute set on $file"
            fi
        fi
    done
done
```

Remediation:

Making global modifications to users' files without alerting the user community can result in unexpected outages and unhappy users. Therefore, it is recommended that a monitoring

policy be established to report user `.netrc` file permissions and determine the action to be taken in accordance with site policy.

9.2.10 Check for Presence of User .rhosts Files (Scored)

Profile Applicability:

- Level 1

Description:

While no `.rhosts` files are shipped with RHEL7, users can easily create them.

Rationale:

This action is only meaningful if `.rhosts` support is permitted in the file `/etc/pam.conf`. Even though the `.rhosts` files are ineffective if support is disabled in `/etc/pam.conf`, they may have been brought over from other systems and could contain information useful to an attacker for those other systems.

Audit:

```
#!/bin/bash
for dir in `/bin/cat /etc/passwd | /bin/egrep -v '(root|halt|sync|shutdown)' |\
    /bin/awk -F: '($7 != "/sbin/nologin") { print $6 }'`; do
    for file in $dir/.rhosts; do
        if [ ! -h "$file" -a -f "$file" ]; then
            echo ".rhosts file in $dir"
        fi    done
done
```

Remediation:

If any users have `.rhosts` files determine why they have them.

9.2.11 Check Groups in /etc/passwd (Scored)

Profile Applicability:

- Level 1

Description:

Over time, system administration errors and changes can lead to groups being defined in `/etc/passwd` but not in `/etc/group`.

Rationale:

Groups defined in the `/etc/passwd` file but not in the `/etc/group` file pose a threat to system security since group permissions are not properly managed.

Audit:

Create a script as shown below and run it:

```
#!/bin/bash

for i in $(cut -s -d: -f4 /etc/passwd | sort -u ); do
grep -q -P "^.*?:x:$i:" /etc/group
if [ $? -ne 0 ]; then
echo "Group $i is referenced by /etc/passwd but does not exist in /etc/group"
fi
done
```

Remediation:

Analyze the output of the Audit step above and perform the appropriate action to correct any discrepancies found.

9.2.12 Check That Users Are Assigned Valid Home Directories (Scored)

Profile Applicability:

- Level 1

Description:

Users can be defined in `/etc/passwd` without a home directory or with a home directory does not actually exist.

Rationale:

If the user's home directory does not exist or is unassigned, the user will be placed in "/" and will not be able to write any files or have local environment variables set.

Audit:

This script checks to make sure that home directories assigned in the `/etc/passwd` file exist.

```
#!/bin/bash

cat /etc/passwd | awk -F: '{ print $1 " " $3 " " $6 }' | while read user uid dir; do
if [ $uid -ge 1000 -a ! -d "$dir" -a $user != "nfsnobody" ]; then
echo "The home directory ($dir) of user $user does not exist."
fi
done
```

Remediation:

If any users' home directories do not exist, create them and make sure the respective user owns the directory. Users without assigned should be removed or assigned a home directory as appropriate.

9.2.13 Check User Home Directory Ownership (Scored)

Profile Applicability:

- Level 1

Description:

The user home directory is space defined for the particular user to set local environment variables and to store personal files.

Rationale:

Since the user is accountable for files stored in the user home directory, the user must be the owner of the directory.

Audit:

This script checks to make sure users own the home directory they are assigned to in the `/etc/passwd` file.

```
#!/bin/bash

cat /etc/passwd | awk -F: '{ print $1 " " $3 " " $6 }' | while read user uid dir; do
if [ $uid -ge 1000 -a -d "$dir" -a $user != "nfsnobody" ]; then
owner=$(stat -L -c "%U" "$dir")
if [ "$owner" != "$user" ]; then
echo "The home directory ($dir) of user $user is owned by $owner."
fi
fi
done
```

Remediation:

Change the ownership any home directories that are not owned by the defined user to the correct user.

9.2.14 Check for Duplicate UIDs (Scored)

Profile Applicability:

- Level 1

Description:

Although the `useradd` program will not let you create a duplicate User ID (UID), it is possible for an administrator to manually edit the `/etc/passwd` file and change the UID field.

Rationale:

Users must be assigned unique UIDs for accountability and to ensure appropriate access protections.

Audit:

This script checks to make sure all UIDs in the `/etc/passwd` file are unique.

```bash
#!/bin/bash

echo "The Output for the Audit of Control 9.2.15 - Check for Duplicate UIDs is"
/bin/cat /etc/passwd | /bin/cut -f3 -d":" | /bin/sort -n | /usr/bin/uniq -c |\
    while read x ; do
    [ -z "${x}" ] && break
    set - $x
    if [ $1 -gt 1 ]; then
        users=`/bin/gawk -F: '($3 == n) { print $1 }' n=$2 \
            /etc/passwd | /usr/bin/xargs`
        echo "Duplicate UID ($2): ${users}"
    fi
done
```

Remediation:

Based on the results of the script, establish unique UIDs and review all files owned by the shared UID to determine which UID they are supposed to belong to.

9.2.15 Check for Duplicate GIDs (Scored)

Profile Applicability:

- Level 1

Description:

Although the `groupadd` program will not let you create a duplicate Group ID (GID), it is possible for an administrator to manually edit the `/etc/group` file and change the GID field.

Rationale:

User groups must be assigned unique GIDs for accountability and to ensure appropriate access protections.

Note: In the case of extremely large groups it can become necessary to split a GID across group names due to character limits per line. Any such instances should be carefully audited, unless absolutely necessary such instances should be avoided.

Audit:

This script checks to make sure all GIDs in the `/etc/group` file are unique. You can also use the `/usr/sbin/grpck` command to check for other inconsistencies in the `/etc/group` file.

```bash
#!/bin/bash

echo "The Output for the Audit of Control 9.2.16 - Check for Duplicate GIDs is"

/bin/cat /etc/group | /bin/cut -f3 -d":" | /bin/sort -n | /usr/bin/uniq -c |\
    while read x ; do
    [ -z "${x}" ] && break
    set - $x
    if [ $1 -gt 1 ]; then
        grps=`/bin/gawk -F: '($3 == n) { print $1 }' n=$2 \
            /etc/group | xargs`
        echo "Duplicate GID ($2): ${grps}"
    fi
done
```

Remediation:

Based on the results of the script, establish unique GIDs and review all files owned by the shared GID to determine which group they are supposed to belong to.

9.2.16 Check That Reserved UIDs Are Assigned to System Accounts (Scored)

Profile Applicability:

- Level 1

Description:

Traditionally, UNIX systems establish "reserved" UIDs (0-999 range) that are intended for system accounts.

Rationale:

If a user is assigned a UID that is in the reserved range, even if it is not presently in use, security exposures can arise if a subsequently installed application uses the same UID.

Audit:

This script checks to make sure that "reserved" UIDs (0-499 range) are not assigned to non-system (default) accounts.

```bash
#!/bin/bash

defUsers="root bin daemon adm lp sync shutdown halt mail news uucp operator games
gopher ftp nobody nscd vcsa rpc mailnull smmsp pcap ntp dbus avahi sshd rpcuser
nfsnobody haldaemon avahi-autoipd distcache apache oprofile webalizer dovecot squid
named xfs gdm sabayon usbmuxd rtkit abrt saslauth pulse postfix tcpdump"
/bin/cat /etc/passwd |\
    /bin/awk -F: '($3 < 1000) { print $1" "$3 }' |\
    while read user uid; do
        found=0
        for tUser in ${defUsers}
        do
            if [ ${user} = ${tUser} ]; then
                found=1
            fi
        done
        if [ $found -eq 0 ]; then
            echo "User $user has a reserved UID ($uid)."
        fi
    done
```

Remediation:

Based on the results of the script, change any UIDs that are in the reserved range to one that is in the user range. Review all files owned by the reserved UID to determine which UID they are supposed to belong to.

9.2.17 Check for Duplicate User Names (Scored)

Profile Applicability:

- Level 1

Description:

Although the `useradd` program will not let you create a duplicate user name, it is possible for an administrator to manually edit the `/etc/passwd` file and change the user name.

Rationale:

If a user is assigned a duplicate user name, it will create and have access to files with the first UID for that username in `/etc/passwd`. For example, if "test4" has a UID of 1000 and a subsequent "test4" entry has a UID of 2000, logging in as "test4" will use UID 1000. Effectively, the UID is shared, which is a security problem.

Audit:

This script checks to make sure all user names in the `/etc/passwd` file are unique.

```
#!/bin/bash

echo "The Output for the Audit of Control 9.2.18 - Check for Duplicate User Names is"
cat /etc/passwd | cut -f1 -d":" | /bin/sort -n | /usr/bin/uniq -c |\
    while read x ; do
    [ -z "${x}" ] && break
    set - $x
    if [ $1 -gt 1 ]; then
        uids=`/bin/gawk -F: '($1 == n) { print $3 }' n=$2 \
            /etc/passwd | xargs`
        echo "Duplicate User Name ($2): ${uids}"
    fi
done
```

Remediation:

Based on the results of the script, establish unique user names for the users. File ownerships will automatically reflect the change as long as the users have unique UIDs.

9.2.18 Check for Duplicate Group Names (Scored)

Profile Applicability:

- Level 1

Description:

Although the `groupadd` program will not let you create a duplicate group name, it is possible for an administrator to manually edit the `/etc/group` file and change the group name.

Rationale:

If a group is assigned a duplicate group name, it will create and have access to files with the first GID for that group in `/etc/group`. Effectively, the GID is shared, which is a security problem.

Audit:

This script checks to make sure all group names in the `/etc/group` file are unique.

```
#!/bin/bash

echo "The Output for the Audit of Control 9.2.19 - Check for Duplicate Group Names is"
cat /etc/group | cut -f1 -d":" | /bin/sort -n | /usr/bin/uniq -c |\
    while read x ; do
```

```
    [ -z "${x}" ] && break
    set - $x
    if [ $1 -gt 1 ]; then
        gids=`/bin/gawk -F: '($1 == n) { print $3 }' n=$2 \
            /etc/group | xargs`
        echo "Duplicate Group Name ($2): ${gids}"
    fi
done
```

Remediation:

Based on the results of the script, establish unique names for the user groups. File group ownerships will automatically reflect the change as long as the groups have unique GIDs.

9.2.19 Check for Presence of User .netrc Files (Scored)

Profile Applicability:

- Level 1

Description:

The `.netrc` file contains data for logging into a remote host for file transfers via FTP.

Rationale:

The `.netrc` file presents a significant security risk since it stores passwords in unencrypted form. Even if FTP is disabled, user accounts may have brought over `.netrc` files from other systems which could pose a risk to those systems.

Audit:

```
#!/bin/bash

for dir in `/bin/cat /etc/passwd |\
    /bin/awk -F: '{ print $6 }'`; do
    if [ ! -h "$dir/.netrc" -a -f "$dir/.netrc" ]; then
        echo ".netrc file $dir/.netrc exists"
    fi
done
```

Remediation:

Making global modifications to users' files without alerting the user community can result in unexpected outages and unhappy users. Therefore, it is recommended that a monitoring policy be established to report user `.netrc` files and determine the action to be taken in accordance with site policy.

9.2.20 Check for Presence of User .forward Files (Scored)

Profile Applicability:

- Level 1

Description:

The `.forward` file specifies an email address to forward the user's mail to.

Rationale:

Use of the `.forward` file poses a security risk in that sensitive data may be inadvertently transferred outside the organization. The `.forward` file also poses a risk as it can be used to execute commands that may perform unintended actions.

Audit:

This script checks for the presence of .forward files that may be in violation of the site security policy.

```
#!/bin/bash

for dir in `/bin/cat /etc/passwd |\
/bin/awk -F: '{ print $6 }'`; do
if [ ! -h "$dir/.forward" -a -f "$dir/.forward" ]; then
echo ".forward file $dir/.forward exists"
fi
done
```

Remediation:

Making global modifications to users' files without alerting the user community can result in unexpected outages and unhappy users. Therefore, it is recommended that a monitoring policy be established to report user `.forward` files and determine the action to be taken in accordance with site policy.

Appendix: Change History

Date	Version	Changes for this version
08-04-2014	1.0.0	Initial Release
04-02-2015	1.1.0	Updated 8.3 audit and remediation (Ticket #467)
04-02-2015	1.1.0	Updated 3.2 audit and remediation (Ticket #485)
04-02-2015	1.1.0	Updated 5.2.13-14 audit and remediation (Ticket #489)
04-02-2015	1.1.0	Updated 5.2.12 remediation (Ticket #489)
04-02-2015	1.1.0	Updated 5.2.10-11 description, audit, and remediation (Ticket #489)
04-02-2015	1.1.0	Updated 9.2.16 description and audit (Ticket #489)
04-02-2015	1.1.0	Updated 7.2 audit and remediation (Ticket #489)
04-02-2015	1.1.0	Updated 6.3.1 remediation (Ticket #489)
04-02-2015	1.1.0	Fixed typo in 5.2.17 audit and remediation (Ticket #483)
04-02-2015	1.1.0	Updated 5.2.7 remediation (Ticket #466)
04-02-2015	1.1.0	Updated 1.5.2 title (Ticket #460)
04-02-2015	1.1.0	Fixed typo in 9.2.6 description (Ticket #462)
04-02-2015	1.1.0	Fixed typo in 2.1.12 description (Ticket #475)
04-02-2015	1.1.0	Updated 4.3.1 audit and remediation (Tickets

		#465, #481)
04-02-2015	1.1.0	Fixed typo in 6.3.4 audit and remediation (Ticket #476)
04-02-2015	1.1.0	Updated 6.3.2 recommendation (Tickets #474, #461)
04-02-2015	1.1.0	Updated 5.2.4 audit and remediation (CentOS Ticket #10)
04-02-2015	1.1.0	Updated 1.4.1 title (Ticket #459)