Red Hat Enterprise Linux 5 (RHEL5)

CIS Benchmark Version 1.1

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[CIS RHEL5 Benchmark]
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1 CIS Red Hat Enterprise Linux 5 Benchmark

Introduction

Red Hat Enterprise Linux version 5 (RHEL5) is the new server-class release from Red Hat, Inc, that stabilizes SELinux, has been Common Criteria evaluated at EAL4+ and brings further stability and robustness to the enterprise level with this OS. Security hardening remains a vital element to the defense-in-depth approach for all computing elements within the enterprise. The Center for Internet Security proudly brings the latest consensus-achieved security hardening recommendations in this Benchmark and accompanying scoring tool.

The content and intent of this Benchmark is to drive you, the reader to be more informed in regards to actions necessary for hardening and securing Red Hat Enterprise Linux systems. It is not going to provide non-security hardening information and guidance just for the sake of providing it. Some basics of a particular function might be touched upon, but this is usually for the relevance it directly provides to the security hardening actions at hand.

Feedback is welcome CIS is always interested in receiving information on bugs, detailed error reports as well as specific comments, discussion and even suggestions for improvement. Please forward them to: cis-feedback@cisecurity.org. Include your first/last name and relevant email address. Additionally, a telephone number would be beneficial.

Please enjoy this edition of the Center for Internet Security Benchmark to harden Red Hat Enterprise Linux version 5.

Applying CIS Benchmark Recommendations

Question¹:

*After applying all the recommendations in the Benchmark (and due diligence), is my system "secure"?*

The answer to this question depends on what is meant by "secure". If you're asking whether following the Benchmark eliminates *all* known security vulnerabilities and renders this system *completely* invulnerable to unauthorized access, then the answer has to be an unequivocal "no".

However, carefully following the steps in the Benchmark results in a system which is substantially more reliable and secure than a default install of the given OS and results in a system which is not vulnerable (or not as vulnerable) to many well-known security holes. At the time of this Benchmark's writing, the Center for Internet Security's consensus-building process resulted in a solid core of security recommendations. These targeted specific, otherwise vulnerable, portions of the Red Hat Enterprise Linux operating system for hardening. The vulnerability discovery process continues without abatement. So, more are likely to exist, even now.

Every day, many systems are compromised (and later used to attack other systems) because the administrators of those machines failed to exercise even "minimum due care" when installing and configuring the system: patches are not kept up to date, dangerous services remain installed, much less left running even though vulnerabilities have been published, etc...

---

¹ Original question/answer from online CIS Members forum, dated 2006/08/30
Compliance with the Benchmark means the system administrator has executed a regular backup process (which supports disaster recovery), brought the system up to date with patches (system is current) and accomplished the Benchmark recommendations (done the hardening)--AND--continue to actively monitor/manage it, you've done the best possible from a CIS security hardening perspective.

When accomplishing Benchmark compliance, CIS recommends a log be kept. This could be a paper trail of notes regarding actions taken and results along the way. A better option would be a terminal window (or windows) with very large numbers of scroll back history where all the actions are accomplished and errors are visible.

**Audience**

This document is intended for Information System Security Officer (ISSO) and System Administrative (SA) types of folks. Additionally, it should be studied and applied by anyone responsible for installing, maintaining and/or configuring servers operating Red Hat Enterprise Linux 5. In the context of this document, an administrative user is defined as someone who will create and manage user accounts and groups, manage controls for how the operating system performs access control, understands how to set account policies and user rights, is familiar with auditing and real audit logs, and can configure other similar system-related functionality.

**Applicability**

This Benchmark was developed and tested on Red Hat Enterprise Linux (RHEL) version 5.0 (the initial release). It is likely to work for subsequent Red Hat Enterprise Linux distributions -- and probably other Red Hat, Fedora and CENTOS derivatives -- as well (just simply hasn’t been tested against them, yet). The scoring tool may not execute or may yield inaccurate results on non-RHEL systems.

The CIS Benchmark has been tested and verified on Intel/AMD 32. Specifically it has not been vetted against the Intel 64 bit, Itanium and the various IBM architectures.

**Precedence of Benchmark-Compliance Audit**

A Benchmark 'audit' is a method to check if an item has been secured. The following precedence was used in developing this Benchmark, it will guide implementer's in their application, and will demonstrate how the CIS-CAT scoring tool will score/evaluate a system being reviewed.

- ♦ Determine if an applicable service or application is installed. When ...
  - ○ **True** - Process other relevant audit/checks, even if the service/app is disabled
  - ○ **False** - All other related checks automatically PASS (it is not an error for the service to not exist)
- ♦ Service and applications only require hardening if installed
- ♦ All other audit/checks proceed in sequential order, from the top of the document to the bottom

For any specific CIS Benchmark recommendation where this precedence must be over-ridden, such will be clearly stated for that check. This might affect the implementation of the hardening actions, and will also guide exactly how the CIS-CAT scoring tool will assess the system. This provides stability and consistency across the network, within individual systems, and for those implementing it.
Partitioning Considerations

Before installing the Red Hat Enterprise Linux operating system plan out (to the greatest extent possible) a security-minded partitioning scheme.

Note: Neither partitioning, nor implementation of quotas, are scored by CIS-CAT due to their inherent complexity and diversity, while still complying with the intent of this Benchmark.

It is important to keep /var and possibly /home (if necessary) on their own partitions. Some applications have a tendency to crash when the / or /usr filesystem reaches 100%. This could happen if users were to store considerable amounts of data (developers storing JAVA jar files or copies of application logs, for example) or system logs were to fill up their partition. Some enterprises define a /logs-based partition and direct all application logs there. Such variations are encouraged, especially to better control the availability (uptime) of a system.

/home should be its own distinct partition, but then only when this system is employed as a home server for local system or enterprise users, otherwise it should simply be an empty directory, since it will then be a mount point (via automount) for mounting the central repository of enterprise users. So, for a system that only has personnel who perform system administrative tasks (i.e. access root commands via sudo), no /home partition is necessary. For systems that do require local non-administrative users, or is the enterprise server distributing home directories to other servers, then a distinct /home partition is the secure way to accomplish this.

Note: To further limit the inconveniences caused by filling up /home, consider implementing user and group quotas on the /home filesystem (i.e. on those servers that are repositories for users and their home directories). Quotas will limit how much a single user (or single group) can store on a given filesystem. Application of quotas is also not scored by CIS-CAT.

It is preferable to have the audit data stored on its own partition so that auditd can correctly calculate when its out of space. For example, any user can loop the logger program in a script and fill up /var with messages to syslogd. But, the overall strategy is to apply security concepts to OS partitioning during installation in such a way that mount options can be applied to secure the machine - e.g. noexec options for /tmp and /home.

Recommend manually changing the /var/tmp directory to be a symbolic link to /tmp. This will prevent hardlinks to databases and executables possibly held in /var somewhere. This can be accomplished with:

```
rm -rf /var/tmp
ln -s /tmp /var/tmp
```

Red Hat does not recommend putting things in non-standard locations, since SELinux already has a notion of where things belong; otherwise run semanage to adjust file contents.

Balanced by the guidance provided below, the CIS Benchmark recommends system disk partitioning similar to what is found in the following table:
The "Original Allot." column shows partitioning sizes entered during system installation.

More information is available from the online websites:

Software Package Removal

There has been considerable debate over the disposition of unused software packages. Some people feel that as long as the software is not being used, leaving it installed poses no appreciable risk. Others feel that unused software presents another attack vector and increases the maintenance effort for the administrators. This Benchmark currently makes no recommendation for the removal of specific unused software. This Benchmark does encourage a healthy review of installed packages, with an emphasis towards removing those that are clearly not required to support mission applications.

Note: When vulnerable software is present on a system, that vulnerability may be exploitable by a local attacker, and the reader is advised to consider the effort in either its removal or maintenance and the security risks thereof. For example, a service might be unused, disabled (via `chkconfig`)---yet it might also have SUID/SGID executables or scripts that could be used by a miscreant for attacks. This Benchmark recommends carefully evaluating what packages are installed and removing as many of those known to not have a bearing on the functionality of the mission system. Where possible, evaluate this minimization technique on a laboratory system. The rpm commands provide access to the internal documentation of installed packages.

Backup Key Files

Before performing the steps of this Benchmark on a production system it is strongly recommended that administrators make backup copies of critical configuration files that may get modified by various Benchmark items. If this step is not performed, then the site may have no reasonable back-out strategy for reversing system modifications made as a result of this document. The critical file protection script, provided in Appendix B of this document will automatically back up all files that may be modified by accomplishing the Benchmark actions below.

Note: An executable copy of the backup script is also provided in the archive containing the PDF version of this document and the CIS scoring tool. Assuming the administrator is in the directory where the archive has been unpacked, the command to execute the backup script would be:

```
./do-backup.sh
```
One of the byproducts of the `do-backup.sh` script is a dynamic system-specific restoration script: `"/root/cis/do-restore.sh"`, which is generated based on the results of the `do-backup.sh` script.

To roll back the changes made by this Benchmark, run `do-restore.sh` with a subsequent reboot, and all changes will be backed out. Since Linux installations are not all identical, the `do-restore.sh` script is created based on the files that actually existed at the time `do-backup.sh` was run, to include preservation of their original permissions.

Once the Benchmark items have been planned for a particular system, it is wise to fully test on a lab duplicate the backup and restoration process and the resultant system operation.

**Note:** When making changes manually to any of the files that were preserved by `do-backup.sh`, those changes will be lost when `do-restore.sh` is executed. It would be prudent to delete (or save an offline copy of) the `do-restore.sh` script (and specific to the system it came from) once all changes have been validated to prevent inadvertently undoing the changes. The recommended CIS Benchmark backup script is generic, the restoration script is dynamically generated and unique.

### Executing Actions

The actions listed in this document are written with the assumption that they will be executed in the order presented, and especially should be evaluated on a test/lab system representing a like-production system first. Some actions may need to be modified if the order is changed, as all possibilities and combinations cannot be anticipated nor exhaustively tested. Remediation has been written so that the script'lets may be copied directly from this document into a root shell window with a "cut-and-paste" type of operation.

It is possible for some of the "`chkconfig`" actions, which activate or deactivate services, produce the message: "`error reading information on service <svc>: No such file or directory`". These messages are quite normal and are not a cause for alarm – they simply indicate the program or service being referenced was not installed on the machine being hardened. As Red Hat Enterprise Linux installs allow a great deal of flexibility in what software is chosen to be installed (as well as behind-the-scenes resolution of dependencies), these messages occur at times while accomplishing some Benchmark compliance tasks; and are normal.

**Note:** A strong word of caution is necessary here. Many of the Benchmark script'lets assume specific content within configuration files, specific file locations, etc... They are good enough for demonstrating to a system administrator what should be addressed, and perhaps good enough to execute against clean/virgin systems. However, some script'lets are downright DANGEROUS to run on a system with changed configuration files, that have evolved as the system is used and administered, without otherwise testing them first!

A relevant, non-trivial, example is the script'let within Section 2.3 "Configure SSH". At one point it removes all "`Host *`" lines. This potentially changes the semantics of the configuration file on an operational production system, if the removed entry was preceded by a different, and yet valid, "`Host`" header (or more). This is but one example, even within this section, but by no means the only one.
So, the prudent precaution is to perform CIS Benchmark actions on a duplicate of a production system, not the production system itself! Carefully examine all before and after files for the changes made, and incorporate 'fixes' beyond what the Benchmark can anticipate, to ensure the system is still functioning correctly. Test resulting changed files, configurations and functionality for proper, assured and consistent behavior. Subsequently, migrate stable security hardening, tempered by lessons learned, to production system(s).

Finally, no single change or application of a single section from this Benchmark will fully harden a system. In fact, the bulk of these recommendations are necessary as a whole, though, of course, tailored to the specific environment and role/function of the system itself.

A Root Shell Environment Is Assumed

The actions listed in this document are written with the assumption that they will be executed by an Administrative person logged into the system as the root user, running the bash shell and with noclobber unset (set +o noclobber). Also, the following directories are assumed to be in root's path while accomplishing the CIS Red Hat Enterprise Linux Benchmark hardening/compliance. Use "echo $path" to determine what the current path is set to.

/bin:/sbin:/usr/bin:/usr/sbin

There is the concept of ‘an’ established place whereby the CIS Benchmark is executed from, and potentially any hardening actions are operated from. This is established, for consistency as:

cishome='/root/cis'; export cishome

Where two or more lines to are shown in the remediation area to execute, system administrators are encouraged to carefully collect and run them from a separate shell script rather than individually pasting them directly in an ssh session or terminal to the shell. There can be inadvertent and unresolved line wrapping, line termination, and quoting issues with the latter. To make a shell script, do the following in creating a file with a favorite editor, such as:

vi /root/myscript.sh

Put this as the very first line in the /root/myscript.sh file:

#!/bin/bash

Paste the commands to run from the Benchmark into the file (ensure the entire script'let for the applicable sections are copied intact). A method to accomplish this would be to have the Benchmark PDF file open in one window, with an xterm window open beside it. Then simply cut and paste sections of script from the Benchmark directly onto the test/development/lab system. For those lines of script ending in a backslash ("\"), make sure that is the last character on the line within the script. The line feed <enter key> must immediately follow it, with no trailing spaces or tabs.

Note: When pasting from Windows or a Macintosh, be careful to ensure the final file has a Unix style of line break; a single LF (Line Feed, ASCII 0x10). Files edited on Windows will commonly have a CR (Carriage Return, 0x13) followed by LF (Line Feed, 0x15). This causes odd errors, including shell scripts that do not run; the typical "Command not found" error occurs because it appears to Unix that the script asked for a shell of "/bin/bash^M", not "/bin/bash".

To prevent this from happening, execute the following:

tr -d "\015" < /root/myscript.sh > /root/myscriptNEW.sh
mv /root/myscriptNEW.sh /root/myscript.sh

{Another alternative would be to use "unix2dos"; check the man page}
Once the script has been saved, make it executable with:

```bash
chmod 0700 /root/myscript.sh
```

As necessary, ensure root ownership with:

```bash
chown root:root /root/myscript.sh
```

Finally, though beneficial when using the bash shell (it isn't required) unalias the `mv` and `cp` commands, as some Unix commands during Benchmark hardening will overwrite files; and might be prompted numerous times about overwriting these files:

```bash
unalias mv cp
```

### Software Package Installation

Throughout this Benchmark, a system administrator may be directed to enable software package init scripts using the `chkconfig` command. This assumes the system administrator has already installed said package(s), and if they are required to satisfy the mission of the particular system.

If the `chkconfig` command fails, verify the installed software is actually required (`rpm -qa <package name>`). The `chkconfig` command enables or disables service initialization at the next reboot, whereas the `service` command affects a service now.

**Note:** Though `chkconfig` and `service` are complimentary in function, they employ unique options and arguments in managing services.

### Vulnerabilities

Every service within the OS has the potential of being an entry point into a system if (when?) a vulnerability is found. This is why CIS Benchmarks recommend that unneeded services are disabled/removed even though there might currently be no clear way to exploit them, and there has never been a problem with the service (an ounce of prevention….). When running an unnecessary service, additional risks exist of a vulnerability being discovered and/or exploited in that service in the future.

Taking this mindset a step further… Careful thought and consideration should be given to application of the CIS Benchmarks across the various systems employed in any given enterprise. Consider the role of the system, number of administrators and/or users accessing it and automated processes operating on it. Fewer services should be installed, much less executing, on systems directly accessible to the Internet. As opposed to systems physically isolated to a test lab environment which is logically and physically isolated.

Where possible, install and maintain systems with a logical consistency, employ an appropriate level of configuration management, leverage stable backup technology, etc. The point here is that this Benchmark is focused on solid RHEL hardening, while it is the end users responsibility to balance the appropriate level of hardening across the enterprise by role and function.
SELinux

Red Hat Enterprise Linux 5 makes SELinux available during installation. CIS highly recommends to enable this during system installation by selecting "ENFORCING MODE". This setting is helpful to overall system hardening, as it employs the existing protection profiles rolled within this release and activates them for dynamic use during system operation. Again, testing this in a lab environment is recommended in combination with mission applications to validate expected functionality.

With this initial release of the RHEL5 Benchmark, that is as far as SELinux is going to be covered. CIS has plans to develop and release an appendix update to this RHEL5 Benchmark which addresses SELinux in comprehensive detail. The concern is that for this Benchmark many of the script'lets create new versions of configuration files and then move them into place where the original had been. Many of these files have specific SELinux contexts which get destroyed by running the hardening script'let.

- One area to be included in this future section is addressing the restoration of the SELinux 'context' for files this Benchmark modifies. The following script'let illustrates the point, though it is not empirically incorporated throughout the Benchmark.

  ```bash
  if [ -x /sbin/restorecon ]; then
    restorecon -v ${file}
  fi
  ```

- Address the appropriateness of 'touch ~/.autorelabel'; etc, etc...

About Bastille

Previous editions of this CIS Benchmark recommended, made use of and/or complimented a system hardened with Bastille by Jay Beale. Bastille is a non-vendor approved (i.e. Red Hat) method of automating and hardening some actions to the operating system, though the currently published version (3.0.9-1) does not natively execute very well against RHEL5. This edition of the CIS RHEL5 Benchmark focuses exclusively on standardized consensus-based application of security hardening to the operating system without reference to Bastille. To be clear, Bastille is an excellent product which can be applied to an RHEL5 system.

It has been recommended to continue to include Bastille in a revised edition to this Benchmark. User feedback and comments are welcome.

Reboot Required

Rebooting the system is required after completing all of the actions specified within the Benchmark in order to complete the re-configuration of the system. In many cases, the changes made in the steps below will not take effect until this reboot is performed. If substantial operating system updates are performed after the initial OS load, the system administrator may have to reboot more than once. Check the SELinux paragraph above and the reboot section (at 11.8) for additional information on relabeling and reconfiguration needed to support SELinux security contexts when SELinux is installed and employed.
Housekeeping, preparatory to accomplishing the remainder of the Benchmark:

As a matter of consistency, this procedure presumes a subdirectory under /tmp gets created with secure permissions to temporarily hold work-in-progress files. This temporary directory is to be removed at the end of the Benchmark-compliant hardening process. It is established as follows:

```shell
mkdir /tmp/cis
chown 0:0 /tmp/cis
chmod 0700 /tmp/cis
```

Conventions

The following typographical conventions are used in this document:

- **Roman font (12pt)** normal text
- **Courier (12pt)** used to indicate a UNIX command, standard parameter, filename, …
- **Roman font italics (12pt)** a question the system administrator must evaluate before continuing

This Benchmark has been written in compliance with the CIS Benchmark Formatting Guide, dated June 22nd, 2007.
2 Patches, Packages and Initial Lockdown

2.1 Apply Latest OS Patches

**Description:**
Developing a standard procedure for keeping up-to-date with vendor patches is critical for the security and reliability of the system. Vendors issue operating system updates when they become aware of security vulnerabilities and other serious functionality issues, but it is up to their customers to actually download and install these patches.

When Red Hat publishes an update, they include with it the procedures for updating the packages. This usually entails downloading the new RPMs from Red Hat, and making them available to the individual servers. Some Enterprises make these packages available over a Red Hat Satellite server, an NFS share or an internal anonymous FTP/HTTP server – the Enterprise may follow this practice or do something entirely unique/different.

Red Hat offers at least partially automated internet patch download and installation, via Red Hat yum. In lieu of an existing local Enterprise Standard, consider installing yum and using it on a regular schedule, and whenever Red Hat announces a vulnerability. If the local Enterprise has several servers, consider installing a Red Hat Satellite Update Server that can locally be used in place of Red Hat's Internet yum servers – the updates will go much faster, use much less bandwidth from the ISP, and will reduce the load on Red Hat's servers. When yum is used locally, it should be used on a lab server and the patches validated and the system regression tested before going to live/production systems.

Some RPMs may need to be installed before others. For the most part, RPM understands and resolves dependencies during the system build phase. Red Hat creates separate instructions for special cases, like the replacement of the kernel or the general C library glibc. Examine the list of updates to check for any of these cases.

There is some risk to using a non-patched, non-hardened machine to download the patches, as this involves connecting a system with unresolved security vulnerabilities on an Internet-connected network, which is not in conformance with Industry Best Practices. Please consider these issues carefully.

It is also important to observe that the mission applications work properly after patching. Though problems in patches are quite rare in Red Hat Enterprise Linux, it is generally recommended that any patch be deployed to a non-production system first for testing. Once it passes testing, then apply it to the production system(s).

The Center for Internet Security and Red Hat specifically encourages system owners, to the greatest extent possible, to upgrade/migrate systems to the latest release of the OS. It will contain all the merged/updated packages.

**Audit:** TBD

**Remediation:**
Update this system per local enterprise update procedures. When connected to the Internet, do: **yum update**
One other viable remediation step would be to incorporate frequent automatic execution of `yum`, via `cron`, with an entry like the following:

```
<minute>  <hour>  *    * /usr/sbin/rhn_check > /dev/null 2>&1 \n&& /usr/bin/yum -y update > /dev/null 2>&1
```

Replace the `<hour>` and `<minute>` entries with times that are appropriate for the system.

Additional and/or separate procedures may be necessary to patch/update the system from a local Red Hat Satellite server, or some other method.

**Scoring Status:** Not Scorable

**Compliance Mapping:** TBD

**Additional References:** TBD

### 2.2 Validate The System Before Making Changes

**Description:**
Ensuring the system is functioning properly before making a change is a prudent system administration best practice and will save hours of aggravation. Applying this Benchmark to a system that already has issues makes troubleshooting very difficult and may incorrectly indicate the Benchmark is at fault.

Examine the system and application logs (`/var/log`). Key words to look for include, but are not limited to, "error", "warning", "critical", and "alert".

**Audit:** TBD

**Remediation:**
```
cd /var/log
egrep -i "(crit|alert|error|warn)" * | less
```

Resolve all issues before continuing.

**Scoring Status:** Not Scorable

**Compliance Mapping:** TBD

**Additional References:** TBD

### 2.3 Configure SSH

**Description:**
OpenSSH is a popular free distribution of the industry standard SSH protocols which has become the best-practice implementation on Linux distributions. For more information on OpenSSH, see [http://www.openssh.org](http://www.openssh.org).
The settings in this section ensure safe defaults for both the ssh client and the ssh server. Specifically, both the ssh client and the sshd server are configured to use only SSH protocol 2, as long-standing serious security vulnerabilities have been found in the first SSH protocol. This may cause compatibility issues at sites still using the vulnerable SSH protocol 1; these sites should endeavor to configure all systems to use only SSH protocol 2 and migrate away from SSH protocol 1.

The hardening below is divided into changes applicable to the use client for SSH (the first one) and then the SSH Daemon server. The options to ssh that are hardened here, are done so as to explain their various options. Please read the man pages, a wealth of internet resources, and Reference AN, as identified in Appendix D.

**Client SSH:**
- **Host:** Begins a section, so multiple sections can exist. This indicates a *host specification*, identifying what host or hosts the following options are applicable to when initiating ssh communications.
- **Protocol:** The older protocol version 1 (one) has significant well-known vulnerabilities and available exploits, therefore it is not to be used. "2" (two) is a more recent version of the ssh protocol and is more robust and safer to use. Whereas version 1 lacks a strong mechanism for ensuring the security of the communications connection.
- **Port:** A default of '22' is recommended, but can be migrated to any otherwise unused port.
- **PubkeyAuthentication:** Public Key Authentication is stronger than password based. It is the recommended default. It requires the establishment and exchange of public and private key pairs.

**Server SSH:**
- **Port:** same as above.
- **Protocol:** same as above.
- **LogLevel:** Numerous logging levels are provided to log greater and greater details of ssh sessions. Note that "DEBUG" is specifically not recommended other than strictly for debugging ssh communications. "INFO" is the basic level that will record login's of ssh users. "VERBOSE" will record login and logout and is the minimum level, though higher levels are authorized, depending upon site policy.
- **PermitRootLogin:** The secure answer for this is 'no'. By default, users should login to the system with their own non-privledge userID, and either utilize *sudo* or *su* to root to perform administrative functions. The preference there, is for *sudo*.
- **RhostsRSAAuthentication:** This is focused on protocol 1, and should be set to 'no'.
- **HostbasedAuthentication:** Protocol 2-based and should be set to 'no'. If it were enabled, it would be less secure then public/private key usage.
- **IgnoreRhosts:** Will be set to 'no' and thus denies usage of insecure authentication via .rhost files.
- **PasswordAuthentication:** Will be set to 'no', denying insecure usage of passwords from the /etc/passwd file for allowed users, thus leveraging an emphasis on public/private keys.
- **PermitEmptyPasswords:** Will be set to 'no' to prevent userIDs with blank passwords on this system from being accessed remotely.
- **Banner:** Will be used, pointing to /etc/issue.net, to provide all ssh users with a consent-to-use message.

**Note:** Display of a consent-to-use banner is added to the sshd_config file – this hardening process will create this banner later and it is discussed in detail in Section 10. If it is decided to choose not to implement a notification banner, remove the reference to /etc/issue from
sshd_config manually. Please read the man page section on the legal use and benefits of banners before deciding to remove it.

At least one non-root user account should exist on the system, to avoid access/connectivity problems once this section of the Benchmark is applied, and especially if managing it remotely via SSH. At a minimum the process would be one of:

- To add a user account (which will be used to su to root for administrative access):
  
  ```bash
  useradd <username>
  ```

- Next, include this userID in membership of the wheel group so they can switch users (su) to root:
  ```bash
  usermod -G wheel <username>
  ```

- Establish the password for the userID, ensuring it is compliant with password complexity rules:
  ```bash
  passwd <username>
  ```

**Audit:** TBD

**Remediation:**

```bash
unalias cp rm mv
SSH_CONFIG="'/etc/ssh/ssh_config'
SSHD_CONFIG="/etc/ssh/sshd_config"
if [ -e $SSH_CONFIG ]; then
  echo "Securing $SSH_CONFIG"
  grep -v "^Host */" /etc/ssh/ssh_config-preCIS | grep -v "^# Protocol 2,1" |
  > /tmp/cis/ssh_config.tmp
  awk '/^#.* Host / { print "Host *"; print "Protocol 2"; next };'
  /^#.*Port / { print "Port 22"; next ];
  /^#.*PubkeyAuthentication/ { print "PubkeyAuthentication yes"; next ];
  { print }'/tmp/cis/ssh_config.tmp |
  > /tmp/cis/ssh_config.tmp2
  if [ ""$'egrep -l ^Protocol /tmp/cis/ssh_config.tmp2'" == "" ]; then
    echo 'Protocol 2' >> /tmp/cis/ssh_config.tmp2
  fi
  /bin/cp -pf /tmp/cis/ssh_config.tmp2 $SSH_CONFIG
  chown root:root $SSH_CONFIG
  chmod 0644 $SSH_CONFIG
  echo "diff $SSH_CONFIG-preCIS $SSH_CONFIG"
  diff $SSH_CONFIG-preCIS $SSH_CONFIG
else
  echo 'OK - No $SSH_CONFIG to secure.'
fi

if [ -e $SSHD_CONFIG ]; then
  echo "Securing $SSHD_CONFIG"
  "Had to put the " no" in for the RhostsRSAAuthentication source pattern
  "match, as otherwise the change was taking place twice so the file ended
  "up with TWO records like that. The " no" pattern made the one unique.
  "That 2nd record was a combination of comments in the original file.
  "Some lines ARE duplicated in the original config file, one is commented
  "out, the next one isn't."
  "Also, the spacing below is a little off so lines fit on the page.
  awk '/^#.*Port / { print "Port 22"; next ];
  /^#.*Protocol / { print "Protocol 2"; next ];
  /^#.*LogLevel / { print "LogLevel VERBOSE"; next ];
  /^#.*PermitRootLogin / { print "PermitRootLogin no"; next ];
  /^#RhostsRSAAuthentication no / { print "RhostsRSAAuthentication no"; next ];
  /^#HostbasedAuthentication / { print "HostbasedAuthentication no"; next ];
```
2.4 Enable System Accounting

Description:
System accounting is an optional process which gathers baseline system data (CPU utilization, disk I/O, etc.) every 10 minutes, by default. The data may be accessed with the sar command, or by reviewing the nightly report files named /var/log/sa/sar*. Once a normal baseline for the system has been established, with frequent monitoring - unauthorized activity (password crackers and other CPU-intensive jobs, and activity outside of normal usage hours) may be detected due to departures from the normal system performance curve.

Understandably system accounting provides benefits to system administrators in regards to system functionality, performance, utilization, etc… as a monitoring activity (i.e. NOT prevention). An SA will use it to keep tabs on how well a system is functioning, and/or review such history as a normal part of their routine. When abnormalities occur here, it might be an understandable change, or an out-of-band indicator that some malicious activity has taken place. So this function can support normal auditing (i.e. auditd) not supplant it.

Note: By default, this data is only archived for one week before being automatically removed by the regular nightly cron job. Administrators may wish to independently archive the /var/log/sa directory on a regular basis to preserve this data for longer periods.

Audit: TBD
**Remediation:**
Install package sysstat.
`yum install sysstat`

**Scoring Status:** Scorable

**Compliance Mapping:** TBD

**Additional References:** TBD
3 Minimize xinetd network services

3.1 Disable Standard Services

Description:
On Linux, \texttt{inetd} has outpaced \texttt{xinetd} as the default network \texttt{superserver}. \texttt{xinetd} is no longer automatically installed, though is available for installation from the original media. \texttt{rpcbind}, for example, can execute without needing \texttt{xinetd}. Red Hat Enterprise Linux continues the Red Hat tradition of having \texttt{xinetd} available for some of the outdated and deprecated services, though it is reaching the point of being deprecated. The CIS Benchmarks recommend discontinuing its use as soon as possible.

3.1t - Table of xinetd services (usage of these are deprecated)

<table>
<thead>
<tr>
<th>xinetd Service Name</th>
<th>Default State (from Red Hat)</th>
<th>CIS Benchmark Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td>amanda:</td>
<td>off</td>
<td>off</td>
</tr>
<tr>
<td>amandaidx:</td>
<td>off</td>
<td>off</td>
</tr>
<tr>
<td>amixtape:</td>
<td>off</td>
<td>off</td>
</tr>
<tr>
<td>auth:</td>
<td>off</td>
<td>off</td>
</tr>
<tr>
<td>chargen-dgram:</td>
<td>off</td>
<td>off</td>
</tr>
<tr>
<td>chargen-stream:</td>
<td>off</td>
<td>off</td>
</tr>
<tr>
<td>cvs:</td>
<td>off</td>
<td>off</td>
</tr>
<tr>
<td>daytime-dgram:</td>
<td>off</td>
<td>off</td>
</tr>
<tr>
<td>daytime-stream:</td>
<td>off</td>
<td>off</td>
</tr>
<tr>
<td>discard-dgram:</td>
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<td>off</td>
</tr>
<tr>
<td>eklogin:</td>
<td>off</td>
<td>off</td>
</tr>
<tr>
<td>ekrb5-telnet:</td>
<td>off</td>
<td>off</td>
</tr>
<tr>
<td>gssftp:</td>
<td>off</td>
<td>off</td>
</tr>
<tr>
<td>klogin:</td>
<td>off</td>
<td>off</td>
</tr>
<tr>
<td>krb5-telnet:</td>
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<td>off</td>
</tr>
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<td>rsync:</td>
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<tr>
<td>talk:</td>
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<tr>
<td>time-stream:</td>
<td>off</td>
<td>off</td>
</tr>
<tr>
<td>uucp:</td>
<td>off</td>
<td>off</td>
</tr>
</tbody>
</table>
Description (cont'd):
The stock `inetd` and `xinetd` configurations have gotten better and better with each major release over the past years. In 1999, at the time of Red Hat 5.2, distributions offered many services which were either rarely-used or for which there were more secure alternatives. After enabling SSH, it is possible to do away with all `xinetd`-based services, since SSH provides both a secure login mechanism and a means of transferring files to and from the system. The hardening below will disable all standard services normally enabled in the Red Hat `xinetd` configuration.

When running these commands, one or more errors like this may be displayed:
```
error reading information on service xxx: No such file or directory
```
This is perfectly acceptable, as all it means is the software for that service was not installed.
The rest of the actions in this section give the administrator the option of re-enabling certain services. Rather than disabling and then re-enabling these services, experienced administrators may wish to simply disable only those services that they know are unnecessary for their systems. One size does not fit all---therefore, not all services shall have the same setting across all the systems in any given enterprise. If there is any doubt, it is better to disable everything, then re-enable one-by-one the necessary services based on the function of the server.

Audit: TBD

Remediation:
```
for SERVICE in \
  amanda \n  chargen \n  chargen-udp \n  cups \n  cups-lpd \n  daytime \n  daytime-udp \n  echo \n  echo-udp \n  eklogin \n  ekrb5-telnet \n  finger \n  gssftp \n  imap \n  imaps \n  ipop2 \n  ipop3 \n  klogin \n  krb5-telnet \n  kshell \n  ktalk \n  ntalk \n  rexec \n  rlogin \n  rsh \n  rsync \n  talk \n  tcpmux-server \n  telnet \n  tftp \n  time-dgram \n  time-stream \
```
3.2 Configure TCP Wrappers and Firewall to Limit Access

**Description:**

**Question:**

Is there a reason to allow unlimited network access to this server?

If the answer to this question is no, then perform the action below.

TCP Wrappers and Host-Based Firewalls are presented together as they are similar and complementary in functionality.

**TCP Wrappers**

By limiting access to the server, exposure to threats from attackers on remote systems is reduced. For Internet-connected servers that provide service to the whole Internet, limiting access may not make sense. Intranet servers, limited-access servers, and workstations should limit access to only authorized networks. To display which services are compiled with TCPwrappers support included, do this:

```bash
egrep libwrap /sbin/* /usr/sbin/* | sort
```

Many daemons (SSH for example) are compiled with TCP Wrapper support built-in, so use `/etc/hosts.allow` and `/etc/hosts.deny` to limit SSH access to the systems. The portmap daemon also uses TCP wrappers and there is a specific note to this effect in the default TCP wrappers config files.

**Note:** It is important to be aware that TCP wrappers looks at `hosts.allow` first, then `hosts.deny`, and controls access based on the first match. Omitting entries in `hosts.allow` and deny access to ALL in `hosts.deny`, will result in all access being blocked to all network clients.

**Host-Based Firewalls**

Host-based firewalls (also known as personal firewalls) have the following benefits:

- Protection from compromised systems on the local network;
- Defense in depth where an attacker must overcome both the border firewall and the host-based firewall to attack a system; extremely fine tuned control over what systems may or may not access the system.

The Center for Internet Security recommends installing a host-based firewall on workstations, and suggests end-users consider installing them on servers as well.
Workstations are defined as Red Hat Linux systems that offer no services to any external network or system. For example, a workstation that is running Apache and serving up content to the local network segment is not a workstation.

Host-based firewalls are available in iptables (installed by default) or via commercial offerings. The Center for Internet Security makes no recommendations for a vendor or even a specific firewall configuration as firewalls are very complex. Entire books have been written on iptables and are outside the scope of this Benchmark. The default Red Hat iptables configuration is suitable for workstations and is a good starting point for servers. The Center for Internet Security does recommend using a tool (graphical- or text-based) to configure the iptables firewall, as manual rule configuration is extremely error-prone and you may end up with a false sense of security and have a less secure system.

See the following iptables resources:
Web-Based:

Package-Based:
Firewall Builder - http://sourceforge.net/projects/fwbuilder
GuardDog - http://www.simonzone.com/software/guarddog

Note: Inclusion of a tool on this list is not an endorsement or recommendation by the Center for Internet Security.

Audit: TBD

Remediation:

Note: Positively ensure remote access to the system is allowed, before configuring and implementing deny-access rules. Complete both parts of this section.

TCP Wrappers
Deny access to this server from all networks:

```bash
xyz="`tail -1 /etc/hosts.deny`"
if [ "$xyz" != "ALL: ALL" ]; then
    # Only make the change once
    echo "ALL: ALL" >> /etc/hosts.deny
fi
chown root:root /etc/hosts.deny
chmod 0644 /etc/hosts.deny

echo "diff /etc/hosts.deny-preCIS /etc/hosts.deny"

diff /etc/hosts.deny-preCIS /etc/hosts.deny
```

To allow access from the authorized networks, refer to the hosts.allow man page and enter the service and the network in /etc/hosts.allow. At a minimum, allow localhost traffic. The following script will create a sample hosts.allow file that will allow access to the locally connected networks. Tailor this further to narrow traffic down to only what is appropriate for the network.
printf "ALL: localhost" >> /etc/hosts.allow
for I in `ifconfig | grep "inet addr" | cut -f2 -d: | cut -f1-3 -d"." \  | grep -v ^127 | sort -n`
do
  echo "Adding (, $I) to /etc/hosts.allow."
  printf ", $I." >> /etc/hosts.allow;
done
echo >> /etc/hosts.allow
chown root:root /etc/hosts.allow
chmod 0644 /etc/hosts.allow
echo "diff /etc/hosts.allow-preCIS /etc/hosts.allow"
diff /etc/hosts.allow-preCIS /etc/hosts.allow

Note: The above script assumes a netmask of 255.255.255.0. If the system being worked on is within a different network context, then adjust /etc/hosts.allow for the environment.

Note: The above script ignores IPv6 networking. Additional hardening is necessary for any system/network which requires IPv6. The SNAC guidance from NSA (refer to Reference G, in Appendix D) has excellent coverage of IPv6 protections for RHEL5. IPv6 is enabled by default in RHEL5. To disable IPv6, add "install ipv6 /bin/true" into the "/etc/modprobe.d/blacklist" file, as that will prevent the ipv6 module from loading.

Review the resulting /etc/hosts.allow file to ensure it meets mission application needs. Test the configuration by logging in remotely.

It is recommended to further customize/harden the system configuration, though doing so is not further included in the scoring. For example, if the requirement is to ensure that only one IP address, 192.168.50.4, can access SSH on the server at 192.168.50.2, then follow the example below.

Change /etc/hosts.allow from:
ALL: localhost, 192.168.50.2/255.255.255.0
to:
sshd : 192.168.50.4
ALL EXCEPT sshd: localhost, 192.168.50.4/255.255.255.255

Further customization of TCP Wrappers is beyond the scope of this Benchmark.

Firewall
See discussion.

**Scoring Status:** Scorable

**Compliance Mapping:** TBD

**Additional References:** TBD

### 3.3 Only Enable telnet, If Absolutely Necessary

**Description:**

Question:
Is there a mission-critical reason that requires users to access this system via telnet, rather than the more secure SSH protocol?

If the answer to this question is yes, proceed with the actions below.

telnet uses an unencrypted network protocol, which means data from the login session (such as passwords and all other data transmitted during the session) can be stolen by eavesdroppers on the network, and also that the session can be hijacked by outsiders to gain access to the remote system.

The freely-available SSH utilities that ship with Red Hat Enterprise Linux (see http://www.openssh.com) provide encrypted network logins and should be used instead.

To aid in the migration to SSH, there is a freely available SSH client for Windows called putty, which is available from Simon Tatham (see http://www.chiark.greenend.org.uk/~sgtatham/putty).

Additionally, there are numerous viable open-source and commercially supported SSH clients as well – check to see if the local Enterprise already has an Enterprise SSH client.

Some Enterprises are using telnet over SSL, however, the simpler and more standard solution is to use SSH. Configuring telnet over SSL is beyond the scope of a Level 1 Benchmark and will not be addressed here.

It is understood that large Enterprises deeply entrenched in using telnet, it may take considerable effort in migrating from telnet to ssh, so telnet may have to be enabled. When it can be disabled, simply run chkconfig telnet off to turn it off again.

This Benchmark scores telnet as a failure when it is active.

Audit: TBD

Remediation:
chkconfig telnet on

Scoring Status: Scorable

Compliance Mapping: TBD

Additional References: TBD

3.4 Only Enable FTP, If Absolutely Necessary

Description:

Question:
Is this machine an FTP server, or is there a mission-critical reason why data must be transferred to and from this system via an ftp server, rather than sftp or scp?

If the answer to this question is yes, proceed with the actions below.

Note: Red Hat switched from distributing wu-ftpd to vsftpd after RHEL2.1 was released. For security reasons, as well as consistency with future Red Hat versions, consider replacing
wu-ftp with vsftpd. vsftpd is available on the Red Hat Enterprise Linux distribution media and is the standard, fully supported ftp daemon for RHEL5.

Like telnet, the ftp protocol is unencrypted, which means passwords and other data transmitted during the session can be captured by sniffing the network, and that the ftp session itself can be hijacked by an external attacker. Anonymous ftp servers are common for providing fast and easy downloading of publicly available files, however anonymous access should be configured to not allow uploading of files to the ftp server. ftp servers are also commonly used for Web Servers, but should be replaced by sftp if possible. ftp / sftp access should be chrooted to include the document root of the web site or the portion of the web site that the individual is responsible for. Of course access to the system configuration files and other web files is to be excluded from the chrooted environment. This is especially important if there are multiple web sites.

SSH provides two different encrypted file transfer mechanisms – scp and sftp – either of which should be used instead of the vanilla ftp client. Even if ftp is required, consider requiring non-anonymous users on the system to transfer files via SSH-based protocols. For further information on restricting ftp access to the system, see section 8.2 below.

Note: Any directory writable by an anonymous ftp server should have its own partition. This helps prevent an ftp server from filling a hard drive used by other services.

To aid in the migration away from ftp, there are a number of freely available scp and sftp client for Windows, such as FileZilla from http://sourceforge.net/projects/filezilla and WinSCP available from http://winscp.sourceforge.net/eng/index.php which provides for a Graphical interface to putty, and pscp, which is a part of the previously mentioned putty package.

Some Enterprises are using ftp over SSL, however, the simpler and more standard solution is to use sftp. Configuring ftp over SSL, as well as demonstrating how to employ sftp, is beyond the scope of a Level 1 Benchmark and will not be addressed here.

Audit: TBD

Remediation:
chkconfig --levels 35 vsftpd on

Scoring Status: Scorable

Compliance Mapping: TBD

Additional References: TBD

3.5 Only Enable rlogin/rsh/rcp, If Absolutely Necessary

Description:
The r-commands suffer from the same hijacking and sniffing issues as telnet and ftp, and in addition have a number of well-known weaknesses in their authentication scheme. SSH was designed to be a drop-in replacement for these protocols. Given the wide availability of free SSH implementations, it
seems unlikely that there is ever a case where these tools cannot be replaced with SSH (again, see http://www.openssh.com).

If these protocols are left enabled, please also see section 8.1 for additional security-related configuration settings.

**Audit:** TBD

**Remediation:**

**Question:**
*Is there a mission-critical reason why rlogin/rsh/rcp must be used instead of the more secure ssh/scp?*

If the answer to this question is yes, proceed with the actions below.

```bash
chkconfig login on
chkconfig rlogin on
chkconfig rsh on
chkconfig shell on
```

**Scoring Status:** Scorable

**Compliance Mapping:** TBD

**Additional References:** TBD

### 3.6 Only Enable TFTP Server, If Absolutely Necessary

**Description:**
TFTP is typically used for network booting of diskless workstations, X-terminals, and other similar devices. Routers and other network devices may copy configuration data to remote systems via TFTP for backup. However, unless this system is needed in one of these roles, it is best to leave the TFTP service disabled.

**Note:** The tftp-server software is not installed by default on Red Hat Enterprise Linux. It must be manually selected for installation to use it. After installing it, perform the actions below.

**Audit:** TBD

**Remediation:**

**Question:**
*Is this system a boot server or is there some other mission-critical reason why data must be transferred to and from this system via TFTP?*

One possibility is a system used to serve Red Hat kickstart. In that case, the tftp service is necessary for initial PXE load of the boot image across the network.

If the answer to this question is yes, proceed with the actions below.

```bash
chkconfig tftp on
if [ -e "/tftpdboot" ]; then
    chown -R root:root /tftpdboot
    chmod -R 0744 /tftpdboot
else
    mkdir -m 0744 /tftpdboot & & chown root:root /tftpdboot
```
Scoring Status: Scorable
Compliance Mapping: TBD

3.7 Only Enable cyrus-imapd, If Absolutely Necessary

Description:
{Formerly IMAP}
Remote mail clients (like Eudora, Netscape Mail and Kmail) may retrieve mail from remote mail servers using IMAP, the Internet Message Access Protocol, or POP, the Post Office Protocol. If this system is a mail server that must offer this protocol, cyrus-imapd may be activated. cyrus-imapd activates an SSL-encrypted, and thus much safer, version of IMAP. Standard IMAP is not encrypted and allows an attacker to eavesdrop on all e-mails being transferred or to take over the connection. It may, based on which authentication method is used, allow an attacker to steal user passwords as well.


Audit: TBD

Remediation:

Question:
Is this machine a mail server with a mission-critical reason to use imap to serve mail to remote mail clients? If the answer to this question is yes, proceed with the actions below.
chkconfig cyrus-imapd on

Scoring Status: Scorable

Compliance Mapping: TBD

Additional References: TBD

3.8 Only Enable dovecot, If Absolutely Necessary

Description:
{Formerly POP}
Remote mail clients (like Eudora, Netscape Mail and Kmail) may retrieve mail from remote mail servers using IMAP, the Internet Message Access Protocol, or POP, the Post Office Protocol. If this system is a mail server that must offer the POP protocol, dovecot may be activated. dovecot activates an SSL-encrypted, and thus much safer, version of POP. Standard POP is not encrypted and thus allows an attacker to eavesdrop on all e-mails being transferred or to take over the connection. It may – based on which authentication method is used – allow an attacker to steal user passwords as well. POP-SSL suffers none of these problems. It is recommended to generate a new SSL certificate.
Audit: TBD
Remediation:
Question:
Is this machine a mail server with a mission-critical reason to use pop to serve mail to remote mail clients? If the answer to this question is yes, proceed with the actions below.

chkconfig dovecot on

Scoring Status: Scorable

Compliance Mapping: TBD

Additional References: TBD
4 Minimize boot services

The following table illustrates each of the services potentially available natively within RHEL5. The first seven columns describe the service, by name and the default state per runlevel, as distributed by Red Hat. The next two rows show the CIS Benchmark recommendation for run levels 3 and 5, multi-user modes for text and graphical desktop respectively. This table accounts for services available natively through release 5.1---and is subject to change in future editions distributed by Red Hat.

4t Table of RHEL5 inetd/boot Services

<table>
<thead>
<tr>
<th>inetd/boot Services</th>
<th>Default</th>
<th>Boot state applicable to each runlevel</th>
<th>CIS Benchmark Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td>acpid</td>
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<td>1:off 2:off 3:on 4:off 5:on 6:off</td>
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CIS Red Hat Enterprise Linux Benchmark, v1.1 (2008/04)

### Table current as of RHEL5.1 (20080204)

<table>
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<tr>
<th>inetd/boot Services</th>
<th>Default</th>
<th>Boot state applicable to each runlevel</th>
<th>CIS Benchmark Recommendation</th>
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<td>0:off 1:off 2:off 3:off 4:off 5:off 6:off</td>
<td>off  off</td>
</tr>
</tbody>
</table>

---

² CIS recommends enabling this for systems utilizing IPv6, but should leave it disabled for systems with only IPv4
³ Preferably on for any multi-core or multi-processor system, optional for single-core/single processor systems
⁴ Preferably off for all systems without wireless NIC cards; enable it for systems with wireless connectivity
<table>
<thead>
<tr>
<th>inetd/boot Services</th>
<th>Boot state applicable to each runlevel</th>
<th>CIS Benchmark Recommendation</th>
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</thead>
<tbody>
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<tr>
<td>restorecond</td>
<td>0:off 1:off 2:off 3:off 4:off 5:off 6:off</td>
<td>on 6</td>
</tr>
<tr>
<td>rhnsd</td>
<td>0:off 1:off 2:off 3:off 4:off 5:off 6:off</td>
<td>off 6</td>
</tr>
<tr>
<td>ripd</td>
<td>0:off 1:off 2:off 3:off 4:off 5:off 6:off</td>
<td>off 6</td>
</tr>
<tr>
<td>ripngd</td>
<td>0:off 1:off 2:off 3:off 4:off 5:off 6:off</td>
<td>off 6</td>
</tr>
<tr>
<td>rpcgssd</td>
<td>0:off 1:off 2:off 3:off 4:off 5:off 6:off</td>
<td>off 6</td>
</tr>
<tr>
<td>rpcidmapd</td>
<td>0:off 1:off 2:off 3:off 4:off 5:off 6:off</td>
<td>off 6</td>
</tr>
<tr>
<td>rpcsvcgssd</td>
<td>0:off 1:off 2:off 3:off 4:off 5:off 6:off</td>
<td>off 6</td>
</tr>
<tr>
<td>rstatd</td>
<td>0:off 1:off 2:off 3:off 4:off 5:off 6:off</td>
<td>off 6</td>
</tr>
<tr>
<td>rusersd</td>
<td>0:off 1:off 2:off 3:off 4:off 5:off 6:off</td>
<td>off 6</td>
</tr>
<tr>
<td>rhwod</td>
<td>0:off 1:off 2:off 3:off 4:off 5:off 6:off</td>
<td>off 6</td>
</tr>
<tr>
<td>saslauthd</td>
<td>0:off 1:off 2:off 3:off 4:off 5:off 6:off</td>
<td>off 6</td>
</tr>
<tr>
<td>sendmail</td>
<td>0:off 1:off 2:off 3:off 4:off 5:off 6:off</td>
<td>off 6</td>
</tr>
<tr>
<td>setroubleshoot</td>
<td>0:off 1:off 2:off 3:off 4:off 5:off 6:off</td>
<td>off 6</td>
</tr>
<tr>
<td>smartd</td>
<td>0:off 1:off 2:off 3:off 4:off 5:off 6:off</td>
<td>off 6</td>
</tr>
<tr>
<td>smb</td>
<td>0:off 1:off 2:off 3:off 4:off 5:off 6:off</td>
<td>off 6</td>
</tr>
<tr>
<td>smpd</td>
<td>0:off 1:off 2:off 3:off 4:off 5:off 6:off</td>
<td>off 6</td>
</tr>
<tr>
<td>snmptrapd</td>
<td>0:off 1:off 2:off 3:off 4:off 5:off 6:off</td>
<td>off 6</td>
</tr>
<tr>
<td>spama</td>
<td>0:off 1:off 2:off 3:off 4:off 5:off 6:off</td>
<td>off 6</td>
</tr>
<tr>
<td>squid</td>
<td>0:off 1:off 2:off 3:off 4:off 5:off 6:off</td>
<td>off 6</td>
</tr>
<tr>
<td>sshd</td>
<td>0:off 1:off 2:off 3:off 4:off 5:off 6:off</td>
<td>on 7</td>
</tr>
<tr>
<td>syslog</td>
<td>0:off 1:off 2:off 3:off 4:off 5:off 6:off</td>
<td>on 7</td>
</tr>
<tr>
<td>sysstat</td>
<td>0:off 1:off 2:off 3:off 4:off 5:off 6:off</td>
<td>on 7</td>
</tr>
<tr>
<td>tog-pegasus</td>
<td>0:off 1:off 2:off 3:off 4:off 5:off 6:off</td>
<td>off 7</td>
</tr>
<tr>
<td>tomcat5</td>
<td>0:off 1:off 2:off 3:off 4:off 5:off 6:off</td>
<td>off 7</td>
</tr>
<tr>
<td>tux</td>
<td>0:off 1:off 2:off 3:off 4:off 5:off 6:off</td>
<td>off 7</td>
</tr>
<tr>
<td>vncserver</td>
<td>0:off 1:off 2:off 3:off 4:off 5:off 6:off</td>
<td>off 7</td>
</tr>
<tr>
<td>vsftpd</td>
<td>0:off 1:off 2:off 3:off 4:off 5:off 6:off</td>
<td>off 7</td>
</tr>
<tr>
<td>winbind</td>
<td>0:off 1:off 2:off 3:off 4:off 5:off 6:off</td>
<td>off 7</td>
</tr>
<tr>
<td>wpa_supplicant</td>
<td>0:off 1:off 2:off 3:off 4:off 5:off 6:off</td>
<td>off 7</td>
</tr>
<tr>
<td>xend</td>
<td>0:off 1:off 2:off 3:off 4:off 5:off 6:off</td>
<td>off 7</td>
</tr>
<tr>
<td>xenomd</td>
<td>0:off 1:off 2:off 3:off 4:off 5:off 6:off</td>
<td>off 7</td>
</tr>
<tr>
<td>xls</td>
<td>0:off 1:off 2:off 3:off 4:off 5:off 6:off</td>
<td>off 7</td>
</tr>
<tr>
<td>xinetd</td>
<td>0:off 1:off 2:off 3:off 4:off 5:off 6:off</td>
<td>off 7</td>
</tr>
<tr>
<td>ypbind</td>
<td>0:off 1:off 2:off 3:off 4:off 5:off 6:off</td>
<td>off 7</td>
</tr>
<tr>
<td>yppasswdd</td>
<td>0:off 1:off 2:off 3:off 4:off 5:off 6:off</td>
<td>off 7</td>
</tr>
<tr>
<td>ypserv</td>
<td>0:off 1:off 2:off 3:off 4:off 5:off 6:off</td>
<td>off 7</td>
</tr>
<tr>
<td>ypbind</td>
<td>0:off 1:off 2:off 3:off 4:off 5:off 6:off</td>
<td>off 7</td>
</tr>
<tr>
<td>yum-updatesd</td>
<td>0:off 1:off 2:off 3:off 4:off 5:off 6:off</td>
<td>off 7</td>
</tr>
<tr>
<td>zebra</td>
<td>0:off 1:off 2:off 3:off 4:off 5:off 6:off</td>
<td>off 7</td>
</tr>
</tbody>
</table>

5 Natively restores the SELinux context/condition to files; prevents files from being mis-labeled in their security context
4.1 Set Daemon umask

Description:
The system default umask should be set to at least 027 (allowed to be as high as 077, with testing in the local environment) in order to prevent daemon processes (such as the syslog daemon) from creating world-writable files by default. If a particular daemon needs a less restrictive umask, consider editing that specific daemon startup script to grant that daemon the required umask while maintaining the increased server security posture for all the others.

Audit: TBD

Remediation:
```
sed 's/022/027/' /etc/rc.d-preCIS/init.d/functions > /etc/rc.d/init.d/functions
echo "umask 027" >> /etc/sysconfig/init

chown root:root /etc/sysconfig/init
chmod 0755 /etc/sysconfig/init
```
```
echo "diff /etc/sysconfig/init-preCIS /etc/sysconfig/init"
diff /etc/sysconfig/init-preCIS /etc/sysconfig/init
```

Scoring Status: Scorable

Compliance Mapping: TBD

Additional References: TBD

4.2 Disable xinetd, If Possible

Description:
If the actions in Section 3 of this Benchmark resulted in no services being enabled in the inet super daemon /etc/xinetd.d, then the xinetd service may be disabled completely on this system.

Experienced SysAdmins have learned the inet super daemon should be restarted after a change to its configuration file. This is not necessary in this case as the system will be rebooted and the change will take effect at that time.

Audit: TBD

Remediation:
```
echo "The 'chkconfig' status of 'xinetd' is shown before it is turned off and"
echo "then after so it can visually be compared."
echo "Note: The remaining chkconfig checks, in this hardening script, do the"
echo "same thing."
chkconfig --list xinetd
chkconfig --level 12345 xinetd off
chkconfig --list xinetd
```

Scoring Status: Scorable

Compliance Mapping: TBD
4.3 Ensure sendmail is only listening to the localhost, If Possible

Description:
By default, the sendmail daemon on Red Hat systems listens on port 25/tcp for email messages from the local machine only. If the machine is not acting as an email server, then there should not be a reason for this system to receive incoming email messages from other hosts on the network. The check below ensures that the sendmail daemon is listening only on the internal "loopback" network for outgoing messages generated on the local system. This configuration prevents direct access to the sendmail daemon from external network devices and greatly reduces the impact of future sendmail vulnerabilities on the local machine.

Leaving sendmail in local-only mode permits mail to be sent out from the local system. If the local system will not be processing or sending any electronic mail, then the sendmail service should be completely disabled. If you completely disable sendmail for local use, messages sent to the root account, such as for cron job output or audit daemon warnings, will fail to be delivered properly unless submitted to a central email server.

That mail server must be configured to correctly handle email addressed directly to root, as well as to other users from the local machine.

As a viable alternative to sendmail, 'postfix' is recommended for installation and use. Currently the inclusion and hardening of postfix is not included within this Benchmark.

(1) It is possible to run a Unix system with the sendmail daemon disabled and still allow users on that system to send email out from that machine. Running sendmail in "daemon mode" (with the -bd command-line option) is only required on machines that act as a mail server, receiving and processing email interactively to and from other hosts on the network.

(2) Although recent versions of Red Hat have set sendmail to listen only to the loopback network interface, this document still deactivates sendmail from operating in "daemon mode". Listening on the loopback interface still presents a slightly higher level of exposure to miscreant attack than not listening at all. Experienced administrators will understand that a chroot-jailed user or program can still properly interact with a sendmail process listening on the loopback interface.

Note: If the system is an email server, the administrator is encouraged to search the Web for additional insight on Sendmail security issues. Some information is available at:
http://www.deer-run.com/~hal/sysadmin/sendmail.html
http://www.deer-run.com/~hal/sysadmin/sendmail2.html
http://www.deer-run.com/~hal/sysadmin/greet_pause.html
http://www.deer-run.com/~hal/sysadmin/Sendmail-Unprivileged.html
http://www.sendmail.org

(3) If mail services are not needed on the host disable the mail server (Sendmail, postfix, qmail, etc.). If mail services are required only to relay locally generated messages then configure the mail server to listen only on the loopback interface. If this host will act as a full fledged mail server then secure the
configuration of the mail server as appropriate (insert links and pointers to secure configuration guidelines for various types of mail servers).

**Audit:**

grep MTA /etc/mail/sendmail.cf | grep "Addr=127.0.0.1, " | wc -l

Returns "1" when set up correctly (for the following context line from the sendmail.cf file)

O DaemonPortOptions=Port=smtp,Addr=127.0.0.1, Name=MTA

**Remediation:**

**Question:**

Is this system a mail server – that is, does this machine receive and process email from other hosts?

Proceed with the appropriate actions below.

Yes – employment of sendmail:

```
cd /etc/sysconfig
cp -pf sendmail-preCIS sendmail
chown root:root sendmail
chmod 0644 sendmail
```

No – sendmail is not required:

```
echo "DAEMON=no" > /etc/sysconfig/sendmail
echo "QUEUE=1h" >> /etc/sysconfig/sendmail
chkconfig --list sendmail
chkconfig --level 12345 sendmail off
chkconfig --list sendmail
chown root:root /etc/sysconfig/sendmail
chmod 0644 /etc/sysconfig/sendmail
echo "diff /etc/sysconfig/sendmail-preCIS /etc/sysconfig/sendmail"

diff /etc/sysconfig/sendmail-preCIS /etc/sysconfig/sendmail
```

**Note:** The email server need not be running to send outgoing mail.

**Scoring Status:** Scorable

**Compliance Mapping:** TBD

**Additional References:** TBD

### 4.4 Disable GUI Login, If Possible

**Description:**

There is usually no reason to run X Windows on a dedicated server machine, such as a dedicated web server. This action disables the graphical login, if present, leaving the user to login via SSH or a local text-based console. Even if the GUI login screen is deactivated (going back to run level 3), unprivileged users can still run X Windows by typing `startx` at the shell prompt. Doing so assumes the `xfs` service is running (which must be accomplished by root; see section 4.5).

In Red Hat Enterprise Linux, there are two predominant runlevels for operation. Runlevel 5 boots directly into X Windows, so as to allow graphical login or easy use of specialized X terminals and
other convenient graphical tools. Otherwise, for normal text-based console login, runlevel 3 is desirable. GUI login is activated or deactivated by changing this runlevel in /etc/inittab.

**Note:** runlevel 3 allows a user to run X Windows (assuming the xfs service is running) by typing:

```
sudo startx
```

Permissions on the /etc/inittab file are recommended at 0600, though they can be as open as 0644, if the system or a local application requires it, though this should be a rare exception.

**Audit:** TBD

**Remediation:**

**Question:**

*Is there a mission-critical reason to run a GUI login program on this system?*

If the answer to this question is no, proceed with the actions below.

```
echo "RunLevel was ('grep initdefault /etc/inittab | grep -v NOT')."
```

```
 sed -e 's/id:5:initdefault:/id:3:initdefault:/' /etc/inittab-preCIS /etc/inittab
chown root:root /etc/inittab
chmod 0600 /etc/inittab
```

```
echo "diff /etc/inittab-preCIS /etc/inittab"
```

```
diff /etc/inittab-preCIS /etc/inittab
```

```
echo "New runLevel will be ('grep initdefault /etc/inittab | grep -v NOT')."
```

**Scoring Status:** Scorable

**Compliance Mapping:** TBD

**Additional References:** TBD

### 4.5 Disable X Font Server, If Possible

**Description:**

There's usually no reason to run X Windows on a dedicated server machine, like a dedicated web server. If an X server is not necessary on this machine, this action will deactivate the X font server (xfs) upon which X Windows is dependent. The X font server isn't used by any other process. An unprivileged user cannot start the X font server, though. This must be accomplished by root.

**Audit:** TBD

**Remediation:**

**Question:**

*Is there a mission-critical reason to run X Windows on this system?*

If the answer to this question is no, proceed with the actions below.

```
chkconfig --list xfs
```

```
chkconfig --level 12345 xfs off
```

```
chkconfig --list xfs
```

**Scoring Status:** Scorable
Compliance Mapping: TBD

Additional References: TBD

4.6 Disable Standard Boot Services

Description:
Every system daemon that does not have a clear and compelling purpose to be executing on the host should be deactivated. This greatly reduces the chances that the machine will be running a vulnerable daemon when the next vulnerability is discovered in its operating system.

Red Hat Enterprise Linux uses a facility called chkconfig to manage all the SysV rc-scripts. chkconfig adds or deletes links in each of the appropriate runlevel directories (/etc/rc.d/rc*.d) to activate or deactivate each of the rc-scripts.

This process "chkconfig's" all of the rc-scripts off, so that the local administrator can easily reactivate any of these scripts upon discovery of a mission-critical need for one of these services. One could reactivate the daemon script by typing chkconfig daemon on in most cases, which activates it in runlevels 2 through 5. If one of these runlevels is undesirable, like runlevel 2 for the NFS script, or the script needs to run in one of the other available runlevels, chkconfig takes the argument "--level <levels>" where one can explicitly specify runlevels that it should act on.

Note: The vendor patches may restore some of the original entries in the startup script directories /etc/rc.d/rc*.d – it is always a good idea to check these boot directories and remove any scripts that may have been added by the patch installation process. This would be a good time to ensure this check is in the local Enterprise OS Upgrade Procedure.

The rest of the actions in this section give the administrator the option of re-enabling certain services – in particular, the services that are disabled in the second loop in the "Action" section below. Rather than disabling and then re-enabling these services, experienced administrators may wish to simply disable only those services that they know are unnecessary for their systems.

The third loop in the "Action" section locks daemon-user accounts related to servers that we examine by setting a lockout password. This will not prevent a given daemon from running as these users – it simply confirms that these users are not available for human login. It also changes the shell to /sbin/nologin (standard for most service accounts under RHEL5) for an additional layer of security as long as shell access is not necessary.

Note: Not all of the scripts listed below will exist on all systems, as this is a superset of the available rc-scripts in the various Red Hat distribution versions. The Benchmark’s recommended action will register some trivial errors on each distribution version as a result – these are not cause for alarm.

Audit: TBD

Remediation:
telinit 3
Once logged back in as root:

```
  echo " When doing this from within Xwindows the display will slow to a horrible"  
  echo " crawl as soon as the xfs service is disabled. Recommend doing this"  
  echo " script from init 3 (runlevel 3)."

# From a scripted perspective, this will be backwards from what the CIS Benchmark
# recommends. Philosophy is to leave the few known/necessary services on, that
# do remain in the minimized baseline, and then as each other step/procedure
# below is covered, it will disable what we know we don't need for a secure and
# hardened baseline.
#
# The following services ARE stopped/disabled using the following effort for the
# baseline:
# This affects network/NFS mapping during system building and/or during kickstart
# %post processing.
#    autofs
#    automount
#    iptables
#    portmap
#    NFS services
#    NFS statd
#    system message bus

# ** Warning** Disabling 'nfs' at this point in the script forcefully unmounts
# any NFS network mounts.
# The following services should normally be enabled, unless there is a compelling
# reason not to: (which is why this hardening section does not alter their state)

  for SERVICE in  
    acpid  
    amd  
    anacron  
    apmd  
    arptables_jf  
    aprwatch  
    atd  
    autofs  
    avahi-daemon  
    avahi-dnsconfd  
    bpgd  
    bluetooth  
    bootparamd  
    capi  
    conman  
    cups  
    cyrus-imapd  
    dc_client  
    dc_server  
    dhcdbd  
    dhcp6s  
    dhcpd  
    dhcrelay  
    dovecot  
    dund  
    firstboot  
    gpm  
    haldaemon  
    hidd
```
setroubleshoot \ 
smartd \ 
smb \ 
smmsp \ 
snmptrapd \ 
spamassassin \ 
squid \ 
tog-pegasus \ 
tomcat5 \ 
tux \ 
winbind \ 
wine \ 
wpa_supplicant \ 
xend \ 
xendomains \ 
xfs \ 
xinetd \ 
ypbind \ 
ypasswdd \ 
ypserv \ 
ypxfrd \ 
yum-updatesd \ 
zebra;

do
  if [ -e /etc/init.d/$SERVICE ]; then
    # Doing business this way causes less needless errors that a
    # reviewer of the hardening process doesn't need to deal with.
    service $SERVICE stop
    chkconfig --level 12345 $SERVICE off
  else
    echo "SERVICE doesn't exist on this system ($SERVICE)."
  fi
done

**Scoring Status**: Scorable, Not Scorable or Not Applicable

**Compliance Mapping**: TBD

**Additional References**: TBD

### 4.7 Only Enable SMB (Windows File Sharing) Processes, If Absolutely Necessary

**Description:**
Red Hat Enterprise Linux includes the popular Open Source Samba server for providing file and print services to Windows-based systems. This allows a Unix system to act as a file or print server in on a Windows network, and even act as a Domain Controller (authentication server) to older Windows operating systems. However, if this functionality is not required by the site, the service should be disabled.

This section removes the SMB client software as well. If there is a mission-oriented reason to mount Windows Shares, do not remove the packages: samba-client and samba-common.

**Audit**: TBD
Remediation:

Question:
Is this machine sharing files via the Windows file sharing protocols?
If the answer to this question is yes, proceed with the actions below.

chkconfig smb on

Scoring Status: Scorable

Compliance Mapping: TBD

Additional References: TBD

4.8 Only Enable NFS Server Processes, If Absolutely Necessary

Description:
NFS is frequently exploited to gain unauthorized access to files and systems. Clearly there is no need to run the NFS server-related daemons on hosts that are not NFS servers of vital mission application filesystems. If the system is an NFS server, the administrator should take reasonable precautions when exporting file systems, including restricting NFS access to a specific range of local IP addresses and exporting file systems "read-only" to the greatest extent possible. For more information, consult the exports manual page.

Audit: TBD

Remediation:

Question:
Is there a mission-critical reason why this machine must serve as an NFS file server?
If the answer to this question is yes, proceed with the actions below.

chkconfig --level 35 nfs on
chkconfig --level 35 portmapper on
chkconfig --level 35 rpc on

Scoring Status: Scorable

Compliance Mapping: TBD

Additional References: TBD

4.9 Only Enable NFS Client Processes, If Absolutely Necessary

Description:
Again, unless there is a significant need for this system to acquire data via NFS, administrators should disable NFS-related services.

Note: Other file transfer schemes (such as rdist via SSH) can often be preferable to NFS for certain applications.

Audit: TBD
Remediation:
Question:
Is there a mission-critical reason why this system must access file systems from remote servers via NFS?
If the answer to this question is yes, proceed with the actions below.
chkconfig --level 35 nfslock on
chkconfig --level 35 autofs on

Scoring Status: Scorable

Compliance Mapping: TBD

Additional References: TBD

4.10 Only Enable NIS Client Processes, If Absolutely Necessary

Description:
Unless this site must use NIS, it should really be avoided. While it can be very useful for simplifying and transparently scaling the management for a large number of workstations (and servers), it's not well designed for security. Even Sun Microsystems is phasing out NIS+ in favor of LDAP for naming services – NIS and NIS+ are now reaching end of life. Where possible, utilize LDAP.

Audit: TBD

Remediation:
Question:
Is there a mission-critical reason why this machine must be an NIS client?
If the answer to this question is yes, proceed with the actions below.
chkconfig ypbind on

Scoring Status: Scorable

Compliance Mapping: TBD

Additional References: TBD

4.11 Only Enable NIS Server Processes, If Absolutely Necessary

Description:
Unless this site must use NIS, it should be avoided. While it can be very useful for transparently scaling the number of workstations, it is not well designed for security.

Audit: TBD

Remediation:
Question:
Is there a mission-critical reason why this machine must be an NIS server?
If the answer to this question is yes, proceed with the actions below.
chkconfig ypserv on
chkconfig yppasswdd on

Scoring Status: Scorable

Compliance Mapping: TBD

Additional References: TBD

### 4.12 Only Enable RPC Portmap Process, If Absolutely Necessary

**Description:**
RPC-based services typically use very weak or non-existent authentication and yet may share very sensitive information. Unless one of the services listed above is required on this machine, best to disable RPC-based tools completely. If there is uncertainty in whether or not a particular third-party application requires RPC services, consult with the application vendor.

**Audit:** TBD

**Remediation:**

**Question:** Are any of the following statements true?
- This machine is an NFS client or server. This machine is an NIS (YP) or NIS+ client or server
- The machine runs a third-party software application which is dependent on RPC support

If the answer to both of these questions is yes, proceed with the actions below.

chkconfig --level 35 portmap on

Scoring Status: Scorable

Compliance Mapping: TBD

Additional References: TBD

### 4.13 Only Enable netfs Script, If Absolutely Necessary

**Description:**
If there are no network file sharing protocols being used, one can deactivate the netfs script. This script mounts network drives on the client. Though this is not a persistent daemon and thus not so dangerous, thinning out the /etc/rc.d/rcN.d directories makes the system much easier to audit.

**Audit:** TBD

**Remediation:**

**Question:** Is this machine sharing files via the NFS, Novell Netware or Windows file sharing protocols?
If the answer to this question is yes, proceed with the actions below.

chkconfig --level 35 netfs on
4.14 Only Enable Printer Daemon Processes, If Absolutely Necessary

Description:
If users will never print files from this machine and the system will never be used as a print server by other hosts on the network, then it is safe to disable the print daemon, lpd or cupsd, and removed the relevant packages from the system. The Unix print servers have generally had a poor security record – be sure to keep up-to-date on vendor patches, if such services are required.

Note: This item also sets cupsd, when present, to run as a non-root user and group, namely user lp and group sys; which is more secure.

Audit: TBD

Remediation:
Question:
Is this system a print server, or is there a mission-critical reason why users must submit print jobs from this system?
If the answer to this question is yes, proceed with the actions below.

if [ -e /etc/init.d/cups ]; then
  echo "Enable appropriate cups permissions and ownership"
  sed -e "s/^#User lp/User lp/" -e "s/^#Group sys/Group sys/" \
  /etc/cups/cupsd.conf-preCIS > /etc/cups/cupsd.conf
  chown lp:sys /etc/cups/cupsd.conf
  chmod 0600 /etc/cups/cupsd.conf
  echo "diff /etc/cups/cupsd.conf-preCIS /etc/cups/cupsd.conf"
  diff /etc/cups/cupsd.conf-preCIS /etc/cups/cupsd.conf
  chkconfig cups on
fi

# If this system does need printing capabilities, but does not need to act as a
# print server, then configure the /etc/cups/client.conf file with the
# "ServerName" directive, pointing to a system running the cups server
echo "ServerName printserver.yourdomain.com" >> /etc/cups/client.conf
chown root:lp /etc/cups/client.conf
chmod 0644 /etc/cups/client.conf
echo "diff /etc/cups/client.conf-preCIS /etc/cups/client.conf"
  diff /etc/cups/client.conf-preCIS /etc/cups/client.conf

Obviously, replace "printserver.yourdomain.com" with an appropriate FQDN.

If the answer to this question is no, then remove the following, though some of these packages might or might not be installed, depending upon how the system was built:
rpm -e bluez-utilz-cups
rpm -e cups
rpm -e libgnomecups
rpm -e cups-libs
**4.15 Only Enable Web Server Processes, If Absolutely Necessary**

**Description:**
Even if this machine is a web server, the local site may choose not to use the web server provided with Linux in favor of a locally developed and supported Web environment.

**Audit:** TBD

**Remediation:**
Question:

*Is there a mission-critical reason why this system must run a Web server on this system?*

Web Servers should be run on dedicated systems serving only as web server. Unfortunately web servers tend to be enabled on many systems that don’t need the web service, and are often not properly secured and administered. If Apache (the default web server) is required, review and apply the CIS Apache Benchmark available at [http://www.cisecurity.org/bench_apache.html](http://www.cisecurity.org/bench_apache.html).

**Note:** The Red Hat Enterprise Linux uses piranha to administer the Linux Virtual Server software, which requires apache and php.

If this is not a web server, and are not using piranha, the answer is no.

If the answer to this question is yes, proceed with the actions below.

If Apache is used, download and apply appropriate recommendations from the CIS Apache Benchmark.

Please read the discussion before executing these commands and select the appropriate one(s).

```
chkconfig apache on
```

**Scoring Status:** Scorable

**Compliance Mapping:** TBD

**Additional References:** TBD
4.16 Only Enable SNMP Processes, If Absolutely Necessary

**Description:**
If SNMP is used to monitor the hosts on this network, experts recommend changing the default community string used to access data via SNMP. On Red Hat Enterprise Linux systems, this parameter has already been changed to a reasonably secure setting in the file `/etc/snmp/snmpd.conf`:

```
com2sec notConfigUser default public
```

No further action is required.

**Note:** In a large Enterprise that relied heavily on SNMP, it was discovered during the Linux rollout that SNMP was not a critical service, and not having it enabled increased the security posture of the servers. When using HP hardware with the HP provided health monitoring tools, SNMP and WBEM are the only options for reporting currently (and SNMP is the more granular). Because of this some organizations may require it.

**Audit:** TBD

**Remediation:**
**Question:** Are hosts at this site remotely monitored by a tool (e.g., HP OpenView, MRTG, Cricket) that relies on SNMP? If the answer to this question is yes, proceed with the action:

```
chkconfig snmpd on
```

**Scoring Status:** Scorable

**Compliance Mapping:** TBD

**Additional References:** TBD

4.17 Only Enable DNS Server Process, If Absolutely Necessary

**Description:**
Most of the machines in the organization do not need a DNS server running on the box. Unless this is one of the organization's name servers, it is safe to shut this down.

If this must be left active, please patch often and security harden the configuration according to the CIS BIND Benchmark which provides detailed implementation and configurations recommendations. Two highly suggested configuration is to bind the DNS server program in a chroot environment, and run it as a non-root user. This significantly restricts the resources that the DNS server has access to on the system, reducing this set to the minimum required for the program to function properly. Carefully consider the consequences that if a name server is compromised then traffic that depends on the name service such as web, ftp and e-mail can be redirected to malicious servers.

Additionally, consider the use of Access Control Lists (ACL's) in `/etc/named.conf` to limit who can query the name server. For example, Internal name servers should not respond to outside requests. Large Enterprises run multiple name servers so this should not be an issue. However, smaller organizations may not be able to deploy both internal and external name servers and should instead use
an reputable externally hosted DNS service. Details on how to accomplish this are provided in the CIS BIND Benchmark, available at http://www.cisecurity.org/bench_bind.html

**Audit:** TBD

**Remediation:**

**Question:**
Is this machine a DNS server, or name server, for this site?
If the answer to this question is yes, proceed with the actions below.
Download and following the appropriate configurations from the CIS BIND Benchmark, then enable the BIND as follows.
\[
\text{chkconfig named on}
\]

**Scoring Status:** Scorable

**Compliance Mapping:** TBD

**Additional References:** TBD

---

**4.18 Only Enable SQL Server Processes, If Absolutely Necessary**

**Description:**
If this machine does not need to run the mainstream database (SQL) servers Postgres or MySQL, it is safe to deactivate them. If they must be enabled, issue the command (below) for the database that is installed.

Additional hardening of SQL functionality and security can and should be accomplished, though are outside the scope of this Level I Benchmark. Such actions include utilizing a strong password of sufficient complexity, limiting access to the database administrative accounts, etc…

**Audit:** TBD

**Remediation:**

**Question:**
Is this machine a SQL (database) server?
If the answer to this question is yes, proceed with the actions below.
Please read the discussion before executing these commands and select the appropriate command.
\[
\text{chkconfig postgresql on}
\]
\[
\text{chkconfig mysqld on}
\]

**Scoring Status:** Scorable

**Compliance Mapping:** TBD

**Additional References:** TBD
4.19 Only Enable Squid Cache Server, If Absolutely Necessary

Description:
Squid can actually be beneficial to security, as it imposes a proxy between the client and server. On the other hand, if it is not being used, it should be deactivated and removed. This deactivation decreases the risk of system compromise should a security vulnerability later be discovered in Squid. Finally, for any site that uses Squid, configure it carefully. Many Squid caches are badly configured to either allow outsider attackers to probe internal machines through the firewall or to use the cache to hide their true source IP address from their target hosts. Each site should configure Squid to not allow people outside their perimeter to use the cache without authentication of some sort. A better deployment for squid is on a server with no external-facing network interface (unless using it for a reverse web proxy, which is a very specific installation, and beyond the scope of this Benchmark).

Audit: TBD

Remediation:
Question:
Do you use the squid web cache to speed up web transactions?
If the answer to this question is yes, proceed with the actions below.
chkconfig squid on

Scoring Status: Scorable

Compliance Mapping: TBD

Additional References: TBD

4.20 Only Enable Kudzu Hardware Detection, If Absolutely Necessary

Description:
kudzu and hald/udev are Red Hat's hardware detection programs, which are normally set to run during system startup. Their functionality detects changes in hardware and, without demanding authentication of any sort, allows the user at the console to configure that hardware. This lack of authentication presents the primary danger – meaning, that any user sitting at the console during a reboot can configure any new devices added to the system, potentially in malicious ways.

This configuration is an unnecessary risk for most sites, with the exception of those that need to allow users to easily make hardware changes without having a root password. Sites in the exception class might need to allow students to connect external hard drives, backup drives or other potentially common external devices.

Even if this rc-script is deactivated, kudzu is still accessible. To run kudzu after installing new hardware, run /etc/rc.d/init.d/kudzu start at the shell prompt while logged in as root.

Another, security benefit would be to limit the runlevels kudzu is permitted to function at. Those systems normally operating at runlevel 3, should then only enable kudzu at the same runlevel.

Audit: TBD
Remediation:
Question:
Does the site absolutely need to allow users at the console to add hardware to the system?
If the answer to this question is yes, then perform the action below.
`chkconfig --level 35 kudzu on`

Scoring Status:  Scorable

Compliance Mapping:  TBD

Additional References:  TBD
5 System Network Parameter Tuning

5.1 Network Parameter Modifications

Description:
For an explanation of some of these parameters, see the local copy of the kernel source (requires installing the kernel source RPMs); or read the latest from the cross-referencing Linux site:

For additional insights, consult the following links:
http://ipsysctl-tutorial.frozentux.net/ipsysctl-tutorial.html
http://lwn.net/Articles/45386
http://www.gossamer-threads.com/lists/linux/kernel/653569

See also SN.9 for additional security-related network tunings to be considered.

- **net.ipv4.tcp_max_syn_backlog = 4096**
  tcp_max_syn_backlog specifies the maximum number of incomplete tcp connection requests that will be remembered. When this system is under a syn flood, a larger number will increase its chance of being able to handle legitimate requests.

- **net.ipv4.tcp_syncookies = 1**
  With syncookies enabled, if we reach a point where there are more than 4096 incomplete connections (highly unlikely under normal loads), this system will change how it responds to new connection requests. Instead of remembering all new connections, it sends out a coded response (the "syncookie") and completely forgets that the connection request came in at all. If the client actually completes the connection request with the third ACK packet, the server can see the cookie coming back and can then rebuild the connection in memory. The remaining connection requests (the syn flood packets) will never send this third ACK packet, so the server now has a way to hold legitimate conversations without tying up huge amounts of memory and processor time handling the flood. When syncookies are turned on and we overflow the above backlog, the excess connections are completed, but we lose the ability to use TCP extensions for those connections. This may result in some performance hit for those connections, but the damage here is far less than the damage from the syn flood itself.

- **net.ipv4.conf.all.rp_filter = 1**
  Arriving packets get a simple check; is the packet arriving on the correct interface for its source address? In other words, would a response to this packet go back out the same interface? This simple routing table check can quickly handle some attempts at spoofing source addresses. The only reason why this might need to be left off is if your network using asymmetric routing. One example might be a satellite link where incoming packets arrive on an ethernet interface, but outgoing packets go out through a modem.

- **net.ipv4.conf.all.accept_source_route = 0**
  This IP option specifies how incoming and outgoing packets get routed. While originally intended as a troubleshooting technique, it is used almost exclusively to exploit IP trust relationships with spoofed source packets, and should be disabled.
- **net.ipv4.conf.all.accept_redirects = 0**
  When disabled, this system will no longer accept ICMP Redirect messages. While these can occasionally be legitimately used to temporarily patch an incorrect routing table on a host machine, malicious hosts can use these to force packets through a sniffer or invalid gateway. For hosts with correct routing tables, this type of packet only has malicious uses. For hosts with incorrect routing tables, ignoring these packets will only slightly impact network performance.

- **net.ipv4.conf.all.secure_redirects = 0**
  When enabled, this would allow redirects from local routers. It’s disabled for the same reasons as the above; malicious hosts could lie about the source address for the redirect.

- **net.ipv4.conf.default.rp_filter = 1**
- **net.ipv4.conf.default.accept_source_route = 0**
- **net.ipv4.conf.default.accept_redirects = 0**
- **net.ipv4.conf.default.secure_redirects = 0**
  The previous settings (the "net.ipv4.conf.all.*" settings) affect all interfaces that exist when the change is implemented at boot time. These "net.ipv4.conf.default.*" make the same changes for any additional interfaces that are created later, such as hotplug USB or PCMCIA network cards.

- **net.ipv4.icmp_echo_ignore_broadcasts = 1**
  When set to ignore, this system will not respond to broadcast pings such as those used in Smurf attacks. The system will continue to respond to normal ping packets, just not participate in creating floods of echo replies.

**Audit:** TBD

**Remediation:**
```
cat <<END_SCRIPT >> /etc/sysctl.conf
# The following 11 lines added, per CIS Red Hat Enterprise Linux Benchmark sec 5.1:
net.ipv4.conf.default.secure_redirects = 0
net.ipv4.conf.all.secure_redirects = 0
net.ipv4.icmp_echo_ignore_broadcasts = 1
net.ipv4.conf.all.accept_redirects = 0
net.ipv4.conf.default.accept_redirects = 0
net.ipv4.tcp_syncookies = 1
net.ipv4.conf.all.rp_filter = 1
net.ipv4.conf.default.rp_filter = 1
net.ipv4.conf.all.accept_source_route = 0
net.ipv4.conf.default.accept_source_route = 0
END_SCRIPT
chown root:root /etc/sysctl.conf
chmod 0600 /etc/sysctl.conf
```

**Scoring Status:** Scorable

**Compliance Mapping:** TBD

**Additional References:** TBD
5.2 Additional Network Parameter Modifications

Description:
For an explanation of some of these parameters, see `/Documentation/networking/ip-sysctl.txt` in the local copy of the kernel source or read the latest from the cross-referencing Linux site: http://lxr.linux.no/source/Documentation/networking/ip-sysctl.txt.

Audit: TBD

Remediation:
Question:
Is this system going to be used as a firewall or gateway to pass network traffic between different networks?
If the answer to this question is no, then perform the action below.
```
cat <<END_SCRIPT  >>  /etc/sysctl.conf
# The following 04 lines added, per CIS Red Hat Enterprise Linux Benchmark sec 5.2:
net.ipv4.ip_forward = 0
net.ipv4.conf.all.send_redirects = 0
net.ipv4.conf.default.send_redirects = 0
net.ipv4.icmp_ignore_bogus_error_responses = 1
END_SCRIPT
chown root:root /etc/sysctl.conf
chmod 0600      /etc/sysctl.conf
```

diff /etc/sysctl.conf

Scoring Status: Scorable

Compliance Mapping: TBD

Additional References: TBD
6 Logging

The items in this section cover enabling various different forms of system logging in order to keep track of activity on the system. Because it is often necessary to correlate log information from many different systems (particularly after a security incident) experts recommend establishing some form of time synchronization 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. More information on NTP can be found at http://www.ntp.org and http://www.ibiblio.org/pub/Linux/docs/HOWTO/otherformats/html_single/TimePrecision-HOWTO.html.

6.1 Capture Messages Sent To syslog AUTHPRIV Facility

**Description:**
A great deal of important security-related information is sent via logging channels (e.g., network service startups, commands like `usermod` and `chage`, etc). The below action causes this information to be captured in the `/var/log/secure` file (which is only readable by the superuser). This file should be reviewed and archived on a regular basis.

The priority, within `syslog.conf` is one of the following words, in ascending order: `debug`, `info`, `notice`, `warning`, `warn` (same as `warning`), `error`, `err` (same as `error`), `crit`, `alert`, `emerg`, and `panic` (same as `emerg`).

**Audit:** TBD

**Remediation:**

```bash
if [ `grep -v '^#' /etc/syslog.conf | grep -c 'authpriv'` -eq 0 ]; then
echo "Established the following record in /etc/syslog.conf"
echo "authpriv.*\t\t\t/var/log/secure"
echo -e "authpriv.*\t\t\t/var/log/secure" >> /etc/syslog.conf
else
echo "syslog OK. Didn't have to change syslog.conf for authpriv; the"
echo "following record is good:"
grep "^authpriv" /etc/syslog.conf | grep '/var/log/secure'
fi

# Add record for 'auth.*', too, placing it after the authpriv record
if [ `grep -v '^#' /etc/syslog.conf | grep -c 'auth.*'` -eq 0 ]; then
  ed /etc/syslog.conf <<END_SCRIPT
  1
  /^authpriv
  a
  auth.*
  .
  w
  q
END_SCRIPT
else
  echo "syslog OK. Didn't have to change syslog.conf for auth.*; the"
  echo "following record is good:"
  grep 'auth.*' /etc/syslog.conf
fi
chown root:root /etc/syslog.conf
# Original/default permissions are 0644.
chmod 0600 /etc/syslog.conf
echo "diff /etc/syslog.conf-preCIS /etc/syslog.conf"
```

```
diff /etc/syslog.conf-preCIS /etc/syslog.conf
# Create the log file if it doesn't already exist.
touch /var/log/secure
chown root:root /var/log/secure
chmod 0600 /var/log/secure
echo "Restarting syslog service to immediately implement the latest configuration."
service syslog stop
service syslog start

Scoring Status: Scorable

Compliance Mapping: TBD

Additional References: TBD

6.2 Turn On Additional Logging For FTP Daemon

Description:
Red Hat Enterprise Linux already logs connections and all files transferred in vsftpd. The modifications below ensure all commands sent to the server are logged.

Audit: TBD

Remediation:

FILE=""
if [ -f /etc/vsftpd.conf ]; then
  FILE="/etc/vsftpd.conf"
else
  FILE="/etc/vsftpd/vsftpd.conf"
fi
if [ -f $FILE ]; then
  awk ' /^(?#xferlog_std_format)/ 
    { print "xferlog_std_format=NO"; next }; 
  /^(?#log_ftp_protocol)/ 
    { print "log_ftp_protocol=YES"; next }; 
  { print }' $FILE-preCIS > $FILE
  if [ `egrep -c log_ftp_protocol $FILE` == 0 ]; then
    echo "log_ftp_protocol=YES" >> $FILE
  fi
  chown root:root $FILE
  chmod 0600 $FILE
  echo "diff $FILE-preCIS $FILE"
diff $FILE-preCIS $FILE
else
  echo "OK - No /etc/vsftpd.conf."
fi

Scoring Status: Scorable

Compliance Mapping: TBD

Additional References: TBD
6.3 Confirm Permissions On System Log Files

**Description:**
It is critical to protect system log files from being modified by unauthorized individuals. Also, certain logs contain sensitive data that should only be available to the system administrator.

If any of the services that affect the below logs are required, please revisit this section to ensure the logs have the correct/secure permissions.

**Note:** The `chmod` command will display errors, when the file does not exist.

**Audit:** TBD

**Remediation:**
```bash
#echo "Some errors MAY appear here for directories, logs and/or files not installed on this system."
cd /var/log

# Part 1
echo "Extra---Ensure the btmp log file for 'lastb' is in place and with proper permissions. This satisfies DISA SRR (GEN000440)"
touch /var/log/btmp
chown root:root /var/log/btmp
chmod 0600 /var/log/btmp

echo "Before listing of the log directory [explicit]."
ls -la /var/log

# Part 2
echo "LogPerms Part 1."
for LogFile in \ boot.log \ btmp \ cron \ dmesg \ ksym \ dmesg \ dmesg \ dmesg \ dmesg \ httpd \ lastlog \ maillog \ maillog \ maillog \ messages \ news \ psql \ rpmpkgs \ sa \ sa \ sa \ scrollkeeper.log \ secure \ spool \ squid \ vbox \ wtmp
do
      # This check allows only entries that exist to have permissions set.
      # Visually cleaner for the person running it.
      if [ -e ${LogFile} ]; then
         # Utilizing recursive here is harmless when applied to a single file.
```
echo "LogPerms Part 1."

for LogFile in \
    boot.log  \
    cron       \
    dmesg      \
    gdm        \
    httpd      \
    ksymns     \
    lastlog    \
    maillog    \
    mailman    \
    messages   \
    news       \
    psql       \
    rpmkgs     \
    samba      \
    sa         \
    scrollkeeper.log  \
    secure     \
    spooler    \
    squid      \
    vbox       

do
    if [ -e ${LogFile} ]; then
        chmod -R o-rwx ${LogFile}*
    else
        echo "LogFile didn't exist ($LogFile)."
    fi
done

echo "LogPerms Part 2."

for LogFile in \
    boot.log  \
    cron       \
    dmesg      \
    gdm        \
    httpd      \
    ksymns     \
    lastlog    \
    maillog    \
    mailman    \
    messages   \
    news       \
    psql       \
    rpmkgs     \
    samba      \
    sa         \
    scrollkeeper.log  \
    secure     \
    spooler    \
    squid      \
    vbox       

do
    if [ -e ${LogFile} ]; then
        chmod -R g-w ${LogFile}*
    else
        echo "LogFile didn't exist ($LogFile)."
    fi
done

echo "LogPerms Part 3."

for LogFile in \
    boot.log  \
    cron       \
    httpd      \
    lastlog    \
    maillog    \
    mailman    \
    messages   \
    psql       \
    sa         \
    samba      \
    secure     \
    spooler    

do
    if [ -e ${LogFile} ]; then
        chmod -R g-rx ${LogFile}*
    else
        echo "LogFile didn't exist ($LogFile)."
    fi
done

echo "LogPerms Part 4."

for LogFile in \

gdm    
httpd    
news    
samba    
squid    
sa    
vbox

do
  if [ -e ${LogFile} ]; then
    chmod -R o-w ${LogFile}*
  else
    echo "LogFile didn't exist ($LogFile)."
  fi
done

echo "LogPerms Part 5."
for LogFile in \\
hpdd    
samba    
squid    
sa
  do
    if [ -e ${LogFile} ]; then
      chmod -R o-rx ${LogFile}*
    else
      echo "LogFile didn't exist ($LogFile)."
    fi
  done

echo "LogPerms Part 6."
for LogFile in \\
kernel    
lastlog    
mailman    
syslog    
loginlog
  do
    if [ -e ${LogFile} ]; then
      chmod -R u-x ${LogFile}*
    else
      echo "LogFile didn't exist ($LogFile)."
    fi
  done

echo "LogPerms Part 7."
# Removing group write permissions to btmp and wtmp
chgrp utmp btmp
chmod g-w btmp
chgrp utmp wtmp
chmod g-w wtmp

# Fixing "/etc/rc.d/rc.sysinit", as it unsecurities permissions for wtmp.
awk '{ $1 == "chmod" && $2 == "0664" && $3 == "/var/run/utmp" && $4 == "/var/log/wtmp" } { print "chmod 0600 /var/run/utmpx /var/log/wtmpx"; next };
  ( $1 == "chmod" && $2 == "0664" && $3 == "/var/run/utmpx" && $4 == "/var/log/wtmpx" ) { print " chmod 0600 /var/run/utmpx /var/log/wtmpx"; next };
  { print }' /etc/rc.d-preCIS/rc.sysinit > /etc/rc.d/rc.sysinit
chown root:root /etc/rc.d/rc.sysinit
chmod 0700 /etc/rc.d/rc.sysinit

echo "diff /etc/rc.d-preCIS/rc.sysinit /etc/rc.d/rc.sysinit"
  diff /etc/rc.d-preCIS/rc.sysinit /etc/rc.d/rc.sysinit

echo "LogPerms Part 8."
[ -e news ] && chown -R news:news news
[ -e pgsql ] && chown postgres:postgres pgsql
[ -e squid ] && chown -R squid:squid squid
[ -e lastlog ] && chown 0600 lastlog
chown -R root:root .
echo ""

Diff /etc/rc.d-preCIS/rc.sysinit /etc/rc.d/rc.sysinit

Follow on listing of the log directory [explicit]."
ls -1a /var/log

Scoring Status: Scorable

Compliance Mapping: TBD

Additional References: TBD

6.4 Configure syslogd to Send Logs to a Remote LogHost

Description:
Remote logging is essential in detecting intrusion and monitoring several servers operating in concert. An intruder – once he/she has obtained root – can edit the system logs to remove all traces of the attack. If the logs are stored off the machine, those logs can be analyzed for anomalies and used for prosecuting the attacker.

Audit: TBD

Remediation:
In the script below, replace loghost with the proper name (FQDN, if necessary) of the loghost.
printf "Following 05 lines added per CIS Red Hat Enterprise Linux Benchmark sec 6.4 \n  RHEL Benchmark Section 6.4\n  kern.warning;*.err;authpriv.none@loghost\n  *.info;mail.none;authpriv.none;cron.none@loghost\n  *.emerg@loghost\n  local7.*@loghost " >> /etc/syslog.conf
chown root:root /etc/syslog.conf
chmod 0600 /etc/syslog.conf

echo "diff /etc/syslog.conf-preCIS /etc/syslog.conf"
  diff /etc/syslog.conf-preCIS /etc/syslog.conf

Scoring Status: Scorable

Compliance Mapping: TBD

Additional References: TBD
7 File and Directory Permissions/Access

7.1 Add 'nodev' Option To Appropriate Partitions In /etc/fstab

**Description:**
Placing "nodev" on these partitions prevents non-administrative users from mounting unauthorized devices on any partitions that should not contain devices. There should be little need to mount devices on any partitions other than device entries established subordinate to /dev.

One notable exception, of course, is the case where system programs are being placed into "chroot jails" - these often require that several devices be created in the chroot directory. If using chroot jails on any of the machines, be careful with the nodev option.

Configuring filesystems to prevent abuse is an important step in securing a system. Where feasible filesystems should be mounted with the most restrictive set of permissions possible that still allows normal operation. The three most important restrictions are nodev (prevent devices from being created on this filesystem), nosuid (do not respect the suid bit on this filesystem) and noexec (do no execute files from this filesystem).

At a minimum the nodev option should be applied to all filesystems except / to prevent users from mounting unauthorized devices. There should be little need to mount devices on any filesystems other than /dev.

**Note:** The printf command may cause unexpected concatenation of fields, when one of them is too long.

**Audit:** TBD

**Remediation:**
```
{ printf "%-26s%-22s%-8s%-16s %-1s%-1s\n",$1,$2,$3,$4,$5,$6 } 
/etc/fstab > /tmp/cis/fstab.tmp2
# Kept /tmp/cis/fstab.tmp2 as input to the next step (CIS 7.2).
chown root:root /etc/fstab
chmod 0644 /etc/fstab
# Note: the diff IS not for the same pair of files, as this step is treated
# as intermediary. But, we'll show the users the damage done so far and
# they see the progress.
echo "diff /etc/fstab-preCIS /etc/fstab"
diff /etc/fstab /tmp/cis/fstab.tmp2
chmod -R 0400 /tmp/cis/*
```

**Scoring Status:** Scorable

**Compliance Mapping:** TBD

**Additional References:** TBD
7.2 Add 'nosuid' and 'nodev' Option For Removable Media In /etc/fstab

Description:
Removable media is one vector by which malicious software can be introduced onto the system. By forcing these file systems to be mounted with appropriate secure options, the administrator prevents users from bringing hostile programs onto the system via CDROMs, floppy disks, USB drives, etc.

Generally, many usb devices can be implemented and the OS will ignore settings in 'console_perms'. Therefore, the only solid way of preventing usb drives from mounting is via udev. On some Linux systems all mountable devices may be handled by /etc/fstab. In this case the instructions for securing removable file systems are the same as in Section 7.1, the nodev, nosuid and optionally the noexec option should be added to each entry for a removable device in /etc/fstab.

RHEL 5 uses udev and the Hardware Abstraction Layer (HAL) daemon software to update the filesystem description table (/etc/fstab) based on a series of SGML policies located in /usr/share/hal/fdi. Editing these SHML files manually is beyond the scope of this Benchmark. Therefore, if changes are made to /etc/fstab, set it to be immutable (via chattr, check the man page). It is not required, though, for the immutable bit to be set, to be Benchmark compliant.

Some clarification on RHEL 5 behavior: because the action has changed significantly from RHEL 4. In RHEL 5 udev and hal cooperatively interact to mount inserted removable media. The policies governing the mounting come from a combination of the udev and hal config files. udev 's primary contribution is to create the device node, set device permissions and alert hal. hal executes the mount after referencing it's rules list. hal uses the /usr/libexec/hal-storage-mount program to perform the mount.

RHEL 5, by default, does the "right thing" when mounting removable media (mounts with nodev, nosuid and noexec options), however, auditing the behavior can be a challenge. The default mount options that are applied to all removable media mounts do_not_appear in any of the hal rules files. The reason is that the mount options are coded into the /usr/libexec/hal-storage-mount program that executes the mount (review the source, or run strings on the binary and see the mount options "noexec,nosuid,nodev"). It appears that unless the mount option is specifically allowed for a given media type in the 20-storage-methods.fdi file then an unprivileged user cannot mount with that mount option. Therefore, since there does not appear to be any allowed mount options in the stock file to allow the overriding of the nodev and nosuid options it should be impossible for an unprivileged user to mount a device, even with suid or dev support.

Audit: TBD

Remediation:
# Part 1
# Additional devices this section 'might' consider could be a DVD or cd recorder
awk '($2 ~ /^\S/m.*(/floppy|cdrom|corder)\$/) && ($4 !~ /,nodev,nosuid/ ) 
  { $4 = $4 ",nodev,nosuid" };
{ printf "%-26s%-22s%-8s%-16s %-1s %-1s
",$1,$2,$3,$4,$5,$6 }'
/tmp/cis/fstab.tmp2 > /tmp/cis/fstab.tmp3
mv /tmp/cis/fstab.tmp3 /etc/fstab
chown root:root /etc/fstab
chmod 0644 /etc/fstab
echo "diff /etc/fstab-preCIS /etc/fstab"
diff /etc/fstab-preCIS /etc/fstab
echo "This hardening procedure will NOT set /etc/fstab immutable, (contrary to the Benchmark)"
echo "since the HAL daemon manages portions of it."

# Part 2

fdiPATH='unknown'
if [-e /usr/share/hal/fdi/95userpolicy ]; then
  # Apply this to RHEL AS4 system
  fdiPATH="/usr/share/hal/fdi/95userpolicy"
else
  if [-e /usr/share/hal/fdi/policy/20thirdparty ]; then
    # apply this for RHEL5
    fdiPATH="/usr/share/hal/fdi/policy/20thirdparty"
  fi
fi
if [ "$fdiPATH" == 'unknown' ]; then
  echo "Neither path was available, fdi for hal NOT secured."
  echo "RHEL AS4: /usr/share/hal/fdi/95userpolicy"
  echo "RHEL5: /usr/share/hal/fdi/policy/20thirdparty"
else
  echo "Placing floppycdrom.fdi at: ($fdiPATH)."
  cat <<END_SCRIPT >> $fdiPATH/floppycdrom.fdi
<?xml version="1.0" encoding="ISO-8859-1"?>
<deviceinfo version="0.2">
  <device>
    <match key="info.udi" string="/org/freedesktop/Hal/devices/computer">
      <merge key="storage.policy.default.mount_option.nodev" type="bool">true</merge>
      <merge key="storage.policy.default.mount_option.nosuid" type="bool">true</merge>
    </match>
  </device>
</deviceinfo>
END_SCRIPT
  chown root:root $fdiPATH/floppycdrom.fdi
  chmod 0640 $fdiPATH/floppycdrom.fdi
  echo "Established $fdiPATH/floppycdrom.fdi"
fi

Additional Optional Action for RHEL5 is to set the immutable bit on the fstab file. However, this is not a mandatory hardening action, as hal normally manages this file and expects to be able to update it dynamically as the need arises. Use with caution, and watch the syslog messages file for errors.

# USE with caution:
chattr +i /etc/fstab

Scoring Status: Scorable

Compliance Mapping: TBD

Additional References: TBD
7.3 Disable User-Mounted Removable File Systems

Description:
In Red Hat Enterprise Linux, the pam_console PAM module gives the user at the console (the machine's true physical keyboard) temporarily enhanced privileges. This is configured through the /etc/security/console.perms file or console.perms.d/50-default.perms. Under the Red Hat-shipped settings, the console user is given ownership of the floppy and CD-ROM drive, along with a host of other devices.

Many of these devices correspond to removable media and thus represent a security risk. This item disables the enhanced privileges on these devices. Be aware that allowing users to mount and access data from removable media drives makes it easier for malicious programs and data to be imported onto the network or data to be removed from the server.

Audit: TBD

Remediation:
Question:
Is there a mission-critical reason to allow unprivileged users to mount CD-ROMs and floppy disk file systems on this system? If the answer to this question is no, then perform the action below.

cd /etc/security
  CONS_PERM_FILE="console.perms"
  DEF_FILE="console.perms.d/50-default.perms"
  # If the test below passes, the 2nd file is changed, not the first.
  # Need to protect both.
  test -f $DEF_FILE && CONS_PERM_FILE="$DEF_FILE"
  # Each entry listed below will NOT be commented out in the "console.perms" file.
  # The remaining entries in that file WILL be commented out and thus disabled
  # post-reboot.
  # Further, "memstick" and "diskonkey" were not part of the original CIS
  # specification to be left alone, but have been included to tailor the hardened
  # build for usage of normal system USB requirements (such as keyboards and mice).
  awk '{ $1 == "<console>" ) && ( $3 !~ /sound|fb|kbd|joystick|v4l|mainboard|gpm|scanner|memstick|diskonkey/ )
    { $1 = "#<console>" }; ( print )' ${CONS_PERM_FILE}
# Virgin default permissions were 0644 & 0600 respectively... Just noting the difference.
chown root:root $CONS_PERM_FILE
chmod 0600 $CONS_PERM_FILE
echo "diff $(CONS_PERM_FILE)-preCIS $CONS_PERM_FILE"
diff $(CONS_PERM_FILE)-preCIS $CONS_PERM_FILE
cd $cishome

Scoring Status: Scorable

Compliance Mapping: TBD

Additional References: TBD
7.4 Verify passwd, shadow, and group File Permissions

**Description:**
These are the default owners and access permissions for these files. It is worthwhile to periodically check these file permissions as there have been package defects that changed /etc/shadow permissions to 0644. Tripwire (http://www.tripwire.org/downloads/index.php) though it hasn't been updated since 2001, AIDE (http://sourceforge.net/projects/aide) – a successor to Tripwire, and zlister (http://www.ibiblio.org/pub/linux/system/admin/zlisterProduction-1.7a) are excellent products for alerting to changes in these files, and others throughout the filesystem.

**Audit:** TBD

**Remediation:**

```
ls -la /etc/group /etc/gshadow /etc/passwd /etc/shadow
chown root:root /etc/group /etc/gshadow /etc/passwd /etc/shadow
chmod 0644 /etc/group /etc/passwd
chmod 0400 /etc/gshadow /etc/shadow
ls -la /etc/group /etc/gshadow /etc/passwd /etc/shadow
```

**Scoring Status:** Scorable

**Compliance Mapping:** TBD

**Additional References:** TBD

7.5 Ensure World-Writable Directories Have Their Sticky Bit Set

**Description:**
When the so-called "sticky bit" is set on a directory, then only the owner of a file may remove that file from the directory (as opposed to the usual behavior where anybody with write access to that directory may remove the file). Setting the sticky bit prevents users from overwriting each other's files, whether accidentally or maliciously, and is generally appropriate for most world-writable directories. However, consult appropriate vendor documentation before blindly applying the sticky bit to any world writable directories found in order to avoid breaking any application dependencies on a given directory. Alternatively, ensure such directories are not world-writeable.

**Audit:** TBD

**Remediation:**

The automated tool supplied with this Benchmark will flag world-writable directories that do not have the sticky bit set.

Administrators who wish to obtain a list of these directories may execute the following commands:

```
for PART in `awk '( $3 ~ "ext[23]" ) { print $2 }' /etc/fstab`; do
    find $PART -xdev -type d \(-perm -0002 -a ! -perm -1000 \) -print
done
```

There should be no entries returned.


Scoring Status: Scorable

Compliance Mapping: TBD

Additional References: TBD

### 7.6 Find Unauthorized World-Writable Files

**Description:**
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.

Generally removing write access for the "other" category (chmod o-w <filename>) is advisable, but always consult relevant vendor documentation in order to avoid breaking any application dependencies on a given file.

**Audit:** TBD

**Remediation:**
The CIS-CAT automated testing tool supplied as a companion to this Benchmark will flag unexpected world-writable files on local system partitions.

Administrators who wish to obtain a list of the world-writable files currently installed on the system may run the following commands to identify them:
```
for PART in $( grep -v '^#' /etc/fstab | awk '{ $3 ~ "ext[23]" } { print $2 }' ); do  
    find $PART -xdev -type f \( -perm -0002 -a ! -perm -1000 \) -print 
  done
```

There should be no entries returned. If `grub.conf` shows up, its permissions will be adjusted in section 8.8.

Scoring Status: Scorable

Compliance Mapping: TBD

Additional References: TBD

### 7.7 Find Unauthorized SUID/SGID System Executables

**Description:**
The administrator should take care to ensure that no rogue or inappropriate set-UID programs/scripts have been introduced into the system. In addition, if possible, the administrator should accomplish a set-UID audit and reduction/elimination of those unnecessary to the systems functioning.

The script below has the list of those binaries/scripts which come by default in the distributed OS as having SUID (- --s --s --) and/or GUID (- --- --s --) enabled.
All users primary group should be their user private group they are then granted membership in other groups as needed. Depending on the level of group interaction and security/integrity requirements of the documents all users are then set with an 007 or 027 default umask. File sharing spaces are designated by creating a folder owned by the group with the SGID bit set. This causes all files placed in that folder to assume the group ownership of the folder regardless of the primary group of the creator. Ex. Jane, a member of the accounting group, creates a spreadsheet. The permissions on the spreadsheet in her home folder are jane:jane 0640. She then moves the file to the "accounting" folder which has permissions root:accounting 4770. The spreadsheet's new permissions should be jane:accounting 0640.

**Audit:** TBD

**Remediation:**
The automated testing tool supplied with this Benchmark will flag unexpected set-UID and set-GID applications on the system. Administrators who wish to obtain a list of the set-UID and set-GID programs currently installed on the system may run the following commands:

```
# Part1
echo "Generate list of SUID/SGID files that exist on the system..."
for PART in $(grep -v '^#' /etc/fstab | awk '($3 ~ "ext[23]") { print $2 }')
  do
     find $PART -xdev $( -perm -04000 -o -perm -02000 ) -print | sort \
     >> /tmp/cis/CIS_7.7_f1
  done

# Part2
for FILE in \
  /bin/mount \
  /bin/ping \
  /bin/ping6 \
  /bin/su \
  /bin/traceroute \
  /bin/traceroute6 \
  /bin/umount \
  /media/.hal-mtab-lock \
  /sbin/mount.nfs \
  /sbin/mount.nfs4 \
  /sbin/netreport \
  /sbin/pam_timestamp_check \
  /sbin/pwdB_chkpwd \
  /sbin/umount.nfs \
  /sbin/umount.nfs4 \
  /sbin/unix_chkpwd \
  /usr/X11R6/bin/Xorg \
  /usr/bin/at \
  /usr/bin/chage \
  /usr/bin/chfn \
  /usr/bin/chsh \
  /usr/bin/crontab \
  /usr/bin/cu \
  /usr/bin/gataxx \
  /usr/bin/glines \
  /usr/bin/gnibbles \
  /usr/bin/gnobots2 \
  /usr/bin/gnome
```
CIS Red Hat Enterprise Linux Benchmark, v1.1 (2008/04)

```
/usr/libexec/mc/cons.saver
/usr/libexec/openssh/ssh
/usr/libexec/umtemper/umtemper
/usr/sbin/amcheck
/usr/sbin/ccreds_validate
/usr/sbin/exim
/usr/sbin/gnome-pty-helper
/usr/sbin/lockdev
/usr/sbin/postdrop
/usr/sbin/postqueue
/usr/sbin/sendmail.sendmail
/usr/sbin/suexec
/usr/sbin/userhelper
/usr/sbin/userisdnctl
/usr/sbin/utempter
/usr/sbin/uucico
/usr/sbin/uuxqt
/usr/sbin/utempter

do
  # Valid files with either SUID or SGID set are listed above, so this
  # next piece will remove them from what's been found.
  grep -v '${FILE}' /tmp/cis/CIS_7.7_f1 > /tmp/cis/CIS_7.7_f2
  # Put the file back and continue searching
  /bin/cp -pf /tmp/cis/CIS_7.7_f2 /tmp/cis/CIS_7.7_f1
done
x=`wc -c /tmp/cis/CIS_7.7_f1 | cut -d" " -f1`
if [ $x == 0 ]; then
  echo "($x) OK - No inappropriate SUID or SGID files found."
else
  sed 's/.*/ls -lad &/ ' /tmp/cis/CIS_7.7_f1 > /tmp/cis/CIS_7.7_f2
  echo "The following files have either the SUID and/or the SGID bit set."
  echo "These are not in the list of approved files/executables to have either"
  echo "of those bits set. Recommend removing the SUID/SGID bits on them."
  /bin/bash /tmp/cis/CIS_7.7_f2
fi

Scoring Status: Scorable

Compliance Mapping: TBD

Additional References: TBD

7.8 Find All Unowned Directories and Files

Description:
Investigate and do not allow any unowned directories and/or files on the system. Unowned entities may be an indication an intruder has accessed the system or improper package maintenance or installation. Sometimes a package removal results in unowned files or directories related to this software as the user/group associated with that package is removed, but that user's files (i.e., files changed after the package was installed) are left behind.
When users are removed from the system, a check for unowned directories and files should occur at that time, so that someone responsible for such information (programs, data, etc…) can rightfully assume ownership.

Another common cause is the installation of software that does not properly set file ownerships. Files in any NFS mounts should be investigated/researched as the user ID mapping between systems may be out of sync. If the local Enterprise uses a central user management system (NIS or LDAP), the presence of unowned files may indicate some other problem and should be investigated.

**Audit:** TBD

**Remediation:**

```bash
for PART in $(grep -v '^#' /etc/fstab | awk '{ print $2 }'); do
    find $PART -xdev -nouser -o -nogroup -print > /tmp/cis/CIS_7.8_f1
done

sed 's/^.*/ls -lad &/' /tmp/cis/CIS_7.8_f1 > /tmp/cis/CIS_7.8_f2
cat /tmp/cis/CIS_7.8_f2
chmod -R 0400 /tmp/cis/*
```

There should be no entries returned.

**Scoring Status:** Scorable

**Compliance Mapping:** TBD

**Additional References:** TBD

### 7.9 Disable USB Devices

**Description:**

USB drives and memory devices represent another attack vector against a system. The prices for a 1GB USB memory device, or larger, have become very affordable, and is enough storage to transport vast quantities of data off a system. Few servers have need for USB devices and this whole avenue should be disabled.

Another possible attack would be to have a bootable Linux system installed on the USB device. Most modern BIOS' allow booting from USB devices, so this would let a person with physical access to a server an extremely easy way take over a system and bypass some of the security being set up. See the discussion regarding floppy and CD-ROM drives in section 7.2.

For these reasons, should also disable USB in the system BIOS if possible.

**Note:** Hotplugger is required by `udev`, which is required by several other required packages, making very unlikely to be able to remove it. Therefore, for new Red Hat versions the `nousb` kernel boot argument should be employed to disable USB devices. The script below uses `grubby` to add the nousb kernel boot argument to the default kernel image. Adding nousb to other kernel images is also recommended. The `/etc/grub.conf` symbolic link may also be viewed or
edited as well. The \texttt{nousb} argument is placed at the end of the lines starting with kernel, as shown below.

```
kerneld /vmlinuz-2.6.xx.FC5 ro root=LABEL=/ nousb
```

"The \texttt{nousb}" argument to the kernel may also disable USB keyboards and mice. A potentially serious problem on legacy free systems that do not have PS2 connections or for systems using USB KVMs. An alternative remediation would be to insert the line \texttt{install usb-storage /bin/true} into \texttt{/etc/modprobe.conf}. This will disable USB storage devices by preventing the kernel module from loading".

**Audit:** TBD

**Remediation:**

\begin{verbatim}
DEF_KERN=$( grubby --default-kernel)
grubby --update-kernel=$DEF_KERN --args="nousb"
\end{verbatim}

**Scoring Status:** Scorable

**Compliance Mapping:** TBD

**Additional References:** TBD
8 System Access, Authentication, and Authorization

8.1 Remove .rhosts Support In PAM Configuration Files

Description:
Used in conjunction with the BSD-style "r-commands" (rlogin, rsh, rcp), the .rhosts files implement a weak form of authentication based on the network address or host name of the remote computer (which can be spoofed by a potential attacker to exploit the local system). Disabling .rhosts support helps prevent users from subverting the system's normal access control mechanisms. On an RHEL5.1 system, PAM documentation can be found under “/usr/share/doc/pam-0.99.7.1/txts.

If .rhosts support is required for some reason, some basic precautions should be taken when creating and managing .rhosts files. Never use the "+" wildcard character in .rhosts files. In fact, .rhosts entries should always specify a specific trusted host name along with the user name of the trusted account on that system (e.g., "trustedhost alice" and not just "trustedhost"). Avoid establishing trust relationships with systems outside of the organization's security perimeter and/or systems not controlled by the local administrative staff. Firewalls and other network security elements should actually block rlogin/rsh/rcp access from external hosts.

Finally, make sure that .rhosts files are only readable by the owner of the file (i.e., these files should be mode 0600).

Audit: TBD

Remediation:
ls -la /etc/pam.d/* > /tmp/cis/CIS_7.1.Before.tmp
cd /etc/pam.d
for FILE in `find . -type f -exec grep -l rhosts_auth {} \`; do
echo "Removing .rhosts support in ${FILE}.'
   grep -v rhosts_auth $FILE > /tmp/cis/${FILE}.tmp
   /bin/cp -f /tmp/cis/${FILE}.tmp $FILE
   chown root:root $FILE
   chmod 0644 $FILE
done
ls -la /etc/pam.d/* > /tmp/cis/CIS_7.1.After.tmp
echo "The following entries changed under '/etc/pam.d'"
chmod -R 0400 /tmp/cis/*
cd $cishome

Scoring Status: Scorable

Compliance Mapping: TBD

Additional References: TBD
8.2 Create ftpusers Files

Description:
/etc/ftpusers and /etc/vsftpd.ftpusers contain a list of users who are not allowed to access the system via WU-FTPd and vsftpd, respectively. Generally, only normal users should ever access the system via FTP-there should be no reason for "system" type accounts to be transferring information via this mechanism. Certainly the root account should never be allowed to transfer files directly via FTP.

If vsftpd is used, it may be desirable to reverse the usage of the users file to be a list of users who ARE able to ftp to the server, instead of a list of users who are NOT able to ftp into the server. This provides greater control and safety in denying the ftp usage by default for users NOT listed. To reverse the meaning of the vsftpd users list file set userlist_deny=NO in the vsftpd.conf file. The script below attempts to check for the userlist_deny vsftpd setting and will not create or modify the default vsftpd user list file if the value is NO. It is important to carefully test the configuration after these changes to be sure that only the expected users are allowed to login via ftp.

Audit: TBD

Remediation:
if [ -f /etc/ftpaccess ]; then
   for NAME in `cut -d: -f1 /etc/passwd`; do
      if [ `id -u $NAME` -lt 500 ]; then
         echo $NAME >> /etc/ftpusers
      fi
   done
   chown root:root /etc/ftpusers
   chmod 0600 /etc/ftpusers
   echo "diff /etc/ftpusers-preCIS /etc/ftpusers"
   diff /etc/ftpusers-preCIS /etc/ftpusers

   VSFTP_CONF="/etc/vsftpd/vsftpd.conf"
   ALT_CONF="/etc/vsftpd/vsftpd.conf"
   test -f $ALT_CONF && VSFTP_CONF=$ALT_CONF
   if [ -e $VSFTP_CONF ] && ! grep -q "^userlist_deny=NO" $VSFTP_CONF; then
      /bin/cp -fp /etc/ftpusers /etc/vsftpd.ftpusers
      chown root:root /etc/vsftpd/vsftpd.conf
      chgrp 0600 /etc/vsftpd/vsftpd.conf
      [ -e /etc/vsftpd.ftpusers-preCIS ] && echo "diff /etc/vsftpd.ftpusers-preCIS /etc/vsftpd.ftpusers"
      diff /etc/vsftpd.ftpusers-preCIS /etc/vsftpd.ftpusers
   fi
else
   echo "OK - No /etc/ftpaccess to tailor."
fi

Scoring Status: Scorable

Compliance Mapping: TBD

Additional References: TBD
8.3 Prevent X Server From Listening On Port 6000/tcp

**Description:**
X servers listen on port 6000/tcp for messages from remote clients running on other systems. However, X Windows uses a relatively insecure authentication protocol and an attacker who is able to gain unauthorized access to the local X server can easily compromise the system.

Invoking the "-nolisten tcp" option causes the X server not to listen on port 6000/tcp by default. This prevents authorized remote X clients from displaying windows on the local system as well. However, the forwarding of X events via SSH will still happen normally. This is the preferred and more secure method transmitting results from remote X clients in any event.

**Audit:** TBD

**Remediation:**
```bash
if [ -e /etc/X11/xdm/Xservers ]; then
    cd /etc/X11/xdm
    awk '{ $1 != /^#/ && $3 == "/usr/X11R6/bin/X" } { $3 = $3 " -nolisten tcp" }' Xservers-preCIS > Xservers
    chown root:root Xservers
    chmod 0444 Xservers
    echo "diff Xservers-preCIS Xservers"
else
    echo "No /etc/X11/xdm/Xservers file to secure."
fi
if [ -d /etc/X11/xinit ]; then
    cd /etc/X11/xinit
    if [ -e xserverrc ]; then
        echo "Fixing /etc/X11/xinit/xserverrc"
        awk '/X/ && !/^#/ { print $0 " :0 -nolisten tcp \$@"; next }'; \n        { print }' xserverrc-preCIS > xserverrc
    else
        cat <<END_SCRIPT > xserverrc
        #!/bin/bash
        exec X :0 -nolisten tcp \$@
        END_SCRIPT
    fi
    chown root:root xserverrc
    chmod 0755 xserverrc
    [ -e xserverrc-preCIS ] && echo "diff xserverrc-preCIS xserverrc"
    [ -e xserverrc-preCIS ] && diff xserverrc-preCIS xserverrc
    cd $cishome
else
    echo "No /etc/X11/xinit file to secure."
fi
```

**Scoring Status:** Scorable

**Compliance Mapping:** TBD

**Additional References:** TBD
8.4 Restrict at/cron To Authorized Users

**Description:**
The cron.allow and at.allow files are a list of users who are allowed to run the `crontab` and `at` commands to submit jobs to be run at scheduled intervals. On many systems, only the system administrator needs the ability to schedule jobs.

**Note:** Even though a given user is not listed in `cron.allow`, cron jobs can still be run as that user. `cron.allow` only controls administrative access to the `crontab` command for scheduling and modifying cron jobs.

**Audit:** TBD

**Remediation:**
```
# With x.allow only users listed can use 'at' or 'cron'
# (where 'x' indicates either 'at' or 'cron')
# Without x.allow then x.deny is checked, members of x.deny are excluded
# Without either (x.allow and x.deny), then only root can use 'at' and 'cron'
# At a minimum x.allow should exist and list root
echo "Attempting to list the following files for the 'before' picture."
echo "Any 'errors' are alright, as we are simply looking to see what exists."
ls -la /etc/at.allow /etc/at.deny /etc/cron.allow /etc/cron.deny
rm -f /etc/at.deny /etc/cron.deny
echo root > /etc/at.allow
echo root > /etc/cron.allow
chown root:root /etc/at.allow /etc/cron.allow
chmod 0400 /etc/at.allow /etc/cron.allow
if [ ! -e /etc/at.allow-preCIS ]; then
  echo "diff /etc/at.allow-preCIS /etc/at.allow"
  diff /etc/at.allow-preCIS /etc/at.allow
fi
if [ ! -e /etc/cron.allow-preCIS ]; then
  echo "diff /etc/cron.allow-preCIS /etc/cron.allow"
  diff /etc/cron.allow-preCIS /etc/cron.allow
fi
```
```
echo "Listing the state of these AFTER imposing restrictions..."
echo "Missing file 'errors' are ok here too."
ls -la /etc/at.allow /etc/at.deny /etc/cron.allow /etc/cron.deny
```

**Scoring Status:** Scorable

**Compliance Mapping:** TBD

**Additional References:** TBD

8.5 Restrict Permissions On crontab Files

**Description:**
The system `crontab` files are accessed only by the `cron` daemon (which runs with superuser privileges) and the `crontab` command (which is set-UID to root). Allowing unprivileged users to read or (even worse) modify system `crontab` files can create the potential for a local user on the system to gain elevated privileges.
Audit: TBD

Remediation:
ls -lad /etc/cron* /var/spool/cron*
chown root:root /etc/crontab
chmod 0400 /etc/crontab
chown -R root:root /var/spool/cron
chmod -R go-rwx /var/spool/cron

cd /etc
ls | grep cron | grep -v preCIS | xargs chown -R root:root
ls | grep cron | grep -v preCIS | xargs chmod -R go-rwx

cd $cishome
  # What about permissions for the following:
  #   drwxr-xr-x 2 root root 4096 Aug  2  2006 /etc/cron.d
  #   drwxr-xr-x 2 root root 4096 Aug  2  2006 /etc/cron.daily
  #   -rw-r--r-- 1 root root  0 Aug  2  2006 /etc/cron.deny
  #   drwxr-xr-x 2 root root 4096 Aug  2  2006 /etc/cron.hourly
  #   drwxr-xr-x 2 root root 4096 Aug  2  2006 /etc/cron.monthly
  #   drwxr-xr-x 2 root root 4096 Aug  2  2006 /etc/cron.weekly
  #   -rw-r--r-- 1 root root  255 Dec 10  2005 /etc/crontab

  echo "After..."
  ls -lad /etc/cron* /var/spool/cron*

Scoring Status: Scorable

Compliance Mapping: TBD

Additional References: TBD

8.6 Restrict Root Logins To System Console

Description:
Anonymous root logins should never be allowed, except on the system console in emergency situations. At all other times, the administrator should access the system via an unprivileged account and use some authorized mechanism (such as the su command, or the freely-available sudo package) to gain additional privileges. These mechanisms provide at least some audit trail in the event of problems.

Many Enterprises – who use serial port concentrators to connect to a server in a data center without physically having to use the keyboard – consider the serial port a console. This is in keeping with the Unix server tradition of controlling headless Unix machines using a serial port console. Just like the virtual consoles, this one needs to be strongly protected as well. If this applies to the organization, execute either, or both of these lines, as needs dictate:

  echo ttyS0 >> /etc/securetty
  echo ttyS1 >> /etc/securetty

Be advised that doing so will reduce the CIS-CAT Scoring Tool score and reduce the security posture.

Audit: TBD
Remediation:

```
Remediation:
echo console > /etc/securetty
# These are acceptable for the GUI and runlevel 3, when trimmed down to 6
for i in `seq 1 6`; do
  echo vc/$i >> /etc/securetty
done
#
### Commented this out to be more secure as it denies root logins to the physical
TEXT console.
### Additionally, disabling this is in compliance with the DISA STIG, as well.
# Check pg 14 in Hardening Linux for additional safety in the /etc/inittab
file.
# Do we want this as a required argument submitted on the command line?
#
# for i in `seq 1 6`; do
#    echo tty$i >> /etc/securetty
# done
chown root:root /etc/securetty
chmod 0400 /etc/securetty
```

diff /etc/securetty-preCIS /etc/securetty

diff /etc/securetty-preCIS /etc/securetty

```
# Part 2
# Second modification of gdm.conf, if it exists.
if [-e /etc/X11/gdm/gdm.conf ]; then
  ##### There is another file to consider: "/etc/X11/gdm/gdm.conf"
  # "AllowRoot=true" should be set to false to prevent root from logging in to
  the gdm GUI.
  # "AllowRemoteRoot=true" should be set to false to prevent root logins from
  remote systems.
  # Doing this change is supportive of logging in as a regular user and using
  'su' to get to root.
  # Before allowing a reboot, ensure at least one account is created for a
SysAdmin type.
  cd /etc/X11/gdm
  /bin/cp -pf gdm.conf /tmp/cis/gdm.conf.tmp
  sed -e 's/AllowRoot=true/AllowRoot=false/'
    -e 's/AllowRemoteRoot=true/AllowRemoteRoot=false/'
    -e 's/^#Use24Clock=false/Use24Clock=true/
  /tmp/cis/gdm.conf.tmp > gdm.conf
  chown root:root gdm.conf
  chmod 0644 gdm.conf
  echo "diff gdm.conf-preCIS gdm.conf"
  diff gdm.conf-preCIS gdm.conf
  cd $cishome
else
  echo "No /etc/X11/gdm/gdm.conf file to further secure."
fi

# Part 3
echo "The following is only required when a serial console is used for this
server."
```

debug "Either of these would be added manually post-baseline compliance, depending"
debug "on the COM port the serial cable is physically attached to."
debug "#
```

echo "#    echo ttyS0 >> /etc/securetty"
echo "#    echo ttyS1 >> /etc/securetty"
chmod -R 0400 /tmp/cis/*
```

Scoring Status: Scorable
8.7 Set GRUB Password

Description:
An unprotected GRUB boot loader prompt allows an attacker with physical access to subvert the normal boot process very easily. The action below will allow the system to boot normally, only requiring a password when the anyone attempts to modify the boot process by passing commands to GRUB. Make sure to replace <password> in the actions below with an md5-hashed password (check the man page for /sbin/grub-md5-crypt).

Audit: TBD

Remediation:
1. Add this line to /etc/grub.conf before the first uncommented line:
   
   password <password>

   Replace <password> with an md5 encrypted password.

2. Execute the following commands as root:
   
   chown root:root /boot/grub/grub.conf
   chmod 0600 /boot/grug/grub.conf

Scoring Status: Scorable

Compliance Mapping: TBD

Additional References: TBD

8.8 Require Authentication For Single-User Mode

Description:
By default on Red Hat Enterprise Linux, a system administrator can enter single user mode simply by typing "linux single" at the GRUB boot-editing menu. Some believe that this is left in to ease support of users with lost root passwords. In any case, it represents a clear security risk – authentication should always be required for root-level access. It should be noted that it is extremely difficult to prevent compromise by any attacker who has knowledge, tools, and full physical access to a system.

This kind of measure, in a simple way, increases the difficulty of compromise by requiring more of each of these factors. These last two items have attempted to address concerns of physical/boot security. To make these preparations more complete, one should consider setting the BIOS to boot only from the main hard disk and locking this setting with a BIOS password.

For more information on reducing the threat posed by an attacker with physical/boot access, consider the article "Anyone with a Screwdriver Can Break In," available at: http://www.bastille-linux.org/jay/anyone-with-a-screwdriver.html.
Audit: TBD

Remediation:
cd /etc
if [ "grep -l sulogin inittab" = "" ]; then
    awk '{ print }; /^id:[0123456sS]:initdefault:/ { print
"~:S:wait:/sbin/sulogin" }' "
    inittab > /tmp/cis/inittab.tmp
    /bin/cp -pf /tmp/cis/inittab.tmp inittab
    chown root:root inittab
    chmod 0600 inittab
    echo "diff inittab-preCIS inittab"
    diff inittab-preCIS inittab
else
    echo "OK. /etc/inittab already properly configured for Single-User"
    echo "Mode Authentication."
fi

cd $cishome
chmod -R 0400 /tmp/cis/*

Scoring Status: Scorable

Compliance Mapping: TBD

Additional References: TBD

8.9 Restrict NFS Client Requests To Privileged Ports

Description:
Setting the secure parameter causes the NFS server process on the local system to ignore NFS client requests that do not originate from the privileged port range (ports less than 1024); and this is the default behavior for RHEL5. This should not hinder normal NFS operations but may block some automated NFS attacks that are run by unprivileged users.

Audit: TBD

Remediation:
Add the secure option to all entries in the /etc/exports file. The following Perl code will perform this action automatically. This isn't necessary if there are no NFS exported filesystems.

```
# Changed the check from '-s' to an exact 'value-based' check if the size is
greater then 3 characters
# This is due to a failing in /etc/init.d/nfs improperly putting two characters in
/etc/exports.
echo "'/etc/exports size is (`wc -c /etc/exports | cut -d' ' -f1`')."
if [ `wc -c /etc/exports | cut -d' ' -f1` == 0 ]; then
    echo "Ok - No changes were necessary to /etc/exports."
else
    echo "Size (for /etc/exports) is greater than 0"
    ls -la /etc/exports*
    perl -i.orig -pe 'next if (/^s*#/ || /^s*$/);
               ($res, @hst) = split(" ");
               foreach $ent (@hst) { 
                   undef(%set);
```
($optlist) = $ent =~ /\{(.*)\}/;
foreach $opt (split(/,/, $optlist)) {
    $set{$opt} = 1;
}
delete($set{"insecure"});
$set{"secure"} = 1;
$ent =~ s/\{(.*)\}//;
$ent .= "(" . join("", keys(%set)) . ")";
$hst[0] = "(secure)" unless (@hst);
$_ = "$res\t" . join(" ", @hst) . "\n";
} fi
# echo "zq-Debugging...`ls -la /etc/exports`"
chown root:root /etc/exports
chmod 0644      /etc/exports
echo "diff /etc/exports-preCIS /etc/exports"
    diff /etc/exports-preCIS /etc/exports

Scoring Status:  Scorable

Compliance Mapping:  TBD

Additional References:  TBD

8.10 Only Enable syslog To Accept Messages, If Absolutely Necessary

Description:
By default the system logging daemon, syslogd, in Linux systems, does not listen for logging messages from other systems on network port 514/udp, and thus by default is more secure.

It is considered a good security management practice to set up one or more machines as central "log servers" to aggregate log traffic from all machines at a site. However, unless a system is set up to be one of these "log server" systems, it should not be listening on 514/udp for incoming log messages as the protocol used to transfer these messages does not include any form of authentication, so a malicious outsider could simply barrage the local system's syslog port with spurious traffic either as a denial-of-service attack on the system, or to fill up the local system's logging file systems so that subsequent attacks will not be logged.

Note:  A future edition of this Benchmark will see this section moved/combined within Section 6.

Audit:  TBD

Remediation:
Question:
Is this machine a log server, or does it need to receive Syslog messages via the network from other systems?
If the answer to this question is yes, then perform the action below.
Read syslog manpage to understand the -l, -r and -s options.
Edit /etc/init.d/syslog and look for the line that says:
SYSLOGD_OPTIONS="-m 0"
and add the entries that are appropriate for the site. An example entry would look like this:
SYSLOGD_OPTIONS="-m 0 -l loghost -r -s mydomain.com"

**Scoring Status:** Scorable

**Compliance Mapping:** TBD

**Additional References:** TBD
9 User Accounts and Environment

Note: That the items in this section are tasks that the local administrator should undertake on a regular, ongoing basis perhaps in an automated fashion via cron. The automated host-based scanning tools provided from the Center for Internet Security can be used for this purpose. These scanning tools are typically provided with this document, but are also available for free download from http://www.CISecurity.org

9.1 Block Login of System Accounts

Description:
These accounts are non-human system accounts that should be made less useful to an attacker by locking them and setting the shell to a shell not in /etc/shells. They can even be deleted if the machines does not use the daemon/service that each is responsible for, though it is safest to simply deactivate them as is done here. To deactivate them, lock the password and set the login shell to an invalid shell. /dev/null is a good choice because it is not a valid login shell, and should an attacker attempt to replace it with a copy of a valid shell the system will not operate properly.

Audit: TBD

Remediation:
# In the book "Hardening Linux", pg 20, it says using "/dev/null" is bad.
echo "Basically change the '/sbin/nologin' portion to '/dev/null' in /etc/passwd"
echo " and add an exclamation point to the password field in /etc/shadow."
cd /etc
for NAME in `cut -d: -f1 /etc/passwd`; do
    MyUID=`id -u $NAME`
    if [ $MyUID -lt 500 -a $NAME != 'root' ]; then
        usermod -L -s /dev/null $NAME
    fi
done
ls -la /etc/passwd
echo "sdiff passwd-preCIS passwd"
echo "----------------------
chown root:root /etc/passwd
chmod 0644 /etc/passwd
sdiff passwd-preCIS passwd

ls -la /etc/shadow
echo "sdiff shadow-preCIS shadow"
echo "----------------------
chown root:root /etc/shadow
chmod 0400 /etc/shadow
sdiff shadow-preCIS shadow
cd $cishome

Scoring Status: Scorable

Compliance Mapping: TBD

Additional References: TBD
9.2 Verify That There Are No Accounts With Empty Password Fields

**Description:**
An account with an empty password field means that anybody may log in as that user without providing a password at all. All accounts should have strong passwords or should be locked by using a password string like “!!”. By using “!!”, passwd will warn when attempting to unlock an account with an empty password.

**Audit:** TBD

**Remediation:**
The command:

```
awk -F: '( $2 == "" ) { print $1 }' /etc/shadow
```

should return no lines of output.

**Scoring Status:** Scorable

**Compliance Mapping:** TBD

**Additional References:** TBD

9.3 Set Account Expiration Parameters On Active Accounts

**Description:**
It is a good idea to force users to change passwords on a regular basis. The commands below will set all active accounts (except system accounts) to force password changes every 90 days (-M 90), and then prevent password changes for seven days (-m 7) thereafter. Users will begin receiving warnings 14 days (-W 14) before their password expires. Once the password expired, the account will be locked out after 7 days (-I 7). Finally, the instructions below set a minimum password length of 9 characters. These are recommended starting values. Some regulated industries require more restrictive values – ensure they comply with the local Enterprise security policy.

**Audit:** TBD

**Remediation:**
```
# Interestingly enough, the login.defs manpage indicates these functions are now all handled by PAM.

# This changes the defaults applicable to new accounts added to the system after this point.

# This applies the same basis of changes to existing accounts.
# -m: (7) The number of days between permitted password changes.
# -M: (90) The maximum number of days a password is valid.
```
9.4 Verify No Legacy '+' Entries Exist In passwd, shadow, And group Files

Description:
Plus ('+') entries 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 may provide an avenue for attackers to gain privileged access on the system, and should be deleted if they exist.

Audit: TBD

Remediation:
# Do a context specific diff to only show differences related to having plus signs in the file.
# Otherwise the output is too much
grep -v ^+ /etc/group > /tmp/cis/group.tmp
grep -v ^+ /etc/gshadow > /tmp/cis/gshadow.tmp
grep -v ^+ /etc/passwd > /tmp/cis/passwd.tmp
grep -v ^+ /etc/shadow > /tmp/cis/shadow.tmp
# Express the essence of what is compared.
echo "diff /etc/group-preCIS /etc/group"
diff /etc/group-preCIS /tmp/cis/group.tmp
echo "diff /etc/gshadow-preCIS /etc/gshadow"
diff /etc/gshadow-preCIS /tmp/cis/gshadow.tmp
echo "diff /etc/passwd-preCIS /etc/passwd"
diff /etc/passwd-preCIS /tmp/cis/passwd.tmp
echo "diff /etc/shadow-preCIS /etc/shadow"
diff /etc/shadow-preCIS /tmp/cis/shadow.tmp
chown root:root /tmp/cis/group.tmp /tmp/cis/gshadow.tmp /tmp/cis/passwd.tmp
/tmp/cis/shadow.tmp
chmod 0644 /tmp/cis/group.tmp /tmp/cis/passwd.tmp
chown 0400 /tmp/cis/gshadow.tmp
/tmp/cis/shadow.tmp
/bin/cp -pf /tmp/cis/group.tmp /etc/group
/bin/cp -pf /tmp/cis/gshadow.tmp /etc/gshadow
/bin/cp -pf /tmp/cis/passwd.tmp /etc/passwd
/bin/cp -pf /tmp/cis/shadow.tmp /etc/shadow

should return no lines of output.

Scoring Status: Scorable

Compliance Mapping: TBD

Additional References: TBD

9.5 No '.' or Group/World-Writable Directory In Root's $PATH

Description:
Including the current working directory '.' (dot) 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.

Note: Errors occur when a directory specified in the path does not exist. For example, on a new RHEL5 build, the below find generated this error:
find: /root/bin: No such file or directory

Investigate and correct the cause of such errors.

Audit: TBD

Remediation:
The automated testing tool supplied with this Benchmark will alert the administrator if action is required.

To find '.' in $PATH:
  echo $PATH | egrep "((^|)\.|(\.|\|\|))"

To find group- or world-writable directories in $PATH:
  # Part 1
  echo "Any entries listed here should be fixed (other than an error for missing /root/bin)."
  echo "$PATH."
  echo "PATH($PATH) ."
  echo "Any entries listed next indicated a period exists in the PATH environment variable (BAD)."
  echo $PATH | egrep "((^|)\.|(\.|\|\|))"
  # Part 2
  echo "Here, are paths with group/world writeable directories in root's PATH (BAD)."
echo "(roots PATH variable contains '/root/bin', even though that directory
doesn't exist, by default)"
# Does anyone know why '/root/bin' is there in root's $PATH in the first
place?

echo "(Errors regarding /mnt/sysimage, are ghosts held over from a kickstarted
system build"

find `echo $PATH | tr ':' ' '` -type d ( -perm -002 -o -perm -020 ) -ls

These commands should produce no errors or output on a properly hardened system.

**Scoring Status:** Scorable

**Compliance Mapping:** TBD

**Additional References:** TBD

### 9.6 User Home Directories Should Be Mode 0750 or More Restrictive

**Description:**
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. Disabling "read" and "execute" access for users
who are not members of the same group (the "other" access category) allows for appropriate use of
discretionary access control by each user. While the below modifications are relatively benign,
making global modifications to user home directories without alerting the user community can result in
unexpected outages and unhappy users. Also, consider special case home directories such as the sftp /ftp
accounts used to transfer web content to a web server, typically need to be world readable (r) and
searchable (x) as they contain documents for the web server.

User home directories are a potentially fragile area that foster human interaction with the system,
ostensibly for the purpose of mission-oriented work. The hazards of weak passwords and numerous
other insecurites potentially leave this area fertile for miscreant attention. One way to combat this is to
tighten permission to 0700 for home directories. This would be in addition to what is recommended
here (and not currently scored).

The nfsnobody user account has a UID of 65534, and a home directory of /var/lib/nfs.

**Audit:** TBD

**Remediation:**
```
for DIR in `awk -F: '$3 >= 500' /etc/passwd`; do
  if [ $DIR != /var/lib/nfs ]; then
    chmod -R g-w $DIR
    chmod -R o-rwx $DIR
  fi
done
```

**Scoring Status:** Scorable

**Compliance Mapping:** TBD
9.7 No User Dot-Files Should Be World-Writable

Description:
World-writable user configuration files may enable malicious users to steal or modify other users' data or to gain another user's system privileges. While the below modifications are relatively benign, making global modifications to user home directories without alerting the user community can result in unexpected outages and unhappy users.

One option is to add protective commands into `/etc/profile` which execute as the user logs in everytime to enforce user dot files not being world write-able. Though not scored or recommended empirically by CIS, it is an option if the user environment supports it.

Audit: TBD

Remediation:
```
for DIR in `awk -F: '$3 >= 500' /etc/passwd`; do
  for FILE in $DIR/[A-Za-z0-9]*; do
    if [ ! -h "$FILE" -a -f "$FILE" ]; then
      chmod go-w "$FILE"
    fi
  done
done
```

Scoring Status: Scorable

Compliance Mapping: TBD

Additional References: TBD

9.8 Remove User .netrc Files

Description:
`.netrc` files may contain unencrypted passwords which may be used to attack other systems. While the below modifications are relatively benign, making global modifications to user home directories without alerting the user community can result in unexpected outages and unhappy users. If the first command returns any results, carefully evaluate the ramifications of removing those files before executing the remaining commands as it may end up impacting an application that has not had time to revise its architecture to a more secure design. And the output from these commands can lend further support to administrative efforts in those directions.

One option is to add protective commands into `/etc/profile` which execute as the user logs in everytime to enforce removal of `.netrc` files. Though not scored or recommended empirically by CIS, it is an option if the user environment is not adversely affected by it.

Audit: TBD
**Remediation:**

```bash
find / -name .netrc > /tmp/cis/LISTof.netrcFiles 2>&1
```

Stop!!! Read the discussion before proceeding.

```bash
cat /tmp/cis/LISTof.netrcFiles
echo "Now doing a targeted search of user home directories."
echo "No output here is correct."
for DIR in `cut -d";" -f6 /etc/passwd`; do
  if [ -e $DIR/.netrc ]; then
    echo "Removing $DIR/.netrc"
    rm -f $DIR/.netrc
  fi
done
```

# Once this is done, there should be options to search NIS and LDAP stores for userID's

# Determine if they are local to this system and then check them, too.

```bash
chmod -R 0400 /tmp/cis
```

**Scoring Status:** Scorable

**Compliance Mapping:** TBD

**Additional References:** TBD

### 9.9 Set Default umask For Users

**Description:**

With a default umask setting of 077 – a setting agreed to as part of a security consensus/discussion process with DISA and NSA – files and directories created by users should not be readable (by default) by any other human user on the system. 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. 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. A gentler umask value that many institutions use is 022, due to the problems within their applications when set to 077.

**Note:** This strict a setting (umask of 077) has been shown to occasionally cause problems with the installation of software packages where the installation script relies on a default umask – the directories are owned by root with 0700 permissions, and then the application and/or daemon cannot read its files. A simple fix to this problem is to manually issue a less restrictive umask (such as umask 022) for the shell session doing the installation, or place such a umask command in the beginning to a less restrictive value before the installation, or in the beginning of the installation script. There are, of course, special cases to consider, for example the recommended umask setting of 077 interferes with the sftp and ftp users who need to have the web files transferred be world readable and directories world searchable. Typically, the umask setting needs to be 022 or occasionally 002 for sftp and ftp web transfer accounts. While the umask can be configured in the ftp server configuration file however for sftp users, a patch is required for the sftp server before umask control is available. The patch is available as part of the sftp logging patch [http://sftplogging.sourceforge.net](http://sftplogging.sourceforge.net)
The Benchmark will score for 022 as well as accept/test up to 077. Therefore utilize what is best, yet strictest for the environment.

The Benchmark will adjust root's umask setting separately in this item, as root shells don't necessarily read the system-wide configuration files. For example, root sessions using bash doesn't get umask settings from /etc/profile. The same concerns and recommendations apply to root's umask setting.

**Audit: TBD**

**Remediation:**
# Forced umask assignment into /etc/skel/.bashrc for consistency
# (though the CIS scoring tool doesn't check here yet)
CISum="077"
sed -e "s/002/$CISum/" -e "s/022/$CISum/" /etc/bashrc-preCIS > /etc/bashrc
sed -e "s/002/$CISum/" -e "s/022/$CISum/" /etc/csh.cshrc-preCIS > /etc/csh.cshrc
sed "s/027/$CISum/" /etc/csh.login-preCIS > /etc/csh.login
sed "s/027/$CISum/" /etc/profile-preCIS > /etc/profile
echo "umask "$CISum"">>
/etc/skel/.bashrc
sed "s/027/077/" /root/.bash_profile > /root/.bash_profile-preCIS
echo "umask 077" >> /root/.bashrc
echo "umask 077" >> /root/.cshrc
echo "umask 077" >> /root/.tcshrc
chown root:root /etc/bashrc /etc/csh.cshrc /etc/csh.login /etc/profile
chmod 0444 /etc/bashrc /etc/csh.cshrc /etc/csh.login /etc/profile
echo "diff /etc/bashrc-preCIS /etc/bashrc"
diff /etc/bashrc-preCIS /etc/bashrc
echo "diff /etc/csh.cshrc-preCIS /etc/csh.cshrc"
diff /etc/csh.cshrc-preCIS /etc/csh.cshrc
echo "diff /etc/csh.login-preCIS /etc/csh.login"
diff /etc/csh.login-preCIS /etc/csh.login
echo "diff /etc/profile-preCIS /etc/profile"
diff /etc/profile-preCIS /etc/profile
echo "diff /root/.bash_profile-preCIS /root/.bash_profile"
diff /root/.bash_profile-preCIS /root/.bash_profile
echo "diff /etc/skel/.bashrc-preCIS /etc/skel/.bashrc"
diff /etc/skel/.bashrc-preCIS /etc/skel/.bashrc
echo "diff /root/.bashrc-preCIS /root/.bashrc"
diff /root/.bashrc-preCIS /root/.bashrc
echo "diff /root/.cshrc-preCIS /root/.cshrc"
diff /root/.cshrc-preCIS /root/.cshrc
echo "diff /root/.tcshrc-preCIS /root/.tcshrc"
diff /root/.tcshrc-preCIS /root/.tcshrc
#
# Suggest a process that walks all existing user accounts (> 500) and force's the same permissions
# into their profile scripts.

**Scoring Status: Scorable**
**9.10 Disable Core Dumps**

**Description:**
Core dumps can consume large volumes of disk space and may contain sensitive data. On the other hand, developers using this system may require core files in order to aid in debugging. The `limits.conf` file can be used to grant core dump ability to individual users or groups of users.

**Audit:** TBD

**Remediation:**
Question: 
*Do developers need to debug crashed programs or send low-level debugging information to software developers/vendors?*

If the answer to this question is no, then perform the action below:

```bash
awk '{ $1 == "#*" && $2 == "soft" && $3 == "core" && $4 == "0" } {  
  print "*                soft    core            0";
  print "*                hard    core            0"; next  } 
{ print }' /etc/security/limits.conf-preCIS > /etc/security/limits.conf
chown root:root /etc/security/limits.conf
chmod 0644 /etc/security/limits.conf
```

```
echo "diff /etc/security/limits.conf-preCIS /etc/security/limits.conf"
  diff /etc/security/limits.conf-preCIS /etc/security/limits.conf
```

**Scoring Status:** Scorable

**Compliance Mapping:** TBD

**Additional References:** TBD

**9.11 Limit Access To The Root Account From su**

**Description:**
The `su` command allows a system administrator to become other users on the system. This is commonly used to become “root” and execute commands as the super-user. If it is not desirable for certain users to `su` to `root` then uncomment the following line in `/etc/pam.d/su`:

```bash
auth required /lib/security/$ISA/pam_wheel.so use_uid
```

Uncommenting this line allows only the users in the `wheel` group to become `root` by using the `su` command and entering the `root` password. All other users will receive a benign message stating the password is incorrect.

By limiting access to the `root` account, even if a user knows the `root` password, they will not be able to become `root` unless that user has physical access to the server's console, or they are added to the `wheel` group. This adds another layer of security to the system and prevents unauthorized system access.
Audit: TBD

Remediation:
WARNING: Ensure a legitimate administrative user has a valid user account listed in the wheel group before running the below script. Failure to do so will prevent anyone from using su to become root.

echo "Note: With this activated, only members of the wheel group can su to root."
cd /etc/pam.d/
awk '($1=="#auth" && $2=="required" && $3~"pam wheel.so") { print "auth\t\required\t\$3,\"\tuse uid\"; next }' /etc/pam.d/su
chown root:root /etc/pam.d/su
chmod 0644 /etc/pam.d/su
diff /etc/pam.d/su-preCIS /etc/pam.d/su
cd $cishome

# Part 2
# The process is beneficial when using kickstart for building of systems, then
# deliberately go back to all those systems and forcefully change the
# root/SysAdmin passwords to be in new.

echo "(${AdminsComma}) are to be System Administrators for this system."

for USERID in `echo $AdminSP`
do
    echo "1. Dealing with userid($USERID)...
    ID=`cat /etc/passwd | cut -d: -f1 | grep $USERID 2>&1`
    if [ "$ID" != "$USERID" ]; then
        # The user-id was NOT found
        echo "2a  Adding new user ($USERID) 'procedure-compliant'."
        # Use grub-md5-crypt to generate the encrypted password
        useradd -f 7 -m -p '$1$PyDA7$L81b0Sp1u.DyGnjbRUp/3/' $USERID
        chage -m 7 -M 90 -W 14 -I 7 $USERID
    else
        echo "2b  User ($USERID) already in the system."
        chage -m 7 -M 90 -W 14 -I 7 $USERID
    fi
    ls -la /home
done

echo "Doing pwck -r"
pwck -r
echo ""

# Part 3
# Perform steps to ensure any users identified in $Admins are added to the "wheel"
# group. This is probably only going to add the example 'tstuser' account, or
# whichever userID the system builder names during the initial system build.
# Note: /etc/group requires entries to be comma-separated.

if [ "$Admins" != "" ]; then
echo "At least one AdminID has been identified to be added to the wheel group."
    echo "Admins($Admins), AdminSP($AdminSP), AdminsComma($AdminsComma)."
cd /etc
    # Resultant /etc/group file is now nicely sorted as well
    /bin/cp -pf group /tmp/cis/group.tmp
    awk -F: '($1~"wheel" && $4~"root") { print $0 "," Adds }; /$1 !="wheel"} {print} Add="" \n    /tmp/cis/group.tmp | sort -t: -nk 3 > /tmp/cis/grouptmpl
    chown root:root /tmp/cis/grouptmpl
chmod 0644 /tmp/cis/group.tmp1
/bin/cp -pf /tmp/cis/group.tmp1 group

else
  echo "BAD. No SysAdmin IDs were identified to be added to the wheel group."
fi

# Part 4
echo "#### This is done in concert with Bastille that was executed before this step in the"
echo "#### standard baseline hardening. This will add SPACE-delimited SysAdmin userIDs to"
echo "#### the /etc/security/access.conf file. These are the same names as are added to"
echo "#### the wheel group in the /etc/group file. This action prohibits any user NOT in"
echo "#### the wheel group from logging in to the system on the physical console."
echo "#### Can treat this as a known entity with one entry to deal with since the state of"
echo "#### this system up to this point is well known."
echo "#### No differences may appear, if the same users are listed here, as were added by bastille."

# The line in question resembles the following, 3 colon-separated fields:
# -:ALL EXCEPT root tstuser:LOCAL
# To be turned into something that looks like the following (sorted IDs are easier to read):
# -:ALL EXCEPT abc-Admin root def-Admin tstuser:LOCAL

# Check if there are any uncommented lines to ADD $Admins to.
x="`grep -v ^# access.conf | wc -l | cut -d: -f1`"

echo "x($x)"
if [ "$x" == "0" ]; then
  # Most likely the Bastille hardening hasn't been applied yet.
  # Must manually add the users, as the file is otherwise 'empty'.
  echo "Manually adding the ($Admins); none previously existed there."
  echo "-:ALL EXCEPT root" $AdminSP":LOCAL" >> access.conf
else
  # Extract just the userIDs
  x="`grep -v ^# access.conf | cut -d: -f2 | cut -d' ' -f3`"
  # Bundle in the new SysAdmin IDs passed during script invocation, and sort the names alphabetically.
  # Need a piece here to compare what's there with what we have to add, to avoid duplicates.
  y="`echo $AdminsComma $x | tr -s ',' ' ' | tr ' ' '"\012' ' ' | sort -u | tr '"\012' ' ' `"
  # 2nd -e is to eliminate the extra space before the final colon, if one exists.
  sed -e "s/$x/$y/" -e 's/ :L/:L/' access.conf-preCIS > access.conf
  if [ "$y" ]; then
    echo "diff /etc/security/access.conf-preCIS /etc/security/access.conf"
    echo "diff /etc/security/access.conf-preCIS /etc/security/access.conf"
    chown root:root /etc/security/access.conf
    chmod 0640 /etc/security/access.conf
  fi

chown root:root /etc/security/access.conf
chmod 0640 /etc/security/access.conf
cd $cishome
chmod -R 0400 /tmp/cis/*

**Scoring Status:** Scorabble

**Compliance Mapping:** TBD

**Additional References:** TBD
10 Warning Banners

Presenting some sort of statutory warning message prior to the normal user logon may assist the prosecution of trespassers on the computer system. Changing some of these login banners also has the side effect/benefit of hiding OS version information and other detailed system information from attackers attempting to target specific attacks at a system (though there are other mechanisms available for acquiring at least some of this information).

Guidelines published by the US Department of Defense require that warning message 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. Clearly, the organization's local legal counsel and/or site security administrator should review the content of all messages before any system modifications are made, as these warning messages are inherently site-specific.


10.1 Create Warnings For Network And Physical Access Services

**Description:**
The contents of the `/etc/issue` file are displayed prior to the login prompt on the system's console and serial devices. `/etc/motd` 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.

Edit the banner currently in `/etc/issue` – if empty, utilize copy provided below and it may need to be changed for the local Enterprise, based upon policy. Leave the words “COMPANYNAME” as this will be replaced in the next step with the name of the organization.

```
NOTICE TO USERS
-----------------
This computer system is the private property of COMPANYNAME, whether individual, corporate or government. It is for authorized use only. Users (authorized & unauthorized) have no explicit/implicit expectation of privacy

Any or all uses of this system and all files on this system may be intercepted, monitored, recorded, copied, audited, inspected, and disclosed to your employer, to authorized site, government, and/or law enforcement personnel, as well as authorized officials of government agencies, both domestic and foreign.

By using this system, the user expressly consents to such interception, monitoring, recording, copying, auditing, inspection, and disclosure at the discretion of such officials. Unauthorized or improper use of this system may result in civil and criminal penalties and administrative or disciplinary action, as appropriate. By continuing to use this system you indicate your awareness of and consent to these terms and conditions of use. LOG OFF IMMEDIATELY if you do not agree to the conditions stated in this warning.

Audit: TBD
```
Remediation:
Create banners for console access:

Note: Change “COMPANYNAME” in the text below to an appropriate value for the organization (don’t use any special characters like single or double quote marks).

unalias cp mv
cd /etc
# Remove OS indicators from banners
for FILE in issue motd; do
cp -f ${FILE} ${FILE}.tmp
egrep -vi "red hat|kernel|fedora" ${FILE}.tmp > ${FILE}
rm -f ${FILE}.tmp
done
# Change name of owner
# Remember to enter name of your company here:
COMPANYNAME="The Company"
cp -f issue issue.tmp
sed -e "s/its owner/${COMPANYNAME}/g" issue.tmp > issue
rm -f issue.tmp
diff issue-preCIS issue
if [ "`grep -i authorized /etc/issue`" == "" ]; then
echo "Authorized uses only. All activity may be \monitored and reported." >> /etc/issue
fi
if [ "`grep -i authorized /etc/motd`" == "" ]; then
echo "Authorized uses only. All activity may be \monitored and reported." >> /etc/motd
fi

3. Create banners for network access:
/bin/cp -pf /etc/issue /etc/issue.net
/bin/cp -pf /etc/issue /etc/motd.net

4. Protect banner:
chown root:root /etc/issue /etc/issue.net /etc/motd
chmod 0644 /etc/issue /etc/issue.net /etc/motd

Scoring Status: Scorable

Compliance Mapping: TBD

Additional References: TBD
10.2 Create Warnings For GUI-Based Logins

**Description:**
The standard graphical login program for Red Hat Enterprise Linux is *gdm*, which requires the user to enter their username in one text box and their password in a second text box. The commands below set the warning message on *xdm*, *kdm* and *gdm* – in case something other than the default X login GUI was chosen to be installed.

These are optional settings to make, if the X Windows interface it not installed (and it isn't required for Linux to be operational).

**Audit:** TBD

**Remediation:**

```bash
# 1st Part
if [ $Consent == "DoD" ]; then
    echo "Set for DoD"
    GreetMsg1='xlogin*greeting: This is a U.S. Govt Computer - Authorized USE only!'
    GreetMsg2='This is a U.S. Govt Computer - Authorized USE only!'
else
    echo "---------
    Set for Generic/Anonymous
    ---------"
    echo "GreetString="
    echo "GreetString="
    GreetMsg1='xlogin*greeting: This is a private system --- Authorized USE only!'
    GreetMsg2='This is a private system --- Authorized USE only!'
fi

# 2nd Part
if [ -e /etc/X11/xdm/Xresources ]; then
    cd /etc/X11/xdm
    awk '/xlogin\*greeting:/ { print GreetValue; next };{ print }' GreetValue="$GreetMsg1" Xresources > Xresources
    chown root:root Xresources
    chmod 0644      Xresources
    echo "diff Xresources-preCIS Xresources"
    diff Xresources-preCIS Xresources
    cd $cishome
else
    echo "OK. No '/etc/X11/xdm/Xresources'."
fi

# 3rd Part
if [ -e /etc/X11/xdm/kdmrc ]; then
    cd /etc/X11/xdm
    awk '/GreetString=\" { print GreetString; next };{ print }' GreetString="$GreetMsg2" kdmrc-preCIS > kdmrc
    chown root:root kdmrc
    chmod 0644      kdmrc
    echo "diff kdmrc-preCIS kdmrc"
    diff kdmrc-preCIS kdmrc
    cd $cishome
else
```
echo "OK. No '/etc/X11/xdm/kdmrc'.'"
fi
echo ""

# 4th Part - Provided by Dave Mullins (RHCE), ProSync 20070206#
# This FORCES the user, upon successfully passing thru a credentialed GUI login,
# to positively acknowledge Consent-to-Use.
if [ ! -e /etc/gdm/PreSession/Default ]; then
  ed /etc/gdm/PreSession/Default  <<END_SCRIPT
  1
  /^SESSREG=
  a
  /usr/bin/xmessage -center -buttons " I acknowledge and consent to monitoring \
  " : 2, " Cancel Login ": 3 -file /etc/issue
  egxit="\$?"
  if [ \$egxit != 2 ]; then
    # Immediately FORCE logout by killing the 'X' session process
    echo "Consent-To-Use: User (\$LOGNAME) cancelled login (\`date\')." \
    >> /var/log/messages
    kill -9 \`ps -ef |grep /usr/bin/X |grep -v grep | tr s ' ' | cut -d ' ' -f2`\n  fi
.
  w
  q
END_SCRIPT
  chown root:root /etc/gdm/PreSession/Default
  chmod 0755 /etc/gdm/PreSession/Default
  echo "diff /etc/gdm/PreSession/Default-preCIS /etc/gdm/PreSession/Default"
          diff /etc/gdm/PreSession/Default-preCIS /etc/gdm/PreSession/Default
else
  echo "Part 4-OK. No '/etc/gdm/PreSession/Default file to harden'."
fi

**Scoring Status:** Scorable

**Compliance Mapping:** TBD

**Additional References:** TBD

### 10.3 Create "authorized only" Banners For vsftpd, proftpd, If Applicable

**Description:**
This item configures a vsftpd "authorized users only" banner messages.

**Audit:** TBD

**Remediation:**
cd /etc
if [ ! -d vsftpd ]; then
cd vsftpd
fi
if [ ! -e vsftpd.conf ]; then
  echo "ftpd_banner=Authorized users only. All activity may be monitored and reported."
  >> vsftpd.conf
```bash
echo "diff vsftpd.conf-preCIS vsftpd.conf"
diff vsftpd.conf-preCIS vsftpd.conf
chown root:root vsftpd.conf
chmod 0600      vsftpd.conf
else
  echo "OK - No vsftpd to change."
fi

cd $cishome
```

**Scoring Status:** Scorable

**Compliance Mapping:** TBD

**Additional References:** TBD
11 Misc odds and ends

11.1 Configure and enable the auditd and sysstat services, if possible

Description:
System auditing is an essential element to the defense-in-depth paradigm for system security hardening. The following remediation configures and enables the auditing service to collect logging records. Also, the sysstat service is enabled.

Note:  This is applicable to 32bit RHEL5, not 64bit. Further testing/work is necessary to provide a safe, stable and sane configuration for 64bit.

Audit:  TBD

Remediation:

```bash
echo "Configure and enable the auditd and sysstat services, if possible."
date
auditPATH='unknown'
if [ -e /etc/audit/rules ]; then
  # RHEL AS4 implementation
  auditPATH='/etc'
else
  if [ -e /etc/audit/audit.rules ]; then
    # RHEL5 implementation
    auditPATH='/etc/audit'
  fi
fi
if [ "$auditPATH" == "unknown" ]; then
echo "Auditing service not installed"
else
  Part 1
  # Enable auditing (within the context of the 'audit.rules' file)
  # Restarting 'auditd' makes this take effect, or rebooting.
  # Of course the 'service' must be started/enabled.
ed $auditPATH/audit.rules <<END_SCRIPT
1
-D
a
  # The following 03 lines added, per CIS Red Hat Enterprise Linux Benchmark sec 11.1:
  # This addition satisfies DISA SRR #s GEN002720, GEN002740, GEN002760 and GEN002820.
  # "-e 1" enables/tURNS on the auditing subsystem (0 disables it, leaves it off).
  -e 1
  .
  w
  q
END_SCRIPT
  chown root:root $auditPATH/audit.rules
  # Red Hat default/original permissions were 0640.
  chmod 0600 $auditPATH/audit.rules
  echo "diff $auditPATH/audit.rules-preCIS $auditPATH/audit.rules"
  diff $auditPATH/audit.rules-preCIS $auditPATH/audit.rules
  # Part 2
  echo "Enforce basic auditing minimums."
```
# This will enforce basic auditing minimums applicable to EVERY system.
/bin/cp -pf $auditPATH/audit.rules /tmp/cis/audit.rules.tmp
# Increase the size of the log
sed "s/-b 256/-b 1024/" /tmp/cis/audit.rules.tmp > $auditPATH/audit.rules
cat <<END_SCRIPT >> $auditPATH/audit.rules
# The following 10 lines added, per CIS Red Hat Enterprise Linux Benchmark sec
11.1 (part 2):
# These additions satisfy DISA SRR #s GEN002720, GEN002740, GEN002760 and
GEN002820.
-a exit,always -S open -F success!=0
-a exit,always -S unlink -S rmdir
-w /var/log/audit/
-w /etc/auditd.conf
-w /etc/audit.rules
-a exit,always -S stime -S acct -S reboot -S swapon -S settimeofday
-a exit,always -S setrlimit -S setsdomainname -S sched_setscheduler
-a exit,always -S chmod -S fchmod -S chown -S chown32 -S fchown
-a exit,always -S fchown32 -S lchown -S lchown32
END_SCRIPT
chown root:root $auditPATH/audit.rules
chmod 0600      $auditPATH/audit.rules
echo "diff $auditPATH/audit.rules preCIS $auditPATH/audit.rules"
diff $auditPATH/audit.rules-preCIS $auditPATH/audit.rules

# Part 3
echo "Strengthen auditd.conf settings."
sed -e "s/num_logs = 4/num_logs = 5/"
-e "s/max_log_file = 5/max_log_file = 100/"
-e "s/space_left = 75/space_left = 125/"
-e "s/admin_space_left = 50/admin_space_left = 75/"
-e "s/space_left_action = SYSLOG/space_left_action = email/"
$auditPATH/auditd.conf.preCIS > $auditPATH/auditd.conf
chown root:root $auditPATH/auditd.conf
# Default permissions were originally 0640.
chmod 0600      $auditPATH/auditd.conf
echo "diff $auditPATH/auditd.conf-preCIS $auditPATH/auditd.conf"
diff $auditPATH/auditd.conf-preCIS $auditPATH/auditd.conf

# Part 4
echo "Make auditd applicable across reboots."
chkconfig --list auditd
chkconfig --list sysstat
echo "--------"
chkconfig --level 35 auditd on
chkconfig --level 35 sysstat on
echo "--------"
# Enable the auditd service upon next boot, but not at this time
# service auditd restart
service sysstat restart
echo "--------"
chkconfig --list auditd
chkconfig --list sysstat
chmod -R 0400 /tmp/cis/* 
fi
echo ""

Scoring Status:  Scorable
Compliance Mapping: TBD

Additional References: TBD

11.2 Verify no duplicate userIDs exist

Description:
Eliminate duplicate userIDs, unless a mission application cannot function without them.

Audit: TBD

Remediation:

```
# Though CIS 7.4 is already set up to eliminate duplicates naturally.
# sort the userid name field to a temp file with "-u", then diff the
two
# sort the UID field to a temp file with -u then diff the two
# any differences equate to problems
# Sort/check ID
sort -t: /etc/group > /tmp/cis/group.p1
otherID=''
for x in `cut -d: -f1 /tmp/cis/group.p1`;
do
  if [ "$x" == "$otherID" ]; then
    echo "Duplicate userIDs exist in /etc/group ($x)."
  fi
  otherID=$x
done

# Sort/check GID
sort -t: -nk 3 /tmp/cis/group.p1 > /tmp/cis/group.p2
otherGID=''
for x in `cut -d: -f3 /tmp/cis/group.p2`;
do
  if [ "$x" == "$otherGID" ]; then
    echo "Duplicate GIDs exist in /etc/group ($x)."
  fi
  otherGID=$x
done

# Sort/check ID
sort -t: /etc/passwd > /tmp/cis/passwd.p1
otherID=''
for x in `cut -d: -f1 /tmp/cis/passwd.p1`;
do
  if [ "$x" == "$otherID" ]; then
    echo "Duplicate userIDs exist in /etc/passwd ($x)."
  fi
  otherID=$x
done

# Sort/check UID
otherUID=''
for x in `cut -d: -f3 /tmp/cis/passwd.p2`;
do
  if [ "$x" == "$otherUID" ]; then
```
```bash
echo "Duplicate UIDs exist in /etc/passwd ($x)."

if [ "x" != "x" ]; then
    otherUID=$x
done

Scoring Status: Scorable

Compliance Mapping: TBD

Additional References: TBD

11.3 Force permissions on root's home directory to be 0700

Description:
Protect the root home directory from non-administrative users.

Audit: TBD

Remediation:
ls -lad /root
chown root:root /root
chmod 0700 /root
ls -lad /root

Scoring Status: Scorable

Compliance Mapping: TBD

Additional References: TBD

11.4 Utilize PAM to Enforce UserID password complexity

Description:
This puts protections in place for PAM authentication, clearly defining password complexity (also, resolves DISA SRR (GEN000600/620/640/800)) in a strengthened manner. The minimum length for the number of required characters is 1, though increasing this (say to 2 or even 3) is acceptable. This metric applies to the number of uppercase, lowercase, digits and special characters combined to form a legitimate password. Additionally, the minimum length of 9 characters for a password increases the time required for traditional password cracking tools to execute in order to gain access.

Note: The password complexity enforcement changes made to /etc/pam.d/system-auth have been manually accomplished by using the script'let below. Such changes will be overwritten if authconfig is ever executed. The authconfig utility has no mechanism to recognize these changes nor to save or implement them in any other way.

Additional information can be found on the web:
http://www.deer-run.com/~hal/sysadmin/pam_cracklib.html

Audit: TBD
Remediation:

```bash
echo "Address DISA SRR (GEN000600/620/640/800) ($RHELver)."
date
#
# Have to copy the file before modifying it, as its also worked on in CIS SN.8.
# dcredit is number of numerals/digits required (1)
# lcredit is number of lower-case characters required (1)
# ocredit is number of other/special/punctuation characters required (1)
# ucredit is number of upper-case characters required (1)
cd /etc/pam.d
/bin/cp -pf /etc/pam.d/system-auth /tmp/cis/system-auth.tmp
if [ "$RHELver" == "RHELAS4" ]; then
    echo "Applicable to RHEL AS4"
    awk '{ $1 == "password" && $2 == "requisite" && $3 == 
        "/lib/security/$(ISA)/pam_cracklib.so" } { \n        print $0 " dcredit=-1 lcredit=-1 ocredit=-1 ucredit=-1
minlen=9"; next }
        { print }' /tmp/cis/system-auth.tmp > system-auth
else
    echo "Applicable to RHEL5"
    awk '{ $1 == "password" && $2 == "requisite" && $3 == "pam_cracklib.so" } { \n        print $0 " dcredit=-2 lcredit=-2 ocredit=-2 ucredit=-2
minlen=9"; next }
        { print }' /tmp/cis/system-auth.tmp > system-auth
fi
chown root:root /etc/pam.d/system-auth
chmod 0644 /etc/pam.d/system-auth
echo "diff /etc/pam.d-preCIS/system-auth /etc/pam.d/system-auth"
    diff /etc/pam.d-preCIS/system-auth /etc/pam.d/system-auth
echo "-----also RHEL($RHELver) -----"
echo " system-auth [original contents] ----------------------------------------"
cat /etc/pam.d-preCIS/system-auth
echo " system-auth [updated contents] ----------------------------------------"
cat /etc/pam.d/system-auth
echo "----------------------------------------"
echo "Protecting a hardened copy of /etc/pam.d/system-auth"
/bin/cp -pf /etc/pam.d/system-auth /etc/pam.d/system-auth.HardenedProtectedCopy
ls -la /etc/pam.d/system-auth*
cd $cishome
chmod -R 0400 /tmp/cis/*
```

Scoring Status: Scorable

Compliance Mapping: TBD

Additional References: TBD
11.5 **Restrict permissions to 0644 on /usr/share/man and /usr/share/doc content**

**Description:**
Reduce the excessive permissions on man pages and system documentation files down to 0644, from 0666. These are stable files, provided by the Operating System and package vendor that users have no need for more than read access to.

**Audit:** TBD

**Remediation:**
```
echo "Restrict permissions to 0644 on /usr/share/man and /usr/share/doc content"
date
chmod -R go-w /usr/share/doc /usr/local/share/doc
chmod -R go-w /usr/share/man /usr/local/share/man
```

**Scoring Status:** Scorable

**Compliance Mapping:** TBD

**Additional References:** TBD

---

11.6 **Set permissions on cron scripts known to be executed by cron to be 0600**

**Description:**
Establish restrictive permissions on scripts known to be executed by cron, to 0600.

**Note:** A future edition of this Benchmark will see this section moved/combined within Section 8.4.

**Audit:** TBD

**Remediation:**
```
echo "Set permissions on cron scripts known to be executed by cron to be 0600"
date
if [ -e /etc/log.d ]; then
    # Applicable to RHEL AS4
    echo "Setting permissions on scripts with /etc/log.d"
    find /etc/log.d/scripts -type f -exec chmod 0600 {} \;
else
    echo "/etc/log.d not found on this system."
fi
echo ""
```

**Scoring Status:** Scorable

**Compliance Mapping:** TBD

**Additional References:** TBD
11.7 Reboot

Description:
Whenever making substantial changes to a system, reboot. Some System Administrators believe any change to the init scripts warrant a reboot to ensure the system comes up as expected. Hours of lost productivity with extensive troubleshooting (not to mention lost revenue) have occurred because a system did not start up as expected. The root cause was an init problem that would have been detected had the reboot taken place.

Script'lets executed from this Benchmark create new versions of many existing configuration files. In the process of hardening the system, such script'lets will cause the pre-existing SELinux context to be lost. Touching the `.autorelabel` file and subsequently rebooting the system will reapply them.

Rationale: TBD

Remediation:
Touch `.autorelabel`
`init 6`

Scoring Status: Scorable

Compliance Mapping: TBD

Additional References: TBD
12 Anti-Virus Consideration

Certain systems – such as mail servers and file servers – at a minimum, should have anti-virus software installed to protect the Windows clients that use the server. Few Linux focused viruses exist, though the greatest protection would be the ubiquitous nature of Windows clients, applications and data that pass to, from and through Linux servers.

The following table summarizes some popular anti-virus offerings which are optionally available for the Linux platform. The Center for Internet Security makes no endorsement for any particular product. Usage (or lack) of any Anti-Virus product does not affect the overall CIS-CAT score for the system being evaluated.

<table>
<thead>
<tr>
<th>Vendor</th>
<th>Product</th>
</tr>
</thead>
<tbody>
<tr>
<td>Computer Associates InoculateIT;</td>
<td><a href="http://www.cai.com">http://www.cai.com</a></td>
</tr>
<tr>
<td>Clam AV; <a href="http://www.clamav.net">http://www.clamav.net</a></td>
<td>Commercial</td>
</tr>
<tr>
<td>f-prot AntiVirus;</td>
<td><a href="http://www.f-prot.com/products/corporate_users/unix">http://www.f-prot.com/products/corporate_users/unix</a></td>
</tr>
<tr>
<td>H+B edv (hbedv);</td>
<td><a href="http://www.pintunet.com">http://www.pintunet.com</a></td>
</tr>
<tr>
<td>McAfee; <a href="http://www.mcafee.com">http://www.mcafee.com</a></td>
<td>Commercial</td>
</tr>
<tr>
<td>NAI Virus Scan; <a href="http://www.nai.com">http://www.nai.com</a></td>
<td>Commercial</td>
</tr>
<tr>
<td>Sophos; <a href="http://www.sophos.com">http://www.sophos.com</a></td>
<td>Commercial</td>
</tr>
<tr>
<td>Trend Micro; <a href="http://www.trendmicro.com">http://www.trendmicro.com</a></td>
<td>Commercial</td>
</tr>
</tbody>
</table>
13 Remove CIS Benchmark Hardening Backup Files

**Description:**
When the Benchmark hardening changes are successful and tested, remove the backup files as they will have insecure contents and/or permissions/ownerships. Further, they consume additional disk space. By leaving these files on the system, an attacker can use the backup files as if they were the originals thereby defeating much of the CIS security hardening efforts. The last entry removes temporary intermediary files utilized during hardening actions.

**Audit:** TBD

**Remediation:**
```
find / -xdev | grep preCIS | xargs rm -rf
rm -rf /etc/cron.d-preCIS
rm -rf /etc/cron.daily-preCIS
rm -rf /etc/cron.hourly-preCIS
rm -rf /etc/cron.monthly-preCIS
rm -rf /etc/cron.weekly-preCIS
rm -rf /etc/pam.d-preCIS
rm -rf /etc/rc.d-preCIS
rm -rf /etc/skel-preCIS
rm -rf /etc/xinetd.d-preCIS
rm -rf /var/spool/cron-preCIS
```

**System cleanup:**
At the beginning of the CIS RHEL5 Benchmark hardening process, a temporary place was created for storage of work files. Now is the time to clean up those insecure files.
```
rm -rf /tmp/cis
```

**Scoring Status:** Not Scorable

**Compliance Mapping:** TBD

**Additional References:** TBD
Appendix A: Additional Security Notes

The items in this section are security configuration settings that have been suggested by several other resources and system hardening tools. However, given the other settings in the Benchmark document, the settings presented here provide relatively little incremental security benefit. Nevertheless, none of these settings should have a significant impact on the functionality of the system, and some sites may feel that the slight security enhancement of these settings outweighs the (sometimes minimal) administrative cost of performing them.

None of these settings will be checked by the automated scoring tool provided with the Benchmark document. They are purely optional and may be applied or not at the discretion of local site administrators.

Note: As a matter of performance, accomplish these actions prior to completion of hardening in Section 13 of this Benchmark.

SN.1 Create Symlinks For Dangerous Files

Description:
The /root/.rhosts, /root/.shosts, and /etc/hosts.equiv files enable a weak form of access control (see the discussion of .rhosts files below). Attackers will often target these files as part of their exploit scripts. By linking these files to /dev/null, any data that an attacker writes to these files is simply discarded (though an astute attacker can still remove the link prior to writing their malicious data).

Audit: TBD

Remediation:
for FILE in /root/.rhosts /root/.shosts /etc/hosts.equiv /etc/shosts.equiv; do
  rm -f $FILE
  ln -s /dev/null $FILE
done

Scoring Status: Not Scorable

Compliance Mapping: TBD

Additional References: TBD

SN.2 Change Default Greeting String For sendmail

Description:
The default SMTP greeting string displays the version of the Sendmail software running on the remote system. Hiding this information is generally considered to be good practice, since it can help attackers target attacks at machines running a vulnerable version of Sendmail. However, the actions in the Benchmark document completely disable Sendmail on the system, so changing this default greeting string is something of a moot point unless the machine happens to be an email server.

Audit: TBD
### Remediation:

cd /etc/mail
awk '/O SmtpGreetingMessage=/ { print "O SmtpGreetingMessage=Mail Server Ready; $b"; next} 
    { print }' sendmail.cf-preCIS | sed 's/^O HelpFile=/#O HelpFile=/' > sendmail.cf
chown root:bin sendmail.cf
chmod 0444 sendmail.cf
echo "diff sendmail.cf-preCIS sendmail.cf"
    diff sendmail.cf-preCIS sendmail.cf

cd $cishome
echo ""
# Part 2 - Deactivate the decode entry in the /etc/aliases file
echo "Fixed /etc/aliases without decode"

cd $cishome
echo "Fixed /etc/aliases without decode"

### Scoring Status:
Scorable

### Compliance Mapping:
TBD

### Additional References:
TBD

---

### SN.3 Enable TCP SYN Cookie Protection

**Description:**
A "SYN Attack" is a denial of service (DoS) attack that consumes resources on the system forcing a reboot. This particular attack is performed by beginning the TCP connection handshake (sending the SYN packet), and then never completing the process to open the connection. This leaves the system with several (hundreds or thousands) of half-open connections. This is a fairly simple attack and should be blocked.

**Note:** A future edition of this Benchmark will probably combine this entry with CIS 5.1, and employ this fix via /etc/sysctl.conf.

**Audit:** TBD

**Remediation:**
echo "echo 1 > /proc/sys/net/ipv4/tcp_syncookies" >> /etc/rc.d/rc.local
cd $cishome
echo "Fixed /etc/aliases without decode"

### Scoring Status:
Scorable

### Compliance Mapping:
TBD
SN.4 Additional GRUB Security

Description:
Setting the immutable flag on the GRUB config files will prevent any changes (accidental or otherwise) to the grub.conf or menu.lst files. Preferably, to modify either file, unset the immutable flag using the `chattr` command with `-i` instead of `+i`.

Audit: TBD

Remediation:

```bash
[ -e /boot/grub/menu.lst ] && echo "(set immutable) for /boot/grub/menu.lst"
[ -e /boot/grub/menu.lst ] && /usr/bin/chattr +i /boot/grub/menu.lst

[ -e /boot/grub/grub.conf ] && echo "(set immutable) for /boot/grub/grub.conf"
[ -e /boot/grub/grub.conf ] && /usr/bin/chattr +i /boot/grub/grub.conf
```

Scoring Status: Scorable

Compliance Mapping: TBD

Additional References: TBD

SN.5 Evaluate Packages Associated With Startup Scripts

Description:
The most effective way to get rid of the much of the unused software is to look in the startup directory `/etc/init.d` and evaluate which of these remaining services are not necessary. Use `rpm -qf <scriptname>` to determine the package it belongs to, use `rpm -qi <packagename>` to read about it, then use `rpm -e <packagename>` to remove it.

For example, this server may not use Broadcom NIC drivers, and therefore will not need the bcm5820 package. `rpm -qf bcm5820` shows us bcm5820 belongs to bcm5820-1.17-6. `rpm -qi bcm5820` proves we do not need this package. `rpm -e bcm5820` takes care of it.

In some cases, it might not be desirable or possible remove a script/package – kdcrotate is a good example: it belongs to package krb5-libs, which is required by several packages, including sendmail and nss_ldap. In cases like this, use `chkconfig <servicename> off` to keep it from running.

Note: Consider configuring iptables to act as a server-level firewall. There is controversy over this technique as some organizations feel all they need is the perimeter firewall and others feel the perimeter is just the first line of defense.

Audit: TBD
Remediation:
Question: How many of the startup scripts do you really need?

Perform the action below.
```
cd /etc/init.d
ls -1a
```

Scoring Status: Not Scorable

Compliance Mapping: TBD

Additional References: TBD

SN.6 Evaluate Every Installed Package

Description:
The default Red Hat Enterprise Linux installation includes many packages that are usually not necessary in an Enterprise server environment (dosfstools, for example). This should be done as a precursor to any system installation, especially in a Configuration Managed environment.

Computer Security Industry Best Practices recommend removing unused services and software to minimize attack vectors on a system.

The following references suggest and discuss removing unused software:

This task can be performed fairly quickly by logging in twice and running
```
rpm -qa | sort | less
```
in one shell, and then using the other shell to remove the packages.

Some packages are dependent upon others and the system administrator will have to remove several packages at once. In some cases, an unused package will be required by another useful package, and it will have to remain installed – for example, dateconfig relies upon audiofile (for RHEL 2,1).

If the features of dateconfig are required, then audiofile will have to remain. One may think that the functionality of dateconfig is not necessary, however, the Red Hat Enterprise Linux documentation uses this tool to adjust the date, timezone and NTP settings of the server, and some Enterprises will have problems making system changes to servers without using the vendor-recommended tools.

For services which are disabled, the relevant software should be removed for the following reasons:
1. Less software to maintain and monitor for security issues
2. The service cannot be inadvertently enabled by an errant administrator or miscreant
3. Minimize damage in an attack should the attacker gain (or already have) access to the server
4. Achieve a smaller attack surface from which to rebuff attacks

Removed software can always be reinstalled using the Enterprise procedures.

By using this methodology on a test server, a still functional basic server was produced with less than 230 packages installed (down from the original 350 packages) taking up under 350MB of disk storage. This was performed in under an hour. Further, can be stabilized in an automated way via anaconda/kickstart.

**Audit:** TBD

**Remediation:**

**Question:**
*How much unused software was installed on your system?*

**Scoring Status:** Not Scorable

**Compliance Mapping:** TBD

**Additional References:** TBD

---

**SN.7 Install and Configure sudo**

**Description:**
sudo is a package that allows the System Administrator to delegate activities to groups of users. These activities are normally beyond the administrative capability of that user – restarting the web server, for example. If frequent web server configuration changes are taking place (or the system has a bug and the web server keeps crashing), it becomes very cumbersome to continually engage the SysAdmin just to restart the web server. *sudo* allows the Administrator to delegate just that one task which relies upon *root* authority without allowing that group of users any other *root* capability.

Once *sudo* is installed, configure it using *visudo* – do not *vi* the config file. *visudo* has error checking built in specific to the *sudo* configuration. Experience has shown that if */etc/sudoers* gets botched (from using *vi* without *visudo*’s error checking feature), recovery may become very difficult.

**Audit:** TBD

**Remediation:**

Using the local Enterprise process, install *sudo*, then configure it as follows:

```
# The /etc/sudoers file contains one line that can be uncommented out to suitably
# permit SysAdmins with membership in the wheel group (i.e. the same ones who
# 'could' su to root) to utilize 'sudo' instead. Note: file consists of TABs
# between fields. 'visudo' IS the proper command to manually change this file,
# yet the change below passes muster when visudo is next executed.
 echo "Implementing permissions for members of the wheel group to utilize sudo;"
 echo "This prevents any user from having to 'su' to root for common"
 echo "administrative tasks. Ideally now the root password would be changed to
 echo "something very few would know (hint!);"
 sed 's/# %wheel ALL=(ALL) NOPASSWD: ALL/%wheel ALL=(ALL) NOPASSWD: ALL/'
```
/etc/sudoers-preCIS > /etc/sudoers
chown root:root /etc/sudoers
chmod 0440 /etc/sudoers
echo "diff /etc/sudoers-preCIS /etc/sudoers"
diff /etc/sudoers-preCIS /etc/sudoers

echo "More specifically, system owners are strongly encouraged to more tightly"
echo "restrict who can utilize sudo on a name by name basis (explicitly) as well"
echo "as further restrict what commands those SysAdmins are limited to using."
echo "Align this with least-privilege."

**Scoring Status:** Scorable

**Compliance Mapping:** TBD

**Additional References:** TBD

### SN.8 Lockout Accounts After 3 Failures

**Description:**
A system policy of locking out an account that fails several successive authentication attempts is an industry best practice, and is easily implemented in this Benchmark. The below value (deny=3) will cause the account to be locked out after 3 successive failed login attempts. This value is chosen as it is a common value used in some Federally-regulated industries – it can be increased, if that is desired.

**Note:** The below command assumes account lockouts are not already implemented on the system. If they are already implemented, edit /etc/pam.d/system-auth manually.

To unlock a user that has been locked out, use the `faillog` command. For example, to unlock user oracle, issue this command:

```bash
faillog -u oracle -r
```

See also the discussion at [http://www.puschitz.com/SecuringLinux.shtml](http://www.puschitz.com/SecuringLinux.shtml)

**Audit:** TBD

**Remediation:**

- Part 1 (addresses DISA SRR GEN000560) removing entries for 'nullok'
  - The removal affects the 'auth' and 'password' service types in that file.
  ```bash
cd /etc/pam.d
sed '/nullok// {s/ nullok/ /}' /etc/pam.d-preCIS/system-auth > system-auth
```

- Part 2 (addresses DISA SRR GEN000800)
  - Adding this option to the service type 'password' line, for 'pam_unix'.
  ```bash
/bin/cp -p /tmp/cis/system-auth.tmp /etc/pam.d/system-auth
/bin/cp /etc/pam.d/system-auth /tmp/cis/system-auth.tmp
awk '$1 == "password" && $3 == "pam_unix.so"' /tmp/cis/system-auth.tmp > system-auth
```

- Part 3 (addresses CIS Benchmark SN.8, and DISA SRR GEN000460)
  - Must be set AFTER the above fix, as it needs to be done first.
  ```bash
# In the official PAM documentation, "deny=n; Deny access if tally for this user EXCEEDS n". Where 'n' equals the number of attempts permitted.
# Set deny=2, as opposed to what the Benchmark recommends of '3'.
# Setting it to '3' will allow a 4th login attempt after 3 failed ones.
```
# Setting it to '2' will permit a total of 3 attempts.
Also, DISA's STIG, Checklist and SRR all incorrectly expect 'deny' to equal '3'.
Table of meaning (positively tested in practice for proof):

- "deny=1" means 2 local attempts before lockout, but only 1 from SSH (remotely)
- "deny=2" means 3 local attempts before lockout, but only 2 from SSH (remotely)
- "deny=3" means 4 local attempts before lockout, but only 3 from SSH (remotely)
- "deny=4" means 5 local attempts before lockout, but only 4 from SSH (remotely)

These two extra lines were properly integrated 'into' the standard PAM stacks, vice just being added to the end of the file.

```
/bin/cp -p system-auth /tmp/cis/system-auth.tmp
awk '{ $1 == "auth" && $2 == "required" && $3 == "pam_deny.so" ) { \n    print "# The following line added, per CIS Red Hat Enterprise Linux Benchmark sec SN.8, to harden the baseline image:";
    print "auth required pam_tally2.so onerr=fail no_magic_root"; print $0; next };
    { $1 == "account" && $2 == "required" && $3 == "pam_permit.so" } \n    { print "# The following line added, per CIS Red Hat Enterprise Linux Benchmark sec SN.8, to harden the baseline image:";
    print "account required pam_tally2.so deny=2 no_magic_root reset"; print $0; next };
    { print }' /tmp/cis/system-auth.tmp > system-auth
chown root:root system-auth
chmod 0644 system-auth
```

diff /etc/pam.d-preCIS/system-auth /etc/pam.d/system-auth

cd $cishome
chmod -R 0400 /tmp/cis/*

**Scoring Status:** Scorable

**Compliance Mapping:** TBD

**Additional References:** TBD

### SN.9 Additional Network Parameter Tunings

**Description:**
Before implementing these changes, please review them with the local environment in mind. The below value for `tcp_max_orphans` is much lower than the default 16,384, and may be too low, depending on the server's use and environment.

Also be aware that logging all `tcp_max_orphans` may generate an excessive amount of audit log data, especially on multi-homed servers with at least one network interface on a hostile network (i.e., the border firewalls). You should ensure you have plenty of log space available as well as sending the logs to a remote logging host.

**Audit:** TBD

**Remediation:**
```
cat <<END_SCRIPT >> /etc/sysctl.conf
# The following 02 lines added, per CIS Red Hat Enterprise Linux Benchmark sec SN.9, to harden the baseline image:
net.ipv4.tcp_max_orphans = 256
```
Scoring Status: Scorable

Compliance Mapping: TBD

Additional References: TBD

SN.10 Remove All Compilers and Assemblers

Description:
C compilers, and others, pose a credible high-risk threat to production systems and should not be installed. Compilers should be installed on select development systems – those systems that have a legitimate business need for a compiler – and the resulting output binaries deployed onto other development and production systems using the existing Enterprise change processes.

Note: Some failed dependencies may result when removing compilers and assemblers. Remove gcc’s dependencies first before removing gcc.

Audit: TBD

Remediation:

Question:
Is there a mission-critical reason to have a compiler or assembler on this machine?
If the answer is no, perform the action below.

The following command will identify the packages installed on the system:
rpm -qa | egrep "^gcc|java|bin86|dev86|nasm|as"

Remove the following packages (gcc, gcc3, gcc3-c++, gcc3-g77, gcc3-java, gcc3-objc, gcc-c++, gcc-chill, gcc-g77, gcc-java, gcc-objc, bin86, dev86, nasm and as), if they exist on the system, with this commands:
rpm -e gcc gcc3 gcc3-c++ gcc3-g77 gcc3-java gcc3-objc gcc-c++ gcc-chill gcc-g77
rpm -e gcc-java gcc-objc bin86 dev86 nasm as

If the answer is yes, then carefully evaluate why this system is a mission-critical, as the inclusion of compilers and the risks to a mission critical system are contradictory.

Packages can be removed by:
rpm -e <package name>

Scoring Status: Scorable

Compliance Mapping: TBD
SN.11 Verify That No Unauthorized/Duplicate UID 0 Accounts Exists

**Description:**
Any account with UID 0 has superuser privileges on the system. The preferred and best practice for administrators obtaining superuser privileges, is to login with an unprivileged account in the wheel group, and then use `sudo` for the operations that require root level access. The `sudo` software is typically installed by default with Red Hat Enterprise Linux distributions; for details see the `sudo(8)`, `sudoers(5)` and `visudo(8)` man pages or [http://www.sudo.ws](http://www.sudo.ws)

Given that `sudo` is industry-accepted best practice, there is still the recognized occasional need for direct administrative console access as provided for in item 8.7 "Restrict Root Logins To System Console". For these situations, having multiple uid 0 accounts may be used by experienced administrators to provide individually assigned superuser passwords to eliminate or reduce usage of a shared root password, and to increase accountability. However some tools and situations do not always handle multiple uid 0 accounts as expected or desired, therefore testing is required. Specifically when booting to single user mode Item 8.9 "Require Authentication For Single-User Mode" the system will prompt for the "root" password, and none of the other uid 0 passwords will work. Also most of the GUI X-windows administration tools, if run by a non-privileged user, will prompt for the "root" password. There may be other applications or tools that behave unexpectedly, so testing is required.

**Audit:** TBD

**Remediation:**
The commands:
```
echo "The only single authorized entry is 'root'; any other entries here, (or"
echo "duplicates of root) must either be removed, or documented by the ISSO in the"
SSP:"
echo "The second set of lines searches for inappropriate GID 0 groups. Again,"
echo "a single listing of root is the only acceptable output."
echo "------------------------------------"
awk -F: '$3 == "0" { print $1 }' /etc/passwd
awk "------------------------------------"
```

should return only the word "root", unless additional uid 0 accounts have been specifically authorized. Having multiple uid 0 accounts are acceptable if the accounts are authorized, but not recommended for some situations; see the discussion for more detail.

Audit: TBD

**Scoring Status:** Scorable

**Compliance Mapping:** TBD

**Additional References:** TBD
Appendix B: File Backup Script

#!/bin/bash
cishome="/root/cis"

echo "Creating $cishome/do-restore.sh"
cat <<END_SCRIPT > $cishome/do-restore.sh
#!/bin/bash

# This script restores those files changed by hardening IAW the CISecurity Benchmark
# Built by the RHEL Linux Benchmark do-backup.sh script.
# Errors for unalias get sent to the console when not 'set'
unalias rm mv cp 2> /dev/null

/usr/bin/chattr -i /etc/fstab /boot/grub/menu.lst /boot/grub/grub.conf

sed -n "39,9999p" $cishome/do-restore.sh | while read LINE; do
  FILE=\`echo $LINE | awk '{print $1}'\`
  PERMS=\`echo $LINE | awk '{print $2}'\`
  echo "Restoring $FILE with $PERMS permissions"
  [ -f $FILE-preCIS ] && /bin/cp -pf $FILE-preCIS $FILE
  /bin/chmod $PERMS $FILE
  [ -f $FILE-preCIS ] && /bin/rm $FILE-preCIS
done

### END OF SCRIPT. DYNAMIC DATA FOLLOWS. ###

chown root:root $cishome/do-restore.sh
chmod 0700 $cishome/do-restore.sh

echo "Performing a modified 'do-backup.sh' (taken from the CIS v1.0.6 Benchmark)."
echo "Backing up individual system files, `date`"
# Manually sorted the CIS file/dir list alphabetically, removed duplicates, and
corrected
#    spacing to ease the finding/adding of new ones.
# Files that don't natively exist in a virgin RHEL5 system:
# /etc/at.allow
# /etc/audit.rules
# /etc/auditd.conf
# /etc/cron.allow
# /etc/ftpaccess
# /etc/ftpusers
# /etc/vsftpd.conf
# /etc/vsftpd.ftpusers
# /etc/vsftpd/vsftpd.conf
# /etc/X11/xdm/Xservers
# /etc/X11/gdm/gdm.conf
# /etc/X11/gdm/PreSession/Default
# /etc/X11/xinit/xserverrc
# /etc/X11/xdm/Xresources
# /etc/X11/xdm/kdmrc
# /etc/xinetd.conf
# /var/spool/cron

for FILE in \
    /boot/grub/grub.conf \
    /etc/aliases \
    /etc/at.allow \
    /etc/at.deny \
    /etc/audit.rules \
    /etc/auditd.conf \
    /etc/audit/audit.rules \
    /etc/audit/auditd.conf \
    /etc/bashrc \
    /etc/cron.allow \
    /etc/cron.deny \
    /etc/crontab \
    /etc/csh.cshrc \
    /etc/csh.login \
    /etc/cups/cupsd.conf \
    /etc/exports \
    /etc/fstab \
    /etc/ftpaccess \
    /etc/ftpusers \
    /etc/group \
    /etc/grub.conf \
    /etc/gshadow \
    /etc/hosts.allow \
    /etc/hosts.deny \
    /etc/initial \
    /etc/issue \
    /etc/issue.net \
    /etc/login.defs \
    /etc/mail/sendmail.cf \
    /etc/motd \
    /etc/pam.d/su \
    /etc/pam.d/system-auth \
    /etc/passwd \
    /etc/profile \
    /etc/proftpd.conf \
    /etc/securetty
/etc/security/access.conf
/etc/security/console.perms
/etc/security/console.perms.d/50-default.perms
/etc/security/limits.conf
/etc/shadow
/etc/skel/.bashrc
/etc/ssh/ssh_config
/etc/ssh/sshd_config
/etc/sudoers
/etc/sysconfig/sendmail
/etc/sysctl.conf
/etc/vsftpd.conf
/etc/vsftpd/ftpusers
/etc/X11/xdm/Xservers
/etc/X11/gdm/gdm.conf
/etc/X11/gdm/PreSession/Default
/etc/X11/xinit/xserverrc
/etc/X11/xdm/Xresources
/etc/X11/xdm/kdmrc
/etc/xinetd.conf
/root/.bash_profile
/root/.bashrc
/root/.cshrc
/root/.tcshrc
/var/spool/cron;
/var/spool/cron;
do
  if [ -f ${FILE} ]; then
    # Backup files that exist (some might not)
    echo "Protected: `ls -lad ${FILE}`" >> $cishome/do-restore.savelog
    /bin/cp -pf ${FILE} ${FILE}-preCIS
    # Add it to the do-restore script
    echo ${FILE} `find ${FILE} -printf "%m"` >> $cishome/do-restore.sh
    else
      # This helps to compare various OS updates for correctness.
      echo "FILE didnt exist on this system ($FILE)." | tee -a $cishome/do-restore.savelog
  fi
done

echo "Completed CIS file backups - backing up applicable directories"

# Manually sorted the CIS-provided file/dir list alphabetically, removed duplicates, and corrected
# spacing to ease the finding/adding/organization of new ones.
for DIR in \
  /etc/cron.*  \
  /etc/pam.d    \
  /etc/rc.d     \
  /etc/skel     \
  /etc/xinetd.d \
  /var/spool/cron;
do
  # echo ${DIR}
  [ -d ${DIR} ] && /bin/cp -pr ${DIR} ${DIR}-preCIS
done

echo "Completed CIS RHEL Benchmark directory backups."

echo "(CIS) Recording log permissions"
find /var/log -printf "%h/%f %m\n" >> $cishome/do-restore.sh

echo "CIS Red Hat Enterprise Linux Backup protections are complete---`date`"
echo ""
Appendix C: Change History

April 2008 - Version 1.1
- Removed erroneous/confusing change history entries.

February 2008 - Version 1.0
- Public Release
Appendix D: References

The Center for Internet Security

Free Benchmark documents and security tools for various OS platforms and applications:
http://www.cisecurity.org

Red Hat Software

Patches and related documentation:
https://www.redhat.com/security

Red Hat Update Manager tools:
yum:
https://rhn.redhat.com/help/latest-up2date.pxt
https://rhn.redhat.com
yum: http://www.linuxgazette.com/node/view/8835
HAL:
http://www.redhat.com/magazine/003jan05/features/hal

Other Misc Documentation

Various documentation on Linux security issues:
https://www.redhat.com/security

Primary source for information on NTP:
http://www.ntp.org

Information on MIT Kerberos:
http://web.mit.edu/kerberos/www

Apache "Security Tips" document:
http://httpd.apache.org/docs-2.0/misc/security_tips.html

Information on Sendmail and DNS:
http://www.sendmail.org
http://www.deer-run.com/~hal/dns-sendmail/DNSandSendmail.pdf

OpenSSH (secure encrypted network logins):
http://www.openssh.org

TCP Wrappers source distribution:
ftp.porcupine.org

PortSentry and Logcheck (port and log monitoring tools):
http://sourceforge.net/projects/sentrytools

Swatch (log monitoring tool):
http://www.oit.ucsb.edu/~eta/swatch

Open Source Sendmail (email server) distributions:
ftp://ftp.sendmail.org

LPRng (Open Source replacement printing system for Unix):
http://www.lprng.org

sudo (provides fine-grained access controls for superuser activity):
http://www.courtesan.com/sudo

Tripwire – file modification utility:
http://www.tripwire.org
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