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SELINUX FOR MERE MORTALS

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06.27.12

Agenda

- About Us
- What is SELinux?
  - Where did it come from?
  - DAC vs. MAC
- So How Does SELinux Work?
  - Labeling and Type Enforcement
- How Do I Deal With Labels?
- Real World Examples

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- http://excogitat.us
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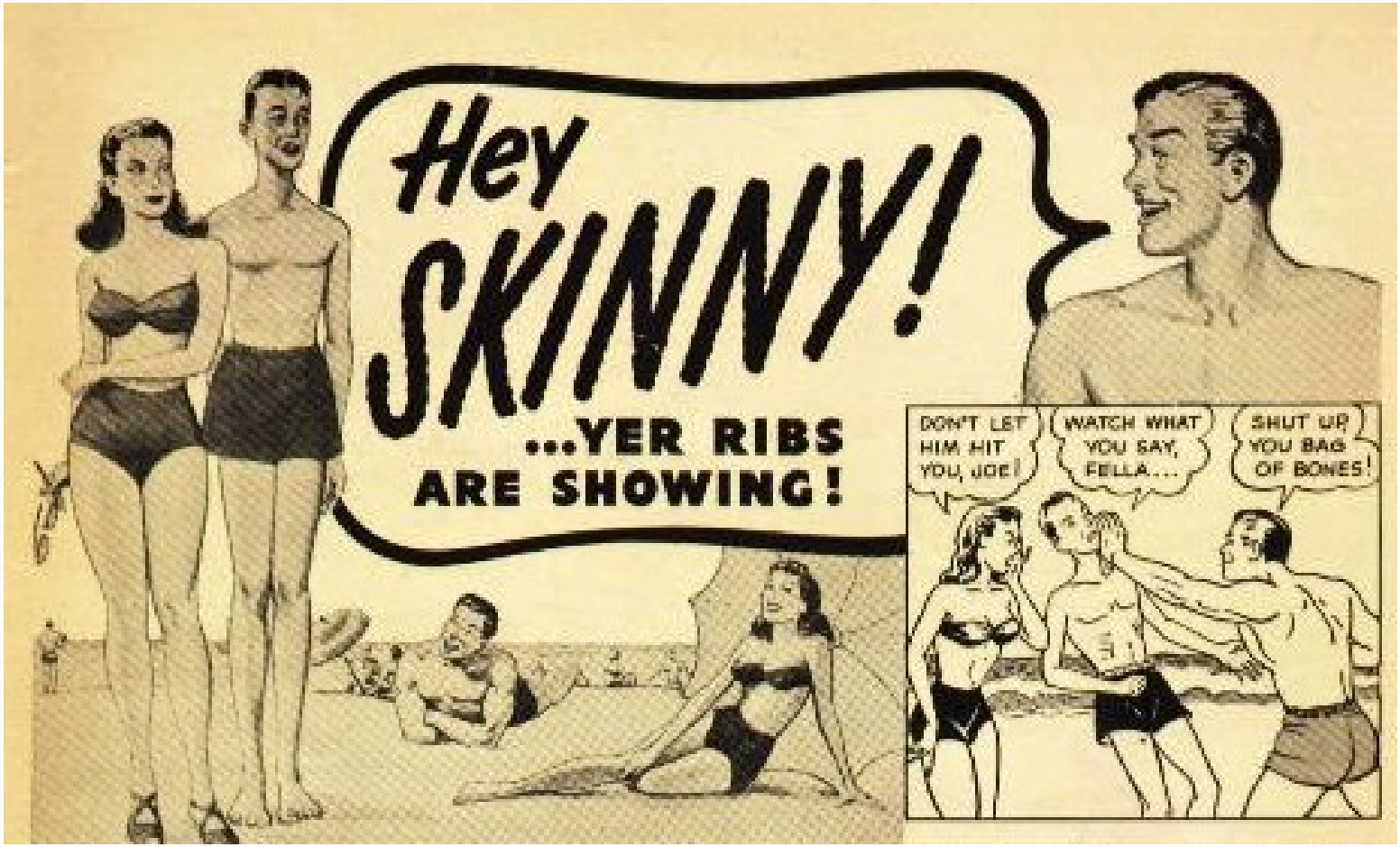
About Us

- Red Hat leads the way in SELinux development. John Dennis, Ulrich Drepper, Steve Grubb, Eric Paris, Roland McGrath, James Morris and Dan Walsh, all Red Hat staffers, acknowledged by the NSA for their contributions to SELinux at:
- http://www.nsa.gov/research/selinux/contrib.shtml
- Red Hat acknowledged by the NSA as a corporate contributor as well.

What is SELinux?

- Where did it come from?
  - Created by the United States National Security Agency (NSA) as set of patches to the Linux kernel using Linux Security Modules (LSM)
  - Released by the NSA under the GNU General Public License (GPL) in 2000
  - Adopted by the upstream Linux kernel in 2003

What Thomas thought SELinux was



If you feel the same way...

If you feel the same way...

- You're in the right place!

What is SELinux?

What is SELinux?

- SELinux is an example of a Mandatory Access Control system for Linux.

DAC vs. MAC

- Historically, Linux and Unix systems have used discretionary access control.
  - Ownership (user, group, and other) plus permissions.
  - Users have the ability (discretion) to change permissions on their own files. A user can `chmod +rwx` his or her home directory, and nothing will stop them. Nothing will prevent other users or processes from accessing the contents of his home directory.


SHOOT HERE

DAC vs. MAC

- Historically, Linux and Unix systems have had discretionary access control.
  - The root user is omnipotent.

DAC vs. MAC

- On a mandatory access control system, there is policy which is administratively set and fixed.
- Even if you change the DAC settings on your home directory, if there is a policy in place which prevents another user or process from accessing it, you're generally safe.

DAC vs. MAC

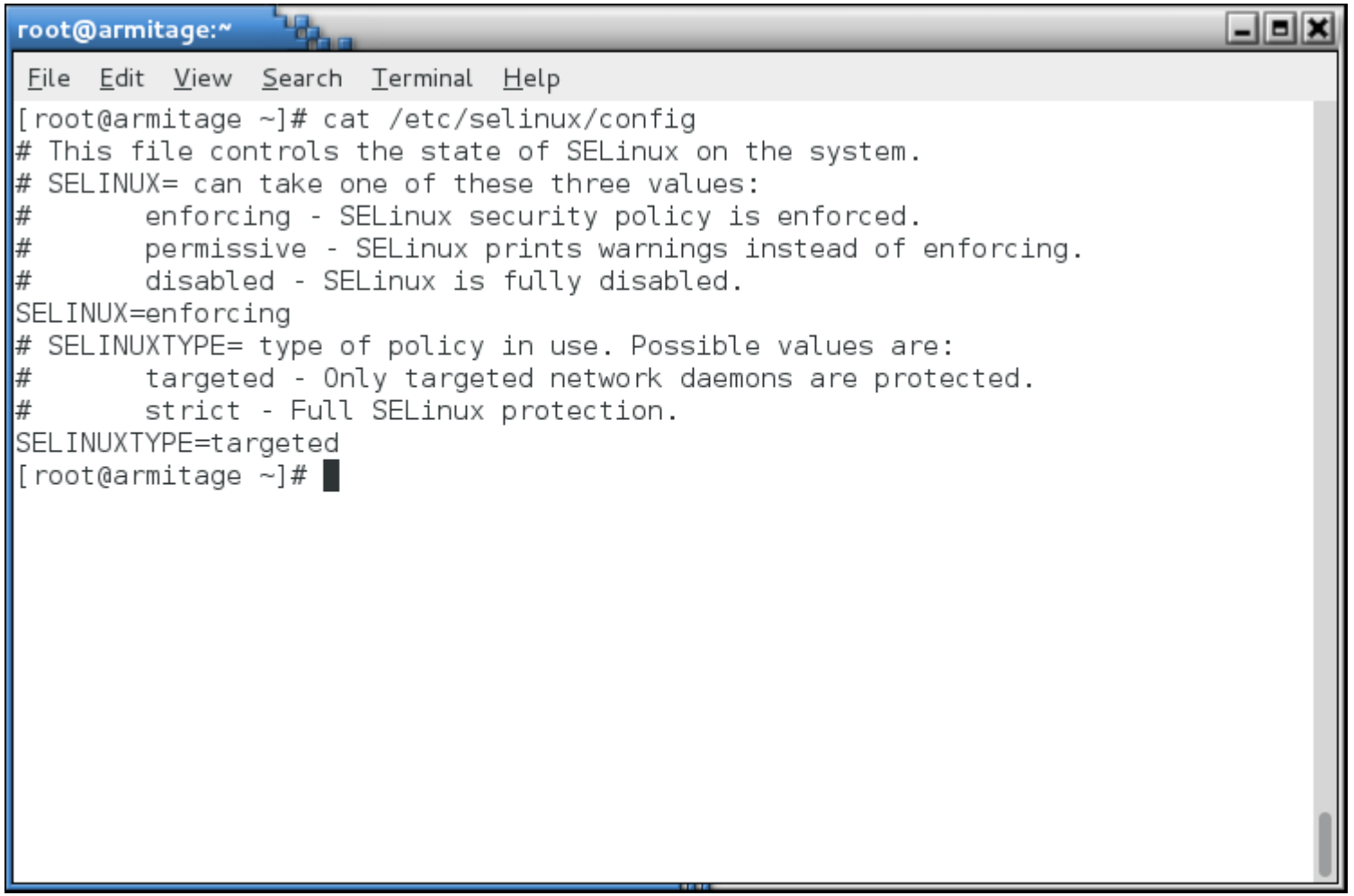
- These policies can be very fine grained. Policies can be set to determine access between:
  - Users
  - Files
  - Directories
  - Memory
  - Sockets
  - tcp/udp ports
  - etc...

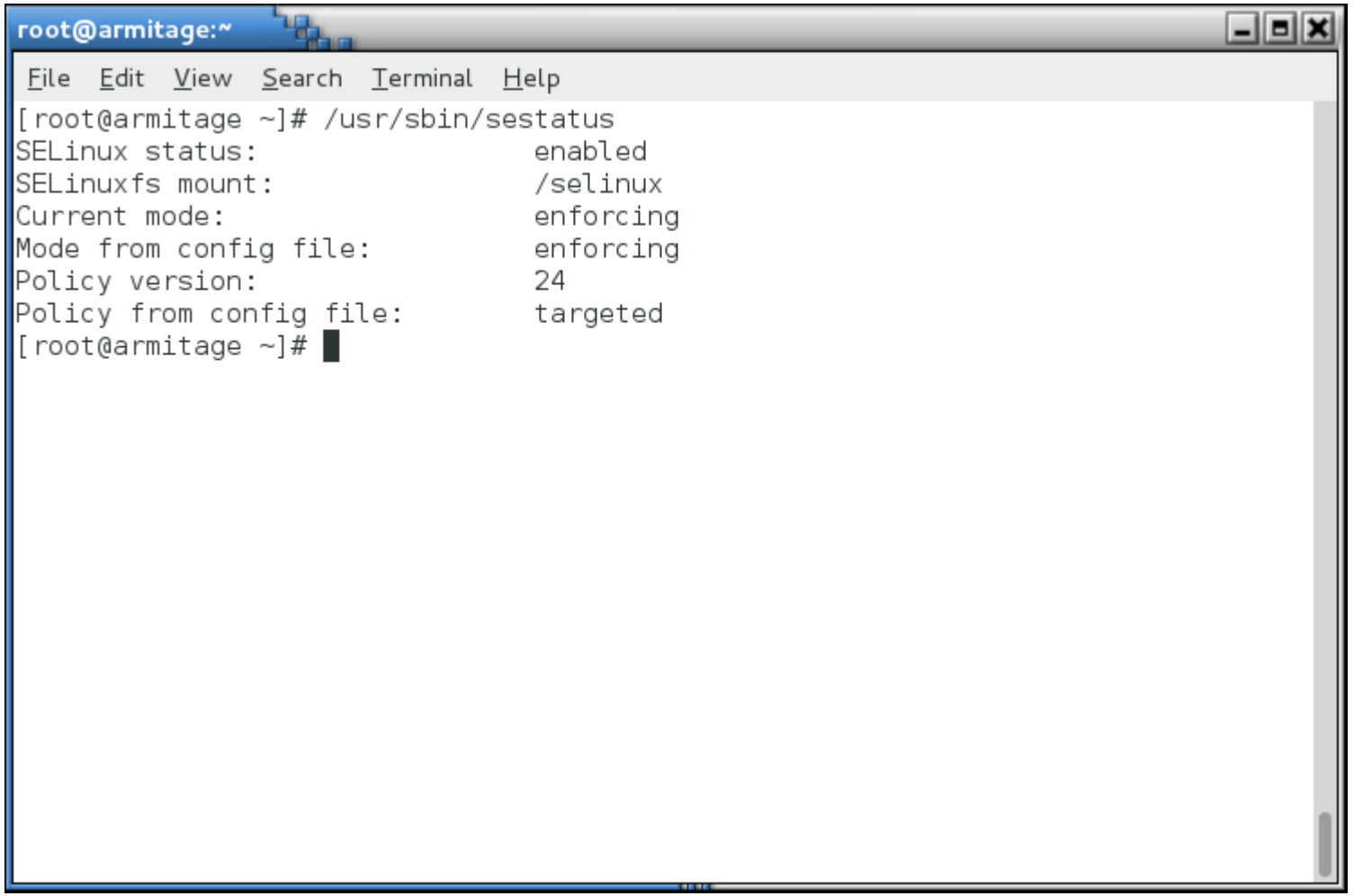
Policy

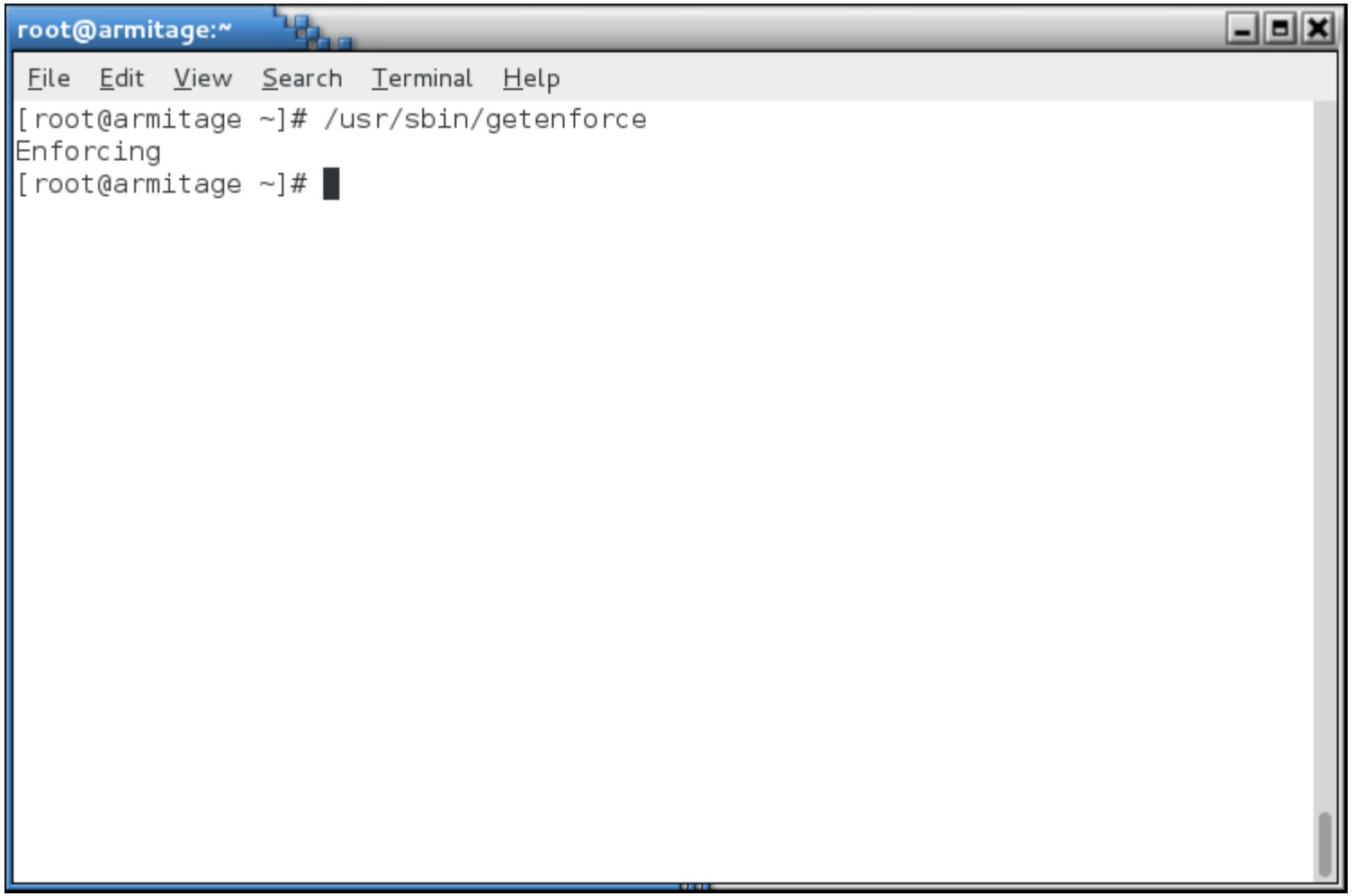
- In Red Hat Enterprise Linux 6, there are two policies you'll generally see.
  - “targeted” - the default policy
    - Only targeted processes (there are hundreds) are protected by SELinux
    - Everything else is unconfined
  - “mls” - multi-level/multi-category security
    - Out of scope for today's presentation
    - Can be very complex
    - Typically used in TLA government organizations

So How Does SELinux Work?

- You can determine what policy your system is set to use by looking at /etc/selinux/config (which is also symlinked to /etc/sysconfig/selinux)
- You can check via /usr/sbin/sestatus
- You can also check via /usr/sbin/getenforce


root@armitage:~
File Edit View Search Terminal Help
[root@armitage ~]# cat /etc/selinux/config
# This file controls the state of SELinux on the system.
# SELINUX= can take one of these three values:
#   enforcing - SELinux security policy is enforced.
#   permissive - SELinux prints warnings instead of enforcing.
#   disabled - SELinux is fully disabled.
SELINUX=enforcing
# SELINUXTYPE= type of policy in use. Possible values are:
#   targeted - Only targeted network daemons are protected.
#   strict - Full SELinux protection.
SELINUXTYPE=targeted
[root@armitage ~]#


root@armitage:~
File Edit View Search Terminal Help
[root@armitage ~]# /usr/sbin/sestatus
SELinux status: enabled
SELinuxfs mount: /selinux
Current mode: enforcing
Mode from config file: enforcing
Policy version: 24
Policy from config file: targeted
[root@armitage ~]#


root@armitage:~
File Edit View Search Terminal Help
[root@armitage ~]# /usr/sbin/getenforce
Enforcing
[root@armitage ~]#

So How Does SELinux Work?

- Two of the important concepts to understand with SELinux are:
  - Labeling
  - Type Enforcement

So How Does SELinux Work?

- Labeling
  - Files, processes, ports, etc., are all labeled with an SELinux context.
  - For files and directories, these labels are stored as extended attributes on the filesystem.
  - For processes, ports, etc., the kernel manages these labels.

So How Does SELinux Work?

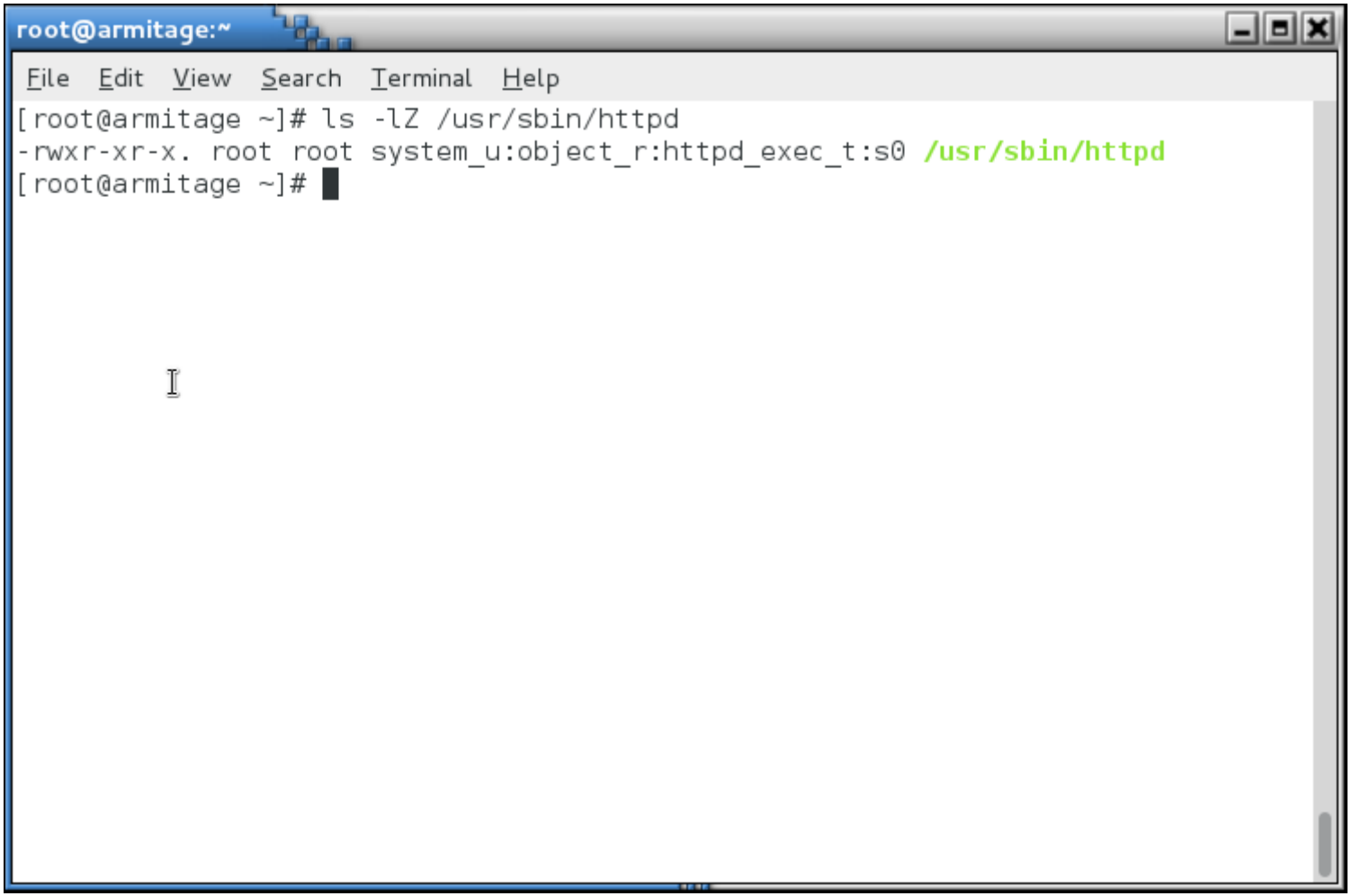
- Labeling
  - Labels are in the format:
    - user:role:type:level(optional)
  - For the purpose of this presentation, we will not deal with the SELinux user, role or level. These are used in more advanced implementations of SELinux (MLS/MCS).
  - What we really care about for today's presentation is the type (remember, labeling and type enforcement).

So How Does SELinux Work?

- We'll look at a fairly complex service, one which provides access from the network, potentially on several ports, and potentially, access to the whole filesystem.
- The Apache web server is not necessarily insecure, it is just very wide ranging in its access.

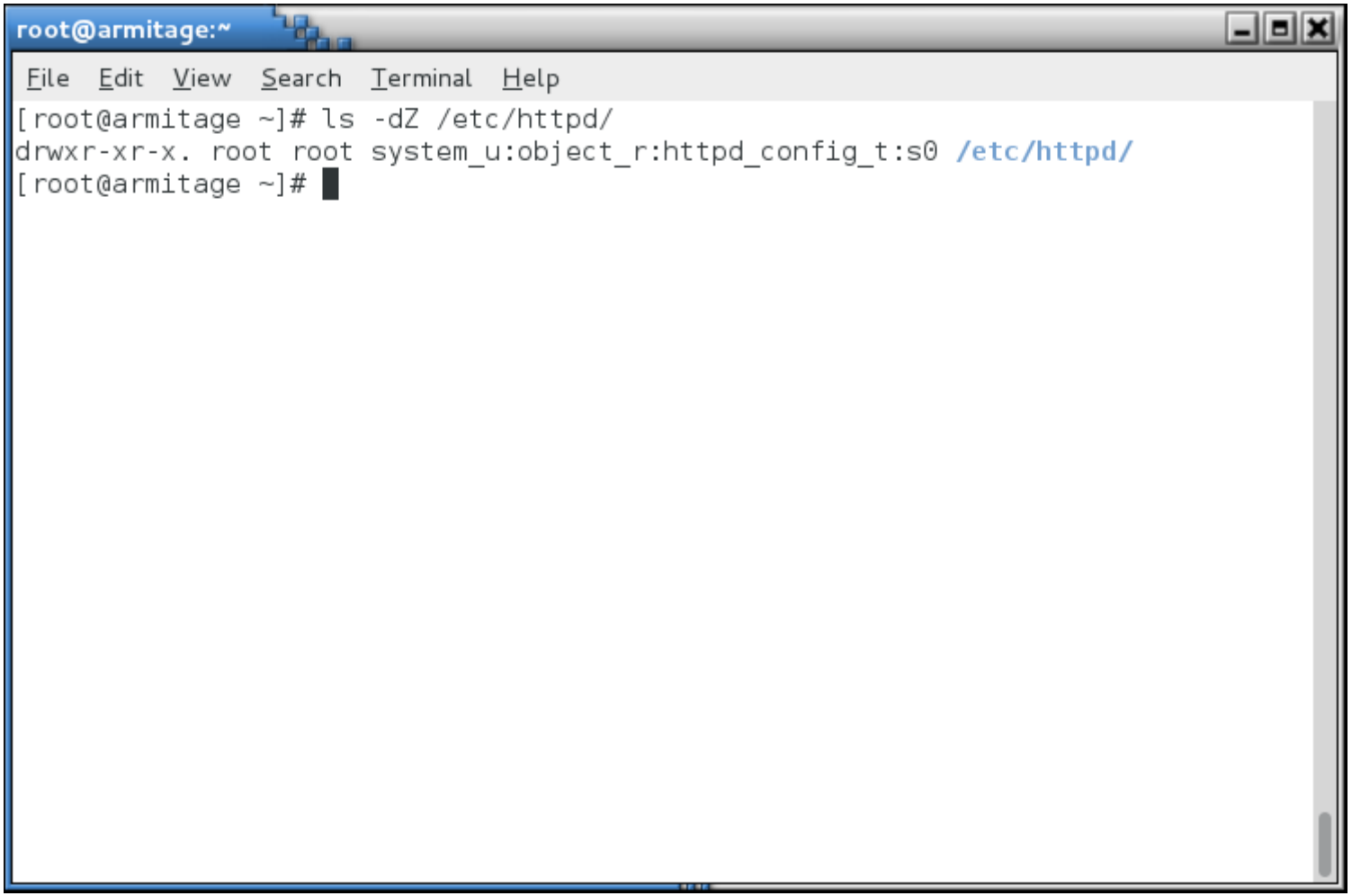
So How Does SELinux Work?

- The Apache web server has a binary executable which launches from /usr/sbin. When you look at that file's SELinux context, you see its type is httpd_exec_t:


root@armitage:~
File Edit View Search Terminal Help
[root@armitage ~]# ls -lZ /usr/sbin/httpd
-rwxr-xr-x. root root system_u:object_r:httpd_exec_t:s0 /usr/sbin/httpd
[root@armitage ~]#

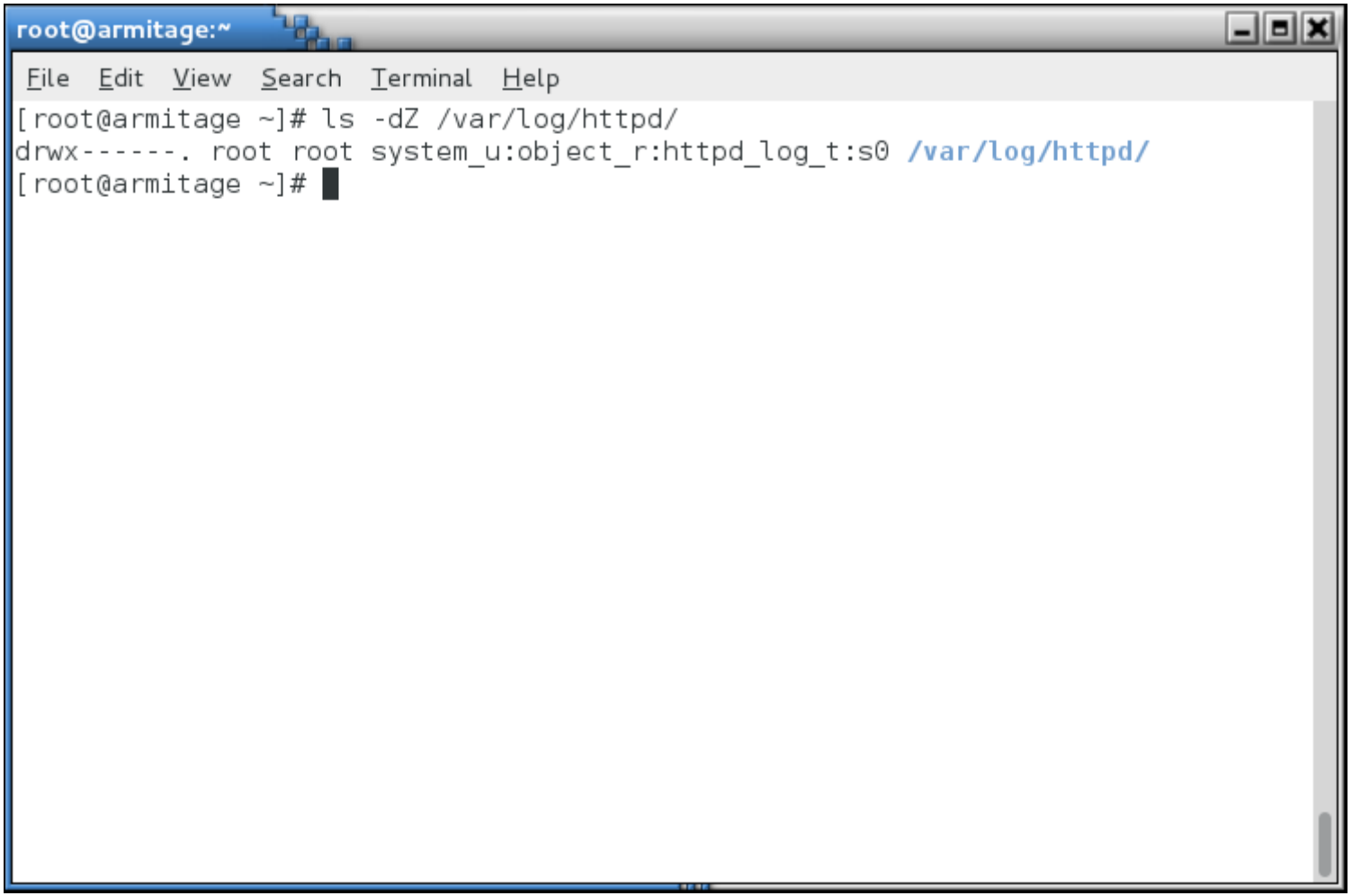
So How Does SELinux Work?

- The web server's configuration directory is labeled httpd_config_t:


root@armitage:~
File Edit View Search Terminal Help
[root@armitage ~]# ls -dZ /etc/httpd/
drwxr-xr-x. root root system_u:object_r:httpd_config_t:s0 /etc/httpd/
[root@armitage ~]#

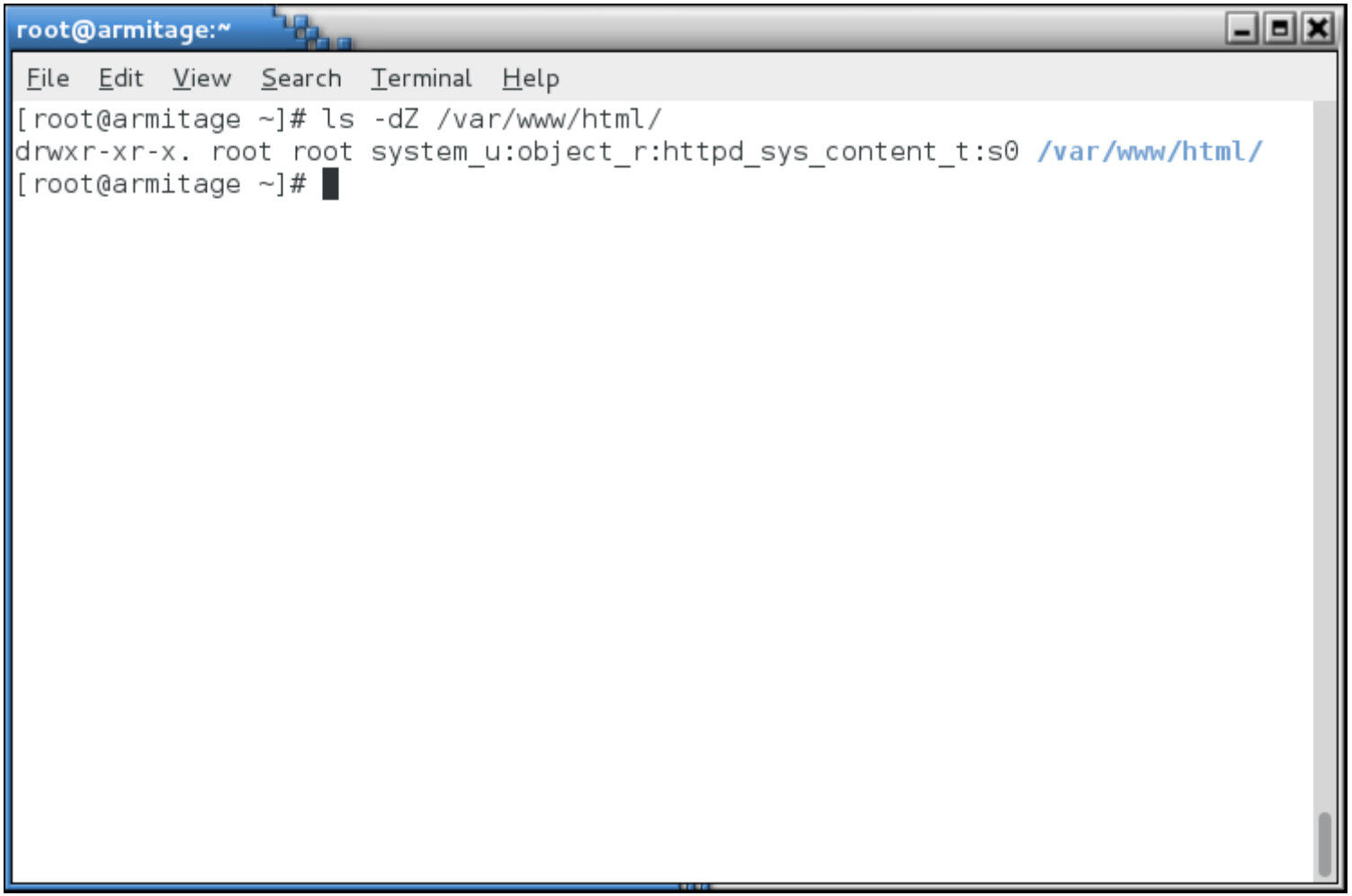
So How Does SELinux Work?

- The web server's logfile directory is labeled httpd_log_t:


root@armitage:~
File Edit View Search Terminal Help
[root@armitage ~]# ls -dZ /var/log/httpd/
drwx------. root root system_u:object_r:httpd_log_t:s0 /var/log/httpd/
[root@armitage ~]#

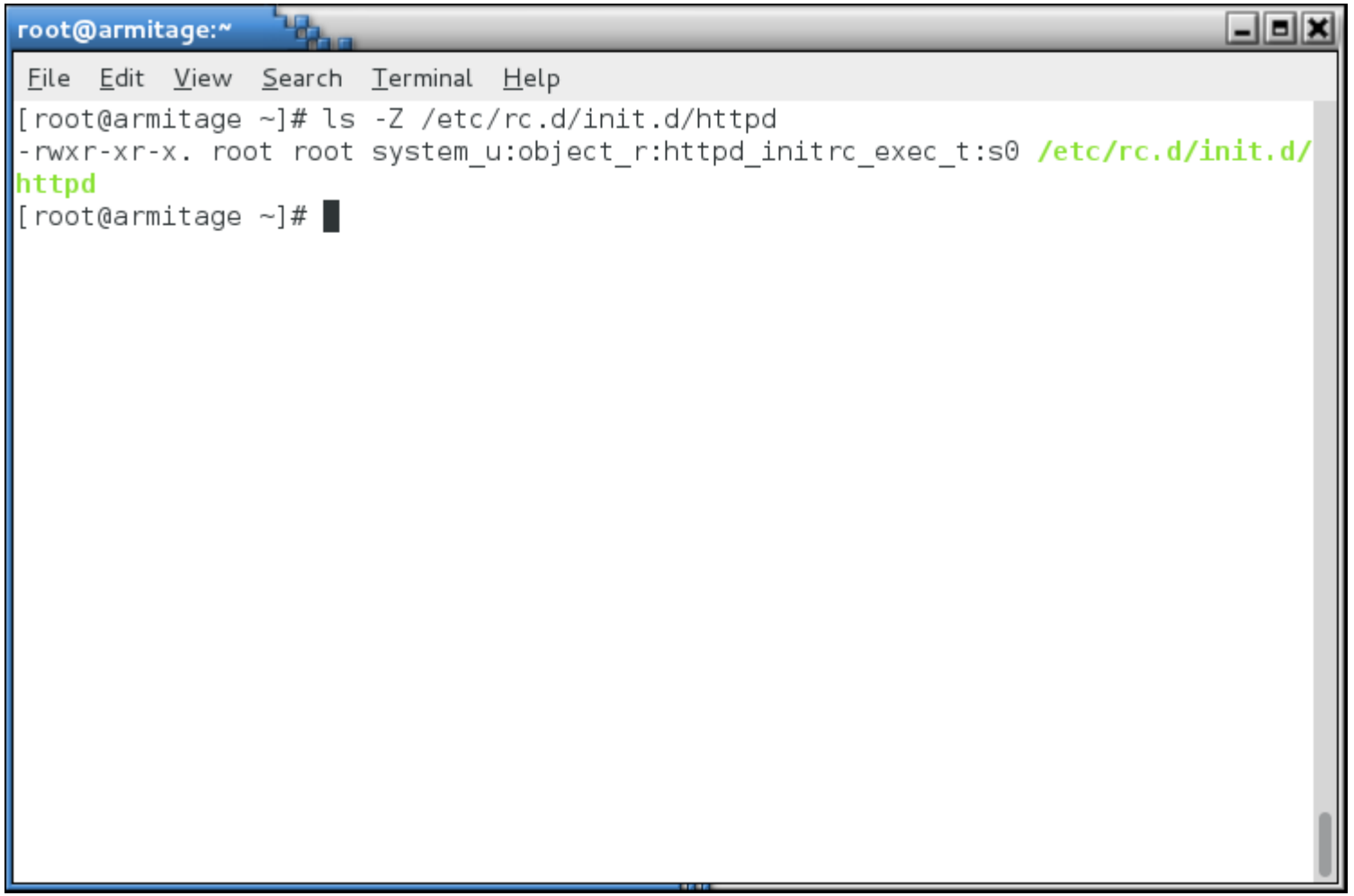
So How Does SELinux Work?

- The web server's content directory is labeled httpd_sys_content_t:


root@armitage:~
File Edit View Search Terminal Help
[root@armitage ~]# ls -dZ /var/www/html/
drwxr-xr-x. root root system_u:object_r:httpd_sys_content_t:s0 /var/www/html/
[root@armitage ~]#

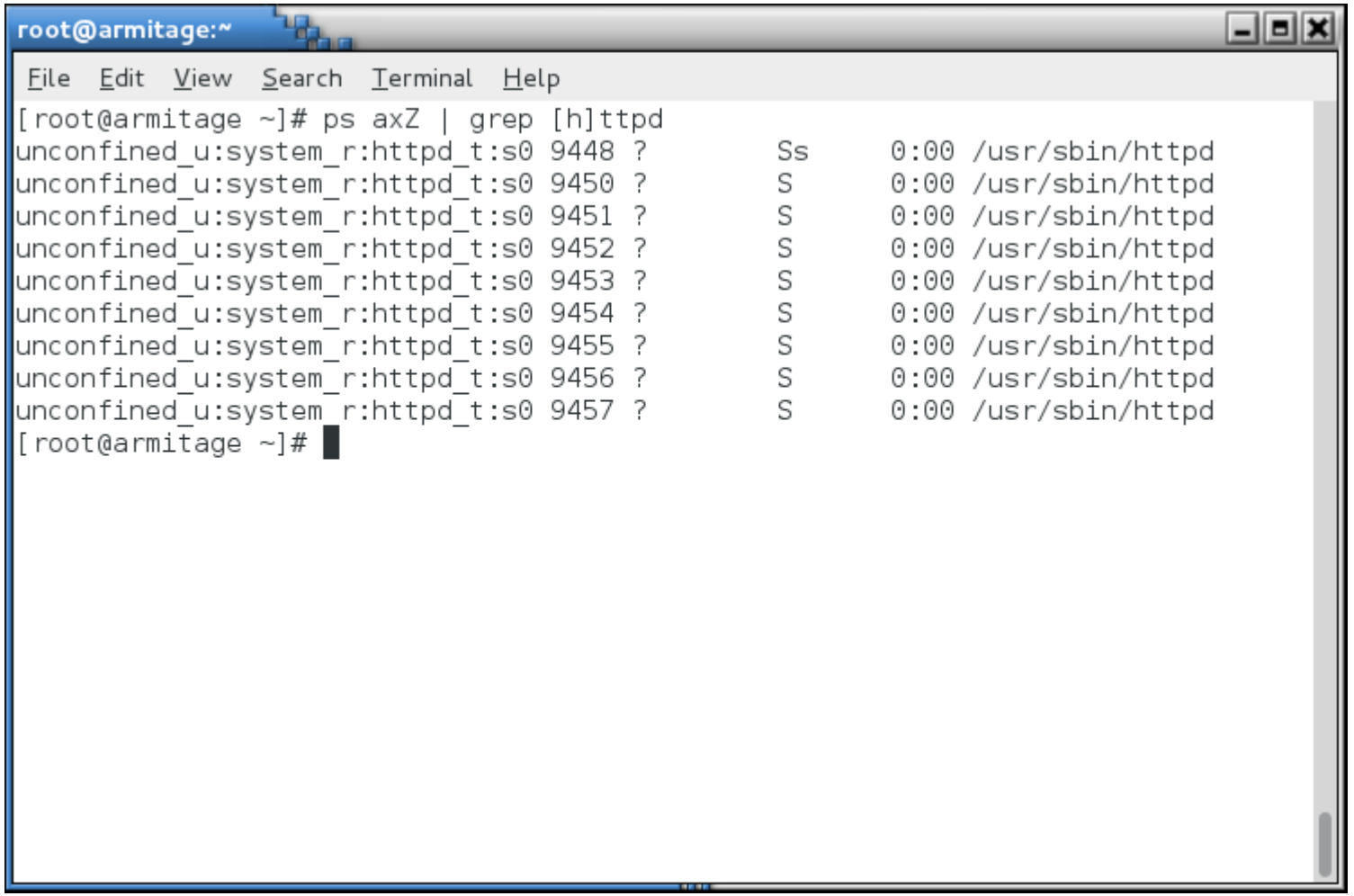
So How Does SELinux Work?

- The web server's startup script is labeled httpd_initrc_exec_t:


root@armitage:~
File Edit View Search Terminal Help
[root@armitage ~]# ls -Z /etc/rc.d/init.d/httpd
-rwxr-xr-x. root root system_u:object_r:httpd_initrc_exec_t:s0 /etc/rc.d/init.d/
httpd
[root@armitage ~]#

So How Does SELinux Work?

- As the web server runs, it's process is labeled httpd_t:


root@armitage:~
File Edit View Search Terminal Help
[root@armitage ~]# ps axZ | grep [h]ttpd
unconfined_u:system_r:httpd_t:s0 9448 ? Ss 0:00 /usr/sbin/httpd
unconfined_u:system_r:httpd_t:s0 9450 ? S 0:00 /usr/sbin/httpd
unconfined_u:system_r:httpd_t:s0 9451 ? S 0:00 /usr/sbin/httpd
unconfined_u:system_r:httpd_t:s0 9452 ? S 0:00 /usr/sbin/httpd
unconfined_u:system_r:httpd_t:s0 9453 ? S 0:00 /usr/sbin/httpd
unconfined_u:system_r:httpd_t:s0 9454 ? S 0:00 /usr/sbin/httpd
unconfined_u:system_r:httpd_t:s0 9455 ? S 0:00 /usr/sbin/httpd
unconfined_u:system_r:httpd_t:s0 9456 ? S 0:00 /usr/sbin/httpd
unconfined_u:system_r:httpd_t:s0 9457 ? S 0:00 /usr/sbin/httpd
[root@armitage ~]#

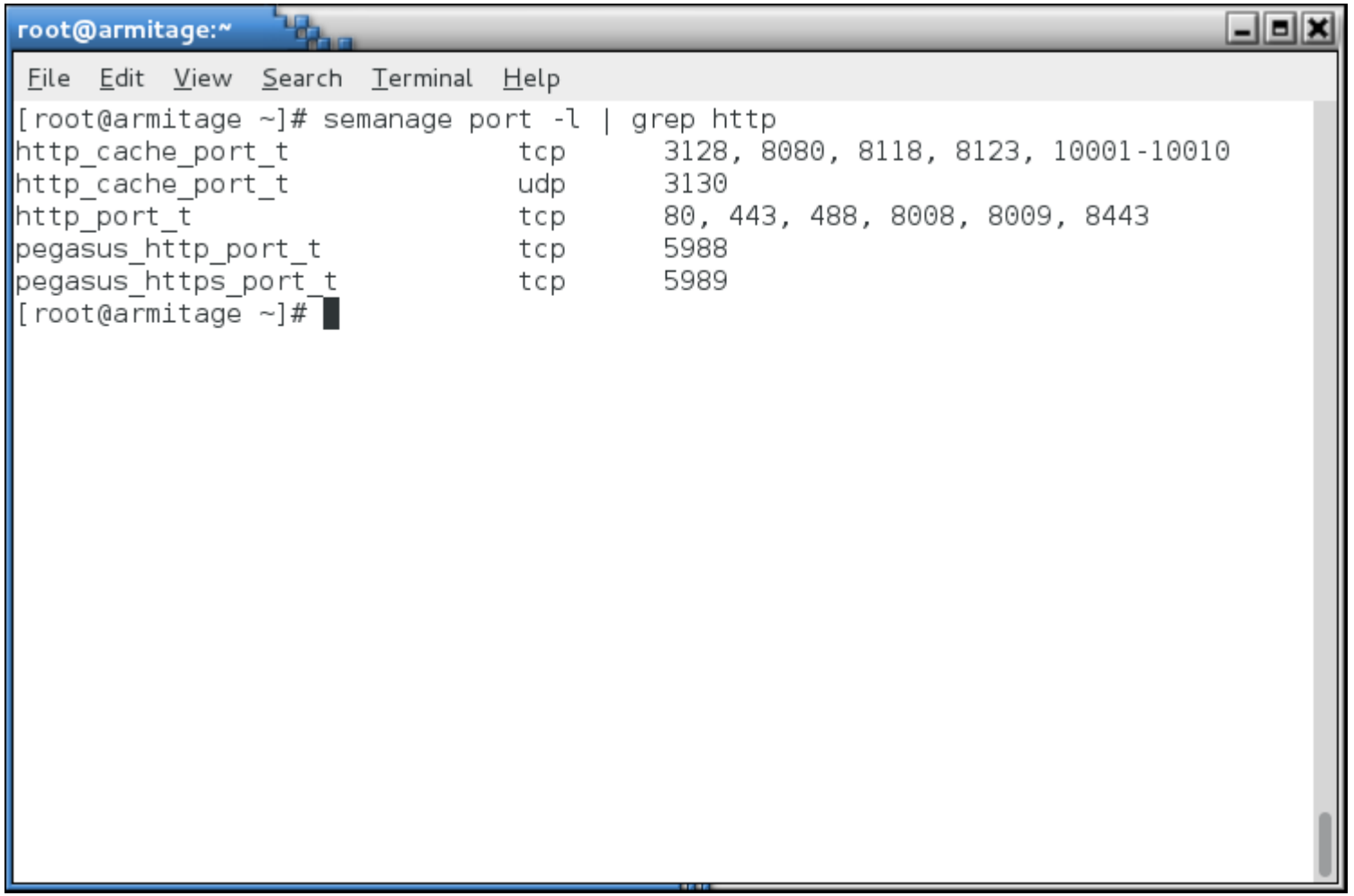
So How Does SELinux Work?

- If you look at the ports upon which the web server listens, you'll see that even they are labeled.

root@armitage:~

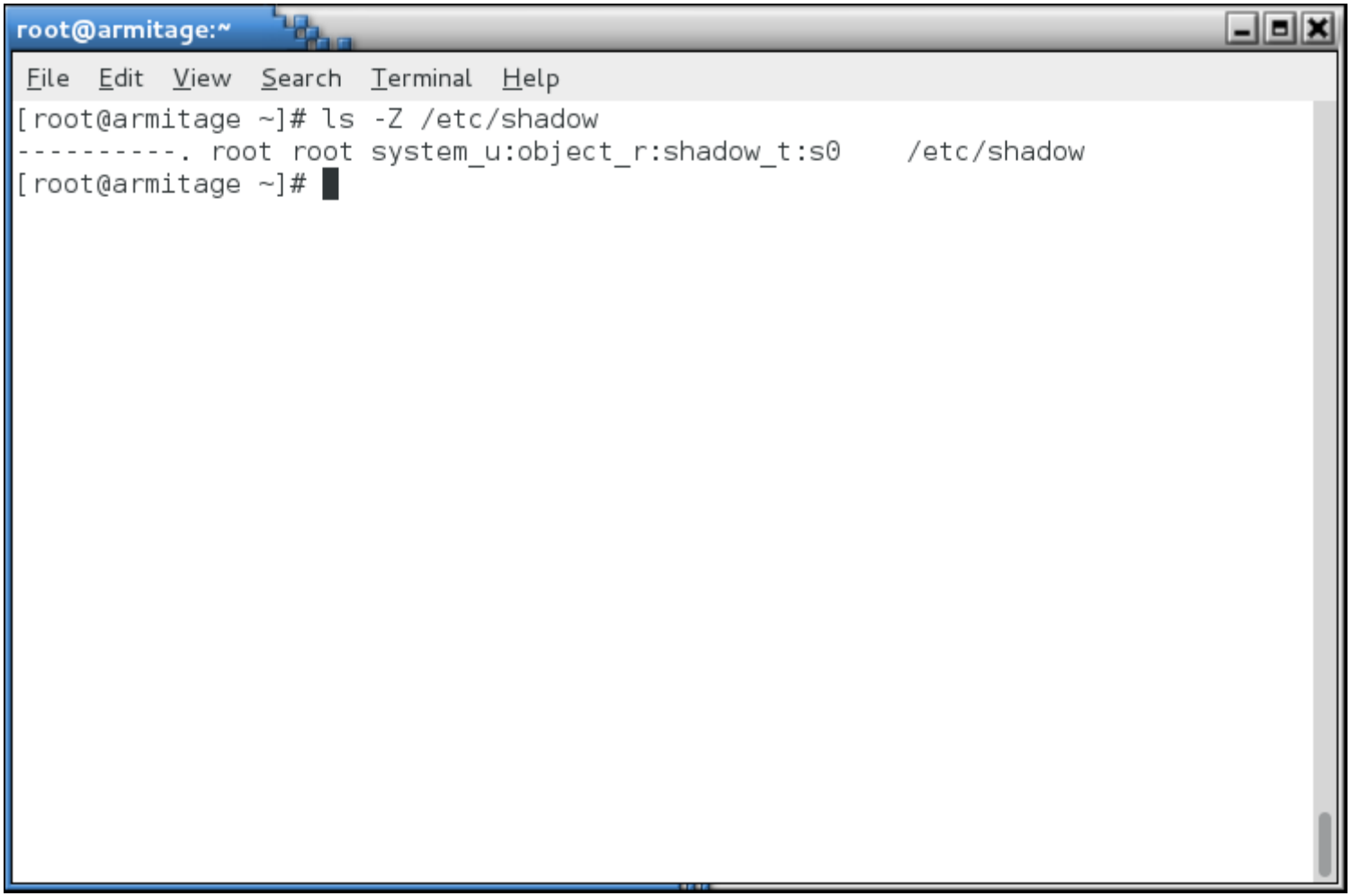
File Edit View Search Terminal Help

```
[root@armitage ~]# netstat -tnlpZ | grep httpd
tcp        0      0 :::80                       :::*                        LISTEN      2135/httpd          unconfined_u:system_r:httpd_t:s0

tcp        0      0 :::443                      :::*                        LISTEN      2135/httpd          unconfined_u:system_r:httpd_t:s0

[root@armitage ~]#
```



root@armitage:~
File Edit View Search Terminal Help
[root@armitage ~]# semanage port -l | grep http
http_cache_port_t tcp 3128, 8080, 8118, 8123, 10001-10010
http_cache_port_t udp 3130
http_port_t tcp 80, 443, 488, 8008, 8009, 8443
pegasus_http_port_t tcp 5988
pegasus_https_port_t tcp 5989
[root@armitage ~]#

So How Does SELinux Work?

- Now then... The /etc/shadow file has a type shadow_t:


root@armitage:~
File Edit View Search Terminal Help
[root@armitage ~]# ls -Z /etc/shadow
----------. root root system_u:object_r:shadow_t:s0 /etc/shadow
[root@armitage ~]#

So How Does SELinux Work?

- Type enforcement

So How Does SELinux Work?

- Type enforcement
  - It probably makes sense for a process running in the httpd_t context to interact with a file with the httpd_config_t label.

So How Does SELinux Work?

- Type enforcement
  - Do you think it makes sense for a process running with the httpd_t context label to be able to interact with a file with, say, the shadow_t label?

So How Does SELinux Work?

- Type enforcement
  - Type enforcement is the part of the policy that says, for instance, “a process running with the label httpd_t can have read access to a file labeled httpd_config_t”

How Do I Deal With Labels?

How Do I Deal With Labels?

- You've seen me use the -Z argument to several commands to view context. Many commands accept this argument:
  - ls -Z
  - id -Z
  - ps -Z
  - netstat -Z

How Do I Deal With Labels?

- You can actually use the -Z argument to create and modify files and contexts, as well.
  - cp -Z
  - mkdir -Z

How Do I Deal With Labels?

- You can use SELinux aware tools like chcon or restorecon to change the context of a file (more on this later).
- Contexts are set when files are created, based on their parent directory's context (with a few exceptions).
- RPMs can set contexts as part of installation.
- The login process sets the default context (unconfined in the targeted policy)

How Do I Deal With Labels?

- File transitions (defined by policy)
  - If an application foo_t creates a file in a directory labeled bar_t, policy can require a transition so that file is created with the baz_t label.
  - Example: A process, dhclient, running with the dhclient_t label creates a file, resolv.conf, labeled net_conf_t in a directory, /etc, labeled etc_t. Without that transition, /etc/resolv.conf would have inherited the etc_t label.

How Do I Deal With Labels?

- You've also seen me use the semanage command. It can be used to manage SELinux settings for:
  - login
  - user
  - port
  - interface
  - module

How Do I Deal With Labels?

- You've also seen me use the semanage command. It can be used to manage SELinux settings for:
  - node
  - file context
  - boolean
  - permissive state
  - dontaudit

What Does It Mean If I Get An SELinux Error?

What Does It Mean If I Get An SELinux Error?

- If you see an SELinux error, it means that something is wrong!
- Turning off SELinux is like turning up the radio really loud when your car is making a strange noise!

What Does It Mean If I Get An SELinux Error?

- It may mean that labeling is wrong
  - Use the tools to fix the labels. We'll talk more about that later.

What Does It Mean If I Get An SELinux Error?

- It may mean that the policy needs to be tweaked.
  - booleans
  - Policy modules

What Does It Mean If I Get An SELinux Error?

- There could be a bug in the policy
  - We need to know about these! Open a ticket (do not file a Bugzilla report - there are no SLAs around BZ).

What Does It Mean If I Get An SELinux Error?

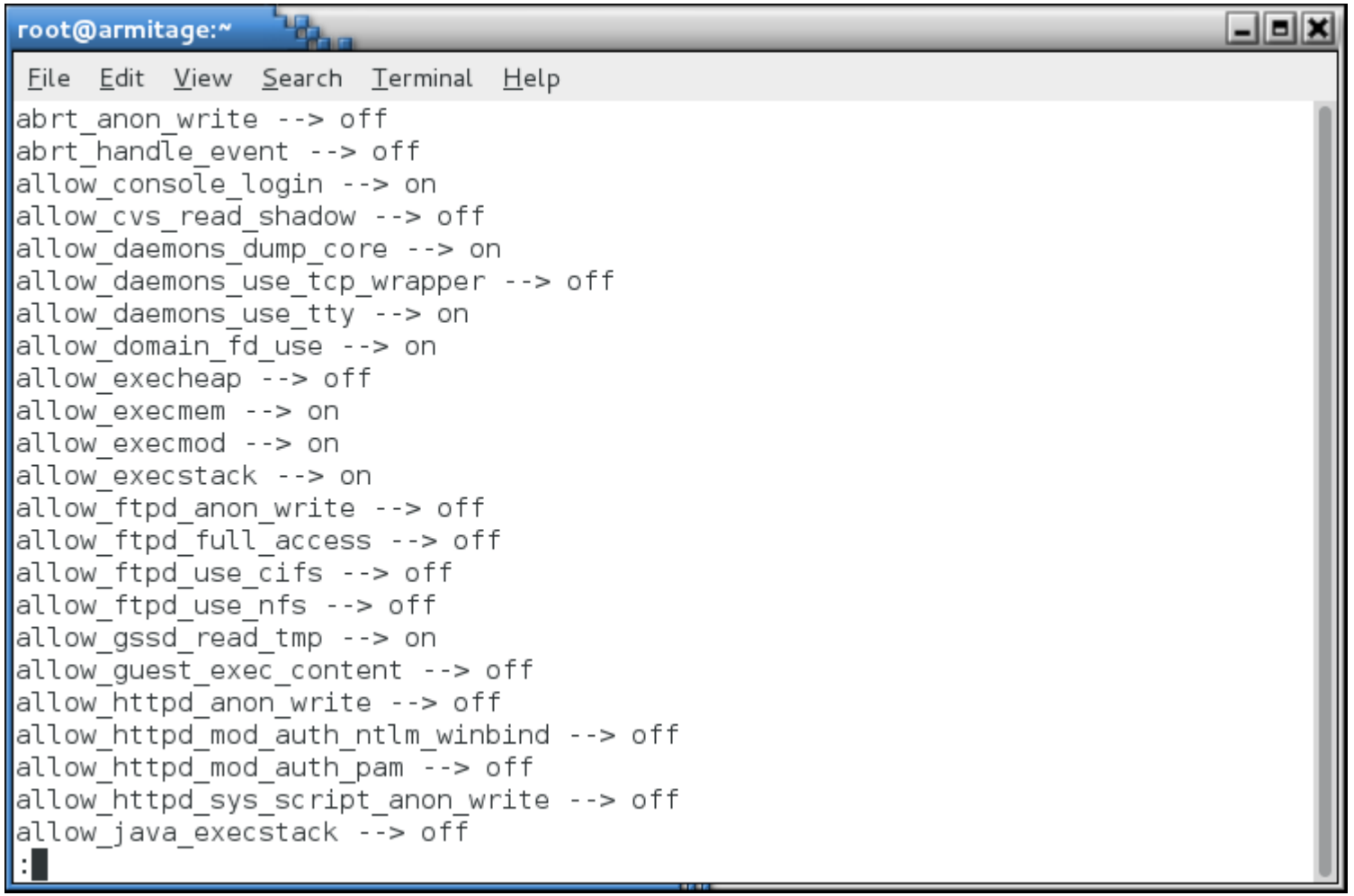
- You have been, or are being, broken up to
  - Man the battle stations!

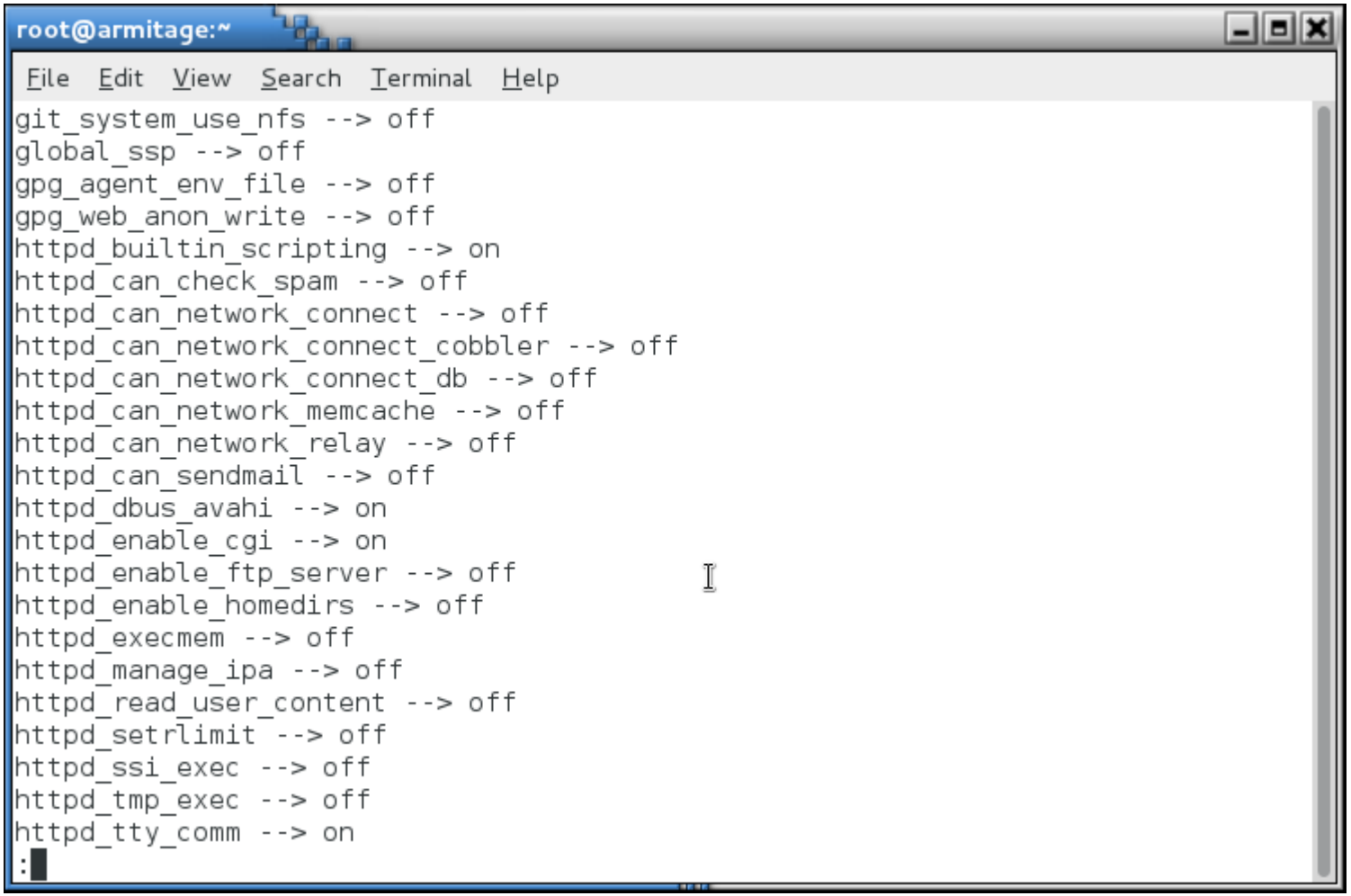
What Are Booleans?

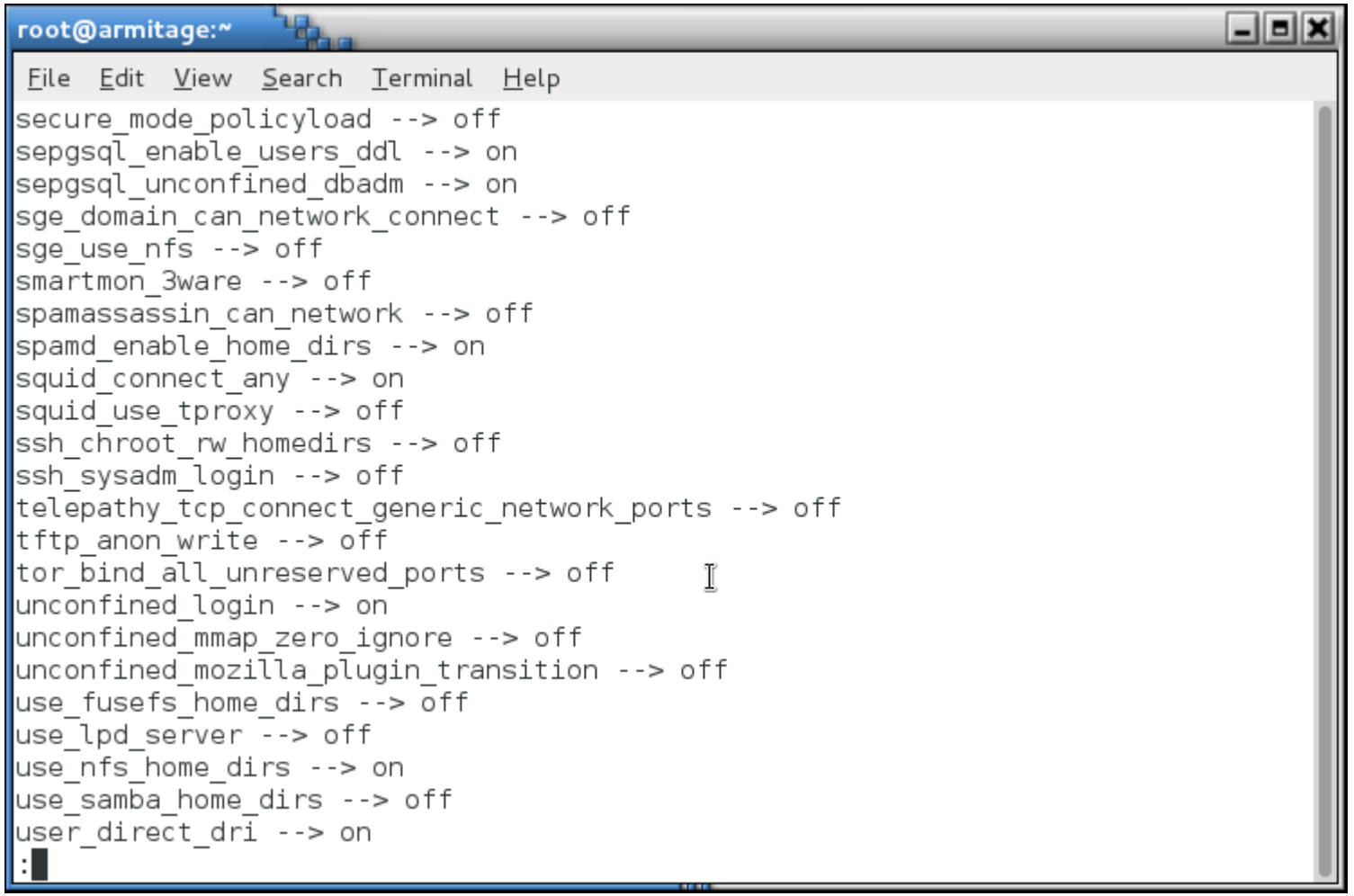
- Booleans are just off/on settings for SELinux.
  - From simple stuff like “do we allow the ftp server access to home directories” to more esoteric stuff like “httpd can use mod_auth_ntlm_winbind.”

What Are Booleans?

- To see all the booleans, run getsebool -a


root@armitage:~
File Edit View Search Terminal Help
abrt_anon_write --> off
abrt_handle_event --> off
allow_console_login --> on
allow_cvs_read_shadow --> off
allow_daemons_dump_core --> on
allow_daemons_use_tcp_wrapper --> off
allow_daemons_use_tty --> on
allow_domain_fd_use --> on
allow_execheap --> off
allow_execmem --> on
allow_execmod --> on
allow_execstack --> on
allow_ftpd_anon_write --> off
allow_ftpd_full_access --> off
allow_ftpd_use_cifs --> off
allow_ftpd_use_nfs --> off
allow_gssd_read_tmp --> on
allow_guest_exec_content --> off
allow_httpd_anon_write --> off
allow_httpd_mod_auth_ntlm_winbind --> off
allow_httpd_mod_auth_pam --> off
allow_httpd_sys_script_anon_write --> off
allow_java_execstack --> off
:


root@armitage:~
File Edit View Search Terminal Help
git_system_use_nfs --> off
global_ssp --> off
gpg_agent_env_file --> off
gpg_web_anon_write --> off
httpd_builtin_scripting --> on
httpd_can_check_spam --> off
httpd_can_network_connect --> off
httpd_can_network_connect_cobbler --> off
httpd_can_network_connect_db --> off
httpd_can_network_memcache --> off
httpd_can_network_relay --> off
httpd_can_sendmail --> off
httpd_dbus_avahi --> on
httpd_enable_cgi --> on
httpd_enable_ftp_server --> off
httpd_enable_homedirs --> off
httpd_execmem --> off
httpd_manage_ipa --> off
httpd_read_user_content --> off
httpd_setrlimit --> off
httpd_ssi_exec --> off
httpd_tmp_exec --> off
httpd_tty_comm --> on
:

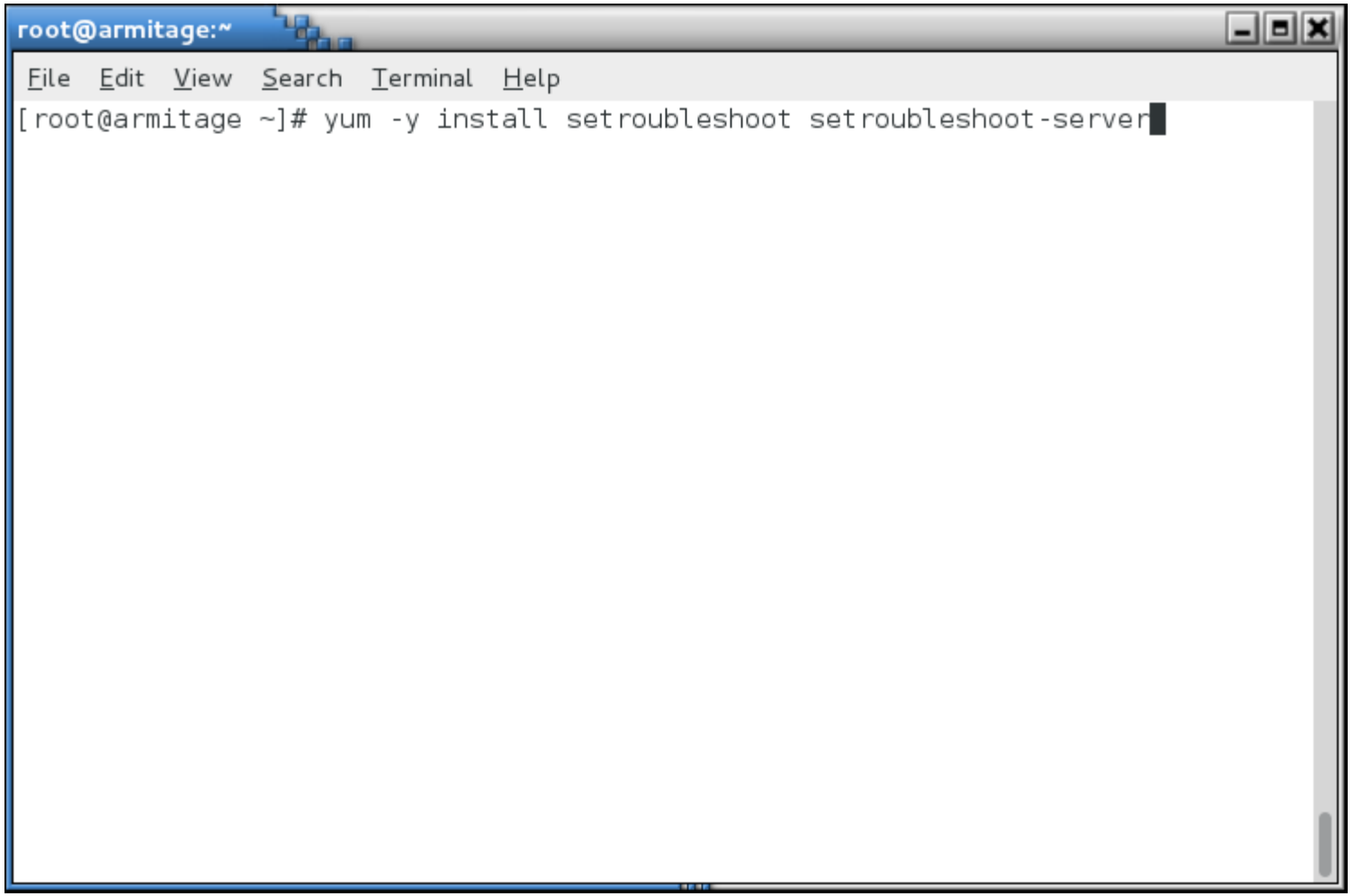

root@armitage:~
File Edit View Search Terminal Help
secure_mode_policyload --> off
sepgsql_enable_users_ddl --> on
sepgsql_unconfined_dbadm --> on
sge_domain_can_network_connect --> off
sge_use_nfs --> off
smartmon_3ware --> off
spamassassin_can_network --> off
spamd_enable_home_dirs --> on
squid_connect_any --> on
squid_use_tproxy --> off
ssh_chroot_rw_homedirs --> off
ssh_sysadm_login --> off
telepathy_tcp_connect_generic_network_ports --> off
tftp_anon_write --> off
tor_bind_all_unreserved_ports --> off
unconfined_login --> on
unconfined_mmap_zero_ignore --> off
unconfined_mozilla_plugin_transition --> off
use_fusefs_home_dirs --> off
use_lpd_server --> off
use_nfs_home_dirs --> on
use_samba_home_dirs --> off
user_direct_dri --> on
:

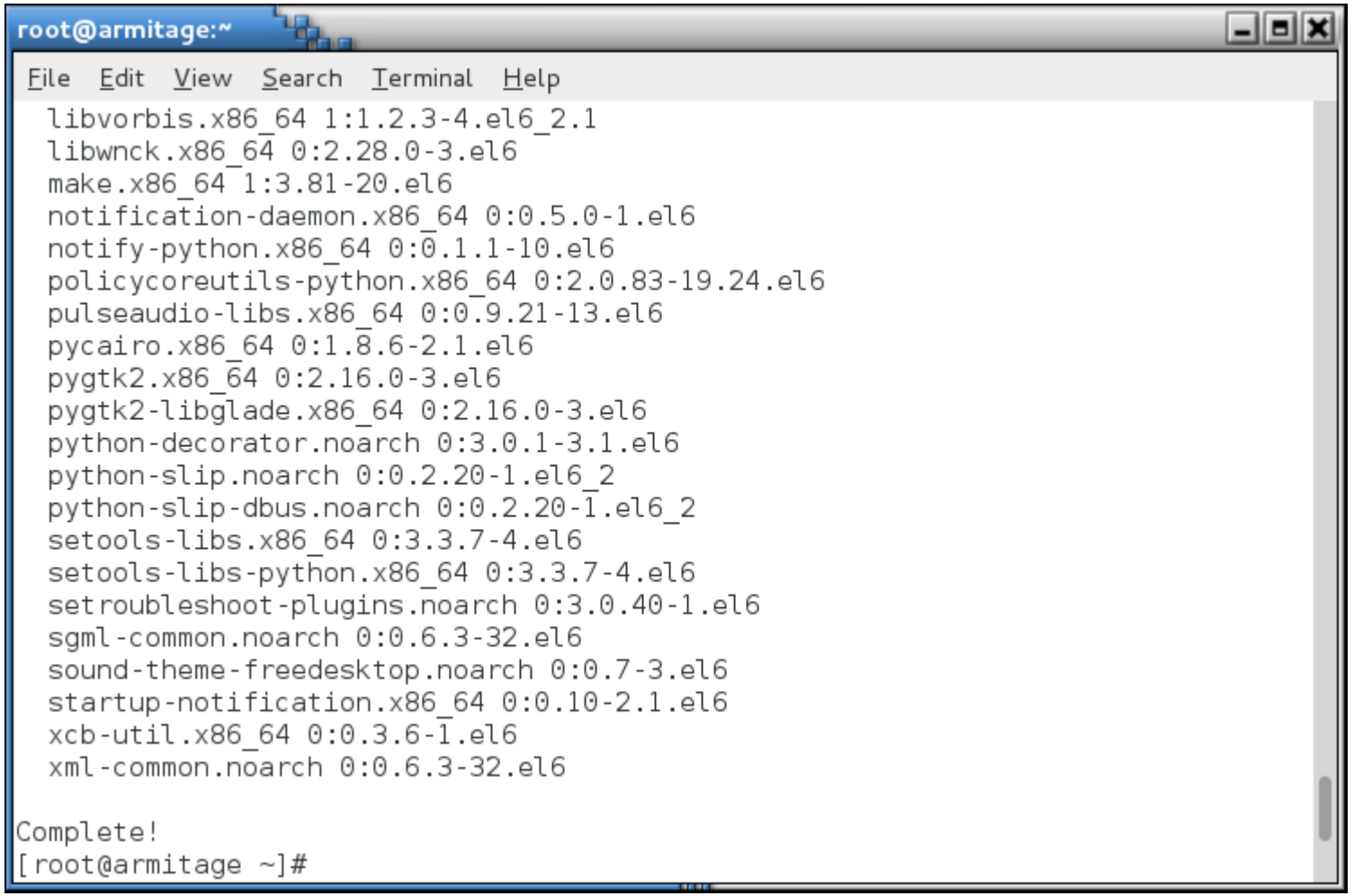
What Are Booleans?

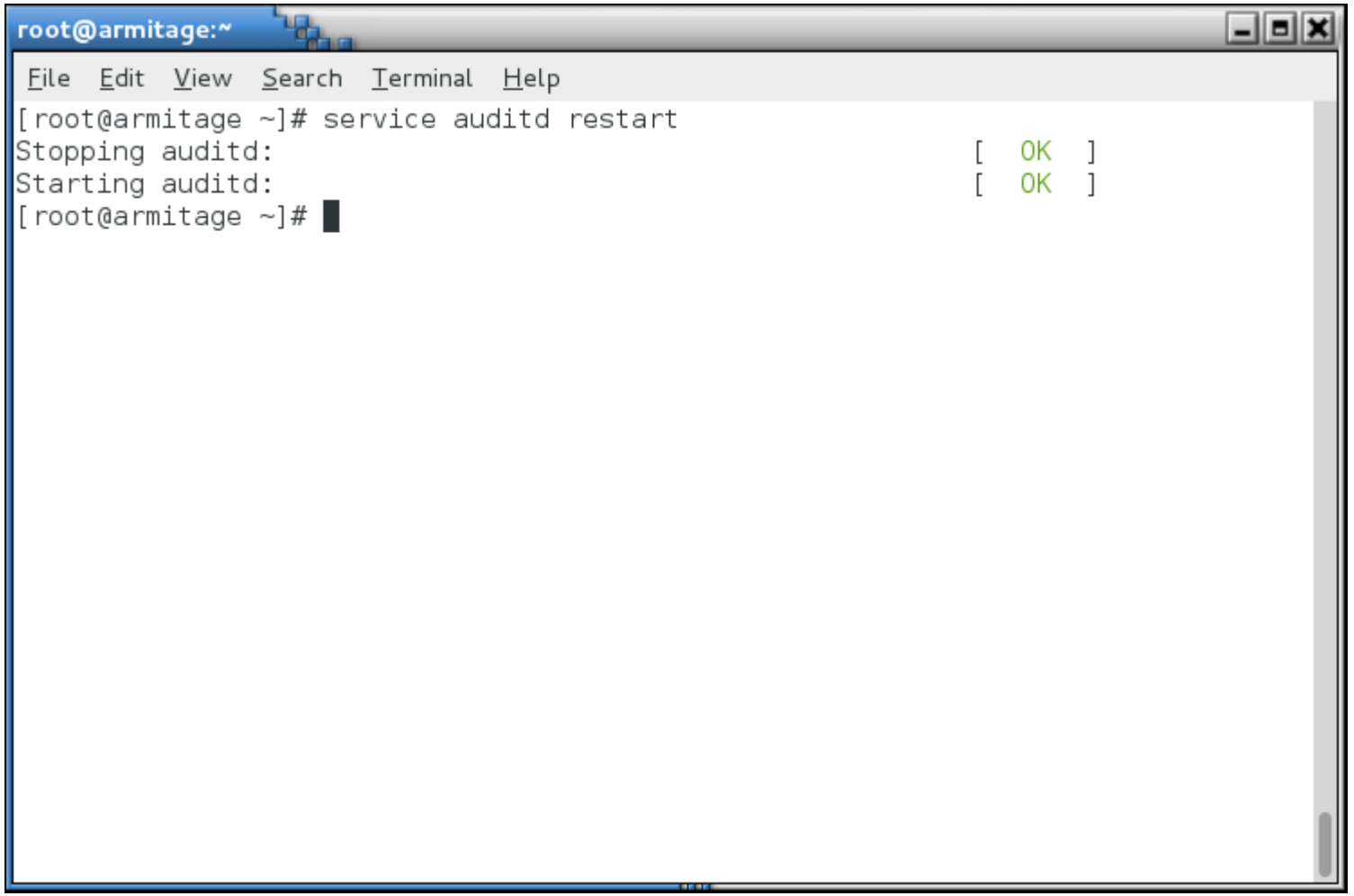
- To set a boolean, run setsebool [boolean] [0|1]
- To make it permanent, pass the -P argument to setsebool

Tips and Tricks

- Install setroubleshoot and setroubleshoot-server on machines you'll be developing policy modules on. They drag in a bunch of tools to help diagnose and fix SELinux issues.
- Reboot or restart auditd after you install.


root@armitage:~
File Edit View Search Terminal Help
[root@armitage ~]# yum -y install setroubleshoot setroubleshoot-server

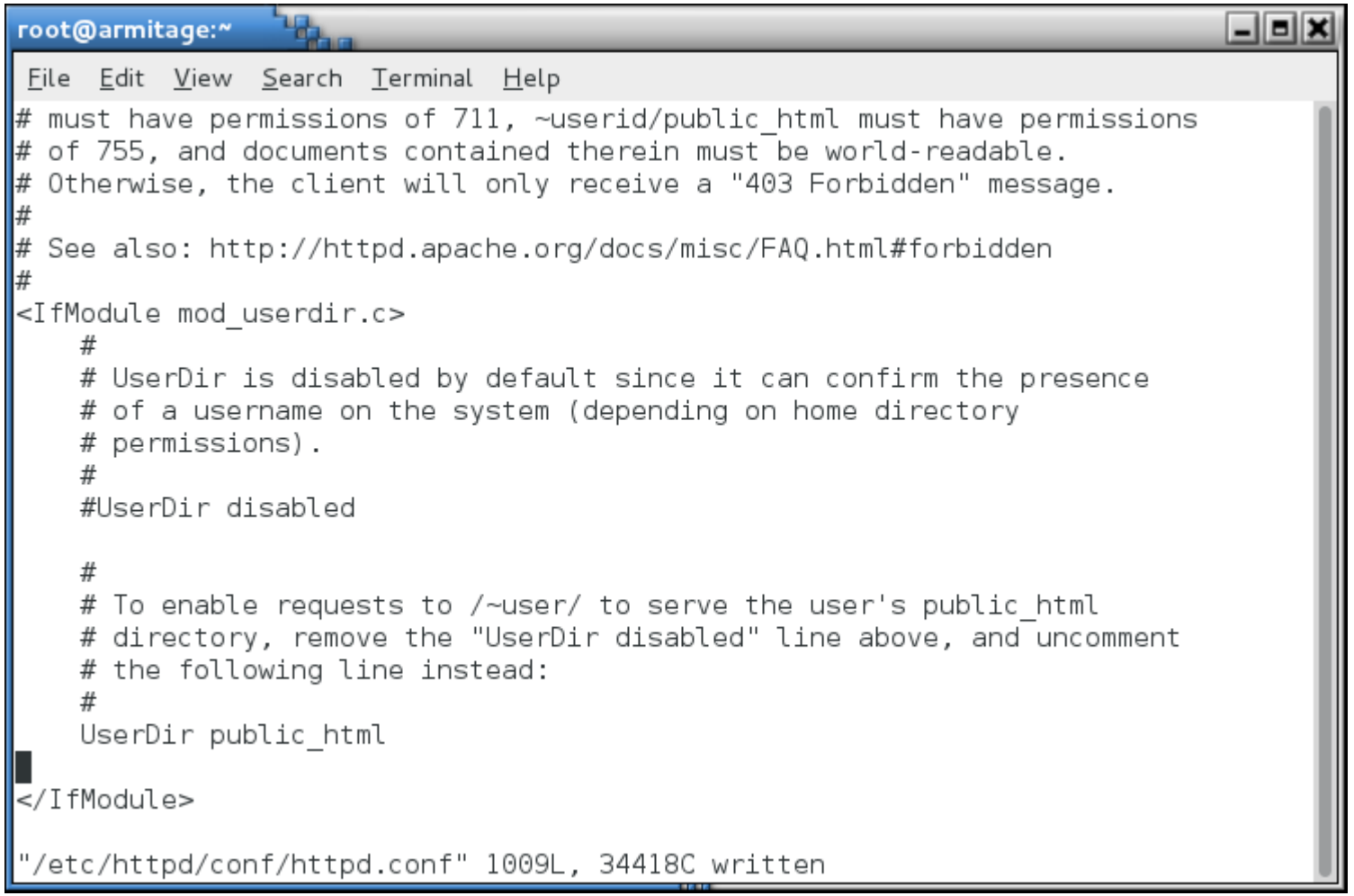

root@armitage:~
File Edit View Search Terminal Help
libvorbis.x86_64 1:1.2.3-4.el6_2.1
libwnck.x86_64 0:2.28.0-3.el6
make.x86_64 1:3.81-20.el6
notification-daemon.x86_64 0:0.5.0-1.el6
notify-python.x86_64 0:0.1.1-10.el6
policycoreutils-python.x86_64 0:2.0.83-19.24.el6
pulseaudio-libs.x86_64 0:0.9.21-13.el6
pycairo.x86_64 0:1.8.6-2.1.el6
pygtk2.x86_64 0:2.16.0-3.el6
pygtk2-libglade.x86_64 0:2.16.0-3.el6
python-decorator.noarch 0:3.0.1-3.1.el6
python-slip.noarch 0:0.2.20-1.el6_2
python-slip-dbus.noarch 0:0.2.20-1.el6_2
setools-libs.x86_64 0:3.3.7-4.el6
setools-libs-python.x86_64 0:3.3.7-4.el6
setroubleshoot-plugins.noarch 0:3.0.40-1.el6
sgml-common.noarch 0:0.6.3-32.el6
sound-theme-freedesktop.noarch 0:0.7-3.el6
startup-notification.x86_64 0:0.10-2.1.el6
xcb-util.x86_64 0:0.3.6-1.el6
xml-common.noarch 0:0.6.3-32.el6
Complete!
[root@armitage ~]#


root@armitage:~
File Edit View Search Terminal Help
[root@armitage ~]# service auditd restart
Stopping auditd: [OK]
Starting auditd: [OK]
[root@armitage ~]#

Real World Examples

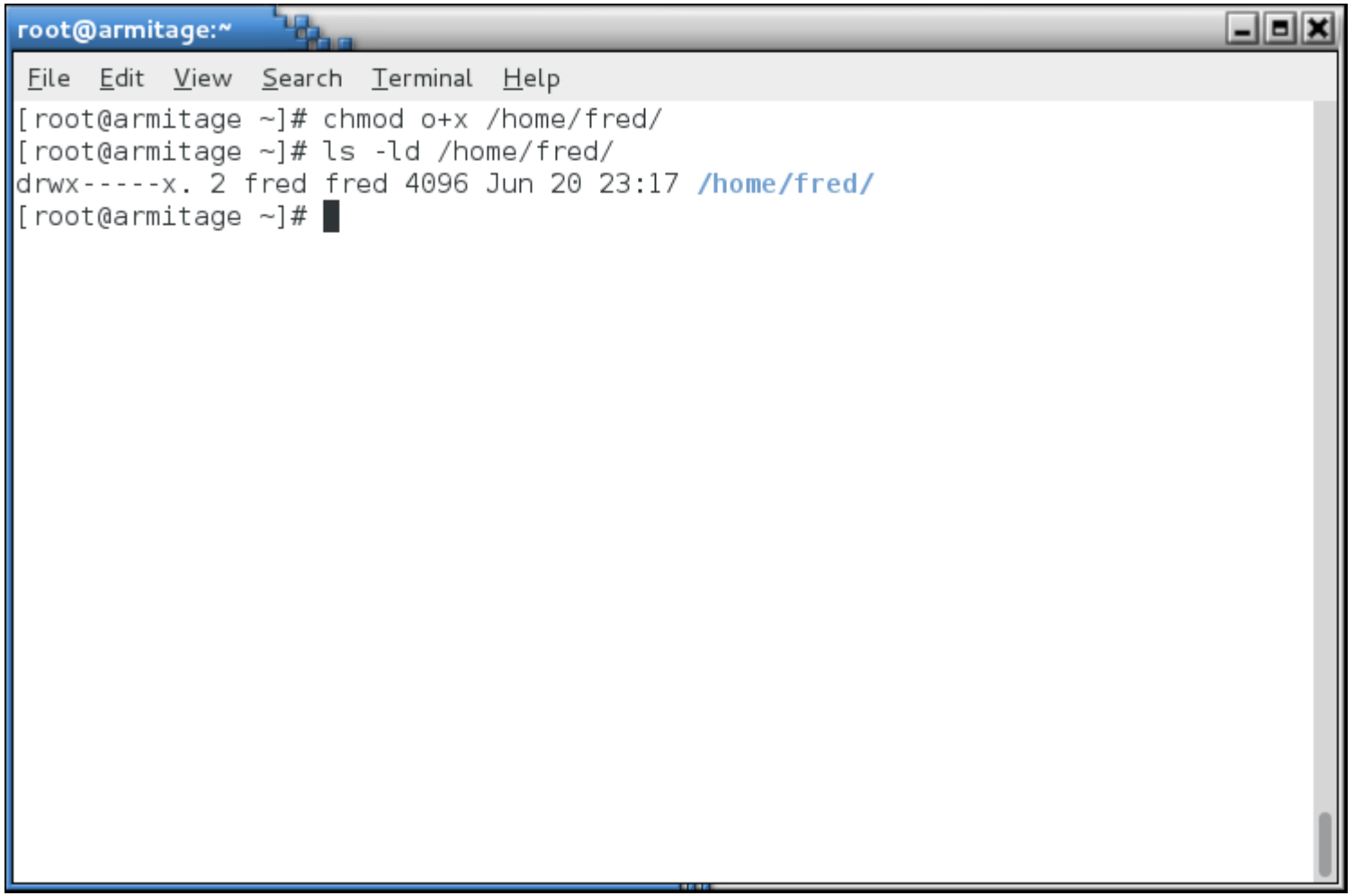
Real World Examples

- A user, fred, wants to have his own web page in /home/fred/public_html on a web server.
  - You enable UserDir in /etc/httpd/conf/httpd.conf
  - Restart the web server


root@armitage:~
File Edit View Search Terminal Help
must have permissions of 711, ~userid/public_html must have permissions
of 755, and documents contained therein must be world-readable.
Otherwise, the client will only receive a "403 Forbidden" message.
#
See also: http://httpd.apache.org/docs/misc/FAQ.html#forbidden
#
<IfModule mod_userdir.c>
#
UserDir is disabled by default since it can confirm the presence
of a username on the system (depending on home directory
permissions).
#
#UserDir disabled
#
To enable requests to /~user/ to serve the user's public_html
directory, remove the "UserDir disabled" line above, and uncomment
the following line instead:
#
UserDir public_html
</IfModule>
"/etc/httpd/conf/httpd.conf" 1009L, 34418C written

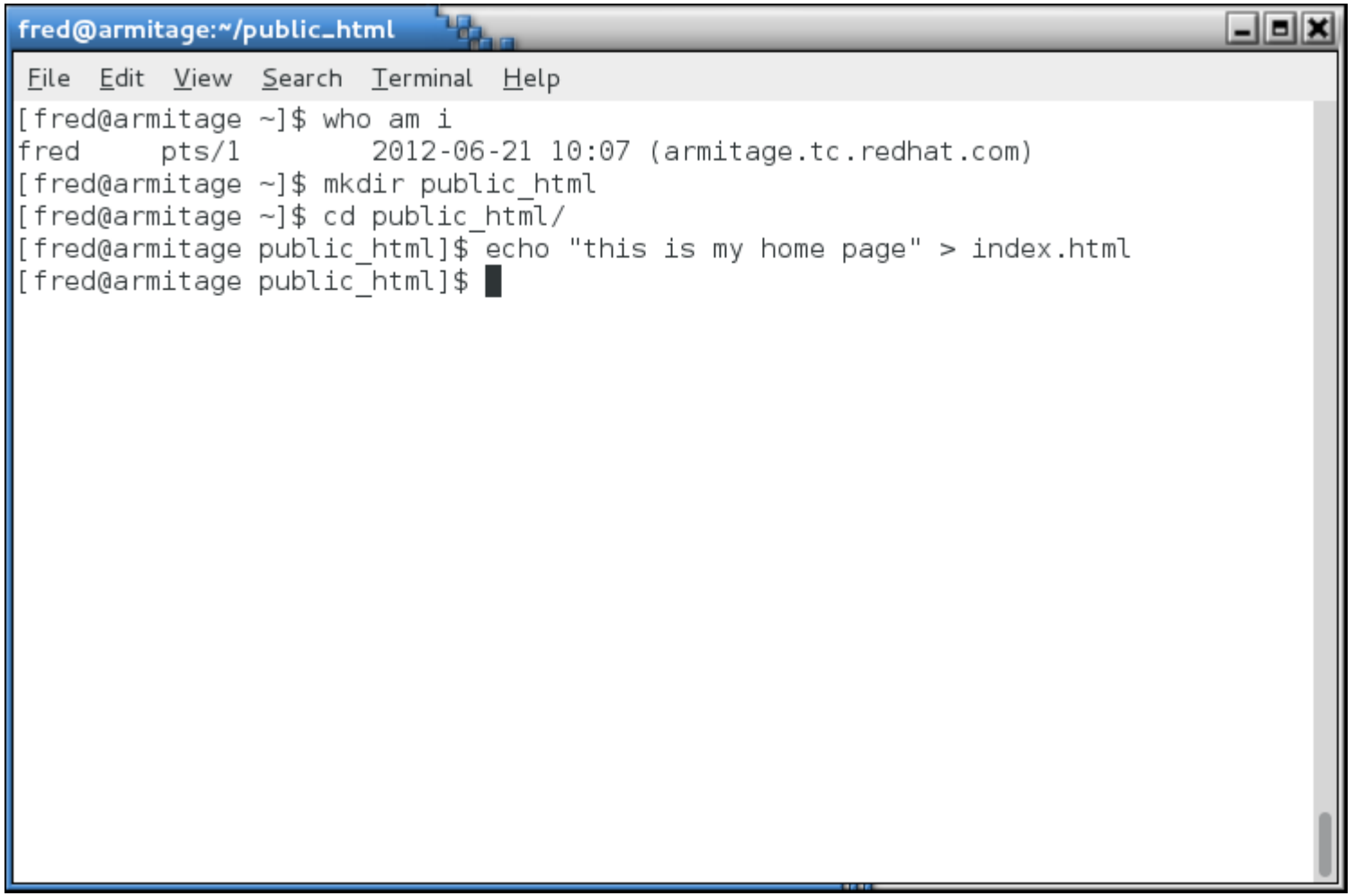
Real World Examples

- A user, fred, wants to start have his own web page in /home/fred/public_html
  - Change permissions so the web server can access his home directory.


root@armitage:~
File Edit View Search Terminal Help
[root@armitage ~]# chmod o+x /home/fred/
[root@armitage ~]# ls -ld /home/fred/
drwx-----x. 2 fred fred 4096 Jun 20 23:17 /home/fred/
[root@armitage ~]#

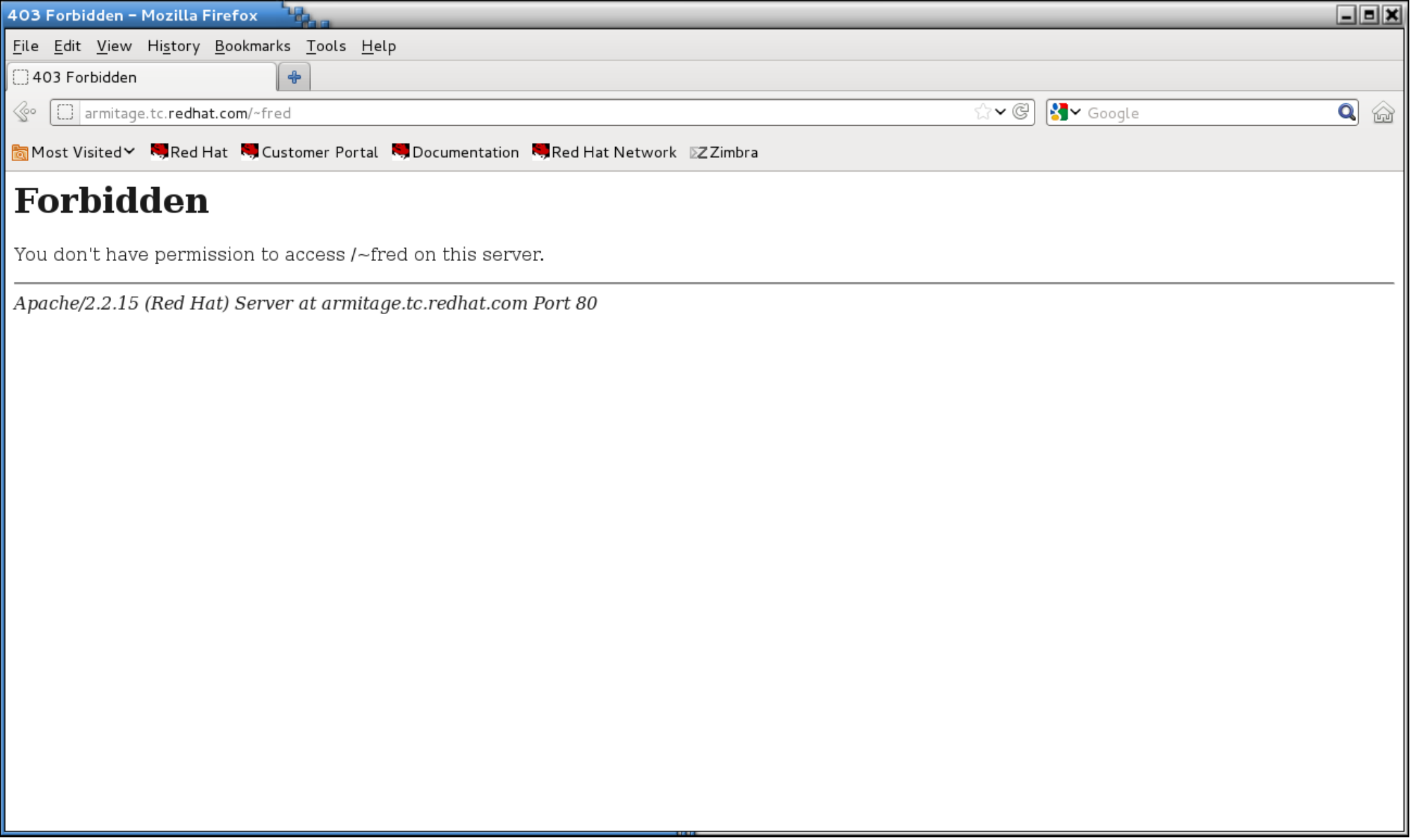
Real World Examples

- A user, fred, wants to start have his own web page in /home/fred/public_html
  - Fred logs in, creates his public_html directory and an index.html file.


fred@armitage:~/public_html
File Edit View Search Terminal Help
[fred@armitage ~]$ who am i
fred pts/1 2012-06-21 10:07 (armitage.tc.redhat.com)
[fred@armitage ~]$ mkdir public_html
[fred@armitage ~]$ cd public_html/
[fred@armitage public_html]$ echo "this is my home page" > index.html
[fred@armitage public_html]$

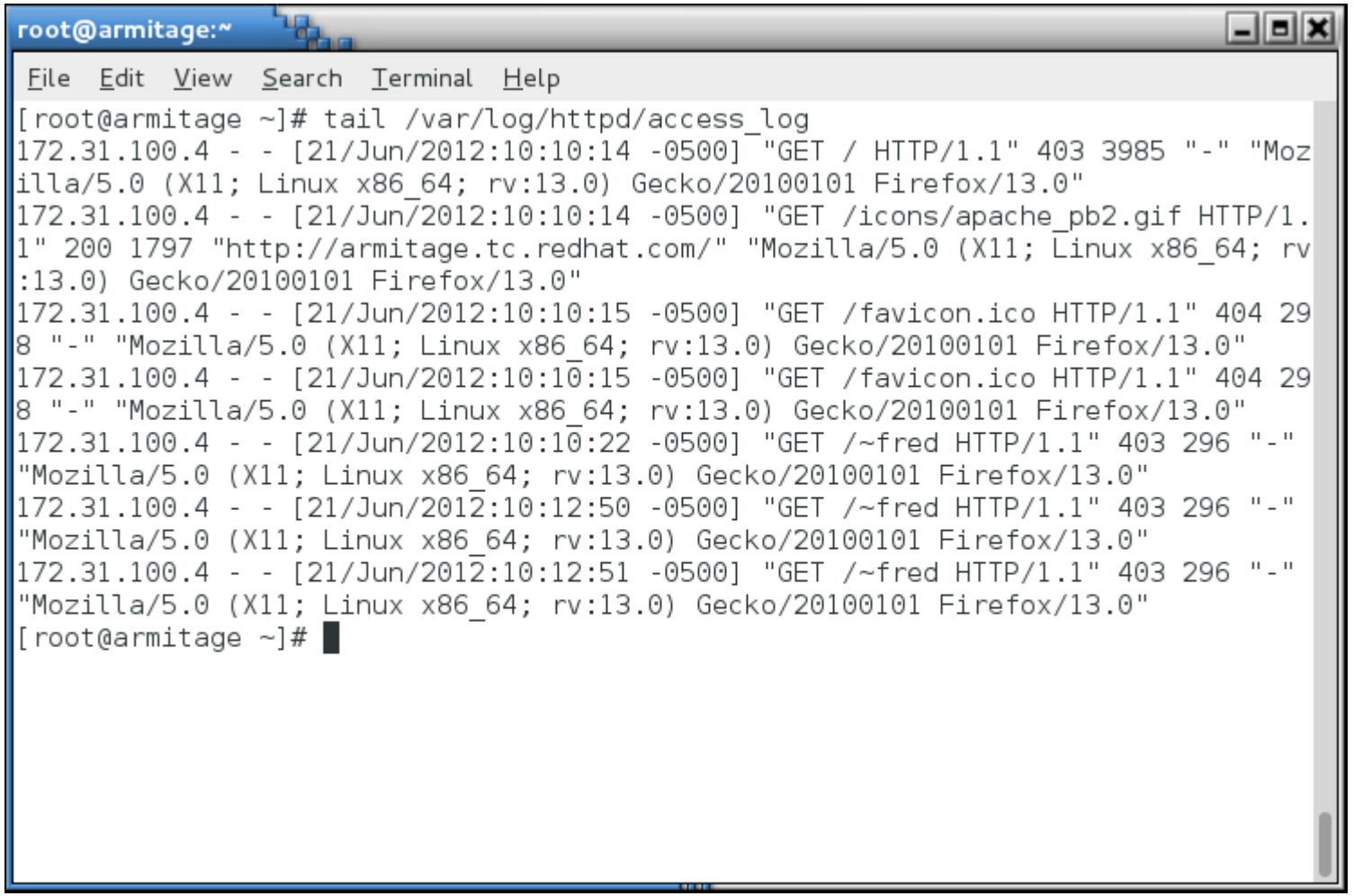
Real World Examples

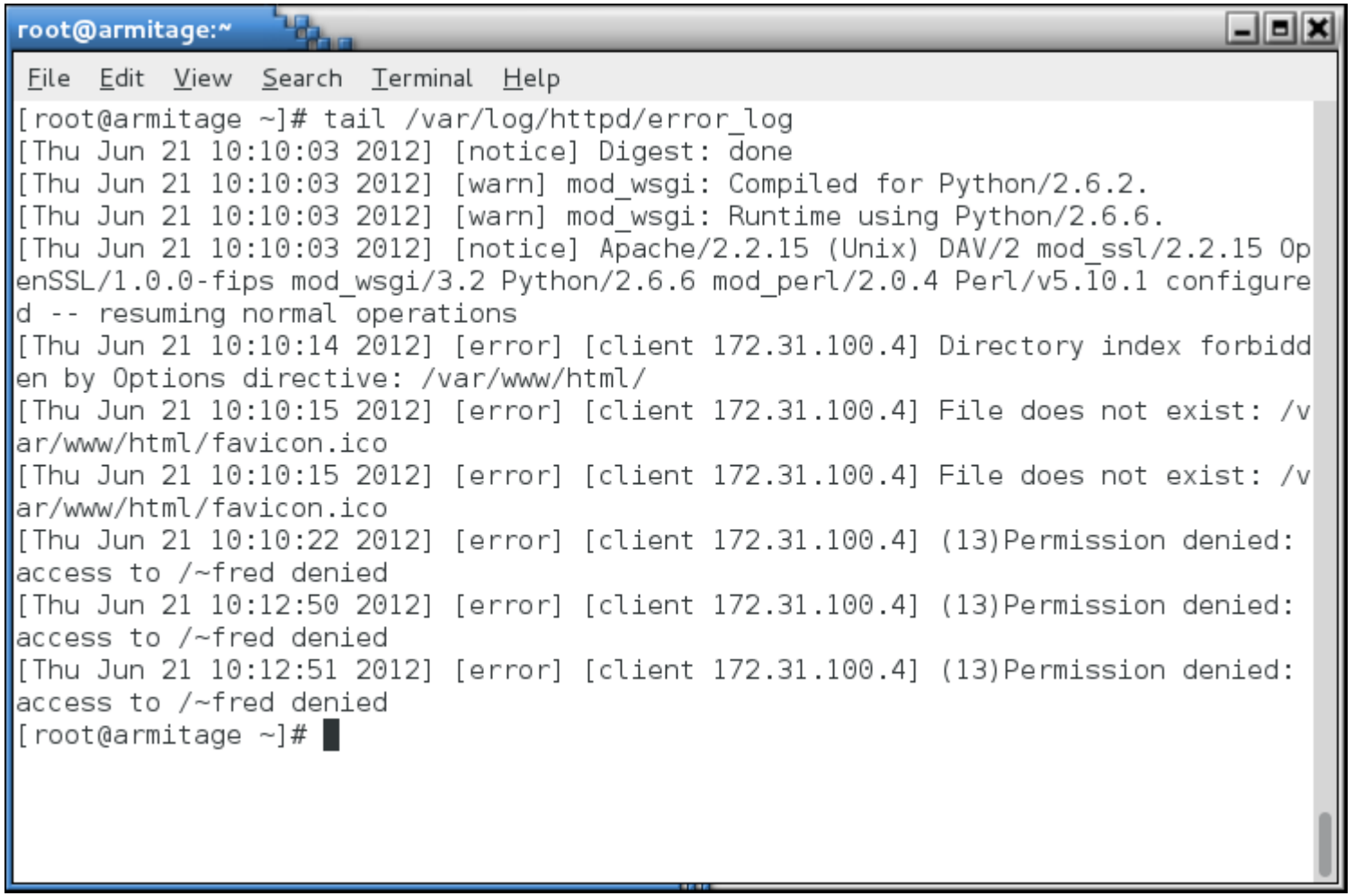
- A user, fred, wants to start have his own web page in /home/fred/public_html
  - We fire up the web browser, and:



Real World Examples

- A user, fred, wants to start have his own web page in /home/fred/public_html
  - So now we check the usual suspects.
    - /var/log/httpd/access_log
    - /var/log/httpd/error_log


root@armitage:~
File Edit View Search Terminal Help
[root@armitage ~]# tail /var/log/httpd/access_log
172.31.100.4 - - [21/Jun/2012:10:10:14 -0500] "GET / HTTP/1.1" 403 3985 "-" "Mozilla/5.0 (X11; Linux x86_64; rv:13.0) Gecko/20100101 Firefox/13.0"
172.31.100.4 - - [21/Jun/2012:10:10:14 -0500] "GET /icons/apache_pb2.gif HTTP/1.1" 200 1797 "http://armitage.tc.redhat.com/" "Mozilla/5.0 (X11; Linux x86_64; rv:13.0) Gecko/20100101 Firefox/13.0"
172.31.100.4 - - [21/Jun/2012:10:10:15 -0500] "GET /favicon.ico HTTP/1.1" 404 298 "-" "Mozilla/5.0 (X11; Linux x86_64; rv:13.0) Gecko/20100101 Firefox/13.0"
172.31.100.4 - - [21/Jun/2012:10:10:15 -0500] "GET /favicon.ico HTTP/1.1" 404 298 "-" "Mozilla/5.0 (X11; Linux x86_64; rv:13.0) Gecko/20100101 Firefox/13.0"
172.31.100.4 - - [21/Jun/2012:10:10:22 -0500] "GET /~fred HTTP/1.1" 403 296 "-" "Mozilla/5.0 (X11; Linux x86_64; rv:13.0) Gecko/20100101 Firefox/13.0"
172.31.100.4 - - [21/Jun/2012:10:12:50 -0500] "GET /~fred HTTP/1.1" 403 296 "-" "Mozilla/5.0 (X11; Linux x86_64; rv:13.0) Gecko/20100101 Firefox/13.0"
172.31.100.4 - - [21/Jun/2012:10:12:51 -0500] "GET /~fred HTTP/1.1" 403 296 "-" "Mozilla/5.0 (X11; Linux x86_64; rv:13.0) Gecko/20100101 Firefox/13.0"
[root@armitage ~]#

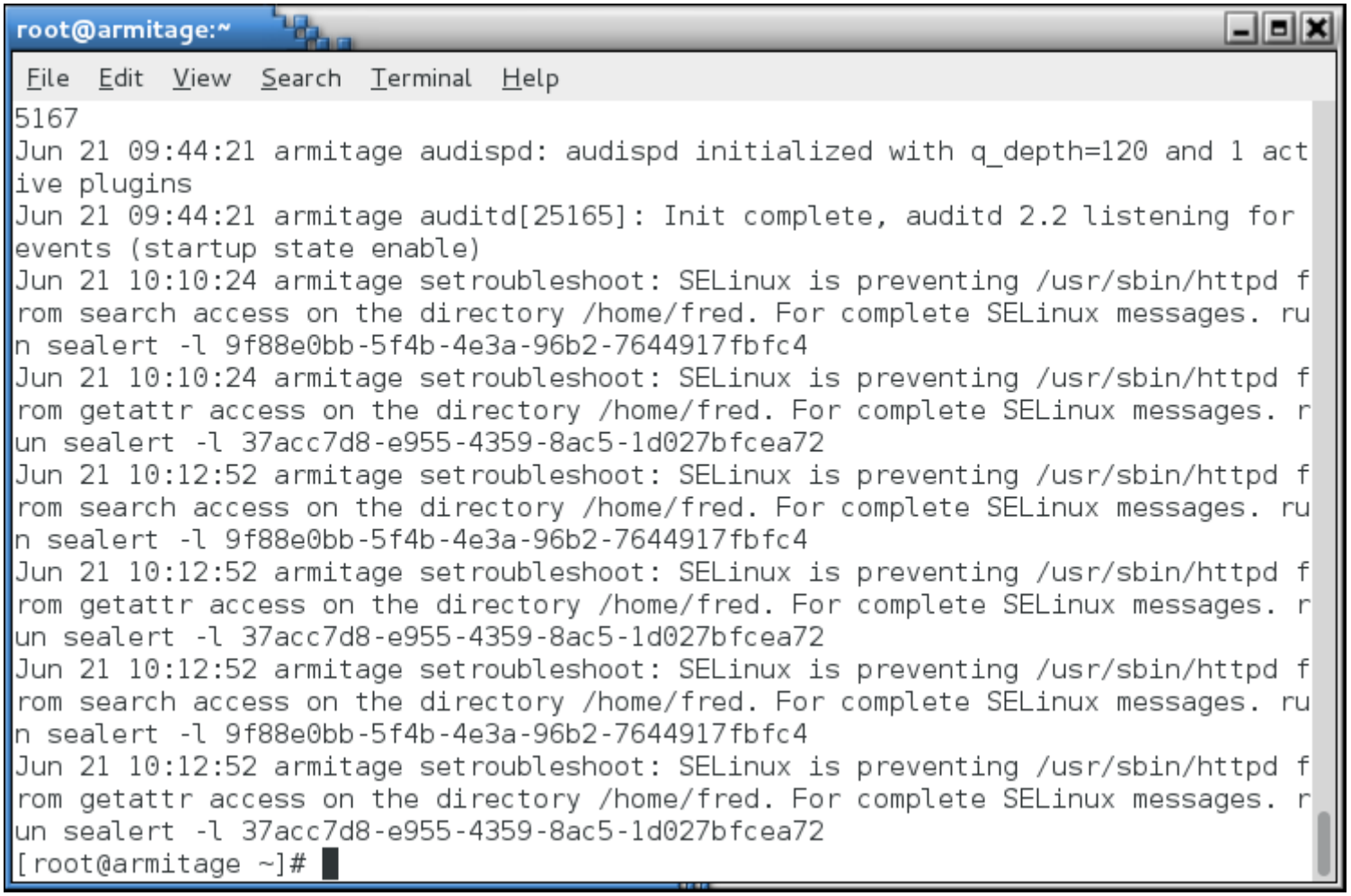

root@armitage:~
File Edit View Search Terminal Help
[root@armitage ~]# tail /var/log/httpd/error_log
[Thu Jun 21 10:10:03 2012] [notice] Digest: done
[Thu Jun 21 10:10:03 2012] [warn] mod_wsgi: Compiled for Python/2.6.2.
[Thu Jun 21 10:10:03 2012] [warn] mod_wsgi: Runtime using Python/2.6.6.
[Thu Jun 21 10:10:03 2012] [notice] Apache/2.2.15 (Unix) DAV/2 mod_ssl/2.2.15 OpenSSL/1.0.0-fips mod_wsgi/3.2 Python/2.6.6 mod_perl/2.0.4 Perl/v5.10.1 configured -- resuming normal operations
[Thu Jun 21 10:10:14 2012] [error] [client 172.31.100.4] Directory index forbidden by Options directive: /var/www/html/
[Thu Jun 21 10:10:15 2012] [error] [client 172.31.100.4] File does not exist: /var/www/html/favicon.ico
[Thu Jun 21 10:10:15 2012] [error] [client 172.31.100.4] File does not exist: /var/www/html/favicon.ico
[Thu Jun 21 10:10:22 2012] [error] [client 172.31.100.4] (13)Permission denied: access to /~fred denied
[Thu Jun 21 10:12:50 2012] [error] [client 172.31.100.4] (13)Permission denied: access to /~fred denied
[Thu Jun 21 10:12:51 2012] [error] [client 172.31.100.4] (13)Permission denied: access to /~fred denied
[root@armitage ~]#

Real World Examples

- A user, fred, wants to start have his own web page in /home/fred/public_html
  - We already knew that!

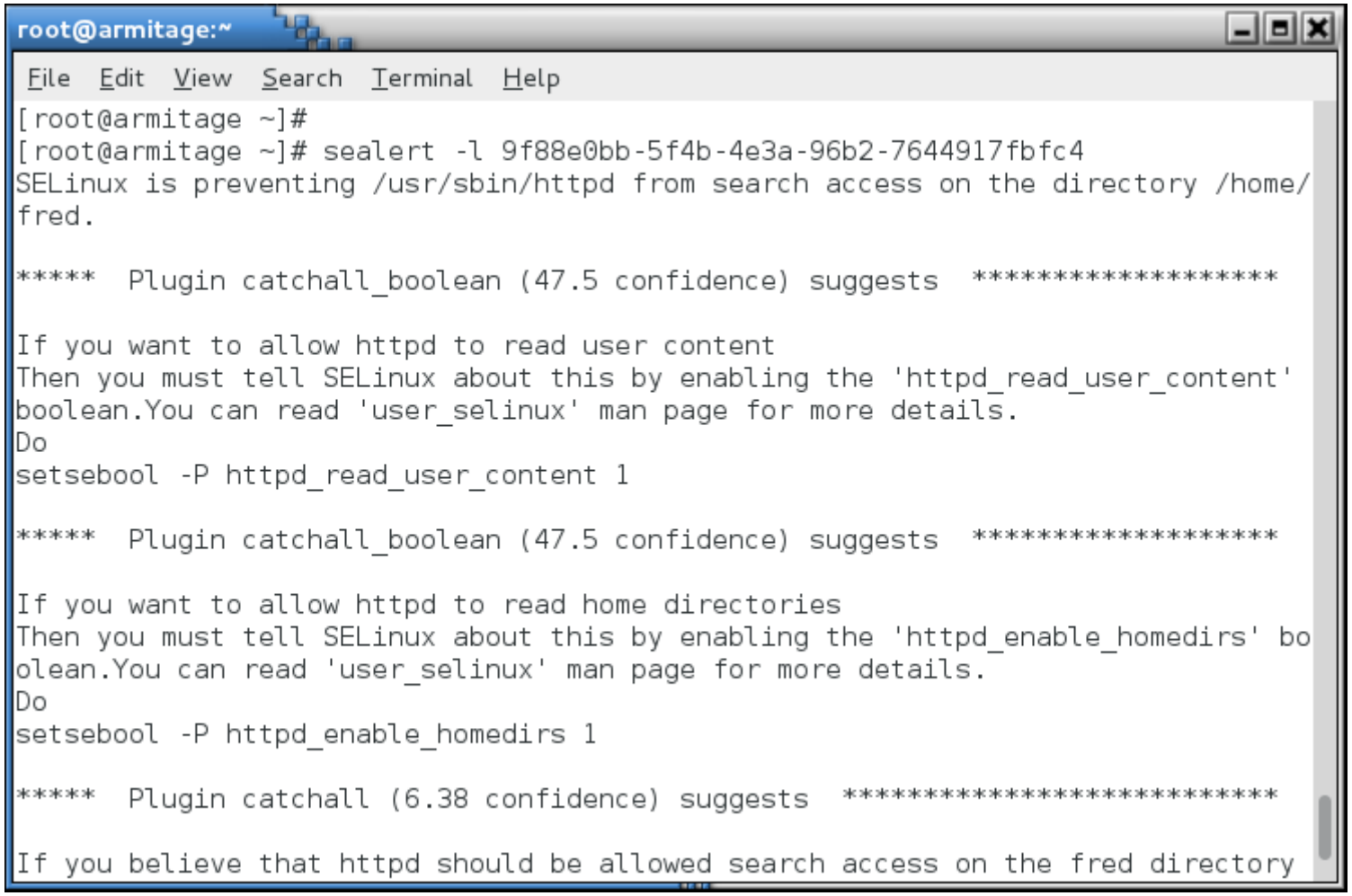
Real World Examples

- A user, fred, wants to start have his own web page in /home/fred/public_html
  - So now we look at /var/log/messages


root@armitage:~
File Edit View Search Terminal Help
5167
Jun 21 09:44:21 armitage audispd: audispd initialized with q_depth=120 and 1 act
ive plugins
Jun 21 09:44:21 armitage auditd[25165]: Init complete, auditd 2.2 listening for
events (startup state enable)
Jun 21 10:10:24 armitage setroubleshoot: SELinux is preventing /usr/sbin/httpd f
rom search access on the directory /home/fred. For complete SELinux messages. ru
n sealert -l 9f88e0bb-5f4b-4e3a-96b2-7644917fbfc4
Jun 21 10:10:24 armitage setroubleshoot: SELinux is preventing /usr/sbin/httpd f
rom getattr access on the directory /home/fred. For complete SELinux messages. r
un sealert -l 37acc7d8-e955-4359-8ac5-1d027bfcea72
Jun 21 10:12:52 armitage setroubleshoot: SELinux is preventing /usr/sbin/httpd f
rom search access on the directory /home/fred. For complete SELinux messages. ru
n sealert -l 9f88e0bb-5f4b-4e3a-96b2-7644917fbfc4
Jun 21 10:12:52 armitage setroubleshoot: SELinux is preventing /usr/sbin/httpd f
rom getattr access on the directory /home/fred. For complete SELinux messages. r
un sealert -l 37acc7d8-e955-4359-8ac5-1d027bfcea72
Jun 21 10:12:52 armitage setroubleshoot: SELinux is preventing /usr/sbin/httpd f
rom search access on the directory /home/fred. For complete SELinux messages. ru
n sealert -l 9f88e0bb-5f4b-4e3a-96b2-7644917fbfc4
Jun 21 10:12:52 armitage setroubleshoot: SELinux is preventing /usr/sbin/httpd f
rom getattr access on the directory /home/fred. For complete SELinux messages. r
un sealert -l 37acc7d8-e955-4359-8ac5-1d027bfcea72
[root@armitage ~]#

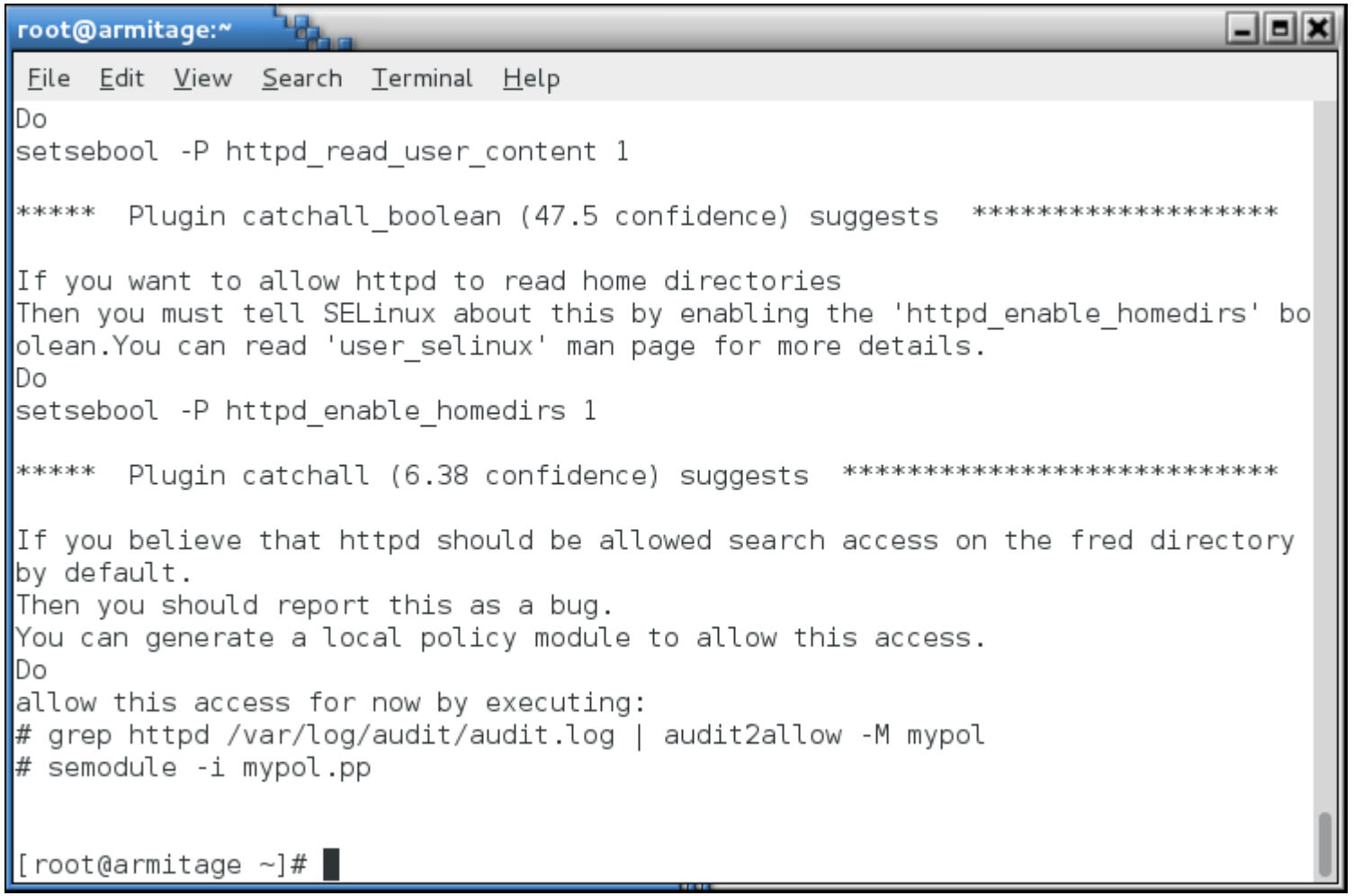
Real World Examples

- A user, fred, wants to start have his own web page in /home/fred/public_html
  - AH-HAH! Follow the instructions and run “sealert -l 9f88e0bb-5f4b-4e3a-96b2-7644917fbfc4”
  - It reveals that there are two issues.
    - User content
    - httpd access to home directories


root@armitage:~
File Edit View Search Terminal Help
[root@armitage ~]#
[root@armitage ~]# sealert -l 9f88e0bb-5f4b-4e3a-96b2-7644917fbfc4
SELinux is preventing /usr/sbin/httpd from search access on the directory /home/
fred.
***** Plugin catchall_boolean (47.5 confidence) suggests **********
If you want to allow httpd to read user content
Then you must tell SELinux about this by enabling the 'httpd_read_user_content'
boolean.You can read 'user_selinux' man page for more details.
Do
setsebool -P httpd_read_user_content 1
***** Plugin catchall_boolean (47.5 confidence) suggests **********
If you want to allow httpd to read home directories
Then you must tell SELinux about this by enabling the 'httpd_enable_homedirs' bo
olean.You can read 'user_selinux' man page for more details.
Do
setsebool -P httpd_enable_homedirs 1
***** Plugin catchall (6.38 confidence) suggests **********
If you believe that httpd should be allowed search access on the fred directory

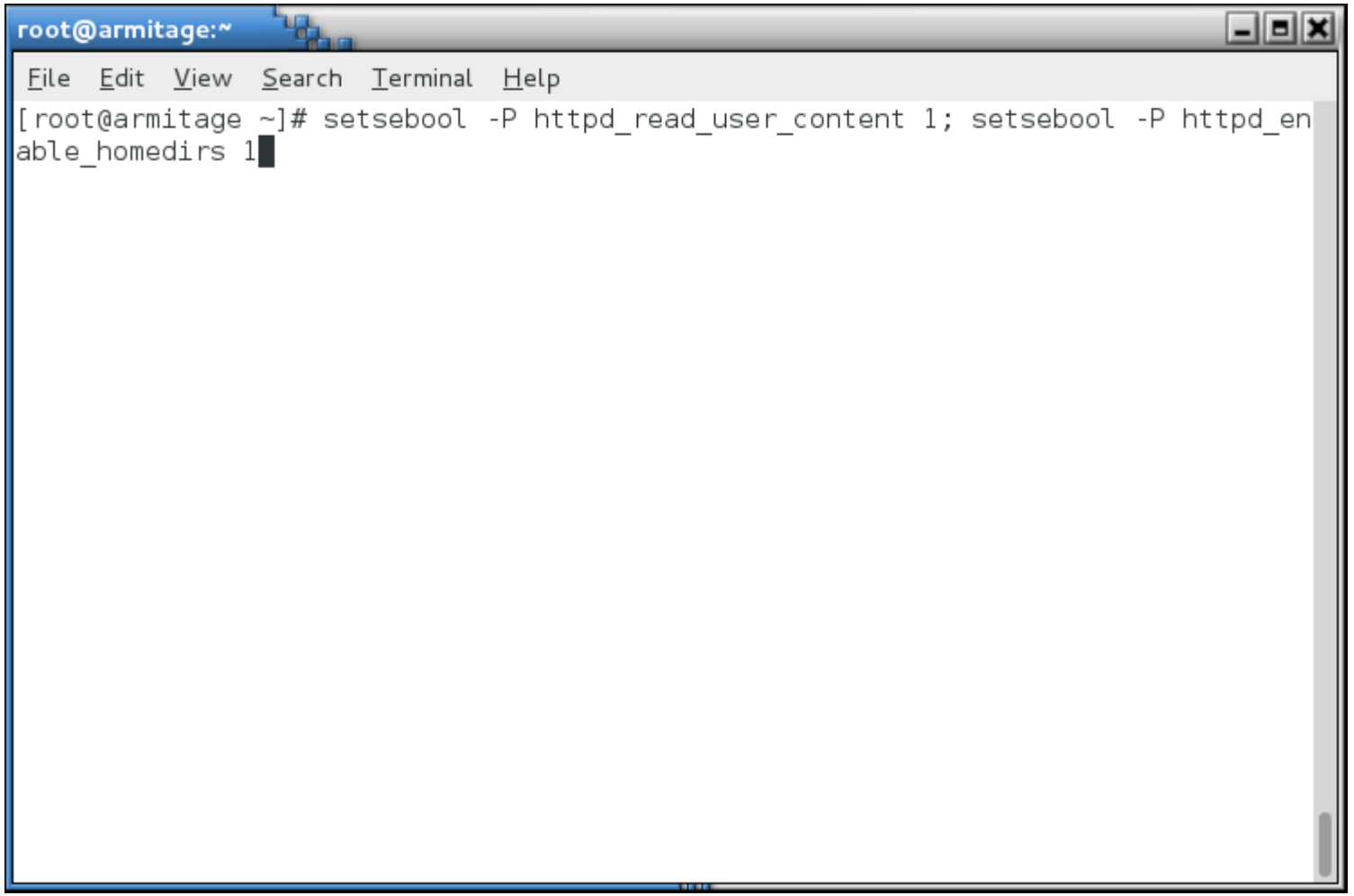
Real World Examples

- A user, fred, wants to start have his own web page in /home/fred/public_html
  - It also says we can create a policy module to allow this, but in this case, setting a boolean is easier and makes more sense.


root@armitage:~
File Edit View Search Terminal Help
Do
setsebool -P httpd_read_user_content 1
***** Plugin catchall_boolean (47.5 confidence) suggests **********
If you want to allow httpd to read home directories
Then you must tell SELinux about this by enabling the 'httpd_enable_homedirs' bo
olean.You can read 'user_selinux' man page for more details.
Do
setsebool -P httpd_enable_homedirs 1
***** Plugin catchall (6.38 confidence) suggests **********
If you believe that httpd should be allowed search access on the fred directory
by default.
Then you should report this as a bug.
You can generate a local policy module to allow this access.
Do
allow this access for now by executing:
grep httpd /var/log/audit/audit.log | audit2allow -M mypol
semodule -i mypol.pp
[root@armitage ~]#

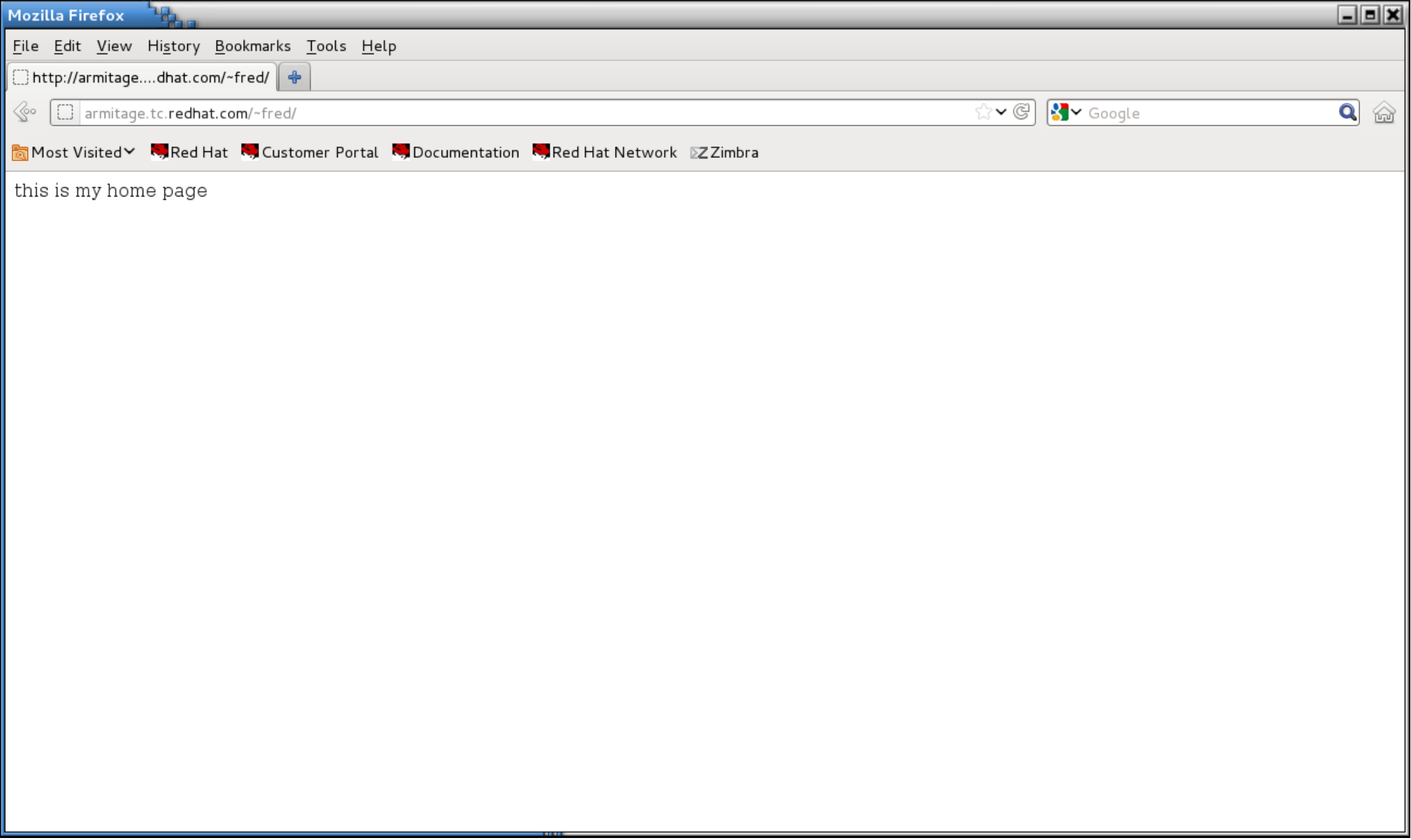
Real World Examples

- A user, fred, wants to start have his own web page in /home/fred/public_html
  - Follow the instructions and set the two booleans.


root@armitage:~
File Edit View Search Terminal Help
[root@armitage ~]# setsebool -P httpd_read_user_content 1; setsebool -P httpd_en
able_homedirs 1

Real World Examples

- A user, fred, wants to start have his own web page in /home/fred/public_html
  - And... Voila!



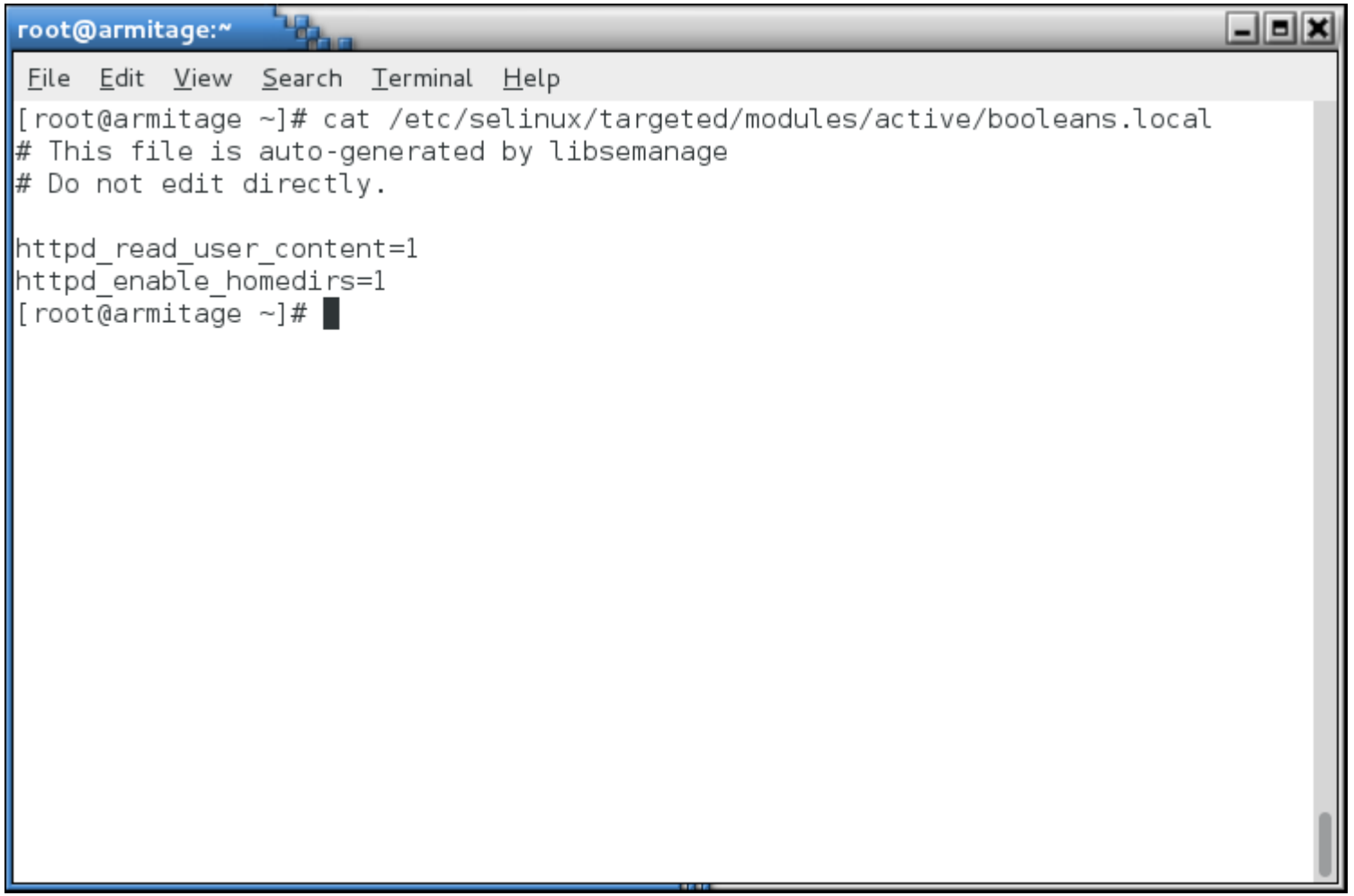
Real World Examples

- And people say this SELinux thing is too hard! Pffft!

How Can I See What Booleans Have Been Set?

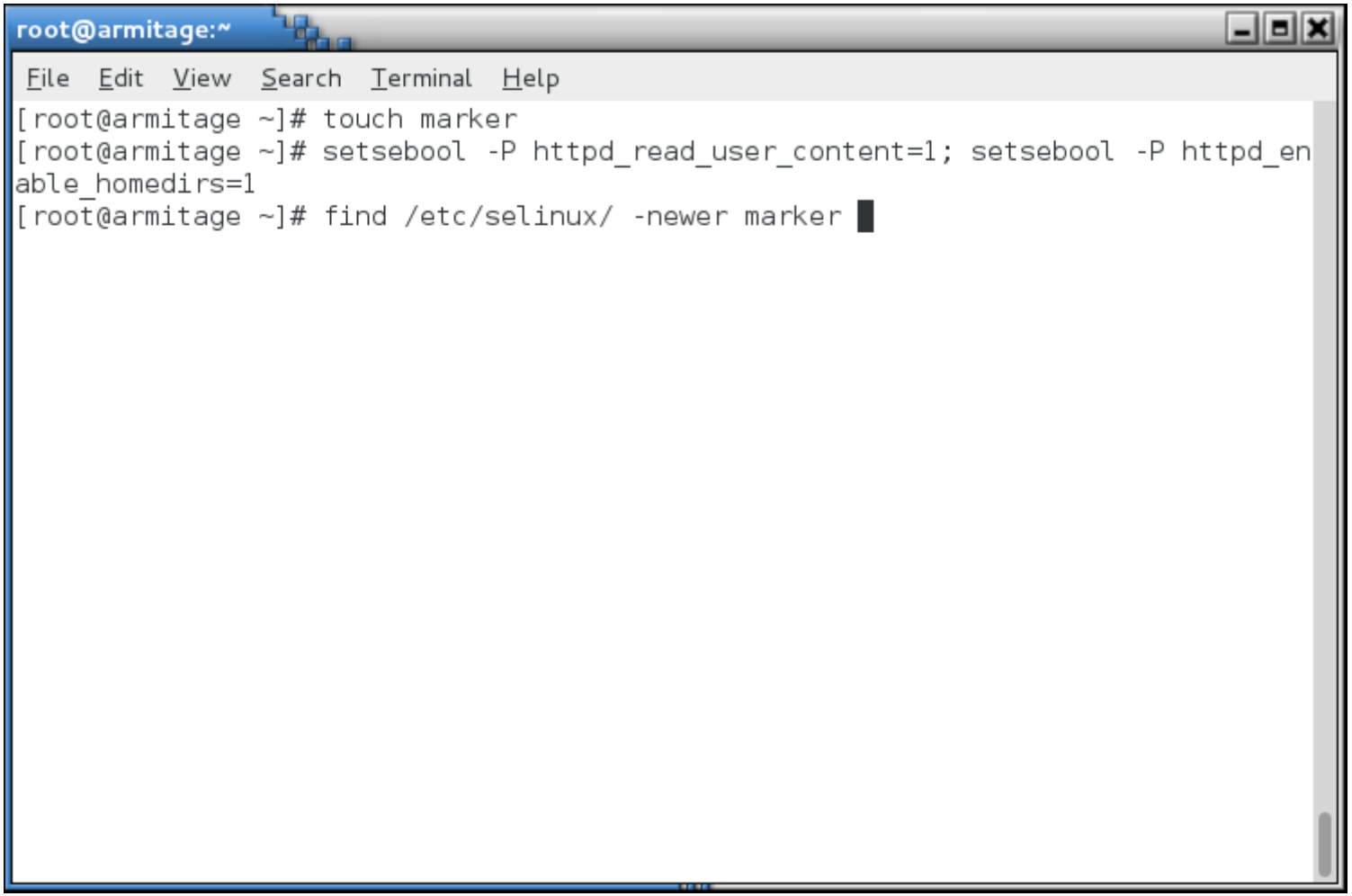
How Can I See What Booleans Have Been Set?

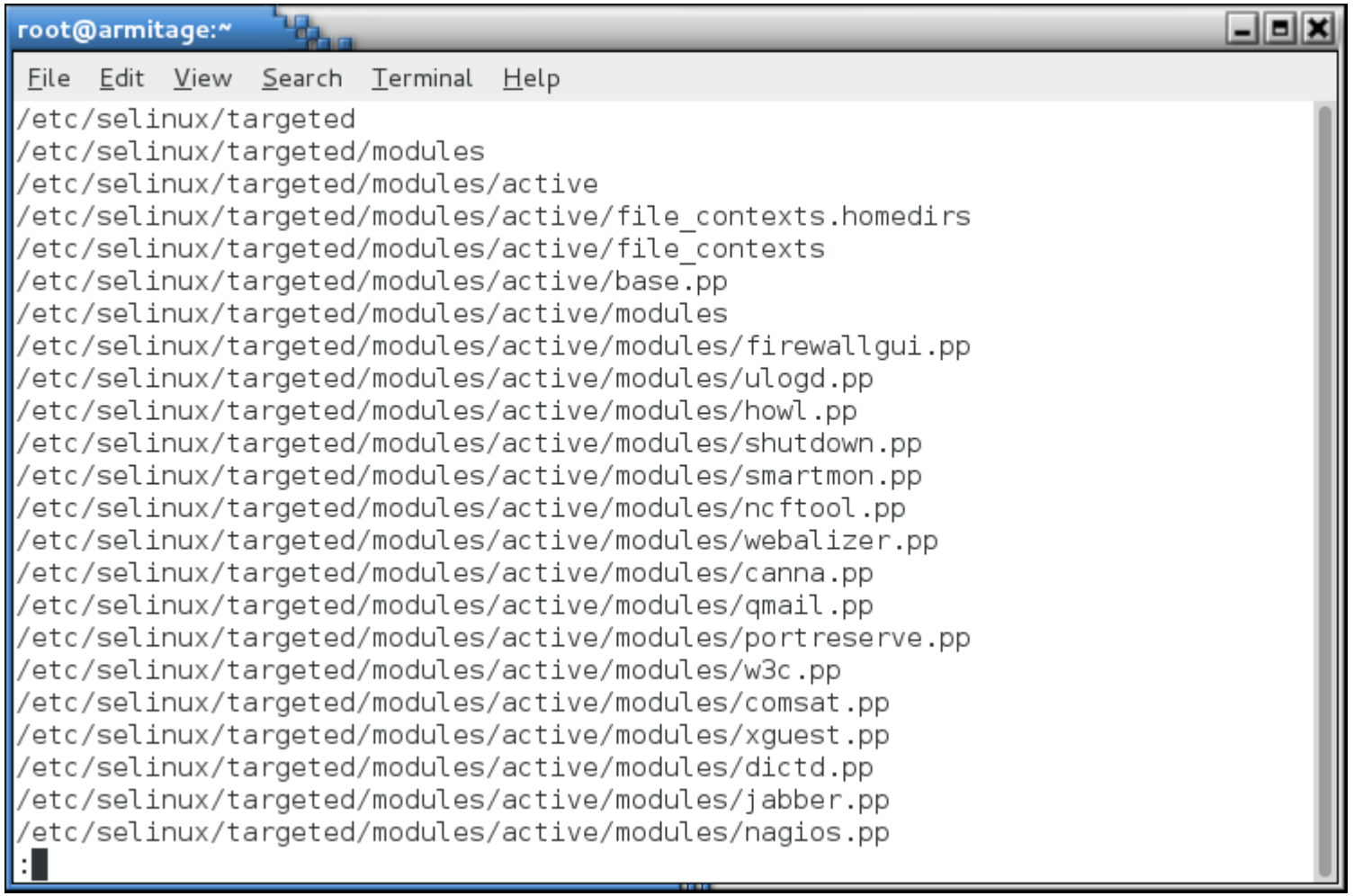
- Look at the booleans.local file under /etc/selinux/targeted/modules/active/

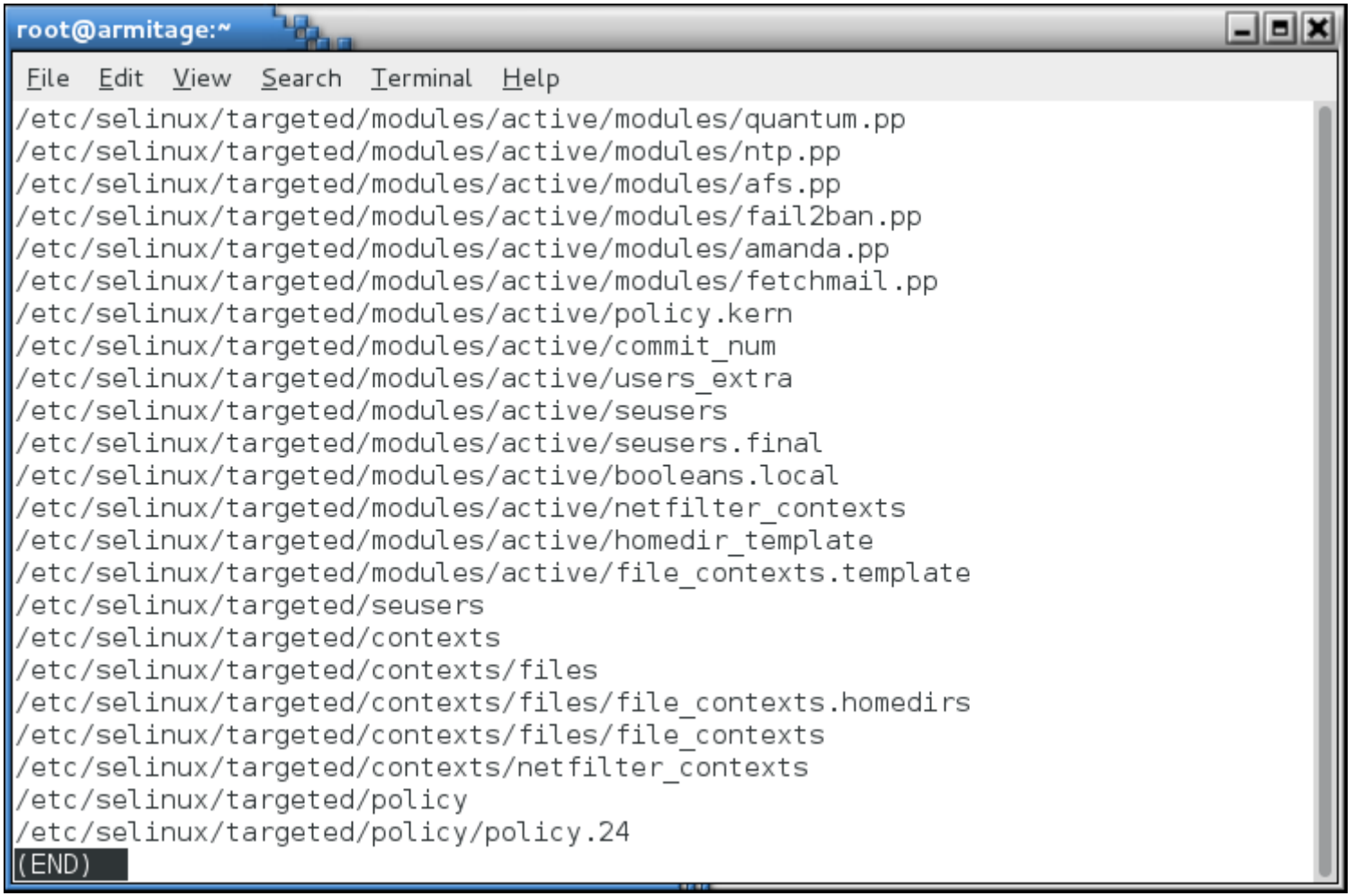

root@armitage:~
File Edit View Search Terminal Help
[root@armitage ~]# cat /etc/selinux/targeted/modules/active/booleans.local
# This file is auto-generated by libsemanage
# Do not edit directly.
httpd_read_user_content=1
httpd_enable_homedirs=1
[root@armitage ~]#

How Can I See What Booleans Have Been Set?

- Note that when you use setsebool -P (and other commands we'll cover later), the entire /etc/selinux/targeted directory is regenerated. That file doesn't actually do anything - it just tells you what's been set. Believe it when it says “Do not edit directly” - it won't do anything.


root@armitage:~
File Edit View Search Terminal Help
[root@armitage ~]# touch marker
[root@armitage ~]# setsebool -P httpd_read_user_content=1; setsebool -P httpd_en
able_homedirs=1
[root@armitage ~]# find /etc/selinux/ -newer marker


root@armitage:~
File Edit View Search Terminal Help
/etc/selinux/targeted
/etc/selinux/targeted/modules
/etc/selinux/targeted/modules/active
/etc/selinux/targeted/modules/active/file_contexts.homedirs
/etc/selinux/targeted/modules/active/file_contexts
/etc/selinux/targeted/modules/active/base.pp
/etc/selinux/targeted/modules/active/modules
/etc/selinux/targeted/modules/active/modules/firewallgui.pp
/etc/selinux/targeted/modules/active/modules/ulogd.pp
/etc/selinux/targeted/modules/active/modules/howl.pp
/etc/selinux/targeted/modules/active/modules/shutdown.pp
/etc/selinux/targeted/modules/active/modules/smartmon.pp
/etc/selinux/targeted/modules/active/modules/ncftool.pp
/etc/selinux/targeted/modules/active/modules/webalizer.pp
/etc/selinux/targeted/modules/active/modules/canna.pp
/etc/selinux/targeted/modules/active/modules/qmail.pp
/etc/selinux/targeted/modules/active/modules/portreserve.pp
/etc/selinux/targeted/modules/active/modules/w3c.pp
/etc/selinux/targeted/modules/active/modules/comsat.pp
/etc/selinux/targeted/modules/active/modules/xguest.pp
/etc/selinux/targeted/modules/active/modules/dictd.pp
/etc/selinux/targeted/modules/active/modules/jabber.pp
/etc/selinux/targeted/modules/active/modules/nagios.pp
:

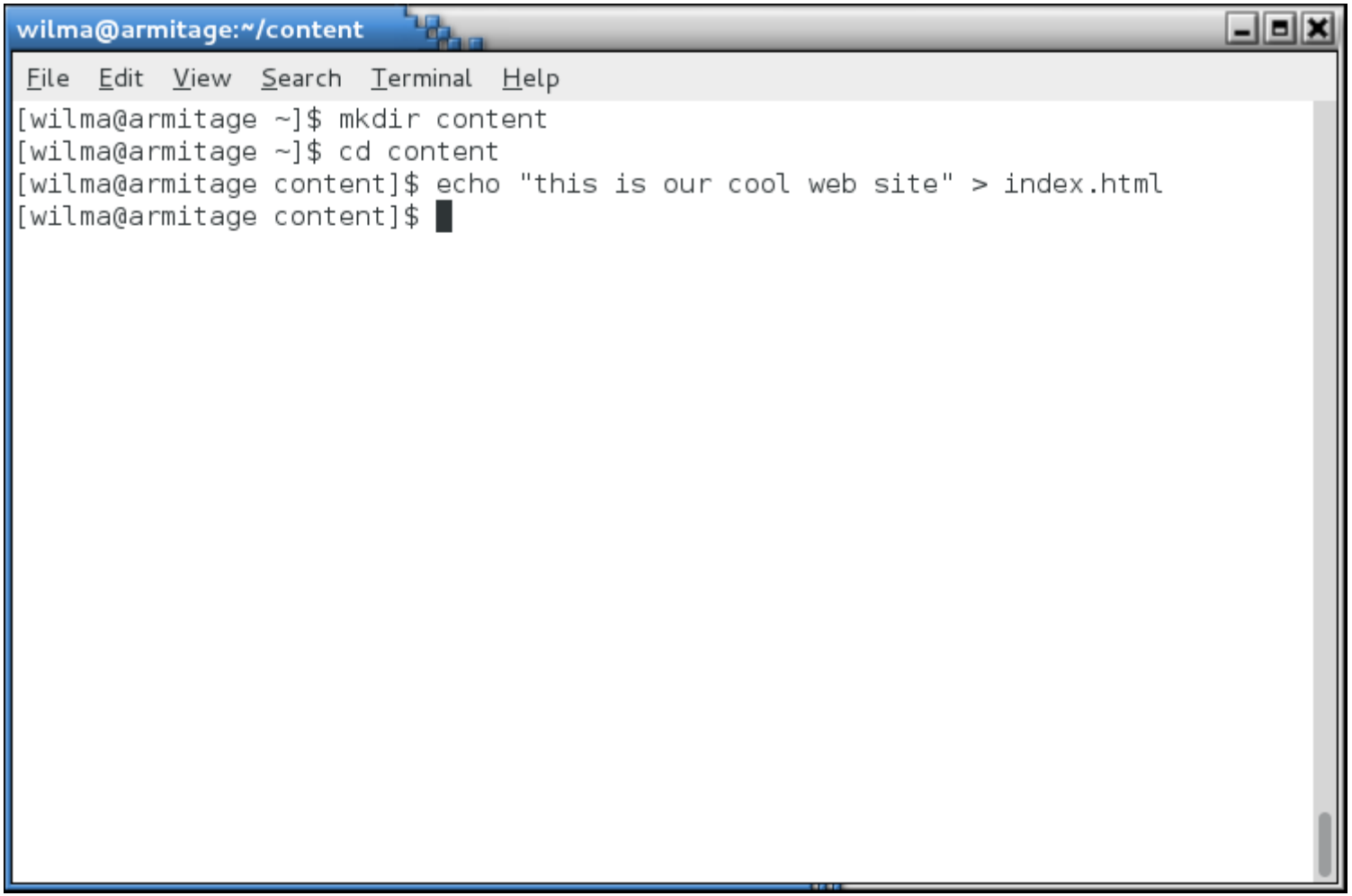

root@armitage:~
File Edit View Search Terminal Help
/etc/selinux/targeted/modules/active/modules/quantum.pp
/etc/selinux/targeted/modules/active/modules/ntp.pp
/etc/selinux/targeted/modules/active/modules/afs.pp
/etc/selinux/targeted/modules/active/modules/fail2ban.pp
/etc/selinux/targeted/modules/active/modules/amanda.pp
/etc/selinux/targeted/modules/active/modules/fetchmail.pp
/etc/selinux/targeted/modules/active/policy.kern
/etc/selinux/targeted/modules/active/commit_num
/etc/selinux/targeted/modules/active/users_extra
/etc/selinux/targeted/modules/active/seusers
/etc/selinux/targeted/modules/active/seusers.final
/etc/selinux/targeted/modules/active/booleans.local
/etc/selinux/targeted/modules/active/netfilter_contexts
/etc/selinux/targeted/modules/active/homedir_template
/etc/selinux/targeted/modules/active/file_contexts.template
/etc/selinux/targeted/seusers
/etc/selinux/targeted/contexts
/etc/selinux/targeted/contexts/files
/etc/selinux/targeted/contexts/files/file_contexts.homedirs
/etc/selinux/targeted/contexts/files/file_contexts
/etc/selinux/targeted/contexts/netfilter_contexts
/etc/selinux/targeted/policy
/etc/selinux/targeted/policy/policy.24
(END)

Real World Examples

- This next example assumes an unmodified SELinux environment, so ignore the changes from the last example.

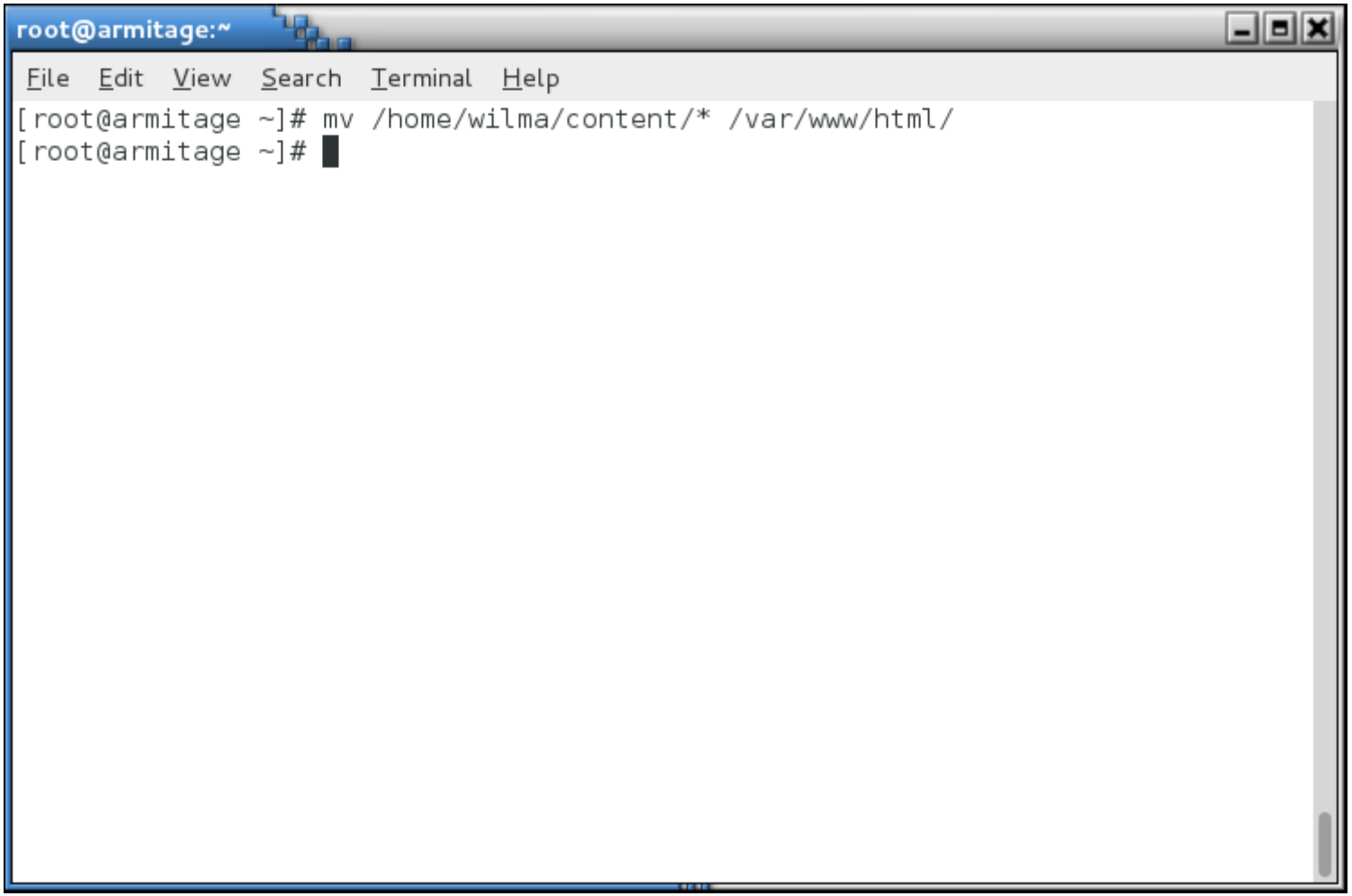
Real World Examples

- A user, Wilma, is a web content author. She has created content in her home directory and asked that you move it to the web site.


wilma@armitage:~/content
File Edit View Search Terminal Help
[wilma@armitage ~]$ mkdir content
[wilma@armitage ~]$ cd content
[wilma@armitage content]$ echo "this is our cool web site" > index.html
[wilma@armitage content]$

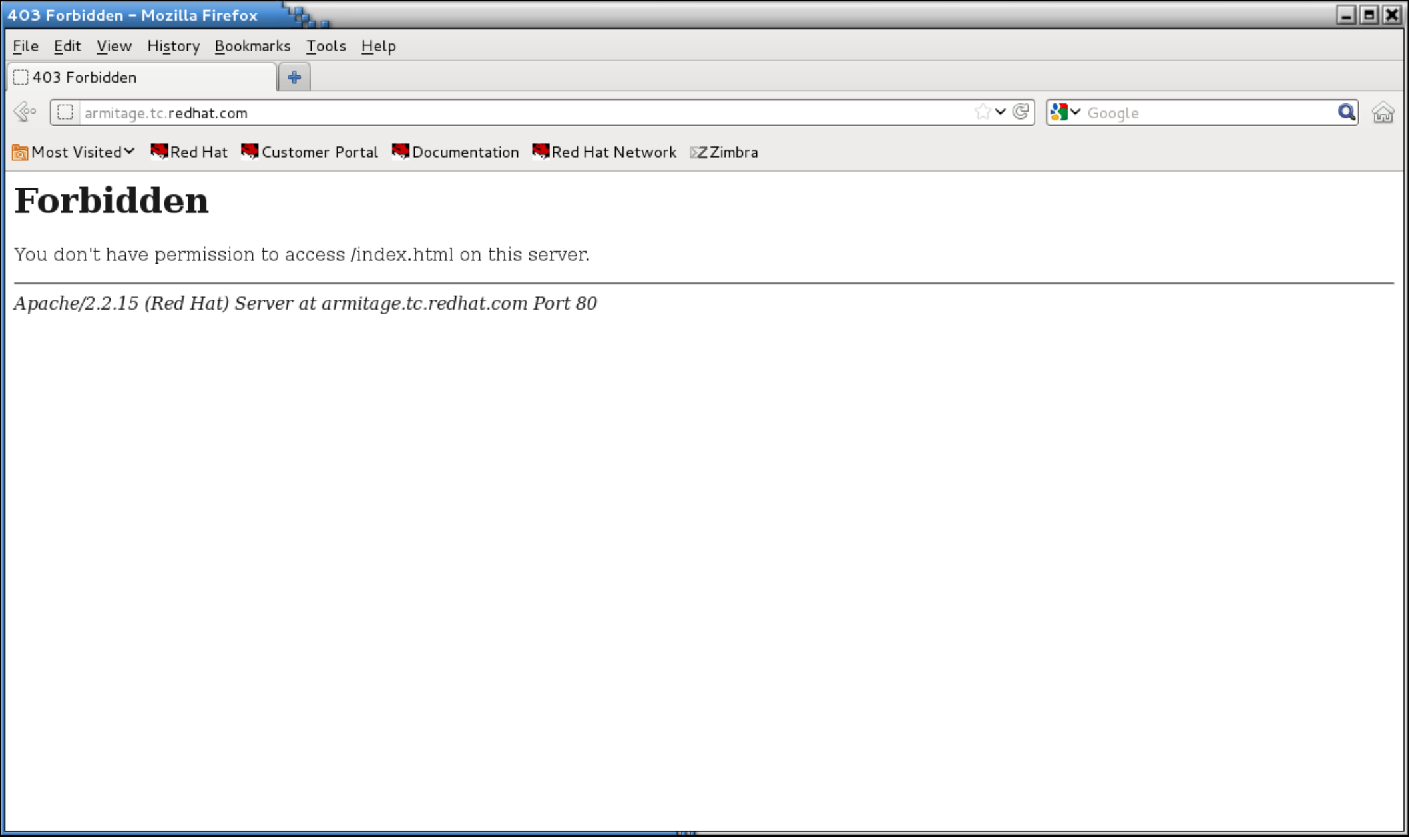
Real World Examples

- So, you move it over.


root@armitage:~
File Edit View Search Terminal Help
[root@armitage ~]# mv /home/wilma/content/* /var/www/html/
[root@armitage ~]#

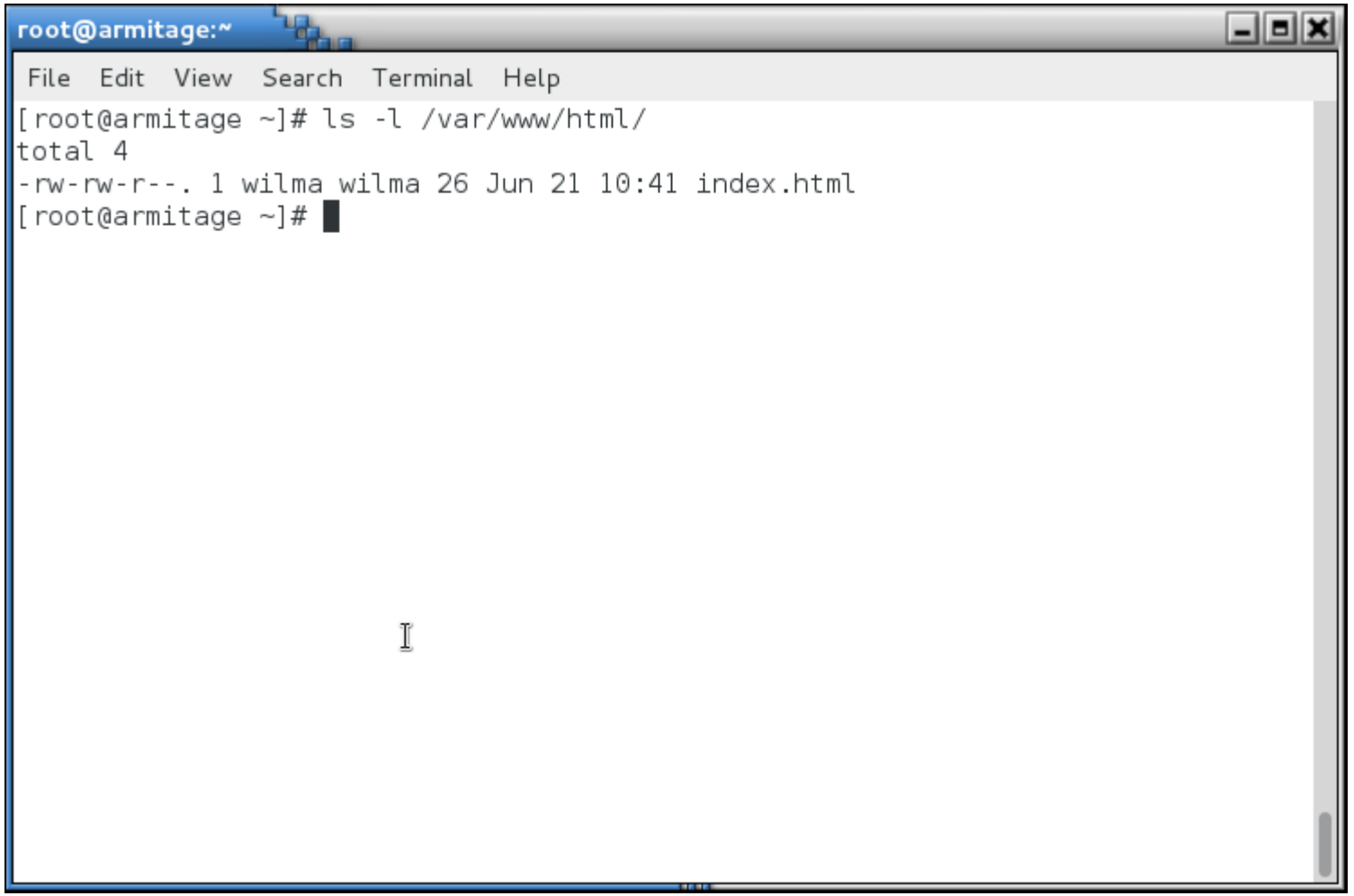
Real World Examples

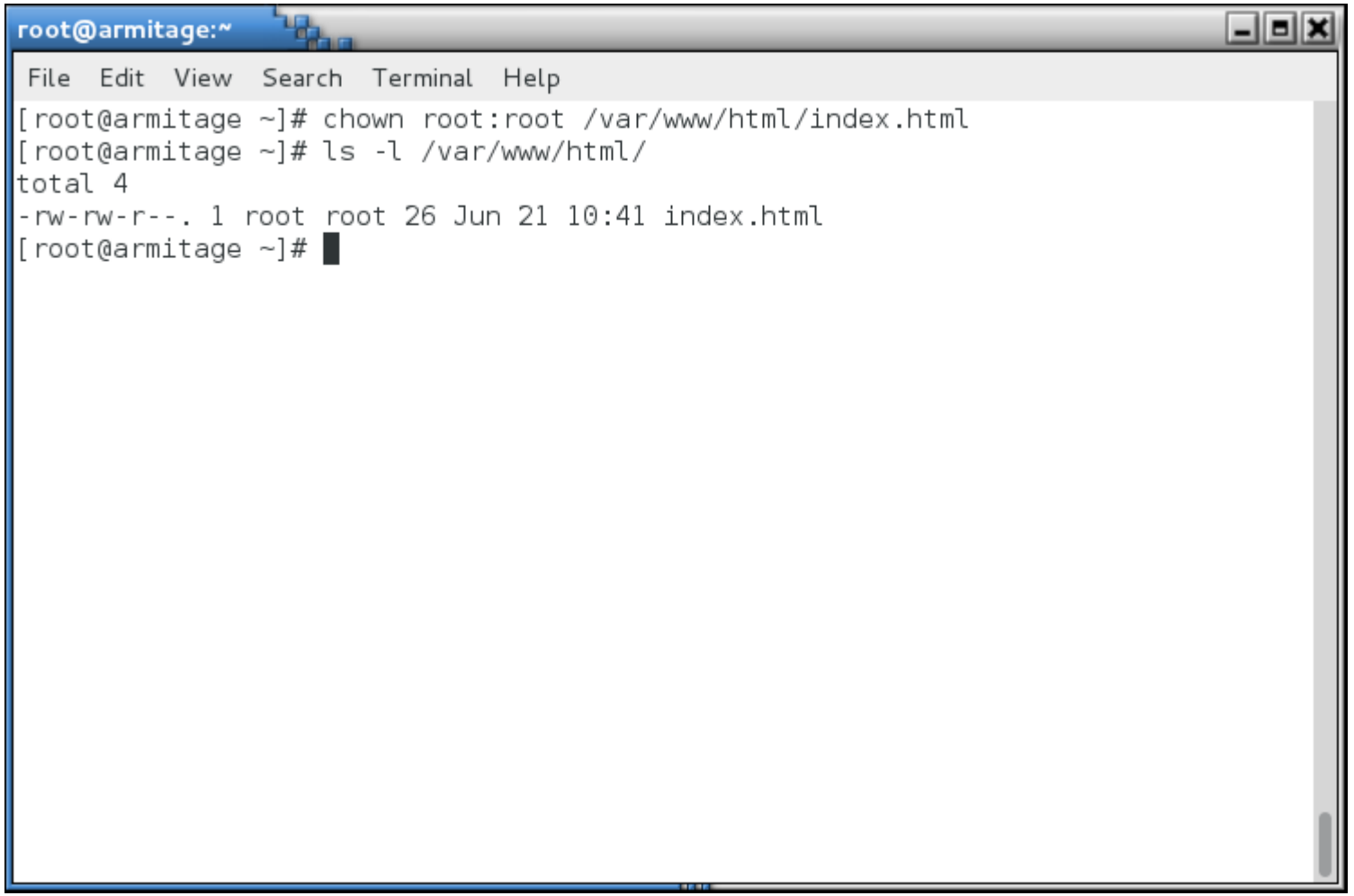
- And when you go to test...



Real World Examples

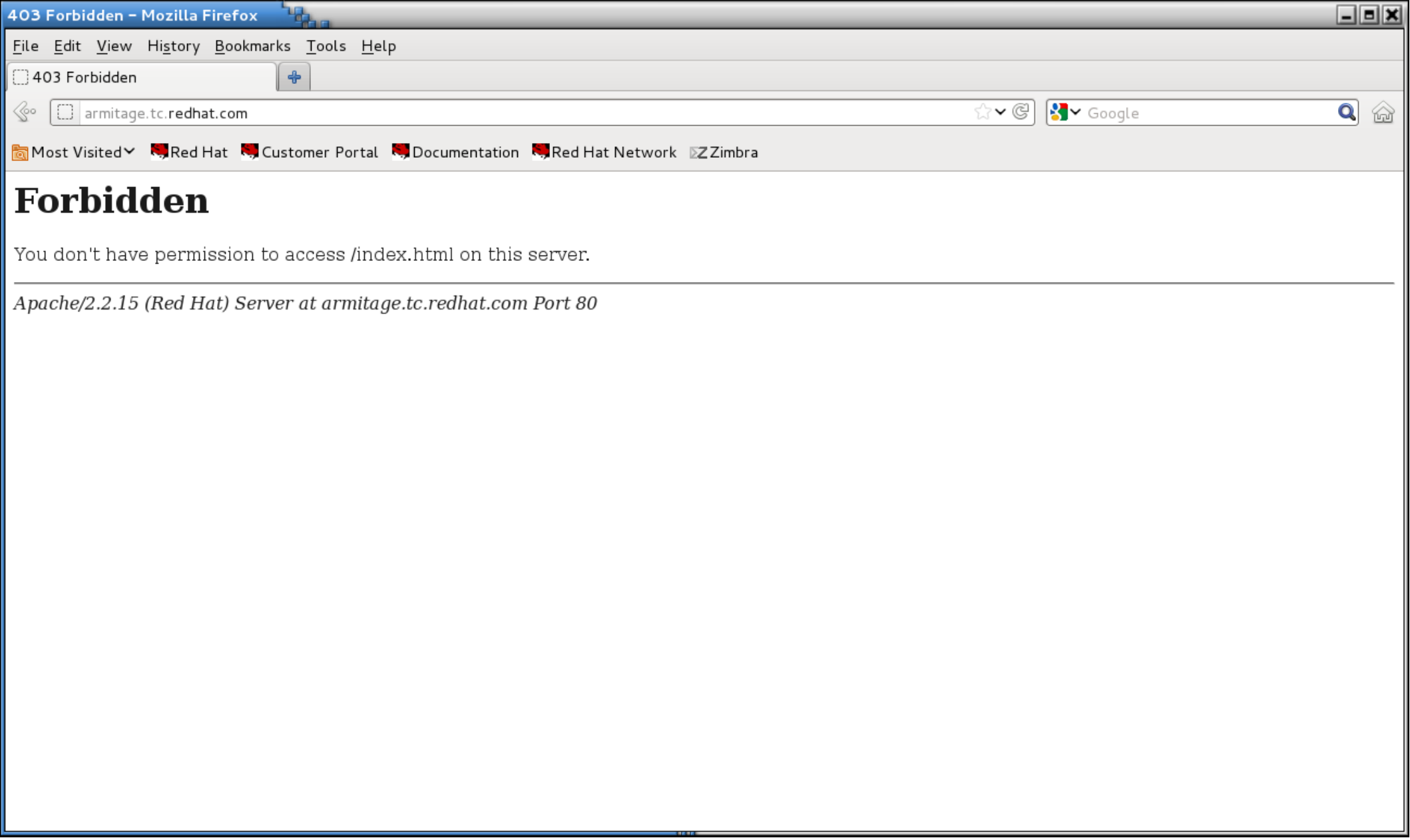
- Ah, it's the wrong owner, right?


root@armitage:~
File Edit View Search Terminal Help
[root@armitage ~]# ls -l /var/www/html/
total 4
-rw-rw-r--. 1 wilma wilma 26 Jun 21 10:41 index.html
[root@armitage ~]#


root@armitage:~
File Edit View Search Terminal Help
[root@armitage ~]# chown root:root /var/www/html/index.html
[root@armitage ~]# ls -l /var/www/html/
total 4
-rw-rw-r--. 1 root root 26 Jun 21 10:41 index.html
[root@armitage ~]#

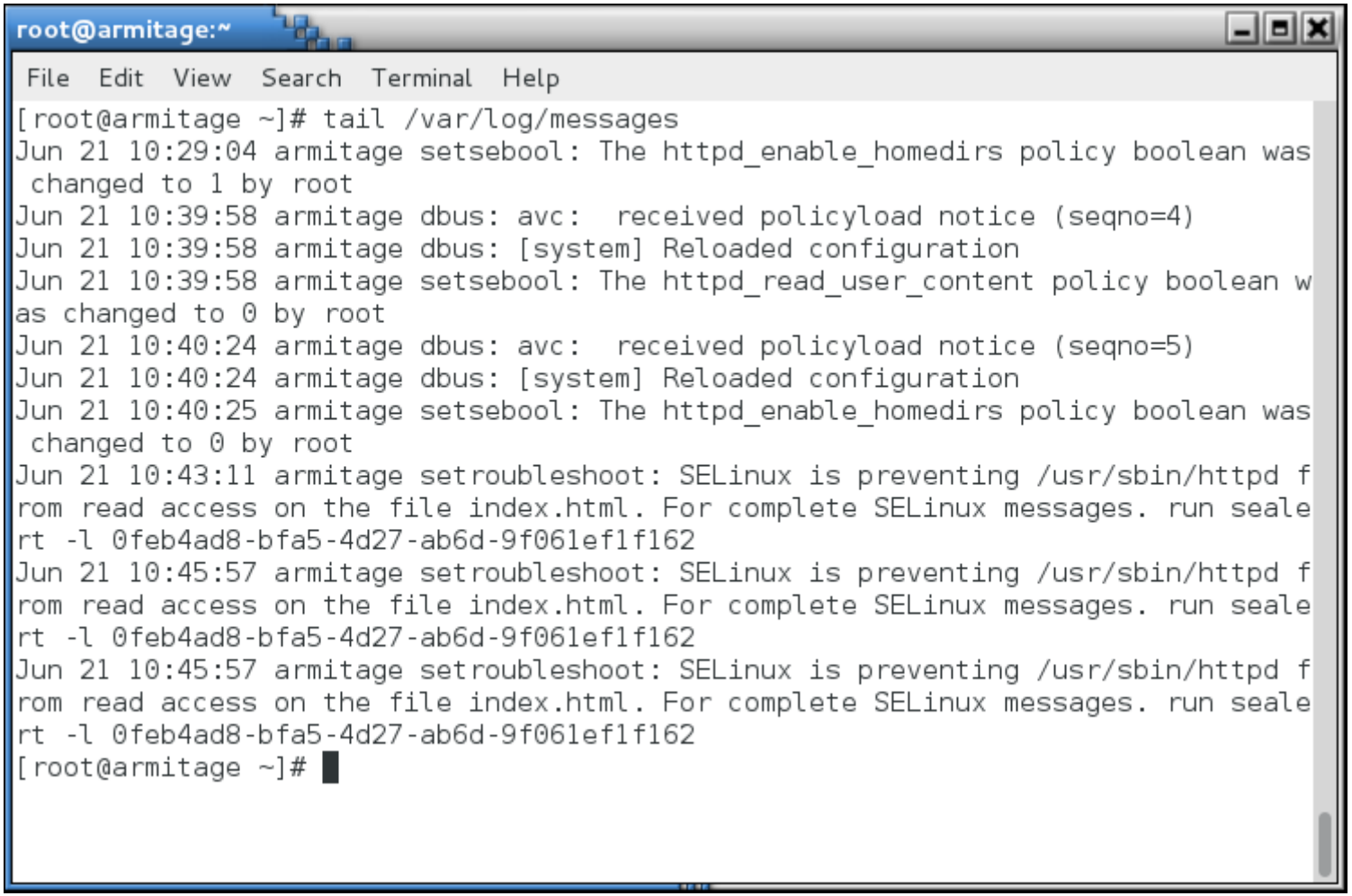
Real World Examples

- But when you test...



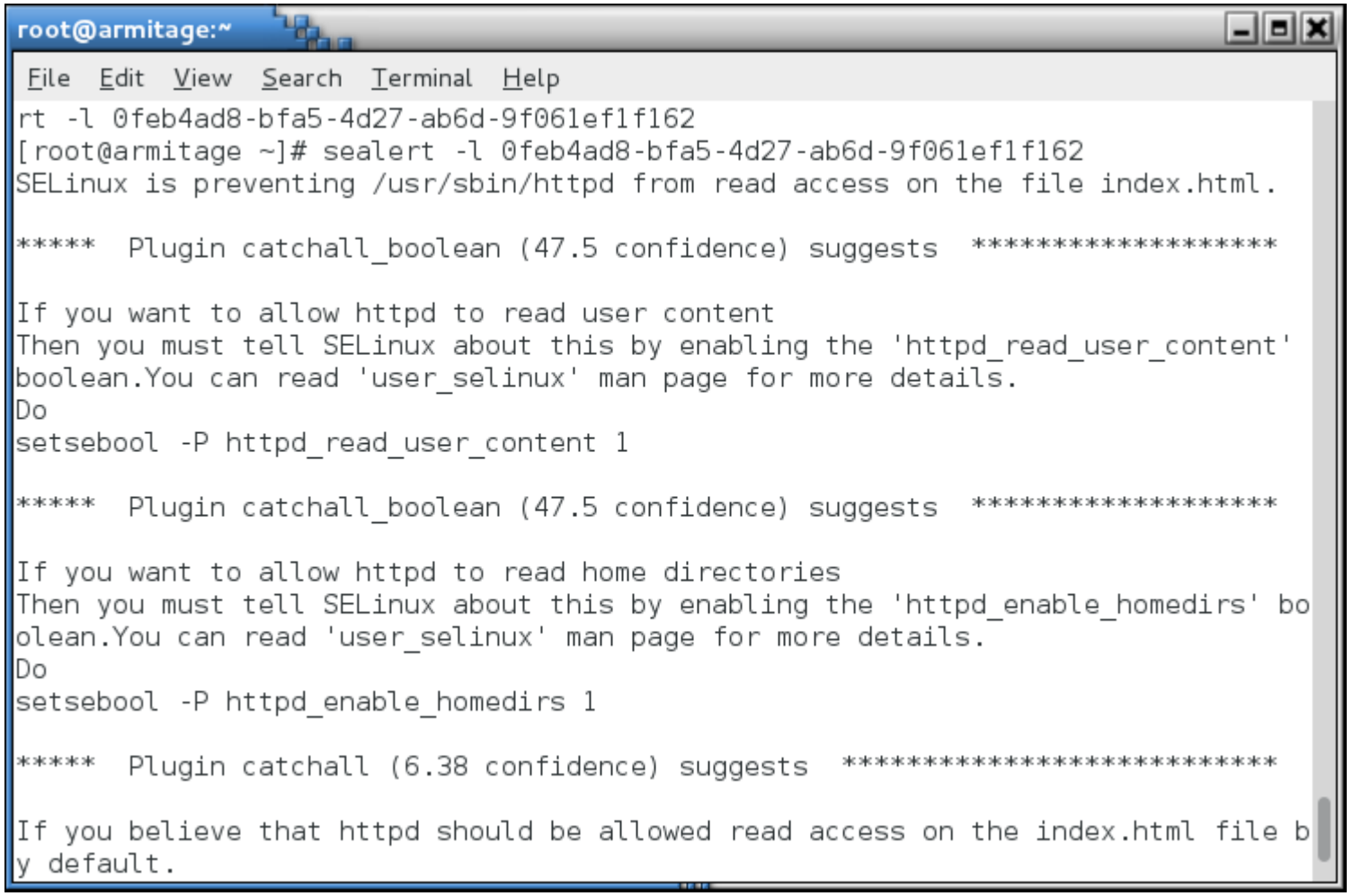
Real World Examples

- Checking /var/log/messages again tells you to run sealert.


root@armitage:~
File Edit View Search Terminal Help
[root@armitage ~]# tail /var/log/messages
Jun 21 10:29:04 armitage setsebool: The httpd_enable_homedirs policy boolean was changed to 1 by root
Jun 21 10:39:58 armitage dbus: avc: received policyload notice (seqno=4)
Jun 21 10:39:58 armitage dbus: [system] Reloaded configuration
Jun 21 10:39:58 armitage setsebool: The httpd_read_user_content policy boolean was changed to 0 by root
Jun 21 10:40:24 armitage dbus: avc: received policyload notice (seqno=5)
Jun 21 10:40:24 armitage dbus: [system] Reloaded configuration
Jun 21 10:40:25 armitage setsebool: The httpd_enable_homedirs policy boolean was changed to 0 by root
Jun 21 10:43:11 armitage setroubleshoot: SELinux is preventing /usr/sbin/httpd from read access on the file index.html. For complete SELinux messages. run sealert -l 0feb4ad8-bfa5-4d27-ab6d-9f061ef1f162
Jun 21 10:45:57 armitage setroubleshoot: SELinux is preventing /usr/sbin/httpd from read access on the file index.html. For complete SELinux messages. run sealert -l 0feb4ad8-bfa5-4d27-ab6d-9f061ef1f162
Jun 21 10:45:57 armitage setroubleshoot: SELinux is preventing /usr/sbin/httpd from read access on the file index.html. For complete SELinux messages. run sealert -l 0feb4ad8-bfa5-4d27-ab6d-9f061ef1f162
[root@armitage ~]#

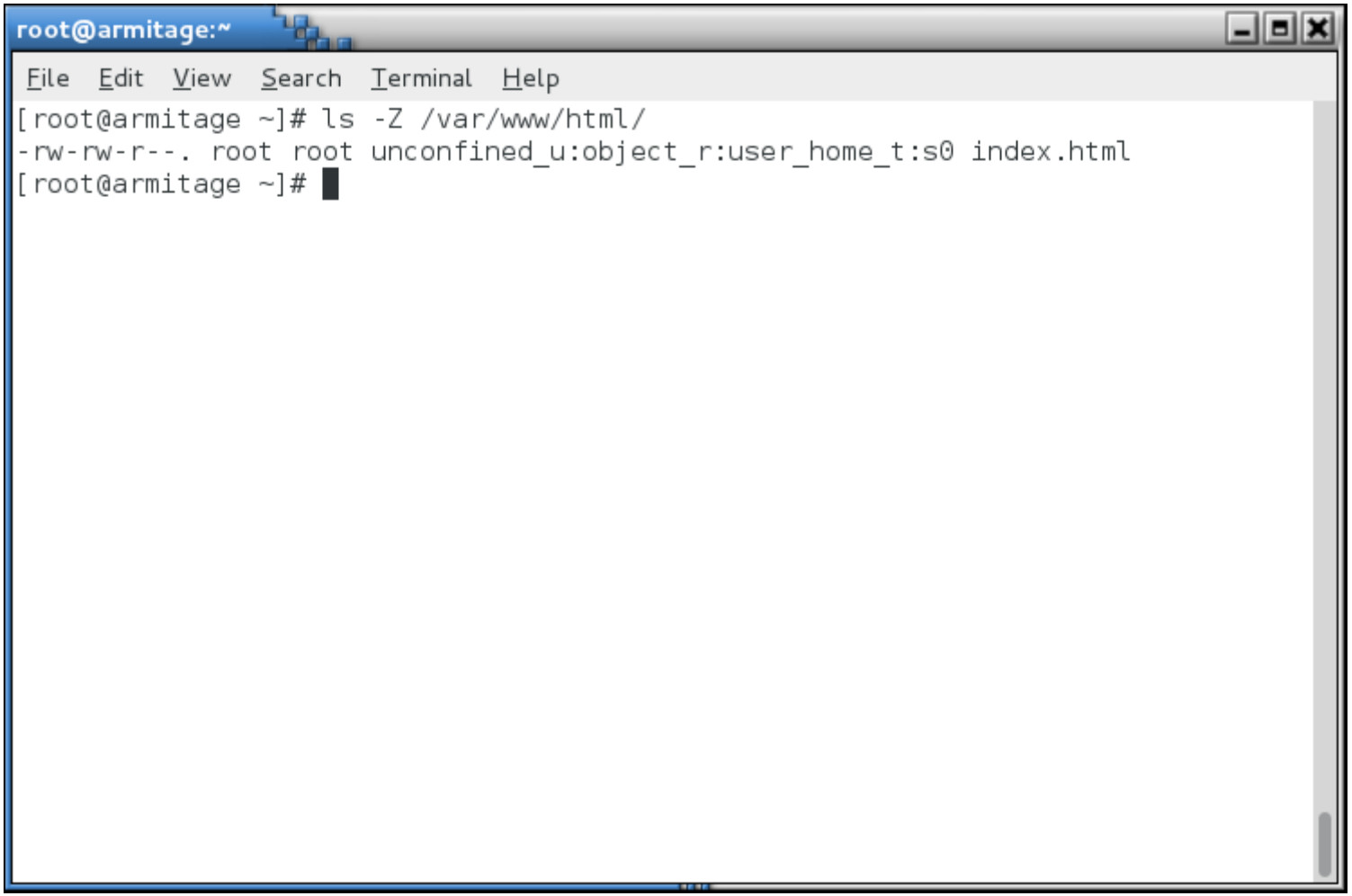
Real World Examples

- But this time, sealert is still talking about user content and home directories... We're dealing wiht content in the **system** web content directory, /var/www/html.


root@armitage:~
File Edit View Search Terminal Help
rt -l 0feb4ad8-bfa5-4d27-ab6d-9f061ef1f162
[root@armitage ~]# sealert -l 0feb4ad8-bfa5-4d27-ab6d-9f061ef1f162
SELinux is preventing /usr/sbin/httpd from read access on the file index.html.
***** Plugin catchall_boolean (47.5 confidence) suggests **********
If you want to allow httpd to read user content
Then you must tell SELinux about this by enabling the 'httpd_read_user_content'
boolean.You can read 'user_selinux' man page for more details.
Do
setsebool -P httpd_read_user_content 1
***** Plugin catchall_boolean (47.5 confidence) suggests **********
If you want to allow httpd to read home directories
Then you must tell SELinux about this by enabling the 'httpd_enable_homedirs' bo
olean.You can read 'user_selinux' man page for more details.
Do
setsebool -P httpd_enable_homedirs 1
***** Plugin catchall (6.38 confidence) suggests **********
If you believe that httpd should be allowed read access on the index.html file b
y default.

Real World Examples

- A quick ls -Z reveals the issue.

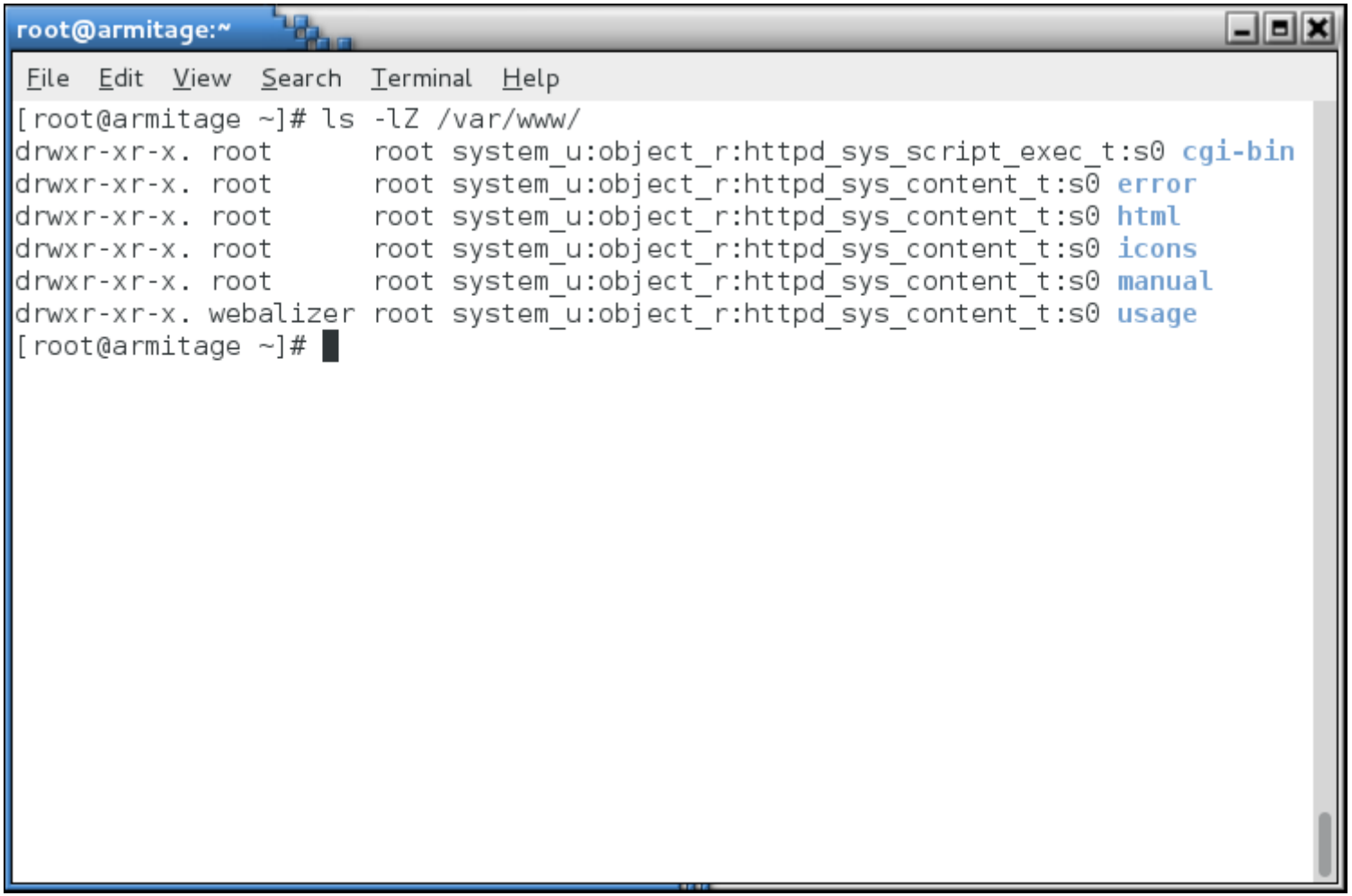

root@armitage:~
File Edit View Search Terminal Help
[root@armitage ~]# ls -Z /var/www/html/
-rw-rw-r--. root root unconfined_u:object_r:user_home_t:s0 index.html
[root@armitage ~]#

Real World Examples

- We moved instead of copied, so the file kept its original context.
- To change the context, we can run one of a couple of commands.

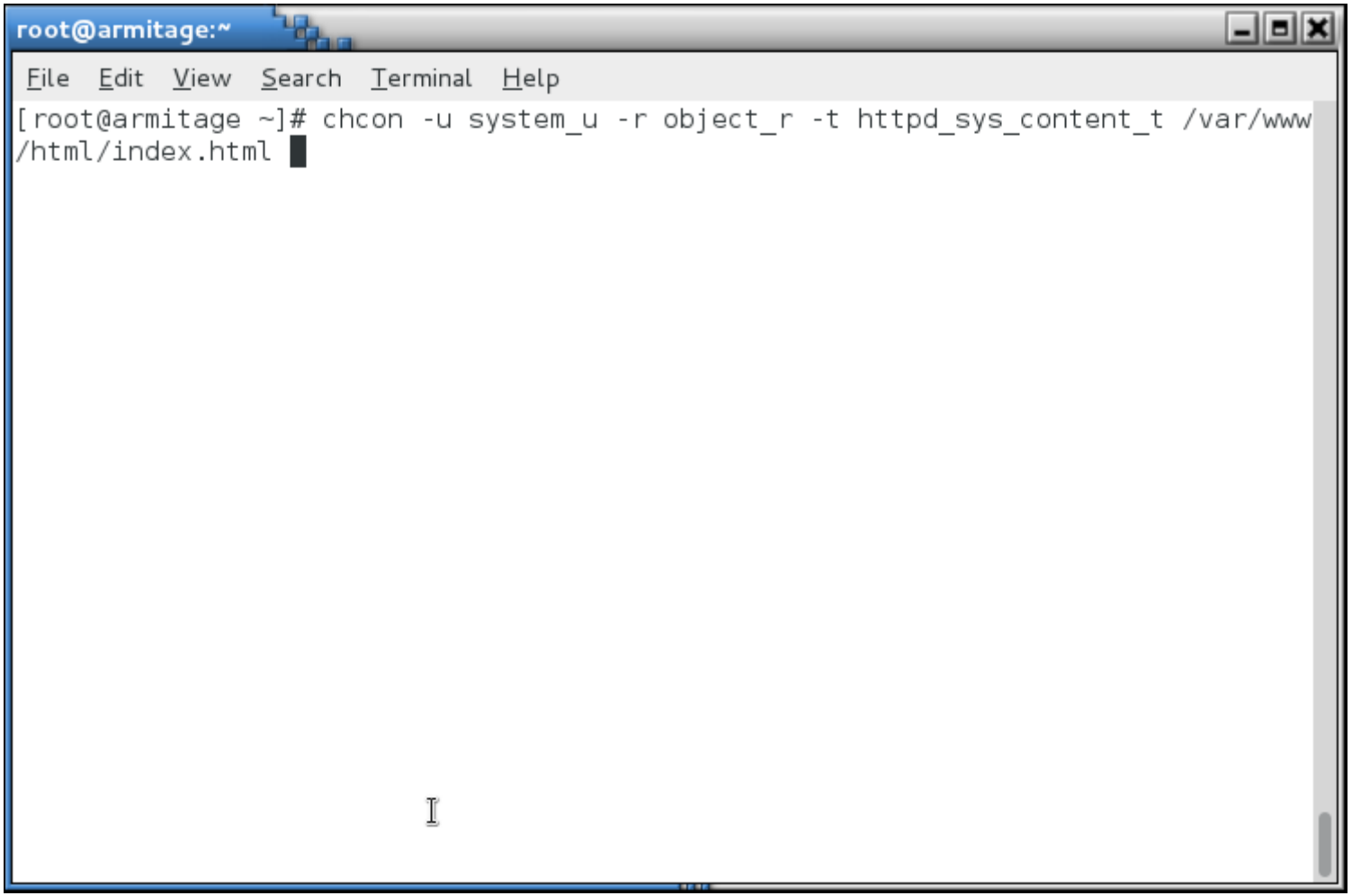
Real World Examples

- First we need to figure out what the label **should** be. Look at a known good file label.


root@armitage:~
File Edit View Search Terminal Help
[root@armitage ~]# ls -lZ /var/www/
drwxr-xr-x. root root system_u:object_r:httpd_sys_script_exec_t:s0 cgi-bin
drwxr-xr-x. root root system_u:object_r:httpd_sys_content_t:s0 error
drwxr-xr-x. root root system_u:object_r:httpd_sys_content_t:s0 html
drwxr-xr-x. root root system_u:object_r:httpd_sys_content_t:s0 icons
drwxr-xr-x. root root system_u:object_r:httpd_sys_content_t:s0 manual
drwxr-xr-x. webalizer root system_u:object_r:httpd_sys_content_t:s0 usage
[root@armitage ~]#

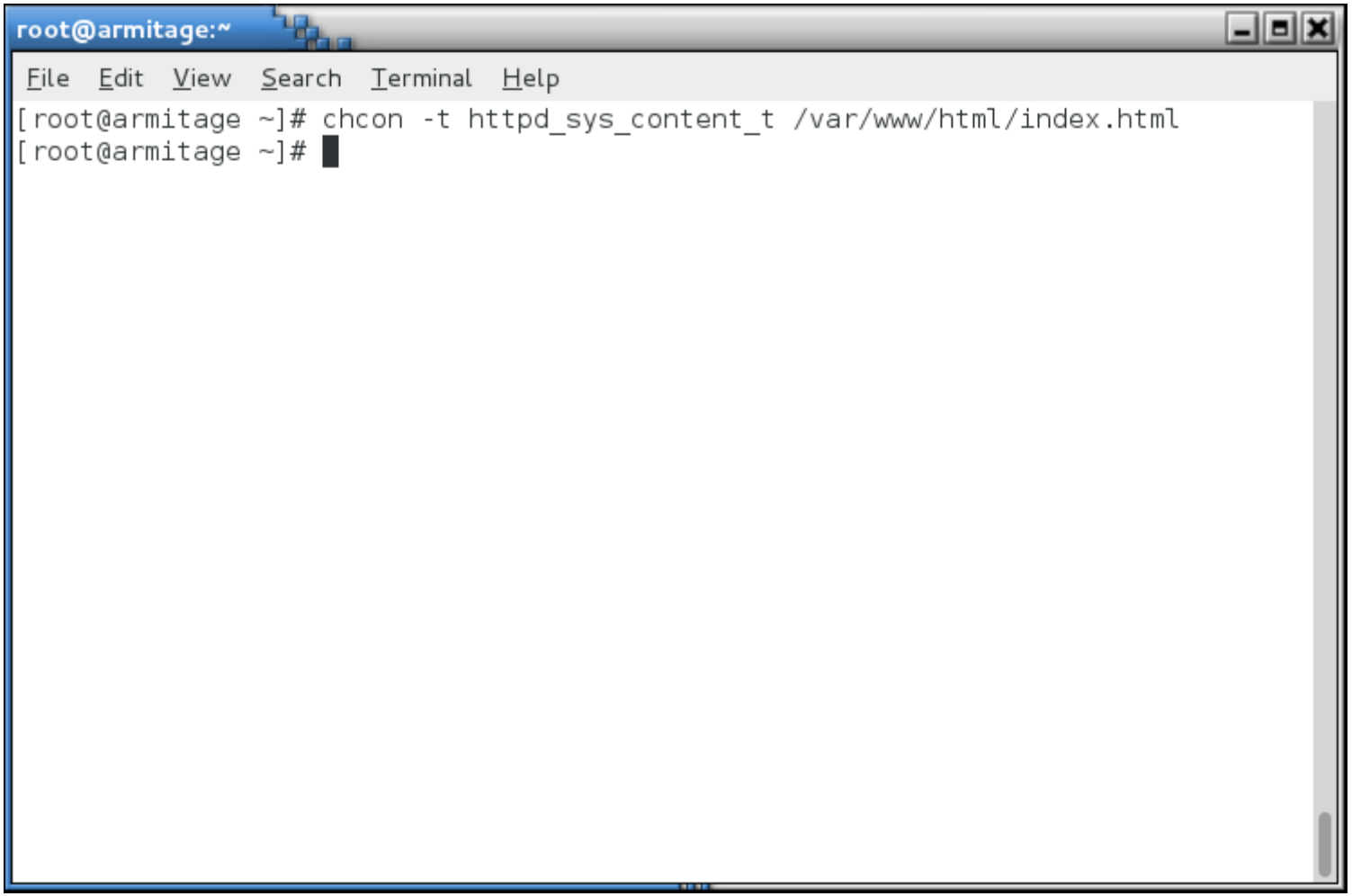
Real World Examples

- Use that information as arguments for the chcon (change context) command
- The long form is:


root@armitage:~
File Edit View Search Terminal Help
[root@armitage ~]# chcon -u system_u -r object_r -t httpd_sys_content_t /var/www
/html/index.html

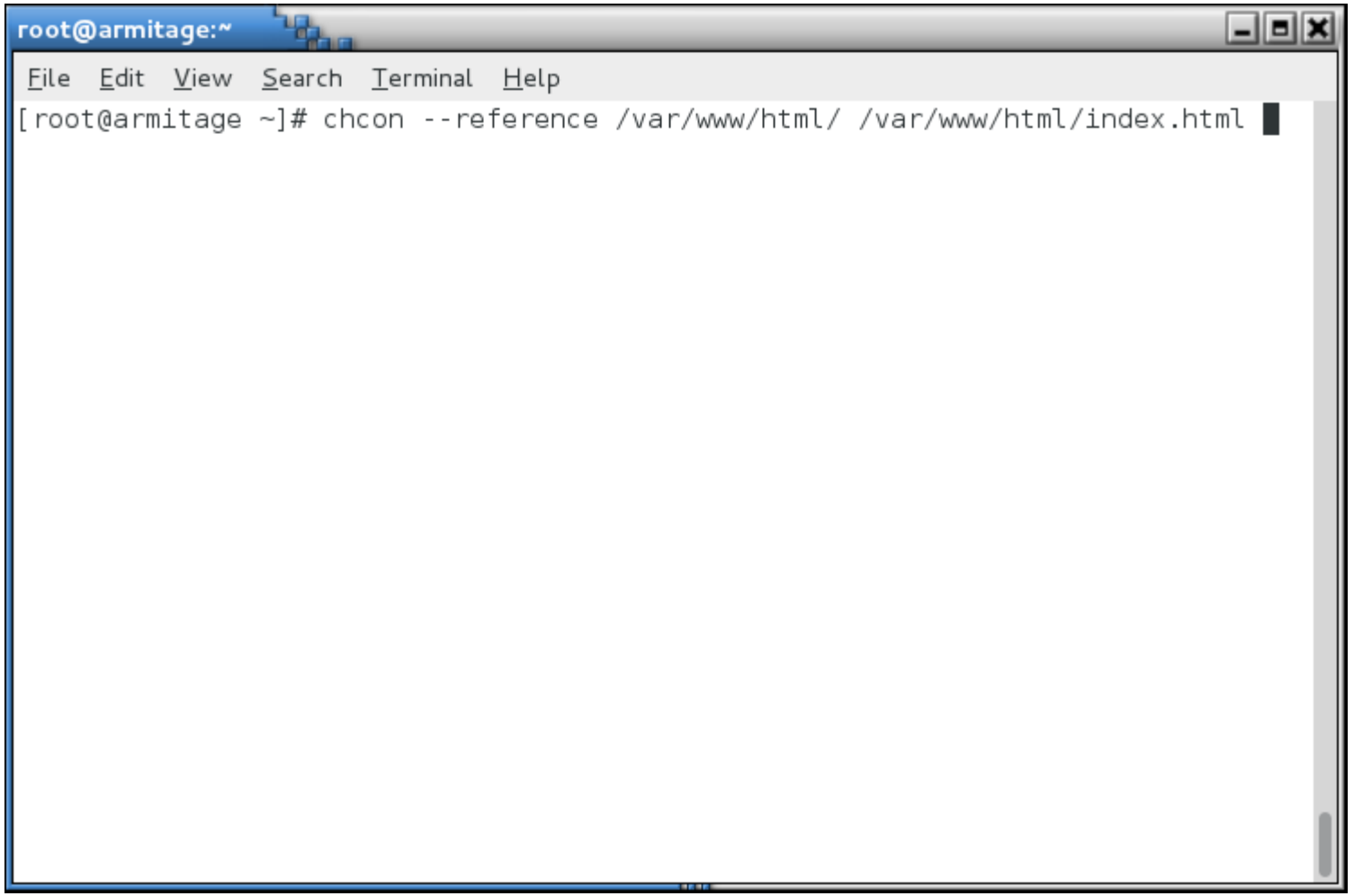
Real World Examples

- Remember that the targeted policy doesn't use the SELinux user or role. The short form is:


root@armitage:~
File Edit View Search Terminal Help
[root@armitage ~]# chcon -t httpd_sys_content_t /var/www/html/index.html
[root@armitage ~]#

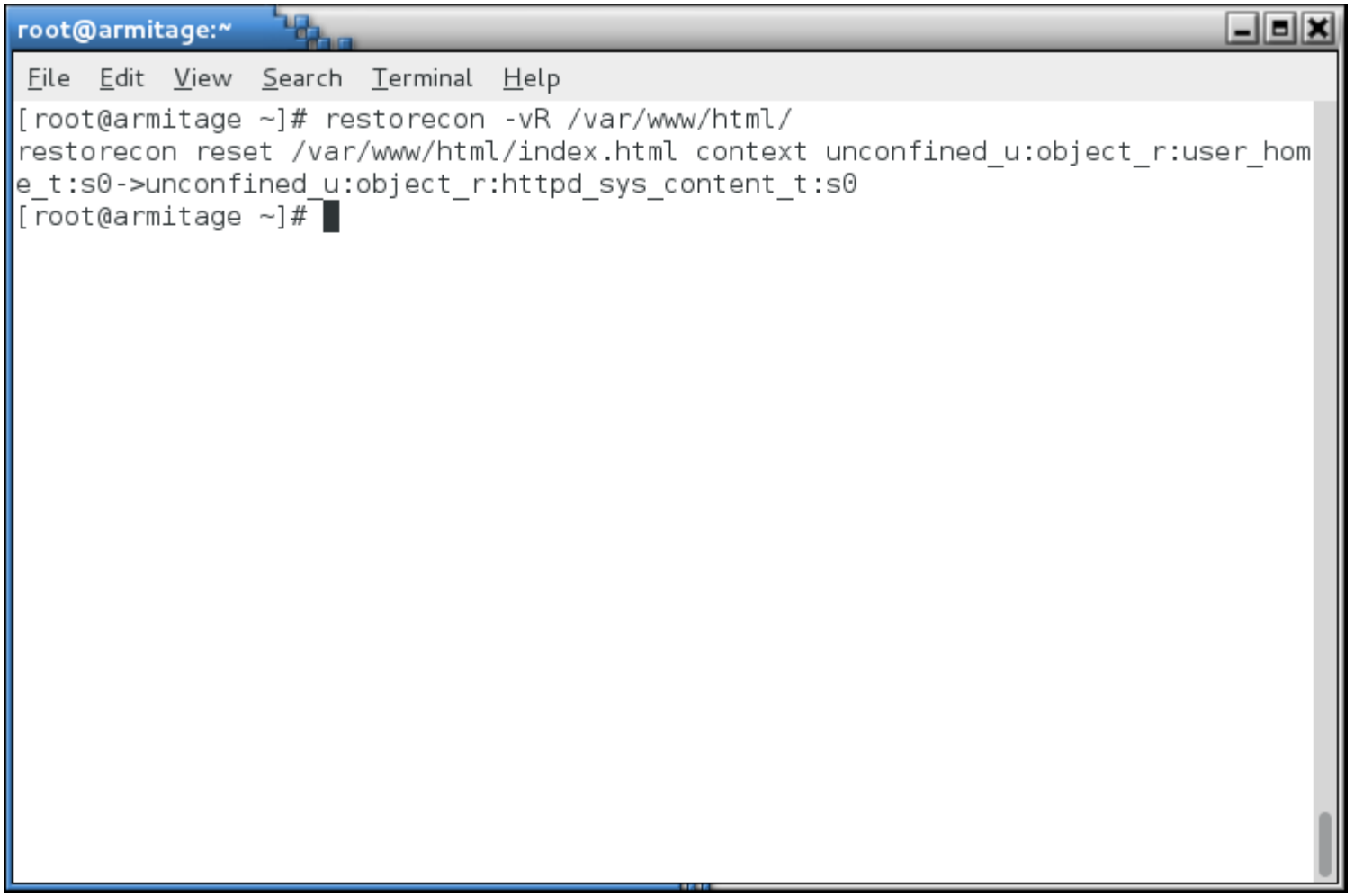
Real World Examples

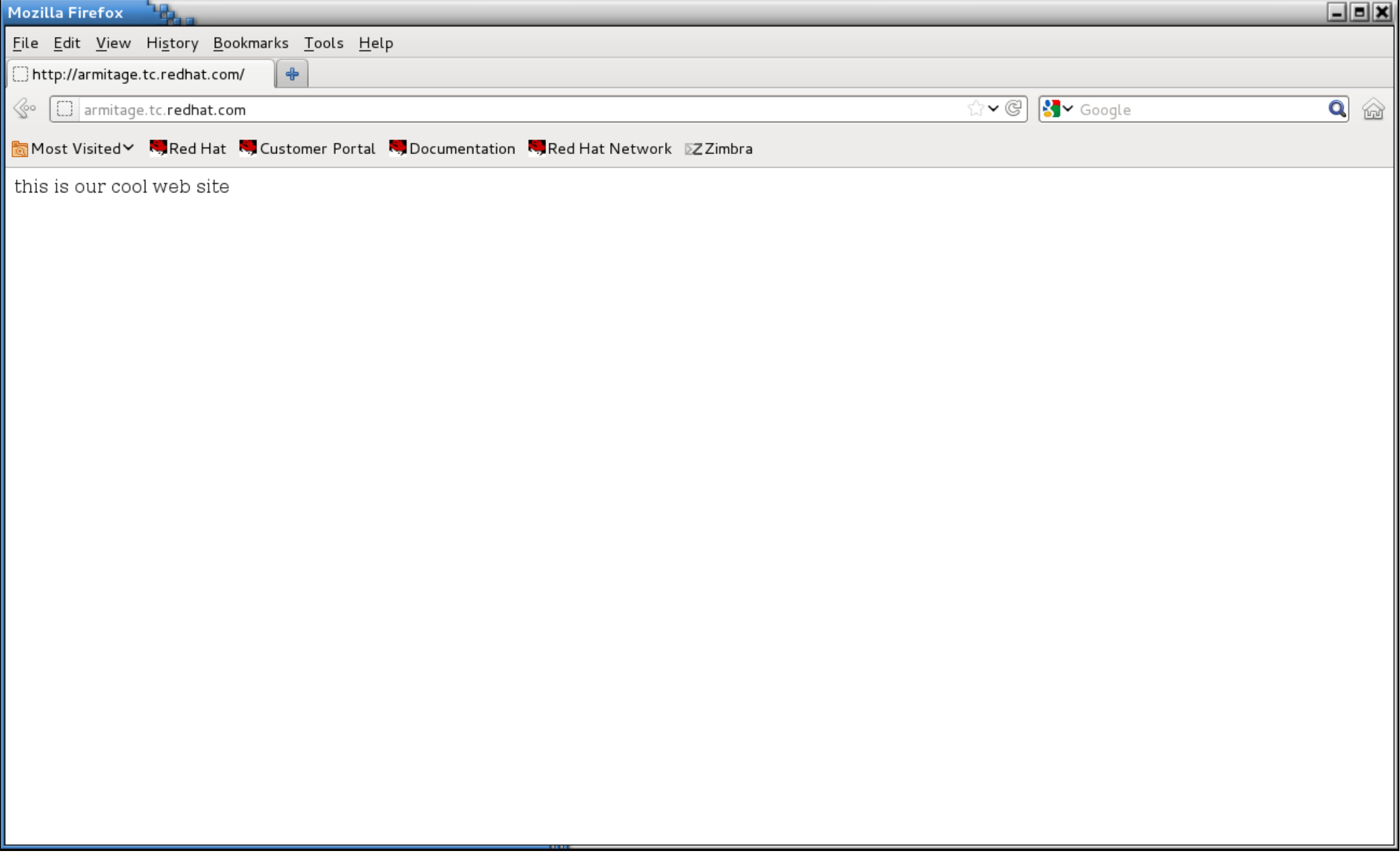
- I'm lazy. If I just want to reference a known good context, the shortest form is:


root@armitage:~
File Edit View Search Terminal Help
[root@armitage ~]# chcon --reference /var/www/html/ /var/www/html/index.html

Real World Examples

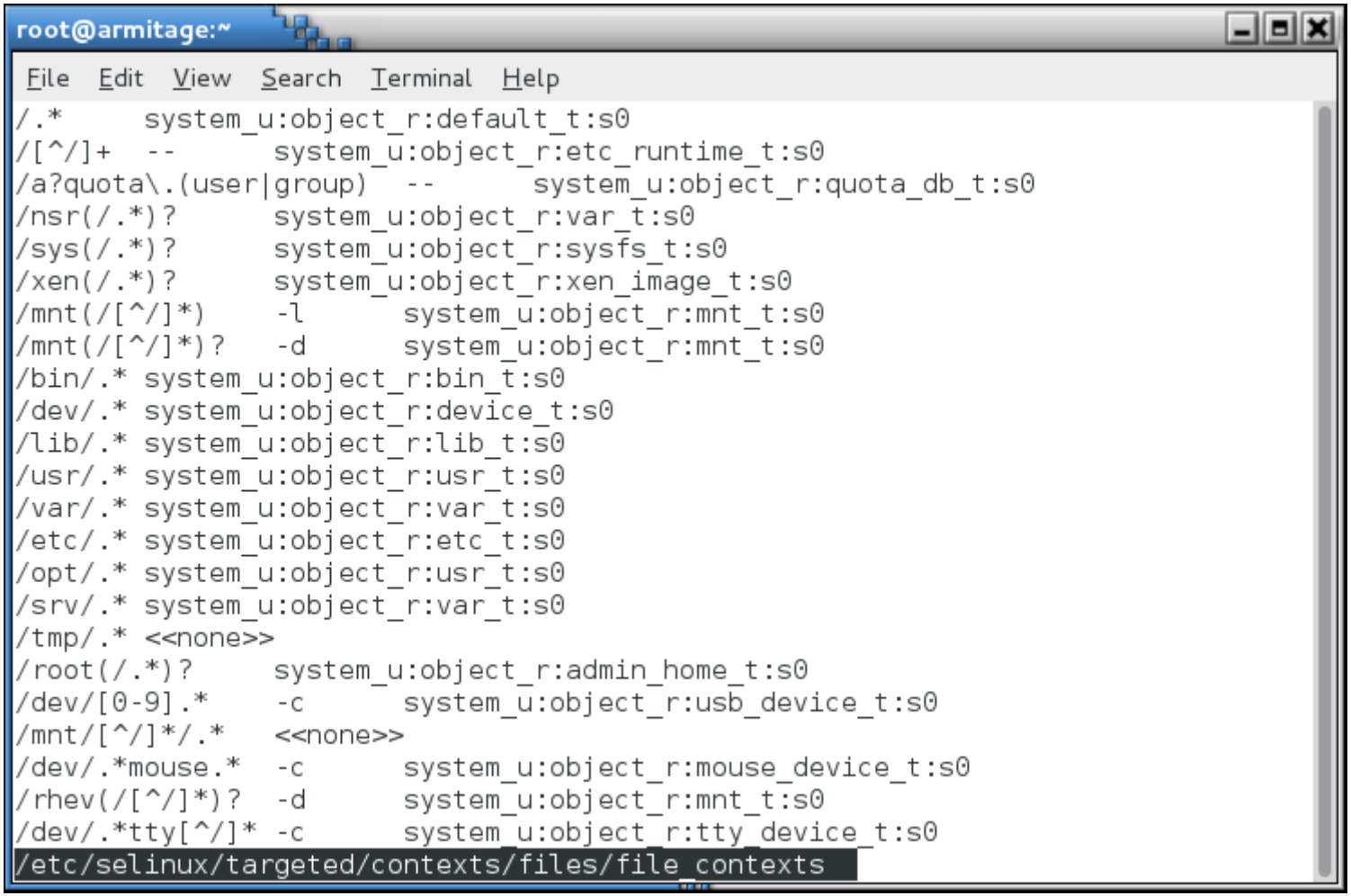
- If you just want to restore a directory and all its files to the default context, the easiest to remember is restorecon:

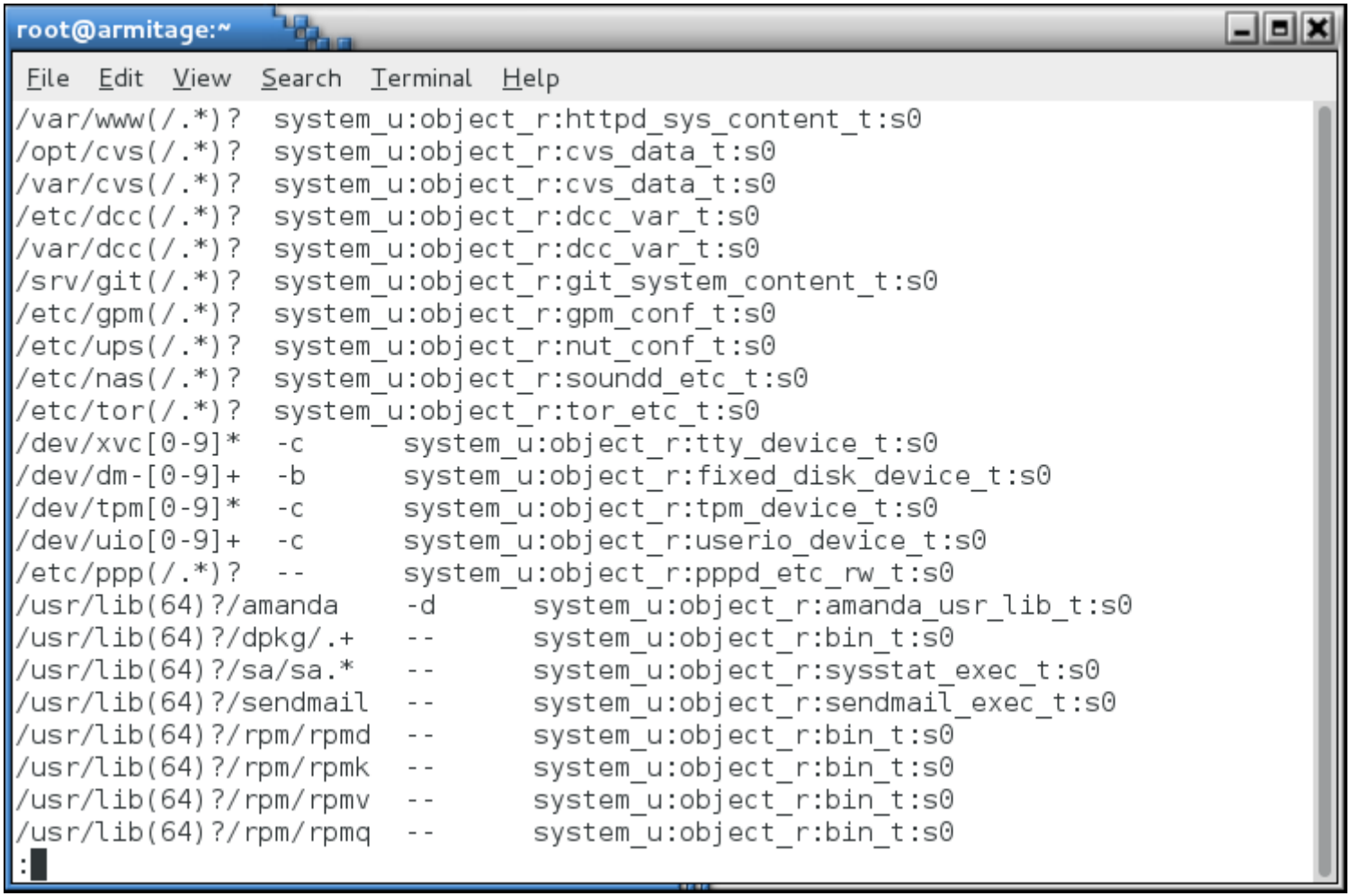

root@armitage:~
File Edit View Search Terminal Help
[root@armitage ~]# restorecon -vR /var/www/html/
restorecon reset /var/www/html/index.html context unconfined_u:object_r:user_hom
e_t:s0->unconfined_u:object_r:httpd_sys_content_t:s0
[root@armitage ~]#


Mozilla Firefox
File Edit View History Bookmarks Tools Help
http://armitage.tc.redhat.com/
armitage.tc.redhat.com
Google
Most Visited
Red Hat
Customer Portal
Documentation
Red Hat Network
Zimbra
this is our cool web site

Where Are These Contexts Stored?

- restorecon uses information from /etc/selinux/targeted/contexts/files/file_contexts (and other files in that directory) to determine what a file or directory's context should be.
- There are over 4000 entries in this file. Don't modify this file directly, your changes will be lost!


root@armitage:~
File Edit View Search Terminal Help
/.* system_u:object_r:default_t:s0
/[^/]+ -- system_u:object_r:etc_runtime_t:s0
/a?quota\.(user|group) -- system_u:object_r:quota_db_t:s0
/nsr(/.*)? system_u:object_r:var_t:s0
/sys(/.*)? system_u:object_r:sysfs_t:s0
/xen(/.*)? system_u:object_r:xen_image_t:s0
/mnt(/[^/]*) -l system_u:object_r:mnt_t:s0
/mnt(/[^/]*)? -d system_u:object_r:mnt_t:s0
/bin/.* system_u:object_r:bin_t:s0
/dev/.* system_u:object_r:device_t:s0
/lib/.* system_u:object_r:lib_t:s0
/usr/.* system_u:object_r:usr_t:s0
/var/.* system_u:object_r:var_t:s0
/etc/.* system_u:object_r:etc_t:s0
/opt/.* system_u:object_r:usr_t:s0
/srv/.* system_u:object_r:var_t:s0
/tmp/.* <<none>>
/root(/.*)? system_u:object_r:admin_home_t:s0
/dev/[0-9].* -c system_u:object_r:usb_device_t:s0
/mnt/[^/]*/.* <<none>>
/dev/.*mouse.* -c system_u:object_r:mouse_device_t:s0
/rhev(/[^/]*)? -d system_u:object_r:mnt_t:s0
/dev/.*tty[^/]* -c system_u:object_r:tty_device_t:s0
/etc/selinux/targeted/contexts/files/file_contexts


root@armitage:~
File Edit View Search Terminal Help
/var/www(/.*)? system_u:object_r:httpd_sys_content_t:s0
/opt/cvs(/.*)? system_u:object_r:cvs_data_t:s0
/var/cvs(/.*)? system_u:object_r:cvs_data_t:s0
/etc/dcc(/.*)? system_u:object_r:dcc_var_t:s0
/var/dcc(/.*)? system_u:object_r:dcc_var_t:s0
/srv/git(/.*)? system_u:object_r:git_system_content_t:s0
/etc/gpm(/.*)? system_u:object_r:gpm_conf_t:s0
/etc/ups(/.*)? system_u:object_r:nut_conf_t:s0
/etc/nas(/.*)? system_u:object_r:soundd_etc_t:s0
/etc/tor(/.*)? system_u:object_r:tor_etc_t:s0
/dev/xvc[0-9]* -c system_u:object_r:tty_device_t:s0
/dev/dm-[0-9]+ -b system_u:object_r:fixed_disk_device_t:s0
/dev/tpm[0-9]* -c system_u:object_r:tpm_device_t:s0
/dev/uio[0-9]+ -c system_u:object_r:userio_device_t:s0
/etc/ppp(/.*)? -- system_u:object_r:pppd_etc_rw_t:s0
/usr/lib(64)?/amanda -d system_u:object_r:amanda_usr_lib_t:s0
/usr/lib(64)?/dpkg/.+ -- system_u:object_r:bin_t:s0
/usr/lib(64)?/sa/sa.* -- system_u:object_r:sysstat_exec_t:s0
/usr/lib(64)?/sendmail -- system_u:object_r:sendmail_exec_t:s0
/usr/lib(64)?/rpm/rpmd -- system_u:object_r:bin_t:s0
/usr/lib(64)?/rpm/rpmk -- system_u:object_r:bin_t:s0
/usr/lib(64)?/rpm/rpmv -- system_u:object_r:bin_t:s0
/usr/lib(64)?/rpm/rpmq -- system_u:object_r:bin_t:s0
:

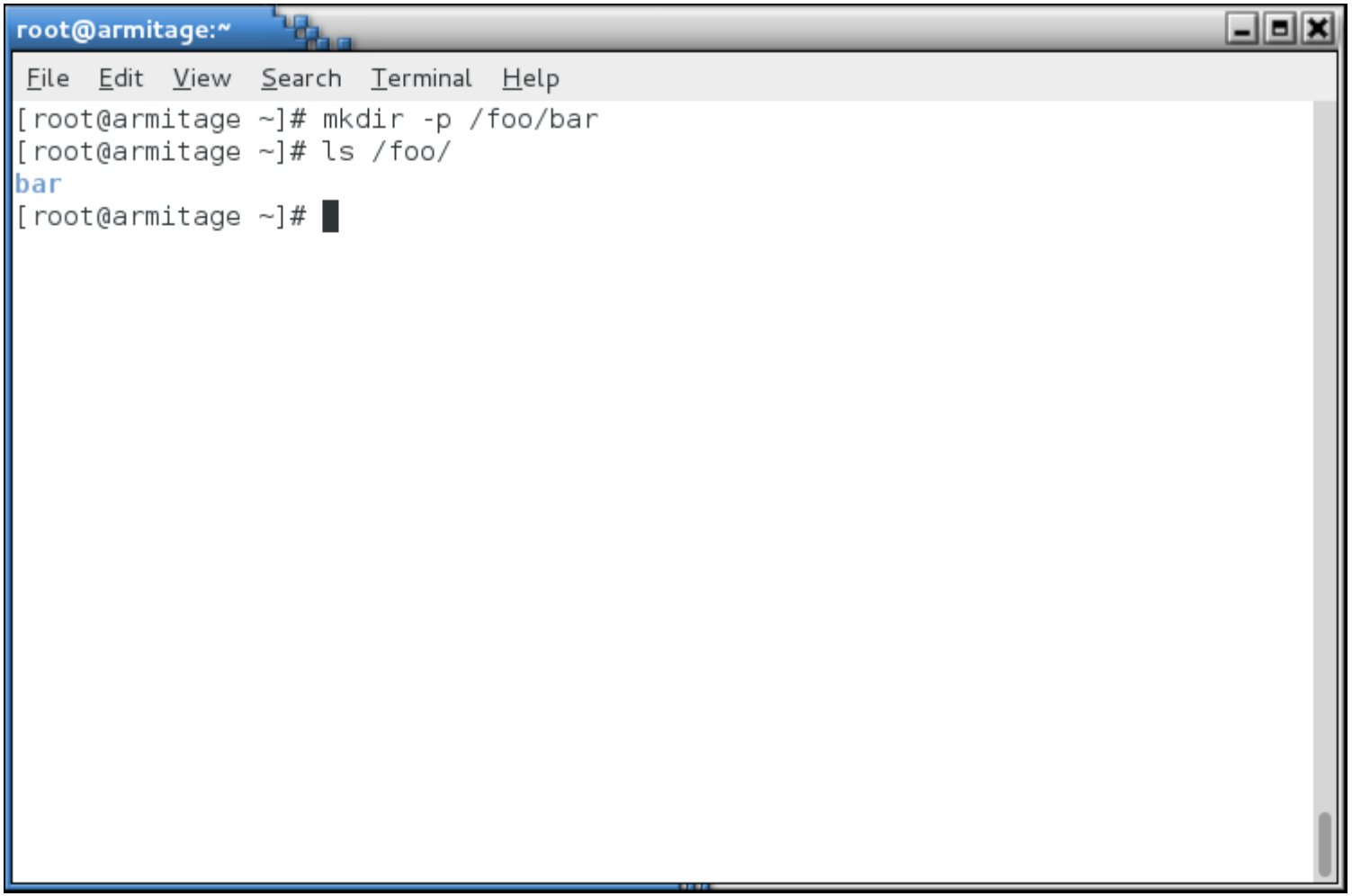
Real World Examples

Real World Examples

- Someone tells you to create a web directory somewhere non-standard - /foo/bar - for a virtual web site.

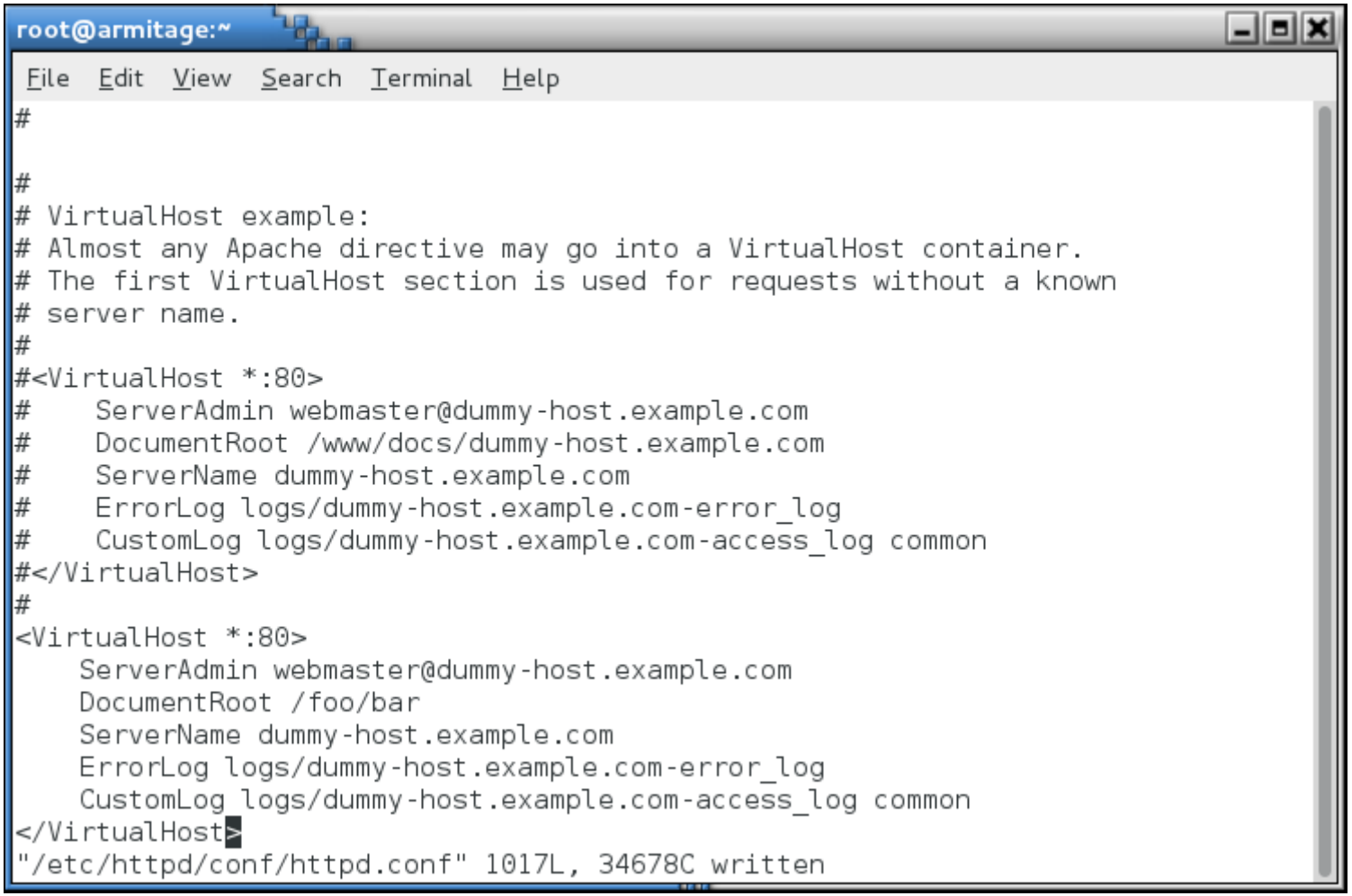
Real World Examples

- You create the directory:


root@armitage:~
File Edit View Search Terminal Help
[root@armitage ~]# mkdir -p /foo/bar
[root@armitage ~]# ls /foo/
bar
[root@armitage ~]#

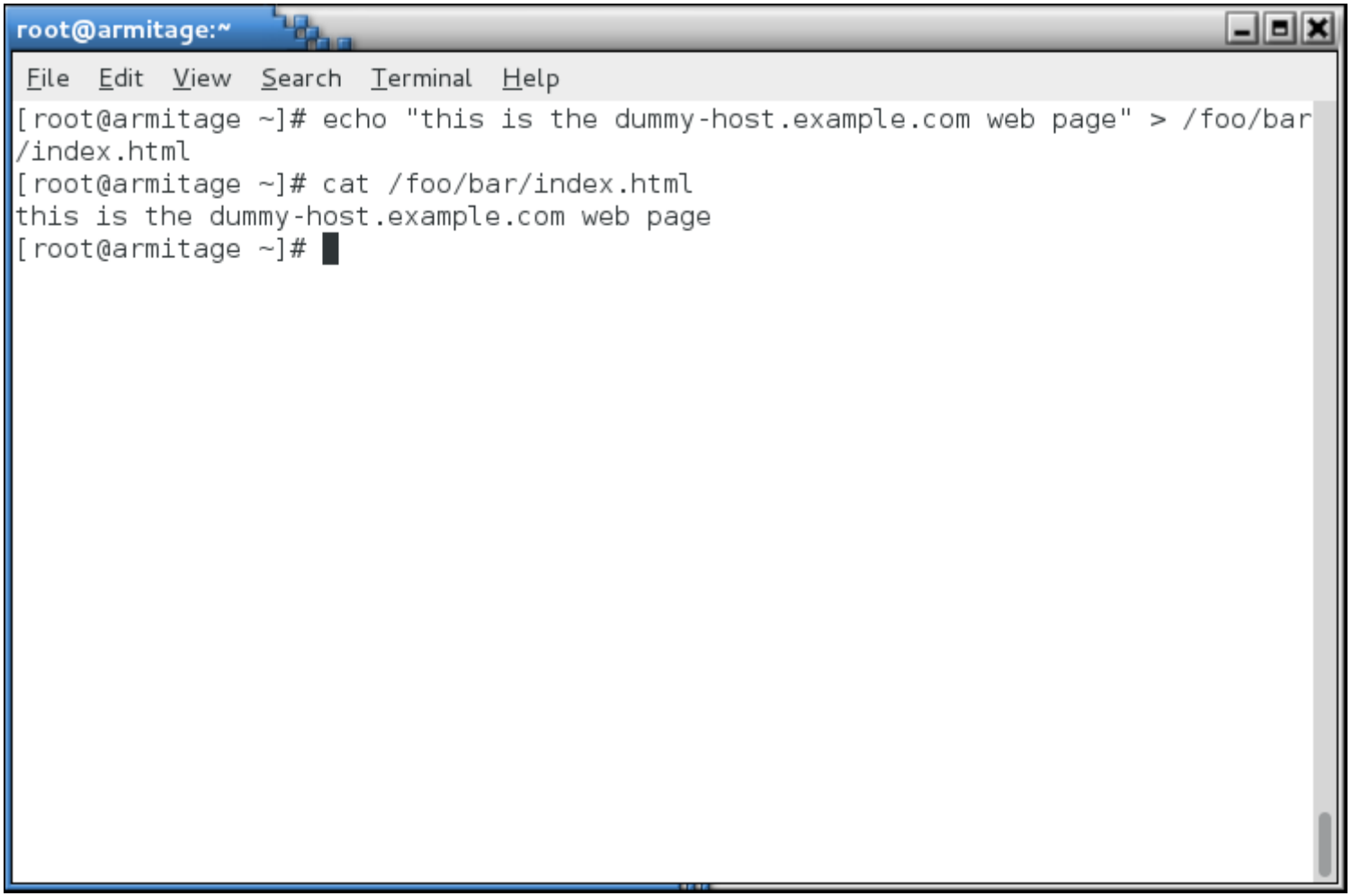
Real World Examples

- You define the virtual web site in httpd.conf:


root@armitage:~
File Edit View Search Terminal Help
#
#
VirtualHost example:
Almost any Apache directive may go into a VirtualHost container.
The first VirtualHost section is used for requests without a known
server name.
#
#<VirtualHost *:80>
ServerAdmin webmaster@dummy-host.example.com
DocumentRoot /www/docs/dummy-host.example.com
ServerName dummy-host.example.com
ErrorLog logs/dummy-host.example.com-error_log
CustomLog logs/dummy-host.example.com-access_log common
#</VirtualHost>
#
<VirtualHost *:80>
    ServerAdmin webmaster@dummy-host.example.com
    DocumentRoot /foo/bar
    ServerName dummy-host.example.com
    ErrorLog logs/dummy-host.example.com-error_log
    CustomLog logs/dummy-host.example.com-access_log common
</VirtualHost>
"/etc/httpd/conf/httpd.conf" 1017L, 34678C written

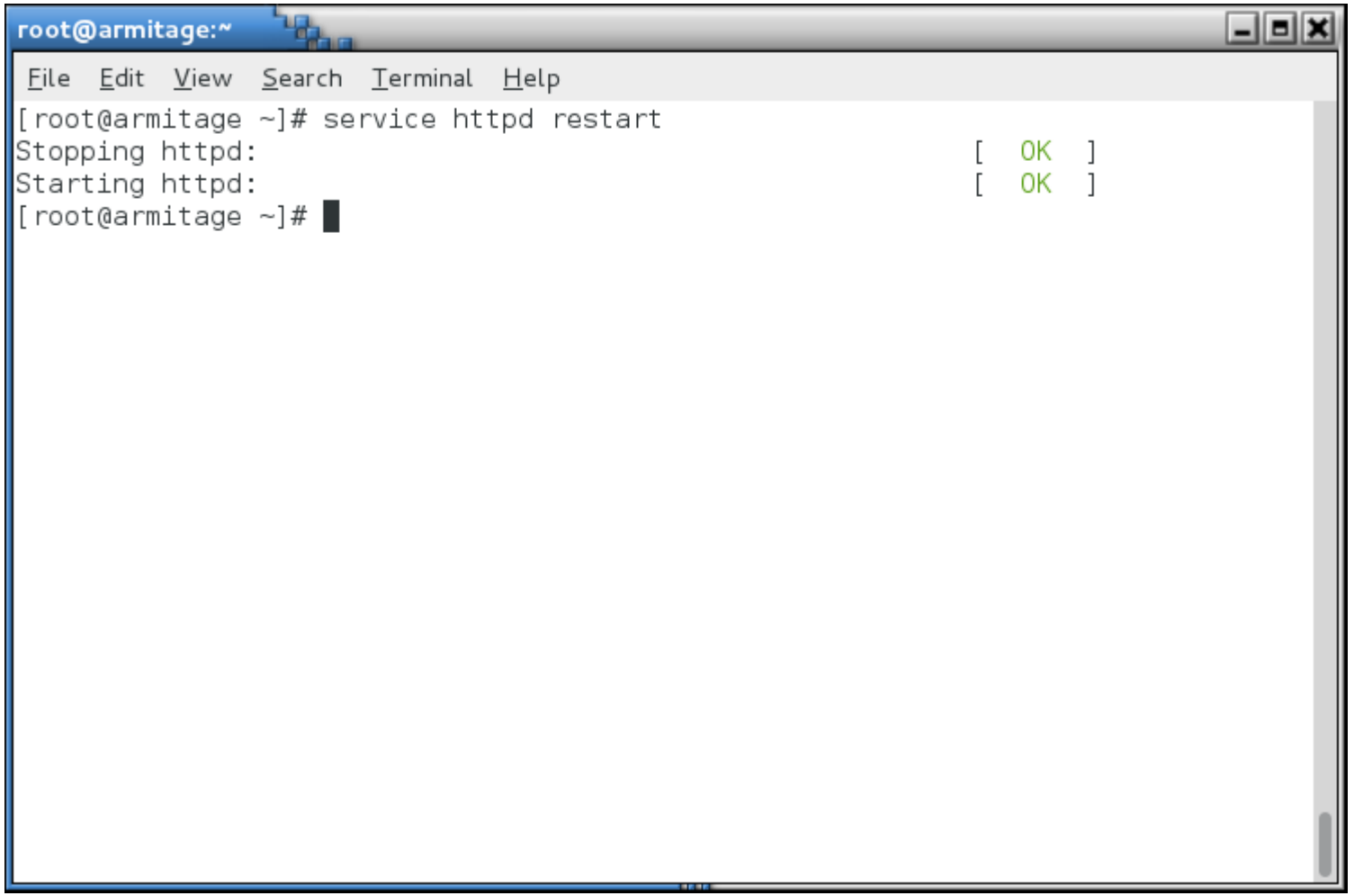
Real World Examples

- You create an index.html file:


root@armitage:~
File Edit View Search Terminal Help
[root@armitage ~]# echo "this is the dummy-host.example.com web page" > /foo/bar
/index.html
[root@armitage ~]# cat /foo/bar/index.html
this is the dummy-host.example.com web page
[root@armitage ~]#

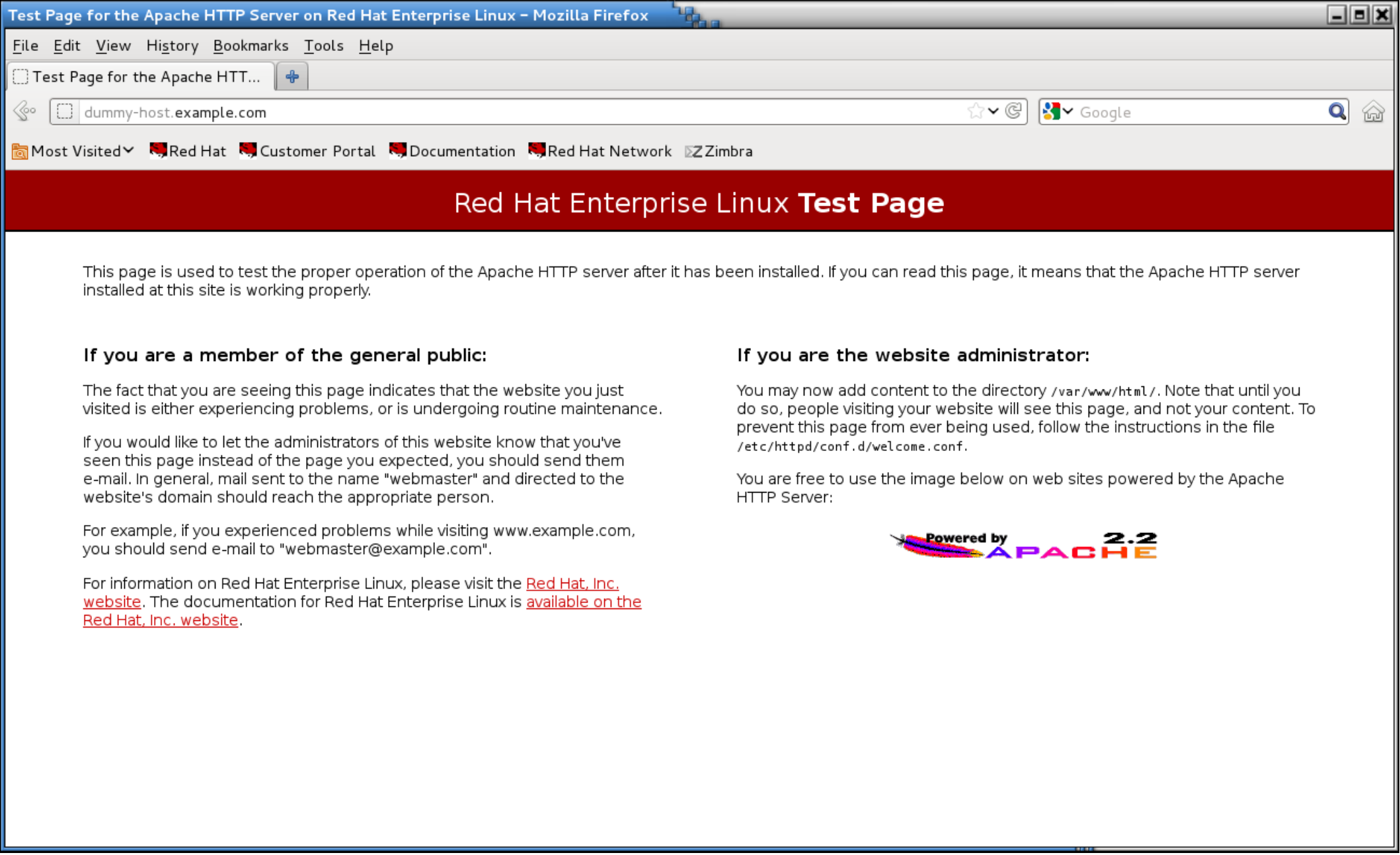
Real World Examples

- Restart the web server:


root@armitage:~
File Edit View Search Terminal Help
[root@armitage ~]# service httpd restart
Stopping httpd: [OK]
Starting httpd: [OK]
[root@armitage ~]#

Real World Examples

- When you test the page...

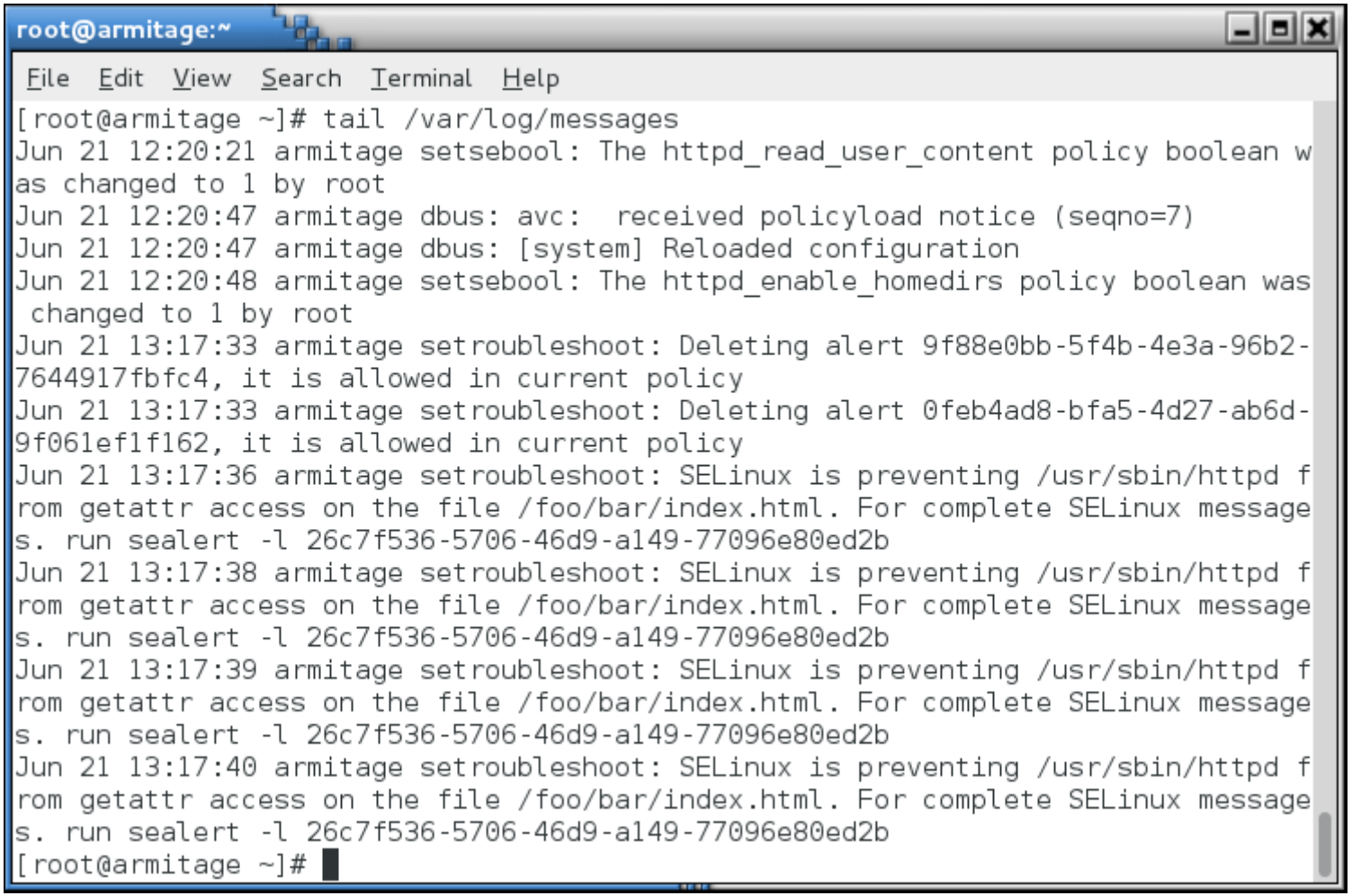


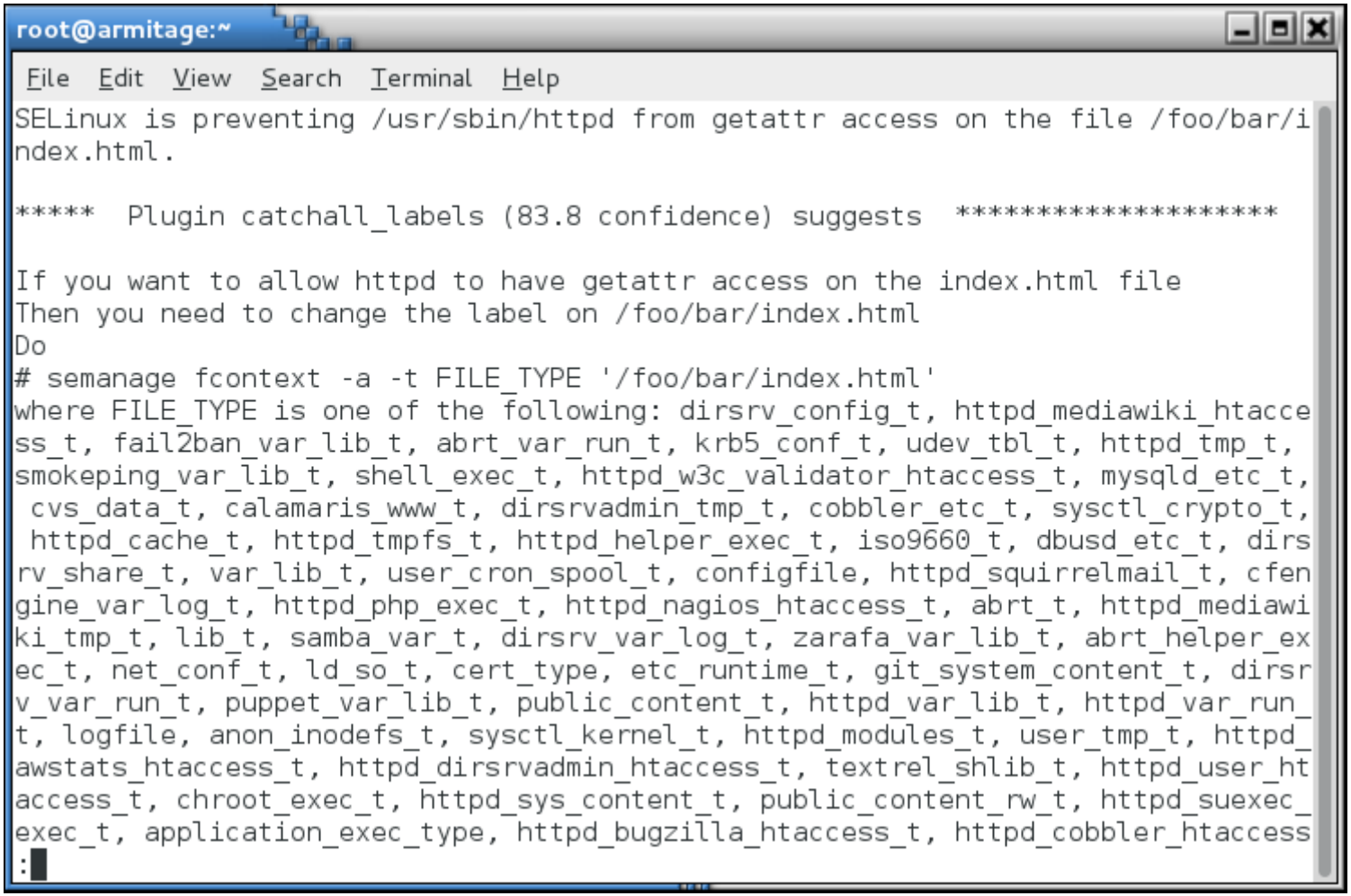
Real World Examples

- What logfile should we check?

Real World Examples

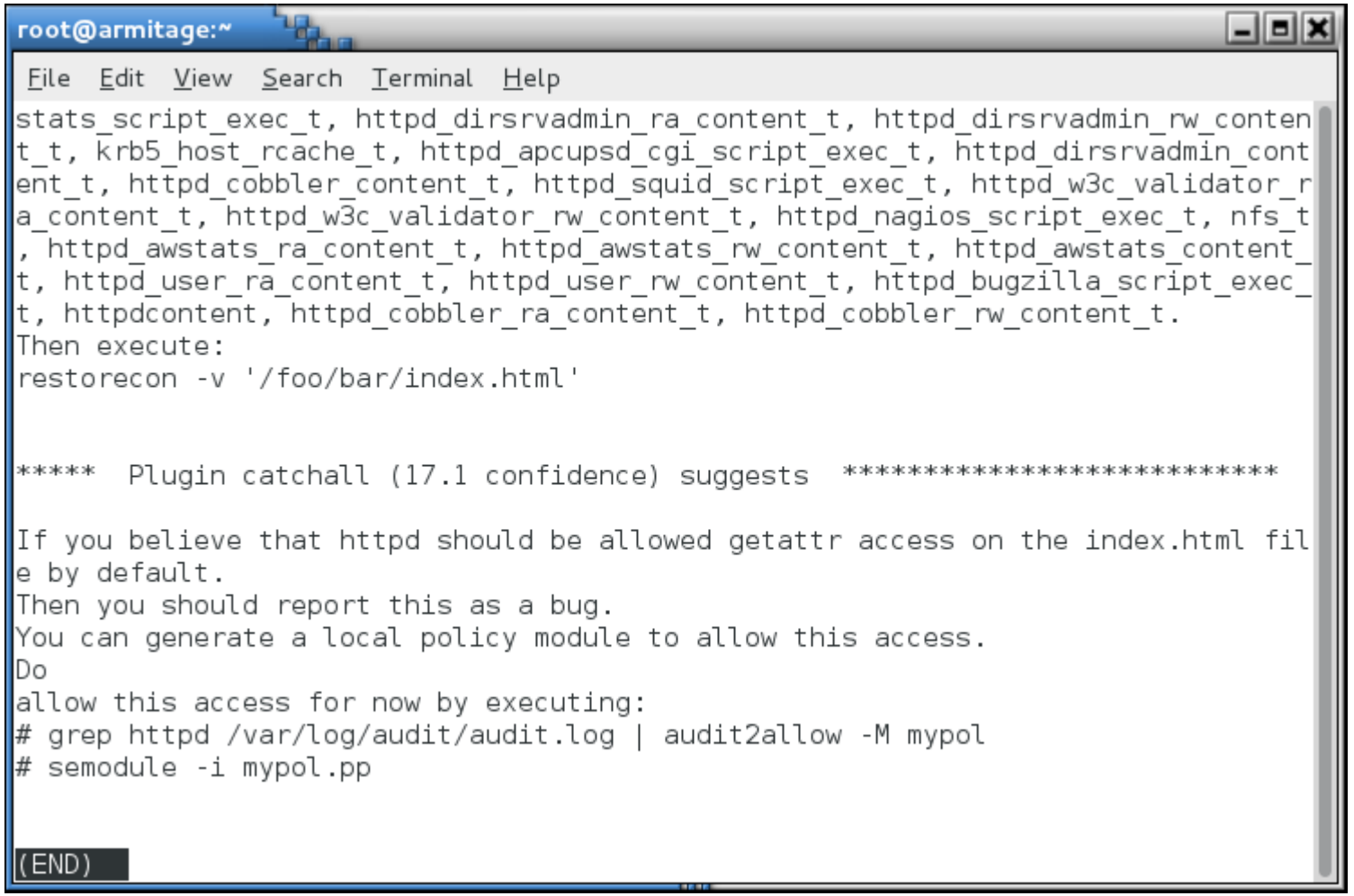
- /var/log/messages


root@armitage:~
File Edit View Search Terminal Help
[root@armitage ~]# tail /var/log/messages
Jun 21 12:20:21 armitage setsebool: The httpd_read_user_content policy boolean w
as changed to 1 by root
Jun 21 12:20:47 armitage dbus: avc: received policyload notice (seqno=7)
Jun 21 12:20:47 armitage dbus: [system] Reloaded configuration
Jun 21 12:20:48 armitage setsebool: The httpd_enable_homedirs policy boolean was
 changed to 1 by root
Jun 21 13:17:33 armitage setroubleshoot: Deleting alert 9f88e0bb-5f4b-4e3a-96b2-
7644917fbfc4, it is allowed in current policy
Jun 21 13:17:33 armitage setroubleshoot: Deleting alert 0feb4ad8-bfa5-4d27-ab6d-
9f061ef1f162, it is allowed in current policy
Jun 21 13:17:36 armitage setroubleshoot: SELinux is preventing /usr/sbin/httpd f
rom getattr access on the file /foo/bar/index.html. For complete SELinux message
s. run sealert -l 26c7f536-5706-46d9-a149-77096e80ed2b
Jun 21 13:17:38 armitage setroubleshoot: SELinux is preventing /usr/sbin/httpd f
rom getattr access on the file /foo/bar/index.html. For complete SELinux message
s. run sealert -l 26c7f536-5706-46d9-a149-77096e80ed2b
Jun 21 13:17:39 armitage setroubleshoot: SELinux is preventing /usr/sbin/httpd f
rom getattr access on the file /foo/bar/index.html. For complete SELinux message
s. run sealert -l 26c7f536-5706-46d9-a149-77096e80ed2b
Jun 21 13:17:40 armitage setroubleshoot: SELinux is preventing /usr/sbin/httpd f
rom getattr access on the file /foo/bar/index.html. For complete SELinux message
s. run sealert -l 26c7f536-5706-46d9-a149-77096e80ed2b
[root@armitage ~]#


root@armitage:~
File Edit View Search Terminal Help
SELinux is preventing /usr/sbin/httpd from getattr access on the file /foo/bar/index.html.
***** Plugin catchall_labels (83.8 confidence) suggests **********
If you want to allow httpd to have getattr access on the index.html file
Then you need to change the label on /foo/bar/index.html
Do
semanage fcontext -a -t FILE_TYPE '/foo/bar/index.html'
where FILE_TYPE is one of the following: dirsrv_config_t, httpd_mediawiki_htaccess_t, fail2ban_var_lib_t, abrt_var_run_t, krb5_conf_t, udev_tbl_t, httpd_tmp_t, smokeping_var_lib_t, shell_exec_t, httpd_w3c_validator_htaccess_t, mysqld_etc_t, cvs_data_t, calamaris_www_t, dirsrvadmin_tmp_t, cobbler_etc_t, sysctl_crypto_t, httpd_cache_t, httpd_tmpfs_t, httpd_helper_exec_t, iso9660_t, dbusd_etc_t, dirsrv_share_t, var_lib_t, user_cron_spool_t, configfile, httpd_squirrelmail_t, cfengine_var_log_t, httpd_php_exec_t, httpd_nagios_htaccess_t, abrt_t, httpd_mediawiki_tmp_t, lib_t, samba_var_t, dirsrv_var_log_t, zarafa_var_lib_t, abrt_helper_exec_t, net_conf_t, ld_so_t, cert_type, etc_runtime_t, git_system_content_t, dirsrv_var_run_t, puppet_var_lib_t, public_content_t, httpd_var_lib_t, httpd_var_run_t, logfile, anon_inodefs_t, sysctl_kernel_t, httpd_modules_t, user_tmp_t, httpd_awstats_htaccess_t, httpd_dirsrvadmin_htaccess_t, textrel_shlib_t, httpd_user_htaccess_t, chroot_exec_t, httpd_sys_content_t, public_content_rw_t, httpd_suexec_exec_t, application_exec_type, httpd_bugzilla_htaccess_t, httpd_cobbler_htaccess
:

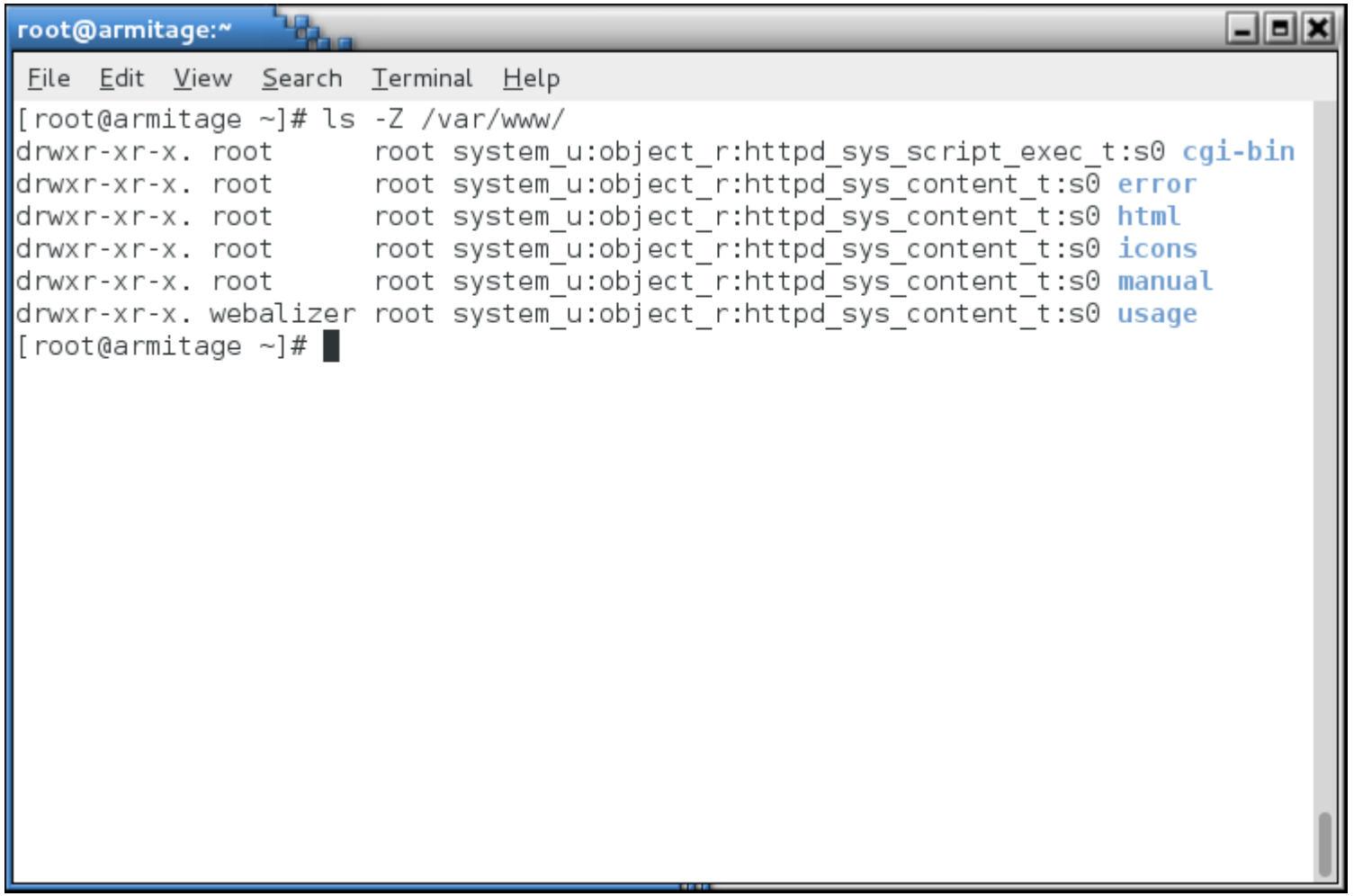
Real World Examples

- Note that at the end it tells you to restorecon!


root@armitage:~
File Edit View Search Terminal Help
stats_script_exec_t, httpd_dirsrvadmin_ra_content_t, httpd_dirsrvadmin_rw_conten
t_t, krb5_host_rcache_t, httpd_apcupsd_cgi_script_exec_t, httpd_dirsrvadmin_cont
ent_t, httpd_cobbler_content_t, httpd_squid_script_exec_t, httpd_w3c_validator_r
a_content_t, httpd_w3c_validator_rw_content_t, httpd_nagios_script_exec_t, nfs_t
, httpd_awstats_ra_content_t, httpd_awstats_rw_content_t, httpd_awstats_content_
t, httpd_user_ra_content_t, httpd_user_rw_content_t, httpd_bugzilla_script_exec_
t, httpdcontent, httpd_cobbler_ra_content_t, httpd_cobbler_rw_content_t.
Then execute:
restorecon -v '/foo/bar/index.html'
***** Plugin catchall (17.1 confidence) suggests **********
If you believe that httpd should be allowed getattr access on the index.html fil
e by default.
Then you should report this as a bug.
You can generate a local policy module to allow this access.
Do
allow this access for now by executing:
grep httpd /var/log/audit/audit.log | audit2allow -M mypol
semodule -i mypol.pp
(END)

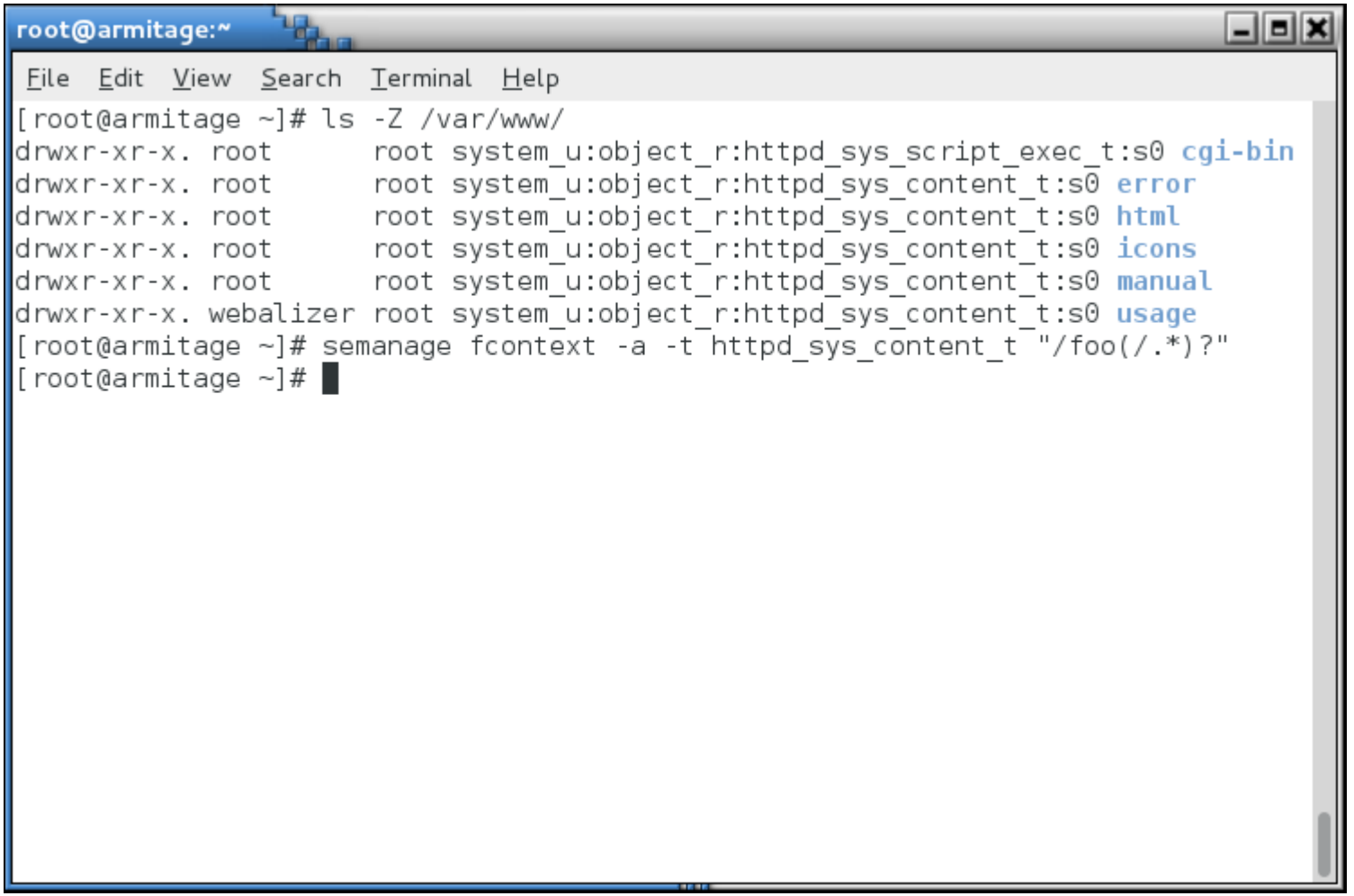
Real World Examples

- What directory should we look at to get the correct context label?


root@armitage:~
File Edit View Search Terminal Help
[root@armitage ~]# ls -Z /var/www/
drwxr-xr-x. root root system_u:object_r:httpd_sys_script_exec_t:s0 cgi-bin
drwxr-xr-x. root root system_u:object_r:httpd_sys_content_t:s0 error
drwxr-xr-x. root root system_u:object_r:httpd_sys_content_t:s0 html
drwxr-xr-x. root root system_u:object_r:httpd_sys_content_t:s0 icons
drwxr-xr-x. root root system_u:object_r:httpd_sys_content_t:s0 manual
drwxr-xr-x. webalizer root system_u:object_r:httpd_sys_content_t:s0 usage
[root@armitage ~]#

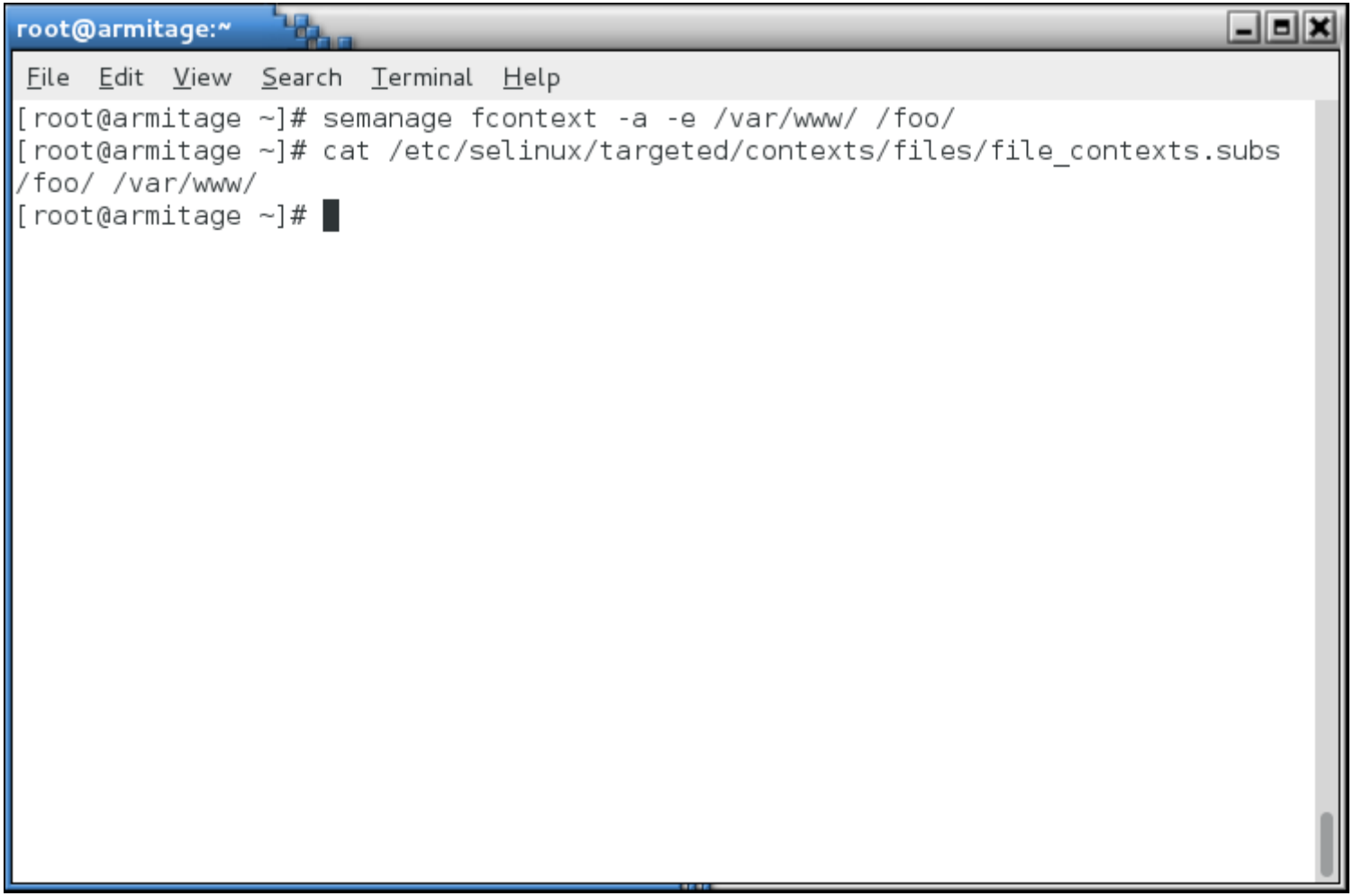
Real World Examples

- We actually want **all** of the files under /foo to have the right context, so we'll use a regular expression (you can get the syntax from /etc/selinux/targeted/contexts/files/file_contexts):


root@armitage:~
File Edit View Search Terminal Help
[root@armitage ~]# ls -Z /var/www/
drwxr-xr-x. root root system_u:object_r:httpd_sys_script_exec_t:s0 cgi-bin
drwxr-xr-x. root root system_u:object_r:httpd_sys_content_t:s0 error
drwxr-xr-x. root root system_u:object_r:httpd_sys_content_t:s0 html
drwxr-xr-x. root root system_u:object_r:httpd_sys_content_t:s0 icons
drwxr-xr-x. root root system_u:object_r:httpd_sys_content_t:s0 manual
drwxr-xr-x. webalizer root system_u:object_r:httpd_sys_content_t:s0 usage
[root@armitage ~]# semanage fcontext -a -t httpd_sys_content_t "/foo(/.*)?"
[root@armitage ~]#

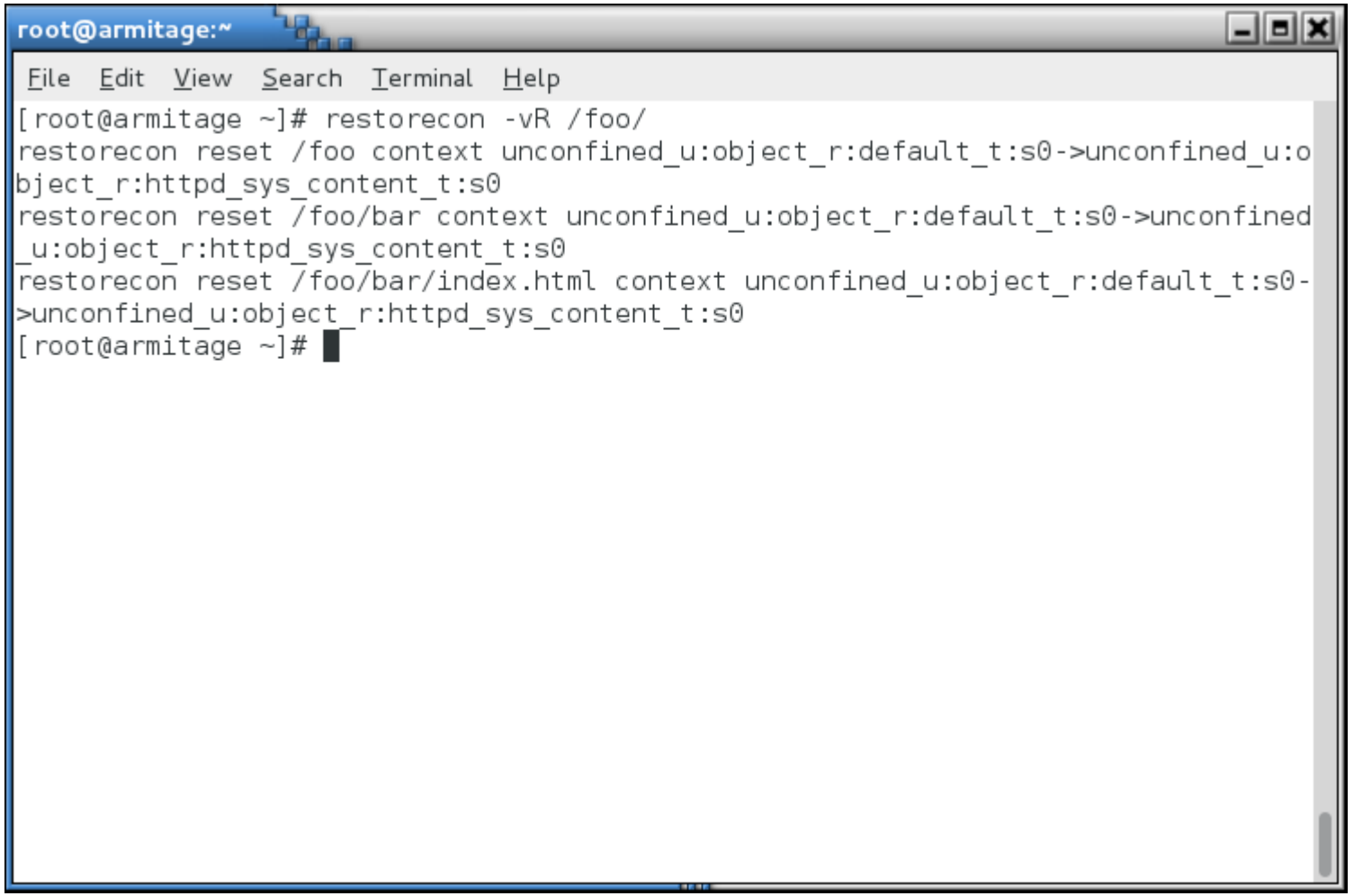
Real World Examples

- Or, if you're like me (lazy), you can use the -e (equals) argument to semanage fcontext:


root@armitage:~
File Edit View Search Terminal Help
[root@armitage ~]# semanage fcontext -a -e /var/www/ /foo/
[root@armitage ~]# cat /etc/selinux/targeted/contexts/files/file_contexts.subs
/foo/ /var/www/
[root@armitage ~]#

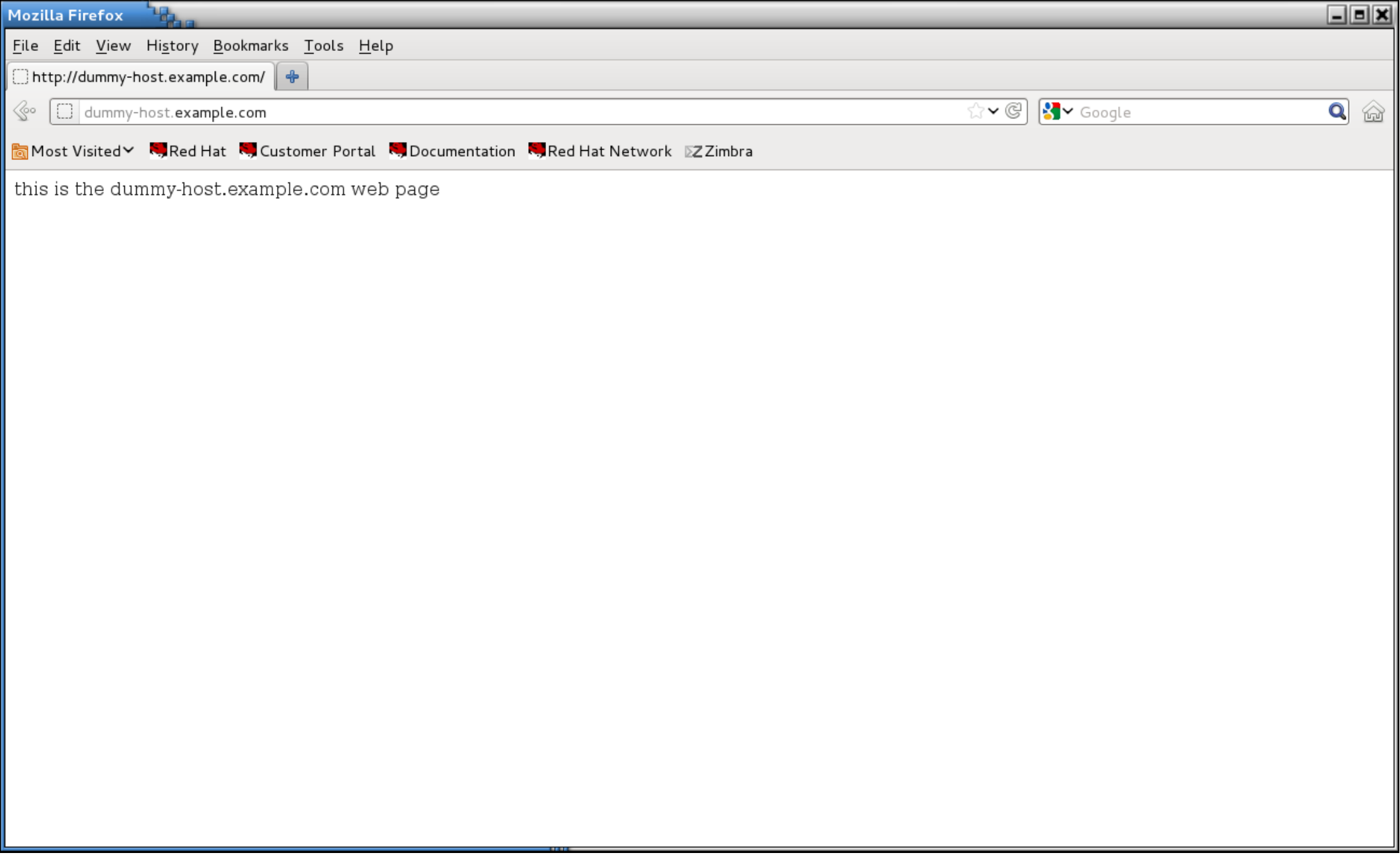
Real World Examples

- Now run restorecon against the directory:


root@armitage:~
File Edit View Search Terminal Help
[root@armitage ~]# restorecon -vR /foo/
restorecon reset /foo context unconfined_u:object_r:default_t:s0->unconfined_u:object_r:httpd_sys_content_t:s0
restorecon reset /foo/bar context unconfined_u:object_r:default_t:s0->unconfined_u:object_r:httpd_sys_content_t:s0
restorecon reset /foo/bar/index.html context unconfined_u:object_r:default_t:s0->unconfined_u:object_r:httpd_sys_content_t:s0
[root@armitage ~]#

Real World Examples

- Test the site:



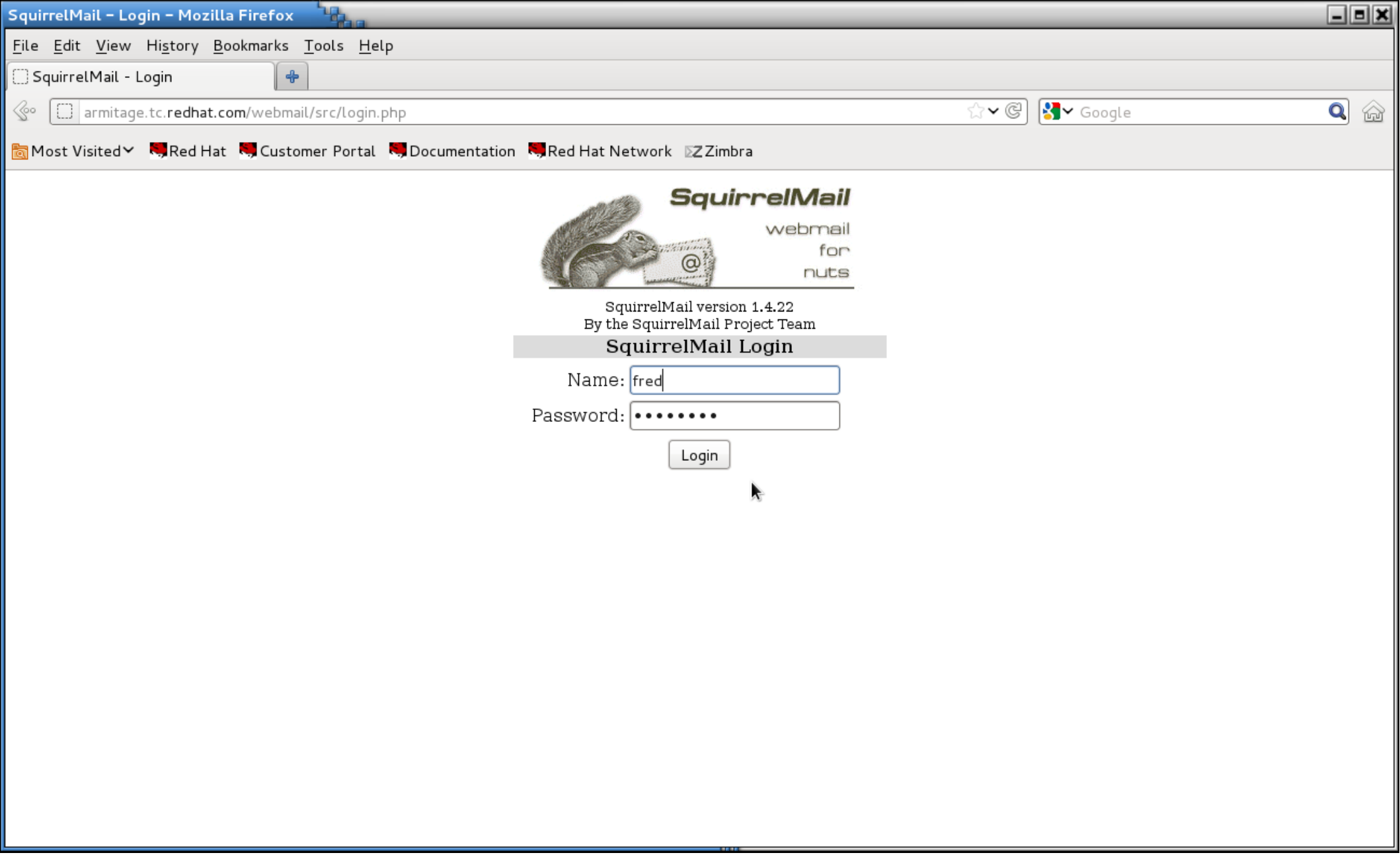
Creating Policy Modules

Creating Policy Modules

- In the case that a boolean or labeling does not fix your issue, you might have to create a policy module.

Creating Policy Modules

- In this example, I want to install squirrelmail on a RHEL 6.3 mail server.



SquirrelMail – Error connecting to IMAP server: localhost. – Mozilla Firefox

File Edit View History Bookmarks Tools Help

SquirrelMail - Error connecting ...

armitage.tc.redhat.com/webmail/src/redirect.php

Google

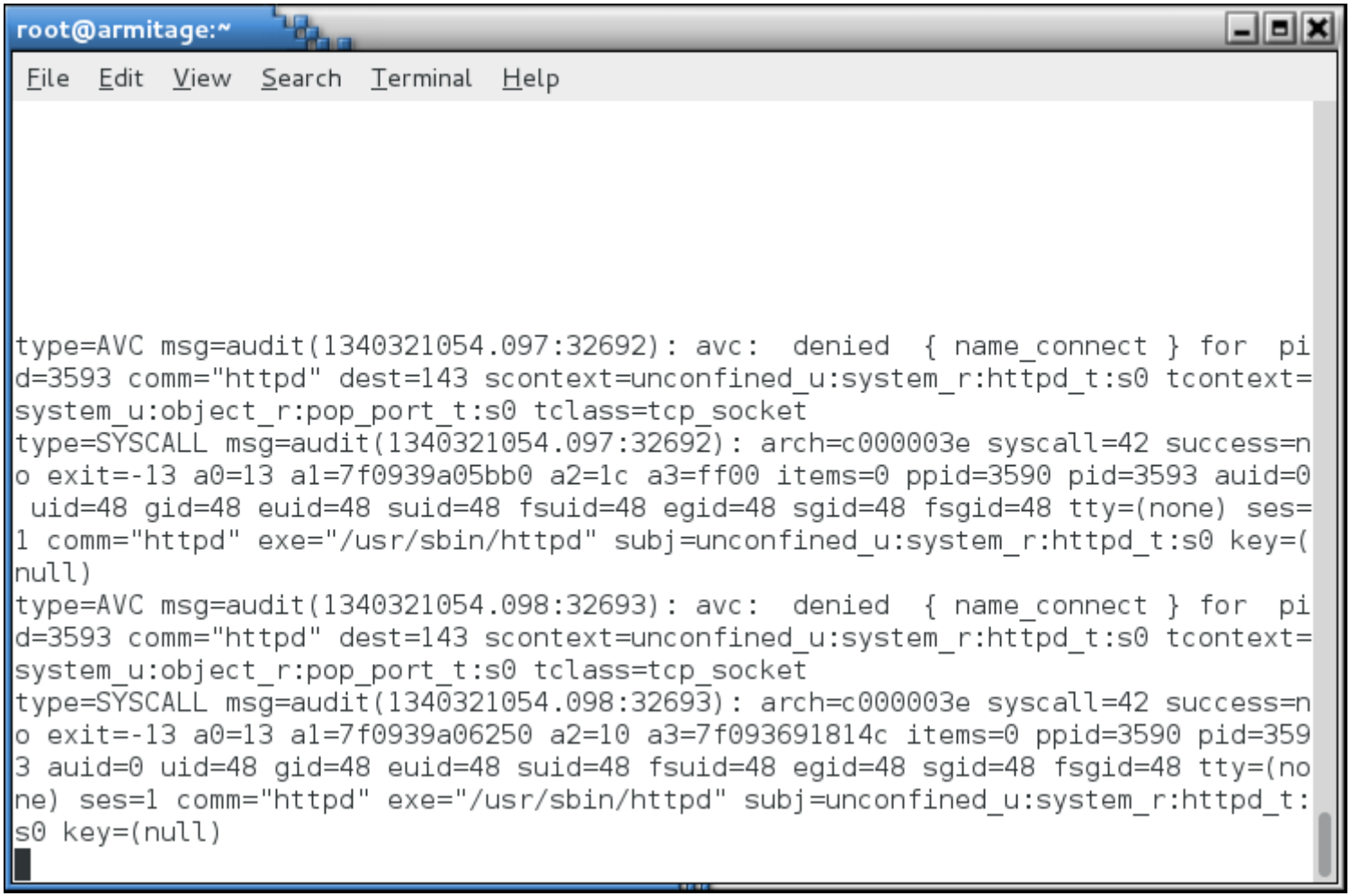
Most Visited Red Hat Customer Portal Documentation Red Hat Network Zimbra

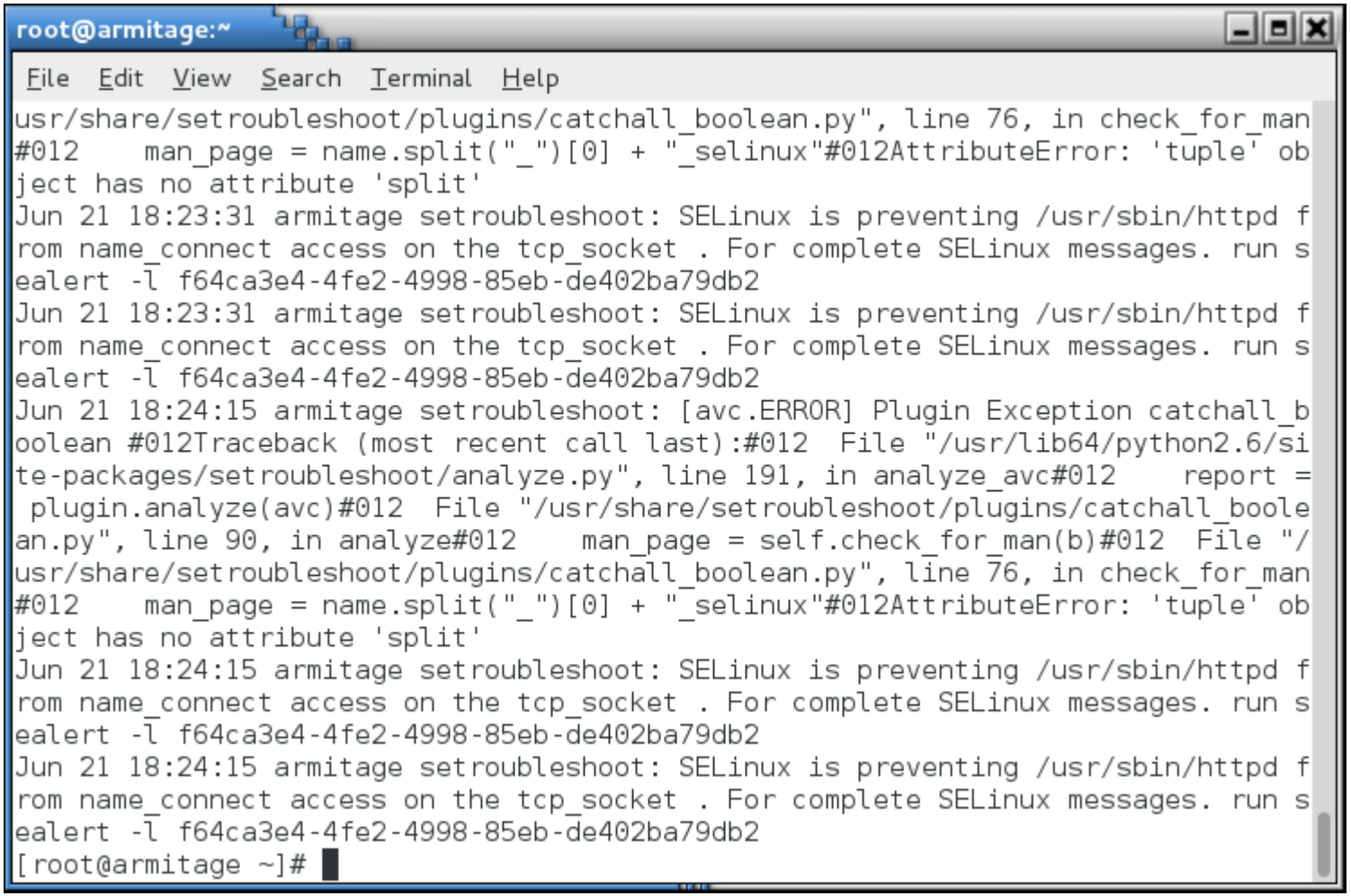
SquirrelMail version 1.4.22
By the SquirrelMail Project Team

ERROR

Error connecting to IMAP server: localhost.
13 : Permission denied

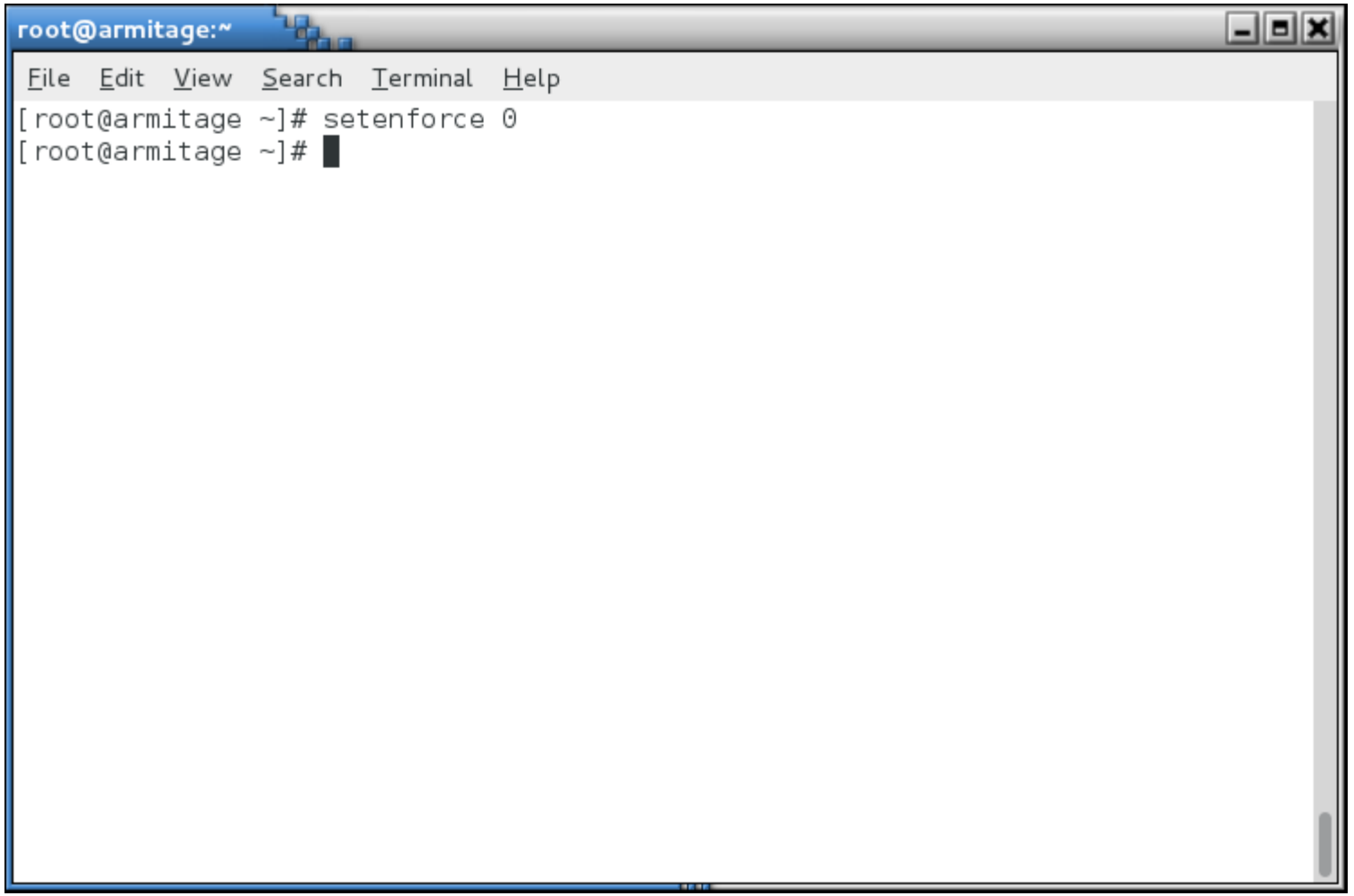
Go to the login page

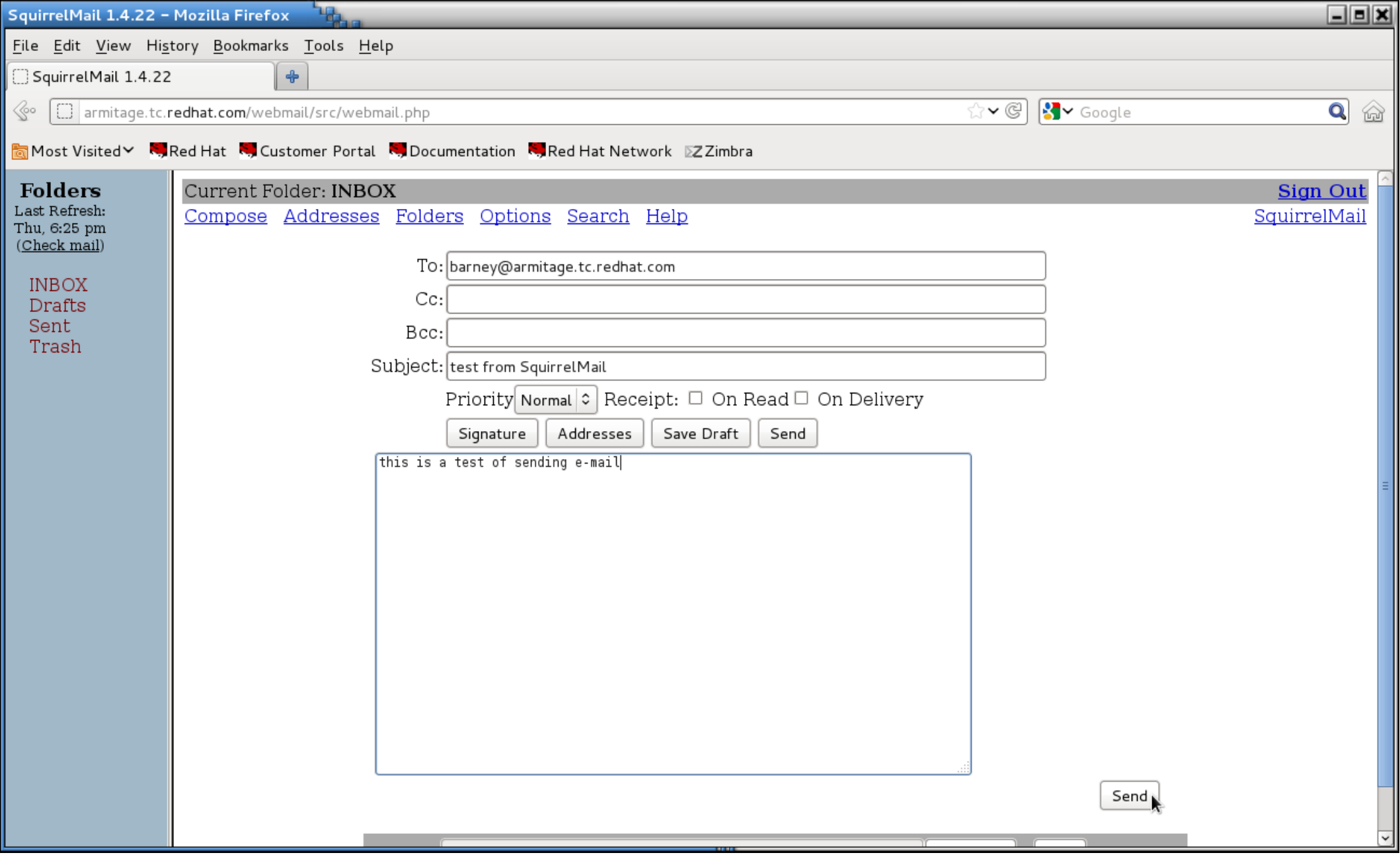

root@armitage:~
File Edit View Search Terminal Help
type=AVC msg=audit(1340321054.097:32692): avc: denied { name_connect } for pi
d=3593 comm="httpd" dest=143 scontext=unconfined_u:system_r:httpd_t:s0 tcontext=
system_u:object_r:pop_port_t:s0 tclass=tcp_socket
type=SYSCALL msg=audit(1340321054.097:32692): arch=c000003e syscall=42 success=n
o exit=-13 a0=13 a1=7f0939a05bb0 a2=1c a3=ff00 items=0 ppid=3590 pid=3593 auid=0
uid=48 gid=48 euid=48 suid=48 fsuid=48 egid=48 sgid=48 fsgid=48 tty=(none) ses=
1 comm="httpd" exe="/usr/sbin/httpd" subj=unconfined_u:system_r:httpd_t:s0 key=(
null)
type=AVC msg=audit(1340321054.098:32693): avc: denied { name_connect } for pi
d=3593 comm="httpd" dest=143 scontext=unconfined_u:system_r:httpd_t:s0 tcontext=
system_u:object_r:pop_port_t:s0 tclass=tcp_socket
type=SYSCALL msg=audit(1340321054.098:32693): arch=c000003e syscall=42 success=n
o exit=-13 a0=13 a1=7f0939a06250 a2=10 a3=7f093691814c items=0 ppid=3590 pid=359
3 auid=0 uid=48 gid=48 euid=48 suid=48 fsuid=48 egid=48 sgid=48 fsgid=48 tty=(no
ne) ses=1 comm="httpd" exe="/usr/sbin/httpd" subj=unconfined_u:system_r:httpd_t:
s0 key=(null)

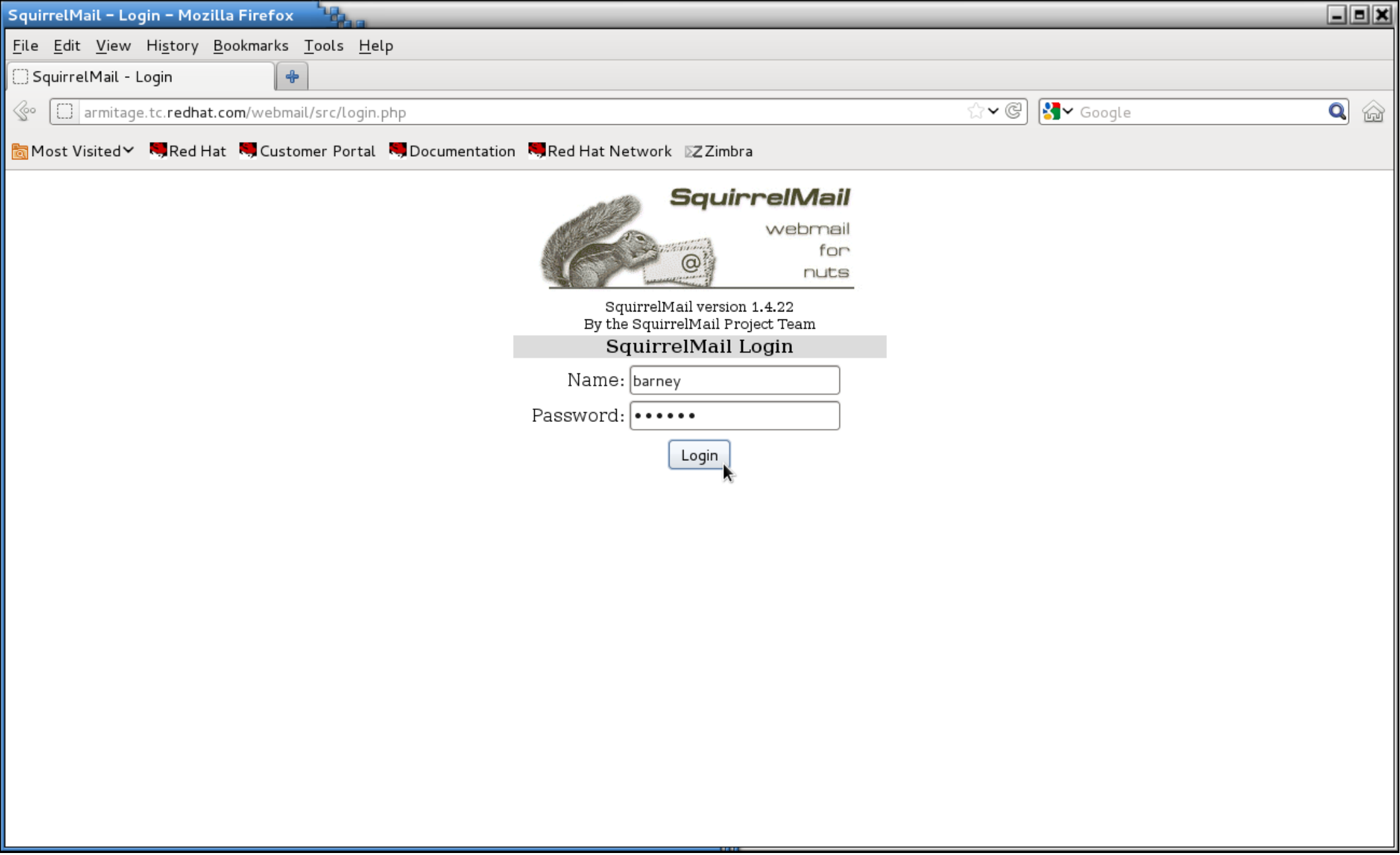

root@armitage:~
File Edit View Search Terminal Help
usr/share/setroubleshoot/plugins/catchall_boolean.py", line 76, in check_for_man
#012   man_page = name.split("_")[0] + "_selinux"#012AttributeError: 'tuple' ob
ject has no attribute 'split'
Jun 21 18:23:31 armitage setroubleshoot: SELinux is preventing /usr/sbin/httpd f
rom name_connect access on the tcp_socket . For complete SELinux messages. run s
ealert -l f64ca3e4-4fe2-4998-85eb-de402ba79db2
Jun 21 18:23:31 armitage setroubleshoot: SELinux is preventing /usr/sbin/httpd f
rom name_connect access on the tcp_socket . For complete SELinux messages. run s
ealert -l f64ca3e4-4fe2-4998-85eb-de402ba79db2
Jun 21 18:24:15 armitage setroubleshoot: [avc.ERROR] Plugin Exception catchall_b
oolean #012Traceback (most recent call last):#012 File "/usr/lib64/python2.6/si
te-packages/setroubleshoot/analyze.py", line 191, in analyze_avc#012   report =
 plugin.analyze(avc)#012 File "/usr/share/setroubleshoot/plugins/catchall_boole
an.py", line 90, in analyze#012   man_page = self.check_for_man(b)#012 File "/
usr/share/setroubleshoot/plugins/catchall_boolean.py", line 76, in check_for_man
#012   man_page = name.split("_")[0] + "_selinux"#012AttributeError: 'tuple' ob
ject has no attribute 'split'
Jun 21 18:24:15 armitage setroubleshoot: SELinux is preventing /usr/sbin/httpd f
rom name_connect access on the tcp_socket . For complete SELinux messages. run s
ealert -l f64ca3e4-4fe2-4998-85eb-de402ba79db2
Jun 21 18:24:15 armitage setroubleshoot: SELinux is preventing /usr/sbin/httpd f
rom name_connect access on the tcp_socket . For complete SELinux messages. run s
ealert -l f64ca3e4-4fe2-4998-85eb-de402ba79db2
[root@armitage ~]#

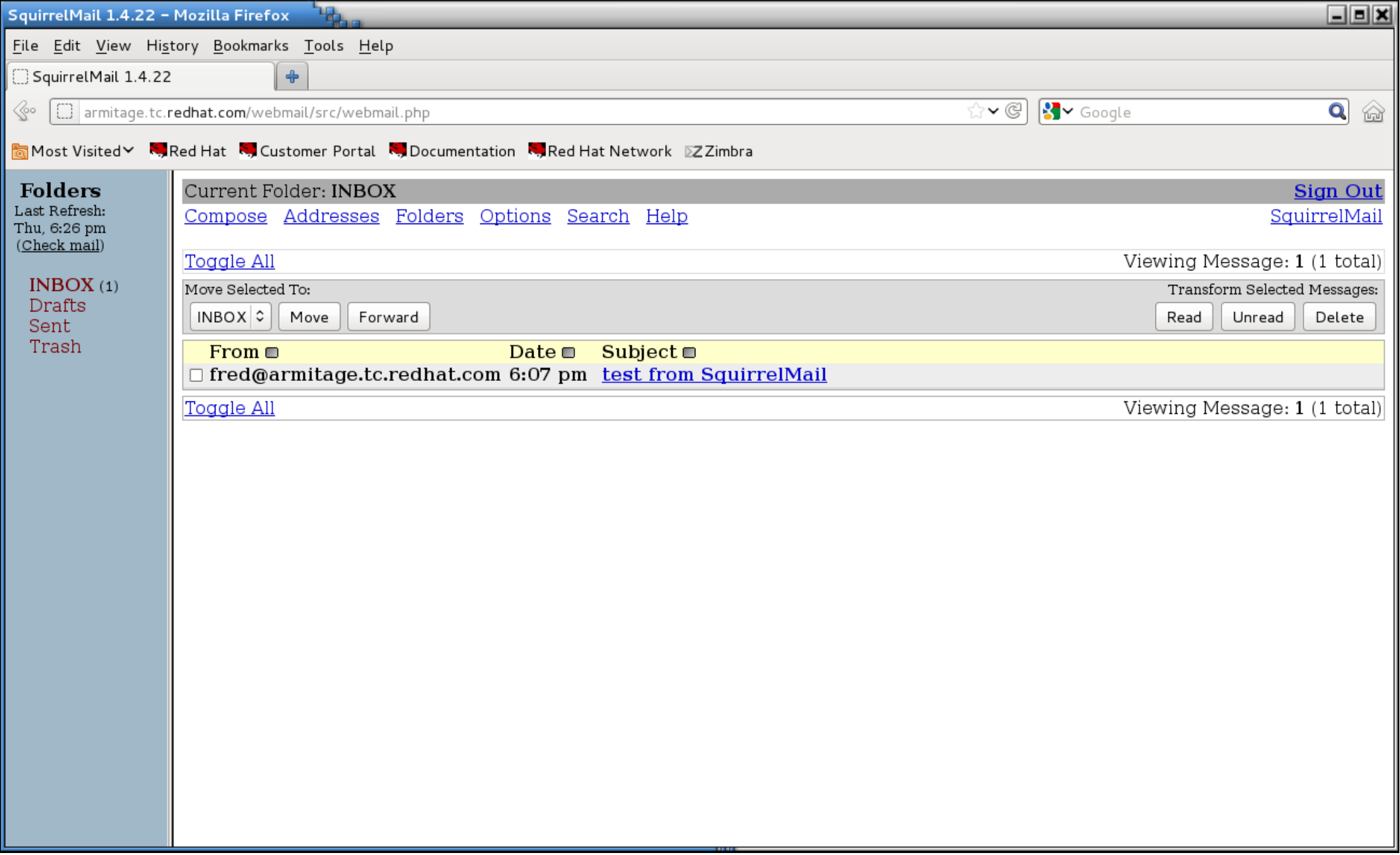
Creating Policy Modules

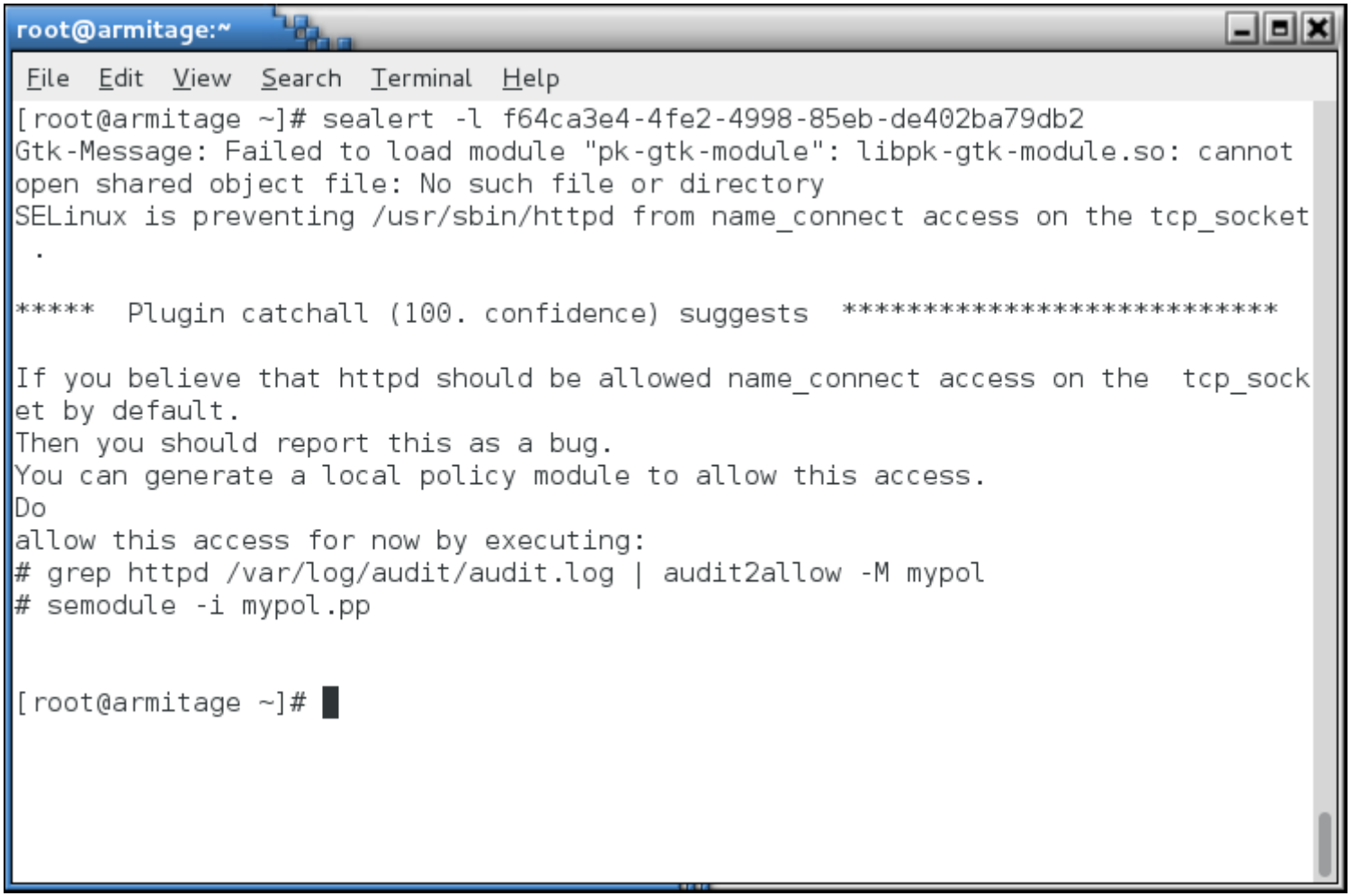
- Now that I know there is an SELinux issue, I set SELinux enforcement to “permissive” and then run the application through all its paces. In this case, sending and receiving mail.
- This will log denials but not act on them. If you don't do this, you'll fix one, trigger a second, fix the second, trigger a third, etc. It's easier to run the app in permissive mode and catch **all** of them.

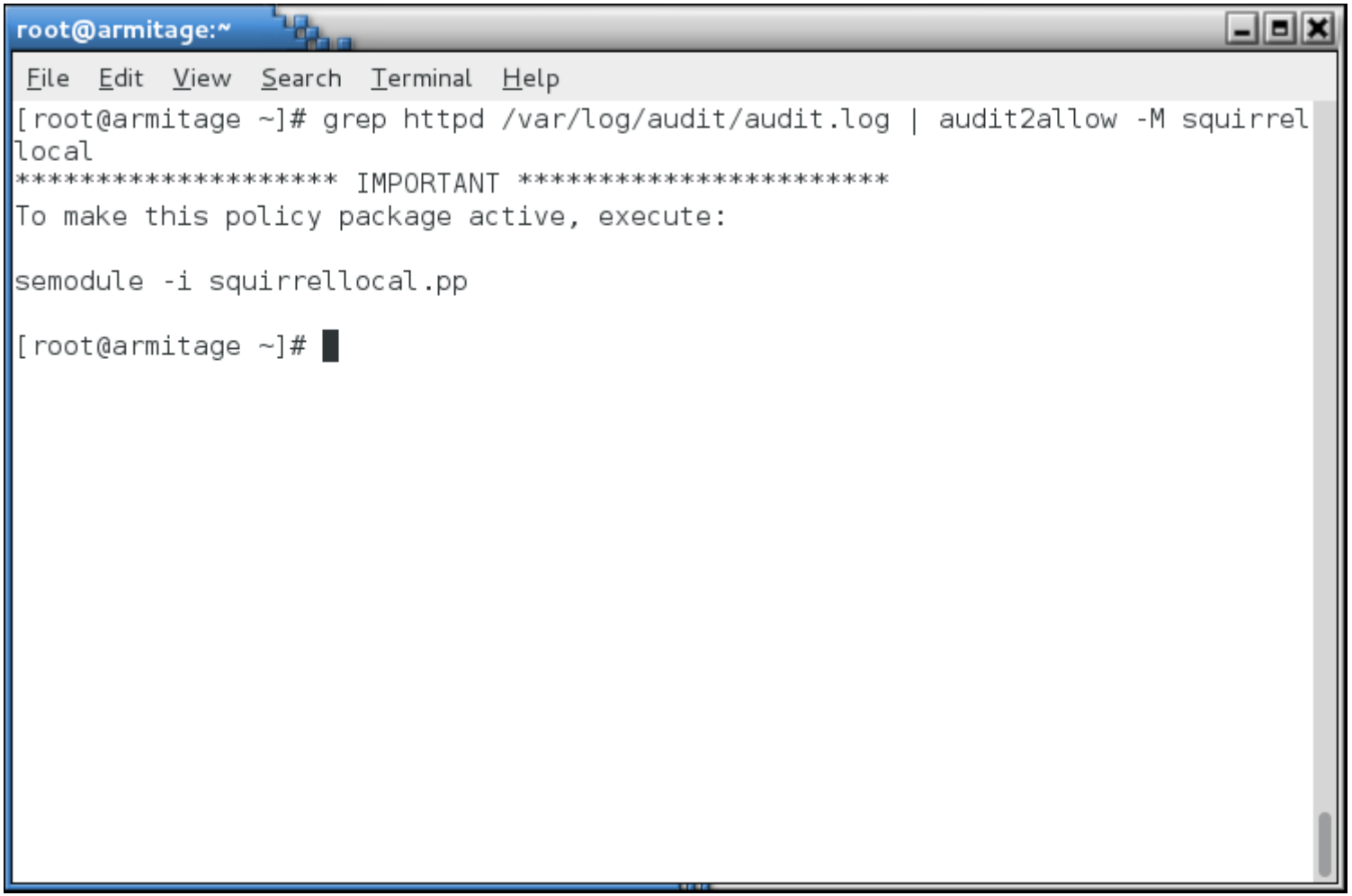

root@armitage:~
File Edit View Search Terminal Help
[root@armitage ~]# setenforce 0
[root@armitage ~]#





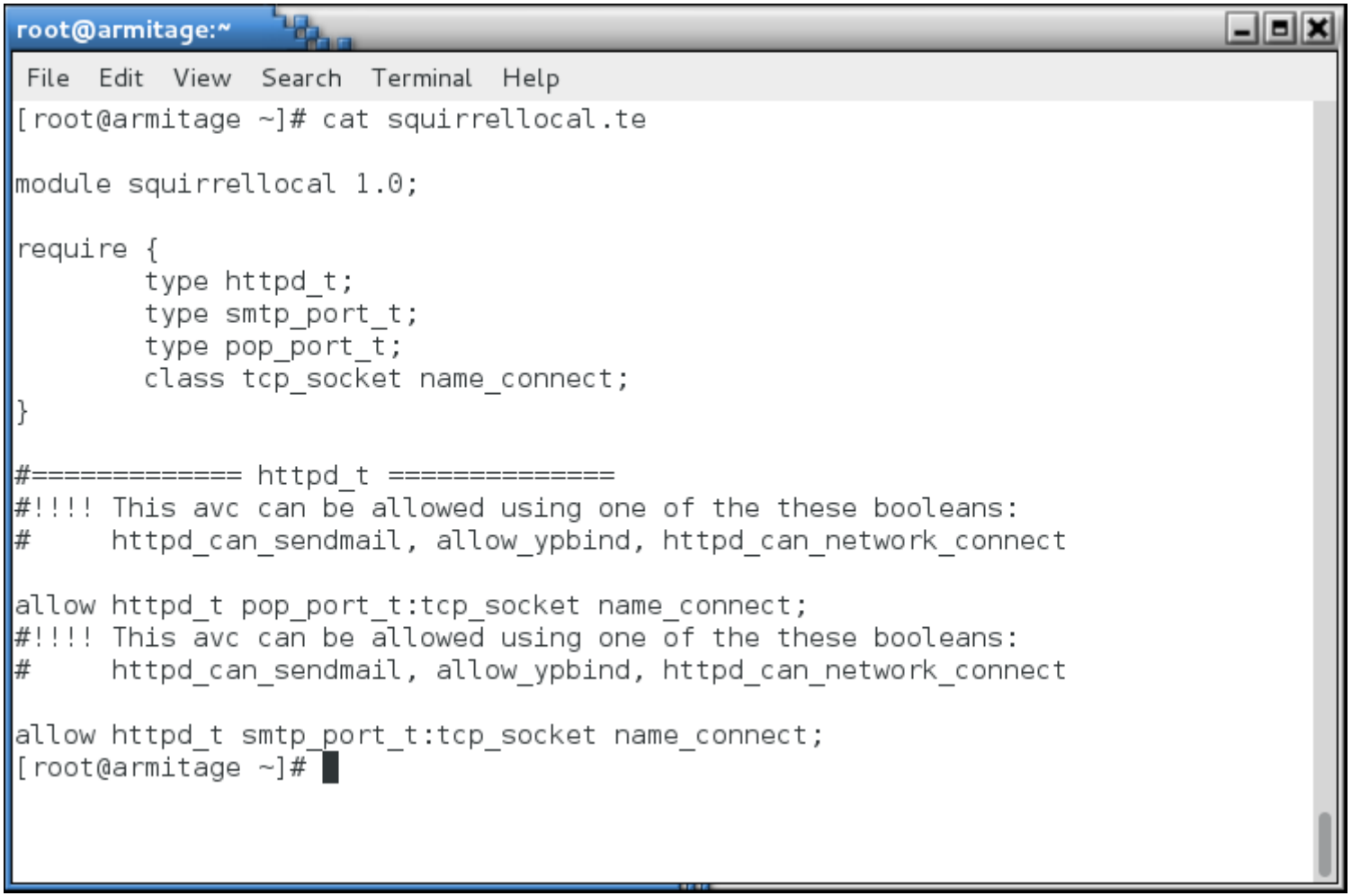


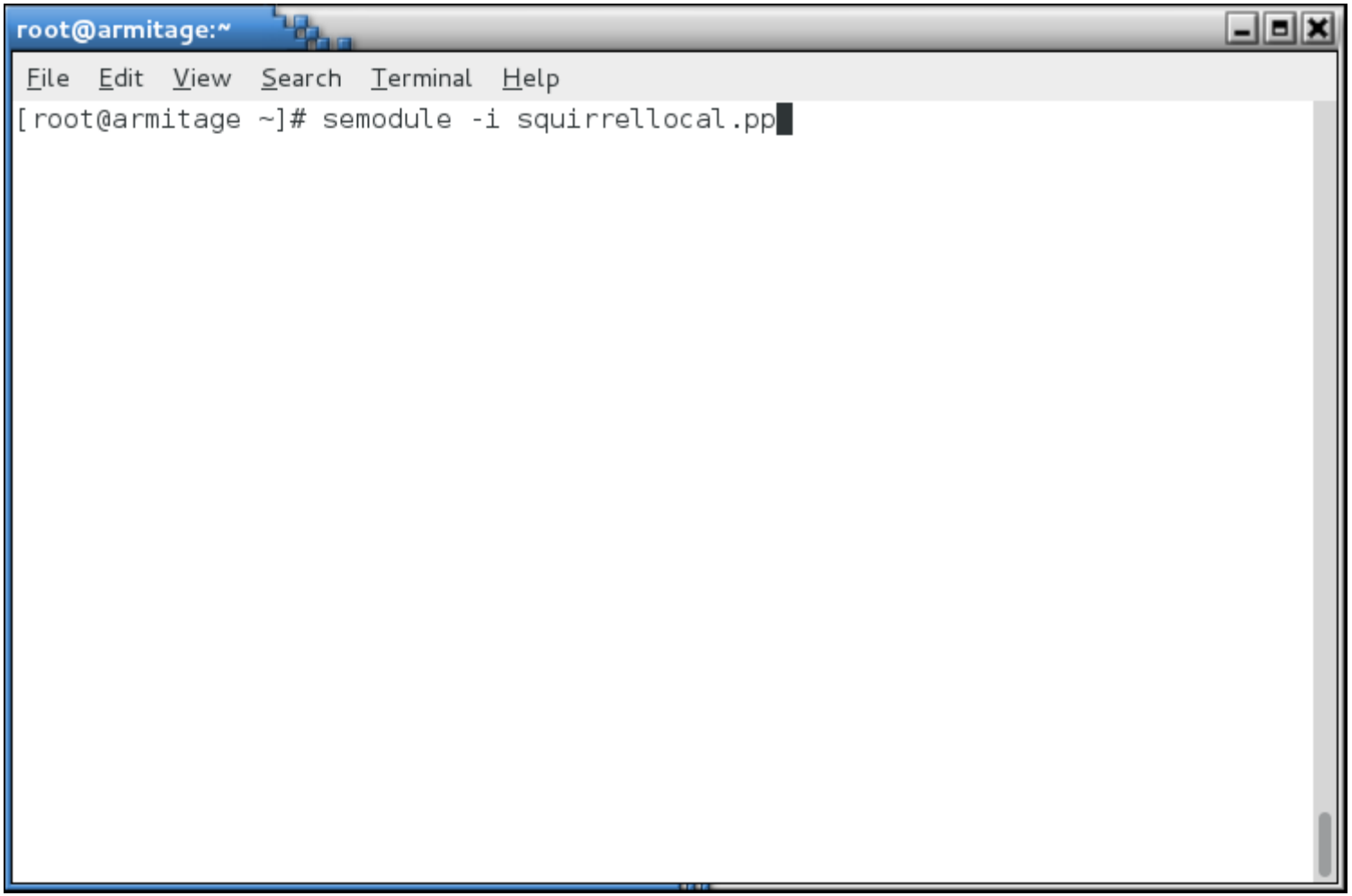

root@armitage:~
File Edit View Search Terminal Help
[root@armitage ~]# sealert -l f64ca3e4-4fe2-4998-85eb-de402ba79db2
Gtk-Message: Failed to load module "pk-gtk-module": libpk-gtk-module.so: cannot
open shared object file: No such file or directory
SELinux is preventing /usr/sbin/httpd from name_connect access on the tcp_socket
.
***** Plugin catchall (100. confidence) suggests **********
If you believe that httpd should be allowed name_connect access on the tcp_sock
et by default.
Then you should report this as a bug.
You can generate a local policy module to allow this access.
Do
allow this access for now by executing:
grep httpd /var/log/audit/audit.log | audit2allow -M mypol
semodule -i mypol.pp
[root@armitage ~]#

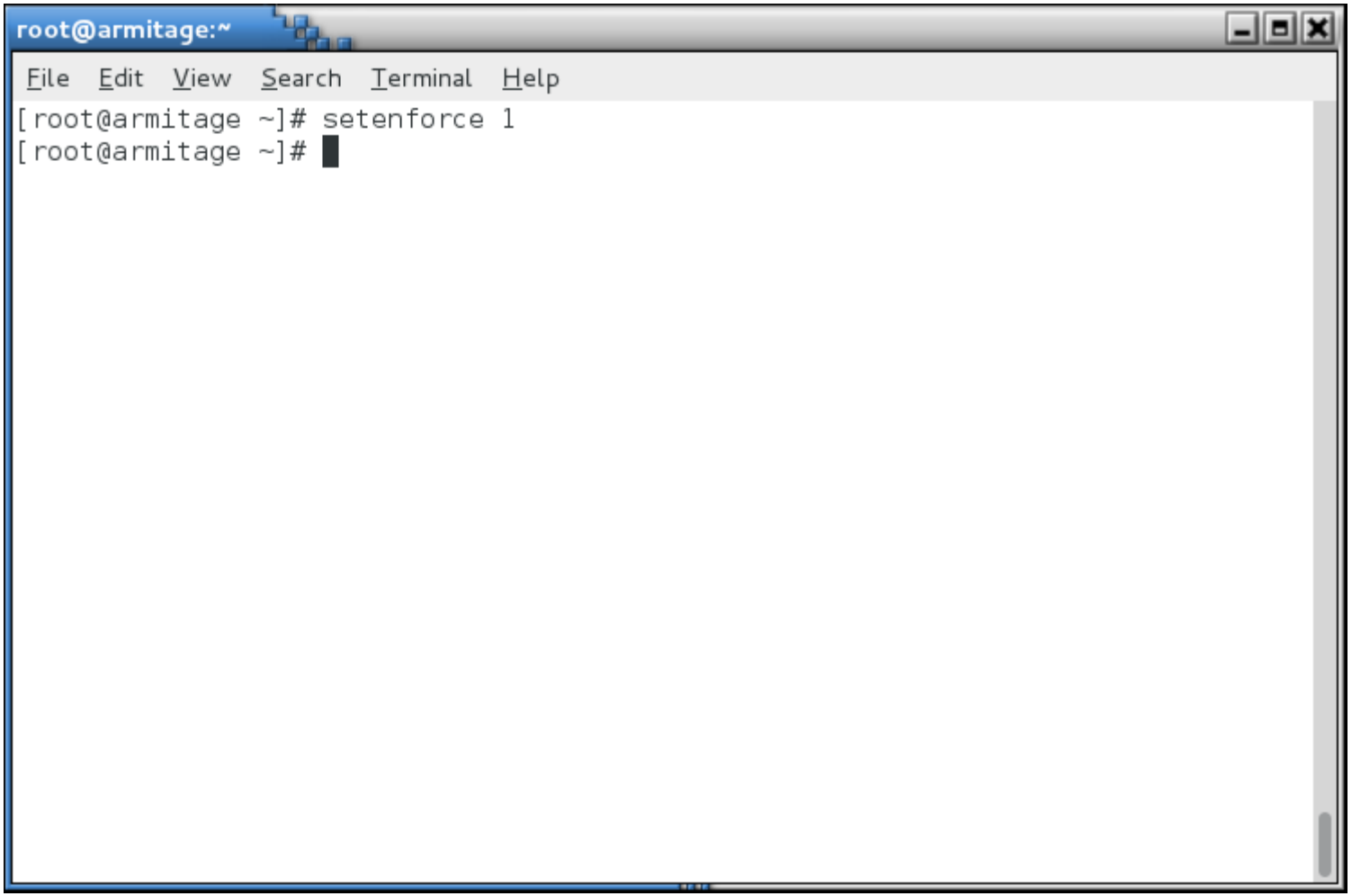

root@armitage:~
File Edit View Search Terminal Help
[root@armitage ~]# grep httpd /var/log/audit/audit.log | audit2allow -M squirrel
local
********************** IMPORTANT ************************
To make this policy package active, execute:
semodule -i squirrellocal.pp
[root@armitage ~]#

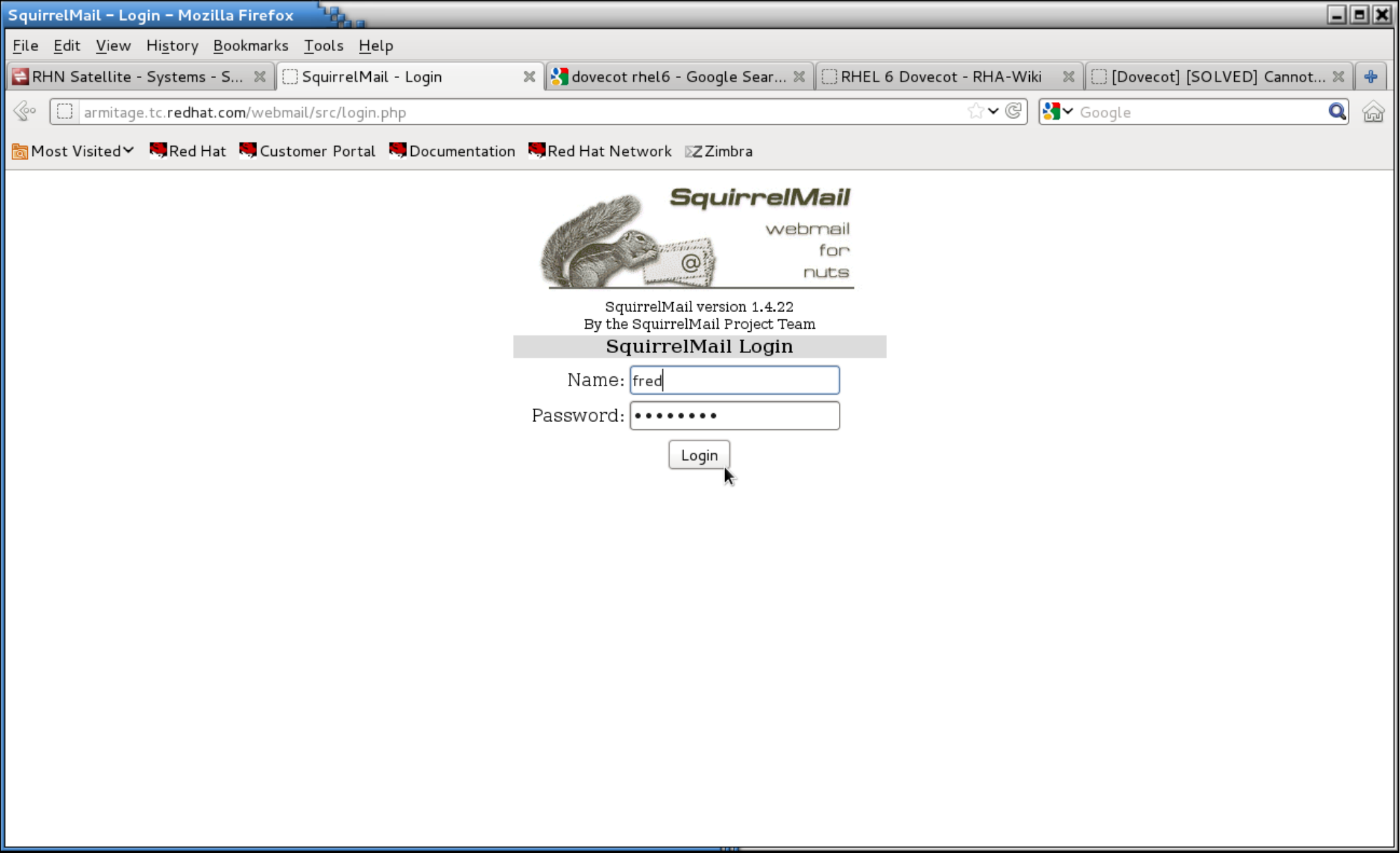
Note

- Actually, this error **could** be fixed by setting a boolean. I am just creating a policy module so you can see it being done.


root@armitage:~
File Edit View Search Terminal Help
[root@armitage ~]# cat squirrellocal.te
module squirrellocal 1.0;
require {
type httpd_t;
type smtp_port_t;
type pop_port_t;
class tcp_socket name_connect;
}
#============= httpd_t ==============
#!!!! This avc can be allowed using one of the these booleans:
httpd_can_sendmail, allow_ypbind, httpd_can_network_connect
allow httpd_t pop_port_t:tcp_socket name_connect;
#!!!! This avc can be allowed using one of the these booleans:
httpd_can_sendmail, allow_ypbind, httpd_can_network_connect
allow httpd_t smtp_port_t:tcp_socket name_connect;
[root@armitage ~]#


root@armitage:~
File Edit View Search Terminal Help
[root@armitage ~]# semodule -i squirrellocal.pp


root@armitage:~
File Edit View Search Terminal Help
[root@armitage ~]# setenforce 1
[root@armitage ~]#



SquirrelMail 1.4.22 - Mozilla Firefox

File Edit View History Bookmarks Tools Help

RHN Satellite - Systems - S... | SquirrelMail 1.4.22 | dovecot rhel6 - Google Sear... | RHEL 6 Dovecot - RHA-Wiki | [Dovecot] [SOLVED] Cannot...

armitage.tc.redhat.com/webmail/src/webmail.php

Google

Most Visited | Red Hat | Customer Portal | Documentation | Red Hat Network | Zimbra

Folders
Last Refresh:
Thu, 6:18 pm
(Check mail)

INBOX
Drafts
Sent
Trash

Current Folder: INBOX

Sign Out

Compose Addresses Folders Options Search Help

SquirrelMail

Move Selected To:

INBOX | Move | Forward

Transform Selected Messages:

Read | Unread | Delete

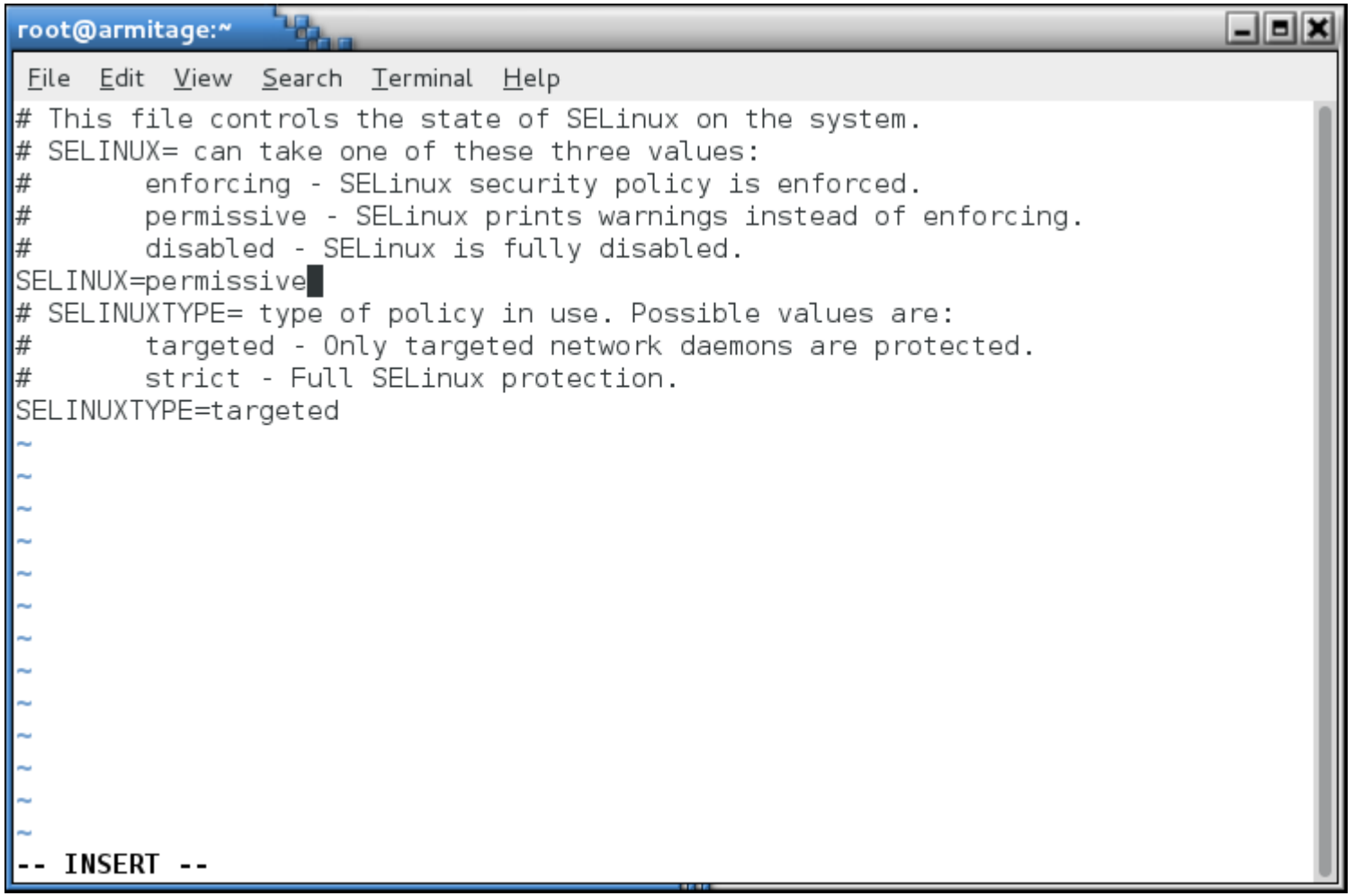
From	Date	Subject

THIS FOLDER IS EMPTY

Enabling SELinux

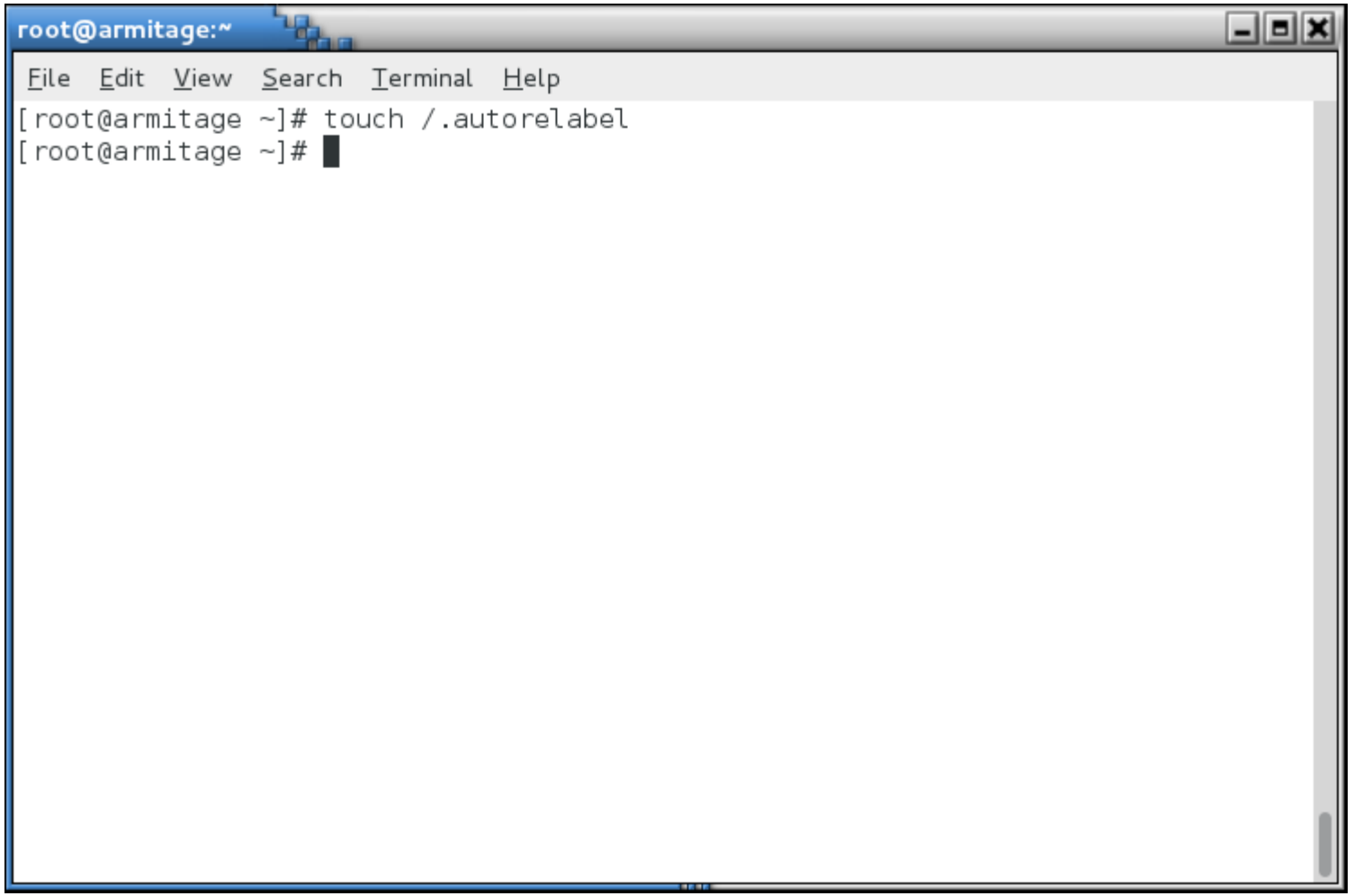
Enabling SELinux

- To enable SELinux on a system, edit /etc/selinux/config and set SELINUX=permissive
- Do not set it to enforcing, as it will more than likely hang at boot time.


root@armitage:~
File Edit View Search Terminal Help
# This file controls the state of SELinux on the system.
# SELINUX= can take one of these three values:
#   enforcing - SELinux security policy is enforced.
#   permissive - SELinux prints warnings instead of enforcing.
#   disabled - SELinux is fully disabled.
SELINUX=permissive
# SELINUXTYPE= type of policy in use. Possible values are:
#   targeted - Only targeted network daemons are protected.
#   strict - Full SELinux protection.
SELINUXTYPE=targeted
~
~
~
~
~
~
~
~
~
~
~
~
~
~
-- INSERT --

Enabling SELinux

- Then create a file in the root of the filesystem called .autorelabel


root@armitage:~
File Edit View Search Terminal Help
[root@armitage ~]# touch /.autorelabel
[root@armitage ~]#

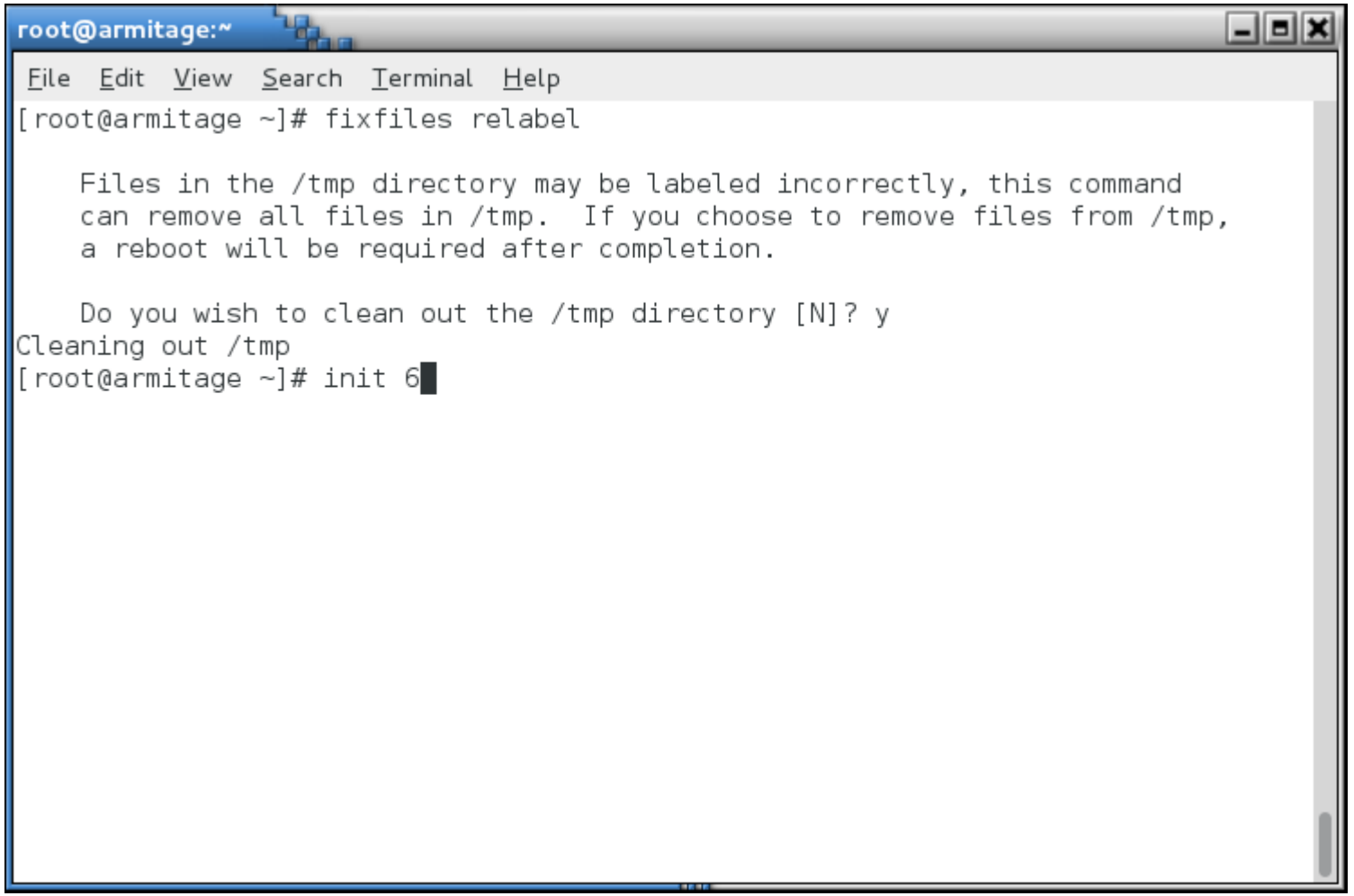
Enabling SELinux

- Reboot, and the system will relabel the filesystem.

```
                                                           [  OK  ]
Checking filesystems
/dev/vda3: clean, 34262/1234576 files, 348839/4935424 blocks
/dev/vda1: clean, 38/51200 files, 34415/204800 blocks
                                                           [  OK  ]
Remounting root filesystem in read-write mode:             [  OK  ]
Mounting local filesystems:                                [  OK  ]
Enabling local filesystem quotas:                          [  OK  ]
                Welcome to Red Hat Enterprise Linux Server
Starting udev:                                             [  OK  ]
Setting hostname localhost:                                [  OK  ]
Setting up Logical Volume Management:   No volume groups found
                                                           [  OK  ]
Checking filesystems
/dev/vda3: clean, 34262/1234576 files, 348839/4935424 blocks
/dev/vda1: clean, 38/51200 files, 34415/204800 blocks
                                                           [  OK  ]
Remounting root filesystem in read-write mode:             [  OK  ]
Mounting local filesystems:                                [  OK  ]
Enabling local filesystem quotas:                          [  OK  ]

*** Warning -- SELinux targeted policy relabel is required.
*** Relabeling could take a very long time, depending on file
*** system size and speed of hard drives.
*****************************_
```


Enabling SELinux

- You can also run fixfiles relabel.
  - Don't do it in runlevel 5 - it deletes everything in /tmp and your X font server will get **real** cranky about that.
- Reboot after it's done.


root@armitage:~
File Edit View Search Terminal Help
[root@armitage ~]# fixfiles relabel
Files in the /tmp directory may be labeled incorrectly, this command
can remove all files in /tmp. If you choose to remove files from /tmp,
a reboot will be required after completion.
Do you wish to clean out the /tmp directory [N]? y
Cleaning out /tmp
[root@armitage ~]# init 6

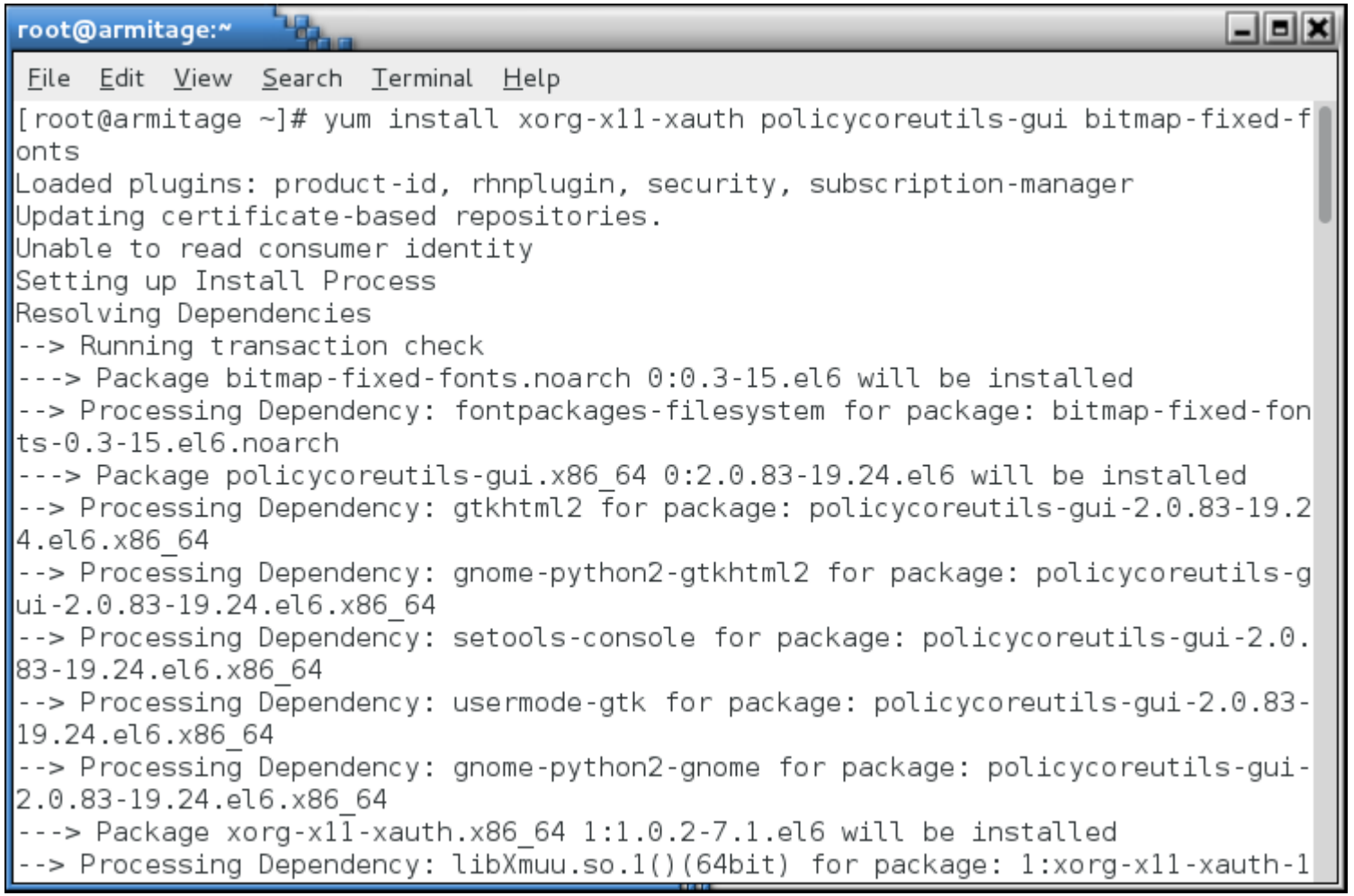
Enabling SELinux

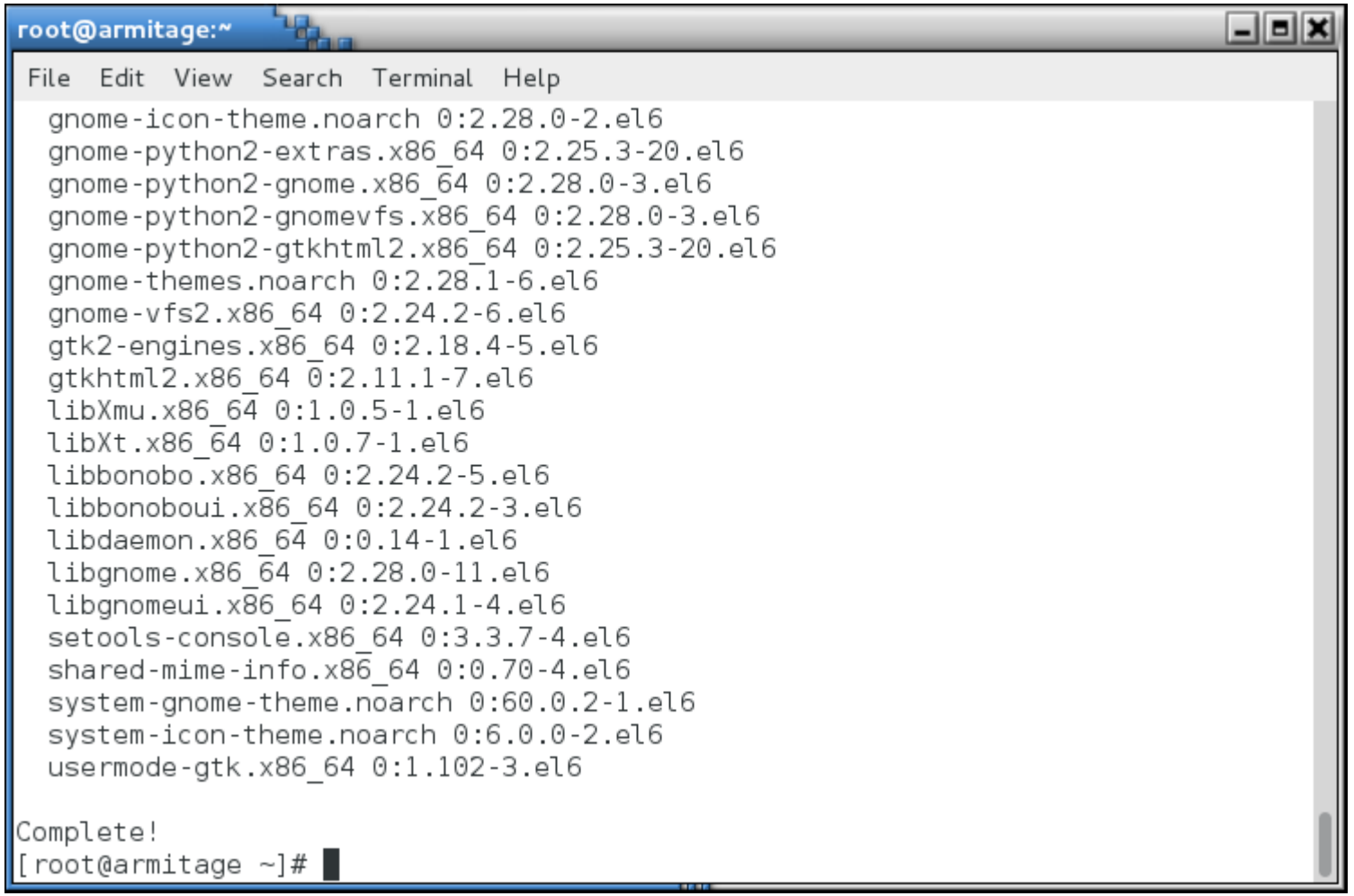
- After everything is relabeled, then set it to enforcing in /etc/selinux/config and reboot or run setenforce 1.

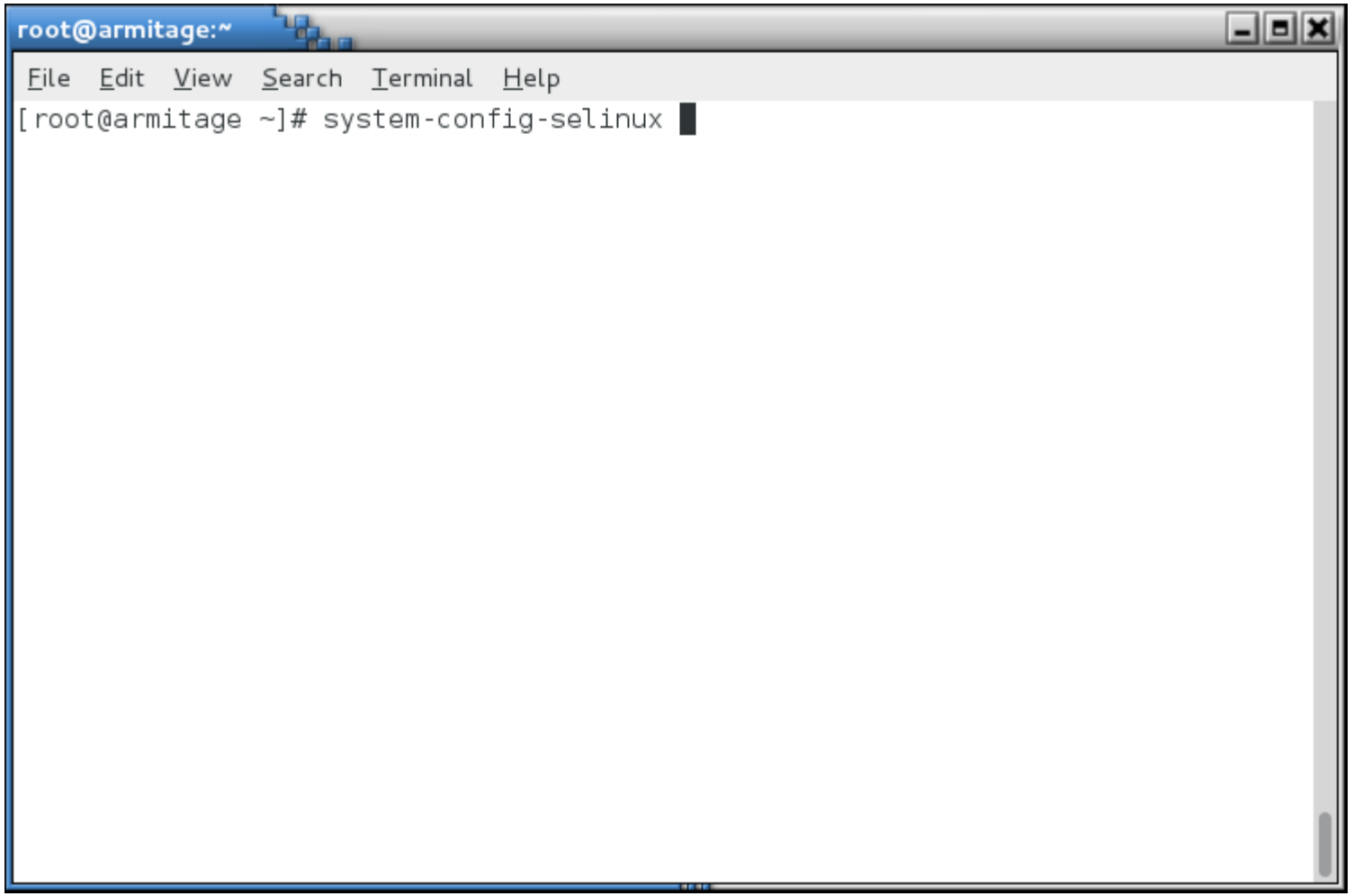
Graphical Tools

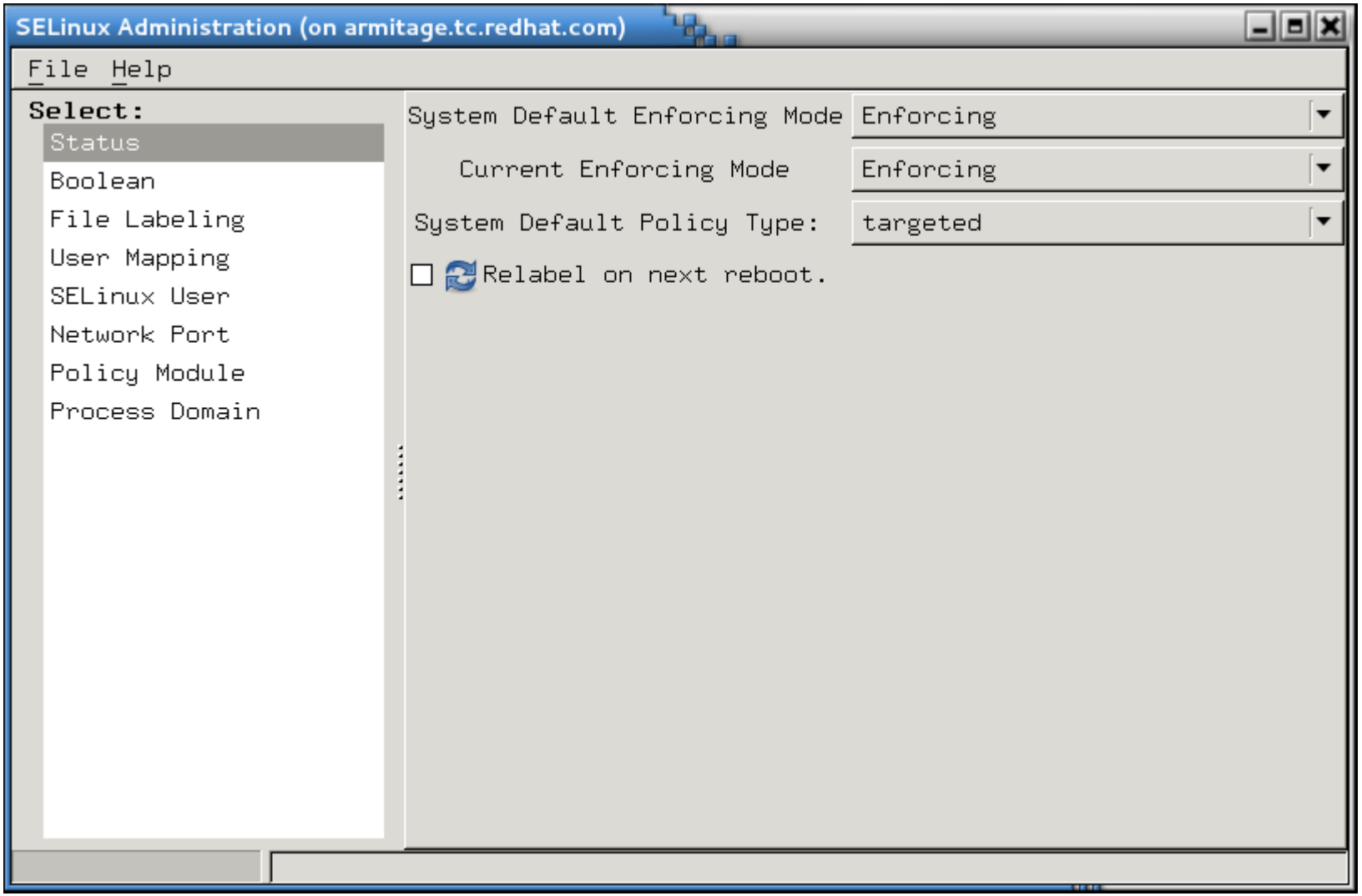
Graphical Tools

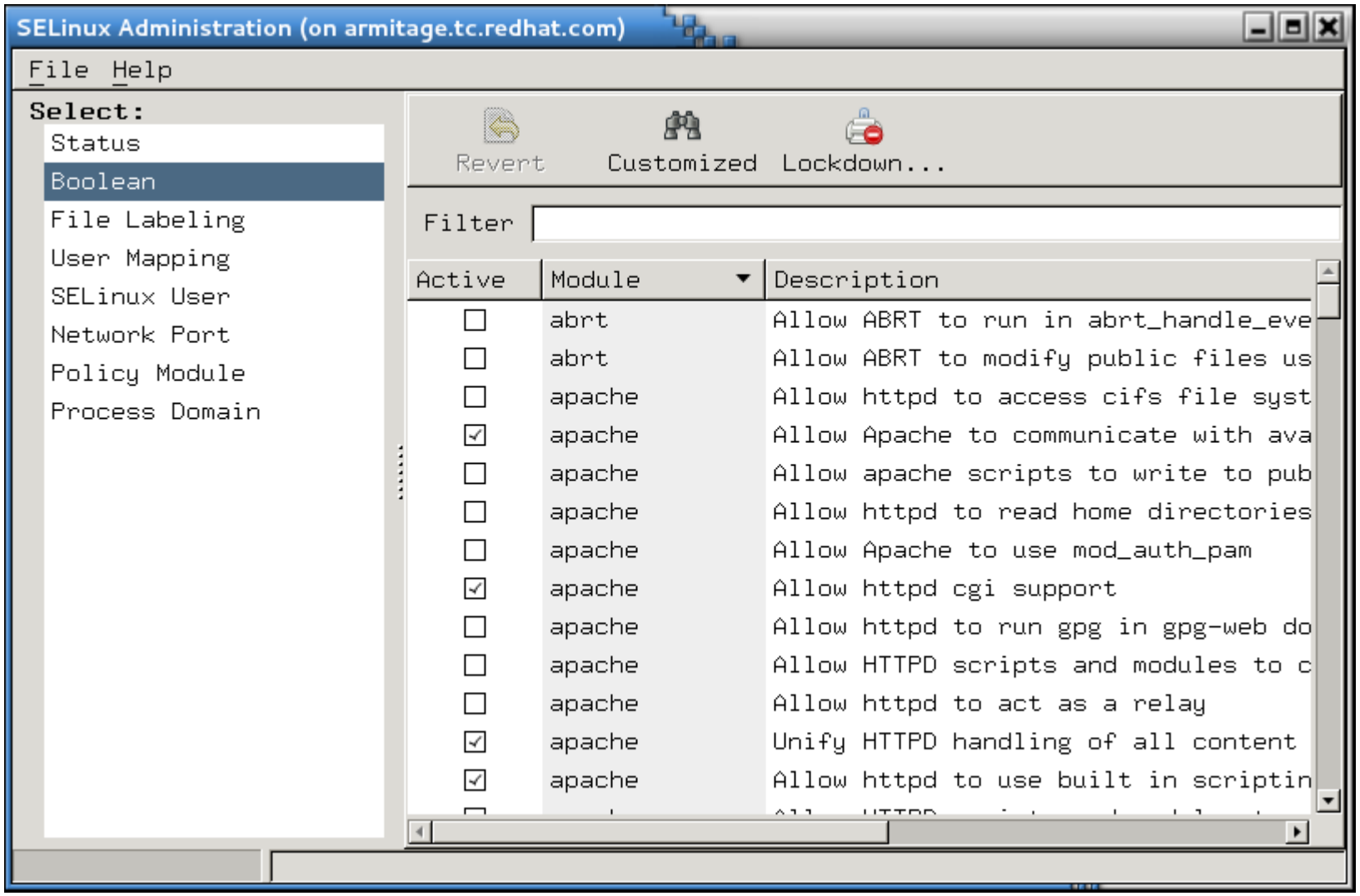
- This stuff is so easy, even a Windows admin can do it!
  - Install xorg-x11-xauth, a font (I like bitmap-fixed-fonts, or you can do yum groupinstall fonts), and policycoreutils-gui. and you can ssh -X into the box and run system-config-selinux

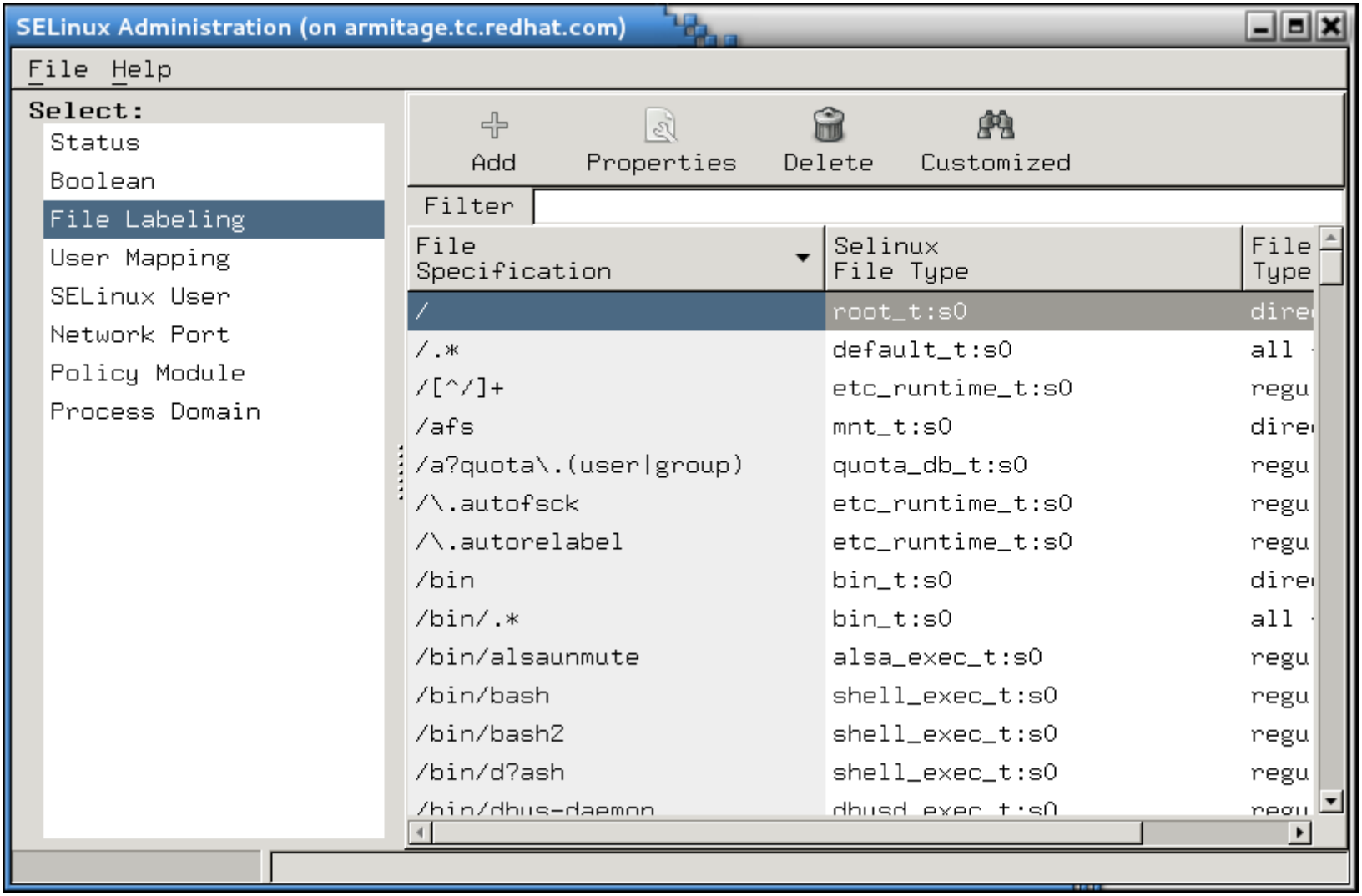

root@armitage:~
File Edit View Search Terminal Help
[root@armitage ~]# yum install xorg-x11-xauth policycoreutils-gui bitmap-fixed-fonts
Loaded plugins: product-id, rhnplugin, security, subscription-manager
Updating certificate-based repositories.
Unable to read consumer identity
Setting up Install Process
Resolving Dependencies
--> Running transaction check
---> Package bitmap-fixed-fonts.noarch 0:0.3-15.el6 will be installed
--> Processing Dependency: fontpackages-filesystem for package: bitmap-fixed-fonts-0.3-15.el6.noarch
---> Package policycoreutils-gui.x86_64 0:2.0.83-19.24.el6 will be installed
--> Processing Dependency: gtkhtml2 for package: policycoreutils-gui-2.0.83-19.24.el6.x86_64
--> Processing Dependency: gnome-python2-gtkhtml2 for package: policycoreutils-gui-2.0.83-19.24.el6.x86_64
--> Processing Dependency: setools-console for package: policycoreutils-gui-2.0.83-19.24.el6.x86_64
--> Processing Dependency: usermode-gtk for package: policycoreutils-gui-2.0.83-19.24.el6.x86_64
--> Processing Dependency: gnome-python2-gnome for package: policycoreutils-gui-2.0.83-19.24.el6.x86_64
---> Package xorg-x11-xauth.x86_64 1:1.0.2-7.1.el6 will be installed
--> Processing Dependency: libXmuu.so.1()(64bit) for package: 1:xorg-x11-xauth-1

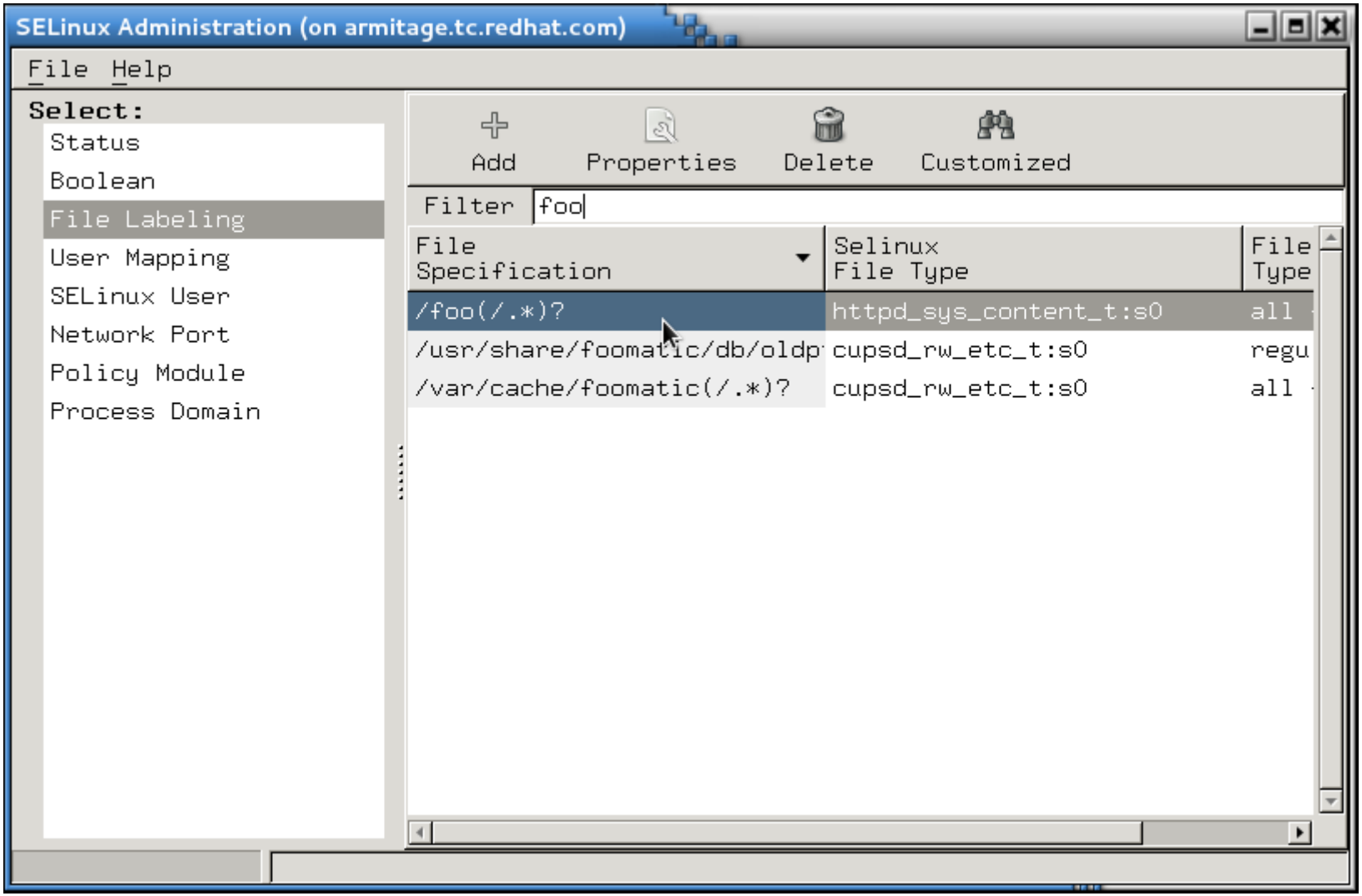

root@armitage:~
File Edit View Search Terminal Help
gnome-icon-theme.noarch 0:2.28.0-2.el6
gnome-python2-extras.x86_64 0:2.25.3-20.el6
gnome-python2-gnome.x86_64 0:2.28.0-3.el6
gnome-python2-gnomevfs.x86_64 0:2.28.0-3.el6
gnome-python2-gtkhtml2.x86_64 0:2.25.3-20.el6
gnome-themes.noarch 0:2.28.1-6.el6
gnome-vfs2.x86_64 0:2.24.2-6.el6
gtk2-engines.x86_64 0:2.18.4-5.el6
gtkhtml2.x86_64 0:2.11.1-7.el6
libXmu.x86_64 0:1.0.5-1.el6
libXt.x86_64 0:1.0.7-1.el6
libbonobo.x86_64 0:2.24.2-5.el6
libbonoboui.x86_64 0:2.24.2-3.el6
libdaemon.x86_64 0:0.14-1.el6
libgnome.x86_64 0:2.28.0-11.el6
libgnomeui.x86_64 0:2.24.1-4.el6
setools-console.x86_64 0:3.3.7-4.el6
shared-mime-info.x86_64 0:0.70-4.el6
system-gnome-theme.noarch 0:60.0.2-1.el6
system-icon-theme.noarch 0:6.0.0-2.el6
usermode-gtk.x86_64 0:1.102-3.el6
Complete!
[root@armitage ~]#

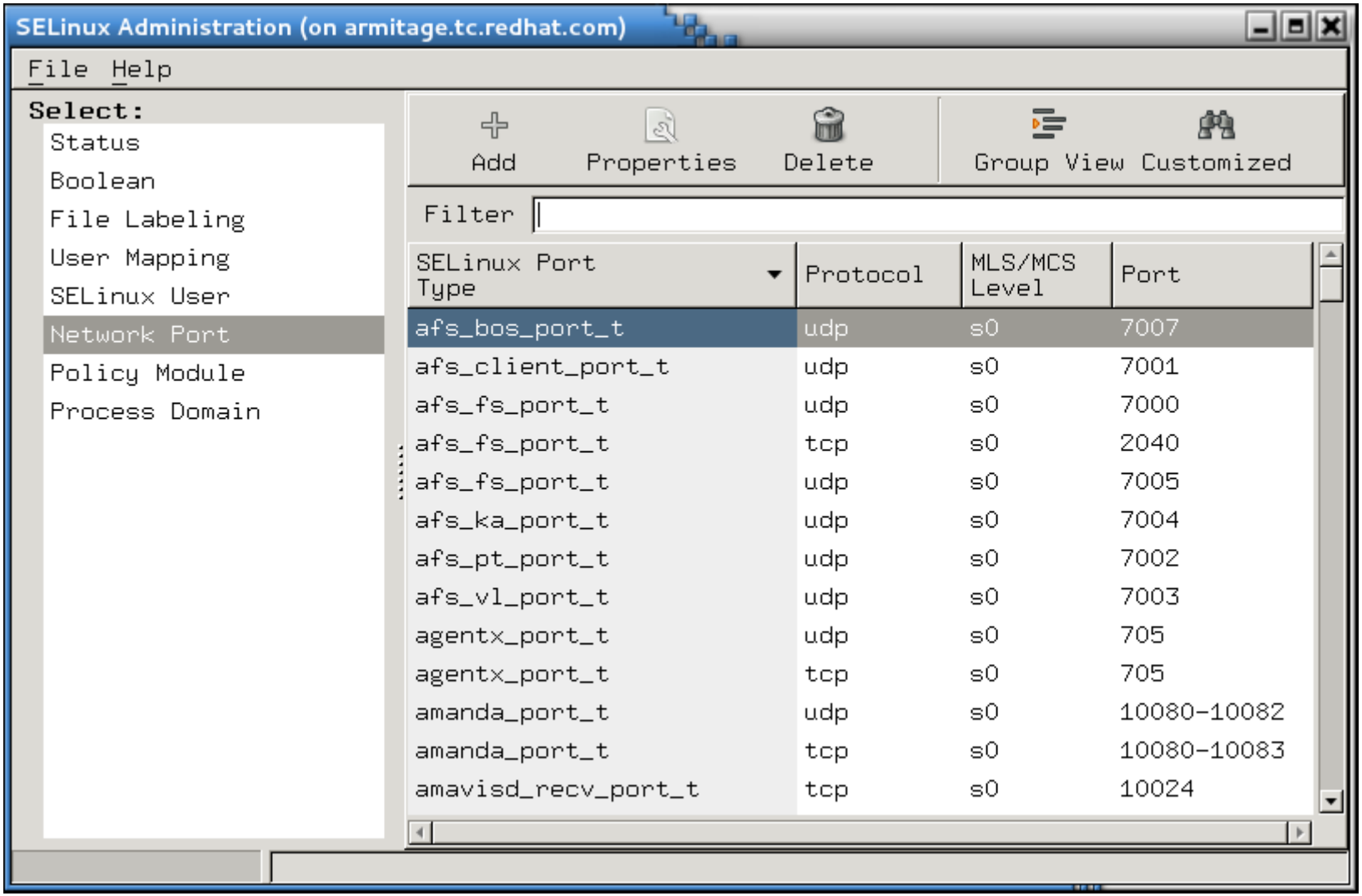

root@armitage:~
File Edit View Search Terminal Help
[root@armitage ~]# system-config-selinux

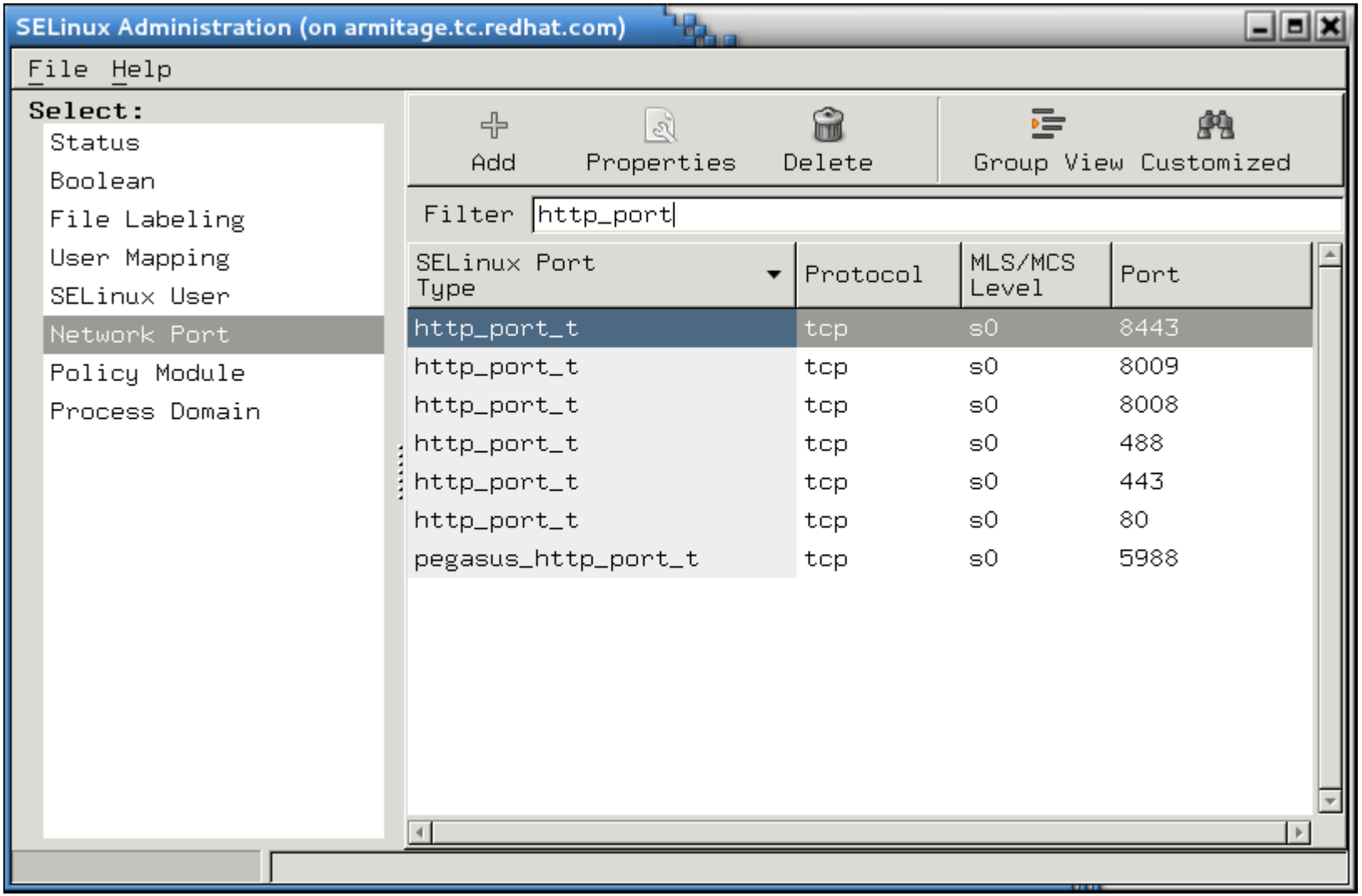

SELinux Administration (on armitage.tc.redhat.com)
File Help
Select:
Status
Boolean
File Labeling
User Mapping
SELinux User
Network Port
Policy Module
Process Domain
System Default Enforcing Mode
Enforcing
Current Enforcing Mode
Enforcing
System Default Policy Type:
targeted
Relabel on next reboot.

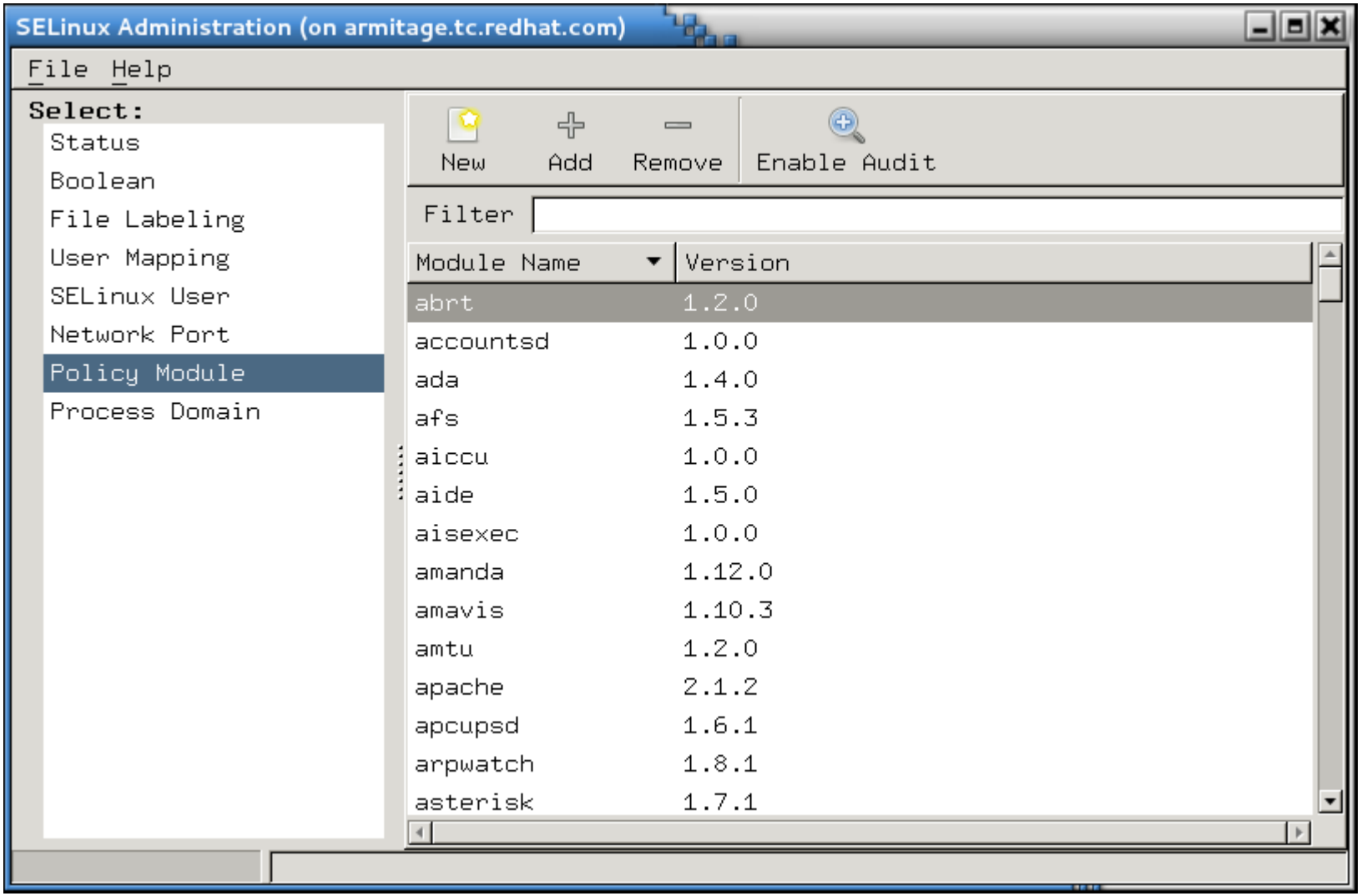

SELinux Administration (on armitage.tc.redhat.com)
File Help
Select:
Status
Boolean
File Labeling
User Mapping
SELinux User
Network Port
Policy Module
Process Domain
Revert
Customized
Lockdown...
Filter
Active
Module
Description
abrt
Allow ABRT to run in abrt_handle_eve
abrt
Allow ABRT to modify public files us
apache
Allow httpd to access cifs file syst
apache
Allow Apache to communicate with ava
apache
Allow apache scripts to write to pub
apache
Allow httpd to read home directories
apache
Allow Apache to use mod_auth_pam
apache
Allow httpd cgi support
apache
Allow httpd to run gpg in gpg-web do
apache
Allow HTTPD scripts and modules to c
apache
Allow httpd to act as a relay
apache
Unify HTTPD handling of all content
apache
Allow httpd to use built in scriptin

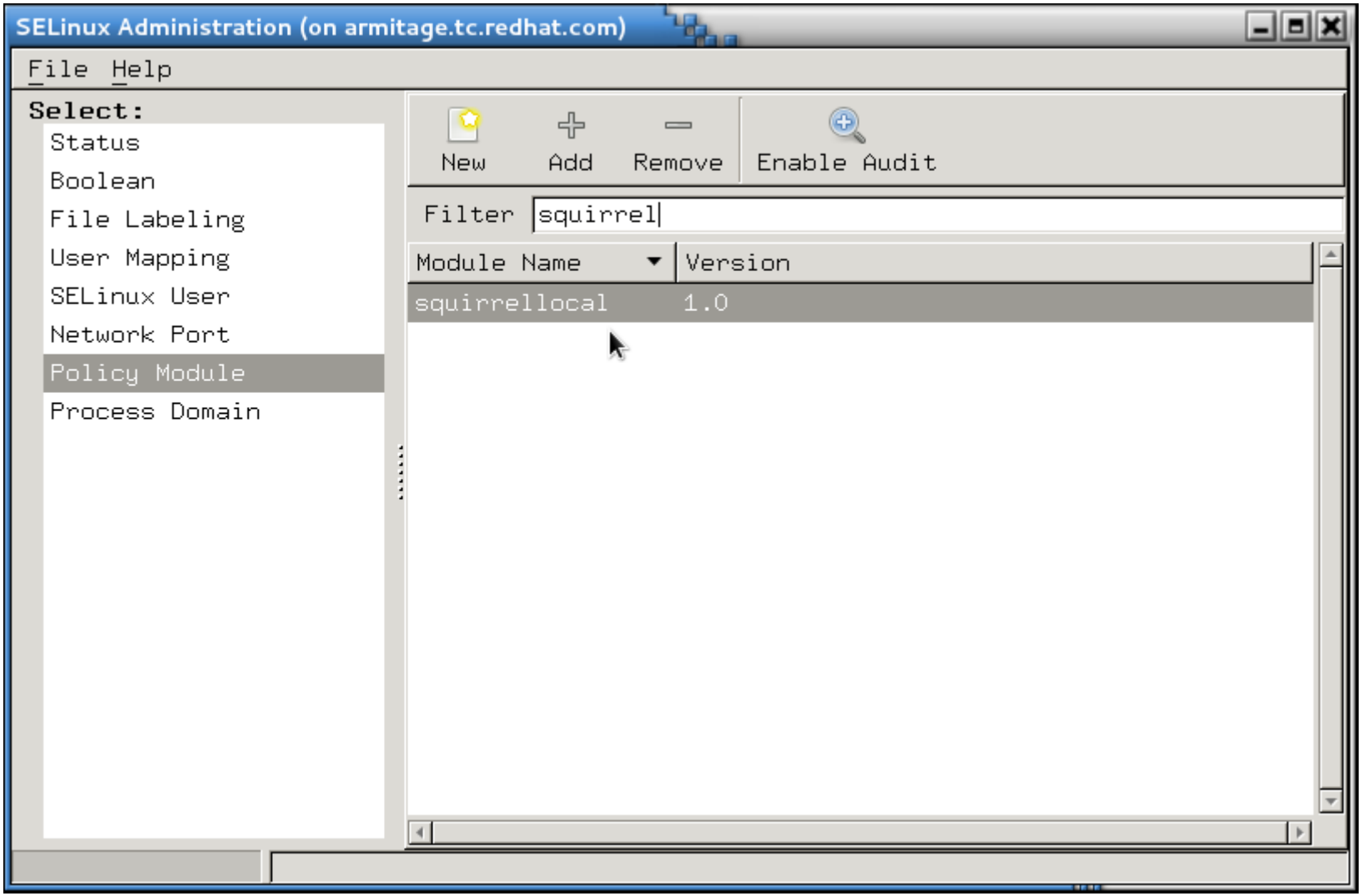



SELinux Administration (on armitage.tc.redhat.com)
File Help
Select:
Status
Boolean
File Labeling
User Mapping
SELinux User
Network Port
Policy Module
Process Domain
Add
Properties
Delete
Customized
Filter
foo
File Specification
Selinux File Type
File Type
/foo(/.*)?
httpd_sys_content_t:s0
all
/usr/share/foomatic/db/oldp
cupsd_rw_etc_t:s0
regu
/var/cache/foomatic(/.*)?
cupsd_rw_etc_t:s0
all


SELinux Administration (on armitage.tc.redhat.com)
File Help
Select:
Status
Boolean
File Labeling
User Mapping
SELinux User
Network Port
Policy Module
Process Domain
Add
Properties
Delete
Group View
Customized
Filter
SELinux Port Type
Protocol
MLS/MCS Level
Port
afs_bos_port_t udp s0 7007
afs_client_port_t udp s0 7001
afs_fs_port_t udp s0 7000
afs_fs_port_t tcp s0 2040
afs_fs_port_t udp s0 7005
afs_ka_port_t udp s0 7004
afs_pt_port_t udp s0 7002
afs_vl_port_t udp s0 7003
agentx_port_t udp s0 705
agentx_port_t tcp s0 705
amanda_port_t udp s0 10080-10082
amanda_port_t tcp s0 10080-10083
amavisd_recv_port_t tcp s0 10024


SELinux Administration (on armitage.tc.redhat.com)
File Help
Select:
Status
Boolean
File Labeling
User Mapping
SELinux User
Network Port
Policy Module
Process Domain
Add
Properties
Delete
Group View
Customized
Filter
http_port
SELinux Port Type
Protocol
MLS/MCS Level
Port
http_port_t tcp s0 8443
http_port_t tcp s0 8009
http_port_t tcp s0 8008
http_port_t tcp s0 488
http_port_t tcp s0 443
http_port_t tcp s0 80
pegasus_http_port_t tcp s0 5988


SELinux Administration (on armitage.tc.redhat.com)
File Help
Select:
Status
Boolean
File Labeling
User Mapping
SELinux User
Network Port
Policy Module
Process Domain
New
Add
Remove
Enable Audit
Filter
Module Name
Version
abrt 1.2.0
accountsd 1.0.0
ada 1.4.0
afs 1.5.3
aiccu 1.0.0
aide 1.5.0
aisexec 1.0.0
amanda 1.12.0
amavis 1.10.3
amtu 1.2.0
apache 2.1.2
apcupsd 1.6.1
arpwatch 1.8.1
asterisk 1.7.1


SELinux Administration (on armitage.tc.redhat.com)
File Help
Select:
Status
Boolean
File Labeling
User Mapping
SELinux User
Network Port
Policy Module
Process Domain
New
Add
Remove
Enable Audit
Filter
squirrel
Module Name
Version
squirrellocal
1.0

And That's It!

- Hopefully, you now feel like:

Final Thoughts

- Don't turn it off!
- SELinux can really save you in the event of a breach.
- It's **much** easier to use SELinux today than it was just a few months ago
- NSA grade security is available at no extra cost - use it!

Thank You!

- If you liked today's presentation, please let us know!

More Information

- SELinux Guide: http://docs.redhat.com/docs/en-US/Red_Hat_Enterprise_Linux/6/html/Security-Enhanced_Linux/index.html
- Fedora Project SELinux Docs: http://fedoraproject.org/wiki/SELinux
- fedora-selinux-list (mailing list):
  - https://www.redhat.com/mailman/listinfo
- Red Hat Training - Red Hat Enterprise SELinux Policy Administration: http://www.redhat.com/training

More Information

- http://access.redhat.com has several videos about SELinux. Dave Egts and Dan Walsh have covered topics from confining users to sandboxing.
- Dan Walsh's blog:
  - http://danwalsh.livejournal.com/

Questions?

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