

Презентация по лабораторной работе №6

Информационная безопасность

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Информация

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Вводная часть

- Обеспечение безопасности
- Предотвращение пересечений между пользовательскими аккаунтами
- Совместный доступ к файлам

Цель работы

Цель данной лабораторной работы — развить навыки администрирования в операционной системе Linux с акцентом на использование технологии SELinux. Основное внимание уделено настройке SELinux для работы с веб-сервером Apache, что позволяет на практике проверить ограничения прав доступа.

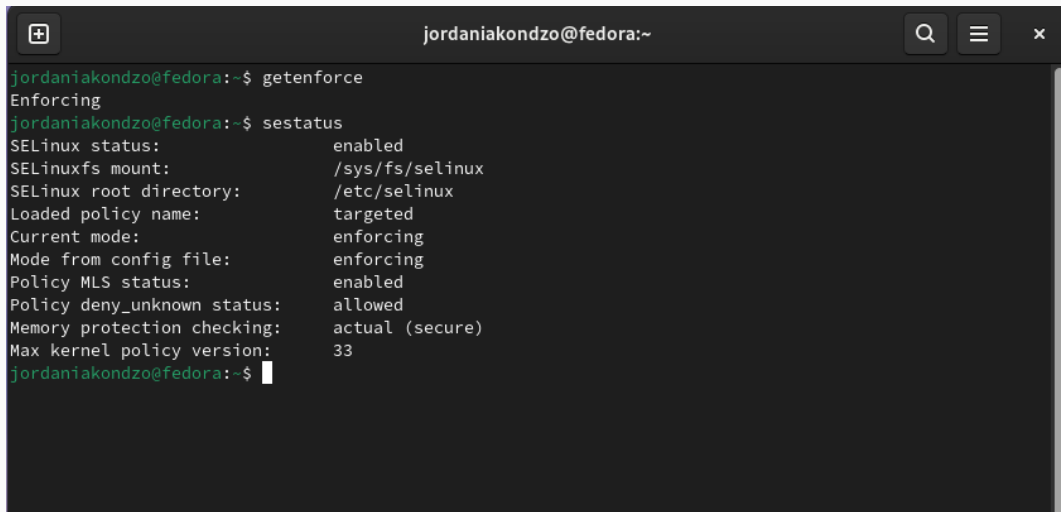
Теоретическое введение

Для выполнения лабораторной работы использовался дистрибутив Linux с включённой политикой SELinux targeted и режимом enforcing. В качестве веб-сервера использовался Apache, который был настроен для работы на портах 80 и 81. Важно было убедиться, что iptables настроен корректно и не блокирует доступ к данным портам.

- Веб-сервис **GitHub** для работы с репозиториями
- Программа для виртуализации ОС **VirtualBox**
- Процессор **pandoc** для входного формата Markdown
- Результирующие форматы
 - pdf
 - docx
- Автоматизация процесса создания: **Makefile**

Выполнение лабораторной работы

Проверка статуса SELinux

A terminal window titled 'jordaniakondzo@fedora:~' with search, menu, and close icons in the title bar. The terminal shows the execution of 'getenforce' and 'sestatus' commands. The output of 'sestatus' shows SELinux is enabled, enforcing, with various configuration details.

```
jordaniakondzo@fedora:~$ getenforce
Enforcing
jordaniakondzo@fedora:~$ sestatus
SELinux status:                enabled
SELinuxfs mount:                /sys/fs/selinux
SELinux root directory:         /etc/selinux
Loaded policy name:              targeted
Current mode:                    enforcing
Mode from config file:           enforcing
Policy MLS status:               enabled
Policy deny_unknown status:      allowed
Memory protection checking:      actual (secure)
Max kernel policy version:       33
jordaniakondzo@fedora:~$
```

Результат показал, что система настроена корректно для выполнения лабораторной 7/31

Настройка веб-сервера Apache

```
jordaniakondzo@fedora:~ — /bin/systemctl status httpd.service

jordaniakondzo@fedora:~$ service httpd status
Redirecting to /bin/systemctl status httpd.service
• httpd.service - The Apache HTTP Server
  Loaded: loaded (/usr/lib/systemd/system/httpd.service; disabled; preset: disabled)
  Drop-In: /usr/lib/systemd/system/service.d
           └─10-timeout-abort.conf
  Active: active (running) since Thu 2024-10-10 23:15:42 MSK; 13h ago
  Docs: man:httpd.service(8)
  Main PID: 8579 (httpd)
  Status: "Total requests: 5; Idle/Busy workers 100/0; Requests/sec: 0.000104; Bytes served/sec: 0"
  Tasks: 230 (limit: 4645)
  Memory: 17.2M (peak: 20.1M swap: 5.8M swap peak: 5.8M)
  CPU: 11.116s
  CGroup: /system.slice/httpd.service
          └─ 8579 /usr/sbin/httpd -DFOREGROUND
             8586 /usr/sbin/httpd -DFOREGROUND
             8588 /usr/sbin/httpd -DFOREGROUND
             8589 /usr/sbin/httpd -DFOREGROUND
             8635 /usr/sbin/httpd -DFOREGROUND
             11458 /usr/sbin/httpd -DFOREGROUND

oct. 10 23:15:34 fedora systemd[1]: Starting httpd.service - The Apache HTTP Server...
oct. 10 23:15:34 fedora (httpd)[8579]: httpd.service: Referenced but unset environment variable evalua>
oct. 10 23:15:36 fedora httpd[8579]: AH00558: httpd: Could not reliably determine the server's fully q>
oct. 10 23:15:42 fedora httpd[8579]: Server configured, listening on: port 80
oct. 10 23:15:42 fedora systemd[1]: Started httpd.service - The Apache HTTP Server.
lines 1-24/24 (END)
```

Проверка контекста SELinux для Apache

```
jordaniakondzo@fedora:~  
jordaniakondzo@fedora:~$ ps auxZ | grep httpd  
system_u:system_r:httpd_t:s0 root 8579 0.0 0.2 20020 8392 ? Ss 10:50 0:01 /usr  
/sbin/httpd -DFOREGROUND  
system_u:system_r:httpd_t:s0 apache 8586 0.0 0.0 19732 2576 ? S 10:50 0:00 /usr  
/sbin/httpd -DFOREGROUND  
system_u:system_r:httpd_t:s0 apache 8588 0.0 0.1 1569012 4360 ? Sl 10:50 0:03 /usr  
/sbin/httpd -DFOREGROUND  
system_u:system_r:httpd_t:s0 apache 8589 0.0 0.1 1437908 6012 ? Sl 10:50 0:02 /usr  
/sbin/httpd -DFOREGROUND  
system_u:system_r:httpd_t:s0 apache 8635 0.0 0.1 1437908 4496 ? Sl 10:50 0:02 /usr  
/sbin/httpd -DFOREGROUND  
system_u:system_r:httpd_t:s0 apache 11458 0.0 0.1 1437908 6956 ? Sl 11:53 0:01 /usr  
/sbin/httpd -DFOREGROUND  
unconfined_u:unconfined_r:unconfined_t:s0-s0:c0.c1023 jordani+ 13740 0.0 0.0 227808 2400 pts/0 S+ 12:4  
1 0:00 grep --color=auto httpd  
jordaniakondzo@fedora:~$ ps -eZ | grep httpd  
system_u:system_r:httpd_t:s0 8579 ? 00:00:01 httpd  
system_u:system_r:httpd_t:s0 8586 ? 00:00:00 httpd  
system_u:system_r:httpd_t:s0 8588 ? 00:00:03 httpd  
system_u:system_r:httpd_t:s0 8589 ? 00:00:02 httpd  
system_u:system_r:httpd_t:s0 8635 ? 00:00:02 httpd  
system_u:system_r:httpd_t:s0 11458 ? 00:00:01 httpd  
jordaniakondzo@fedora:~$
```

Проверка текущих настроек SELinux для Apache

```
jordaniakondzo@fedora:~  
jordaniakondzo@fedora:~$ getsebool -a | grep httpd  
httpd_anon_write --> off  
httpd_builtin_scripting --> on  
httpd_can_check_spam --> off  
httpd_can_connect_ftp --> off  
httpd_can_connect_ldap --> off  
httpd_can_connect_mythtv --> off  
httpd_can_connect_zabbix --> off  
httpd_can_manage_courier_spool --> 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_redis --> off  
httpd_can_network_relay --> off  
httpd_can_sendmail --> off  
httpd_dbus_avahi --> off  
httpd_dbus_sssd --> off  
httpd_dontaudit_search_dirs --> off  
httpd_enable_cgi --> on  
httpd_enable_ftp_server --> off  
httpd_enable_homedirs --> off  
httpd_execmem --> off  
httpd_graceful_shutdown --> off  
httpd_manage_ipa --> off  
httpd_mod_auth_ntlm_winbind --> off  
httpd_mod_auth_pam --> off  
httpd_read_user_content --> off  
httpd_run_ipa --> off  
httpd_run_preupgrade --> off  
httpd_run_stickshift --> off  
httpd_serve_cobbler_files --> off  
httpd_setrlimit --> off  
httpd_ssi_exec --> off  
httpd_sys_script_anon_write --> off  
httpd_tmp_exec --> off  
httpd_tty_comm --> off  
httpd_unified --> off  
httpd_use_cifs --> off  
httpd_use_fusefs --> off  
httpd_use_gpg --> off  
httpd_use_nfs --> off  
httpd_use_openssl --> off
```

Анализ политик и типов SELinux

```
jordaniakondzo@fedora:~  
jordaniakondzo@fedora:~$ seinfo  
Statistics for policy file: /sys/fs/selinux/policy  
Policy Version:          33 (MLS enabled)  
Target Policy:           selinux  
Handle unknown classes:  allow  
Classes:                  134      Permissions:          460  
Sensitivities:            1      Categories:           1024  
Types:                    5262    Attributes:            264  
Users:                    8       Roles:                 15  
Booleans:                 365     Cond. Expr.:          398  
Allow:                    68036   Neverallow:            0  
Auditallow:               181     Dontaudit:             8829  
Type_trans:               284188  Type_change:           94  
Type_member:              37      Range_trans:           6164  
Role_allow:               40      Role_trans:            419  
Constraints:              70      Validatetrans:         0  
MLS Constrain:            72      MLS Val. Tran:         0  
Permissives:              9       Polcap:                 6  
Defaults:                 7       Typebounds:             0  
Allowxperm:               0       Neverallowxperm:       0  
Auditallowxperm:         0       Dontauditxperm:        0  
Ibendportcon:             0       Ibpkeycon:              0  
Initial SIDs:             27      Fs_use:                 35  
Genfscon:                 110     Portcon:                665  
Netifcon:                 0       Nodecon:                0  
jordaniakondzo@fedora:~$
```


Определение типа файлов и поддиректорий, находящихся в директории `/var/www`, с помощью команды:

```
jordaniakondzo@fedora:~  
jordaniakondzo@fedora:~$ ls -lZ /var/www  
total 0  
drwxr-xr-x. 1 root root system_u:object_r:httpd_sys_script_exec_t:s0 0 1 août 03:00 cgi-bin  
drwxr-xr-x. 1 root root system_u:object_r:httpd_sys_content_t:s0 0 11 oct. 01:45 html  
jordaniakondzo@fedora:~$
```

Определение типа файлов, находящихся в директории '/var/www/html:

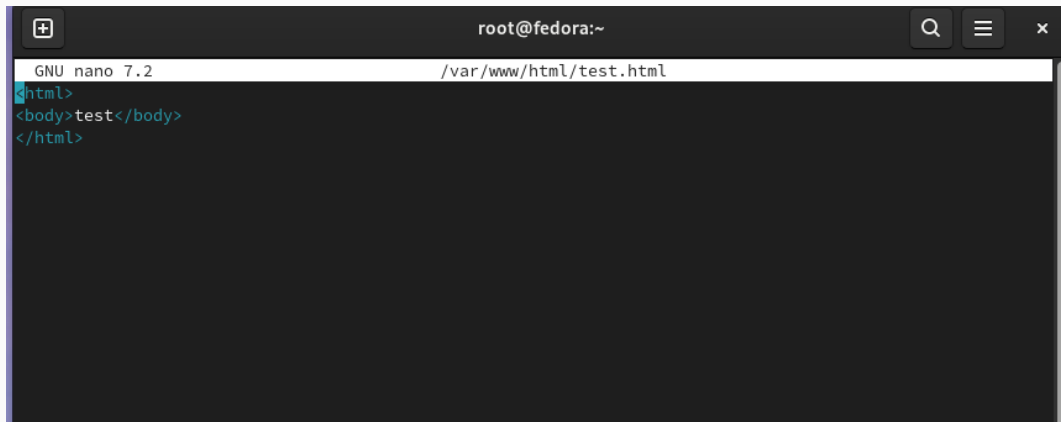


```
jordaniakondzo@fedora:~$ ls -ldZ /var/www/html
drwxr-xr-x. 1 root root system_u:object_r:httpd_sys_content_t:s0 0 11 oct. 01:45 /var/www/html
jordaniakondzo@fedora:~$
```

Определение круга пользователей

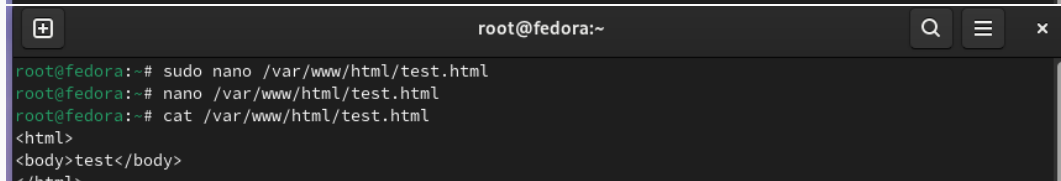
```
jordaniakondzo@fedora:~$ sestatus -A -s unconfined_t -t httpd_sys_content_t -c dir -p write
allow files_unconfined_type file_type:dir { add_name append audit_access create execmod execute getattr ioctl link lock mounton open quotaon read relabelfrom relabelto remove_name rename reparent rmdir search setattr swapon unlink watch watch_mount watch_reads watch_sb watch_with_perm write };
allow named_filetrans_domain httpd_sys_content_t:dir { add_name getattr ioctl lock open read remove_name search write };
jordaniakondzo@fedora:~$
```

Создание тестового файла и проверка доступа



A terminal window titled 'root@fedora:~' with search, menu, and close icons. It shows the GNU nano 7.2 editor editing the file /var/www/html/test.html. The editor contains the following HTML code:

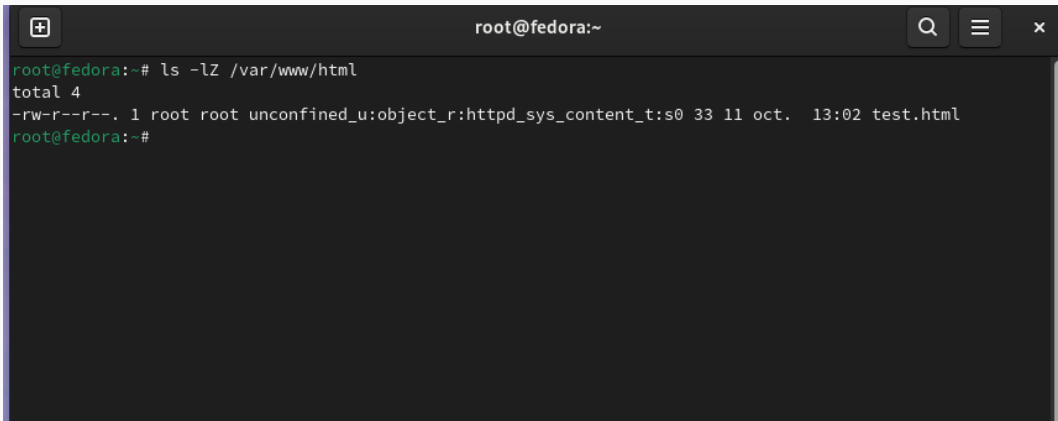
```
<html>  
<body>test</body>  
</html>
```



A terminal window titled 'root@fedora:~' with search, menu, and close icons. It shows the following commands and their output:

```
root@fedora:~# sudo nano /var/www/html/test.html  
root@fedora:~# nano /var/www/html/test.html  
root@fedora:~# cat /var/www/html/test.html  
<html>  
<body>test</body>  
</html>
```

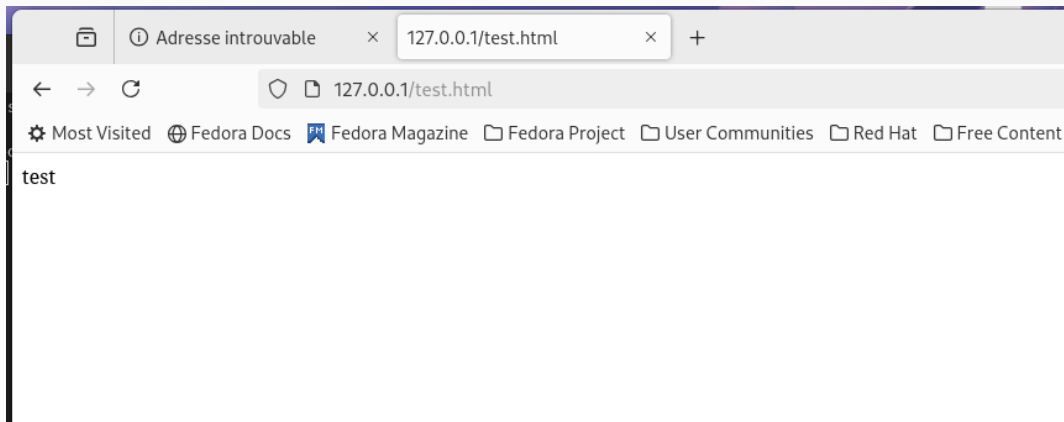
Проверка контекста созданного файла

A terminal window titled 'root@fedora:~' with search, menu, and close icons in the top right. The terminal shows the command 'ls -lZ /var/www/html' and its output. The output indicates a file named 'test.html' with permissions '-rw-r--r--', owned by 'root' and 'root', and SELinux context 'unconfined_u:object_r:httpd_sys_content_t:s0'.

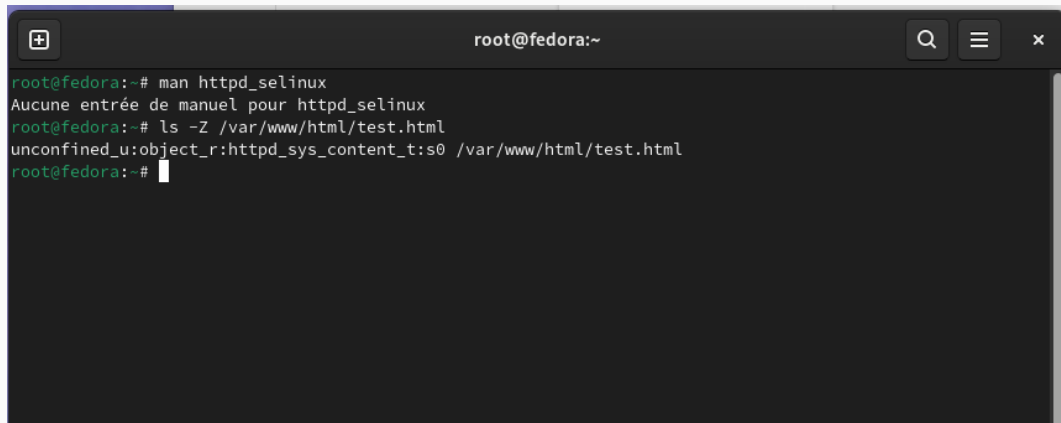
```
root@fedora:~# ls -lZ /var/www/html
total 4
-rw-r--r--. 1 root root unconfined_u:object_r:httpd_sys_content_t:s0 33 11 oct. 13:02 test.html
root@fedora:~#
```

Контекст был установлен как `httpd_sys_content_t`, что позволило серверу Apache получить доступ к файлу через браузер.

Тестирование работы веб-сервера



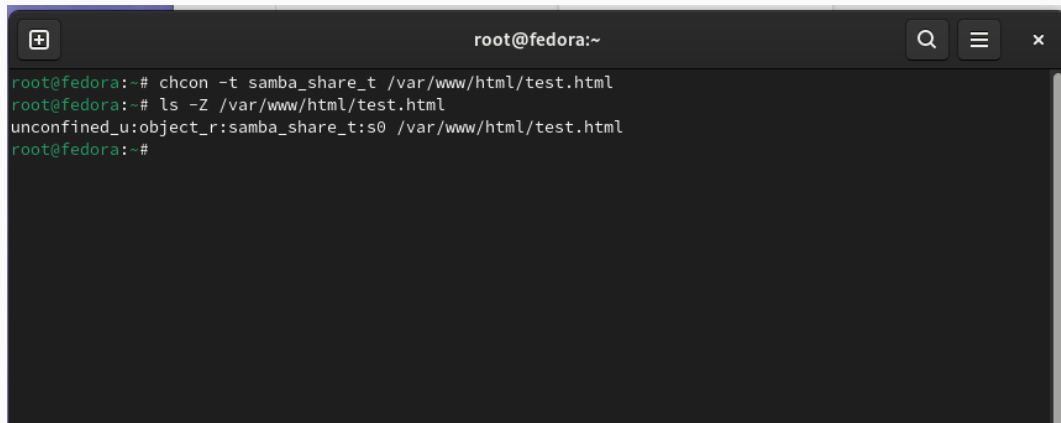
Файл успешно отобразился, что подтвердило правильность настроек SELinux для данного файла.



A terminal window titled "root@fedora:~" with search, menu, and close buttons in the title bar. The terminal shows the following commands and output:

```
root@fedora:~# man httpd_selinux
Aucune entrée de manuel pour httpd_selinux
root@fedora:~# ls -Z /var/www/html/test.html
unconfined_u:object_r:httpd_sys_content_t:s0 /var/www/html/test.html
root@fedora:~#
```

Изменение контекста безопасности



A terminal window titled 'root@fedora:~' with search, menu, and close icons in the top right. The terminal shows the following commands and output:

```
root@fedora:~# chcon -t samba_share_t /var/www/html/test.html
root@fedora:~# ls -Z /var/www/html/test.html
unconfined_u:object_r:samba_share_t:s0 /var/www/html/test.html
root@fedora:~#
```




После этого проверил, что контекст поменялся.

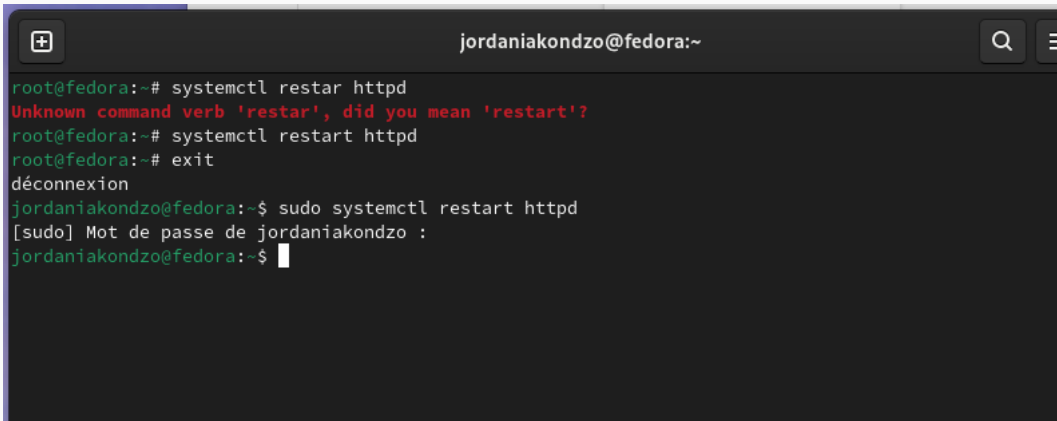
Анализ ситуации

```
root@fedora:~  
root@fedora:~# ls -l /var/www/html/test.html  
-rw-r--r--. 1 root root 33 11 oct. 13:02 /var/www/html/test.html  
root@fedora:~# tail /var/log/messages  
tail: impossible d'ouvrir '/var/log/messages' en lecture: Aucun fichier ou dossier de ce nom  
root@fedora:~# tail /var/log/httpd/error_log  
[Thu Oct 10 23:15:36.216514 2024] [suexec:notice] [pid 8579:tid 8579] AH01232: suEXEC mechanism enabled (wrapper: /usr/sbin/suexec)  
AH00558: httpd: Could not reliably determine the server's fully qualified domain name, using fe80::e025:80df:3d38:1a9%enp0s3. Set the 'ServerName' directive globally to suppress this message  
[Thu Oct 10 23:15:42.182180 2024] [lbmethod_heartbeat:notice] [pid 8579:tid 8579] AH02282: No slotmem from mod_heartbeat  
[Thu Oct 10 23:15:42.190237 2024] [systemd:notice] [pid 8579:tid 8579] SELinux policy enabled; httpd running as context system_u:system_r:httpd_t:s0  
[Thu Oct 10 23:15:42.217776 2024] [warn] [pid 8587:tid 8587] ./mod_dnssd.c: No services found to register  
[Thu Oct 10 23:15:42.230686 2024] [mpm_event:notice] [pid 8579:tid 8579] AH00489: Apache/2.4.62 (Fedora Linux) configured -- resuming normal operations  
[Thu Oct 10 23:15:42.230741 2024] [core:notice] [pid 8579:tid 8579] AH00094: Command line: '/usr/sbin/httpd -D FOREGROUND'  
[Fri Oct 11 00:50:02.812031 2024] [core:error] [pid 11458:tid 11487] (13)Permission denied: [client 127.0.0.1:50252] AH00035: access to /test.html denied (filesystem path '/var/www/html/test.html') because search permissions are missing on a component of the path  
[Fri Oct 11 13:29:05.272422 2024] [core:error] [pid 8589:tid 8677] (13)Permission denied: [client 127.0.0.1:41352] AH00035: access to /test.html denied (filesystem path '/var/www/html/test.html') because search permissions are missing on a component of the path  
root@fedora:~# tail /var/log/audit/audit.log  
type=BPF msg=audit(1728642363.038:765): prog-id=163 op=UNLOAD  
type=SERVICE_STOP msg=audit(1728642368.849:766): pid=1 uid=0 auid=4294967295 ses=4294967295 subj=system_u:system_r:init_t:s0 msg='unit=systemd-hostnamed comm="systemd" exe="/usr/lib/systemd/systemd" hostname=? addr=? terminal=? res=success' UID="root" AUID="unset"  
type=BPF msg=audit(1728642368.872:767): prog-id=166 op=UNLOAD  
type=BPF msg=audit(1728642368.872:768): prog-id=165 op=UNLOAD  
type=BPF msg=audit(1728642368.872:769): prog-id=164 op=UNLOAD  
type=USER_END msg=audit(1728642374.364:770): pid=15498 uid=1000 auid=1000 ses=3 subj=unconfined_u:unconfined_r:unconfined_t:s0-s0:c0.c1023 msg='op=PAM:session_close grantors=pam_keyinit,pam_limits,pam_unix acct="root" exe="/usr/bin/sudo" hostname=? addr=? terminal=/dev/pts/0 res=success' UID="jordanakondzo" AUID="jordanakondzo"  
type=CRED_DISP msg=audit(1728642374.377:771): pid=15498 uid=1000 auid=1000 ses=3 subj=unconfined_u:unconfined_r:unconfined_t:s0-s0:c0.c1023 msg='op=PAM:setcred grantors=pam_unix acct="root" exe="/usr/bin/sudo" hostname=? addr=? terminal=/dev/pts/0 res=success' UID="jordanakondzo" AUID="jordanakondzo"  
type=SERVICE_STOP msg=audit(1728642528.033:772): pid=1 uid=0 auid=4294967295 ses=4294967295 subj=system_u:system_r:init_t:s0 msg='unit=packagekit comm="systemd" exe="/usr/lib/systemd/systemd" hostname=? addr=? terminal=? res=success' UID="root" AUID="unset"  
type=AVC msg=audit(1728642545.195:773): avc: denied { getattr } for pid=8589 comm="httpd" path="/var/www/html/test.html" scontext=system_u:system_r:httpd_t:s0 tcontext=system_u:system_r:httpd_t:s0 tclass=file
```

Замение порта 80 на 81 для Apache в SELinux

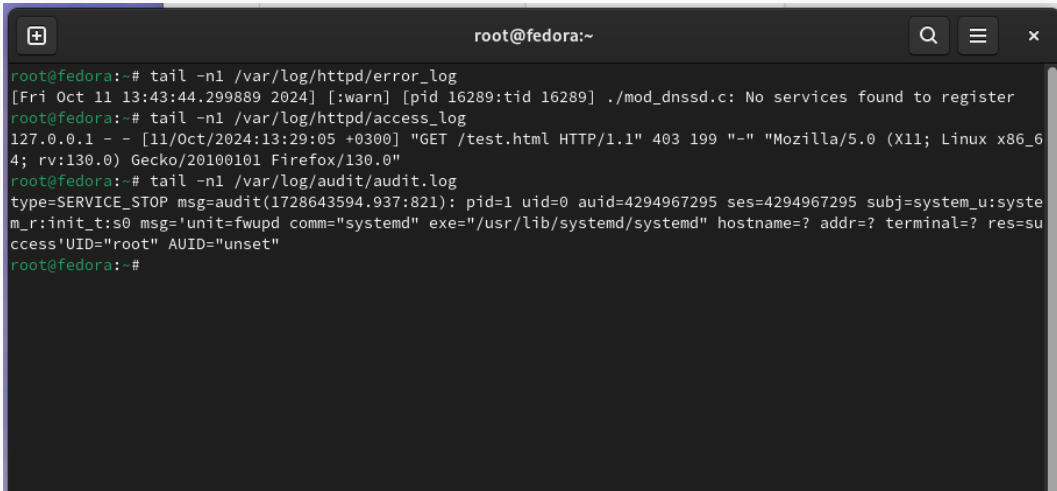
```
root@fedora:~  
GNU nano 7.2 /etc/httpd/conf/httpd.conf Modified  
#  
# Listen: Allows you to bind Apache to specific IP addresses and/or  
# ports, instead of the default. See also the <VirtualHost>  
# directive.  
#  
# Change this to Listen on a specific IP address, but note that if  
# httpd.service is enabled to run at boot time, the address may not be  
# available when the service starts. See the httpd.service(8) man  
# page for more information.  
#  
#Listen 12.34.56.78:80  
Listen 81  
#  
# Dynamic Shared Object (DSO) Support  
#  
# To be able to use the functionality of a module which was built as a DSO you  
# have to place corresponding 'LoadModule' lines at this location so the  
# directives contained in it are actually available _before_ they are used.  
# Statically compiled modules (those listed by 'httpd -l') do not need  
# to be loaded here.  
#  
# Example:  
# LoadModule foo_module modules/mod_foo.so  
#  
Include conf.modules.d/*.conf  
#  
# If you wish httpd to run as a different user or group, you must run  
# httpd as root initially and it will switch.  
#  
# User/Group: The name (or #number) of the user/group to run httpd as.  
# It is usually good practice to create a dedicated user and group for  
# running httpd, as with most system services.  
#  
User apache  
Group apache  
#  
# 'Main' server configuration  
#  
# The directives in this section set up the values used by the 'main'
```

Перезапуск веб-сервера Apache



```
jordaniakondzo@fedora:~  
root@fedora:~# systemctl restar httpd  
Unknown command verb 'restar', did you mean 'restart'?  
root@fedora:~# systemctl restart httpd  
root@fedora:~# exit  
déconnexion  
jordaniakondzo@fedora:~$ sudo systemctl restart httpd  
[sudo] Mot de passe de jordaniakondzo :  
jordaniakondzo@fedora:~$
```

При перезапуске не возникло никаких сбоев, что подтвердило корректность конфигурации.



```
root@fedora:~  
root@fedora:~# tail -n1 /var/log/httpd/error_log  
[Fri Oct 11 13:43:44.299889 2024] [:warn] [pid 16289:tid 16289] ./mod_dnssd.c: No services found to register  
root@fedora:~# tail -n1 /var/log/httpd/access_log  
127.0.0.1 - - [11/Oct/2024:13:29:05 +0300] "GET /test.html HTTP/1.1" 403 199 "-" "Mozilla/5.0 (X11; Linux x86_64; rv:130.0) Gecko/20100101 Firefox/130.0"  
root@fedora:~# tail -n1 /var/log/audit/audit.log  
type=SERVICE_STOP msg=audit(1728643594.937:821): pid=1 uid=0 auid=4294967295 ses=4294967295 subj=system_u:system_r:init_t:s0 msg='unit=fwupd comm="systemd" exe="/usr/lib/systemd/systemd" hostname=? addr=? terminal=? res=success'UID="root" AUID="unset"  
root@fedora:~#
```

Добавление порта 81 для Apache в SELinux

```
jordaniakondzo@fedora:~  
root@fedora:~# semanage port -a -t http_port_t -p tcp 81  
usage: semanage [-h]  
               {import,export,login,user,port,ibpkey,ibendport,interface,module,node,fcontext,boolean,permissi  
ve,dontaudit}  
               ...  
semanage: error: unrecognized arguments: -p 81  
root@fedora:~# exit  
déconnexion  
jordaniakondzo@fedora:~$ sudo semanage port -a -t http_port_t -p tcp 81  
[sudo] Mot de passe de jordaniakondzo :  
Port tcp/81 already defined, modifying instead  
jordaniakondzo@fedora:~$ semanage port -l | grep http_port_t  
ValueError: La stratégie SELinux n'est pas gérée ou la base n'est pas accessible.  
jordaniakondzo@fedora:~$ sudo semanage port -l | grep http_port_t  
http_port_t          tcp      81, 80, 81, 443, 488, 8008, 8009, 8443, 9000  
pegasus_http_port_t  tcp      5988  
jordaniakondzo@fedora:~$
```

Это позволило серверу Apache работать на порту 81.

Проверка списка портов

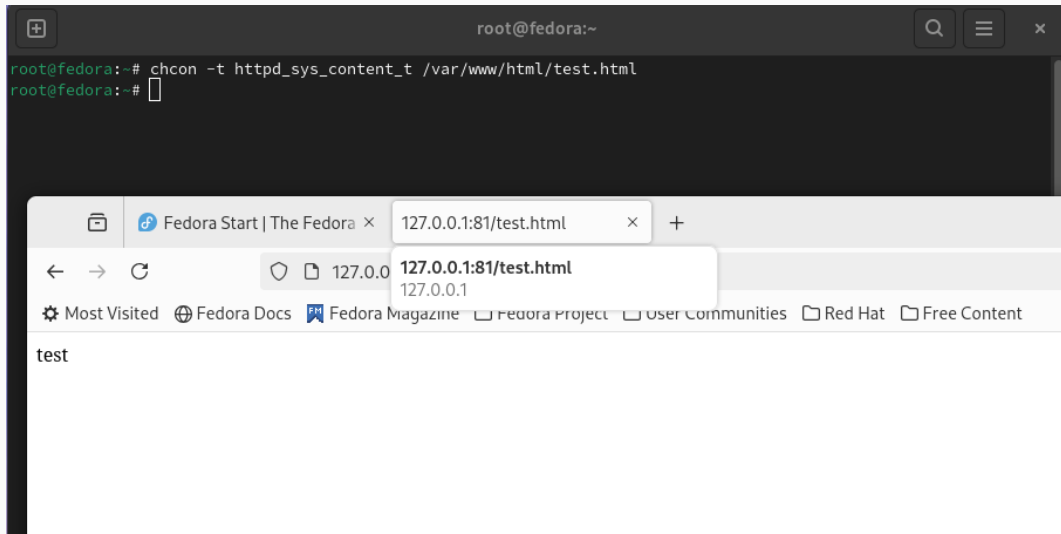
A terminal window titled 'jordaniakondzo@fedora:~' with search, menu, and close buttons in the title bar. The terminal shows a root user attempting to restart the httpd service, which fails due to a timeout. The user then exits the root shell and attempts to restart the service as a regular user using sudo.

```
jordaniakondzo@fedora:~  
root@fedora:~# systemctl restart httpd  
Job for httpd.service failed because a timeout was exceeded.  
See "systemctl status httpd.service" and "journalctl -xeu httpd.service" for details.  
root@fedora:~# exit  
déconnexion  
jordaniakondzo@fedora:~$ sudo systemctl restart httpd  
jordaniakondzo@fedora:~$
```

В выводе я увидел, что порты 80 и 81 доступны для Apache.

Перезапуск Apache

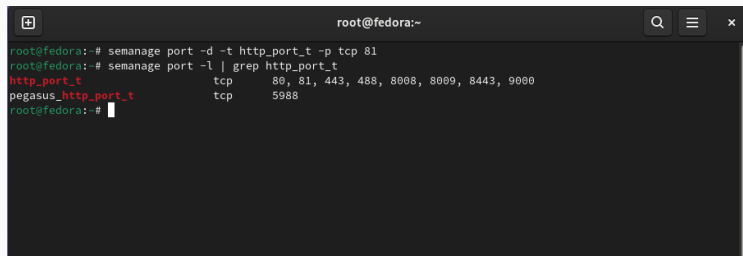
Файл *test.html* успешно отобразился, что подтвердило работу Apache на новом порту 81.



Вернул контекст httpd_sys_content__t к файлу /var/www/html/ test.html:

```
root@fedora:~
GNU nano 7.2 /etc/httpd/conf/httpd.conf Modifié
#
# Do NOT simply read the instructions in here without understanding
# what they do. They're here only as hints or reminders. If you are unsure
# consult the online docs. You have been warned.
#
# Configuration and logfile names: If the filenames you specify for many
# of the server's control files begin with "/" (or "drive:/" for Win32), the
# server will use that explicit path. If the filenames do *not* begin
# with "/", the value of ServerRoot is prepended -- so 'log/access_log'
# with ServerRoot set to '/www' will be interpreted by the
# server as '/www/log/access_log', where as '/log/access_log' will be
# interpreted as '/log/access_log'.
#
# ServerRoot: The top of the directory tree under which the server's
# configuration, error, and log files are kept.
#
# Do not add a slash at the end of the directory path. If you point
# ServerRoot at a non-local disk, be sure to specify a local disk on the
# Mutex directive, if file-based mutexes are used. If you wish to share the
# same ServerRoot for multiple httpd daemons, you will need to change at
# least PidFile.
#
ServerRoot "/etc/httpd"
#
# Listen: Allows you to bind Apache to specific IP addresses and/or
# ports, instead of the default. See also the <VirtualHost>
# directive.
#
# Change this to Listen on a specific IP address, but note that if
# httpd.service is enabled to run at boot time, the address may not be
# available when the service starts. See the httpd.service(8) man
# page for more information.
#
#Listen 12.34.56.78:80
Listen 80
#
# Dynamic Shared Object (DSO) Support
#
#G Aide #O Écrire #W Chercher #X Couper #T Exécuter #C Emplacement #U Annuler
```

Удаление привязки порта 81 к Apache



```
root@fedora:~  
root@fedora:~# semanage port -d -t http_port_t -p tcp 81  
root@fedora:~# semanage port -l | grep http_port_t  
http_port_t          tcp      80, 81, 443, 488, 8008, 8009, 8443, 9000  
pegasus_http_port_t  tcp      5988  
root@fedora:~#
```

The image shows a terminal window with a dark background. The title bar of the window is dark gray and contains a plus icon on the left, the text 'root@fedora:~' in the center, and search, menu, and close icons on the right. The terminal text is as follows: the first line is 'root@fedora:~# semanage port -d -t http_port_t -p tcp 81' in green; the second line is 'root@fedora:~# semanage port -l | grep http_port_t' in green; the third line is 'http_port_t' in red, followed by 'tcp' in black and a list of ports '80, 81, 443, 488, 8008, 8009, 8443, 9000' in black; the fourth line is 'pegasus_http_port_t' in red, followed by 'tcp' in black and the port '5988' in black; the fifth line is 'root@fedora:~#' in green with a white cursor character.

Удаление тестового файла



```
root@fedora:~  
root@fedora:~# rm /var/www/html/test.html  
rm : supprimer '/var/www/html/test.html' du type fichier ? y  
root@fedora:~# ls /var/www/html  
root@fedora:~# ls -l /var/www/html  
total 0  
root@fedora:~#
```

Выводы

В ходе лабораторной работы я приобрел практические навыки работы с SELinux в связке с веб-сервером Apache. Я научился настраивать контексты безопасности для файлов и управлять портами, используя SELinux для обеспечения мандатного контроля доступа. Работая с различными контекстами, такими как `httpd_sys_content_t` и `samba_share_t`, я увидел, как SELinux блокирует несанкционированный доступ, что помогает значительно повысить безопасность системы.