

# Troubleshooting SELinux

## WHAT?

A system with SELinux in the enforcing mode may cause access denials that may prevent applications from running correctly. You can use **audit2allow** or setroubleshoot to analyze denial messages in a user-friendly way.

## WHY?

This article provides instructions on how to solve access denials caused by SELinux without decreasing the security of your system.

## EFFORT

It takes approximately 30 minutes to read the article.

## GOAL

You will be able to use one of the further described tools to debug SELinux denials.

## REQUIREMENTS

- A running system with enabled SELinux.

Publication Date: 17 Oct 2024

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# 1 The `/var/log/audit/audit.log` file

By default, if SELinux is the reason something is not working, a log message to this effect is sent to the `/var/log/audit/audit.log` file.



## Note: Empty `/var/log/audit/audit.log`

If you see an empty `/var/log/audit/audit.log`, it usually means that the `auditd` service is not running. In this case, proceed as follows:

1. Start the `auditd` service:

```
> sudo systemctl start auditd
```

2. Enable the service in the targets of your system, using

```
> sudo systemctl enable auditd
```

The `/var/log/audit/audit.log` file stores messages of access denials, service events and so on.

In *Example 1: "Example lines from `/etc/audit/audit.log`"*, you can see a partial example of the contents of `/var/log/audit/audit.log`.

EXAMPLE 1: EXAMPLE LINES FROM `/etc/audit/audit.log`

```
type=DAEMON_START msg=audit(1348173810.874:6248): auditd start, ver=1.7.7 format=raw
kernel=3.0.13-0.27-default audit=0 pid=4235 subj=system_u:system_r:auditd_t res=success
type=AVC msg=audit(1348173901.081:292): avc: denied { write } for
pid=3426 comm="smartd" name="smartmontools" dev=sda6 ino=581743
scontext=system_u:system_r:fsdaemon_t tcontext=system_u:object_r:var_lib_t tclass=dir
type=AVC msg=audit(1348173901.081:293): avc: denied { remove_name } for pid=3426
comm="smartd" name="smartd.WDC_WD2500BEKT_75PVMT0-WD_WXC1A21E0454.ata.state~" dev=sda6
ino=582390 scontext=system_u:system_r:fsdaemon_t tcontext=system_u:object_r:var_lib_t
tclass=dir
type=AVC msg=audit(1348173901.081:294): avc: denied { unlink } for pid=3426
comm="smartd" name="smartd.WDC_WD2500BEKT_75PVMT0-WD_WXC1A21E0454.ata.state~" dev=sda6
ino=582390 scontext=system_u:system_r:fsdaemon_t tcontext=system_u:object_r:var_lib_t
tclass=file
type=AVC msg=audit(1348173901.081:295): avc: denied { rename } for pid=3426
comm="smartd" name="smartd.WDC_WD2500BEKT_75PVMT0-WD_WXC1A21E0454.ata.state" dev=sda6
ino=582373 scontext=system_u:system_r:fsdaemon_t tcontext=system_u:object_r:var_lib_t
tclass=file
```

```

type=AVC msg=audit(1348173901.081:296): avc: denied { add_name } for pid=3426
comm="smartd" name="smartd.WDC_WD2500BEKT_75PVMT0-WD_WXC1A21E0454.ata.state~"
scontext=system_u:system_r:fsdaemon_t tcontext=system_u:object_r:var_lib_t tclass=dir
type=AVC msg=audit(1348173901.081:297): avc: denied { create } for pid=3426
comm="smartd" name="smartd.WDC_WD2500BEKT_75PVMT0-WD_WXC1A21E0454.ata.state"
scontext=system_u:system_r:fsdaemon_t tcontext=system_u:object_r:var_lib_t tclass=file
type=AVC msg=audit(1348173901.081:298): avc: denied { write open } for pid=3426
comm="smartd" name="smartd.WDC_WD2500BEKT_75PVMT0-WD_WXC1A21E0454.ata.state" dev=sda6
ino=582390 scontext=system_u:system_r:fsdaemon_t tcontext=system_u:object_r:var_lib_t
tclass=file
type=AVC msg=audit(1348173901.081:299): avc: denied { getattr } for pid=3426
comm="smartd" path="/var/lib/smartmontools/smartd.WDC_WD2500BEKT_75PVMT0-
WD_WXC1A21E0454.ata.state" dev=sda6 ino=582390 scontext=system_u:system_r:fsdaemon_t
tcontext=system_u:object_r:var_lib_t tclass=file
type=AVC msg=audit(1348173901.309:300): avc: denied { append } for pid=1316

```

A single message looks as follows:

```

type=AVC msg=audit(1348173901.081:299): avc: denied { getattr } for pid=3426
comm="smartd" path="/var/lib/smartmontools/smartd.WDC_WD2500BEKT_75PVMT0-
WD_WXC1A21E0454.ata.state" dev=sda6 ino=582390 scontext=system_u:system_r:fsdaemon_t
tcontext=system_u:object_r:var_lib_t tclass=file

```

Every line of the message can be broken down into sections. For example, the sections in the last line are:

type=AVC:

Every SELinux-related audit log line starts with the type identification, for example, type=AVC. Note that a message with the type=SYSCALL that follows one with a different type and has the same value of msg may provide further information regarding the event.

msg=audit(1348173901.309:300):

This is the time stamp, which is written in epoch time, the number of seconds that have passed since Jan 1, 1970. You can use **date -d** on the part up to the dot in the epoch time notation to find out when the event happened:

```

> date -d @1348173901
Thu Sep 20 16:45:01 EDT 2012

```

avc: denied { append }:

The specific action that was denied. In this case, the system has denied the appending of data to a file. While browsing through the audit log file, you can see other system actions, such as write open, getattr and more.

for pid=1316:

the process ID of the command or process that initiated the action

comm="rsyslogd":

the specific command that was associated with that PID

name="smartmontools":

the name of the subject of the action

dev=sda6 ino=582296:

the block device and inode number of the file that was involved

scontext=system\_u:system\_r:syslogd\_t:

the source context, which is the context of the initiator of the action

tclass=file:

a class identification of the subject

## 2 Analyzing `/var/log/audit/audit.log` with `audit2allow`

Instead of interpreting the events in `/var/log/audit/audit.log` yourself, you can use the `audit2allow` command.

The command helps analyze the cryptic log messages in `/var/log/audit/audit.log`. An `audit2allow` troubleshooting session always consists of three different commands. First, you would use `audit2allow -w -a` to present the audit information in a more readable way. The `audit2allow -w -a` by default works on the `audit.log` file. If you want to analyze a specific message in the `audit.log` file, copy it to a temporary file and analyze the file with:

```
> sudo audit2allow -w -i FILENAME
```

EXAMPLE 2: ANALYZING AUDIT MESSAGES

```
> sudo audit2allow -w -i testfile
type=AVC msg=audit(1348173901.309:300): avc: denied { append } for pid=1316
comm="rsyslogd" name="acpid" dev=sda6 ino=582296
scontext=system_u:system_r:syslogd_t tcontext=system_u:object_r:apmd_log_t tclass=file
```

This was caused by:

A missing type enforcement (TE) allow rule.

To generate a loadable module to allow this access, run

```
> sudo audit2allow
```

To find out which specific rule has denied access, you can use `audit2allow -a` to show the enforcing rules from all events that were logged into the `audit.log` file, or `audit2allow -i FILENAME` to show it for messages that you have stored in a specific file:

EXAMPLE 3: VIEWING WHICH LINES DENY ACCESS

```
> sudo audit2allow -i testfile
#===== syslogd_t =====
allow syslogd_t apmd_log_t:file append;
```

To create an SELinux module with the name `mymodule` that you can load to allow the access that was previously denied, run

```
> sudo audit2allow -a -R -M mymodule
```

If you want to do this for all events that have been logged into the `audit.log` file, use the `-a -M` command arguments. To do it only for specific messages that are in a specific file, use `-i -M` as in the example below:

EXAMPLE 4: CREATING A POLICY MODULE ALLOWING AN ACTION PREVIOUSLY DENIED

```
> sudo audit2allow -i testfile -M example
***** IMPORTANT *****
To make this policy package active, execute:

semodule -i example.pp
```

As indicated by the `audit2allow` command, you can now run this module by using the `semodule -i` command, followed by the name of the module that `audit2allow` has created for you (`example.pp` in the above example).

### 3 Analyzing AVC messages using `setroubleshoot`

To analyze AVC denial messages in a user-friendly way, you can use the `setroubleshoot` tool.

## 3.1 Overview of **setroubleshoot**

### 3.1.1 What is **setroubleshoot**?

**setroubleshoot** is a tool that collects SELinux audit events from the kernel and analyses these events. If such an event occurs, **setroubleshoot** informs the administrator.

### 3.1.2 **setroubleshoot** components

The SELinux troubleshooting process involves the following components, all of which are installed on SLE Micro by default.

- **setroubleshoot-server** provides the following tools:
  - **setroubleshootd**—the main daemon handling incoming requests and plug-in definitions. The daemon is activated on demand and does not require running via the **systemd** service. It can be managed only by a privileged user and a dedicated **setroubleshoot** user.
  - a database of alerts in the file `/var/lib/setroubleshoot/setroubleshoot_database.xml`
  - **sealert**—a command-line user interface to analyze the `/var/log/audit.log`
  - **sedispatch**—an audit dispatcher that scans SELinux AVC messages and transforms them into a Dbus message, then passed to the daemon.
- **setroubleshoot-plugins**—the plug-ins are used for AVC message analysis and provide suggestions on how to fix problems.

### 3.1.3 How does **setroubleshoot** work?

**setroubleshoot** comprises a daemon and analysis plug-ins. When a plug-in detects a problem, it is reported to the daemon, which then checks whether this is a known problem. If not, the new problem is added to the database along with a suggested solution.

### 3.1.4 Benefits of **setroubleshoot**

**setroubleshoot** provides the following functionalities to help you solve problems on your SELinux secured systems:

- Sending alerts to the administrator when there is an AVC denial.
- Automatic analysis of AVC denials.
- Suggesting possible fixes, such as adjusting system configuration or installing updates and so on.
- Browsing of previous alerts.

## 3.2 Configuring **setroubleshoot**

Even though the configuration of **setroubleshoot** does not require adjustment, you may face particular use cases when you need to change the defaults. The following sections provide the usual use cases.

The configuration file for **setroubleshoot** is `/etc/setroubleshoot`. Usually, you do not have to modify the configuration besides setting the e-mail notifications. However, if you need to change the configuration, you can either edit the file, or you can use the **setroubleshootd** command to configure a particular item. The command syntax is the following:

```
# setroubleshootd -c  
SECTION.OPTION=VALUE
```

For example, to set the `from_address` option, run the command as follows:

```
# setroubleshootd -c  
email.from_address="example@mail.com"
```

### 3.2.1 Configuring **setroubleshoot** logging level

The default logging level (the value of `sealert_log` and `setroubleshootd_log`) is set to `warning`. However, you can set the value to one of the following:

**critical**

Only serious errors that prevent the system from functioning are logged.



#### error

Serious errors that may influence the system are reported.

#### warning

An indication that something unexpected happened, or that a problem might occur in the near future. However, the system works as expected.

#### info

A confirmation that the system is running correctly is logged.

#### debug

Detailed information for debugging purposes is logged.

### 3.2.2 Configuring `setroubleshoot` to send e-mail notifications

`setroubleshoot` can send you e-mail notifications if there is an AVC denial in the system.

To get these notifications, proceed as follows:

1. Open the `/etc/setroubleshoot/setroubleshoot.conf`.

2. In the file, adjust the following configuration items to suit your needs:

#### `smtp_host`

If the SMTP server does not run on the local host, fill in the server address.

#### `smtp_port`

The default is 25. Usually, this value does not require any adjustment.

#### `from_address`

Add the sender address.

#### `subject`

Configure a generic subject of all messages.

#### `recipients_filepath`

Specify the location of the notification recipients list.

#### `use_sendmail`

Set to `true` if you use SendMail.

3. Create the mail recipients file on the path defined by the `recipients_filepath` option (`/var/lib/setroubleshoot/email_alerts-recipients` by default).

Each e-mail address must be on a separate line. Comments are denoted with the # symbol.

### 3.2.3 Configuring the `setroubleshoot` database

You can change the amount of records in the `setroubleshootd` database, its location or the file name prefix.

#### `database_dir`

Specify an absolute path to the directory where the database XML file should reside.

#### `filename`

Configure a custom prefix of the database file name. The file name then looks as follows: `FILENAME_PREFIX_database.xml`.

#### `max_alerts`

Defines the maximum number of records in the database. Specify `0` for an unlimited number of records.

#### `max_alert_age`

Alerts older than the set limit are deleted from the database. You can use the units: *year, month, day, hour, minute and second* even in the plural form and you can use more than one unit, for example, 3 weeks 2 days, which equals to 23 days. If left empty, there is no limit.

### 3.2.4 Configure `setroubleshoot` to collect information from remote servers

You can configure `setroubleshoot` to gather SELinux audit data from remote servers. To do so, configure the address list.

#### `[listen_for_client] address_list`

On the server side.

#### `[client_connect_to] address_list`

On the client side.

Addresses on the list are in this format:

```
[{FAMILY}]ADDRESS[:PORT_NUMBER]
```

Where `{FAMILY}` is `{inet}` or `{unix}%{path}s`. If the address family is `inet`, you can optionally specify a port number, otherwise the port number is set to the default specified by the `default_port` configuration option. The default value `{unix}%{path}s hostname` means listening on the local Unix domain socket.

### 3.3 Running the `/var/log/audit/audit.log` analysis

To let the `setroubleshoot` tool analyze the audit log file, run the command:

```
> sudo sealert -a /var/log/audit/audit.log
```

In the following example output, there are two port values assigned to the SSHD service:

```
100% done
found 1 alerts in /var/log/audit/audit.log
-----

SELinux is preventing sshd from name_bind access on the tcp_socket port 2222.

**** Plugin bind_ports (92.2 confidence) suggests ****

If you want to allow sshd to bind to network port 2222
Then you need to modify the port type.
Do
# semanage port -a -t PORT_TYPE -p tcp 2222 ①
   where PORT_TYPE is one of the following: ssh_port_t, vnc_port_t, xserver_port_t.

**** Plugin catchall_boolean (7.83 confidence) suggests ****

If you want to allow nis to enabled
Then you must tell SELinux about this by enabling the 'nis_enabled' boolean.

Do
setsebool -P nis_enabled 1

**** Plugin catchall (1.41 confidence) suggests ****

If you believe that sshd should be allowed name_bind access on the port 2222 tcp_socket
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:
# ausearch -c 'sshd' --raw | audit2allow -M my-sshd
```

```
# semodule -X 300 -i my-sshd.pp

Additional Information:
...

First Seen                2024-02-07 14:26:27 UTC
Last Seen                 2024-02-08 03:30:12 UTC
Local ID                  b5cbdd75-3f8d-425d-af75-f6cbf1540ffd

Raw Audit Messages
type=AVC msg=audit(1707363012.797:25): avc: denied { name_bind } for
pid=841 comm="sshd" src=2222 scontext=system_u:system_r:sshd_t:s0-s0:c0.c1023
tcontext=system_u:object_r:unreserved_port_t:s0 tclass=tcp_socket permissive=0

Hash: sshd,sshd_t,unreserved_port_t,tcp_socket,name_bind
```

- 1 The `bind_ports` plug-in provides the most suitable solution for the problem here.

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