Managing SELinux in SUSE® Linux Enterprise Server 12

TUT 7986

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Agenda

- What is SELinux?
- SELinux State in SUSE® Linux Enterprise Server 12
- Understanding SELinux Modes
- The SELinux Policy
- SELinux Access Control
- Managing SELinux
- Troubleshooting SELinux
- Customizing SELinux Policy
- Creating Custom Rules
- Using SELinux Users and Roles

Why do you need Kernel Level Security?

What is SELinux?

What is SELinux?

- All syscalls are denied by default, unless specifically enabled
- All objects (files, ports, processes) are provided with a security label (the context)
  - User, role and type part in the context
  - Type part is the most important
- The SELinux policy contains rules where you can see which source context has access to which target context

SELinux Components

- The policy is the key component
- It defines security contexts for type enforcements
  - That means: if you use **ls –Z** on a directory, you'll find a context user, role and type and the policy knows what to do with it.
- It all comes down to a line like the following that is defined in the policy:
  - allow user_t bin_t file {read execute getattr};
    - Which states that user_t (the source) has allow to bin_t (the target) on the object class file with the permissions read execute and getattr.
- The SELinux Policy contains thousands of rules

SELinux versus AppArmor

- Both are supported in SUSE Linux Enterprise Server
- SELinux is becoming the de facto standard
  - wide support
  - relatively difficult configuration
  - starts from an all denied situation
- AppArmor also offered
  - default profiles available
  - relatively easy to create new configurations

SELinux State in SUSE Linux Enterprise Server 12

SELinux State in SUSE Linux Enterprise Server 12

- Full support for binaries and kernel support
- No SUSE Linux Enterprise Server policy yet
- Policy expected for SUSE Linux Enterprise Server 12 SP1
- Currently, the OpenSUSE 13.1 policy works quite good

Enabling SELinux in SUSE Linux Enterprise Server 12

- zypper in selinux-tools selinux-policy
- download selinux-policy-targeted from opensuse and install
  - ensure version matches that of selinux-policy
  - install both policy packages
- run **selinux-ready**; it will tell you what you need to do to enable SELinux
  - Add **security=selinux selinux=1** to the kernel boot parameters and don't forget to update grub using **grub2-mkconfig /boot/grub2/grub.cfg**.
  - Run **pam-config –a --selinux**
- **reboot**

Finalizing SUSE Linux Enterprise Server 12 SELinux Configuration

- Relabel the entire filesystem: **restorecon –R /**
- Start the auditing service for messages in /var/log/audit/audit.log
  - **systemctl start auditd**
  - **systemctl enable auditd**
- **reboot**
- Type **sestatus** to verify current status

Understanding SELinux Modes

SELinux States and Modes

- Enabled
  - Enforcing: fully functional
  - Permissive: not blocking anything, but logging
    - SELinux support is available in the kernel, so applications will load with all SELinux libraries and behave differently
    - Expect unexpected behavior on some occasions.
    - Log files are in /var/log/audit.log
      - Understand timestamps in audit.log using date –d @timestamp (e.g.: **date –d @1413359626**
- Disabled
  - SELinux support is not available in the kernel, so applications will load differently

The SELinux Policy

Refpolicy: the Mother of All Policies

- The refpolicy is a generic fully functional policy that is managed as a free software project
- Application developers provide code for the refpolicy, where after peer review it can be included
- Refpolicy is a common base for distributions that only need to make modifications to it
- Because of differences that in some cases are big, making changes can be hard.

Policy Features

- Targeted is the normal policy, which works with context labels only
- Multi Level Security (MLS) is used to give every object a security clearance label
- Multi Category Security (MCS) is like MLS but less detailed
- Support of features is indicated by policy version – current version is 28
  - use **sestatus** to find out
- Several options need to be compiled in if desired
  - Handling of unknown permissions
  - Support for unconfined domains

SELinux Access Control

SELinux Access Control

- Type Enforcement is important in the targeted policy
  - Find out using –Z option on several commands
    - netstat –Ztulpen
    - ps –Zaux
    - ls –Z
- Access is allowed between similar source and target types
  - This prevents services from accessing user files
  - User processes are typically running as unconfined

Managing SELinux

Managing SELinux Means Applying Context

- Context on files are set in the policy and applied to the filesystem
  - **semanage fcontext –a –t http_sys_content_t "/web(/.*)?"**
  - **restorecon –Rv**

- **Do not use chon**
  - chcon is evil
  - context applied to the inode, not to the policy
  - it won't survive an autorelabel

Finding the Right Context

- Easiest: check default objects
- Use **semanage fcontext –l** to get a list of all context settings in the policy
- Get the information from the policy, using **seinfo –t**
- Where available, use _selinux manpages (**man –k _selinux**)

Applying Port Security

- Applications (**ps Zaux**) and ports have context labels also.
- Managing port context can be required

  semanage port –a –t ssh_port_t –p tcp 2022

  semanage port –m –t ssh_port_t –p tcp 443

  -m is necessary to relabel a port that has a current label applied already.

Using Booleans

- Booleans provide an easy interface to change settings in the policy
- Use **semanage boolean –l** for an overview of available booleans
- Use **getsebool –a** alternatively
- Set booleans using **setsebool –P yourboolean [0|1]**

Troubleshooting SELinux

Using sealert

- Created to make human readable reports based on /var/log/audit/audit.log
  - Displays analysis as well as recommended action
- Matches against an event database and gives every solution a probability score
- When applied to /var/log/messages, **sealert** is used with a UUID on specific events
- Or use **sealert –a /var/log/audit/audit.log** to generate messages for all events that have happened
- Use **sealert –b** for a graphical interface

Reading Boolean Content

- **sesearch –b allow_ftpd_anon_write –ACT**
  - First character in output shows state in the policy (Disabled or Enabled)
  - Second character shows if the displayed rule is enabled or disabled (True or False)
- Search rules with a specific permission
  - **sesearch -b allow_ftpd_anon_write –p read -AC**

Reading SELinux Labels

- **sesearch –s httpd_t –t user_home_t –p read –AC**
  - shows all allow rules where httpd_t gets access to user_home_t

Finding Out What an Application Can Do

- First, find the source context type set to your applications
  - **ps Zaux | grep http** would give **httpd_t**
- Use **sesearch –A | grep httpd_t** to see all allow rules and to what specifically access is allowed.
  - These are *existing* rules, not just *effective* rules!
- Use **sesearch –AC | grep httpd_t** instead.
  - This shows the boolean needed to allow the rule displayed, and its current state. (ET / DF = Enabled, True / Disabled / False)

SELinux and Unsupported Applications

- Most applications are not SELinux aware
  - In general, they could be integrated with SELinux
- Some applications are and they make active calls to SELinux libraries
  - The applications behave differently if SELinux code is active
  - Use **ldd** to find out if SELinux libraries are used
  - On SUSE SELinux native applications are rare

Disabling SELinux for Specific Context Types

- **semanage permissive –a somelabel_t**
- Switch off using **semanage permissive –d somelabel_t**
- Use **semanage permissive –l** for an overview of domains that are currently set to permissive
- Don't use this too much because it makes your system more vulnerable!

Customizing SELinux Policy

Customizing SELinux Policy

- Booleans provide an easy interface to customize policy
- Modules can be used to provide basic support for SELinux functionality
  - **semodule –l** to list
  - **semodule –f** to shut off all rules for a part of the system
  - **audit2allow** is provided as easy-to-use interface to compile your own

Understanding Policy Modules

- ***.te** files contain all rules that are compiled into the policy (these files are key)
- ***.if** files define how other policy modules get access to this policy
- ***.fc** files contain labeling instructions
- ***.pp** files are the binary policy modules

Understanding Policy Modules

- After using **audit2allow** a *.te file and a *.pp file are created
- If refpolicy is installed, find these fiels in /etc/selinux/refpolicy/modules/services
- Manual changes are allowed but not recommended
  - After making modifications, run **make && make install && make load**

Using audit2allow

- audit2allow is dangerous if you don't know what you're doing!
- Example: **grep http /var/log/audit/audit/log | audit2allow –M mypolicy**
  - Creates mypolicy.te and mypolicy.pp
  - Read mypolicy.te to see what it is doing
  - Use **semodule –i modulename.pp** to run the newly created policy module

Creating Custom Rules

Creating Custom Rules

- In a modular policy, the source files of the policy modules are where you want to apply modifications
- In particular, look at the *.te files that contain what exactly has to be done
- **audit2allow** is a reactive interface to generate some *.te files
- Use policy sources for full access

Understanding Custom Rules

- Default rule syntax:
  - allow <source> <destination> : <class> <permissions> ;
  - See audit.log for examples
- Source is always a domain
- Destination can be anything
- <class> is the thing that is accessed in the target
  - file, directory, socket, capability, etc
  - use **seinfo –c** for a complete overview
- Each class has specific permissions associated to it
  - Use **seinfo –c<class> -x** to show
  - As in **seinfo –cfile -x**

Translating Audit Message to Custom Rules

- Consider this message in audit.log
  - **type=AVC msg=audit(1413357425.988:1060): avc: denied { name_bind } for pid=29198 comm="sshd" src=443 scontext=unconfined_u:system_r:sshd_t:s0-s0:c0.c1023 tcontext=system_u:object_r:http_port_t:s0 tclass=tcp_socket**
- Which translates into the following rule if you want to allow: **allow sshd_t http_port_t : tcp_socket { name_bind };**
- Don't do this manually, use **audit2allow** instead!
  - **grep ssh /var/log/audit/audit.log | audit2allow –M mypolicy**

Manually Adding Policy Files (1 of 2)

- Start by creating a .te file (~/sander.te)

```
module sanderpolicy 1.0;
require {
        type sshd_t;
        type http_port_t;
        class tcp_socket { name_bind };
}
allow sshd_t http_port_t:tcp_socket { name_bind };
```

Manually Adding Policy Files (2 of 2)

- Create the policy module:
  - **checkmodule –M –m –o sander.mod sander.te**
  - **semodule_package –o sander.pp –m sander.mod**
- Run the policy module
  - **semodule –i sander.pp**
- Enable the policy module
  - **semodule –e sander.pp**

Using SELinux Users and Roles

Managing SELinux Users

- By default, users are logged in as unconfined_u
- Some default user roles exist:
  - user_u: regular restricted users
  - staff_u: operators
  - sysadm_u: system admins
  - custom users can be created
- An SELinux user defines the roles that a user can switch to
- Use **semanage user –l** for an overview

Understanding Unconfined

- By default, unconfined_u users have access to items running in unconfined domains.
  - Use **seinfo –aselinux_unconfined_type –x** to find out what exactly those are
- Linux users on login by default are all mapped to the unconfined_u user
  - **semanage login –l** shows available mappings
  - **__default__** is mapped to unconfined_u, as is the root user
  - **_system_u** is for all system processes

Creating SELinux Users

- **semanage login –a –s user_u linda**
  - Creates a user linda that is mapped to the SELinux user_u user role
  - When applying changes to existing users, you must relabel the homedirectory: **restorecon /RF /home/linda**
- **semanage login –a –s sysadm_u "%admins"**
  - Maps all members of the admins group to the SELinux sysadm_u user
- Use **semanage user –l** for an overview of current SELinux users
- Use **seinfo –adomain –r** for an overview of roles

Using roles

- A role is a collection of tasks that is allowed.
  - Use **seinfo –adomain –r** to show currently existing roles
- Users can enter a new role using the **newrole –r** command, as in **newrole –r sysadm_r**
- Services can be started in a specific role using **run_init /etc/init.d/myservice start**. This will start services in the system_r role, instead of the role of the current user
  - This happens as a default on most Linux distributions
  - No longer needed on systemd systems
    - From systemd perspective, services are started by systemd, not by the user

Specific SELinux Cases

Resetting the Root Password Using rd.break

- Understanding rd.break root password recovery
  - Root password is reset with SELinux disabled
  - When using passwd, a new temporary file is created. This file has no context label.
  - While booting, SELinux gets enabled and finds /etc/shadow without context labels, so shuts down all access to it
    - **ls –Z** will show ???? or unlabeled_t
  - To prevent, use **touch /.autorelabel** which relables all
- You can also consider using **load_policy –i** right after entering rd.break mode. This loads the policy and makes sure file labels are set correctly.

Summary

More information

Refpolicy project: http://oss.resys.com/projects/refpolicy

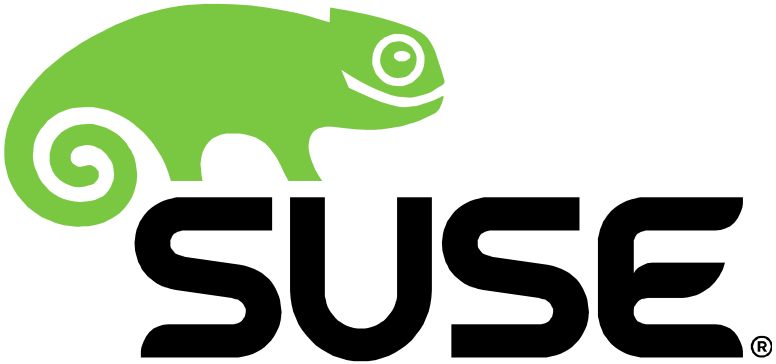
Dan Walsh blog: http://danwalsh.liveblog.com

Sven Vermeulen, SELinux System Administration
(ISBN 978-1-78328-317-0)

Check it out yourself!

QUESTIONS?

Thank you.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