2772999 - Red Hat Enterprise Linux 8.x: Installation and Configuration

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Symptom

You want to use SAP server software on Red Hat Enterprise Linux 8.x

Other Terms

Red Hat, Redhat, RH, Enterprise Linux, RHEL8, x86_64, ppc64, s390x, System Z, PowerLinux

Reason and Prerequisites

You want to use SAP server software on Red Hat Enterprise Linux 8.x

Solution

Environment

This document describes the installation and configuration of Red Hat Enterprise Linux 8 for the installation of SAP server software. In the following, "RHEL 8" means any minor release of Red Hat Enterprise Linux 8.x unless specified otherwise.

In general, if RHEL 8 is listed as supported in the SAP Product Availability Matrix, you can use any update release of RHEL 8, for example RHEL 8 Update 1 (RHEL 8.1).
For SAP HANA, please check SAP Note 2235581 - SAP HANA: Supported Operating Systems for the list of supported RHEL 8 minor releases.

The installation or configuration of RHEL 8 for a database server for SAP software is not the primary purpose of this document. If you want to install a database server, please consult the operating system and database system documentation as well.

Supportability Prerequisites

In order for your SAP system to be fully supported on RHEL 8, the following prerequisites must be fulfilled (this list is not exclusive, other notes may apply):

- You need to use the **Red Hat Enterprise Linux for SAP Applications** or the **Red Hat Enterprise Linux for SAP Solutions** subscription for all RHEL 8 servers running SAP applications. See SAP Note 2871484 and the Red Hat Enterprise Linux for SAP Solutions page for more information. Please contact your local Red Hat sales representative for more information about how to purchase **Red Hat Enterprise Linux for SAP Applications** or **Red Hat Enterprise Linux for SAP Solutions**.
- You need to have valid support and update entitlements (subscriptions) from Red Hat for RHEL 8 and

any additional layered components (e.g. Virtualization, Clustering, Cluster Storage). If the RHEL release has reached the end of the regular maintenance cycle (see SAP Note 936887 for an overview of the maintenance cycles of the Linux distributions supported by SAP), you need to make sure to have valid "Extended Lifecycle Support" subscriptions from Red Hat to be able to continue to use RHEL 8 until the final maintenance for the distribution by Red Hat ends.
- Your server must be able to retrieve additional RHEL 8 software packages and updates from the Red Hat Customer Portal either directly or via a Red Hat Satellite/Proxy server.
- You need to use hardware that is certified for SAP use on Linux by your hardware vendor. See the respective notes on certified hardware which are listed in SAP Note 2369910.
- For s390x, see SAP Note 1452070 for additional recommendations.
- It is recommended to always install the latest patches provided by Red Hat for all RHEL 8 packages installed on the system.

Supported Hardware Platforms

Certification of specific SAP products on specific versions of Red Hat Enterprise Linux notwithstanding, the following hardware platforms are certified for use of SAP software on Red Hat Enterprise Linux:

- x86_64 (64bit Intel or AMD processors)
- ppc64le (IBM Power LE)
- s390x (IBM System Z)

Supported File Systems

In general, any file system supported by Red Hat for RHEL8 can also be used for SAP installations. Since the database vendors can limit the support of their database to certain file systems, please check with your DB vendor if the file system you plan to use is also supported by them. See SAP note 405827 for more information on file systems for SAP on Linux.

Upgrading From a Previous Red Hat Enterprise Linux Release to RHEL 8

You can upgrade an existing RHEL 7 system to RHEL 8. For requirements, limitations, and instructions, please see the Upgrading to RHEL 8 guide.

Before starting the upgrade, please make sure that all SAP and DB instances running on the server have been updated to a level that is supported on RHEL 8, that a backup of the server exists, and that a restore test with this backup has been completed successfully. All SAP and DB instances running on the server must be stopped, and all file systems belonging to the SAP installation (/usr/sap, /sapmnt, /<DB>) must be unmounted before starting the OS upgrade procedure to avoid damage to the SAP installation during the OS upgrade.

Installing Red Hat Enterprise Linux 8

Install the operating system as described in one of the RHEL 8 Installation guides, for example for performing an interactive or a non-interactive (kickstart) RHEL 8 installation, using the following guidelines:

- Use English as the installation and system language. You can still change the keyboard layout to your local preference in the "Keyboard" configuration screen.
- In the software selection, use the "Server" Base Environment (=environment group). No Add-Ons are required during installation. After the installation has finished, or as part of an automated installation, futher packages need to be installed dependent on the SAP software to be used. See section Installing Additional Software Packages below.
- In the "Network & Hostname" configuration screen, enter the short name (e. g. "sapserver1") and not the fully qualified hostname (e. g. "sapserver1.example.com"). How to map the short hostname to the

fully qualified hostname is described below under Configuring the Hostname.
- Manually partitioning the disks is strongly recommended to reserve space for the application. You can, however, also use one large "/" file system, which might be useful for test systems.
- Select the correct timezone and make sure the date and time are set correctly in the "Date & Time" configuration screen. If a local NTP server is available, you should also configure it in this screen.

Enabling Access to Red Hat Software Updates

You have to register the system on the Red Hat Customer Portal or a local Red Hat Satellite (version 6 or higher) server to retrieve update packages for your server. It is recommended that you update all packages (including kernel and glibc) to the latest version available in the official RHEL 8 repositories after the initial OS installation and at regular intervalls later on.

Installing Additional Software Packages

The following additional packages need to be installed for all SAP products:

- uuidd
- libnsl
- tcsh
- psmisc
- nfs-utils
- bind-utils

For SAP HANA, the following additional packages need to be installed:

- expect
- graphviz
- iptraf-ng
- krb5-workstation
- libatomic
- libcanberra-gtk2
- libibverbs
- libicu
- libpng12
- libssh2
- lm_sensors
- numactl
- PackageKit-gtk3-module
- xorg-x11-xauth

The following packages are also required for SAP HANA but these are part of the "Server" environment group:

- bind-utils
- cairo
- libaio
- krb5-libs
- net-tools
- openssl
- rsyslog
- sudo
- xfsprogs

The following packages are also required for SAP HANA but these are installed as a dependency of the graphviz package:

- gtk2
- libtool-ltdl

You can install or reinstall packages, package groups, or environment groups, with the following commands, provided that your system can access the RHEL software channels via the officially supported ways (directly or via Red Hat Satellite/Proxy):

yum [group] install <spec1> [<spec2> [<spec3> [...]]]
where <spec*> are the names of the packages, groups, or environment groups to be installed, e.g.:
yum install tcsh uuidd
yum group install Server

Note: Instead of "yum group install", you can also use "yum install" and add a "@" in front of the specifier, as in the following example:

yum install @Server

To list all available groups and environment groups, use:

yum group list -v

To list all packages of a group or all groups of an environment group, use:

yum group info <group|environment group>

Required Patches

The following patches must be installed (minimum patch levels):

RHEL 8.0:

- setup-2.12.2-2.el8_0.1

RHEL 8.1:

- setup-2.12.2-2.el8_1.1

Configuring SELinux

Red Hat Enterprise Linux uses SELinux technology for additional security, which is enabled by default. Because several components of an SAP server system (like the installation tools or some underlying databases) are not aware of SELinux, you have to set the mode of SELinux to "Disabled" or "Permissive". If you disable SELinux, you have to reboot the server for the change to become effective. Setting SELinux to "Permissive" mode is possible without a system reboot. A small negative performance impact is to be expected when using mode "Permissive" instead of "Disabled" due to additional kernel overhead.

For checking the SELinux mode, use the getenforce command, as in the following example:

getenforce
Permissive

Changing the SELinux mode from "Enforcing" or "Permissive" to "Disabled" immediately on a running system is not possible. Changing the SELinux mode to "Permissive" can be done with the setenforce command, as in the following example:

setenforce Permissive

or:

setenforce 0

For setting the SELinux mode to "Disabled" permanently, use the following command and reboot the server:

sed -i 's/\(SELINUX=enforcing\|SELINUX=permissive\)/SELINUX=disabled/g' /etc/selinux/config

The change will only become effective after a system reboot. Note that all characters of the SELINUX value in file /etc/selinux/config are in lowercase, whereas the SELINUX value in the setenforce command has an uppercase character at the beginning.

Configuring the Hostname

Ensure that the system hostname is set to the short name as described above so that both commands "hostname" and "hostname -s" will return the hostname without domain. The "hostname -f" command must return the fully qualified hostname and domain. See the following example:

hostname
sapserver1
hostname -s
sapserver1
hostname -f
sapserver1.example.com

To set the hostname permanenty, use the "hostnamectl" command with the set-hostname subcommand, e.g.:

hostnamectl set-hostname sapserver1

In addition to the correct hostname setting, file /etc/hosts needs to be configured with the fully qualified hostname in the seconds column and the hostname only in the 3rd column (followed by further aliases if needed), just like in the following example:

cat /etc/hosts
127.0.0.1 localhost.localdomain localhost
192.168.0.1 sapserver1.example.com sapserver1 sapsv1

Any additional hosts should be added after these two lines.

The hostname of the server must not be associated with IP address 127.0.0.1.

If you accidentially entered the fully qualified hostname during installation, you can run the command 'hostname <shorthostname>' to set the short hostname without having to reboot the system.

See SAP Note 611361 for hostname requirements for SAP NetWeaver based systems.

Finally, make sure the name resolution and reverse name resolution works correctly, using the "host" command, as in the following example:

host sapserver1.example.com
sapserver1.example.com has address 192.168.0.1
host 192.168.0.1
1.0.168.192.in-addr.arpa domain name pointer sapserver1.example.com.

Configuring Network Time and Date

The system time of all your servers in a SAP landscape needs to be identical. In RHEL 8, chrony is the default implementation of the Network Time Protocol, and ntp is no longer supported. Chronyd is enabled by default after RHEL 8 is installed. It comes with a read-to-run configuration file /etc/chrony.conf, which can be changed according to any requirements of your organization if necessary.

In addition, the time zones of all your servers need to be configured identically.

For an explanation on how to configure network time and date with chrony, please see chapter 5, Using the Chrony suite to configure NTP in the RHEL 8 Configuring basic system settings guide.

Note: TAI based timezones are not supported on a RHEL 8 installation for SAP. For further information, please see documents Resolve Leap Second Issues in Red Hat Enterprise Linux and Leap Second queries related to tzdata.

Configuring the Firewall

To protect your SAP servers from unauthorized access, you can configure the built in firewall of your RHEL system to only allow access via the ports which the SAP software uses for communication. You can use the firewall-config graphical tool or the command line tool firewall-config-cmd which are part of the firewall-config package.

For further information on how to configure the firewall, please see chapter 5, Using and Configuring firewalls in the RHEL 8 Securing networks guide.

To avoid problems with the firewall during installation, you can disable it completely with the following commands:

```
# systemctl stop firewalld
# systemctl disable firewalld
```

Configuring uuidd

The UUID generation daemon needs to be started now and at system boot. Run the following commands:

```
# systemctl start uuidd
# systemctl enable uuidd
```

Configuring TMPFS

Please follow SAP Note 941735, chapter B) "Linux operating system parameters", paragraph "TMPFS" to configure the size of tmpfs. See the Red Hat document "How do I modify the size of tmpfs?" for additional guidance if necessary.

Configuring Linux Kernel Parameters

Linux kernel parameter vm.max_map_count (RHEL 8 default: 65530) has to be increased to meet the requirements of SAP software. Also, the default of systemd parameter TasksMax, which limits the number of tasks per user on RHEL 8, can be too low for SAP workloads. This parameter is set to 80% of kernel parameters kernel.pid_max or kernel.threads-max, whatever is less, in RHEL 8. In order to automatically increase TasksMax to a more reasonable value, it is necessary to increase kernel.pid_max to the maximum possible value.

To do this, create a file /etc/sysctl.d/sap.conf with the following content:


```
# SAP settings
vm.max_map_count = 2147483647
kernel.pid_max = 4194304
```

For RHEL 7, we recommended to also set parameter kernel.sem. With RHEL 8, this is no longer necessary, as the default is higher than the SAP software requirement. See the following commands and their outputs as an example for displaying the above mentioned kernel tunables:

```
# sysctl vm.max_map_count
vm.max_map_count = 2147483647
# sysctl kernel.pid_max
kernel.pid_max = 4194304
# sysctl kernel.sem
kernel.sem = 32000 1024000000 500 32000
```

SAP Notes 900929 and 1980196 contain more information on parameter vm.max_map_count.

Run the command "sysctl --system" to activate the modified kernel parameters. You can use the command "ipcs -l --human" to check the current limits for shared memory, semaphores and message queues in the Linux kernel.

SAP Note 941735 contains more information on memory related settings for 64bit systems.

Configuring Process Resource Limits

- **Number of open files per process**

  Some components (e.g. the SAP J2EE engine, Oracle RDBMS software, ...) need to keep a large number of file handles opened simultaneously. The RHEL 8 default is 1024, which is too small in certain cases. To increase the limit of files one process can open at a time for all OS users of the SAP system and DB, please create the file /etc/security/limits.d/99-sap.conf with the following content (these are the recommended minimum values, higher values can be used too):

  ```
  @<group> hard nofile 65536
  @<group> soft nofile 65536
  ```

  where <group> is the name of the RHEL group which is used for the SAP instance and of the RHEL group which is used for the database processes. Example:

  ```
  @sapsys hard nofile 65536
  @sapsys soft nofile 65536
  @dba hard nofile 65536
  @dba soft nofile 65536
  ```

  These settings only become effective for new processes, so you have to logout and login all users belonging to these groups and to restart all processes running under those users.

- **Number of processes per user**

  Some components need to create a higher amount of processes per user from time to time, which might exceed the default maximum allowed number of processes per user on RHEL 8. In order to avoid this, please make sure that file /etc/security/limits.d/99-sap.conf has entries like the following:

  ```
  @<group> hard nproc unlimited
  @<group> soft nproc unlimited
  ```


where <group> is the name of the RHEL group which is used for the SAP instance and of the RHEL group which is used for the database processes. Example:

@sapsys hard nproc unlimited
@sapsys soft nproc unlimited
@dba hard nproc unlimited
@dba soft nproc unlimited

For more information on nproc, please see SAP note 2620175.

These settings only become effective for new processes, so you have to logout and login all users belonging to these groups and to restart all processes running under those users.

- **General remarks**

Use the command "cat /proc/self/limits" to verify the correct setting for "Max open files" and "Max processes".

To ensure that the process resource limits also get adjusted when the SAP system is started via sapcontrol or a web service client (e. g. SAP MMC), please make sure to update your SAP system at least to SAP kernel 720 PL 400. See SAP Note 1771258 for more information.

For more information on setting process resource limits, please refer to Red Hat Documents "How to set ulimit values" and "How to set or change the default soft or hard limit for the number of user's processes?"

Configuring systemd-tmpfiles

In order to ensure that important lock files and sockets in /tmp will not be deleted by systemd-tmpfiles, please add the file /etc/tmpfiles.d/sap.conf with the following contents to all RHEL 8 systems running SAP applications:

```
# systemd.tmpfiles exclude file for SAP
# SAP software stores some important files in /tmp which should not be deleted automatically

# Exclude SAP socket and lock files
x /tmp/.sap*

# Exclude HANA lock file
x /tmp/.hdb*lock

# Exclude TREX lock file
x /tmp/.trex*lock
```

Do not use cpio

When using BRBACKUP, do not use cpio as a backend due to certain limitations. Please refer to the cpio man page or to SAP Note 20577 for more information.

This document refers to

SAP Note/KBA	Title

2871484	SAP supported variants of Red Hat Enterprise Linux
2812427	Timeout or connection failure in SAP process after Linux kernel update
2369910	SAP Software on Linux: General information
1771258	Linux: User and system resource limits

This document is referenced by

SAP Note/KBA	Title
2620175	Reason for RHEL nproc to be set to Unlimited for SAP Systems
2777782	SAP HANA DB: Recommended OS Settings for RHEL 8
2820692	Db2-z/OS: SAP on IBM Z - Technical Updates & Enhancements
2378874	Install SAP Solutions on Linux on IBM Power Systems (little endian)
1452070	DB2-z/OS: SAP on Linux on IBM Z and z/VM
2919991	Db2-z/OS: Platform Availability Matrix - Additional Details
2695381	Db2-z/OS: Release of Linux on IBM Power Systems Little Endian as an application server platform

