Red Hat Enterprise Linux System Roles for SAP

Overview

Red Hat Enterprise Linux (RHEL) 7 introduced RHEL System Roles for SAP to assist with remotely or locally configuring RHEL 7.6 and later, before installing SAP HANA or SAP NetWeaver software. RHEL System Roles for SAP development is based on the Linux System Roles upstream project. The following RHEL System Roles for SAP are provided as a Technology Preview:

- `sap-preconfigure`
- `sap-netweaver-preconfigure`
- `sap-hana-preconfigure`

For more information, see the RHEL 7.7 and the RHEL 8.1 Release Notes.

Important: RHEL System Roles for SAP in Technology Preview status is tested as stable but the interface (role inputs) may receive future updates that might be incompatible with the current state. For information about Red Hat scope of support for Technology Preview features, see Technology Preview Features Support Scope.

Note: Before applying the roles, verify that the RHEL release is supported by the SAP software version that you are planning to install.

RHEL System Roles is a collection of roles executed by Ansible to assist administrators with server configuration. These roles are provided in the RHEL Extras repository. In contrast, RHEL System Roles for SAP is provided in the RHEL for SAP Solutions repositories. RHEL System Roles for SAP can be used by Ansible Engine, Ansible Tower, and Red Hat Satellite 6.5 and later to manage RHEL systems.

Important: RHEL subscriptions provide support for RHEL System Roles with Ansible Engine, which is available in the Ansible Engine channel. However, RHEL subscriptions do not include full support for Ansible Engine. If you require full support for Ansible Engine, a separate support subscription is necessary. Additional information is available at Top Support Policies for Red Hat Ansible Automation.

You can install Ansible Engine and RHEL System Roles for SAP on control nodes, which are used to configure or manage client nodes. RHEL System Roles for SAP is tested and supported by RHEL 7.6 and later. The roles should not be used for earlier clients, as SAP requirements and RHEL parameter settings might differ.

Getting Started

Use this procedure to install RHEL System Roles for SAP and Ansible.

Procedure:

1. Use subscription-manager to list the available Ansible Engine repositories. The generic `"2"` repository provides the latest release of the 2.X stream as opposed to configuring a more specific version such as 2.8.

   NOTE: Ansible Engine 2.8 or later is recommended when running on a RHEL 7 control node that is managing RHEL 8 nodes to properly handle the transition to python3.

   ```
   # subscription-manager refresh
   # subscription-manager repos --list | grep ansible
   ```

2. Permanently enable the Ansible Engine and the RHEL for SAP Solutions repositories using Red Hat Subscription Manager:

   RHEL 7:
   ```
   # subscription-manager repos \
   --enable=rhel-7-server-ansible-2-rpms \
   --enable=rhel-sap-hana-for-rhel-7-server-rpms
   ```

   RHEL 8:
   ```
   # subscription-manager repos \
   --enable=ansible-2.8-for-rhel-8-x86_64-rpms \
   --enable=rhel-8-for-x86_64-sap-solutions-rpms
   ```

3. Install Ansible Engine and RHEL System Roles for SAP:

   ```
   # yum install ansible rhel-system-roles-sap
   ```

Additional resources

The `rhel-system-roles-sap` package is installed to the following locations where `SUBSYSTEM` is the name of the individual role; for example, `sap-preconfigure` and `sap-hana-preconfigure`. Each subsystem role includes a README file that explains all variables and how to use the role.

- Documentation:
  RHEL 7: `/usr/share/doc/rhel-system-roles-sap-<version>/SUBSYSTEM/`
  RHEL 8: `/usr/share/doc/rhel-system-roles-sap/SUBSYSTEM/`

- Ansible Roles: `/usr/share/ansible/roles/SUBSYSTEM/`

Detailed description of RHEL System Roles for SAP

System Roles and SAP Notes

The following table contains the System Role, the SAP Note, or the corresponding action for the supported RHEL release.

System Role	SAP Note for RHEL 7	SAP Note for RHEL 8
`sap-preconfigure`	SAP Note 2002167	SAP Note 2772999
	SAP Note 1391070	
`sap-netweaver-preconfigure`	SAP Note 2526952 (tuned profiles only)	SAP Note 2526952 (tuned profiles only)
`sap-hana-preconfigure`	Install required packages as per documents SAP HANA 2.0 running on RHEL 7.x, and SAP HANA SPS 12 running on RHEL 7.x which are attached to SAP Note 2009879	Install required packages as per SAP Note 2772999
	SAP Note 2009879	
	SAP Note 2055470 (ppc64le only)	SAP Note 2055470 (ppc64le only)

	SAP Note 2292690	SAP Note 2777782
	SAP Note 2455582	
	SAP Note 2382421	SAP Note 2382421
	https://www14.software.ibm.com/support/customercare/sas/f/lopdiags/home.html - contains instructions for platform ppc64le	
	SAP note 2235581	

Implemented SAP Notes

The following table contains SAP Notes and their purpose and scope. The RHEL column indicates the specific RHEL releases that each SAP Note supports.

SAP Note	RHEL			Title	Purpose and scope
	6	7	8		
2002167		X		Red Hat Enterprise Linux 7.x: Installation and Upgrade	General configuration steps before installing SAP NetWeaver
1391070	X	X	X	Linux UUID solutions	Installation and configuration of uuidd
2772999			X	Red Hat Enterprise Linux 8.x: Installation and Configuration	General configuration steps before installing SAP NetWeaver or SAP HANA
2526952		X	X	Red Hat Enterprise Linux for SAP Solutions	Description of RHEL for SAP Solutions, including tuned-profiles
2235581	X	X	X	SAP HANA: Supported Operating Systems	Prerequisites for installing SAP HANA on RHEL
2009879	X	X		SAP HANA Guidelines for Red Hat Enterprise Linux (RHEL) Operating System	OS settings for HANA 1 and HANA 2 on RHEL 6.x and RHEL 7.x
2292690		X		SAP HANA DB: Recommended OS settings for RHEL 7	RHEL 7.x minor release-specific package requirements and kernel settings for SAP HANA

2455582		X		Linux: Running SAP applications compiled with GCC 6.x	Installation of `compat-sap-c++-6`
2382421	X	X	X	Optimizing the Network Configuration on HANA- and OS-Level	Configuration of network-related kernel parameters for SAP HANA
2777782			X	SAP HANA DB: Recommended OS Settings for RHEL 8	RHEL 8.x kernel settings for SAP HANA

Role variables, SAP Notes, and associated actions

Role variables are used for configuring the behavior of each role. They are described in the `README.md` file of each role, which is located in the following directories:

- **RHEL 7:** `/usr/share/doc/rhel-system-roles-sap-<version>/SUBSYSTEM/`
- **RHEL 8:** `/usr/share/doc/rhel-system-roles-sap/SUBSYSTEM/`

The following tables describe the chapter in the SAP Note and the corresponding action.

Role sap-preconfigure

RHEL 7

1. SAP Note 2002167 - Red Hat Enterprise Linux 7.x installation and update

Step #	Chapter in SAP Note	Action
1	Installing Red Hat Enterprise Linux 7	- Installation of package groups and packages
2a	Configuration changes required after the initial OS installation: Configure the Firewall	- Stop and disable service firewalld - Get the status of firewalld
2b	Configuration changes required after the initial OS installation: Configure SELinux	- Disable SELinux - Check for SELinux
3	Setting the hostname	- Verify that the short hostname is returned with "hostname" command and not FQDN - Verify that the server's IP address is in `/etc/hosts`
4	Linux kernel parameters	- Create file `/etc/sysctl.d/sap.conf` if it does not exist

		- Set kernel parameter `kernel.sem` - Set kernel parameter `vm.max_map_count`
5	Process resource limits	- Create file `/etc/security/limits.d/99-sap.conf` if it does not exist - Set the hard limit for the max number of open files per process (nofile) to 32800 for group `sapsys` - Set the soft limit for the max number of open files per process (nofile) to 32800 for group `sapsys` - Set the hard limit for the max number of open files per process (nofile) to 32800 for the database group - Set the soft limit for the max number of open files per process (nofile) to 32800 for the database group
6	Additional notes for installing SAP systems	- Link LDAP library libldap - Link LDAP library liblber - Copy file `/etc/tmpfiles.d/sap.conf`

2. SAP Note 1391070 - Linux UUID solutions

Step #	Chapter in SAP Note	Action
1	UUID Daemon (uuidd) activation	- Start and enable service uuidd - Get the status of `uuidd`

RHEL 8

1. SAP Note 2772999 - Red Hat Enterprise Linux 8.x installation and configuration

Step #	Chapter in SAP Note	Action
1	Installing Additional Software Packages	- Installation of required package groups and packages
2	Configuring SELinux	- Disable SELinux - Check for SELinux

3	Configuring the Hostname	- Verify that the short hostname is returned with "hostname" command and not FQDN - Verify that the server's IP address is in `/etc/hosts`
4	Configuring Network Time and Date	- Start and enable the service `chronyd` - Get the status of `chronyd`
5	Configuring the Firewall	- Stop and disable the service `firewalld` - Get the status of `firewalld`
6	Configuring `uuidd`	- Start and enable the service `uuidd` - Get the status of `uuidd`
7	Configuring `Tmpfs`	- Check and configure the size of `tmpfs` - `grep /dev/shm /etc/fstab` - `mount -o remount /dev/shm` - `df -k /dev/shm`
8	Configuring Linux Kernel Parameters	- Create file `/etc/sysctl.d/sap.conf` if it does not exist - Set kernel parameter `vm.max_map_count`
9	Configuring Process Resource Limits	- Create the file `/etc/security/limits.d/99-sap.conf` - Set the hard limit for the max number of open files per process (nofile) to 32800 for group sapsys - Set the soft limit for the max number of open files per process (nofile) to 32800 for group sapsys - Set the hard and soft limit for the max number of open files per process (nofile) to 32800 for the database group - Set the soft limit for the max number of processes per user (nproc) to unlimited for group sapsys - Set the soft limit for the max number of processes per user (nproc) to unlimited for the database group
10	Configuring `systemd-tmpfiles`	- Create the file `/etc/tmpfiles.d/sap.conf` if it does not exist - Copy the file `/etc/tmpfiles.d/sap.conf`

Role sap-netweaver-preconfigure

RHEL 7

1. SAP Note 2526952 - Red Hat Enterprise Linux for SAP Solutions

Step #	Activity	Action
1	Installing `tuned-profiles-sap`	- Installation of package `tuned-profiles-sap`
2	Activating `tuned-profiles-sap-netweaver`	- Enable and start tuned - Show active tuned profile - Switch to tuned `profile sap-netweaver` if not currently active - Switch to tuned `profile sap-netweaver` - Show active tuned profile

RHEL 8

1. SAP Note 2526952 - Red Hat Enterprise Linux for SAP Solutions

Step #	Activity	Action
1	Installing `tuned-profiles-sap`	- Installation of package `tuned-profiles-sap`
2	Activating `tuned-profiles-sap-netweaver`	- Enable and start tuned - Show the active tuned profile - Switch to the tuned profile `sap-netweaver` if not currently active - Switch to the tuned profile `sap-netweaver` - Show the active tuned profile

Role sap-hana-preconfigure

RHEL 7

1. SAP Note 2009879 - SAP HANA Guidelines for Red Hat Enterprise Linux Operating System

Step #	Chapter in SAP Note	Action	Also covered by tuned profile "sap-hana"
0	N/A	- Check for EUS or E4S repository	
1	PDF chapter 3.9: create compatibility links for RHEL 7.3+	- 3.9 create compatibility links for RHEL 7.2 - 3.9 create compatibility links for RHEL 7.3+	no
2	PDF chapter 3.10: disable THP	See SAP note 2292690 below	`yes: "transparent_hugepages=never"`
3	PDF chapter 3.11: configure CPU governor for performance	See SAP note 2292690 below	`yes: "include=throughput-performance" -> "governor=performance"`
4	PDF chapter 3.12: configure processor c-states	See SAP note 2292690 below	`yes: "force_latency=70"`
5	Not in pdf: increase file handles to 32800 for `sapsys` group	Set by the HANA installer	no
6	PDF chapter 3.13: set number of process to unlimited for `sapsys` group	- 3.13 set number of process to unlimited for sapsys group	no
7	PDF chapter 3.14: disable core dumps	- 3.14 disable abrt - 3.14 disable abrt-ccpp - 3.14 disable core dumps	no
8	PDF chapter 3.14: disable kdump	- 3.14 disable kdump	no
9	PDF chapter 3.15: disable firewalld	- 3.15 Ensure firewall is disabled when instance ID unknown	no

2. SAP Note 2055470 (ppc64le only) - HANA on POWER Planning and Installation Specifics - Central Note:

Step #	Chapter in SAP Note	Action
1	Set MTU size to 9000 for all network adapters	http://www-03.ibm.com/support/techdocs/atsmastr.nsf/002573f7000ac64286256c71006d2e0a/c32b40501f4f76c886257de0004fa1d4/$FILE/Network_Configuration_for_HANA_Workloads_on_IBM_Power_Servers_V6.pdf, D 1.ii)
2	TSO = largesend option	D 1.ii)
3	largesend kernel parameter	D iii.2)

3. SAP Note 2292690 - SAP HANA DB: Recommended OS settings for RHEL 7

Step #	Chapter in SAP Note	Action	Also covered by tuned profile "sap-hana"
1	Minor release-specific requirements	- Installation of minimum required packages	no
2	Configure tuned to use profile `"sap-hana"`	- Enable tuned - Get current tuned profile - Apply tuned profile, - Apply tuned profile on VMware systems	N/A
3	Turn off auto-numa balancing	- Turn off auto-numa balancing - disable numad	`yes: "kernel.numa_balancing = 0"`
4	Disable transparent hugepages	- Disable transparent hugepages at boot	`yes: "transparent_hugepages=never"`
5	Configure C-States for lower latency in Linux (x86_64 only)	- Disable intel c states in grub config (RHEL 7)	`yes: "force_latency=70"`

6	CPU Frequency/Voltage scaling (x86_64 only)	N/A (tuned only)	`yes: "include=throughput-performance" -> "governor=performance"`
7	Energy Performance Bias (EPB, x86_64 only)	N/A (tuned only)	`yes: "include=throughput-performance" -> "energy_perf_bias=performance"`
8	Kernel samepage merging (KSM)	- ensure file `/etc/init.d/boot.local` exists - Kernel samepage merging (KSM) - make sure Kernel samepage merging is off in the running system	no
9	SELinux	- Disable selinux	no
10	Update systemd	-> `variable sap_hana_preconfigure_min_packages_7.2 in vars/RedHat_7.yml`	no
11	Database startup fails with an error message `/etc/sudoers...`	- Ensure 'Defaults requiretty' is not set in `/etc/sudoers`	no
12	Message `ERROR: ld.so: object ... cannot be preloaded: ignored`	N/A	no
13	Message `Cannot access required library ...compat-sap-c++-5.so`	-> variable `sap_hana_preconfigure_packages`	no
14	IBM EnergyScale for POWER8 Processor-Based Systems	- Verify package `pseries-energy` is not installed	no
15	Network settings: See SAP note 2382421	N/A	no

16	Intel Cluster-On-Die (COD) / sub-NUMA clustering technology	N/A	no

4. SAP Note 2455582 - Linux: Running SAP applications compiled with GCC 6.x

Step #	Chapter in SAP Note	Action
1	RHEL 7 -> `compat-sap-c++-6`	Installation of package `compat-sap-c++-6`

5. SAP Note 2382421 - Optimizing the Network Configuration on HANA- and OS-Level

Step #	Chapter in SAP Note	Action
1	Linux Kernel Parameters	Set network-related kernel parameters

RHEL 8

1. Install required packages as per SAP note 2772999

Step #	Activity	Action
1	Install required packages as per SAP note 2772999	- Installation of required package groups and packages

2. SAP Note 2777782 - SAP HANA DB: Recommended OS Settings for RHEL 8

Step #	Chapter in SAP Note	Action	Also covered by tuned profile "sap-hana"
1	Disable SELinux	- Disable SELinux - Check for SELinux	no
2	Configure tuned to use profile `sap-hana`	- Enable and start tuned - Show active tuned profile - Switch to tuned profile sap-hana if not currently active - Show active tuned profile	N/A
3	Disable ABRT, core dumps, and kdump	- Stop and disable the service kdump - Create the file `/etc/security/limits.d/99-sap.conf` if it does not exist - Disable core file creation for all users, hard limit - Disable core file creation for all users, soft limit	no
4	Turn off auto-numa balancing	- Check if numad is installed - Disable numad if installed - Get status of numad	`yes: "kernel.numa_balancing = 0"`
5	Disable THP	- Disable transparent hugepages at boot time	`yes: "transparent_hugepages=never"`
6	Configure C-States at boot time (Intel only)	- Configure C-States for lower latency	`yes: "force_latency=70"`
7	Configure CPU Governor for Performance	- Check if system is able to set CPU Governor for performance - if yes: - Create file `/etc/rc.d/rc.local` if it does not exist - Configure CPU Governor for performance at boot time (x86_64 platform only)	`yes: "include=throughput-performance" -> "governor=performance"`

		- Configure CPU Governor for performance on the running system (x86_64 platform only) - Get status of CPU Governor	
8	Configure Configure Energy Performance Bias (EBP)	- Check if system supports Intel's performance bias setting - Create file `/etc/init.d/boot.local` if it does not exist - Configure EBP at boot time - Configure EBP on the running system - Get status of EBP	`yes: "include=throughput-performance" -> "energy_perf_bias=performance"`
9	Disable Kernel samepage merging (KSM)	- Create file `/etc/init.d/boot.local` if it does not exist - Disable KSM at boot time - Disable KSM on the running system - Get status of KSM	no
10	Increase kernel.pid_max	- Create file `/etc/sysctl.d/99-sap.conf` if it does not exist - Set `kernel.pid_max` to 4194304 at boot time - Set `kernel.pid_max` to 4194304 on the running system	no

3. SAP Note 2382421 - Optimizing the Network Configuration on HANA- and OS-Level

Step #	Chapter in SAP Note	Action
1	Linux Kernel Parameters	Set network-related kernel parameters

Using RHEL System Roles for SAP

Use the following procedures to configure servers for the installation of SAP NetWeaver or SAP HANA using RHEL System Roles for SAP.

Prerequisites:

1. Verify that the servers to be configured with RHEL System Roles for SAP are correctly set up for installing Red Hat software packages from a Red Hat Satellite server or the Red Hat Customer Portal.
2. RHEL System Roles for SAP requires that the Ansible control node uses locale `C` or `en_US.UTF-8` to display system messages in English. Run the following command on the Ansible control node to check the current setting:

   ```
   # locale
   ```

   The output should display either `C` or `en_US.UTF-8` in the line starting with `LC_MESSAGES=.`

   If the locale command does not produce the expected output, run the following command on the Ansible control node before executing the `ansible-playbook` command:

   ```
   # export LC_ALL=C
   ```

   Or

   ```
   # export LC_ALL=en_US.UTF-8
   ```

Configuring a server with System Role sap-netweaver-preconfigure

If the Ansible engine is installed on the same host on which SAP NetWeaver is to be installed, perform the following two steps:

1) Create a file named `sap-netweaver.yml` with the following lines. Note that indentation is essential for yml files.

```
---

- hosts: localhost

  connection: local

  roles:

  - role: sap-preconfigure

  - role: sap-netweaver-preconfigure

...
```

2) Run the RHEL System Roles sap-preconfigure and sap-netweaver-preconfigure:

```
# ansible-playbook sap-netweaver.yml
```

This will configure the local hosts according to applicable SAP notes for SAP NetWeaver.

In case you have a separate Ansible Engine host, perform the following steps to automatically configure one or more hosts (example: host names `host01` and `host02`):

1) Create or modify the file /etc/ansible/hosts containing each host to be configured in a separate line:

```
host01

host02
```

2) Create a file named sap-netweaver.yml as follows. Note that indentation is essential for yml files.

```
---

- hosts: all

  roles:

  - role: sap-preconfigure

  - role: sap-netweaver-preconfigure

...
```

3) Run the RHEL System Roles sap-preconfigure and sap-netweaver-preconfigure:

```
# ansible-playbook -l host01,host02 sap-netweaver.yml
```

This will configure the remote hosts `host01` and `host02` according to applicable SAP notes for SAP NetWeaver.

Configuring a server with System Role sap-hana-preconfigure

If the Ansible engine is installed on the same host on which SAP HANA is to be installed, perform the following two steps:

1) Create a file named `sap-hana.yml` with the following lines. Note that indentation is essential for yml files.

```
---

- hosts: localhost

  connection: local

  roles:

  - role: sap-preconfigure

  - role: sap-hana-preconfigure

...
```

2) Run the RHEL System Roles sap-preconfigure and sap-hana-preconfigure:

```
# ansible-playbook sap-hana.yml
```

This will configure the local hosts according to applicable SAP notes for SAP HANA.

In case you have a separate Ansible Engine host, perform the following steps to automatically configure one or more hosts (example: host names `host01` and `host02`):

1) Create or modify the file /etc/ansible/hosts containing each host to be configured in a separate line:

```
host01

host02
```

2) Create a file named `sap-hana.yml` as follows. Note that indentation is essential for yml files.

```
---

- hosts: all

  roles:

  - role: sap-preconfigure

  - role: sap-hana-preconfigure

...
```

3) Run the RHEL System Roles sap-preconfigure and sap-hana-preconfigure:

   # **ansible-playbook -I host01,host02 sap-hana.yml**

   This will configure the remote hosts host01 and host02 according to applicable SAP notes for SAP HANA.

For further information about using System Roles, see the Red Hat Article [3050101 - Red Hat Enterprise Linux (RHEL) System Roles](#).

Revision History

Revision	Date	Author
1.0 - First release	November 5, 2019	Bernd Finger
1.1 - Second release	April 20, 2020	Bernd Finger