Red Hat Enterprise Linux System Roles for SAP

v.2

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Contents

1. Overview

Red Hat Enterprise Linux (RHEL) 7 RHEA-2019:3190 introduced RHEL System Roles for SAP to assist with remotely or locally configuring a RHEL system for the installation of SAP HANA or SAP NetWeaver software. RHEL System Roles for SAP development is based on the Linux System Roles upstream project.

RHEL System Roles is a collection of roles executed by Ansible to assist administrators with server configuration right after the servers have been installed. These roles are provided in the RHEL Extras repository. In contrast, **RHEL System Roles for SAP** is provided in the RHEL for SAP Solutions subscription and can be used by Ansible Engine and Ansible Tower to manage RHEL systems.

The Red Hat Enterprise Linux subscription provides support for RHEL System Roles with Ansible Engine, which is available in the Ansible Engine repository (e.g. `ansible-2-for-rhel-8-$(uname -m)-rpms`). However, if you require full support for the Ansible Engine itself, a separate Red Hat Ansible Automation Subscription is necessary. Additional information is available at Top Support Policies for Red Hat Ansible Automation.

The following RHEL System Roles for SAP are fully supported on control nodes running RHEL 8.2 and later:

- *sap-preconfigure*

- *sap-netweaver-preconfigure*

- *sap-hana-preconfigure*

These roles can be used to configure the local host running RHEL 8.2 or later, or remote hosts (called *managed nodes* in the context of Ansible) running RHEL 7.6 or later and RHEL 8.0 or later. See the following table for the support status:

Control Node	Managed Node	Support Status
RHEL 8.2	RHEL 8.0 or later	fully supported
RHEL 8.2	RHEL 7.6 or later	fully supported
RHEL 8.2	RHEL 7.5 or earlier	not supported
RHEL 8.1 or earlier	RHEL (any release)	not supported(*)

Note: For *control nodes* running RHEL 7.8, RHEL 7.9, or RHEL 8.1, you can use the previous versions of `rhel-system-roles-sap` which are in Tech Preview support status. Please find the instructions for these versions here.

See the table below for the supported hardware/virtualization/cloud platforms of the managed node:

Hardware platform	Bare Metal/Virtualization/ Cloud platform	Support Status
x86_64	bare metal, Red Hat Virtualization/libvirt, VMware ESX, Red Hat Certified Cloud and Service Providers	fully supported
ppc64le	PowerVM LPARs	fully supported

s390x	zVM guest	fully supported: *sap-preconfigure*, *sap-netweaver-preconfigure*

Note: The roles are designed to be used right after the initial installation of a managed node. Do not run these roles against a SAP or other production system. The role will enforce a certain configuration on the managed node(s), which might not be intended.

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

2. Installation

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

1) Use subscription-manager to list the available Ansible Engine repositories.

```
#subscription-manager refresh
```

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

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

Note: The generic version "2" of the Ansible Engine repository provides the latest release of the 2.X stream but it is also possible to specify a certain minor Ansible Engine version such as 2.9.

```
#subscription-manager repos --enable=ansible-2-for-rhel-8-$(uname -m)-rpms
--enable=rhel-8-for-$(uname -m)-sap-solutions-rpms
```

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

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

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

Documentation: `/usr/share/doc/rhel-system-roles-sap/<role>`

Ansible Roles: `/usr/share/ansible/roles/<role>`

3. Known issues

3.1 Roles produce limited output when run in check mode

Running roles in check mode will not show all changes which are performed on a system when running in normal mode, as some Ansible modules have no or just partial support for check mode. For example, tasks will not report the values of kernel parameters. For more information on the Ansible check mode, please refer to https://docs.ansible.com/ansible/latest/user_guide/playbooks_checkmode.html.

3.2 Role *sap-preconfigure* fails if DNS domain is not set on the managed node

In case there is no DNS domain set on the managed node, which is typically the case on cloud systems, the role *sap-preconfigure* will fail in task *Verify that the DNS domain is set*. To avoid this, set variable `sap_domain` in file

`/usr/share/ansible/roles/sap-preconfigure/defaults/main.yml` or run the `ansible-playbook command` with line parameter

`-e "sap_domain=example.com"` (with the domain name being example.com in this case - please replace it by your domain name).

(sap-preconfigure issue #32)

3.3 Role *sap-preconfigure* incorrectly attempts to install `compat-sap-c++-*` packages on managed nodes running RHEL 7 on s390x

When running role *sap-preconfigure* against a managed node running RHEL 7 on s390x, it will attempt to install packages `compat-sap-c++-5`, `compat-sap-c++-6`, `compat-sap-c++-7`, and `compat-sap-c++-9`. As these packages are not part of repository `rhel-sap-for-rhel-7-for-system-z-rpms`, the task *Ensure required packages are installed* will fail. Use the following option to the ansible-playbook command as a workaround:

```
-e "{'__sap_preconfigure_packages': ["uuidd", "tcsh", "psmisc"]}"
```

Example:

```
#ansible-playbook sap.yml -l host01 -e "{'__sap_preconfigure_packages':
["uuidd", "tcsh", "psmisc"]}"
```

(sap-preconfigure issue #99)

3.4 Installation of package `libssh2` missing from role *sap-hana-preconfigure*

Despite the initial plans to no longer ship package `libssh2` in RHEL 8, this package is still available in RHEL 8 and can still be used to install SAP HANA as a *scale out* (distributed) configuration. However, the `libssh2` package is currently not part of role

sap-hana-preconfigure. If you want to configure your RHEL Systems for installation of SAP HANA in a *scale out* configuration, and if you want to use the default `libssh2` instead of the `saphostagent` connection method when installing SAP HANA, install package `libssh2` as part of your playbook or manually, e.g. via `ssh`. Alternatively, you can specify all packages of variable `__sap_hana_preconfigure_packages` which are contained in the role's `vars/RedHat_8.yml` file, plus `libssh2`, on the command line, similar to the previous example.

(sap-hana-preconfigure issue #118)

4. Quick Start

Use this procedure to configure one or more systems for the installation of SAP NetWeaver or SAP HANA.

4.1 Configure the local system

Prepare the local system for the installation of SAP NetWeaver

1) 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 local host 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 local host before executing the `ansible-playbook` command:

```
#export LC_ALL=C
```

Or

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

2) Make sure that there is no production software running on the system. The roles will enforce a certain configuration on the system, which typically is intended only **right after** the installation of RHEL and **before** the **initial** installation of SAP software.

3) In case you would like to preserve the original configuration of the server, perform a backup. Typically, these roles are run right after the installation of RHEL, so a backup should not be necessary.

4) Create a YAML file named `sap-netweaver.yml` with the following content:

Raw

```
- hosts: localhost
  connection: local
  roles:
    - sap-preconfigure
    - sap-netweaver-preconfigure
```

Note that the correct indentation (e.g. 2 spaces in front of `roles:`) is essential.

5) Make sure there is at least 20480 MB of swap space configured on the local system.

6) Run the RHEL System Roles *sap-preconfigure* and *sap-netweaver-preconfigure* to prepare the managed nodes for the installation of SAP NetWeaver.

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

At the end of the playbook run, the command will report that a reboot is required because role *sap-preconfigure* has changed the SELinux state from `enabled` to `disabled`, according to SAP note 2772999.

7) Reboot the managed nodes so that the new SELinux state will become effective.

Note: By changing role variable `sap_preconfigure_selinux_state` from the default `disabled` to `permissive` before or at the time of running the playbook, you can have the role *sap-preconfigure* set the SELinux state to `permissive`, which is also allowed for SAP NetWeaver on RHEL 8. See the Examples section in this document for more information on setting role variables.

4.2 Configure remote systems

Prepare the control node and ssh access to all managed nodes

1) Verify that the managed nodes 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
```

3) Make sure that you can log in via the `ssh` command to all managed nodes from the Ansible control node without using a password. See the man pages for `ssh-copy-id` and `man ssh` if you need more information about this topic.

Prepare one or more remote servers (managed nodes) for the Installation of SAP HANA

1) Verify that there is no production software running on any of the managed nodes you want to configure.

2) Make sure that the version of SAP HANA you will be installing is supported for the RHEL major and minor release which is installed on the managed nodes. For information on supported RHEL releases for SAP HANA, see SAP note 2235581.

3) In case you would like to preserve the original configuration of any of the servers, perform a backup of the server(s). Typically, these roles are run right after installation, so a backup should not be necessary.

4) Create an inventory file or modify file `/etc/ansible/hosts` so that it contains the name of a group of hosts and each host which you intend to configure (=managed node) in a separate line (example for three hosts in a host group named `sap_hana`):

Raw

```
[sap_hana]
host01
host02
host03
```

5) Use some simple commands to verify that you can log in to all three hosts using ssh without password:

```
#ssh host01 uname -a

#ssh host02 hostname

#ssh host03 echo test
```

6) Create a YAML file named `sap-hana.yml` with the following content:

Raw

```
- hosts: sap_hana
  roles:
    - sap-preconfigure
    - sap-hana-preconfigure
```

Note that the correct indentation (e.g. 2 spaces in front of `roles:`) is essential.

7) Run the RHEL System Roles *sap-preconfigure* and *sap-hana-preconfigure* to prepare the managed nodes for the installation of SAP HANA.

Note: Do not run these roles against an SAP or other production system. The role will enforce a certain configuration on the managed node(s), which typically is intended only **right after** the installation of RHEL and **before** the **initial** installation of SAP software.

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

At the end of the playbook run, the command will report for each managed node that a reboot is required, for example because role *sap-preconfigure* has changed the SELinux

state from `enabled` to `disabled` (as per requirement in SAP notes 2292690 or 2777782).

8) Reboot the managed nodes so that the new SELinux state will become effective.

5. Detailed Description

This chapter describes the RHEL System Roles for SAP in detail.

The purpose of the three roles *sap-preconfigure*, *sap-netweaver-preconfigure*, and *sap-hana-preconfigure* is described in the following table:

System Role	Purpose
sap-preconfigure	Install software and perform all configuration steps which are required for the installation of **SAP NetWeaver** and **SAP HANA**.
sap-netweaver-preconfigure	Install software and perform all configuration steps which are required for the installation of **SAP NetWeaver only**.
sap-hana-preconfigure	Install additional software and perform additional configuration steps which are required for **SAP HANA only**.

5.1 System Roles and SAP Notes

The following table contains the System Role and the corresponding action or SAP Note for the RHEL release of the managed node.

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 for SAP HANA as mentioned in SAP Note 2772999
	ppc64le only: Install additional required packages as per https://www14.software.ibm.com/support/customercare/sas/f/lopdiags/home.html	ppc64le only: Install additional required packages as per https://www14.software.ibm.com/support/customercare/sas/f/lopdiags/home.html
	Perform configuration steps 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	
	ppc64le only: SAP Note 2055470	ppc64le only: SAP Note 2055470
	SAP Note 2292690	SAP Note 2777782
	SAP Note 2382421	SAP Note 2382421

5.2 Implemented SAP Notes

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

SAP Note	RHEL		Title	Purpose and scope
	7	8		
2002167	X		*Red Hat Enterprise Linux 7.x: Installation and Upgrade*	General RHEL 7 installation and configuration steps before installing SAP NetWeaver
1391070	X		*Linux UUID solutions*	Installation and configuration of `uuidd`
2772999		X	*Red Hat Enterprise Linux 8.x: Installation and Configuration*	General RHEL 8 installation and configuration steps, including uuidd, 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
2009879	X		*SAP HANA Guidelines for Red Hat Enterprise Linux (RHEL) Operating System*	Kernel and OS settings for SAP HANA on RHEL 6.x and RHEL 7.x
2055470	X	X	*HANA on POWER Planning and Installation Specifics - Central Note*	Specific installation and configuration steps for SAP HANA on POWER

2292690	X		*SAP HANA DB: Recommended OS settings for RHEL 7*	Specific package requirements, Kernel and OS settings for SAP HANA on RHEL 7.x
2777782		X	*SAP HANA DB: Recommended OS Settings for RHEL 8*	Specific package requirements, Kernel and OS settings for SAP HANA on RHEL 8.x
2382421	X	X	*Optimizing the Network Configuration on HANA- and OS-Level*	Network-related kernel settings for SAP HANA

5.3 Role variables

In each role, default variable settings can be modified to change the behavior of the role. The `README.md` file of each role, located in directory `/usr/share/ansible/roles/<role>`, describes the purpose of these variables as well as their default settings. The variables are defined and can be changed in each role's file `main.yml` in directory `/usr/share/ansible/roles/<role>/defaults`. They can also be set by using the **`ansible-playbook`** command line parameter **`--extra-vars`** or **`-e`**. See the next section for examples.

Some of the variables are described in more detail below to explain their behavior and dependencies:

Kernel related variables in *sap-hana-preconfigure*

Kernel variables can be set either in the kernel command line via *grub*, or using *tuned* profile *sap-hana*. Use the following combinations of these variables in `/usr/share/ansible/roles/sap-hana-preconfigure/defaults/main.yml` for the cases described below:

Case 1: Use *tuned* profile *sap-hana* only

In case you would like to use *tuned* profile *sap-hana* only, leave the default settings in place:

```
sap_hana_preconfigure_switch_to_tuned_profile_sap_hana: yes
```

```
sap_hana_preconfigure_use_tuned_where_possible: yes
```

```
sap_hana_preconfigure_modify_grub_cmdline_linux: yes
```

```
sap_hana_preconfigure_run_grub2_mkconfig: yes
```

(You can also set `sap_hana_preconfigure_modify_grub_cmdline_linux` and `sap_hana_preconfigure_run_grub2_mkconfig` to **`no`**. However, these two variables do not not influence the role behavior in case `sap_hana_preconfigure_use_tuned_where_possible` is set to **`yes`**. So you can just leave these variables untouched.)

Case 2: Modify the kernel command line and also use *tuned*

In case you would like to modify the kernel command line and use *tuned* profile *sap-hana* for all other settings, change `sap_hana_preconfigure_use_tuned_where_possible`: from **`yes`** to **`no`**:

```
sap_hana_preconfigure_switch_to_tuned_profile_sap_hana: yes
```

```
sap_hana_preconfigure_use_tuned_where_possible:no
```

```
sap_hana_preconfigure_modify_grub_cmdline_linux: yes
```

```
sap_hana_preconfigure_run_grub2_mkconfig: yes
```

Case 3: Modify the kernel command line and not switch to *tuned* profile *sap-hana*

In case you would like to modify the kernel command line and not switch to *tuned* profile *sap-hana* (for example because you would like to configure all settings manually), change `sap_hana_preconfigure_switch_to_tuned_profile_sap_hana` and `sap_hana_preconfigure_use_tuned_where_possible`: from **`yes`** to **`no`**:

```
sap_hana_preconfigure_switch_to_tuned_profile_sap_hana:no

sap_hana_preconfigure_use_tuned_where_possible:no

sap_hana_preconfigure_modify_grub_cmdline_linux: yes

sap_hana_preconfigure_run_grub2_mkconfig: yes
```

6. Examples

As a preparation step for these examples, follow the instructions in section *Quick Start*, chapter Prepare the control node and ssh access to all managed nodes of this document.

6.1 Example for SAP NetWeaver

You want to configure the three RHEL 7.7 x86_64 systems (managed nodes) `sap-test`, `sap-qa`, and `sap-prod` (test, QA, and production) and RHEL 8.2 s390x system (managed node) `sap-test-z` for the installation of SAP NetWeaver. For system `sap-test-z`, you do not have access to the root user but to a user with id 0 and with name `root2`. You need to run the roles *sap-preconfigure* and *sap-netweaver-preconfigure*.

The default behavior of the role *sap-preconfigure* is to not update the managed node to the latest RHEL software level but you would really like to update all four managed nodes to the latest RHEL software level. You do not want to fail the roles due to less

than 20480 MB of swap space being configured, and you do not want to fail the roles in case a reboot is required. Use the following steps:

1) Verify that there is no other production software running on any of the four managed nodes.

2) In case you would like to preserve the original configuration of any of the serves, perform a backup of the managed nodes(s). Typically, these roles are run right after RHEL installation, so a backup should not be necessary.

3) Create an inventory file or modify file `/etc/ansible/hosts` so that it contains the following lines:

Raw

```
[sap_netweaver]
sap-test
sap-qa
sap-prod
sap-test-z ansible_user=root2
```

4) Use some simple commands to verify that you can log in to all four managed nodes using ssh without password:

```
#ssh sap-test uname -a
#ssh sap-qa uname -a
#ssh sap-prod uname -a
#ssh root2@sap-test-z uname -a
```

5) Create a YAML file named **`sap-netweaver.yml`** with the following content:

Raw

```
- hosts: sap_netweaver
  roles:
    - sap-preconfigure
    - sap-netweaver-preconfigure
```

Note that the correct indentation (e.g. 2 spaces in front of `roles:`) is essential.

6) Run the following ansible-playbook command to configure the four managed nodes as described above:

```
#ansible-playbook sap-netweaver.yml -e "{'sap_preconfigure_update': yes,
'sap_preconfigure_fail_if_reboot_required': no,
'sap_netweaver_preconfigure_fail_if_not_enough_swap_space_configured': no}"
```

7) Reboot all four managed nodes to make sure all required configuration changes are in effect.

6.2 Example for SAP HANA

You want to configure RHEL 7.6 x86_64 server (managed node) `hana-x-76` and RHEL 8.1 ppc64le (POWER9) PowerVM LPAR (managed node) `hana-p-81` for the installation of SAP HANA. You have already verified in SAP note 2235581 that these RHEL releases are supported for the SAP HANA version you want to install, and you have also verified that your hardware vendor has certified the hardware for this SAP HANA version. You need to run the roles *sap-preconfigure* and *sap-hana-preconfigure*.

You would like the role sap-hana-preconfigure to enable the required repositories for SAP HANA and also set the RHEL minor release to the currently installed level (7.6 and 8.1) so a `yum update` will not cause the managed nodes to be updated beyond these minor releases. You also want the role to update to the latest software level of that minor RHEL release. Instead of the default behavior of the role, which is to not modify `grub` but only use `tuned` to set kernel and other parameters, you would like to have the boot command line modified for SAP HANA and also use *tuned* profile *sap-hana* for setting kernel parameters.

Use the following steps:

1) Verify that there is no production software running on any of the two managed nodes.

2) In case you would like to preserve the original configuration of any of the managed nodes, perform a backup of the server(s). Typically, these roles are run right after RHEL installation, so a backup should not be necessary.

3) Create an inventory file or modify file `/etc/ansible/hosts` so that it contains the following lines (in this example, the hosts have not been made part of a specific host group):

Raw

```
hana-x-76

hana-p-81
```

4) Use some simple commands to verify that you can log in to all three hosts using ssh without password:

```
#ssh hana-x-76 uname -a

#ssh hana-p-81 uname -a
```

5) Create a YAML file named **`sap-hana.yml`** with the following content:

Raw

```
- hosts: all
  roles:
    - sap-preconfigure
    - sap-hana-preconfigure
```

Note that the correct indentation (e.g. 2 spaces in front of `roles:`) is essential.

6) Modify file /usr/share/ansible/roles/sap-hana-preconfigure/defaults/main.yml to contain the following lines instead of the defaults:

```
sap_hana_preconfigure_enable_sap_hana_repos:yes
sap_hana_preconfigure_set_minor_release:yes
sap_hana_preconfigure_use_tuned_where_possible:no
```

7) Run the following ansible-playbook command to configure the two managed nodes. Note that in this example, `- hosts: all` is used in the playbook and there is no group name for the hosts in file `/etc/ansible/hosts`, so the names of the hosts have to be specified after the `-l` command line parameter:

```
# ansible-playbook -l hana-x-76,hana-p-81 sap-hana.yml
```

8) Reboot all managed nodes to make sure all required configuration changes are in effect.

7. Related Information

- Linux System Roles upstream project

- Red Hat Enterprise Linux (RHEL) System Roles - Red Hat KB Article