Introduction to SLES for SAP Minimal VM

SLES for SAP Minimal VM images allow you to run SUSE Linux Enterprise Server for SAP applications in a virtual or cloud environment without having to perform a full installation. Learn which Minimal VM image to choose, the ways to deploy them and how to configure them on first boot.

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1 What is SLES for SAP Minimal VM?

SLES for SAP Minimal VM is a set of ready-to-run virtual machine images that let you deploy SUSE Linux Enterprise Server for SAP applications without running an installer. Each image includes a lightweight system, serving as a foundation for building systems for use in a data center, creating virtual application images and building appliances. Because the images contain fewer packages, they require less patching and expose fewer potential security vulnerabilities.

SLES for SAP Minimal VM images come with the SAP base pattern preinstalled and **`saptune`** base tuning applied, so the operating system arrives prepared for an SAP workload.

1.1 Deployment options

SLES for SAP Minimal VM is available as preconfigured and ready-to-run virtual machine images. It is also possible to create customized Minimal VM images using the supplied KIWI NG configuration files, called templates. They are provided by the `kiwi-templates-Minimal` package. For more information about how to use KIWI templates, see KIWI NG Documentation (https://documentation.suse.com/appliance/kiwi-9/).

1.2 Default configuration

The following settings are active as soon as a Minimal VM image boots. They describe the state of the system as shipped. For how Minimal VM differs from an installed SUSE Linux Enterprise Server for SAP applications system, see *Section 2, "Differences between SLES for SAP Minimal VM and SUSE Linux Enterprise Server for SAP applications"*.

First-boot provisioning

For an automated setup, you can use Combustion to configure the system on first boot from a configuration you supply. Alternatively, on cloud, VMware and ppc64le images, you can use `cloud-init`. If no configuration is provided, the JeOS Firstboot wizard runs on first boot and allows you to configure basic settings, such as system locales and the `root` password.

Access and remote authentication

SSH on TCP port 22 is enabled as the default externally accessible port. Remote password-based `root` login is disabled by default.

- `cloud-init` and Combustion can be used to create a user account and install SSH public keys supplied in the configuration.
- When using JeOS Firstboot, the wizard prompts you to set a local `root` password, create a standard user account and enroll SSH public keys for remote access.

Networking

The default network configuration uses DHCP, managed by NetworkManager.

Security and firewall

Because the SAP base pattern is pre-installed, the Minimal VM sets SELinux to permissive mode by default. The status of the host-based firewall depends on the image you deploy:

- On the cloud image, no firewall service is installed or enabled.
- On the non-cloud images, the `firewalld` package is installed and the service is enabled and running by default.

Kernel

SLES for SAP Minimal VM images use the `kernel-default-base` as the default kernel, which contains only a subset of kernel modules. This results in a smaller image size.

System recovery

On the non-cloud images, the system automatically creates a Btrfs snapshot including the initial configuration. This means that you can easily revert all subsequent changes, if necessary.

Core dumps

Unlike in previous versions, `systemd-coredump` is enabled by default in SLES for SAP Minimal VM 16.1 to collect application core dumps for troubleshooting.

System registration

The Minimal VM images contain no preconfigured software repositories. Register the system to access online repositories. Registration requires a paid subscription.

2 Differences between SLES for SAP Minimal VM and SUSE Linux Enterprise Server for SAP applications

The following differences affect how you deploy and operate the system:

No installation step

There is no installer to run. The images are ready to boot, and basic settings are configured on first boot using the JeOS Firstboot tool, Combustion or `cloud-init`.

Reduced kernel

To keep the image small, Minimal VM uses `kernel-default-base` as the default kernel. This kernel does not contain drivers for bare metal. If your scenario requires additional drivers, install the `kernel-default` package to get the full functionality. This is the kernel used by a regular installation.

Preinstalled SAP patterns

The images come with the SAP base pattern preinstalled, so the system is already prepared to receive an SAP workload. To list the installed patterns, run the following command:

```
> sudo zypper search --type pattern --installed-only
```

The output includes `sles_sap_base_sap_server` and `sles_sap_minimal_sap`, alongside the base and SELinux patterns.

Automatic base tuning

Because the SAP pattern pulls in **`saptune`**, base tuning is applied automatically. On installation, **`saptune`** applies the `SAP_Base` solution, which implements the recommendations of SAP Note 1275776 (https://me.sap.com/notes/1275776).



Note: Workload-specific tuning solutions

Base tuning is a starting point only. Apply the solution that matches your workload, for example, `HANA`, `NETWEAVER`, `S4HANA-APPSERVER` or `S4HANA-APP+DB`. Only one solution can be active at a time. For more information, see How to Tune Systems with **`saptune`** (https://documentation.suse.com/sles-sap/16.1/html/SAP-saptune/).

Zypper configuration

Part of the size reduction comes from two options in the Zypper configuration:

- `rpm.install.excludedocs = yes` excludes all files marked as documentation, such as man pages, from installation.
- `solver.onlyRequires = true` disables installation of supplementing and recommended packages.

Base packages

The images are built from KIWI NG templates that list the packages to include. Keep in mind that packages listed in a template can pull in dependencies during the build, so an image usually contains more packages than the template names.

Predefined disk layout

Unlike SUSE Linux Enterprise Server for SAP applications, which calculates an adjustable disk layout proposal during installation, SLES for SAP Minimal VM uses a predefined virtual image partitioning scheme:

- 2 MB BIOS boot
- 512 MB EFI system
- 24 GB root file system in non-cloud flavors
- A dynamically sized root file system in cloud flavors

The root file system holds the operating system and is not sized for SAP data. Before you deploy an SAP workload, add storage for the SAP file systems, for example, `/usr/sap`, `/hana/data`, `/hana/log` and `/hana/shared`, and configure swap according to the SAP sizing recommendations for your workload.

To add space, either extend the existing disk from the virtual host or add a secondary disk to the virtual machine. If you extend the existing disk, the `kiwi-repart` dracut module automatically resizes the root partition and its file system to fill the available space during the next boot. If you add a secondary disk, you must partition and format it manually.

3 Obtaining Minimal VM images

The image you choose determines the hypervisor you can run it on and how the system is configured on first boot. The initial configuration mechanism depends on your target environment.

Download the images from the official Download (https://www.suse.com/download/sle-sap/) page. Images have the platform in the name, based on their purpose:

- `Cloud` for cloud platforms
- `kvm-and-xen` for KVM and Xen hypervisors
- `MS-HyperV` for Microsoft Hyper-V hypervisors
- `VMware` for VMware hypervisors



Note: Architecture-specific naming

Depending on the architecture, image names might instead indicate specific hardware, storage types or disk formats.

4 Interactive setup with JeOS Firstboot

By default, if you boot the virtual machine without providing an automated configuration method (such as Combustion or `cloud-init`), the system launches JeOS Firstboot. To deploy the image interactively, manually complete this text-based wizard on the system console. Deploying involves two tasks:

1. Start the virtual machine on your platform.
2. Configure the system on the first boot with JeOS Firstboot.

Because starting a virtual machine varies wildly by platform, the exact procedure depends on your hypervisor. For platforms such as Microsoft Hyper-V and VMware, use their respective management tools to create the virtual machine.

4.1 Starting a KVM virtual machine

For KVM-compatible images, you can start the virtual machine directly by using QEMU or **`virt-install`**.

QEMU:

```
> qemu-system-ARCH \
    -enable-kvm \
    -cpu host \
    -m 1G \
    -smp 1 \
    -drive if=virtio,format=qcow2,file=IMAGE.qcow2 \
    -nographic \
    -netdev user,id=net0,hostfwd=tcp::2222-:22 \
    -device virtio-net,netdev=net0
```

`virt-install`:

```
> virt-install \
    --name VM_NAME \
    --memory 1024 \
    --vcpus 1 \
    --import \
    --disk IMAGE.qcow2,bus=virtio \
    --osinfo detect=on,require=off
```

4.2 Configuring a system with JeOS Firstboot

JeOS Firstboot is a text-based wizard that runs on the first boot and collects the basic settings. It appears on the console of the virtual machine, whichever platform you started it on.

1. Select the keyboard layout.
2. Read and accept the license agreement. You cannot proceed without accepting it.
3. Select the time zone.
4. Enter and confirm the `root` password.
5. Optionally, enroll keys for SSH access and create additional user accounts.
6. After the first boot, register the system. For more information, see *Section 7, “Post-deployment configuration”*. If you are only testing the image, you can skip registration.

Tip: Reconfiguring settings with `jeos-config`

If you need to change these settings after the initial deployment, you can use **`jeos-config`**. Running this command as `root` opens an interactive text-based tool where you can adjust your initial choices.

5 Automated setup using Combustion

SLES for SAP Minimal VM comes with the Combustion configuration tool, which configures the system on first boot from a script that you supply. This can be particularly useful when you need to deploy multiple virtual machines with an identical initial configuration. When Combustion runs successfully, JeOS Firstboot does not start. Because Minimal VM does not configure a default `root` password, the script must include a login method, either a `root` password or an SSH public key for remote access.

1. Create a configuration file named `script`.
   For more information about how to create the script, see https://documentation.suse.com/sle-micro/html/Micro-deployment-raw-images-virtual-machines/index.html#configuring-combustion-script.

2. Add at least one login method to the script:

   - To log in with a password, generate a hash of your desired `root` password:

     ```
     > openssl passwd -6
     ```

     Add the following line to the script, replacing *`HASH`* with the value you just generated:

     ```
     echo 'root:HASH' | chpasswd -e
     ```

   - To set up SSH key authentication, add the following lines to the script:

     ```
     mkdir -pm 700 /root/.ssh
     echo 'SSH_PUBLIC_KEY' >> /root/.ssh/authorized_keys
     ```

3. Make the script executable:

   ```
   > chmod +x script
   ```

4. Pass the script to the virtual machine. Use the method that matches your platform.

KVM platforms

Pass the script file directly with `fw_cfg`.

QEMU:

```
> qemu-system-ARCH \
    -enable-kvm \
    -cpu host \
    -m 1G \
    -smp 1 \
    -drive if=virtio,format=qcow2,file=IMAGE.qcow2 \
    -nographic \
    -netdev user,id=net0,hostfwd=tcp::2222-:22 \
    -device virtio-net,netdev=net0 \
    -fw_cfg name=opt/org.opensuse.combustion/script,file=script
```

`virt-install`:

```
> virt-install \
    --name VM_NAME \
    --memory 1024 \
    --vcpus 1 \
    --import \
    --disk IMAGE.qcow2,bus=virtio \
    --osinfo detect=on,require=off \
    --sysinfo type=fwcfg,entry0.name="opt/org.opensuse.combustion/
script",entry0.file="ABSOLUTE_PATH_TO_SCRIPT"
```

Microsoft Hyper-V, VMware and other platforms

Provide the script on a storage device with the file system label `combustion`, holding the script at `combustion/script`.

To build such a device as an ISO image:

```
> mkdir -p iso_root/combustion
> mv script iso_root/combustion/
> mkisofs -output combustion.iso -volid combustion -rational-rock iso_root
```

Create the virtual machine using your downloaded Minimal VM image as the primary virtual hard disk. Before booting the virtual machine for the first time, attach `combustion.iso` as a virtual disc drive.

By default, Combustion produces no output while it runs. The indication that it worked is that JeOS First-boot does not start and you can log in as `root` using the method you configured in the script.

6 Deploying an image with `cloud-init`

The cloud, VMware and ppc64le Minimal VM images can use `cloud-init` to configure the system on first boot from a `user-data` file. Deploying with `cloud-init` has two parts: writing the configuration and making it available to the virtual machine through a data source.

If no data source is provided, the system defaults to JeOS Firstboot on initial boot.



Note: Scope of the `cloud-init` section

This section applies to images on a local hypervisor, where `cloud-init` uses the `NoCloud` data source.

On VMware and on cloud platforms such as OpenStack, supply your `user-data` through the interface of the platform. For the data sources that `cloud-init` supports, see https://docs.cloud-init.io/en/latest/reference/datasources.html#datasources-supported.

6.1 How to write the `user-data` file

To deploy the image with `cloud-init`, you must first create the `user-data` file. The first line of the file must be `#cloud-config`.

To view the default SUSE configuration for `cloud-init`, check the `/etc/cloud/cloud.cfg` file provided by the `cloud-init-config-suse` package.

By default, `cloud-init` does not set a `root` password. Instead, it creates a user account called `sles` that acts as the default user and has **`sudo`** rights. Use the following example to create passwords for both users.

EXAMPLE 1: ADD PASSWORDS

```
#cloud-config
chpasswd:
  list: |
    root:$6$HdJCmMKHZT2NLcwv
$4cRJ4yGGmDpPIvt0pqSa3KeEOKMKT8vR4DrYX23LlYrvM6suF79CzWomCFyreiT645fWVaFXMtyUM5zFOJMa9/
    sles:$6$HdJCmMKHZT2NLcwv
$4cRJ4yGGmDpPIvt0pqSa3KeEOKMKT8vR4DrYX23LlYrvM6suF79CzWomCFyreiT645fWVaFXMtyUM5zFOJMa9/
  expire: False
```

To create the SHA-512 hashes used in the example, run the command: **`openssl passwd -6`**.



Warning: User passwords

To prevent potential security risks, avoid using passwords in production environments. When using hashed passwords, you are exposed to dictionary attacks. For better security, use SSH authentication instead.

However, local logins, for example, in a recovery scenario, still require a password. This is why setting a `root` password, as shown in the previous example, might still be necessary even when you use SSH keys for regular access.

When creating users, keep in mind that logging in with a password is disabled by default (`lock_passwd: true`), and that the newly created users do not have **`sudo`** rights.

The following examples show configurations for creating different users.

EXAMPLE 2: NEW USER WITH PASSWORD AND **sudo**

```
#cloud-config
users:
  - default
  - name: USER
    shell: /bin/bash
    groups: users
    # lock_passwd: Disable password login. Defaults to true
    lock_passwd: false
    passwd: HASH
    sudo: ALL=(ALL) NOPASSWD:ALL
```

EXAMPLE 3: NEW USER WITH SSH KEYS AND **sudo**

```
#cloud-config
users:
  - name: USER
    shell: /bin/bash
    groups: users
    ssh_import_id: None
    lock_passwd: true
    sudo: ALL=(ALL) NOPASSWD:ALL
    ssh_authorized_keys:
      - SSH_PUBLIC_KEY_1
      - SSH_PUBLIC_KEY_2
```

To connect and register with the SUSE Multi-Linux Manager, RMT or SUSEConnect, use `runcmd` to run the desired commands, for example:

EXAMPLE 4: SUSECONNECT CONFIGURATION

```
#cloud-config
runcmd:
  - SUSEConnect -r REGISTRATION_CODE -e EMAIL_ADDRESS
```

EXAMPLE 5: RMT CONFIGURATION

```
#cloud-config
runcmd:
 - curl --output rmt-client-setup http://RMT_SERVER/tools/rmt-client-setup
 - sh rmt-client-setup --host RMT_SERVER
     --regcert http://RMT_SERVER/rmt.crt
     --fingerprint FINGERPRINT --yes
```

Replace *`FINGERPRINT`* with the output of the following command that you run on your RMT server:

```
> sudo openssl x509 -noout -fingerprint -in /etc/rmt/ssl/rmt-ca.crt
```

For example: `0F:1F:2F:3F:4F:5F:6F:7F:8F:9F:AF:BF:CF:DF:EF:FF`.

For further information, see https://documentation.suse.com/sles-15/html/SLES-all/cha-rmt-client.html.

EXAMPLE 6: SUSE MULTI-LINUX MANAGER CONFIGURATION

```
#cloud-config
runcmd:
  - curl -SksO https://SERVER_HOSTNAME/pub/bootstrap/bootstrap.sh
  - /bin/bash bootstrap.sh
```

For further information, see https://documentation.suse.com/multi-linux-manager/en/docs/client-configuration/registration-bootstrap.html.

The following example shows a configuration that installs a package and starts a service during the first boot.

EXAMPLE 7: ADD *PACKAGE* AND START A SERVICE

```
#cloud-config
packages:
  - PACKAGE
runcmd:
  - systemctl enable SERVICE.service
  - systemctl start --no-block SERVICE.service
```



Note: Optional configuration files

You can optionally create other configuration files, called `meta-data`, `network-config` and `vendor-data`. For more information, see https://docs.cloud-init.io/en/latest/reference/data-sources/nocloud.html.

After you write the `user-data` file, provide the file to the virtual machine, as described in the following section.

6.2 Providing the user-data file to the virtual machine

Choose the method that matches your tooling.

6.2.1 Deploying with QEMU

There are two ways to deliver the configuration: on a seed image attached as a CD-ROM or from a Web server.

1. Make the configuration available to the virtual machine. Use either a seed image or a Web server:

   - **Seed image:** Create the seed image containing the `user-data` file:

     ```
     > mkisofs \
         -output seed.iso \
         -volid cidata -rational-rock -joliet \
         user-data
     ```

   - **Web server:** Copy the configuration file into a directory served by a Web server, for example, `/srv/www/htdocs/cloud-init/`, served at `http://www.example.com/cloud-init/`.

2. Start the virtual machine.

   ```
   > qemu-system-ARCH \
       -enable-kvm \
       -cpu host \
       -m 1G \
       -smp 1 \
       -drive if=virtio,format=qcow2,file=IMAGE.qcow2 \
       -nographic \
   ```

```
    -netdev user,id=net0,hostfwd=tcp::2222-:22 \
    -device virtio-net,netdev=net0 \
    DATA_SOURCE_OPTION
```

Replace *DATA_SOURCE_OPTION* based on the chosen method from the previous step:

- If you use seed image data source:

  ```
  -drive file=seed.iso,media=cdrom
  ```

- If you use Web server data source:

  ```
  -smbios 'type=1,serial=ds=nocloud-net;s=http://www.example.com/cloud-init/'
  ```

6.2.2 Deploying with **virt-install**

If you deploy with `libvirt`, **virt-install** can generate the data source for you:

```
> virt-install \
    --name VM_NAME \
    --memory 1024 \
    --vcpus 1 \
    --import \
    --disk IMAGE.qcow2,bus=virtio \
    --cloud-init user-data=./user-data \
    --osinfo detect=on,require=off
```

7 Post-deployment configuration

After successfully deploying and configuring your SLES for SAP Minimal VM, the system is running and ready for use. To ensure optimal security and localization, perform the following post-deployment tasks.

7.1 Registering the system

Registering your SLES for SAP Minimal VM links it to your SUSE subscription. If the system was not registered during first boot, register it manually.

```
> sudo SUSEConnect -r REGISTRATION_CODE -e EMAIL_ADDRESS
```

You can also register with RMT using the setup script. For more information, see Configuring clients with `rmt-client-setup` (https://documentation.suse.com/sles-15/html/SLES-all/cha-rmt-client.html#sec-rmt-client-clientsetupscript).

7.2 Installing system updates

After SLES for SAP Minimal VM is successfully installed and registered, it is highly recommended to install the latest available online updates:

```
> sudo zypper patch
```

7.3 Changing the system locale

By default, the SLES for SAP Minimal VM image includes only the `en_US` locale. To use a different system language, install and select your desired locale. The following example commands configure the system for the `de_DE` locale.

1. Add the desired locale and install the required translation packages:

   ```
   > sudo zypper addlocale de_DE
   ```

2. Set the new locale:

   ```
   > localectl set-locale LANG=de_DE.UTF-8
   ```

   You can list all available system locales by running **`localectl list-locales`**.

7.4 Removing setup packages

JeOS Firstboot and the packages it pulls in are only required for the initial configuration of the system. You can leave these packages on the system, or, when the system is fully configured and you do not intend to reconfigure it, you can safely remove the wizard together with the dependencies:

```
> sudo zypper remove -u jeos-firstboot
```



Note: Configuration tools are removed as well

The command removes JeOS Firstboot along with dependencies, including configuration tools such as `jeos-config` or `ssh-pairing`. If you still need any of these tools, keep JeOS Firstboot installed.

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