

Oracle Linux 8

Creating Custom Images With Image Builder



F77249-02
July 2024



Oracle Linux 8 Creating Custom Images With Image Builder,
F77249-02

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A Image Types and Output Formats

Preface

[Oracle Linux 8: Creating Custom Images With Image Builder](#) provides information about creating customized images of Oracle Linux that you can deploy on different platforms such as the cloud or bare metal systems.

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Conventions

The following text conventions are used in this document:

Convention	Meaning
boldface	Boldface type indicates graphical user interface elements associated with an action, or terms defined in text or the glossary.
<i>italic</i>	Italic type indicates book titles, emphasis, or placeholder variables for which you supply particular values.
<code>monospace</code>	Monospace type indicates commands within a paragraph, URLs, code in examples, text that appears on the screen, or text that you enter.

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mindful of the necessity to maintain compatibility with our customers' existing technologies and the need to ensure continuity of service as Oracle's offerings and industry standards evolve. Because of these technical constraints, our effort to remove insensitive terms is ongoing and will take time and external cooperation.

1

About Image Builder

Image Builder is a tool for creating customized images of Oracle Linux that you can deploy on different platforms such as the cloud or bare metal systems. With Image Builder, you can generate these customized images in different formats, such as `tar` or `iso`.

Image Builder isn't automatically included in an Oracle Linux installation and requires a separate package download. After installing Image Builder and completing the required system configurations, you can use either the command line or the Cockpit web console to create custom Oracle Linux images.



Note:

For more information about installing Image Builder, see [Installing Image Builder](#).

To use Image Builder, you need to understand the following concepts that are specific to the way the tool works:

- [Blueprints](#)
- [Customizations](#)
- [Composer Images](#)

Blueprints

Image Builder uses blueprints to create custom images.

A blueprint is the primary reference for creating custom images with Image Builder. A blueprint consists of block entries that define the specifications for the images. Block entries in a blueprint contain varied information but can be divided into two kinds: entries for packages and entries for other customizations.

Each block entry has a heading. The general headings are either `[[packages]]` if the block entry contains package information, or `[[customizations]]` if the block contains customizations that are unrelated to packages.

Package information specify packages to be downloaded for the image and include the following:

- **Packages:** A package block entry requires the package name and version. The version format follows `dnf` version specifications. For example, the version for a major release is specified as `n.n.n`, such as 8.7.0. To specify the latest package version, enter an asterisk (*) in place of the version number. For a minor release, type `major-nbr.*`, such as 8.*.
- **Package groups:** A package group block entry requires only the name of the package group. The information is entered under a `[[groups]]` heading.

Definitions in a block entry follow the convention `parameter = "value"`. For more information about the contents of a blueprint, see [Blueprint Format](#).

When you create images based on a blueprint, those images become associated with that blueprint in the Image Builder interface of the Cockpit web console.

To create or edit a blueprint, you can use any text editor. However, you must save the blueprint in Tom's Obvious Minimal Language (TOML) format.

Customizations

Customizations are blueprint entries that aren't package related.

Customizations are other image specifications that aren't part of package specifications. These other items might include predefined users and groups, SSH keys that implement system security, and other data.

Customizations in blueprints can be varied. A customization that has a general application, such as specifying a host name for the image, is defined in a `[[customizations]]` block entry. More specific customizations would have tags appended to the heading to become better identifiers. For example, user definitions are in a `[[customizations.user]]` block, while serviced customizations are under the `[[customizations.services]]` heading, and so on.

Similar to package listings, customization parameters also follow the `parameter = value` format.

Composer Images

Composer images are images that are generated by the `composer-cli compose` command.

The actual creation of a custom image occurs when you run the `composer-cli compose` command. Therefore, the image is called a composer image. A composer image is the final result of the image building process.

Aside from the definitions that are specified in the blueprint, a composer image also includes logs, metadata, and the processes that are run to create the image.

Composer images are of different types. For each type, the system automatically installs default packages. Also, the type has associated services that are enabled automatically when the image is deployed. For example, for a `tar` image, the system automatically includes the `polycoreutils` and `selinux-policy-targetd` packages. However, no extra services are enabled.

Customizations in the blueprint can specify other services that need to be enabled. However, these customizations can't override the required services for an image type that are automatically enabled when the image is deployed.

2

Preparing to Use Image Builder

Before using Image Builder, complete the following:

- Fulfill the system requirements.
- Install the Image Builder component packages.
- Configure specific repositories needed by the OS image.

System Requirements

Image Builder requires a dedicated system with the following minimal configurations:

- 2-core processors
- 4 GiB of memory
- 20 GiB available disk space in the `/var` directory
- Access to the Internet
- Appropriate privileges for performing administrator tasks



Note:

A dedicated virtual machine can also serve as the environment for running Image Builder.

Installing Image Builder

Image Builder isn't automatically included in an Oracle Linux installation. This task describes how to install and configure Image Builder.

1. Install the Image Builder packages.

```
sudo dnf install -y osbuild-composer composer-cli cockpit-composer bash-completion
```

2. Enable the Image Builder service to automatically start after every system reboot.

```
sudo systemctl enable --now osbuild-composer.socket
sudo systemctl enable --now cockpit.socket
```

3. (Optional) Enable the autocomplete feature of the `composer-cli` command by loading the configuration script.

```
source /etc/bash_completion.d/composer-cli
```

About Default Image Builder Repositories

Composed images use Image Builder repositories to download their required packages.

Image Builder doesn't use the system repositories that are defined in `/etc/yum.repos.d/` in a typical Oracle Linux installation. Instead, the repository definitions for Image Builder are automatically installed in `/usr/share/osbuild-composer/repositories`. In this directory, repository definitions are contained in files in JSON format, which is different from the `*.repo` files in `/etc/yum.repos.d/`.

The following extract is an example of a `*.json` repository file for the latest Oracle Linux 8 release on the `x86_64` platform.

```
{
  "x86_64": [
    {
      "name": "ol8_baseos_latest",
      "baseurl": "https://yum.oracle.com/repo/OracleLinux/OL8/baseos/latest/
x86_64/",
      "gpgkey": "THE ENTIRE GPG PUBLIC KEY BLOCK",
      "check_gpg": true,
      "enabled": true
    },
    {
      ...other repositories...
    }
  ]
}
```

The repository definitions in the JSON file correspond to information in the parallel `*.repo` file in the `/etc/yum.repos.d` directory. In the previous example, the JSON file is based on the `/etc/yum.repos.d/oracle-linux-ol9.repo` file.

You can override the default repositories in `/usr/share/osbuild-composer/repositories` by defining custom repositories in a different location.

Creating Custom Repositories

This task describes how to create a separate custom repository file to override the default repositories that are created when you install Image Builder.

1. Create a directory to store the customized repositories.

```
sudo mkdir -p /etc/osbuild-composer/repositories
```

2. Using a text editor, create a file for the version of Oracle Linux image you want to create.

Alternatively, you can copy a default repository file to use as a template. For example, for an Oracle Linux 8 image, you would copy the Oracle Linux 8 JSON file from the default location.

```
sudo cp /usr/share/osbuild-composer/repositories/OL8.json /etc/osbuild-
composer/repositories/
```

3. Following the repository JSON specification, include the following information for each repository in the file that you created:

- System architecture of the OS.
- `name`: name of the repository.
- `baseurl`: the URL of the yum repository.
- `gpgkey`: package GPG key block.
- `check_gpg`: must always be set to true.

The following is an example of a JSON file for an Oracle Linux 9 image:

```
{
  "x86_64": [
    {
      "name": "ol8_baseos_latest",
      "baseurl": "https://yum.oracle.com/repo/OracleLinux/OL8/baseos/
latest/x86_64/",
      "gpgkey": "-----BEGIN PGP PUBLIC KEY BLOCK-----\n\n (...)",
      "check_gpg": true,
      "enabled": true,
      "metadata_expire": ""
    }
  ]
}
```

4. (Optional) Verify that the URLs in the file are correct by comparing them to the corresponding repository file in `/etc/yum.repos.d`.

For the current example, you would use an Oracle Linux repository file for verification.

```
cat /etc/yum.repos.d/oracle-linux-ol8.repo
```

5. Restart `osbuild-composer.service`.

```
sudo systemctl restart osbuild-composer.service
```

3

Deploying Custom Image Builder Images

Deploying a custom image applies the following work flow:

1. Create a blueprint, or edit an existing blueprint.
2. Import the blueprint.
3. Create the image based on the blueprint.
4. Download the resulting image.
5. Install the software according to the image specifications.

Creating a Blueprint

The following procedure describes how to create a blueprint configuration using the CLI. Alternatively, you can create a blueprint using the Cockpit web console interface, see [Oracle Linux: Using the Cockpit Web Console](#) for more details.

1. Create a blueprint configuration as follows:
 - a. Using any text editor, create a text file.
 - b. In the text file, specify the blueprint specifications based on the packages and customize the image settings as required.

Ensure that you provide the basic metadata information about the blueprint. For reference, see [Blueprint Format](#)
 - c. Save the file as a toml file. For example, `myblueprint.toml`
 - d. Push or import the blueprint into Image Builder, for example:
2. (Optional) View the blueprint configuration.
3. Verify that the blueprint's components and versions and corresponding dependencies are valid.

```
sudo composer-cli blueprints push myblueprint
```

```
sudo composer-cli blueprints show myblueprint
```

```
sudo composer-cli blueprints depsolve myblueprint.toml
```

If Image Builder is unable to validate the dependencies, remove the `osbuild-composer` cache.

```
sudo rm -rf /var/cache/osbuild-composer/*
sudo systemctl restart osbuild-composer
```

Editing a Blueprint

The following procedure describes how to edit an existing blueprint configuration by using the CLI. Alternatively, you can edit a blueprint using the Cockpit web console interface, see [Oracle Linux: Using the Cockpit Web Console](#) for more details.

1. Edit an existing blueprint as follows:
 - a. (Optional) List the existing blueprints.

```
sudo composer-cli blueprints list
```
 - b. Save or export the blueprint you want to edit.

```
sudo composer-cli save myblueprint
```
 - c. Using a text editor, edit the blueprint configuration by revising package and customization entries as required.
 - d. Remove the line `packages = []` if it exists in the blueprint.
 - e. Update the version by incrementing the number as appropriate.
Ensure that the version follows the scheme in <https://semver.org/>.
 - f. Save the changes.
 - g. Push or import the blueprint into Image Builder.

```
sudo composer-cli blueprints push myblueprint
```
2. (Optional) View the revised blueprint configuration.

```
sudo composer-cli blueprints show myblueprint
```
3. Verify that the blueprint's components, versions, and corresponding dependencies are valid.

```
sudo composer-cli blueprints depsolve myblueprint.toml
```

If Image Builder is unable to validate the dependencies, remove the `osbuild-composer` cache.

```
sudo rm -rf /var/cache/osbuild-composer/*  
sudo systemctl restart osbuild-composer
```

Creating the Image in Image Builder

You must have an existing blueprint to use for creating an image.

The following task describes how to create a custom image based on a specified blueprint and how to download the resulting composer image.

1. Create the image with the blueprint specifications.

```
sudo composer-cli compose start myblueprint image-type
```

For a list of valid image types, see [Image Types and Output Formats](#). Alternatively, type:

```
sudo composer-cli compose types
```

While the process is running in the background, the composer image's UUID is displayed.

Use the UUID to track the progress of the image building process with the following command:

```
sudo composer-cli compose info image-uuid
```

2. After the process ends, check the status of the image.

```
sudo composer-cli status image-uuid
```

The image's status should indicate `FINISHED`.

3. Download the image file.

```
sudo composer-cli compose image image-uuid
```

To download the image's metadata and logs, type:

```
sudo composer-cli compose [metadata|logs] image-uuid
```

4

Use Cases in Deploying Image Builder Images

This chapter shows cases where Image Builder is used to create and deploy images for specific setup and configurations.

Creating ISO Images for Deployment

You must have a valid blueprint with the specifications you require for the image. This blueprint must be pushed or imported to Image Builder. To fulfill these requirements, see [Creating a Blueprint](#) or [Editing a Blueprint](#).

Perform this procedure to create an ISO image which installs the OS on a bare metal system. At the end of the procedure, an `.iso` file is created that contains the following:

- Standard Anaconda installer ISO
- Embedded Oracle Linux system tar file
- Kickstart file that installs the commit with the minimum default requirements

The installer ISO contains a preconfigured system image that you can use to install on a bare metal system.

1. (Optional) Verify that the blueprint for the ISO image is in Image Builder.

```
sudo composer-cli blueprints show myblueprint
```

2. Create the ISO image.

```
sudo composer-cli compose start myblueprint iso
```

While the process is running in the background, the composer image's UUID is displayed.

3. After the process ends, check the status of the image.

```
sudo composer-cli status image-uuid
```

The image's status indicates `FINISHED` when Image Builder has completed the build process.

4. Download the ISO image file.

```
sudo composer-cli compose image image-uuid
```

The ISO image file contains a `*.tar` file which is the OS image to be installed on a system.

5. (Optional) Mount the downloaded image and extract the contents.

- a. Mount the downloaded image.

```
sudo mount -o ro iso-image /mnt
```

iso-image includes the full path and the name of the ISO image file.

The `/mnt/` mount point contains the `liveimag.tar.gz` file.

- b. Extract the contents of the *.tar file

```
tar xvf /mnt/liveimg.tar.gz
```

6. Select the appropriate method for installing the OS.

For example, you can use the ISO image as an installer when booting a system from a location where you want to automatically load the image to a hard disk. Otherwise, you can extract the image file, as described, and use this file to manually deploy the image to a target environment (such as a cloud environment, virtual machine, and so on).

For more information about installing Oracle Linux, see [Oracle Linux 8: Installing Oracle Linux](#).

A

Image Types and Output Formats

Image builder can generate different types of image that can be deployed on specific platforms.

Image Description	Output File Extension
Oracle Linux optical disc image	.iso
Oracle Cloud Infrastructure images	.qcow2
TAR Archive	.tar
QEMU QCOW2 image	.qcow2
Azure Disk Image	.vhd
Amazon Machine Image Disk	.raw

To list the types of image that you can build, run the following command:

```
sudo composer-cli compose types
```

B

Blueprint Format

Blueprint content consists of basic metadata information, package information, and customizations.

A blueprint contains the specifications for an Image Builder custom image. The general types of information that you can add to a blueprint are package related information and other customizations. Elements in a typical blueprint file include: 1) basic metadata information, 2) package listing, and 3) other customizations. All configuration entries in a blueprint use the `parameter = "value"` format convention.

Basic Metadata Information

The blueprint's metadata provides general information about the blueprint itself. The metadata is entered at the top of the file and consists of the blueprint name, an optional description, and a version. The version follows the semantic versioning scheme in <https://semver.org/>. You define the metadata only one time in the entire blueprint.

Important:

The metadata information is required in any blueprint.

```
name = "Blueprint name"
description = "Description of the blueprint"
version = "Version number"
```

Package Information

Package information is a general term that identifies a list of packages, modules, containers, and groups. Each entry has a corresponding heading in the format `[[heading]]`.

The parameters under each heading depend on what the heading describes. For example package and module lists require the name and version of the package. Containers and groups require different information and would use other parameters. Each package, module, container, or group listing must have its own heading, as shown in the following example:

```
[[packages]]
name = "tmux"
version = "2.7"

[[packages]]
name = "python3"
version = "3.6.8"

[[groups]]
name = "graphical-admin-tools"
```

Customizations

Customizations are blueprint specifications in addition to package lists. While a customization would typically appear under the heading `[[customization]]`, more specific customizations

append a keyword to the heading for better identification. Customizations typically include more parameters than package information entries.

The following example shows customizations for the image's hostname, locale, time zone, and groups.



Note:

A custom group refers to a UNIX group, which is different from a group of packages to be downloaded. Therefore, a custom UNIX group definition has its own blueprint heading that's distinct from a package group heading.

```
[[customizations]]
hostname = "system1"

[[customizations.locale]]
languages = ["en_GB.utf8"]
keyboard = "gb"

[[customizations.timezone]]
timezone = "Europe/Dublin"
ntpserver = ["uk.pool.ntp.org"]

[[customizations.groups]]
name = "students"
```

Other custom entries that you can define include the following:

- **Users:** Contains all the required details that apply to the specific user account, such as the user's name, home directory, the user's default shell, groups to which the user is assigned, and so on.
- **SSH key:** Contains the particular user's name and the public SSH key that you create for the user. This key is added to the user's `authorized_keys` file.
- **Kernel:** Contains arguments to append to the bootloader's command line.
- **Firewall ports:** Contain the list of ports that you want to open. The ports are specified by using the `port:protocol` format, for example, `22:tcp`.
- **Firewall services:** A separate listing that contains a list of services that you enable and disable for the image. To identify which services you can enable or disable, run the `firewall-cmd --get-services` command.
- **Systemd services:** Similar to firewall services, this entry contains a list of `systemd` services that you enable and disable for an image.

The preceding list is partial. For a complete list of blueprint entries, see <https://osbuild.org/docs/user-guide/blueprint-reference/>.