Oracle® Linux 8

Installing Oracle Linux
Abstract

This manual provides information about how to install Oracle Linux 8 systems.
# Table of Contents

Preface ......................................................................................................................... v  
1 Pre-Installation Configuration .................................................................................. 1  
   1.1 System Requirements ....................................................................................... 1  
   1.2 Obtaining and Preparing Installation Media ..................................................... 1  
       1.2.1 Preparing CD or DVD Installation Media .................................................. 3  
       1.2.2 Preparing USB Installation Media ............................................................. 3  
       1.2.3 Extracting the Contents of the Full Installation ISO Image .............................. 3  
   1.3 Planning an Installation .................................................................................... 4  
   1.4 Using a Driver Update Disk ............................................................................ 4  
2 Options for Installation ............................................................................................. 7  
   2.1 Installation Boot Options .................................................................................. 7  
3 Installing Oracle Linux Manually ............................................................................. 11  
   3.1 Performing Graphics-Based Installations .......................................................... 11  
      3.1.1 Starting the Installation .............................................................................. 11  
      3.1.2 Setting Localization Options ..................................................................... 14  
      3.1.3 Setting Software Options ......................................................................... 17  
      3.1.4 Setting System Options ............................................................................ 19  
      3.1.5 Completing the Installation ...................................................................... 27  
   3.2 Performing Text-Based Installations .................................................................. 29  
4 Automating an Oracle Linux 8 Installation by Using Kickstart ................................... 31  
   4.1 About Kickstart Installations ............................................................................ 31  
   4.2 About the Kickstart Configuration File ............................................................. 31  
      4.2.1 Installation Options ................................................................................. 32  
      4.2.2 Packages to Install ................................................................................... 33  
      4.2.3 Pre-Installation Options ......................................................................... 34  
      4.2.4 Post-Installation Options ........................................................................ 34  
   4.3 Performing a Kickstart Installation ................................................................... 35  
      4.3.1 Installing Over the Network With Kickstart ............................................. 35  
      4.3.2 Installing Kickstart Locally With Kickstart ............................................. 35  
5 Post-Installation Configuration ............................................................................... 37  
   5.1 Registering With the Unbreakable Linux Network ............................................. 37  
   5.2 Obtaining Errata and Updates From the Oracle Linux Yum Server ...................... 37  
   5.3 Obtaining Packages From the Oracle Linux Installation Media ....................... 38  
   5.4 Applying Updates ......................................................................................... 38  
   5.5 Managing an Oracle Linux System After an Installation .................................. 39  
6 Troubleshooting Oracle Linux Installations .............................................................. 41  
   6.1 Troubleshooting Menu Options ....................................................................... 41  
   6.2 Debug and Log Information ............................................................................ 41  
A Performing a Network Installation ........................................................................ 43  
   A.1 Requirements for a Network Installation .......................................................... 43  
   A.2 Setting Up an Oracle Linux Network Installation ........................................... 43  
   A.3 Configuring PXE Boot Loading ....................................................................... 47  
   A.4 Supporting Different Kinds of Clients ............................................................. 50
Preface

*Oracle® Linux 8: Installing Oracle Linux* provides information about how to install the Oracle Linux 8 release.

**Audience**

This document is intended for administrators who need to install and configure Oracle Linux 8. It is assumed that readers are familiar with web technologies and have a general understanding of administering the Linux operating system.

**Document Organization**

The document is organized as follows:

- **Chapter 1, Pre-Installation Configuration** describes the system requirements for Oracle Linux 8, how to obtain the Oracle Linux 8 software, information that is required to install a system, and how to set up a network installation server.

- **Chapter 2, Options for Installation** describes some of the options you have for installing Oracle Linux 8, including various boot options that you can use to control the installation.

- **Chapter 3, Installing Oracle Linux Manually** describes how to manually install Oracle Linux 8 from a boot image that is available on a CD, DVD, USB memory stick, or hard drive. The packages used for the installation can be available locally or hosted on a network installation server.

- **Chapter 4, Automating an Oracle Linux 8 Installation by Using Kickstart** describes how you can automate the installation of Oracle Linux by using kickstart.

- **Chapter 5, Post-Installation Configuration** describes configuration changes that you might make to a system after an installation.

- **Chapter 6, Troubleshooting Oracle Linux Installations** describes some options for troubleshooting Oracle Linux installations.

- **Appendix A, Performing a Network Installation** describes examples for setting up network installation of Oracle Linux.

**Related Documents**

The documentation for this product is available at:

*Oracle® Linux 8 Documentation*

**Conventions**

The following text conventions are used in this document:

<table>
<thead>
<tr>
<th>Convention</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>boldface</strong></td>
<td>Boldface type indicates graphical user interface elements associated with an action, or terms defined in text or the glossary.</td>
</tr>
<tr>
<td><em>italic</em></td>
<td>Italic type indicates book titles, emphasis, or placeholder variables for which you supply particular values.</td>
</tr>
</tbody>
</table>
### Documentation Accessibility

For information about Oracle’s commitment to accessibility, visit the Oracle Accessibility Program website at [https://www.oracle.com/corporate/accessibility/](https://www.oracle.com/corporate/accessibility/).

### Access to Oracle Support

Oracle customers that have purchased support have access to electronic support through My Oracle Support. For information, visit [https://www.oracle.com/corporate/accessibility/learning-support.html#support-tab](https://www.oracle.com/corporate/accessibility/learning-support.html#support-tab).

<table>
<thead>
<tr>
<th>Convention</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>monospace</td>
<td>Monospace type indicates commands within a paragraph, URLs, code in examples, text that appears on the screen, or text that you enter.</td>
</tr>
</tbody>
</table>
Chapter 1 Pre-Installation Configuration

Table of Contents

1.1 System Requirements ................................................................. 1
1.2 Obtaining and Preparing Installation Media .................................. 1
   1.2.1 Preparing CD or DVD Installation Media .................................. 3
   1.2.2 Preparing USB Installation Media ........................................... 3
   1.2.3 Extracting the Contents of the Full Installation ISO Image ............ 3
1.3 Planning an Installation ......................................................... 4
1.4 Using a Driver Update Disk ....................................................... 4

This chapter describes the system requirements for installing Oracle Linux 8, including information about how to obtain the software and general preparation guidelines.

1.1 System Requirements

Oracle Linux 8 includes the Red Hat Compatible Kernel (RHCK). To install Oracle Linux 8, your system must meet the following requirements:

• Minimum of 2 logical CPUs up to 2048 logical CPUs
• 1.5 GB of memory per logical CPU, up to a maximum of 64 TB
• At least 10 GB of disk space (20 GB is the recommended minimum)
• On UEFI systems, ensure that the target disk uses GPT (GUID Partition Table), as some UEFI firmwares do not support UEFI/MBR boot.

Note
Oracle Linux 8 for the 64-bit Arm (aarch64) platform is available as a developer preview release only. You can install this preview release on generic 64-bit Armv8 hardware.

You can download the developer preview of Oracle Linux 8 for the 64-bit Arm (aarch64) platform from https://www.oracle.com/linux/downloads/linux-beta8-downloads.html.

Refer to the following additional resources for information related to installation issues and system requirements:

• Oracle® Linux 8: Release Notes for Oracle Linux 8
• https://linux.oracle.com/hardware-certifications

1.2 Obtaining and Preparing Installation Media

The Oracle Linux distribution is free to download, use, and distribute. Oracle makes the Oracle Linux 8 ISO image for the x86_64 platform at the Oracle Software Delivery Cloud at https://edelivery.oracle.com/.

The same ISO image is also available at https://yum.oracle.com/oracle-linux-isos.html.

For the 64-bit Arm (aarch64) platform, you can download the developer preview release from https://www.oracle.com/linux/downloads/linux-beta8-downloads.html.
Obtaining and Preparing Installation Media

The latest Oracle Linux 8 packages are also available in the Unbreakable Linux Network (ULN) and the Oracle Linux yum server. To install additional software for Oracle Linux 8, do one of the following:

- Subscribe to different channels on ULN.
  
  To explore the channels that are available to you on ULN, log in to https://linux.oracle.com/ and view the Channels option.

- Enable the required repositories within your yum or DNF configuration.
  
  To view the Oracle Linux yum repositories that are available for Oracle Linux 8, visit https://yum.oracle.com/.

  **Note**
  
  The Oracle Linux yum server does not provide equivalent repositories for some channels that are available on ULN. These channels provide non-open source packages.

The Media Pack contains the following ISO images:

- **Oracle Linux 8 for x86_64 (64 bit)**
  
  This ISO image contains everything needed to boot a system and install Oracle Linux.

- **Oracle Linux 8 Boot ISO image for x86_64 (64 bit)**
  
  This ISO image contains everything that is required to boot a system and start an installation. However, to complete the installation, you must specify the location of the packages, for example on a local disk or an NFS share. RHCK is used during the installation and both UEK and RHCK kernels are installed. After the installation, the system boots the UEK kernel by default.

- **Oracle Linux 8 Source DVD 1 and 2**
  
  These ISO images contain the source code for the software packages in the release.

This installation guide assumes that you are performing installations on physical systems at your site. However, you can also install a full Oracle Linux 8 media image on a compute instance on Oracle Cloud Infrastructure, provided that you have an account. For more information, visit https://cloud.oracle.com/en_US/compute.

You can use the full installation ISO image or the boot ISO image to install Oracle Linux 8 from various boot sources, including the following:

- CD or DVD. See Section 1.2.1, “Preparing CD or DVD Installation Media” for instructions.

- Bootable USB drive. See Section 1.2.2, “Preparing USB Installation Media” for instructions.

- Network drive. See Appendix A, Performing a Network Installation.

- Virtual DVD-ROM. This source enables you to boot and install an Oracle VM or Oracle VM VirtualBox virtual machine (guest).

Note that the media pack might contain additional content that may pertain to a particular release update of Oracle Linux. Items such as Driver Update Disks may also be included. These items are described in further detail in the release notes for the particular update release.

After installation, you can obtain Oracle Linux packages from the Unbreakable Linux Network (ULN) and the Oracle Linux yum server. For more information, see Chapter 5, Post-Installation Configuration.
Preparing CD or DVD Installation Media

1.2.1 Preparing CD or DVD Installation Media

Due to storage limits, you can write the full installation ISO image only on a recordable DVD. A recordable CD can only store the boot ISO image.

To write an ISO image file to a CD or DVD, use a command such as `cdrecord`, for example:

```
# cdrecord -v -eject speed=16 dev=ATA:0,2,0 file_name.iso
```

To display the SCSI subsystem and device that corresponds to the CD or DVD writer, use the `cdrecord -scanbus` command.

1.2.2 Preparing USB Installation Media

If a system's firmware supports booting from a USB drive, you can create a boot image on the drive to use to install Oracle Linux. Whether you can create the full installation ISO image or only the boot ISO image depends on the capacity of the USB media.

To create a bootable USB drive, use the `dd` command or a separate utility that can write an ISO image to a USB drive. The following steps describe how to use the `dd` command.

**Caution**

This procedure destroys any existing data on the drive. Therefore, ensure that you specify the correct device name for the USB drive on your system.

1. Insert a USB drive into an Oracle Linux system.
2. Unmount any file systems on the device.
   
   Assuming that the USB drive is the `/dev/sdb1` device, you would type:

   ```
   # df /media/USB
   Filesystem 1K-blocks Used Available Use% Mounted on
   /dev/sdb1 35346 35346 0 100% /media/USB
   # umount /dev/sdb1
   ```
3. Write the contents of the ISO image file to the USB device, for example:

   ```
   # dd if=./full_image.iso of=/dev/sdb bs=512k
   ```

   The USB drive is now ready to be used to boot a system and start the installation.

1.2.3 Extracting the Contents of the Full Installation ISO Image

1. Mount the full installation ISO image on a suitable mount point such as `/mnt`:

   ```
   # mount -t iso9660 -o loop full_image.iso /mnt
   ```

2. Extract the contents of the full installation ISO image.

   Ensure that the command you use extracts the `.treeinfo` file at the root of the ISO image, for example:

   ```
   # cp -a -T mount_dir output_dir
   ```

   The following example extracts the ISO image mounted on `/mnt` to an NFS share at `/var/OSimage/OL8`:
Planning an Installation

# cp -a -T /mnt /var/OSimage/OL8

To extract the ISO image mounted on /mnt to a web server directory at /var/www/html/OSimage/OL8, you would enter:

# cp -a -T /mnt /var/www/html/OSimage/OL8

3. Unmount the DVD image:

# umount mount_dir

1.3 Planning an Installation

The following are the main considerations when planning to install a system:

**Storage**

Includes the following:

- Storage devices on which you intend to install the operating system, such as a local hard disk. Identify the partitions, if any exist, that can be used for the installation. The installation program indicates how much disk space is required, and displays a warning if disk space is insufficient.

- Layout of the storage devices on which the operating system’s file systems will be installed, including any provision for logical volume management or RAID configuration.

- Required amount of space for each file system (/, /boot, /home, /var/tmp, and so on), the file system type, and whether the block device underlying each file system should be encrypted.

- For iSCSI or FCoE connections, the WWID or the port, target, and LUN to be used.

**Network**

Includes the following:

- Network interface to use for network installation, as well as the IP address, netmask, and gateway settings if you do not use DHCP.

- Fully qualified domain name of the system, or, if using DHCP, the host name.

- Other network interfaces to be configured during installation, and, if not using DHCP, their IP addresses, netmasks, and gateway settings.

- Other specialized network interfaces to be configured during installation, such as VLANs and bonds.

**Software**

Includes the following:

- Software packages to be installed based on system's intended purpose, such as a web server.

- URLs of any additional repositories and proxy settings to be used to install packages.

1.4 Using a Driver Update Disk

A Driver Update Disk (DUD) provides a mechanism for delivering updated device drivers during system installation. On some systems, hardware may not be fully supported for an Oracle Linux release. In these cases, a DUD may be released at a later date to facilitate installation on newer hardware.
Preparing to use a Driver Update Disk image

DUDs are released as modules become available for previously unsupported hardware. The DUD is usually in the form of an ISO and is available in the Oracle Software Delivery Cloud or through Oracle Support.

Preparing to use a Driver Update Disk image

Warning

Writing the DUD ISO to the wrong device may result in data loss. Check that you reference the correct device node when you copy the image. Use the `lsblk` utility to help you to identify the different disks block devices on your system.

Use the `dd` command line utility to transfer the DUD image to an alternate storage device:

```
# dd if=/path/to/DUD.iso of=/dev/sdX
```

- `/path/to/DUD.iso`: Full path to the location of the DUD ISO file.
- `/dev/sdX`: Device node of the storage media that you intend to use for the DUD.

As an alternative, you can transfer the DUD image to a location that is accessible over the network such as a web server or an NSF server.

Using the Driver Update Disk during installation

To use the DUD during an installation, choose from one of the following methods depending on where the DUD image is stored.

- **DUD image is in an attachable media (USB)**
  1. Boot the system from the standard Oracle Linux installation media.
  2. While the system is booting, but before the installer starts, attach the media that contains the DUD image.

    As an example, attach the media when the system displays the GRUB boot prompt.

    The installer recognizes the DUD and would use it. The installer might also prompt you to select the drivers to install.

    **Note**

    The kernel used by the installer might not include support for USB 3.0. When using the DUD on USB media, ensure that you use a USB 2.0 compatible port when connecting the USB media to the system.

- **DUD image is on the network**
  1. While the system is booting, press the key that enables you to edit the boot options.


  2. Add the following line to the boot options:

```
inst.dd=network-location
```

    The network location can be a URL, such as `http://www.example.com/dd.iso`, or the full path of the NFS share directory.
If you are using DUD in a kickstart installation, indicate the DUD location in the kickstart file. The specific entry to add depends on the location of the DUD image.

- **DUD image is in an attached block device:**

```bash
driverdisk /dev/sdb1
```

- **DUD image is on the network location:**

```bash
driverdisk --source=network-location
```

The network location can be a URL, such as `http://www.example.com/dd.iso`, or the full path of the NFS share directory.
Chapter 2 Options for Installation

Table of Contents

2.1 Installation Boot Options ........................................................................................................... 7

This chapter describes some of the options you have for installing Oracle Linux 8.

2.1 Installation Boot Options

To customize boot loader actions beyond the default behavior, for example to specify network settings, edit the boot command line.

1. Boot the system.

2. When the boot menu is displayed, select any installation option, then press either E on UEFI-based systems or Tab on BIOS-based systems.

   The boot options line is displayed with some default options already defined.

3. Add options at the end of the line.

   Separate multiple boot options with a space. Options that require parameters must be in the option=parameter format.

4. Save the changes by pressing either Ctrl+X on UEFI-based systems or Return on BIOS-based systems.

   To discard your changes and return to the boot menu, press Esc.

In this example, the added boot options dictate the boot loader actions:

- Use the full installation image stored on an NFS share directory.

- Start the installation automatically by using a kickstart file also stored on an NFS share directory.

\[
\text{inst.repo=nfs:nfs.example.com:/ISOs/OL8/full_image.iso} \ \text{inst.ks=nfs:nfs.example.com:/kickstart/OL8/server-ks.cfg ip=dhcp}
\]

See the following references for more information about boot options you can use. Check these documentation especially if you are upgrading from a previous release to identify any removed or deprecated options.


- Dracut kernel command line options. For details, see the dracut.cmdline(7) manual page.

The following are some of the most commonly used boot options:

**Boot Options for Specifying Installation Type**

**inst.graphical**

   Specifies a graphical-based installation.
**Installation Boot Options**

**inst.gpt**

Applies only to BIOS-based systems with less than 2 TiB sized disk. Specifies to use the GUID partition table when boot loader is installed instead of the default MBR.

**Boot Options for Specifying Installation Source**

**inst.repo=cdrom[:device]**

Specifies a CD or DVD drive as the location that contains everything needed to install the software.

The installation program searches all the system’s CD or DVD drives, unless a `device` is specified.

If access to a network is required and no network boot options are specified, the installation program enables DHCP on all available network devices.

**inst.repo=ftp://user:password@FTP_server/path**

Specifies an FTP server as the location that contains everything needed to install the software.

If access to a network is required and no network boot options are specified, the installation program enables DHCP on all available network devices.

**inst.repo=hd:device:path**

Specifies a local disk as the location that contains everything needed to install the software.

You can specify the `device` by its device name (`sdb2`), label (`LABEL=label`), or UUID (`UUID=uuid`).

**inst.repo=[http:|https://]//HTTP_server/path**

Specifies a web server as the location that contains everything needed to install the software. If your system has access to the Internet, you can use the BaseOS repository on the Oracle Linux yum server for the Oracle Linux release that you are installing. For example, you could set this value to `https://yum.oracle.com/repo/OracleLinux/OL8/baseos/latest/x86_64`

**inst.repo=nfs:[options:]NFS_server:path**

Specifies an NFS share as the location that contains everything needed to install the software.

Use `options` to specify a comma-separated list of NFS mount options.

The NFS share can be the path to an ISO image or a directory.

**inst.stage2=[installation_source]**

Specifies the location to fetch the installer runtime image; packages are ignored. If this option is not specified, `inst.repo` is used instead. The path specified for `installation_source` can match any of the protocol and path options used for `inst.repo`.

The directory path specified for the `installation_source` should contain a valid `.treeinfo` file that specifies the location of the runtime image. If a `.treeinfo` file is not present at the source, the installer uses `LiveOS/squashfs.img` as the default location at the specified source.

**Boot Options for Configuring the Network**

**ip=[interface:]dhcp|dhcp6|auto6|ibft**

Specifies a network automatic configuration method. If `interface` is not specified, all interfaces are configured. Use `ibft` to use the MAC address of the interface specified by the iSCSI Boot Firmware Table (iBFT) in the system BIOS or firmware.
Installation Boot Options

**ip=ip::gateway:netmask:hostname:interface:none**

Specifies a static IP configuration for `interface`. Enclose IPv6 addresses in square brackets, for example `[2509:f0d0:1001::0004]`.

**nameserver=IP**

Specifies the IP address of a DNS server to use during installation. Multiple `nameserver` options can be used.

**bootdev=interface**

Specifies the primary network interface. Required if you use more than one `ip` option.

**inst.dhcpclass**

Specifies a vendor class identifier to DHCP.

**Boot Options for Kickstart Installations**

**inst.ks=cdrom[:device]/path**

Specifies a kickstart file on a CD or DVD drive.

**inst.ks=ftp://user:password@FTP_server/path**

Specifies a kickstart file on an FTP server.

**inst.ks=hd:device:path**

Specifies a kickstart file a local disk.

You can specify the `device` by its device name (`sdb2`), label (`LABEL=label`) or UUID (`UUID=uuid`).

**inst.ks=[http|https]://HTTP_server/path**

Specifies a kickstart file on a web server.

**inst.ks=nfs:[options:]NFS_server:path**

Specifies a kickstart file on an NFS share.

Use `options` to specify a comma-separated list of NFS mount options.

**Boot Options for Remote Installations**

**inst.vnc**

Enables remote graphical-based installation by starting a VNC server.

A VNC client can connect by using a command such as `vncviewer server:port`, where `server` is the IP address of the system being installed.

After installation, the system starts in text mode even if a graphical desktop environment is selected as the base environment.

**inst.vncconnect=client[:port]**

Specifies the VNC client and optional port that is listening for connections from a VNC server (`vncviewer -listen`). The default port is 5900.
Installation Boot Options

\texttt{inst.vncpassword=password}

    Specifies the password for client connections using VNC.

**Miscellaneous Boot Options**

\texttt{inst.keymap=layout}

    Specifies the keyboard layout for installation.

\texttt{inst.lang=language}

    Specifies the language for installation.

\texttt{loglevel=level}

    Specifies the logging level for installation: \texttt{critical, debug, error, info, or warning}. The default level is \texttt{info}.
This chapter describes how to perform a basic Oracle Linux installation by using a CD, DVD, or a USB drive. The installation can be in either graphics mode or text mode. The chapter describes both.

3.1 Performing Graphics-Based Installations

The graphics-based installation method involves setting installation directives that are presented in a series of graphical screens. Use the appropriate keys to navigate through each screen.

3.1.1 Starting the Installation

To install Oracle Linux, you must boot the system from a boot image. You might also need to configure the host system's BIOS or hypervisor settings to use the boot device that you have chosen.

Figure 3.1 Boot Menu

The boot menu contains the following options:

Install Oracle Linux 8.0

Uses the graphical installation program to install Oracle Linux, provided that the system has sufficient memory and the video card is supported.
Starting the Installation

Test this media & install Oracle Linux 8.0

Default option, which tests the installation media and then uses the graphical installation program to install Oracle Linux, provided that the system has sufficient memory and the video card is supported. Otherwise, text-based installation is used.

Troubleshooting

Provides access to a separate menu, which contains options for resolving issues with installing or booting an Oracle Linux 8 system. See Section 6.1, “Troubleshooting Menu Options”.

From this menu, you can also access the boot configuration options for each menu item and add other options as needed. For a system that has limited resources, for example, you can specify the inst.vnc option to run the graphical installation program in a VNC session. Or, you can use the network install method instead of using VNC.

Select one of the options to install Oracle Linux and press Enter. The Welcome to Oracle Linux 8 screen is displayed.

Note

If your BIOS system or UEFI-based system in BIOS legacy mode has a disk size of less than 2 TiB, the boot loader is automatically installed on the master boot record (MBR). However, if you want to use the GUID partition table (GPT) instead, then you would need to configure the boot options from this menu. Do the following:

1. Select one of the options to install Oracle Linux and press Tab.

   The boot command line appears, including some default options.

2. Add inst.gpt at the end of the line and press Enter.

   The boot process begins. After it completes, the welcome screen is displayed.
Starting the Installation

Figure 3.2 Welcome to Oracle Linux 8.0

From the language list, select the language to use for the installation. Alternatively, type the name of the language in the search box to locate your preferred language. The language that you select becomes the default language for the system. Then, from the locale list, select a locale. If necessary, you can change the default language after you have installed the software.
Selecting any of the menu options opens additional screens for configuring the options. As a minimum, you must visit the options with a warning icon next to them. However, going through all the options is recommended so that you can see the various configuration settings that are available for the installation. You can change the installation configuration options as much as you like. The installation does not begin until you click **Begin Installation**. As you visit the configuration options, pay attention to any warning messages that are displayed at the bottom of the screen.

### 3.1.2 Setting Localization Options

On this screen, you select the localization options to implement on the target system.

**Adding Keyboard Layouts**

To add support for any additional keyboards that will be used with the system, click the **Keyboard** option to display the Keyboard Layout screen.

**Note**

At the top right of the screen is the Keyboard switch. This switch appears in all of the option screens to enable you to change to a different available keyboard layout at any time during configuration. See Adding Keyboard Layouts for more details about keyboard layouts.
Figure 3.4 Keyboard Layout

The default keyboard is automatically listed on the left pane. Click the plus sign (+) to add keyboard layouts that you want to install on the system. To change the order of the list, use the arrow keys. A keyboard at the top of the list becomes the default keyboard.

To view a keyboard's layout, select the keyboard and click the **Keyboard** icon at the bottom of the left pane.

To test a keyboard, click the **Keyboard** switch to change to the next keyboard layout on the list. Continue clicking until the keyboard you want to test is displayed. Then type some text on the text box. You can also click **Options** to configure the keyboard shortcut for switching between layouts.

Click **Done** to save your configuration and return to the Installation Summary screen.

**Adding Language Support**

To add support for any additional locales that will be used with the system, click the **Language Support** option on the Installation Summary screen to display the Language Support screen.
Setting Localization Options

Figure 3.5 Language Support

Select a language from the list of languages, or type a language in the search box, then select one or more locales from the list of locales.

Click **Done** to save your configuration and return to the Installation Summary screen.

Setting the System Time

To set the correct time for the system, click the **Date & Time** option on the Installation Summary screen to display the Date & Time screen.

Figure 3.6 Date & Time
Pick a time zone by clicking your system’s location on the map or by using the region and city drop-down lists. You need to specify a time zone even if you intend to use the Network Time Protocol (NTP) to set the time on the system.

To set the date and time manually, ensure that the **Network Time** switch is toggled to **OFF**, then adjust the date and time.

To enable NTP, you must first enable the network through the **Network & Hostname** option on the Installation Summary screen (see **Configuring Network & Host Name**). Then, return to the Date & Time screen and toggle the **Network Time** switch to **ON**. Finally, click **Settings** to display a dialog box, where you can configure the NTP servers that the system should use.

Click **Done** to save your configuration and return to the Installation Summary screen.

### 3.1.3 Setting Software Options

This section describes how to use the options in the Software section of the Installation Summary screen.

**Selecting the Source of the Installation Image**

When you install Oracle Linux, you need to specify a location that contains the full installation image. To specify a location, click the **Installation Source** option on the Installation Summary screen to display the Installation Source screen.

**Figure 3.7 Installation Source**

Select the location of the installation image:
Auto-detected installation media

This option is only available if the installation program detected a local device that contains the installation image. If you did not check the installation media when you started the installation, click Verify to check the media.

On the network

Note

The On the network option is not available unless you enable the network through the Network & Host Name option in the Installation Summary screen. See Configuring Network & Host Name).

Select the network protocol that is required to access a network installation server from the list and then specify the appropriate information:

- For HTTP or HTTPS, the URL of the installation image.

  If needed, click Proxy setup and configure the details for your organization's proxy server that acts as an intermediary for Internet access.

- For NFS and FTP, the domain name or IP address of the server and the path to the directory that contains the installation image.

  For NFS, the path can be the path to an ISO image. Enter any NFS mount options that are required.

Click the plus sign (+) to add repositories of software that you want to install.

Click Done to save your configuration and return to the Installation Summary screen.

Selecting the Software to Install

To select the software you want to install on the system, click the Software Selection option on the Installation Summary screen to display the Software Selection screen.
Figure 3.8 Software Selection

From the list of base environments, select the environment that best matches the purpose for which you will use your system. From the list of add-ons, select the software that you want to add to the selected base environment. The add-on list varies depending on the base environment that you select.

Only the Server with GUI base environment, which is the default option, includes a graphical desktop when the system boots. All other base environments boot into a command-line environment.

The Minimal Install base environment contains only the minimum set of packages that are required to run Oracle Linux. It does not include many administration tools that you might normally use, such as `wget` or `unzip`. This environment is the most secure environment to install and requires the least system resources to run. After the software is installed, you can install any other packages that you require.

There is no base environment or add-on for installing the Oracle Database (RDBMS). After you install Oracle Linux 8, you can use the Oracle RDBMS Server Pre-Install RPM to perform pre-installation configuration tasks for Oracle Database. For more information, visit https://docs.oracle.com/en/database/oracle/database/18/adb/html/automatically-configuring-oracle-linux-with-oracle-preinstallation-rpm.html#GUID-22846194-58EF-4552-AAC3-6F6D0A1DF794.

Click **Done** to save your configuration and return to the Installation Summary screen.

### 3.1.4 Setting System Options

This section describes how to use the options in the System section of the Installation Summary screen.

**Choosing Where to Install the Software and Configuring Storage**

To choose where to install the software and configure the storage, click the **Installation Destination** option to display the Installation Destination screen.
On this screen, you select the disks to use for the installation, as well as customize the disk configuration if you do not want to use the default settings.

Choose the devices on which you want to install Oracle Linux:

- In the Local Standard Disks section, select the local disks that you want to use for the installation. A Tick icon is displayed next to the disks you have selected.

- For specialized and network disks, you can add hardware RAID, iSCSI or Fibre Channel over Ethernet (FCoE) storage devices. Click **Add Disk** to display the options for adding and configuring these device types.

By default, storage configuration is set to automatic.

Automatic disk partitioning creates the following layout on the selected disks:

- A standard partition for an XFS file system mounted at `/boot`. This partition is sized to 1 GiB on systems running Oracle Linux 8 or later.

- A 200 MiB EFI system partition mounted at `/boot/efi` (UEFI-based systems only).

- A partition in the remaining disk space configured as a Logical Volume Manager (LVM) physical volume for an LVM volume group that contains:
  - A logical volume for an XFS file system for the root file system (`/`).
  - A logical volume for an XFS file system for the `/home` file system (if the selected disks are larger than 50 GiB in total).
• A logical volume for a swap partition.

If you want to customize the configuration, select the **Custom** option and then click **Done** to open the Manual Partitioning screen, where you can create partitions for mount points with assigned disk spaces. You can partition disks using standard partitions, LVM logical volumes, or LVM thin provisioning.

On a BIOS system whose disk size is less than 2 TiB, MBR is used by default. If you want to use GPT instead, configuring the boot menu with the `inst.gpt` option is the simplest approach. See the note in Section 3.1.1, "Starting the Installation" for instructions. However, if you were not able to configure the boot menu at the beginning, then you would need to create a BIOS Boot partition manually from this screen. After selecting **Custom**, do the following:

1. From the Manual Partitioning screen, if no partitions exist on the device yet, select **Click here to create them automatically**.
   
   This step creates the standard partitions for an Oracle Linux 8 installation.

2. Click the plus sign (+) to create a new partition.

3. From the Mount Point drop down list, select **biosboot**.

4. For the Desired Capacity, enter 1 MiB then click **Add mount point**.

   If the partition cannot be created, adjust the sizes of the other partitions to provide sufficient space to the new partition. Then create the BIOS boot partition again with the indicated partition size.

5. Select the newly created BIOS boot partition and on the right side of the screen that displays the partition's details, ensure that Device Type is Standard Partition. The partition must not be on an LVM volume.

6. Click **Done**.

   A summary of the changes is displayed. If you are satisfied with these changes, click **Accept Changes**.

If you are manually configuring a regular UEFI system, the following are some considerations:

• You do not need to create a BIOS boot partition.

• Verify that a `/boot/efi` partition is created.

   From the Manual Partitioning screen, if you select **Click here to create them automatically**, the `/boot/efi` partition is included among the standard partitions. The partition size should be at least 50 MiB, although the optimal size is 200 MiB. Check that the partition is on Standard Partition, not on an LVM volume.

If partitions already exist on the system, then disk space might be insufficient for an Oracle Linux 8 installation. The information at the bottom of the screen indicates how much disk space is required to install the software you have selected. Ensure beforehand that disk space on the system is available for the software.

With automatic partitioning, you might not have sufficient space to install the software if the disk is already partitioned. The information at the bottom of the screen tells you how much disk space is required to install the software that you have selected. If you click **Done** while the destination disk has insufficient space, you would be prompted to free disk space.

To free up disk space, select **I would like to make additional space available** and click **Done** to display the Reclaim Disk Space window.
Note

The option to create additional disk space is available only with automatic partitioning.

Figure 3.10 Reclaim Disk Space

Select the partitions that you want to use, then click **Delete**, **Shrink**, or **Delete all** to free up disk space. Then, click **Reclaim Space** to available space.

If you select **Encrypt my data** on the Installation Destination screen, you are prompted to enter a passphrase for the encryption when you click **Done**.

This option encrypts all of the disk partitions, with the exception of the partition that contains `/boot`, by using Linux Unified Key Setup (LUKS).

**Warning**

If a partition is encrypted, you cannot access data on the partition without entering the passphrase. If you lose this passphrase, you cannot recover the data on the disk.

If you only want to encrypt particular partitions, then you must select Custom configuration at the Installation Destination screen so that you can manually partition the disk. Then, for the encryption option, select the partitions on which to implement encryption. Note the following important issues when encrypting data:

- For LVM, selecting **Encrypt my data** encrypts the LVM physical volume and all of the logical volumes that it contains. If you do not select **Encrypt my data**, you can encrypt the logical volume by selecting the **Encrypt** check box on the Manual Partitioning screen or encrypt the physical volume by selecting the **Encrypt** check box on the Configure Volume screen.
• Do not select the Encrypt check box or an LVM or LVM Thin Provisioning device type for the /boot file system. The /boot file system must be configured on a standard partition and should be of the type, ext4 or XFS.

Clicking Full disk summary and bootloader displays the disk configuration including the location of the boot loader. From the display, you can change the boot loader's location or, if you prefer, skip the boot loader installation.

Click Done to save your configuration and return to the Installation Summary screen.

Configuring Kdump

To configure Kdump, click the Kdump option on the Installation Summary screen to display the Kdump screen.

Figure 3.11 Kdump

Kdump is a kernel crash dumping mechanism. In the event of a system crash, Kdump will capture information from your system that can be invaluable in determining the cause of the crash. Note that Kdump does require reserving a portion of system memory that will be unavailable for other uses.

Enable kdump
Kdump Memory Reservation: Automatic Manual
Memory To Be Reserved (MB): 128
Total System Memory (MB): 2048
Usable System Memory (MB): 1820

In the event of a system crash, Kdump captures information that assists in determining the cause. By default, Kdump is enabled and the amount of memory reserved for Kdump is calculated automatically. Select the Manual option if you want to set the amount of reserved memory yourself.

Click Done to save your configuration and return to the Installation Summary screen.

Configuring Network & Host Name

Network connections are disabled by default. To connect the system to a network, either during installation or when the system boots, click the Network & Host Name option on the Installation Summary screen.
To enable a network interface, select the interface from the list of interfaces and then toggle the switch to **ON**. By default, the IP settings for a network interface are configured automatically by using DHCP for IPv4 and the Automatic method for IPv6. To edit the connection, click **Configure** to display the Network Connection Settings window.

To enable the connection whenever the network is available, select **Automatically connect to this network when it is available** on the General tab. Using the other tabs, configure the settings for the
connection, as appropriate. To set a static IPv4 address, click **IPv4 Settings** and select **Manual** for the Method, and then enter values for the IP address, network mask, gateway, and DNS parameters. When you have finished configuring the connection. Click **Save** to save the configuration.

On the Network & Host Name screen, enter the host name of the system, as either as a single name or as a fully-qualified domain name (FQDN), for example, `host01.example.com`. If you use the Dynamic Host Configuration Protocol (DHCP) to provide network settings, enter a single name and allow DHCP to assign the domain name.

You can also add special network devices such as an interface bond or team, or a VLAN (virtual local area network) device. Click the plus sign (+) to access the configuration settings for these devices.

Click **Done** to save your configuration and return to the Installation Summary screen.

### Setting the Security Policy

You can optionally set security policy at installation time by configuring settings in the Security Policy screen.

- **Note**
  
  Because security policy is not required on all systems, only use the Security Policy screen if you need to enforce a specific security policy as defined by your organization or by government regulations.

As shown in Figure 3.14, there are several pre-defined policies (profiles) that are available in the Security Policy screen. These security policies follow the recommendations and guidelines that are defined by the Security Content Automation Protocol (SCAP) standard.

You can also add custom security policies that you download from an HTTP, HTTPS, or FTP server. You use the **Change content** option in the Security Policy screen to configure custom policies.
Select a profile from the displayed list. Click **Select profile**. A message confirming the selection is displayed in the **Changes that were done or need to be done** field. A check mark is displayed next to the selected profile.

**Note**

By default, applying a security policy is enabled. If you do not select a profile, then no security policy is implemented despite the setting. Alternatively, you can set the **Apply security policy** switch to **off** to disable applying security policy on the system.

To use a custom profile from either an HTTP server or an FTP server, select **Change content**. A window opens where you type the URL to access the custom profile. Click **Fetch** to download the custom security profile.

Check that the **Changes that were done or need to be done** field shows the changes to be made. Click **Done** to save the changes and return to the Installation Summary screen.

During the installation, the security policy that you applied is installed according to the restrictions and recommendations that are defined in the specified profile. In addition, the **openscap-scanner** package is added to the packages that are installed. This package provides a tool for compliance and vulnerability scanning.

When the installation has completed, the system is automatically scanned to verify compliance, and the results are saved to the **/root/openscap_data** directory on the system.
3.1.5 Completing the Installation

After you have selected all of your installation configuration options, click **Begin Installation** on the Installation Summary screen to start the installation. The Configuration screen is displayed.

**Figure 3.15 User Settings**

You can configure the options on this screen while the installation is in progress. You must set the root password to finish the installation. Creating a user is optional and can be accomplished when the installation is complete. However, creating the user at installation time is recommended so that you do not need to log in to the system as the root user later.

**Note**

Authenticating users through mechanisms such as LDAP or Kerberos cannot be set at this stage of the installation, only after the installation has completed.

**Setting the Root Password**

Click **Root Password** to display the Root Password screen.

**Figure 3.16 Root Password**
Completing the Installation

Enter the root password in the Root Password field, then confirm the password in the Confirm field. Click Done to return to the Configuration screen. Note that if you set a weak password, you have to click Done twice.

Creating a User

Click User Creation to display the Create User screen.

Figure 3.17 Create User

Enter the details of the local user account that you want to create. Again, there is a visual indication about the strength of the password.

Select Make this user administrator if you want the user to be able to administer the system. Selecting this option adds the user to the wheel user group, which enables the user to run administrative tools by using the sudo command.

If you want more control over how the user is configured, for example, to specify the user’s home directory or user ID, click Advanced.

Click Done to return to the Configuration screen.

Note that if you set a weak password, you must click Done twice.

Rebooting and Initial Setup

After the packages are installed, click Reboot.

Depending on the base environment, the boot process might end with a non-graphical login prompt. After logging in, you can review the license agreement at /usr/share/oraclelinux-release/EULA. Otherwise, the system displays the Initial Setup screen.

Figure 3.18 Initial Setup
Performing Text-Based Installations

Select the License Information option to open the License Information screen. Accept the license agreement then click Done to return to the previous screen.

Note

The User Creation option is only displayed if you did not create a user during installation. If you create a user here, the options for creating a user are the same as during the installation.

Click Finish Configuration. At the end of this process, the system reboots and then displays the Gnome Display Sign In screen.

3.2 Performing Text-Based Installations

The Oracle Linux installation program can also run in text mode. Text mode is used automatically under certain circumstances, for example, if the system has insufficient memory or the video card is not supported. You can manually switch to the text mode by specifying inst.text as a boot option on the boot command line or by adding that option in a kickstart file.

To add the option to the boot command line, do the following:

1. Boot the system from the ISO installation boot image.

   The same opening screen for graphics-based installation is displayed. See Figure 3.1, “Boot Menu”.

2. Press Tab to access the boot line options.

3. At the end of this line, add inst.text.

   Continue booting. At the end of the boot process, the text-based installation menu is displayed:

   Figure 3.19 Text-Based Installation

   The numbered options on the menu are the equivalent of the screen options in graphic-based installations. Each option is preceded by a flag surrounded by brackets:

   • [ ] – Option is not configured.

   • [x] – Option is configured with the default setting.

   The setting is displayed between parentheses under the option.

   • [!] – Option is configured but needs examination in case you want to specify your own setting.

   To configure an option, type the option’s number. The screen displays numbered values that are available for that option. Choose the value by typing the value’s number. Then type c to continue. Continuing either returns you to the main menu screen, or displays additional related but non-obligatory options for you to configure. Type c also to skip screens.
After completing the examination or configuration of all the necessary menu options, type `b` to begin installing. At the end of the installation, the system reboots and then displays the login screen.

---

**Note**

Not all configuration options in graphical installations might be available in text-based installations.

---

When you log in for the first time, the license information is displayed. Accept the license agreement to be able to use the system.
4.1 About Kickstart Installations

The kickstart feature enables you to automate the OS installation. A kickstart installation uses a configuration file that instructs the installer how it should implement a specific installation. The feature offers the following benefits:

- No user intervention is required during the installation process.
- Greater facility in installing on multiple systems.
- The kickstart configuration file is useful for troubleshooting a boot-time problem with an installed system.

You can use kickstart to install Oracle Linux locally. However, the best use of this feature is in the installation of the OS on multiple systems over the network. In network installations, a kickstart operation would include the following components:

- Kickstart configuration file
- Configured network that supports network installs such as providing connectivity to clients to access the necessary installation files, including the kickstart configuration file.

For an example of how to create a network installation setup, see Appendix A, Performing a Network Installation.

4.2 About the Kickstart Configuration File

The kickstart configuration file determines how the installer performs the installation on target clients. The instructions are in the form of kickstart-specific options and parameter definitions.

Every Oracle Linux installation creates a configuration file called /root/anaconda-ks.cfg. The file contains configuration definitions based on the system on which Oracle Linux is installed. The file's contents can be read by kickstart and is therefore ready for use, either as is or as a template, to perform kickstart installations on other clients.

To obtain a kickstart configuration file for an automated installation of Oracle Linux 8, use one of the following methods:
Installation Options

• Use the `/root/anaconda-ks.cfg` file of an existing system that is running Oracle Linux, such as Oracle Linux 7.

You would need to revise the file's contents to make them applicable to an Oracle Linux 8 installation. If the system also includes the `pykickstart` package, the following useful tools can help you with reconfiguring the file's contents:

• `ksverdiff` identifies removed or deprecated kickstart options.

• `ksvalidator` checks that the syntax in the file is correct.

• Install Oracle Linux 8 manually on a system which would generate the `/root/anaconda-ks.cfg` file. Use the file to perform automated installation on other clients. You might need to adjust some of the file's configurations depending on the specifications you want to apply to those clients.


The kickstart configuration file is divided into parts. Each part contains a group of options and are described in further detail in the subsequent sections:

• Installation

• Packages

• Pre-installation

• Post-installation

4.2.1 Installation Options

Installation options define parameters to apply to the system during installation such as system storage, keyboard definitions, language setting, and so on. The line in bold in the following example enables PXE to bring up the network interface and is important in network installations.

```
#platform=x86, AMD64, or Intel EM64T
#version=RHEL8
# Firewall configuration
firewall --enabled --service=ssh
# Install OS instead of upgrade
install
# Use CDROM installation media
cdrom
# Root password
rootpw --iscrypted SHA512_password_hash
# Use graphical install
graphical
firstboot --disable
# Keyboard layouts
keyboard --vckeymap=us --xlayouts='us'
# System language
lang en_US.UTF-8
# SELinux configuration
selinux --enforcing
# Installation logging level
```
# Packages to Install

logging --level=info

- System timezone
timezone America/Los_Angeles

- Network information
  network --bootproto=dhcp --device=em1 --onboot=yes
  --hostname=hostname

- System bootloader configuration
  bootloader --append="rhgb crashkernel=auto quiet" --location=mbr --driveorder="sda"

- Non-administrative user
  user --name=user --homedir=/home/user --password=SHA512_password_hash --iscrypted

- Partition information
  cleardisks --all --drives=sda
  part /boot --fstype=ext4 --size=500
  part pv.008002 --grow --size=1
  volgroup vg_hostname --pesize=4096 pv.008002
  logvol / --fstype=ext4 --name=lv_root --vgname=vg_hostname --grow --size=1024 --maxsize=51200
  logvol swap --name=lv_swap --vgname=vg_hostname --grow --size=2016 --maxsize=4032

## 4.2.2 Packages to Install

Packages to be installed are listed under the group heading `%packages`. The list is terminated by the `%end` line.

%packages
@base
@core
@desktop-debugging
@dial-up
@fonts
@gnome-desktop
@guest-agents
@guest-desktop-agents
@input-methods
@internet-browser
@multimedia
@print-client
@print-server
@x11
@mtools
@pax
@python-dmidecode
@odjjob
@wodim
@sgpio
@genisoimage
@device-mapper-persistent-data
@abrt-gui
@samba-winbind
@certmonger
@openldap-clients
@pam_krb5
@krb5-workstation
@ldapjdk
@slapi-nis
@libXmu
@perl-DBD-SQLite
@perl-Mozilla-LDAP
%end
Pre-Installation Options

The list would include package groups and individual packages. Names of package groups use the @ prefix, such as @base, to distinguish them from individual packages.

Use the `dnf group list` command on an existing Oracle Linux server to display both the installed package groups and the package groups that are available to install.

To specify multiple packages, you can use the wildcard character (*). To exclude a package from the installation, insert the – character as a prefix to the package name.

The `%packages` keyword can take options. The following are the most useful:

- **--ignoremissing** Installs the available packages without prompting about missing packages. Without this option, kickstart would interrupt the installation and prompt you to continue or cancel the installation.
- **--multilib** Sets the multilib policy in `dnf` configuration to all so that 32-bit packages can be installed on the system.

Instead of listing packages directly into the configuration file, you can compile these names into a file and store it in an accessible location, such as locally in a kickstart’s ramdisk file system, or on an HTTP server or an NFS share. Then on the configuration file, specify the full path to the list in an `%include` statement, for example:

```
%packages --ignoremissing
%include /tmp/package-list
%end
```

**4.2.3 Pre-Installation Options**

Pre-installation options define the actions that the installer must perform before beginning the installation process. Configuring this group of options is optional. The options are under the `%pre` heading and terminated by the `%end` line.

In the following example, the installer is instructed to run the script `config-partitions` that is stored on an HTTP server. Further, the installer should also download a list of packages from the web server for use with a `%include /tmp/package-list` statement in the `%packages` section.

```
%pre
%include http://192.168.1.100/scripts/config-partitions
%end
```

In this example, the `wget` command saves the package list in kickstart’s file system, which exists as a ramdisk in memory.

An included script or file must be accessible at the specified path or URL. If no name service is available to identify hosts, then use IP addresses.

**4.2.4 Post-Installation Options**

Post-installation options define any actions that the installer must perform after the completion of the installation. Configuring this group of options is optional.

Post-installation options are under the `%post` heading and terminated by the `%end` line.

By default, kickstart runs post-installation tasks in a chroot environment that is based on the root file system of the newly installed system. If you need to access any files that are outside the chroot
Performing a Kickstart Installation

environment, specify the --nochroot option to %post line. You can then access files in the kickstart file system with the newly installed system’s root file system being mounted at /mnt/sysimage.

In the following example, the script /tmp/post-config is run at the end of the installation.

```
%post --nochroot
%include /tmp/post-config
%end
```

If you configure the installed system's network interface to obtain its settings using DHCP, you must either use IP addresses instead of domain names or set up a temporary resolv.conf file, for example:

```
%post
%include http://instsvr.mydom.com/scripts/post-config
%
[end]
```

4.3 Performing a Kickstart Installation

The steps to execute a kickstart installation differ slightly when used over the network and when used locally.

4.3.1 Installing Over the Network With Kickstart

Ensure that you have completed the following preparations:

- The network has been configured to support network installation and that clients can properly access the necessary installation files.
- Network locations are set up to contain the following:
  - The full Oracle Linux 8 installation ISO image
  - Properly configured boot loaders for PXE clients.
  - Kickstart configuration file(s)

Refer to Appendix A, Performing a Network Installation for details about configuring the network and the boot loaders.

To begin the installation, do the following:

1. Boot the client system.
2. While the system is booting, access its BIOS.
3. On the displayed BIOS screen, change the system’s boot settings to boot from the network.
4. Save the revisions and continue the boot process.

After the boot sequence is completed, the installation proceeds automatically.

4.3.2 Installing Kickstart Locally With Kickstart

For local use of kickstart, ensure that the following requirements are met:
• Access to the full installation media, which can be on a local CD-ROM drive or USB drive. See the instructions on media preparation in Section 1.2, "Obtaining and Preparing Installation Media".

• Local access to the kickstart configuration file.

To begin the installation using kickstart, do the following:

1. Boot the system from the local boot media.

2. Select an installation option in the boot menu and then press either E (UEFI-based systems) or Tab (BIOS-based systems) to access the boot prompt.

3. Add the `inst.ks` boot option to specify the location of the kickstart file on the local media, for example:
   ```
   inst.ks=cdrom:/dev/sbd1/tmp/ks.cfg
   ```
   If you are using an NFS server on the network, see Section A.3, "Configuring PXE Boot Loading" for examples of how you can define `inst.ks`.

   For PXE clients, kickstart parameters are typically specified in the boot loader configuration files. For more information, see Section A.3, "Configuring PXE Boot Loading".

   For more information about boot options, see Section 2.1, "Installation Boot Options".

4. Save the revisions and continue the boot process.

   After the boot sequence is completed, the installation proceeds automatically.
Chapter 5 Post-Installation Configuration

Table of Contents

5.1 Registering With the Unbreakable Linux Network .......................... 37
5.2 Obtaining Errata and Updates From the Oracle Linux Yum Server .......... 37
5.3 Obtaining Packages From the Oracle Linux Installation Media ................ 38
5.4 Applying Updates ...................................................................... 38
5.5 Managing an Oracle Linux System After an Installation ....................... 39

This chapter describes system configuration changes that you might be required to make after an installation.

5.1 Registering With the Unbreakable Linux Network

After you install Oracle Linux 8 on a system, you have the option of registering the system with the Unbreakable Linux Network (ULN), provided you have an account. To register the system, visit https://linux.oracle.com. To obtain Oracle Linux updates from ULN, you must have an Oracle Linux support subscription.

You can also register with ULN by using the uln_register shell command or from the Oracle Linux 8 GNOME desktop menu by selecting Activities and then searching for 'ULN Registration'. Click the ULN Registration shortcut icon to start the graphical registration wizard.

For more information about ULN, see Oracle® Linux 8: Managing Software on Oracle Linux.

During the ULN registration, your server is automatically registered with the Oracle Linux 8 BaseOS Latest and Oracle Linux 8 Application Stream Packages repositories. ULN also provides channels for Oracle-specific software packages such as Ksplice and other software that is available to Oracle Premier Support customers. To enable access to these packages, log in to ULN and subscribe your system to the Oracle Software for Oracle Linux 8 channel.

If you have an Oracle Linux Premier Support account, you can opt to use Ksplice, which enables you to keep your systems secure and highly available by automatically updating them with the latest kernel security errata and other critical updates. If you choose to use Ksplice, you can subscribe your systems to the Ksplice for Oracle Linux channel and install Ksplice packages on them. After completing the registration, use the yum command to install the Ksplice Uptrack package. The Ksplice Uptrack client downloads the access key from ULN and automatically configures itself so that your system can immediately begin to use Ksplice Uptrack. For more information, see Oracle® Linux: Ksplice User's Guide.

5.2 Obtaining Errata and Updates From the Oracle Linux Yum Server

Oracle also provides all errata and updates for Oracle Linux through the Oracle Linux yum server, which includes updates to the base distribution, but does not include Oracle-specific software. You do not require an Oracle Linux support subscription to use this service. For more information about obtaining updates from the Oracle Linux yum server, go to https://yum.oracle.com.

By default, all new installations of Oracle Linux 8 are automatically configured to use the Oracle Linux yum server. If you subsequently register the system with ULN, any configuration for using the Oracle Linux yum server is automatically disabled.

The following entries in the /etc/yum.repos.d/oracle-linux-ol8.repo file enable you to download the latest available packages for Oracle Linux 8:
5.3 Obtaining Packages From the Oracle Linux Installation Media

After installation, following these steps to configure dnf to use the full installation ISO image as a repository for installing packages:

1. Mount the full installation ISO image on a suitable mount point, such as /mnt:

   ```
   # mount -t iso9660 -o loop full_image.iso /mnt
   ```

2. Create the file `/etc/yum.repos.d/Media.repo` that contains entries similar to the following:

   ```
   [ol8_base_media]
   name=Oracle Linux 8 Base Media
   baseurl=file:///mnt/BaseOS
   gpgkey=file:///etc/pki/rpm-gpg/RPM-GPG-KEY-oracle
   gpgcheck=1
   enabled=1
   
   [ol8_appstream_media]
   name=Oracle Linux 8 AppStream Media
   baseurl=file:///mnt/AppStream
   gpgkey=file:///etc/pki/rpm-gpg/RPM-GPG-KEY-oracle
   gpgcheck=1
   enabled=1
   ```

   Adjust the value of the `baseurl` and `gpgkey` parameters to match the mount point of the ISO image on your system.

3. Use the `dnf repolist` command to check the repository configuration.

5.4 Applying Updates

After you have set up the ULN channels, Oracle Linux yum server repositories, or the installation media repositories that `yum` should use, update all of the installed packages:

```
# dnf update
```

This command upgrades your system to the latest available update of Oracle Linux 8.

Use the following command to install or update a specific package:

```
# dnf update package
```

To install or update the Z-shell package (`zsh`) enter as follows:

```
# dnf update zsh
```

For more information, see the `dnf(8)` man page.
5.5 Managing an Oracle Linux System After an Installation

The following are some common tasks for managing an Oracle Linux system after an installation:

System Locale and Keyboard Layout

Use the `localectl` command to change the default system locale and keyboard layout, or you can edit the settings in the `/etc/locale.conf` file, and then reboot the system. For more information, see the `localectl(1)` and `locale.conf(5)` man pages.

System Date and Time

Use the `timedatectl` command to change the system date and time. For more information, see the `timedatectl(1)` man page.

System Services

Use the `systemctl` command to enable, start and stop system services. For more information, see the `systemctl(1)` man page.

System Firewall

To implement a simple, general-purpose firewall, you can use the Firewall Configuration GUI (`firewall-config`) or the `firewall-cmd` command to create basic packet filtering rules. Many services are pre-defined so that you can add rules for entire services, without needing to know which ports to enable. For example, to enable HTTP access to your system, you could run:

```
# firewall-cmd --permanent --zone=public --add-service=http
```

To see a listing of pre-defined services, run:

```
# firewall-cmd --get-services
```

If a service that you require is not already defined, or you are using a non-standard port for the service, you could specify a port manually, for example:

```
# firewall-cmd --permanent --zone=public --add-port=3890/tcp
```

For more information about the `firewalld` service, see `https://firewalld.org/documentation/`.

To create a more complex firewall configuration, use the `nft` command to configure the nftables framework rules for IPv4 and IPv6 directly. See the `nft(8)` man page for details.

System State

Use the `systemctl` command to change the run state of the system. See the `systemctl(1)` man page for details.

Change the default system state and switch to the multi-user graphical environment (run level 5 in previous Oracle Linux releases) as follows:

```
# systemctl set-default graphical.target
# systemctl isolate graphical.target
```

Change the default system state and switch to the multi-user command-line environment (run level 3 in previous Oracle Linux releases) as follows:

```
# systemctl set-default multi-user.target
```
# systemctl isolate multi-user.target

Reboot the system:

```bash
# systemctl reboot
```

Shut down and power off the system by running the following command:

```bash
# systemctl poweroff
```
Chapter 6 Troubleshooting Oracle Linux Installations

Table of Contents

6.1 Troubleshooting Menu Options ................................................................. 41
6.2 Debug and Log Information ................................................................. 41

This chapter describes some options for troubleshooting Oracle Linux installations. Also check Oracle® Linux 8: Release Notes for Oracle Linux 8 for any known issues.

6.1 Troubleshooting Menu Options

The boot menu on the Oracle Linux 8 installation media contains a Troubleshooting option with the following options:

Install Oracle Linux 8 in basic graphics mode

Use this option if the screen goes blank or appears distorted when you try to install Oracle Linux in graphics mode.

Rescue a Oracle Linux system

Use this option to boot an installed system in a mode that enables you to edit partitions or configuration files to fix a variety of boot problems.

Run a memory test

Use this option to run the memtest86 utility, which verifies the integrity of the system's RAM.

Boot from local drive

Use this option to boot an installed system from the hard disk.

6.2 Debug and Log Information

During an installation, you can press Ctrl+Alt+F1 to display the virtual console for the installation program. This console contains messages and debugging information output for the installation program. Additional virtual consoles are available to display log information from different sources, as described in the following section. Press Ctrl+b, and then press either n (for next) or b (for back) to switch between the virtual consoles. To return to the graphical installation program, press Ctrl+Alt+F6.

During an installation, several log files are generated, which capture messages from the following sources:

Anaconda program

The /tmp/anaconda.log file contains Anaconda logs relating to the installation.

During the installation you can access the messages stored in this log by pressing Ctrl+Alt+F1 to display the virtual console, then press Ctrl+b, and then press 3.

If the installation succeeds, the log file is copied to /var/log/anaconda/anaconda.log.

Hardware detection and configuration

The /tmp/syslog file contains messages relating to the system hardware.
Debug and Log Information

If the installation succeeds, the log file is copied to `/var/log/anaconda/syslog`.

**Kickstart**

The `/tmp/ks-name.log` file contains logs from kickstart installations.

If the installation succeeds, the log file is copied to `/var/log/anaconda/ks-script-name.log`.

**Network detection and configuration**

The `/tmp/ifcfg.log` file contains logs relating to network configuration.

If the installation succeeds, the log file is copied to `/var/log/anaconda/ifcfg.log`.

**Other programs**

The `/tmp/program.log` file contains logs from all other programs used during the installation.

During the installation you can view the messages stored in this log by pressing Ctrl+Alt+F1 to display the virtual console, then press Ctrl+b, and then press 5.

If the installation succeeds, the log file is copied to `/var/log/anaconda/program.log`.

**Package installation**

The `/tmp/packaging.log` file contains package installation messages output by the `dnf` and `rpm` commands.

If the installation succeeds, the log file is copied to `/var/log/anaconda/packaging.log`.

**Storage detection and configuration**

The `/tmp/storage.log` file contains logs from the storage modules.

During the installation you can view the messages stored in this log by pressing Ctrl+Alt+F1 to display the virtual console, then press Ctrl+b, and then press 4.

If the installation succeeds, the log file is copied to `/var/log/anaconda/storage.log`.

If the installation fails, the messages from these log files are combined into a single log file at `/tmp/anaconda-tb-name`.

To access a shell prompt as the root user during the installation, press Ctrl+Alt+F1 to display the virtual console. Then, press Ctrl+b, followed by pressing the number 2. You can use the shell prompt to access the log files and to copy them to a local storage device such as a USB device. Or, you can copy the log files to a network location by using the `scp` command.
Appendix A Performing a Network Installation

Table of Contents

A.1 Requirements for a Network Installation ................................................................. 43
A.2 Setting Up an Oracle Linux Network Installation .................................................. 43
A.3 Configuring PXE Boot Loading ................................................................................. 47
A.4 Supporting Different Kinds of Clients ...................................................................... 50

Performing a network installation instead of a text-based installation is useful if you are installing on multiple systems. This appendix describes how to prepare a network installation setup.

A.1 Requirements for a Network Installation

If you use a boot ISO or the Preboot eXecution Environment (PXE) to install the OS on systems, you can set up a network installation configuration that would consist of the following components:

- A network installation server that provides the IP and network configuration, the PXE configuration files, kernel and boot images, and kernel boot directives. In this appendix, dnsmasq is used to provide these services.

- A network accessible file system served over a protocol such as NFS or HTTP, where packages, the kickstart file, and other required configuration files might be stored. In this appendix, NFS is used for this function. Note that if your systems have direct access to the Internet, it is possible to configure your kickstart installation to use the BaseOS and AppStream repositories directly available on the Oracle Linux yum server for the installation of packages; however, you would still need to provide a mechanism to serve the kickstart file up to the system when it boots.

The two components can be on separate systems. Also, they are not required run the current Oracle Linux 8 version. A previous release, such as Oracle Linux 7, would suffice. For convenience, this appendix assumes the two components are co-hosted in one system. These instructions make use of the `yum` command so that they are compatible with both Oracle Linux 7 and Oracle Linux 8.

Note

This appendix assumes that the actual installation of Oracle Linux through the network would be executed by using kickstart. For more details about this installation method, see Chapter 4, Automating an Oracle Linux 8 Installation by Using Kickstart.

If you haven't done so yet, download the full Oracle Linux installation ISO image to the system. See Section 1.2, “Obtaining and Preparing Installation Media”.

A.2 Setting Up an Oracle Linux Network Installation

This section focuses on the initial configuration of NFS and dnsmasq.

How to Configure NFS

If you have an existing NFS server, you can use this service to host the extracted contents of an ISO and your Kickstart configuration files. Ensure that the exported share directories are accessible to the IP ranges specified for your PXE boot hosts. If you do not have an available NFS server, you can follow the procedure provided here to install and configure the service sufficient to enable network installation.
This procedure provides only the NFS configuration steps that are relevant to network installation. For more complete information in configuring NFS, refer to the appropriate System Administration guide.

1. Install the `nfs-utils` package:

   ```
   # yum install nfs-utils
   ```

2. If you are running a firewall service, enter the following firewall command.

   ```
   # firewall-cmd --add-service nfs --permanent
   ```

   If you are using an alternate firewall service or you have an external firewall device, ensure that you configure rules to allow PXE boot hosts to access the NFS service on this system.

3. Create a directory to store the ISO image, for example.

   ```
   # mkdir /var/nfs-exports/ISOs
   ```

4. Export the NFS share directory to make it accessible.

   ```
   # exportfs -i -o ro /var/nfs-exports/ISOs
   ```

   This syntax grants world access to the NFS share with read only permissions. To limit access only to clients in a specific subnet, specify a subnet preceding the NFS share, for example `192.0.2.0/24:/var/nfs-exports/ISOs`.

   If you prefer, you can add an entry for exporting the share directory in the `/etc/exports` file, for example:

   ```
   /var/nfs-exports/ISOs   192.0.2.0/24(ro)
   ```

   Then, reload the `/etc/exports` to implement the entry:

   ```
   # exportfs -ra
   ```

   For more information, see the `exportfs(8)`, `exports(5)`, and `showmount(8)` manual pages.

5. Start the `nfs-server` service and configure it to automatically start after every system reboot:

   ```
   # systemctl start nfs-server
   # systemctl enable nfs-server
   ```

6. Extract the downloaded ISO image to a subdirectory of the NFS share directory.

   ```
   # cp -a path-to-download-image /var/nfs-exports/ISOs/ol8
   ```

   For more information, see Section 1.2.3, “Extracting the Contents of the Full Installation ISO Image”.

7. If using kickstart, put the kickstart files in a subdirectory of the NFS share directory also, such as `/var/nfs-exports/ISOs/ksfiles`.

8. (Optional) From a different system, test that the NFS share directory is accessible.

   Ensure that you specify the NFS server’s IP address to be able to connect to the directory, for example:

   ```
   # mount -t nfs server-ip:/var/nfs-exports/ISOs /mnt
   ```

**How to Configure dnsmasq**

The dnsmasq router advertisement server is designed to act as a DNS forwarder, DHCP server, and TFTP server. Because the dnsmasq can be applicable in most network installation scenarios, it is a convenient alternative to configuring separate DHCP and TFTP services.
For more information about dnsmasq, see the `dnsmasq(8)` manual page, the `/usr/share/doc/dnsmasq-version` file, and [http://www.thekelles.org.uk/dnsmasq/doc.html](http://www.thekelles.org.uk/dnsmasq/doc.html).

1. Install the `dnsmasq` package.
   
   ```bash
   # yum install dnsmasq
   ```

2. Configure parameters in the `/etc/dnsmasq.conf` file.

   At a minimum, you must have the `enable-tftp` entry as well as define a TFTP server directory for `tftp-root`. See the entries in bold in the following example:

   ```plaintext
   interface=em1
dhcp-range=10.0.0.101,10.0.0.200,6h
dhcp-host=80:00:27:c6:a1:16,10.0.0.253,svr1,infinite
dhcp-boot=pxelinux/pxelinux.0
dhcp-match=set:efi-x86_64,option:client-arch,8
dhcp-boot=tag:efi-x86_64,shim.efi enable-tftp
tftp-root=/var/lib/tftpboot
   ```

   **Note**

   If SELinux is enabled in enforcing mode on your system and you configured a TFTP server directory other than `/var/lib/tftpboot`, you will need to install the `policycoreutils-python` and `policycoreutils` packages so that you can run the following commands:

   ```bash
   # /usr/sbin/semange fcontext -a -t tftpdir_t "/var/tftpboot(/.*)?"
   ```
Setting Up an Oracle Linux Network Installation

```
# /sbin/restorecon -R -v /var/tftpboot
```

These commands define the default file type of the TFTP server directory hierarchy as `tftpdir_t` and apply the file type to the entire directory hierarchy.

The example also defines the following additional parameters:

**interface**

Specifies the interface to be monitored for incoming client requests.

**dhcp-range**

Identifies a range of available IP addresses. The \texttt{6h} setting in the example specifies a six-hour lease of the addresses. For an infinite lease, specify \texttt{infinite}.

To configure static addresses instead of a pool, specify a static network address and use the \texttt{static} keyword, for example:

```
dhcp-range=10.0.0.253,static,infinite
```

**dhcp-host**

Specifies a reserved IP address for a client system. The system is identified by its name and MAC address.

**dhcp-boot**

Specifies the location of the boot loader file for clients, such as `pxelinux/pxelinux.0` for BIOS-based clients. For UEFI-based clients, include the \texttt{tag:efi-x86_64} keyword in the setting before specifying the boot loader, for example:

```
dhcp-boot=tag:efi-x86_64,shim.efi
```

You must create separate entries for BIOS-based and UEFI-based clients.

3. (Optional) To use dnsmasq as a caching-only name server, do the following:

   a. In the \texttt{/etc/resolv.conf} file, configure a name server entry for 127.0.0.1 that precedes other name server entries, for example:

   ```
nameserver 127.0.0.1
nameserver 10.0.0.8
nameserver 10.0.0.4
```

   The dnsmasq server ignores the 127.0.0.1 entry and forwards DNS queries to the other listed name servers.

   b. Configure the firewall to accept DNS requests:

   ```
   # firewall-cmd --add-service=dns --permanent
   ```

4. Start the \texttt{dnsmasq} service and configure it to automatically start after every system reboot.

   ```
   # systemctl start dnsmasq
   # systemctl enable dnsmasq
   ```
A.3 Configuring PXE Boot Loading

The two boot loader configuration procedures apply to BIOS-based and UEFI-based clients respectively.

How to configure the boot loader for BIOS-based PXE clients

1. Install the `syslinux` package that contains the `pxelinux.0` boot loader.
   ```
   # yum install syslinux
   ```

2. Create the `pxelinux/pxelinux.cfg` directory under the TFTP server directory.
   ```
   # mkdir -p /var/lib/tftpboot/pxelinux/pxelinux.cfg
   ```

3. Copy the boot loader file to the `pxelinux` subdirectory.
   ```
   # cp /usr/share/syslinux/pxelinux.0 /var/lib/tftpboot/pxelinux
   ```

4. From the NFS share directory, copy the installation kernel (`vmlinuz`), and the ram-disk image file (`initrd.img`) to the `pxelinux` subdirectory.
   ```
   # cp /var/nfs-exports/ISOs/ol8/vmlinuz -O /var/lib/tftpboot/pxelinux/vmlinuz
   # cp /var/nfs-exports/ISOs/ol8/initrd.img -O /var/lib/tftpboot/pxelinux/initrd.img
   ```

5. Copy the modules for displaying the boot loader as a menu to the boot loader directory.
   ```
   # cp /usr/share/syslinux/*.c32 /var/lib/tftpboot/pxelinux
   ```

6. In the `pxelinux.cfg` subdirectory, create a boot configuration file and then add entries to it.

   You can assign any name to the file, such as `pxe.conf`. The following example provides entries that you would typically add to the file:

   ```
   DEFAULT menu.c32
   TIMEOUT 400
   ONTIMEOUT BootLocal
   PROMPT 0
   MENU INCLUDE pxelinux.cfg/pxe.conf
   NOESCAPE 1
   LABEL BootLocal
   localboot 0
   TEXT HELP
   Boot to local hard disk
   ENDTXT

   LABEL OL8
   MENU LABEL OL8
   kernel vmlinuz
   append initrd=initrd.img inst.repo=/var/nfs-exports/ISOs/ol8/ \ 
   inst.ks.sendmac inst.ks=/var/nfs-exports/ISOs/ksfiles/kstart-file
   TEXT HELP
   Install Oracle Linux 8
   ENDTXT
   ```

   Based on these entries, the boot loader would automatically attempt to boot from the local drive if no user intervention occurs during the `TIMEOUT` period. If no OS is installed, then the boot loader would boot from the network and initiate the installation process.

   This list explains some of the directives used in the configuration file:

   - `default` identifies the module you want to use for displaying the boot loader menu.
Configuring PXE Boot Loading

For a basic text display, the `menu.c32` module suffices. However, if you add directives for a graphical display, such as images and colors, then specify the `vesamenu.c32` module instead.

- **timeout** specifies the period in `timeout/10` seconds before the boot loader boots the client according to the subsequent directives. The next directive (`ontimeout`) specifies the action when the wait period expires.

- **prompt** determines how the prompt is displayed. To include `boot:` in the prompt, change the value of `prompt` to 1. To display the prompt itself, press Shift or Alt at the console.

- **menu include** identifies the boot configuration file you created.

- **kernel** defines the name of the kernel executable.

- **append** defines any parameters that should be appended when loading the kernel, such as the name of the ram-disk image and the location of a kickstart file.

**Important**

The kernel and ram-disk image file paths are assumed to be relative to the subdirectory that contains the boot loader, such as `pxelinux`. If you place the `vmlinuz` and `initrd.img` files in a subdirectory such as `pxelinux/OL8`, ensure you have the correct relative paths.

**How to configure the boot loader for UEFI-based PXE clients**

1. Install the following packages:
   - `grub2-efi` that contains the `grubx64.efi` boot loader
   - `shim` that contains the first-stage boot loader `shim.efi`

   This package is required to support Secure Boot on UEFI clients, but should be used for all UEFI clients as a passthrough boot loader.

2. Go to the package location and extract their contents.

   ```
   # cd /tempdir
   # rpm2cpio grub2-efi-version.rpm | cpio -idmv
   # rpm2cpio shim-version.rpm | cpio -idmv
   ```

3. Create a subdirectory, for example, `efi`, under the TFTP server directory.

   ```
   # mkdir -p /var/lib/tftpboot/efi
   ```

4. Copy the boot loader file to the `efi` subdirectory.

   ```
   # cp /tempdir/boot/efi/EFI/redhat/grubx64.efi /var/lib/tftpboot/efi
   # cp /tempdir/boot/efi/EFI/redhat/shim.efi /var/lib/tftpboot/efi
   # cp /tempdir/boot/efi/EFI/redhat/MokManager.efi /var/lib/tftpboot/efi
   ```

**Note**

The `shim.efi` and `MokManager.efi` files are needed if you want to support Secure Boot on clients. The `MokManager.efi` provides utilities for managing the keys used to sign EFI binaries. As a passthrough boot loader, you would then specify `shim.efi` when setting `dhcp-boot` for UEFI-based clients in the `/etc/dnsmasq.conf` file. See How to Configure `dnsmasq`.
5. From the NFS share directory, copy the installation kernel (`vmlinuz`) and the ram-disk image file (`initrd.img`) to the `efi` subdirectory.

```
# cp /var/nfs-exports/ISOs/ol8/vmlinuz -O /var/lib/tftpboot/efi/vmlinuz
# cp /var/nfs-exports/ISOs/ol8/initrd.img /var/lib/tftpboot/efi/initrd.img
```

6. In the `efi` subdirectory, create and then add entries to the `grub.cfg` boot loader configuration file.

The configuration file should have the options for booting from the network as well as booting locally. The client would boot from the network to begin the installation process. Then when the client reboots at the end of the installation, the system this time boots from the local drive.

The following example shows typical entries:

```
set default 0
set timeout=10

menuentry 'ol8 localboot' {
    echo "Booting from local disk"
    set root=(hd0,gpt1)
    chainloader efi/shim.efi
    boot
}

menuentry 'ol8' {
    echo "Loading vmlinuz"
    linuxefi vmlinuz inst.repo=/var/nfs-exports/ISOs/ol8/ inst.ks.sendmac \ 
    inst.ks=/var/nfs-exports/ISOs/ksfiles/kstart-file
    initrddefi initrd.img
    echo "Loading /initrd.img"

    boot
}
```

**Caution**

Boot loader configuration is not uniform across UEFI-based systems. Because of variables such as differing disk layout, a specific boot loader setup will not universally apply to all systems. The previous example illustrates only one way of configuring the boot loader. But you must create boot loader configurations appropriate to your own systems.

- `linuxefi` defines the name of the kernel executable and any parameter that should be appended when loading the kernel, such as the location of the installation packages and the location of a kickstart file.

- `initrdefi` defines the name of the ram-disk image.

**Important**

The kernel and ram-disk image file paths are assumed to be relative to the subdirectory that contains the boot loader, such as `efi`. If you place the `vmlinuz` and `initrd.img` files in a subdirectory, such as `efi/OL8`, ensure you have the correct relative paths.

For information about configuring and using kickstart to perform automated installation, see Chapter 4, *Automating an Oracle Linux 8 Installation by Using Kickstart*. 
A.4 Supporting Different Kinds of Clients

To support different types of client, you can create a configuration file with the name based on the following:

- Client’s UUID, for example, `a8943708-c6f6-51b9-611e-74e6ac80b93d`

**Note**

A UUID-based file name is valid only for BIOS-based clients. Do not apply it for UEFI-based clients.

- Client’s MAC address prefixed by `01-`, which represents the ARP hardware type for Ethernet, and using dashes to separate each byte value instead of colons, for example, `01-80-00-27-c6-a1-16`.

Use lowercase characters when typing the MAC address.

- Client’s IP address expressed in hexadecimal without any leading 0x, for example, `0A0000FD` represents the IP address 10.0.0.253.

To reduce the number of configuration files, you can group clients by IP address range, for example, `0A0000E` represents the IP address range 10.0.0.224 through 10.0.0.239.

If you are serving both types of clients, ensure that the file names are distinct from each other. Where the configuration file for BIOS-based clients is `A000FC`, for example, the equivalent file for UEFI-based clients can be `grub.cfg-A000FC`, and so on.

Place the configuration files in their respective boot loader subdirectories such as `pxelinux/pxelinux.cfg` for BIOS-based clients or `efi` subdirectory for UEFI-based clients.

The boot loader searches for a configuration file in the following order, until a matching file name is found:

- **UUID** (for example, `a8943708-c6f6-51b9-611e-74e6ac80b93d`)
- **01-MAC_address** (for example, `[grub2-cfg-]01-80-00-27-c6-a1-16`)
- Full 32 bits of the IP address (for example, `[grub.cfg-]0A0000FD`)
- Most significant 28 bits of the IP address (for example, `[grub.cfg-]0A0000F`)
- Most significant 24 bits of the IP address (for example, `[grub.cfg-]0A0000`)
- Most significant 16 bits of the IP address (for example, `[grub.cfg-]0A000`)
- Most significant 12 bits of the IP address (for example, `[grub.cfg-]0A00`)
- Most significant 8 bits of the IP address (for example, `[grub.cfg-]0A0`)
- Most significant 4 bits of the IP address (for example, `[grub.cfg-]0A`)
- Default configuration file (either `default` for BIOS-based clients or `grub.cfg` for UEFI-based clients).

If several configuration files for a client type have identical content, you can use the `ln` command to link the files to a master copy, for example:

```
# ln master-ol8 [grub.cfg-]0A0000FD
```
For more information about pxelinux, see https://www.syslinux.org/wiki/index.php/pxelinux.

For more information about GRUB 2, run the `info grub` command to access the GRUB 2 manual.