

Oracle® Linux 7

Release Notes for Oracle Linux 7 Update 5 (aarch64)

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Preface

[Oracle® Linux 7: Release Notes for Oracle Linux 7 Update 5 \(aarch64\)](#) provides a summary of the new features and known issues in Oracle Linux 7 Update 5 (aarch64). This document may be updated after it is released.

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Audience

This document is intended for users and administrators of Oracle Linux 7. It describes potential issues and the corresponding workarounds you may encounter while using Oracle Linux 7. Oracle recommends that you read this document before installing Oracle Linux 7. It is assumed that readers have a general understanding of the Linux operating system.

Related Documents

The latest version of this document and other documentation for this product are available at:

[Oracle® Linux 7 Documentation](#)

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Convention	Meaning
boldface	Boldface type indicates graphical user interface elements associated with an action, or terms defined in text or the glossary.
<i>italic</i>	Italic type indicates book titles, emphasis, or placeholder variables for which you supply particular values.
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Chapter 1 System Requirements and Limits

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1.1 File System, Storage, and Address Space Limitations 1

System requirements and limitations for 64-bit Arm architecture are under review. You can check whether your hardware is supported on Oracle Linux 7 by checking the Hardware Certification List at <https://linux.oracle.com/hardware-certifications>. Hardware is listed as it becomes available and is validated.

1.1 File System, Storage, and Address Space Limitations

The following table describes the maximum file size and maximum file system size for the `btrfs`, `ext4`, and `XFS` file systems. File system limitations are affected by kernel versions and features, and by the architecture of the system where Oracle Linux is installed. The values depicted here are estimates based on the known variables that might affect the maximum theoretical value that can be achieved. The theoretical values might be higher than those depicted here, and the actual achievable values might be below the values that are shown, depending on hardware and the kernel version used.

File System Type	Maximum File Size	Maximum File System Size
<code>btrfs</code>	8 EiB	8 EiB
<code>ext4</code>	16 TiB	1 EiB
<code>XFS</code>	8 EiB	8 EiB

The limits for the `ext4` file system that are described here are higher than recommended and might prove unstable. If you plan to work with systems where you are intend to work towards using higher file system sizes or file sizes, it is recommended that you use either the `btrfs` or `XFS` file system.

The maximum supported size for a bootable logical unit number (LUN) is 50 TB. GPT and UEFI support are required for LUNs that are larger than 2 TB.

The maximum size of the address space that is available to each process is 128 TB.

Chapter 2 Shipped Kernels

Oracle Linux 7 Update 5 (aarch64) ships with the following kernel packages:

`kernel-uek-4.14.35-1818.0.9.el7uek` Unbreakable Enterprise Kernel Release 5 (UEK R5), which is the default kernel.

Oracle Linux 7 Update 5 (aarch64) is only shipped with Unbreakable Enterprise Kernel Release 5 and only this kernel is supported at this time.

The Oracle Linux release is tested as a bundle as shipped on the installation media image. When installed from the installation media image, the minimum kernel version supported is the one included in the image. Downgrading kernel packages is not supported, unless recommended by Oracle Support.

The kernel source code for the shipped kernel is available after the initial release through a public git source code repository at <https://github.com/oracle/linux-uek>.

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This section describes new features and changes in Oracle Linux 7 Update 5 (aarch64). For details of the new features and changes in the initial release of Oracle Linux 7, see [Oracle® Linux 7: Release Notes for Oracle Linux 7](#). Note that Oracle Linux 7 Update 5 (aarch64) is the first release of Oracle Linux 7 that is supported for Arm architecture platforms.

3.1 MySQL Community Packages

The MySQL Community 8.0.11 packages are available for Arm on the Unbreakable Linux Network (ULN) and the Oracle Linux yum server.

You can install MySQL Community packages directly from ULN or the Oracle Linux yum server by enabling the appropriate channel or repository. For example, if you are using the Oracle Linux yum server you can enable the `ol7_MySQL80` repository by installing the `mysql-release-el7` package to obtain the correct yum repository configuration and then running `yum-config-manager` to update the configuration:

```
# yum install mysql-release-el7
# yum-config-manager --enable ol7_MySQL80
```

To enable the channel on ULN, use the ULN web interface to subscribe the system to the appropriate channel:

1. Log in to <https://linux.oracle.com> with your ULN user name and password.
2. On the Systems tab, click the link named for the system in the list of registered machines.
3. On the System Details page, click **Manage Subscriptions**.
4. On the System Summary page, select each required channel from the list of available channels and click the right arrow to move the channel to the list of subscribed channels.

Subscribe the system to the `ol7_aarch64_MySQL80_community` channel.

5. Click **Save Subscriptions**.



Note

Arm support is limited to MySQL Community 8.0.11. Channels for prior MySQL Community releases are not available for aarch64.

3.2 Packaging

Starting with Oracle Linux 7 Update 5, the setup package provides and sources environment settings in a defined order that overrides any unpredictable environment settings. This change is especially useful in situations where multiple scripts changed the same environment setting.

3.3 DTrace

DTrace has been enabled for Arm platforms and ports of the DTrace code are available in UEK R5. Please refer to the [Unbreakable Enterprise Kernel: Release Notes for Unbreakable Enterprise Kernel Release 5](#).

The DTrace user space code in the `dtrace-utils` package has also all been ported to run on 64-bit Arm platforms to fully enable DTrace for Oracle Linux 7 Update 5 (aarch64)

3.4 Developer Toolchain

The Oracle Linux 7 Update 5 (aarch64) release includes a toolchain that provides a solid developer toolset to build code for 64-bit Arm platforms and to compile modules against the provided kernel. This includes the version 7.3 of the `gcc` compiler used to build the aarch64 version of UEK R5.

Developer tools are released as a software collection that can be found in the `/addons/Oscl` directory repository on the provided ISO. You can install the `oracle-armtoolset-1` software collection using `yum`:

```
# yum install scl-utils oracle-armtoolset-1
```

Once the `oracle-armtoolset-1` software collection is installed, you can enable it by running the following command:

```
# scl enable oracle-armtoolset-1 bash
```

The `oracle-armtoolset-1` software collection is released as an addition to the Software Collection Library for Oracle Linux and is only available on aarch64 platforms.



Note

The `oracle-armtoolset-1` software collection is required if you need to build kernel modules from source.

3.5 Virtualization

The following virtualization features, bug fixes, and enhancements are included in this update:

- **KASLR for KVM guests added.** Capability for Kernel address-space layout randomization (KASLR) for KVM guests has been added in this update.
- **libvirt updated to version 4.7.0.** This version of the `libvirt` utility includes bug fixes and improvements from the previous version. Note that version 4.0.0 of the package is shipped on the installation media. If you install this package from the installation media, you must use ULN or the Oracle Linux yum server to update to version 4.7.0 or later. Oracle does not provide ongoing support for versions of `libvirt` prior to 4.7.0 on the Arm platform.
- **QEMU updated to version 3.0.0.** This version of QEMU includes several bug fixes, including important security fixes and a large number of KVM integration improvements. Note that version 2.11.1 is shipped on the installation media. If you install this package from the installation media, you must use ULN or the Oracle Linux yum server to update to version 3.0.0 or later. Oracle does not provide ongoing support for versions of `qemu` prior to 3.0.0 on the Arm platform.

3.6 Technology Preview

Features that are currently under technology preview when using UEK R5 are described in [Unbreakable Enterprise Kernel: Release Notes for Unbreakable Enterprise Kernel Release 5](#).

This section specifies items specific to the Arm architecture and Oracle Linux 7 Update 5 (aarch64) that are not supported but which may be made available under technology preview.

Oracle makes available a disk image of Oracle Linux 7 Update 5 (aarch64) for use on Raspberry Pi™ 3 Model B+ hardware. This disk image is available as a technology preview for developer use only and Oracle does not provide support for the disk image or the hardware. Oracle recommends that developers assist each other on the Oracle Linux for Arm community forum at https://community.oracle.com/community/technology_network_community/server_%26_storage_systems/linux/oracle-linux-for-arm

Linux Containers (LXC) are available as a technology preview and functionality may be limited.

Chapter 4 Known Issues

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This chapter describes the known issues for Oracle Linux 7 Update 5 (aarch64).

Note that additional issues specific to the kernel that you are using might also be present. Please see the release notes for the UEK R5 release that you are running, which are available as part of the [Unbreakable Enterprise Kernel Documentation Library](#), for issues specific to the kernel.

4.1 Support limited to text-mode environments and server software

Oracle Linux 7 Update 5 (aarch64) is engineered and tested for server-related usage only. Although packages for desktop and productivity features are built and provided, testing of these packages is limited and support for graphical mode packages is not provided in this release. You can install any of these packages on your platform, but it is possible that some of these applications may not work or may have issues that are not documented here.

Oracle does not provide support for these packages, and any assistance is community-based. If you choose to run a desktop environment or any desktop applications, you should direct any questions to the Oracle Linux for Arm community forum at https://community.oracle.com/community/technology_network_community/server_%26_storage_systems/linux/oracle-linux-for-arm.

4.2 Installation Issues

The following issues that might be encountered during installation.

4.2.1 Alternate installation options

When performing a text based installation, the installer detects the video controller and offers a graphical installation on the system video console by default. The boot menu may not offer options to perform text-based or VNC-based installation.

To perform a text-based installation you must specify the `inst.text` option on the boot command line. If you intend to perform a remote graphical installation over VNC, you must use the `inst.vnc` option, but you must also specify boot options to configure the network. Typically `ip=dhcp` is used for this purpose.

For more information on boot options, see [Oracle® Linux 7: Installation Guide](#). (Bug ID 27581120)

4.2.2 Installation on an iSCSI disk

When installing on an iSCSI disk, add either `ip=ibft` or `rd.iscsi.ibft=1` to the boot command line and specify at least one MBR or GPT-formatted disk as an installation target. Otherwise, the installation fails with the error message `No valid boot loader target device found`. (Bug ID 22076589)

4.2.3 Kernel panic for QLogic `cnic` module on ThunderX2 during installation

The QLogic `cnic` driver module is unsupported for 64-bit Arm platforms. The Cavium ThunderX2 servers include hardware that can cause the `cnic` driver module to load, triggering a kernel panic.

To work around the issue, blacklist the `cnic` module at boot using the boot option `module_blacklist=cnic` in the kernel command line for the installer. To prevent the module from installing or loading in the future, create the file `/etc/modprobe.d/cnic.conf` and ensure that it contains the following lines:

```
blacklist cnic
install cnic /bin/true
```

(Bug IDs 27011806, 28109733)

4.3 File System Bugs

The following file systems related issues pertain to Oracle Linux 7 Update 5.

4.3.1 `btrfs`: Convert operation results in a file system that cannot be mounted

The `btrfs-convert` tool can be used to convert an `ext4` file system to `btrfs`. However, if the tool attempts to convert a file system that has not been created with a sector block size that matches the system default page size, which is set to 64 KB for aarch64, the resulting file system cannot be mounted. This issue may result if the original `ext4` file system is not created using the `-b 65536` option, to specify a 64 KB block size. (Bug ID 28200561)

4.3.2 `ext4`: System hangs on unmount after an append to a file with negative `i_size`

While it is invalid for a file system to load an inode with a negative `i_size`, it is possible to create a file with a negative `i_size` and append to it. However, doing so causes an integer overflow in the routines underlying writeback, which results in the kernel locking up. (Bug ID 25565527)

4.4 Automatic Bug Reporting Tool

The daemons and features provided by the Red Hat Automatic Bug Reporting Tool (ABRT) are not supported in Oracle Linux. ABRT packages and associated files, such as `libreport`, are included in the distribution to satisfy package dependencies, but the features within these packages are not supported. For technical assistance, contact Oracle Support by accessing the My Oracle Support portal or by telephone.

4.5 Manual execution of the `shim` first-stage bootloader may fail in the UEFI shell

Manually loading shim binaries from the UEFI shell may fail in some scenarios. The following cases are known to fail:

- `FS0:\EFI\redhat\shimaa64.efi`
- `FS0:\EFI\redhat\> shimaa64.efi`

`FS0:\> \EFI\redhat\shimaa64.efi` is known to work correctly.

A standard installation is unaffected by this bug and the problem is limited to the manual execution of `shim` in the UEFI shell. (Bug ID 27962691)

4.6 Kdump tools fail to create `vmcore-dmesg.txt` on systems with 64 or more CPUs

On systems with 64 or more CPUs, the crash dump tools, included with Kdump, fail to create the `vmcore-dmesg.txt` file which is created with the vmcore file. This may result in a segmentation fault:

```
...
kdump: saving to /sysroot//var/crash/127.0.0.1-2018-05-22-12:34:45/
kdump: saving vmcore-dmesg.txt
/lib/kdump-lib-initramfs.sh: line 118: 459 Segmentation fault
$_dmesg_collector /proc/vmcore > ${_path}/vmcore-dmesg-incomplete.txt
kdump: saving vmcore-dmesg.txt failed
kdump: saving vmcore
Copying data : [100.0 %] \
eta: 0s
kdump: saving vmcore complete
```

The dmesg output can be retrieved manually by running `crash` against the vmcore and using the `dmesg` command once in the crash shell. (Bug ID 28064675)

4.7 Snapshots of KVM guests using UEFI fail and are unsupported

You cannot do snapshots of KVM guests if they use UEFI. In older versions of QEMU and libvirt, the tools may allow you to create the snapshot without an error or warning, but the snapshot could be corrupted. More recent versions of these tools prevent snapshot creation with an error. For example:

```
virsh # snapshot-create-as OL7-seboot
error: Operation not supported: internal snapshots of a VM with pflash based
firmware are not supported
```

(Bug ID 26826800)

4.8 Virtual machine with copied disk fails to boot

Attempting to start a virtual machine that has been created to use a copied virtual machine hard disk can fail with the messages:

```
Section 0 has negative size
Failed to load image: Unsupported
start_image() returned Unsupported
Error: Image at 002384AD000 start failed: Unsupported
Unloading driver at 0x002384AD000
```

The bootloader drops back into the UEFI Interactive Shell after it fails.

The issue is caused by a problem with the default EFI boot option that is used by the aarch64 virtual machine firmware when it attempts to boot the disk.

To work around the issue, when the virtual machine drops to the UEFI shell after it fails to boot, you can enter the following to manually load the appropriate shim binary:

```
Shell> FS0:\EFI\BOOT\fbaa64.efi
```

This is a one-time requirement and future reboots of the same virtual machine do not require manual intervention. (Bug ID 27972230)

4.9 grubby fatal error during kernel upgrade when /boot is on a btrfs subvolume

If /boot is hosted on a btrfs subvolume, GRUB 2 is unable to correctly process the `initramfs` and `vmlinuz` pathnames. This problem occurs when you update or install a new kernel and `grubby` attempts to update the GRUB 2 configuration. In the case where you are running a fresh installation of Oracle Linux 7 Update 5, and you upgrade the UEK kernel, the following error is displayed:

```
grubby fatal error: unable to find a suitable template
```

When the system is rebooted after the kernel update, the system boots to the old kernel.

The workaround for this problem is to use `grub2-mkconfig` to regenerate the `/etc/grub2/grub.cfg` file immediately after the kernel has been installed or upgraded, for example:

```
# grub2-mkconfig -o /boot/grub2/grub.cfg
```

Obtain a listing of the kernel menu entries in the generated configuration as follows:

```
# grep -P "submenu|^menuentry" /boot/grub2/grub.cfg | cut -d '"' -f2
```

From the listing, select the kernel entry that you want to run as the default kernel and set this entry as the default using the following command, substituting `menu entry title` with the title of the kernel entry that you identified in the listing:

```
# grub2-set-default "menu entry title"
```

You can use the `grub2-editenv list` command to check that the `saved_entry` has been updated with the selected kernel menu title.

Reboot and use `uname -a` to check that the correct kernel is now running.

(Bug ID 22750169)

4.10 Hebrew LaTeX fonts

Installing the `tex-fonts-hebrew` package fails unless you first install all `texlive*` packages. (Bug ID 19059949)

4.11 Unable to create LXC containers on btrfs

The creation of a Linux container (LXC) may fail when the container file system is specified as btrfs. For example:

```
lxc-create -B btrfs --template=oracle --name=test
-- --release=7.4
lxc-create: lxccontainer.c: do_bdev_create: 936 Failed to create backing
store type btrfs
lxc-create: lxccontainer.c: do_lxcapi_create: 1419 Error creating backing
store type btrfs for test
lxc-create: lxc_create.c: main: 274 Error creating container test
```

LXC is available as a technology preview in this release and some functionality may not work correctly. (Bug ID 27823142)

4.12 Unable to create Oracle Linux 7 LXC containers on NFS

The creation of Oracle Linux 7 containers fails when the `root` file system (`/container`) is hosted on an NFS share. The problem occurs because the `iputils` package in Oracle Linux 7 releases, (Updates 4 and 5) is built to use the Linux file extended attributes `[xattr(7)] security capabilities(7)`. The NFS protocol does not support these file capabilities, so the `iputils` package might not be installed into an NFS files system. For example, when attempting to create an Oracle Linux 7 Update 4 container, the installation fails while installing the `iputils` package, producing the following error:

```
Error unpacking rpm package iputils-20121221-7.el7.x86_64
error: unpacking of archive failed on file /usr/bin/ping: cpio: cap_set_file
error: iputils-20121221-7.el7.x86_64: install failed
```

Similar issues are seen when attempting to install the `initscripts` and `systemd` packages while creating an Oracle Linux 7 Update 3 container.

This issue occurs on both NFSv3 and NFSv4.

Oracle Linux 6 containers are not affected. LXC is available as a technology preview in this release and some functionality may not work correctly. (Bug ID 25024258)

4.13 `isql` unable to connect via `unixODBC`

The `isql` command shipped in the `unixODBC` package fails to connect to the database and returns the error:

```
[ISQL]ERROR: Could not SQLConnect
```

This issue is related to an unsolved dynamic library requirement for `unixODBC`. The requirement also affects the ODBC driver for MySQL shipped in the `mysql-connector-odbc` package. (Bug ID 26861190)

4.14 Segmentation fault when running `bluedevil-wizard`

The `bluedevil-wizard`, available in the `bluedevil` package, is unable to connect or locate bluetooth devices and fails with a segmentation fault when it is run. (Bug ID 27101618)

4.15 `dsktune` command fails with an unsupported error message

The `dsktune` command included with the 389 Directory Server base package, `389-ds-base`, fails with an error message notifying that the system does not have support for `cx16`, a feature commonly available on x86 platforms:

```
ERROR: This system does not support CMPXCHG16B instruction (cpuflag cx16).
nsslapd-enable-nunc-stans must be set to "off" on this system.
In a future release of Directory Server this platform will NOT be
```

```
supported.
```

```
ERROR : The above errors MUST be corrected before proceeding.
```

The `dsktune` command helps to check that a system meets requirements and can provide information that helps with the configuration, but is not required to run the 389 Directory Server. (Bug ID 26861135)

Chapter 5 Installation and Availability

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You can download a full Oracle Linux 7 Update 5 (aarch64) installation media image from the Oracle Software Delivery Cloud at <https://edelivery.oracle.com/linux>. You can also obtain the latest Oracle Linux 7 packages from the Unbreakable Linux Network (ULN) and the Oracle Linux yum server.

Oracle Linux 7 Update 5 (aarch64) is made available in two forms:

- [rpi3-ol7.5-image.img.xz](#) : A disk image that can be installed onto an SD Card and used on a Raspberry Pi 3 Model B or Raspberry Pi 3 Model B+ single-board computer. This image includes the necessary firmware to boot the Raspberry Pi 3 directly into Oracle Linux 7. This image is made available for developers who may not have access to alternate Arm hardware.



Note

The disk image for the Raspberry Pi is available as a technology preview for developer use only. Oracle does not provide support for Oracle Linux on Raspberry Pi systems. Oracle recommends that developers assist each other on the Oracle Linux for Arm community forum at https://community.oracle.com/community/technology_network_community/server_%26_storage_systems/linux/oracle-linux-for-arm

- [OracleLinux-R7-U5-Server-aarch64-dvd.iso](#) : An ISO image that can be used for a standard installation on generic 64-bit Armv8 hardware. This ISO has been tested on Arm hardware and is engineered for use with Ampere™ eMAG™-based EVK platform and the Cavium ThunderX2® processor. For the latest hardware validated for Oracle Linux 7 Update 5 (aarch64) please refer to the Hardware Certification List at <https://linux.oracle.com/hardware-certifications>. Hardware is listed as it becomes available.

This ISO image can be loaded from local media, such as DVD-ROM or USB flash drive, or can be used to perform a network-based kickstart installation via PXE. If you perform a network-based installation and you wish to access the graphical interface for the installer, you must change kernel boot parameters to enable VNC and to set the network address at boot.

You can install additional software for Oracle Linux 7 by subscribing to the different channels on ULN or by enabling the required repositories within your yum configuration. To explore the channels that are available to you on ULN, log in to <https://uln.oracle.com/> and view the Channels option. To view the Oracle Linux yum repositories that are available for Oracle Linux 7, visit <https://yum.oracle.com/oracle-linux-7.html>.



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.

UEK R5 is the default boot kernel for fresh installations of Oracle Linux 7 Update 5 (aarch64). UEK R5 is the only supported kernel available for the aarch64 platform. For more information, see [Unbreakable Enterprise Kernel: Release Notes for Unbreakable Enterprise Kernel Release 5](#).

5.1 Installation of ISO

The installation process to install Oracle Linux 7 Update 5 (aarch64) does not differ substantially from the installation process to install Oracle Linux 7 Update 5 on an x86 platform. The instructions and information provided in [Oracle® Linux 7: Installation Guide](#) apply.

The recommended installation process is as follows:

1. Obtain the ISO image from the Oracle Technology Network (<https://www.oracle.com/linux/products.html>)
2. Configure a Network Installation Server to perform the installation. See [Oracle® Linux 7: Installation Guide](#) for more information.
3. Create a kickstart file to automate your installation. See [Oracle® Linux 7: Installation Guide](#) for more information on the contents of this file and how to use it when booting the installer.
4. Connect your target Arm hardware to the network and configure the firmware to network boot or to boot from PXE. Refer to your hardware documentation for instructions.
5. Boot the target hardware and wait for the installation to complete.

Exceptions and additional information that may be required to complete the installation are provided in this section.

Graphical network-based installation

If you are performing a manual installation over the network and intend to use the remote graphical installer over VNC by setting the `inst.vnc` boot option, you must also set the boot options to configure the network, or the graphical installer fails to load and the installation reverts to text mode.

To ensure that the VNC server starts at boot, append the appropriate `ip` option to your kernel boot command. Typically, for a DHCP configuration, this may look similar to the following: `ip=eth0:dhcp`.

Software Selection Groups

Note that the available Software Selection Groups in the installer may differ slightly from the groups available in the x86 installer.

Software Sources

Note that unlike the x86 installer, there are no alternate Software Source repositories provided on this ISO.

5.2 Installation of Raspberry Pi™ 3 Image



Note

The disk image for the Raspberry Pi is available as a technology preview for developer use only. Oracle does not provide support for Oracle Linux on Raspberry Pi systems. Oracle recommends that developers assist each other on the Oracle Linux for Arm community forum at https://community.oracle.com/community/technology_network_community/server_%26_storage_systems/linux/oracle-linux-for-arm

Oracle provides an installation image of Oracle Linux 7 Update 5 (aarch64) specifically designed to run on Raspberry Pi 3 Model B or Raspberry Pi 3 Model B+ hardware. The provided installation image is a

default installation of Oracle Linux 7 Update 5 (aarch64) into a raw disk image that can be cloned block-by-block to an SD Card for immediate boot. The default file system used in the image is Btrfs. Raspberry Pi is a trademark of the Raspberry Pi Foundation. More information on installing a Linux image onto the Raspberry Pi is available at:

<https://www.raspberrypi.org/documentation/installation/installing-images/linux.md>

In summary, the recommended installation process is as follows:

1. Obtain the Raspberry Pi 3 disk image from the Oracle Technology Network (<https://www.oracle.com/linux/products.html>). You should unzip the disk image once you have downloaded it.
2. On an existing Oracle Linux system, insert the SD Card into an SD Card reader connected to the system. The image is 5 GB in size, so your SD Card must have the capacity to store this image at minimum. An 8 GB SD Card is the recommended minimum.
3. Identify the device name for the SD Card. You can use this using the output from `dmesg` when you connect the device, using the `lsblk` or by using `fdisk -l` to list device names and device information.
4. Use the `dd` command to perform a block copy of the image file to the SD Card device. For example:

```
# dd if=/path/to/img of=/dev/mmcblk0 bs=4M
```

Replace `/path/to/img` with the relative path to the image file, and replace `/dev/mmcblk0` with the device name for the SD Card. This operation is destructive and will overwrite any data on the device that you have specified. Ensure that you have specified the correct device name. The operation may take some time to complete.

5. When the operation is complete, eject the SD Card from the reader, insert it into the SD Card reader on the Raspberry Pi and boot into Oracle Linux 7.
6. Log into the image as the **root** user with the password **oracle**. Change the password immediately after you login.

If your SD Card is larger than the image (5 GB) you can grow the partition size to maximize disk usage. You can do this by running the following commands after installation is complete and once you have logged into the system on the Raspberry Pi:

```
# yum install -y cloud-utils-growpart
# growpart /dev/mmcblk0 4
# btrfs filesystem resize max /
```

Appendix A Package Changes from the x86_64 Release

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The following sections lists the differences between packages provided on the x86_64 architecture ISO and the ISO that is shipped for aarch64.

A.1 Additional packages not available for x86_64

The following packages are available on the aarch64 ISO, but are not available on the x86_64 ISO:

- `bcache-tools`
- `dtc`
- `gtest`
- `isl`
- `oracle-armtoolset-1`
- `oracle-armtoolset-1-binutils`
- `oracle-armtoolset-1-gcc`
- `oracle-armtoolset-1-gdb`
- `oracle-armtoolset-1-golang`
- `qemu`
- `zstd`

A.2 Modified Packages

The following packages included on the ISO are modified specifically for this release. Changes may include patches or changes to versioning to resolve build issues, changes to apply Oracle-specific modifications and improvements, or changes to resolve bugs when running the application on ARM architecture:

- `anaconda`
- `binutils`
- `booth`
- `btrfs-progs`
- `clufteer`

- corosync
- dlm
- dnssec-trigger
- dtrace-utils
- dyninst
- fence-virt
- fuse
- gfs2-utils
- glibc
- gnome-boxes
- java-atk-wrapper
- junit
- kexec-tools
- libdtrace-ctf
- libvirt
- libvirt-python
- ndctl
- net-tools
- ocfs2-tools
- oraclelinux-release
- pacemaker
- pcs
- postfix
- ppp
- qemu
- reflink
- rhn-client-tools
- rsyslog
- sbd
- shim-signed

- `spice`
- `tpm2-abrmd`
- `tpm2-tools`
- `tpm2-tss`
- `virt-manager`
- `xfspgrog`

A.3 Removed Packages

The following packages have been removed from the ISO because they are either not ARM compatible, are unable to be built for dependency reasons or are architecture specific:

- `biosdevname`
- `compat-dapl`
- `compat-gcc-32`
- `compat-gcc-34`
- `compat-gcc-44`
- `compat-glibc`
- `compat-libgfortran-41`
- `cpuid`
- `crash-ptdump-command`
- `hyperv-daemons`
- `infinipath-psm`
- `intel-cmt-cat`
- `ixpdimm_sw`
- `java-1.6.0-openjdk`
- `kabi-yum-plugins`
- `kernel`
- `kmod-kvdo`
- `ksc`
- `libinvm-cim`
- `libinvm-cli`
- `libinvm-il8n`

- `libpsm2`
- `libsmbios`
- `mcelog`
- `memkind`
- `memtest86+`
- `microcode_ctl`
- `mkbootdisk`
- `nvml`
- `opa-ff`
- `opa-fm`
- `openssl098e`
- `open-vm-tools`
- `oracleasm`
- `oracleasm-support`
- `oracle-database-server-12cR2-preinstall`
- `prelink`
- `qemu-kvm`
- `seabios`
- `sgabios`
- `syslinux`
- `tboot`
- `vdo`
- `x86info`
- `xorg-x11-drv-intel`
- `xorg-x11-drv-openchrome`
- `xorg-x11-drv-vesa`
- `xorg-x11-drv-vmmouse`
- `xorg-x11-drv-vmware`

A.4 Moved Packages

The following packages were moved from the optional package list onto the ISO package list due to dependency requirements for ARM architecture builds:

- `libmpc-devel`

