AMD-RAID™ Quick Start Guide for Red Hat (RHEL) Operating System

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Advanced Micro Devices

Contents

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Revision History

Date	Revision	Description
October 2021	1.00	• Updated system requirements in Table 1. • In Chapter 4, “Create the Bootable Virtual Disk,” added recommendation not to use SMR hard drives with AMD RAID systems. • Updated Section 5.1, "Secure Boot Enablement," to reflect Secure Keys are already part of BIOS. • Section “For RHEL 8.3” on page 14 also applies to RHEL 8.4. • Clarified package name in Section 5.3, “Install the RAIDXpert2 Management Application.”
January 2021	0.60	• Updated Table 1, “System Requirements.” • Added new Section 5.1, “Secure Boot Enablement.” • Added section title for Section 5.2, “Red Hat: Install the AMD RAID Driver During the OS Installation.” • Added section “For RHEL 8.3” on page 14. • Labeled instructions “For RHEL 8.2” on page 16. • Changed previous Section 5.1.1 to Section 5.3, “Install the RAIDXpert2 Management Application.”
September 2020	0.50	Initial preliminary release.

Chapter 1 General Information

1.1 Purpose

This Quick Start Guide is designed to assist with system setup in RAID Mode, by performing the following general procedures:

- Copy AMD RAID device drivers to removable storage media for the following operating system:
  - Red Hat (RHEL)®
- Load AMD RAID device drivers on a system at the time during RHEL operating system installation.
- Install the AMD-RAIDXpert2 (GUI) for RAID array management.

1.2 System Requirements

Table 1. System Requirements

Component	Requirements
Memory (RAM)	Minimum: 16 GB total for AMD Ryzen® processors and AMD Ryzen® desktop processors. Recommended: 32 GB total for AMD Ryzen® processors and AMD Ryzen® desktop processors
Hard Disk, SSD	Total 14 devices Support includes ATAPI DVD, SATA drives, SATA SSD drives, M.2 SATA drives, NVMe M.2 devices, NVMe HHHL devices or NVMe U.2 devices. The number of disks depends on the number, type, and capacity of the arrays to be created.
Max number of NVMe devices	10
Max Controller Count	11 (Four controllers with Device ID 0x7917 and NVMe, one controller per NVMe)
Supported AMD Processors	3rd Gen AMD Ryzen™ Threadripper Processors
Supported AMD Chipsets	TRX40/WRX80

Table 2. Information about Supported BIOS Configuration

SoC SATA Mode	Chipset SATA Mode	NVMe RAID Mode	SATA RAID Support	NVMe RAID Support
AHCI / Auto	AHCI / Auto	Disabled	No	No
RAID	RAID	Enabled	Yes	Yes

Maximum Device Support:

Max number of devices supported is 14 including ATAPI, SATA and NVMe.

1.3 Generic System Setup

A generic system setup process is described below:

1. Copy the **AMD-RAID** drivers to a removable storage medium. (Refer to Section 2.1.)
2. Power-on the system.
3. Access the platform BIOS window for the system.
   a. Configure the BIOS settings as outlined in Section 3.1 to enable RAID Mode.
   b. This enables the loading of the **AMD-RAID** UEFI driver.
4. Initialize the disks, using the RAIDXpert2 Configuration Utility (HII) or UEFI shell.
5. Create arrays, using the HII Configuration Utility or UEFI shell. (Refer to Chapter 4.)
6. Load the **AMD-RAID** drivers during the operating system installation. (Refer to Chapter 5.)
7. Complete the rest of the operating system installation.
8. Install the OS RAID Management GUI (AMD RAIDXpert2). (Refer to Section 5.3.)

IMPORTANT: *To protect your data; always perform a backup prior to installing any new, major hardware or software. If you are adding NVMe as RAID to your existing RAID arrays, then update all existing RAID controller drivers to the latest version and reboot the system. Later connect NVMe and install RAID driver on the NVMe devices or download the driver software from the vendor support page.*

IMPORTANT: *A Native AHCI installation will not boot into the OS after you change the BIOS setting to RAID mode.*

Chapter 2 Bootable Arrays

Note: *Before beginning, have the Red Hat® operating system installation media available and ready to install.*

Note: *Windows: Removable storage (Flash Drive) required for Copying AMD -RAID drivers.*

2.1 Copy AMD-RAID Drivers to a Removable Storage Medium: Red Hat (RHEL)

A removable storage medium is needed to copy **AMD RAID** drivers required for OS installation onto an AMD-RAID bootable array.

1. Locate and use a system that is running a Windows/Linux operating system and has an available I/O port for removable storage media (such as a USB flash drive formatted as FAT32).
2. Insert the storage medium into the system.
3. Go to a browser and access the website of your system supplier or motherboard vendor.
4. Download the AMD-RAID drivers from the website to the appropriate removable storage medium.
5. For RHEL: Copy the .iso image file (that matches the applicable distribution of Linux to the USB flash drive. For example:

   ```
   dd-rcraid-RHEL8-4-18.0-305.el8.x86_64.iso
   ```

6. Proceed to Red Hat Install and load AMD-RAID drivers during a Red Hat OS installation.

Chapter 3 Pre-Installation Steps

3.1 Enable RAID for AMD Ryzen™ SP3-Series Processors

Note: *The steps to configure a system to RAID mentioned here are specific to **AMD NDA BIOS** based on the **AMI BIOS**. The steps for other BIOS vendors are different.*

Complete the following pre-installation steps:

1. Power-on the system.
2. Press **ESC** to enter the System BIOS setup page.
3. In the BIOS setup:
   a. Select the **Advanced** tab.
   b. Select **CSM Configuration**, then press **Enter**.
   c. Set **CSM Support** to **Enabled**, then press **Enter**.
   d. Set **Boot option filter** to **UEFI** only, then press **Enter**.
   e. Set **Storage** to **UEFI**, then press **Enter**.
4. In the BIOS setup:
   a. Select the **Advanced** tab.
   b. Select **AMD CBS**, then press **Enter**.
   c. Select **FCH Common Options**, then press **Enter**.
   d. Select **SATA Configuration Options**, then press **Enter**.
   e. Set **SATA Enable** to **Enabled**, then press **Enter**.
   f. Set **SATA Mode** to **RAID**, then press **Enter**.
5. In the BIOS setup:
   a. Select the **Advanced** tab.
   b. Select **AMD CBS**, then press **Enter**.
   c. Select **Chipset Common Options**, then press **Enter**.
   d. Select **Chipset SATA Configuration Options**, then press **Enter**.
   e. Set **Chipset SATA0 Enable to Enabled**, then press **Enter**.
   f. Set **Chipset SATA1 Enable to Enabled**, then press **Enter**.
   g. Set **Chipset SATA Mode to RAID**, then press **Enter**.
6. In the BIOS setup:
   a. Select the **Advanced** tab.
   b. Select **AMD PBS** tab, then press **Enter**.
   c. Set the **NVMe RAID Mode** to **Enabled**, then press **Enter**.
7. Save (**F4**) the settings and restart the system.

Chapter 4 Create the Bootable Virtual Disk

Note: *The steps to configure arrays in RAID mode mentioned here are specific to* ***AMD NDA BIOS*** *and are based off* ***AMI BIOS****.*

Note: *AMD recommends not using SMR hard drives with AMD RAID systems because it can cause poor performance or failures. SMR drives are not suitable for workloads that require many random writes (such as boot drive). If used with RAID, the multiple SMR drives and background RAID tasks (such as creates and rebuilds) compound any issues or problems.*

4.1 RAIDXpert2 Configuration Utility (HII Mode) For the AMD Ryzen™ SP3-Series Processor

4.1.1 Use HII to Create a Bootable Virtual Disk

1. Power-on the system.
   a. Press **ESC** or **DEL** to get into the **Platform BIOS**.
   b. Select the **Advanced** tab.
   c. Select **RAIDXpert2 Configuration Utility**, then press **Enter**.
2. At the RAIDXpert2 Configuration Utility's Main Menu, use the arrow keys to select **Array Management**, then press **Enter**.
3. Use the **arrow keys** to select **Create Array**, then press **Enter**.
4. Select RAID Level, then press Enter.
   a. From the **Select RAID Level** drop-down menu, use the **arrow keys** to select the desired **RAID level**, then press **Enter**.
5. Select the disks with which to create the array:
   a. Use the **arrow keys** to select **Select Physical Disks**, then press **Enter**.
   b. To select individual disks, highlight a disk with the **arrow keys** and press the **Space Bar** or **Enter**. Any number of disks may be selected using this method.
   c. To select all disks, use the **arrow keys** to select **Check All**, then press **Enter**.
   d. Use the **arrow keys** to select **Apply Changes**, then press **Enter**.
6. Select an array size by doing the following:
   a. Use the **arrow keys** to select **Array Size**, then press **Enter**.
   b. The Array size defaults to the Maximum size allowed by the number of physical disks and RAID level selected. If you want a smaller size Array size, enter the desired value.
   c. Press **Enter** when the desired size is reached.
7. Use the **arrow keys** to select **Cache Tag Size**.
   a. Any Array with only HDD/SSD has the default CTS of 64 k.

b. Any Array with only NVMe has the default CTS of 256 k.

8. Use the **arrow keys** to select **Read Cache Policy**, then press **Enter**.
   a. Select the desired **Read Cache Policy**, then press **Enter**.
9. Use the **arrow keys** to select **Write Cache Policy**, then press **Enter**.
   a. Select the desired **Write Cache Policy**, then press **Enter**.
   b. Use the **arrow keys** to select **Create Array**, then press **Enter**.
10. After completion of array creation save and reboot the BIOS.

4.2 UEFI Mode

4.2.1 Use the Command Line to Create a Bootable Virtual Disk

1. At the system **Power-On Self-Test (POST)** screen, press **F7 / F12 / ESC** (or similar) to access the **UEFI Configuration Utility** (aka UEFI Boot Manager).
2. Boot to the **EFI Internal** shell.

   Note: *Obtain the* `rcadm.efi` *file from your system supplier or motherboard vendor and copy it onto a UEFI flash drive in the root directory.*

3. Enter `fs`*x*: where *x* is the number of the UEFI Flash Drive.
4. Use `rcadm` to create the desired Boot Virtual Disk.

Examples:

Note: *You may need to press the Page-Up key to see more of the information.*

- Query the devices connected in the system (Output displays the UEFI Version, physical devices and arrays.):

  ```
  rcadm.efi –M -qa
  ```

- Create a RAID1 on disks 2, 3 with a max size available and enables Read/Write Cache – default cache setting:

  ```
  rcadm.efi –C –r1 –d 2 3
  ```

- Create a RAID0 on disks 1, 2 with a size of 10 0 Gbs and enables Read Cache:

  ```
  rcadm.efi –C –r0 –d 1 2 –s 100000 –ca r
  ```

- Create a RAID10 on disks 1, 2, 3, 4 with a size of 125 Gbs and enables Write Cache:

  ```
  rcadm.efi –C –r10 –d 1 2 3 4 –s 125000 –ca w
  ```

Chapter 5 Install the AMD RAID Drivers During a RHEL Linux Installation

5.1 Secure Boot Enablement

Note: *If you do not want to enable Secure Boot, go to Section 5.2 to install AMD RAID drivers.*

Note: *The steps to enable Secure boot mentioned here are specific to **AMD NDA BIOS** and are based on **AMI BIOS**.*

5.1.1 Enable Secure Boot

1. Power-on the system.
2. Press **ESC**, to enter the platform BIOS.
3. Select the **Security** tab
4. Select **Secure Boot**, then press **Enter**.
5. Select **Restore Factory Keys**, then press **Enter**.
6. Select **Yes**, then press **Enter**.
7. Select **Secure Boot**, then press **Enter**.
8. Select **Enable**, then press **Enter**.
9. Press **F4**, to save and exit the BIOS.

5.2 Red Hat: Install the AMD RAID Driver During the OS Installation

Note: *Prior to starting this procedure, obtain the AMD-RAID drivers from your system supplier or motherboard vendor. Copy them to a removeable storage medium. (See Section 2.1.)*

Note: *When installing Red Hat, use Linux dd installation mode instead of Linux expert mode.*

Note: *Not all the windows indicated in this procedure display during installation.*

Note: *AMD recommends a reset/reboot of the system if you are adding or removing a SATA M.2 SSD or NVMe device(s):*

1. *In the OS, issue a reset/reboot.*
2. *Wait for the AMD BIOS screen to display, press ESC to enter the BIOS.*
3. *Power off the system.*
4. *Install or remove the necessary device(s).*
5. *Power on the system and allow the OS to boot properly.*

5.2.1 Install the AMD RAID Driver During the RHEL OS Installation

1. Power-on the system.
2. Insert the Red Hat installation CD-ROM, DVD or USB.
3. Create a bootable array. (See Chapter 4)
4. At the Red Hat Enterprise Linux Welcome window:
   a. Press the **Up Arrow**.
   b. Select **Install Red Hat Enterprise Linux 8.x** (the text should be high-lighted in white).
   c. Press `E`.
   d. Press the down arrow twice and select the `linuxefi /images` string.
   e. Press the **END** key to move the cursor to the end of the line.
   f. At the end of the string, add:
      `inst.dd modprobe.blacklist=ahci modprobe.blacklist=nvme`

      Example: `linuxefi /images…quiet inst.dd modprobe.blacklist=ahci modprobe.blacklist=nvme`
   g. Press **CTRL X**.

   Note: *If the shell does not display (the screen is black) reset the system and try with the following settings.*

   h. At the end of the string, add:
      `inst.dd modprobe.blacklist=ahci modprobe.blacklist=nvme nomodeset`

      Example: `linuxefi /images……quiet inst.dd modprobe.blacklist=ahci modprobe.blacklist=nvme nomodeset`
   i. Press **CTRL X**.
5. At the Driver Disk Device Selection:
   a. Insert the USB drive (which contains the AMD-RAID dd-rcraid….x86_64.iso) into the USB port.
   b. Press `r`.
   c. Press **Enter** to refresh.
   d. Press the number of USB flash drives previously inserted.
   e. Press **Enter**.
6. At the Choose Driver Disk ISO file:
   a. Press **1** (the number of the `dd-rcraid-RHEL….el8.x86_64.iso` entry).
   b. Press **Enter**.
7. At the Select Drivers to Install:
   a. Press **1** (the number of the `/media/DD/….x86_64.rpm` entry).
   b. Press **Enter**.

The `/media/DD/`…is now selected and should look like:
`[X] /media/DD/…..x86_64.rpm`

c. Press `c`.

d. Press **Enter**.

8. At the Driver Disk Device Selection:
   a. Press `c`.
   b. Press **Enter**.
   c. Remove the USB flash drive.
9. At the Welcome to Red Hat Enterprise Linux screen:
   a. Choose the desired **Language**.
   b. Choose the desired **Country**.
   c. In the bottom-right corner, click **Continue**.

For RHEL 8.3 or 8.4 (*"For RHEL 8.2," see page 16.*)

10. For RHEL 8.3/8.4, at the Installation Summary screen, configure the following:
    a. Under **Localization**:
       - **Keyboard**
       - **Language Support**
       - **Time and Date**

    b. Under **System**:
       - **Installation Destination**
       - Under **Local Standard Disks**, select **AMD-RAID Array 01**.
       - Under **Storage Configuration**, select **Custom**.
       - In the upper-left corner, click **Done**.
       - Click the **Click here to create them automatically** link.

    Note: *AMD-RAID only supports a file system type of ext4, using the XFS file system will cause an unrecoverable installation error.*

    c. Under **Installation**:
       - Select **DATA/home**.
       - Change **File System** from **xfs** to **ext4**.
       - Select **SYSTEM/rhel-root**.
       - Change **File System** from **xfs** to **ext4**.
       - Select **SYSTEM/boot**.
       - Change **File System** from **xfs** to **ext4**.
       - In the upper-left corner, click **Done**.
       - In the **Summary of Changes** window, click **Accept Changes**.

d. Under **Network and Hostname**:
   - In the bottom-left corner, enter a valid **Hostname**, then press the **Apply** button.
   - Select an **Ethernet Port**.
   - In the bottom-right corner, click **Configure**.
   - Enter valid entries.
   - Click **Save**.
   - Under Ethernet, click the **ON** button.
   - In the upper-left corner, click **Done**.

e. Under **Software**:

   Connect to Red Hat

   1. Enter a valid **Username**.
   2. Enter a valid **Password**.
   3. Click **Register**.
   4. In the upper-left corner, click **Done**.

   Software Selection

   5. Select **Server with GUI**.
   6. In the upper-left corner, click **Done**.

f. Under **User Settings**:
   1. Click **Root Password**.
      - Enter an applicable root password.
      - Re-enter the root password.
      - In the upper-left corner, click **Done**.
   2. Click **User Creation**.
      - Enter a **Full Name**.
      - Enter a **Username**.
      - Enter an applicable password.
      - Re-enter the user password.
      - In the upper-right corner, click **Done**.

g. At the Installation Summary screen, click **Beginning Installation**.

Note: *Wait for the following message to display: "**Red Hat Enterprise Linux is now successfully installed and ready for you to use! Go ahead and reboot to start using it!**"*

h. In the bottom-right corner, click **Reboot**.

i. Remove the installation media.

11. **Continue the installation** on page 17.

For RHEL 8.2, continued from Step 9 on page 14 (*"For RHEL 8.3," see page 14.*)

10. For RHEL 8.2, at the Installation Summary screen, configure the following:
    a. Under **Localization**:
        - **Keyboard**
        - **Language Support**
        - **Time and Date**
    b. Under **Software**:
        - **Software Selection**
        - Select **Server with GUI** under **Base Environments**.
        - In the upper-left corner, click **Done**.
    c. Under **System**:
        - **Installation Destination**
        - Select **AMD-RAID Array 01** under **Local Standard Disks**.
        - Select **Custom** under **Storage Configuration**.
        - In the upper-left corner, click **Done**.
        - Click the **Click here to create them automatically** link.

    Note: *AMD-RAID only supports a file system type of ext4. Using the XFS file system causes an unrecoverable installation error.*

    d. Under **Installation**:
        - Select **DATA/home**.
        - Change **File System** from **xfs** to **ext4**.
        - Select `SYSTEM/rhel-root`.
        - Change **File System** from **xfs** to **ext4**.
        - Select `SYSTEM/boot`.
        - Change **File System** from **xfs** to **ext4**.
        - In the upper-left corner, click **Done**.
        - In the **Summary of Changes** window, click **Accept Changes**.
    e. Under **Network and Hostname**:
        - In the bottom-left corner, enter a valid **Hostname**, then press the **Apply** button.
        - Select an **Ethernet Port**.
        - In the bottom-right corner, click **Configure**.
        - Enter valid entries.
        - Click **Save**.
        - Under **Ethernet**, click the **ON** button.
        - In the upper-left corner, click **Done**.
11. In the bottom-right corner, click **Begin Installation**.

12. At the **Configuration** window:
    a. Click **Root Password**:
        - Enter an applicable root password.
        - Re-enter the root password.
        - In the upper-left corner, click **Done**.
    b. Click **User Creation**:
        - Enter a **Full Name**.
        - Enter a **Username**.
        - Enter an applicable password.
        - Re-enter the user password.
        - In the upper-right corner, click **Done**.

    Note: *Wait for the following message to display: "**Red Hat Enterprise Linux is now successfully installed and ready for you to use! Go ahead and reboot to start using it!**"*

        - In the bottom-right corner, click **Reboot**.
        - Remove the installation media.
13. At the **Initial Setup** window:
    a. Under **Licensing**:
        - Click **License Information**.
        - Review the EULA and select (check mark) **I accept the License Agreement**.
        - In the upper-left corner, click **Done**.
    b. Under **System**:
        - Configure **Subscription Manager**.
        - In the bottom-right corner, click **Finish Configuration**.
14. **Continue the installation** below.

Continue the installation for RHEL 8.2/8.3/8.4:

1. Login to the system:
    a. Select a user.
    b. Enter a password.
2. At the **Welcome** window:
    a. Select the desired **Language**.
    b. Click **Next**.
3. At the **Typing** window:
    a. Select the desired **Language**.
    b. Click **Next**.

4. If desired, configure **Privacy**:
   a. Click Next.
5. At the Connect your Online Accounts:
   a. Configure or click **Skip**.
6. Click **Start using the Red Hat Enterprise Linux Server**.

5.3 Install the RAIDXpert2 Management Application

1. Contact your system supplier or motherboard vendor to obtain the new AMD-RAID Linux Management Application.
2. Copy the AMD-RAID 9.3.0-00xxx_linux_raidxpert2.tgz to a USB flash drive, formatted as FAT32.
3. Insert a USB flash drive containing the package:
   `AMD-RAID 9.3.0-00xxx_linux_raidxpert2.tgz`
4. Log into the system as `root` or `su root`.
5. Click **Activities** > **Files** and select the USB flash drive inserted previously.
6. Locate and select the `AMD-RAID 9.3.0-00xxx_linux_raidxpert2.tgz` package and drag it to **/home** on your desktop.
7. Click **Activities** > **Terminal** to open a terminal / console window.
8. Enter: `tar xzvf 9.3.0-00xxx_linux_raidxpert2.tgz -C /opt`
9. To open the AMD-RAID RAIDXpert2 Management Application:
   a. Click **Activities** > **Terminal** to open a terminal / console window.
   b. Enter: `cd /opt/raidxpert2/bin`
   c. Enter: `./RAIDXpert2 &`

   Note: *"Cannot Open Display" Error While Launching RAIDXpert2 on RHEL 8.x. When the latest RAIDXpert2 Management Utility is executed, you may receive an error that looks like:* `qt.qpa.xcb: could not connect to display :0`

   Note: *RHEL requires elevated permissions to run the program, use the following commands to create temporary elevated session permission:*

   1. *Open a terminal window to allow clients to connect from any host using* `xhost+`.
   2. *The following command must be entered as a* ***non-root*** *user:*

      Enter the following command: `xhost+`

      Access control is disabled, clients can connect from any host.

Note: *This grants you* ***temporary*** *elevated permissions to run the program. Please note, once you reboot or update the program, you need to re-enter these commands to regrant yourself these permissions.*