



# Parallels Server Bare Metal 5.0

Installation Guide

Parallels Holdings, Ltd.  
c/o Parallels International GmbH.  
Parallels International GmbH  
Vordergasse 49  
CH8200 Schaffhausen  
Switzerland  
Tel: + 41 526320 411  
Fax: + 41 52672 2010  
[www.parallels.com](http://www.parallels.com)

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CHAPTER 1

# Introduction

This chapter provides basic information about Parallels Server Bare Metal 5.0 and this guide.

## In This Chapter

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## About Parallels Server Bare Metal 5.0

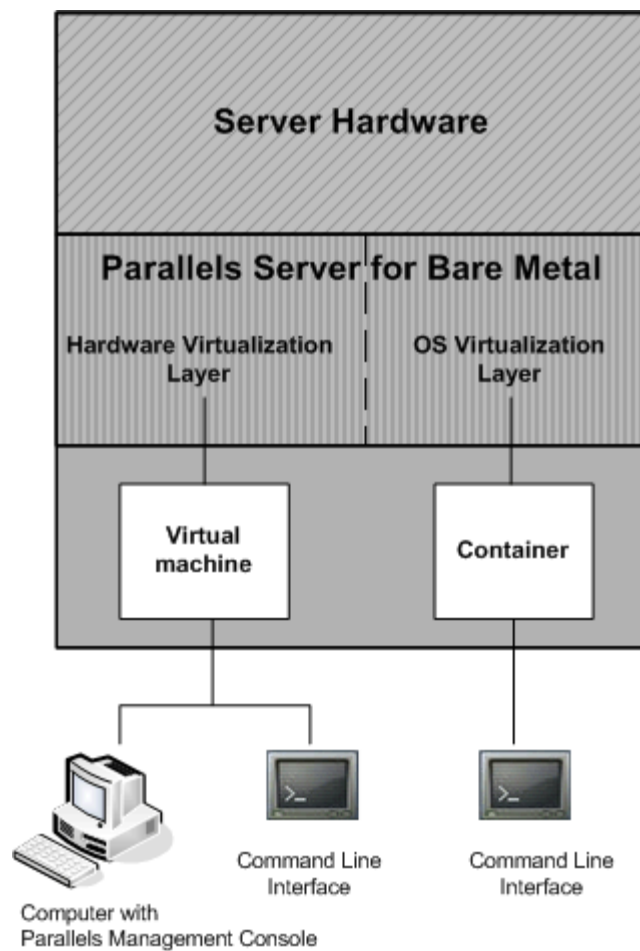
Parallels Server Bare Metal 5.0 allows you to simultaneously run Parallels virtual machines and Containers on a single server. With Parallels Server Bare Metal, you can efficiently use your server's hardware resources by sharing them among multiple virtual machines and Containers.

Parallels Server Bare Metal is installed directly on the server hardware and does not need any operating system for its functioning. Once it is installed, Parallels Server Bare Metal allows you to create virtual machines and Containers and manage them using the following tools:

- **Command-line interface (CLI).** The command-line interface comprises a set of Parallels command-line utilities that you can use to manage virtual machines and Containers both locally and remotely.
- **Parallels Management Console.** Parallels Management Console is a remote management tool for Parallels Server Bare Metal with a graphical user interface. You can use this tool to manage servers and Parallels virtual machines residing on them.

**Note:** In this version of Parallels Server Bare Metal, you cannot use Parallels Management Console to create and manage Parallels Containers.

Graphically, a server with the Parallels Server Bare Metal software installed can be represented as follows:



## About This Guide

The *Parallels Server Bare Metal 5.0 Installation Guide* provides detailed information on installing Parallels Server Bare Metal on a physical server.

The primary audience for this guide is anyone interested in installing and putting Parallels Server Bare Metal in operation on their servers.

## Organization of This Guide

This guide is organized in the following way:

- **Chapter 1, Introduction**, gives an overview of the Parallels Server Bare Metal product and this guide.
- **Chapter 2, Preparing for Installation**, describes the hardware and software requirements a physical server must meet to successfully install Parallels Server Bare Metal.
- **Chapter 3, Installing Parallels Server Bare Metal 5.0**, provides detailed information on how to install Parallels Server Bare Metal on a physical server.
- **Chapter 4, Starting to Work in Parallels Server Bare Metal 5.0**, provides instructions on how to start working in Parallels Server Bare Metal using both Parallels command-line utilities and Parallels Management Console.

## Documentation Conventions

Before you start using this guide, it is important to understand the documentation conventions used in it.

The table below presents the existing formatting conventions.

Formatting convention	Type of Information	Example
Special Bold	Items you must select, such as menu options, command buttons, or items in a list.	Go to the <b>Resources</b> tab.
	Titles of chapters, sections, and subsections.	Read the <b>Basic Administration</b> chapter.

<i>Italics</i>	Used to emphasize the importance of a point, to introduce a term or to designate a command-line placeholder, which is to be replaced with a real name or value.	These are the so-called <i>EZ templates</i> . To destroy a Container, type <code>vzctl destroy <i>ctid</i></code> .
Monospace	The names of commands, files, and directories.	Use <code>vzctl start</code> to start a Container.
Preformatted	On-screen computer output in your command-line sessions; source code in XML, C++, or other programming languages.	Saved parameters for Container 101
Monospace Bold	What you type, as contrasted with on-screen computer output.	<b># rpm -v virtuozzo-release</b>
Key+Key	Key combinations for which the user must press and hold down one key and then press another.	Ctrl+P, Alt+F4

Besides the formatting conventions, you should also know about the document organization convention applied to Parallels documents: chapters in all guides are divided into sections, which, in their turn, are subdivided into subsections. For example, **About This Guide** is a section, and **Documentation Conventions** is a subsection.

## Getting Help

In addition to this guide, you can use the following resources to learn how to work in Parallels Server Bare Metal.

### Manuals:

- *Getting Started With Parallels Server Bare Metal 5.0*. This guide provides basic information on installing Parallels Server Bare Metal on a physical server, creating new Containers and virtual machines, and performing main operations on them. Unlike this guide, it does not contain detailed description of all the operations needed to install and set Parallels Server Bare Metal to work.
- *Parallels Server Bare Metal 5.0 User's Guide*. This guide provides comprehensive information on Parallels Server Bare Metal covering the necessary theoretical conceptions as well as all practical aspects of working with the product. The guide does not deal with the process of installing and configuring Parallels Server Bare Metal systems.
- *Parallels Server Bare Metal 5.0 Templates Management Guide*. This guide is meant to provide complete information on Parallels templates - an exclusive Parallels technology allowing you to efficiently deploy standard Linux applications inside your Containers and to greatly save the physical server resources (physical memory, disk space, etc.).
- *Parallels Command Line Reference Guide*. This guide is a complete reference on all Parallels Server Bare Metal configuration files and command line utilities.
- *Deploying Clusters in Parallels-Based Systems*. This guide describes the process of creating Parallels failover and GFS clusters using the Red Hat Cluster Suite (RHCS) software.

### Help systems:

- *Getting Started with Parallels Management Console*. This help system provides information on how to start working in Parallels Management Console. You will learn how to install this application on your computer, connect to a physical server running Parallels Server Bare Metal, and perform the basic operations on your virtual machines.
- *Parallels Management Console User's Guide*. This help system provides detailed information on Parallels Management Console - a graphical user interface tool for managing physical servers and their virtual machines.

## Feedback

If you spot a typo in this guide, or if you have an opinion about how to make this guide more helpful, you can share your comments and suggestions with us by completing the Documentation Feedback form on our website (<http://www.parallels.com/en/support/usersdoc/>).

## CHAPTER 2

# Preparing for Installation

This chapter describes the hardware and software requirements your physical server must meet to successfully install Parallels Server Bare Metal 5.0. It also provides information on how to obtain the Parallels Server Bare Metal distribution set.

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## Installation Requirements

Before installing Parallels Server Bare Metal on your server, make sure that it meets the requirements listed in this section.

## Hardware Compatibility

Parallels Server Bare Metal can be installed on a physical server that meets the following hardware requirements:

- Platform:  
X86 or x86-64 platform with Intel VT-x or AMD-V hardware virtualization support.
- CPU:  
1.5 GHz or higher processor (a 64-bit processor is required for launching 64-bit guest operating systems).
- Memory:  
2 GB or more RAM.
- Hard disk:  
10 GB or more for the root partition that will keep Parallels Server Bare Metal files.  
Around 2 GB for the `swap` partition.  
30 GB or more for the `/vz` partition that will keep virtual machines and Containers files.
- Network:  
Ethernet network adapter.  
Valid IP address.
- Other hardware:  
DVD-ROM drive.

The actual number of virtual machines and Containers you can run on a physical server and their performance depend on the resources they require. In general, the more resources your physical server has, the more virtual machines and Containers you can run and the higher is their performance.

## Software Compatibility

Parallels Server Bare Metal is installed on a bare-metal server and does not need any operating system for its functioning.

## Network Requirements

To connect to the physical server with Parallels Server Bare Metal (for example, to manage it using Parallels Management Console), you need to establish a network connection (wireless or wired) between this server and the remote computer. So, you must have a valid IP address for the physical server as well as other IP parameters (default gateway, network mask, DNS configuration).

## Obtaining Parallels Server Bare Metal 5.0 Distribution Set

You can use one of the following ways to obtain the Parallels Server Bare Metal 5.0 distribution set:

- Download the ISO image of Parallels Server Bare Metal 5.0 from the Parallels web site to your computer. If you use this way of getting the Parallels Server Bare Metal distribution set, you will need to burn the downloaded ISO image to a DVD before starting the installation.
- Contact a Parallels sales representative and get a DVD with Parallels Server Bare Metal 5.0.

## CHAPTER 3

# Installing Parallels Server Bare Metal 5.0

This chapter provides detailed information on installing Parallels Server Bare Metal 5.0 on your physical server.

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## Installation in a Nutshell

To install Parallels Server Bare Metal 5.0, follow the steps below. To know more about a particular step, see **Installing in Graphical Mode** (p. 18).

- 1** Configure the server to boot from the CD/DVD-ROM drive.
- 2** Insert the DVD with the Parallels Server Bare Metal distribution set into the server's CD/DVD-ROM drive, and restart the server.
- 3** When the server boots, make sure that the **Install or upgrade an existing system** option is selected, and press Enter.
- 4** Click **Next** to accept the Parallels end user license agreement, and in the displayed window, click **Agree** to confirm your decision.
- 5** Specify a hostname for your server in the **Hostname** field; click the **Configure Network** button and set up your network settings. When you are done, click **Next**.
- 6** Set your time zone settings, and click **Next**.
- 7** Enter the Parallels Server Bare Metal license, and click **Next**.
- 8** Enter the password for the root account, and click **Next**.
- 9** In the **Partitioning** window, select the **Use All Space** radio button, and click **Next**.
- 10** Specify a unique IP address and a unique hostname for the PVA Management Node, and click **Next**.

**Notes:**

1. This screen is not displayed if your license does not support Parallels Virtual Automation.
2. To set up the PVA Management Node, your server must have an active Internet connection.

- 11** Once the installation is complete, click **Reboot** to restart the server.

## Choosing the Installation Type

You can install Parallels Server Bare Metal 5.0 in one of the following modes:

- *graphical mode* (default): install Parallels Server Bare Metal using the graphical installer. This is the recommended mode of installing the product.
- *graphical mode with basic video driver*: install Parallels Server Bare Metal in a special graphical mode. Use this mode if the installer cannot load the correct driver for your video card.
- *expert mode*: install Parallels Server Bare Metal using the graphical installer in extended mode. As compared to the default graphical mode, this mode gives you more options to configure your system and is recommended for advanced users.
- *text mode*: install Parallels Server Bare Metal using the text mode installer.

All modes are described in the subsequent sections in detail.

## Installing in Graphical Mode

The default graphical mode allows you to install Parallels Server Bare Metal using the graphical installer. In this mode, you specify only the basic parameters required for installing the software.

To install Parallels Server Bare Metal in graphical mode, do the following:

- 1 Configure the server to boot from the CD/DVD-ROM drive.
- 2 Insert a DVD containing the Parallels Server Bare Metal distribution set into the server's CD/DVD-ROM drive, and restart the server.
- 3 After the server boots, the installation starts automatically.



- 4 Make sure that the **Install or upgrade an existing system** option is selected, and press Enter.
- 5 Read and accept the Parallels end user license agreement. To do this, click **Next**, and in the displayed window, click **Agree**.
- 6 Choose a hostname for your server. You can specify a hostname as a fully qualified domain name (*hostname.domainname*) or as a short hostname (*hostname*).



On this screen, you also need to configure your network settings. You have to configure at least one network card. To do this, click the **Configure Network** button, select the network card you want to configure, and click **Edit**.



You can do one of the following:

- Accept the network settings offered by the installer. View the default settings in the editing network card window, and if you are satisfied with them, click **Apply**; then click **Close**.
- Configure the network card settings. Click the necessary tabs in the editing network card window, and configure the settings to meet your demands. When you are done, click **Apply**; then click **Close**.

Click **Next** to continue with the installation.

**7** Specify your time zone settings.



To set your time zone, you can either select the nearest city to your physical location on the drop-down menu or click on the interactive map to zoom in to the needed place. You can also select the **System clock uses UTC** check box to set your system to UTC (Universal Time Coordinated), which makes it automatically switch between normal and daylight savings time.

- 8 Enter the Parallels Server Bare Metal license. Every physical server must have its own license installed. Licenses are issued by Parallels and needed to start using Parallels Server Bare Metal on your server. Type the product key for Parallels Server Bare Metal in the field provided, and click **Next**.



You can also skip this step and install the license after the installation. However, in this case you will not be able to install Parallels Virtual Automation and its components along with Parallels Server Bare Metal. For more information on installing Parallels Virtual Automation, see the next step.

- 9 Specify a password for the root account.



The screenshot shows the Parallels Server Bare Metal 5.0 installation interface. At the top, the Parallels logo and "Parallels® Server Bare Metal 5" are displayed. Below this, a message with a shield icon states: "The root account is used for administering the system. Enter a password for the root user." There are two input fields: "Root Password:" and "Confirm:". At the bottom, there are two buttons: "Back" and "Next".

You will need to log in to the physical server as `root` to be able to manage Parallels virtual machines and Containers. After providing the password and confirming it, click **Next**.

**10** In the **Partitioning** window, you are supposed to choose the way of partitioning your server.



Do the following:

- Select the **Use All Space** radio button to create the default layout on the server, which includes creating the following partitions:

Partition	Description
/	The root partition containing all Parallels Server Bare Metal files.
/vz	The partition intended to host all Containers and virtual machines data.
swap	The paging partition for Parallels Server Bare Metal.

If you do not feel comfortable with partitioning your server, we recommend that you select this option and let the installer automatically partition your system.

- Select the **Create custom layout** radio button to manually partition your disk drive. Detailed information on how you can do it is given in **Creating Custom Layout** (p. 26).
- 11** Choose the Parallels Virtual Automation components to install on your server. This screen is displayed only if you entered the license in the previous step and your license provides support for the Parallels Virtual Automation.



Do the following:

- Clear the **Install PVA Agent for Parallels Server** and **Install PVA Management Node** check boxes, and click **Next** if you do not want to use Parallels Virtual Automation for managing your server and virtual machines and Containers.
- Leave the **Install PVA Agent for Parallels Server** and **Install PVA Management Node** check boxes selected to set up the Parallels Virtual Automation application and its components on the server. Using Parallels Virtual Automation, you can connect to the Parallels server and manage your virtual machines and Containers with your favorite browser.

If you select the check boxes, you need to specify a valid IP address in the **IP Address** field for a special Management Node and can also set its hostname in the **Hostname** field. Once the installation is complete, you can log in to Parallels Virtual Automation by opening `http://IP_address_or_hostname` in the browser and using the `root` user name and the password you specified in the previous step.

When the check boxes are selected, the Parallels Server Bare Metal installer performs the following operations after restarting the server:

- a Downloads the installation packages for Parallels Virtual Automation from the Parallels web site to the server. Notice that the download process may take some time, depending on the speed of your Internet connection.
- b Installs Parallels Virtual Automation and its components on the server and inside a specially created Container. The installation is automatically initiated once the installation packages are downloaded to the server and runs without your interaction.

When you are done, click **Next** to start installing Parallels Server Bare Metal.

**Notes:**

1. Your server must be connected to the Internet to download the Parallels Virtual Automation installation packages from the Parallels remote repository. Using alternative (local) repositories for downloading the Parallels Virtual Automation components is also supported but in kickstart files only. For more information, see the *Installation via PXE* document.
2. You can use Parallels Virtual Automation to manage Parallels servers only if your license allows you to do so. If the license does not support using Parallels Virtual Automation, the PVA components screen is not displayed. In this case, you must first upgrade your license and then install the Parallels Virtual Automation application manually. For more information, see **Installing Parallels Virtual Automation Manually** (p. 66).
3. For more information on setting up and logging in to Parallels Virtual Automation, refer to **Using Parallels Virtual Automation** (p. 63).

Once the installation is complete, the **Congratulations** window appears. Click **Reboot** to restart the server and boot into Parallels Server Bare Metal.

## Creating Custom Layout

If you choose to create a custom layout (that is, select the **Create custom layout** radio button in the step of specifying your partition settings and click **Next**), you will see the following window:



The process of partitioning your system is similar to that used to partition servers with the Disk Druid partitioning tool which comes with most Linux distributions. You can use the provided buttons (**Create**, **Edit**, and so on) to create and configure your partitions. The partitions you need to create are listed in the table below:

Partition	Description	Size
/	Root partition containing all Parallels Server Bare Metal program files.	12 GB or more
swap	Paging partition for Parallels Server Bare Metal.	2 times RAM if RAM <=2 GB otherwise, RAM + 2 GB
/vz	Partition for storing all virtual machines and Containers data. You are recommended to allocate as much disk space as possible to this partition and to format it as ext3.  If you do not make a separate /vz partition, a directory with this name will be automatically created in the root filesystem.	all the remaining space on the hard disk

## Installing in Expert Mode

The installation in expert mode gives you more options for configuring your system. The additional steps, as compared to the steps described in **Installing in Graphical Mode** (p. 18), are described below in the order they appear during the installation.

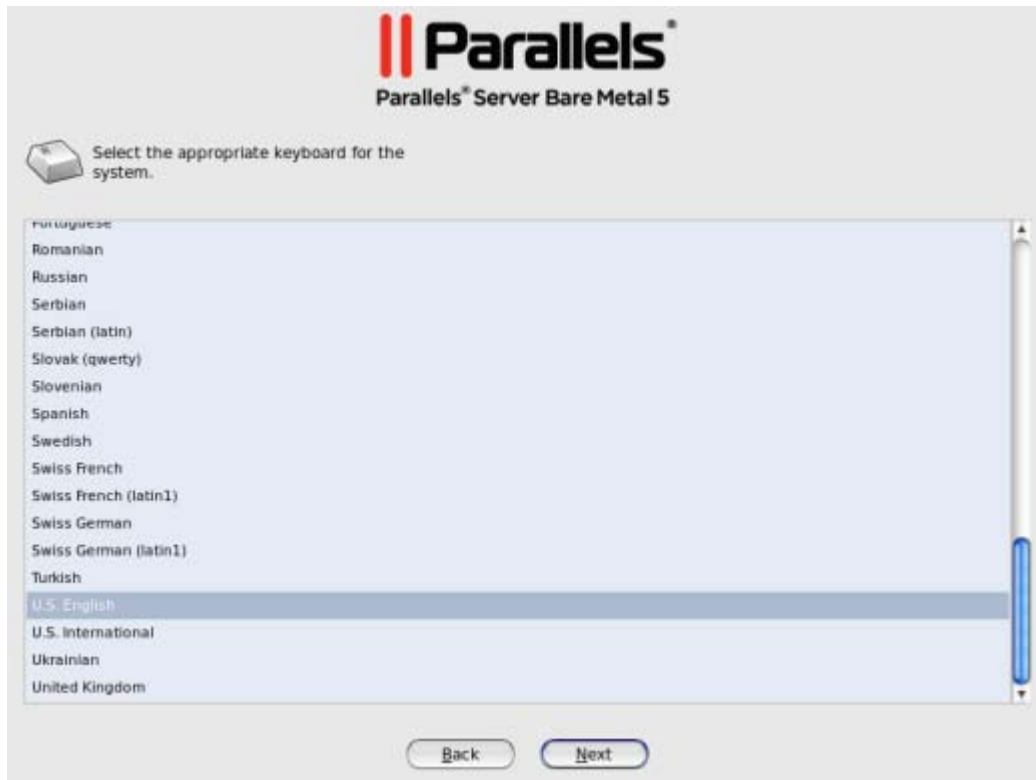
### Choosing the language

Choose the language to use during the installation of Parallels Server Bare Metal. Select any of the supported languages, and click **Next**.



## Selecting the keyboard type

Select the layout type for the keyboard you want to use for the installation and as the system default.



## Choosing the type of storage

Choose the type of storage device to install Parallels Server Bare Metal on.

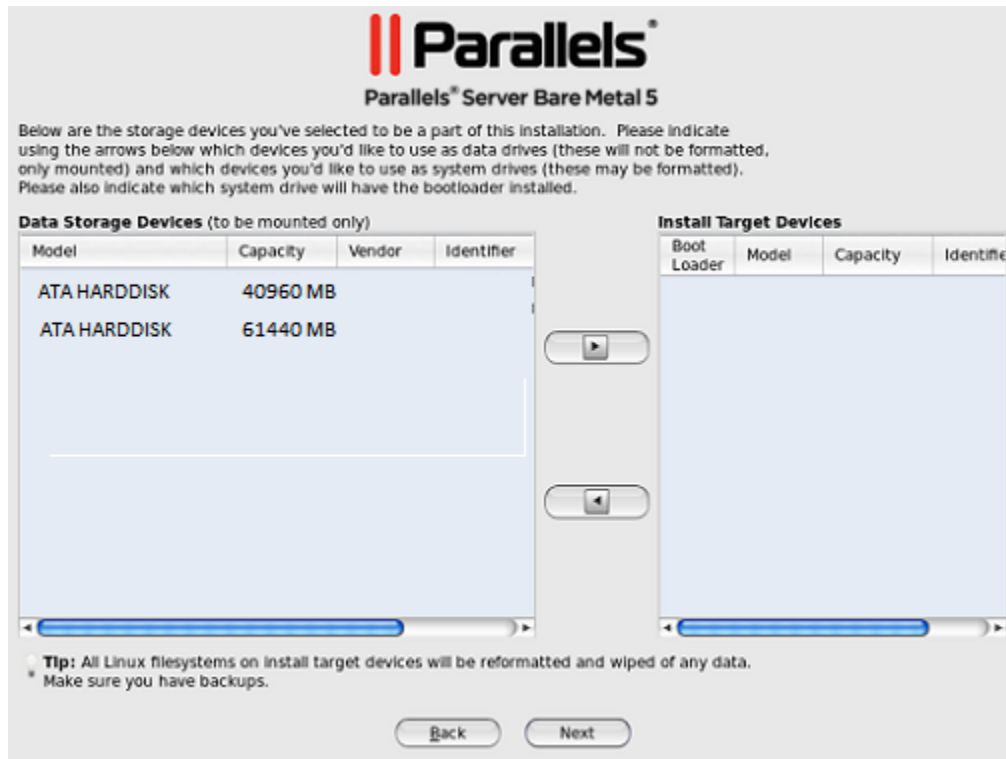


You can choose one of the following options:

- **Basic Storage Devices** (default). Use this option to install Parallels Server Bare Metal on local hard drives that are directly attached to your system. If you plan to install Parallels Server Bare Metal on a local disk, click **Next**.
- **Specialized Storage Devices**. Use this option to install Parallels Server Bare Metal on the following storage devices: storage area networks (SANs), direct access storage devices (DASDs), firmware RAID devices, and multipath devices. For detailed information on configuring these types of devices, consult the *Red Hat Enterprise 6 Installation Guide* at [http://docs.redhat.com/docs/en-US/Red\\_Hat\\_Enterprise\\_Linux/](http://docs.redhat.com/docs/en-US/Red_Hat_Enterprise_Linux/).

## Choosing the device

Choose the storage device where you want to install Parallels Server Bare Metal. This screen is displayed only if your system contains more than one storage devices.



You should tell the system which storage device to use for installing Parallels Server Bare Metal and the boot loader. To choose a device, click its name in the **Data Storage Devices** table, and then click the right arrow button to move the device to the **Install Target Devices** table. If you move more than one device to the **Install Target Devices** table, you also need to choose the device for installing the boot loader. To do this, click the radio button next to the desired device.

Note that the devices you leave in the **Data Storage Devices** table will be attached to the file system as data storage devices but will not be partitioned or formatted.

## Configuring the boot loader

Configure the boot loader.



On this screen, you can view the current boot loader settings and configure them, if necessary. For example, you can choose another partition for installing the boot loader using the **Change device** button or set a boot loader password to protect your system.

## Choosing the packages for installation

Choose the packages to install on the server.



You can choose one of the two packages sets:

- **Base.** This packages set includes the following packages:
  - Basic packages required for the correct operation of your system.
  - Packages specific for the OS virtualization part of Parallels Server Bare Metal.
  - Packages specific for the hardware virtualization part of Parallels Server Bare Metal.
  - Packages required for creating clusters from Parallels Server Bare Metal systems.
  - Templates included in the Parallels Server Bare Metal distribution.

To install the base packages set, make sure that the **Basic** radio button is selected, and click **Next**.

- **Full.** This packages set includes all the packages from the base packages set plus a number of additional packages for Parallels Server Bare Metal. To view the additional packages:
  1. Select either the **Full** radio button.
  2. Select the **Customize now** radio button at the bottom of the screen.
  3. Click **Next**.

4. In the left part of the screen, select the **Virtualization** option.
5. In the right part of the screen, select the **Optional Packages** option, and click the **Optional packages** button at the bottom of the screen.



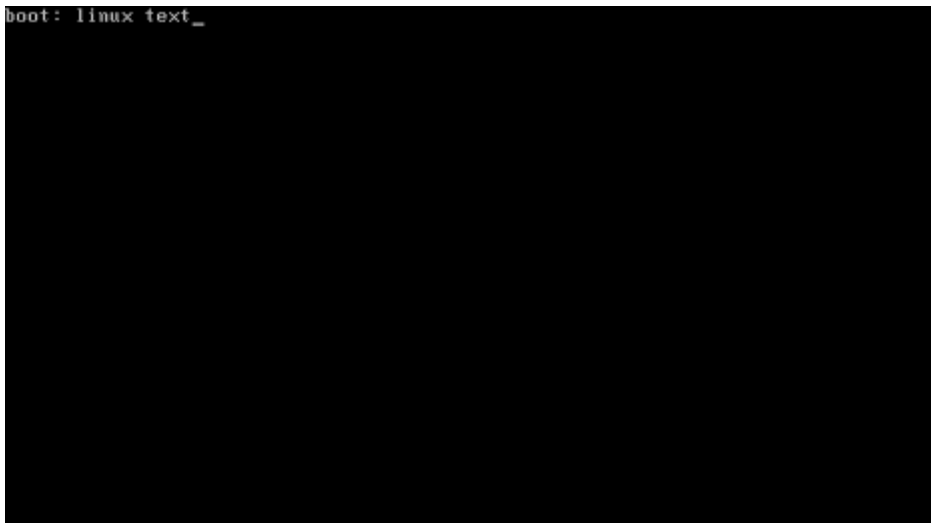
## Installing With Basic Video Driver

If the installer cannot load the correct driver for your video card, you can try to install Parallels Server Bare Metal in the *graphical mode with basic video driver* mode. To install in this mode, choose the **Install system with basic video driver** option on the **Welcome** screen, and press Enter. The process of installing Parallels Server Bare Metal using this mode does not differ from that of using the default graphical mode. Consult **Installing in Graphical Mode** (p. 18) for information on particular installation steps.

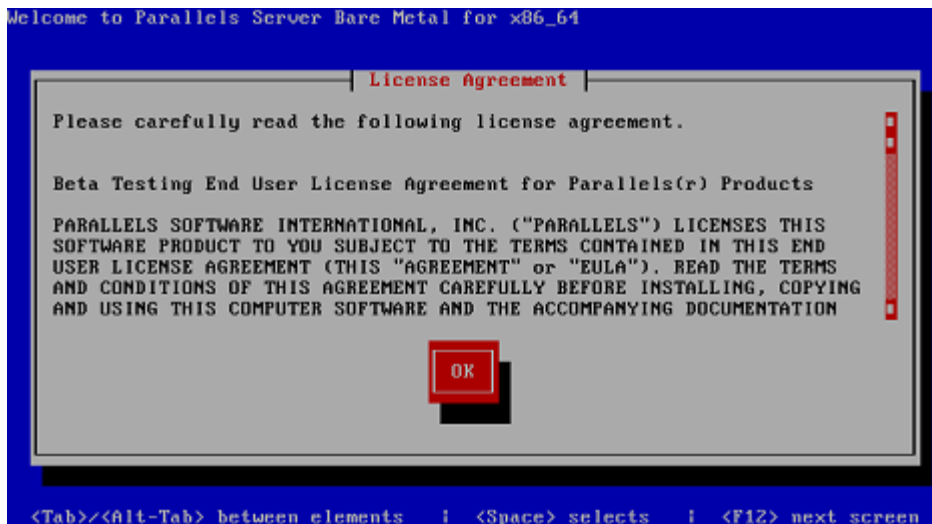
## Installing Parallels Server Bare Metal in Text Mode

To install Parallels Server Bare Metal in text mode, follow the instructions below:

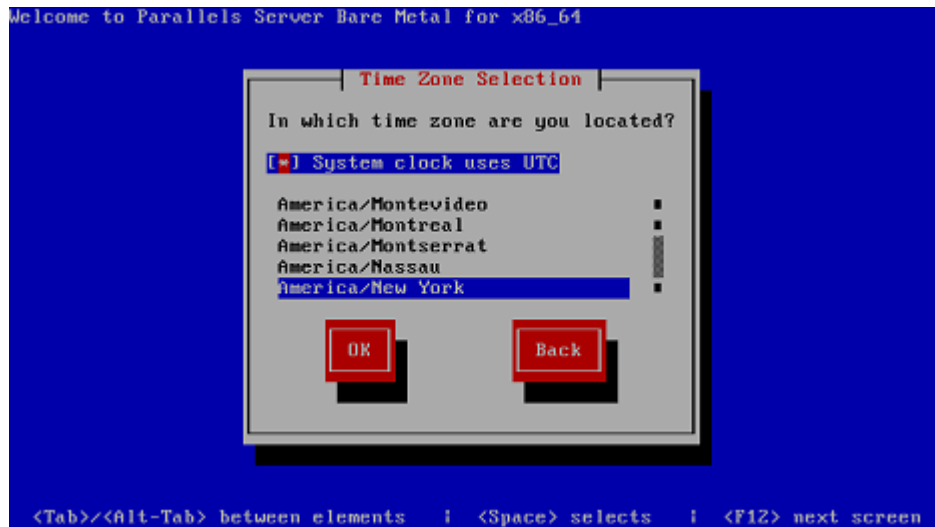
- 1 Configure the server to boot from the CD/DVD-ROM drive.
- 2 Insert a DVD containing the Parallels Server Bare Metal distribution set into the server's CD/DVD-ROM drive, and restart the server.
- 3 When the server boots, press the Esc key on your keyboard.
- 4 At the boot prompt, type `linux text`, and press Enter.



- 5 Read the Parallels end user license agreement, select **OK**, and press Enter.



- 6 Accept the license agreement by selecting **Agree** in the displayed window and pressing Enter.
- 7 In the **Time Zone Selection** window, select the time zone to use. You can also select **System clock uses UTC** to set your system to UTC (Universal Time Coordinated), which makes it automatically switch between normal and daylight savings time. When finished, select **Next**, and press Enter.

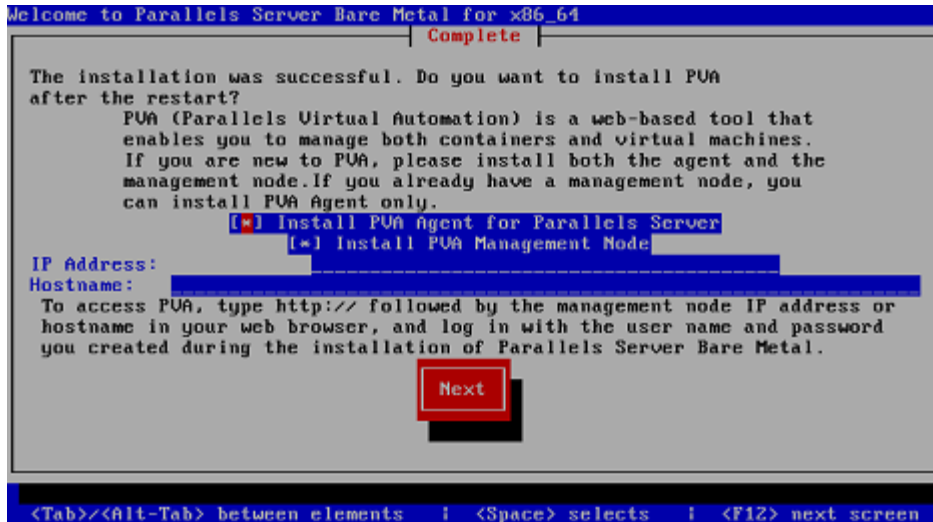


- 8 On the next screen, you are prompted to enter the Parallels Server Bare Metal license. Every physical server must have its own license installed. Licenses are issued by Parallels and needed to start using Parallels Server Bare Metal on your server. Type the product key for Parallels Server Bare Metal in the field provided, select **Next**, and press Enter.



You can also proceed without entering the product key and install the license after the Parallels Server Bare Metal installation. However, if you skip this step, you will not be able to automatically install Parallels Virtual Automation and its components once the Parallels Server Bare Metal installation is complete. For more information on installing Parallels Virtual Automation, see the next step.

- 9 Choose the Parallels Virtual Automation components to install on your server. This screen is displayed only if you entered the license in the previous step and your license provides support for the Parallels Virtual Automation.



Leave the **Install PVA Agent for Parallels Server** and **Install PVA Management Node** check boxes selected to set up the Parallels Virtual Automation application and its components on the server. Using Parallels Virtual Automation, you can connect to the Parallels server and manage your virtual machines and Containers with your favorite browser.

If you select the check boxes, you need to specify a valid IP address in the **IP Address** field for a special Management Node and can also set its hostname in the **Hostname** field. Once the installation is complete, you can log in to Parallels Virtual Automation by opening `http://IP_address_or_hostname` in the browser and using the `root` user name and the password you specified in the previous step.

When the check boxes are selected, the Parallels Server Bare Metal installer performs the following operations after restarting the server:

- a Downloads the installation packages for Parallels Virtual Automation from the Parallels web site to the server. Notice that the download process may take some time, depending on the speed of your Internet connection.
- b Installs Parallels Virtual Automation and its component on the server and inside a specially created Container. The installation is automatically initiated once the installation packages are downloaded to the server and runs without your interaction.

If you do not want to install Parallels Virtual Automation and its components, clear the **Install PVA Agent for Parallels Server** and **Install PVA Management Node** check boxes, and click **Next**.

### Notes:

1. Your server must be connected to the Internet to download the Parallels Virtual Automation installation packages from the Parallels remote repository. Using alternative (local) repositories for downloading the Parallels Virtual Automation components is also supported but in kickstart files only. For more information, see the *Installation via PXE* document.

2. You can use Parallels Virtual Automation to manage Parallels servers only if your license allows you to do so. If the license does not support using Parallels Virtual Automation, the **Install PVA Agent for Parallels Server** and **Install PVA Management Node** options will be grayed out and you will not be able to select them. In this case, you must first upgrade your license and then install the Parallels Virtual Automation application manually. For more information, see **Installing Parallels Virtual Automation Manually** (p. 66).

3. For more information on setting up and using Parallels Virtual Automation, refer to **Using Parallels Virtual Automation** (p. 63).

**10** In the **Root Password** window, set the root password, confirm it, select **OK**, and press Enter to start the installation.

Wait while the installer installs Parallels Server Bare Metal on your server. You can view the installation progress in the **Package Installation** screen.

**11** Select the **Reboot** button, and press Enter to complete the installation.

## Upgrading to Parallels Server Bare Metal 5.0

If you are upgrading from an earlier version of Parallels Server Bare Metal, use the guidelines below.

### Upgrading in Graphical Mode

To upgrade Parallels Server Bare Metal in graphical mode, do the following:

- 1 Configure the server to boot from the CD/DVD-ROM drive.
- 2 Insert a DVD containing the Parallels Server Bare Metal distribution set into the server's CD/DVD-ROM drive and restart the server.
- 3 After the server boots, press Enter to choose the graphical installation mode.



- 4 Read and accept the Parallels end user license agreement. To do this, click **Next**, and in the displayed window, click **Agree**.

**Note:** If the installed version of Parallels Server Bare Metal is the same or newer than the version you are trying to install, you will be presented with the corresponding message. In this case, you can either reinstall the system (click **Yes**) or cancel the upgrade (click **Reboot**).

- 5 Next, the installation program checks for existing installations of Parallels Server Bare Metal. If it finds any, the following window appears.



Select the **Upgrade an Existing Installation** option, and click **Next**. If you have more than one installation of Parallels Server Bare Metal on your physical server, choose the necessary installation on the drop-down menu.

- 6 Follow the on-screen instructions to install Parallels Server Bare Metal.

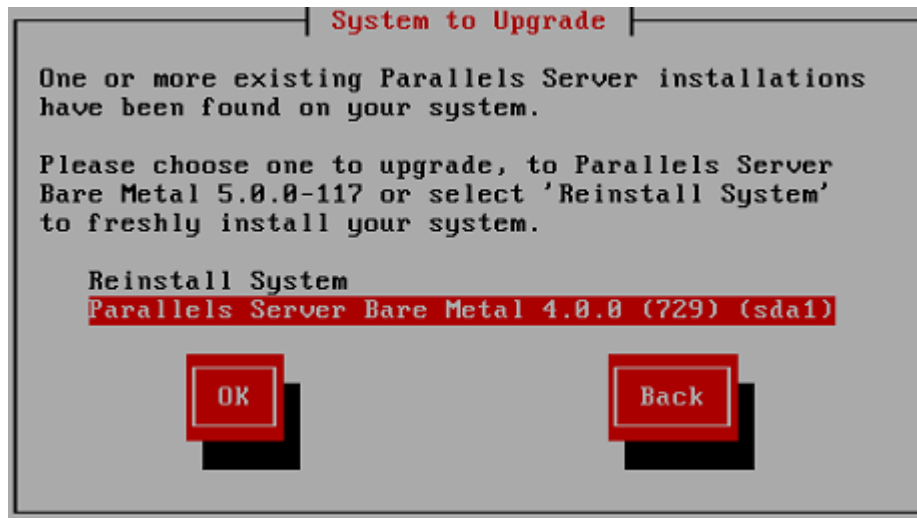
## Upgrading in Text Mode

To upgrade Parallels Server Bare Metal in text mode, do the following:

- 1 Configure the server to boot from the CD/DVD-ROM drive.
- 2 Insert a DVD containing the Parallels Server Bare Metal distribution set into the server's CD/DVD-ROM drive, and restart the server.
- 3 When the server boots, press the Esc key on your keyboard.
- 4 At the boot prompt, type `linux text`, and press Enter
- 5 Read the Parallels end user license agreement, select **Next**, and press Enter. Accept the license agreement by selecting **Agree** in the displayed window and pressing Enter.

**Note:** If the installed version of Parallels Server Bare Metal is the same or newer than the version you are trying to install, you will be presented with the corresponding message. In this case, you can either reinstall the system (select **Yes** and press Enter) or cancel the upgrade (select **Reboot** and press Enter).

- 6 Next, the installation program checks for existing installations of Parallels Server Bare Metal. If it finds any, you are presented with this window.



Select the name of the Parallels Server Bare Metal version you want to upgrade, then select **OK**, and press Enter.

- 7 Follow the on-screen instructions to install Parallels Server Bare Metal.

### Upgrading using a PXE Server

You can also upgrade Parallels Server Bare Metal over a network using a PXE (Preboot Execution Environment) server. To upgrade Parallels Server Bare Metal 5.0 over a network, you need to complete the following steps:

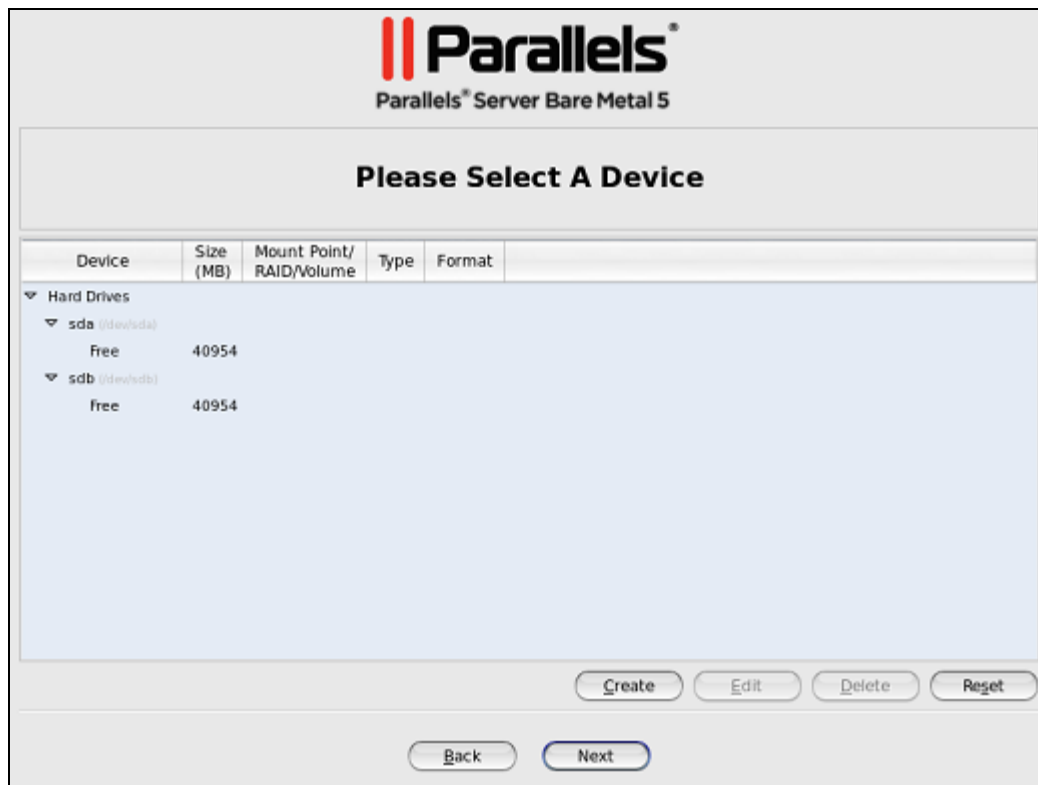
- 1 Prepare for installation from a PXE server.
- 2 Create a kickstart file. This step is only required if you plan to automate the procedure of deploying Parallels Server Bare Metal on your servers.
- 3 Upgrade Parallels Server Bare Metal.

For detailed information on performing these steps, consult the *Installation via PXE Server* guide.

## Creating Software RAIDs

A software RAID consists of two or more physical hard disks combined to act as a single logical unit. Software RAIDs are created using special software and are meant for improving the disk performance and providing fault tolerance from disk errors.

You can create software RAIDs when installing Parallels Server Bare Metal on your server. To do this, select the **Create custom layout** radio button in the **Partitioning** window, and click **Next**. The main partitioning window appears:



The process of creating software RAIDs is similar to that used to create software RAIDs in most modern Linux distributions (e.g., Red Hat Enterprise Linux or CentOS) and includes the following stages:

- 1 Making software RAID partitions.
- 2 Creating RAID arrays (or devices) from the newly made software RAID partitions.

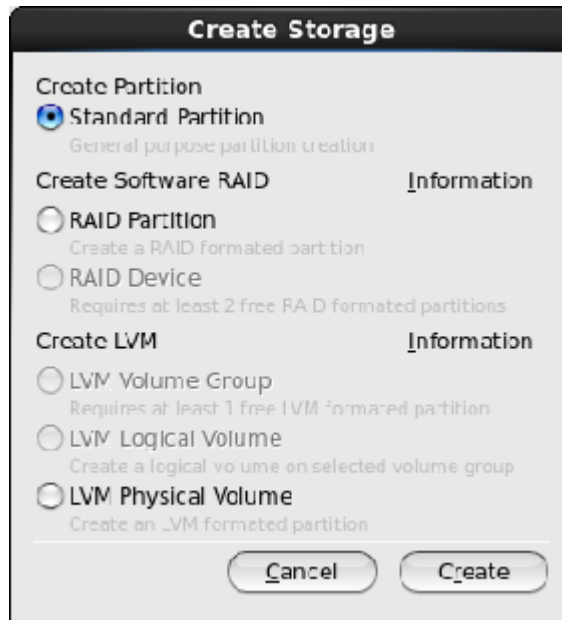
This section describes how to create a software RAID for the `/vz` partition when running the Parallels Server Bare Metal installer in the graphical mode. However, you can easily adapt the procedures shown here to create software RAIDs for other partitions (e.g., for the root partition) in both the graphical and text modes.

## Making software RAID partitions

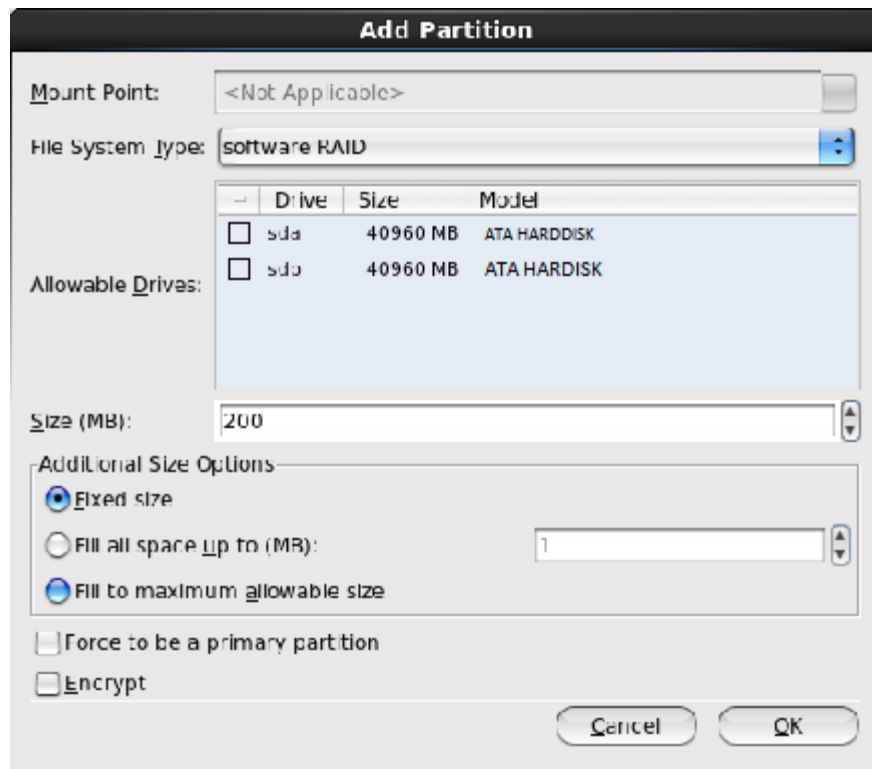
In the first step, you need to create two or more identical software RAID partitions for the `/vz` partition. These RAID partitions will then be used as the basis for making a RAID array.

To create a software RAID partition:

- 1 Click the **Create** button on the **Please Select a Device** screen.

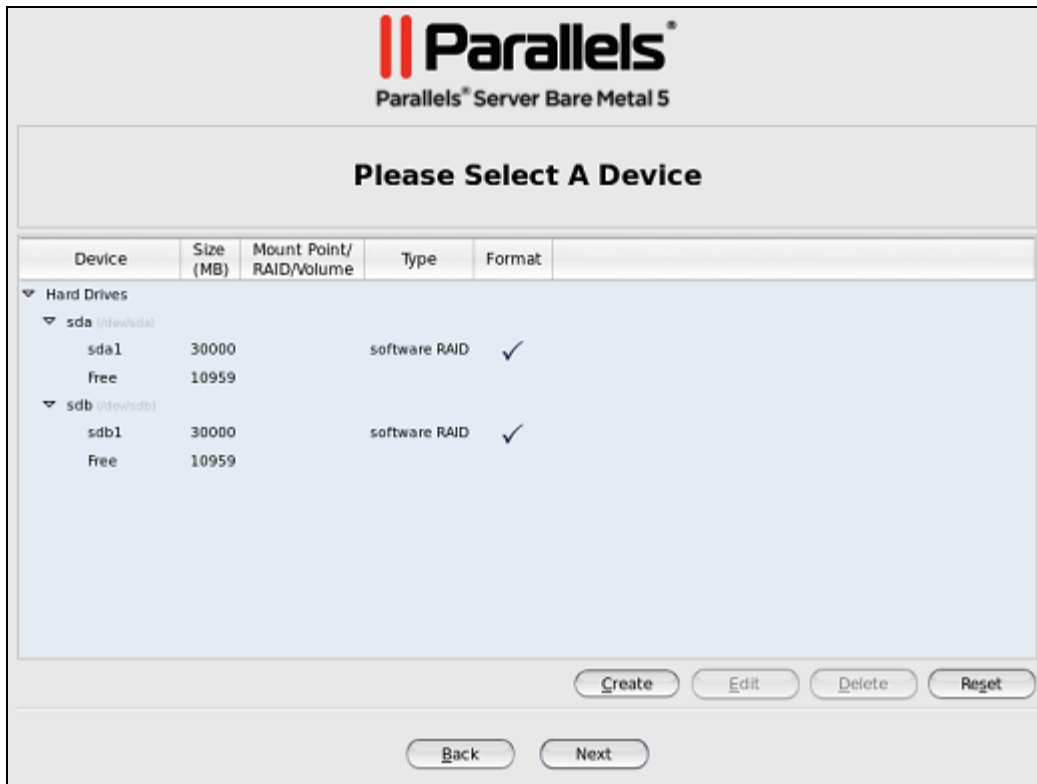


- 2 On the **Create Storage** screen, select the **RAID Partition** radio button, and click **Create**.



- 3 In the **Allowable Drives** section, select the check box of the drive you want to use for the RAID. Make sure the check boxes of all the other drives are cleared. This is necessary because a software RAID partition can be situated on one disk drive only.
- 4 In the **Size** field, specify the size for the /vz partition. The /vz partition is intended to store all virtual machines and Containers data and should occupy as much disk space as possible.
- 5 Select **Force to be a primary partition** if you want to make the /vz partition a primary partition.
- 6 Click **OK**. The newly created software RAID partition will appear in the main partitioning window.

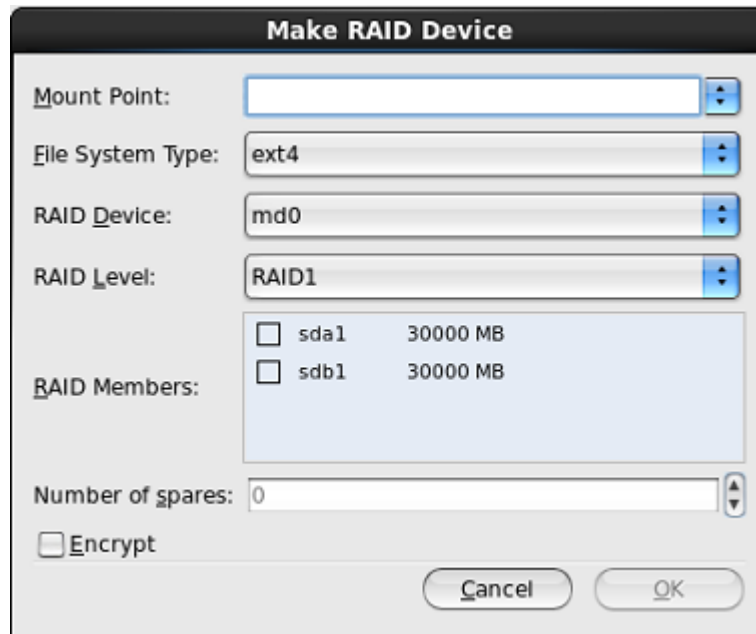
Repeat the steps above to create other software RAID partitions for the /vz partition. Their number can differ depending on the RAID configuration you want to implement. For example, if you are going to deploy the RAID 1 configuration where 2 mirrored hard drives are used, you need to create one more software RAID. Once you create it, your window should look like the following:



## Creating RAID devices

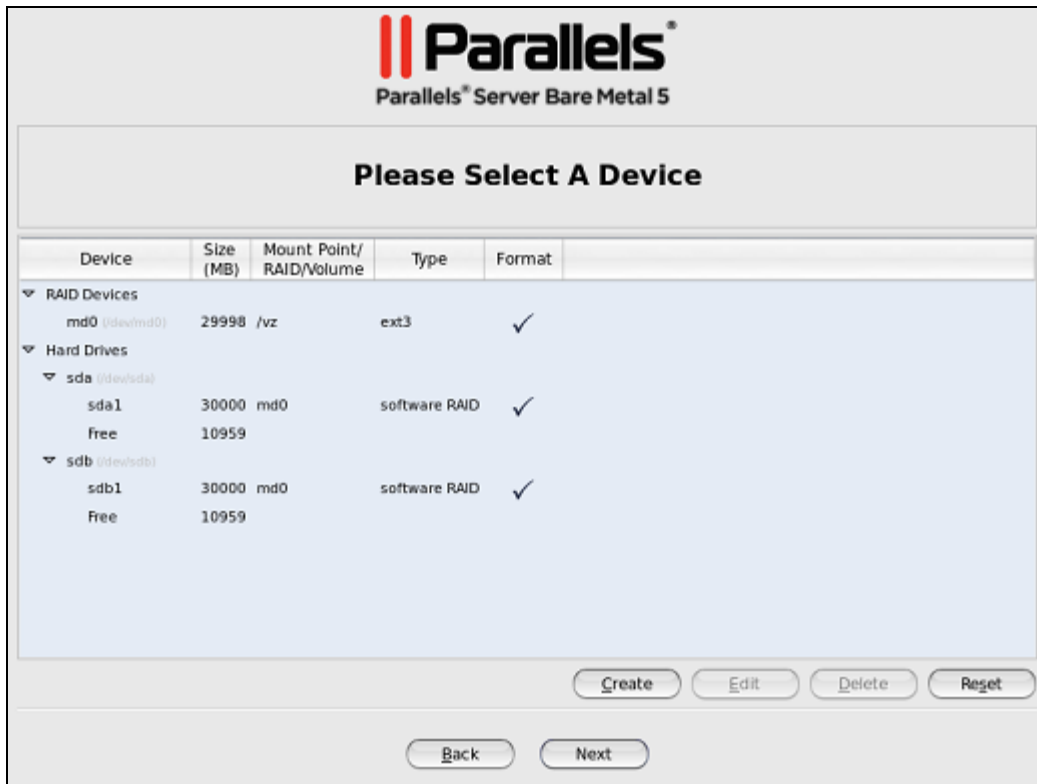
Now that you have created the necessary RAID partitions for the /vz partition, you can make a RAID array on their basis. To do this:

- 1 On the **Please Select a Device** screen, click the **Create** button.
- 2 On the Create Storage screen, select the **RAID Device** radio button, and click **Next**.



- 3** In the **Make RAID Device** dialog, set the following parameters for the RAID device:
- Specify a mount point in the **Mount Point** field. In our case, the mount point should be `/vz`.
  - Choose the filesystem type for the array in the **File System Type** field. `ext3` is the recommended filesystem type to use on servers running Parallels Server Bare Metal.
  - Select a name for the RAID array in the **RAID Device** field. You can leave the name offered by default or specify your own one.
  - Choose the RAID level in the **RAID Level** field. For the `/vz` partition, you can choose any of the RAID levels available in the drop-down menu.
  - The **RAID Members** section lists all your software RAID partitions. Select the check boxes next to the RAID partitions you created for the `/vz` partition.
  - Specify the number of spare partitions in the **Number of spares** field. Spare partitions can be configured in RAID 1 and RAID 5 implementations only.

When you are done, click **OK**. The created RAID array appears in the **Devices** column under **RAID Devices**.



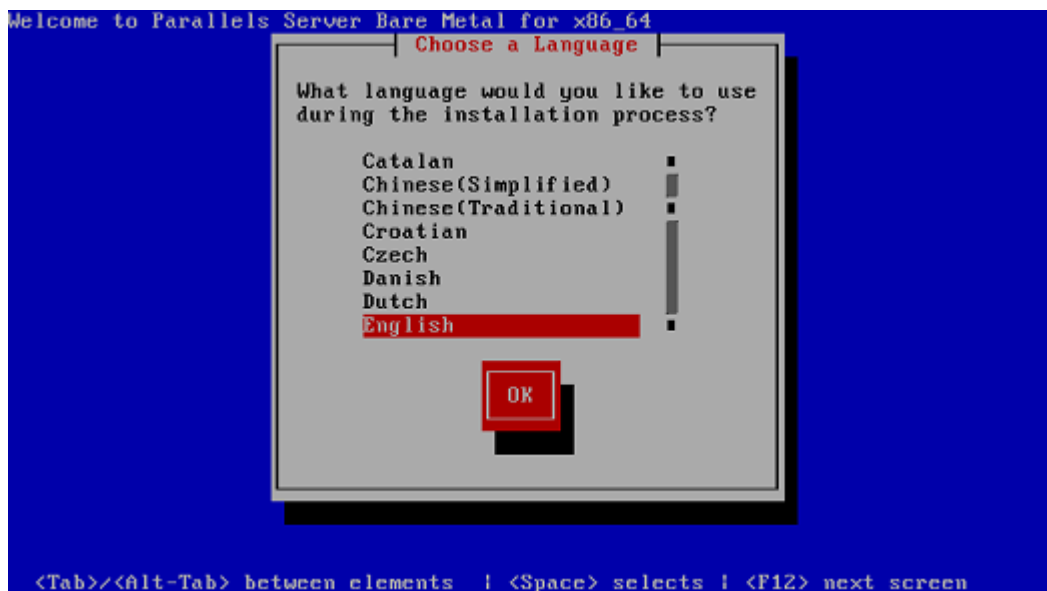
For more information on RAID's, see [https://raid.wiki.kernel.org/index.php/Linux\\_Raid](https://raid.wiki.kernel.org/index.php/Linux_Raid).

## Booting Into Rescue Mode

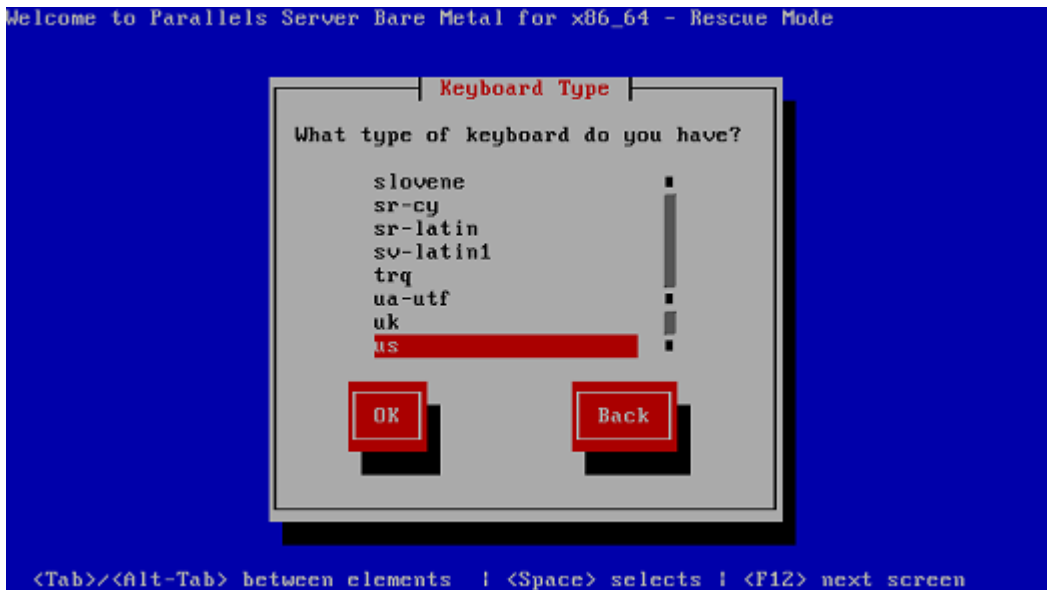
If you experience a problem with your system, you can boot into rescue mode and try to troubleshoot your problem. Once you are in the rescue mode, your Parallels Server Bare Metal installation is mounted under `/mnt/sysimage`, and you can go to this directory and make the necessary changes to your system.

To enter rescue mode, do the following:

- 1 Configure the server to boot from the CD/DVD-ROM drive.
- 2 Insert a DVD containing the Parallels Server Bare Metal distribution set into the server's CD/DVD-ROM drive, and restart the server.
- 3 After the server boots, choose the **Rescue installed system** option, and press Enter.
- 4 Choose the language to use when you are working in rescue mode.



- 5 Choose the type of keyboard.



- 6 Choose the media that contains the Parallels Server Bare Metal distribution.

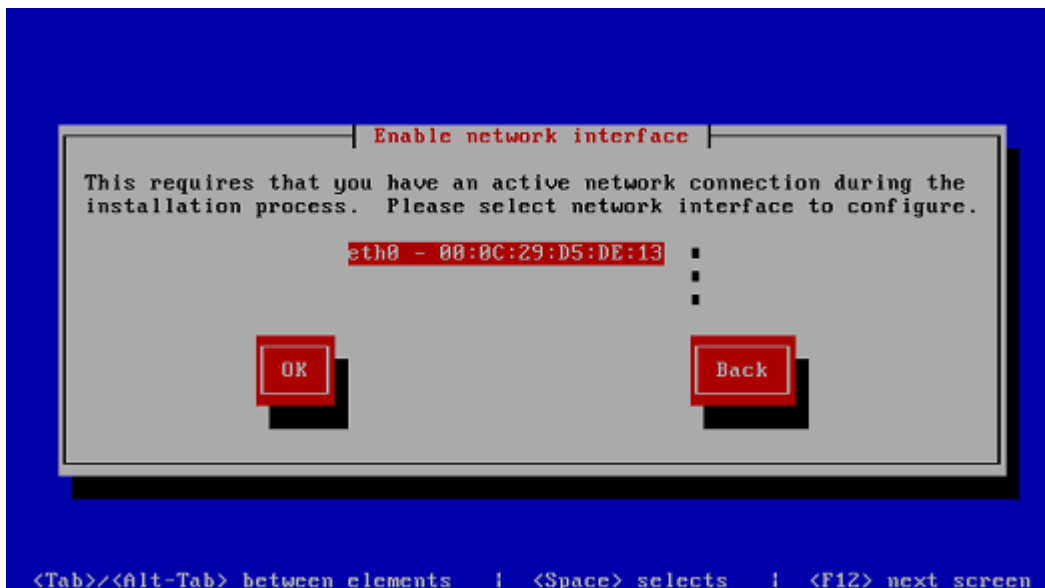


- 7 In the **Setup Networking** window, decide whether or not to start the network devices installed on the server.

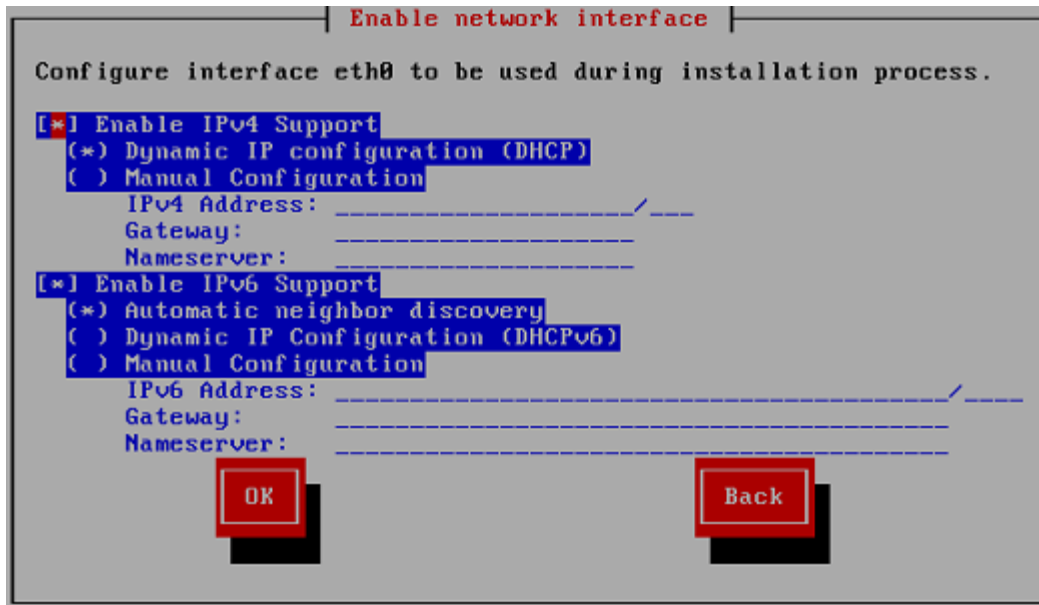


Select **Yes**, and press Enter if you want to start the network devices. Otherwise, select **No**, and click Enter.

- 8 If you choose to start your network devices, you are prompted to configure their settings. Refer to **Configuring Network Settings** for information on configuring network settings. First, choose the network card to configure.

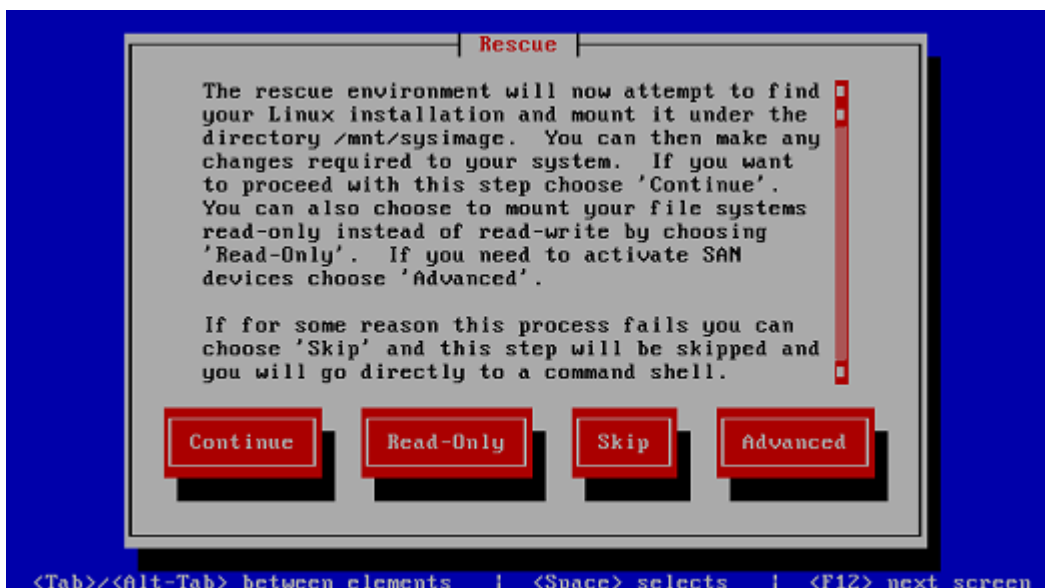


Then, configure its settings.



9 The **Rescue** window informs you of what will be done when entering the rescue mode. Read the information carefully before proceeding. You can choose one of the following options to work in the rescue mode:

- **Continue.** Choose this option to mount your filesystem in read and write mode under /mnt/sysimage.
- **Read-Only.** Choose this option to mount your filesystem in read-only mode under /mnt/sysimage.
- **Skip.** Choose this option your filesystem cannot be mounted; for example, when it is corrupted.
- **Advanced.** Choose this option to activate SAN devices.



**10** Once your filesystem is in the rescue mode, you are presented with the **Rescue** window informing you of this fact and providing further instructions on working in this mode. Read the instructions carefully, and press Enter.

**11** In a prompt that appears, run this command to change to the root partition of your filesystem:

```
# chroot /mnt/sysimage
```

Now you can run commands and try to fix the problem you are experiencing.

**Note:** If you choose the **Skip** option, you can try to manually mount your filesystem using the `mount` utility.

**12** After you fix the problem, run the `exit` command to exit the `chroot` environment, and restart the system.

# Running Parallels Server Bare Metal 5.0 in Virtual Machines

Starting with version 5, you can install Parallels Server Bare Metal in virtual machines. Running Parallels Server Bare Metal 5.0 in a virtual machine may prove useful if you want to evaluate the product but do not have a spare physical server.

To run virtual machines with Parallels Server Bare Metal 5.0, a physical server must meet the following requirements:

*Have the following architecture:*

- Intel with VT-x and EPT (Nehalem, Westmere, SandyBridge)
- AMD SVM and RVI (Barcelona, MagnyCore, Bulldozer)

*Run one of the following products:*

- Parallels Desktop for Mac 7
- Parallels Workstation for Windows 6
- Parallels Workstation for Linux 6
- VMware Fusion 3

## Recommended Virtual Machine Configuration

A virtual machine is best optimized for use with Parallels Server Bare Metal 5.0 if it has the following configuration:

- CPU:  
2 or more virtual CPUs
- Memory:  
2 GB or more RAM
- Hard disk:  
40 GB or more disk space; the disk must be of the plain type.

The process of installing Parallels Server Bare Metal in a virtual machine does not differ from that you use to install the product on a standalone server. For detailed installation instructions, refer to the *Parallels Server Bare Metal 5.0 Installation Guide*.

## Restrictions and Peculiarities

When using Parallels Server Bare Metal in a virtualized environment, keep in mind the following restrictions and specifics:

- Running Parallels Server Bare Metal in a virtual machine is intended for evaluation purposes only. You are not recommended to use such installations in production.
- If you change the configuration of a virtual machine where Parallels Server Bare Metal is installed, you may need to reactivate the product.
- VMware Fusion may show a warning when you start a virtual machine with Parallels Server Bare Metal that it requires full access to the network traffic. Ignore this message, and proceed with booting the virtual machine.
- To run in a virtualized Parallels Server Bare Metal environment, a virtual machine must have Parallels Tools installed. So before starting a virtual machine for the first time, make sure that you have installed Parallels Tools in it.
- Virtual machines may run only 32-bit operating systems and have only one CPU.

## CHAPTER 4

# Starting to Work in Parallels Server Bare Metal 5.0

After you restart the Parallels server, you will see a screen providing instructions on how to start working in Parallels Server Bare Metal 5.0.

```
Dear Parallels user!  
Use the following hostname and IP address  
to connect to this server:  
  
(192.168.124.136)  
  
To download the management software for  
Parallels Server Bare Metal, go to  
http://192.168.124.136/  
  
Mon Aug  8 11:21:45 EDT 2011  
localhost login: _
```

You can manage Parallels Server Bare Metal using these tools:

- Parallels command line utilities
- Parallels Management Console
- Parallels Virtual Automation

Detailed information on both tools is given in the following sections.

### In This Chapter

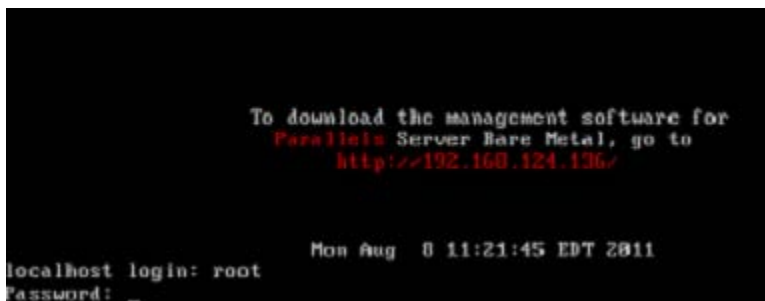
Using CLI .....	55
Using Parallels Management Console .....	56
Using Parallels Virtual Automation .....	63

## Using CLI

Parallels Server Bare Metal provides a set of utilities that allow you to manage Parallels virtual machines and Containers both locally and remotely.

### Connecting to Parallels Server Bare Metal Locally

To manage your virtual machines and Containers locally, i.e. from the same server where Parallels Server Bare Metal is installed, log in to the server by typing the `root` username and the password you provided when installing Parallels Server Bare Metal at the bottom of the welcome screen.



After you have successfully logged in to the server, you will see a command prompt and can start creating and managing your Parallels virtual machines and Containers using Parallels command line utilities.

### Connecting to Parallels Server Bare Metal Remotely

To connect to Parallels Server Bare Metal remotely, use the IP address or hostname indicated on the server's screen. For example, you can use a Secure Shell client to connect to your Parallels server. When logging in to the server, use the `root` user name and the password you provided when installing Parallels Server Bare Metal.

## Using Parallels Management Console

If you prefer working with GUI tools, you can set up Parallels Management Console to remotely connect to Parallels Server Bare Metal. However, this tool is intended for managing Parallels virtual machines only. So, if you need to create a Container or perform any operation on it, you should use the corresponding Parallels command line utilities.

To set up Parallels Management Console:

- 1** Make sure that the computer where you are going to install Parallels Management Console meets the necessary system requirements.
- 2** Download the Parallels Management Console installation file.
- 3** Install Parallels Management Console.
- 4** Launch Parallels Management Console and connect to the server with Parallels Server Bare Metal.

All these operations are explained in the following subsections in detail.

## Checking System Requirements

Parallels Management Console can be installed on any computer that meets the following requirements:

### Hardware Configuration

- 700+ MHz Intel-compatible x86 or x64 processor
- 1 GB of RAM
- 100 MB of hard disk space for Parallels Management Console installation files
- Ethernet or WiFi network adapter

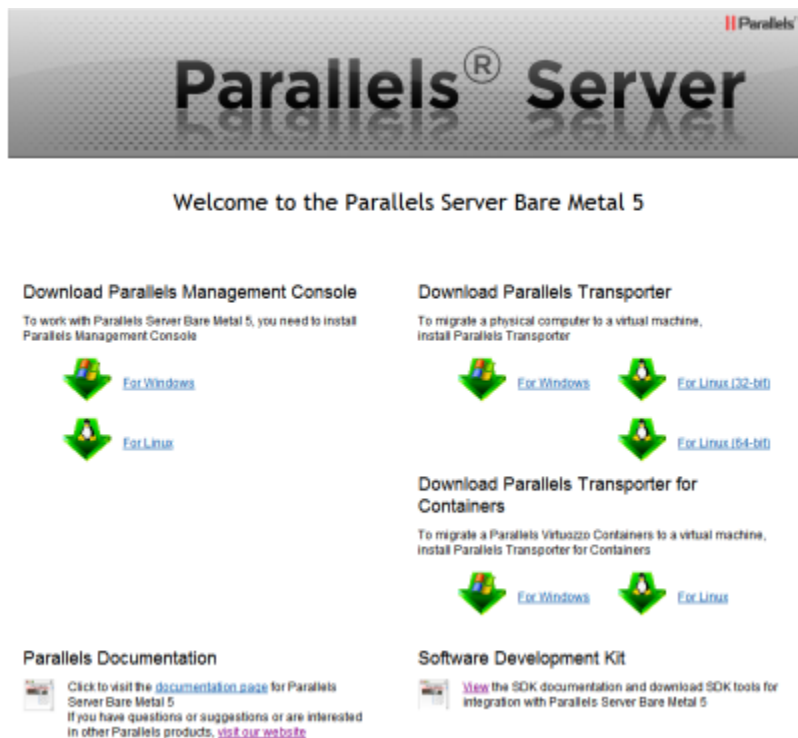
### Supported Operating Systems

Red Hat Enterprise Linux 6 (x86, x64)	SUSE Linux Enterprise Server 10 and 11 with Service Pack 1 (x86, x64)
Red Hat Enterprise Linux 5.5 and 5.6 (x86, x64)	Windows 7 with or without Service Pack 1 (x86, x64)
Red Hat Enterprise Linux 4.8 (x86, x64)	Windows Server 2008 R2 with Service Pack 1 (x64)
CentOS 5.5 and 5.6 (x86, x64)	Windows Server 2003 Service Pack 2 or R2 (x86, x64)
CentOS 4.8 (x86, x64)	Windows XP with Service Pack 3 (x86, x64)
Ubuntu Server 10.04 and 10.10 (x86, x64)	Windows Vista with Service Pack 2 (x86, x64)

## Downloading Parallels Management Console

After checking the installation requirements, you should obtain the Parallels Management Console installation file. To do this:

- 1 Ensure that the server with Parallels Server Bare Metal can be accessed over the network.
- 2 On a computer connected to the network, open your favorite browser and type the IP address or hostname of the Parallels server running Parallels Server Bare Metal. You will be presented with the following window:



- 3 Under **Download Parallels Management Console**, click the link corresponding to your system architecture:
  - **For Windows.** Click this link to download the Parallels Management Console installation file for installing on Windows computers.
  - **For Linux.** Click this link to download the Parallels Management Console installation file for installing on Linux computers.
- 4 Download the file.
- 5 If you wish to install Parallels Management Computer on another computer, transfer the file to that computer.

## Installing Parallels Management Console

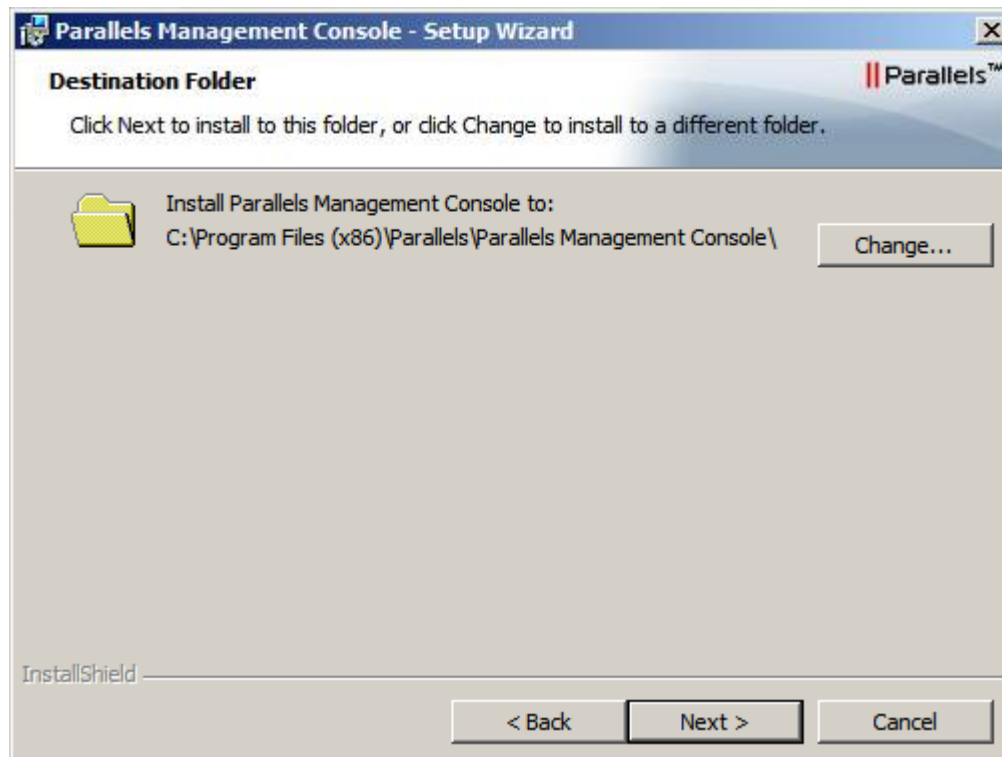
The process of installing Parallels Management Console differs depending on the operating system installed on your computer.

### Installing on Windows Computers

- 1 Locate the Parallels Management Console installation file, and double-click it to launch the **Parallels Management Console Setup** wizard.
- 2 In the **Welcome** window, click **Next**.
- 3 In the **License Agreement** window, carefully read the end user license agreement for Parallels products. If you agree with the terms of the license agreement, select **I accept the terms in the license agreement**, and click **Next**. If you want to print the text of the license agreement for your records, click **Print**.

**Note:** You must accept the license agreement to proceed with the installation.

- 4 In the **Destination Folder** window, specify the folder where you want to install Parallels Management Console, and click **Next**. By default, Parallels Management Console is installed to C:\Program Files\Parallels\Parallels Management Console.



- 5 In the **Ready to Install the Program**, click **Install** to start installing Parallels Management Console. You can view the installation progress in the **Setup Status** window.
- 6 Once the installation is complete, click **Finish** to exit the wizard.

## Installing on Linux Computers

- 1** Locate the installation package and launch the `parallels-management-console-4.0.XXXX.XXXX.run` file to run the Parallels Management Console Installer. You can also run this file in terminal.
- 2** Confirm your wish to install Parallels Management Console by clicking **Run** when prompted. Wait until the process of uncompressing Parallels Management Console is complete and the Installer launches.
- 3** In the **Welcome** window, select **Next**.
- 4** In the **License Agreement** window, carefully read the end user license agreement. If you agree with the terms of the license agreement, select **I accept the terms in the license agreement** and click **Next**. If you want to print the text of the license agreement for your records, click **Print**.

**Note:** You must accept the license agreement to proceed with the installation.

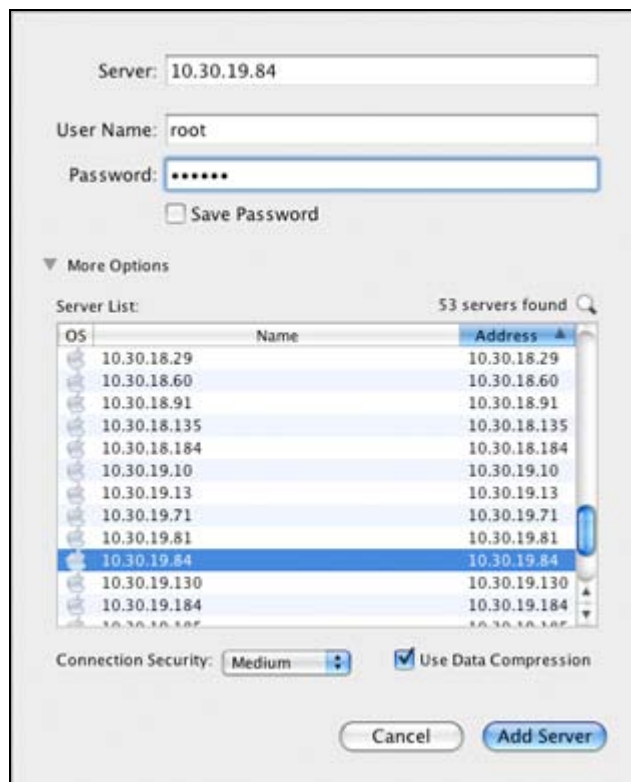
- 5** In the **Installation Completed** window, click **Exit** to quit the Installer.
- 6** By default, Parallels Management Console is installed to `/usr/lib/parallels-management-console`. To launch Parallels Management Console, start a terminal and execute `pmc-standalone`.

## Connecting to Parallels Server Bare Metal

Now that you have installed Parallels Management Console, you can connect to the server where Parallels Server Bare Metal is installed. Do the following:

- 1 Launch Parallels Management Console:
  - On Windows, click **Start > All Programs > Parallels > Parallels Management Console > Parallels Management Console**.
  - On Linux, start a terminal and execute `pmc-standalone`.
- 2 In the Parallels Management Console main window, click **Connect to Parallels Server**.
- 3 In the **Parallels Server Login** dialog, specify the parameters to be used to log in to the Parallels server:
  - In the **Server** list, type the IP address or hostname of the Parallels server.
  - In the **User Name** field, type `root`. You must use the root account to log in to the Parallels server.
  - In the **Password** field, type the password for the root user. Use the password you specified when installing Parallels Server Bare Metal on the server.

If you want Parallels Management Console to remember your login and password, select the **Save Password** option. With this option selected, you do not need to specify the root credentials each time you connect to the server.



- 4 Click **Add Server** to establish connection to the Parallels server.

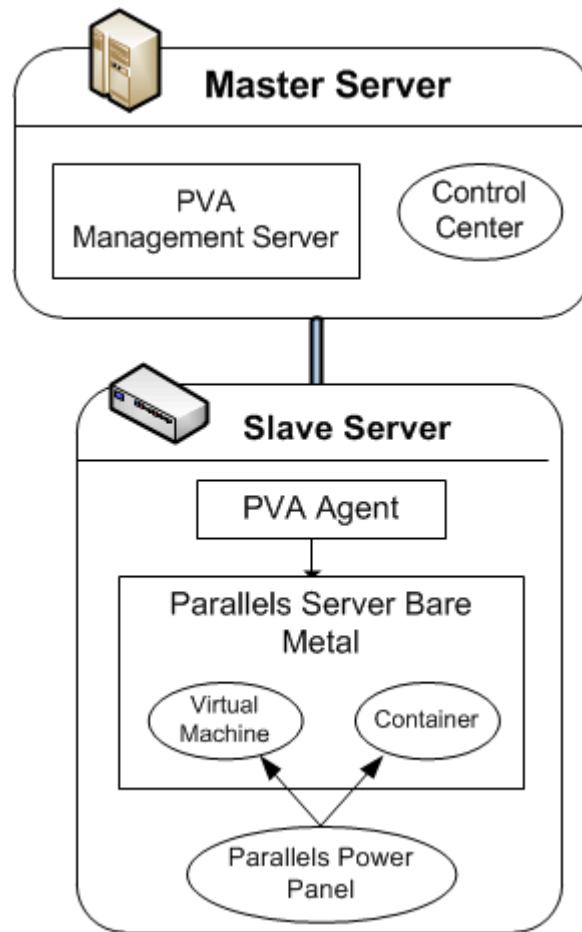
After the server has been successfully registered in Parallels Management Console, it appears in the left menu of the Parallels Management Console main window. For further information on using Parallels Management Console, refer to the *Parallels Management Console User's Guide*.

## Using Parallels Virtual Automation

Parallels Virtual Automation is a flexible and easy-to-use administration tool for managing servers with Parallels Server Bare Metal and virtual machines and Containers residing on these servers. Once you set up Parallels Virtual Automation, you can use it to connect to your Parallel servers with a standard web browser on any platform. Parallels Virtual Automation includes the following components:

- *PVA Management Server (or Master Server or Management Node)*. This is a physical server that ensures the communication between the server running Parallels Server Bare Metal (known as *Slave Server*) and the Parallels Virtual Automation application. The Master Server keeps a database with the information about all registered Slave Servers.
- *Control Center*. This is a front-end to the Parallels Virtual Automation application. You see Control Center in the browser window when you log it to the Slave Server using Parallels Virtual Automation.
- *PVA Agent*. This is a special agent installed on a Slave Server and ensuring the interaction between the Slave Server, the Master Server, and your client computer (i.e. the computer you use to connect to the Slave Server). Without this component, a server cannot be registered in Management Server.
- *Slave Server*. This is a physical server running the Parallels Server Bare Metal software and hosting a number of virtual machines and Containers. You use Control Center to log in to the Slave Server and manage your virtual machines and Containers.
- *Parallels Power Panel*. This is a tool installed on the Slave Server and used for managing particular virtual machines and Containers.

Graphically, a typical system with Parallels Virtual Automation can be represented as follows.



## Setting Up Parallels Virtual Automation

Parallels Virtual Automation is automatically set up on your server during the Parallels Server Bare Metal installation, provided you select the **Install PVA Agent for Parallels Server** and **Install PVA Management Node** options in the **Congratulations** window of the Parallels Server Bare Metal installer. During the setup procedure, the installer performs the following operations:

- Installs the PVA Agent component, including Parallels Power Panel, on the server. After that, the server starts acting as the Slave Server.
- Creates a special Container on the server and installs the PVA Management Server and Control Center components inside the Container. Once the Container is created and the components are installed, the Container starts acting as the Master Server.

The last point needs further explanation. The PVA Management Server and Control Center components cannot be installed directly on a server with Parallels Server Bare Metal. Instead, a special Container is automatically created during the Parallels Server Bare Metal installation where these components are installed. The Container is created with the following configuration:

- The Container is running the CentOS operating system.
- The amount of disk space inside the Container is set to 10 GB.
- The root account is automatically created inside the Container. The root password is automatically set to that you specify during the Parallels Server Bare Metal installation for logging in to the server.
- The Container can be accessed by the IP address and hostname you provide in the **Congratulations** window of the Parallels Server Bare Metal installer.
- The Container uses the same DNS server you specify for the Parallels server during the Parallels Server Bare Metal installation.

## Installing Parallels Virtual Automation Manually

During the Parallels Server Bare Metal installation, the Parallels Virtual Automation application is not installed on the server in the following cases:

- You skipped the step of installing the license.
- Your license does not allow you to use Parallels Virtual Automation.
- You had no Internet connection when installing Parallels Server Bare Metal or the connection got broken for some reason.

Later on, if you make up your mind to use Parallels Virtual Automation for managing Parallels servers and their virtual machines and Containers, you can install this application manually by doing the following:

- 1** Obtain the appropriate license from Parallels. This step is required only if your license does not support using Parallels Virtual Automation.
- 2** Install the license on the server using Parallels Management Console or the `vzlicload` utility. For information on installing licenses using these tools, see the *Parallels Management Console User's Guide* and *Parallels Server Bare Metal 5.0 User's Guide*, respectively.
- 3** Once the license is installed, create the `pva_opt.cfg` file, open it for editing, and specify the following options:
  - `PVA_AGENT=1` if you want to install the PVA Agent components or `PVA_AGENT=0` if you do not want to.
  - `PVA_MN=1` if you want to install the PVA Management Server and Control Center components or `PVA_MN=0` if you do not want to.
  - `PASSWD="XXXXXX"` where `XXXXXX` is the password of the root user on the Parallels server (you set this password during the Parallels Server Bare Metal installation). This option is mandatory if you choose to install PVA Management Server and Control Center components.
  - `PVA_IP="X.X.X.X"` where `X.X.X.X` is the IP address to be assigned to the Management Node. You will then use this IP address to log in to the Management Node. This option is mandatory if you choose to install PVA Management Server and Control Center components.

**Note:** The Management Node must be assigned a public IP address to download the installation files from the Parallels remote repository. Using alternative (local) repositories for downloading the Management Node installation files is also supported but via kickstart files only. For more information, see the *Installation via PXE* document.

- `PVA_HOSTNAME="hostname"` where `hostname` is the hostname to be assigned to the Management Node. This option is mandatory if you choose to install PVA Management Server and Control Center components
- 4** Make sure the Parallels server is connected to the Internet.

- 5 In a terminal, change to the directory where the `pva_opt.cfg` file is located, and run this command:

```
# /usr/libexec/pva-setup.sh --install pva_opt.cfg
```

## Connecting to a Server

To connect to a server using Parallels Virtual Automation, do the following:

- 1 On any computer, open your favorite web browser.
- 2 Make sure that the computer can access the server with Parallels Server Bare Metal over the network.
- 3 Type the IP address or hostname of the Container acting as the Master Server in the browser window (e.g. `http://123.124.125.126`).
- 4 Use the root credentials to log in to the Container (i.e. the root user name and the password you entered during the Parallels Server Bare Metal installation).

**Note:** For more information on using Parallels Virtual Automation for managing servers with Parallels Server Bare Metal, refer to the *Parallels Virtual Automation 4.5 User's Guide* (available at <http://www.parallels.com/products/pva45/resources/>).

## Glossary

This glossary defines terms and spells out abbreviations used in Parallels Server Bare Metal documentation. References to terms defined elsewhere in the glossary appear in italics.

**Application template.** A template used to install a set of applications in *Containers*. See also *Template*.

**Container (or regular Container).** A virtual private server, which is functionally identical to an isolated standalone server, with its own IP addresses, processes, files, its own users database, its own configuration files, its own applications, system libraries, and so on. Containers share one *Parallels server* and one OS kernel. However, they are isolated from each other. A Container is a kind of ‘sandbox’ for processes and users.

**Guest operating system (Guest OS).** An operating system installed inside a virtual machine and Container. It can be any of the supported Windows or Linux operating systems.

**Hardware virtualization.** A virtualization technology allowing you to virtualize physical servers at the hardware level. Hardware virtualization provides the necessary environment for creating and managing Parallels virtual machines.

**Operating system virtualization (OS virtualization).** A virtualization technology allowing you to virtualize physical servers at the operating system (kernel) level. OS virtualization provides the necessary environment for creating and managing Parallels Containers.

**OS template (Operating System template).** A template used to create new *Containers* with a pre-installed operating system. See also *Template*.

**Package set.** See *Template*.

**Parallels Management Console.** A Parallels Server Bare Metal management and monitoring tool with graphical user interface. Parallels Management Console is cross-platform and can run on Microsoft Windows and Linux computers.

**Parallels Server.** A hardware virtualization solution that enables you to efficiently use your physical server's hardware resources by sharing them between multiple virtual machines created on this server.

**Parallels server (physical server or server).** A server where the Parallels Server Bare Metal software is installed for hosting Parallels virtual machines and Containers. Sometimes, it is marked as Container 0.

**Parallels Server Bare Metal license.** A special license that you should install on the physical server to be able to start using Parallels Server Bare Metal. Every physical server must have its own license installed.

**Parallels Virtuozzo Containers for Linux.** An operating system virtualization solution allowing you to create multiple isolated Containers on a single physical server to share hardware, licenses, and management effort with maximum efficiency.

**Private area.** A part of the file system storing *Container* files that are not shared with other *Containers*.

**Template (package set).** A set of original application files (packages) repackaged for mounting over Virtuozzo File System. There are two types of templates. OS Templates are used to create new *Containers* with a pre-installed operating system. Application templates are used to install an application or a set of applications in *Containers*.

**UBC.** An abbreviation of *User Beancounter*.

**User Beancounter.** The subsystem of the Parallels Server Bare Metal software for managing *Container* memory and some system-related resources.

**Virtual Environment (VE).** An obsolete designation of a *Container*.

**Virtuozzo File System (VZFS).** A virtual file system for mounting to *Container* private areas. VZFS symlinks are seen as real files inside *Containers*.

**Virtual machine (VM).** A computer emulated by Parallels Server Bare Metal. Like a *Container*, a virtual machine is functionally identical to an isolated standalone computer, with its own IP addresses, processes, files, its own users database, its own configuration files, its own applications, system libraries, and so on. However, as distinct from *Containers*, virtual machines run their own operating systems rather than sharing one operating system kernel.

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