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About Parallels Virtuozzo Containers 4.6

Parallels Virtuozzo Containers 4.6 is a patented OS virtualization solution. It creates isolated partitions, or Containers, on a single physical server and OS instance to utilize hardware, software, data center and management effort with maximum efficiency. The basic Parallels Virtuozzo Containers capabilities are:

- Intelligent Partitioning. Division of the server into as many as hundreds of Containers with full server functionality.
- Complete Isolation. Containers are secure and have complete functional, fault, and performance isolation.
- Dynamic Resource Allocation. The CPU, memory, network, disk and I/O resources can be adjusted without rebooting.
- Mass Management. The suite of tools and templates for automated, multi-Container and multi-server administration.

The diagram below represents a typical Parallels Virtuozzo Containers system structure:
The Parallels Virtuozzo Containers OS virtualization model is streamlined for the best performance, management, and efficiency. At the base resides a standard Windows host operating system. Next is the virtualization layer with a proprietary file system and a kernel service abstraction layer that ensure the isolation and security of resources between different Containers. The virtualization layer makes each Container appear as a standalone server. Finally, the Container itself houses the applications and workload.

The Parallels Virtuozzo Containers OS virtualization solution has the highest efficiency and manageability, making it the best solution for organizations concerned with containing the IT infrastructure and maximizing resource utilization. The complete set of management tools and unique architecture make Parallels Virtuozzo Containers the perfect solution for easily maintaining, monitoring, and managing virtualized server resources for consolidation and business continuity configurations.

About This Guide

This guide is meant to provide comprehensive information on Parallels Virtuozzo Containers 4.6—high-end server virtualization software for Windows-based servers. The issues discussed in this guide cover the necessary theoretical conceptions as well as practical aspects of working with Containers. The guide will familiarize you with the way to create and administer Containers on Parallels Virtuozzo Containers-based physical servers and to employ both the graphical and command line interfaces for performing various tasks.
Note: The guide does not familiarize you with the process of installing, configuring, and deploying your Parallels Virtuozzo Containers system. Detailed information on all these operations is provided in the *Parallels Virtuozzo Containers 4.6 Installation Guide*.

According to the task-oriented approach, most topics of this guide are devoted to a particular task and the ways to perform it. However, Parallels Virtuozzo Containers is equipped with as many as three different tools to perform various administrative tasks:

1. Parallels Management Console with graphical user interface. Management Console is considered the primary tool for administering Parallels Virtuozzo Containers and performing main administrative tasks on Hardware Nodes and in the Container context. Therefore, when describing the ways to perform this or that task, we have provided the corresponding procedures for Parallels Management Console only.

2. Parallels Virtuozzo Containers command line utilities. If you are used to working in the command line, you can turn to the *Parallels Virtuozzo Containers 4.6 Reference Guide* to learn to manage Hardware Nodes and Containers by means of Parallels Virtuozzo Containers command line utilities.

3. Parallels Virtual Automation with web interface. Parallels Virtual Automation, a web counterpart of Management Console, is provided with its own guide as well as a comprehensive online help system.

Besides, there is another tool for managing Containers - Parallels Power Panel. However, this tool is mainly regarded as a means for individual Container customers to manage their personal Containers and is therefore not described in this guide.

**Intended Audience**

The primary audience for this guide is anyone responsible for administering one or more systems running Parallels Virtuozzo Containers 4.6. To fully understand the major Parallels Virtuozzo Containers notions and learn to perform the main administrative operations, no more than basic Windows administration habits is required.

**Organization of This Guide**

**Chapter 2, Parallels Virtuozzo Containers Philosophy**, is a must-read chapter that helps you grasp the general principles of Parallels Virtuozzo Containers operation.

**Chapter 3, Managing Containers**, covers operations that you can perform on Containers by means of Parallels Management Console or Parallels Virtuozzo Containers utilities: creating and deleting Containers, starting and stopping them, migrating between Hardware Nodes, and do on.

**Chapter 4, Managing Resources**, focuses on configuring the resource control parameters for different Containers. These parameters include disk quotas, CPU time, and a set of memory-related resources.

**Chapter 5, Keeping Your Parallels Virtuozzo Containers System Up to Date**, provides information on the ways to keep all the software components of a Hardware Node up to date.

**Chapter 6, Managing Hardware Nodes**, concentrates on all those operations you as the Hardware Nodes administrator can perform on your Nodes.
Chapter 7, Logs and Monitors, explains the ways to keep track of all system events and the consumption of all kinds of resources by the running Containers and the Hardware Node itself.

Chapter 8, Managing Services and Processes, lists the operations you can perform on processes and services in Parallels Virtuozzo Containers by using the Parallels Management Console graphical interface and Parallels Virtuozzo Containers command line utilities.

Chapter 9, Managing Parallels Virtuozzo Containers Network, familiarizes you with the Parallels Virtuozzo Containers network structure, enumerates Parallels Virtuozzo Containers networking components, and explains how to manage these components in Parallels Virtuozzo Containers-based systems.

Chapter 10, Advanced Tasks, enumerates those tasks that are intended for advanced system administrators who would like to obtain deeper knowledge about Parallels Virtuozzo Containers capabilities.

Chapter 11, Troubleshooting, suggests ways to resolve common inconveniences should they occur during your work with Parallels Virtuozzo Containers.

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.

<table>
<thead>
<tr>
<th>Formatting convention</th>
<th>Type of Information</th>
<th>Example</th>
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</thead>
<tbody>
<tr>
<td><strong>Special Bold</strong></td>
<td>Items you must select, such as menu options, command buttons, or items in a list.</td>
<td>Go to the <strong>Resources</strong> tab.</td>
</tr>
<tr>
<td></td>
<td>Titles of chapters, sections, and subsections.</td>
<td>Read the <strong>Basic Administration</strong> chapter.</td>
</tr>
<tr>
<td><em>Italics</em></td>
<td>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.</td>
<td>These are the so-called <strong>OS templates</strong>.</td>
</tr>
<tr>
<td></td>
<td>To remove a Container, type <code>prlctl delete ctid</code>.</td>
<td></td>
</tr>
<tr>
<td><strong>Monospace</strong></td>
<td>The names of commands, files, and directories.</td>
<td>Use <code>prlctl start</code> to start a Container.</td>
</tr>
<tr>
<td><strong>Preformatted</strong></td>
<td>On-screen computer output in your command-line sessions; source code in XML, C++, or other programming languages.</td>
<td><code>Saved parameters for Container 101</code></td>
</tr>
<tr>
<td><strong>Monospace Bold</strong></td>
<td>What you type, as contrasted with on-screen computer output.</td>
<td><code>C:\vzlist -a</code></td>
</tr>
<tr>
<td><strong>Key+Key</strong></td>
<td>Key combinations for which you must press and hold down one key and then press another.</td>
<td>Ctrl+P, Alt+F4</td>
</tr>
</tbody>
</table>
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.

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**Getting Help**

In addition to this guide, there are a number of other resources available for Parallels Virtuozzo Containers 4.6 which can help you use the product more effectively. These resources include:

- **Getting Started With Parallels Virtuozzo Containers 4.6.** This guide provides basic information on how to install Parallels Virtuozzo Containers 4.6 on your server, create new Containers, and perform main operations on them.

- **Parallels Virtuozzo Containers 4.6 Installation Guide.** This guide provides exhaustive information on the process of installing, configuring, and deploying your Parallels Virtuozzo Containers system. Unlike the Getting Started With Parallels Virtuozzo Containers 4.6 guide, it contains a more detailed description of all the operations needed to install and set Parallels Virtuozzo Containers 4.6 to work, including planning the structure of your Parallels Virtuozzo Containers network, performing the Parallels Virtuozzo Containers unattended installation, etc. Besides, it does not include the description of any Container-related operations.

- **Parallels Virtuozzo Containers 4.6 Templates Management Guide.** This guide is meant to provide complete information on Parallels Virtuozzo Containers templates - an exclusive Parallels Virtuozzo Containers technology allowing you to efficiently deploy standard Windows applications inside your Containers and to greatly save the Hardware Node resources (physical memory, disk space, etc.).

- **Parallels Virtuozzo Containers 4.6 Reference Guide.** This guide is a complete reference on all Parallels Virtuozzo Containers configuration files and Hardware Node command-line utilities.

- **Parallels Management Console Help.** This help system provides detailed information on Parallels Management Console, a graphical user interface tool for managing Hardware Nodes and their Containers.

- **Parallels Virtual Automation Online Help.** This help system shows you how to work with Parallels Virtual Automation, a tool for managing Hardware Nodes and their Containers with the help of a standard Web browser on any platform.

- **Parallels Power Panel Online Help.** This help system deals with Parallels Power Panel, a means for administering individual Containers through a common Web browser on any platform.
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://sp.parallels.com/en/support/usersdoc/).
About Parallels Virtuozzo Containers

This section provides general information about Parallels Virtuozzo Containers and its applications.

What is Parallels Virtuozzo Containers

Parallels Virtuozzo Containers 4.6 is a complete server automation and virtualization solution based on a patented technology developed by Parallels. On a single physical server, Parallels Virtuozzo Containers creates multiple isolated Containers which share hardware, licenses, and management effort with maximum efficiency. For its users, each Container performs exactly like a standalone server. It can be rebooted independently and has its own Administrator access, Active Directory domain users, IP addresses, memory, processes, files, applications, system libraries, and configuration files. The light overhead and efficient design of Parallels Virtuozzo Containers makes it the right virtualization choice for production servers with live applications and real-life data.

The key capabilities of Parallels Virtuozzo Containers are:

- **Intelligent Partitioning.** Divides a server into as many as hundreds of Containers with full server functionality.
- **Complete Isolation.** Ensures that Containers are secure and have full functional, fault, and performance isolation.
- **Dynamic Resource Allocation.** Of key system resources such as CPU, memory, network, disk, and I/O enables almost real-time changes.
Live Migration and other business continuity capabilities ensure the data is available and recoverable.

Management Tools include a full suite of tools and templates for automated, multi-Container and multi-server administration.

What is a Container

A Container is a virtual private server that is functionally identical to an isolated standalone server:

- Each Container has its own processes, Active Directory domain users, files and provides full administrative access.
- Each Container has its own IP addresses, port numbers, filtering, and routing rules.
- Each Container can have its own configuration for system and application software, as well as its own versions of Dynamic Link Libraries (DLLs), system libraries, and registry. You can install or customize software packages inside a Container independently from other Containers or the host server. Multiple distributions of a package can be run on the same Windows box.
- Each Container has its own unique Administrator user with full control over the given Container and full access to other user accounts inside this Container.
- Each Container can be a member of a Windows domain (e.g., access any of the network shares to which the Container's user has rights). Moreover, any Container can act as a domain controller granting other Containers and standalone servers access to a set of network resources (applications, printers, etc.).

Applications of Parallels Virtuozzo Containers

Parallels Virtuozzo Containers 4.6 can be efficiently applied in a wide range of areas: enterprise server consolidation, Web and application hosting, software development and testing, user training, and so on.

If you administer a number of Windows servers within an enterprise, you can benefit from Parallels Virtuozzo Containers as follows:

- Reduce the number of required physical servers and corresponding support effort by grouping multiple servers into one without losing valuable information or compromising performance.
- Increase server utilization and maximize server potential.
- Provision servers in minutes by using Parallels Virtuozzo Containers templates.
- Migrate Containers in the time of network data transfer, nearly eliminating planned downtime and enabling fast reaction to unplanned downtime.
- Monitor OS and application versions and update software easily across all Hardware Nodes running Parallels Virtuozzo Containers and Containers hosted on those.
- Guarantee Quality-of-Service in accordance with the corporate service level agreement (SLA).
- Automate such routine tasks as updating.
- Minimize software license and support requirements.

Due to its unique efficiency and completeness, Parallels Virtuozzo Containers also has a wide variety of profitable uses for hosting service providers, allowing them to:
- Provide users with means of managing their Containers (Parallels Power Panel), including system backup/restore and monitoring tools.
- Have a multitude of customers with their individual full-featured Containers sharing a single physical server.
- Transparently move customers and their environments between servers without any manual reconfiguration.
- Increase profitability through better management and leverage of hardware and software investments.
- Automate service provisioning by using Parallels Virtuozzo Containers templates.

Besides, Parallels Virtuozzo Containers proves invaluable for IT educational institutions that can now provide every student with a personal Windows server, which can be monitored and managed remotely. Software development companies may also use Containers for testing purposes and the like.

## Distinctive Features of Parallels Virtuozzo Containers

The concept of Parallels Virtuozzo Containers is distinct from the concept of traditional virtual machines in the respect that Containers always run the same OS kernel as the host server. This single-kernel implementation technology allows you to run Containers with nearly zero overhead. Thus, Parallels Virtuozzo Containers offers much higher efficiency and manageability than traditional virtualization technologies.

### OS Virtualization

From the point of view of applications and Container users, each Container is an independent system. The independence is provided by a virtualization layer over the kernel of the host OS. Only a small part of CPU resources (around 1-2%) is spent on virtualization at that. The main features of the virtualization layer implemented in Parallels Virtuozzo Containers 4.6 are the following:

- Each Container looks like a normal Windows system. No special modifications are required to run applications in Containers.
- Each Container has its own unique `Administrator` user with full control over the given Container. It can also have a number of other local users with different rights and permissions.
- Users can install third-party applications in their Containers.
- Each Container can be a member of an Active Directory domain and access network shares to which the Container user has rights. Moreover, each Container can act as an Active Directory domain controller granting other Containers and standalone servers access to a set of network resources (applications, printers, etc.).
- Containers are fully isolated from each other in respect of their users, processes, services, file systems, and installed applications.
- Containers share the same executable code, which greatly saves both RAM and disk space.
Processes belonging to a Container are scheduled for execution on all available CPUs. Consequently, Containers are not bound to only one CPU, and any application in each Container can use all available CPU power.

**Virtuozzo File System**

The Virtuozzo File System (VZFS) is a file system that allows multiple Containers to share common files without sacrificing security. Any Container user can modify, update, replace, and delete any file inside a Container as they would do it on an isolated standalone server. When a user modifies a shared file, VZFS creates a private copy of the file transparently for the user. Thus, the modifications do not affect the other users of the file.

The main benefits of VZFS are the following:

- Economy of memory required for executables and Dynamic Link Libraries (DLLs). A typical Container running a simple Website may consume around 30-50 megabytes of RAM just for executable images. Sharing this memory improves scalability and total system performance.
- Economy of disk space. A typical Windows Server installation may take up gigabytes of disk space. Sharing the system files allows you to save over 90% of disk space.

**Templates**

A template in Parallels Virtuozzo Containers 4.6 is a set of application files and registry settings installed on the host operating system in such a way as to be usable by any Container by mounting over Virtuozzo File System. Parallels Virtuozzo Containers provides tools for creating, installing, removing templates, adding templates to Containers, and so on. Using templates lets you:

- securely share RAM among similar applications running in different Containers to save hundreds of megabytes of memory;
- securely share template files among different Containers to save gigabytes of disk space;
- simultaneously install applications and patches in many Containers.

Parallels Virtuozzo Containers has two types of templates: OS templates and application templates:

- An OS template includes an operating system and a standard set of applications available right after installation. Parallels Virtuozzo Containers uses OS templates to create new Containers with a pre-installed operating system.
- An application template is a set of application files and corresponding registry settings. Parallels Virtuozzo Containers uses application templates to add extra software to existing Containers. For example, you can create a Container based on the Windows Server 2008 OS template and then add the AdobeReader application template so that Acrobat Reader becomes available.

**Resource Management**

*Parallels Virtuozzo Containers resource management* controls the amount of resources available to Containers. The controlled resources include such parameters as CPU power, disk space, a set of memory-related parameters. Resource management allows Parallels Virtuozzo Containers to:
- effectively share available Hardware Node resources among Containers
- guarantee Quality-of-Service in accordance with a service level agreement (SLA)
- provide performance and resource isolation and protect from denial-of-service attacks
- simultaneously assign and control resources for a number of Containers
- manage a multitude of Hardware Nodes in a unified way by means of Parallels Management Console and Parallels Virtual Automation
- collect usage information for system health monitoring

Resource management is much more important for Parallels Virtuozzo Containers than for a standalone server since server resource utilization in a Parallels Virtuozzo Containers-based system is considerably higher than that in a typical system.

Main Principles of Parallels Virtuozzo Containers Operation

This section describes the basics of Parallels Virtuozzo Containers technology and discusses the main tools for managing Parallels Virtuozzo Containers systems.

Basics of Parallels Virtuozzo Containers Technology

In this section, we will try to let you form a more or less precise idea of the way the Parallels Virtuozzo Containers software operates on your server. Please see the figure below:
This figure presumes that you have a number of physical servers united into a network. In fact, you may have only one dedicated server to effectively use Parallels Virtuozzo Containers. If you have more than one Parallels Virtuozzo Containers-based physical server, each one of the servers will have a similar architecture. In Parallels Virtuozzo Containers terminology, such servers are called Hardware Nodes (or just Nodes), because they represent hardware units within a network.

Parallels Virtuozzo Containers 4.6 is installed on a server running the Windows Server 2003, 2008, or 2008 R2 operating system (shown as Host Operating System in the figure above). Once Parallels Virtuozzo Containers is installed, you can run Parallels Virtuozzo Containers services supporting virtualization on your server. This support is presented above as Parallels Virtuozzo Containers Layer. The Parallels Virtuozzo Containers layer ensures that Containers, sharing the same Hardware Node and the same OS kernel, are isolated from each other. A Container is a kind of ‘sandbox’ for processes and users.

Before you are able to create a Container, you need to install the corresponding OS template in Parallels Virtuozzo Containers 4.6. This is displayed as Parallels Templates in the scheme above. After you have installed at least one OS template, you can create any number of Containers with the help of various Parallels management tools (Parallels Management Console, Parallels Virtual Automation, or the command line tools), configure their network and/or other settings, and work with these Containers as with fully functional Windows servers.
Templates

Templates are part and parcel of Parallels Virtuozzo Containers, providing a way of sharing resources among multiple Containers, enabling huge savings in terms of disk space and RAM. A template is a set of application files and registry settings installed on the host operating system in such a way as to be usable by any Container. Parallels Virtuozzo Containers provides tools for creating, installing, removing templates, adding templates to Containers, and so on. Using templates lets you:

- securely share RAM among similar applications running in different Containers to save hundreds of megabytes of memory;
- securely share template files among different Containers to save gigabytes of disk space;
- simultaneously install applications and patches in many Containers.

Parallels Virtuozzo Containers has two types of templates:

- OS templates. An OS template includes an operating system and a standard set of applications available right after installation. Parallels Virtuozzo Containers uses OS templates to create new Containers with a pre-installed operating system.
- Application templates. An application template is a set of application files and corresponding registry settings. Parallels Virtuozzo Containers uses application templates to add extra software to existing Containers. For example, you can create a Container based on the Windows Server 2008 OS template and then add the AdobeReader application template so that Acrobat Reader becomes available in that Container. You can also install Adobe Reader the usual way, but using the template you can easily propagate its functionality to multiple Containers at once and also save much disk space. When a template is added to a Container, it only contains special placeholders of application files which occupy zero bytes.

Note: For further information on templates, see the Parallels Virtuozzo Containers 4.6 Templates Management Guide.

Parallels Management Console Overview

Parallels Management Console is a remote management tool for Parallels Virtuozzo Containers with a graphical user interface. It is intended to be installed on the administrator's server and allows the administrator to control multiple Hardware Nodes, to manage all their Containers, and to monitor the system. The main window of Management Console consists of two parts: the tree pane on the left, and view pane on the right. There is a list of Hardware Nodes in the tree pane. The Hardware Node subtree represents various aspects of its management, for example, Logs, Services, and Templates. The content of the view pane depends on the selected item in the tree pane.
Below the view pane on the right, there is also a small Actions/Messages/Operations pane. You can switch between the modes by clicking the corresponding buttons to the right of this pane. The Actions pane displays the progress of Parallels Management Console actions. The Messages pane displays the detailed diagnostics of various Management Console errors. The Operations pane shows the result of various asynchronous tasks performed with Hardware Nodes and their Containers.

Parallels Management Console uses a typical client/server architecture. The client Management Console program runs on Microsoft Windows 2000/XP/2003/2008/2008 R2. The client application with the graphical user interface connects to the Parallels Agent software, which is running on the Hardware Node. Parallels Agent communicates with the client via the well-documented open Parallels Agent XML API and controls the Hardware Node itself and its Containers.

The client can control multiple Hardware Nodes simultaneously by connecting to multiple Parallels Agents. As the communications between the client and Parallels Agents are secure, the Management Console workstation may be located virtually anywhere on the network.

More detailed information on the Parallels Management Console installation and operating is provided in the *Parallels Virtuozzo Containers 4.6 Installation Guide*.

**Parallels Virtual Automation Overview**

Designed for Hardware Node administrators, Parallels Virtual Automation provides a way to manage multiple Hardware Nodes and Containers residing on them from a standard Web browser. The following browsers are supported:
Internet Explorer 8.x or newer,
Firefox 16.x or newer,
Safari 5.x or newer,
Chrome 22.x or newer.

Note: Other browsers may also work, although Parallels Virtual Automation has not been tested as extensively with them.

The interface of Parallels Virtual Automation is designed to enable Parallels Virtuozzo Containers administrators perform all required tasks quickly and easily:

The interface of Parallels Virtual Automation is designed to enable Parallels Virtuozzo Containers administrators perform all required tasks quickly and easily:

- The left menu frame which lists and allows you to access and manage Hardware Nodes and Containers registered in Parallels Virtual Automation.
- The toolbar on top of the right frame which allows you to perform operations on Hardware Nodes, Containers, Container backups, packages updates, etc.
- The content part on the right frame which displays detailed information on Hardware Nodes, Containers, and other related objects.

Note: For the detailed information on Parallels Virtual Automation, see its built-in help and the *Parallels Virtual Automation Administrator's Guide*. 
Container Administrator's Tools

Wherever Parallels Virtuozzo Containers is applied, there are people who are supposed to be administrators of particular Containers only, with no access rights to Hardware Nodes. Such people can be subscribers to a hosting provider, university students, administrators of a particular server within an enterprise, etc. Personal Containers can be managed with the help of Parallels Power Panel. Power Panel is a means for administering personal Containers through a common browser: Internet Explorer, Mozilla, and others. It allows Container administrators to do the following:

- Start, stop, or restart the Container.
- Back up and restore the Container.
- Change the Administrator password of the Container.
- Start, stop, or restart certain services inside the Container.
- View the processes currently running in the Container and send signals to them.
- View the current resources consumption and resources overusage alerts.
- Connect to the Container by means of RDP.
- View the system logs.

For further information on Parallels Power Panel, see the Parallels Power Panel online help system.

**Note:** Apart from Parallels Power Panel, Container administrators are able to use the standard Windows Remote Desktop Connection (RDP) or MS Terminal Service Client (MS TSC) to connect to their Containers and work inside them.

Hardware Node Availability Considerations

The availability of a Hardware Node is more vital than that of a typical server. A Hardware Node hosts multiple Containers running critical services, so its downtime may be as disastrous and costly as simultaneous downtime of multiple servers.

In order to increase Hardware Node availability and security, follow the recommendations below:

- Keep private areas of critically important Containers in RAID. We recommend that you use hardware RAID or, if that is not available, at least software mirroring RAID.
- Do not run software directly on the Hardware Node. Create dedicated Containers and host the required services (FTP, IIS, and so on) in them.
- Configure firewalls so the Hardware Node would only accept connections from a predefined set of IP addresses.
- Do not create users directly on the Hardware Node. You can create as many users as you need in any Container.
Do not remove components installed on the Hardware Node even if you do not use them. Doing so (e.g., removing Internet Information Server) may cause Parallels Virtuozzo Containers to malfunction.

**Important:** Compromising the Hardware Node means compromising all its Containers at once.
Creating New Containers

This section guides you through creating and configuring a Container.

Before You Begin

Before you start creating a Container, do the following:

- Make sure that the Hardware Node has network access. Otherwise, your Containers will not be accessible from other servers.
• Make sure that you can provide at least one IP address per Container in the same network as the Hardware Node, or configure routing to Containers via the Hardware Node.

**Note:** You can use a private IP addresses for the Hardware Node itself.

### Choosing a Container ID

Every Container has a numeric ID, also known as Container ID, associated with it. The ID is a 32-bit integer number beginning with zero and unique for a given Hardware Node. When choosing an ID for a Container, follow the guidelines below:

- ID 0 is used for the Hardware Node itself. You cannot create a Container with ID 0.
- Parallels Virtuozzo Containers reserves the IDs ranging from 0 to 100. Though Parallels Virtuozzo Containers 4.6 uses only ID 0, the next version might use additional Containers IDs for internal needs. *To facilitate upgrading, do not create Containers with IDs below 101.*

The only strict requirement for a Container ID is to be unique for a particular Hardware Node. However, if you are going to have several servers running Parallels Virtuozzo Containers, we recommend assigning different Container ID ranges to them. For example, on Hardware Node 1 you can create Containers within the range of IDs from 101 to 1000; on Hardware Node 2 you can use the range from 1001 to 2000, and so on. This approach makes it easier to remember on which Hardware Node a Container has been created, and eliminates the possibility of Container ID conflicts when a Container migrates from one Hardware Node to another.

Another approach to assigning Container IDs is to follow some pattern of Container IP addresses. Thus, for example, if you have a subnet with the 10.0.x.x address range, you may want to assign the ID 17015 to the Container with the IP address 10.0.17.15, the ID 39108 to the Container with the IP address 10.0.39.108, and so on. This makes it much easier to run a number of Parallels Virtuozzo Containers utilities eliminating the necessity to check up the Container IP address by its ID and similar tasks. You can also think of your own patterns for assigning Container IDs depending on the configuration of your network and your specific needs.

Before you decide on a new Container ID, you may want to make sure that no Container with this ID has yet been created on the Hardware Node.

It is enough to click on the name of your Hardware Node in the left pane, and then on the **Parallels Virtuozzo Containers** item. The Management Console right pane will display the list of existing Containers on the Node.
In the example above, you can see that currently three Containers—101, 102, and 103—exist on the Hardware Node.

**WARNING!** When deciding on a Container ID, do not use the ID of any Container that was ever present in the system unless you are sure that no data belonging to the old Container remains on the Node. The fact is that the administrator of the newly-created Container might have access to these data in this case, i.e. to the backups of the old Container, its logs, statistics, and so on.

### Creating Container

Parallels Management Console uses one wizard, **Create New Containers**, to create and initially configure a Container. You can launch the wizard by selecting the **Parallels Virtuozzo Containers** item under the corresponding Hardware Node name in the Management Console left pane and choosing the **Create Container** option on the **Action** menu.
The main Container parameters, including the templates and resource management parameters, can be retrieved on the basis of the Container configuration sample indicated in the very first option. For more information on Container configuration samples, see Managing Container Configuration Samples (p. 126).

Once you have decided which configuration sample to use (if any), you need to define the number of Containers to create in the **Number of Containers to create** field. By default, you are offered to create one Container.

In the **Specify Container Parameters** window, you can also do the following:

- Specify an arbitrary name for your Container in the **Containers Name** field. This name can then be used, along with the Container ID, to refer to the Container when performing Container-related operations. In the case of creating several Containers at once, you can use the `$VEID` placeholder which is automatically replaced with the ID of the Container being created. For example, if you are creating Containers in the range from 101 to 103 and enter `MyCT$VEID` into the **Container Name** field, your Containers will have the following names: `MyCT101, MyCT102, MyCT103`.

- Provide the description of the Container in the **Description** field. You can enter any Container-related information you consider reasonable.

Under the **Container ID** group, you can choose the way of assigning an ID to your Container:
- Select the **Assign Container ID automatically** radio button to automatically assign the first unoccupied ID to the Container. For example, if you already have Containers with IDs from 101 through 105 and 107, the Container will be assigned ID 106.

- Select the **Assign Container IDs starting from** radio button to manually specify the ID to be assigned to the Container. If you are creating several Containers at once, the specified ID will denote the starting ID for the first created Container. For example, if you are making 2 Containers and indicate 110 in the field provided, the first Container will be assigned the ID of 110 and the second one - the ID of 111 (provided you do not already have Containers with such IDs).

The **Hostname** group of options on the first page of the wizard shown above might help you make use of your DNS server. If your DNS server has records for the IP addresses that will be assigned to the newly-created Containers, select the **Assign hostname automatically** radio button. The hostnames will be assigned on the basis of DNS records found. Selecting the **Hostname** radio button allows you to manually set a hostname for the Container. As in the case of assigning names to your Containers, you should use the $VEID placeholder if you are creating several Containers at once. This placeholder is then automatically replaced with the ID of the Container being created.

Also set the **Administrator** password for the Container being created on the first page of the wizard by typing the desired password in the **Password** and **Confirm password** fields. You will need this password in future to connect to the Container by means of Parallels Power Panel or by using the standard Microsoft Terminal Services Client/Windows Remote Desktop Connection applications. If you are creating several Containers, all Containers will be given the same **Administrator** password. However, you can change the password for each Container at a later time (p. 83).

Clicking the **Next** button displays the window where you can specify the settings for Container virtual network adapters:
This window allows you to do the following:

- Configure the settings of the venet0 virtual network adapter which is the default adapter created for every Container on the Hardware Node. To configure the parameters of this network adapter, select the adapter name in the Interfaces table, and click the Properties button. In the displayed window, you will be able to:
  - change the operating mode of the virtual adapter
  - specify one or more IP addresses to be assigned to the virtual adapter
  - set the default gateway to be used by the virtual adapter to connect to external networks (this option is available only for adapters operating in the bridged mode)
  - indicate one or more DNS servers that the virtual adapter is supposed to use
  - define one or more WINS servers to be used by the virtual adapter
- Create additional virtual network adapters for the Container by clicking the Add Interface button and entering the necessary information in the displayed window.

Note: Detailed information on adapter network modes and all network parameters that can be set for Container adapters is provided in the Managing Parallels Virtuozzo Containers Network chapter (p. 182).
In the next step, you are asked to choose the OS template to base your Container on:

All OS templates that are installed on the Hardware Node and can be used for creating the Container are listed in the table on the *Specify OS Template* screen. To choose an OS template, click its name in the **Name** column and choose its version, if necessary. Detailed information on OS templates is provided in the *Parallels Virtuozzo Containers 4.6 Template Management Guide*.

You can click on the **Finish** button in this step of the wizard and create the Container with the configuration parameters specified in the configuration sample you chose in the first step of the wizard. If you do not rely on any configuration sample, click the **Next** button instead of **Finish**. In this case, you will have to go through a number of steps and set all the parameters of the new Container separately. However, you can click **Finish** in every of the following steps of the wizard to start creating the Container. All the pages of the wizard are self-explanatory, so there is no need in dwelling upon them here in detail. You have the possibility to:

- Specify one or more application templates to be added to the Container. Detailed information on application templates is provided in the *Parallels Virtuozzo Containers 4.6 Template Management Guide*.

- Configure Quality of Service parameters. The Quality of Service parameters are explained in *Managing Resources* (p. 106); please consult it to gather more understanding of this topic.
Managing Containers

- Change the default Container private area and root paths or leave them intact.
- Add one or more hostnames to the Container search list for hostname lookups.
- Indicate one or more search domains the Container is supposed to use. If you leave the **Search domains** field empty, the search list for hostname lookups will contain the local domain name only. However, you will be able to add other hostnames for the Container later on.
- Enable the offline management for the Container for it to be directly managed by its Administrator from any browser at the Container IP address. Detailed information on offline management is provided in [Configuring Container Offline Management](p. 222).
- Configure network shaping parameters. For detailed information on network shaping, see [Managing Network Accounting and Bandwidth](p. 121).
- Choose the Terminal Services mode in which the Container will start functioning right after its creation and can specify one or more Terminal Server License (TSL) servers to be used by the Container if it is set to work in the Terminal Server mode. For more information on managing Terminal Services inside Containers, see [Configuring Terminal Services Inside Container](#).
- Specify whether the Container is to be started on the Hardware Node boot and the Container ID string is to be displayed on the Container desktop.
- Enable the network browsing feature and QoS packet scheduler inside the Container. Detailed information on these features is provided in [Managing Network Resources](p. 119).
- Save all the defined parameters as a configuration sample file to be used in future for creating new Containers on its basis. The information on Container samples is provided in the [Managing Resources](#) chapter (p. 106).

Creating a new Container may take some time. You can see the progress in the **Actions** pane.

**Note:** Any created Container has the time zone settings similar to those set on the Hardware Node at the moment of the Parallels Virtuozzo Containers installation. You can change the default time zone for a Container as you would do it on a stand-alone server (e.g., by logging in to the corresponding Container via RDP, opening Control Panel, clicking **Date and Time**, and changing the time zone on the **Time Zone** tab of the displayed window).

After you have created, for example, Containers with IDs 101, 102, and 103, you can see them in the right pane of the Parallels Management Console window.
Starting, Stopping, Querying Status of Containers

When a Container is created, it may be started up and shut down like an ordinary server. In Parallels Management Console, you can see the status of all the Containers of the given Hardware Node simply by selecting the Parallels Virtuozzo Containers item under the corresponding Node.

To start or stop one or more Containers, right-click it (them) in the Parallels Virtuozzo Containers table in the right pane, and choose Start/Stop.

Note: If you are launching a Container for the first time after its creation, the time needed for the Container startup may be rather considerable. However, all subsequent Container startups will be performed in the normal mode of operation and the time will be reduced approximately by 2 times.
You can use CTRL+Click to select or deselect an entry, SHIFT+Click to select a range of Containers, CTRL+A to select all Containers. If you are stopping one or more Containers, you will be asked to confirm your decision by clicking Yes in the displayed window.

When a Container is being started or stopped, all the typical operations are performed that happen during the startup and shutdown of the Windows operating system on a standalone server. Therefore, starting or stopping a considerable number of Containers may take a rather long run. The progress is displayed in the Actions pane.

**Note:** Before stopping a Container, make sure that there are no users connected to the Container by means of Microsoft Terminal Services Client or Remote Desktop Protocol. To do this, open Container Manager of the corresponding Container, select Monitor > Resources, and make sure that the **Number of TS sessions** parameter value is equal to 0. Keep in mind that Windows Server 2008 and newer operating systems maintain an extra terminal session to each Container. As a result, this value may remain 1 even when no user-initiated sessions are open.

---

**Accessing Containers**

You can access a Container in the same way you would access a standalone server:

- Via Microsoft Terminal Services Client (MS TSC).
- Via Windows Remote Desktop Connection.
Managing Containers

- Via Windows file sharing.

In all these cases, you will need Container's IP address or hostname as well as administrator's or other user's credentials set while creating or managing the Container.

Configuring Terminal Services in Containers

The Terminal Services component is used to provide remote access to any Container on your Hardware Node. In Parallels Virtuozzo Containers, each Container on the Node has its own Terminal Services (TS) component installed instead of using the Node's. Like any other standalone host running the Windows Server OS, a Container can operate in one of the two TS modes: Remote Desktop for Administration and Terminal Server.

By default, Containers are automatically set to work in the Remote Desktop for Administration mode, and no additional preparations are required to connect to Containers in this mode. Like in any other system with a Windows Server OS, the Remote Desktop for Administration mode allows you to simultaneously open no more than two remote sessions and a console session to any Container on the Hardware Node.

To enable the Terminal Server mode for a Container and to manage TSL servers, use the --tsmode and --tslicservers options of the vzctl set command. For example:

```
C:\Users\Administrator>vzctl set 101 --tsmode app_user --tslicservers 10.30.128.130
```

With this command, you set the TS mode to the user-based licensing scheme and specify the IP address of a Terminal Server License (TSL) server to be used by the Container.

For more information on these options, see the Parallels Virtuozzo Containers 4.6 Reference Guide.

Note: If you have Citrix Presentation Server installed in Containers hosted on a Hardware Nodes running Parallels Virtuozzo Containers 3.5.1 or earlier, you will need to reinstall and reconfigure it directly inside these Containers after upgrading the Node to Parallels Virtuozzo Containers 4.5. The reason is that Citrix Presentation Server, like Terminal Services, is now installed and configured directly inside Containers and does not need to be installed on the Hardware Node.

Using Remote Desktop Services

You can connect to Containers via Microsoft Remote Desktop Connection (RDC), formerly known as Terminal Services Client (TSC). The example below describes connecting to a Container from a server running Windows Server 2008 R2:

1. On the server, click Start > All Programs > Accessories > Remote Desktop Connection.
2. Enter Container's IP address or hostname in the Computer field.
3. Click Connect.
4. Enter Administrator's credentials when prompted and click OK.

After the logon, you will be able to change passwords, create new users, and perform other tasks the usual way.
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Using Remote Desktop Connection

Remote Desktop Connection is a standard Windows application that allows you to connect to running Containers via the Remote Desktop Protocol (RDP). Do the following:

1. Launch RDC in the host operating system by selecting **Start > Programs > Accessories > Communications > Remote Desktop Connection**.

2. Enter Container's IP address or hostname in the **Computer** field.

3. Click **Connect**.

4. Enter Administrator's credentials when prompted and click **OK**.

After the logon, it is possible to change passwords, to create new users and do all related tasks in the standard way inside the Container.

In case of connecting to a Container as a non-Administrator user, you should make sure of the following:

- The user whose credentials you wish to use to log in to the Container is created inside this Container.
- The **Remote Desktop Users** group allowing the Container users to remotely log in to Containers via RDC exists inside the Container.
- The user belongs to the **Remote Desktop Users** group.

Using Windows File Sharing

To access Container's shared folders from a Windows-based network location, type Container's IP address or hostname preceded by two back slashes in the Command Prompt or Windows Explorer's address line. Optionally, you can specify Container's name to see what shares are available. For example:

```
C:\Users\Administrator>\ct103\c$
C:\Users\Administrator>\192.168.20.103
```

If prompted, enter username and password required to access the Container. You can use Administrator's credentials or those of a user created in the Container.

Listing Containers

Sometimes, you may want to get an overview of the Containers existing on the given Hardware Node and to get additional information about them: their IP addresses, hostnames, status, etc. In Parallels Management Console, you can display the list of all Containers by clicking the **Parallels Virtuozzo Containers** item.
You can see that currently Containers with IDs 101, 102, and 103 exist on the Hardware Node.

The most important Container information is:

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ID</td>
<td>The ID assigned to the Container. Containers are assigned IDs starting from 101.</td>
</tr>
<tr>
<td>Name</td>
<td>The name assigned to the Container. This name can be used, along with the Container ID, to perform Container-related operations.</td>
</tr>
<tr>
<td>Hostname</td>
<td>The hostname of the Container.</td>
</tr>
<tr>
<td>IP Address</td>
<td>The IP address assigned to the Container.</td>
</tr>
<tr>
<td>Status</td>
<td>The current status of the Container. Detailed information on all Container statuses is provided in the next subsection.</td>
</tr>
<tr>
<td>Resources</td>
<td>The circle opposite the corresponding Container reflects the current state of the resource parameters consumed by the Container:</td>
</tr>
<tr>
<td></td>
<td>- If the resource consumption lies within 90% of the limits defined for the Container, the green circle with a white tick is displayed. It means that the Container experiences no shortage in resources required for the normal course of work.</td>
</tr>
<tr>
<td></td>
<td>- If the Container consumes between 90% and 100% of the limits defined for it, the orange circle with a white exclamation mark is displayed.</td>
</tr>
<tr>
<td></td>
<td>- If the Container is currently consuming 100% or more of the limits defined for it, the red circle with a white exclamation mark is displayed. A Container is allowed to consume more than 100% of its quota only in extreme situations.</td>
</tr>
</tbody>
</table>
Managing Containers

If you do not solve the problem in a reasonable time, applications running inside the Container may be denied some of the resources, so application crashes and other problems are most probable.

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>OS</td>
<td>The OS template the Container is based on.</td>
<td></td>
</tr>
<tr>
<td>Architecture</td>
<td>The system architecture of the Container.</td>
<td></td>
</tr>
<tr>
<td>Original Sample</td>
<td>The name of the configuration sample the Container is based on.</td>
<td></td>
</tr>
<tr>
<td>Description</td>
<td>The Container description.</td>
<td></td>
</tr>
</tbody>
</table>

To facilitate working with Containers, you can sort them by different parameters: their ID, type, hostname, status, IP address, etc. Just click the column with the appropriate name to put Containers in the desired order.

You can also view the Containers existing on the Hardware Node using these tools:

- Parallels Virtual Automation. For more information on this web-based tool, see the Parallels Virtual Automation Administrator's Guide at http://sp.parallels.com/products/pva46/resources.
- vzlist. Detailed information on this command-line utility is provided in the Parallels Virtuozzo Containers 4.6 Reference Guide.

Container Statuses

At any given point of time, a Container is characterized by its status (or state). There are three stable and a number of transitional states that a Container may be in. A Container in a stable state will likely remain in that state until the administrator changes it by performing an operation on the Container. A Container in a transitional state will eventually change to another state, ending up stable. No operations can be performed on Containers in transitional state.

**Stable Statuses**

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>stopped</td>
<td>The Container is stopped and its private area is unmounted.</td>
<td>Starting/mounting</td>
</tr>
<tr>
<td>mounted</td>
<td>The Container's private area is initialized and ready, but the Container is not running.</td>
<td>Starting/unmounting</td>
</tr>
<tr>
<td>running</td>
<td>The Container's private area is mounted and the Container is running.</td>
<td>Stopping</td>
</tr>
</tbody>
</table>

**Transition Statuses**

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>creating</td>
<td>The Container is being created.</td>
</tr>
<tr>
<td>mounting</td>
<td>The Container is being mounted.</td>
</tr>
<tr>
<td>starting</td>
<td>The Container is being started.</td>
</tr>
<tr>
<td>stopping</td>
<td>The Container is being stopped.</td>
</tr>
</tbody>
</table>
### Backing Up and Restoring Containers

This section explains how to back up and restore Containers in Parallels Virtuozzo Containers.

#### Backups Overview

In the backup and restoration context, a Hardware Node can be one of the following:

- **Source Node**, where Containers are hosted while being backed up;
- **Backup Node**, where Container backups are stored;
- **Destination Node**, where Container backups are restored.

One and the same Hardware Node can be two or even all of the above. In most situations, the source and destination Nodes are the same, however, setting up a dedicated backup Node is recommended.

You can perform the following backup-related operations:

- Set the default backup folder storing Container backups on the backup Node.
- Back up specific Containers to the backup Node.
- Back up the entire Hardware Node to the backup Node.
List Container backups on the backup Node.
Browse the contents of Container backups.
Restore specific Containers from the backup Node to the destination Node.
Restore individual files from Container backups on the backup Node to the destination Node.

The detailed information on these operations is provided in the following subsections.

Setting Default Backup Parameters

By default, the vzabackup command uses the following backup parameters:

- backup type: full,
- compression: normal,
- backup folder: X:\vz\backups

You can set a different folder for future backups with the vzabackup --set-folder --backup-folder-path command. For example, to set the default backup folder to C:\backups:

```
C:\Users\Administrator>vzabackup --set-folder --backup-folder-path C:\backups --backup-folder-login "Administrator" 10.30.22.6
```

**Note:** You can check the current backup folder with the vzabackup --view-folder command.

If you need to use different backup type and compression, set them for each backup operation you perform.

**Note:** If you exclude one or more system or hidden files/folders from a Container backup, you will only be able to restore individual files from this backup, not the backup as a whole.

Assigning Default Backup Node

When backing up Containers from a Source Node, you need specify the Backup Node where the resulting backups will be stored. Parallels Management Console allows you to set the default Backup Node for a given Source Node by doing the following:

1. Right-click the respective Source Node, and choose Backup > Set Default Backup Options.
2. Click the Change button next to the Server field:
In the Backup Storage window, do the following:

- If you do not want to use a dedicated Node for storing Container backups, select the Use local Hardware Node radio button, and click OK to set the Source Node as the default Backup Node.

- If you are going to use a dedicated Node for storing Container backups, select the Choose Hardware Node from the list below radio button. The table below this radio button lists all Nodes registered in Parallels Management Console together with their IP addresses. If the default Backup Node already exists for the given Source Node, it is selected in the table. Select the Node you want to be the default Backup Node for the Source Node, and click OK.

4 Click OK.

The assignment of the default Backup Node brings about the following effects:

- When backing up Containers from the corresponding Source Node in Parallels Management Console and Parallels Virtual Automation using the 'default' backup mode, the backups are automatically placed onto the default Backup Node.

- When backing up Containers from the corresponding Source Node in Parallels Management Console and Parallels Virtual Automation using the 'custom' backup mode, you are automatically offered to place the backups onto the default Backup Node.

- When a Container administrator backs up his or her Container using Parallels Power Panel, the backup is automatically placed on the default Backup Node.

There are no restrictions as to which Hardware Node can be the default Backup Node. It just must be registered in Parallels Management Console (otherwise, it will not be displayed in the table on the Backup Storage screen) and have sufficient disk space for housing multiple backups.
Note: You can use any Hardware Node as a backup node irrespective of the Parallels Virtuozzo Containers version installed on this node. So, you can back up a Container from the node running the Parallels Virtuozzo Containers 32-bit version and store it on the node running the Parallels Virtuozzo Containers 64-bit version and vice versa.

**Setting Default Backup Location**

By using the `vzabackup` utility with the `--backup-folder-path` option, you can change the location of the folder on the Backup Node where all Container backups are to be stored. For instance:

```
C:\Users\Administrator>vzabackup --set-folder --backup-folder-path C:\backup_testing --backup-folder-login "Administrator" localhost
```

By default, the `X:\vz\backups` folder is used as the default backup folder.

Note: While defining the default backup folder, make sure that the disk drive where this folder is to be located has sufficient disk space for housing multiple Container backups.

Parallels Virtuozzo Containers allows you to configure the default backup compression level by setting it to one of the following:

- **None.** In this case, the Container backup is created without any compression. Using this level of compression, you can greatly reduce the backup creation time. However, the size of the resulting backup file may significantly increase as compared to other compression levels.

- **Normal.** In this case, the Container backup is created with a normal level of compression. This compression level is set by default and is suitable for backing up most Container files and directories.

- **High.** In this case, the Container backup is created with the high level of compression. The size of the resulting backup file is smaller than that of the backup file compressed in the 'normal' and 'none' modes; however, it takes longer to create the backup file.

- **Maximum.** In this case, the Container backup is created with the maximum level of compression. The size of the resulting backup file is the smallest and the time of the backup creation is the longest.

In general, the optimal data compression level depends on the type of files to be stored in the backup archive. For example, it is advisable to use the 'normal' and 'none' compression types if most of the files to be backed up are already compressed (e.g., the files with the .zip and .rar extensions) or can be compressed with a low degree of efficiency (for example, all executable files with the .exe extension or image files with the .jpg, .jpeg, and .gif extensions).

To configure the default backup compression level, do the following:

1. Right-click the respective Source Node, and choose **Backup > Set Default Backup Options**.
2 Under the Compression Level group in the displayed window, move the slider to the left or to the right to specify the desired compression level.

3 Click OK.

Specifying the Default Backup Type

Another parameter that you may wish to configure and that will be applied to all Container backups created using the default backup mode is the backup type. Each backup file can be of one of the following types:

- A full backup containing the whole Container private area and its configuration file.
- An incremental backup containing only the files changed since the full backup or the previous incremental backup. An incremental backup may prove very useful because it records only the changes since the last Container backup (either full or incremental) and therefore is much less in size and takes much less time than the full backup. However, after several consecutive incremental backups it is recommended to create a full backup anew and start the incremental backups chain from scratch.
A differential backup containing only the files changed since the last full backup. As a rule, this kind of backup requires less space than a full backup, but more space than an incremental backup.

You can configure the default backup type by doing the following:

1. Right-click the respective Source Node, and choose **Backup > Default Backup Node Configuration**:

   ![Default Backup Options for "Local Server"](image)

   - **Backup Node**
     - Server: Local Hardware Node.
   - **Backup Type**
     - Full
       - Choose this option to create a full backup containing the entire Container private area, configuration files, action scripts, and quota information.
     - Incremental
       - Choose this option to create an incremental backup containing only those changes that have occurred since the last backup (be it full, differential, or incremental).
     - Differential
       - Choose this option to create a differential backup containing only those changes that have occurred since the last full backup.
   - **Compression Level**
     - Specify the compression level to be used for the backup creation. Please keep in mind that the higher the compression level, the smaller the backup archive will be and the longer the backup will take to create.
     - None
     - Normal
     - High
     - Maximum
   - **Parallels Power Panel Settings**
     - Maximum number of allowed Container backups: 1

2. Under the **Backup Type** group in the displayed window, choose one of the following options:
   - Select the **Full** radio button to always create full backup archives containing the whole Container private area, all Container-related configuration files, action scripts, etc.
   - Select the **Incremental** or **Differential** radio button to always perform incremental or differential backups, respectively. If an incremental or differential backup is performed, and the corresponding full backup cannot be found, a full backup is automatically performed.

3. Click **OK**.

**Back up Specific Containers**

To back up any number of specific Containers, use the `vzabackup -e` command. You will need to specify the IP address and credentials of the source Node and the IDs of the Containers to back up. For example, to back up Containers 101 and 102:
Back up all Containers on the source Node, use the `vzabackup` command with the source Node IP address and credentials as the option. For example:

```
C:\Users\Administrator>vzabackup Administrator:1q2w3e@10.30.22.6 -e 101 102
```

Browsing Backup Contents

To browse the contents of a Container backup, use the `vzarestore --browse` command. For example, to view the contents of the folder `C:/Users` in the Container backup, use:

```
C:\Users\Administrator>vzarestore --browse 6e5ad31c-ac52-4a2a-a51a-af80f0937115/20130829132939 -d C:/Users
```

Restoring Specific Containers

To restore specific Containers from their respective backups, use the `vzarestore -e` command. For instance:

```
C:\Users\Administrator>vzarestore -e 101 102
```

This command will restore Containers 101 and 102.

Restoring Individual Files

To restore individual files and folders from a Container backup, use the `vzarestore --files` command. For instance:

```
C:\Users\Administrator>vzarestore 101 --files C:/userfiles
```

This command will restore the folder `C:/userfiles` from Container 101.

Restoring Entire Hardware Nodes

To restore the entire Hardware Node, use the `vzarestore` command with the source Node IP address and credentials as the option. For example:

```
C:\Users\Administrator>vzarestore -e
```

During restoration, Container's current data will be overwritten with the data from the backup.
Managing Backup Nodes

Any Hardware Node can perform the functions of the Backup Node, i.e. store the backups of any Containers of any Hardware Nodes. To see the list of Container backups stored on a Hardware Node, expand its name in the left pane of the Parallels Management Console main window, and select the **Backups** item.

The table in the right pane presents the following information about the Container backups stored on the current Backup Node:

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
<td>The name of the backed up Container.</td>
</tr>
<tr>
<td>Source Node</td>
<td>The Node where the Container was hosted during its backing up.</td>
</tr>
<tr>
<td>Last Backup Date</td>
<td>The date and time when the last backing up of the Container took place.</td>
</tr>
<tr>
<td>Number of Backups</td>
<td>The number of Container backups on the Node.</td>
</tr>
<tr>
<td>Description</td>
<td>The backup description.</td>
</tr>
</tbody>
</table>

The backup manager window allows you to perform the following operations:

- Restore a single Container from its backup. To do this, right-click the needed Container backup, and choose **Restore Container** to launch the **Restore Container** wizard. In this wizard, you need to select the
Destination Node, i.e. the place whither the Container will be restored. By default, the Container Source Node is selected. Only the Nodes registered in Parallels Management Console are shown.

On the Review Container Restoration Settings screen, click Finish to start restoring the Container to the selected Destination Node.

- Restore one or several files and/or folders from a particular Container backup. To do this, right-click the Container backup whose files/folders you want to restore, and choose Restore Individual Container Files to launch the Restore Individual Container Files wizard. In this wizard:
  a Select the Destination Node, i.e. the place whither the Container files/folders will be restored.
By default, the Source Node is selected. Only the Nodes registered in Parallels Management Console are shown. You can also restore the files/folders to your local computer, i.e. to the computer where Parallels Management Console is installed. To do this, select the **Restore to local machine** radio button and, in the **Path** field, specify the path to the folder whither to restore the files.

b Select the Container files/folders that will be restored to the Destination Node. The **Choose Files to Restore** window provides you with a tree view of the files and folders you have backed up. To select a file/folder for restoring, click its check box. You can select the check box next to the corresponding directory to restore all the files and subfolders from this folder.

c Review the parameters that will be used for restoring Container files and folders in the **Review Container Restoration Settings** window. If you are satisfied with the specified parameters, click **Finish** to start restoring the selected files/folders to the Destination Node. Otherwise, click **Back** and change the corresponding parameters.

Right-clicking on a Container backup in this table and choosing **Properties** brings about the **Container Backups** dialog where you can view extensive information about the current Container backup, including all its full and incremental backups, as well as delete any of these backups, explore their contents (i.e. the Container drives, files, and folders), or restore the Container or any of its files/folders by selecting their check boxes and clicking the **Restore Selected Items** button.
Searching for Container Backups

If you do not remember the place where you are storing the backup of a particular Container (identified by its ID or its IP address or its hostname or by the date of its creation), you can search for the backup across all the Hardware Nodes registered in Parallels Management Console.

To search for a backup, do the following:

1. Right-click the **Parallels Virtuozzo Containers** item under the corresponding Backup Node name, and choose **Backup > Search for Backups** to open the **Find Container Backups** dialog:

2. On the upper left drop-down menu, choose the Container parameter by which you want to search for the corresponding Container backup.

3. Enter the value of the parameter in the text field on the right. All the Containers with the corresponding parameter including the specified value as its part will be found. For example, if you enter "100" as the value for Container ID, the backups of Containers 100, 1000, 1001, 1002, 2100, 3100, and so on, will be searched for.
4 Check those Nodes where you want to search for the backups.
5 Click the Search button.

The Search results table presents the following information about the found backups:

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
<td>The name of the Container whose backup has been found.</td>
</tr>
<tr>
<td>Source Node</td>
<td>The Node where the Container was hosted during its backing up.</td>
</tr>
<tr>
<td>Date of Creation</td>
<td>The date and time when the backup was created.</td>
</tr>
<tr>
<td>Type</td>
<td>The backup type. Detailed information on all backup types is given in Defining Default Backup Type (p. 43).</td>
</tr>
<tr>
<td>Backup Node</td>
<td>The Backup Node - the Node where the backup has been found.</td>
</tr>
<tr>
<td>Description</td>
<td>The backup description.</td>
</tr>
</tbody>
</table>

Double-clicking on a Container backup in this table brings about the Container Backups dialog where you can view extensive information about the current Container backup, including all its full and incremental backups, as well as delete any of these backups or restore them in the manner depicted above.

**Scheduling Container Backups**

Parallels Management Console allows you to automate the task of backing up your Containers by setting Container backups to be run on a schedule. You can specify different time intervals when the Container is to be backed up: daily, weekly, monthly. It is also possible to specify a particular day of month for a Container backup to be executed.

Parallels Management Console provides you with a special wizard, Schedule Backup Task for Containers, helping you schedule the time when your Containers are to be backed up. To invoke the wizard, right-click the Scheduled Tasks item under the corresponding Hardware Node name, and choose Schedule New Task > Back Up Containers.

In this wizard:

1 Choose the Containers to be backed up on the schedule you will set on the following steps of the wizard. To do this, click the Add button in the top right corner of the Choose Containers to Backup Up window, select the names of the corresponding Containers, and click OK. Click Next.

2 Choose the Container backup mode:
   - **Default**: select this radio button to back up the Container using the default backup mode. In this case, the default backup parameters will be used for creating Container backups. Besides, when run in this mode, the wizard does not allow you to exclude any files from the resulting backup archives, to set the backup description, and configure the default backup policy.

   **Note**: Detailed information on what default backup parameters are and how to manage them is given in Setting Default Backup Parameters (p. 40).
• **Custom**: select this radio button to manually set the parameters to be applied to the resulting backup archive. In this case, you will have to go through a number of additional steps (Steps 3 and 4) of the **Schedule Backup Task for Container(s)** wizard and set the necessary parameters of the Container backup one by one.

3 Specify the files and folders to be included in the backup.

![Schedule Backup Task for Container(s)](image)

By default, all the Container files and folders are included in the backup archive. To leave out a file or folder from the backup process, clear its check box in the **Included files** table. You can also use the following options to filter out the files/folders:

- Select the **All hidden files and folders** check box to exclude all hidden files and folders inside the Container from the backup process.
• Select the **All system files and folders** check box to exclude all system files and folders from the backup process.

• Select the **Matching the following criteria** check box and use the **Add** button to set the parameters to be met by the file/folder to exclude it from the backup process. You can specify the full path to the corresponding file/folder, enter its name, or define any filter compatible with standard Windows masking rules. For example, you can indicate C:\MyFolder\MyFile.txt to exclude the MyFile.txt file from the backup process or type *.bmp to leave out all files with the bmp extension.

Keep in mind that the selected options will be valid for all Containers to be backed up.

**Notes:**

1. The **Included files** table is not shown if you are creating a backup task for several Containers.

2. If you exclude one or more system or hidden files/folders from the Container backup (e.g., either the **All hidden files and folders** or **All system files and folders** check box is selected, or the **Entire Contents of..** check box is cleared), you will be able to restore only individual files from this backup, but not the Container as a whole.

Next, specify the main backup parameters.
You can configure the following backup parameters:

- **Backup Node.** This Node is the place where the Container backup will be stored. You may leave the Backup Node offered by Management Console by default or use the Change button to specify the desired Backup Node. For detailed information on Backup Nodes, see Assigning Default Backup Node (p. 40).

- **Backup compression level:** 'None', 'Normal', 'High', or 'Maximum'. Detailed information on all compression levels is provided in Defining Default Compression Level (p. 42).

- **Backup type.** It may be full, incremental, or differential. Detailed information on backup types is provided in Specifying Default Backup Type (p. 43). If you are backing up a single Container, and no backup of this Container has been found on the Backup Node, the Backup Type group is not shown, and a full backup is automatically created.
In the next step of the wizard, you can set the following parameters for the Container backup:

- Provide the backup description. The description can be any text containing any backup-related information (e.g., the backup purpose).
- Specify whether to stop the backup process if any errors appear.
- Specify whether to stop the backup process if one or more of the Containers to be backed up are not present on the Source Node. This option is available when you back up more than one Container at once.

Next, specify parameters for the backup task.

You can specify the following parameters:

- Set the name for the backup task.
- Provide the task description.
- Set the schedule for the Container backup (specify the task start time, set the time interval when the Container backup is to be performed, etc.).
- Define the date when the backup task is to be removed from the schedule.

You can also clear the Enabled ... check box if you want to run the scheduled task during a certain period of time. You can always enable the task later on by right-clicking the task and choosing Enable.

7 In the last step of the wizard, review the parameters to be used for creating Container backups. If you are satisfied with the specified parameters, click Finish to schedule the task. Otherwise, click the Back button to return to the previous steps and change the corresponding parameters.

At any time, you can configure any parameters of the scheduled backup task, disable the task, or even delete it. To do this, choose the Scheduled Tasks item under the corresponding Hardware Node name, right-click the corresponding backup task in the Management Console right pane, and choose one of the following options:
- Disable to temporarily stop backing up your Containers on the set schedule.
- Delete to permanently remove the scheduled backup task.
- Properties to change the settings of the backup task.

**Setting the Maximum Number of Backups for Parallels Power Panel**

Parallels Management Console allows you to configure the number of backups Container administrators are allowed to create on the given Hardware Node using Parallels Power Panel. By default, any Container administrator is allowed to create only one Container backup in Parallels Power Panel. However, you can increase the number of allowed backups by doing the following:

1 Right-click the Hardware Node where the Container for which you want to increase the number of allowed backups is residing, and choose Backup > Set Default Backup Options.
2 Specify the number of Container backups the Container administrator will be able to create with Parallels Power Panel by typing the desired number in the Maximum number of allowed Container backups field or using the spin button.

3 Click OK.

Keep in mind that the limit set on the number of Container backups concerns only the process of backing up Containers using the Parallels Power Panel tool. There are no restrictions for any users creating Container backups by means of other Parallels Virtuozzo Containers tools (for example, Parallels Virtual Automation or Parallels Management Console); they are allowed to create as many Container backups as they want to.

**Using Third-Party Backup Software**

This section provides general information on third-party backup software that can be used to back up and restore your Containers.
Overview

Parallels Virtuozzo Containers supports the Microsoft Volume Shadow Copy Service (MS VSS) technology allowing you to use third-party backup software for creating Container backups.

The integration with VSS is provided by the special Parallels VSS Writer Service. Like any other VSS writer, it ensures that, during backup operations, all data are persistent and stable. The writer also creates one VSS component per Container on the Hardware Node. Each VSS component controls the following Container-related files on the Node:

- all files in the X:\vz\private\CT_ID folder,
- the CT_ID.conf and CT_ID.conf.bak files in the X:\vz\Conf folder.

You can use the following third-party tools to back up Container:

- Symantec Backup Exec 2010
- IBM Tivoli Storage Manager
- NTBACKUP built into Windows Server 2003

Creating Container backups on the Hardware Node with these tools is typically as follows:

1. The backup application requests a list of VSS components from the Parallels VSS Writer Service.
2. The Parallels VSS Writer Service provides the requested list (i.e. one VSS component per Container).
3. The backup application sends the list of volumes to take part in the backup process to the Parallels VSS Writer Service and asks it to pause activity.
4. On the basis of the received volumes list, the Parallels VSS Writer Service makes a list of running Containers for backing up and forces the MS VSS services inside the Containers in question to freeze all VSS writers, suspending the activity of all VSS-aware applications inside these Containers (MS SQL Server, MS Exchange Server, etc.).
5. The MS VSS service on the Hardware Node creates a shadow copy of the volumes to be backed up.
6. The backup application makes a backup of Container files from the shadow copy.
7. After backup creation, the backup application asks the Parallels VSS Writer Service to resume activity. It its turn, the Parallels Virtuozzo Containers Service sends the received signal to the corresponding Containers, thus allowing the Container VSS services and VSS-aware applications inside the Containers to resume activity.

Although the concept of backing up Containers using the VSS technology is the same for all third-party applications listed above, each application has a number of peculiarities which should be taken into account when making Container backups. The detailed information on these peculiarities is provided in the following subsections.
Managing Containers

Backing Up Containers with Symantec Backup Exec

Symantec Backup Exec 2010 provides fast, flexible, granular protection and recovery, and scalable management of local and remote server backups. To use this software for creating Container backups, follow these guidelines:

1. When installing Symantec Backup Exec 2010 on the Hardware Node, follow the installation instructions provided in the Symantec Backup Exec Installation Guide. Make sure that the Advanced Open File Option component is selected for installing on your server on the Symantec Backup Exec Features screen.

2. When configuring your Backup Exec environment:
   - Use the Getting Started with Backup Exec wizard to perform the standard initial configuration of Symantec Backup Exec. To invoke the wizard, select All Programs > Symantec Backup Exec > Backup Exec 2010 in the Windows Start menu.
   - Disable the Active File Exclusion feature. Detailed information on this feature and what should be done to disable it is given at http://seer.support.veritas.com/docs/259152.htm.

3. When creating a backup job (e.g., by clicking the New job link in the Backup Tasks section), configure it to meet your demands and make sure of the following:
   - The Back up files and directories by following junction points check box on the Advanced tab is cleared.
The Use Advanced Open File Option check box on the Advanced File Option tab is selected and the Automatically select open file technology radio button is selected under Open file configuration.

The X:\vz\private\CT_ID\root folder is excluded from the backup selection list.

Pre- and post-backup scripts for suspending and resuming the Container activity during the backup operation are specified on the Pre/Post Commands tab.
You need to use scripts because Symantec Backup Exec does not suspend the VSS writers' activity when creating backups in the file system backup mode (see below). In scripts, use the `vzvssctl` command for suspending/resuming the Container activity. Detailed information on this utility is provided in the *Parallels Virtuozzo Containers 4.6 Reference Guide*.

After completing the aforementioned tasks, you can use one of the following ways to back up your Containers:

- Using the standard file system backup procedure. To do this, manually add the following files and folders to the backup selection list:
  - `X:\vz\private\CT_ID`
  - `X:\vz\conf\CT_ID.conf`
  - `X:\vz\conf\CT_ID.conf.bak`
  and exclude the `X:\vz\private\CT_ID\root` and the `X:\vz\root` folders from the backup process. For example:
In the example above, Container 101 will be backed up.

- Using the **Shadow copy components** backup procedure. To do this, select the **Shadow Copy Components > Service State > Virtuozzo VSS Writer > CT_ID** component during the backup job creation. For example:
In the example above, Container 101 will be suspended by the VSS service and backed up by Symantec Backup Exec.

**Backing Up Containers and Hardware Node with IBM Tivoli**

IBM Tivoli Storage Manager (TSM) enables you to protect your organization’s data from failures and other errors by storing backup and archive data in a hierarchy of offline storage. The sections below explain the way to install and configure the TSM application on your server and to use it for backing up and restoring your Hardware Node and all Containers residing on it.
Supported Versions

Parallels Virtuozzo Containers currently provides support for version 6.1.3 of IBM Tivoli Storage Manager.

Installing and Configuring Tivoli Storage Manager

When setting up the TSM server software, follow the installation and configuration instructions given in the Tivoli Storage Manager Installation Guide and Tivoli Storage Manager Backup-Archive Clients Installation and User's Guide and make sure that the following points are correctly handled:

1. During the TSM server installation, select the Complete radio button on the Setup Type screen of the IBM Tivoli Storage Manager Server Installation Wizard.

2. During the TSM server configuration:
   - Launch Tivoli Management Console by selecting Programs > Tivoli Storage Manager > Management Console in the Windows Start menu.
   - In the displayed window, select the Standard Configuration radio button and click Start.

   Follow the instructions of the wizards (Initial Configuration Environment Wizard, Performance Configuration Wizard, Server Initialization Wizard, Configure Devices Wizard, Client Node Configuration Wizard) to complete the TSM server configuration.
When setting up the TSM client software, follow the installation and configuration instructions given in the Tivoli Storage Manager Installation Guide and Tivoli Storage Manager Backup-Archive Clients Installation and User's Guide and make sure that the following points are correctly handled:

1. During the TSM client installation:
   a. On the Setup Type screen, select the Custom Setup radio button.
   b. On the Custom Setup screen, select the Open File Support feature for installing on your server:

   ![Custom Setup Screen]

   - **Feature Description**: Open File Support - See the client README file for Windows Logo Certification status.
     This feature requires 4KB on your hard drive.

   - **Note**: The Open File Support feature is installed by default in version 5.4 or higher of IBM Tivoli Storage Manager; so you can skip this step.

2. During the TSM client configuration, configure the "X:\Program Files\Tivoli\TSM\baclient\dsm.opt" file and the Open File Support feature as described in the Configuring Tivoli Storage Manager chapter of the Tivoli Storage Manager Backup-Archive Clients Installation and User's Guide.

### Backing Up the Hardware Node and Containers

Now that you have installed and configured the TSM software, you are ready to back up your Hardware Node and all its Containers.

**Backing Up the Hardware Node Manually**

To back up the Hardware Node, do the following:
1 Launch the TSM backup-archive GUI by selecting Programs > Tivoli Storage Manager > Backup-Archive GUI in the Windows Start menu.

2 In the GUI main window, click Backup to open the Backup window.

3 In the left part of the Backup window, expand the directory tree by clicking the plus sign and click the selection boxes next to the disk drives you wish to back up.

4 Expand the disk drive where the Parallels Virtuozzo Containers data folder is stored (C:\vz by default) and do the following:
   - Clear the selection boxes for the Conf, private, root, and Templates folders to exclude them from the backup process.
   - Expand the Templates folder and click the selection box for the __cache folder to include it in the backup.

5 Click the Backup button to start backing up the selected disk drives.

Backing Up Containers Manually

To back up all Containers currently existing on the Hardware Node, do the following:

1 Launch the TSM backup-archive GUI by selecting Programs > Tivoli Storage Manager > Backup-Archive GUI on the Windows Start menu.

2 In the GUI main window, click Backup to open the Backup window.
3 In the left part of the Backup window, expand the System Services item and click the selection box next to the Virtuozzo VSS Writer component. For example:

![IBM Tivoli Storage Manager - [Backup]](image)

Displaying System Services\Virtuozzo VSS Writer
For Help, press F1

4 Click the Backup button to start the backup procedure. During this procedure:
   a The Virtuozzo VSS Writer service suspends all running Containers.
   b The TSM application backs up the suspended and stopped Containers.
   c The Virtuozzo VSS Writer service resumes the suspended Containers.

**Automating the Backup Procedure**

You can automate the process of taking backups of your Hardware Node and its Containers by doing the following:

1 Open the dsm.opt client options file for editing (e.g. using Notepad) and add the following strings to it:

```
INCLUDE.DIR "*:\...\vz\Templates\__cache"
```
EXCLUDE.DIR "*:\...\vz\Conf"
EXCLUDE.DIR "*:\...\vz\private"
EXCLUDE.DIR "*:\...\vz\root\*"
EXCLUDE.DIR "*:\...\vz\Templates"

This will exclude the Conf, private, root, and Templates folders from and include the Templates\_cache folder in the backup process.

2 Edit your automation script to include the following strings:

- To back up the contents of a Hardware Node disk drive:

  ```
  dsmc.exe incremental X:
  dsmc.exe incremental Y:
  ```

  X: and Y: in the strings above denote the name of disk drives to be backed up. You can also configure individual folders to be backed up instead of entire disk drives. For information on how you can do it, refer to the *Tivoli Storage Manager Backup-Archive Clients Installation and User's Guide*.

- To back up all the Containers on the Hardware Node:

  ```
  dsmc.exe backup systemservices "VIRTUOZZO VSS WRITER"
  ```

**Restoring the Hardware Node and Containers**

The restore process differs depending on whether you are trying to restore the backed up disk drives on the Hardware Node or the backed up Containers.

*Restoring the Contents of Disk Drives*

To restore the contents of a backed up disk drive:

1 Stop the Virtuozzo Management Service service on the Node:

   a Click **Start > Administrative Tools > Services** to open the Services snap-in.

   b In the list of services, locate the Virtuozzo Management Service service and click it.

   c In the central part of the Services snap-in, click **Stop**.

2 Launch the TSM backup-archive GUI by selecting **Programs > Tivoli Storage Manager > Backup-Archive GUI** on the Windows **Start** menu.

3 In the GUI main window, click **Restore** to open the **Restore** window.

4 In the left part of the **Restore** window, expand the backed up disk drive and click the selection boxes next to the folders you wish to restore. If you are going to restore the entire Hardware Node (including the Parallels Virtuozzo Containers data folder), make sure that you select all the folders of the backed up drives:
5 Click the **Restore** button to restore the selected folders.

6 Reinstall all OS and application templates on the Hardware Node. This step is needed if you are restoring the entire Node. The templates to be reinstalled are located in the \(X:\vz\Templates\__cache\) folder on the Hardware Node. So, you can use the following script to reinstall the templates from this folder:

\[
\text{vzpkgls} \; \text{> backup_pkgls.txt} \; \text{& for /f %i in (backup_pkgls.txt) do vzpkgdeploy -u %i & & vzpkgdeploy -i %i & & del backup_pkgls.txt}
\]

7 Open the Services snap-in and make sure that the **Virtuozzo Management Service** service is running. If it is not, start this service.

**Restoring Containers**

To restore the backed up Containers:

1 Make sure that all Containers on the Hardware Node are stopped.
2 Launch the TSM backup-archive GUI by selecting Programs > Tivoli Storage Manager > Backup-Archive GUI in the Windows Start menu.

3 In the GUI main window, click Restore to open the Restore window.

4 In the left part of the Restore window, expand the System Service folder and select the Virtuozzo VSS Writer component:

5 Click the Restore button to start restoring the backed up Containers.

**Backing Up Containers with NTBACKUP**

Windows Server 2003 has a built-in program—NTBACKUP—allowing you to back up your system environment, including any of the Containers residing on the Hardware Node. To start using this tool for backing up your Containers, complete the following tasks on the Node:

1 Start NTBACKUP by selecting Programs > Accessories > System Tools > Backup in the Windows Start menu.
2 Click the Advanced Mode link in the Backup or Restore Wizard (if the Backup utility is launched in the wizard mode).

3 In the displayed window, click Tool > Options.

4 On the General tab of the Options window, clear the Back up the contents of mounted drives check box:

![Options Window](image)

5 Click OK.

Now you can back up any of the Containers existing on the Node in the same way you would back up your normal data with NTBACKUP. For example, you can back up Container 101 by doing the following:

1 Start NTBACKUP by selecting Programs > Accessories > System Tools > Backup in the Windows Start menu.

2 In the Welcome to the Backup or Restore Wizard window, click Next.

3 In the Backup or Restore window, select the Backup files and settings radio button and click Next.

4 In the What to Back Up window, select the Let me choose what to back up radio button and click Next.

5 In the Items to Backup Up window, select the following files:
   - X:\vz\private\101
   - X:\vz\conf\101.conf
   - X:\vz\conf\101.conf.bak
6. In the Backup Type, Destination, and Name window, specify the desired parameters and click Next.

7. In the Completing Backup or Restore Wizard window, click Finish to start backing up Container 101 and all its data. During the backup operation, the NTBACKUP utility creates a volume shadow copy of the Container data which is backed up afterwards.

**Backing Up Containers with Windows Server Backup**

Windows Server Backup built into Windows Server 2008 and Windows Server 2008 R2 allows you to back up your Hardware Node, including any of the Containers residing on it. Backing up Containers with Windows Server Backup does not differ from backing up regular data. The only peculiarity is that you need to back up the entire volume where your Containers are stored. For example, assuming that you use the Y:\ volume for storing Containers and their configuration data, you can back up all Containers residing on this volume by doing the following:

1. Click Start > Administrative Tools > Windows Server Backup to launch the Windows Server Backup snap-in.

2. In the Actions pane, click Backup Once to open the Backup Once wizard.

3. In the Backup Options window, select the Different options radio button, and click Next.

4. In the Select Backup Configuration window, select the Custom radio button, and click Next.

5. In the Select Items for Backup window, do the following:
a  Click Advanced Settings > VSS Settings, and make sure that the VSS copy Backup option is selected.

b  Click Add Items, select the check box next to the Y: volume, and click OK:

Click Next.

6  In the Specify Destination Type window, choose the type of storage where you plan to keep the created backup, and click Next.
7 In the next window, specify either the local drive or remote shared folder to be used for storing the backup, and click Next.

8 In the Confirmation window, review the settings made, and click Backup start backing up Containers and their configuration data.
During the backup operation, Windows Server Backup creates a volume shadow copy of the Containers data which is backed up afterwards.

9 Once the backup is created, click Close to close the Backup Once wizard.

You can also configure Windows Server Backup to automatically back up your Containers on a regular schedule. To do this, open the Windows Server Backup snap-in, and run the Backup Schedule wizard to set up the necessary backup parameters.

Restoring Containers

At any time, you can restore Containers from the created backup using the Recovery wizard:

1 Launch the Recovery wizard, and follow the instructions until the Select Recovery Type window is displayed.

2 Choose the Files and folders option, and click Next.

3 In the Select Items to Recover window, select the Container-related files to recover. For example, to restore Container 101, you need to select these files and folders: Y:\vz\Conf\101.conf, Y:\vz\Conf\101.conf.bak, and Y:\vz\private\101.

4 Follow the instructions of the wizard to complete the recovery process.
Searching for Containers

Sometimes, there are a great number of Containers on your Hardware Nodes. To quickly find the necessary Container:

1. Right-click the Parallels Virtuozzo Containers item, and choose Task > Search for Containers. The Find Containers window opens.

2. Indicate the parameter by which you want to search for Containers on the upper left drop-down menu, and then the value of the parameter. If you choose to search for Containers by their state (status) or ID, you will be presented with a list of predefined values of these parameters. It is connected with the fact that there is a fixed number of Container statuses, and Container IDs can be only of the integer type. By searching for Containers by their name or IP address, you can enter any string in the corresponding field. In this case, the search results will display all the Containers whose name/IP address contain the specified string, even if only as a part.
3. Select the Hardware Nodes where you want to search for Containers with the specified characteristics. Containers from different Nodes matching the search criterion will be displayed in one and the same search result table. Once you have selected the Hardware Nodes, click the **Search** button. The table will be populated at the bottom of the window.

The Containers in the **Search Results** table corresponding to the specified search criterion may also be sorted by a number of parameters, among which are their ID, name, the Hardware Node they belong to, their IP address, etc. To sort the Containers by a parameter, click the corresponding column name. Another click will reverse the sorting order.

From the **Search Results** table, you may also open the Container manager window by double-clicking the corresponding Container.

---

**Moving Containers within Hardware Node**

You can move Containers within your Hardware Node with the help of the **Move Container** wizard. Moving a Container within one and the same Hardware Node consists in changing the Container ID and its private area path. So, you can use the wizard to change the ID of the corresponding Container only or to additionally modify the Container private area location. To invoke the **Move Container** wizard, select the **Parallels Virtuozzo Containers** item under the corresponding Hardware Node name, right-click the Container you want to change the ID of, and choose **Tasks > Move Container**.

![Move Container wizard](image.png)

**Specify New Container ID**

In this window you should specify a new ID for your Container.

Please specify a new ID for your Container.

- **Current Container ID:** 101
- **New Container ID:** 104

- \[ [ ] Assign Container ID automatically \]
On the **Specify New Container ID** screen, specify a new ID for the Container. Note that the old Container ID will be lost and all Container private data will be transferred to the $X:\vz\private\<new\_CT\_ID>$ folder, where $X$ is the disk drive used to store your Container data and $<new\_CT\_ID>$ denotes the new ID you will assign to the Container.

On the next screen, specify the path to the Container private area folder.

You can leave the path offered by default or select the **Override default path to Container private area** check box and type the desired path in the **Path to Container private area** field. You can use the **Set Default** button to restore the default path, if necessary.

Clicking **Next** will display the **Review Container Movement Settings** window. The window enables you to review the settings made by you in the previous steps. Click the **Finish** button to begin the moving process. This process may take some time, so be sure to wait for it to complete.

You can also move Containers using these tools:

- **Parallels Virtual Automation.** For more information on this web-based tool, see the *Parallels Virtual Automation Administrator’s Guide* at http://sp.parallels.com/products/pva46/resources.
- **vzmlocal.** Detailed information on this command-line utility is provided in the *Parallels Virtuozzo Containers 4.6 Reference Guide*. 
Copying Containers within the Hardware Node

To copy (clone) one or more Containers within the Hardware Node, use the `vzmlocal --copy` command. For each Container to copy, you will need to provide the old Container ID, a new Container ID, and a new path for Container's private area. For example:

```
C:\Users\Administrator>vzmlocal 101:201:C:\MyCT201, 110:210:C:\MyCT210 --copy
```

*Note:* You can copy (clone) both running and stopped Containers.

Copying Single Containers

To make a copy of a Container on the Hardware Node, use the `vzmlocal` command with the `--copy` option:

```
C:\Users\Administrator>vzmlocal 101:201:C:\MyCT201 --copy
```

*Note:* You can copy (clone) both running and stopped Containers.

Copying Multiple Containers

To copy a group of Containers, use the `vzmlocal` command with the `--copy` option.

```
C:\Users\Administrator>vzmlocal 101:201:C:\MyCT201, 110:210:C:\MyCT210 --copy
```

*Note:* You can clone both running and stopped Containers.

Migrating Containers

To migrate one or more Containers to another Hardware Node using Parallels Management Console:

1. Select the **Parallels Virtuozzo Containers** item in the left pane.
2. Select the Containers you want to migrate from the list in the right pane.
3. Right-click the selection, and choose **Tasks > Migrate to Another Hardware Node**. Note that the target Hardware Node must be already registered in Management Console; otherwise, the migration option will not be available. The **Migrate Containers** window appears.
Review the three check boxes at the bottom of the window and check up the needed ones. The **Force migration** check box, when selected, forces the Container migration even if the templates necessary for the Container correct operation are not installed on the Destination Node. However, it will be impossible to start such a Container after the migration in case of the absence of the needed templates. Select the target Hardware Node where you want to migrate the selected Container(s) and press the **Migrate** button.

You can move both stopped and running Containers. Migrating a stopped Container includes copying all Container private files and registry from one Node to another and does not differ from copying a number of files from one workstation to another over the network. In its turn, the migration procedure of a running Container is a bit more complicated and can be described as follows:

1. After initiating the migration process, a snapshot of all Container private files and registry is made, i.e. all Container private files and registry are remembered in the state they were at the beginning of the migration.
2. The files and registry are copied to the Destination Node. During this time, the Container on the Source Node continues running.
3. The Container on the Source Node is stopped.
4. The Container private files and registry copied to the Destination Node are compared with those on the Source Node, and if any files and registry keys were changed during the 2nd migration step, they are copied to the Destination Node again and rewrite the outdated versions.
5. The Container on the Destination Node is started.

There is a short downtime needed to stop the Container on the Source Node, copy the Container files and registry changes to the Destination Node, and start the Container on the Destination Node.
Migration Requirements and Restrictions

When migrating Containers from one Hardware Node to another, keep in mind the following:

**Hardware Nodes requirements and restrictions.** Both the Source and Destination Nodes must meet the following requirements:

- Have the same system architecture. You cannot migrate Containers residing on 64-bit Hardware Nodes to 32-bit Nodes, and vice versa.
- Have the same operating system installed. For example, you cannot move Containers from Hardware Nodes running Windows Server 2003 to Nodes running Windows Server 2008, and vice versa.
- Run the same edition of Windows Server. For example, you can migrate Containers residing on Hardware Nodes with the Windows Server 2003 Datacenter Edition operating system installed only to Hardware Nodes running the same edition of Windows Server 2003.
- Have the same language packs installed. For example, you cannot move Containers from Hardware Nodes running the German version of Windows Server 2003 to Nodes running the English version of Windows Server 2003.
- Have the same Service Packs installed. The migration is also possible if the Destination Node is running a higher version of Service Pack. For example, you can migrate Containers residing on Hardware Nodes running Windows Server 2003 Service Pack 1 to Nodes running Windows Server 2003 Service Pack 1, 2, or 3.
- Be installed using the same installation options. This requirement is only for migrating Containers between Hardware Nodes that run Windows Server 2008 or Windows Server 2008 R2. Both such Nodes must run Windows installed using the same installation option: either the *Server Core* or *Full* installation option.

**Container-related requirements and restrictions.** You should also take into account these requirements and restrictions when migrating Containers:

- All SCSI disk drives forwarded from the Hardware Node to a Container are not kept during the Container migration.
- A Container with a shared loopback file created inside cannot be migrated.
- If a Container has one or more shared loopback files mounted and these loopback files do not belong to this Container (i.e. were created inside other Containers), they are not kept during the Container migration.

Migrating a Container

To migrate one or more Containers to another Hardware Node using Parallels Management Console:

1. Select the *Parallels Virtuozzo Containers* item in the left pane.
2. Select the Containers you want to migrate from the list in the right pane.
3. Right-click the selection, and choose Tasks > Migrate to Another Hardware Node. Note that the target Hardware Node must be already registered in Management Console; otherwise, the migration option will not be available. The *Migrate Containers* window appears.
Managing Containers

Review the three check boxes at the bottom of the window and check up the needed ones. The Force migration check box, when selected, forces the Container migration even if the templates necessary for the Container correct operation are not installed on the Destination Node. However, it will be impossible to start such a Container after the migration in case of the absence of the needed templates. Select the target Hardware Node where you want to migrate the selected Container(s) and press the Migrate button.

You can also migrate Containers using these tools:

- Parallels Virtual Automation. For more information on this web-based tool, see the Parallels Virtual Automation Administrator's Guide at http://sp.parallels.com/products/pva46/resources.
- vzmigrate. Detailed information on this command-line utility is provided in the Parallels Virtuozzo Containers 4.6 Reference Guide.

Deleting Containers

Parallels Management Console allows you to delete Containers that are not needed anymore. To delete a Container, select it in the Containers table in the right pane of the Management Console main window. You can use CTRL+Click to select or deselect an entry, SHIFT+Click to select a range of Containers, CTRL+A to select all Containers. Then right-click the selected Containers, and choose Delete.
Managing Containers

You can also click the **Delete** button on the toolbar or select **Delete** on the **Action** menu. In the displayed dialog, click **Yes** to confirm your decision.

Deleting a considerable number of Containers may take some time. The progress is displayed in the **Actions** pane.

In the command line, you can delete a Container by using either the `vzctl delete` or `vzctl destroy` command. Detailed information on these commands is provided in the Parallels Virtuozzo Containers 4.6 Reference Guide.

---

**Note:** Removing a Container means that the private area of the Container (located in the `C:\vz\private` folder on the Hardware Node by default) is completely deleted from the Host OS and all the Container private files are irrevocably erased from the Node without being moved to the Recycle Bin.

---

You can also delete Containers using these tools:

- Parallels Virtual Automation. For more information on this web-based tool, see the Parallels Virtual Automation Administrator's Guide at http://sp.parallels.com/products/pva46/resources.
- `vzctl delete` or `vzctl destroy`. Detailed information on these command-line tools is provided in the Parallels Virtuozzo Containers 4.6 Reference Guide.
Changing the Administrator's Password

While creating a new Container, you must have specified the Administrator password to log in to the Container as the Administrator user through Parallels Power Panel, RDP, or MS TSC. This Administrator user differs from the Administrator user of the Hardware Node and has full control over the given Container only.

To change the specified Administrator password for a Container:

1. Select the Parallels Virtuozzo Containers item under the Hardware Node name.
2. Right-click the corresponding Container in the table, and choose Properties.
3. Once the Properties of Container dialog is displayed, click the Advanced tab.
4. Click the Change Password button, and type the new password in the provided fields.

Alternatively, you can open a separate console for the Container (Container Manager) and set the password for the Administrator user as is described in Managing Users and Groups (p. 95).

You can also change the Administrator password of a Container using these tools:

- Parallels Virtual Automation. For more information on this web-based tool, see the Parallels Virtual Automation Administrator's Guide at http://sp.parallels.com/products/pva46/resources.
- vzctl set. Detailed information on this command-line tool is provided in the Parallels Virtuozzo Containers 4.6 Reference Guide.

Setting Container Names

To set a custom name for your Container, use the vzctl set --name command. For instance:

```
C:\Users\Administrator>vzctl set 101 --name container101
```

This command changes the Container's name to "container101".
Managing Containers

Note: Like Container's ID, the name is unique.

Storing Extended Information on Containers

Sometimes, it may be difficult to remember the information on certain Containers. The probability of this increases together with the number of Containers and with the time elapsed since the Container creation. Parallels Virtuozzo Containers allows you to set the description of any Container on the Hardware Node and view it later on, if required. The description can be any text containing any Container-related information; for example, you can include the following in the Container description:

- the owner of the Container
- the purpose of the Container
- the summary description of the Container

To provide a description for a Container in Management Console, do the following:

1. Choose the Parallels Virtuozzo Containers item under the corresponding Hardware Node, right-click the Container for which you want to set the description, and choose Properties.

2. On the General tab of the displayed window, type the necessary information in the Description field. You can use any symbols you like in the Container description (new lines, dashes, underscores, spaces, etc).

3. Click OK.

At any time, you can change the provided Container description by performing the aforementioned operations and entering some other information in the Description field.

To specify Container descriptions, you can also use these tools:
Parallels Virtual Automation. For more information on this web-based tool, see the *Parallels Virtual Automation Administrator's Guide* at http://sp.parallels.com/products/pva46/resources.

```
vzctl set. Detailed information on this command-line tool is provided in the *Parallels Virtuozzo Containers 4.6 Reference Guide*.
```

---

### Defragmenting Container Disks

Similar to physical disk drives, virtual disks in Containers can become fragmented. Such fragmentation leads to inefficient use of storage space and reduction of overall Container performance. Parallels Virtuozzo Containers offers two ways to defragment virtual disks in a Container:

- Automatically by setting a schedule with tools built into Windows Server.
- Manually with the `vzctl defrag` command.

Both ways are described in the following subsections in detail.

---

#### Defragmenting Virtual Disks Automatically


**Windows Server 2008, Windows Server 2008 R2**

Windows Server 2008 and Windows Server 2008 R2 come with Disk Defragmenter that lets you set a defragmentation schedule. For example, to defragment Container 101 running Windows Server 2008:

1. Log in to Container 101 (e.g., via RDP).
2. Launch Disk Defragmenter by clicking `Start > Programs > Accessories > System Tools > Disk Defragmenter`.
3  Select the Run on a schedule check box.

4  Use the Modify schedule and Select volumes buttons to set defragmentation time and select virtual disks to defragment, respectively.

5  Click OK.

For more information on Disk Defragmenter, refer to documentation on Windows Server 2008 and Windows Server 2008 R2.

**Windows Server 2003**

Unlike the Disk Defragmenter of Windows Server 2008 and Windows Server 2008 R2, that of Windows Server 2003 does not allow you to automatically defragment disk drives. To solve this issue, Parallels Virtuozzo Containers runs a service in each Container that does the following:

1  Checks the fragmentation level of Container's virtual disks every 30 minutes.

2  If the level of virtual disk fragmentation exceeds 15%, the service starts defragmentation.

**Notes:**

1. Automatic defragmentation is performed for both running and mounted Containers.

2. You cannot disable automatic defragmentation in the current version of Parallels Virtuozzo Containers.
Defragmenting Virtual Disks Manually

You can manually check virtual disks' fragmentation level and defragment them with the `vzctl defrag` command.

To check how fragmented are Container's virtual disks, use the `vzctl defrag` command with the `--analysis` option. For example, to find out the fragmentation percentage of the virtual disk `C:` of Container 101, run the following command:

```
C:\Users\Administrator> vzctl defrag 101 --drive C: --analysis
```

```
DiskSize = 204797952
UsedSpace = 165264128
FreeSpace = 21533824
TotalFiles = 10723
NumFraggedFiles = 44
AvgFragsPerFile = 102
NumExcessFrgs = 270
FreeSpacePercent = 9
PercentDiskFragged = 33
FreeSpaceFragPercent = 3
Command 'defrag' is successfully finished
```

The `vzctl defrag` command shows the following parameters:

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>DiskSize</td>
<td>The size of the virtual disk, in bytes.</td>
</tr>
<tr>
<td>UsedSpace</td>
<td>The amount of used disk space on the virtual disk, in bytes.</td>
</tr>
<tr>
<td>FreeSpace</td>
<td>The amount of free disk space on the virtual disk, in bytes.</td>
</tr>
<tr>
<td>TotalFiles</td>
<td>The total number of files on the virtual disk.</td>
</tr>
<tr>
<td>NumFraggedFiles</td>
<td>The total number of fragmented files on the virtual disk.</td>
</tr>
<tr>
<td>AvgFragsPerFile</td>
<td>The average number of fragments per file on the disk.</td>
</tr>
<tr>
<td>NumExcessFrgs</td>
<td>The total number of excess file fragments on the virtual disk.</td>
</tr>
<tr>
<td>FreeSpacePercent</td>
<td>The percentage of free space on the virtual disk.</td>
</tr>
<tr>
<td>PercentDiskFragged</td>
<td>The percentage of fragmented occupied space on the virtual disk.</td>
</tr>
<tr>
<td>FreeSpaceFragPercent</td>
<td>The percentage of fragmented free space on the virtual disk.</td>
</tr>
</tbody>
</table>

If you think that the virtual disk is too fragmented, you can use the `vzctl defrag` command to defragment it. Before doing so, make sure the virtual disk has at least 15% of free space for defragmentation to be most efficient. If there is less than 15% of free space on the virtual disk, you can still defragment it using the `--force` option. In this case, however, defragmentation may be partial.

**Note:** The current version of `vzctl defrag` does not support Containers running Windows Server 2008 R2 and Windows Server 2012.

To defragment a virtual the virtual disk `C:` of Container 101, run the following command:

```
C:\Users\Administrator> vzctl defrag 101 --drive C:
```
Managing Containers

DiskSize = 204797952
UsedSpace = 168456192
FreeSpace = 36341760
TotalFiles = 10959
NumFraggedFiles = 1
AvgFragPerFile = 100
NumExcessFrag = 4
FreeSpacePercent = 17
PercentDiskFragged = 0
FreeSpaceFragPercent = 0
Command 'defrag' is successfully finished

Configuring Containers Boot Order

On Hardware Node boot, all Containers having the --onboot option set to yes are started one after another in accordance with the priority defined by their IDs (the lower the ID, the higher the priority). For example, if Containers 101 and 102 are set to start on Node boot, Container 101 will start before Container 102. However, you can also use the --bootorder option of the vzctl set command to configure the order your Containers will start in.

Let us assume that your Hardware Node hosts Containers 101, 102, 103, and 104. If configured to start on Node boot, the Containers will start in the default order: 101, 102, 103, 104. Let us say that you want to configure the Containers to start on Node boot in the following order: 102, 104, 101, 103. To do it:

1. Configure each Container to start on Node boot. For example, for Container 101, run:
   
   C:\Users\Administrator>vzctl set 101 --onboot yes --save

2. Set the highest priority for Container 102, which should start first:
   
   C:\Users\Administrator>vzctl set 102 --bootorder 1

3. Set the second highest priority for Container 104, which should start second:
   
   C:\Users\Administrator>vzctl set 104 --bootorder 2

The remaining Containers 101 and 103 will have lower priority and start in the default order, i.e. according to their IDs: 101, 103. The resulting boot order will be 102, 104, 101, 103, as required.

To check the current boot order, use the vzlist command. For example:

   C:\Users\Administrator>vzlist -a -o ctid,bootorder
   CTID  BOOTORDER
   101   -
   102   1
   103   -
   104   2

To revert the boot order to default, set it to 0 for each Container in question. For example, for Container 102:

   C:\Users\Administrator>vzctl set 102 --bootorder 0
Forwarding SCSI Disks to Containers

To forward a hardware device (SCSI, iSCSI, etc.), which is attached to the Hardware Node, to your Container, use the `vzdevctl` command. For example:

```
C:\Users\Administrator>vzdevctl add 101 --deviceid "PCI\VEN_9005&DEV_8017&SUBSYS_00459005&REV_10" --exclusive --connect --onboot
```

Notes:

1. Migrating a Container will remove forwarded SCSI disks from it.
2. Any SCSI disk can be forwarded to only one Container on the Hardware Node.

Viewing Container Uptime

To find out for how long a Container has been running since start, you can use the standard Windows Task Manager. Do the following:

1. Log in to the Container in question (e.g., via RDP).
2. Right-click on the taskbar and choose Tasks Manager to launch Windows Task Manager.
3. Click the Performance tab.
The current system uptime is shown under **System** in the **Up Time** field.

**Note:** This method will only work for Containers running Windows Server 2008 and Windows Server 2008 R2.

---

**Determining Container ID by Session and Process IDs**

You can find out a Container ID with the `vzquery` command and appropriate subcommands described below. You will also need to supply the identifier of either a process or session running in the Container as the option.

**Note:** You can also learn what PIDs and session IDs belong to what Container by using Windows Task Manager on the Hardware Node. For more information, refer to Using Task Manager to Control Processes.
Each process running in a Container has a unique process identifier (PID). For example, when you start the Notepad, it is assigned a specific process ID. This PID can be used to monitor and control the application (e.g., by means of Windows Task Manager).

To find out the ID of the Container the specified process is running in, use the vzquery p2v command. For example:

```
C:\Users\Administrator>vzquery p2v 4360
Process ID: 4360
Session ID: 2
CT ID: 101
```

In this example, the process with ID 4360 is running in Container 101.

When using the vzquery p2v command, keep in mind the following:

- If the process is running on the Hardware Node itself, the Container ID will be 0. For example:

```
C:\Users\Administrator>vzquery p2v 4360
Process ID: 4360
Session ID: 2
CT ID: 0
```

- If the process with the specified ID is not running on either the Hardware Node or in its Containers, an error message is displayed:

```
C:\Users\Administrator>vzquery p2v 4360
Process 4360 not found
```

Along with the process and Containers IDs, the vzquery p2v command also displays the ID of the Terminal Services session that owns process 4360 (Session ID: 2 in the examples above). A unique session ID is created for each user logged in to a Container. Knowing it, you can find out the ID of the Container the session belongs to by using the vzquery s2v command. For example:

```
C:\Users\Administrator>vzquery s2v 2
Session ID: 2
CT ID: 101
```

The output indicates that the session with ID 2 is established to Container 101.

To find out what sessions are currently opened to a Container, use the vzquery v2s command. For example:

```
C:\Users\Administrator>vzquery v2s 101
CT ID: 101
Session ID: 1 (ROOT)
Session ID: 2
```

In this example, Container 101 has sessions 1 and 2 established to it. Session 1 marked as ROOT is a special session created for each Container on its start and required for the Container to function properly. While such session can be assigned different IDs in different Containers, it is always marked ROOT.
Managing Server Roles in Containers

Parallels Virtuozzo Containers provides special command line tools for managing server roles inside Containers running Windows Server 2008 or Windows Server 2008 R2. Using these tools, you can perform the following role-related operations:

- add new roles to Containers,
- list roles currently installed in a Container,
- remove installed roles from Containers.

Notes:

1. You can also manage roles, services, and features with Server Manager when logged in the Container (e.g., via RDP).

2. For more information on Server Manager, refer to http://go.microsoft.com/fwlink/?LinkId=48541.

Adding New Roles to Containers

By default, a newly created Container does not have any server roles installed in it. You can add new roles with the `vzctl addrole` command. Let us assume that you want to configure Container 101 for the Network Policy and Access Services, Print Services, and Web Server roles. To do this:

1. Determine what names the `vzctl` utility uses to manage the required roles.
2. Add the required roles to Container 101 with the `vzctl addrole` command.

To find out what names the `vzctl` utility uses for the needed roles, execute the following command on the Hardware Node:

```
C:\Users\Administrator>vzctl enumroles 101
----- Roles -----  
[ ] Active Directory Certificate Services  [AD-Certificate]  
[ ] Certification Authority  [ADCS-Cert-Authority]  
[ ] Certification Authority Web Enrollment  [ADCS-Web-Enrollment]  
[ ] Active Directory Domain Services  
[ ] Active Directory Domain Controller  [ADDS-Domain-Controller]  
[ ] Identity Management for UNIX  [ADDS-Identity-Mgmt]  
[ ] Server for Network Information Services  [ADDS-NIS]  
[ ] Password Synchronization  [ADDS-Password-Sync]  
...  
----- Features -----  
[ ] .NET Framework 3.0 Features  [NET-Framework]  
[ ] .NET Framework 3.0  [NET-Framework-Core]  
[ ] XPS Viewer  [NET-XPS-Viewer]  
[ ] WCF Activation  [NET-Win-CFAC]  
[ ] HTTP Activation  [NET-HTTP-Activation]  
[ ] Non-HTTP Activation  [NET-Non-HTTP-Activ]  
...  
```
The Roles section in the command output lists all the roles that are available to Container 101 (e.g., Active Directory Certificate Services) and the role services provided by these roles (e.g., Certification Authority and Certification Authority Web Enrollment and Active Directory Domain Services). The Features section, in its turn, displays the auxiliary features that can be added to the Container to augment the installed roles. All the roles, role services, and features listed by the `vzctl enumroles` command correspond to those available to a standalone server running Windows Server 2008 and Windows Server 2008 R2. You can consult the documentation shipped with this operating system to get detailed information on each role, role service, or feature.

The brackets before each role denote whether the corresponding role is already installed in the Container (the brackets contain the X sign) or is not yet applied to it (the brackets are empty). The brackets after role names display the name you need to supply to the `vzctl` utility. In our example, the roles that you wish to add to Container 101 have the following names:

- Print-Services: Print Services.

Now that you know the names of the necessary roles, you can add them to Container 101 using the following command:

```
C:\Users\Administrator>vzctl addrole 101 --role NPAS Print-Services Web-Server
Command 'addrole' is successfully finished
```

The installation of some server roles or role services may require a Container restart. In this case, the command output will display the following message:

```
Restart of CT<CT_ID> is required to complete the installation of <role_name>.
```

where:

- `<CT_ID>` is the ID of the Container you need to restart for the changes to take effect.
- `<role_name>` is the name of the server role or role service you are installing inside the Container.

For example, if you are installing the TS-Terminal-Server role service inside Container 101, you will be presented with the following message:

```
Restart of CT101 is required to complete the installation of TS-Terminal-Server.
```

You can also specify the `--restart` option when adding a role or role service that requires the Container restart. In this case, the Container will be automatically restarted during the role/role service installation. So, you can execute the following command to install the TS-Terminal-Server role service in Container 101 and automatically restart it during the installation:

```
C:\Users\Administrator>vzctl addrole 101 --role TS-Terminal-Server --restart
```

### Listing Roles Installed in Containers

After you have installed one or more roles in your Containers, you can list them using the `vzctl enumroles` command. In our example:

```
C:\Users\Administrator>vzctl enumroles 101
----- Roles -----
...
The X sign in brackets next to the roles names denotes that all three server roles are now installed inside Container 101. However, the vzctl addrole command does not add all elements of a role to a Container, but only those included in the role's default configuration. For example, the LPD Service role service was not installed inside Container 101 along with the Print Services role because this service is not part of the default configuration of this role. So, if you wish to have this role service installed in Container 101, run the vzctl addrole command once more and specify the name of this service after the --role option.

As you may also notice, vzctl has added a number of additional components to Container 101. This is explained by the fact that the utility automatically handles the dependencies of the server roles to be installed and applies to the Container all software components (role services, features, etc.) required by these roles. For example, installing the Web Server role inside Container 101 will automatically add the Remote Server Administration Tools and Web Server (IIS) Tools features to this Container.

**Removing Roles from Containers**

To remove a role from a Container, use the vzctl delrole command. So, to delete the Network Policy and Access Services role from Container 101 in our example, execute the following command on the Hardware Node:

```
C:\Users\Administrator> vzctl delrole 101 --role NPAS
Command 'delrole' is successfully finished
```

As in the case with adding roles, you may need to restart the Container to complete the deletion of a role or role service that requires Container restart. You can either manually restart the Container or specify
--restart option when executing the `vzctl delrole` command to automatically restart the Container during the role deletion.

---

**Performing Operations in Containers**

You can perform operations with files and folders in Containers by using the Command Prompt or logging in to the Container (e.g., via RDP) and working in it like you would on a regular Windows server.

**Managing Users and Groups**

Parallels Management Console allows you to manage users and groups inside Containers with the help of Container Manager. All users and groups are adjustable. You can also add new users and groups.

To manage groups or users inside a Container, open the main tree for this Container, select the **Users and Groups** item, and click either the **Users** or **Groups** tab to view the users or groups currently existing inside the Container, respectively.

![Container Manager](image)

To open the group properties dialog, double-click on the group name in the table of groups or select **Properties** on the context menu. To add a new user to the group, click the **Add** button. To remove a user from the group, select the user name, and press the **Remove** button.
To add a new group, click the **New Group** button on the toolbar (note that this button appears only if you are currently working with Container groups). Then enter the group name, and click **OK**.

To delete a group, select its name in the table of groups, and click the **Delete** button on the toolbar or select the **Delete** item on the context menu.

To add a new user, open the list of users and click the **New user** button at the top toolbar. Enter the user login (user name). This is the only mandatory parameter. You may also set the user description and password and add the user to one or more groups (see the **Member Of** tab). Then click **OK**.

To edit an existing user, double-click on the user name in the table of users or use the **Properties** item on the context menu. The user properties dialog is analogous to the **New User** dialog.

To change the password for a user, right-click the user in the table of users, select **Set Password** on the context menu, then enter the password in the fields provided.

To delete a user, select its name in the table of users and click the **Delete** button at the top toolbar or select the **Delete** option on the context menu.

**Note:** In the current version of Parallels Virtuozzo Containers, you cannot create Active Directory domain user accounts inside your Container by means of Parallels Management Console. However, you can log in to the Container which acts as a domain controller via RDP and create a domain user like you would do it on any other stand-alone Windows server.

---

### Accessing Container's Private Area

You can access the private area of a stopped Container from the Hardware Node to quickly perform operations on files and folders stored on Container's virtual disks. To do that, mount the Container with the `vzctl mount` command. For instance:

```
C:\Users\Administrator>vzctl mount 101
```

The private area of Container 101 will be mounted to the folder `C:\vz\root\101`. Opening it in the standard Windows Explorer, you will see shortcuts to virtual disks the Container 101 has. Clicking a shortcut will open a folder with the virtual disk contents, which you can manage like regular files and folders.

**Note:** When a Container is started, its private area is mounted automatically.

---

### Uploading Files to Containers

The Container Manager window allows you to upload any number of files or whole folders from the local computer (the computer where Parallels Management Console is installed) to any folder on any Container disk drive. In the Container main tree, expand the **File Manager** item, choose the folder inside the Container where the files are to be uploaded, and choose **Tasks > Upload Local File**. The **Upload Files** wizard opens.
It is a three-step wizard. In the first step, you should define the Containers and the path inside this Container (these Containers) where the files will be uploaded. Click the Add button to open the Select Containers window where you should consecutively select a Hardware Node and/or a Container from this node and add it to the Container upload list. Repeat this sequence for every Container where you wish to upload files and then click OK. After that, you should enter the path where the files are to be uploaded or browse for this path inside the remote Container. Click Next when you are finished.

In the second step, you should specify the local files or folders you want to upload to the Containers that you specified in the previous step.
Managing Containers

Click the Add button and select a file or a group of files from a single folder for uploading. You can also upload the whole folder by clicking the Add Directory button. If you need to upload files from various local folders, click the Add button the required number of times. After you have added all the files and folders to be uploaded, click Next.

The next window lets you review all the information provided in the previous step of the wizard. Make sure that the settings are correct. To change any settings, click the Back button and make the necessary corrections. After you click Next, the uploading process begins. The operation progress is graphically displayed in the window of the Upload Files wizard. You can see how each of the selected files is being consecutively uploaded to the selected Containers. Please wait for the operation to finish.

After the uploading process is finished, you will get informed of the results of the operation. The table in the displayed window lets you view the results regarding every file uploaded to the selected Containers. Click Finish to exit the wizard.

Note: You can also upload files and folders to Containers using Parallels Virtual Automation. For more information on this web-based tool, see the Parallels Virtual Automation Administrator’s Guide at http://sp.parallels.com/products/pva46/resources.

Downloading Files to a Local Computer

Parallels Management Console allows you to download any file or folder located on any Container disk drive to the computer where Management Console is installed. To do this:

1. Expand the File Manager item in the Container main tree.
2 Select the file/folder you want to download to your local computer (you can use CTRL+Click to select or deselect the file/folder, SHIFT+Click to select a range of files/folders, CTRL+A to select all files/folders);

3 Right-click the selected files/folders, and choose Tasks > Copy To Local Computer.

4 In the displayed window, specify the folder on your local computer where to download the selected files/folders.

5 Click OK.

**Note:** You can also download files and folders from Containers to your local computer using Parallels Virtual Automation. For more information on this web-based tool, see the Parallels Virtual Automation Administrator’s Guide at http://sp.parallels.com/products/pva46/resources.

## Configuring File Properties

Parallels Management Console allows you to view and/or configure the properties of files and folders. To do this, expand the File Manager item in the Container main tree, right-click the file/folder whose properties you want to display or configure, and choose Properties. The file/folder Properties window opens.
Managing Containers

The information in this window is presented on two tabs:

- **General**: This tab contains:
  - The **Name** field where you can rename the current file/folder.
  - The **Read-only** check box allowing you to specify whether the file/folder can be edited (the check box is cleared) or can be opened for viewing only (the check box is selected).

  You can also view the type, location, size, and the last modification date of the file/folder.

- **Ownership**: This tab allows you to view the owner of the file/folder and set another owner by selecting the needed name on the drop-down menu.

**Note**: To configure file and folder properties, you can also use Parallels Virtual Automation. For more information on this web-based tool, see the *Parallels Virtual Automation Administrator’s Guide* at http://sp.parallels.com/products/pva46/resources.

---

**Listing Windows Updates Inside Containers**

The Windows Server operating system (OS) installed inside a Container is automatically updated during the Host OS update, i.e. all updates installed on the Hardware Node are automatically applied to all Containers residing on this Node. Parallels Virtuozzo Containers provides special means for listing Windows Server updates currently applied to your Containers:

- the Container Update Manager tool
the vzwinupdatecmd utility

The following subsections provide detailed information on both tools.

Note: Container Update Manager and vzwinupdatecmd provide an easy and convenient way to view Windows Server updates inside your Containers from a single place on the Hardware Node. However, you can still view and manage the updates inside a particular Container in the same way you would do it on any other standalone server, i.e. logging in to the Container via RDP and using the Add or Remove Programs applet in Control Panel.

Viewing Updates in Update Manager

Parallels Virtuozzo Containers provides a special tool - Container Update Manager - enabling you to easily view Windows updates installed inside your Containers. To launch the manager, select Programs > Parallels > Parallels Virtuozzo Containers > Parallels Virtuozzo Containers for Windows Update Manager on the Windows Start menu. You will be presented with the following window:

The Container Update Manager window consists of three panes:

- The Container List pane on the left. This pane contains a list of all Containers currently available on the Hardware Node. The information on these Containers is provided in the table having the following columns:

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ID</td>
<td>The ID assigned to the Container.</td>
</tr>
</tbody>
</table>
### Managing Containers

<table>
<thead>
<tr>
<th>Hostname</th>
<th>The hostname assigned to the Container.</th>
</tr>
</thead>
<tbody>
<tr>
<td>IP address</td>
<td>The IP address assigned to the Container.</td>
</tr>
<tr>
<td>Status</td>
<td>The current status of the Container.</td>
</tr>
</tbody>
</table>

- The **Update List** pane at the right top section of the **Container Update Manager** window that displays a list of Windows updates which are currently applied to the Container selected in the **Container List** pane:

  ![Container Update Manager Window](image)

  To view detailed information about any available update, right-click it, and choose **Properties**.

- The **Updated Files** pane at the right bottom section of the **Container Update Manager** window showing the files inside the Container (selected in the **Container List** pane) which are included in the Windows update selected in the **Update List** pane.
The information on the update files is presented in the table with the following columns:

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
<td>Description</td>
</tr>
<tr>
<td>File</td>
<td>The path to the update file inside the Container.</td>
</tr>
<tr>
<td>Container Size</td>
<td>The size of the update file inside the Container.</td>
</tr>
<tr>
<td>Container Version</td>
<td>The version of the update file inside the Container.</td>
</tr>
<tr>
<td>Updated Size</td>
<td>The size of the update file on the Hardware Node.</td>
</tr>
<tr>
<td>Updated Version</td>
<td>The version of the update file on the Hardware Node.</td>
</tr>
</tbody>
</table>

Please keep in mind that the data in the Container Size and Container Version columns are available for running and mounted Containers only. To mount a Container, right-click it in the Container List pane, and choose Mount. The Container is also automatically mounted on performing any operation on it (e.g., removing a Windows update from it).

### Listing Updates with vzwinupdatecmd

In Parallels Virtuozzo Containers, you can also use the vzwinupdatecmd utility to list all updates that are currently available and applied to a Container. For example, you can do it as follows:

```bash
c:\users\administrator>vzwinupdatecmd /listctupd 101 102
List of available and installed updates for Container 101
[X] KB893756 - Security Update for Windows Server 2003 (KB893756)
[X] KB896358 - Security Update for Windows Server 2003 (KB896358)
[X] KB896428 - Security Update for Windows Server 2003 (KB896428)
[ ] KB899587 - Security Update for Windows Server 2003 (KB899587)
[ ] KB899588 - Security Update for Windows Server 2003 (KB899588)
```
List of available and installed updates for Container 102

[X] KB893756 - Security Update for Windows Server 2003 (KB893756)
[X] KB896358 - Security Update for Windows Server 2003 (KB896358)
[X] KB896428 - Security Update for Windows Server 2003 (KB896428)
[ ] KB899587 - Security Update for Windows Server 2003 (KB899587)
[ ] KB899588 - Security Update for Windows Server 2003 (KB899588)

This command lists the Windows updates currently available to Containers 101 and 102. Each string in the command output includes the corresponding update ID (e.g., KB893756) and a brief description of the update (e.g., Security Update for Windows Server 2003). The brackets at the beginning of each string denote whether the corresponding update is currently installed inside the Container (the brackets contain the X sign) or is not yet applied to it (the brackets are empty).

You can also list the updates that are applied to all Containers currently existing on the Hardware Node (including the Service Container) by specifying /all instead of a Container ID:

```
C:\Users\Administrator>vzwinupdatecmd /listctupd /all
```

### Changing Registration Information for Containers

Normally, you specify the user and company names when performing the Windows OS installation on your server. In Parallels Virtuozzo Containers, however, all Containers on your Hardware Node are based on the same Windows OS template and have by default the same registered user and company names:

- The registered owner name is set to User.
- The registered organization name is set to Organization.

You can change the default owner and organization names of a particular Container using the --regowner and regorganization options of the vzctl utility. For example, to modify these names for Container 101 and set them to User1 and Company1, you can run the following command:

```
C:\...\Administrator>vzctl set 101 --regowner User1 --regorganization Company1
```

You can use one of the following ways to check that the registration information inside Container 101 has been successfully changed:

- On the Hardware Node - using the vzlist utility:
  ```
  C:\...\Administrator>vzlist 101 -o regowner,regorganization
  REGOWNER REGORGANIZATION
  User1 Company1
  ```
- Inside Container 101 - using the Windows winver.exe utility:
  a. Log in to Container 101.
  b. Launch Windows Explorer.
  c. Click Start > Run, enter cmd, and press Enter to open the command line prompt.
Run the `winver.exe` utility.

![About Windows](image.png)

Microsoft® /Windows Server®
Version 6.0 (Build 6001; Service Pack 1)
Copyright © 2007 Microsoft Corporation. All rights reserved.
The Windows Server® 2008 Standard operating system and its user interface are protected by trademark and other pending or existing intellectual property rights in the United States and other countries.

This product is licensed under the Microsoft Software License Terms to:
  user1
company1

Physical memory available to Windows Server®: 1,030,992 KB

When managing the registration information for your Containers, keep in mind the following:

- You can remove the current user or organization name from a Container. In this case the Container will have no registered user and organization names set. To do this, indicate empty quotation marks instead of real names when running the `vzctl set` command. For example, the following command
  ```
  C:\...\Administrator> vzctl set 101 --regorganization ""
  ```
removes the registered organization name (Company1) from Container 101.

- You can create a customized Container sample that will have the `RegisteredOwner` and `RegisteredOrganization` parameters set to specific values. You can then use this customized sample to create new Containers on its basis, and all the newly created Containers will have the values from this sample.

- The `--regowner` and `--regorganization` options provide a convenient way of changing the registered user and company names inside your Containers directly from the Hardware Node. However, you can still change these names in the same way you would do it on a standalone server, i.e. log in to the corresponding Container and modify the `RegisteredOwner` and `RegisteredOrganization` values in the Windows registry.
Managing Resources

The main goal of resource control in Parallels Virtuozzo Containers 4.6 is to provide Service Level Management or Quality of Service for Containers. Correctly configured resource control settings prevent impact from Container's resource overusage (accidental or malicious) on other Containers. Using resource control parameters for resource management also allows you to provide fairness of resource usage by Containers and better service quality for preferred Containers, if necessary. This chapter provides information on how you can manage Container resources in Parallels Virtuozzo Containers.

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Managing Container Disk Space Quotas

Parallels Virtuozzo Containers allows you to control the amount of disk space a Container can use. The disk space quota imposed on the Container is actually the size of its virtual hard disk, i.e. the size of the rootefd file in the X:\vz\private\<CT_ID> folder on the Hardware Node.

The following subsections explain how to set the disk space quota parameters for Containers and check their current status.

Setting Up Disk Space Quota

In Parallels Management Console, you can set up the disk space quota parameter by performing the following operations:

1. Click Parallels Virtuozzo Containers in the Management Console left pane, then right-click the needed Container in the right pane, and choose Properties.
2. Click the Resources tab, and select the Disk Quota item in the left part of the displayed window.
3. In the Parameters table, double-click the Container disk space parameter to display the Resource Counter Properties window.
In this window, you can change the value of disk space that can be used by the Container. To do this, specify the needed value in the Value field, and choose the right measurement units on the drop-down menu. The value must be taken from the value range indicated in the Allowed range field. Otherwise, the symbol will be displayed opposite the Allowed range field. Notice that this value does not include the operating system files and the files of applications added to the Container by means of application templates. As there are only placeholders of these files inside the Container, they do not occupy any space. So, there is no need to assign too much disk space (no more than 500-600 MB) to individual Containers.

4 Click OK twice.

It is possible to change the disk space quota parameter for a running Container. In this case, the changes will take effect immediately.

You can also configure the disk space quota parameter using these tools:

- Parallels Virtual Automation. For more information on this web-based tool, see the Parallels Virtual Automation Administrator's Guide at http://sp.parallels.com/products/pva46/resources.
- vzctl set. Detailed information on this command-line tool is provided in the Parallels Virtuozzo Containers 4.6 Reference Guide.

Checking Disk Space Quota Status

To check the status of the disk space quota set for a Container, use the vzquota stat command. For example:

```
C:\Users\Administrator>vzquota stat 101
<table>
<thead>
<tr>
<th>disk</th>
<th>resource</th>
<th>usage</th>
<th>hardlimit</th>
<th>path</th>
</tr>
</thead>
<tbody>
<tr>
<td>C:</td>
<td>1k-blocks</td>
<td>399888</td>
<td>4000000</td>
<td>C:\vz\Private\101\rootefd</td>
</tr>
</tbody>
</table>
```
The output above shows that the current disk space quota for Container 101 is 4,000,000 1-kilobyte blocks, i.e. 4GB.

Managing Container CPU Resources

This section describes how to manage Containers' CPU resource parameters.

Managing Container CPU Usage

In the current version of Parallels Virtuozzo Containers, you can configure and monitor the following CPU resource parameters for each Container on the Hardware Node:

- **CPU Units.** CPU units represent a positive integer number that defines how much CPU time one Container will receive in comparison with the other Containers on the Hardware Node in case all the CPUs of the Node are fully used. For example, if Containers 101 and 103 are set to receive 1000 CPU units each and Container 102 - 2000 CPU units, Container 102 will get twice as much CPU time as Containers 101 or 103 in case all the CPUs of the Node are completely loaded.

  **Note:** Processes belonging to any Container are scheduled for execution on all the CPUs of the Hardware Node. Consequently, Containers are not bound to only one CPU, and any application inside each Container can use all the free CPU power of the Node.

  By default, the Hardware Node (Container 0) receives 5000 CPU units and each Container on the Node gets 1000 CPU units. In Parallels Virtuozzo Containers, you cannot modify the default CPU value for the Hardware Node or any of its Containers. Instead, you can change the current value of the CPU resource parameter for a particular Container (but not for the Node itself) by means of Parallels Management Console.

- **CPU guarantee.** This is a positive integer number indicating the CPU time, in percent, the corresponding Container is guaranteed to receive. By default, this parameter is disabled for all Containers on the Hardware Node, i.e. the amount of CPU time allocated to a Container depends on the value of the CPU Units parameter and the Hardware Node workload. If both parameters - CPU Units and CPU guarantee - are set, the CPU guarantee parameter is first taken into account when distributing processor(s) time among the Containers existing on the Node; the remaining CPU time, if any, is given to the Containers in accordance with the value of the CPU Units parameter.

  Any Container can consume more than the guaranteed value if there are no other Containers competing for the CPU (e.g., with higher values of the CPU Units parameter) and the value of the CPU guarantee parameter does not equal that of the CPU limit parameter.

- **CPU limit.** This is a positive integer number indicating the CPU time, in percent, the corresponding Container is not allowed to exceed. By default, this parameter is disabled for all Containers on the Hardware Node, i.e. any application inside any Container can use all the free CPU power of the Node.

All three CPU resource parameters are controlled by the Parallels Virtuozzo Containers hierarchical scheduler and can be configured by doing the following:
1 Click **Parallels Virtuozzo Containers** in the Parallels Management Console left pane, then right-click the needed Container in the right pane, and choose **Properties**.

2 Click the **Resources** tab and select **CPU parameters** in the left part of the displayed window:

3 In the **Parameters** table, double-click either the **CPU Units**, **CPU limit**, or **CPU guarantee** parameter and enter the right value for the given Container in the **Value** field of the **Resource Counter Properties** window:

   - For the **CPU Units** parameter, you can specify any value in the range from 50 to 50000 CPU units. If the value is set out of the allowed range, you will see the ![info icon](image) icon opposite the **Allowed range** field.
   - For the **CPU limit** parameter, you can enter any value in the range from 10 to 100. If the value is set out of the allowed range, you will see the ![info icon](image) icon opposite the **Allowed range** field.
   - For the **CPU guarantee** parameter, you can enter any value in the range from 0 to 90. If the value is set out of the allowed range, you will see the ![info icon](image) icon opposite the **Allowed range** field.
Managing Resources

Note: Specifying 0 as the value of the CPU guarantee parameter will remove all CPU guarantees for the given Container.

4 Click OK.

It is possible to change the CPU resource parameter for both stopped and running Containers. In the latter case, the changes will take effect immediately.

You can also configure any of the CPU resource parameters using these tools:

- Parallels Virtual Automation. For more information on this web-based tool, see the *Parallels Virtual Automation Administrator's Guide* at http://sp.parallels.com/products/pva46/resources.
- `vzctl set`. Detailed information on this command-line tool is provided in the *Parallels Virtuozzo Containers 4.6 Reference Guide*.

**Configuring Number of CPUs Inside Container**

If your Hardware Node has more than one physical processor installed, you can control the number of CPUs which will be used to handle the processes running inside separate Containers. By default, a Container is allowed to consume the CPU time of all processors on the Hardware Node, i.e. any process inside any Container can be executed on any processor on the Node. However, you can modify the number of physical CPUs which will be simultaneously available to a Container. For example, if your Hardware Node has 4 physical processors installed, i.e. any Container on the Node can make use of these 4 processors, you can set the processes inside Container 101 to be run on 2 CPUs only by performing the following operations:

1 In Management Console, select the *Parallels Virtuozzo Containers* item under the corresponding Hardware Node name.

2 Right-click the Container for which you want to change the number of available CPUs, and choose Properties.

3 In the Parameters table on the Resources tab of the displayed window, double-click the Number of CPUs item.
Clear the **Not limited** check box, and enter '2' in the **Value** field.

**Note:** The number of CPUs to be set for a Container must not exceed the number of physical CPUs installed on the Hardware Node. Specifying 0 as the value of the **Number of CPUs** parameter or selecting the **Not limited** check box will enable the Container to use all the CPUs available on the Node.

Click **OK** twice.

Restart the Container for the changes to take effect.

From this moment on, Container 101 will be bound to only two processors on the Hardware Node instead of 4 available for the other Containers on this Node. It means that the processes of Container 101 will be simultaneously executed on no more than 2 physical CPUs while the other Containers on the Node will continue consuming the CPU time of all 4 Hardware Node processors, if needed. Also notice that the physical CPUs of Container 101 might not remain the same during the Container operation; they might change for load balancing reasons, the only thing that cannot be changed is their maximal number.

You can also configure the number of CPUs to be available to Containers using these tools:

- **Parallels Virtual Automation.** For more information on this web-based tool, see the *Parallels Virtual Automation Administrator's Guide* at http://sp.parallels.com/products/pva46/resources.
- **vzctl set.** Detailed information on this command-line tool is provided in the *Parallels Virtuozzo Containers 4.6 Reference Guide.*
Managing Resources

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Managing CPU Pools

If your physical server has more than one processor installed, you can control the number of CPUs that 
will be used to handle the processes running in particular Containers. To allocate only certain processors 
to your Containers, you create CPU pools and assign them to specific Containers. All processes running in 
such a Container will be handled only by the CPUs included in the CPU pool assigned to it.

The following subsections describe how to perform the following operations on CPU pools:

- Create a new CPU pool.
- Configure the number of processors in the CPU pool.
- Delete an existing CPU pool.
- Assign a CPU pool to a Container.
- Configure the number of CPUs to be simultaneously available to a Container within the assigned CPU 
  pool.

Creating New CPU Pools

During the installation of Parallels Virtuozzo Containers on your Hardware Node, only one CPU pool is 
created. This pool is marked as default, includes all CPUs installed on the server, and is assigned by 
default to all newly created Containers. It means that any Container can consume the CPU time of all 
processors installed on the physical server. However, Parallels Virtuozzo Containers provides you with the 
vzcpucfg utility, allowing you to create additional CPU pools and include in these pools certain 
processors only. You can then assign the created CPU pools to your Containers, thus making them 
consume the CPU time of the processors from the assigned pools only.

Let us assume that your physical server has 6 processors installed. All these processors are included in the 
default CPU pool, i.e. any Container on the server can make use of any of these 6 processors. You want to 
create two additional CPU pools and bind them to different Containers. The first pool (Pool_1) will 
consist of 2 processors and the second one (Pool_2) will include the 4 remaining processors.

In the first step, you create two CPU pools. To do this, execute the following commands on the Hardware 
Node:

- To make the first CPU pool:
  C:\Users\Administrator>vzcpucfg pool set Pool_1 0-1

- To make the second CPU pool:
  C:\Users\Administrator>vzcpucfg pool set Pool_2 2-5

0-1 (the processors numeration starts from zero) and 2-5 in the commands above denote the index 
numbers of processors installed on the physical server. Index numbers can be specified as one CPU range 
(0-1) or several comma-separated CPU ranges (0-1,3,4-5).
You can include one and the same processor in more than one CPU pool. For example, you can create Pool_3 and add the processors with index numbers 0, 1, 4, and 5 to it using the following command:

```bash
vzcpucfg pool set Pool_3 0-1,4-5
```

You can check that both pools have been successfully created using the following command:

```
C:\Users\Administrator>vzcpucfg pool list
```

```
CPUPOOL    AFFINITY
default    0-5
Pool_1     0-1
Pool_2     2-5
Pool_3     0-1,4-5
```

Now that you have created two additional pools, you can assign them to your Containers. Detailed information on how you can do it is given in Assigning CPU Pools to Containers (p. 114).

### Configuring Pools

Using the `vzcpucfg` utility, you can configure the number of processors constituting the corresponding CPU pool. If, for example, you have Pool_1 that contains two CPUs (0 and 1) and want to add another CPU to this pool, you can execute the following command:

```
C:\Users\Administrator>vzcpucfg pool set Pool_1 0-2
```

You can also configure the number of processors in the default CPU pool which originally includes all the processors installed on the physical server. For example, if your server has 6 processors (0-5) installed, you can reduce the number of processors in the default pool by 2 CPUs as follows:

```
C:\Users\Administrator>vzcpucfg pool set default 0-3
```

To check the number of processors currently included in your CPU pools, use the following command:

```
C:\Users\Administrator>vzcpucfg pool list
```

```
CPUPOOL    AFFINITY
default    0-3
Pool_1     0-2
Pool_2     2-5
```

As you can see, now the Pool_1 pool comprises three processors (0, 1, and 2) and the default pool contains only four processors (0, 1, 2, and 3).

### Deleting CPU Pools

You can use the `vzcpucfg` utility to delete any of the existing CPU pools, except for the default one. Assuming that you have three CPU pools on your physical server (default, Pool_1, and Pool_2), you can delete Pool_1 as follows:

```
C:\Users\Administrator>vzcpucfg pool del Pool_1
```

To check that the pool has been successfully deleted, run this command:

```
C:\Users\Administrator>vzcpucfg pool list
```

```
CPUPOOL    AFFINITY
default    0-5
Pool_2     2-5
```
As you can see from the command output, Pool_1 is not present any more in the list of existing CPU pools. If Pool_1 was assigned to some Containers, these Containers are automatically bound to the default CPU pool and start using the processors from this pool.

When removing CPU pools from your Hardware Node, keep in mind the following:

- If you are migrating a Container associated with some CPU pool to a Hardware Node that does not have such a pool, the Container will be assigned to the default CPU pool on that Node.
- If you are restoring a Container that was associated with some CPU pool at the time of its backing up on a Hardware Node that does not have such a pool, the restored Container is assigned to the default CPU pool on this Node.

### Assigning CPU Pools to Containers

All newly created Containers are set to consume the CPU time of the processors from the default CPU pool. However, if you have created one or more additional CPU pools, you can configure Containers to use the CPU power of the processors included in these pools only. Let us assume the following:

- Your physical server has 6 processors installed.
- Pool_1 includes 2 processors (0 and 1) and Pool_2 contains 4 processors (2 to 5).
- You want the processes running inside Container 101 to be executed on the processors from Pool_1 and the processes running Container 102 on the processors from Pool_2.

To do this:

1. Assign Pool_1 to Container 101 and Pool_2 to Container 102 by executing the following commands:

   ```
   C:\Users\Administrator> vzctl set 101 --cpupool Pool_1 --save
   C:\Users\Administrator> vzctl set 102 --cpupool Pool_2 --save
   ```

2. Restart the Containers for the changes to take effect:

   ```
   C:\Users\Administrator> vzctl restart 101
   C:\Users\Administrator> vzctl restart 102
   ```

To check that Container 101 and 102 are now bound to Pool_1 and Pool_2, respectively, run the following command:

```
C:\Users\Administrator> vzlist -o ctid,cpupool
CTID CPUPOOL
101 Pool_1
102 Pool_2
```

Now imagine the following situation. For some reason, you need to remove the processor with index 1 from the physical server. This processor is included in Pool_1 which is, in its turn, assigned to Container 101. As soon as you remove the processor from the server, Container 101 will be automatically reassigned to the default pool.
Assigning CPU Pools to Containers on NUMA Nodes

Sometimes, you may need to assign CPU pools to a Container residing on a NUMA-based Hardware Node and having the NUMA support enabled. In this case, the CPU pool settings applied to the Container will take precedence of the NUMA settings. Let us assume the following:

- Your Hardware Node has 8 CPUs installed.
- The CPUs are divided into 2 NUMA nodes: NUMA_1 includes processors 0-3 and NUMA_2 contains processors 4-7.
- You have two CPU pools on the Hardware Node: Pool_1 includes 5 processors (0-4) and Pool_2 contains 3 processors (5-7).
- The NUMA support is enabled for Container 101.

By default, all processes inside Container 101 are executed on all processors available on the Hardware Node. If Container 101 is configured to use no more than 4 processors and no CPU pool is assigned to it, the Container will consume the CPU time of processors from one of the two NUMA nodes. If you assign Container 101 to Pool_2, it will consume the CPU time of 3 processors from the NUMA_2 node because all CPUs in this pool belong to this NUMA node. If you assign Container 101 to Pool_1, it will consume the CPU time of all processors from the NUMA_1 node (because 4 processors in this pool belong to this NUMA node) and one of the processors from the NUMA_2 node. In the latter case, your system performance may slightly degrade.

For more information on managing Containers on NUMA-based Hardware Nodes, refer to Configuring Containers to Use CPUs From NUMA Nodes (p. 116).

Configuring the Number of CPUs for a Container within a CPU Pool

By default, a Container is allowed to consume the CPU time of all processors from the CPU pool assigned to this Container. For example, if Container 102 is bound to Pool_2 containing four processors, it will consume the CPU power of all four processors. However, you can configure the number of CPUs that will be simultaneously available to a Container within the assigned pool. So, you can make Container 102 use only two processors from Pool_2 instead of four. To do this:

1. Execute the following command:
   ```bash
   C:\Users\Administrator>vzctl set 102 --cpus 2 --save
   ```
2. Restart Container 102 for the changes to take effect:
   ```bash
   C:\Users\Administrator>vzctl restart 102
   ```

When the Container is started, it will be bound to only two processors from Pool_2. It means that the processes of Container 102 will be simultaneously executed on no more than 2 logical CPUs from Pool_2, while the other Containers assigned to this pool will continue consuming the CPU time of all four processors.

When deciding on the number of CPUs to be assigned to your Containers, keep in mind the following:

- The number of CPUs to be set for a Container must not exceed the number of logical CPUs available on the Hardware Node.
Specifying 0 as the value of the Number of CPUs parameter will enable the Container to use all the CPUs installed on the Hardware Node.

The logical CPUs set to handle the processes inside the Container might not remain the same during the Container operation; they might change for load balancing reasons. The only thing that cannot be changed is their maximal number.

### Configuring Containers to Use CPUs from NUMA Nodes

By default, Containers are able to make use of all CPUs installed on the physical server, irrespective of whether it is an ordinary or NUMA(Non-Uniform Memory Access)-based server. For example, if the server has 8 CPUs installed, Containers will consume the CPU power of all eight processors. However, if your physical server is NUMA-based, you can enable the NUMA support inside Containers and take all the benefits provided by this technology.


Let us assume the following:

- Your physical server has 8 CPUs installed.
- The CPUs are divided into 2 NUMA nodes, each having 4 CPUs.
- You want all processes inside Container 101 to be executed on 2 processors from a NUMA node.

To set Container 101 to use 2 processors from a NUMA node, do the following:

1. Enable the NUMA support inside Container 101:
   ```
   C:\Users\Administrator>vzctl set 101 --numa yes --save
   ```
2. Configure Container 101 to use 2 processors on the Hardware Node instead of 8 used by this Container by default:
   ```
   C:\Users\Administrator>vzctl set 101 --cpus 2 --save
   ```
3. Restart Container 101 for the changes to take effect:
   ```
   C:\Users\Administrator>vzctl restart 101
   ```

When Container 101 is started, all processes running inside it will be executed on no more than 2 processors from one of the two NUMA nodes available on the physical server. The decision to what NUMA node the Container will be bound is made automatically by the system.

When deciding on the number of processors for a Container, keep in mind the following: If the number of CPUs set for handling the Container processes exceeds the number of CPUs in each NUMA node, the processors will be taken from all NUMA nodes on a random basis. For example, if you configure Container 101 to consume the CPU power of 5 processors, these 5 processors will be taken from both NUMA nodes.

To disable the NUMA support for Container 101, you can execute the following command:

```
C:\Users\Administrator>vzctl set 101 --numa no --save
```
Managing Container System Resources

The resources a Container may allocate are defined by the system resource control parameters:

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Typical value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Container memory</td>
<td>The size of private or potentially private memory that can be allocated to all applications inside the Container, in megabytes. Shared or potentially shared memory (e.g., memory mapped files) is not included in this resource parameter.</td>
<td>100 - 500</td>
</tr>
<tr>
<td>number of processes</td>
<td>The maximal number of processes the Container may simultaneously create. It is important to properly estimate the maximal number of processes when configuring the resource control system.</td>
<td>30 - 100</td>
</tr>
<tr>
<td>number of TS sessions</td>
<td>The number of terminal sessions. This parameter is usually used to limit the number of concurrent terminal sessions. An incorrect configuration of this parameter can affect the application functioning in the given Container.</td>
<td>2 - 5</td>
</tr>
</tbody>
</table>

**Note:** Multi-thread processes are treated as a single process.

**Note:** Windows Server 2008 and newer operating systems maintain an extra terminal session to each Container. To provide for it, increase the number by 1.

To view and/or change any of these parameters for a particular Container in Parallels Management Console, do the following:

1. Click **Parallels Virtuozzo Containers** in the Management Console left pane, right-click the needed Container in the right pane, and choose **Properties**.

2. Click the **Resources** tab and select the **System parameters** item in the left part of the displayed window.
3 Double-click the necessary parameter, and, if needed, enter the right value for the given Container in the **Value** field of the **Resource Counter Properties** window. If the parameter is set out of the allowed range, you will see the ⬗ icon opposite the **Allowed range** field. The typical values for all system parameters are given in the table above.

4 Click **OK**.

You can also configure system parameters using these tools:

- Parallels Virtual Automation. For more information on this web-based tool, see the *Parallels Virtual Automation Administrator's Guide* at http://sp.parallels.com/products/pva46/resources.

- `vzctl set`. Detailed information on this command-line tool is provided in the *Parallels Virtuozzo Containers 4.6 Reference Guide*. 
Managing Network Resources

The given section provides information on how you can enable the Quality of Service scheduler and network browsing for your Containers.

Enabling QoS Scheduler for Container

Quality of Service (QoS) in Windows Server is a collection of components that enable differentiation and preferential treatment for subsets of data transmitted over the network. QoS provides different applications with a means which can be used to define the quality of network resources (e.g., bandwidth) to be allocated for an application. For example, you can use Quality of Service to differentiate between data transmitted by critical applications (e.g., Plesk) and excessive data (e.g., multimedia applications) and allow preferential treatment for the critical applications.

Windows Server QoS is comprised of a number of components. One of the main components playing a central role in the provisioning of quality of service is the Quality of Service packet scheduler. The QoS packet scheduler is the traffic control module that can be used to regulate how much traffic an application inside your Container is allowed, thus enforcing the QoS parameters originally set for a particular application.

By default, the QoS scheduler is disabled for all Containers residing on the Hardware Node. To enable it for a particular Container, do the following:

1. In Management Console, select the Parallels Virtuozzo Containers item under the Hardware Node name.
2. Right-click the corresponding Container in the right part of Management Console, and choose Properties.
3. On the Options tab of the displayed window, select the Enable QoS packet scheduler check box.
4 Click OK.

5 If you have enabled the QoS packet scheduler for a running Container, restart this Container for the changes to take effect.

After you have enabled the QoS packet scheduler, you can manage your Container as a normal stand-alone Windows server in respect of setting and working with all Quality of Service components. From this moment on, it depends entirely upon the Container administrator to define which applications will be QoS-enabled and use all the benefits of Windows Quality of Service.

Note: Additional information on the QoS packet scheduler is provided in the Managing Bandwidth section of the Windows Server Help system that can be invoked by selecting Help and Support on the Windows Start menu.
Enabling Network Browsing for Container

The network browsing allows you to view and access all the network servers and file sharing resources available on your Windows network. However, to start using the network browsing feature inside a Container, which is disabled by default, you should first enable it for this Container.

To enable the network browsing for a particular Container, do the following:

1. In Parallels Management Console, select the Parallels Virtuozzo Containers item under the Hardware Node name.
2. Right-click the corresponding Container in the right part of Management Console, and choose Properties.
3. On the Options tab of the displayed window, select the Enable network browsing check box.
4. Click OK.

Now you can go to My Network Places > Entire Network > Microsoft Windows Network inside your Container, view what network resources are available for the Container, and use these resources in accordance with the rights assigned to the Container on the network.

Note: You can open My Network Places by clicking Start > Programs > Accessories > Windows Explorer and selecting the My Network Places item in the left part of the displayed window.

Managing Network Bandwidth

This section explains how to perform the following tasks in Parallels Virtuozzo Containers:

- set up network classes,
- view network traffic statistics,
- enable and disable traffic shaping (network bandwidth management) and limit bandwidth for all or particular Containers.

Configuring Network Classes

Parallels Virtuozzo Containers allows you to track the inbound and outbound network traffic as well as to shape the outgoing traffic for Containers. In order to provide the ability to distinguish between different kinds of traffic (e.g., domestic and international traffic), a concept of network classes is introduced. A network class is a range of IP addresses for which Parallels Virtuozzo Containers counts and shapes the traffic. Parallels Virtuozzo Containers can have up to 16 different network classes specified. Each class can contain one or more IP address ranges. It is possible to have different bandwidth shaping settings for each class.

By default, Parallels Virtuozzo Containers is pre-configured to have network class 1. Class 1 is defined to match any IP address. It must be always present on the Hardware Node. Other network classes can be defined after class 1. They represent exceptions from the "matching-everything" rule of network class 1.
Note: Network class 0 defines the IP address range for which no accounting is done. Usually, it corresponds to the Hardware Node subnet (the Node itself and its Containers). Setting up network class 0 is not required; however, its correct setup may improve performance.

The example below illustrates how to create network class 2 matching IP addresses in the range from 10.0.0.0 to 10.255.255.255:

1. In the left pane of the Management Console window, right-click the Node where you want to create a new network class, and choose Network Configuration > Configure Traffic Accounting and Shaping.

2. On the Accounting tab of the displayed window, click the New IP addresses range button to display the Add IP Range window.

3. Fill in the following fields:
   a. Type 2 as the identifier of the new network class in the Class ID field.
   b. Specify 10.0.0.0 as the starting IP address of network class 2 in the Start IP address field.
   c. Indicate 255.0.0.0 as the subnet mask in the Subnet mask field (this mask denotes that class 2 includes all IP addresses in the range from 10.0.0.0 to 10.255.255.255).
   d. Provide any 'class 2'-related information in the Comment field, if necessary.

4. Click OK.

Network class 2 should appear in the table on the Traffic Accounting and Shaping screen. To edit or delete the newly created network class or any other existing network class, use the corresponding buttons on the Accounting tab of the screen.

You can also configure network classes using these tools:

- Parallels Virtual Automation. For more information on this web-based tool, see the Parallels Virtual Automation Administrator's Guide at http://sp.parallels.com/products/pva46/resources.
vznetcfg. Detailed information on this command-line tool is provided in the Parallels Virtuozzo Containers 4.6 Reference Guide.

Viewing Network Traffic Statistics

To view the current network traffic statistics for any Container on the Hardware Node, use the vznetstat command. For example:

```
C:\Users\Administrator>vznetstat -v 101
VEID Net.Class Input(bytes) Input(pkts) Output(bytes) Output(pkts)
101  1      3206479       18562        6182889       17563
101  2                0           0              0           0
```

In this case, around 3 MB of data were uploaded to the Container and about 6 MB were downloaded from it. All the traffic matches the definition of Class 1 and no data was exchanged with any hosts from Class 2 networks.

Turning On and Off Network Bandwidth Management

Traffic shaping (also known as network bandwidth management) allows you to control what network bandwidth Containers on the Hardware Node receive for outgoing traffic. Traffic shaping is off by default in Parallels Virtuozzo Containers. To turn it on, do the following:

Note: Container incoming traffic cannot be controlled in Parallels Virtuozzo Containers.

1. In the left pane of the Management Console window, right-click the needed Node, and choose Network Configuration > Configure Traffic Accounting and Shaping.

2. Click the Shaping tab.
3 Configure the traffic shaping parameters by doing the following:

- Select the **Enable traffic shaping** check box to globally enable traffic shaping on the Hardware Node.
- Select the name of the corresponding network class, and click the **Enable** button to turn on traffic shaping for this class.
- Select the name of the network class for which traffic shaping has been enabled, and click the **Edit** button:

   ![Set Network Class Shaping](image)

   In the **Rate limit** field, specify the maximal network bandwidth, in kilobits per second, all Containers on the Node will be able to receive for outgoing traffic within the given network class.

   **Note:** You can also use the `vznetcfg` utility to configure the maximal network bandwidth for your Containers.

4 Click **OK**.

### Configuring Network Bandwidth Management for Container

Using Parallels Management Console, you can configure the network bandwidth settings for any Container. To do this:

1 Click the **Parallels Virtuozzo Containers** item in the Management Console left pane, right-click the needed Container in the right pane, and choose **Properties**.
2 Go to the **Network** tab of the displayed window and select **Traffic Shaping**.
3 Configure the Container network bandwidth settings as follows:

- Select the corresponding network class, and click the **Enable/Disable** button to enable/disable, respectively, traffic shaping for the Container within the selected network class.

- Select the corresponding network class, click the **Edit** button, and specify the bandwidth limit to be used by the Container within the selected network class.

- Select the corresponding network class, and click the **Scale** button to scale the traffic shaping configuration. Using this button, you can produce a "heavier" or "lighter" configuration in comparison with the existing one. In the displayed window, determine whether you want to scale up or down the current configuration and specify the factor. All the parameters of the existing configuration are multiplied by a given number. A heavier configuration is produced with a factor greater than 1, and a lighter one with a factor between 0 and 1.

4 Click **OK**. The traffic shaping settings will take effect immediately.
You can also configure the network bandwidth settings of a Container using Parallels Virtual Automation. For more information on this web-based tool, see the *Parallels Virtual Automation Administrator's Guide* at http://sp.parallels.com/products/pva46/resources.

## Managing Container Configuration Samples

You can create new Containers quicker if you use sample configuration files (*.conf-sample) shipped with Parallels Virtuozzo Containers. A sample configuration file defines Container's main parameters, including the OS template, the number of CPUs, the amount of memory and disk space, etc. Depending on the operating system your Hardware Node runs, the following sample configuration files may be provided:

- **basic** — Use to create standard Containers.
- **MSDE** — Use to create Containers for Microsoft SQL Server Desktop Engines.
- **Oracle** — Use to create Containers for Oracle database servers.
- **Plesk** — Use to create Containers for the Plesk control panel.
- **SharePoint** — Use to create Containers for SharePoint Portal Server.
- **ADDS** — Use to create Containers for the domain controller.
- **Exchange** — Use to create Containers for Microsoft Exchange Server.

By default, Container configuration samples are stored in the `C:\Program Files\Parallels\Containers\Configs` folder.

### Creating Container Configuration Sample

If you are not satisfied with the Container configuration sample files shipped with Parallels Virtuozzo Containers, you can create your own ones. In Parallels Management Console, you can use the **Create Container Sample** wizard to create new Container configuration samples. To invoke the wizard, click the name of the Hardware Node where you want to create the sample file, and in the right pane, follow the **Create Container Sample** link at the Hardware Node dashboard.

The **Create Container Sample** wizard opens.
In the first step, you are asked to choose a variant of the Container configuration sample file creation. You can choose between two options:

- Set the Container sample configuration manually. Select the **Set Container sample configuration manually** radio button if there are no Container configuration samples that can be used as the basis for the new one. In this case, you will need to define all resources parameters one by one.

- Use one of Container configuration samples that are shipped with Parallels Virtuozzo Containers or have been already created by you. You can make use of this option if your new configuration sample differs from the existing one only slightly and can be created by adjusting some of its parameters. The information on the sample files shipped with Parallels Virtuozzo Containers is provided in *Managing Container Configuration Samples* (p. 126). All the available configuration samples are listed in the table below the **Use one of Container configuration samples** option. Just select the **Use one of Container configuration samples** radio button, click on the needed sample, and proceed with adjusting it.

Next, the wizard prompts you to specify the basic configuration sample file parameters.
Choose a name for the configuration sample file. You can type any alphanumeric identifier (without spaces) you consider reasonable for this file and that will be used to refer to the Container sample configuration. Besides, you can enter any relevant comment on the file. It will be displayed within the list of Container sample configurations. Click Next.

Next, choose the OS template that will be used as the basis for creating Containers. OS templates are used to create new Containers. If you do not want the Container sample to predefine any specific OS template, select none in the Name column. Click Next.

In the next step, you can choose application templates to add to Containers which will be created from this configuration sample. All application templates available on the Hardware Node are listed in the table of the Select Application Templates window. Click Next.
Note: The **Select Application Templates** screen is displayed only if you chose the OS template in the previous step of the wizard.

After that, you are asked to define the Container resources parameters.

In this window, you can adjust the following resources parameters:

- CPU usage parameters (p. 108)
- disk space quota parameters (p. 106)
- a number of system resource control parameters (p. 117)

To configure a resource parameter, expand the corresponding group, and double-click the parameter you want to adjust. After you have set the necessary parameters, click **Next**.
If you are creating your new sample on the basis of an existing Container configuration sample, have configured some resource parameter values, and now want to reset them to the values from the original configuration sample, click the curved arrows over the Resource counters table.

In the next step, you can specify a number of network settings for the configuration sample file.

Use the provided Add, Remove, and Edit buttons for the corresponding operations on Container search domains and DNS servers.

In the Configure Offline Services for Container Configuration Sample window, you can determine whether the Container created on the basis of the given configuration sample can be directly managed by its Administrator from any browser at its own IP address using Parallels Tools (e.g., Parallels Power Panel). You can also specify what offline services will be available for this Container. Detailed information on offline management functionality is provided in Configuration Container Offline Management (p. 222).
The next window of the **Create Container Sample** wizard allows you to configure the network shaping parameters. These parameters are used to control what network bandwidth a Container based on the configuration sample being created will receive for outgoing traffic.

Detailed information on how to configure the network shaping settings is provided in *Managing Network Bandwidth* (p. 121).

In the next step, you can specify the Terminal Services mode in which the Container created on the basis of the given configuration sample will be set right after its creation. For detailed information on Terminal Services, see *Configuring Terminal Services Inside Container*.

Finally, you are prompted to configure the automatic boot mode. Select the **Yes** radio button if you want the Containers based on the configuration sample being created to start automatically on the Hardware Node boot. To start the Containers manually, select **No**.
The last screen summarizes all the data you provided in the previous steps. If you are satisfied with the entered information, click **Finish** to start creating the Container sample file. Otherwise, click **Back** to return to any step and change the necessary parameters.

Once the new Container configuration sample is created, you can use it for making Containers on its basis. The sample will be displayed on the first screen of the **Create Containers** wizard together with the configuration files shipped with Parallels Virtuozzo Containers.

**Note:** You can also create new Container configuration samples using Parallels Virtual Automation. For more information on this web-based tool, see the *Parallels Virtual Automation Administrator's Guide* at [http://sp.parallels.com/products/pva46/resources](http://sp.parallels.com/products/pva46/resources).

## Copying Container Configuration Sample

Parallels Management Console allows you to copy Container configuration samples from one Hardware Node to another. This is particularly useful when you have created a custom configuration file on one of the Nodes and want to use it on the other Nodes as well.

To copy a sample Container file, do the following:

1. Select the **Container Samples** item in the Hardware Node main tree.
2. Right-click the sample configuration file, and choose **Tasks > Copy to Another Hardware Node**.


3 In the displayed window:
   - Select the Hardware Nodes where you want to copy the files. You can use the Select All and Deselect All buttons to do this.
   - Select the action to perform if a configuration sample file with the same name already exists on the Destination Node.

4 Click the Copy button. In the Copying Status column, you can view the result of the operation.

5 If the copy operation has completed successfully, click Close to close the window. If not, click the Details button to learn more about the errors that occurred during the operation process. This is the only case when this button becomes active.

If you take default configuration samples files, modify them, and copy to another Node preserving the default names, chances are that files with the same names already exist on the destination Node. To resolve this conflict, choose at the bottom of the window one of the three corresponding options, which best fits your needs.

Note: You can also copy Container configuration samples using Parallels Virtual Automation. For more information on this web-based tool, see the Parallels Virtual Automation Administrator's Guide at http://sp.parallels.com/products/pva46/resources.
Saving and Uploading Configuration Files

Parallels Management Console allows you to upload a new sample file to your Node from and save any of the existing configuration sample files to your local computer.

To upload a new configuration sample file to the Hardware Node, do the following:

1. Copy the sample file to the computer where Parallels Management Console is installed.

2. In Parallels Management Console, right-click the **Container Samples** item under the Hardware Node name, and choose **Tasks > Upload Container Sample from Local Computer**.

3. Specify the path to the configuration file you want to upload using the **Browse** button. You can also:
   - Change the original name of the configuration sample file by typing the desired name in the **Container sample configuration name** field. This name will be used to refer to this sample file in the Container configuration sample files listing.
   - Provide the sample file description in the **Description** field. This description will be displayed to the right of the sample file in the Container configuration sample files listing.

4. Click **Upload**.

After the configuration sample file has been successfully uploaded, you can find it in the `X:\Program Files\Parallels\Containers\Configs` folder on the Hardware Node.

You can also save any of the configuration sample files available on the Node to a computer where Management Console is installed. To do this:
1 In the Parallels Management Console left pane, select the Container Samples item under the corresponding Hardware Node name.

2 In the right pane, right-click the configuration sample file you want to download, and choose Tasks > Save to Local Computer.

3 Specify the path to the location on the computer hard disk where you want to save the sample file.

4 Click Save.

Scaling Container Configuration Sample

Any configuration sample can prove insufficient for your needs. For example, you might have an application that does not fit into existing configurations. The easiest way of producing a Container configuration is to scale an existing one. Scaling produces a “heavier” or “lighter” configuration in comparison with an existing one. All the parameters of the existing configuration are multiplied by a given number. A heavier configuration is produced with a factor greater than 1, and a lighter one with a factor between 0 and 1.

If you scale a configuration sample file, it is correspondingly modified. That is why, it is recommended to create a copy of the configuration sample file you are going to scale before scaling it.

To scale an existing configuration using Parallels Management Console, do the following:

1 Select the Container Samples item under the corresponding Hardware Node name.

2 Right-click the sample configuration file you want to scale, and choose Properties.

3 Click the Resources tab, and click the Scale button.
In this window, do the following:

- Determine whether you want to scale up or scale down the current configuration and specify the factor.
- Choose the groups of parameters to scale under the Apply scaling to group.

4 Click OK to save the changes.

**Applying New Configurations to Containers**

You can change Container configuration by editing the configuration sample file the Container is based on and applying it to the Container with the `vzctl set --applyconfig` command. You can change parameters like disk space, memory, and such (but not OS or application templates). Let us assume that
you want to change the amount of disk space on the virtual disk of Container 101, which is based on the ve-basic.conf-sample configuration file, to 4 GB. To do this:

1. Open ve-basic.conf-sample in a text editor and change the value of the DISKSPACE parameter to 4096000 (4GB in 1-kilobyte blocks).

2. Save the file as a custom configuration sample, e.g., ve-basic-4gb.conf-sample.

3. Apply the configuration to Container 101:

   C:\Users\Administrator>vzctl set 101 --applyconfig C:\Program Files\Parallels\Containers\Configs\ve-basic-4gb.conf-sample

Increasing parameter values is applied to the Container immediately. Reducing parameter values is applied on Container restart.
This chapter provides information on how you can update Parallels Virtuozzo Containers as well as the Windows Server operating system installed on your Hardware Node.

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Chapter 5

Keeping Your System Up To Date

Parallels Virtuozzo Containers has a special module, *Parallels Virtuozzo Containers Update Services (PVCUS)*, that helps you deploy Parallels Virtuozzo Containers updates to your Hardware Node. By default, PVCUS is set to automatically check the Parallels Virtuozzo Containers Update Center for updates and download them to the Node. After new updates have been successfully downloaded to the Hardware Node, the blue-and-grey (️) icon appears in the system tray. To install the downloaded updates, double-click the icon to launch the *Parallels Virtuozzo Containers Update* wizard.

Running the Parallels Virtuozzo Containers Update Wizard

When the wizard is started, you are presented with the *Welcome* screen.
In this window, do the following:

- If the Hardware Node does not use a proxy server, i.e. is directly connected to the Internet, click **Next** to start updating Parallels Virtuozzo Containers.

- If the Hardware Node is using a proxy server, click the **Proxy Settings** button to display the **Proxy Settings** window.
This window allows you to configure the proxy server parameters as follows:

- Select the **Do not use proxy server** radio button if the Hardware Node does not use a proxy server, i.e. is directly connected to the Internet.

- Select the **Specify a proxy server** radio button to use a proxy server. You will need to specify the IP address and port of the proxy server in the **Address** and **Port** fields, respectively. You can use the Internet Explorer proxy settings by clicking **Use Internet Explorer proxy settings**.

- If your proxy server is requires authentication, select the **Proxy server requires authentication** check box and specify the corresponding credentials in the **Proxy user name** and **Proxy password** fields.

Once you click **Next** in the **Welcome** window, you are presented with the list of Parallels Virtuozzo Containers updates currently available for the Hardware Node. Select the corresponding updates, and click **Next** to install them on the Hardware Node. If there are multiple updates available, you can specify the last update you want to have installed, and only updates up to and including the specified will be installed on the Node. For example, if 8 updates are available for installation—from **VZU460001** to **VZU460008**—and you specify the update **VZU46005** as the last update, only the updates **VZU460001** through **VZU460005** will be installed on the Node.

If your server fails to connect to the Parallels website, the **Select Update Folder** window appears.
In this window, do the following:

- Configure the proxy server settings using the **Proxy Settings** button. Click **OK**.

- If you have Parallels Virtuozzo Containers updates in a local or network folder, type the path to the folder in the provided field or click the ... button and navigate to the folder. When typing the path manually, use one of the formats indicated in the **Select Update Folder** window. Click **OK**.

- Click the **Ignore** or **Cancel** button to exit the **Parallels Virtuozzo Containers Update** wizard without installing any updates.

**Configuring Parallels Virtuozzo Containers Update Settings**

You may want to modify the default Parallels Virtuozzo Containers update settings to meet your requirements. To do this, right-click the icon, and choose **Properties**. The **Parallels Virtuozzo Containers Update Settings** window is displayed.
In this window, you can configure Parallels Virtuozzo Containers update settings as follows:

- Select the **Keep my Parallels Virtuozzo Containers installation up to date** check box to globally enable automatic updates on the Hardware Node and to set the schedule when to update the Parallels Virtuozzo Containers software in the fields provided under **Automatically check for new updates**.

- Expand the **Parallels Virtuozzo Containers Update Settings** item, select **Parallels Virtuozzo Containers 4.6**, and choose one of the following:
  - **Automatically download and install updates**. Select this radio button if you want Parallels Virtuozzo Containers updates to be automatically downloaded and installed on the Hardware Node on the schedule you specify in the fields provided under **Automatically check for new updates** on the **Update Settings** screen.
  - **Download updates and notify me before installation**. Select this radio button if you want Parallels Virtuozzo Containers Update Services to automatically download the updates in the background on the schedule you specify in the fields provided under **Automatically check for new updates** on the **Parallels Virtuozzo Containers Update Settings** screen. This radio button is selected by default. We recommend that you use this option to be informed of new Parallels Virtuozzo Containers updates.

  When using this option, keep in mind the following:

  a  If there are no updates for your Parallels Virtuozzo Containers installation, the blue-and-grey ( ) icon is shown in the system tray.

  b  After new updates have been downloaded, the icon changes its color from blue-and-grey to blue-and-green ( ), and the following hint is displayed when you move the mouse pointer over the
Keeping Your System Up To Date

New Parallels Virtuozzo Containers updates are available. Double-clicking the icon invokes the Parallels Virtuozzo Containers Update Wizard that helps you install the downloaded updates in a few simple steps described above.

Each time you shut down or restart the Hardware Node and there are new updates available for installation, you are notified of it and offered to install these updates.

- **Notify me before installing or downloading updates.** Select this radio button if you want PVCUS to check the Parallels Virtuozzo Containers Update Center for available updates on the schedule you specify in the fields provided under **Automatically check for new updates** on the Parallels Virtuozzo Containers Update Settings screen and inform you of new updates. Once you choose this option, the blue-and-grey ( ) icon appears in the system tray, notifying you each time new Parallels Virtuozzo Containers updates are ready for download from the Parallels Virtuozzo Containers Update Center. In this case, the icon changes its color from blue-and-grey to blue-and-green, and the following hint is displayed when you move the mouse pointer over the icon: **New Parallels Virtuozzo Containers updates are available**. Double-clicking the icon invokes the Parallels Virtuozzo Containers Updates Wizard that helps you download and install the corresponding Parallels Virtuozzo Containers updates in a few simple steps described above.

Note: If you do not want the ( ) icon to be displayed in the system tray, right-click it, and choose **Exit**. In this case, the icon will automatically appear again as soon as new Parallels Virtuozzo Containers updates are ready for download and/or installed on your Hardware Node.

- **Download updates, but don’t notify me or install them.** Select this radio button if you want Parallels Virtuozzo Containers Update Services to automatically download updates in the background on the schedule you specify in the fields provided under **Automatically check for new updates** on the Update Settings screen. When this radio button is selected, PVCUS handles the updates in the same way it does when the **Download updates and notify me before installation** radio button is checked. The only difference is that you are not offered to install new updates each time you shut down or restart the Hardware Node.

- **Turn off automatic Parallels Virtuozzo Containers updates.** Select this radio button to disable the automatic update of the Parallels Virtuozzo Containers software and to manually update your Parallels Virtuozzo Containers software with the help of the Parallels Virtuozzo Containers Update Wizard. To invoke the wizard, select **Programs > Parallels > Parallels Virtuozzo Containers > Parallels Virtuozzo Containers Update Wizard** on the Windows Start menu. This is the same wizard that is launched when the automatic update is enabled and you double-click the ( ) icon in the system tray to download and/or install new Parallels Virtuozzo Containers updates (see the information above to learn how to work with the wizard). It is highly recommended to regularly run this wizard to ensure that you always use the latest Parallels Virtuozzo Containers version.

In the **Install updates from** section, you can configure the location of the repository storing Parallels Virtuozzo Containers updates. By default, the Parallels Virtuozzo Containers Update Center accessible at the Parallels web site is used to check for the available Parallels Virtuozzo Containers updates (the Parallels Virtuozzo Containers Update Center check box is selected). However, you can select the **Another location** check box and specify the URL to another location with Parallels Virtuozzo Containers updates. Notice that you need enter the full path to the update.xml file.
Keeping Your System Up To Date

- The **Download Folder** button allows you to modify the folder Parallels Virtuozzo Containers updates are downloaded to before they are installed on the Hardware Node. By default, the `X:\Program Files\Parallels\Containers\Updates` folder is used.

![Parallels Containers Update Settings](image)

**Note:** Make sure that you always run the latest version of Parallels Virtuozzo Containers. Along with getting new Parallels Virtuozzo Containers functionality, this will allow you to have the latest Windows Server updates installed on the Hardware Node. More information on managing Windows Server updates is provided in [Updating Windows Server Software](p. 147).

### Installing Parallels Virtuozzo Containers Updates From Local Folders

By default, the Parallels Virtuozzo Containers Update Services (PVCUS) component on your Hardware Node is configured to download updates from the Parallels Virtuozzo Containers Update Center. If, however, some of your servers do not have Internet access, you can copy Parallels Virtuozzo Containers updates to a local folder and install them from there.

To configure your physical server to get updates from a local folder, do the following:

1. Obtain the latest Parallels Virtuozzo Containers updates. You can use one of the following ways to do this:
   - Use the **Parallels Virtuozzo Containers Update** wizard. On a physical server running Parallels Virtuozzo Containers and connected to the Internet, launch this wizard and follow the on-screen instructions to download and install the latest Parallels Virtuozzo Containers updates. Detailed
information on how to install Parallels Virtuozzo Containers updates using this wizard is given in Updating Parallels Virtuozzo Containers.

- Use the vzautoinstall60.exe utility. On a physical server connected to the Internet, run this utility and follow the on-screen instructions to download the latest Parallels Virtuozzo Containers updates to a local folder on the server. Detailed information on how to download Parallels Virtuozzo Containers updates using vzautoinstall60.exe is given in Downloading Parallels Virtuozzo Containers Updates Using vzautoinstall60.exe (p. 146).

2 After the download is complete, locate the folder storing the downloaded updates and copy its contents to a folder on the local server where you want to update the Parallels Virtuozzo Containers software.

3 On the local server, select Programs > Parallels > Parallels Virtuozzo Containers > Parallels Virtuozzo Containers Update Wizard on the Windows Start menu to launch the Parallels Virtuozzo Containers Update wizard.

4 In the Welcome window, click the Proxy Settings button, expand Parallels Virtuozzo Containers Update Settings in the left pane of the displayed window, and select Parallels Virtuozzo Containers 4.6.

5 Select the Another location radio button, and specify the path to the folder where you copied the Parallels Virtuozzo Containers updates.

6 Click OK.

7 Click Next to start installing the updates from the specified local folder.

8 After the updates have been successfully installed, click Finish to exit the Parallels Virtuozzo Containers Update wizard.
Keeping Your System Up To Date

Downloading Parallels Virtuozzo Containers Updates Using vzautoinstall60.exe

The vzautoinstall60.exe utility provides you with the possibility to check for available Parallels Virtuozzo Containers updates and download them to a local folder on your server. For example, you may need to keep updates handy if some of your servers running Parallels Virtuozzo Containers are not connected to the Internet for security reasons. In this case you can copy the downloaded updates from your local folder to the necessary server and install them there.

To download the latest Parallels Virtuozzo Containers updates to a local folder on the server, do the following:

1. Run the vzautoinstall60.exe utility by double-clicking it.
2. In the Choose language dialog, choose the user interface language of the Parallels Virtuozzo Containers Autoinstall wizard (which is set to English by default), according to your preferences, by selecting any of the supported languages on the drop-down menu.
3. In the Welcome window, select the Download only radio button, and click Next.
4. In the Parallels Virtuozzo Containers Components window, expand the plus sign of the appropriate Parallels Virtuozzo Containers version, click the down arrow next to the updates you want to download, and select Available on the drop-down menu. Click Next.
5 In the **Download Information** window, specify the path to a folder on the server where you want to save the selected updates. The downloaded updates will be put in the `<Folder_Name>\Windows\<arch>` folder where `<Folder_Name>` is the name of the folder you specify and `<arch>` denotes the version of the Parallels Virtuozzo Containers software. For example, if you are downloading updates for the x64 version of Parallels Virtuozzo Containers and indicate `Updates` as the folder name, the updates will be downloaded to the `Updates\Windows\<x64>` folder.

6 Click the **Download** button to start downloading the updates to your server.

7 When the download is complete, click **Finish** to exit the **Parallels Virtuozzo Containers Autoinstall** wizard.

---

**Updating Windows Server Software**

Any standard Windows Server installation supports the Automatic Updates feature. It allows Windows Server to periodically check the Windows Update website for updates, download these updates, and install them on your server. For compatibility purposes, Parallels Virtuozzo Containers redirects Automatic Updates to the Parallels Virtuozzo Containers Update Center instead of the Windows Update website and downloads Windows updates from there.

All Windows updates in the Parallels Virtuozzo Containers Update Center are checked for compatibility with Parallels Virtuozzo Containers and can be installed on your Node. However, to be consistent with new Windows updates, Parallels Virtuozzo Containers may (and usually does) undergo slight changes. It means that only Windows updates compatible with your current version of Parallels Virtuozzo Containers can be downloaded and installed on your server. To keep your Parallels Virtuozzo Containers installation up-to-date, check for updates regularly. For details on updating Parallels Virtuozzo Containers, see **Updating Parallels Virtuozzo Containers**.

The Windows Server updating procedure may proceed as follows:

1 The latest Parallels Virtuozzo Containers updates are downloaded and installed on the Hardware Node. You can do this by running the Parallels Virtuozzo Containers wizard manually or enabling the automatic update of Parallels Virtuozzo Containers (for more details, see **Updating Parallels Virtuozzo Containers**).

2 The Windows Automatic Update service connects to the Parallels Virtuozzo Containers Update Center and downloads the latest Windows update to the Node.

   **Note:** Make sure that the Windows Automatic Update service is enabled on the Hardware Node. Otherwise you will not be able to download Windows Server updates.

3 After you have confirmed the installation, the Windows updates are installed on the Node.

When deploying Windows Server updates, keep in mind the following:

- You do not have to update operating systems installed inside Containers. They get updated automatically during the Host OS update.
• Do not try to update your Windows Server operating system manually by clicking **Start > Windows Update**, connecting to the Windows Update website, downloading new updates from this site, and installing them on your Node. This may cause Parallels Virtuozzo Containers to malfunction.

• Microsoft updates for server roles installed in Containers but missing on the Hardware Node will not be applied. For details, see **Updating Server Roles in Containers** (p. 148).

### Updating Server Roles in Containers

Normally, server roles installed in Containers are updated automatically along with other Windows components as described in **Updating Windows Server Software** (p. 147). However, server roles installed in a Container but missing from the Hardware Node itself are not automatically updated. In this case, you either need to install the missing role on the Hardware Node or manually install the updates in each affected Container.

#### Installing the Missing Server Role on the Hardware Node

Consider doing this if a lot of containers are affected and just a few server roles need to be updated.

In this case do the following:

1. Install the missing server role on the Hardware Node,
2. Install updates for this server role,
3. Reboot the Hardware Node to apply the installed updates.

---

**Notes:**

1. Before migrating such a Container, make sure that the destination Node has the same set of server roles installed.

2. To restore a backup of such a Container on a different Hardware Node, that Node must have the same set of server roles as the original had when the backup was created.

---

#### Manually Installing Updates in the Affected Containers

Consider doing this if the updates contain no drivers (*.sys), just a few Containers are affected, and a lot of server roles need to be updated.

In this case do the following:

1. Download the updates in each affected Container,
2. Install updates manually in each Container,
3. Restart the updated Containers.
Managing Hardware Nodes

This chapter explains how you can manage Parallels Virtuozzo Containers licenses and files on Hardware Nodes.

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Managing Parallels Virtuozzo Containers Licenses

This chapter provides information on managing Parallels Virtuozzo Containers licenses. In particular, how to view the current license status, install a new license on the Hardware Node or update an existing, how to transfer the license from one Node to another, and so on.

Understanding Licensing

Running Parallels Virtuozzo Containers 4.6 involves dealing with two types of licenses: for Parallels Virtuozzo Containers and the Windows Server OS.


Second, you will need a Parallels Virtuozzo Containers license to start using Parallels Virtuozzo Containers and management tools (Parallels Virtual Automation and Parallels Power Panel). You can install the Parallels Virtuozzo Containers license after or when installing Parallels Virtuozzo Containers on your server. Every Hardware Node must have its own license installed. Licenses are issued by Parallels and define a number of parameters in respect of your Node. The main license parameters are listed below:

- The number of CPUs which can be installed on the Hardware Node. Keep in mind that one Dual Core and Hyper-Threading processor is regarded as one CPU.
- The number of users who can simultaneously use Parallels Virtual Automation to manage the Hardware Node and its Containers.
- The license expiration date. Any license can be time-limited or permanent. Parallels Virtuozzo Containers licenses have a start date and, if time-limited, an expiration date specified in them. Make sure you set up your system clock correctly, or license validation may fail.
- The number of Containers the Hardware Node will be able to host.
- The platform and architecture with which Parallels Virtuozzo Containers is compatible.
- The possibility of managing the Hardware Node by means of Parallels Virtual Automation.

Licenses can be shipped in one of the following forms:

- As an activation code. In this case, you are provided with a special alphanumerical code which you must activate before starting to use Parallels Virtuozzo Containers on the Hardware Node. During the activation, the code is sent to the Parallels Key Authentication (KA) server which verifies the code, generates a special license file, sends it back to the Node, and installs it there.
- As a product key. In this case, you are provided with an alphanumerical key which is installed on the Hardware Node directly, without connecting to the Parallels KA server and exchanging any information with it.

### Updating Licenses

You can update the Parallels Virtuozzo Containers license currently installed on the Hardware Node. To do this, use the `vzlicload` utility with the `--update` option. Before you begin updating, make sure that the Hardware Node where you are planning to update the license is connected to the Internet.

**Note:** In the current version of Parallels Virtuozzo Containers, you can update the Parallels Virtuozzo Containers license installed on the Hardware Node with the help of activation code only. If you want to update a Parallels Virtuozzo Containers product key, contact a Parallels sales representative for assistance.

### Transferring a License to Another Node

Sometimes, you may need to transfer a Parallels Virtuozzo Containers license from one Hardware Node to another. For example, this may be the case if the Node where the Parallels Virtuozzo Containers license is installed starts experiencing problems or requires the hardware upgrade. The procedure of transferring a Parallels Virtuozzo Containers license from one Hardware Node to another depends on the license type and is described below.

#### Transferring a License Key

If you have activated your Parallels Virtuozzo Containers installation by means of a product key, you can transfer the installed license from the Source to the Destination Node as follows:

1. Make sure that the Source Node is down or the license is removed from this Node.
2. Log in to the Destination Node.
3. Install the product key on the Destination Node. Detailed information on how to install Parallels Virtuozzo Containers licenses is provided in [Installing License](#).
Transferring an Activation Code

If you have activated your Parallels Virtuozo Containers installation by means of an activation code, do the following to transfer the license from the Source to the Destination Node:

1. Ascertain that the Source Node is shut down or the license is removed from this Node.
2. Make sure that the Destination Node is connected to the Internet.
3. Use the `vzlicload` utility with the `-t` and `-p` option on the Destination Node. For example:
   ```bash
   vzlicload -t -p XXXXXX-XXXXXX-XXXXXX-XXXXXX-XXXXXX
   ``
4. Parallels Virtuozo Containers will connect to the Parallels KA server, inform the server of your intention to transfer the license to a new Hardware Node, get a new license file from the KA server, and install it on the Destination Node.

**Note:** You can also transfer Parallels Virtuozo Containers licenses using Parallels Virtual Automation. For more information, see the *Parallels Virtual Automation Administrator's Guide.*

Viewing Licenses

To view the information about the Parallels Virtuozo Containers license installed on the Hardware Node and check its current status, click on the corresponding Hardware Node name, and follow the Manage License link at the Hardware Node dashboard.
The command output shows the full information about the license. The main license parameters are listed in the following table:

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Product</strong></td>
<td>The product name for which the license has been issued.</td>
</tr>
<tr>
<td><strong>Serial</strong></td>
<td>The license serial number.</td>
</tr>
<tr>
<td><strong>Status</strong></td>
<td>The status of the license currently installed on the Hardware Node.</td>
</tr>
<tr>
<td><strong>Expiration date</strong></td>
<td>The license expiration date, if it is time-limited.</td>
</tr>
<tr>
<td><strong>Version</strong></td>
<td>The version of Parallels Virtuozzo Containers with which the license is compatible.</td>
</tr>
<tr>
<td><strong>Grace period</strong></td>
<td>The period, in seconds, during which Parallels Virtuozzo Containers continues functioning after your license has expired.</td>
</tr>
<tr>
<td><strong>Architecture</strong></td>
<td>The system architecture with which the license is compatible.</td>
</tr>
<tr>
<td><strong>Platform</strong></td>
<td>The operating system with which the license is compatible.</td>
</tr>
<tr>
<td><strong>Key number</strong></td>
<td>The number under which the Parallels Virtuozzo Containers license is registered on the Parallels Key Authentication server.</td>
</tr>
</tbody>
</table>
### Managing Hardware Nodes

<table>
<thead>
<tr>
<th>Number of CPUs</th>
<th>The total number of central processor units (CPUs) which can be installed on the Hardware Node.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Containers</td>
<td>The total number of Containers which can simultaneously run on the Hardware Node.</td>
</tr>
<tr>
<td>Parallels Power Panel allowed</td>
<td>Indicates whether you can manage Containers using Parallels Power Panel.</td>
</tr>
<tr>
<td>Parallels Virtual Automation allowed</td>
<td>Indicated whether you can manage Containers using Parallels Virtual Automation.</td>
</tr>
<tr>
<td>Parallels Management Console users</td>
<td>The number of users who can simultaneously connect to the Node using Parallels Management Console.</td>
</tr>
</tbody>
</table>
| Workflow management | Indicates whether the 'Container requesting' functionality is enabled:  
  - yes: the 'Container requesting' functionality is enabled.  
  - no: the 'Container requesting' functionality is disabled.  
For more information on the 'Container requesting' functionality, see the Parallels Virtual Automation documentation. |

You can also view the contents of Parallels Virtuozzo Containers licenses using these tools:

- Parallels Virtual Automation. For more information on this web-based tool, see the *Parallels Virtual Automation Administrator's Guide* at http://sp.parallels.com/products/pva46/resources.
- vzlicview. Detailed information on this command-line tool is provided in the *Parallels Virtuozzo Containers 4.6 Reference Guide*.

### License Statuses

When viewing information on licenses, pay special attention to their status:

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACTIVE</td>
<td>The license installed on the Hardware Node is valid and active.</td>
</tr>
<tr>
<td>VALID</td>
<td>The license the utility parses is valid and can be installed on the Hardware Node.</td>
</tr>
<tr>
<td>EXPIRED</td>
<td>The license has expired.</td>
</tr>
<tr>
<td>GRACED</td>
<td>The license has been successfully installed on the Hardware Node; however, it has expired and is currently on the grace period (i.e. it is active till the end of the grace period).</td>
</tr>
<tr>
<td>INVALID</td>
<td>The license is invalid (for example, because of the Hardware Node architecture mismatch) or corrupted.</td>
</tr>
</tbody>
</table>

### Managing Files

Parallels Management Console comes with a built-in file manager allowing you to perform various operations on files and folders on your Hardware Node. You can access the file manager by clicking the
**File Manager** item under the corresponding Hardware Node name. After expanding the **File Manager** item, you will see a list of drives available on the Hardware Node.

The principles of working with the Hardware Node file manager are standard. You can move through the hierarchy of drives and folders by double-clicking their names or selecting the necessary drives and folders in the left pane. Use the menu items, toolbar buttons, table view, and context menus to perform the following tasks:

- View the contents of simple text files.
- View the principal information about a file/folder.
- Upload any number of files or whole folders from your local computer (the computer where Parallels Management Console is installed) to any folder on the Hardware Node.
- Download any number of files from the Hardware Node to your local computer.
- Create new folders within the drives on the Hardware Node.
- Copy files to another drive/folder on the Hardware Node.
- Move files to another drive/folder on the Hardware Node.
- Delete files/folders from the Hardware Node.
- Rename files/folders on the Hardware Node.

Parallels Management Console provides a user-intuitive interface for performing all these tasks.
Uploading Files to Hardware Nodes

In Parallels Management Console, you can upload any number of files or whole folders from the local computer (the computer where Management Console is installed) to any folder on the Hardware Node. Under the corresponding Hardware Node name, right-click the File Manager item, and choose Tasks > Upload Local File(s). The Upload Files wizard opens.

It is a three-step wizard. In the first step, you are asked to define the Hardware Node and the folder where to download the files. If you want to upload the files to several Nodes at once, click the Add button and select the Node to add to the upload list. Repeat this sequence for every Hardware Node where you want to upload files, and click OK. After that, enter the path where the files are to be uploaded or browse for this path. Click Next.

In the second step, you need to specify the local files you want to upload.
Click the Add button and select a file or a group of files from a single folder for uploading. You can also upload the whole folder by clicking the Add Directory button. If you need to upload files from various local folders, click the Add button the required number of times. After you have added all the files and folders to be uploaded, click Next.

In the last step, you can review the information you provided in the previous steps of the wizard. Make sure the settings are correct. To change the settings, click the Back button and make the necessary corrections. After you click Next, the uploading process begins. The operation progress is graphically displayed in the window of the Upload Files wizard. You can see how each of the selected files is being consecutively uploaded to the Hardware Node. Wait for the operation to finish.

Once the uploading process is finished, you will see the results of the operation. The table in the displayed window lets you view the results regarding every file uploaded to the Node. Click Finish to exit the wizard.

Downloading Files to a Local Computer

Parallels Management Console allows you to download any file or folder located on the Hardware Node to the computer where Management Console is installed. To do this:

1. Expand the File Manager item under the corresponding Hardware Node name.
2 Select the file/folder to download to your local computer (you can use CTRL+Click to select or
deselect the file/folder, SHIFT+Click to select a range of files/folders, CTRL+A to select all
files/folders).

3 Right-click it, and choose **Tasks > Copy To Local Computer**.

4 In the displayed window, specify the folder on your local computer where you wish to download the
selected file/folder.

5 Click **OK**.
This chapter provides information on how to keep track of the system events and resources consumption on the Hardware Node and inside Containers.

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Monitoring Resources

You can use the Monitor feature of Parallels Management Console for monitoring resources. This feature provides either the whole Hardware Node resources monitoring or the monitoring of resources consumption by a single Container, depending on whether you use the main window of Parallels Management Console or the manager window of a particular Container:

- To access the Parallels Management Console Monitor feature, select the Monitor item in the left pane.
- To open the manager window of a Container, select the Parallels Virtuozzo Containers item, and double-click the respective Container.

The principles of working with these two kinds of monitors are essentially the same (only the set of parameters that can be displayed is slightly different); therefore, they can be described together.

Note: You can also monitor the resource consumption by Containers using Parallels Virtual Automation. For more information on this Web-based tool, see the Parallels Virtual Automation Administrator's Guide at http://sp.parallels.com/products/pva46/resources.

Using Charts Representation

The charts section of Parallels Management Console lets you display a number of charts for monitoring various kinds of resources on a single grid. It offers means for better visualization of charts, like assigning colors and line styles to all the elements of the grid and charts or choosing a peculiar representation scale for each chart. You can save and load a set of counters you would usually monitor, thus avoiding the necessity of adding the counters one by one each time you start Management Console. You also have the possibility to replay the charts for any specified period of time by using logs.

The sequence of your actions can be the following:
1. To display the chart, expand the **Monitor** item in the window you are working with (either the Parallels Management Console main window or a Container manager window), and click **Charts** to see the monitor grid in the right pane.

2. Click the **Add Counters** button on the **Charts** toolbar.

3. In the **Add Monitoring Counters** dialog window, select the set of counters from which you want to add one(s) by selecting the desired group on the **Counter type** drop-down menu.

4. Select the needed counters, and click **Add**. You can use the Ctrl and Shift keys to add a number of counters from a group. When you select a certain counter with your mouse, the counter description is provided in the lower part of the **Add Monitoring Counters** dialog window. For example:

![Add Monitoring Counters dialog window](image)

5. Click **Close** after you have added all the desired counters.

Now that you have a number of counters on the grid, you can see a red line indicating the current moment of time moving from left to right as time passes and new values of monitored parameters appear on the grid. Now it’s time to customize your view and learn the other opportunities. You may want to perform the following tasks:

- Adjust the periodicity of refreshing the information on the grid.
- Adjust the representation scale for each counter.
- Adjust colors and line styles for the visual elements.
- Highlight a certain counter.
- Save the current configuration of counters to be able to open it at any moment of time.
- Use the grid to replay some past real-time information about a set of parameters.
Adjusting Periodicity of Refreshing Information

To set the time interval at which the information is refreshed for all the charts, right-click the **Charts** item in the Hardware Node or Container main tree and choose one of the following options:

- **Update Speed > High**. Choose this option to set the time interval to 1 second.
- **Update Speed > Normal**. Choose this option to set the time interval to 5 seconds.
- **Update Speed > Low**. Choose this option to set the time interval to 15 seconds.
- **Update Speed > Paused**. Choose this option to stop refreshing the information for the charts.

Adjusting Representation Scale

The value of any counter on the grid may vary from 0 to 100. These numbers are marked on the left of the grid. But the “weight” of these numbers is different for each counter. It is difficult to use one and the same scale, for example, for memory usage which can amount to hundreds of thousands of KBs and for CPU usage in percent. You can adjust the scale for each parameter separately for their better visualization on the grid:

1. Right-click the name of the corresponding counter in the table of displayed counters below the grid, and choose **Properties**.

   ![Properties dialog box](image)

   - **General** tab:
     - Add or Remove counters.
     - **Color**: Customize the color of the counter.
     - **Scale**: Adjust the scale of the counter.
   - **Data** tab:
     - **Type**: Choose the type of counter data.
     - **Width** and **Style**: Customize the appearance of the counter.

2. Select the necessary scale on the **Scale** drop-down menu on top of the grid, and click **Apply**.
Adjusting Colors and Styles

You can define the way a counter is displayed on the grid:

1. Right-click the name of the corresponding counter in the table of displayed counters below the grid, and choose Properties.

![Properties window]

2. In the corresponding boxes, adjust the color of the counter line, its width and style as desired.

3. Click the General tab, and adjust the view of the grid elements. The options on that tab are self-explaining.

4. Click OK.

Highlighting Counters

In case there are many counters being simultaneously displayed on the grid, it might be difficult to quickly single out the needed one. Parallels Management Console provides a means for highlighting any one of the counters at a time:

1. Click the name of the corresponding counter in the table of displayed counters below the grid.

2. Click the Highlight Counter button on the toolbar.

The selected counter will be highlighted on the grid with a broad white line.
Saving Counters Configuration

You can save the information about the current set of counters in the Parallels Management Console configuration file to call this information the next time it is needed, sparing the labor of adding the counters one by one again. Only one set of counters can thus be saved. Just right-click the counter you want to save, and choose **Save Counters**. When you alter the counters configuration (for example, when you restart Parallels Management Console, all the counters are erased) and want to restore the saved configuration, click the **Load Counters** button. The saved set of counters will be loaded from the configuration file.

Replaying Information From Logs

The function of replaying the resources consumption information over a specified time span in the past is ensured by the background logging of all the parameters in Parallels Virtuozzo Containers. The default
periodicity of refreshing the resources consumption information in the logs is set to be 1 (one) hour. You can have the logs collect the resources consumption information more frequently by "accelerating" the necessary logs with the help of the Log Setup folder under the Monitor item. For example:

1. Click Logging Period Setup under the Monitor item.
2. In the right of the Management Console window, double-click the necessary log group in the Parameters table, or right-click it, and choose Properties.

![Change Logging Period on My Node](image)

3. In the Change Logging Period window, set the update period for the given group of logs.
4. Click OK for the changes to take effect.

Logs are replayed using the same grid of the Charts function as for real-time monitoring. The counters are also displayed and configured in the same way as for real-time monitoring. The principal difference is that when replaying the counters, the information for the charts is taken from the logs (both the default logs and the logs accelerated in the Logging Period Setup section are used), and not from real-time monitoring.

To switch to the charts replaying mode:

1. Click Charts under the Monitor item.
2. On the Logged Counters tab, click the Add Counters button on the toolbar to display the Add Logged Counters window.
3. On the Data tab of the Add Logged Counters window, click the Add button to add any of the available counters in the same way as they are added for real-time monitoring.
4. After adding the desired counters, adjust the style of their visualization with the help of the corresponding options on the Data tab.
5. Go to the Time tab of the Add Logged Counters window, define the update period, and the time span for which you wish to view the logs for the specified counters. For example:
Using Table Representation

Besides charts, it is possible to monitor many of the Hardware Node or Container parameters in real time as a list of lines each of which reflects the name and the value of a parameter, as well as the attributes specific for this or that kind of parameters. In such a way, you can view the Network and Processes groups for a particular Hardware Node, and the Network, Processes, Resources, and Quotas and Usage groups for a particular Container. Choose any of these groups either in the Parallels Management Console main window or in a Container manager window to see the real-time information about the selected parameters in the form of a table. For example, if you choose Network under a Hardware Node tree, you will see the following window:
The chart in the Management Console right pane shows the values for the incoming and outgoing traffic rate, in bytes per second and packets per second, for all the network interfaces present on the Hardware Node. You can view this information as a chart as well.

**Viewing Network Traffic Summary**

Parallels Management Console allows you to view the information on all incoming and outgoing traffic for your Hardware Node or any of the Containers residing on it over a specified time period in the past. To view the traffic:

1. Expand the Monitor item in the main tree under either the Hardware Node name or the Container name, and click Traffic Summary.
2 Specify the time period for which you would like to view the logs.
3 Click Show Logs to display the list of log entries in the right pane of the window.

**Viewing System and Parallels Virtuozzo Containers Logs**

Parallels Management Console allows you to view the logs which are maintained on the corresponding Hardware Node both for the Hardware Node itself and for a particular Container. The following log types are available for a particular Hardware Node in the Management Console main window:

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parallels Virtuozzo Containers</td>
<td>Parallels Virtuozzo Containers system messages.</td>
</tr>
<tr>
<td>Events</td>
<td>All Container-related events (start, stop, migrate, etc.).</td>
</tr>
</tbody>
</table>
### Alerts
Resource management system messages generated in case a Container is coming very close to the resources limits specified for it.

### Tasks
Asynchronous tasks performed on Containers.

For Containers, only the **Events and Alerts** and **Tasks Log** logs are available in the corresponding Container manager window.

To view the logs, do the following:

1. Expand the **Logs** folder in the main tree under either the Hardware Node name or the Container name, and click the needed log type.
2. Specify the time period for which you would like to view the logs.
3. Click **Search** to display the list of log entries. For example:

![Log view example](image_url)

You can also view system and Parallels Virtuozzo Containers logs using Parallels Virtual Automation. For more information on this web-based tool, see the *Parallels Virtual Automation Administrator's Guide* at [http://sp.parallels.com/products/pva46/resources](http://sp.parallels.com/products/pva46/resources).
Subscribing to Parallels Management Console Alerts

Parallels Management Console allows you to subscribe to email notifications about resource-overusage system alerts. The subscription to this kind of alerts consists in specifying the email address to send notification to. However, prior to subscribing to alerts, you need to provide your email relay server IP address to send email notifications through. To do this:

1. In Parallels Management Console, click the **Manage E-mail Alert Subscription** link at the Hardware Node dashboard.
2. In the **Manage E-mail Alert Subscription** window, click the **Configure** button.

   ![Manage Configuration for E-mail Alerts](image)

3. In the displayed window, enter the IP address of the mail relay server in the **E-mail relay IP address** field.
4. Click **OK**.

Now that you have set the email relay server IP address, you can subscribe to an alert:

1. Click the **Manage E-mail Alert Subscription** link at the Hardware Node dashboard.
2 Type the email address where the alert notification is to be sent in the To field.
3 Click the Subscribe button.

Parallels Management Console uses a pre-configured notification template. This template includes special placeholders representing special symbols that will be substituted for in the actual message by the actual Container name, parameter name, etc. The list of main placeholders is given below:

- **$TITLE**: the name assigned to the Container. If there is no name set for the Container, its hostname is used.
- **$ID**: the name of the resource parameter (in the actual message, it will be “diskspace”, etc.).
- **$CURTYPE**: the alert type (at the alert generation moment). The “yellow” alert means that the barrier value lies in the range from 90% to 100% and the “red” alert indicates that the limit value has been hit.
- **$TOTALMAXTYPE**: the maximal alert type (“yellow” or “red”) registered during the time when alerts were collected.
- **$COUNT**: the number of registered alerts from the time when the last email notification was sent.
- **$TYPERANGE**: the range of alert types registered during the time when alerts were collected (e.g. if all types of alerts were registered, the value of this parameter in the email notification will be set to "yellow" or "red").
- **$TIMERANGE**: the alert time (the server time).
- **$CURVALUE**: the current value of the parameter (at the alert generation moment).
- **$MAXVALUE**: the maximal value of the parameter during the time when alerts were collected.
- **$SOFT**: the parameter value barrier.
- **$HARD**: the parameter value limit.
By default, only one alert is sent per subscription and you have to resubscribe to an alert each time after its receiving. However, you can configure the default alert policy by doing the following:

1. Click the Manage E-mail Alert Subscription link at the Hardware Node dashboard.
2. In the Manage E-mail Alert Subscription window, click the Configure button.
3. In the displayed window, choose one of the following options:
   - **Stop sending alerts.** In this case, after having received an alert, you have to resubscribe to it again. This option is selected by default.
   - **Keep sending alerts.** In this case, you will get alerts on a permanent basis without having to resubscribe to them each time after their receiving.
   - **Collect alerts before sending for...** In this case, alerts will be permanently collected by Parallels Management Console in a special database. This database will be periodically, i.e. with the period specified in the field opposite the option name, checked and if there were any alerts gathered during the set time, the corresponding notification will be sent to your email address. The alert checking time is measured in seconds and can be set either by using the spin button or entering the needed period by hand.
4. After you have chosen the right option, click OK to save the settings.

---

**Monitoring Top Resources Consumption**

Parallels Management Console provides you with the ability to view the Containers with high resources consumption. You can use this option to avoid or solve the problem of the Hardware Node overcommitment or simply monitor the load on your Containers. To see the list of resource demanding Containers, expand the Monitor item under the corresponding Hardware Node name, and select the **Top Resource Consumers** item in the Management Console left pane.

**Note:** The statistics on a certain resource utilization shown in the right Parallels Management Console pane is an averaged usage data for a given time frame.

You can currently view the following statistics:

- **CPU used:** displays the CPU time usage of the Container against the entire CPU usage on the Hardware Node, in per cent.
- **CPU share used:** shows the real CPU usage of the Container against the CPU limit for this Container, in per cent.
- **Total memory used:** displays the statistics results of the physical memory consumption by the Container on the Node, in megabytes or kilobytes depending on the amount of physical memory used.
- **Memory share used:** shows the real memory consumption by the Container against the physical memory usage limit set for this Container.
- **Disk usage:** allows you to view the disk space utilization by the Container on the Hardware Node, in bytes, kilobytes, or megabytes depending on the amount of physical memory used.
- **Disk share usage**: enables you to view the real disk space utilization by the Container against the disk space limit set for this Container, in per cent.
- **Incoming traffic**: reflects the incoming traffic statistics of the Container, in megabytes or kilobytes depending on the amount of incoming traffic.
- **Outgoing traffic**: lists the outgoing traffic statistics results for the Container, in megabytes or kilobytes depending on the amount of outgoing traffic.

**Top CPU Resource Consuming Containers**

You may run the need to view the most CPU time consuming Containers on your Hardware Node, which can help you avoid the Node overcommit and the consequent Containers operation impairments. To view the CPU usage of all Containers on your Node, expand the **Monitor** item under the corresponding Hardware Node name, select the **Top Resource Consumers** item in the Management Console left pane, and click on the **CPU used** tab in the Management Console right pane:

![Image of top CPU resource consuming containers](image.png)

The statistics results are presented in the form of the **Containers With Top CPU Consumption** diagram where the Y-axis denotes the IDs of the Containers for which the CPU resource usage statistics has been collected and the X-axis represents the averaged CPU time, in per cent, consumed by the given Container for the selected timespan.

The **View Properties** group above the diagram allows you to define the following parameters to govern the statistics results:
- The time interval for which the CPU usage statistics is to be displayed. You can select one of the predefined values (day, month, year) on the drop-down menu or specify the needed period in the From and To fields.
- The number of the Containers characterized by the top consumption of the CPU time. You can set the number of Containers to be monitored in the Show top field either by using the spin button or entering the needed value by hand.

In Parallels Management Console, you can also view the real CPU usage, in per cent, of the Container against the CPU limit for this Container. To do this, expand the Monitor item under the corresponding Hardware Node name, select the Top Resource Consumers item in the Parallels Management Console left pane, and click the CPU share used tab in the right pane.

The statistics results are presented in the Containers With Top CPU Share Consumption diagram in the same form as they are depicted in the Containers With Top CPU Consumption diagram.

**Top Physical Memory Consuming Containers**

You might need to view the Containers using extensively the physical memory (RAM) of your Hardware Node. This can help you avoid the Node overcommit and the consequent Containers operation impairments. To view the physical memory consumption by all Containers on the Node, expand the Monitor folder under the corresponding Hardware Node name, select the Top Resource Consumers item in
the Parallels Management Console left pane, and click the **Total used memory** tab in the Parallels Management Console right pane.

The statistics results are presented in the form of the **Containers With Top Total Memory Consumption** diagram where the Y-axis denotes the IDs of the Containers for which the physical memory usage statistics has been collected and the X-axis shows the average amount of physical memory consumed by the given Container for the selected timespan. The measurement units used in the diagram (bytes, kilobytes, or megabytes) vary depending on the actual memory consumption by the Container.

The **View Properties** group above the diagram allows you to define the following parameters to govern the statistics results:

- The time interval for which the physical memory usage statistics is to be displayed. You can select one of the predefined values (**day, month, year**) on the drop-down menu or specify the needed period in the **From** and **To** fields.
- The number of the Containers characterized by the top consumption of physical memory. You can set the number of Containers to be monitored in the **Show top** field either by using the spin button or entering the needed value by hand.

Parallels Management Console also allows you to view the ratio of the real physical memory usage of the Container against the memory limit set for this Container, in per cent. To do this, expand the **Monitor** item under the corresponding Hardware Node name, select the **Top Resource Consumers** item in the Parallels Management Console left pane, and click the **Memory share used** tab in the right pane.
The statistics results are presented in the **Containers With Top Memory Share Consumption** diagram in the same form as they are depicted in the **Containers With Top Memory Consumption** diagram.

**Top Disk Space Consuming Containers**

You might need to view the Containers occupying the most of your Hardware Node disk space. This can help you avoid the Node overcommit and the consequent Containers operation impairments. To monitor the disk space usage on the Node, expand the **Monitor** folder under the corresponding Hardware Node, select the **Top Resource Consumers** item in the Parallels Management Console left pane, click the **Disk usage** tab in the Management Console right pane.
The statistics results are presented in the form of the **Containers With Top Disk Space Consumption** diagram where the Y-axis denotes the IDs of the Containers for which the disk space usage statistics has been collected and the X-axis shows the average amount of disk space consumed by the given Container for the selected timespan. The measurement units used in the diagram (bytes, kilobytes, or megabytes) vary depending on the actual disk space usage by the Container.

The **View Properties** group above the diagram allows you to define the following parameters to govern the statistics results:

- The time interval for which the disk space usage statistics is to be displayed. You can select one of the predefined values (day, month, year) on the drop-down menu or specify the needed period in the From and To fields.
- The number of the Containers characterized by the top consumption of disk space. You can set the number of Containers to be monitored in the Show top field either by using the spin button or entering the needed value by hand.

Parallels Management Console also allows you to view the ratio of the real disk space consumption by the Container against the disk space limit set for this Container, in per cent. To do this, expand the Monitor item under the corresponding Hardware Node name, select the Top Resource Consumers item in the Parallels Management Console left pane, and click on the Disk share usage tab in the right pane.
The statistics results are presented in the **Containers With Top Disk Space Share Consumption** diagram in the same form as they are depicted in the **Containers With Top Disk Space Consumption** diagram.

**Top Incoming Traffic Receiving Containers**

You might need to view the most incoming-traffic active Containers on your Hardware Node. For example, this can help you keep in check the traffic used by all the Containers on the Node. To view the Containers incoming traffic, expand the **Monitor** folder under the corresponding Hardware Node name, select the **Top Resource Consumers** item in the Management Console left pane, and in the right pane, click the **Incoming traffic (bytes)** or **Incoming traffic (packets)** tab, depending on whether you want to view the Container traffic statistics in bytes or in packets. For example:
The statistics results are presented in the form of the **Containers With Top Incoming Traffic (in Bytes)** or **Containers With Top Incoming Traffic (in Packets)** diagram where the Y-axis denotes the IDs of the Containers for which the incoming traffic statistics has been collected and the X-axis shows the average amount of incoming traffic, in bytes or in packets, for the given Container for the selected timespan.

The **View Properties** group above the diagram allows you to define the following parameters to govern the statistics results:

- The time interval for which the incoming traffic statistics is to be displayed. You can select one of the predefined values (day, month, year) on the drop-down menu or specify the needed period in the **From** and **To** fields.
- The number of the Containers characterized by the top consumption of incoming traffic. You can set the number of Containers to be monitored in the **Show top** field either by using the spin button or entering the needed value by hand.

**Top Outgoing Traffic Consuming Containers**

Sometimes, you may need to view the most outgoing-traffic active Containers on the Hardware Node. For example, this can help you monitor the traffic used by all the Containers on the Node. To view the Containers outgoing traffic on the Node, expand the **Monitor** folder under the corresponding Hardware Node name, select the **Top Resource Consumers** item in the Management Console left pane, and in the
right pane, click the **Outgoing traffic (bytes)** or **Outgoing traffic (packets)** tab, depending on whether you want to view the Container traffic statistics in bytes or in packets. For example:

The statistics results are presented in the form of the **Containers With Top Outgoing Traffic (in Bytes)** or **Containers With Top Outgoing Traffic (in Packets)** diagram where the Y-axis denotes the IDs of the Containers for which the outgoing traffic statistics has been collected and the X-axis shows the average amount of outgoing traffic, in bytes or in packets, for the given Container for the selected timespan.

The **View Properties** group above the diagram allows you to define the following parameters to govern the statistics results:

- The time interval for which the outgoing traffic statistics is to be displayed. You can select one of the predefined values (**day**, **month**, **year**) on the drop-down menu or specify the needed period in the **From** and **To** fields.
- The number of the Containers characterized by the top consumption of outgoing traffic. You can set the number of Containers to be monitored in the **Show top** field either by using the spin button or entering the needed value by hand.
Chapter 8

Managing Services and Processes

This chapter provides information on what services and processes are, the influence they have on the operation and performance of your system, and the tasks they perform in the system. You will learn how to do the following:

- Use Parallels Management Console to manage services and processes in Parallels Virtuozzo Containers (e.g., monitor, start, stop, or restart services and processes).
- Use Windows Task Manager to control active processes in your system (e.g., monitor the processes currently running on the Hardware Node and inside its Containers and send different signals to them).

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What Are Services and Processes

Instances of any programs currently running in the system are referred to as processes. A process can be regarded as the virtual address space and the control information necessary for the execution of a program. A typical example of a process is the Notepad program (or any other program) running on the Hardware Node or inside Containers. Along with common processes, there are a great number of processes that provide an interface for other processes to call. These are called services. In many cases, services act as the brains behind many crucial system processes; they typically spend most of their time waiting for an event to occur or for a period when they are scheduled to perform some task. Many services provide the possibility for other servers on the network to connect to the given one via various network protocols.

Parallels Virtuozzo Containers has a set of services at its disposal that perform certain tasks on the Hardware Node or in Containers. A number of services are launched during the Hardware Node startup (for example, Parallels Virtuozzo Containers Kernel Abstraction Layer or Parallels Virtuozzo Containers Management Service), which is explained by the fact that Parallels Virtuozzo Containers requires a specific set of running services to provide virtualization capabilities for the Node. These services are necessary for the proper functioning of your system (they are also known as critical services).

When working with services, keep in mind the following. During the lifetime of a service, it uses many system resources. It uses the CPUs in the system to run its instructions and the system's physical memory to hold itself and its data. It opens and uses files within the filesystems and may directly or indirectly use certain physical devices in the system. Therefore, in order not to damage your system performance, try to run only those services that are really needed at the moment.
Besides, you should always remember that running services in the Host OS is much more dangerous than running them in Containers. In case violators get access to one of the Containers through any running service, they will be able to damage only the Container where this service is running, but not the other Containers on the Hardware Node. The Hardware Node itself will also remain unhurt. And if the service were running on the Hardware Node, it would have damaged both the Hardware Node and all the Containers residing on it. Thus, make sure that you run only those services on the Hardware Node that are really necessary for its proper functioning. Launch all additional services you need at the moment inside separate Containers. It will significantly improve your system safety.

Main Operations on Services and Processes

The ability to monitor and control processes and services in your Parallels Virtuozzo Containers system is essential because of the profound influence they have on the operation and performance of your whole system. The more you know about what each process or service is up to, the easier it will be to pinpoint and solve problems when they creep in.

The most common tasks associated with managing services in the Host operating system of the Hardware Node or inside a Container are starting, stopping, and restarting a service. For example, you might need to start a service in order to use certain server-based applications, or you might need to stop or pause a service in order to perform testing or to troubleshoot a problem. All these operations can be performed by means of the Command Prompt.

As for processes, the main operations you can perform on them are monitoring the processes currently running on the Hardware Node or inside Containers and carrying out some control operations on them. You can complete these tasks using the Command Prompt or Windows Task Manager.

Managing Services and Processes

In Parallels Virtuozzo Containers, you can use the following tools to monitor and, to some extent, configure the services and processes present in the Hardware Node operating system or in a Container:

- Command Prompt to start, stop, or restart a service or to send different signals to a process.
- Windows Task Manager to control the processes currently running on the Hardware and inside its Containers.

The following subsections provide detailed information on how you can manage services and processes using these tools.
Managing Services

You can manage all services available on the Node or in a Container by using the standard Services Microsoft Management Console (MMC). To do this, run the `services.msc` command either on the Hardware Node or in the Container remote desktop connection window, respectively. For example, you can start, stop, or restart services, define their startup type (automatic, manual, disabled), view their dependencies, etc.

**Note:** You can also manage services using Parallels Virtual Automation. For more information, see the *Parallels Virtual Automation Administrator's Guide.*
This chapter familiarizes you with the Parallels Virtuozzo Containers network structure, lists Parallels Virtuozzo Containers networking components, and explains how to manage these components in Parallels-based systems. In particular, it provides information on the following:

- What virtual networks are and how to manage them on the Hardware Node.
- What the host-routed and bridged networking modes are and how to enable them for Containers.
- How to create and configure VLAN adapters in Containers.
- How to connect Containers to physical and virtual local area networks.
- How to enable support for Virtual Private Network (VPN) and Network Address Translation (NAT) in Containers.

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Managing Network Adapters on Hardware Nodes

Physical and VLAN (Virtual Local Area Network) adapters installed on the Hardware Node are used to provide Containers with access to each other and to external networks. During the Parallels Virtuozzo Containers installation, all physical and VLAN network adapters on the Node are registered with Parallels Virtuozzo Containers. Once the installation is complete, you can perform the following operations on adapters:

- List the adapters currently installed on the Hardware Node.
- Connect adapters to Virtual Networks on the Hardware Node.

Both operations are described in the following subsections in detail.
Listing Adapters

Parallels Virtuozzo Containers allows you to view the physical and VLAN network adapters currently installed on the Hardware Node. To do this, right-click the Hardware Node in Parallels Management Console, and choose Network Configuration > Configure Network Adapters.

The Adapters table in the displayed window lists all the network adapters currently available on the Node. To view detailed information on an adapter, select its name in the Adapters table. All adapter-related data (its name, type, the MAC and IP address assigned to the adapter, etc.) will be shown in the Details table at the bottom of the Hardware Node Network Configuration window.

You can also list the physical and VLAN adapters available on the Hardware Node using these tools:

- Parallels Virtual Automation. For more information on this web-based tool, see the Parallels Virtual Automation Administrator’s Guide at http://sp.parallels.com/products/pva46/resources.
- vznetcfg. Detailed information on this command-line tool is provided in the Parallels Virtuozzo Containers 4.6 Reference Guide.
Connecting Adapters to Virtual Networks

Connecting a physical or VLAN adapter to a Virtual Network allows you to join all Containers included in the Virtual Network to the network, either Ethernet or VLAN, where the corresponding adapter is connected. To join an adapter to a Virtual Network in Parallels Management Console, do the following:

1. Right-click the needed Hardware Node, and choose Network Configuration > Configure NetworkAdapters.

2. In the Hardware Node Network Configuration window, select the name of the network adapter to be joined to a Virtual Network, and click Edit button.

3. Under Virtual Network, choose on the drop-down menu the Virtual Network to which you want to join the network adapter.

4. Click OK.

To disconnect an adapter from the corresponding Virtual Network, perform Steps 1 and 2 above, and in the Properties window, choose Not connected on the drop-down menu.

You can also connect adapters to and disconnect them from Virtual Networks using these tools:

- Parallels Virtual Automation. For more information on this web-based tool, see the Parallels Virtual Automation Administrator’s Guide at http://sp.parallels.com/products/pva46/resources.
- vznetcfg. Detailed information on this command-line tool is provided in the Parallels Virtuozzo Containers 4.6 Reference Guide.

Managing Virtual Networks

A Virtual Network acts as a binding interface between a Container virtual network adapter and the corresponding physical or VLAN adapter on the Hardware Node allowing you to include your Containers
in different networks (local or VLAN). Parallels Virtuozzo Containers enables you to manage Virtual Networks as follows:

- Create a new Virtual Network on the Hardware Node and remove an existing one.
- List the Virtual Networks currently existing on the Hardware Node and configure their properties.
- Delete a Virtual Network that you do no need any more from the Hardware Node.

These operations are described in the following subsections in detail.

## Creating Virtual Networks

Virtual Networks serve as binding interfaces between the virtual network adapters inside Containers and the physical/VLAN adapters on the Hardware Node, which allows you to connect the Containers to different Ethernet and VLAN networks. To create a new Virtual Network in Parallels Management Console, do the following:

1. Right-click the needed Hardware Node, and choose **Network Configuration > Configure Virtual Networks**.
2. In the **Virtual Networks** window, click the **Add** button.

   ![Add a new virtual network](image)

   3. In the displayed window:
      - Specify an arbitrary name for the Virtual Network in the **Name** field. This name will be used to distinguish the given Virtual Network from the other Virtual Networks on the Hardware Node.
      - Provide the Virtual Network description, if necessary, in the **Description** field.
4 Click **OK**.

After a while, the newly created Virtual Network will be shown in the **Networks** table on the **Virtual Networks** screen.

You can also create new Virtual Networks using these tools:

- Parallels Virtual Automation. For more information on this web-based tool, see the *Parallels Virtual Automation Administrator’s Guide* at http://sp.parallels.com/products/pva46/resources.
- **vznetcfg**. Detailed information on this command-line tool is provided in the *Parallels Virtuozzo Containers 4.6 Reference Guide*.

**Listing Virtual Networks**

Sometimes, you may wish to list all Virtual Networks existing on the Hardware Node. To do this:

1 In Parallels Management Console, right-click the needed Hardware Node, and choose **Network Configuration > Configure Virtual Networks**.

2 The **Virtual Networks** window lists the Virtual Networks existing on the Hardware Node.

The information on Virtual Networks is presented in the table having the following columns:

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
<td>The name assigned to the Virtual Network.</td>
</tr>
<tr>
<td><strong>Connection Status</strong></td>
<td>Indicates whether the Virtual Network is connected to some adapter (physical or VLAN) on the Hardware Node.</td>
</tr>
<tr>
<td><strong>Assigned Interface</strong></td>
<td>If the Virtual Network is connected to some physical or VLAN adapter on the Node,</td>
</tr>
</tbody>
</table>
displays the name of this adapter.

| Description | The Virtual Network description, if set. |

You can also list the Virtual Networks existing on the Hardware Node using these tools:

- Parallels Virtual Automation. For more information on this web-based tool, see the *Parallels Virtual Automation Administrator's Guide* at http://sp.parallels.com/products/pva46/resources.
- `vznetcfg`. Detailed information on this command-line tool is provided in the *Parallels Virtuozzo Containers 4.6 Reference Guide*.

### Deleting Virtual Networks

At any time, you can remove a Virtual Network that you do not need any more from the Hardware Node. To do this:

1. In Parallels Management Console, right-click the needed Hardware Node, and choose **Network Configuration > Configure Virtual Networks**.
2. In the Virtual Networks window, select the name of the Virtual Network you want to delete, and click the **Remove** button.

---

You can also delete an existing Virtual Network from the Hardware Node using these tools:

- Parallels Virtual Automation. For more information on this web-based tool, see the *Parallels Virtual Automation Administrator's Guide* at http://sp.parallels.com/products/pva46/resources.
- `vznetcfg`. Detailed information on this command-line tool is provided in the *Parallels Virtuozzo Containers 4.6 Reference Guide*. 
Managing Container Virtual Network Adapters

This section provides information on managing virtual network adapters in Containers.

Networking Modes

In Parallels Virtuozzo Containers, any Container adapter can operate in one of the two network modes:

- host-routed mode
- bridged mode

Detailed information on both modes is provided in the following subsections.

Host-Routed Networking

A virtual network adapter is automatically made for every Container on the Hardware Node during its creation. By default, it is set to work in the host-routed mode. The picture below provides an example of the Parallels Virtuozzo Containers network structure when all Containers (Container #1, Container #2, Container #3) on the Node are functioning in the host-routed mode.
All Containers on the Hardware Node use the *Parallels Network Adapter*, which is automatically created on the Node during the Parallels Virtuozzo Containers installation, and the TCP/IP protocol stack of the Hardware Node to send and receive data to/from other networks (shown as the *PUBLIC NETWORK* in the picture above). The procedure of handling Container outgoing and incoming traffic can be described as follows:

- All outgoing IP packets from Containers operating in the host-routed mode come to the MAC address of the Parallels Network Adapter. They are then transferred to the TCP/IP stack of the Node where they are processed and forwarded through a public IP address of the Hardware Node to the corresponding workstation on the public network.

- All IP packets coming from the outer world and destined for Container IP addresses are sent to the MAC address of the Hardware Node first and, afterwards, transferred to the TCP/IP protocol stack of the Node where they are processed and forwarded to the MAC addresses of the corresponding Containers. In this case, the Node acts as an ARP (Address Resolution Protocol) server translating the Container IP addresses to their network addresses and transfers the IP packets to the right Container with no modification made.
The Parallels Network Adapter is also used to exchange the traffic among all the Containers hosted on the given Hardware Node. All the network traffic of a Container is isolated from that of the other Containers, i.e. all Containers are protected from each other in the way that makes traffic snooping impossible.

### Bridged Networking

You can also make the virtual network adapter inside a Container operate in the bridged mode. The following figure represents an example of the Parallels Virtuozzo Containers network where all Containers (Container #1 and Container #2) are operating in the bridged mode.

The bridged mode demonstrates the following differences as compared to the host-routed mode:

- A Container virtual network adapter is bound directly to a certain network adapter on the Hardware Node (depicted as NIC #1 for Container #1 and NIC #2 for Container #2 in the picture above).
- Neither proxy ARP entries nor entries in the routing and ARP tables for the Container are registered on the Hardware Node, i.e. all Container outgoing and incoming network traffic is transferred through the selected network adapter on the Node without being processed (routed).
- All incoming/outgoing IP packets have MAC addresses of the corresponding Containers appended to them. So, IP packets are sent directly to the MAC addresses of Containers rather than to the MAC address of the Hardware Node network adapter.
- Any Container can see all broadcast and multicast packets received from or sent to the selected network adapter on the Hardware Node. Thanks to this fact, all Containers are aware of all IP packets transferred over the Parallels local network and can catch the packets destined for them. In this case
the Parallels network can be compared to a broadcast domain where all IP packets can be transmitted for all Containers on the Hardware Node to receive. While all Containers detect the IP packet transmission on the network, only the Container to which the IP packet is addressed actually receives it.

- Due to the fact that bridged Container network adapters act as full members of the network (rather than 'hidden' beyond the Hardware Node), they are more prone to security vulnerabilities: traffic sniffing, IP address collisions, etc. Therefore, bridged network adapters are recommended to be used in trusted network environments only.
- There is a small productivity gain of bridged Container network adapters against the ones operating in the host-routed mode.

**Creating and Deleting Container Adapters**

A default virtual network adapter is automatically made for each Container during its creation. In Parallels Management Console, you can create additional virtual network adapters for your Containers and set their operating mode.

To create a new Container virtual network adapter, do the following:

1. Select the **Parallels Virtuozzo Containers** item under the corresponding Hardware Node name.
2. In the Management Console right pane, right-click the Container for which you want to create a new network adapter, and choose **Properties**.
3. On the **Network** tab of the displayed window, select the **Network Adapters** item.
4. Click the **Add Interface** button under the **Interfaces** table to display the **Add New Virtual Network Interface** window.
In this window, specify the following parameters for the virtual adapter:

- On the **General** tab:
  - Define the name to be assigned to the virtual network adapter in the **ID** field (by default, you are offered to use the `vznetN` name where `N` denotes the index number of the created Container network adapter).
  - Choose the network mode of the Container adapter by selecting the **Host-routed** or **Bridged** button.

If the adapter is set to operate in the 'bridged' mode, you can also do the following:
- Join the virtual network adapter to a Virtual Network on the Hardware Node. To do this, select the **Connect to** radio button, and choose the corresponding Virtual Network on the drop-down menu (detailed information on Virtual Networks is provided in *Managing Parallels Virtuozzo Containers Network* (p. 184));
- Specify the way of assigning a MAC address to the virtual network adapter. You can either select the **Obtain automatically** radio button to automatically generate the MAC address for the Container adapter or select the **Enter manually** radio button and type the needed MAC address in the field provided. Detailed information on Container MAC addresses is provided in *Managing Container MAC Addresses* (p. 195).

- On the **IP Settings** tab, you can configure the following adapter settings:
- Choose a variant of assigning an IP address to the virtual network adapter under the IP Addresses group:

a Select the Get IP address via DHCP radio button to automatically set an IP address for the adapter using the Dynamic Host Configuration Protocol (DHCP). This option is available only for virtual network adapters operating in the bridged mode.

b Select the Get IP address from pool radio button to automatically assign an IP address to the Container network adapter from the pool of IP addresses on the Hardware Node.

c Select the Enter IP addresses manually radio button, and use the Add button at the bottom of the window to manually specify the IP addresses to assign to the network adapter.

- Choose a variant of setting the default gateway to be used by the virtual network adapter under the Default gateway group: select the Obtain automatically radio button to automatically set the default gateway for the Container network adapter or select the Enter manually radio button and choose the needed gateway on the drop-down menu. This option is available only if the Container adapter is set to operate in the 'bridged' mode.

- On the DNS tab, specify one or more DNS servers to be used by the virtual network adapter.

- On the WINS tab, specify one or more WINS server to be used by the virtual network adapter.

6 Click OK twice.

7 Restart the Container for the changes to take effect.

After the virtual network adapter has been successfully created, it is displayed in the Interfaces table of the Properties window.

Any existing Container network adapter, except for the default one, can be deleted by completing the following tasks:

1 Select the Parallels Virtuozzo Containers item under the corresponding Hardware Node name.

2 In the Management Console right pane, right-click the Container whose network adapter you wish to remove, and choose Properties.

3 On the Network tab of the displayed window, select the Network Adapter item in the left pane, choose the corresponding virtual adapter in the Interfaces table, and click the Remove button at the bottom of the table.

You can also create new virtual adapters and delete existing ones using these tools:

- Parallels Virtual Automation. For more information on this web-based tool, see the Parallels Virtual Automation Administrator's Guide at http://sp.parallels.com/products/pva46/resources.

- vzctl set. Detailed information on this command-line tool is provided in the Parallels Virtuozzo Containers 4.6 Reference Guide.

**Configuring Container Network Adapter Parameters**

Along with creating new and removing existing virtual network adapters, you can perform a variety of other operations on Container adapters. In particular, you can do the following:

- Change the network adapter mode.
- Configure the virtual adapter's IP and MAC addresses.
- Configure DNS and WINS servers to be used by virtual network adapter.
- Configure the default gateway to be used by a virtual network adapter.

You can also configure the parameters of a Container network adapter using Parallels Virtual Automation. For more information on this web-based tool, see the *Parallels Virtual Automation Administrator's Guide*.

### Configuring Network Adapter Modes

Sometimes, you may wish to change the networking mode in which a virtual network adapter is operating. To do this:

1. Select the **Parallels Virtuozzo Containers** item under the corresponding Hardware Node name.
2. In the Management Console right pane, right-click the Container owning the network adapter, and choose **Properties**.
3. On the **Network** tab of the displayed window, select the **Network Adapters** item.
4. In the **Interfaces** table, select the network adapter, and click **Properties**.

![Virtual Network Interface “vznet11” Properties](image-url)
In the Network Adapter Type section on the General tab, choose the network mode of the Container adapter by selecting the Host-routed or Bridged button.

Click OK twice.

Restart the Container for the changes to take effect.

Managing Container MAC Addresses

Each Container is assigned a default Media Access Control address (MAC address) during its creation. This MAC address remains in force during the whole Container life-cycle (i.e. from the Container creation to the Container deletion) and uniquely identifies any particular Container. Parallels Virtuozzo Containers uses the following approach while assigning MAC addresses to Containers:

- If it is operating in the host-routed mode, the Container virtual network adapter gets a random MAC address in the form of 00:FF:XX:XX:XX:XX where the XX:XX:XX:XX part is automatically generated by Parallels Virtuozzo Containers.
- If it is operating in the bridged mode, the virtual network adapter gets a random MAC address in the form of 00:18:51:XX:XX:XX where the XX:XX:XX part is automatically generated by Parallels Virtuozzo Containers.

However, you may wish to have another (custom) MAC address assigned to your Container. Parallels Virtuozzo Containers allows you to replace the default MAC addresses assigned to Container virtual network adapters operating in the bridged mode with your own one by performing the following operations in Parallels Management Console:

1. Select the Parallels Virtuozzo Containers item under the corresponding Hardware Node name.
2. In the Management Console right pane, right-click the Container whose MAC address you want to change, and choose Properties.
3. In the displayed window, go to the Network tab, and select the Network Adapters item in the left part of the window. The list of network adapters currently existing inside the Container will be shown in the Interfaces table in the right part of the window.
4. Select the corresponding network adapter, and click the Properties button at the bottom of the Interfaces table.
5 On the **General** tab of the displayed window, select the **Enter manually** radio button under the **MAC** group, and specify the desired MAC address.

6 Click **OK** twice.

If a Container network adapter has a custom MAC address assigned to it, the adapter will always get this MAC address provided there is no such MAC address already set for some other device on the network. In the case of detecting a MAC address conflict, the corresponding Container will not start.

### Configuring TCP/IP Settings Manually

As any other standalone server, every Container must have a number of TCP/IP settings configured in the proper way to successfully operate on a TCP/IP network. These settings include:

- one or more IP addresses for every virtual network adapter inside the Container
- one or more IP addresses for the default gateway to be used by the Container
- one or more IP addresses for the default DNS server(s) to be used by the Container
- one or more IP addresses for the default WINS server(s) to be used by the Container

Usually, you define all these settings during the Container creation. However, if you have not yet set any of the aforementioned settings or want to modify any of them (e.g., to change the gateway the Container is supposed to use), you can do the following:
1. In Parallels Management Console, select the **Parallels Virtuozzo Containers** item under the corresponding Hardware Node name.

2. In the Management Console right pane, right-click the Container whose settings you want to configure, and choose **Properties**.

3. On the **Network** tab of the displayed window, select the **Network Adapter** item in the left pane to view the list of network adapters currently available inside the Container.

4. Select the corresponding adapter in the **Interfaces** table in the right part of the window, and click the **Properties** button.

5. In the **Virtual Network Interface Properties** window, do the following:
   - On the **IP Settings** tab:
     a. Select the **Enter IP addresses manually** radio button, click the **Add** button, and manually type the desired IP address and subnet mask in the **IP address** and **Subnet mask** fields, respectively.
     b. Select the **Get IP address from pool** radio button to automatically choose and assign an IP address to the Container network adapter from the pool of IP addresses on the Node.
     c. Configure the IP address of the default gateway to be used by the virtual network adapter by typing the desired IP address in the **Default gateway address** field.
   - On the **DNS** tab, use the **Add** button to specify one or more DNS servers that the virtual network adapter is supposed to use.
On the WINS tab, use the Add button to set one or more WINS servers to be used by the virtual network adapter.

6 Click OK twice.

You can also use the vzctl set command to change the properties of a Container virtual network adapter. Detailed information on this command is given in the Parallels Virtuozzo Containers 4.6 Reference Guide.

Obtaining TCP/IP Settings Automatically

Along with a static assignment of network parameters to a Container, you can make the Container receive its TCP/IP settings automatically using the Dynamic Host Configuration Protocol (DHCP). This protocol enables you to automatically provide your Containers with TCP/IP setup information. While using DHCP for Containers, all changes to the network configuration are made centrally on the DHCP server and affect all the Containers on the given Node, i.e. the Hardware Node administrator does not need to apply the changes to each and every Container. The DHCP server can be set up on the Hardware Node itself or inside any of its Containers. You can also use any other server located in the same network segment with the Hardware Node as the DHCP server for your Containers.

Note: To allow a Container to host a DHCP server, you should make sure that the network browsing is enabled inside this Container. For the information on how you can do it, turn to Enabling Network Browsing for Container.

The DHCP server can provide the following main settings for a Container:

- an IP address and subnet mask
- one or more IP addresses for the default gateway
- one or more IP addresses for the default DNS servers
- one or more IP addresses for the default WINS server

For example, if the DNS server address changes, all Containers will automatically start using the new address the next time they contact the DHCP server.

By default, DHCP is disabled for all Containers on the Node. However, you can enable DHCP for any Container (or for any of its virtual network adapters if the corresponding Container has more than one virtual adapter installed) using the --dhcp option of the vzctl set command. The Container can be operating in either mode:

- Host-routed mode:
  - If the DHCP server is located on the Hardware Node or inside one of its Containers, additional configuration changes should be made neither on the Container side nor on the DHCP server side.
  - If the DHCP server is located on a separate server in the network, you should additionally perform the following operations:
    - a Configure and put into operation the DHCP relay agent on the Hardware Node.
    - b Set routing for the DHCP server allowing it to access the IP address of the Parallels Virtuozzo Containers Network Adapter.
Note: We recommend that you set your Container network adapter to operate in the bridged mode if you wish to use a separate server for housing the DHCP server.

- Bridged mode. In this case additional configuration changes should be made neither on the Container side nor on the DHCP server side.

To turn on DHCP for a Container (or any of its virtual network adapters), do the following:

1. Select the **Parallels Virtuozzo Containers** item under the corresponding Hardware Node name.
2. In the Management Console right pane, right-click the Container for which you wish to enable DHCP, and select **Properties**.
3. In the displayed window, go to the **Network** tab, and select the **Network Adapters** item in the left part of the window. The list of network adapters currently existing inside the Container will be shown in the **Interfaces** table in the right part of the window.
4. Select the corresponding network adapter, and click the **Properties** button at the bottom of the **Interfaces** table.
5. Go to the **IP Settings** tab of the **Virtual Network Interface Properties** window, and select the **Obtain IP address via DHCP** radio button.

6. Click **OK** twice.
In the command line, you can use the --dhcp option to \texttt{vzctl set} to enable/disable DHCP for a Container. Detailed information on this command is given in the \textit{Parallels Virtuozzo Containers 4.6 Reference Guide}.

### Connecting Bridged Containers to Network

With the implementation of bridged virtual adapters allowing Containers to function as full participants on the network, it has become possible to include Containers in a wide range of network configurations the most common of which are Ethernet networks and virtual local area networks (VLANs). The process of connecting a bridged virtual network adapter to an Ethernet network or to a VLAN is carried out using a certain physical and VLAN adapter, respectively, and involves completing the following tasks:

1. Creating a Virtual Network on the Node to be an intermediary between the Container bridged adapter and the physical/VLAN adapter on the Node.
2. Joining the Virtual Network where the Container virtual adapter is included to the corresponding physical/VLAN adapter on the Node.
3. Connecting the Container virtual adapter you wish to include in an Ethernet network/VLAN to the Virtual Network.

After performing these operations, the Container will be able to communicate with any computer on the network (either Ethernet or VLAN) where it is included and have no direct access to the computers joined to other networks.

\textbf{Note:} The process of creating new Virtual Networks and joining physical and VLAN adapters to these Virtual Network is described in \textit{Creating Virtual Network} (p. 185) and \textit{Connecting Adapter to Virtual Network} (p. 184), respectively.

To join a Container virtual network adapter to a Virtual Network on the Hardware Node, do the following:

1. Choose the \texttt{Parallels Virtuozzo Containers} item under the corresponding Hardware Node name, right-click the Container whose network adapter you want to join to the Virtual Network, and choose \texttt{Properties}.
2. On the \texttt{Network} tab of the displayed window, select the \texttt{Network Adapters} item.
3. Double-click the virtual network adapter.
4. Make sure the \texttt{Bridged} radio button is selected in the \texttt{Network Adapter Type} section.
5. In the \texttt{Virtual Network Interface Properties} window, under \texttt{Virtual Network}, choose the needed Virtual Network in the \texttt{Connection to} list.
You can also connect bridged adapters to Virtual Networks using these tools:

- Parallels Virtual Automation. For more information on this web-based tool, see the Parallels Virtual Automation Administrator's Guide at http://sp.parallels.com/products/pva46/resources.
- vzctl set. Detailed information on this command-line tool is provided in the Parallels Virtuozzo Containers 4.6 Reference Guide.

Note: If you are deploying Parallels Virtuozzo Containers in a VMware ESX Server environment, you may need to perform the following operations to make your Containers operating in the bridged mode accessible from external servers:
- Make sure that the value of the Promiscuous Mode field on the Security tab of the vSwitch Properties window is set to Accept.
- Ensure that the ESX Server adapter always has one and the same MAC address assigned.

---

### Enabling VPN in Containers

Virtual Private Network (VPN) is a technology allowing you to establish a secure network connection over an insecure public network. In Parallels Virtuozzo Containers, you can make Containers operate as VPN clients connecting to VPN remote access servers. By default, the VPN support inside a Container is disabled. To enable it, use the vzctl set command with the --vpn option. Let us assume that you
want to enable VPN support in Container 101. To do this, execute the following commands on the Hardware Node:

```
C:\Users\Administrator>vzctl set 101 --vpn on --save
```

The changes made to Container 101 will take effect on the next Container startup.

To check that the VPN support is now turned on inside Container 101, run the following command:

```
C:\Users\Administrator>vzlist -o nettype 101
```

```
NETTYPE
routed+vpn
```

The command output shows that Container 101 is currently operating in the host-routed mode and the VPN support is enabled.

Now you can connect Container 101 to private networks like any other standalone server (e.g., using the New Connection Wizard which can be launched by double-clicking the New Connection Wizard icon in the Network Connections applet).

To disable VPN support in Container 101, run the following command:

```
C:\Users\Administrator>vzctl set 101 --vpn off --save
```

---

**Enabling NAT for Containers**

Parallels Virtuozzo Containers allows you to enable Network Address Translation (NAT), a method of connecting multiple servers to the Internet (or any other IP network) using a single IP address, for Containers running in both the host-routed and bridged modes. NAT grants your Containers access to network resources by using the Hardware Node's IP address. So, if you use NAT, your Container will not have its own IP address on the external network. Instead, a separate private network will be set up on the Hardware Node and all your Containers will be assigned private IP addresses on that network. A special NAT device on the Hardware Node will transmit network data between the Containers and the external network. This device will identify incoming data packets intended for each Container and send them to the correct destination.
In the picture above, Container #1 and Container #2 are assigned private IP addresses 10.0.0.101 and 10.0.0.102, respectively. In its turn, the Hardware Node has the public IP address 122.122.145.101. When either Container sends traffic to the external network, that Container's private IP address in each packet is translated to the public IP address of the Hardware Node. When a reply returns to the Hardware Node, the NAT device on the Node determines to which Container to forward the reply.

NAT is disabled for newly created Containers by default. To enable NAT for a Container, use the `vzctl set` command with the `--nat` option. For example, to enable NAT for Container 101:

```bash
C:\Users\Administrator>vzctl set 101 --nat on --save
```

This command enables NAT for the default virtual network adapter in Container 101. If you have more than one virtual network adapter in a Container, you can enable NAT for a specific virtual network adapter using the `vzctl set` command with the `--netif` option. For example, to enable NAT for the virtual network adapter `vznet1`:

```bash
C:\Users\Administrator>vzctl set 101 --netif vznet1 --nat on --save
```

**Note:** For any Container's virtual network adapter operating in the bridged mode, you can enable NAT on all physical network adapters on the Hardware Node except the one to which the Container's adapter is bound. So, if you have NIC1, NIC2, and NIC3 installed on the Node and the Container's adapter is bound to NIC1, you can enable NAT for this adapter on NIC2 and NIC3 only.

At any time, you can disable NAT for any Container on the Hardware Node. For example:

- To disable NAT for the default virtual network adapter in Container 101:
  ```bash
  C:\Users\Administrator>vzctl set 101 --nat off --save
  ```

- To disable NAT for the `vznet2` (non-default) virtual network adapter in Container 101:
  ```bash
  C:\Users\Administrator>vzctl set 101 --netif vznet2 --nat off --save
  ```
Chapter 10

Advanced Tasks

This chapter describes advanced tasks an experienced system administrator may need to perform with Parallels Virtuozzo Containers.

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Migrating a Physical Server to a Container

This section provides information on how you can migrate an external physical server to a Container.

Overview

Along with migrating Containers between Hardware Nodes, you may wish to move a stand-alone physical server to a Container on your Node. The migration process includes copying the whole contents of the physical server (all its files, folders, network settings, and so on) to a Container. Once the migration is complete, you will have the exact copy of the physical server in a Container.

You can also migrate a physical server to a Container using the following tools:

- Parallels Virtual Automation. For more information on this web-based tool, see the Parallels Virtual Automation Administrator's Guide.
- vzp2v. Detailed information on this command-line tool is provided in the Parallels Virtuozzo Containers 4.6 Reference Guide.
Migration Requirements

To avoid delays and problems while migrating a physical server to a Container, make sure that the following requirements are fulfilled in respect of the server and the Hardware Node:

2. The physical server and the Hardware Node must be running the same major and minor versions of Windows Server and Service Pack, if any.
3. A network connection can be established between the physical server to be migrated and the Hardware Node.
4. The Server and Remote Registry services are running on the physical server.
5. The Volume Shadow Copy and Microsoft Software Shadow Copy Provider services are enabled on the physical server.
6. The default administrative shares (especially, ADMIN$) are enabled on the physical server.
7. The following ports are opened on the physical server:
   - standard Windows Server ports used to access the physical server via the network sharing and remote registry capabilities (e.g. 445, 137, 138)
   - Parallels Virtuozzo Containers-specific ports: 4433, 4434, 4435
8. We also recommend that you disable antivirus programs on the physical server before migrating it to a Container.
9. If you are going to migrate a physical server running the Windows Server 2000 operating system and acting as a domain controller, you should first prepare your server for migration by using the adprep utility. Detailed information on how you can do it can be found in the Microsoft Knowledge Base at http://support.microsoft.com/kb/331161 and in the Windows Server TechCenter at http://technet2.microsoft.com/WindowsServer/en/Library/bc5ebbdb-a8d7-4761-b38a-e207baa734191033.mspx?mfr=true.

Migration Restrictions

Although Parallels Virtuozzo Containers allows you to migrate virtually any physical server running the Windows Server 2008, Windows Server 2003, or Windows Server 2000 operating system to a Container on your Hardware Node, there is a number of limitations which should be taken into account before deciding on the migration process:

- The following migration types are supported:
  - Physical servers running Windows Server 2008 R2 can be migrated only to Hardware Nodes running Windows Server 2008 R2.
  - Physical servers running Windows Server 2008 can be migrated only to Hardware Nodes running Windows Server 2008.
  - Physical servers running Windows Server 2003 can be migrated only to Hardware Nodes running Windows Server 2003.
- Physical servers running Windows Server 2000 can be migrated only to Hardware Nodes running Windows Server 2003.
- Non-NTFS volumes cannot be migrated from the physical server to a Container on the Hardware Node.
- After the physical server migration, the Quality of Service packet scheduler is disabled inside the Container irrespective of its state on the server before the migration began. Consult Enabling QoS Scheduler for Container to learn how to enable it inside your Container.
- If you are migrating a physical server running the Windows Server 2000 operating system, keep in mind the following:
  - During the migration, the reboot of the physical server running Windows Server 2000 is required to complete the installation of Parallels Virtuozzo Containers-specific drivers on this server.
  - The Windows components installed on the physical server and not included in the Windows Server 2003 OS template will not be migrated to the Container on the Hardware Node and should be installed anew inside the Container after migration. You can learn what Windows components are incorporated in the OS template by doing the following:
    a. Creating a new Container on your Node.
    b. Logging in to the Container via RDP.
    c. Opening the Control Panel applet and double-clicking Add or Remove Programs.
    d. Selecting the Add/Remove Windows Components tab in the Add or Remove Programs window.
    e. Checking what components are currently installed inside the Container in the Windows Components window.
  - Some applications may fail to start or work not as expected after their migration to the Container on the Node. This is due to substantial changes and enhancements in the Windows Server 2003 technology in comparison to Windows Server 2000, i.e. new features implemented in Windows Server 2003 might break compatibility with a number of applications running under Windows Server 2000.
  - You cannot migrate physical servers running the 32-bit version of Windows Server to Hardware Nodes running the 64-bit version of Parallels Virtuozzo Containers, neither can you move physical servers running the 64-bit version of Windows Server to Nodes running the 32-bit version of Parallels Virtuozzo Containers.

**Migrating Physical Server to Container in Parallels Management Console**

To quickly and reliably migrate a stand-alone physical server to a Container on your Node, use the \texttt{vzp2v} command. For example, the following command

\begin{verbatim}
C:\...\Administrator> vzp2v 101 --src_addr 10.18.75.43 --src_user Administrator -- src_pswd Abcd0123
\end{verbatim}

allows you to log in to the physical server having the IP address of 10.18.75.43 with the credentials of Administrator and Abcd0123 and to migrate this physical server to Container 101 on your Hardware Node.
**Configuring Container Resources Parameters After Migration**

You may wish to configure the resources parameters for the Container where your physical server was migrated. By default, the resources parameters are set as follows:

- The disk space quota imposed on the Container is calculated on the basis of the amount of disk space used on all disk drives that were migrated to the Container plus some additional free disk space needed for the Container error-free performance.
- The Container is allocated 1000 CPU units.
- The Number of TS sessions and Container memory parameters are unlimited.

You can configure any of the aforementioned parameters using Parallels Virtuozzo Containers command line utilities. For details on how you can do it, see [Managing Resources](p. 106).

**Managing Memory Resources**

This section provides information on managing memory resources in Parallels Virtuozzo Containers.

**Managing Memory Resources on Node**

Like any other standalone server running the Windows Server operating system, any Hardware Node can be defined in the memory terms by the following main components:

- **Physical memory**: RAM modules installed on the Hardware Node. The amount of physical memory present on the Hardware Node determines the number and performance of Containers you are able to create and simultaneously run on the given Node. For example, to painlessly run as many as 10 Containers, the Hardware Node should have at least 1 Gb of physical memory.
- **Virtual memory**: paging file used by the operating system on the Hardware Node to simulate more RAM than actually exists on the Hardware Node, thus, allowing you to run larger programs or more programs concurrently. We recommend that you set the size of the paging file by 2 - 2.5 times more than the amount of physical memory installed on the Node.
- **Kernel memory**: the amount of memory used by the operating system on the Hardware Node. This kind of memory is protected and cannot be accessed by regular applications.
- **System memory pools**: paged and non-paged memory pools that the kernel-mode components on the Hardware Node use to allocate system memory. The initial size of these pools is automatically calculated on the system start-up and depends on the amount of physical memory installed on the Node. Thereafter, the pools size is adjusted dynamically and can vary widely depending on the applications and services that are currently running in the system.

The process of monitoring and configuring all the aforementioned components on the Hardware Node does not differ from that on a standalone server. For example, you can increase the amount of physical memory available on the Hardware Node by installing new storage modules or modify the size of the paging file to meet your demands. You can also use standard Windows performance monitoring tools.
(Task Manager, Performance Monitor, Process Explorer, Process Viewer, etc.) to monitor the main memory parameters.

Managing Container Memory Resources

The memory capabilities of any Container are determined by the following main memory components:

- **Private (or potentially private) memory**: memory allocated (or that can be allocated) to all processes inside a particular Container.
- **Shared (or potentially shared) memory**: memory simultaneously used (or that can be used) by two or more processes inside two or more Containers.
- **System memory pools**: memory pools (paged and non-paged) that the kernel-mode components inside a Container use to allocate system memory.

Detailed information on these components and the ways to manage them in Parallels Virtuozzo Containers is provided in the following subsections in detail.

Memory Sharing Among Containers and Copy-on-Write Protection

The usage of shared memory in Parallels Virtuozzo Containers-based systems represents one of the key concepts in the Parallels Virtuozzo Containers virtualization technology. In Parallels Virtuozzo Containers, the shared memory management is based on the Parallels Virtuozzo Containers templates technology and carried out via Virtuozzo File System (VZFS). VZFS allows you to effectively utilize the Hardware Node physical memory resources by sharing them among Containers as follows:

- All Containers on the Hardware Node based on the same OS template share one and the same running instance of the Windows Server operating system.
- All applications added to Containers using the corresponding application templates and simultaneously launched inside two or more Containers share the same code (dynamic code libraries or DLLs) and data (shared memory regions) in the Hardware Node physical memory.

In both cases, the DLL code and data are loaded into the physical memory only once and shared among the processes inside the corresponding Containers.

The following picture demonstrates three Microsoft (MS) SQL applications added to Container #1, Container #2, and Container #3 by means of the MS SQL template, simultaneously launched inside these Containers, and sharing two memory pages ('page 1' and 'page 2'):
Sharing memory among similar processes inside Containers allows you to save megabytes of physical memory, thus considerably improving scalability and total system performance.

At the same time, VZFS does not forbid you to modify any template-based applications or some of their data inside Containers. In this case, the 'copy-on-write' page protection mechanism comes into effect. When a user modifies shared data from inside a Container, VZFS creates a private copy of this data transparently for the user of this Container so that the modifications do not affect the other applications sharing the data. As an example, the following picture shows the situation when a user inside Container #3 has attempted to modify some data on 'shared page 2' simultaneously used by three MS SQL applications (processes):
As can be seen from the picture above, a new page (‘copy of shared page 2’) has been allocated in the physical memory of the Hardware Node. It contains the copy of the original page contents (i.e. of ‘shared page 2’) including the changes made to the page by the user inside Container #3. The newly created page is private to the MS SQL application running inside Container #3 and not visible to the processes inside Container #1 and Container #2 which continue using 'shared page 2'. As for 'shared page 1', all three processes keep sharing its original copy since no attempts to modify it have been made on the Containers part.

**Managing Container Private Memory**

As distinct from shared memory visible to and used by more than one process inside different Containers, private memory can be defined as memory that is available to a particular Container and that can be used exclusively by the processes inside this Container. By default, any Container can consume all free memory on the Hardware Node. However, you can configure the maximal amount of private memory that can be allocated to the processes inside a Container by performing the following operations in Parallels Management Console:

1. Click **Parallels Virtuozzo Containers** in the Management Console left pane, right-click the needed Container in the right pane, and choose **Properties**.
2. Click the **Resources** tab, and select the **Memory-related parameters** item in the left part of the displayed window.
3. Double-click the **Container memory** parameter, clear the **Not limited** check box if it is selected, and enter the needed value for the Container in the **Value** field.

The size of private or potentially private memory that can be allocated to all applications inside the Container, in megabytes. Shared or potentially shared memory (e.g. memory mapped files) is not included in this resource parameter.
If you see the symbol near the **Allowed range** field, this means that the specified value is set out of the allowed range. This may cause the Container to malfunction. So, check the current value and enter a value within the limits specified in the **Allowed range** field.

**Note:** When deciding on the amount of private memory to be allocated to a Container, make sure that the total amount of memory allocated to all Containers on the Hardware Node does not exceed the amount of physical and virtual memory available on this Node.

4 Click **OK**.

You can also configure the amount of private memory for a Container using these tools:

- Parallels Virtual Automation. For more information on this web-based tool, see the *Parallels Virtual Automation Administrator's Guide* at http://sp.parallels.com/products/pva46/resources.
- `vzctl set`. Detailed information on this command-line tool is provided in the *Parallels Virtuozzo Containers 4.6 Reference Guide*.

**Managing Container Memory Pools**

When a Container is started, two types of dynamically sized memory pools are created:

- 'Non-paged pool': a region of memory in the Container system space that cannot be paged to the disk and is guaranteed to reside in the Container memory at all times.
- 'Paged pool': a region of memory in the Container system space that can be paged in and out of the system.

Parallels Virtuozzo Containers allows you to configure the maximal size of the paged and non-paged pools inside Containers using the `vzctl set` utility. For example, this can be of service to you if you want to eliminate the possibility of pools memory leaks inside Containers, which may have a negative impact on the overall Hardware Node performance. Let us assume that you want to set the paged and non-paged pools of Container 101 to 200 Mb and 50 Mb, respectively. To do this, you can execute the following commands on the Hardware Node:

**Note:** In the current version of Parallels Virtuozzo Containers, the limits set for the paged and non-paged pools are effective in respect of the Container TCP/IP software stack only.

```
C:\Users\Administrator>vzctl set 101 --pagedpoollimit 200 --save
C:\Users\Administrator>vzctl set 101 --nonpagedpoollimit 50 --save
```

**Managing External Drives and Image Files for Containers**

This section provides information on how you can add new virtual drives to Containers and configure them to meet your demands. Besides, it explains you the way to mount available drives and image files located on the Hardware Node to drives and files inside a Container to make them accessible from within the Container.
Managing Container Virtual Disks

Parallels Virtuozzo Containers enables you to perform the following operations on Container virtual disk drives:

- Add new disk drives to Containers.
- Increase/decrease the current size of the disk drive and modify its measurement units.
- Remove disk drives from Containers.

All these operations are described below in detail.

Adding New Disk Drives to Containers

In Parallels Virtuozzo Containers-based systems, any Container is created with only one disk drive inside it, the C:\ disk drive. However, Parallels Virtuozzo Containers allows you to add new virtual disk drives to any of your Containers. After a new disk drive has been successfully added to a Container, it becomes visible:

- On the Hardware Node, as a file in the .efd format in the X:\vz\private\CT_ID folder.
- From inside the Container, as a local disk drive.

You can then use the newly created virtual disk drive in the same way as you would use it on a stand-alone computer: format it, create new files and folders on it, and so on.

To add a new virtual disk drive to a Container, do the following:

1. In Parallels Management Console, expand the corresponding Hardware Node name, and select the Parallels Virtuozzo Containers item to display the list of Containers existing on the Node.
2. Right-click the Container you want to add a new virtual drive to, and choose Tasks > Manage Mount Points.

   Alternatively, you can open the Container Manager window for the given Container and click on the Manage Mount Points link in the Actions section of the Management Console view pane.
3. In the opened window, click on the Add button to display the Mount Point window.
In this window, do the following:

- In the **Mount point** list, click the drop-down arrow, and select a drive letter under which the created disk drive will be accessible inside the Container. The specified letter will be also displayed as the name of the subfolder in the `X:\vz\root\CT_ID` folder on the Node.

- Select the **Create new image** radio button to make the options below active:
  
  - In the **Size** field, specify the size for your new disk drive either by using the spin button or by entering the needed value manually. You can also change the units in which the drive size will be measured by selecting **GB** (gigabytes) instead of **MB** (megabytes) on the drop-down menu.
  
  - Under the **Location** subgroup, choose one of the following options to specify where on the Node the file corresponding to the created drive and having the `.efd` extension will be located:
    
    a. Select the **Container private area** radio button to create and locate the file in the private area of the corresponding Container (i.e. in the `X:\vz\private\CT_ID` folder on the Node). You can also specify the name of the file in the **Image file name** field. If you leave this field blank, the file name will be automatically generated by Parallels Management Console in the form of `lpbkCT_Numberefd` where `CT_Number` denotes the index number of the disk drive automatically created inside the Container (i.e. `lpbk0000efd` for the first disk drive, `lpbk0001efd` for the disk second drive, etc.).
    
    b. Select the **Hardware Node** radio button to create and locate the file in a place other than the Container private area. In this case, you need to specify the full path to the file on the Hardware Node (e.g., `C:\MyFolder\MyFileefd`).
4 Click **OK**.

You can also add new virtual disk drives to Containers using these tools:

- Parallels Virtual Automation. For more information on this web-based tool, see the *Parallels Virtual Automation Administrator's Guide* at http://sp.parallels.com/products/pva46/resources.
- `vzctl partadd`. Detailed information on this command-line tool is provided in the *Parallels Virtuozzo Containers 4.6 Reference Guide*.

### Configuring Container Disk Drives

The current version of Parallels Virtuozzo Containers allows you to configure virtual disk drives in Containers as follows:

- Increase/decrease the current size of the disk drive.
- Change the units in which the Container virtual disk is measured.

You can configure the size of a Container disk drive using the `vzctl set` command. Detailed information on this command is provided in the *Parallels Virtuozzo Containers 4.6 Reference Guide*.

### Removing Disk Drives from Containers

You can remove any disk drive from a Container, except for the `C:\` drive (system drive). To remove a virtual disk drive, do the following:

1. In Parallels Management Console, click the **Parallels Virtuozzo Containers** item under the corresponding Hardware Node name to display the list of all Containers on the Node.
2. Right-click the Container from where you want to remove a disk drive, and choose **Tasks > Manage Mount Points**. Alternatively, you can open the Container Manager window for the given Container, and click on the **Manage Mount Points** link in the **Actions** section of the Management Console view pane.

The **Mount Points Manager** window is displayed where you can see all the drives currently available inside the Container.
3. Select the disk drive you want to remove, and click the **Unmount** button.

4. In the **Delete Drive** window displayed after clicking the **Unmount** button, do one of the following:

   - Click **Yes** without selecting the **Delete image file ...** check box. In this case, the disk drive will become inaccessible from within the Container (i.e. invisible in Windows Explorer). However, the .efd file representing the corresponding disk is not removed from the \X:\vz\private\CT_ID\folder on the Hardware Node.

   - Select the **Delete image file ...** check box, and click **Yes**. This will make the disk drive inaccessible from within the Container and remove the .efd file from the \X:\vz\private\CT_ID\folder on the Hardware Node.

**Note:** When deciding on whether to remove a disk drive, keep in mind that all folders and files located on the drive will be permanently deleted from the Container.

You can also remove an existing disk drive from a Container using these tools:

- Parallels Virtual Automation. For more information on this web-based tool, see the *Parallels Virtual Automation Administrator's Guide* at http://sp.parallels.com/products/pva46/resources.

- vzctl partdel. Detailed information on this command-line tool is provided in the *Parallels Virtuozzo Containers 4.6 Reference Guide*.

### Managing Hardware Node Drives

In some circumstances, you may need to give a Container direct access to a drive on the Hardware Node. Parallels Virtuozzo Containers allows you to mount a drive on the Node to a drive inside a Container, thus granting your access to this drive from inside the Container. After mounting the drive, you can log in to the Container via RDP and work with the mounted drive in the same way as you would do it on the Hardware Node.
Virtually any drive available on the Node can be mounted to a Container, for example:

- physical hard drives (SCSI or IDE/ATA)
- DVD-ROM drives
- CD-ROM drives
- floppy disk drives

To mount a Hardware Node drive to a Container, do the following:

1. In Parallels Management Console, click the Parallels Virtuozzo Containers item under the corresponding Hardware Node name to display the list of all Containers on the Node.

2. Right-click the Container where you want to mount a drive, and choose Tasks > Manage Mount Points. Alternatively, you can open the Container Manager window for the given Container, and click on the Manage Mount Points link in the Actions section of the Management Console view pane.

3. In the opened window, click on the Add button to display the Mount Point window.

In this window, do the following:

- In the Mount point list, click the drop-down arrow, and choose a letter under which the mounted drive will be accessible inside the Container.
- Check the **Mount Hardware Node drive** radio button, and on the drop-down menu, select a letter assigned to the drive on the Node.

**Note:** The permissions of the drive mounted to a Container correspond to those of this drive on the Hardware Node, i.e. you are able to perform the same operations on the drive inside the Container as you are allowed on the Node.

At any time, you can unmount the mounted drive from your Container. To do this:

1. In Parallels Management Console, click the **Parallels Virtuozzo Containers** item under the corresponding Hardware Node name to display the list of all Containers on the Node.
2. Right-click the Container from where the drive is to be unmounted, and choose **Tasks > Manage Mount Points**.

   Alternatively, you can open the Container Manager window for the given Container, and click on the **Manage Mount Points** link in the **Actions** section of the Management Console view pane.
3. In the **Mount Points Manager** window, you can see all the drives currently available inside the Container.

   ![Mount Points Manager](image)

   Select the drive you want to unmount from the Container, and click the **Unmount** button.

4. In the opened window, click **OK** to confirm your decision.

You can also mount and unmount Hardware Nodes drives using these tools:

- **Parallels Virtual Automation.** For more information on this web-based tool, see the *Parallels Virtual Automation Administrator's Guide* at http://sp.parallels.com/products/pva46/resources.
- **vzctl mountext and vzctl umountext.** Detailed information on these command-line tools is provided in the *Parallels Virtuozzo Containers 4.6 Reference Guide.*
Managing Image Files

Another possibility to use Hardware Node files from inside a Container is to mount an image file located on the Node to a drive letter inside the Container. Image files can be located anywhere on the Hardware Node (on any of its hard disk drives, CD-ROM or floppy disks, etc.) and must have the .efd extension.

To mount a Hardware Node image file to a drive letter inside a Container, do the following:

1. In Parallels Management Console, click the Parallels Virtuozzo Containers item under the corresponding Hardware Node name to display the list of all Containers on the Node.

2. Right-click the Container where you want to mount an image file from the Hardware Node, and choose Tasks > Manage Mount Points.

   Alternatively, you can open the Container Manager window for the Container, and click on the Manage Mount Points link in the Actions section of the Management Console view pane.

3. In the opened window, click the Add button to display the Mount Point window.

   ![Mount Point Window](image)

   In this window, do the following:

   - In the Mount point list, click the drop-down arrow, and select a letter under which the mounted image file will be accessible inside the Container.
Check the **Mount existing image file** radio button, and type the full path to the image file on the Node by hand. You can also use the ... button to browse to the image file.

**Note:** The permissions of the image file mounted to a Container correspond to those of this image file on the Hardware Node, i.e. you are able to perform the same operations on the file inside the Container as you are allowed on the Node.

At any time, you can unmount the mounted image from your Container. To do this:

1. In Parallels Management Console, click the **Parallels Virtuozzo Containers** item under the corresponding Hardware Node name to display the list of all Containers on the Node.
2. Right-click the Container from where you want to unmount the image, and choose **Tasks > Manage Mount Points**.

   Alternatively, you can open the Container Manager window for the Container, and click on the **Manage Mount Points** link in the **Actions** section of the Management Console view pane.
3. In the **Mount Points Manager** window, select the image, and click the **Unmount** button.
4. In the displayed window, click **OK** to confirm your decision.

### Managing Types of Container Virtual Hard Disks

In Parallels Virtuozzo Containers, virtual disk drives provide storage space for Containers. In a Container, its virtual disk drive is represented as a physical disk and is used by the Container as if it were a standard physical disk. Technically speaking, any Container virtual hard disk is a file having the .efd extension and located in the \X:vz\private\CT_ID folder on the Hardware Node hard disk (e.g., C:vz\private\101 for storing virtual disk drives of Container 101). The root.efd file in this folder represents the main hard drive inside the Container (the system disk). You can also add new virtual disk drives to Containers and assign arbitrary names to .efd files representing these disks. For example, you can create a new disk drive with the name of F: and have it displayed as the MyDisk.efd file inside the \X:vz\private\CT_ID folder. Detailed information on how you can add new virtual disk drives to Containers is provided in **Adding New Disk Drive to Container** (p. 212).

Container virtual disk drives can be of one of the following types:

- **Compact** (default). When creating a compact virtual disk, you set only its maximum size. The hard disk grows in size each time new data is written to it and can increase up to the size specified during the disk creation. The initial size of an .efd file created in this case on the Hardware Node is much less than the disk maximum size. For example, if you create a compact hard disk and set its maximum size to 1 GB, the initial size of the .efd file does not usually exceed 100 MB. As the Container uses the hard disk, the size of the .efd file grows until it reaches the 1 GB barrier.

**Important!** When creating compact virtual hard disks inside Containers, make sure that the maximum size of all created compact disks does not exceed the size of disk space you are going to allocate to Containers. If you see that the disk space on the Hardware Node is nearing its limit, you are highly
recommended to stop all Containers with compact disk drives, free some disk space on the Hardware Node, and start these Containers anew.

- Plain. When creating a plain virtual disk, you allocate all disk space at once. The disk size does not change when data is added to the hard disk or deleted from it. For example, if you create Container 101 and set the size of its virtual hard disk to 1 GB, the root.efd file occupying 1 GB of disk space will be created in the X:\vz\private\101 folder on the Hardware Node.

The main advantage of a compact disk is its smaller file size. Smaller files require less storage space and can be easier moved while cloning or migrating Containers. However, it takes longer to write data to a compact disk than to a plain hard disk.

By default, any Container is created with a system disk drive of the compact type. However, you can use the --disktype option of the vzctl create command to create Containers with plain hard disks. For example, you can issue the following command to create Container 101 with a plain system disk drive:

```
C:\Users\Administrator>vzctl create 101 --pkgset w2k3 --ipadd 10.0.101.101 --disktype plain
```

You can also modify the type of existing virtual hard disks inside a Container using the --disktype option of the vzctl set command. Keep in mind that the changes will be applied to all virtual disk drives inside the Container. For example, the following command will set all virtual disk drives inside Container 101 to the compact type:

```
C:\Users\Administrator>vzctl set 101 --disktype compact
```

After having changed the type of the virtual disk drives inside Container 101, you need to restart the Container for the changes to take effect. It may take up to several minutes to convert all Container disk drives, depending on their size.

**Shrinking Container Virtual Disks**

Parallels Virtuozzo Containers allows you to shrink virtual disk drives of the compact type. Shrinking a virtual disk means removing unused (empty) disk space from a Container, thus reducing the amount of space the virtual disk occupies on the Hardware Node.

Let us assume that you have created the F: virtual disk drive of the compact type inside Container 101, performed a number of disk-related operations (added new files and folders to the disk, deleted existing files and folders from it, and so on), and now want to shrink the F: drive to optimize the disk space occupied by this drive on the Node. To do this, execute the following command on the Hardware Node:

```
C:\Users\Administrator>vzctl shrink 101 --drive F:\
```

Keep in mind the following:

- You can shrink virtual disks inside both running and stopped Containers.
- Shrinking a Container virtual disk does not reduce the maximum capacity of the virtual disk itself, i.e. the disk can always increase up to the size specified during its creation.
- You cannot shrink Container virtual disks of the plain type.
Customizing Container Desktop

By default, each Container on the Node has a string displayed in the top right corner of the desktop and identifying the ID of the Container you are currently logged in to (e.g., Container 133). You can prevent the Container ID string from being displayed on the Container desktop:

- By using Parallels Management Console.
  1. Right-click the corresponding Container, and choose Properties.
  2. Click the Options tab, and clear the Display Container ID on desktop check box.
  3. Click OK.

Next time you log in to the Container via RDP, the Container ID string will be absent from your desktop.

- By executing the `vzctl set` command and passing the `--showctid no` option to it. Next time you log in to the Container via RDP, the Container ID string will be absent from your desktop. For more information on this command, consult the Parallels Virtuozzo Containers 4.6 Reference Guide.

You can also disable the appearance of the Container ID string for all Containers that you will create on the Hardware Node in future:

```
C:\...\Administrator>vzctl set 0 --showctid no
Command 'set' is successfully finished
```

Along with displaying the Container ID string, you can make the Container desktop show the hostname of the Container you are currently logged in to. To do this, you can use the `vzctl set` command and pass the `--showhostname yes` option to it. Let us assume that Container 101 has the hostname of My_Computer and that you wish this hostname to be displayed on the Container desktop each time you are logged in to Container 101. To display the My_Computer legend on the Container desktop, execute the following command:

```
C:\...\Administrator>vzctl set 101 --showhostname yes
Command 'set' is successfully finished
```

You can also configure the hostname string to be displayed for all Containers that you will create on the Hardware Node in future:

```
C:\...\Administrator>vzctl set 0 --showhostname yes
Command 'set' is successfully finished
```

Notes:

1. You need to log off from the Container and log in to it anew every time you customize your Container desktop by using the `vzctl set` command or by means of Parallels Management Console.

2. For more information on the `--showctid` and `--showhostname` options, see the Parallels Virtuozzo Containers 4.6 Reference Guide.
Configuring Container Offline Management

The offline management functionality allows you to manage a particular Container with the help of Parallels Power Panel. When offline management is enabled for a Container, this Container is said to be subscribed to one or more offline services, which means that one or more ports of its IP address are permanently active whatever the Container state. This is needed to ensure the Container manageability in its down state.

The currently supported services are `vzpp` (for managing Containers by means of Parallels Power Panel) and `plesk` (for managing Containers by means of the Plesk control panel integrated with Parallels Power Panel).

By default, offline management is enabled for all Containers residing on the Node. To start using the offline management feature, enter the Container IP address in the address line of an Internet browser when managing a Container by means of Parallels Power Panels or the Plesk control panel. So, it will be enough to enter

```
https://<CT_IP_address_or_hostname>
```

in the address line of any browser and to log in as Administrator with the appropriate password (set during the Container creation) to start to remotely manage the corresponding Container. This way of logging in to a Container is very handy for Container administrators because they need to know only the IP address/hostname of their Container and its Administrator credentials to be able to manage the Container. No additional information (e.g., the Hardware Node IP address) is required.

In case the Plesk control panel application is installed in a Container and this Container is subscribed to the `plesk` service, the Plesk `admin` account can also be used by the Container administrator for logging in to Parallels Power Panel.

At any time, you can disable the offline management for a Container, by setting the `--offline_management` option of the `vzctl set` command to no. For instance:

```
C:\Users\Administrator>vzctl set 101 --offline_management no --save
```

After the command is executed, you can not remotely manage the corresponding Container. Instead, you will see the following message: "Offline management is disabled for Virtual Environment".

Reinstalling Containers

Reinstalling a Container is used if a Container administrator has inadvertently modified, replaced, or deleted any file that is part of an application or OS template, which has brought about the Container malfunction. Parallels Virtuozzo Containers provides you with the `vzctl reinstall` command
allowing you to reinstall a problem Container. For example, to reinstall Container 101, you can issue the following command on the Hardware Node:

```
# vzctl reinstall 101
Reinstalling Container...
The command completed successfully
```

**Note:** The `vzctl reinstall` command can be performed on stopped Containers only.

When executed, the `vzctl reinstall` command performs the following operations:

- Creates a new private area for the problem Container from scratch using its configuration file and its OS and application templates. Thanks to this fact, the newly created Container retains the IP address, hostname, resource control parameters, and all the other settings of the problem Container, i.e. a clean working copy of the problem Container is made.
- In order to retain the personal data inside the old Container, the utility also copies the contents of the old private area to the `C:\reinstall` folder on the Hardware Node (unless the `--skipbackup` option is given). The personal data can then be copied to the corresponding folders of the new private area and the `reinstall` folder eventually deleted.
- Retains the Administrator credentials in the users' database (unless the `--resetpwdb` option is specified).

---

## Managing Parallels Virtuozzo Containers

### Global Parameters

On a Windows Node, you can view the following configuration parameters:

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>actionlogdir</td>
<td>The folder where Parallels Virtuozzo Containers keeps a log of its actions.</td>
</tr>
<tr>
<td>controlpanel_port</td>
<td>This port must be entered in the address line of an Internet browser after the Container IP address when managing the Container by means of Parallels Power Panel.</td>
</tr>
<tr>
<td>in_cluster</td>
<td>Indicates whether the Hardware Node is included in a cluster.</td>
</tr>
<tr>
<td>install and install32</td>
<td>The folder where Parallels Virtuozzo Containers files are installed.</td>
</tr>
<tr>
<td>offline_management</td>
<td>Enables (the value is set to <code>yes</code>) or disables (the value is set to <code>no</code>) the offline managements for all Containers on the Hardware Node.</td>
</tr>
<tr>
<td>template</td>
<td>The folder where to find the templates installed on the Hardware Node. It is not recommended to redefine this option since all the templates built by Parallels use the default folder.</td>
</tr>
<tr>
<td>ve_private</td>
<td>The path to the Container private area where Parallels Virtuozzo Containers keeps its private data.</td>
</tr>
<tr>
<td>ve_root</td>
<td>The path to the Container root folder where the Container private area is mounted.</td>
</tr>
</tbody>
</table>
Advanced Tasks

vz_root | The path to the folder where Parallels Virtuozzo Containers program files are located.
vzprivrange | The Container ID range reserved for Parallels Virtuozzo Containers internal needs. The default range is from 1 to 100; so, when making new Containers, you should not choose IDs below 101.

To manage any of the aforementioned parameters in Parallels Management Console:

1. Right-click the needed Hardware Node, and choose Tasks > Manage Parallels Virtuozzo Containers Configuration:

2. In the displayed window, you can do the following:
   - View the list of available Parallels Virtuozzo Containers parameters.
   - Change the current value of a parameter. To do this, select the respective parameter, click the ... button, enter a new value in the displayed window, click OK, and then click the Apply button.

If you have made some changes to a parameter and want return to the old value, click the icon next to the parameter.
Forwarding Hardware Devices to Containers

In Parallels Virtuozzo Containers, you can use the `vzdevctl` utility to forward hardware devices (SCSI, USB drives, and so on) from the Hardware Node to Containers. The following example demonstrates how to forward a USB flash drive to a Container. For the sake of simplicity, let us consider a Hardware Node hosting only one Container with ID 101. To connect a USB flash drive to this Container, do the following:

1. Insert the flash drive into the USB port of the Hardware Node.

2. Find out the device instance ID of the flash drive, a device identification string uniquely identifying the device in the system:
   a. Log in to the Hardware Node.
   b. Click **Start > Programs > Administrative Tools > Computer Management**.
   c. In the left pane of the **Computer Management** window, expand the **System Tools** item, and select **Device Manager**.
   d. In the right pane, expand **Disk drives**, and double-click the **Flash Disk USB Device** item.
   e. Go to the **Details** tab of the **Flash Disk USB Device Properties** window, and select the **Device Instance Id** item from the **Property** drop-down menu.
   f. Remember or write down the ID displayed on the **Value** tab, as you will need it in the following step. In our example, the device instance ID of the USB flash drive is `USBSTOR\DISK&VEN_USB_2.0&PROD_FLASH_DISK&REV_4.00\12559039359A&0`. 
3 Open any Windows command-line interpreter, like `cmd.exe`, and enter the following command:

```
C:\Users\Administrator>vzdevctl add 101 --deviceid "USBSTOR\DISK&VEN_USB_2.0&P0D_FLASH_DISK&REV_4.00\12559039359A&0" --alias flashdev --exclusive --connect --onboot
```

where

- `add 101` indicates that the USB flash drive will be forwarded to Container 101.
- `--deviceid` specifies the ID to be assigned to the USB flash drive. It is the device instance ID that you found out in **Step 2**. In our example, it is `USBSTOR\DISK&VEN_USB_2.0&P0D_FLASH_DISK&REV_4.00\12559039359A&0`.
- `--alias` assigns a name to the USB flash drive. This name can then be used in commands to indicate the USB flash drive instead of the device instance ID. We recommend that you choose a short name that is easy to remember. In our example, we use `flashdev`.
- `--exclusive` sets the USB flash drive forwarding mode to 'exclusive' instead of 'shared' which is set by default. In this case, the flash drive cannot be forwarded to any other Container on the Hardware Node. This command must be used for any SCSI or USB-flash device that you are going to forward to a Container.
- `--connect` connects the USB flash drive to the Container.
- `--onboot` automatically connects the USB flash drive to the Container on its startup.
To learn more about the vzdevctl utility and its options, refer to the *Parallels Virtuozzo Containers 4.6 Reference Guide*.

4 Enable the loading of SCSI-aware drivers inside the Container. To do this, run the following command:

```
C:\Users\Administrator>vzctl set 101 --scsi yes
```

5 Restart the Container to apply the changes:

```
C:\Users\Administrator>vzctl restart 101
```

6 Mount the USB flash drive on the Container:

   a Log in to the Container via Remote Desktop Protocol.
   b Click **Start > Programs > Administrative Tools > Computer Management**.
   c In the left pane of the **Computer Management** window, expand the **System Tools** item, and select **Device Manager**.
   d In the right pane of the **Computer Management** window, expand the **Disk drives** item, right-click the **Flash Disk USB Device**, and choose **Enable**.
   e Click **Disk Management** in the left pane. You will see the USB Flash Drive displayed on the right. Right-click the flash drive, and choose the **Change Drive Letter and Paths** option.

   f In the **Change Drive Letter and Paths** window, click the **Add** button to open the **Add Drive Letter or Path** window.
Select the **Assign the following drive letter** radio button, and choose the letter from the drop-down list to the right. Click **OK**.

The USB flash drive should now be mounted and ready to use.

---

**Enabling iSCSI Support in Containers**

In Parallels Virtuozzo Containers, you can enable the Internet Small Computer System Interface (iSCSI) support inside a Container and make it act as an iSCSI initiator, sending SCSI commands to SCSI storage devices (known as targets) over the TCP/IP network. For example, this may be necessary if you want the Container to be a member of a failover cluster that uses an iSCSI disk as its shared storage device. To create such a cluster configuration, you must be able to forward the shared iSCSI disk to the Container, which is only possible if you enable the iSCSI support in the Container.

The procedure of enabling the iSCSI support differs depending on the operation system installed in a Container and includes the following steps:

1. **Installing the Microsoft iSCSI software initiator in the Container.** This step is required only if the Container is running Windows Server 2003; in Containers running Windows Server 2008 or Windows Server 2008 R2, the iSCSI initiator is installed by default.

2. **Enabling the iSCSI support in the Container.**

Let us assume that Container 101 is running Windows Server 2003 and you want to provide the possibility to forward external iSCSI storage devices to this Container. To do this, perform the following operations:

**Install the iSCSI Software Initiator in Container 101**

By default, the iSCSI initiator is not installed in Containers running Windows Server 2003. So you first need to do the following:

1. Get the latest version of the Microsoft iSCSI Software Initiator package. For example, you can obtain it from www.microsoft.com/downloads.

2. Log in to Container 101, and install the obtained package there.
Enable iSCSI Support in Container 101

Now you can enable the iSCSI support inside Container 101. You can do this by running the following commands on the Hardware Node:

1. Enable the ISCSI support:
   ```
   C:\Users\Administrator>vzctl set 101 --scsi yes
   ```

2. Apply the changes to the Container:
   ```
   C:\Users\Administrator>vzctl restart 101
   ```

Configure the iSCSI Software Initiator to connect to an iSCSI storage device

Finally, you need to configure the iSCSI initiator to allow connections to iSCSI storage devices:

1. Inside Container 101, launch the iSCSI initiator by clicking **Start > Programs > Microsoft iSCSI Initiator**.

2. Click the **Discovery** tab, and specify the target portal to be used to connect to the iSCSI device. (The target portal must already exist in your network.) For this purpose, click the **Add Portal** button, and in the displayed window, provide the following information:
   
   a. In the **IP address or DNS name** field, specify the IP address of the target portal.

   b. In the **Port** field, set the port number to **3260**. If the target portal uses a port number different than the default, enter this port number.

   For example:

   ![Add Target Portal](image)

   c. If necessary, click the **Advanced** button, and configure the connection and Internet Protocol parameters to be used to connect to the target portal.

   d. Click **OK** to add the portal.
3 Click the **Targets** tab, select the necessary iSCSI storage device in the devices list, and click **Log on**.
When the value in the **Status** column next to the device name changes to **Connected**, the iSCSI device becomes accessible from inside Container 101.

---

**Configuring Services Startup in Containers**

As a rule, you decide on the set of Windows system services that are automatically launched inside your Containers on their startup during the Parallels Virtuozzo Containers installation. So, all newly created Containers are configured to have one of the following sets of Windows services running after their startup:

- The standard set of Windows services. This set includes the same services that would be launched inside any other standalone server after installing Windows Server 2003 or Windows Server 2008 or Windows Server 2008 R2 onto it.
- The minimal set of Windows services. This set differs from the standard one in the following:
The startup types of the Print Spooler, Remote Registry, and DNS Client services in the minimal set are configured as manual.

The standard startup type of the TCP/IP NetBIOS Helper, Computer Browser, Server services in the minimal set corresponds to that of the version of Windows Server installed inside a Container, while in the standard set these services are always set to the automatic startup type.

**Note:** The differences listed above are valid for Containers running Windows Server 2003. The differences between the two sets of services may slightly differ for Containers running Windows Server 2008 or Windows Server 2008 R2.

In Parallels Virtuozzo Containers, you can use the following ways of configuring the services startup type: (1) change the startup type of specific services inside an existing Container and (2) configure the default services set that will apply to all newly created Containers. Both ways are described in the following subsections in detail.

### Configuring Services Startup

Once a Container is created, you can use standard Windows tools to configure the current startup type of specific services. For example, you can do it using the Windows Services snap-in:

1. Click **Start > Programs > Administrative Tools > Services** to open the Services snap-in.
2. In the main pane, right-click the service whose startup type you want to change.
3. On the **General** tab, in the **Startup type** list box, choose **Automatic**, **Manual**, or **Disabled**.

4. Click **OK**.

### Changing Services to Start by Default

Parallels Virtuozzo Containers allows you to configure the default set of Windows services. The services from the configured set will then be automatically launched inside all newly created Containers during their startup. The process of configuring the default services set includes two steps:

1. Creating a script that will define the services to be launched on the Container start.
2. Editing the Hardware Node registry to tell Parallels Virtuozzo Containers to use the new script.

### Creating a Script

The set of services loaded inside all newly created Containers on their start are defined by the two scripts located in the `X:\Program Files\Parallels\Containers\Scripts` folder on the Hardware Node:

- **regadd.min**. This script defines the minimal set of Windows services and is applied to new Containers if you select the **Minimal Set** option during the Parallels Virtuozzo Containers installation.
Advanced Tasks

- regadd.ent. This script defines the standard set of Windows services and is applied to new Containers if you select the **Standard Set** option during the Parallels Virtuozzo Containers installation.

**Note:** For more information on the minimal and standard sets of Windows services, see *Configuring Services Startup Type Inside Containers* (p. 231).

Each script contains the list of registry keys that are added to Containers during their creation and control the load of services on the Container start. The services startup type in the scripts is defined by the "Start"=dword:0000000X string where X can take the following values:

- 2 - configures the service as automatic.
- 3 - configures the service as manual.
- 4 - configures the service as disabled.

To create your own script that will contain a customized set of Windows services or have a different startup type for specific services, do the following:

1. Choose an existing script (regadd.min or regadd.ent) to be used as the basis for your new script and make a copy of it. The script name must be specified in the regadd.name format where name can be any name of your choice (e.g., regadd.myfile).
2. Copy the created script to the X:\Program Files\Parallels\Containers\Scripts folder.
3. Open the script in a text editor (e.g., in Notepad).
4. Modify the script to meet your needs. In general, you can edit it as follows:
   - Change the startup type of a service already specified in the script. For example, you can set the startup type of the Server service (manual by default) to automatic by editing the "Start"=dword:0000000X string for this service as follows:
     ```plaintext
     [HKEY_LOCAL_MACHINE\%VZVPSID%\MACHINE\SYSTEM\CurrentControlSet\Services\lanmanserver]
     "Start"=dword:00000002
     ```
   - Add a new service to the script and set its startup type. For example, you can have the Windows Firewall/Internet Connection Sharing service run on the Container startup by adding the following strings to your script:
     ```plaintext
     [HKEY_LOCAL_MACHINE\%VZVPSID%\MACHINE\SYSTEM\CurrentControlSet\Services\SharedAccess]
     "Start"=dword:00000002
     ```
   - Remove the information on a specific service from the script. In this case the service startup type will be defined by the settings in the Container registry.

**Note:** The examples above show how to configure the services sets inside Containers running Windows Server 2003. Keys for Containers running Windows Server 2008 or Windows Server 2008 R2 may be slightly different.

5. Save the script.

**Editing the Registry**

Now that you have created the script, you need to tell Parallels Virtuozzo Containers to obtain the services set and their startup type from this file. To do this:
Note: The procedure below involves editing the Hardware Node registry. You are highly recommended to back up the registry before starting this procedure. This will allow you to restore the necessary registry settings if something goes wrong during the procedure.

1. Click **Start > Run**, type `regedit`, and press Enter to open Windows Registry Editor.

2. Locate the `HKEY_LOCAL_MACHINE\SOFTWARE\SWsoft\Virtuozzo` entry.

3. In the right pane, double-click the `VzRegAdd` key.

4. Remove the current value from the **Value data** field, and type the name of your script (e.g., `regadd myfile`).

5. Click **OK**.
Participation in the Customer Experience Program

The Customer Experience Program (CEP) is designed to provide Parallels with the information about your physical server and Containers configuration. This information helps Parallels to make the Parallels Virtuozzo Containers software more efficient and easy to use.

**Note:** Parallels does not collect any private information like your name, email address, phone number, and keyboard input. To learn more on how Parallels protects your privacy, follow this link: http://sp.parallels.com/support/pcep-en_US/privacy.

As a rule, you make a decision on participating in the Customer Experience Program when installing the Parallels Virtuozzo Containers software. However, at any time you can configure your participation in the program by doing the following:

1. Click **Start > Programs > Parallels > Parallels Virtuozzo Containers > Parallels Virtuozzo Containers Configuration Wizard** to launch the **Parallels Virtuozzo Containers for Windows Configuration** wizard.

2. In this wizard, click **Next** several times until the **Parallels Virtuozzo Containers Customer Experience Program** window appears.
3  Do one of the following:
   - Select the Participate in the Customer Experience Program radio button to join the program.
   - Select the No, thanks radio button to cancel your participation in the program.
   - Click the http://sp.parallels.com/support/pcep link to learn more about the program.

4  Click Next, and then click Finish.

Using Custom Action Scripts

In Parallels Virtuozzo Containers, you can create custom scripts and configure them to be executed when certain Container-related actions are performed. There are two kinds of scripts you can specify for execution on the Node or in the Container context:

- **Pre-action scripts.** These scripts are executed before a Container-related action is performed. Pre-action scripts are named as `vz-pre<action_name>.<ext>` where `<action_name>` denotes the name of the action to be performed (e.g., `start`), and `<ext>` is the extension of the script file. Currently, the files with the `.exe`, `.cmd`, `.bat`, `.vbs` extensions are supported.

- **Post-action scripts.** These scripts are executed after a Container-related action has been successfully completed. Post-action scripts are named as `vz-post<action_name>.<ext>` where `<action_name>` is the name of the action to be performed (e.g., `stop`), and `<ext>` is the extension of the script file. Currently, the files with the `.exe`, `.cmd`, `.bat`, `.vbs` extensions are supported.

Notes:

1. For the list and descriptions of custom action scripts supported by Parallels Virtuozzo Containers, see *Parallels Virtuozzo Containers 4.6 Reference Guide*.

2. All custom action scripts are executed in the Host OS context.

You can make a script to have effect on all Containers on the Node. To do this, copy the script to the `C:\vz\Scripts\`. In turn, placing a script to the `C:\vz\private\CT_ID\scripts` folder allows you to set the script for executing in the given Container only (per-Container script). In the latter case, you may first need to create the `C:\vz\private\CT_ID\scripts` folder manually. When executed, any script takes only one parameter--the ID of the corresponding Container.

**Note:** During Parallels Virtuozzo Containers installation, the `Scripts` subfolder is automatically created in the folder you specified for storing all Container configuration files. By default, the `C:\vz` folder is used, but you can set a custom folder as well.

Let us assume you have created Container 101 with the private area located in the `C:\vz\Private\101` folder. Now you want to write a script that will be executed each time after the Container start and display the number of events currently recorded in the Container System event log. To do this, open Notepad or another text editor and write the following script code:

```plaintext
strComputer = "." ""
Set objWMIService = GetObject("winmgmts:\" _
   & "{impersonationLevel=impersonate)!" & strComputer & "\root\cimv2")
Set colLogFiles = objWMIService.ExecQuery _
   ("Select * from Win32_NTEventLogFile where LogFileName='System'")
For Each objLogFile in colLogFiles
   Wscript.Echo objLogFile.NumberOfRecords
Next

After that, save the file with the vz-poststart.vbs name, create the scripts subfolder in the C:\vz\Private\101 folder, and place the script to this subfolder. Make sure that the full path of the script is C:\vz\Private\101\scripts\vz-poststart.vbs. From this point on, the vz-poststart.vbs script will be executed every time Container 101 has been successfully started.

Note: By default, Parallels Virtuozzo Containers is shipped with the vz-poststart.cmd script located in the X:\vz\Scripts folder. This script is needed for Container error-free functioning. However, specifying your own per-Container scripts (i.e. scripts in the C:\vz\private\CT_ID\scripts folder) prevents the vz-poststart.cmd script from being executed. Therefore, make sure that each of your per-Container scripts calls the X:\vz\Scripts\vz-poststart.cmd script.
This chapter describes problems which may occur during your work with Parallels Virtuozzo Containers and suggests the ways to solve them.

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General Considerations

The general issues to take into consideration when troubleshooting your Parallels Virtuozzo Containers system are listed below. Please read them carefully before trying to solve more specific problems.

- Make sure a valid license is always installed on the Hardware Node. If your license has expired and the grace period is over, all Containers on the Node will be stopped!
- If a Hardware Node is experiencing slow performance, you can launch Parallels Management Console, and select the Services and Monitor > Processes items in the Management Console main window to find out which process or service affects your system performance. In case of discovering any, you can terminate the problem process/service. Anyway, try to investigate what reason may have brought about the problem before resorting to the last means--rebooting the Node.
- Run the Parallels Virtuozzo Containers Update wizard at regular intervals (at least once a week). Along with the Parallels Virtuozzo Containers updates, this will allow you to automatically download and install the latest Windows Server updates on the Hardware Node. Do not try to update the Windows Server operating system manually. It may cause Parallels Virtuozzo Containers to malfunction.

Preparing Memory Dumps

If a Node running Parallels Virtuozzo Containers crashes or freezes, you should obtain a complete or kernel memory dump file to help the Parallels support team find what caused the problem. Requirements a Node must meet for the resulting dump file to retain integrity and validity are described in the Parallels Virtuozzo Containers Installation Guide.
When a Node crashes, it usually shows the so-called Blue Screen of Death (BSOD). In this case a memory dump is created automatically and the Node restarts. After that you need to store the memory dump file in a safe place to avoid its being overwritten by newer dump files.

When a Node freezes, it stops responding to both network events (e.g. ping) and console events (keyboard and/or mouse input). In this case you have to generate a memory dump manually. To do that, you can use a Non-Maskable Interrupt (NMI) switch of a remote access controller, such as Dell DRAC or HP iLO, to generate an NMI (see http://support.microsoft.com/kb/927069). If an NMI is not available, you can generate a memory dump using a keyboard attached to the Node either directly or through a physical or virtual KVM switch (see http://support.microsoft.com/kb/244139). After that you need to store the memory dump file in a safe place to avoid its being overwritten by newer dump files.

Whichever the case may be, the entire process of creating and storing memory dumps is thoroughly described at the Microsoft Support website (see http://support.microsoft.com/kb/972110).

The Parallels support team may need the following information supplied with each dump file:

- Whether the issue was a crash or a freeze.
- If it was a freeze, what the symptoms were: whether the Node responded to ping, mouse or keyboard input and such.
- A problem report created by means of the vzreport command (for syntax see Parallels Virtuozzo Containers Reference Guide).

You should also verify the integrity of all necessary memory dumps with the help of Microsoft's Debugging Tools for Windows (http://www.microsoft.com/whdc/devtools/debugging/default.mspx).

When dump files are ready, the Parallels support team may ask you to provide access to one of the Nodes (e.g., over RDP) or any Windows-based computer on the network with a fast local access to all memory dumps obtained from all Nodes. The reason is that a memory dump file may be as big as the amount of RAM installed on a Node. Downloading it may take a very long time, especially on slow connections.

## Container Management Issues

This section includes recommendations on how to solve Container-related issues.

### Container Inaccessible from Network

**Solution 1**

The IP address assigned to this Container might be already in use in your network. Make sure it is not. Otherwise, replace the existing IP address with another one.

To assign an IP address in Parallels Management Console, select the Parallels Virtuozzo Containers item in the Management Console left pane, right-click the problem Container in the right pane, and choose Properties. On the Network tab of the displayed window, click the Add IP Address button, and specify a
valid IP address. You can also use the `vzctl set --ipadd` command to add a new IP address to the Container.

**Solution 2**

Make sure the routing to the Container is properly configured. Containers can use the default router for your network, or you may configure the Hardware Node as rooter for its Containers.

### Cannot Log In to Container

The Container starts successfully but you cannot log in to it.

**Solution 1**

You are trying to connect to the Container via RDP or MS TSC, but access is denied. Probably you have not set the password of the **Administrator** user yet. Detailed information on how you can do it is given in *Setting Administrator Password* (p. 83).

**Solution 2**

While connecting to the Container via RDP or MS TSC, you get the following message: *The terminal server has exceeded the maximum amount of allowed connections. Make sure you have no more than 2 (two) RDP/MS TSC sessions opened to the Container at the same time. If it is the case, close one of your opened sessions or install additional TSAL (Terminal Service Access License) licenses inside the Container.*

**Solution 3**

You are trying to connect to the Container by means of Parallels Virtual Automation or Parallels Power Panel, but the corresponding page cannot be displayed by your browser. Make sure the offline management is enabled for the given Container. To do this:

1. Select the **Parallels Virtuozzo Containers** item in the Management Console left pane.
2. Right-click the problem Container in the right pane, and choose **Properties**.
3. On the Network tab of the displayed window, select the **Offline Management** item, and ascertain that the **Enable offline management** check box is selected. If it is not, select it, and click **OK**.

### Cannot Play Audio Files in Container

You have successfully connected to a Container via RDP. However, you cannot play audio files inside this Container.

**Solution**

Do the following:

---

**Note:** If you have open RDP sessions, please close them before completing the steps below.
1. Log in to the problem Container, and select Programs > Administrative Tools > Terminal Services Configuration on the Windows Start menu.

2. In the Terminal Services Configuration window, double-click the RDP-Tcp connection in the right part of the screen.

3. On the Client Settings tab of the RDP-Tcp Properties window, clear the Audio mapping check box.

4. Click the Apply button.

5. On the Hardware Node, start the Remote Desktop Connection client by choosing Programs > Accessories > Communications > Remote Desktop Connection on the Windows Start menu or by selecting Start > Run and executing the mstsc command.

6. Click on the Options button to expand the Remote Desktop Connection window.

7. On the Local Resources tab under the Remote computer sound group, select the Bring to this computer option on the drop-down menu.

8. On the General tab of the Remote Desktop Connection window, specify the IP address of the Container you want to connect to, and click Connect.

Mounted Drives Not Displaying in Container

You have mounted a drive from the Hardware Node to a folder inside a Container. However, the mounted drive is not displayed among other drives in My Computer.

Solution 1

Inside the Container, open My Computer by double-clicking the My Computer icon on the desktop, and type the path to the mounted drive in the address line of Windows Explorer. For example, if you mounted the CD-ROM from the Hardware Node, specify C:\CDROM in the address line, and press Enter to display the CD-ROM content.

Solution 2

Close your current terminal session, and then log in to the Container anew. Open My Computer by double-clicking the My Computer icon on the desktop. Now your mounted drive will be shown in the My Computer folder and can be accessed by double-clicking on its name.

Submitting Problem Reports to Technical Support

In most cases, the Parallels support team must rely on the customer's observations and communications with the customer in order to diagnose and solve the problem. Therefore, a detailed problem report is extremely important. The Submit Support Issue wizard helps you draw up such a report and automatically send it to the Parallels support team. To invoke the wizard, select Programs > Parallels > Parallels
**Troubleshooting**

**Virtuozzo Containers > Submit Support Issue** on the Windows **Start** menu. The **Welcome** window appears where you can click **Next** to proceed with the wizard.

On the next screen, you are asked to provide your contact information and detailed problem description.

![Submit Support Issue Wizard](image)

In this window, do the following:

- Enter your first and last names, email address, and the name of your company into the corresponding fields. Make sure that you type a valid email address; otherwise, the Parallels support team will not be able to contact you.
- In the **Severity** field, set the severity level for your problem report. The available levels and their descriptions are provided in the table below:

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Severity One (Urgent)</td>
<td>Set this level if you are experiencing a critical problem: for example, your system is not functioning, or you are at risk of losing critical data.</td>
</tr>
<tr>
<td>Severity Two (High)</td>
<td>Set this level if the problem seriously affects some parts of your system, but the system in whole is operational: for example, some product features or options cannot be used or do not work as expected.</td>
</tr>
<tr>
<td>Severity Three (Normal)</td>
<td>Set this level if the problem does not seriously affect your system performance and functionality: for example, there are some mistakes or typos in the product interface, or you have some usability problems with the product.</td>
</tr>
</tbody>
</table>
In the **Subject** field, describe the problem you encountered when working with Parallels Virtuozzo Containers.

In the **Issue** field, provide additional information which, in your opinion, can help solve the problem.

If your new issue is related to some problem you have already informed the support team of and you know the ticket ID assigned to this problem, also select the **This ticket is based on the old one** check box, and specify the ID in the field provided.

Next, you are prompted to specify the time period for which the Parallels Virtuozzo Containers logs and the information on your system and network settings are to be collected.

This window allows you to choose between the two options:

- Select the **Collect logs and minidumps** radio button and specify the time period, in days, for which the data is to be gathered.
- Select the **Collect all logs and minidumps** radio button to collect the information contained in all Parallels Virtuozzo Containers and system logs on the Node.

Clicking **Next** in the **Information About Parallels Virtuozzo Containers Installation** starts gathering the Parallels Virtuozzo Containers logs and the information on your system and network settings for the
specified period into a special file. This file will be sent to the Parallels support team upon the completion of the wizard. The file does not contain any private information!

After the necessary information is collected, the **Connection to Parallels Technical Support** window is displayed.

In this window, do the following:

- If your Hardware Node does not use a proxy server, i.e. it is directly connected to the Internet, just click **Next** on to send your problem report to the Parallels technical support team.
- Otherwise, click the **Proxy Settings** button to display the **Enter Proxy Settings** window.
In this window, do one of the following:

- Select the **Do not use proxy server** radio button if your Hardware Node does not use a proxy server, i.e. it is directly connected to the Internet. This option is selected by default.

- Select the **Use Internet Explorer proxy settings** radio button to use your Internet Explorer proxy settings to connect to the Parallels Virtuozzo Containers update center.

- Select the **Specify a proxy server** radio button to use a proxy server differing from the one specified in your Internet Explorer proxy settings. In this case, you need to specify the IP address and the port of the proxy server you are going to use to connect to the Internet in the **Address** and **Port** fields, respectively.

  If your proxy server is password-protected (i.e. you use a special user name and password to log in to the proxy server), also select the **Proxy server requires authentication** check box, and specify the corresponding credentials in the **Proxy user name** and **Proxy password** fields.

Click the **Next** button in the **Connection to Technical Support** window to send the generated report to the Parallels support team. After a while, the **Congratulations!** screen will inform you that your report has been successfully delivered to the destination station. Click **Finish** to exit the wizard.

### Establishing a Secure Channel to Parallels Support

Parallels Virtuozzo Containers provides you with a special tool, Parallels Virtuozzo Containers Support Tunnel, which allows you to establish a private secure channel to the Parallels support team server. After establishing such a channel, the support team will be able to quickly and securely connect to your Node
and diagnose and solve your problem. The secure connection to your server is achieved through a Virtual Private Network (VPN) created between the Parallels support team server and your Hardware Node.

To start using the Parallels Virtuozzo Containers Support Tunnel tool, you need first to obtain a special certificate from Parallels which will uniquely identify you as a Parallels Virtuozzo Containers user. Certificates are issued by Parallels in the form of files and should be copied to the X:\Program Files\Parallels\Containers\Licenses folder on your Node. You can get a certificate in one of the following ways:

- Visit http://sp.parallels.com/support/virtuozzo/certificates, fill out the Request Parallels Virtuozzo Containers Support Certificate form, and click the Submit button. After a while, a certificate will be generated and sent to the email address you provided in the Request Parallels Virtuozzo Containers Support Certificate form.
- Contact the Parallels support team via email or by telephone and ask for a valid certificate.

After you have received a certificate and copied it to the right folder on the Node and in case you encountered a Parallels Virtuozzo Containers-related problem, you can do the following to get assistance from the Parallels support:

1. Make sure that your Hardware Node is connected to the Internet.

2. On the Node, select Programs > Parallels > Parallels Virtuozzo Containers > Parallels Virtuozzo Containers Support Tunnel on the Windows Start menu to launch the Parallels Virtuozzo Containers for Windows Support Tunnel wizard which will automatically perform all the necessary operations to establish the Support Tunnel session. All you have to do is to specify a password of your choice for a temporary account that will be created to access your Hardware Node from the outside during the Support Tunnel session.

   Note: On closing the Support Tunnel, the temporary account is permanently deleted from the Node.

   After entering the desired password in the fields provided, click OK to establish a VPN between your Node and the Parallels support server.

3. Contact the Parallels support team (by telephone or via email) and inform them of the problem you encountered. Also mention that you have launched the Parallels Virtuozzo Containers Support Tunnel tool and established a VPN to the Parallels support server and provide the password entered in Step 2.

4. After that, the Parallels support team will closely examine your problem, connect to your Node using the secure VPN established, if needed, and make its best to solve your problem as quickly as possible.
Chapter 12

Glossary

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

**Container** is a virtual private server, which is functionally identical to an isolated standalone server, with its own IP addresses, processes, files, user database, configuration files, applications, system libraries, and so on. While sharing the same Hardware Node and OS kernel, Containers are isolated from each other. A Container is a kind of ‘sandbox’ for processes and users.

**Hardware Node** (or Node) is the server where Parallels Virtuozzo Containers is installed.

**Host Operating System** (or Host OS) is an operating system installed on the Hardware Node.

**OS template** (or Operating System template) is used to create new Containers with a preinstalled operating system. See also Template.

**Parallels Virtuozzo Containers** is a complete server automation and virtualization solution that allows you to create multiple isolated Containers on a single physical server to share hardware, licenses, and management effort with maximum efficiency.

**Parallels Virtuozzo Containers license** is a special license which you must install on a Hardware Node to be able to use Parallels Virtuozzo Containers. Every Hardware Node must have a license installed.

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

**Parallels Power Panel** is a tools for managing personal Containers via a standard Web browser.

**Parallels Virtual Automation** is a tool for managing Hardware Nodes and Containers residing on them via a standard Web browser.

**Private area** is a location where Container files which are not shared with other Containers are stored.

**Template** is a set of original application files (packages) repackaged for using inside Containers. There are two types of templates: OS Templates are used to create new Containers with a preinstalled operating system, application templates are used to install applications or sets of applications in Containers.

**Parallels Agent** (or Parallels Agent Protocol) is an XML-based protocol used to monitor and manage Hardware Nodes. It is a backend for the Parallels Management Console.
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