



Parallels Virtuozzo Containers 4.7 for Linux

Templates Management Guide

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CHAPTER 1

Introduction

This chapter provides basic information about Parallels Virtuozzo Containers 4.7 and this guide.

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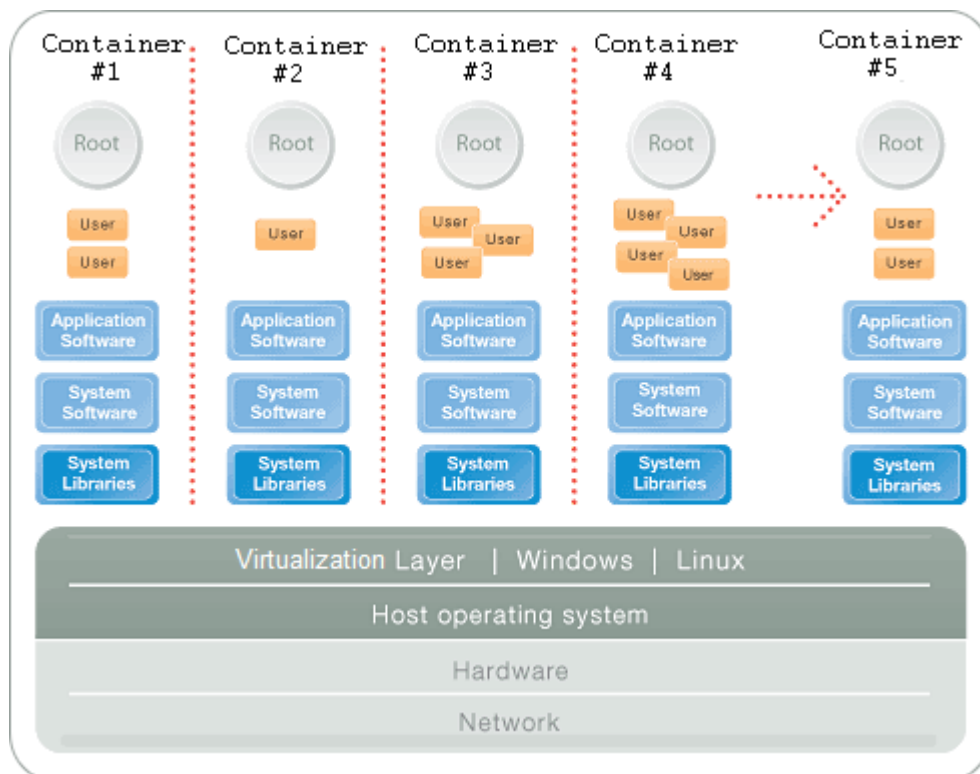
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About Parallels Virtuozzo Containers 4.7

Parallels Virtuozzo Containers 4.7 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 a server into as many as hundreds of Containers with full server functionality.
- **Complete Isolation**—Containers are secure and have full functional, fault and performance isolation.
- **Dynamic Resource Allocation**—CPU, memory, network, disk and I/O can be changed without rebooting.
- **Mass Management**—Suite of tools and templates for automated, multi-Container and multi-server administration.

The diagram below represents a typical model of the 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 Host operating system which can be either Windows or Linux. 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 application or 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 the resource utilization. The Parallels Virtuozzo Containers complete set of management tools and unique architecture makes it the perfect solution for easily maintaining, monitoring, and managing virtualized server resources for consolidation and business continuity configurations.

About This Guide

This guide provides information on Parallels templates, an exclusive technology that allows you to deploy Linux applications in Containers, greatly saving Hardware Node resources (physical memory, disk space, and so on).

The primary audience for this guide is anyone who is intended to deploy one or several applications in their Containers and looking for ways to do it with the maximal level of efficiency. To complete all the operations described in this guide, no more than basic Linux administration habits is required.

Organization of This Guide

Chapter 1, Introduction, provides general information on Parallels Virtuozzo Containers 4.7 and this guide.

Chapter 2, Templates Overview, outlines the basics of EZ templates.

Chapter 3, Managing EZ Templates, provides instructions on managing OS and application EZ templates. You will know how to create and install EZ templates on the Hardware Node, add them to and remove them from Containers, make OS template caches and update them, and so on.

Documentation Conventions

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

The table below presents the existing formatting conventions.

Formatting convention	Type of Information	Example
Special Bold	Items you must select, such as menu options, command buttons, or items in a list.	Go to the Resources tab.
	Titles of chapters, sections, and subsections.	Read the Basic Administration chapter.
<i>Italics</i>	Used to emphasize the importance of a point, to introduce a term or to designate a command-line placeholder, which is to be replaced with a real name or value.	These are the so-called <i>OS templates</i> . To remove a Container, type <code>vzctl delete <i>ctid</i></code> .
Monospace	The names of commands, files, and directories.	Use <code>vzctl start</code> to start a Container.
Preformatted	On-screen computer output in your command-line sessions; source code in XML, C++, or other programming languages.	<pre>Saved parameters for Container 101</pre>
Monospace Bold	What you type, as contrasted with on-screen computer output.	C:\vzlist -a
Key+Key	Key combinations for which the user must press and hold down one key and then press another.	Ctrl+P, Alt+F4

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

Getting Help

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

- *Parallels Virtuozzo Containers 4.7 Installation Guide*. This guide provides detailed information on installing Parallels Virtuozzo Containers on your server, including the pre-requisites and the stages you shall pass.
- *Getting Started With Parallels Virtuozzo Containers 4.7*. This guide provides basic information on how to install Parallels Virtuozzo Containers on your server, create new Containers and virtual machines, and perform main operations on them. Unlike the *Parallels Virtuozzo Containers 4.7 Installation Guide*, it does not contain detailed description of all the operations needed to install and set Parallels Virtuozzo Containers to work (for example, installing Parallels Virtuozzo Containers in unattended mode).
- *Parallels Virtuozzo Containers 4.7 User's Guide*. This guide provides comprehensive information on Parallels Virtuozzo Containers covering the necessary theoretical conceptions as well as all practical aspects of working with the product. However, it does not deal with the process of installing and configuring your system.
- *Parallels Virtuozzo Containers 4.7 Command Line Reference Guide*. This guide is a complete reference on all Parallels Virtuozzo Containers configuration files and command-line utilities.
- *Deploying Clusters in Parallels-Based Systems*. This guide describes the process of creating Parallels failover and GFS clusters using the Red Hat Cluster Suite (RHCS) software.

Feedback

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

CHAPTER 2

Templates Overview

This chapter outlines the basics of EZ templates.

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Parallels Virtuozzo Containers Templates Overview

A template in Parallels Virtuozzo Containers 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. The Parallels Virtuozzo Containers software provides tools for creating templates, installing and removing them on/from the Hardware Node, adding them to a Container, and so on. Using templates lets you

- Securely share the RAM among similar applications running in different Containers to save hundreds of megabytes of memory.
- Securely share the files comprising a template among different Containers to save gigabytes of disk space.
- Install applications and patches simultaneously in many Containers.
- Use different versions of an application on different Containers (for example, perform an upgrade only in certain Containers).

There are two types of templates in Parallels Virtuozzo Containers. These are OS templates and application templates. An OS template is an operating system and the standard set of applications to be found right after the installation. Parallels Virtuozzo Containers uses OS templates to create new Containers with a preinstalled operating system. An application template is a set of repackaged software packages optionally accompanied with configuration scripts. Parallels Virtuozzo Containers uses application templates to add extra software to the existing Containers. For example, you can create a Container on the basis of the `redhat` OS template and add the MySQL application to it with the help of the `mysql` template.

Some of the operations you can perform on templates are listed below:

- creating your own application templates
- uploading new templates to the Hardware Node
- listing the templates currently installed on the Hardware Node
- installing templates on and removing them from the Hardware Node
- adding templates to any number of Containers
- removing templates from the Hardware Node
- removing templates that are not needed any more from Containers
- migrating templates from the Source Node to the Destination Node

All these operations are described in the following chapters in detail.

EZ Templates Overview

EZ templates are part and parcel of the Parallels Virtuozzo Containers philosophy because they provide a way of sharing resources among lots of Containers, thus enabling huge savings in terms of disk space and memory. For example, when you install and cache an OS template on the Hardware Node, Parallels Virtuozzo Containers creates the

`/vz/template/<name_of_the_OS>` directory containing all the OS files that can be shared among Containers. When a Container based on this template is created, it contains only symlinks to the OS template files. These symlinks occupy very little space on the hard disk. They are situated in the so-called *private area* of the Container. The corresponding directory is `/vz/private/<CT_ID>`. The private area of a Container contains not only symlinks to the necessary template files, but also the copy-on-write area of the Container (the area for storing the information about those changes that the Container makes to the template files; this information pertains only to the given directory) and all the private Container files. When the Container is started, this private area is mounted as Virtuozzo File System (VZFS) to the `/vz/root/<CT_ID>` directory. This directory is seen as the root directory from within the Container. And, which is the pivot of it all, thanks to the VZFS, the symlinks of the Container private area are seen as real files there!

Thus, the most important directories in the `/vz` partition are the following:

- `/vz/template` - contains OS and application files shared among Containers;
- `/vz/private` - contains VZFS symlinks to template files;
- `/vz/root` - contains Container mounted symlinks and all other Container files.

The relation of these directories may be represented as below:

`/vz/template` (real files) → `/vz/private` (symlinks) → `/vz/root` (symlinks seen as real files in / for the Container)

While you are able to perform all kinds of tasks within a Container including building RPM packages and installing them, Parallels Virtuozzo Containers provides an easy and far more efficient way of installing the applications you need inside Containers. In the same way as you install an OS template on the Parallels Virtuozzo Containers system in order to create any number of Containers on its basis and share its resources, you can install application templates in Parallels Virtuozzo Containers in order to share application files among any number of Containers. You can then add these applications to any number of Containers with a single command.

EZ Templates Basics

All OS and application EZ templates are defined by the following features:

- EZ templates do not carry any package files. They contain only information about what packages to install on the Hardware Node to make the templates fully operational and from what network repository to download these packages.

Note: For the sake of brevity, we will be saying throughout this guide that packages are included in EZ templates, which actually means that EZ templates contain the information on the corresponding packages without carrying the packages themselves.

- The dependencies of software packages included in an EZ template are automatically resolved during the packages installation on the Hardware Node. So, if the specified packages require other packages to be installed, these packages are also downloaded from the repository and installed on the Node. In case a package has requirements that conflict with existing software on the Node or any dependencies for the package being installed cannot be satisfied, the package installation process fails without making any changes to the system.
- The EZ templates technology allows you to use the original OS and application vendor's packages and to receive the updated packages from a central repository right after their release.

One of the basic concepts in the EZ template technology is the concept of 'repository' where software packages for the given EZ template are stored. A repository is a prepared directory or web site containing the packages and index files for Linux operating systems and/or any of their applications. An example of such a repository is the repository located at the <http://mirrors.usc.edu/pub/linux/distributions/fedora/> web site and storing software packages for the Fedora Core releases. Using repositories gives you the following advantages:

- Software packages included in the given EZ template do not contain versions, but only names (for example, `bash`, `crontabs`). So, you always update any package included in the EZ template to its latest version available in the repository.
- As a result of the fact that a list of packages does not provide their versions, EZ templates do not have versions either (for example, `centos-5-x86`). Thus, you install any EZ template on the Hardware Node only once and, after that, use the installed template to update the packages inside any Container where it is applied.
- You can create several OS EZ template sets for one and the same Linux operating system. Any OS EZ template you are provided with has the default packages set included in it and is called the base OS EZ template. However, you can make your own OS EZ template sets (the so-called non-base OS EZ template sets) which can differ from the corresponding base template:
 - in the number of packages included in these EZ template sets
 - in the number and location of repositories to be used for these EZ template sets
 - in the number and kind of scripts to be executed on different EZ template sets lifecycle stages, etc.

Non-base OS EZ template sets should have their own names and are created by appending a random identifier to the base OS EZ template name. For example, if you wish your Container to run Red Hat Enterprise Linux 5 and to function as a Linux-based server only, you can create the `redhat-e15-x86-server` OS EZ template set and include only those packages in it that are needed for performing main server tasks. So, you can specify packages to be used for setting up file and print sharing and exclude all the packages for graphical interfaces (GNOME and KDE).

Parallels Virtuozzo Containers provides you with a `vzpkg` tool allowing you to automatically locate and obtain the correct packages for your EZ templates from package repositories. The packages are downloaded from the repository and installed on the Hardware Node in one of the following cases:

- when creating a cache for an OS EZ template
- when updating an existing OS EZ template cache (if there are new packages available in the repository)
- when adding an application EZ template or package to the first Container
- when updating EZ templates or software packages inside a destination Container

Note: Detailed information on how to manage software package repositories is provided in the **Setting Up Repositories for EZ Templates** [section](#) (p. 27).

EZ Template Directory Structure

All EZ templates and the software packages included in them and installed on the Hardware Node are located in the so-called template area the path to which is set as the value of the `TEMPLATE` variable in the `/etc/vz/vz.conf` file. By default, the `/vz/template` directory is used. The template area includes two main subdirectories:

- The `cache` subdirectory where the tar archive of the potential private area of a Container based on the corresponding OS EZ template is stored. The tar archive is created during the OS EZ template caching. Please keep in mind that the OS EZ template should be obligatorily cached before you can start creating Containers on its basis.
- The template directory having the name of `<os_name>/<os_version>/<arch>` where:
 - `<os_name>` denotes the name of the Linux distribution for which the OS EZ template is created (`redhat`, `centos`, `fedora-core`, and so on);
 - `<os_version>` is the version of the Linux distribution specified as `<os_name>` (for example, 12 or 13), and
 - `<arch>` denotes the microprocessor architecture where the OS EZ template is to be run (`x86` or `x86-64`).

For example, after installing the 32-bit version of the Fedora 13 EZ template, the `/vz/template/fedora-core/13/x86` directory on the Hardware Node is created.

The `<arch>` directory contains the following subdirectories and areas:

- The template configuration subdirectory including:
 - The `config/os/default` directory where the appropriate configuration files for the base OS EZ template are stored.
 - The `config/os/<setname>` directory where the appropriate configuration files for non-base OS EZ templates, if any, are stored.
 - The `config/app/<app_name>/default` directory where the appropriate configuration files for the base application EZ template are stored. This directory is created if at least one application EZ template for the given OS EZ template is installed on the Hardware Node.
 - The `config/app/<app_name>/<setname>` directory where the appropriate configuration files for non-base application EZ templates, if any, are stored.
- The packages area containing a number of software packages downloaded from the repository and installed on the Hardware Node. The installed files can be shared among Containers, i.e. when a Container based on the given OS EZ template is created or application EZ templates are added to any Container, it contains only symlinks to the template files in the packages area. The installed package has the following structure:

```
<name>-<epoch>:<version>-<release>.<arch>
```

where

- `<name>` is the package name
- `<epoch>` denotes the package epoch
- `<version>` indicates the package version
- `<release>` is the package release
- `<arch>` denotes the microprocessor architecture where the package is to be used

Examples of the installed software packages are the `zlib-1.2.3-14.fc138.i386.rpm` or `glib-1.2.10-28.fc13.i386.rpm` packages that can be found in the packages area on the Hardware Node after installing and caching the Fedora 13 OS EZ template.

- One or several subdirectories containing the packages comprising the corresponding OS EZ template. The directories have the following names:
 - `baseN` for the base OS template
 - `<setname>N` for the non-base OS template with the name of `<setname>`, if any
 - `<appname>N` for the base application template
 - `<appname>-<setname>N` for the application template with the name of `<setname>`, if any

`N` denotes the index number of the URL specified in the `repositories/mirrorlist` file (see information on the `repositories/mirrorlist` file below).

As has been mentioned above, the configuration directory (that is, `/<template_area>/<template_directory>/config`) contains a number of subdirectories storing 'EZ templates'-related configuration files. The contents of these subdirectories can vary depending on whether it is a base OS EZ template or a non-base one and on the EZ template type (OS or application template). The most important configuration files are listed below:

- Data files:
 - `packages`: contains a list of software packages names included in the corresponding EZ template.
 - `package_manager`: specifies the packaging system used to handle the EZ template.
 - `repositories`: a list of repositories where the packages comprising the EZ template are stored.
 - `mirrorlist`: one or several URLs to the file containing a list of repositories from where the packages comprising the EZ template are to be downloaded.
 - `distribution`: the name of the Linux distribution for which the EZ template is created. This file should be absent for application EZ templates.
 - `summary`: brief information on the EZ template.
 - `description`: detailed information on the EZ template. As distinct from the `summary` file, it can contain additional data relevant for the EZ template.
 - `environment`: a list of environment variables set in the form of `key=value`.

- Scripts:
 - `pre-cache`: this script is executed before installing the packages included in the EZ template on the Hardware Node.
 - `post-cache`: this script is executed after installing the packages included in the EZ template on the Hardware Node.
 - `pre-install`: this script is executed before adding the EZ template to or installing the package inside the Container.
 - `post-install`: this script is executed after adding the EZ template to or installing the package inside the Container.
 - `pre-upgrade`: this script is executed before updating the packages inside the Container.
 - `post-upgrade`: this script is executed updating the packages inside the Container.
 - `pre-remove`: this script is executed before removing the application EZ template/package from the Container.
 - `post-remove`: this script is executed after removing the application EZ template/package from the Container.
- Document files: one or several files with arbitrary names containing the information on the EZ template (e.g. `README`).

Note: Detailed information on the files contained in the OS template configuration directory is provided in the *Parallels Virtuozzo Containers 4.7 Reference Guide*.

When working with EZ template configuration files, pay attention to the following:

- The `packages` file should be specified for all EZ templates.
- The `packages`, `package_manager`, and `repositories/mirrorlist` files should be specified for all base OS EZ templates.
- The `package_manager` and `distribution` files should be specified for all base OS EZ templates and absent for non-base OS EZ templates and all application EZ templates.
- The information from the `repositories/mirrorlist` file(s) created for non-base OS and all application EZ templates is added to that in the `repositories/mirrorlist` file(s) for the base OS EZ template.

Differences Between OS and Application EZ Templates

Actually, there are four major differences between OS EZ templates and application templates:

- OS templates are used to create new Containers, whereas application templates provide additional software for already created Containers.
- OS templates may and usually do use action scripts, whereas application templates cannot use action scripts in the current version of Parallels Virtuozzo Containers.
- You may define a list of compatible templates and a list of required templates for application templates.
- OS templates and their updates are cacheable, whereas application templates and their updates are not.

The last point needs further explanation. The fact is that creating a huge number of symlinks to the OS template when creating a Container (i.e. its private area) may take a very considerable amount of time. To reduce the time needed for creating a new Container, you should use the `vzpkg create cache` command allowing you to make a tarball of the potential private area of a Container based on the corresponding template. This tarball is also located in the `/vz/template/cache` directory. When a Container is being created, the tarball is simply deployed into the Container private area.

EZ Template Lifecycle

An EZ template has the following development stages:

- 1** Any EZ template should be first installed on the Hardware Node. The `vzpkg install template` command enables you to install OS and application EZ templates on the Node.
- 2** The EZ template should be cached by using the `vzpkg create cache` command. This step is required for OS EZ templates only. As a result of the `vzpkg create cache` execution, the necessary packages included in the OS EZ template are downloaded from the network repository, installed in the `/vz/template/<os_name>/<os_version>` directory on the Hardware Node, and a gzipped tarball for the OS EZ template is created and put to the `/vz/template/cache` directory.
- 3** Either a new Container is created on the basis of the cached OS EZ template with the `vzctl create` command or an application EZ template is added to any number of Containers by using the `vzpkg install` command. In the latter case, the necessary application files are first downloaded from the network repository and installed on the Hardware Node and then the VZFS links to the installed files are created and added to the Container private area.
- 4** An obsolete EZ template applied to the corresponding Container can be updated by using the `vzpkg update` command.
- 5** Any EZ template excluding OS EZ templates can be removed from the Container with the `vzpkg remove` command.
- 6** An EZ template that is not used by any Container may be completely removed from the Hardware Node with the `vzpkg remove template` command.

All these steps can be performed either through the Parallels Virtuozzo Containers command-line utilities indicated above, with the help of Parallels Virtual Automation, or using Parallels Management Console.

CHAPTER 3

Managing EZ Templates

This chapter describes how to create and manage EZ OS and application templates in Parallels Virtuozzo Containers.

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Creating an EZ Template

Parallels Virtuozzo Containers is shipped with a certain number of OS (e.g., `centos-5-x86_64`) and application (e.g., `mysql-centos-5-x86_64`) EZ templates. This is usually sufficient to deploy the main Linux distributions and their applications in Containers. You can, however, create your own OS and application EZ templates and use them to base Containers on or run different applications in Containers.

You can use one of the following ways to create EZ templates:

- [Make a template on the basis of an existing template](#) (p. 21). In this case, you configure the parameters of one of the templates installed on your Node to meet your needs.
- [Make a template from scratch](#) (p. 21). In this case, you first create a new template configuration and then create the template on its basis.

The following subsections describe both ways of creating templates in detail.

Creating a Template from Official Templates

The easiest way to create a template is to base it on one of the official templates shipped by Parallels and adjust its configuration to meet your demands:

- 1 Install the template you want to use as the basis for your new template (e.g., using the `vzup2date -z` command).
- 2 Create a copy of the directory containing the template configuration files. Depending on whether you want to create a non-base template or a self-contained template, your steps slightly differ:
 - To create a non-base template, create a subdirectory in the `/vz/template/os_name/os_version/arch/config/os` directory and copy to this directory the contents of the `/vz/template/os_name/os_version/arch/config/os/default` subdirectory. For example, to make a non-base template for the official `centos-5-x86_64` template and put its configuration files to the `/customized` directory, you can run this command:

```
# cp -a /vz/template/centos/5/x86_64/config/os/{default,customized}
```

This command creates a new non-based template with the name of `centos-5-x86_64-customized`.

- To create a self-contained template, create a subdirectory in the `/vz/template` directory and copy to this directory the contents of the subdirectory for the original template (`/vz/template/os_name`). For example, to make a self-contained template on the basis of the official `centos-5-x86_64` template and put it to the `/vz/template/centos-customized` directory, you can run these commands:

```
# mkdir -p /vz/template/centos-customized/5/x86_64/config
# cp -a /vz/template/centos{-, -customized}/5/x86_64/config/os
```

The last command creates a new self-contained template with the name of `centos-customized-5-x86_64`.

- 3 Change to the directory containing the configuration files for the new template and adjust them to meet your demands. For example, you can change the list of packages to include in the template by editing the `packages` file or configure the list of mirrors by editing the `mirrorlist` file.

Creating a Template from Scratch

The process of creating a template from scratch includes completing the following tasks:

- 1 Installing the `vztt-build` package on the Node.
- 2 Making a metafile that will be used as the basis for creating the template.
- 3 Using the `vzmktmpl` utility to create the template from the metafile.

The following subsections describe these operations in detail.

Installing vztt-build

The first step in creating a template from scratch is to install the `vztt-build` package on your Node. This package contains

- template metafile samples. You use metafile samples as the basis for creating a metafile for your own template.
- the `vzmktmpl` utility. You use the `vzmktmpl` utility to create the template on the basis of your metafile.

The `vztt-build` package is located in the `/virtuozzo/RPMS/optional` directory of your Parallels Virtuozzo Containers distribution and is not installed by default during the installation. To install the `vztt-build` package, use the `rpm -i` command, for example:

```
# rpm -i /virtuozzo/RPMS/optional/vztt-build-4.7.0-11.x86_64.rpm
```

Creating Metafiles

In the second step, you make a metafile, a plain text file having the `.metafile` extension and containing a list of parameters for your template. The `vzmktmpl` utility uses this file when creating the template.

The following example demonstrates the process of creating a metafile for the x64 version of CentOS 5. To create the metafile:

- 1 Create a new text file with an arbitrary name and the `.metafile` extension (e.g., `centos-5-custom.metafile`).

The easiest way to create a new metafile is to copy one of the metafile samples from the `/usr/share/vztt/samples` directory and configure it to meet your demands. For example, you can use the `/usr/share/vztt/samples/centos-5-x86_64/metafile` file as the basis for creating your new metafile for CentOS 5.

```
# cp /usr/share/vztt/samples/centos-5-x86_64/metafile /home/user1
```

- 2 Configure the metafile to meet your demands:

- a **%osname**. Specify the name of the Linux distribution for which you are creating the OS EZ template:

```
%osname
centos-custom
```

The specified name will be assigned to the template directory where you will install the template (e.g., in our case, it will be `/vz/template/centos-custom`).

- b **%osver**. Specify the version of the Linux distribution for which you are creating the template:

```
%osver
5
```

The specified name will be assigned to the subdirectory that will denote the version of your Linux distribution (e.g., `/vz/template/centos-custom/5`).

- c %osarch.** Provide the information about the microprocessor architecture where the OS EZ template is to be run:

```
%osarch
x86_64
```

You can set the value of the `%osarch` parameter to one of the following:

- * `x86`: specify if you plan to run the template on x86 platforms.
- * `x86_64`: specify if you plan to use the template on x86-64 platforms.

As the template being created is intended for use on x86-64-bit platforms, the `%osarch` parameter is set to `x86_64`.

- d %packages.** Indicate the packages to include in the template.

The names of the packages must correspond to the names of real packages (with or without package versions, for example, `wget` or `wget=1.9.1`) that are stored in the repository used for the OS template (in our case, for CentOS 5). The specified packages will be downloaded from the package repository and installed on the Node when you will cache the OS template.

Note: If you are creating a template for Debian-based distributions (e.g., Debian, Ubuntu), you need to specify in this step three parameters: `%packages_0`, `%packages_1`, and `%packages`. This is explained by the fact that the installation of such distributions is carried out in three stages. If you do not know which packages to include, consult the documentation for the respective distribution.

- e %package_manager.** Specify the package manager to use for handling the template.

```
%package_manager
rpm44x64
```

For the full list of package managers, see **Available Package Managers** below.

- f %repositories.** Define the list of repositories storing packages for the template:

```
%repositories
$CE_SERVER/centos/5/os/x86_64
$CE_SERVER/centos/5/updates/x86_64
```

All the listed parameters are mandatory and must be specified in any metafile. You can also set a number of supplementary parameters in your metafile (e.g., `version` and `release`). For detailed information on all available parameters, see the `vzpkg.metafile` manual pages. For metafile samples, go to the `/usr/share/vztt/samples` directory and look for the `metafile` file in the subdirectory corresponding to specific Linux distributions (e.g., `/usr/share/vztt/samples/centos-5-x86_64/metafile`).

3 Save the file.

Metafiles for Application Templates

The example above explains in detail how to create a metafile for an OS template. The process of creating a metafile for an application template is similar to that described above, except for the following:

- Add the `%appname` parameter to the file to specify a name for the application template, for example:

```
%appname
php-customized
```

- Do not include the `%package_manager`, `%upgradable_versions`, and `%distribution` parameters in the file. These parameters are allowed for OS templates only.
- Make sure that the value of the `%osname` parameter corresponds to the name of the directory of the Linux distribution under which the application template is to be run. For example, if you are creating an application template for CentOS 5 installed in the `/vz/template/centos` directory, set this value to `centos`:

```
%osname
centos
```

- Ensure that the value of the `%osver` parameter corresponds to the version of the respective Linux distribution. For example, for CentOS 5 installed in the `/vz/template/centos/5` directory, set this value to 5:

```
%osver
5
```

Available Package Managers

Depending on the Linux distribution for which you are creating the template, set the following values for the `package_manager` parameter:

x86 Linux distributions

- `rpm49db5x86`: Fedora 17
- `rpm49x86`: Fedora 15 and 16
- `rpm47x86`: Red Hat Enterprise Linux 6 and CentOS 6
- `rpm44x86`: Red Hat Enterprise Linux 5 and CentOS 5
- `rpm43x86`: Red Hat Enterprise Linux 3 and 4, CentOS 3 and 4
- `rpmzypp44x86`: SUSE Linux Enterprise Server 11 with Service Pack 2
- `rpm41x86`: SUSE Linux Enterprise Server 10 and SUSE Linux 10.x
- `rpm41s9x86`: SUSE Linux Enterprise Server 9
- `rpmzypp49x86`: openSUSE 12.1
- `dpkg`: Debian and Ubuntu

x86-64 Linux distributions

- `rpm49db5x64`: Fedora 17
- `rpm49x64`: Fedora 15 and 16
- `rpm47x64`: Red Hat Enterprise Linux 6 and CentOS 6

- `rpm44x64`: Red Hat Enterprise Linux 5 and CentOS 5
- `rpm43x64`: Red Hat Enterprise Linux 3 and 4, CentOS 3 and 4
- `rpmzypp44x64`: SUSE Linux Enterprise Server 11 with Service Pack 2
- `rpm41x64`: SUSE Linux Enterprise Server 10 and SUSE Linux 10.x
- `rpm41s9x64`: SUSE Linux Enterprise Server 9
- `rpmzypp49x64`: openSUSE 12.1
- `dpkgx64`: Debian and Ubuntu

Creating the Template with `vzmktmpl`

In the last step, you use the `vzmktmpl` utility to create the template. To make a template with this utility, you need to specify the path to

- Metafile that defines all parameters for the template; see **Creating Metafiles from Scratch** (p. 22) for details on metafiles.
- Scripts that are to be executed at different stages of the template life cycle (e.g., when caching an OS template or adding an application template to a Container). Each template should have its own set of scripts optimized for use with the Linux distribution for which the template is created. To learn what scripts to specify for your template:
 1. Install an official template provided by Parallels for the same Linux distribution for which you are creating the template. For example, if you are making a template for CentOS 5, install the CenOS 5 OS template (use the `vzupdate -z` command, if necessary).
 2. Go to the configuration directory (`/vz/template/os_name/os_version/arch/config/os/default`) of the installed template.
 3. Look for the files starting with "pre-" and "post-" (e.g, `pre-cache` or `post-install`):

```
# ls -l /vz/template/centos/5/x86_64/config/os/default
...
-rwxr-xr-x 1 root root 453 Aug 13 22:12 post-cache
-rwxr-xr-x 1 root root 3399 Aug 13 22:12 post-install
-rwxr-xr-x 1 root root 610 Aug 13 22:12 pre-cache
-rwxr-xr-x 1 root root 943 Aug 13 22:12 pre-upgrade
...
```

For the full list of scripts, see the **vzmktmpl** section in the *Parallels Virtuozzo Containers 4.7 Command Line Reference Guide*.

Once you have a metafile and the required scripts at hand, copy them to your current working directory and execute the **vzmktmpl** utility. For example, to create a template for CentOS 5, base it on the `centos-5-custom.metafile` file, and include the scripts `post-cache`, `post-install`, `pre-cache`, and `pre-upgrade` in the template, you can run this command:

```
# vzmktmpl --pre-cache pre-cache --pre-upgrade pre-upgrade --post-cache post-cache --
post-install post-install centos-5-custom.metafile
```

Upon the command completion, the created template is put to your current working directory:

```
# ls
centos-custom-5-x86_64-ez-1.0-1.noarch.rpm
...
```

To start using the new OS template, install it on the Node using the `vzpkg install template` command and cache it with the `vzpkg create cache` command.

Setting Up Repositories and Proxy Servers for EZ Templates

If you are going to use OS and application EZ templates in Containers, you first need to have one or more repositories with software packages prepared for these EZ templates. Package repositories are required for the EZ templates functioning due to the fact that these templates do not carry all the necessary package files inside themselves. They contain only information about what packages are included in the corresponding EZ template and from what repository they should be downloaded. In Parallels Virtuozzo Containers, you can make use of the following package repositories:

- Default repositories. When you install an EZ template on the Node, it is pre-configured to use official vendor's file sources (e.g., RPMs from the Fedora website) and a number of packages provided by Parallels and needed for the correct EZ template functioning. So, you can start using the default repositories right after the EZ template installation on the Node. Please note that the default repositories are provided for non-commercial versions of Linux distributions only.
- Local repositories. You can build your own local repositories, which allows you:
 - To greatly save on network bandwidth when deploying package updates to several Nodes in your network.
 - To organize your own package repository if public repositories provided by Linux OS and application vendors are not compatible with a `vzpkg` tool used to manage EZ templates.

Note: The `vzpkg` tool supports all the repositories that can be used by the `yum` utility (version 2.4.0 and higher) and the `apt` utility.

- Repositories for storing software packages and updates for Red Hat Enterprise Linux distributions.

Along with setting up the aforementioned package repositories, you can also create special caching proxy servers and use them to efficiently manage your OS and application EZ templates.

Managing Default Repositories

When you install an OS EZ template on the Node, it is preconfigured to use one or several package repositories storing Linux OS vendor's file sources. The path to the repositories for most OS EZ templates and their application EZ templates is automatically set during the EZ template installation in the `mirrorlist` or `repositories` files located in the

`/vz/template/<os_name>/<os_version>/<arch>/config/os/default` directory.

Thus, you do not have to perform any additional operations to start using an installed OS EZ template (i.e. cache it and create Containers on its basis). The only requirement your system must meet is to have an active Internet connection to access the servers where the preconfigured repositories are located.

Let us assume that you want to use the 32-bit version of Fedora 16 to base your Containers on. To do this, you install the `fedora-core-16-x86-tmpl-4.7.0-3.noarch.rpm` EZ template on the Node:

```
# vzpkg install template fedora-core-16-x86-tmpl-4.7.0-3.noarch.rpm
Preparing... ##### [100%]
 1:fedora-core-16-x86-tmpl ##### [100%]
```

After the OS EZ template has been successfully installed, you can explore the default repositories for Fedora 16 in the `/vz/template/fedora/16/x86/config/os/default/mirrorlist` file. For example:

```
# cat /vz/template/fedora/16/x86/config/os/default/mirrorlist
$SW_SERVER/download/mirrors/fedora-core-16
$SW_SERVER/download/mirrors/updates-released-fc16
http://mirrors.fedoraproject.org/mirrorlist?repo=fedora-16&arch=i386
http://mirrors.fedoraproject.org/mirrorlist?repo=updates-released-f16&arch=i386
```

This file lists the repositories set to handle the Fedora 16 OS EZ template:

- Repositories on the Parallels web server are defined in the first two lines. `$SW_SERVER` denotes the string whose value is specified in the `/vz/template/conf/vztt/url.map` file. In our case, this string is the URL of the Parallels web server. The repositories on the Parallels web server keep a number of software packages needed for the correct operation of the `fedora-core-16-x86` template. Along with `$SW_SERVER`, the `url.map` file contains the list of URLs for all Linux distributions supported by Parallels Virtuozzo Containers and having official repositories.
- Repositories on the Fedora web server are defined in the third and fourth lines. These repositories store all RPM packages for the Fedora 16 distribution.

The priority according to which software packages are downloaded from the specified servers is determined by the repositories order in the `mirrorlist` file. So in the example above, RPM packages from the Parallels web server are downloaded first and, after that, all the packages from the Fedora server.

Notes:

1. You can use the `vzpkg info OS_template_name mirrorlist repositories` command to view the mirrors and repositories for specific OS templates.
2. Commercial Linux distributions (e.g., Red Hat Enterprise Linux) do not have official repositories. You need to manually set up software repositories for such distributions before you can start using them. For more information, see to **Setting Up Repositories with vzcreaterepo**.

Software packages are downloaded and installed on the Node from package repositories when you:

- Cache an OS EZ template.
- Update an existing OS EZ template cache (provided that new packages are available in the repository).
- Add an application EZ template or package to a Container for the first time.
- Update an EZ template or software package in a Container.

You can set up your own repositories (e.g., storing unofficial software packages) for EZ templates. To do this, create the `repositories` file in the

`/vz/template/<os_name>/<os_version>/<arch>/config/os/default` directory on the Node, if it is not present, and specify the path to the desired repository. For example, to add the extra repository at `http://mirrors.dotsrc.org/jpackage/` and keeping Java packages for Fedora 16:

1 Create the `/vz/template/fedora/16/x86/config/os/default/repositories` file on the Node.

2 Add the following string to the file:

```
http://mirrors.dotsrc.org/jpackage
```

3 Save the file.

Creating a Local Repository

Along with using pre-configured repositories, you can create local repositories and configure for handling packages for your EZ templates. Organizing your own local repositories results in less bandwidth consumption and rapid software updates to Containers. You may also want to build a local repository if OS vendors or third-party software developers set up repositories that are not compatible with the `vzpkg` tool.

Note: The `vzpkg` tool supports all the repositories that can be used by the `yum` (version 2.4.0 and higher) and `apt` utilities. For detailed information on these utilities, see their man pages.

The process of setting up a local repository includes the following main steps:

- 1 Obtaining software packages comprising the given Linux distribution. The easiest way of doing it is to copy the necessary packages from your distribution disks or the OS vendor's website.
- 2 Creating the metadata repository from a set of the copied software packages with the `createrepo` utility. This step can be omitted if you are going to create a repository which will be a mirror of a public repository.
- 3 Making your repository accessible for Containers users. You can let Container users access your repository in one of the following ways:
 - By using the `http` protocol. In this case the repository should represent a website containing software packages for the EZ template.
 - By using the `ftp` protocol. In this case the repository should represent an FTP site containing software packages for the EZ template.
 - By using the `file` protocol. In this case the repository should represent a directory path (e.g. on your local Node) containing software packages for the EZ template.

While the first two protocols allow you to remotely (i.e. from Nodes located in other networks) access the created repository, the third one can be used within your local Node only.

Example 1: Creating a Local Repository for Fedora 16

Let us assume that you want to build a local package repository for the Fedora 16 OS EZ template where the RPM packages for Fedora 16 will be downloaded and stored. The repository will be used by Nodes from both your local and other networks, and it will allow downloading packages through the `http` protocol. In our example, we presume the following:

- The package repository will be located inside Container 101. You can use any OS template to base the Container on.

Note: We recommend that you always place your local repositories inside separate Containers not to compromise the Node security. In particular, it is of significant importance if you are going to provide access to your repositories through the `http` and `ftp` protocols.

- Container 101 is started. It has the IP address of 123.145.145.123 and can be accessed from other networks.
- The apache web server is running inside Container 101 and the default document root for apache is /var/www/html, i.e. the apache web server stores its sites in the /vz/root/101/var/www/html directory on the Node.
- The apache user and group inside Container 101 are apache.

To create a local repository for Fedora 16, do the following:

- 1 Install the fedora-core-16-x86 OS EZ template (if it is not already installed):

```
# vzpkg install template fedora-core-16-x86-tmpl-4.7.0-3.noarch.rpm
Preparing... ##### [100%]
 1:fedora-core-16-x86-tmpl ##### [100%]
```

- 2 Change to the /vz/root/101/var/www/html directory, and create two subdirectories within it:

Note: You can also log in to Container 101 and perform the operations described in **Steps 2-8** from inside the Container. In this case your working directory inside Container 101 must be /var/www/html, and you will need to install the createrepo package inside the Container and grant the Container access to the CD-ROM drive on the Node.

- The subdirectory where the base RPM packages for Fedora 16 will be stored:

```
# mkdir -p download/fedora-core/16/i386/os/Fedora/RPMS
```

- The subdirectory where the updated versions of RPM packages for Fedora 16 will be stored:

```
# mkdir -p download/fedora-core/updates/16/i386
```

- 3 Copy all the packages comprising the Fedora 16 distribution (e.g., from your Fedora distribution disks) to the download/fedora/16/i386/os/Fedora/RPMS directory on the Node.

- 4 Get the updates for Fedora 16, and put them to the download/fedora-core/updates/16/i386 directory on the Node.

- 5 Install the createrepo package on the Node, for example:

```
# rpm -Uhv createrepo-0.4.3-1.2.el4.rf.noarch.rpm
Preparing... ##### [100%]
 1:createrepo ##### [100%]
```

- 6 Change to the /vz/root/101/var/www/html directory and create the following metadata repositories:

- For the Fedora 16 base RPM packages:

```
# createrepo download/fedora/16/i386/os
```

- For the updated versions of the Fedora 16 RPM packages:

```
# createrepo download/fedora-core/updates/16/i386
```

Creating the package metadata repository may take some time depending on the speed of your processor and hard disk drive.

- 7 Create a directory for storing mirror site lists. In our case, the lists will be kept in the /vz/root/101/var/www/html/download/mirrors directory:

```
# mkdir -p download/mirrors
```

8 Create the mirror list files and set the path to your local repository. For example, you can do this as follows:

- For the Fedora 16 base RPM packages:

```
# echo 'http://123.145.145.123/download/fedora/16/i386/os/' >> download/mirrors/fedora-core-16
```

- For the updated versions of the Fedora 16 RPM packages:

```
# echo 'http://123.145.145.123/download/fedora/updates/16/i386' >> download/mirrors/updates-released-fc16
```

The aforementioned commands create the `fedora-core-16` and `updates-released-fc16` files in the `/vz/root/101/var/www/html/download/mirrors` directory on the Node and add the

`http://123.145.145.123/download/fedora/16/i386/os/Fedora/RPMS` and `http://123.145.145.123/download/fedora/updates/16/i386` strings to them, respectively.

9 Open the `/vz/template/conf/vztt/url.map` file on the Node for editing (e.g., by using `vi`), and change the value of the `$FC_SERVER` variable as follows:

```
$FC_SERVER http://123.145.145.123
```

10 Grant the `apache` user and the `apache` group access to the created repositories inside Container 101 by executing the following command on the Node:

```
# vzctl exec 101 chown -R apache.apache /var/www/html/download
```

Example 2: Accessing the Repository via the `file` protocol

Once you set up a local repository by following the instructions in the example above, you can start using the `vzpkg` tool to obtain RPM packages for the Fedora 16 EZ template from this repository. You can connect to these repositories via the `http` protocol from both remote and local Nodes.

You can further speed up the process of distributing RPM packages across your repository for those Containers that reside on your local Node (that is, on the Node where the repositories are stored). To do this, configure your system to use the `file` protocol instead of `http` to connect to your repositories:

1 Open the `/vz/template/fedora/16/x86/config/os/default/mirrorlist` file on the Node and comment the strings containing `$FC_SERVER`:

```
#$FC_SERVER/download/mirrors/fedora-core-16
#$FC_SERVER/download/mirrors/updates-released-fc16
```

2 Execute the following commands to create the repository files:

- To create the `/vz/template/fedora/16/x86/config/os/default/repositories` file on the Node and to make it point to the Fedora 16 base RPM packages from your local repository:

```
# echo 'file:///vz/root/101/var/www/html/download/fedora/16/i386/os/Fedora/RPMS' >> /vz/template/fedora/16/x86/config/os/default/repositories
```


- To create the `/vz/template/fedora/16/x86/config/os/default/repositories` file on the Node and to make it point to the updated versions of the Fedora 16 RPM packages from your local repository:

```
# echo 'file:///vz/root/101/var/www/html/download/fedora/updates/16/i386' >>  
/vz/template/fedora/16/x86/config/os/default/repositories
```

Managing Repositories for Commercial Linux Distributions

Commercial Linux distributions (e.g., Red Hat Enterprise Linux and SUS Linux Enterprise Server) do not have official repositories. So if you are going to run a commercial Linux distribution inside your Containers, you should create a special repository which will store the software packages of this distribution and enable you to update the packages inside your Containers.

In the example below, we will create the repository which will store the RPM packages included in the Red Hat Enterprise Linux 4 distribution. Besides, we will consider the situation explaining to you how to keep your repository up-to-date by getting the updated packages from the Red Hat Enterprise Linux 4 website. In our example, we presume the following:

- The Node where the repository will be located is running Red Hat Enterprise Linux 4 (RHEL 4).
- The package repository will be stored inside Container 111.
- Container 111 can be accessed from other networks.
- The `apache` web server is running inside Container 111 and the default document root for `apache` is `/var/www/html`, i.e. the `apache` web server stores its sites in the `/vz/root/111/var/www/html` directory on the Hardware Node.
- The `apache` user and group inside Container 111 are `apache`.
- The `http` protocol will be used to access the RHEL 4 packages repository.

To create a repository for RHEL 4, do the following:

- 1 Install the `redhat-as4-x86` OS EZ template on the Node, if it is not yet installed:

```
# vzpkg install template redhat-as4-x86-templ-4.7.0-3.noarch.rpm
Preparing... ##### [100%]
1:redhat-as4-x86-templ ##### [100%]
```

- 2 Create the Container where the repository storing the RHEL 4 packages will be located and assign an IP address and hostname to it. Let us use the `centos-6-x86` OS EZ template to base your Container on. For example, to create Container 111 having the IP address of `144.134.134.144` and the hostname of `my_repo` for housing the repository, you can execute the following commands:

```
# vzctl create 111 --ostemplate centos-6-x86 --ipadd 144.134.134.144 --hostname my_repo
```

- 3 Make sure that Container 111 is running and the `httpd` service is started in the Container:

```
# vzlist -a
CTID      NPROC STATUS  IP_ADDR      HOSTNAME
1         42    running 10.163.163.1 localhost
111       -     stopped 144.134.134.144 my_repo
...
# vzctl start 111
Starting Container ...
Container is mounted
...
Container start in progress...
# vzctl exec 111 service httpd status
httpd is running...
```

Container 111 should be running to be able to perform the commands listed below.

- 4 Inside Container 111, create a directory where the RPM packages for Red Hat Enterprise Linux 4 will be stored:

```
# mkdir -p /vz/root/111/var/www/html/download/redhat/as4/i386/os/ \
RedHat/RPMS
```

- 5 Copy the RPM packages from the RHEL 4 distribution disks to the /vz/root/111/var/www/html/download/redhat/as4/i386/os/RedHat/RPMS directory by executing the following command for each of the RHEL 4 CDs:

```
# cp /media/cdrom/RedHat/RPMS*.rpm /vz/root/111/var/www/html/ \
download/redhat/as4/i386/os/RedHat/RPMS
```

- 6 Install the createrepo package on the Hardware Node, for example:

```
# rpm -Uhv createrepo-0.4.3-1.2.el4.rf.noarch.rpm
Preparing... ##### [100%]
1:createrepo ##### [100%]
```

- 7 Create the metadata repository for the RHEL 4 packages with the createrepo utility:

```
# createrepo /vz/root/111/var/www/html/download/redhat/as4/ \
i386/os/RedHat/RPMS
```

Creating the RPM metadata repository may take some time depending on the speed of your processors and hard disk drive.

- 8 Create a directory for keeping mirror site lists. In our case, mirror site lists will be stored in the /vz/root/111/var/www/html/download/mirrors directory on the Node:

```
# mkdir -p /vz/root/111/var/www/html/download/mirrors
```

- 9 Create the /vz/root/111/var/www/html/download/mirrors/redhat-as4 mirror list file and make it point to the repository inside Container 111 where RPM packages for RHEL 4 are stored:

```
# echo "http://144.134.134.144/download/redhat/as4/i386/os/RedHat/ \
RPMS/" > /vz/root/111/var/www/html/download/mirrors/redhat-as4
```

This command makes the /vz/root/111/var/www/html/download/mirrors/redhat-as4 file on the Node and adds the http://144.134.134.144/download/redhat/as4/i386/os/RedHat/RPMS string to the file.

So, we have just created a repository for your RHEL 4 OS EZ template. Now you can cache the redhat-as4-x86 EZ template and start creating Containers on its basis. However, if you wish to receive package updates from the RHEL 4 website, you should additionally perform the following steps:

- 1 On the Node, run the up2date utility and register your up2date account with RHEL 4. Please consult the up2date documentation to complete this task.

Note: If your Node has another Linux OS installed on it (e.g., Fedora 16), you need to create a special Container which is to run Red Hat Enterprise Linux 4 and register the up2date account from inside this Container.

- 2 Inside Container 111, create a directory where the updated versions of the RHEL 4 packages will be stored:

```
# mkdir -p /vz/root/111/var/www/html/download/redhat/updates/as4/i386
```

- 3 Create the `/vz/root/111/var/www/html/download/mirrors/updates-released-as4` mirror list file and make it point to the repository inside Container 111 where the updated versions of the RHEL 4 packages are stored:

```
# echo "http://144.134.134.144/download/redhat/updates/as4/i386/" > \
/vz/root/111/var/www/html/download/mirrors/updates-released-as4
```

This command makes the `/vz/root/111/var/www/html/download/mirrors/updates-released-as4` file on the Node and adds the `http://144.134.134.144/download/redhat/updates/as4/i386` string to the file.

- 4 On the Node, create an empty RPM database. For example:

```
# mkdir -p /var/repo/redhat-as4
# rpm --initdb --dbpath /var/repo/redhat-as4
# rpm --dbpath /var/repo/redhat-as4 --import /usr/share/ \
rhn/RPM-GPG-KEY
```

- 5 Install the RPMs from the official RHEL 4 disks in the created database:

```
# find /vz/root/111/var/www/html/download/redhat/as4/i386/os/ \
RedHat/RPMS -name '*.rpm' | xargs rpm -ihv --justdb \
--dbpath /var/repo/redhat-as4 --ignoresize --force --nodeps
```

Installing all RPM packages for the RHEL 4 distribution may take a rather long run; please wait until the installation process completes. After that, you can start using the `up2date` utility to update the created repository.

For example, the following session updates the RPM packages in your local repository inside Container 111:

- Obtain a list of RPM packages

```
# up2date -l --tmpdir=/tmp/up2date --dbpath /var/repo/redhat-as4/ | \
awk 'BEGIN { stage = 0; } \
stage == 0 && /^--*$/ { stage = 1; next; } \
stage == 1 && /^$/ { stage = 2; next } \
stage == 2 { print $1; }' \
> /tmp/pkgs-list
```

- Download them:

```
# cat /tmp/pkgs-list | xargs up2date -d --tmpdir=/tmp/up2date \
--dbpath /var/repo/redhat-as4/
# rpm -ivh --justdb --dbpath /var/repo/redhat-as4/ --ignoresize \
--force --nodeps /tmp/up2date/*.rpm
# mv /tmp/up2date/*.rpm /vz/root/111/var/www/html/download/redhat/ \
updates/as4/i386/
# createrepo /vz/root/111/var/www/html/download/redhat/updates \
/as4/i386
```

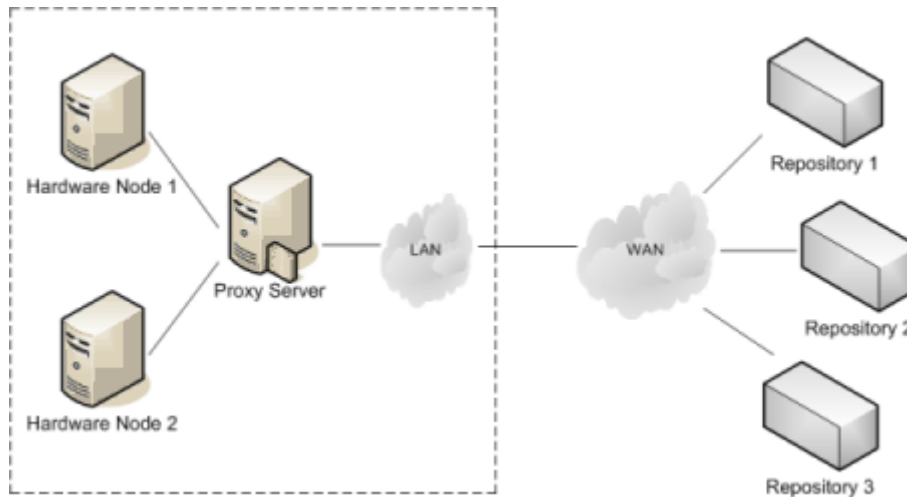
You can also make a script to automatically perform the aforementioned operations and set this script to be run as a `cron` job.

Creating Proxy Servers for EZ Templates

This section describes the process of creating caching proxy servers to efficiently manage OS and application EZ templates in your network.

Setting Up a Proxy Server for EZ Templates

You can set up special caching proxy servers and use them to efficiently manage your OS and application EZ templates. The following figure illustrates an example network configuration that contains two Nodes and a separate proxy server:



In this configuration:

- The caching proxy server sits between the Nodes (*Hardware Node 1* and *Hardware Node 2*) and keeps a number of EZ templates and the repositories (*Repository 1*, *Repository 2*, and *Repository 3*) storing the packages for these EZ templates.
- When either Node requests certain packages from any repository for the first time, these packages are first downloaded to the proxy server where they are cached and then downloaded to the corresponding Node.
- When a Node requests a package that is already available in the cache on the proxy server and none of the repositories has updates for the package, this package is immediately downloaded to the Node from the proxy server. If any updates are available in the official repositories, the procedure of handling these updates is identical to that of the main packages: The update is downloaded to the proxy server where it is cached and then retransmitted to the corresponding Node.
- A special script is automatically run on the proxy server at set intervals. During its execution, the script creates a local repository from the cached packages. All you have to do is to configure the `vzpkg` tool to use packages from this repository instead of obtaining them from remote repositories.

Setting up a proxy server for managing EZ templates has the following advantages:

- 1 Your Internet bandwidth consumption is greatly reduced because all packages are downloaded to the proxy server only once and can then be used by any Node on your network.
- 2 You can more rapidly apply software updates to Containers since the proxy server where the downloaded packages are stored resides in the local network.
- 3 You can always have the software packages included in OS EZ templates at hand and do not have to worry whether they have been changed in or removed from their original repositories. The Parallels script running on the proxy sever does not remove any cached packages; so it is up to you when to delete a specific package, if at all.

Setting Up a Proxy Server

To make a server act as a caching proxy server for EZ templates, you need to install the `vzpkgproxy` package on this server. `vzpkgproxy` is located in the `/virtuozzo/RPMS` directory of your Parallels Virtuozzo Containers distribution and can be installed with the `rpm -i` command on servers (including Containers) meeting the following requirements:

- The Apache `httpd` server, version 2.0.53 and higher, is installed on the server.
- The `createrepo` package, version 0.4.2 and higher, is installed on the server.

Keep in mind that you may also need to install a number of additional packages to satisfy the `vzpkgproxy` dependencies.

By default, the caching proxy server does not allow connections from external hosts. To allow external connections, you need to edit the `/etc/httpd/conf.d/vzproxy.conf` file as described below:

- 1 Locate the following section in the `vzproxy.conf` file.

```
<Proxy *>
    Order deny,allow
    Deny from all
    # Enter all clients here
    Allow from localhost.localdomain
</Proxy>
```

- 2 Replace `localhost.localdomain` with the hostnames of external servers you want to be able to connect to the proxy server. For example, to allow connections from the `myserver1.com` and `myserver2.com` servers, you can edit the section as follows:

```
<Proxy *>
    Order deny,allow
    Deny from all
    # Enter all clients here
    Allow from myserver1.com myserver2.com
</Proxy>
```

You can also remove the string `Deny from all` and change the string `Allow from localhost.localdomain` to `Allow from all` to allow all external hosts to connect to the proxy server.

Once you edit the `/etc/httpd/conf.d/vzproxy.conf` file, you need to tell the `vzpkg` tool to use the packages from the local repository on the proxy server while handling EZ templates. To do this, edit the `/etc/vztt/vztt.conf` file on the Node and specify the following parameters:

- The URL of the proxy server, the port number where the `httpd` daemon is listening, and the path to the directory where the EZ templates local repository is located as the value of the `VZTT_PROXY` parameter. For example, if your proxy server has the `127.123.123.127` IP address assigned, the `httpd` daemon running on the proxy server is listening on port `8080`, and the local repository is stored in `/var/www/html/download`, you should set the `VZTT_PROXY` parameter to `http://127.123.123.127:8080/download`.
- The URL of the proxy server and the port number where the `httpd` daemon is listening as the value of the `HTTP_PROXY` parameter. For example, you should set this value for the aforementioned proxy server to `http://127.123.123.127:8080`. Keep in mind that you also need to set the `HTTP_PROXY_PASSWORD` and `HTTP_PROXY_USER` parameters in the `/etc/vztt/vztt.conf` file if the access to your proxy server is password-protected.

Configuring Proxy Server Parameters

You can configure a number of proxy server parameters to meet your demands:

- Configure the `CACHE_DISABLE` parameter in the `/etc/vzpkgproxy/vzpkgproxy.conf` file on the proxy server to specify the hosts to be excluded from the caching process. By default, the proxy server caches the packages from all external hosts that are allowed to connect to the proxy server.
- Configure the port number on which the `httpd` daemon running on the proxy server is listening. To do this, specify the desired port number in the `/etc/httpd/conf.d/vzproxy.conf` file on the proxy server. The default port number is `8080`.
- Configure the `REPO_DIR` parameter in the `vzpkgproxy.conf` file to change the path to the directory where the local repository created on the basis of the cached packages will be stored. By default, this directory is `/var/www/html/download`.

Setting Up an RHN Proxy Server for RHEL OS EZ Templates

If you plan to run Red Hat Enterprise Linux 4 (RHEL 4) or 5 (RHEL 5) in Containers, you can create a special caching proxy server—*RHN (Red Hat Network) Proxy Server*. Using the RHN proxy server, you can greatly reduce your Internet bandwidth consumption and more rapidly apply software updates to Containers. RHN Proxy Servers can be created using the `vzrhnproxy` utility shipped with Parallels Virtuozzo Containers. This utility can be installed on any computer (including Containers) running the RHEL 4 and RHEL 5 Linux distributions with the `rpm -i` command.

Notes:

1. You may need to install a number of additional packages to satisfy the `vzrhnproxy` dependencies.
2. You can also try to deploy an RHN Proxy Server on systems running other RHEL-based distributions (e.g., CentOS 6), but `vzrhnproxy` has not been extensively tested with them.

Let us assume that you wish to create an RHN Proxy Server on the server with the IP address of `192.168.10.10` that will serve all Containers running the 32-bit version of RHEL 5 and residing on the Node with the hostname of `mycomputer1` and the IP address of `192.168.0.125`. To do this, perform the following operations:

- 1 Log in to the server where you are planning to create the RHN Proxy Server (further referred to as Proxy Server) and make sure the `vzrhnproxy` utility is installed on this server.
- 2 Specify a valid user name and password you use to log in to Red Hat Network (RHN) as the values of the `REDHAT_LOGIN` and `REDHAT_PASSWORD` parameters, respectively, in the `/etc/vz/pkgproxy/rhn.conf` file on the Proxy Server. These credentials will be used by `vzrhnproxy` in the next step to register your system profile with RHN. For example:

```
# vi /etc/vz/pkgproxy/rhn.conf
REDHAT_LOGIN="user1"
REDHAT_PASSWORD="2WSX00KM"
...
```

- 3 Execute the following command on the Proxy Server:

```
# vzrhnproxy register i386 5Server mycomputer1 192.168.0.125
registering for i386-5Server-mycomputer1
...
```

where `i386` and `5Server` denote the system architecture and the operating system you wish to register with RHN (in our case, we are registering the 32-bit version of the Red Hat Enterprise Linux 5 server).

During the command execution, `vzrhnproxy` will do the following:

- Connect to Red Hat Network (available at <http://rhn.redhat.com>) with the credentials specified in the `rhn.conf` file in the previous step.
- Create a profile and register it with RHN for the system running the 32-bit version of RHEL 5.
- Download the headers of the packages comprising the 32-bit RHEL 5 distribution to the Proxy Server.

- Create a pseudo-repository containing the repodata generated on the basis of the downloaded headers.
- Grant the server with the IP address of 192.168.0.125 (i.e. our Node) access to the Proxy Server.

4 On the Node:

- Open the `/vz/template/conf/vztt/url.map` file for editing (e.g. using `vi`) and change the value of the `$RH_SERVER` parameter as follows:

```
$RH_SERVER http://192.168.10.10/rhn
```

- Save the file.

From this moment on:

- If the Node with the IP address of 192.168.0.125 requests certain packages included in the RHEL 5 distribution for the first time (e.g. while caching the RHEL 5 OS EZ template), this request will be sent to the Proxy Server which, in its turn, will connect to Red Hat Network and retrieve the requested packages. These packages will then be downloaded to the Proxy Server where they are cached and finally returned to the Node.
- If the Node requests a package already available in the cache on the Proxy Server, the package will be immediately downloaded from the cache to the Node.

You can make the Proxy Server serve the requests for RHEL 5 packages from more than one Node. To do this, you should specify the IP addresses of the corresponding Nodes during the `vzrhnp proxy register` command execution and properly edit the `/vz/template/conf/vztt/url.map` file on each of these Nodes (see **Step 3** and **4** above). Keep in mind that, while executing the `vzrhnp proxy register` command, you should specify the hostname of one Node only; this can be the hostname of any Node to be handled by the Proxy Server.

You can also create and register several system profiles with Red Hat Network. For example, if you have one or more Nodes hosting Containers with the x86-64-bit version of RHEL 5, you may wish to use the Proxy Server for handling the packages included in this RHEL 5 version as well. To do this, you should perform once more **Steps 1-4** described above and use the following command on **Step 3** to register a new system profile with RHN:

```
# vzrhnp proxy register x86_64 5Server mycomputer2 192.168.22.22
registering for x86_64-5Server-mycomputer2
...
```

where 192.168.22.22 is the IP address of the Node hosting 64-bit Containers.

To list all system profiles registered with RHN, you can execute the following command on the Proxy Server:

```
# vzrhnp proxy list
i386-5Server-mycomputer1
x86_64-5Server-mycomputer2
x86_64-5Server-mycomputer3
```

As you can see, three system profiles are currently registered with RHN: two for servers running the x86-64-bit version of RHEL 5 and one for the server running the 32-bit version of RHEL 5. For each of these profiles, the corresponding pseudo-repository containing the RHEL 5 package repodata exists on the Proxy Server.

After some time, the repodata (and, consequently, the cache on the Proxy Server) may become obsolete. In this case you can use the `vzrhnprefix update` command to update the repodata in pseudo-repositories on the Proxy Server. For example, the following command will update the repodata in the pseudo-repository corresponding to the `i386-5Server-mycomputer1` profile:

```
# vzrhnprefix update i386-5Server-mycomputer2
```

Preparing OS EZ Templates for Creating Containers

OS EZ templates are used to create Containers on their basis. However, before you can use an OS EZ template for creating a Container, you need to do the following:

- 1 Install the OS EZ template on the Node.
- 2 Cache the installed OS EZ template.

To install a new OS EZ template on the Node, you can use the `vzpkg install template` command. For example, to install the CentOS 5 OS EZ template, you can run this command:

```
# vzpkg install template centos-5-x86-ez-4.7.0-3.noarch.rpm
Preparing... ##### [100%]
 1:centos-5-x86 ##### [100%]
# vzpkg list
centos-5-x86
```

As you see, the `centos-5-x86` EZ template is now installed on the Node. The corresponding path is `/vz/template/centos/5`. However, before you can start using the `centos-5-x86` EZ template as a basis for creating Containers, you need to cache it. This can be done with the `vzpkg create cache` command:

Note: To cache an OS EZ template, you may need first to set up a package repository for the template. For example, you have to build a special repository for all commercial versions of the Linux distributions (e.g., Red Hat Linux Enterprise 4 or 5). Detailed information on managing package repositories is provided in the [Setting Up Repositories and Proxy Servers for EZ Templates](#) section (p. 27).

```
# vzpkg create cache centos-5-x86
...
Complete!
Packing cache file centos-5-x86.tar.gz ...
Cache file centos-5-x86.tar.gz [14M] created.
```

The created tar archive is put to the `/vz/template/cache` directory on the Node:

```
# ls /vz/template/cache
centos-5-x86.tar.gz
```

Now you can use the `centos-5-x86` EZ template for creating Containers. Detailed information on how to create Containers on the basis of OS EZ templates is provided in the *Parallels Virtuozzo Containers 4.7 User's Guide*.

Installing Application EZ Templates

The same way as you use an OS EZ template in a Parallels Virtuozzo Containers system to create any number of Containers on its basis and share its resources, you can use application EZ templates to share application files among any number of Containers.

To install a new application EZ template on the Node, you can use the `vzpkg install` template command. For example, to install the `mysql` EZ template intended for use on the CentOS 5 distribution, you can execute the following command:

```
# vzpkg install template mysql-centos-5-x86
Preparing... ##### [100%]
 1:mysql-centos-5-x86 ##### [100%]
```

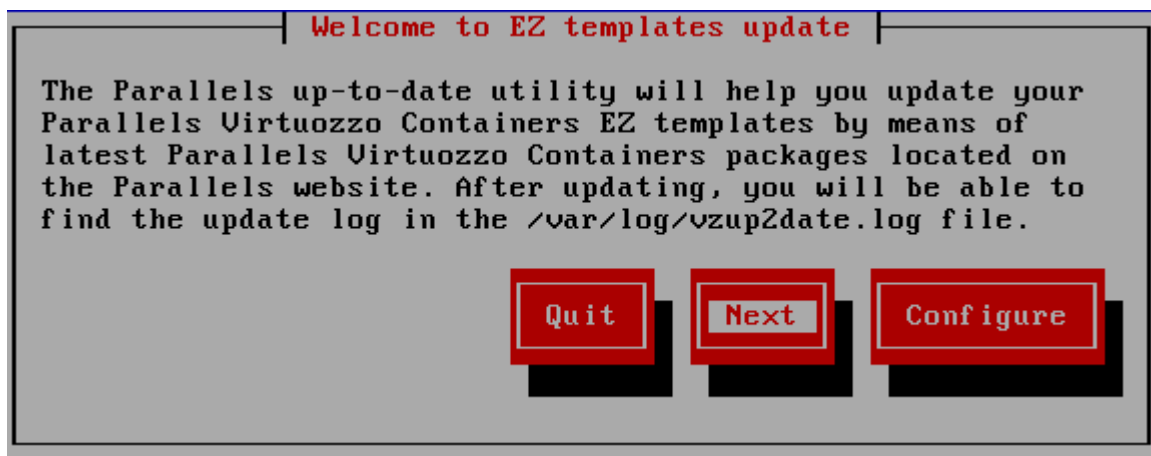
The `mysql` EZ template is installed into the `/vz/template/centos/5/x86/config/app/mysql` directory on the Node. To check that the installation was successful, you can use the `vzpkg list` command:

```
# vzpkg list
centos-5-x86                2010-04-21 02:22:45
centos-5-x86 mysql
```

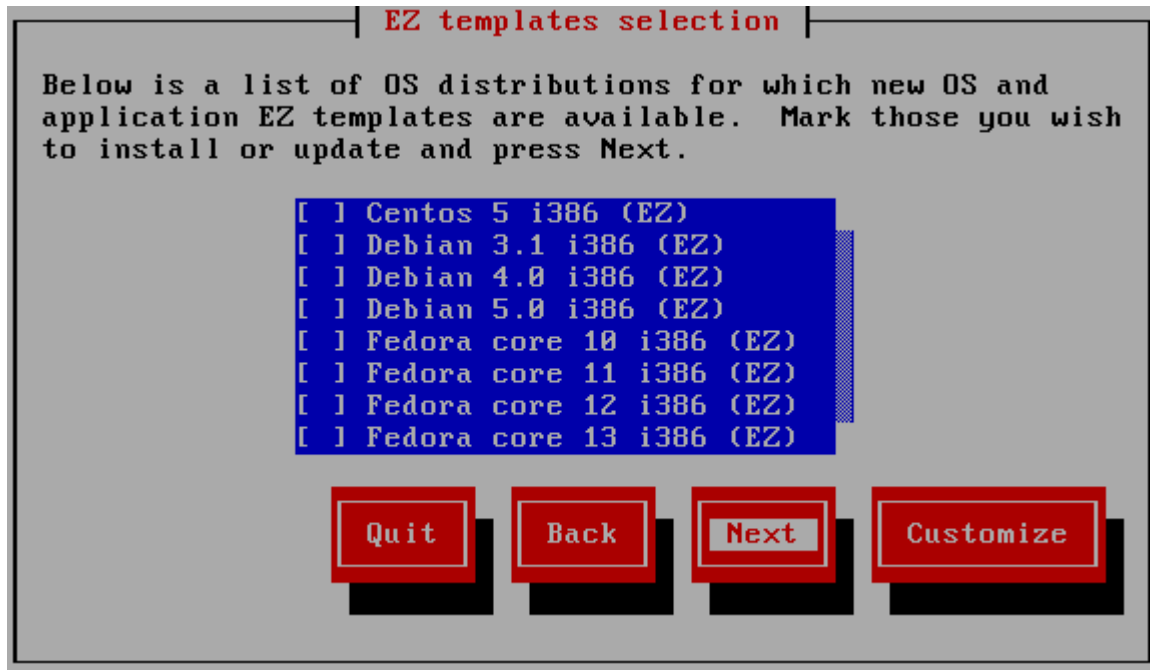
As you see, the `mysql` EZ template is now available on the Node and can be added to Containers.

Downloading and Installing EZ Templates with vzup2date

You can use the `vzup2date` utility to download new OS and application EZ templates to your server and install them there. To do this, execute the utility with the `-z` option. Once you run the utility, the **Welcome** window appears.

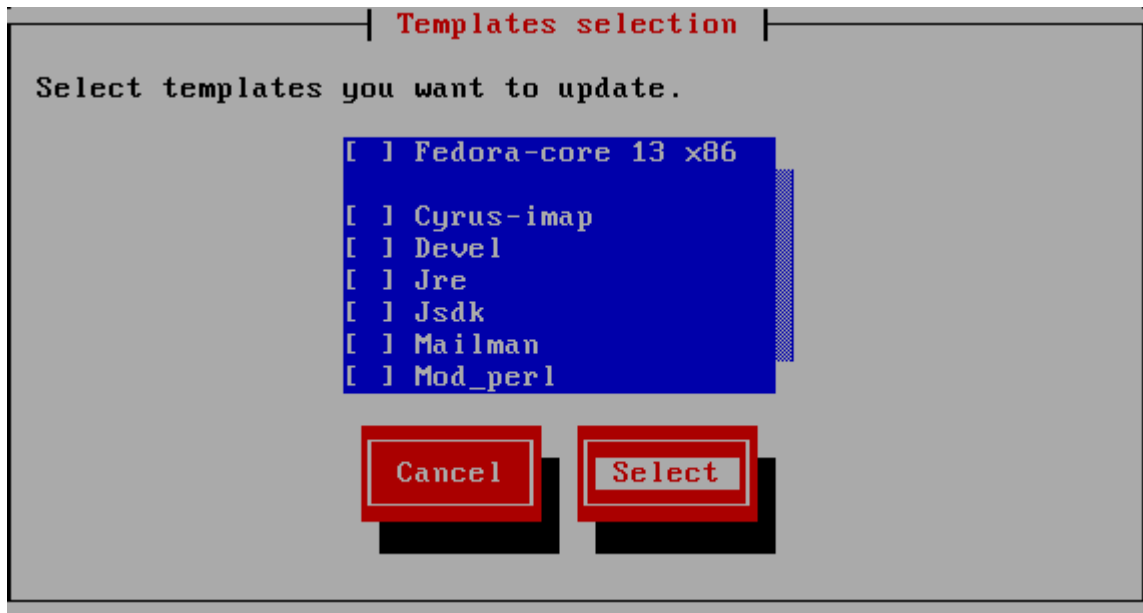


Click **Next** to connect to the Parallels repository that stores EZ templates. If the connection is successful, the **EZ Templates Selection** window is displayed listing all EZ templates that you can install on your Node.



In this window, do one of the following:

- To download and install all available EZ templates for a certain Linux distribution, select this distribution by placing the cursor beside it and pressing the space bar on your keyboard; then click **Next**.
- To download and install only certain EZ templates of the corresponding Linux distribution, place the cursor beside this distribution and press F2 on your keyboard. You will be presented with the **Templates selection** window where you can select the corresponding EZ templates.

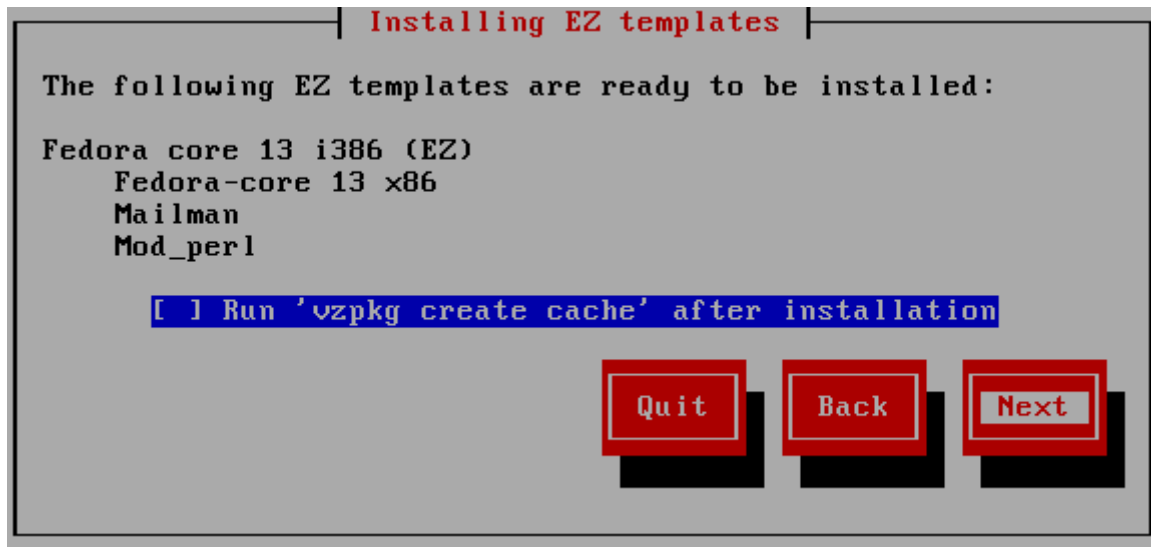


After choosing the necessary EZ templates, click the **Select** button to close the displayed window, and then click **Next** to proceed with the wizard.

Note: New application EZ templates for a Linux distribution can be installed on the Hardware Node only if the corresponding OS EZ template is already installed on this Node.

In the next step, you can review the EZ templates you selected in the previous step and scheduled for downloading and installing on your Hardware Node. If you are not satisfied with the chosen templates, click the **Back** button to return to the previous step and modify the set of templates. Otherwise, click **Next** to start downloading the templates.

Once the EZ templates have been successfully downloaded to the Hardware Node, the **Installing EZ templates** window is displayed.

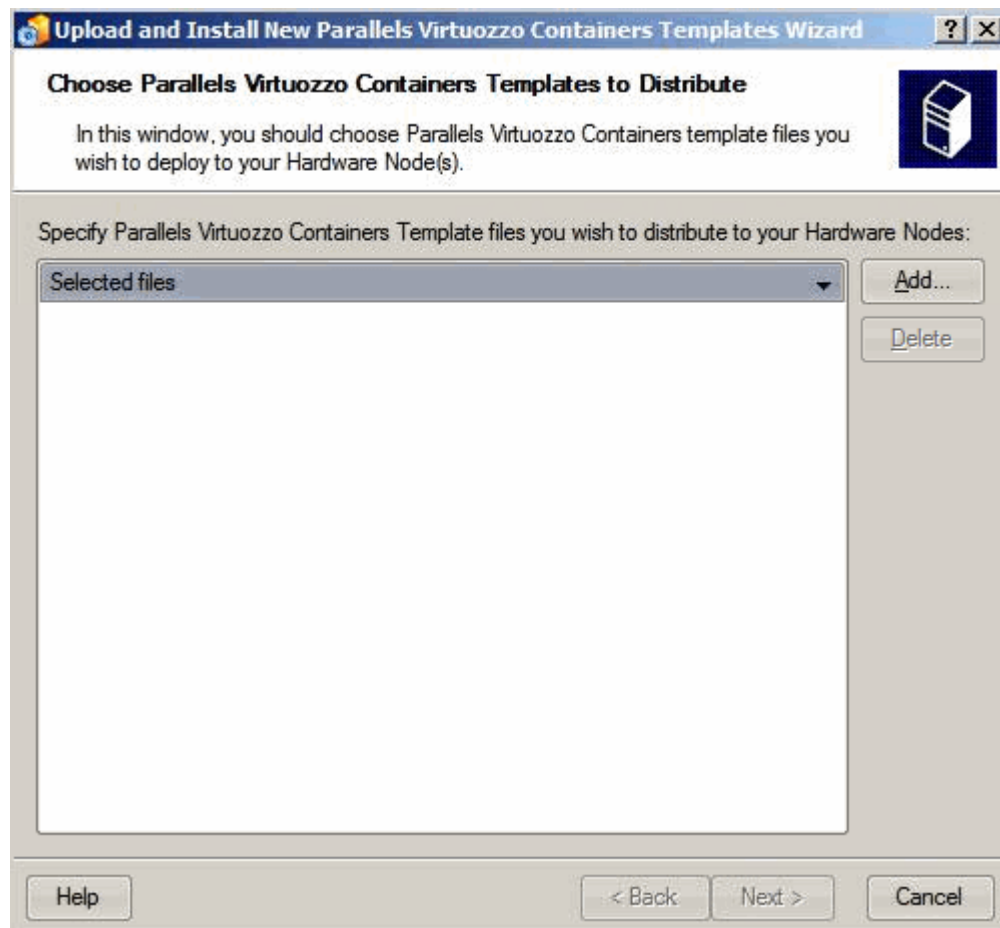


In this window, you can view the templates ready to be installed on your Node. If you are installing a new OS EZ template, you can select the **Run 'vzpkg cache' after installation** check box to cache the OS EZ template right after its installation on the Node. Clicking **Next** starts installing the EZ templates on the Hardware Node.

Uploading and Installing EZ Templates in Parallels Management Console

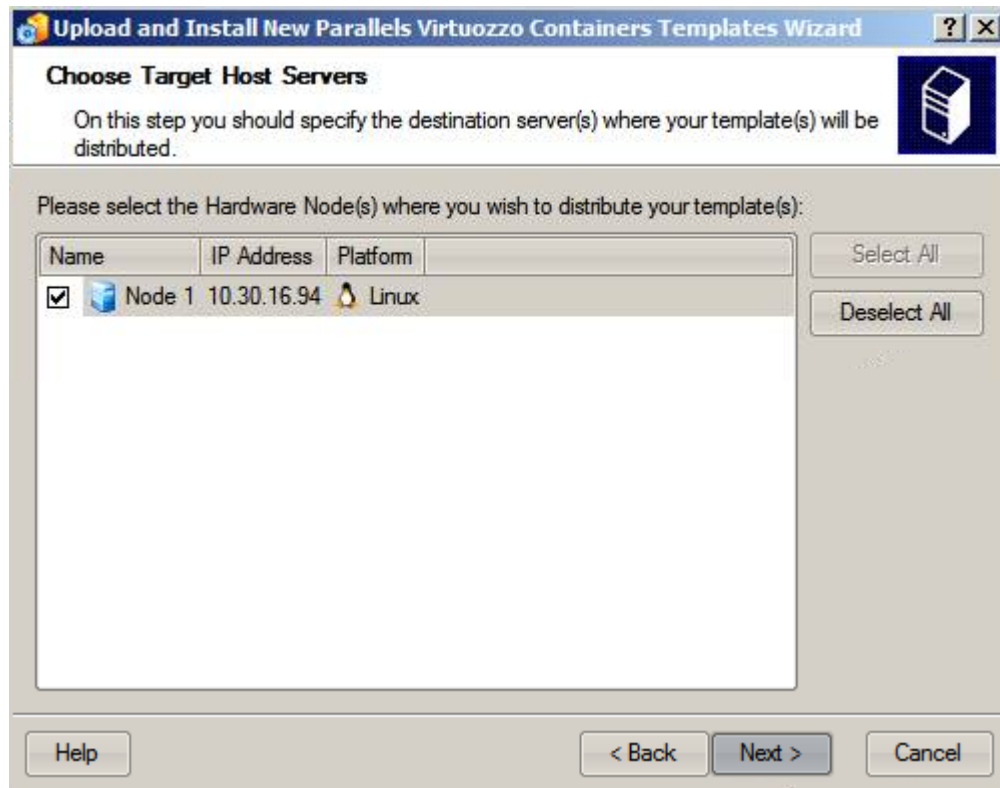
If you have one or more new EZ templates that you would like to upload and install on the Hardware Node, you should first to have these templates accessible from the workstation where Parallels Management Console is installed (e.g., insert the CD-ROM with the templates into the computer's CD-ROM drive or copy the templates to the computer hard disk) and then launch the **Upload and Install New Parallels Virtuozzo Containers Templates** wizard.

To invoke the wizard, expand the **Templates** item under any Hardware Node registered in Parallels Management Console, right-click the **Templates** item, and choose **Upload and Install New Parallels Virtuozzo Containers Templates**. The **Choose Parallels Virtuozzo Containers Templates to Distribute** window opens.



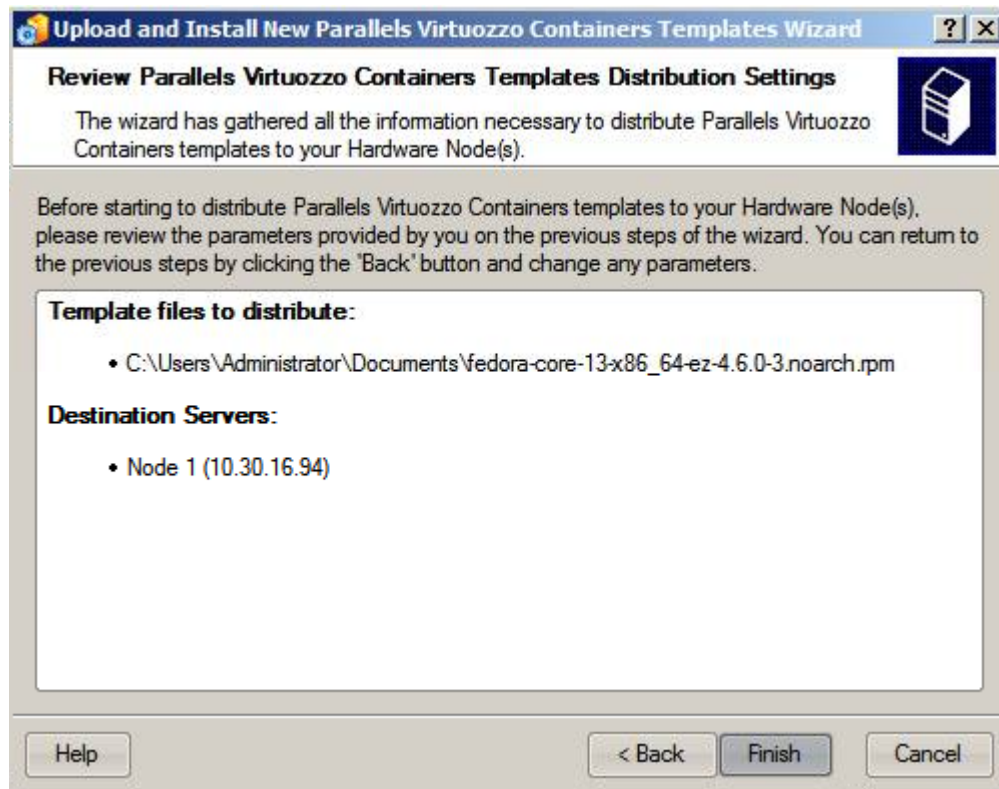
In this window, choose the EZ templates you want to deploy. To do this, click the **Add** button, and provide the path to the templates you would like to install on the Node. Click **Next**.

The next screen will prompt you to define target Hardware Nodes where you wish to add new EZ templates.



Parallels Management Console can upload and install the specified templates to any registered Hardware Node. Choose the Nodes where you wish the templates to be installed (if you have several registered Nodes), and click **Next**. If you have many Nodes, you can use the **Select All** or **Deselect All** buttons.

The last page of the wizard allows you to review the settings made in the previous steps of the wizard.



It summarizes the information provided by you in the previous steps, namely, which templates to install and where to install them. If you are satisfied with the settings, click the **Finish** button. This will launch the upload and installation process. Otherwise, click **Back** to make the necessary changes to the information entered.

Listing EZ Templates

The `vzpkg list` command allows you to list the EZ templates installed on the Node:

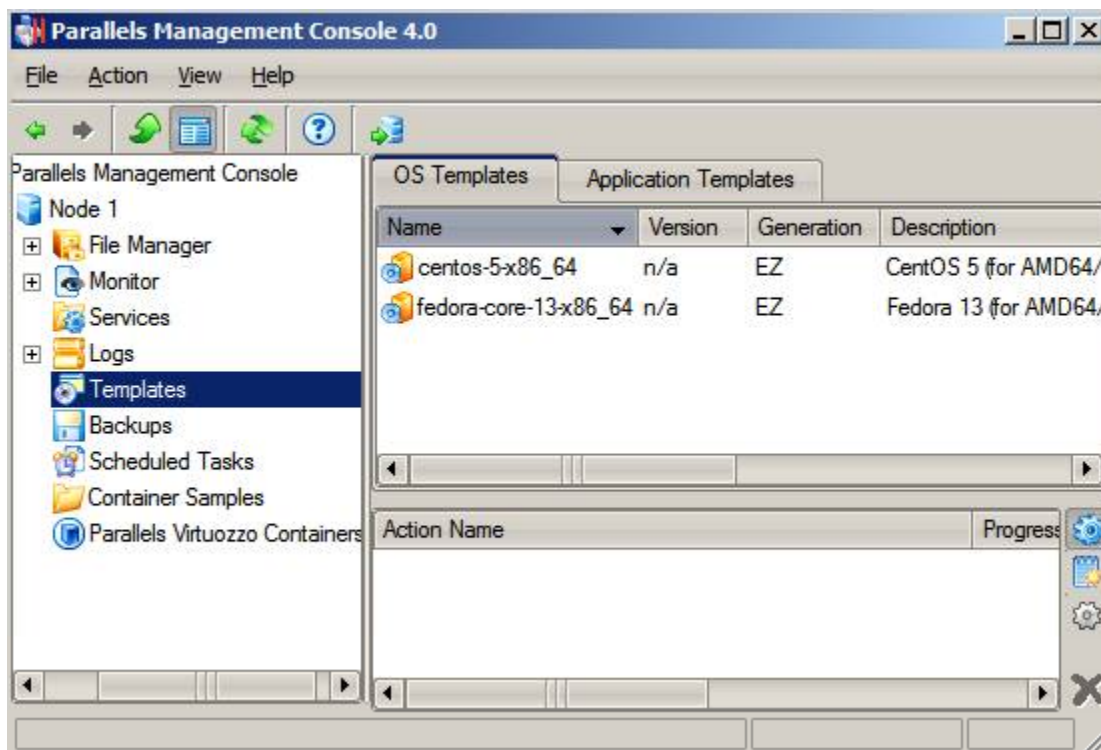
```
# vzpkg list
redhat-el5-x86
fedora-core-13-x86      2010-07-24 15:45:15
```

As you see, the `redhat-el5-x86` and `fedora-core-13-x86` EZ templates are available on the Node. The numerals next to the `fedora-core-13-x86` EZ template inform you of the date and time when software packages included in the template were updated for the last time. The absence of numerals for the `redhat-el5-x86` EZ template, in turn, indicates that the template has not yet been cached at all.

Specifying a Container ID as the parameter, `vzpkg list` prints the EZ templates used by the specified Container:

```
# vzpkg list 101
fedora-core-13-x86      2010-07-24 14:27:19
```

In Parallels Management Console, it is sufficient to choose the **Templates** item under the corresponding Hardware Node name and select either the **OS Templates** or **Application Templates** tab to see the list of the OS or application templates installed on the Node, respectively.



The information on templates is presented in the table having the following columns:

Column Name	Descriptions
Name	The name of the EZ template.
Version	The template version. EZ templates do not have versions; so this column always displays n/a.
Generation	The type of the template: 'standard' or 'EZ'. All EZ templates have the EZ legend in this column.
Description	The description of the EZ template.
Platform	The platform where the EZ template can be used.
Architecture	The system architecture where the EZ template can be used.
Cached	Denotes whether the EZ OS template has been cached or not. For EZ OS templates only.
OS	The name of the Linux distribution under which the EZ application template can be run. For EZ application templates only.

To see the EZ templates used by a particular Container, double-click the needed Container in the Container list in the right pane to open this Container management window, and then again choose the **Templates** item and click the **OS Templates** or **Application Templates** tab in the left pane of the new window.

Adding Application EZ Templates to Containers

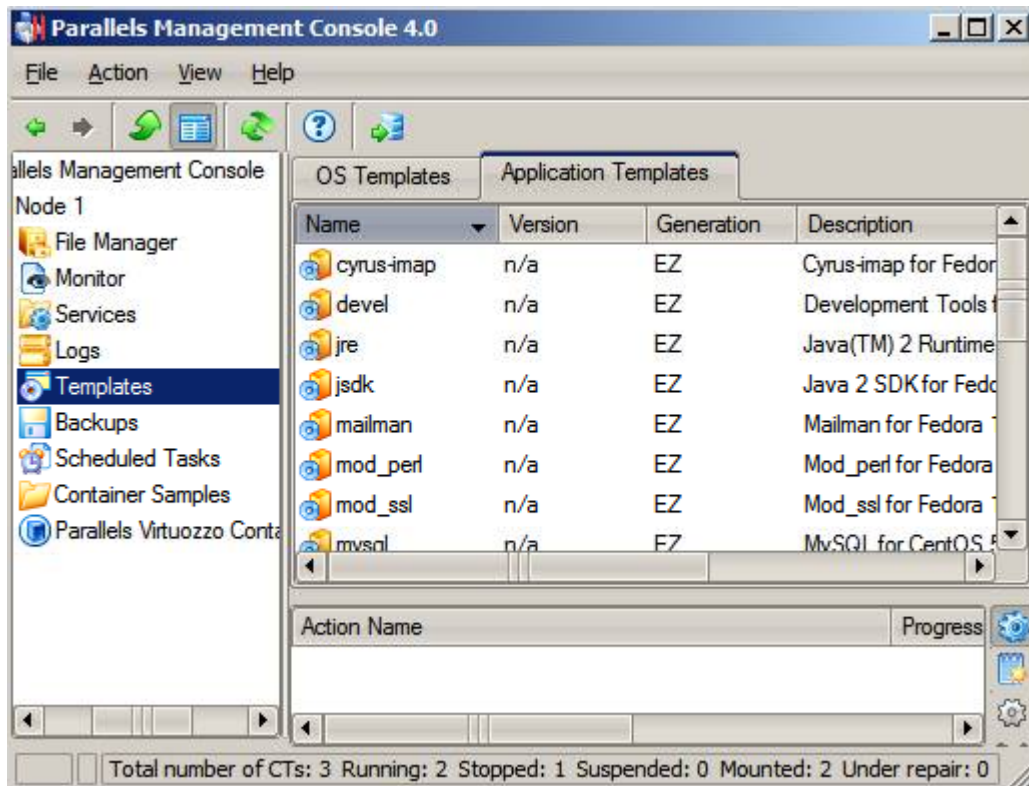
To add an application EZ template to an existing Container, you can use the `vzpkg install` command. To successfully add an application EZ template to a Container, this Container must be running.

In the example below, the `mysql` application EZ template meant for the usage with Red Hat Enterprise Linux 5 and already installed on the Hardware Node is added to Container 101:

```
# vzctl status 101
CTID 101 exists mounted running
#vzpkg list
redhat-el5-x86          2010-05-21 02:21:56
redhat-el5-x86    mysql
...
# vzpkg install 101 mysql
...
Installed:
mysql          i386          0:4.1.12-3.RHEL5.1
mysql-bench    i386          0:4.1.12-3.RHEL5.1
mysql-devel    i386          0:4.1.12-3.RHEL5.1
...
```

You can also add an application EZ template in Parallels Management Console by doing the following:

- 1 In the Parallels Management Console left pane, select the **Templates** item under the corresponding Hardware Node name, and then click the **Application Templates**.



- 2 In the Parallels Management Console right pane, right-click the application EZ template to add to the Container, and choose **Install Into Containers**.
- 3 Select the check boxes of the Containers where the application EZ template is to be added, and click **Next**. You can use the **Select All/Deselect All** buttons to select/deselect all Containers listed in the **Choose Target Containers** window.

Note: To facilitate working with your application EZ templates, you can select the check box at the bottom of the window to display only the Containers running the Linux distributions that are compatible with the given application EZ template.

- 4 On the next screen, you can select the **Force template installation** check box to force the template installation inside the Container. In this case no dependencies and no available versions of the application template will be checked during its installation, which may cause the installed application template to malfunction.
- 5 The last window allows you to review the information entered on the previous steps. If you are satisfied with the data entered, click **Finish** to start adding the application EZ template to the Container; otherwise, click **Back** and change the necessary parameters.

If you are adding an EZ template to only one Container, you can as well do the following:

- 1 Open the list of Containers in the Parallels Management Console main window by selecting the **Parallels Virtuozzo Containers** item in the Hardware Node tree.
- 2 Double-click the name of the Container where you want to add the EZ template.
- 3 Select the **Templates** item in the main tree of the opened Container Manager, click the **Application Templates** tab, right-click somewhere in the top part of the Management Console right pane, and choose **Add Application Template**.
- 4 Follow the instructions of the wizard.

Alternatively, you can:

- 1 Open the list of Containers in the Parallels Management Console main window.
- 2 Right-click the Container where you want to add the template, and choose **Templates > Add/Update Templates**.
- 3 Follow the instructions of the wizard.

Keeping EZ Templates Up To Date

Parallels Virtuozzo Containers allows you to update OS and application EZ templates as follows:

- Update any of the EZ templates installed on the Node.
- Update the caches of OS EZ templates installed on the Node.
- Update the packages that are included in the EZ templates (OS and application) applied to specific Containers.

All the aforementioned operations are described in the following subsections in detail.

Updating EZ Templates on Hardware Node

Sometimes, you may need to update one or more EZ templates (either OS or application) installed on your Node. The process of updating EZ templates consists in updating one or more EZ template configuration files located in the

`/vz/template/<os_name>/<os_version>/<arch>/config` directory on the Node.

Parallels Virtuozzo Containers allows you to use one of the following tools to update the EZ templates installed on the Node:

- the `vzup2date` utility
- the `vzpkg update template` utility
- Parallels Management Console

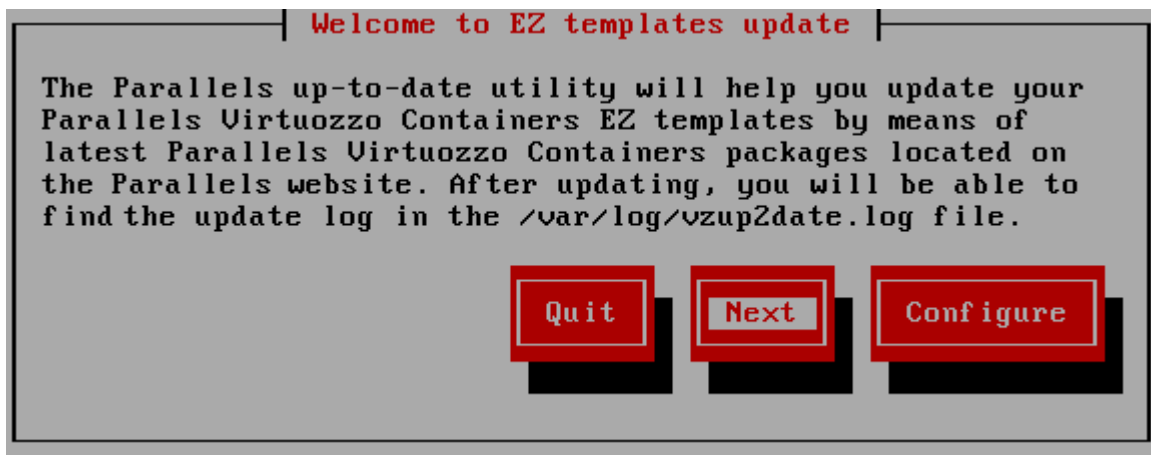
Updating Templates with vzup2date

The `vzup2date` utility allows you to update any of the EZ templates installed on the Node. This utility can also be used to download new EZ templates to the Node and install them there.

`vzup2date` can be launched in two modes:

- graphical mode
- command line mode

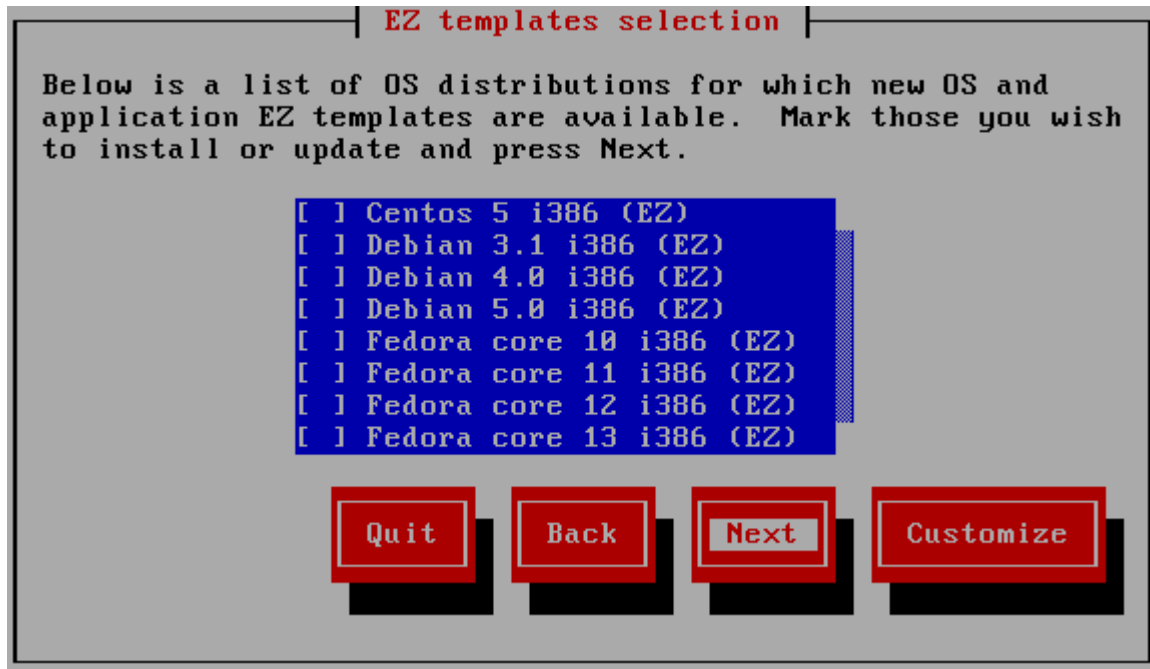
Updating EZ templates in the graphical mode takes place if you have executed the `vzup2date` utility with the `-z` option. After launching the utility, you will be presented with a greeting screen:



In this window, do one of the following:

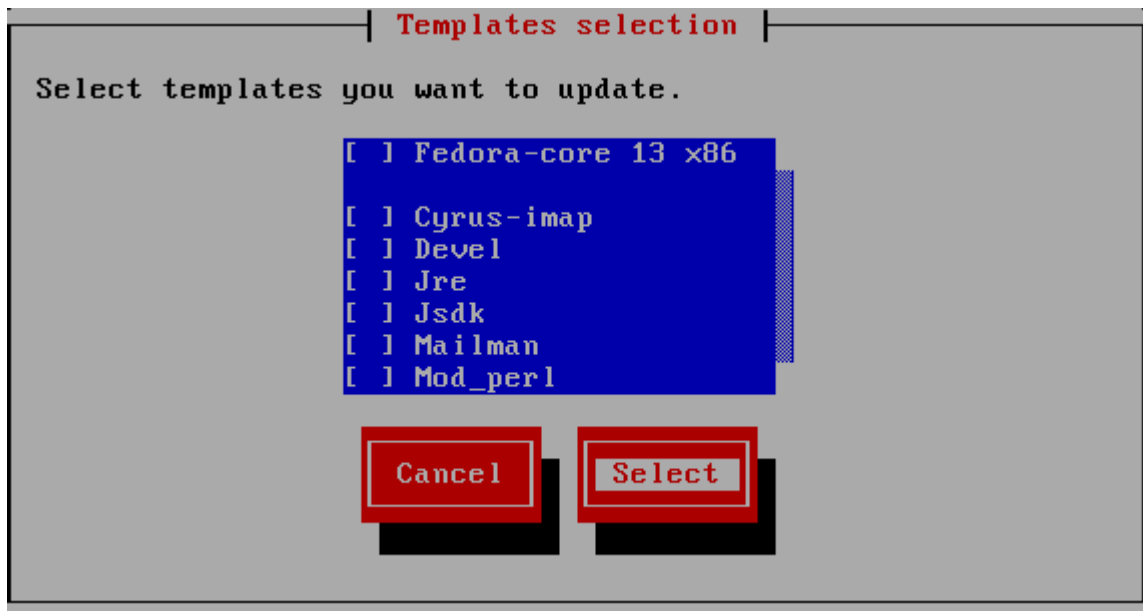
- Click the **Next** button to connect to the repository storing the latest EZ templates (either the Parallels default repository or your own one).
- Click the **Configure** button to configure the parameters used to connect to the EZ templates repository.

As soon as you press **Next** in the **Welcome** window, the utility will try to connect to the EZ templates repository (either the Parallels default repository or your own one) and, if the connection is successful, display the **EZ Templates Selection** window listing all EZ templates that have one or more updates available or that are not installed on your Node at all.



This window allows you do one of the following:

- If you wish to download and install all available EZ templates/template updates for a certain Linux distribution, select this distribution by placing the cursor beside it and pressing the space bar on your keyboard; then click **Next**.
- If you wish only certain EZ templates of the corresponding Linux distribution to be installed/updated on the Node, place the cursor beside this distribution and press F2 on your keyboard. You will be presented with the **Templates selection** window where you can select the corresponding EZ templates:

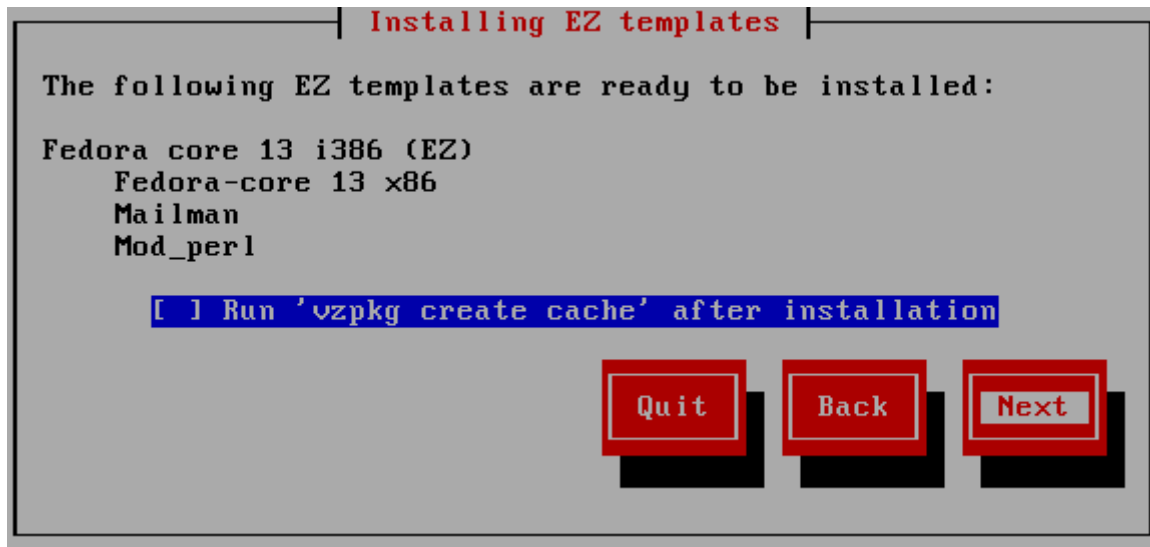


After choosing the right EZ templates, click the **Select** button to close the displayed window, and then click **Next** to proceed with the wizard.

Note: New application EZ templates for a Linux distribution can be installed on the Node only if the corresponding OS EZ template is already available on it.

In the next step, you can review the EZ templates/template updates you selected on the previous step and scheduled for downloading and installing on your Node. If you are not satisfied with the chosen templates/template updates, click the **Back** button to return to the previous step and modify the set of templates; otherwise, click **Next** to start downloading the templates/template updates to the Node.

After the EZ templates/template updates have been successfully downloaded to the Node, the **Installing EZ template** window is displayed.



In this window you can view the templates/template updates ready to be installed on your Node. If you are installing a new OS EZ template/template update, you can make use of the **Run vzpkg cache after installation** check box to cache the corresponding OS EZ template/template update right after its installation on the Node. By default, all OS EZ templates are just installed on the Node without being cached; however, you can select the provided check box and schedule your OS EZ template/template update for caching. Clicking **Next** starts installing the selected EZ templates/template updates on the Node. By the time the wizard finishes you should have updated OS and application EZ templates on your system.

Another way of updating your EZ templates is to run the `vzup2date` utility in the command line mode, which can be done by passing the corresponding commands, switches, and options to `vzup2date`. For example, the following command will update the `fedora-core-13-x86` OS EZ template to the latest version:

```
# vzup2date -z -m batch install fedora-core-13-x86
```

Detailed information on all options that can be passed to the `vzup2date` utility is given in the *Parallels Command Line Reference Guide*.

Updating Templates With `vzpkg update template`

Another way of updating your EZ templates installed on the Node is to use the `vzpkg update template` utility. This utility allows you to update OS or application EZ templates from the corresponding local RPM packages. For example, you can execute the following command to update the CentOS 5 OS EZ template installed on the Node from the `centos-5-x86-ez-4.7.0-3.noarch.rpm` package located in the `/root` directory:

```
# vzpkg update template /root/centos-5-x86-ez-4.7.0-3.noarch.rpm
```

You can update a number of EZ templates at once by specifying the corresponding packages and separating them by spaces. For example, the following command

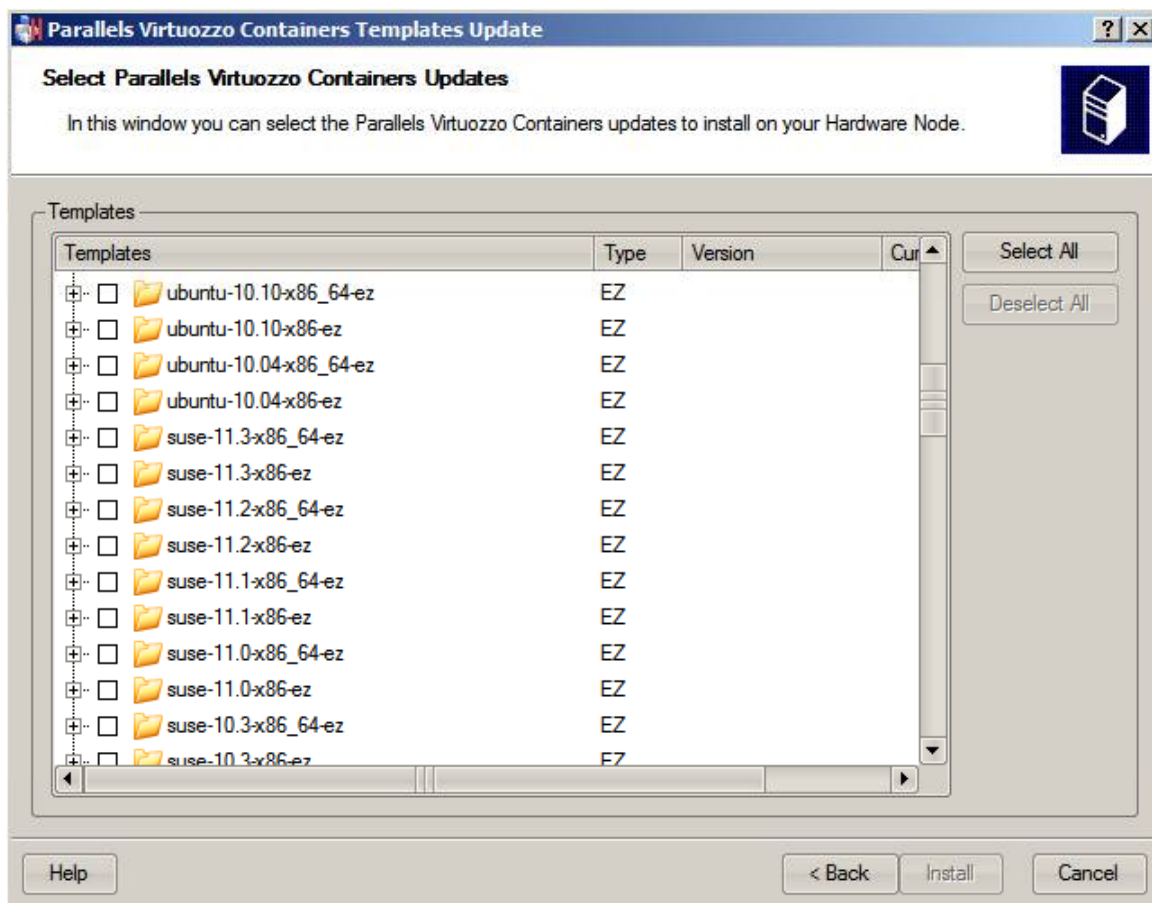
```
# vzpkg update template /root/centos-5-x86-ez-4.7.0-3.noarch.rpm /root/redhat-el5-x86-ez-4.7.0-3.noarch.rpm
```

simultaneously updates the CentOS 5 and Red Hat 5 OS EZ templates installed on the Node.

Updating Templates in Parallels Management Console

Parallels Management Console provides you with the **Templates Update** wizard allowing you to update any of EZ templates installed on your Hardware Node. You can also use this wizard to download new EZ templates to the Hardware Node and install them there. To invoke the **Templates Update** wizard, right-click the **Templates** item under the corresponding Hardware Node name, and choose **Check for Template Updates**. When launched, the wizard tries to connect to the EZ templates repository (either the Parallels default repository or your own one) and, if the connection is successful, display the **Select Updates** window. This window list all EZ templates that have one or more updates available or that are not installed on your Node at all. For example:

Note: If the connection to the Parallels Virtuozzo Containers update server cannot be established, you will be presented with the **Repository Update Settings** window where you will be asked to provide the correct information to connect to the update server. Detailed information on how to change the parameters in this window is given in the **Checking Parallels Virtuozzo Containers Update Server Settings** subsection of the *Parallels Virtuozzo Containers 4.7 User's Guide*.



In this window, you can do one of the following:

- To download and install all available EZ templates/template updates for a certain Linux distribution, click the **Next** button to go to the next step of the wizard.
- To download and install only certain EZ templates of a Linux distribution, click on the plus sign next to the corresponding Linux distribution to display the list of application templates available for this distribution. You can then get detailed information about a particular template by selecting the corresponding template and viewing its data in the right part of the displayed window. By default, all new templates/template updates are set for downloading to and installing on the Hardware Node. To prevent this or that EZ template from being downloaded/installed, just clear its check box. When you are ready, click **Next**.

Click **Finish** to start installing the selected EZ templates/EZ template updates on the Hardware Node.

Updating OS EZ Template Caches

With the release of new updates for the corresponding Linux distribution, the created OS EZ template cache can become obsolete. So, Parallels Virtuozzo Containers provides the `vzpkg update cache` command allowing you to quickly update any of the OS EZ template caches available on the Hardware Node.

Note: If you are going to update the cache of a commercial OS EZ template (e.g. Red Hat Enterprise Server 5 or SLES 10), you should first update software packages in the remote repository used to handle this OS EZ template and then proceed with updating the EZ template cache. Detailed information on how to manage repositories for commercial Linux distributions is provided in the **Setting Up Repositories and Proxy Servers for EZ Templates** [section](#) (p. 27).

When executed, `vzpkg update cache` checks the `cache` directory in the template area (by default, the template area is located in `/vz/template`) on the Hardware Node and updates all existing tarballs in this directory. However, you can explicitly indicate the tarball for what OS EZ template should be updated by specifying the OS EZ template name. For example, to update the tarball for the `fedora-core-13-x86` OS EZ template, you can execute the following command:

```
# vzpkg update cache fedora-core-13-x86
Loading "rpm2vzrpm" plugin
Setting up Update Process
Setting up repositories
base0          100% |=====| 951 B 00:00
base1          100% |=====| 951 B 00:00
base2          100% |=====| 951 B 00:00
base3          100% |=====| 951 B 00:00
...
```

Upon the `vzpkg update cache` execution, the old tarball is renamed by receiving the `-old` suffix (for example, `fedora-core-13-x86.tar.gz-old`):

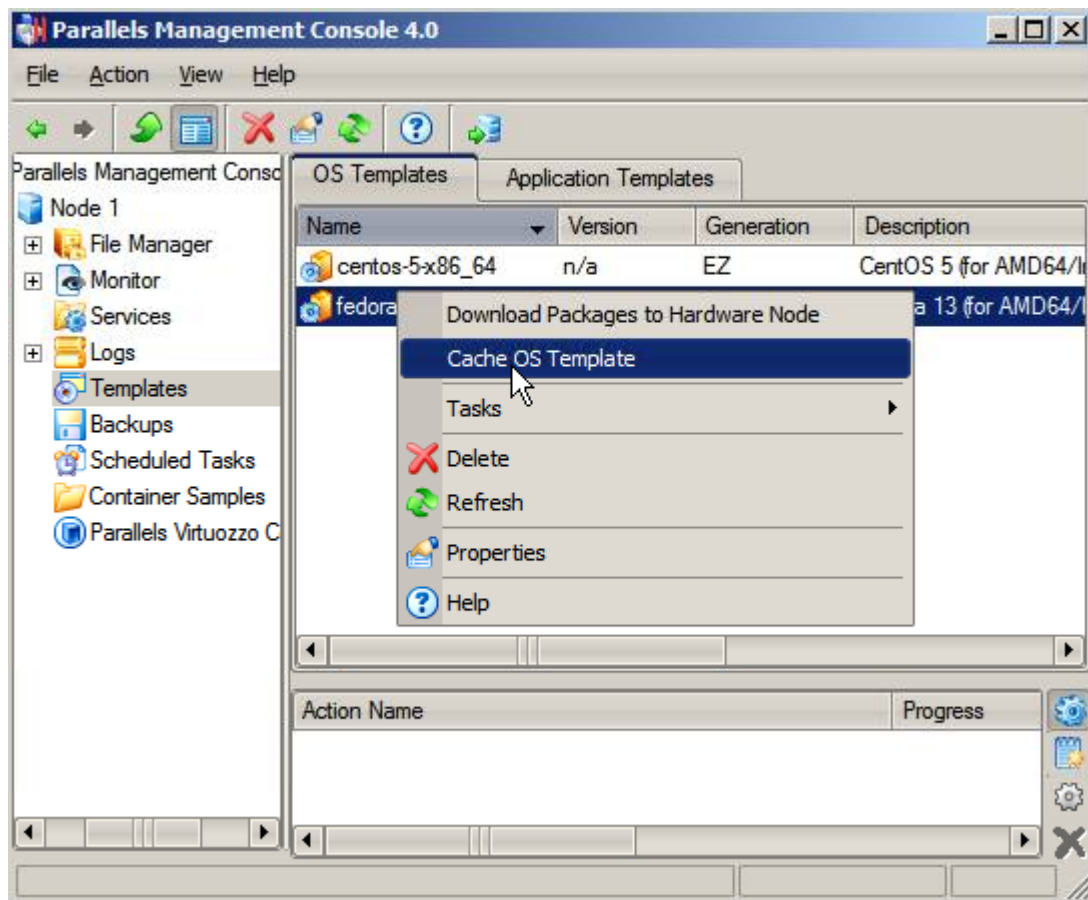
```
# ls /vz/template/cache
fedora-core-13-x86.tar.gz  fedora-core-13-x86.tar.gz-old
```

You can also pass the `-f` option to `vzpkg update cache` to remove an existing tar archive and create a new one instead of it.

If the `vzpkg update cache` command does not find a tarball for one or several OS EZ templates installed on the Node, it creates tar archives of the corresponding OS EZ templates and puts them to the `/vz/template/cache` directory.

To update an OS EZ template cache in Parallels Management Console, do the following:

- 1 Select the **Templates** item under the corresponding Hardware Node name in the Management Console left tree.
- 2 In the Parallels Management Console right pane, click the **OS Templates** tab to display the list of OS templates installed on the Node.
- 3 Right-click the template to cache in the right pane, and choose **Cache OS Template**.



Updating EZ Templates Packages In Containers

Parallels Virtuozzo Containers allows you to update software packages of the OS EZ template a Container is based on and of any application EZ templates applied to the Container. You can do this by using the `vzpkg update` utility. Assuming that Container 101 is based on the `redhat-e15-x86` OS EZ template, you can run the following command to update all packages included in this template:

```
# vzpkg update 101 redhat-e15-x86
...
Updating: httpd                ##### [1/4]
Updating: vzdev                ##### [2/4]
Cleanup : vzdev                ##### [3/4]
Cleanup : httpd                ##### [4/4]

Updated: httpd.i386 0:2.0.54-10.2 vzdev.noarch 0:1.0-4
Complete!
Updated:
httpd          i386          0:2.0.54-10.2
vzdev          noarch        0:1.0-4
```

Notes:

1. You can update templates in running Containers only.
2. If you are going to update the cache of a commercial OS EZ template (e.g., Red Hat Enterprise Server 5 or SLES 10), first update software packages in the remote repository used to handle this OS EZ template and then proceed with updating the EZ template cache. Detailed information on how to manage repositories for commercial Linux distributions is provided in the **Setting Up Repositories and Proxy Servers for EZ Templates** [section](#) (p. 27).

As you can see from the example above, the `httpd` and `vzdev` applications have been updated for the `redhat-e15-x86` OS EZ template. To update all EZ templates (including the OS EZ template) inside Container 101 at once, execute the following command:

```
# vzpkg update 101
...
Running Transaction
  Updating : hwdata                ##### [1/2]
  Cleanup  : hwdata                ##### [2/2]

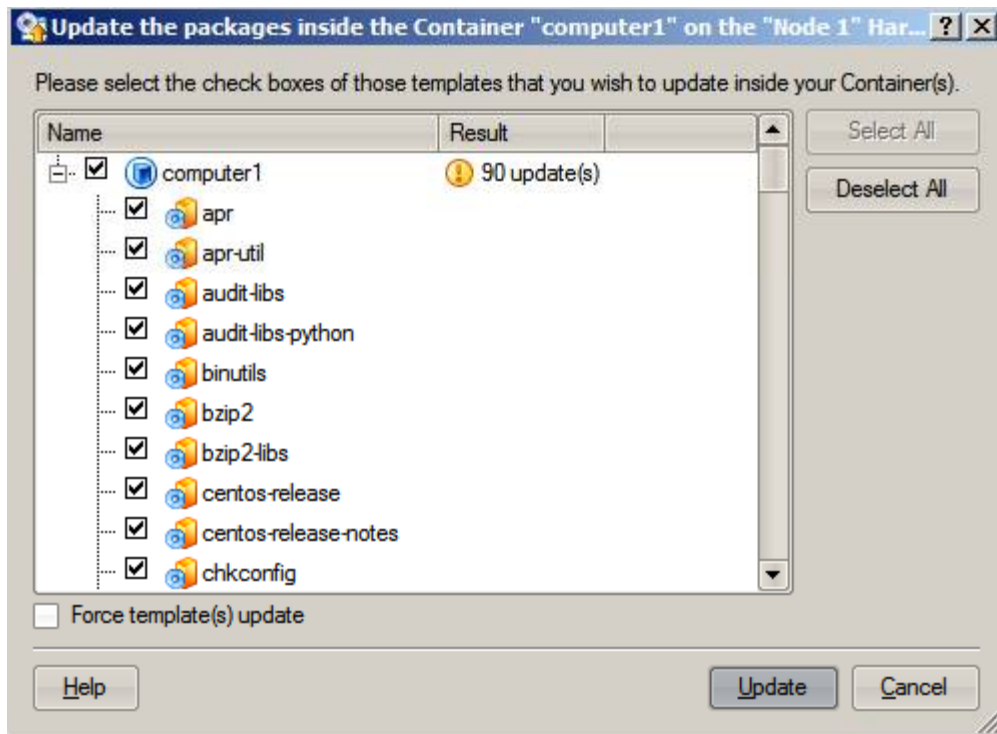
Updated: hwdata.noarch 0:1.0-3
Complete!
Updated:
hwdata          noarch        0:0.158.1-1
```

In the example above, only the `hwdata` package inside Container 101 was out of date and updated to the latest version.

In Parallels Management Console, do the following to update the OS EZ template a Container is based on and/or any of its application EZ templates:

- 1 Open the list of Containers by selecting the **Parallels Virtuozzo Containers** item in the Hardware Node tree.

- 2 Double-click the name of the Container where you want to add an EZ template. The Container Manager opens.
- 3 Click the **Templates** item in the main tree of the Container Manager.
- 4 In the Container Manager right pane, click the **OS Templates** or **Application Templates** tab depending on what EZ template you wish to update.
- 5 Right-click the corresponding EZ template, and choose **Update Installed Packages**.
- 6 In the **Select Updates** window, all available Linux distributions are shown that fit your Parallels Virtuozzo Containers installation.



In this window, you can do one of the following:

- To download and install all available EZ templates/template updates for a certain Linux distribution, click the **Finish** button to start updating to start updating your templates on the Hardware Node.
- To download and install only certain EZ templates of a Linux distribution, click on the plus sign beside the corresponding Linux distribution to display a list of application templates available for this distribution. You can then get detailed information about a particular template by selecting the corresponding template and viewing its data in the right part of the displayed window. By default, all new templates/template updates are set for downloading to and installing on the Hardware Node. To prevent an EZ template from being downloaded/installed, just clear its check box. When you are ready, click **Finish**.

On this screen, you can also select the **Force templates installation** check box to force the EZ template installation inside the Container. In this case no dependencies and no available versions of the application EZ template will be checked during its installation, which may cause the application EZ template to malfunction.

Creating Historical Mirrors for Backed Up Containers

If you have one or several Containers that are based on OS EZ templates and that were backed up long time ago, you may come across problems when trying to restore them on a destination server other than the source server (i.e. the Node where the Containers were hosted during their backing up). This may happen when the following conditions are simultaneously met:

- The destination server does not have one or several software packages included in the OS EZ template the Container being restored is based on.
- The missing packages are not available in the public repositories set to handle the OS EZ template; so, they cannot be downloaded and installed on the destination server. The absence of certain software packages in the public repositories may come out of the fact that some packages that were installed in the Container at the moment of its backing up have become obsolete in the course of time and been replaced with newer versions.

To avoid the aforementioned problems in the future, you can create the so-called 'historical' mirrors which will store an archive of all software packages present in the public repositories and containing the packages installed in the Container during its backing up.

Let us assume that you backed up a number of Containers based on the Fedora 13 OS EZ template. Now to be sure that you always have a repository containing all the necessary RPM packages for your backed up Containers, you wish to create a historical mirror of an official Fedora 13 repository. In our example below, we presume the following:

- The historical mirror will be located inside Container 101. You can use any OS template to base the Container on.

Note: We recommend that you always place your local repositories inside separate Containers to not compromise the Node security. In particular, it is of significant importance if you are going to provide access to your repositories through the `http` and `ftp` protocols.

- Container 101 is started and has the IP address of `123.145.145.123` assigned to it.
- The mirror will be created on a web server, i.e. it can be accessed from other networks through the `http` protocol.
- The `apache` web server is installed and running inside Container 101; the default document root for `apache` is `/var/www/html`, i.e. the `apache` web server stores its sites in the `/vz/root/101/var/www/html` directory on the Node.
- The `apache` user and group inside Container 101 are `apache`.

To create a historical mirror for Fedora 13, you should perform the following operations:

- 1 Change to the `/vz/root/101/var/www/html` directory and create the `fed8mirror` subdirectory within it:

```
# cd /vz/root/101/var/www/html
```

```
# mkdir fed13mirror
```

The `fed13mirror` subdirectory will store an archive of the Fedora 10 repository.

2 Change to the `fed10mirror` subdirectory

```
# cd fed13mirror
```

and execute the following command:

```
# rsync -av http://ftp.rhd.ru/pub/fedora/linux/releases/13/Everything/i386/os
```

This command will make a copy of the entire Fedora 13 repository located at `http://ftp.rhd.ru/pub/fedora/linux/releases/13/Everything/i386/os`. Keep in mind that it may take a rather long run to copy all RPM packages to Container 101 depending on your bandwidth and the load on the Fedora mirror server.

Note: You can use any alternative Web or FTP site containing the Fedora 10 repository instead of the one indicated above.

3 Add your historical mirror to the list of repositories to be checked while performing operations on EZ templates related to Fedora 13 (in particular, while restoring Fedora-based Container backups). You can do it as follows:

- Create the `/vz/template/fedora-core/13/x86/config/os/default/repositories` file on the Node, if it is not yet present.
- Add the following string to the file:

```
http://123.145.145.123/var/www/html/fed13mirror
```

- Save the file.

Copying EZ Templates to Another Hardware Node

Parallels Virtuozzo Containers allows you to copy the installed OS and application EZ templates from one Hardware Node to another using the `vzmtemplate` utility. For example, you can copy the `fedora-core-13-x86` OS template installed on the Source Node to the Destination Node with the IP address of `192.168.0.9` by executing the following command:

```
# vzmttemplate -z root@192.168.0.9 fedora-core-13-x86
root@192.168.0.9's password:
Connection to Destination Node (192.168.0.9) is successfully established
Copying Template ".fedora-core-13-x86"
...
```

During the command execution, `vzmtemplate` will do the following:

- 1 Ask you for the password of the `root` user on the Destination Node.
- 2 Check whether the `fedora-core-13-x86` OS EZ template already exists on the Destination Node. If this templates is installed on the Destination Node, the command will exit.
- 3 Copy the `fedora-core-13-x86` configuration files from the Source Node to the Destination Node. Keep in mind that the `fedora-core-13-x86` OS EZ template is not removed from the Source Node.
- 4 Run the `vzpkg create cache` command on the Destination Node to cache the OS EZ template and prepare it for the Container creation. Detailed information on this command is provided in the **Preparing OS EZ Templates for Creating Containers** [section](#) (p. 43).

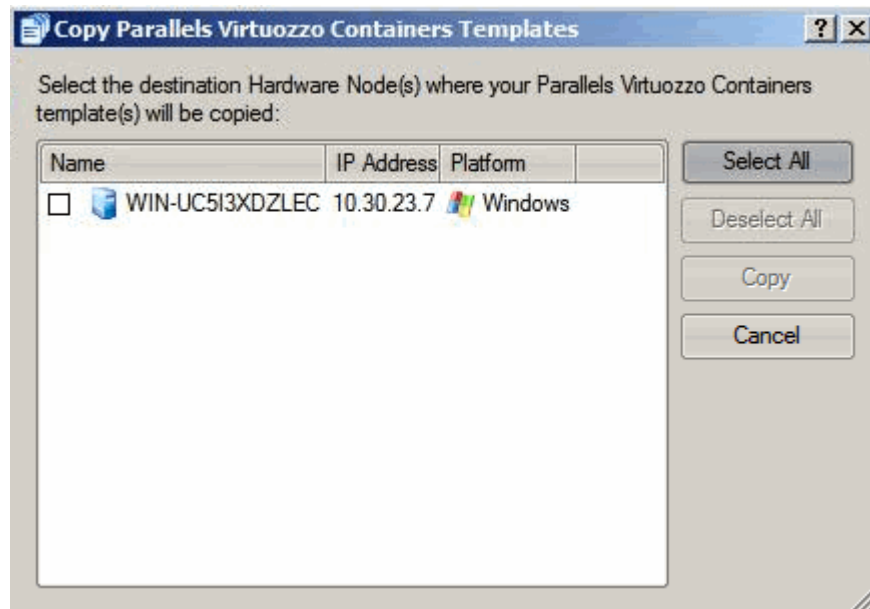
Note: If you are going to copy an application EZ template, you should make sure that the corresponding OS EZ template (i.e. the OS template with which the application EZ template can be used) is installed on the Destination Node; otherwise, the operation will fail.

To check that the `fedora-core-13-x86` OS template has been successfully copied to the Destination Node, you can run the following command on this Node:

```
# vzpkg list
fedora-core-13-x86                2010-08-09 07:05:39
```

In Parallels Management Console, you can copy the installed OS and application EZ templates from the Source Node to any other Node registered in Parallels Management Console by doing the following:

- 1 Select the **Templates** item under the Hardware Node name where the template to be copied is installed, and click either the **OS Templates** or **Application Templates** tab depending on whether you wish to copy an OS or application template, respectively.
- 2 In the Management Console right pane, right-click the template, and choose **Tasks > Copy to Another Hardware Node**.



In the displayed window, you can view the list of Hardware Nodes currently registered in Parallels Management Console. You can copy the template to any of the listed Nodes provided it is compatible with the Host OS installed on this Node. To do this, select the check box next to the template name, and click the **Copy** button to the right of the table.

Removing Application EZ Templates From Containers

The `vzpkg remove` command allows you to remove one or several application EZ templates from a Container. A session below shows you an example how to remove the `mysql` EZ template from Container 101:

```
# vzpkg list 101
redhat-el5-x86                2010-05-21 02:21:56
redhat-el5-x86  mysql         2010-05-21 05:36:42
# vzpkg remove 101 mysql -w
vzpkg remove 101 mysql
Removed:
mysql
mysql-server
mysql-devel
mysql-bench
perl-DBD-MySQL
# vzpkg list 101
redhat-el5-x86                2010-05-21 02:21:56
```

You can see that the `mysql` EZ template has been successfully removed from Container 101. The `-w` option tells the `vzpkg remove` command to also delete from the Container all packages having interdependencies with `mysql`.

To remove an application EZ template from a Container in Parallels Management Console, do the following:

- 1 Open the list of Containers by selecting the **Parallels Virtuozzo Containers** item in the Hardware Node tree.
- 2 Double-click the name of the Container where from you want to delete a template to open the Container Manager.
- 3 Select the **Templates** item in the main tree of the Container Manager, and click the **Application Templates** tab to see the list of application templates currently applied to the Container.
- 4 Right-click the application template you wish to delete, and choose **Delete**.
- 5 Confirm your decision by clicking the **Remove** button in the displayed dialog window. In this window you can also do the following:
 - Select the **Forced removal** check box to force the template deletion from the Container.
 - Select the **Remove dependent packages** check box to also remove the packages having dependencies with the template.

Removing EZ Templates From the Hardware Node

The `vzpkg remove template` command allows you to remove from the Hardware Node those EZ OS and application templates that you do need any more. The process of removing an EZ template includes deleting all the RPM packages comprising this template and all the caches available for this template (for EZ OS templates only). Keep in mind that the template to be removed must not be used by any Container; otherwise, the template deletion will fail. A session below demonstrates how to remove the `redhat-el5-x86` EZ OS template from the Hardware Node:

```
# vzpkg list
redhat-el5-x86                2010-07-16 12:50:17
fedora-core-13-x86           2010-07-18 14:23:12
# vzpkg remove template redhat-el5-x86
redhat-el5-x86 template was removed
# vzpkg list
fedora-core-13-x86           2010-07-18 14:23:12
```

To remove an EZ application template from the Node, additionally specify the `-F` option after the `vzpkg remove template` command. This option denotes the EZ OS template with which the EZ application template is compatible. For example, the following command can be used to remove the `mailman` EZ application template that is intended for running under RHEL 5 from your Node:

```
# vzpkg remove template -F redhat-el5-x86 mailman
redhat-el5-x86 mailman template was removed
```

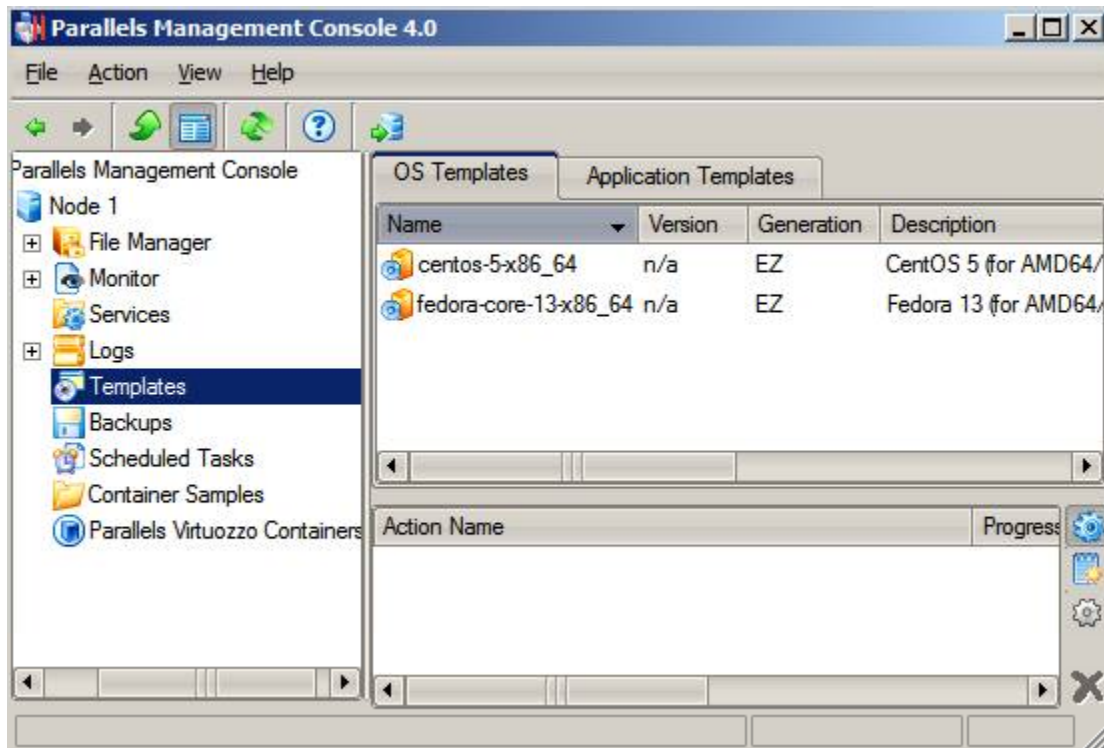
You can also remove several EZ templates at once by specifying their names after `vzpkg remove template` and separating them by spaces. However, when handling application templates, keep in mind that you can delete only those application templates that relate to one and the same EZ OS template. For example:

```
# vzpkg remove template -F redhat-el5-x86 sitebuilder4 mailman
redhat-el5-x86 sitebuilder4 template was removed
redhat-el5-x86 mailman template was removed
```

In this example the `sitebuilder4` and `mailman` EZ application templates intended to run under RHEL 5 have been successfully removed from the Hardware Node.

To remove one or more EZ templates in Parallels Management Console, do the following:

- 1 In the left pane of the Parallels Management Console main window, expand the Hardware Node where the template to be deleted is installed, and select the **Templates**.



- 2 In the right pane of the Parallels Management Console main window, do one of the following:
 - If you want to remove an EZ OS template from the Hardware Node, go to the **OS Templates** tab, right-click the EZ OS you wish to remove, and choose **Delete**.
 - If you want to remove an EZ application template from the Hardware Node, go to the **Application Templates** tab, right-click the EZ application template you wish to remove, and choose **Delete**.
- 3 Confirm your decision by clicking the **Remove** button in the displayed dialog window. In this window you can also do the following:
 - Select the **Forced removal** check box to force the template deletion from the Hardware Node.
 - Select the **Remove dependent packages** check box to also remove the packages having dependencies with the template.

Converting Containers Based on Standard Templates

You can use the `vzveconvert` utility to convert your existing Containers based on standard OS templates (and possibly having a number of standard application templates applied to them) to the EZ template-based ones. Let us assume that you wish to transform Container 101 based on the `fedora-core-3` standard OS template and having the `psa-fc3` standard application template applied to it and make it use the corresponding EZ templates: the `fedora-core-4-x86` OS and the `plesk8` application EZ templates. To this effect, you can issue the following command on the Hardware Node:

Note: You are highly recommended to back up a Container before starting to convert it.

```
# vzveconvert 101
```

During the command execution, the following main operations are performed:

- 1 The `vzveconvert` utility checks if the `fedora-core-4-x86` EZ OS template and the `plesk8` EZ application templates are installed on the Hardware Node. If any of these EZ templates cannot be found on the Node, the command will fail.
- 2 The `pre-fedora-core-4` script located in the `/usr/share/vztt/convert/scripts` directory on the Hardware Node is executed. This script is meant to perform a number of pre-upgrade operations in the Container context.
- 3 The packages comprising the `fedora-core-3` standard OS template and the `psa-fc3` standard application template are compared with those available in the repositories for the `fedora-core-4-x86` EZ OS template and the `plesk8` EZ application template and if any updates are available, they are downloaded to the Hardware Node and installed there. You can also pass the `-C` option to the command to make `vzveconvert` look for the packages updates in the `vzpkg` cache only.
- 4 The packages that are included in the `fedora-core-3` and the `psa-fc3` standard templates and that cannot be found in the repositories for the `fedora-core-4-x86` and `plesk8` EZ templates, if any, are copied to the `/vz/template/vc/<UUID>/<rpm_name>` directory on the Node where `<UUID>` denotes the unique identifier of the Container (you can find out what unique ID is assigned to the Container by viewing the value of the `UUID` parameter in the Container configuration file after the `vzveconvert` execution) and `<rpm_name>` is the name of the package (together with its version, release, and architecture) absent from the EZ template repositories.

- 5 The packages installed in the `/vz/template/fedora-core/4/x86` directory on the Hardware Node (i.e. in the template area of the `fedora-core-4-x86` and `plesk8` EZ templates) are compared with those specified in the `/vz/template/fedora-core/4/x86/os/default/packages` and `/vz/template/fedora-core/4/x86/app/plesk8/default/packages` meta files and if some packages listed in these files are not present in this directory, they are also downloaded from the repository to the Node and installed there.
- 6 The symlinks to the package files in the `/vz/template/fedora-core-3/` and `/vz/template/psa` directories on the Node are replaced with symlinks to the files in the `/vz/template/fedora-core/4/x86` EZ template directory.
- 7 The following parameters in the `/etc/sysconfig/vz-scripts/101.conf` file are updated or set anew in accordance with the changes made: `OSTEMPLATE`, `TEMPLATES`, `UUID`, `TECHNOLOGIES`. Detailed information on these parameters is provided in the **Configuring Parallels Virtuozzo Containers 4.7** chapter of the *Parallels Virtuozzo Containers 4.7 Reference Guide*.
- 8 The `post-fedora-core-4` script from the `/usr/share/vztt/convert/scripts` directory on the Node is executed. This script is meant to perform a number of post-upgrade operations in the Container context.

The full list of "standard OS template --> EZ OS template" and "standard application template --> EZ application template" transformations which can be performed in the current version of Parallels Virtuozzo Containers is provided in the `/usr/share/vztt/convert/os_table` and `/usr/share/vztt/convert/app_table` files on the Hardware Node, respectively. For example, you can issue the following command to learn what standard OS templates can be converted to their EZ counterparts:

```
# cat /usr/share/vztt/convert/os_table
...
fedora-core-1          fedora-core-4-x86
fedora-core-2          fedora-core-4-x86
fedora-core-3          fedora-core-4-x86
fedora-core-4          fedora-core-4-x86
fedora-core-5          fedora-core-5-x86
fedora-core-4-x86_64   fedora-core-4-x86_64
...
```

The left column provides information on standard OS templates whereas the right one informs you of the corresponding OS EZ templates.

Note: The `/usr/share/vztt/convert/app_table` file contains only the names of the EZ application templates having its own repositories for handling the packages included in these templates (e.g., all `plesk` EZ templates).

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