OpenVZ Installation Using PXE

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Chapter 1. Introduction

This guide provides information on installing OpenVZ over network using preboot execution environment (PXE) server.

You can install OpenVZ in a PXE environment using one of the following ways:

- **Manual installation**. When performing this kind of installation, you are asked questions by the OpenVZ installer and define the necessary installation and configuration settings. Manual installation is recommended if you plan to install the product on a small number of physical servers.
- **Unattended installation**. In this kind of installation, the OpenVZ installer uses a kickstart file to determine the necessary installation and configuration settings. Unattended installation assumes that no interaction is required on your part and is recommended if you plan to install the product on a multitude of physical servers.

To install OpenVZ over a network, you need to complete the following steps:

1. Prepare for installation from a PXE server.
2. Create a kickstart file. This step is only required if you plan to automate the procedure of deploying OpenVZ on your servers.
3. Install OpenVZ.

All these steps are explained in the following chapters in detail.

Chapter 2. Preparing for PXE Installation

The process of preparing for installation over network with a PXE server includes the following steps:

1. Choosing servers for the PXE installation.
2. Installing the necessary software on the PXE server.
3. Configuring the TFTP server.
4. Setting up a DHCP server.
5. Setting up an HTTP server.
6. Configuring the OpenVZ server.

All these steps are described below in detail.

2.1. Choosing Servers

First, you should decide on the servers to participate in the PXE installation. You need these servers:

- **PXE server**. This is a server allowing your servers to boot and install OpenVZ over the network. Any server capable of running a Linux operating system and having a network interface card (NIC) can play the role of a PXE server.
- **DHCP server**. This is a standard DHCP server serving computers on your network with the necessary TCP/IP settings. You can use an existing DHCP server, if you have one, or set up a DHCP server from scratch. In the latter case, you can install it on the PXE server or use a dedicated server.
- **OpenVZ server**. This is a server running OpenVZ. The server must meet the requirements described in the **Preparing for Installation** chapter of the *OpenVZ Installation Guide*. In addition to the requirements listed in this chapter, the server must have a NIC with PXE support to be able to boot from the PXE server.
- **HTTP or FTP server**. This is a server storing the OpenVZ installation files. You can use an existing HTTP server, if you have one, or set up an HTTP server from scratch. In the latter case, you can install it on the PXE server or use a dedicated server.

This guide assumes that you will store the installation files on an HTTP server and use HTTP as the installation protocol.

2.2. Installing Software on the PXE Server

Next, you are supposed to install the necessary software on the PXE server. First of all, you need to install a Linux operating system on the server. There are no specific requirements for which operating system to use, so you can choose any (e.g., CentOS 6 or Fedora 17).

Once your system is up and running, install the following packages:

- `tftp-server`
- `httpd` (Install this package only if you plan to deploy the PXE and HTTP servers on the same physical server.)

- `syslinux`
- `dhcp` (Install this package only if you plan to deploy the PXE and DHCP servers on the same physical server.)

Assuming that your PXE server is running an RHEL-like operating system, you can use the `yum` utility to install the packages:

```
# yum install tftp-server dhcp httpd syslinux
```

2.3. Configuring the TFTP Server

In the next step, you need to configure the TFTP server that you installed in the previous step. This section describes the process of configuring the TFTP server for BIOS-based systems. For information on how to configure the TFTP server for installing OpenVZ on EFI-based systems, see **Configuring for EFI** in the *Red Hat Enterprise Linux Installation Guide* at https://access.redhat.com/knowledge/docs/en-US/Red_Hat_Enterprise_Linux/6/html/Installation_Guide/s1-netboot-pxe-config-efi.html.

To configure the TFTP server:

1. On the PXE server, open the `/etc/xinetd.d/tftp` file, and edit it as follows:

   ```
   service tftp
   {
   disable         = no
   socket_type     = dgram
   protocol        = udp
   wait            = yes
   user            = root
   server          = /usr/sbin/in.tftpd
   server_args     = -v -s /tftpboot
   per_source      = 11
   cps             = 100 2
   flags           = IPv4
   }
   ```

   Once you are done, save the file.

2. Copy the following files to the `/tftpboot` directory (if this directory does not exist, create it under the root (`/`) directory):
   - `vmlinuz`
   - `initrd.img`
   - `menu.c32`
   - `pxelinux.0`

   These files are necessary to start the installation of OpenVZ. You can find the first two files in the `/isolinux` directory of the OpenVZ distribution. The `menu.c32` and `pxelinux.0` files are located in the `syslinux` installation directory on the PXE server (usually, this is the `/usr/share/syslinux` or `/usr/lib/syslinux` directory).

3. Create the `/tftpboot/pxelinux.cfg` directory, and inside this directory, make the `default` file.

4. Open the default file for editing, and add the following strings to it:

```
default menu.c32
prompt 0
timeout 100
ontimeout VZ
menu title OpenVZ Boot Menu
label VZ
        menu label Install OpenVZ
        kernel vmlinuz
        append initrd=initrd.img ksdevice=eth0
```

For detailed information on the parameters you can specify in the `/tftpboot/pxelinux.cfg/default` file and their configuration, see the documentation for `syslinux` and its man pages.

5. Restart the `xinetd` service:

```
# /etc/init.d/xinetd restart
```

6. If necessary, configure your firewall on the PXE server to allow access to the TFTP server.

Note: When running the TFTP server, you might get the "**Permission denied**" error. In this case, you may try to fix the problem by running the following command on the server: **`# restorecon -Rv /tftboot/`**.

2.4. Setting Up a DHCP Server

Now you can proceed with configuring a DHCP server. To configure the DHCP server for installing OpenVZ over the network, open the `dhcpd.conf` file (usually, it is located in the `/etc` or `/etc/dhcp` directory) for editing and add the following strings to this file:

```
next-server <PXE_server_IP_address>;
filename "/pxelinux.0";
```

Note: To configure a DHCP server for installation on EFI-based systems, specify `filename "/bootx64.efi"` instead of `filename "/pxelinux.0"` in the `dhcpd.conf` file (where `/bootx64.efi` is the directory to which you copied the EFI boot images when setting up the TFTP server).

2.5. Setting Up an HTTP Server

Now that you have set up the TFTP and DHCP servers, you need to make the OpenVZ distribution files available for installation over the network. To do this:

1. Set up an HTTP server. You can also use an existing HTTP server, if you have one.
2. Copy the contents of your OpenVZ installation DVD to some directory on the HTTP server (e.g., `/var/www/html/vz`).
3. On the PXE server, open the `/tftpboot/pxelinux.cfg/default` file for editing, and specify the path to the OpenVZ installation files on the HTTP server.

Note: For EFI-based systems, the file you need to edit has the name of `/tftpboot/pxelinux.cfg/efidefault` or `/tftpboot/pxelinux.cfg/<PXE_server_IP_address>`.

Assuming that you have the installation files in the `/var/www/html/vz` directory on the HTTP server with the IP address of 198.123.123.198 and the `DocumentRoot` directory is set to `/var/www/html`, you can add the following option to the `append` line of the `default` file to make the OpenVZ files accessible over HTTP:

```
method=http://198.123.123.198/vz
```

So your default file should look similar to the following:

```
default menu.c32
prompt 0
timeout 100
ontimeout VZ
menu title OpenVZ Boot Menu
label VZ
        menu label Install OpenVZ
        kernel vmlinuz
        append initrd=initrd.img ksdevice=eth0 method=http://198.123.123.198/vz
```

2.6. Configuring the OpenVZ Server

Before you can start the OpenVZ installation, configure each server where you plan to install the product to boot from the network. To do this:

1. Switch on the server.
2. Enter the BIOS setup.
3. Enable the network boot.

Chapter 3. Installing OpenVZ

Now that you have prepared all the servers, you can start the OpenVZ installation:

1. Restart the OpenVZ server after configuring its BIOS settings to boot from the network.

   Note: If you plan to perform an unattended installation of OpenVZ, you need to additionally create a kickstart file. See Chapter 4, *Creating a Kickstart File* on page 10 for information about creating kickstart files and installing OpenVZ with these files.

2. Once the server boots, you see a dialog box asking you to select the system to install. Select the entry for OpenVZ (**Install OpenVZ** in our case), and press **Enter**.

3. Follow the on-screen instructions to install OpenVZ. For details, consult the *OpenVZ Installation Guide*.

Chapter 4. Creating a Kickstart File

If you plan to perform an unattended installation of OpenVZ, you can use a kickstart file. A kickstart file is a simple text file containing the information used by the OpenVZ installer to install and configure your physical server. The format of kickstart files used in OpenVZ installations is similar to that used to perform an unattended installation of Red Hat Enterprise Linux (RHEL). To create a kickstart file, you can use your favorite text editor.

You can include in your OpenVZ kickstart file two groups of options:

- The first group comprises the same options that you use when installing any RHEL-like distribution.
- The second group comprises the options specific to OpenVZ.

Both groups of options are described in the following sections in detail.

4.1. Standard Kickstart Options

Your kickstart file may include any of the standard Linux options used in kickstart files for installing Linux operating systems. For the full list of these options and their explanations, consult the respective Linux documentation (e.g., the *Red Hat Enterprise Linux Installation Guide*).

Listed below are the mandatory options and commands that you must include in each kickstart file:

Option	Description
`auth`	Specifies authentication options for the OpenVZ physical server.
`bootloader`	Specifies the way of installing the bootloader.
`install`	Tells the system to install OpenVZ either from `nfs` or `url` (for FTP and HTTP installations, respectively). Specify this option to perform a clean installation of OpenVZ.
`keyboard`	Sets the system keyboard type.
`lang`	Sets the language to use during installation and the default language to use on the installed system.
`part`	Creates partitions on the server.
`rootpw`	Sets the system's root password.
`timezone`	Sets the system time zone.
`zerombr`	Cleans all partition tables on disk drives. **Note:** This option should follow clearpart `--all`.

Note: You can specify the `cmdline` option to install OpenVZ in a completely non-interactive command-line mode, without starting the X Window System.

4.2. OpenVZ Kickstart Options

Along with standard Linux options, OpenVZ provides a number of specific parameters and keywords that you need to add to your kickstart file.

The table below lists all available parameters and keywords.

Table 4.1. General Parameters

Parameter	Description
`key <key>`	Mandatory. Installs the OpenVZ product key on the server. This key is needed to start using the OpenVZ software.
`cep [--agree|--disagree]`	Mandatory. Specify whether you want to participate in the Customer Experience Program. • `--agree`. Join the program. In this case, OpenVZ will periodically collect the information about the configuration of your physical server and virtual machines and containers and use it to make the product better fit your needs. No private information like your name, e-mail address, phone number, and keyboard input will be collected. • `--disagree`. Do not join the program.
`vznetcfg`	Optional. Invokes the `vznetcfg` utility with the specified options. This parameter accepts all options that you can normally pass to `vznetcfg`. The options and their values should be separated by an equals sign (for example, `vznetcfg --net=virt_network1:eth0`). For detailed information on the `vznecfg` options, refer to the **vznetcfg** section in the *OpenVZ Command Line Reference Guide*.
`vziptables`	Deprecated. To configure iptables modules for containers, use the `NETFILTER` parameter in the container configuration file (for details, see the *OpenVZ Command Line Reference Guide*).
`vztturlmap`	Optional. Sets the URL of the repository and repository mirrors to use for handling EZ OS and application templates. By default, OpenVZ uses the following URLs: • `http://fedora.redhat.com` for handling Fedora-related templates. • `http://mirror.centos.org` for handling CentOS-related templates. • `http://archive.ubuntu.com` for handling Ubuntu-related templates. • `http://download.opensuse.org` for handling openSUSE-related templates. • `ftp://ftp.suse.com` for handling SUSE-related templates. • `ftp://ftp.de.debian.org` for handling Debian-related templates.

Parameter	Description
	• `http://vzdownload.swsoft.com` for obtaining specific software packages for the aforementioned Linux distributions. These packages are necessary for the correct operation of your OS templates. To use your own URL, you first need to specify the name of the respective Linux distribution, followed by = and the desired URL (e.g., `$FC_SERVER=http://myrepository.com` to redefine the default repository for Fedora). To use several URLs, separate them by space. **Note:** Some Linux distributions (e.g., Red Hat Enterprise Linux and SUSE Linux Enterprise Server) do not have official repositories. So you should manually create software repositories before starting to use OS templates for such distributions. Refer to the *OpenVZ Templates Management Guide* to learn how you can do it.
`up2date`	Optional. Does the following: 1. Configure the repositories with updates for OpenVZ software and templates. 2. Check the repositories for available updates. 3. Download and install the updated packages, if any, on the server. Using this option, you can ensure that you have the latest OpenVZ software packages and templates right after the installation, without the need to manually check for updates.
`nosfxtemplate`	Optional. Skips installing the pre-created and pre-cached EZ templates on the server. The current version of OpenVZ is shipped with only one pre-created and pre-cached OS EZ template: `centos-6-x86_64`.

`%eztemplates`	Optional. Installs EZ templates on the server. All available templates are listed in the `/Packages` directory of the OpenVZ distribution. You can easily identify them by the `-ez-`*`<number>`*`.swsoft.noarch.rpm` ending (e.g., `centos-6-x86-ez-3.0.0-14.swsoft.noarch.rpm`). The names of the templates must be specified without the ending and separated by the new-line character, for example:
	
	`%eztemplates`
	`centos-6-x86`
	`devel-centos-6-x86`
	
	When using this parameter, keep in mind the following:
	
	• If you specify an empty list, no templates will be installed on the server.
	
	• If you skip this parameter, all templates included in the OpenVZ distribution will be installed on the server.

Parameter	Description
	• You can indicate the `--cache` argument next to a respective OS template to cache it after installation. To cache all specified OS templates, specify `--cache` after `%eztemplates`. **Note:** To cache OS templates for some Linux distributions (e.g. Red Hat Enterprise Linux and SUSE Linux Enterprise Server), you should first create special repositories storing the necessary software packages for these OS templates. Refer to the *OpenVZ Templates Management Guide* to learn how you can do it. • This option must be specified as the first one after the keys.
`ignoredisk`	Optional. Ignores the specified drives or all drives except the one specified. Used with one of the following arguments: • `--drives=<`*`drive`*`>[,…]` - A comma-separated list of drives to ignore. If a server has drives other than those specified in this option, the installer will ask what to do with them. • `--only-use=<`*`drive`*`>` - Ignore every drive except the specified.
`prlnet [--ip-scope-start <`*`start_IP_addr`*`> --ip-scope-end <`*`end_IP_addr`*`>] [--ip <`*`adapter_IP_addr`*`>[/<`*`mask`*`>]] [--dhcp-ip <`*`DHCP_IP_addr`*`>] --name <`*`name`*`>`	Optional. Defines the range of IP addresses the DHCP server will be able to allocate to virtual machines in host-only networks; virtual adapter IP address and subnet mask; DHCP server IP address; and virtual network name. If you omit one or more parameters, the following default values will be used: • `--ip-scope-start`: 10.37.130.1, • `--ip-scope-end`: 10.37.130.254, • `--ip`: 10.37.130.2/255.255.255.0, • `--dhcp-ip`: 10.37.130.1.
`%packages`	Specifies the package groups to install on the server: • `@base` and `@core` (mandatory). Installs the packages required for the correct operation of your system. • `@vz` (mandatory). Installs the packages specific to the OS virtualization part of OpenVZ. • `@ps` (mandatory). Installs the packages specific to the hardware virtualization part of OpenVZ. • `@clustering` (optional). Installs the packages required for creating clusters from OpenVZ systems. • `@templates` (optional). Installs all templates included in the OpenVZ distribution. If you want to install specific templates only, use the `%eztemplates` option. • `@optional` (optional). Installs additional packages that are not installed with OpenVZ by default.

4.3. Kickstart File Example

Below is an example of a kickstart file that you can use to install and configure OpenVZ in unattended mode. You can use this file as the basis for creating your own kickstart files.

```
# Install OpenVZ
install
# Uncomment the line below to install OpenVZ in a completely unattended mode
# cmdline
# Use the path of http://example.com/vz to get the installation files.
url --url http://example.com/vz
# Use English as the language during the installation and as the default system
# language.
lang en_US.UTF-8
# Use the English keyboard type.
keyboard us
# Uncomment the line below to remove all partitions from the SDA hard drive and
# create these partitions: /boot, /, /vz, and swap.
# clearpart --drives=sda --all --initlabel
# zerombr
part /boot --fstype=ext4 --size=512
part / --fstype=ext4 --size=20096
part /vz --fstype=ext4 --size=40768 --grow
part swap --size=4000
# Use a DHCP server to obtain network configuration.
network --bootproto dhcp
# Set the root password for the server.
rootpw xxxxxxxxx
# Use the SHA-512 encryption for user passwords and enable shadow passwords.
auth --enableshadow --passalgo=sha512
# Set the system time zone to America/New York and the hardware clock to UTC.
timezone --utc America/New_York
# Set sda as the first drive in the BIOS boot order and write the boot record to
# mbr.
bootloader --location=mbr
# Tell the OpenVZ installer to reboot the system after installation.
reboot
# Install the OpenVZ license on the server.
key XXXXXX-XXXXXX-XXXXXX-XXXXXX-XXXXXX
# Create the virt_network1 Virtual Network on the server and associate it with the
# network adapter eth0.
vznetcfg --net=virt_network1:eth0
# Configure the ip_tables ipt_REJECT ipt_tos ipt_limit modules to be loaded in
# Containers.
# Use the http://myrepository.com to handle Fedora OS and application templates.
vztturlmap $FC_SERVER http://myrepository.com
# Install the listed EZ templates. Cache all OS templates after installation. Skip
# the installation of pre-created templates.
nosfxtemplate
%eztemplates --cache
centos-6-x86_64
centos-6-x86
mailman-centos-6-x86_64
```

```
mailman-centos-6-x86
# Install the packages for OpenVZ on the server.
%packages
@base
@core
@vz
@ps
```

4.3.1. Kickstart file example for installing on EFI-based systems

You can use the file above to install OpenVZ on BIOS-based systems. For installation on EFI-based systems, you need to modify the following places in the file (the changes are highlighted in bold):

```
# The following 4 commands are used to remove all partitions from the SDA hard
# drive and create these partitions: /boot/efi (required for EFI-based systems),
# /boot, /, /vz, and swap.
# clearpart --drives=sda --all --initlabel
part /boot/efi --fstype=efi --grow --maxsize=200 --size=20
part /boot --fstype=ext4 --size=512
part / --fstype=ext4 --size=20096
part /vz --fstype=ext4 --size=40768 --grow
part swap --size=4000
# Configure the bootloader.
bootloader --location=partition
```

4.4. Copying the Kickstart File

To install OpenVZ using a kickstart file, you first need to make the kickstart file accessible over the network. To do this:

1. Copy the kickstart file to the same directory on the HTTP server where the OpenVZ installation files are stored (e.g., to `/var/www/html/vz`).
2. Add the following string to the `/tftpboot/pxelinux.cfg/default` file on the PXE server:

   ```
   ks=<HTTP_server_address>/<path_to_kickstart_file>
   ```

   Note: For EFI-based systems, the file you need to edit has the name of `/tftpboot/pxelinux.cfg/efidefault` or `/tftpboot/pxelinux.cfg/<PXE_server_IP_address>`.

Assuming that the HTTP server has the IP address of 198.123.123.198, the DocumentRoot directory is set to `/var/www/html` and the full path to your kickstart file on this server is `/var/www/html/vz/ks.cfg`, your `default` file may look like the following:

```
default menu.c32
prompt 0
timeout 100
ontimeout VZ
menu title OpenVZ Boot Menu
label VZ
```

```
                menu label Install OpenVZ
                kernel vmlinuz
                append initrd=initrd.img ks=http://198.123.123.198/vz/ks.cfg
method=http://198.123.123.198/vz ksdevice=eth0
```

4.5. Starting Installation

Now you can start installing OpenVZ. To do this:

1. Restart the server (see Section 2.6, “Configuring the OpenVZ Server” on page 8).
2. After the server boots, a dialog box is displayed asking you to select the system to install. Select the entry for OpenVZ, and press **Enter**. The installation is launched automatically and proceeds without your interaction.