Virtualisation of servers using XenServer open source virtualisation platform

Best Practice Document

Produced by the MREN-led Campus Networking working group

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Summary

This document describes the basic principles of server virtualisation using Citrix company product. The essence of virtualisation is based on using XenServer tools, which need to be installed on a physical machine, as well as XenCenter management software, which needs to be installed on the management console, which should be located in the same part of the network as the servers on which XenServer is installed.

On XenServer level it is possible to add new virtual machines, as well as storage repositories of different types. If XenCenter has multiple servers, they can band together in one cluster, which allows a particular XenServer to be declared the master, while other servers are members of the cluster. XenServer that acts as the master is usually the most common server in terms of starting new virtual machines, storages, etc. By setting up high availability option, it is possible, within a cluster, to specify downloading all tasks from one of the servers, in case it becomes unavailable for some reason.

**Keywords:** XenServer, XenCenter, virtual machine, storage repository, cluster.
1 Introduction

For the needs of all types of server virtualisation, in addition to all the hardware capacity servers possess, it is also necessary for the servers to possess the appropriate processors, which have support for the virtualisation of hardware components. In this way it is possible to easily monitor and manage the hardware resources of the server, via the appropriate management console, where the driver software would be installed.

One of the most appropriate solutions for server virtualisation are Citrix company solutions. This is because Citrix’s applications are primarily open code solutions, as well as because Citrix XenServer and Citrix XenCenter are very simple for installation, which will be described in this document. Servers should be medium or high-performance computers when it comes to the size of the hard drive, RAM memory, processor speed, while the management console can be a computer with slightly worse performance. This performance implies:

- For XenServer:
  - CPU minimum speed of 1.5 to 2 GHz (Intel VT or AMD-V, which means that they support virtualisation). It is recommended that the processor should be 64-bit x 86;
  - RAM memory with minimum 2 GB, and 4 GB or more is recommended;
  - HDD (SATA, PATA, SCSI) minimum 16 GB, and 60 GB or more is recommended;
  - Network card speed of 100Mbps or more. For faster P2V and export/import data exchange, or VM with live migration, network card speed 1Gbps is recommended.

- For XenCenter management console:
  - .NET Framework version 3.5;
  - Minimum CPU speed 750MHz, while 1 GHz or higher is recommended;
  - RAM memory minimum 1 GB, 2 GB or higher is recommended;
  - HDD minimum 1 GB;
  - Network card minimum speed 100Mbps;
  - Screen resolution: minimum 1024 x 768.

Citrix works on a standard principle of virtualisation, which implies that two or more servers are needed, on which Citrix XenServer is to be installed. Also, it is necessary to have a console to install Citrix XenCenter, the application that is required for the control and management of the servers. Therefore, all XenServer resources will be virtualised and graphically shown within XenCenter which will be installed on the management console, or on a computer that will have remote access to the servers.
**Note:** Within this document, the system will be used within a single network segment, so that access to XenServers via the management console will be possible only if the management console with its network parameters is within that part of the network. Prior to installation, as already mentioned, the most important thing is to make sure whether the servers themselves are computers that have support for VT-x (Virtualisation Technology). So, from the point of virtualisation, it is very important that the processors of these computers on which XenServer is installed should have support for VT-x.

The list of processors is available on Intel’s Web site, and some of them are:

a. Intel High end desktop Processors;
b. Intel Core M Processors;
c. Intel Core i3 to i7 Processors of the fifth, fourth, third and second generation;
d. Intel Core i3 to i7 - Previous Generation;
e. Intel Xeon E7 Processors (E7 v3 Family, E7 v2 Family, E7 Family);
f. Intel Xeon E5 Processors (E5 v3 Family, E5 v2 Family, E5 Family);
g. Intel Xeon E3 Processors (E3 v4 Family, E3 v3 Family, E3 v2 Family, E3 Family);
h. Intel Xeon D Processors;
i. Intel Xeon Processors 7000 Sequence, 6000 Sequence, 5000 Sequence, and 3000 Sequence;
j. Intel Itanium Processors;
k. Intel Atom Processors etc.

Also, this is necessary to be further taken into account, because it is necessary to check later in BIOS whether the option VT-x is activated, because in many computers that support VT-x by default this feature is disabled. Therefore, this option must be activated later.
2

Installation of Citrix XenServer

One of the main reasons why the physical Installation of Citrix XenServer is recommended is that Citrix XenServer is an operating system itself, because in its background Linux operating system coLinux distribution is in use.

The following section of the document describes the process of installing XenServer, as well as setting up the basic network settings, which is very important in terms of access to the server via the management console. So, in order to access XenServer from XenCenter, it is necessary to know the username, which is by default "root", then the password you set when you install XenServer, while the third parameter needed to access XenServer is its IP address, which in this document will be in the same network segment, as well as the IP address of the management console on which XenCenter will be installed. The following figure shows the screenshot of the server after being started from the CD on which the XenServer ISO file has been burned.

![Figure 1 Launching Citrix XenServer](image)

After the initial boost of XenServer and verification of individual virtual drivers, the process of installing XenServer can be accessed. The Installation itself is ordinary, and follows common steps. Here we will mention just some of them.

The window offering the installation of some additional packages can be skipped, because the additional packages can be installed after the basic installation of XenServer. You need to select option "No".
Having skipped the local media verification, you come to the simple steps of installing and verifying the XenServer password, as well as selecting the automatic configuration of network parameters of the server, after which, in the next window, you need to choose again the automatic configuration for DNS and Hostname settings.

After the automatic adjustment of the network parameters, the next steps during the installation refer to the simple adjustment of your time zone, where it is enough to select the option "Manual time entry", after which the geographical parameters (the continent and the country where the server is stationed) are adjusted.

After selecting your time zone and the location of the server, you come to the launching of the XenServer installation, by selecting the button "Install XenServer".

After completing the installation process a notification informs you that it is necessary to remove any local media from the disk, and by selecting the "Ok" button the reboot of the system is performed.

After the completion of the reboot of the system, everything is ready for the launch of XenServer, which looks like this:
Just by entering the selected option "Network and Management Interface" you can manually change absolutely all network settings. During the physical installation you need to find the "Device" that can be seen on the right. There you need to select the port which is used as a network server port, which connects it to the rest of the network, which is eth0 in this case.
3 Installation of XenCenter and access to XenServer via XenCenter

As mentioned earlier, management application XenCenter works under Windows 7 operating system. The installation is very simple and will be shown in the next section of the document. First of all you need to download XenCenter .exe file from Citrix site by clicking the link on Citrix website, called "XenCenter Windows Management Console (English)".

After you complete the installation of Citrix XenServer on server machines, as well as the installation of Citrix XenCenter management software on the management console, it is possible to access the virtualisation of all hardware resources of the server on which XenServer is installed and booted. The first thing you need to do is to double-click open a XenCenter shortcut on the management console desktop. Citrix XenCenter is a simple working environment. The left part of the window is a virtualised infrastructure, whereas in the right part of the window, before adding any infrastructure, among other things there is a link that allows you to add XenServer, whose hardware components will become a virtual infrastructure within the management software. By clicking on the link "ADD server", XenServer is added within XenCenter.

Figure 4 Adding Server within XenCenter

After clicking on this link a new window opens as a form which is necessary to fill with the data that defines the Server. The main identifier of the server is IP address and it is entered in the "Server" field. Enter the administrator's credentials for XenServer in "Username" and "Password" fields. The username is root, while the password is defined during the installation of XenServer. After you enter all these parameters, you need to click on the button "Add".

1 http://xenserver.org/open-source-virtualisation-download.html
After this step, in the left part of XenCenter management and monitoring software window there will be something similar to the figure below:

As can be seen from the figure, XenCenter is the "home" system of all the servers that are added within it. "localhost" is the name of XenServer that is shown, that is "pasted" within XenCenter, while XenCenter recognises three XenServer memory repositories, and assigns them in this virtual way. It is very important to note that XenServer in this environment is seen as a virtual host, which can be added within a cluster, which will be described later in this document. Each host can be added a new virtual machine and new storage, while at XenCenter level a new server can be added, as well as a pool (cluster). Adding a new virtual machine or a new storage is performed by simply marking the host name, after which, by clicking on "New VM" or "New Storage" (in the horizontal XenCenter menu), you add a new storage or new VM to the selected host. On XenCenter level it is possible to add a new server or a new pool, by marking XenCenter and selecting the option "Add New Server" or “New Pool” in the same menu, which allows you to add storage or VM to the specific host.
Of course, Pool cannot be added to XenCenter, until another server is added to it, after which you will be able to put them in Pool (one as the master, the other as a slave), after which it is possible to perform HA (High Availability), which makes it possible for the slave server to take over all the jobs done by the master, in case the master server crashes down. The right side of XenCenter gives an overview of general information, memory, storage repository, network information, information about network cards, a possibility of access through the console, performances and the user, which refer to a single host. So within the management software, there are all hardware parameters of the server whose monitoring is performed in this way.

The following parts of the document will describe adding new virtual machines, as well as adding new storage repository at the host level, after which adding new servers and clusters at the level of XenCenter, as well as HA functionality provided by XenCenter, will be described.
4 Adding new virtual machines within XenCenter

As described in the previous section of the document, adding a new virtual machine within the host consists of marking the name of the host, i.e. XenServer, which is "localhost" in this example, then selecting the "New VM" option from XenCenter horizontal menu:

After selecting this option, a Wizard that creates a new virtual machine opens. In the first of eight steps, through which you must pass in order to add a new virtual machine, select the Template, i.e., in this case, select the operating system whose virtual machine will be used within the server. In this example, Ubuntu Trusty Tahr 14.04 will be selected. After selecting the template, you need to click on the "Next" button.

In the next step the virtual machine is given a name and added a description (not required). After that you need to click on "Next".
In the next window select "Installation Media". There are two variants in this step, as follows:
The installation from ISO "library" or DVD drive - this option is selected in the vast majority of cases. It has two subfeatures, as follows:

• "DVD drive he local host" – this option is suitable if there is a physical medium, i.e. an operating system installation disc, which was selected in the first step (Template). That disc should be simply put in a XenServer CD/DVD reader, after which you should select this option.

• “ISO library” – This option is selected only in case that there is a physical medium on a remote system, and one type of the remote system is certainly the NFS server, which can be set from the command line of the remote server via putty, or some other software for remote access. Since in this exercise there is currently no NFS server to use, then you should insert the installation disc into XenServer CD reader and select the first subfeatures – “Install from ISO library or DVD drive” and “DVD drive 0 localhost”, after which you need to click on "Next".

Figure 11 Adding a machine from XenServer physical reader

The other option within the "Installation media" step is "Boot from network". This option is selected if there is one FTP server within the network segment containing XenServer. Within the FTP server you need to have an attached ISO file of the operating system selected in step 1, and the ISO file should be accessed through the following ftp address: ftp://<ip_address_server>/<name_ISO_file/.

After selecting the installation media, you need to select VM location in the server. In this step, you only need to click on "Next".

The next step – "CPU & Memory" defines the number of virtual central processing units, as well as the size of RAM memory of the virtual machine that is added. After the selection has been performed, you only need to click on "Next".
Figure 12 Defining the number of virtual CPU and the size of virtual working memory

The next step is choosing storage for the virtual machine that is added. To start it is enough for the storage that will be used by the virtual machine to be part of the memory of XenServer itself. The recommended storage size is around 20 GB, which can be adjusted by selecting the button "Properties", after which a window opens, designed for editing the disk for the virtual machine, where you can make changes to the size of the disk, after which you need to click the "Ok" button, and then the "Next" button in the "Storage" step.

Figure 13 Changing the size of the disk for the virtual machine

In "Networking" step the virtual machine gets the MAC address, which is actually the MAC address of XenServer. After assigning VM with MAC address, just click on the "Create Now" button, after which the virtual machine is created and the standard installation of the operating system is automatically run. As shown by the following figure, the virtual machine has been added within XenServer. By marking the virtual machine and clicking on the "Console" tab you start the process of the standard installation of virtual Ubuntu 14.04 OS.
After passing through the standard installation of the operating system, the virtual machine is ready for operation under XenServer, and all its hardware parameters, as well as its console, can be accessed in a very simple way, and managed from XenCenter.
5 Adding Storage repository

Adding a new Storage within XenCenter can be done at the level of VM, but also at the level of the host, and that process is, from the perspective of the management software (XenCenter), very simple. All that is required is to select the specific host or VM, which is present within XenCenter, and to choose the option "New Storage", or by right-clicking on the host or VM, and selecting "New SR..." option. The wizard that opens after clicking on "New Storage" or "New SR..." has only three steps which you need to pass in order to add a new repository. The first step is to select the type of Storage that is added, the second step is the name of the Storage, while the third step is the location of the Storage, available to XenServer itself.

So, in the first step of adding Storage the type of repository is selected. There are two subtypes, which are "Virtual disk storage" and "ISO library". This document will consider adding only Virtual disk storage. Virtual disk storage has three types of repository available, two of which are in most common use, as follows:

- VHD NFS (Network File System Virtual Hard Disk) – This type of repository implies the possibility to add a virtual hard disk, which will be available to XenServer or the virtual machine (in this case Ubuntu 14.04) somewhere on the network. Therefore, a specific server located anywhere in a network segment that is accessible to XenServer or VM must act as an NFS server, while in this case XenServer or VM acts as an NFS client, and in this way the two servers communicate with each other in a hierarchy. If this communication does not exist, it is not possible to add a virtual hard disk on the server level or VM level within XenCenter, because the third step when you add storage (location of the virtual hard disk) is actually a DVD drive of this device that acts as an NFS server. This DVD drive, in some later cases, could serve to add a new virtual machine to the virtual disk.

- Hardware HBA (Hardware Bus Adapter) - This repository works on the principle of physical connecting of different types of portable media to the XenServer. First of all, XenServer as a host, among other things, must have support for FC (Fibre Channel), FCoE (Fibre Channel over Ethernet), etc. The configuration, i.e. "preparing the ground", after which this type of adding Storage will work in the best way possible, is based primarily on manual connecting network devices to ports on XenServer, such as iSCSI (Internet Small Computer System Interface), Ethernet, etc.

![Figure 15 Types of Storage repository](image)
5.1 Configuring NFS VHD

As stated earlier in this document, in order to add NFS VHD Storage on host-level or VM level within XenCenter, it is essential that the host or VM acts as an NFS client, while somewhere in a certain part of the network that would be available to the host or VM there would be a server which would be set up to function as a NFS server, so that his DVD drive would be added as a virtual hard disk on a host-level or VM level within XenCenter.

Note: All configuration settings related to VM shall be made within XenCenter software, by clicking on VM and selecting the "Console" tab in the horizontal menu. Settings relating to the NFS server can be performed by using putty or some other remote access software. The configuration refers to a set of commands which supports Ubuntu 14.04 Server Edition. So, in this case, the machine that performs the actual role of the NFS server runs under Ubuntu 14.04 Server Edition. From now on the NFS server will be called the host, while the NFS client (VM Ubuntu 14.04) will be called the client.

The first step in the configuration is the installation of NFS server on the host:
# sudo apt-get update
# sudo apt-get install nfs-kernel-server

Well as NFS common on the client (XenServer or VM):
# sudo apt-get update  ## XenServer supports the command yum update.
# sudo apt-get install nfs-common  ## yum install nfs-common

In the next step, you need to create a shared directory on the host. The directory will be created and placed within the /var directory:
# mkdir /var/nfs

With the following command you need to change the owner and the ownership group of the created shared directory, within the host:
# sudo chown nobody:nogroup /var/nfs

The next thing you need to do is to customise /etc/exports file within the host:
# nano /etc/exports

After opening the file it is necessary to add two configuration lines:
/home ip_address_client(rw, sync, no_root_squash, no_subtree_check)
/var/nfs ip_address_client(rw, sync, no_subtree_check)

In the next step, within the host a table should be created containing all exports, by typing the command:
# sudo exportfs -a

After which it is necessary to start the nfs service, which normally is not started:
# sudo service nfs-kernel-server start
After completing the configuration within the host, you need to switch to the level of the client and create "mounting points" and a remote shared mounting location. In the previous settings the goal was achieved that current directories on the client server should have certain correspondence with their locations on the host server. The following command will create specific directories, as well as the necessary "parent" directories:

```bash
# mkdir -p /mnt/nfs/home
# mkdir -p /mnt/nfs/var/nfs
```

Now, when the created directories are suitable for mounting the data from the remote shared locations, we can execute these commands:

```bash
# sudo mount <ip_address_host>:/home/mnt/nfs/home
# sudo mount <ip_address_host>:/var/nfs mnt/nfs/var/nfs
```

In case you want to see all the NFS sharings that are mounted, you need to type the command:

```bash
# mount -t
```

After setting all configuration parameters, you can test the hierarchical communication between the host server and the client server, by typing commands on the client server:

```bash
# sudo touch /mnt/nfs/home/test_home
# sudo touch /mnt/nfs/var/nfs/test_var_nfs
```

With the following command we can check the information about the newly created file test_home:

```bash
# ls -l /mnt/nfs/home/test_home
```

As can be seen, the owner of this file is the user root. The reason for this lies in the fact that root_squash option is disabled in the file /etc/exports on the server host, which refers to /home directory.

Since root_squash option is turned on in the file /etc/exports, in the part of /var/nfs directory, this means that the owner of the file test_var_nfs should be nobody, and the ownership group nogroup:

```bash
# ls -l /mnt/nfs/var/nfs/test_var_nfs
```

After this feedback, it can be concluded that the configuration was successfully carried out.

**ADVICE:** Since XenServer does not recognise the set of commands that belong to the Ubuntu 14.04 operating system, the previously made configurations should be performed within the running virtual machine which supports the set of commands, and that will in this case be client and use the XenServer IP address!
5.1.1 Adding NFS VHD storage within XenCenter

Since the NFS configuration was successful, and the host server communicates with the client server, now it is very easy to add new NFS VHD storage to the repository within XenCenter, at the host (XenServer) or VM level:

Figure 16 Adding new storage repository at VM level

By clicking on "New SR...", we enter in the dialog box that lets us select a new type storage, which is added. In this case, you need to mark the “NFS VHD” option. After the type of storage repository has been selected, you need to give the name to the new storage.

When you have assigned the name to the new storage repository, you only need to choose the location for the virtual disk. The location is a combination of the IP address of the host server from NFS configuration and a directory path on which root_squash option has not been excluded, and that will be a directory /var/nfs. You need to mark the option "Create new SR" and finally to click on the button "Finish".

Figure 17 Selecting a location for the new storage repository
5.2 Configuring Hardware HBA storage parameters

To add new Hardware HBA storage repositories, as with NFS VHD repository you also need to prepare the ground in order to perform the Add. The most important thing without which this type of repository cannot be used is, for example, connecting switch (that is already connected to XenServer with network cable), to iSCSI HBA.

The next step is to restart XenServer, in order to check in its Fast!Util BIOS configurations if it recognises its device (port), that connects it to the switch in this case. Fast!Util BIOS configuration is available by combined pressing <CRTL>and <Q> keys, while booting XenServer. After entering the Fast!Util BIOS configuration, the screen will display a list of QLogic adapters, which is necessary to configure.

![Figure 18 Entering the Fast!Util BIOS configuration mode](image)

As you can see the device is recognised, but the Boot Mode is "Disable". All configurations within this section of BIOS are performed with a simple movement of keys and selecting certain options by pressing <ENTER> key. In this case the first adapter will be chosen. In order to configure the IP address and other network settings, first you need to choose the option "Configuration settings" and then to select "Host Adapter Settings".

![Figure 19 Host Adapter settings](image)

After you have selected option "Host Adapter Settings" the screen will display the current configuration of the adapter, which contains information such as the serial number of the adapter, LUN number (Logical Unit Number) per Target, etc. And among other things in the current configuration there is “Initiator IP Settings” option which is not defined. You should select this option.
In the next step you perform a standard setup of network parameters, which implies: setting the IP address, Subnet mask, Gateway, then the options to enable or disable addressing in IPv4 or IPv6, possibility of complete IPv6 setup, data on default routes, etc. After the network setup of the QLogic adapters, it is necessary to perform iSCSI setup. Thus, it is necessary to return to the adapter setup menu and select the "iSCSI Boot Settings" option.

In the next window, it is noticeable that QLogic BIOS allows you to configure the primary and secondary devices. In this case it will be enough to set only the primary device, so you need to choose the option "Primary Boot Device Settings". Within "Primary Boot Device Settings", you need to select the option "Security Settings ", where you select IP protocol version, as well as adjust Target IP, Target Port, Boot LUN, etc. Here you need to set the target IP address iSCSI SAN (Storage Area Network), which will be the IP address of the storage itself.
If for some reason in the future you need to change SAN, it is just enough to set a new Target IP address and XenServer will automatically detect the new iSCSI SAN storage. After you change the IP address, you need to save all storage changes and return to the adapter settings menu. Before we perform a scan of all available targets, it is necessary, for the reasons of testing configurations, check if XenServer, in the network sense, can "seek" iSCSI SAN. The test consists of simple pinging the target address, by selecting the option "Ping Utility", after which it is necessary to choose option "Ping target", and if everything is well configured, the screen will display a message that pinging was successfully completed.

As you can see the HBA is configured and can now communicate with iSCSI SAN. In order to scan multiple targets it is necessary to select the option "Scan iSCSI devices", located in the main FastIUtil BIOS menu. A list of all targets that communicate with HBA will be available on the screen, among which will be the target that was just configured.

In order to see the full iSCSI name, only press <F1>. If the target supports multiple LUN’s, it can be easily presented on the screen simply by selecting the target, in this case iSCSI SAN.
5.2.1 Adding new Hardware HBA storage within XenCenter

After all configurations that were made in BIOS, adding a new storage within XenCenter is very simple. The process of adding a new SR is absolutely identical as when adding NFS VHD. Namely, it is necessary to choose XenServer and to click on "New Storage" button in the horizontal menu. In the next step, you need to mark Hardware HBA, and then click on "Next". After the type of storage repository has been selected, you need to give it a name, and then by clicking on "Next" button to go to step 3 of adding storage, which is defining the location.

In the segment that relates to the location of the storage repository, the identification of all LUNs that are contained within a SAN is performed. When LUNs are identified, in the segment that relates to the selection of LUNs, more than one of them may appear, if SAN supports a higher number. It takes a simple click on one of the LUN’s to choose which will have the role of Hardware HBA storage repository in this case. After selecting a LUN, you need to click on the button "Next".

![Figure 24 LUN data required to define the location for Hardware HBA storage](image-url)

After selecting this storage repository location, you will receive a warning that it is necessary to format the storage, i.e. delete all of the data that is currently on it. The warning will be accepted by clicking on the button "Yes". After the formatting, storage repository will be added to XenServer and it will be possible to manage its virtual resources through XenCenter.
6 Creating Pool and XenServer HA functionality

Like all the other tools that are used for virtualisation, Citrix tools also have support for creating pools, that is, support for clustering. Cluster or pool can be created at the level of XenCenter itself, and may include two or more hosts (XenServers), one of which will act as the master, while the other servers will act as pool’s members.

A master server is a server that is running most virtual machines, has a number of storage repositories added etc. The remaining server/s that are members of the cluster should have approximate hardware performances as the master server, so that in the event that the master, for some reason, becomes unavailable, they would take over all its jobs, which is achieved by adjusting HA, after creating the cluster. The cluster is created by marking only the name of XenCenter, after which it is necessary to click on the button "New Pool" in the horizontal menu.

In the next step it is necessary to assign one of the servers the role of the master, and all the other servers the role of the cluster's member. In addition, you should specify the name of the cluster and click on the button "Create pool". Also, in this step, there is also the option of adding new servers, by clicking on the button "Add New Server", when it is possible to add a new server within XenCenter and declare it a member of the cluster at the same time.

![Figure 25 Defining the parameters of the new cluster](image)

After the simple process of creating the cluster within the XenCenter management software, the next step in the administration of XenServer virtual parameters is setting up XenServer HA options. HA option is usually set at the level of the pool, but it can also be set at the server level.
For the purposes of demonstration of configuring XenServer HA options, it is preferable to run as many virtual machines on XenServer, add storage repositories, and then create a cluster, within which one of the servers will be master, and others the cluster’s members. After performing all the actions, it is necessary to set up HA. HA is set by right clicking on the cluster, i.e. the pool, and selecting the option "High Availability..."

![Figure 26 Entering HA configuration](image)

In the next step, you will open a dialog window to configure HA. You only need to click on the button "Next". In the next step you need to perform the scan of the pool, and if during the scanning the system does not recognise the corresponding Heartbeat SR (Storage repository for HA functionality), setup will be interrupted. If Heartbeat SR is recognised, you come to Step 2 of HA configuration, whereby you need to notice that the Heartbeat Storage repository was recognised and need to click "Next".

![Figure 27 HA Heartbeat Storage repository](image)
The next step shows a complete HA program, within which there is a list of all virtual machines, with parameters that define them:

- **Restart priority** – defines whether a specific virtual machine is needed, and how much it should be available in the pool. This option can have three different definitions of the availability of the appropriate virtual machine, as follows:
  - Restarted
  - Restarted if Possible
  - Do Not Restart

- **(Re)Start Order** – this parameter specifies the priority of running virtual machines in a failover mode, and is defined with decade numbers, where the virtual machine with the lower identifier is a priority, and should be started before the machines defined with higher indicators within the field *(Re)Start Order*.

- **Attempt to start next VM** – this is an extremely important parameter which defines the time of starting a specified virtual machine, in relation to starting a previous machine in fail-over mode. So, after you start the VM that is defined with a lower number in the field *(Re)Start Order* (priority to run over those with higher identifier), you need to wait some time until you start the next machine, or "group" of machines. That's exactly the time defined in the field **Attempt to start next VM**.

All these parameters are set up by simply clicking on a specific virtual machine, and then performing a manual setup. After performing the setup you need to click on the button **"Next"**.

<table>
<thead>
<tr>
<th>Virtual machine</th>
<th>Restart priority</th>
<th>Start order</th>
<th>Delay interval</th>
<th>Agile</th>
</tr>
</thead>
<tbody>
<tr>
<td>PROD_SOL_01</td>
<td>Restart if possible</td>
<td>60 seconds</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>DEV_SOL_01</td>
<td>Restart if possible</td>
<td>60 seconds</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>DC_03</td>
<td>Restart if possible</td>
<td>3 seconds</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>DC_02</td>
<td>Restart if possible</td>
<td>1 second</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>DC_01</td>
<td>Restart if possible</td>
<td>6 seconds</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>cmix.XD.03</td>
<td>Restart if possible</td>
<td>30 seconds</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>cmix.XD.02</td>
<td>Restart if possible</td>
<td>30 seconds</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>cmix.XD.01</td>
<td>Restart if possible</td>
<td>30 seconds</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>cmix.XA.03</td>
<td>Restart if possible</td>
<td>0 seconds</td>
<td>No</td>
<td></td>
</tr>
</tbody>
</table>

![Figure 28 HA Plan](image)

After setting up the HA Plan, you come to the last step. You only need to click on the button **"Finish"**.
After this HA setup in the specific pool, HA option is enabled. So HA is enabled, which means that if for some reason one of the servers within the pool becomes unavailable (is not visible in the network, has abruptly shut down, etc.) all of his tasks (running virtual machines, using the storage repository, etc.) will be proportionally taken over by the other members within the pool.

Since there is the possibility of enabling HA functionality, it is also possible to disable HA. If there is a need for it, it is necessary to click on the pool on which it is enabled, and then select the tab "HA", and then click on “Disable HA...”

![Figure 29 Disable HA options](image)

In the next step, you need only to confirm disabling HA options by clicking on the button “Yes”.
Conclusion

As can be seen from this document, Citrix company tools intended for the needs of the server virtualisation in a particular part of the network are a simple, effective and open solution. All Citrix tools are open source solutions, whose installation files very easily found on the web presentation of the company.

Everything you need for virtualisation is two Setup files, as follows:

- XenServer ISO file, which is necessary to physically install on a server with a certain hardware capacity, which also has support for VT-x (so that the server has support for working with virtual machines). Also, there is the possibility of virtual XenServer installation, by using a pre-existing one, e.g. Windows Server, on which you should install Oracle Virtual Box, or some similar software, within which you need to integrate XenServer ISO file, and perform the standard installation.

- The Setup file for the management software (XenCenter), which is necessary to install on a management console that is running under Windows. By simply adding servers within this management software, you can virtually monitor hardware parameters of those machines on which XenServer is installed. All you need is that the management console belongs to the same segment of the network as XenServer.

Management Console allows simple adding of new servers (all you need is the XenServer IP address and the credentials with which the root user accesses its resources), adding new virtual machines (only if the server to which the virtual machine is added has a processor which has support for virtualisation), adding new storage repository (Hardware HBA, NFS, etc.) which require additional adjustments.

The last part of the document describes how to create the cluster, where you can see that Citrix's products, as well as similar products for virtualisation, provide HA option within the cluster. Therefore, it is necessary to have two or more servers of similar hardware features, which are necessary to set in one cluster.

Servers need to perform a lot of tasks, to have a large number of virtual machines that are running under them, to have specific remote storage repositories, etc. One of the servers needs to be the master server within the cluster, and it is usually the server with the highest volume of tasks. Other servers will be members of the cluster. After that, you need to enable HA option on the cluster. If one of the servers, for some reason, becomes unavailable (is not visible on the network, abruptly shuts down etc.) other servers need to take over its tasks, which is the main point of HA option – high availability of all virtual machines and all storage repositories in real-time, and in the way that defines it within the HA plan, especially when viewed from the point of the order in which the specific machines are started after problems within the network.
References


[7] Various Internet resources: videos, installation manuals, etc.
## List of abbreviations

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>EULA</td>
<td>End User Licence Agreement</td>
</tr>
<tr>
<td>FC</td>
<td>Fibre Channel</td>
</tr>
<tr>
<td>FcoE</td>
<td>Fibre Channel over Ethernet</td>
</tr>
<tr>
<td>HA</td>
<td>High Availability</td>
</tr>
<tr>
<td>HBA</td>
<td>Hardware Bus Adapter</td>
</tr>
<tr>
<td>iSCSI</td>
<td>Internet Small Computer System Interface</td>
</tr>
<tr>
<td>LUN</td>
<td>Logical Unit Number</td>
</tr>
<tr>
<td>NFS VHD</td>
<td>Network File System Virtual Hard Disk</td>
</tr>
<tr>
<td>SAN</td>
<td>Storage Area Network</td>
</tr>
<tr>
<td>VDI</td>
<td>VirtualBox Disk Image</td>
</tr>
<tr>
<td>VM</td>
<td>Virtual Machine</td>
</tr>
<tr>
<td>VT-x</td>
<td>Virtualisation Technology</td>
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</tbody>
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