



Installation Documentation for CentOS 6 Linux Operating System

In support of ZeroNines Always Available
Software Version AAv7_1

ZeroNines Technology, Inc.

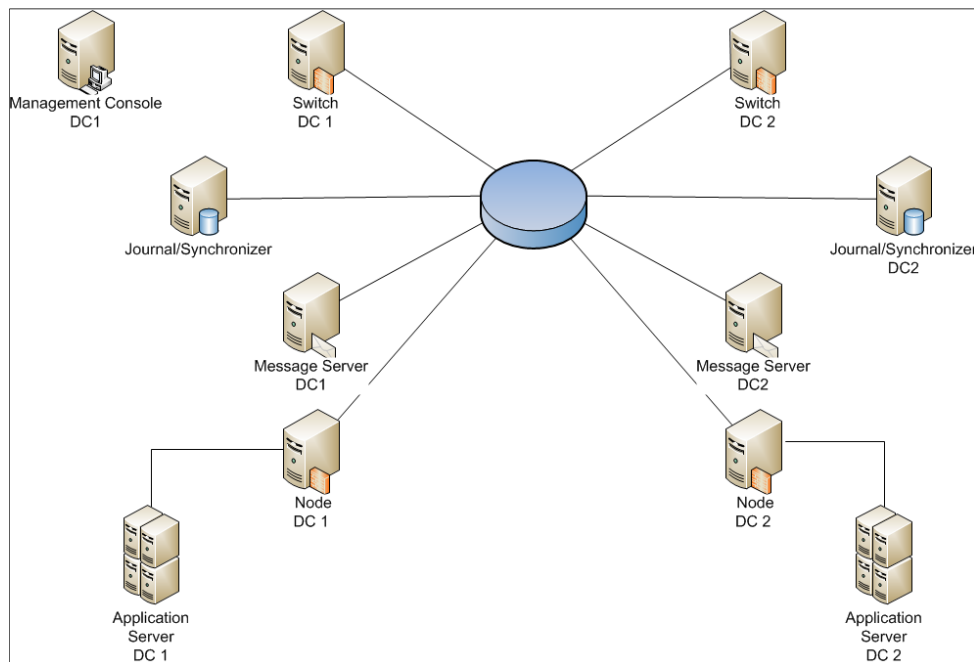
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1 Overview of Configuration

This document describes the installation of the CentOS v6.x Linux operating system in preparation for the installation of the ZeroNines® Always Available™ software. Always Available is a 100% software solution and installs on your existing hardware and network infrastructure; there is no additional hardware required. The installation of the ZeroNines software itself is described in other documents.



ZeroNines Components

1.1 ZeroNines Basic Components and Function

The architecture consists of switch, node and tracker components. It also requires a network to interconnect the devices, preferably a trusted network. Each switch, node and tracker has configurable identifications that consist of a location ID and device ID. The switches, nodes and tracker(s) communicate via subject addresses in a publish/subscription model. The devices have a built-in guaranteed messaging system to resend those messages that were not received by targeted devices.

1.1.1 The Switch

The switch is the component that external users/systems access. For example, an external DNS server, domain controller, or load balancer would point users to the switch, which would be the gateway to the Always Available configuration. The switch's primary function is to interface with the client, encapsulate the client's message in a ZeroNines formatted message, and transmit that message to the nodes. The encapsulated message contains a location ID, switch ID, time stamp, sequence number, and subject address. Replies are picked off the wire and processed in sequence according to the time stamp and sequence number. Missing messages are either automatically sent by the node or requested by the switch. Optionally, replies can be requested from the tracker.

The switch also hosts the proxy services. Users connect to the switch via the proxy services. The session is encapsulated and communicated to the ZeroNines message server.

1.1.2 The Management Console

The management console is a user interface for you to monitor the various ZeroNines components. It provides an interface to configure the switches, nodes and protocol proxy. It also has an interface for managing the messaging system.

1.1.3 The Node

The node is the component that interfaces with the application servers. The node receives encapsulated messages or transactions from the switch and relays them to the application server. The node receives and processes these transactions in sequence according to the time stamp and sequence number assigned by the switch. These transactions are buffered in memory as the application server processes them. This mechanism ensures that all sites process all transactions in the same order. On occasion, the memory buffer may become full before transactions are processed at the application server. This will occur if there is a problem at the application server. As memory gets flushed, the node knows what the last successful transaction was, and the node will query the tracker for the missing transactions. Joint action between the tracker and the switch will deliver the missing transactions to the node. These transactions are then processed normally.

1.1.4 Messaging Server

The messaging server is a built-in function of the ZeroNines messaging system for delivering transactions reliably between the switches and nodes. Transactions are buffered to the messaging server's memory, paged memory and/or disk. Typically, the messaging server can hold 30 minutes worth of transactions. Normally, these transactions flush from buffered memory to free up space once all application servers successfully process the transactions. If one or more application servers are down or are experiencing latency, they will need to catch up by processing the delayed transactions, until they reach the same logical state as the other application servers. These delayed transactions are not flushed but remain in memory on the messaging server while the application server works its way through all the transactions in the correct order. If one of the delayed transactions is not processed within 30 minutes it may be flushed, and the node will then query the tracker for it.

We call this our "guaranteed messaging" architecture. It ensures that transactions are delivered to the application servers in the correct order of delivery, based on time stamps and sequence numbers.

Another function of the messaging server is to enable management messages to be transmitted between devices. Management messages can check for active or inactive devices by watching for "heartbeats" that can indicate whether the system should register new or remove old devices. Management messages also inform the guaranteed message system to stop caching or waiting for messages from inaccessible components.

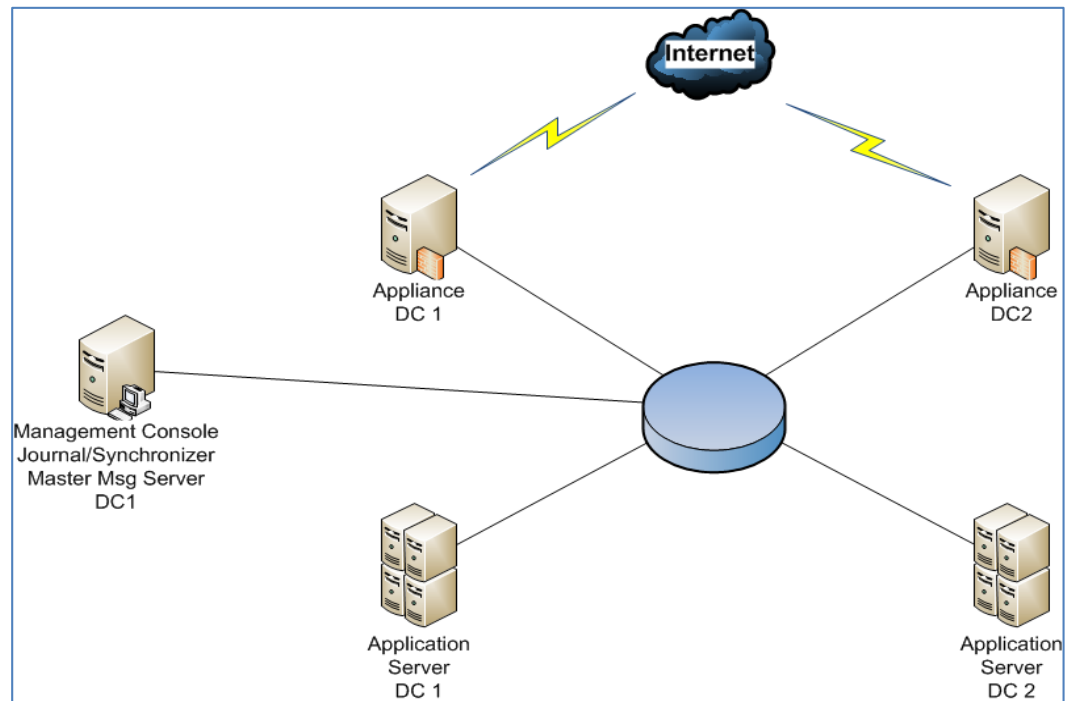
1.1.5 Tracker (Journal/Synchronizer)

The tracker represents the journal and synchronizer in our framework. The tracker's role is mainly to record the transaction messages sent between switches and nodes. With our current deployment, the tracker records the messages to a MySQL database. Hierarchical storage management systems can be employed to ease storage requirements for the tracker. Tape can be used as an archival method for off-loading data. In addition to the messages, the tracker records location ID, device ID, time stamp, and sequence number.

The tracker has a secondary role as a transaction replay module. Working in conjunction with guaranteed messaging, the tracker can replay missing transactions to a node as part of the process of rebuilding an application server. See Section 1.1.3 "The Node". The

tracker works on a primary/secondary configuration, allowing for one active tracker at any time. However, because of the messaging architecture, more than one tracker can be part of the system. If a primary tracker is unavailable, then the device registration will select another tracker as the primary.

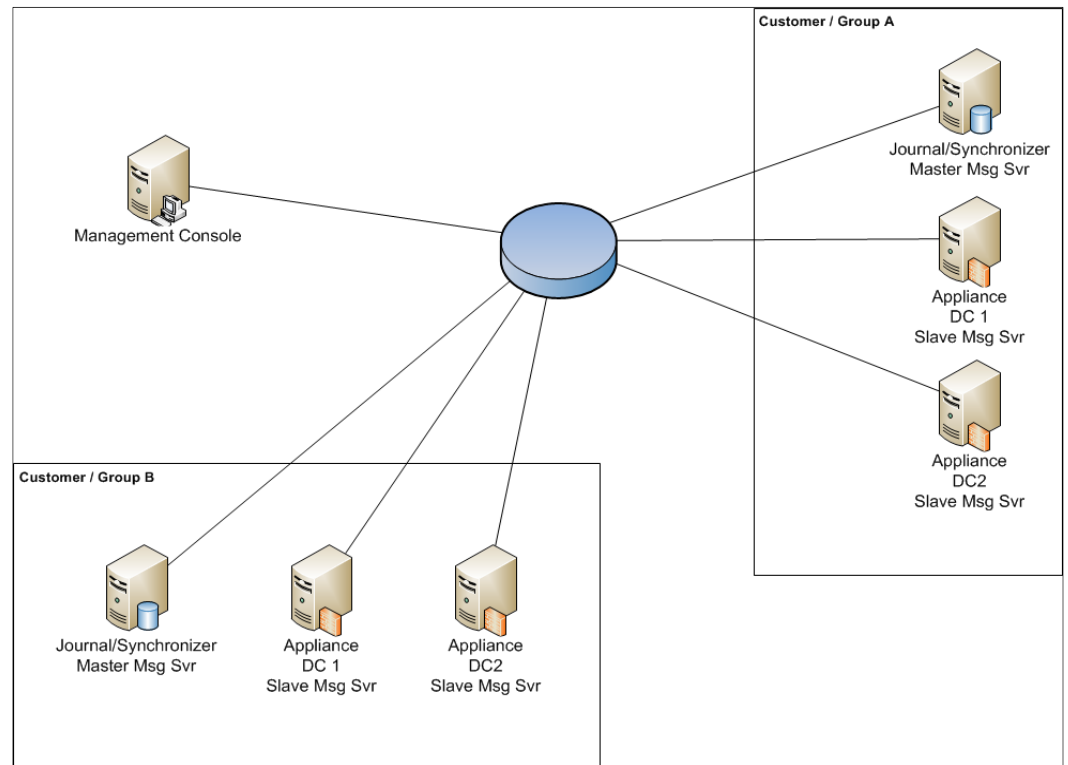
1.1.6 Always Available - Standard Configuration



The Standard configuration consists of an application or customer deployed into two (2) data centers. With this configuration, a master message server, console, and journaling server will be installed on one server. In each data center for the application servers, an appliance server with the switch/switch proxy, node, and slave message servers will be installed.

For brevity, we use the word “appliance” in reference to any collection of ZeroNines software components that work together or that are installed together. For example, the ZeroNines console, journal, and messaging server are all installed together as one *appliance*, which in turn is just a part of the overall ZeroNines software installation.

1.1.7 Always Available - Multi-Tenant / Multi-Application / MSP Configuration



With a multi-tenant or multi-application installation such as might be installed in a managed services environment (MSP), the groups are contained and segmented by the ZeroNines messaging servers. For each group, a ZeroNines message server or cluster of message servers is established. In this configuration, the message server and journal server are not installed on the console. The journal server will monitor transactions for the group that it is configured.

1.2 Hardware Requirements and Configuration

Minimum requirements for all hardware are as follows.

Always Available Standard Model:

Component	RAM (min - rec)	DASD (min - rec)	Cores (min - rec)	NIC (min - rec)
Console/ Message Server/ Journal	8GB - 16GB	100GB+	2 - 4	1 - 2
Appliance	4GB - 16GB	40GB+	2 - 4	1 - 2

Always Available Multi-Tenant / Multi-Application / MSP Model:

Component	RAM (min - rec)	DASD (min - rec)	Cores (min - rec)	NIC (min - rec)
Console	4GB - 8GB	60GB+	1 - 2	1
Journal / Message Server	8GB - 16GB	100GB+	2 - 4	1 - 2
Appliance / Message Server	8GB - 16GB	60GB+	2 - 4	1 - 2

1.3 Network Prerequisites

You will be using one Linux machine to install the 64 bit version of CentOS v6.x Linux operating system, the ZeroNines software, and other necessary platforms onto another physical server or virtual machine.

You should work in advance with your network administrator to obtain the IP address and other networking information for the target machine so it is readily available and so you will not need to interrupt the installation process to obtain it.

The information you will need is:

- IP address reserved for the ZeroNines machine you are installing
- The netmask in bit notation (e.g. 24, 20, 16)
- Gateway and DNS Server numbers

1.4 Conventions Used in this Document

• Indicating and Diagramming Command Lines in Linux and other Environments

This document will specify several command level directives for installing software components and running scripts.

In Linux, such commands are structured as follows:

```
[[user@servername]] # command statement
```

For example, if your user name is "admin" and the server name is "switch" and the command for installing Apache Tomcat 6 is "yum install tomcat6" then the full command line you will use is:

```
[admin@switch] # yum install tomcat6
```

Linux will automatically write out the user name and server name on each command prompt. In this document we will simply denote them with "[user@servername]". The command itself – the part you need to type in – will be in **bold typewriter font** and the entire command line will be written on a new line.

Thus, when we instruct you to type the command line "yum install tomcat6" we will illustrate it as follows:

```
[[user@servername]] # yum install tomcat6
```

Be sure to include any spaces or additional characters such as periods, hyphens, or slashes.

Hit the "Enter" key after typing each command line. In most cases we will not add instructions to hit enter, to avoid cluttering the document. Thus, if we instruct you to enter the command line "su", you would type **su** and hit "Enter".

In Linux, the # (pound sign or hash mark) denotes a user logged in with super user status. (The \$ dollar sign denotes a user with ordinary non-super user status). All the command lines in this installation process require you to be logged in as a super user.

• Entering Data in On-Screen Forms

When we instruct you to type information into on-screen interactive forms we will format it in **plain typewriter font**. For example, if we want you to type the word "switch" in the hostname box, we will write:

In the Hostname box, type **switch**

• On-Screen Buttons and Other Controls

When you need to click or select an on-screen clickable/linked button, tab, text, option, checkbox, or other interactive feature, we will write it in **sans-serif bold italic** type. For example, if we want you to select the "US English" keyboard option and then click "Next" we will write:

Select **US English** from the dropdown list and then click **Next**

• Keystrokes

When you need to hit a key on your keyboard, the name of the key will be in **[BOLD ALL-CAPS, IN SQUARE BRACKETS]**. For example, when we want you to hit the "Control" and the "C" key simultaneously we will write:

Hit **[CTRL] + [C]**

- **Names of pages and page sections**

If a page, a screen, or a section within a page or screen has a distinct name like "Welcome" or "Hostname" we will use normal type and surround the name with double quotes.

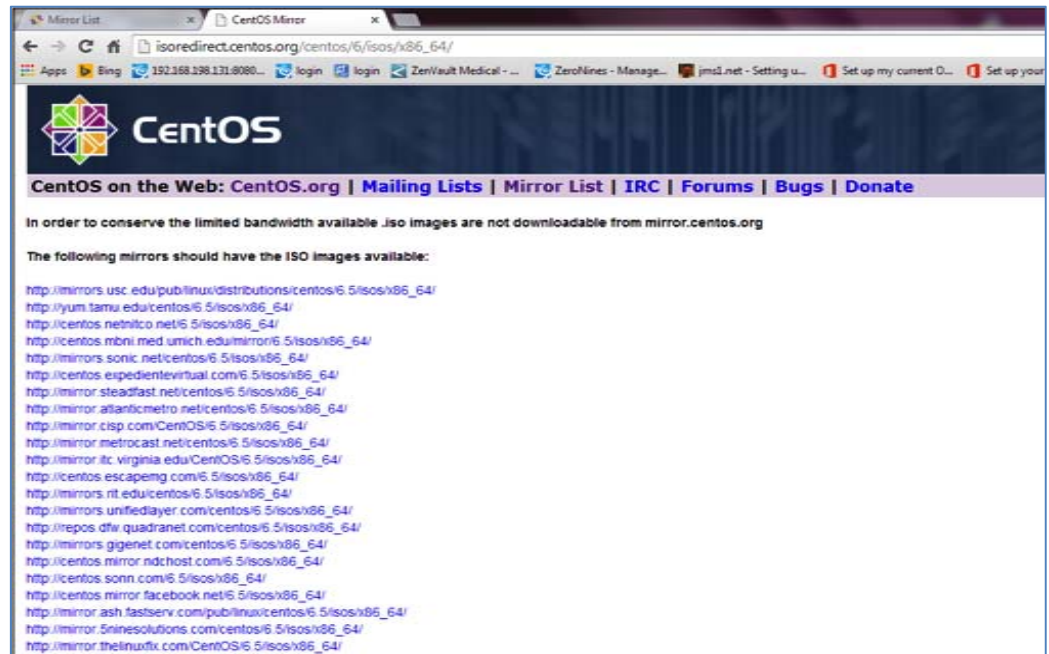
- **Punctuation**

In order to avoid confusion, we will occasionally dispense with proper English punctuation, most notably dropping the periods at the end of sentences where we instruct you to type a character string as a command. This will eliminate any doubt about whether you should include the period or not.

- **Abbreviation of Always Available**

In many cases to save space we have abbreviated Always Available as AA.

In the example below we have clicked on the [x86_64](#) link associated with version CentOS-6. This opens a page with a list of mirror sites from which you can download the software.



You can select and download from any of these mirrors, but some may have faster connections than others. Click on the link for the mirror of your choice. A new screen will open (shown below) showing you the many options for downloads.



Of the array of files you see on this screen, you need only these two DVD-ready files:

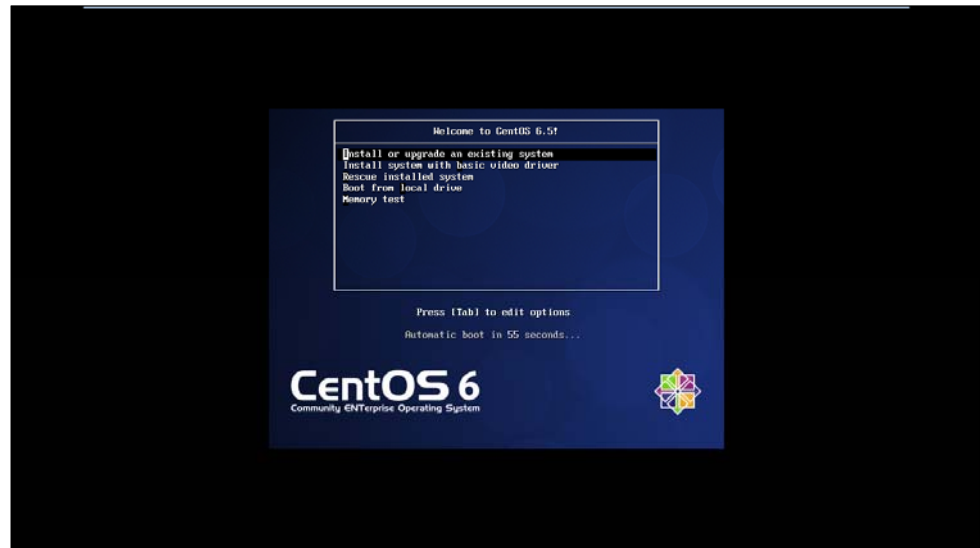
[CentOS-6.5-x86_64-bin-DVD1.iso](#)

[CentOS-6.5-x86_64-bin-DVD2.iso](#)

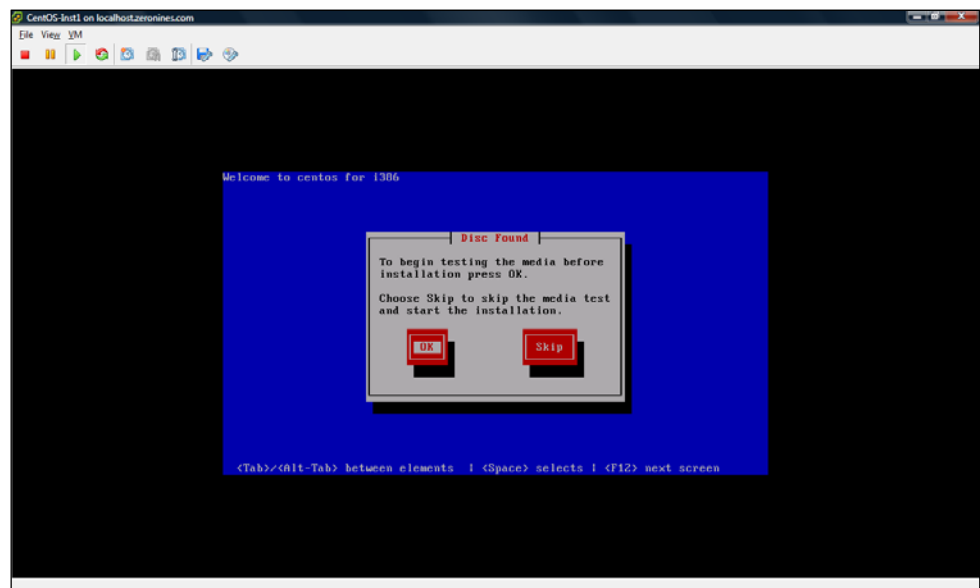
Save these files and then burn them to separate DVDs.

2.1.1 Preparing to Install CentOS

Insert the CentOS DVD1 into the CD or DVD drive and the installation process will begin.



The opening screen gives you the option of installing or upgrading an existing system, installing with basic video driver, rescuing an installed system, or booting from a local drive. These instructions outline a default (graphical) installation of the base operating system. You can select the default by hitting **[ENTER]** or by typing the character **i** on your keyboard and then hitting **[ENTER]**.



You have the option of testing the installation media (DVD, CD-ROM or ISO file) upon installation. If you select **Skip** it will bypass the test and take you to the "Welcome" screen. If you choose to do the test, click **OK** and follow the on-screen instructions (not shown in this document) and when done you will be prompted to select your preferred language and keyboard type. Once you've selected the default language and keyboard type you will then continue to the "Welcome" screen.

2.1.2 Language and Keyboard Preferences



Select your preferred installation language.

Click **OK**



Select your keyboard layout.

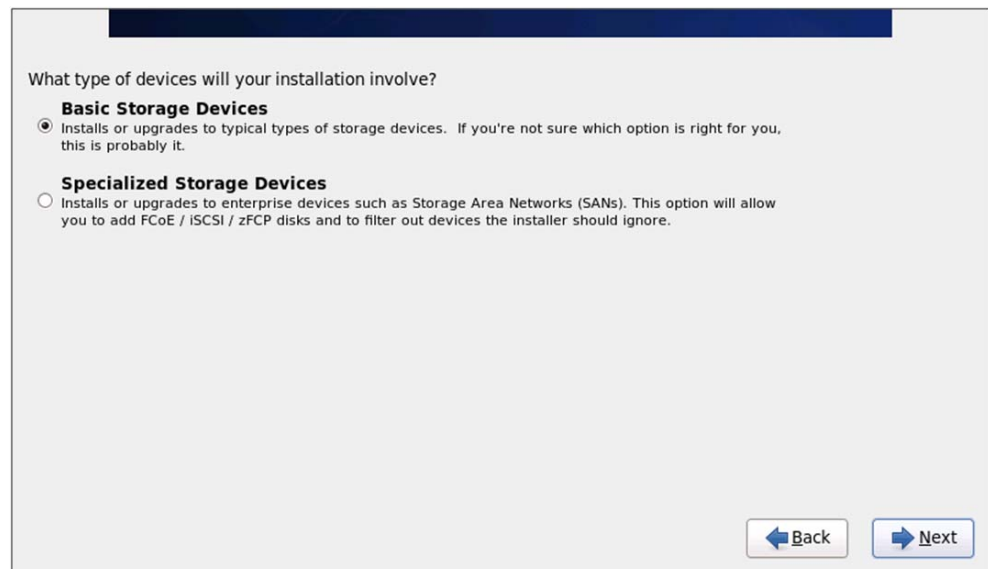
Click **OK**



The Welcome Screen is shown here.

Click **Next**

2.1.3 Optional Specialized Storage

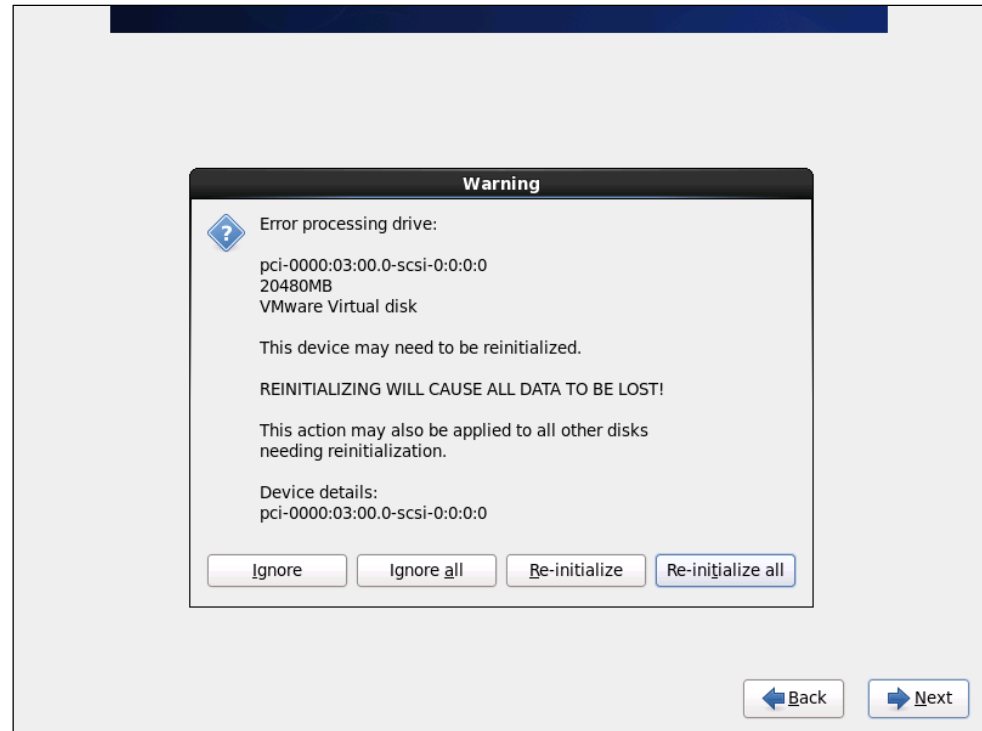


You have the option of installing specialized storage devices, shared storage media, SAN, network attached storage, or RAID devices. Storage drivers may be required for support.

Each system is unique and your system may require additional steps for setting up storage devices. Work with your system administrator to obtain the correct settings for your system. You may also contact ZeroNines via phone or email for support in this area.

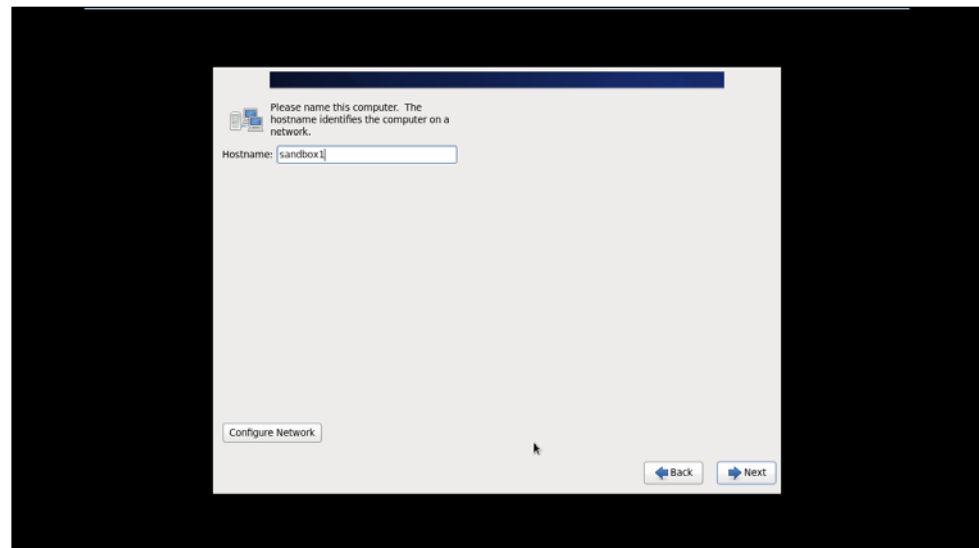
In this example we are installing with **Basic Storage Devices** and have clicked the radio button for that option.

Click **Next**



In virtualized environments, Linux may need to reinitialize the file format. If you receive this warning, hit the **Re-initialize** or **Re-initialize all** button and Click **Next**

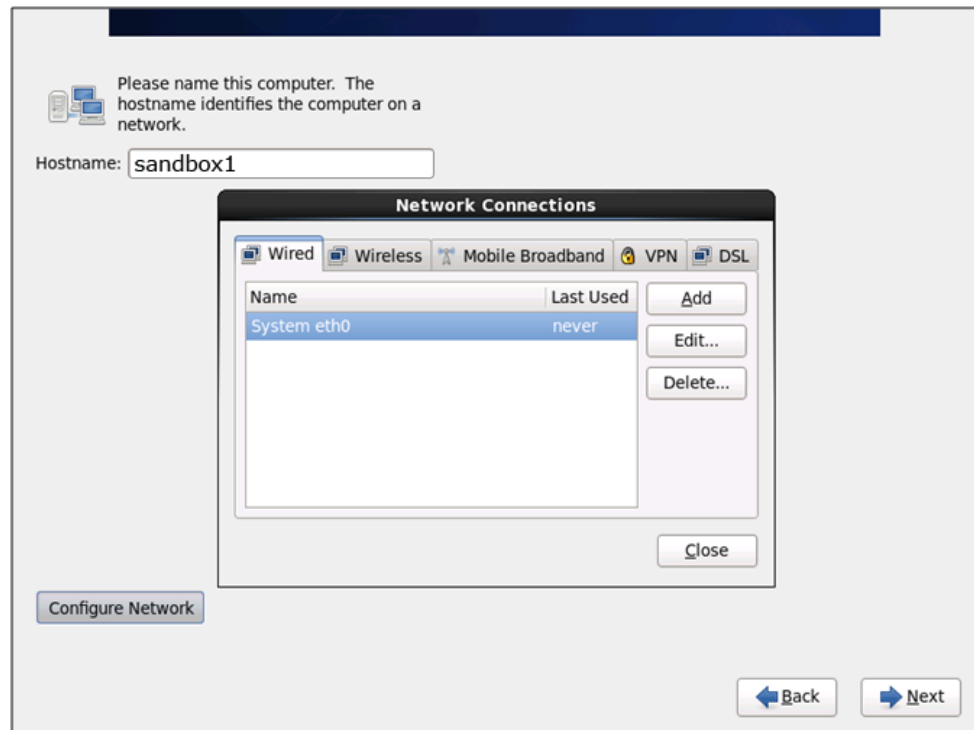
2.1.4 Server Hostname and Configuring the Network



CentOS now ask you to (1) Provide the Hostname or name of the server on which you are installing this installation and (2) configure the network.

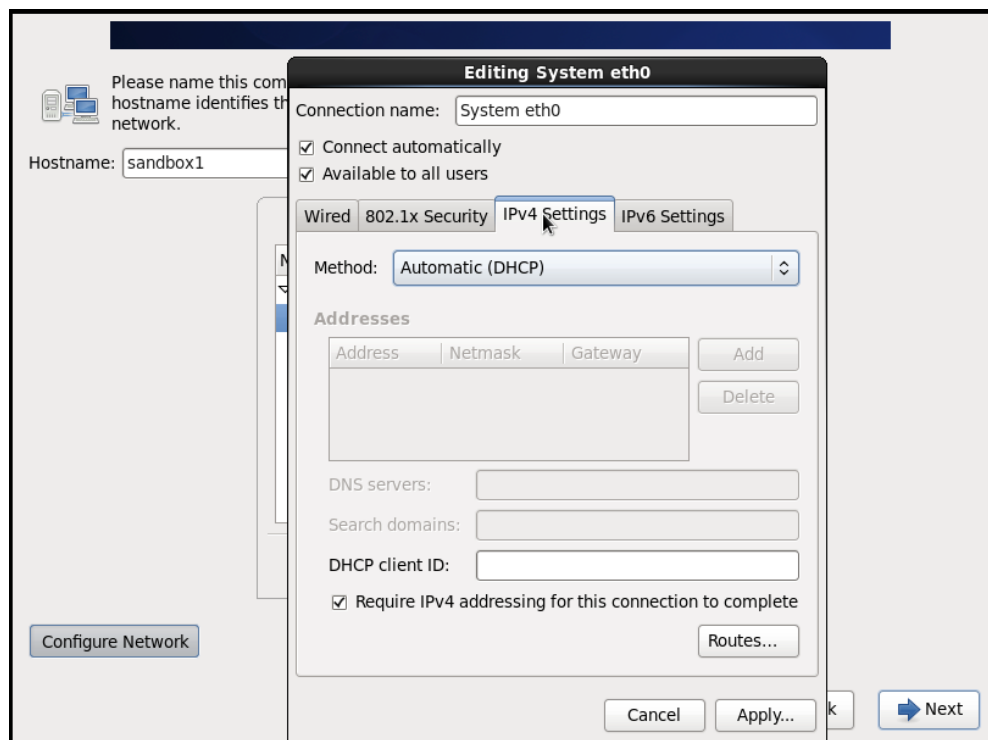
Step (1) The Hostname or server name depends on which device you are installing. In the box titled "Hostname" type **switch**, **node**, **tracker** or the name of an application server, i.e. **accounting**, **webserver1** or **email**. Your network administrator may need to provide this name. In our example above, we've labeled this server **sandbox1**

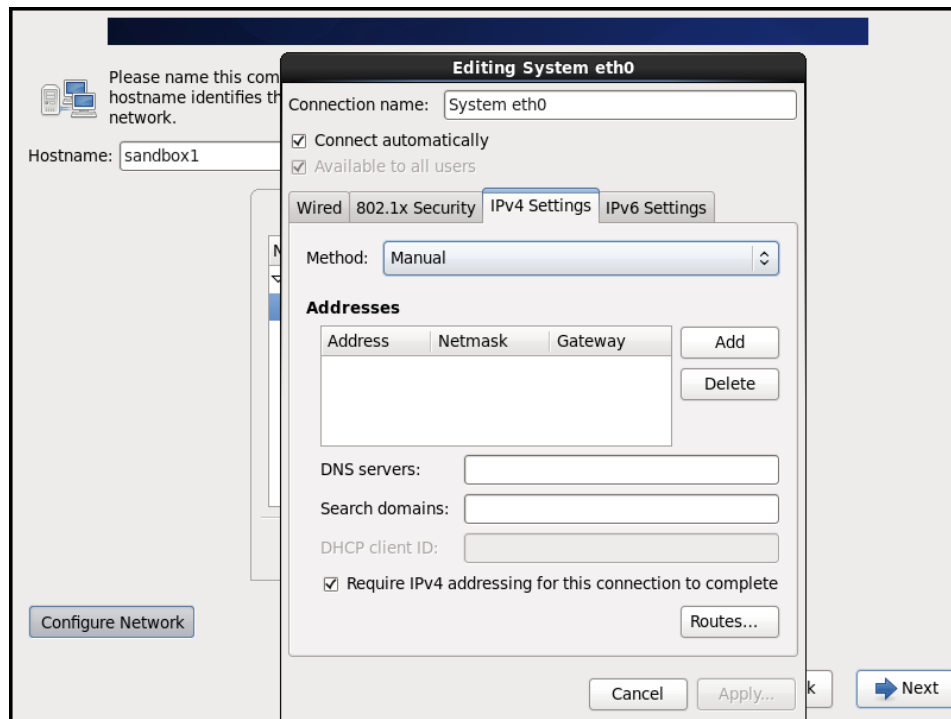
Step (2) Click the **Configure Network** button in the lower left. This step has several dependent operations, outlined below.



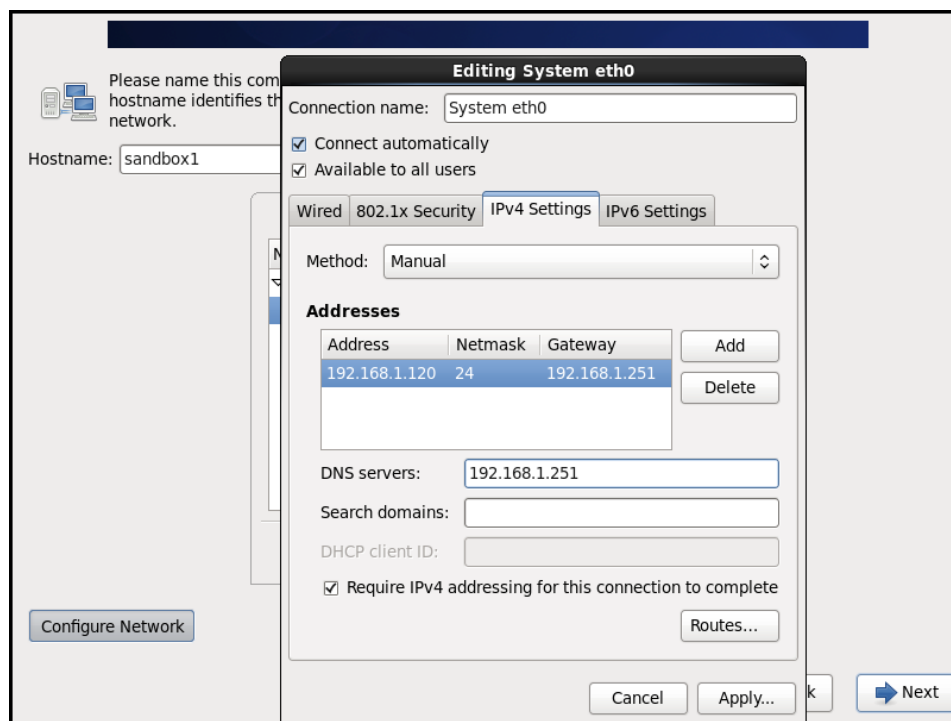
In the "Network Connections" screen that opens, select **System eth0** and click **Edit** on the right.

A smaller "Editing System eth0" screen will open, superimposed over the main window.





On the "Editing System eth0" screen you will configure the Ethernet connection or network connection. Select the tab **IPv4 Settings**. Within the "Method" dropdown, select **Manual** as in the image above.



Once you have selected **Manual**, click on **Add** to add the IP address for the ZeroNines machine you will be installing. Work with your network administrator to obtain this address, which should be a reserved IP network address specifically for the ZeroNines machine.

Enter the mask in bit notation: e.g. 24 bit, 23 bit, or 20 bit notation. In this example we assume 24 bit notation. Work with your network administrator to determine bit count and notation.

Enter the gateway and DNS server numbers. Your network administrator should provide these.

Select the check box for **Connect Automatically** in the upper left.

While filling in this form, refer back to the information you gathered from your network administrator and saved in Section 1.3 "Network Prerequisites".

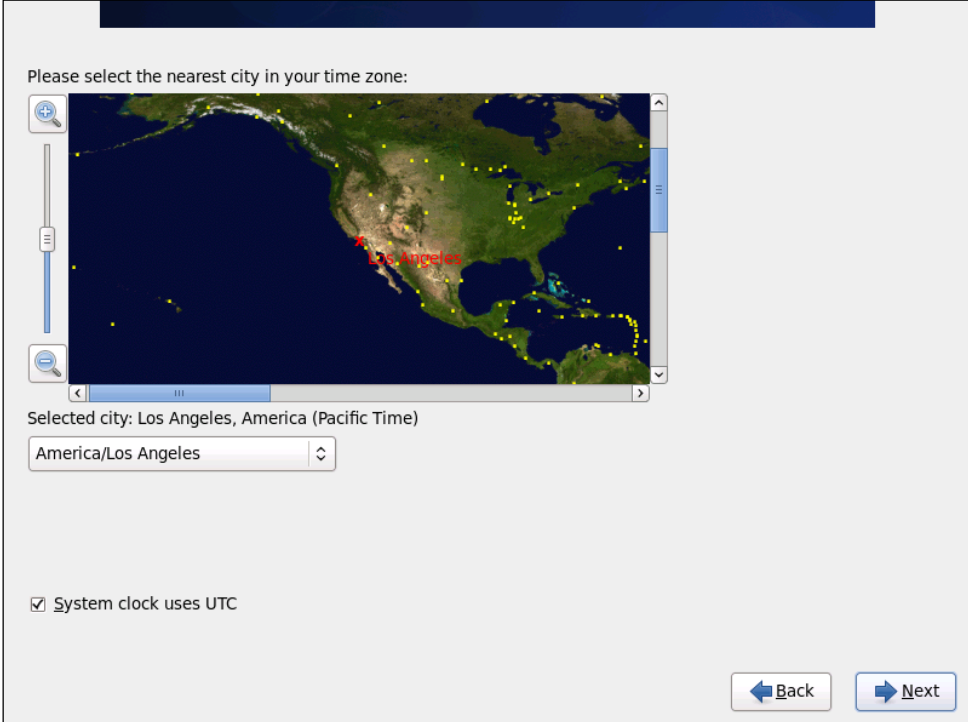
The screen shot above shows the "Editing System eth0" screen properly filled out.

Click **Apply** and this small window will close, completing the network configuration step and returning you to the "Network Connections" window. Click **Close** on the "Network Connections" window.

This will return you to the screen with the "Hostname" box.

Click **Next**.

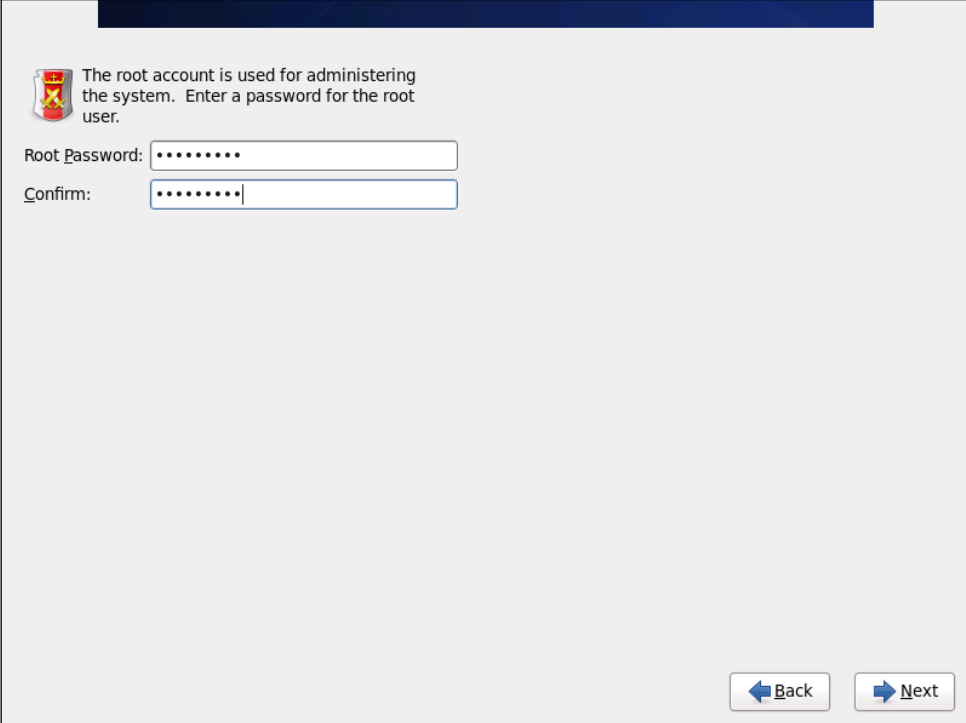
2.1.5 Time Zone



You have the option of selecting your local time zone from the drop-down list. You also have the option to select **System clock uses UTC**. This option synchronizes the components to a universal time clock, ensuring consistent time tracking for all of the components.

Click **Next**

2.1.6 Creating the Root Password



Type in a root password, and enter it again for confirmation. Make a careful note of this password because you will need it to access the "super user" administrative account during some steps of installing ZeroNines Always Available software, as described in other documents.

Click **Next**

2.1.7 File System

Which type of installation would you like?

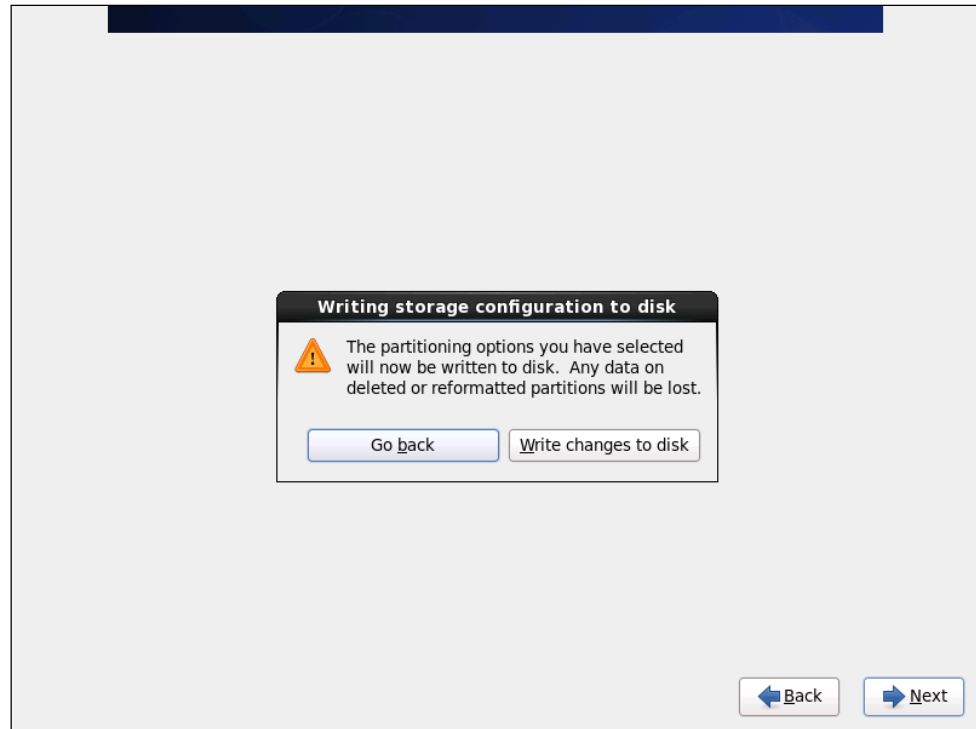
- ☐ **Use All Space**
Removes all partitions on the selected device(s). This includes partitions created by other operating systems.
Tip: This option will remove data from the selected device(s). Make sure you have backups.
- ☒ **Replace Existing Linux System(s)**
Removes only Linux partitions (created from a previous Linux installation). This does not remove other partitions you may have on your storage device(s) (such as VFAT or FAT32).
Tip: This option will remove data from the selected device(s). Make sure you have backups.
- ☐ **Shrink Current System**
Shrinks existing partitions to create free space for the default layout.
- ☐ **Use Free Space**
Retains your current data and partitions and uses only the unpartitioned space on the selected device(s), assuming you have enough free space available.
- ☐ **Create Custom Layout**
Manually create your own custom layout on the selected device(s) using our partitioning tool.

☐ Encrypt system
☐ Review and modify partitioning layout

[Back](#) [Next](#)

On the screen, “Which type of installation would you like?” you have the option of dedicating all or partial use of the file system. If you are using a system that shares partitions with other operating systems you may need to modify the CentOS file system. The default is to **Replace Existing Linux System(s)**.

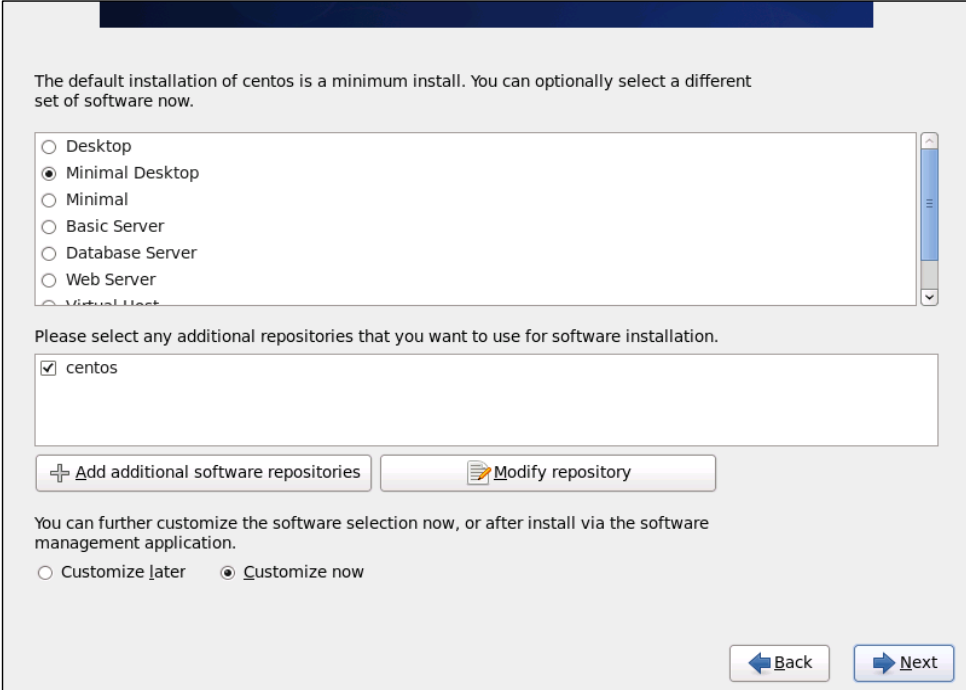
Click **Next**



On the small window "Writing storage configuration to disk" you must click on **Write changes to disk** for the changes to take effect. CentOS will now write your storage configuration changes to disk. CentOS will then take several minutes to format and lay out the file system on the storage device. The time it takes is dependent on the size of the storage device(s).

Click **Next**

2.1.8 Installation Options



The default installation of centos is a minimum install. You can optionally select a different set of software now.

- ☐ Desktop
- ☒ Minimal Desktop
- ☐ Minimal
- ☐ Basic Server
- ☐ Database Server
- ☐ Web Server
- ☐ Virtual Host

Please select any additional repositories that you want to use for software installation.

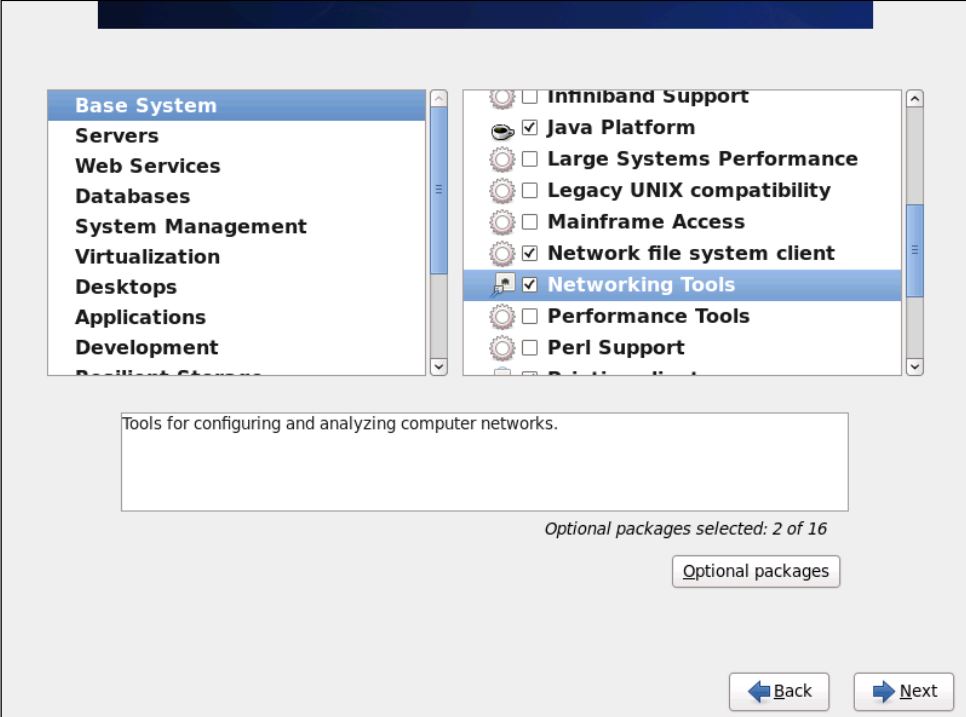
- ☒ centos

You can further customize the software selection now, or after install via the software management application.

☐ Customize later ☒ Customize now

Select the **Minimal Desktop** installation option.

Click the **Customize Now** radio button near the bottom of this screen. This will take you to an additional screen that allows you to select additional components that are required for the ZeroNines Always Available software. **Note: do not uncheck any existing options.**



Base System

- Servers
- Web Services
- Databases
- System Management
- Virtualization
- Desktops
- Applications
- Development

☐ Infiniband Support

☒ Java Platform

☐ Large Systems Performance

☐ Legacy UNIX compatibility

☐ Mainframe Access

☒ Network file system client

☒ Networking Tools

☐ Performance Tools

☐ Perl Support

Tools for configuring and analyzing computer networks.

Optional packages selected: 2 of 16

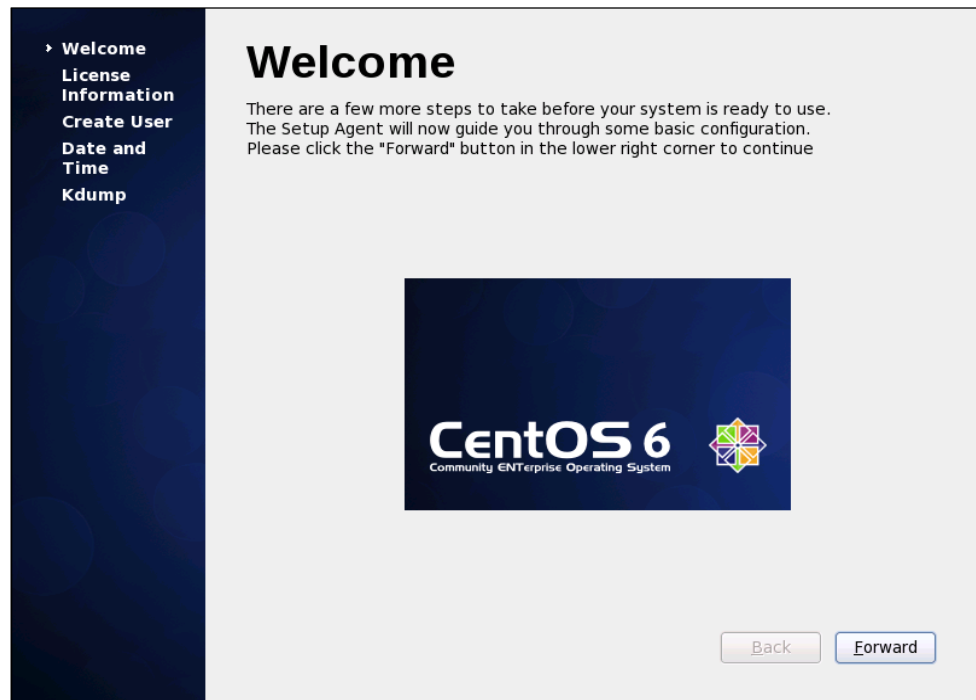
Along with the default module selections for “Minimal Desktop”, ZeroNines recommends you confirm that the following installation options are selected (do not unselect any default options).

Base System	✓ Base ✓ Networking Tools
Servers	✓ System Administration Tools
Web Services	✓ Web Server ✓ Servlet Engine
Databases	Accept Default Options
System Management	✓ System Management
Virtualization	Accept Default Options
Desktops	Accept Default Options
Applications	✓ Internet Browser
Development	Accept Default Options
Resilient Storage	Accept Default Options
High Availability	Accept Default Options
Load Balancer	Accept Default Options
Optional	Accept Default Options
Languages	Accept Default Options

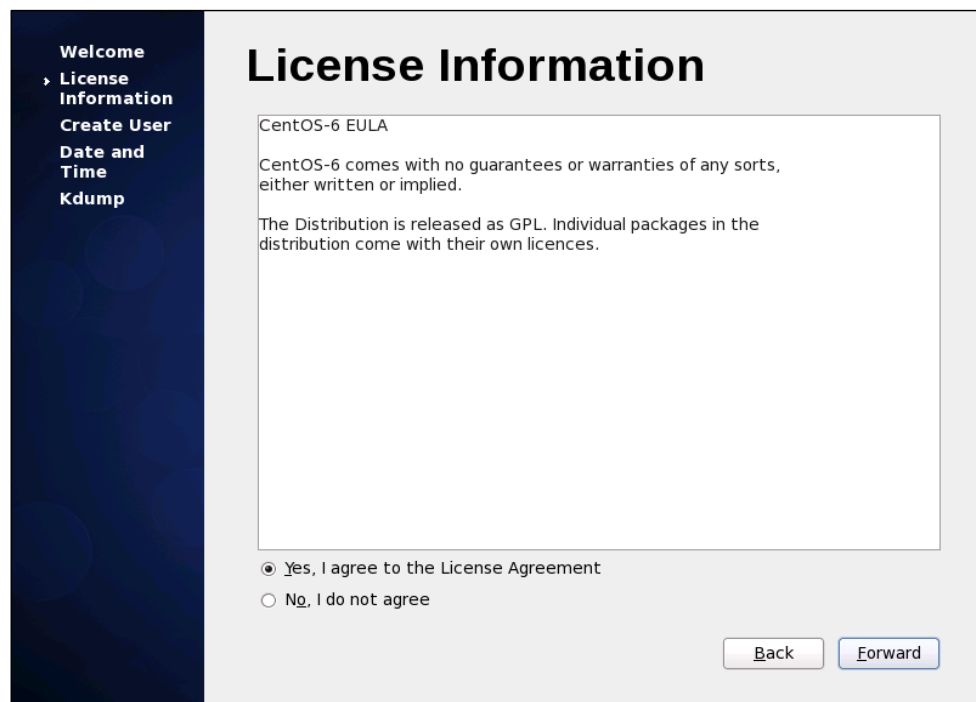
Click **Next** in the lower right to proceed with the installation. CentOS will begin the installation. The time it takes will depend on network bandwidth, options selected above, and the speed of the computer. Once the installation is complete, the system will prompt you that it has completed and will request you to reboot the system. Follow the instructions and reboot the system.

2.1.9 Welcome and License Agreement

Once the system has rebooted, you will be presented with the "Welcome" screen below.



On this "Welcome" screen click **Forward**.



Select the radio button for **Yes, I agree to the License Agreement**

Click **Forward**

2.1.10 Create a User

The screenshot shows a window titled "Create User". On the left is a dark blue sidebar with a menu containing "Welcome", "License Information", "Create User" (highlighted with a right-pointing arrow), "Date and Time", and "Kdump". The main area has a light gray background. At the top, it says "Create User" in large bold text, followed by a paragraph: "You must create a 'username' for regular (non-administrative) use of your system. To create a system 'username', please provide the information requested below." Below this are four input fields: "Username:" with "admin", "Full Name:" with "admin", "Password:" with ".....", and "Confirm Password:" with ".....". There are two buttons: "Use Network Login..." and "Advanced...". At the bottom right are "Back" and "Forward" buttons.

CentOS restricts the "root" (super user) from directly logging in to the desktop environment, so you will need to create a user who **can** log in to the desktop environment. You can create such a user in the "Create User" window. In this case, we are adding a user named **admin** and a password.

Create your user and then click **Forward**

2.1.11 Set the Date and Time

Welcome
License Information
Create User
Date and Time
Kdump

Date and Time

Please set the date and time for the system.

Date and Time

Current date and time: Fri 23 Dec 2011 06:01:05 AM PST

☐ Synchronize date and time over the network

Manually set the date and time of your system:

Date

< December > < 2011 >

Sun	Mon	Tue	Wed	Thu	Fri	Sat
27	28	29	30	1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31
1	2	3	4	5	6	7

Time

Hour: 5

Minute: 44

Second: 56

Back Forward

On the "Date and Time" screen you set the clock for the ZeroNines system. You can do this manually using the calendar, hour, minute, and second controls.

ZeroNines recommends you select **Synchronize date and time over the network** because the Always Available array you are setting up most likely includes many components that could be distributed in different regions.

Welcome
License Information
Create User
Date and Time
Kdump

Date and Time

Please set the date and time for the system.

Date and Time

Current date and time: Fri 23 Dec 2011 06:01:48 AM PST

☒ Synchronize date and time over the network

Synchronize date and time on your computer with a remote time server using the Network Time Protocol:

NTP Servers

0.rhel.pool.ntp.org	Add Edit Delete
1.rhel.pool.ntp.org	
2.rhel.pool.ntp.org	

Advanced Options

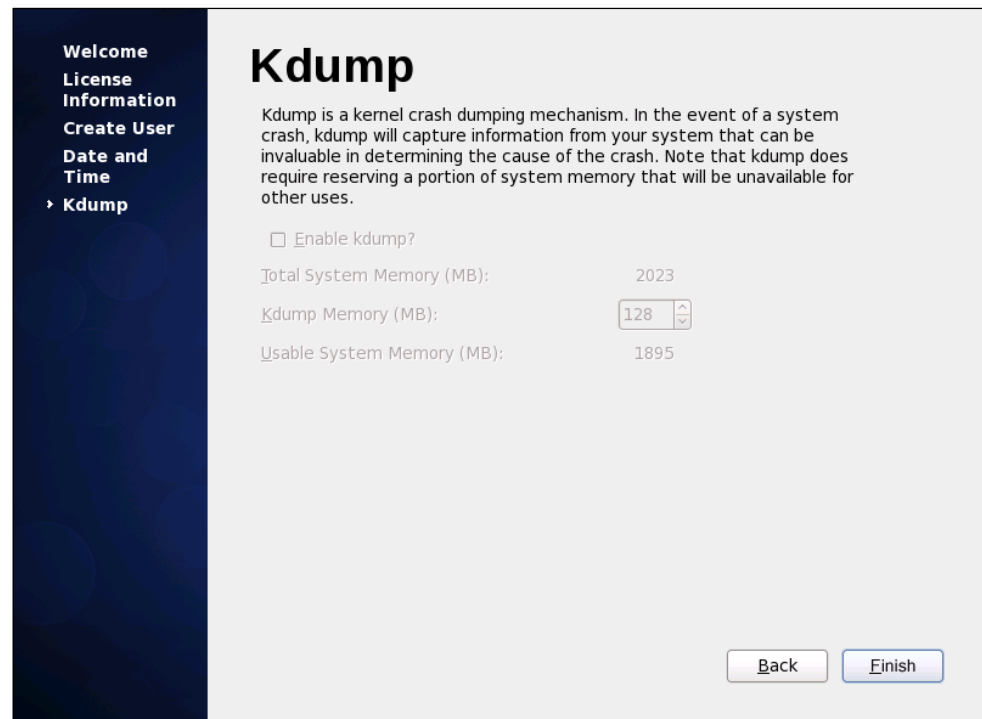
Back Forward

When you select **Synchronize date and time over the network** you will be presented with a pop up window with a default listing of network-based time reference servers as shown above. Click on the server you prefer.

Click **Add** and this window will close, bringing you back to the master "Date and Time" screen.

Click **Forward**

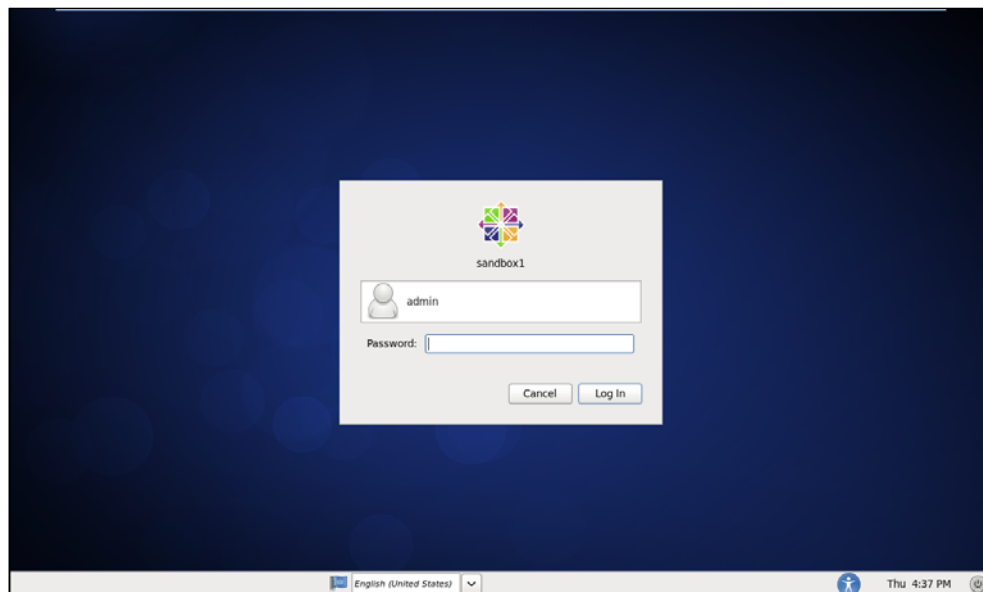
2.1.12 Kdump



You can configure Kdump settings but for performance reasons, ZeroNines recommends not enabling Kdump.

Click **Finish**

Note: The system will now reboot and you will be presented with the login screen as shown below.



This completes the CentOS 6 Linux Operating System installation, which serves as the Base OS for the ZeroNines Always Available software installation.

Note: The previous steps are required for each server in your “Always Available” configuration.

3 Support and Contact Information

If you have questions about this installation or you need help, contact ZeroNines Support at support@zeronines.com.

Always Available™ technology from ZeroNines® Technology, Inc. is a software-only business continuity solution. There is no hardware to install, and it operates on your existing hardware and infrastructure.

Always Available™ is true active-active real-time application replication in multiple sites. It processes all network transactions and data exchanges equally and simultaneously on multiple servers anywhere across the globe. If one goes offline, the others keep processing and your customers don't experience downtime. It keeps your applications and data running despite problems that would knock an ordinary system offline.



ZeroNines® Technology, Inc. provides a new standard in network disaster recovery, shifting the paradigm from reactive recovery to proactive business continuity. Our Always Available™ information security and availability technology pushes application uptime beyond five nines (99.999%) to virtually 100% anytime, all the time – zero nines. This enables uninterrupted access to business data, applications, and transactions despite disasters or network disruptions that would otherwise cripple the enterprise. Always Available™ processes all transactions in parallel on geographically dispersed servers that are all hot and all active, eliminating single points of failure. It operates agnostically across multiple platforms, leveraging existing processing and storage infrastructure. We also offer enterprise infrastructure assessment, program management and project implementations. Founded in 2000 and based in Denver, Colorado, ZeroNines' primary target customer base includes Global 2000 companies.

Corporate HQ

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