



Linux System Recovery Guide

Version 5.3



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1. Introduction

The [SBAdmin for Linux System Recovery Guide](#) is a supplement to the [SBAdmin User Guide](#), providing details on reinstalling a Linux system from a **SBAdmin System Backup**. Note that a System Backup is not limited to reinstalling the same system from which it was made, but it may also be used to “clone” the original system onto different systems containing the same or different hardware.

When to Use this Guide

This guide provides instructions for booting and reinstalling a system from a SBAdmin System Backup. This document should be reviewed after first installing the software to become familiar with this process and its requirements BEFORE a system recovery is required.

Installation from a System Backup is fairly intuitive, but there is information and steps that must be taken to be prepared in the event that a system re-installation is required. The System Backup contains all of the backup data and the information needed to recreate the system and restore the data, but to access the System Installation Process, boot media must be created. This may be either bootable floppy diskettes (4 to 5 of them) or a bootable CDROM.

This guide will refer to information found in the SBAdmin User Guide. When doing so, the reference term or section will be shown in [Blue Text](#). If you need to refer to that information in the Administrator User Guide, highlighted sections (**in bold**) can be found in the [Table of Contents](#), and other terms can be found in the [Index](#).

Terminology

The system recovery process is straight-forward and provides much instruction and help screens to guide you through the process. Even when creating and changing devices, filesystems, partition maps, logical volumes, etc, the information provided should make the process fairly intuitive. There are a few terms you should understand before beginning the process:

- **Linux kernel:** This is the first “program” that gets executed when your Linux system starts. It is considered the “base operating system” from which all other processes are run. Various kernels provide support for different types of hardware and software devices and filesystem types.
- **Kernel modules:** These are individual programs providing support for various devices and filesystems. If the modules are compiled into the kernel, they are considered “build-in”. Otherwise, they are compiled into binary programs outside of the kernel (but may only be executed by the kernel) and are just referred to as “**modules**”. These are placed in a specific directory where the kernel knows where to find them. This directory is `/lib/modules/kernel-name`, where **kernel-name** is the name of your kernel. The kernel “name” is compiled into the kernel, and usually includes the kernel release level and an optional suffix, often referring to the Linux distribution (i.e. “/lib/modules/2.4.18mdk”). You can query the kernel name on your system by typing “**uname -r**” at the command line.
- **Boot Loader:** This is a program that exists on the boot disk or CDROM that is used to find and execute the Linux kernel. It usually will install an initial filesystem in memory, and execute programs within to load device modules needed to access the root (`/`) filesystem. The boot loader depends on the *firmware* of the system, since the firmware must know how to load and execute the boot loader.

- **Firmware:** The firmware of a machine is a mini-operating system that is used to detect available boot devices (disks, CDs, diskettes or network adapters) and load and execute the “real” operating system. The following table shows the system firmware supported by SBAAdmin:

Firmware	Supported Systems	Boot Media Types	Boot loaders
BIOS	Intel-based (32-bit, AMD64 and EM64T)	Disk, CDROM, diskette, network	LILO, GRUB
OpenFirmware (IEEE-1275 Standard)	IBM pSeries (CHRP-based systems)	Disk, CDROM, network, tape	Yaboot
EFI (Extensible Firmware Interface)	Intel Itanium (IA64) systems (HP Integrity)	Disk, CDROM, network	ELILO

The firmware typically reads a *boot loader* from the boot media, which must be written in a manner that the firmware understands how to find. The boot loader is an additional program that is designed to read and execute the Linux kernel, providing it information needed to configure additional devices, etc.

- **LVM:** This is **Logical Volume Management**, and provides the ability to create devices similar to “software partitions”, that are easily resizable, relocatable, and provide optional data striping (RAID 0) for enhanced performance. LVM is supported by most Linux distributions today. If it is available on your system it will be automatically included on the SBAAdmin boot media even if you are not using it. This allows you to implement LVM during the install process if you are not already doing so.
- **Metadisks:** Also referred to as “multi-disks”, this is another form of “software RAID” that provides different RAID types, such as striping (RAID 0), mirroring (RAID 1), striping with parity (RAID 4) and striping with striped parity (RAID 5). It also provides the ability to combine devices into a single sequential device they refer to as “linear” RAID. Meta-disk, or “md” devices are supported by most Linux distributions today. If available on your system it will be automatically included on the SBAAdmin boot media even if you are not using it. This allows you to implement meta-disk devices if you are not already doing so.
- **Filesystems:** There are numerous filesystem types available on Linux. Different Linux distributions automatically provide support for different filesystems, and others may be added to the kernel or compiled as modules. Others not included in the distribution may usually be found on the internet, downloaded and built into the kernel. SBAAdmin supports most popular filesystem types, including **ext2** (always available), **ext3** (same as ext2 but provides journaling), **Reiser**, **JFS**, **XFS**, **Minix** (old Linux filesystem), **MSDOS** (3.1) and **Vfat** (win95 and later). Filesystems build on ext2, for instance, may be changed to a JFS filesystem during the system recovery process, providing simple conversion to more robust filesystems. The root filesystem (*/*) may be build only on filesystems that are built into the kernel.

System and Program Requirements

Every Linux distribution is different, and this poses certain challenges since SBAAdmin must depend on some common programs or support to be installed on your system. The requirements are few, and most Linux distributions provide the base support by default, or as an optional package. This section describes requirements of SBAAdmin that differ most commonly between distributions.

Kernel Support Requirements

To be able to boot from the SBAAdmin boot media (or most any media), you must have **RAM disk support and Initial RAM disk support** built into the kernel. Also, the process of creating the media uses either RAM disks or loopback devices. If your RAM disk driver is only configured to support the default of 4 MB, then **the loopback device support** will also be required (but may be compiled as a module). Refer to your documentation for rebuilding the kernel or adding kernel modules. We recommend the following settings:

Block Devices:

Loopback device support:	Module
RAM disk support:	Built into kernel
Default RAM disk size:	32768 (This will allow up to a 32MB ramdisk to be created)
Initial RAM disk (initrd) support:	Built into kernel

System Memory

The SBAAdmin System Installation process requires that the system have at least 24 MB of memory to operate, although a minimum of 64 MB is recommended.

Programs for Creating and Writing Bootable CDRoms

The program “**mkisofs**” is a free program that must exist on the system from which you will create the bootable CDRom. This program is included on most distributions but may not be installed by default. If you receive a message that this program is missing, you will need to install it from your distribution media or download a copy from the internet. This program will be used to generate the “ISO” image, which is a CDRom format compatible with many operating systems.

To create a bootable CDRom, this software will generate the CDRom image file. It is then up to you to copy that image to a CD Writer device using your own CD Writer software. On most Linux systems, the “**cdrecord**” program exists. If not, then you can usually install it from your distribution media or download a copy from the internet. You will need to refer to the instructions or “man” pages that accompany that program. If you choose any other program to copy the CDRom image to the CD Writer, then you must be sure to specify, if necessary, that this is an **ISO** image.

The Device Filesystem (Devfs)

The **Device Filesystem** is a function implemented on some Linux systems for management of devices. It has, however, been replaced in more recent Linux distribution. Devfs is not a requirement of SBAAdmin, but its existence or use can pose certain problems, so it deserves mention here. Its function to provide a consistent naming convention for devices based on their physical location, rather than allowing the system to name the devices (possibly differently) each time the system is booted based on their order of detection.

Unfortunately, this presents many problems for products designed to work with the “classic” Linux device naming conventions, and also creates quite lengthy filenames and symbolic links between old and new names that are more difficult to manage. A classic partition name such as “**/dev/hda1**”, for example, will be named “**/dev/ide/host0/bus0/target0/lun0/part1**” under Devfs. Devfs often creates another link to this file “**/dev/hd/c0b0t0u0p1**”.

SBAAdmin Backup Administrator must be able to scan for devices on the system, and does so by looking for devices of the classic Linux convention, as this is most widely used. To look also for Devfs filenames would probably result in detecting the same physical devices under multiple different names, so SBAAdmin will only recognize devices by the known “classic” device names.

The product will work quite well on systems with Devfs implemented as long as the system maintains the classic device naming conventions as well. This is the default for most Linux implementations using Devfs.

All functions of the product will work the same on a Devfs system as for those not using Devfs, but all references to disks, partitions and tape devices will use the classic names. SBAdmin also attempts to cross-reference the devfs names to the classic names whenever the system configuration files use the devfs names (as occurs automatically when some Linux distros are installed). System configuration files which may use either devfs or classic names include:

- **/etc/fstab** – Filesystem definitions
- **/etc/raidtab** – Software RAID device definitions
- **/etc/mtab** – Mounted filesystem table (automatically updated by the system)

To avoid any potential problems if you are using Devfs, you should make sure these files reference the classic disk and partition names, such as **/dev/sda** (first SCSI disk) and **/dev/hdc3** (third partition on the third IDE disk) whenever possible. If you attempt to perform a **System Backup** with SBAdmin and are informed that the root filesystem, or any other filesystem, is either not found or not mounted, then SBAdmin may have been unable to determine the devfs names, and you probably need to put the classic names in the **/etc/fstab** file.

Boot Loaders

SBAdmin will attempt to determine which boot loader the system is currently using when making system backup media to be used for system recovery. When recovering the system, SBAdmin will then use the same boot loader when making the hard disk bootable. Because it is not always possible to determine the boot loader that the system currently uses, a copy of **LILO** and **ELILO** (for *Intel*) and **Yaboot** (for IBM *pSeries*) is included in the SBAdmin distribution. This ensures that, after a system recovery, the system can be made bootable regardless of the previous boot loader used.

Initial Ramdisk (initrd) Support

One of the most difficult issues with any system recovery product is trying to figure out how to make the system bootable. It is sometimes not possible to determine what *boot loader* was initially used to make the system bootable or what specific configuration was used to do so. SBAdmin is able to determine the kernel you are running under, what modules are used with that kernel, and the device on which your root filesystem resides. It will attempt to determine the boot loader that is used based on the support installed and the existing configuration files.

After a SBAdmin System Installation is completed, the boot loader is configured to make the system bootable based on that kernel and the root filesystem. This is often not enough information to make everything available at system startup that is required. For example, if your root filesystem resides on a SCSI disk, and the SCSI adapter support is not built into your kernel, then your system probably loads an **Initial Ram Disk (initrd)** containing the SCSI adapter support, which allows the adapter to be configured before an attempt is made to mount the root filesystem. SBAdmin will determine if an initrd is necessary and create one automatically. If not required, SBAdmin will configure the system to boot from your kernel without an initrd image. If your kernel has built-in support for any devices or filesystems required to mount your root filesystem, you should have no problems. If an initrd image is required, you are given the opportunity at the end of the system recovery process to configure your own boot loader, or modify the boot loader configuration file to handle any potential problems.

More specific information creating an **Initial Ramdisk Image** is provided later in this document.

2. Creating Boot Media for System Installation

The SBAAdmin Backup Administrator User Interface provides a very simple procedure for creating boot media, which is described in this section. This interface may be used to create bootable **floppies** and boot **CDROM** images, **network boot** images, or can configure a local **hard disk** to boot the system recovery process. This interface may create any of the boot media types except floppies, since floppies require user intervention on the system they are created on. For this you should refer to the **stmakeboot** command, described at the end of this document, which may be run on any client or server to create bootable diskettes from that system.

When to Create Boot Media

It is generally a good idea to create bootable media for each individual system that is backed up using SBAAdmin. This is because most systems do not run under the same Linux kernel level, have the same device support installed and configured, and have the same software level of various device support and other applications installed.

If you attempt to boot from media created using one Linux kernel version (i.e. "2.4"), then attempt to install the system from a backup that was running under a version 2.6 kernel, you may run into problems during or after the installation completes. This is because the devices and filesystems created during the system recovery will be later accessed by a different Linux kernel version that may not be compatible or provide the proper support. For this reason, the SBAAdmin Installation process provides strong warnings if you boot from a different kernel than was running at the time the backup was created. The installation process also verifies that your boot media contains the device and filesystem support that is required to install the system, based on those devices or filesystems that were in use at the time of the backup. If the support is not provided by the bootable media, you will be required to remove or change those devices or filesystems that are not supported.

If you have multiple systems, all running the same kernel level (but not necessary the exact same kernel), it is generally safe to use the same boot media to boot and install different systems. Because the boot media is *probably the most important boot media you will ever need*, it is probably a good idea to keep at least one spare or create boot media of different types.

When you Should Always Create New Boot Media

1. Any time you compile or install a new kernel. Even if the kernel version does not change, support for built-in devices or filesystems may have been added or removed, and device or filesystem modules may also have been removed.
2. Any time you install a new *release level* of [SBAAdmin System Backup Administrator](#). Although we try to maintain compatibility between current and past versions, there may be times when a new feature supported by the backup software also adds new support to the system recovery process. Since the system recovery programs are written to your boot media, you will need to remake the boot media to make sure you are using the latest installation programs.

Boot Media Size Limitations

The system is only unable to read a boot image from the boot media up to a maximum size:

- When creating a bootable **CDROM** for *Intel*-based systems, the ***isolinux boot loader*** is used, if available. The *isolinux boot loader* is installed with the **Syslinux** package, which is usually included with the Linux distribution media. If *isolinux* is available, it will be used as the boot loader for the CDROM, and there is no size limitation. However, if *isolinux* is not available, the ***LILO boot loader*** will be used, and the CDROM boot image section is limited to 2.88 MB. Although the CDROM boot image you create with SBAdmin is typically about 10 to 15 MB, the actual boot image read by the system BIOS is only the first 2.88 MB portion. The size limitation does not apply to booting from network boot images or hard disks. The boot image portion, in this case, must contain the kernel and enough device support to configure and mount the CDROM device itself. Particularly if the CDROM requires SCSI device support, the 2.88 MB limit may be inadequate. In this case, we recommend installing the *Syslinux* package to circumvent this limitation.
- Bootable **diskettes** are usually limited to 1.44 MB, the first of which must contain the kernel and a small initrd image. As Linux kernels have continually grown in size, it has become less likely that this information will fit on a single diskette. However, if you are using a 2.88 MB diskette, this is generally less of a problem.

For IBM *pSeries* and *Intel IA64* systems, it is not possible to create diskettes, since the kernel size is always larger than the capacity of even a 2.88 MB single diskette. However, on a *pSeries* system, no limitation exists when creating a bootable **CDROM**, hard disk or network boot image.

The boot image must include the kernel and any other device support that might be needed to read the rest of the boot media. For a floppy, this means we only need floppy drive support, which is typically built into the kernel. For CDROMs, this includes any device support needed to access the CDROM drive itself. Since CDROMs may be attached via the IDE, parallel or SCSI interface, all modules of these types that are included on your system will be automatically included in the CDROM boot image.

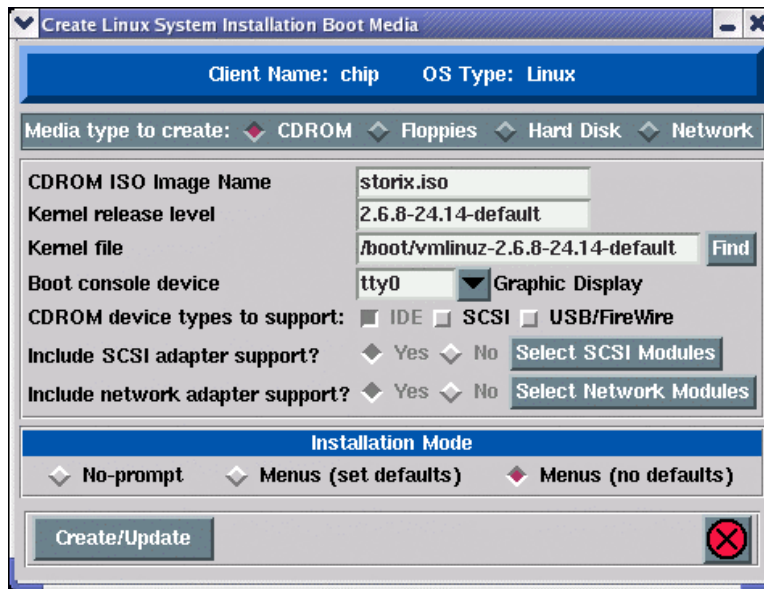
Because of this limitation, especially when making diskettes, the size of the kernel should be kept as small as possible. This means making use of modules, rather than building support for all devices and filesystems directly into the kernel. The modules will be included on the SBAdmin boot media, but not in the actual "boot image" (unless needed to access the boot device itself) which is very limited in size.

Most systems include a 1.44 MB floppy drive. Some include a 2.88 MB drive. For those with a 2.88 MB drive, there is less of a problem. For the 1.44 MB diskettes, the entire kernel must fit onto the diskette. To accomplish this, even for kernels that are larger than 1.44 MB, the SBAdmin media creation process will format the diskettes at 1.72 MB, providing much more space. This higher-density format is supported on most diskettes. Nevertheless, if your kernel will not fit on a single diskette, you will have to create a CDROM image instead. And, if the kernel and device support required for the CDROM image exceed 2.88 MB, you will need to either install the *isolinux boot loader* (with the Syslinux package), remove some unused SCSI modules, or rebuild your kernel at a smaller size by using external modules for devices or filesystems that are not required by the system boot process.

Creating System Installation Boot Media

To create the boot media, select **Utilities->Create System Installation Media** from the menu bar in the administrator main menu. If using a **Network Administrator**, you will be prompted to select the client on which the boot media will be created. Note that the boot media is created on the selected **client**, but may be used to boot other clients of similar system type and operating system release levels.

When selecting a **Linux** client, a screen similar to the following will appear:



You must select at the top of the screen the [Media type to create](#). Note that the above example is for creating **CDROM** boot media. The options which appear in the center portion of this screen will differ slightly, depending on the media type selected.



The Floppy option is disabled for IBM *pSeries* and *Intel IA64-based* systems. This is because the Linux kernel is too large to fit on a single diskette.

Remember to use the [QuickHelp](#) (right mouse button) on any button or entry field for details on the use and options for each.

Creation of each media type is described separately:

CDROM image

This process will make a CDROM ISO image, but will not actually burn the image to the CDROM. This image may be copied to any system where your CD/RW device resides where you can use any software or program you choose to copy the image to the CDROM. When making a CDROM, network support (described below) is always included. If using the *Network Administrator* you can make the CDROM image for the local system or for any other client or server system you have configured.

The only required option is the [CDROM ISO image name](#). You must specify the name of the file to create, but you may not specify the full directory path. All other options will contain a default value, based on the configuration of the system. The CDROM image will be saved on the client or server on which it was created in the */storix/temp* directory (where */storix* is your SBAdmin data directory).

If you are using either a *SCSI* or *USB CDROM* drive, then you need to select the appropriate box(es) on the [CDROM device types to support](#) line. If you do not have a SCSI or USB CDROM, then you should not select to include this supports as this may cause the boot media to exceed the maximum size (2880 Kbytes) that the system will support. Note, however, that when including SCSI cdrom support, you can also select which specific SCSI adapters to support, thereby reducing the size to a minimum..

When this process is complete, you may copy this image to the system containing the CD writer device, if different, and use your CD writer program to copy it to a CDROM drive.

Floppies

The **floppy** option is only available if you are creating the boot media on the local system. To create floppies for a client system (when using Network Administrator), refer to the **stmakeboot** command.

You must select the **Device name** using the drop-down list. Indicate whether or not the floppies should be formatted before copying data to them using the **Format floppies?** option. This is important if you have not yet used the floppies as SBAAdmin boot media, but need not be done more than once if updating the boot diskettes after they have been written to.

When making floppies, you should have 5 floppies handy. The process will require 1 BOOT floppy, 1 ROOT filesystem floppy and typically 2 or 3 UTILITY floppies. If the floppies have not been formatted using SBAAdmin before, then you should select to format the floppies. If the process finds that the floppies have not been formatted at the 1.77 MB capacity (or greater) then it will automatically format the floppies before using them, whether or not you selected to do so.

If you want to be able to restore a backup from a remote system on your network (and you are using the Network Administrator), you must select “**Yes**” to **Include network install support?**. This option is always selected when creating other boot media types, but is optional on floppies, since this may require an additional floppy to contain the network device drivers and programs.

If network support is included on the boot media, you will be able to select an **ethernet**, **token-ring** or **FDDI** network device and the TCP/IP settings needed to contact the server. The server must have been configured using the *Network Administrator* to provide access to the client to be installed and its IP address must be defined to both the Network Administrator and the Install Server (if different).

The specific steps for configuring the network install settings during the install process are described in details in the section REFERENCES.

During the creation of the floppies, a pop-up window will appear prompting you to insert each floppy, one at a time. Be sure to label the floppies as suggested to keep them in the right order. You are not provided an option to retry a different floppy when booting from them, so make sure they stay in the correct order.

Hard Disk

If you configured a disk for **System Backups** (see **SBAAdmin User Guide**), then this disk (or disks) can also be made bootable to boot directly to the system recovery process. This allows you to perform your system backups to a local (or SAN-attached/portable) disk, then boot and reinstall the system from that same disk with no need for other backup media.



Using this option will not change how the system boots by default. After configuring a disk to boot to the SBAAdmin System Install process, you must select to boot from that disk from within your system firmware boot menus.

Select the disk to configure in the **Device Name** field by using the arrow to the right of the entry field. When pressing the arrow, the system will be queried to find one or more disks that were configured using the option **Configure a Disk for System Backup/Recovery** in the **SBAAdmin User Guide**. If no disks are listed, then none were configured for system backup/recovery.

Network

Use this option to create a **network boot image** to be used with various *network boot loaders* to boot a client system over the network from a *network boot server*.

To create a network boot image on any configured client or server and save the image on the boot server, select either:

[Configure](#)→[Network Boot/Install](#)→[Create/Update a Network Boot Image](#) or
[Utilities](#)→[Create System Installation Boot Media](#)

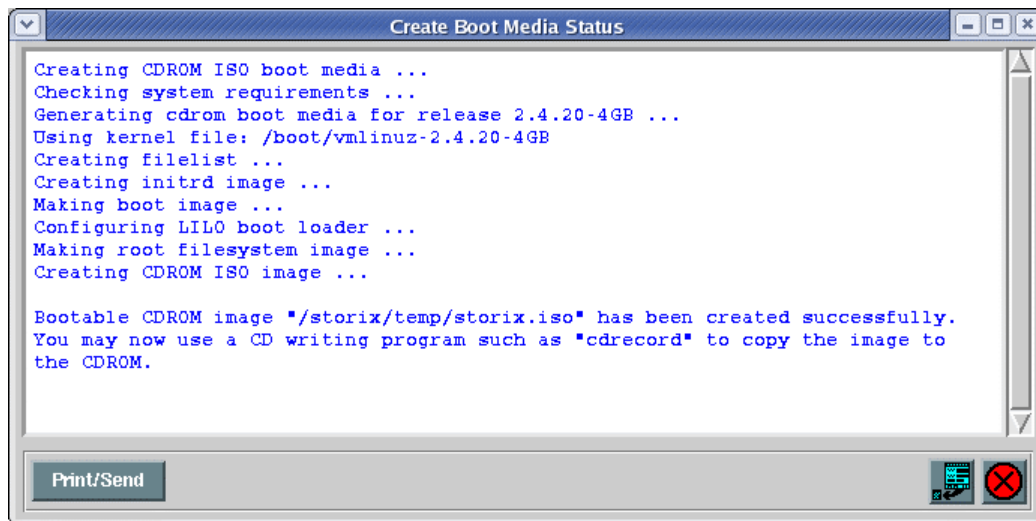
Select the name of the **Network Boot Server**. This is the server on which the network boot image will be stored after it is created. The network boot server may be the same system from which the network boot image is created.

Lastly, type the name of the boot image in the **Network Boot Image Name** field or select the name of an existing image to overwrite by pressing the arrow button to the right of the entry field. If you enter a unique name, a new image will be created using that name. If you select an existing name, the named image will be overwritten.

Note that the network boot “*image*” actually consists of several files on disk, but will always be referred to within the application as a single image by a unique **boot image name**. The files are copied into the directory specified as the **Directory for Network Boot Images** when the server was configured. If you specify the name of an image which already exists, that image will be overwritten.

Upon successful completion, the network boot image will be created and transferred, if necessary, to the boot server. It will now be possible to configure any client to boot from this image using the option “[Enable/Disable Network Installation of a Client](#)” below.

When all selections are complete, press the **Create/Update** button. A new window will appear with the output of the command to create the media and any error message if they should occur, such as in the following example:



```

Create Boot Media Status
Creating CDROM ISO boot media ...
Checking system requirements ...
Generating cdrom boot media for release 2.4.20-4GB ...
Using kernel file: /boot/vmlinuz-2.4.20-4GB
Creating filelist ...
Creating initrd image ...
Making boot image ...
Configuring LILO boot loader ...
Making root filesystem image ...
Creating CDROM ISO image ...

Bootable CDROM image "/storix/temp/storix.iso" has been created successfully.
You may now use a CD writing program such as "cdrecord" to copy the image to
the CDROM.

Print/Send

```

Customizing the Boot Media

There are a number of options when configuring boot media, which may be used to boot the system on different systems and allow it to recognize different types of devices. Refer to the [Create Linux System Installation Boot Media](#) screen. The options specific to each boot media type are defined above. Each option for customizing the boot media is described below:

SCSI Adapter Support

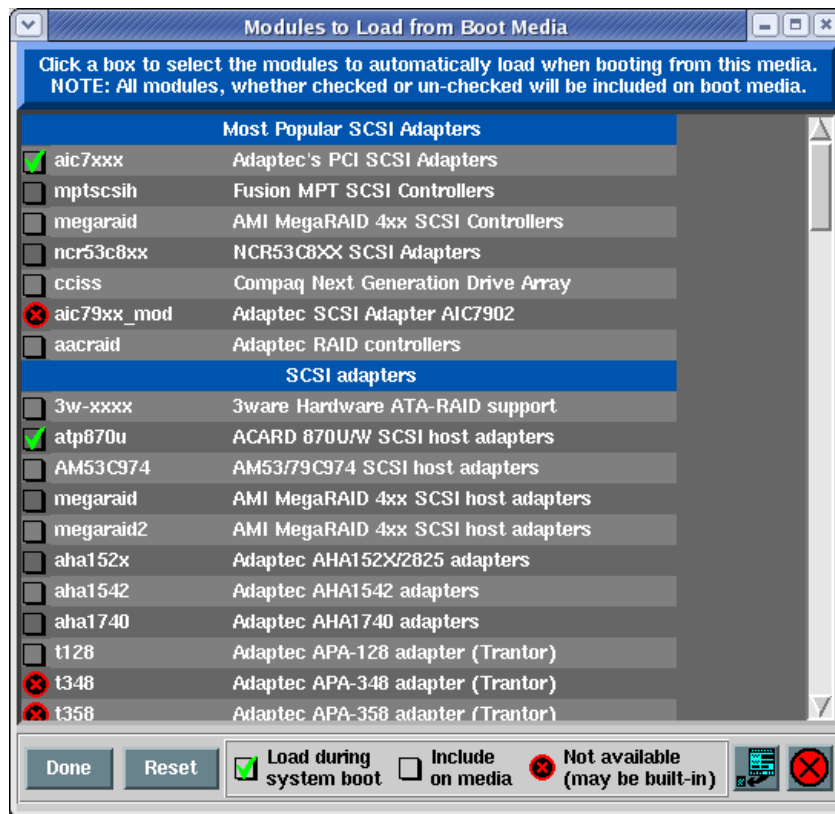
This option is automatically selected to “Yes” when creating CDROM boot media. However, if you are making bootable floppies you may select “No” if you wish not to include SCSI adapter support. This will usually reduce the number of required floppies.

Select SCSI Modules

If SCSI support is included on the boot media (may only be excluded when creating diskettes), you may select which specific adapter support should be automatically loaded when booting from the media. If there are devices (i.e. disk, tape or cdrom) attached to an adapter of a selected type, those devices will be made available automatically.

All SCSI support (if included) will be available on the boot media. Therefore, even if the desired adapters support is not loaded automatically when booting from the media, it may be loaded at a later time from the [System Installation Menu](#) (see [Loading Additional Device Support](#)).

To select which SCSI modules will be automatically loaded on system boot, press the [Select SCSI Modules](#) button. By default, SBAdmin will automatically load only the SCSI modules which are currently loaded on the system. Those adapters, if any, will be automatically selected on the screen which appears, similar to the following:



Modules with an “X” are defined in the configuration file, but do not exist on the system, and therefore cannot be selected or de-selected. Those with a **checkmark** are currently selected and will be loaded on system boot. Those with an **empty box** indicates those available on the system that will be included on the boot media, but not automatically loaded on boot. To select or de-select a module, move the cursor over the checkbox and press the left mouse button.

When finished with selections, press the **Done** button. The **Reset** button may be used if you wish to revert back to the original configuration file distributed with the software. If you wish to cancel only the changes made in this session, press the Cancel button on the far right.

Network Modules

If you wish to manually select the network module support to include on the boot media, you may select or deselect them by pressing the **Select Network Modules** button. By default, SBAAdmin will include all network modules available for the selected kernel release level. Not including certain modules may be helpful if you have conflicts between modules when they are loaded (often causing the boot process to hang) or would like to limit the modules that are actually loaded by the boot media. When creating floppies, this will often reduce the number of diskettes required.

If network support is included on the boot media (not included if no SBAAdmin network license is in use), you may select which specific adapter support should be automatically loaded when booting from the media. If a network adapter is detected by one of the loaded modules, a network device will be automatically created.

All network support (if network license installed) will be available on the boot media. Therefore, even if the desired network adapter support is not loaded automatically when booting from the media, it may be loaded at a later time from the [System Installation Menus](#) (see [Loading Additional Device Support](#)).

To select which network adapter modules will be automatically loaded on system boot, press the **Select Network Modules** button. By default, SBAAdmin will automatically load only the network modules which are currently loaded on the system. Those adapters, if any, will be automatically selected on the screen which appears, similar to the following:



Modules with an "X" are defined in the configuration file, but do not exist on the system, and therefore cannot be selected or de-selected. Those with a **checkmark** are currently selected and will be loaded on

system boot. Those with an **empty box** indicates those available on the system that will be included on the boot media, but not automatically loaded on boot. To select or de-select a module, move the cursor over the checkbox and press the left mouse button.

When finished with selections, press the **Done** button. The **Reset** button may be used if you wish to revert back to the original configuration file distributed with the software. If you wish to cancel only the changes made in this session, press the Cancel button on the far right.

Boot console device

It is necessary to define the type of console device that will be used to display the System Installation Menus. Use the arrow next to the Boot console device field to list and select a device name. Note the description of each device name.

The **tty0** device is considered a graphical display directly-attached to the system. If using a serial console attached to a serial port, select **ttyS0**. Other types may include ttyUSB0 (for USB-attached console devices), etc.



The boot media can only be created to boot a particular console type. If you select the wrong type, the boot process will complete, but you may not see the Installation Menus on the screen.

If booting from a serial terminal, the terminal must be connected to the first serial port (S1 or COM1) and must be set to 9600 baud, 8 bits, 1 stop bit and no parity (9600,8,1,NONE).

Kernel Release Level

Your system may be configured with multiple kernels and associated modules. This is typical of a system that is being tested or in the process of upgrading. This process will automatically display the name of the kernel (as provided by the “*uname -r*” command) your local system (or the client or server system) is currently running under in the **Kernel release level** field. If you have a different kernel installed on your system (typically found in the /boot directory), you may enter the kernel level in this field.

The process must be able to find the name of the actual *kernel file* and the associated modules directory associated with the specified kernel level. If you enter a kernel level, you can press the **Find** button next to the **Kernel file** field, and a kernel filename will appear in the field, if found, for the specified kernel level. If the process is unable to find the kernel file associated with your kernel level, then you must enter the full pathname of the kernel file in the **Kernel file** field before continuing.

When you boot from this media, the kernel and modules you will be running under will match those selected here. Keep in mind that the kernel release level and modules level should also match the level of the backup that you will be restoring.

No-prompt Installation

CDROM, **floppy** and **Network** boot media may be created with the default installation options set, also allowing the system to be installed as soon as a system is booted from this media. This allows an installation to take place simply by booting from a network boot image, for instance, with no operator intervention required.

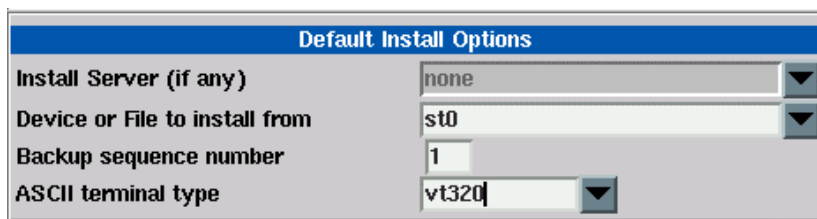


To prevent a system from being inadvertently reinstalled by simply booting from the wrong device, this option is not available when booting from a hard disk. Be very careful, however, not to leave the CDROM in the drive and the system firmware set to boot from CDROM first, as a no-prompt installation could occur without any user intervention.

Be very careful when using this option, as the user will not have the option of intervening in the system recovery process if the boot media was created for no-prompt installation. The exception, however, is if the defaults are not valid (such as an installation device not being available), or if the backup data will not fit onto the new system's hardware without some re-configuration.

When creating **CDROM** or **Floppy** boot media, the following options are available when using the option to [Create System Installation Media](#). For Network boot media, the options are available when selecting to [Enable Network Installation of a Client](#). The reason is that, when creating network boot media, a single network boot image may be used for different client systems, and each client system can be configured with different defaults. Refer to each corresponding section for additional details.

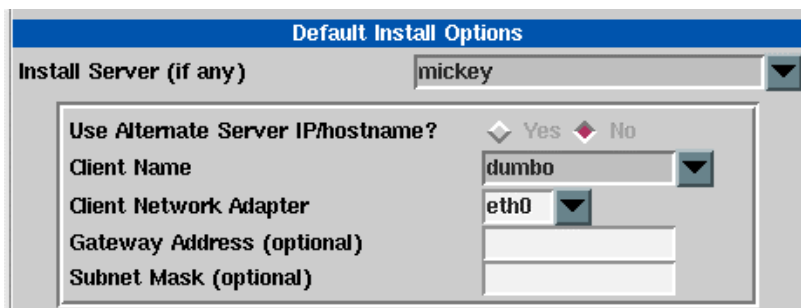
If you select either “**No-prompt**” or “**Menus (set defaults)**” for the **Installation Mode**, additional information will appear within the window, such as in the following example:



Default Install Options	
Install Server (if any)	none
Device or File to install from	st0
Backup sequence number	1
ASCII terminal type	vt320

The **Install Server** is available only if using a *Network Administrator* license. If the client will install from a locally-attached tape drive, leave this field set to “**none**”. If the system will be installed from a remote server, use the arrow button to the right of this field to select a server name.

When selecting a server name, and (when [Enabling a Client for Network Boot/Install](#)) the install server differs from the boot server, more information will appear on the screen below this field:



Default Install Options	
Install Server (if any)	mickey
Use Alternate Server IP/hostname? <input type="radio"/> Yes <input checked="" type="radio"/> No	
Client Name	dumbo
Client Network Adapter	eth0
Gateway Address (optional)	
Subnet Mask (optional)	

For the client to be installed from a remote server, you must select the name of the client to be installed (which must have been configured from the *Network Administrator* interface). Also, the network adapter name (of the client) will be required. Other fields are optional, but may be required for the client to contact the server.

Select **Yes** to the **User Alternate Server IP/Hostname** field if the server was configured with an alternate server adapter. In this case, the client will retrieve the backup data from the server using this alternate adapter. Be sure to select the correct adapter name the client will use to contact the server via its alternate adapter.

3. Network Boot/Install Configuration

The information provided in this section will prepare a client system for network boot and installation from a backup server.

Understanding Network Boot and Network Installation

Any client system defined to the [admin system](#) may be installed or reinstalled from a **System Backup**. That System Backup will typically reside on the disk or on a tape device attached to a backup server. In order for the client to restore from this backup data, it must first be *booted* over the network from a [boot server](#), then installed from an [install server](#).

- The **boot server** is used solely to provide a basic operating system with which the client will run the remainder of the installation process. If the boot server is not running the same level of AIX as the client to be installed or does not have the device support installed for the client, then a network boot image must be created on another system that meets this requirement, then placed on the boot server.
- The **install server** is used only to provide access to the data to be restored and its operating system level is not relevant. If the backup is on tape, the install server will be the system on which the tape drive is attached. Likewise, if the backup is a disk image file, the disk will be attached to the install server.

Although the boot server and install server are typically the same system, this is not a requirement. If, for instance, there are several systems on which tape drives are attached, the client may be installed from any tape on any system, even though the client is always booted from the same boot server.

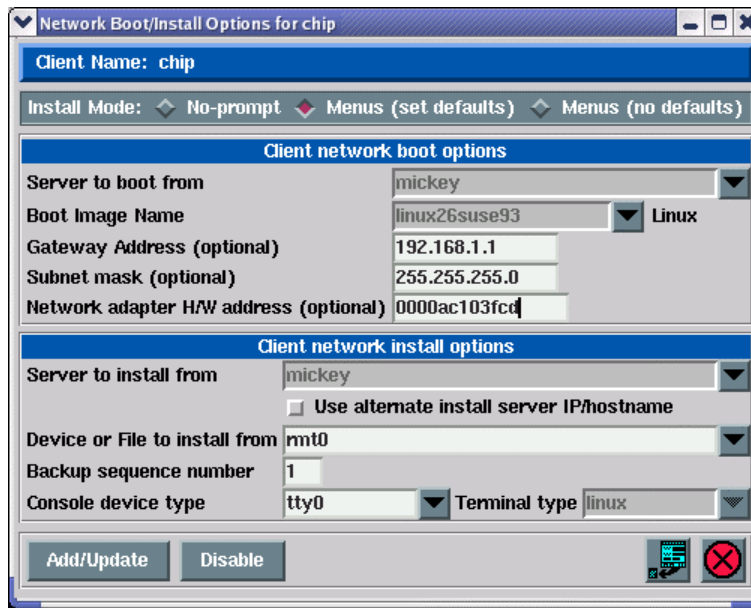
If the client to be booted is running the same level of AIX as the boot server and all device support for the client's platform type and base system devices is already installed on the boot server, then you may skip directly to the option "[Enable/Disable Network Installation of a Client](#)".

If the client and boot server are to run a different level of AIX or if the device support for the client is not already installed on the boot server, then you will need to create a network boot image from the client or any other system running the same level of AIX that you will be installing. The system from which the network boot image is created must also have installed the device support for the client. To create a network boot image on any system and copy the boot image to the boot server, refer to "[Create System installation Boot Media - Network](#)".

Enable/Disable Client for Network Boot/Install

This section provides details on configuring a client to be booted and installed from a network **boot server** and/or network **install server**. Although the basic settings are simple, there are optional settings which may be used for more flexibility, such as configuring a [no-prompt installation](#) of the client, or installing (reading the backup data) from a different network adapter than the one the client was booted from.

To setup the client, select the option [Configure→Network Boot/Install→Enable/Disable Network Installation of a Client](#) from the menu bar. You will be prompted for the client to configure. Select the client and press the [Continue](#) button. A screen similar to the following will appear:



Options may appear or disappear from this screen depending on your selections. The screen is broken into two main sections, one for configuring the [Client network boot options](#) and one for configuring the [Client network install options](#). The setting for the **Install Mode** at the top of the screen determines whether or not the **Client network install options** section will appear.

The following fields are used to configure the client to boot from a [boot server](#):

1. **Install mode:** You must select here whether you want to perform a no-prompt or menu-driven installation:
 - a. By selecting **No-prompt**, the client will be installed without entering any information on the client. This is referred to as a [no-prompt install](#). If selected, all of the remaining prompts must be filled in.
 - b. If **Menus (set defaults)** is selected, you will be provided the additional prompts now, all of which are optional. The information you provide will appear as defaults on the client after it is booted, but those options may also be changed on the client.
 - c. If **Menus (no-defaults)** is selected, it is assumed that and all install options will be selected from the client install menus once it is booted. When selected, all remaining options will disappear from the screen as they no longer apply.
2. **Server to boot from:** If the server in this field is incorrect, use the arrow button to list and select a different server from which to boot from. By default, the boot server is assumed to be the install server as well. However, the [install server](#) may be changed as described later.
3. **Boot Image Name:** Use the arrow button to the right of the entry field to select from a list of boot images previously created using the [Create Bootable Installation Media \(Network\)](#) option. The boot image name selected will determine the operating system, platform and network type that will be used to install the client.
4. **Gateway Address:** If the client must go through a gateway to reach the boot server, enter the IP address of the gateway machine.
5. **Subnet Mask:** If the client is on a subnet, enter the subnet mask.

6. **Network Adapter Hardware Address:** If the client and server are on the same network (no gateway between them) and you want to be able to boot the client without entering the client and server IP addresses onto the client's network boot screen, you can enter the client's network adapter hardware address (12-digits) here. This is also referred to as the **MAC address**, and is used to initiate a **broadcast boot**. Having the MAC address available on the sever allows the client system to be booted without knowing the server or client IP address, as this information is obtained from the server. Refer to the section **Boot a Client for Installation from a System Backup** for details on [determining the client hardware adapter address](#).
7. **Server to install from:** This field will, by default, contain the name of the [boot server](#). If the backup data will be restored from a different server than you booted from, select a different [install server](#) in this field. If the install server differs from the boot server, additional fields will appear on the screen which are described in the section [Using a Different Install Server than the Boot Server](#) below.

If you wish to install the client using the server's alternate network adapter, select the button next to "**Use Alternate Server IP/Hostname**". If selected, additional fields will appear as described in the section [Using a Different Install Server than the Boot Server](#) below, since the client may need to use a different adapter to reach this alternate adapter on the install server.

8. **Device or File to install from:** Use the arrow button to list and select the device or directory from which the backup data will be restored. If a directory is selected, you will be prompted for the specific [System Backup](#) from which to install. After selecting the backup, the filename of the backup image will be placed in this field, and the **Backup Sequence Number** field will be automatically filled in with the sequence number of the client backup selected. If you select a tape device for this field, the device name will be placed in the field, but the backup will not be read at this time, since the backup may not be in the drive at the moment.
9. **Backup Sequence Number:** If the client will be installed from a tape device, you must manually select the backup sequence number on the tape media to install from. If there is only one [System Backup](#) on the tape, the backup sequence number will be 1 (default). If there are more than one, you must enter the appropriate backup sequence number. If you are unsure as to the correct sequence number to use, view the backup label and use the backup sequence number that corresponds to the desired backup.
10. **Console Device Name:** Select the name of the console device that will be used on the client. If the client is using a graphical display, this is likely "lft0". If the client is an [SP node](#), the device is likely "tty0". The device selected will be used to display progress messages and, if an error occurs or prompts are enabled on the client, they will appear on this device.
11. **Console terminal type:** If the console device selected was a graphical device, the terminal type will be set to **LFT**. Otherwise, an [ASCII terminal](#) is assumed and you must list and select the specific terminal type. Using the arrow key, you can list the terminal types that are available during the installation process and select one from the list.

When all selections have been made, select the [Add/Update](#) button at the bottom of the screen. If a boot image for the specified platform and network type does not already exist on the boot server, one will be created which will take a minute or two. The client boot information will be saved and the client will be ready to boot and install. Refer to the section [Boot a Client for Installation from a System Backup](#) to initiate the installation process.

Disable a Network Install Client

It may be desirable to disable the network install for a client once the installation of the client is complete. If the client should inadvertently boot over the network and the client is configured for a [no-prompt install](#), the client may end up being reinstalled automatically.

To un-configure the client, simply select the option [Configure→Network Boot/Install→Enable/Disable Network Installation of a Client](#) from the menu bar. Select the client to disable. The client network install configuration will appear. Simply press the **Disable** button at the bottom of the screen to un-configure the network install.

Un-configuring the network install client will prevent the client from booting over the network. Although the network install will be disabled, the information for the network install will be retained and will be automatically used as defaults should the same client be configured for network install again in the future.

Using an Alternate Network to Restore the Data

Even though the boot and install server may be the same, it may be desirable to perform the network install (actual restoration of the data) using a different network than was used to perform the network boot. For instance, the client may boot from the server using the *ent0* (ethernet) network, but may want to restore the data from the same server using the *tok0* (token-ring) network instead. This is commonly done in order to redirect the restore data traffic onto a different network than that which is in use by other applications.

To install using an alternate server network, a button is provided on the [Network Boot/Install Configuration Screen](#) labeled "**Use Alternate Install Server IP/Hostname**". If you want the alternate server network connection to be used for network install, press the button associated with each option. If the button is not selected, the default network connection used by the client to reach the server (as defined by the server hostname and network routing information on the client) will be used.

Note that this button will not be available if there was no alternate IP address or hostname setup for network installs from the server. To set the alternate IP address or hostname for a server, refer to the [server configuration](#) options.

If you select this button, additional options will appear which will be required only if you are using a different network adapter on the client system to contact the install server than was used to boot the client. Refer to the section [Using a Different Install Server Than the Boot Server](#) below for additional instructions.

Using a Different Install Server than the Boot Server

If the **Server to install from** (install server) is not the same as the **Server to boot from** (boot server), or if you selected to **Use an Alternate Server IP/Hostname** to reach the install server, additional fields will appear on the screen allowing you to configure the network differently for contacting the [install server](#):

Client network install options	
Server to install from	mickey
<input checked="" type="checkbox"/> Use alternate install server IP/hostname	
Gateway Address (optional)	192.168.2.1
Subnet mask (optional)	255.255.240.0
If boot and install network adapters differ:	
Client Network adapter name	ent1
Client IP Address	192.168.2.124

1. **Gateway Address:** If the client must go through a gateway to reach the install server, enter the gateway IP address in this field.
2. **Subnet Mask:** If the network the client uses to reach the install server uses a subnet mask, enter the subnet mask here.

3. **Client Network adapter name:** If the client will use a different network adapter to reach the install server than was used to reach the boot server, use the arrow button to select an adapter name from the list. If you select a different adapter, you must also fill in the additional field as well:
 - a. **Client IP Address:** Enter the IP address associated with the adapter selected. If you are using a different install server than the boot server, the install server must recognize the client by this IP address and the hostname associated with this IP address must have been used to configure the client in the administrator application. If you are using the same server but an alternate server IP/hostname, you must enter the client IP address that will be used to contact the server using the server's alternate address. Refer to the [Configure Servers](#) option for information on using an [Alternate Server Hostname/IP](#) address.

Using the Same Boot Server to Install Different Linux Versions

The same boot server may be used to boot clients of any platform, network type and Linux version. The boot server does not need to have any device support installed to support the client's hardware and does not need to run the same level of Linux as the client. If every system is different, you may create a separate boot image for each client. Or, you may create a single boot image for all clients of similar hardware type and Linux version.

SBAdmin will create a network boot image from any client, then copies that boot image to the boot server. Each boot image is saved under a different name (of your choosing) and may be separately selected when you configure a client to network boot. This allows a single boot image to be used to install different client systems.

This 2-step process is described above in this section. First, [Create a Network Boot Image](#) (which also copies the boot image to the boot server), then [Enable the Network Install of a Client](#) by selecting the boot image on the server you previously created.

Updating Network Boot Images

If you have installed new *base system hardware support* (network devices, disk drives, platform types or display adapters) onto a system that you previously created a network boot image from, you will need to recreate that network boot image before the new device support will be accessible to the clients booting from that image.

After installing the new device support, simply follow the instructions for [Create/Update a Network Boot Image](#) to recreate the boot image and copy to the boot server. If you recreate the boot image for the same platform, network and AIX level, it will not be necessary to reconfigure the clients for network boot/install since the clients using the previous boot image will automatically begin using the newly created boot image.

4. Booting to the System Installation Process

Booting the Various System Types

This section will provide general guidelines for booting a system to the [Installation and Maintenance Menu](#), used to install a system from a [System Backup](#). Note that the steps differ widely between systems and new systems are being introduced frequently. If you are not familiar with the process of booting your system from different media, you should refer to your system documentation for detailed instructions.

To begin the system recovery process, the client system must be booted from [SBAdmin Boot Media](#). This may be a local bootable cdrom, diskette, or a network boot image stored on a boot server. In any case, the remainder of the installation process will be the same.

The instructions for booting the system vary for each boot type and also differ greatly depending on the type of the machine to be booted. SBAdmin supports *Intel-based 32 and 64-bit* systems which use *BIOS* firmware, *Intel IA64* systems with *EFI* firmware and all *IBM pSeries* systems which use *OpenFirmware*. The exact details of how to boot each can vary with each model of hardware and version of firmware.

Although specific instructions on booting the systems from the installation media are not described here, here are some hints to help get you started:

Booting to the System Installation Process

CDROM

If using BIOS, your system BIOS must be configured to allow booting from CDROM. If not, you will need to change it. Also, if your BIOS attempts to boot from a hard disk before booting from CDROM, you will need to change this in case there is already a bootable hard disk in the system. Typically the BIOS can be accessed on most *Intel*-based (x86) systems by pressing the **Delete** key immediately after the display messages begin to appear. Once your BIOS is setup to boot from the correct media, just insert the CDROM and turn on or reset the system.

For other firmware types, which will scan the system for bootable devices, you will normally receive a firmware prompt where you can select the specific device to boot from.

Floppy Diskettes

If your system BIOS is not setup to allow booting from floppies, you will need to change it. Also, if your BIOS attempts to boot from a hard disk before booting from floppy, you will need to change this in case there is already a bootable hard disk in the system. Typically the BIOS can be accessed on most *Intel*-based (x86) systems by pressing the **Delete** key immediately after the display messages begin to appear.

After exiting the setup menus or rebooting the system with the first diskette inserted, you will receive a prompt:

```
VFS: Insert root floppy disk to be loaded into RAM disk and press ENTER
```

At this time, insert the "*Root Filesystem*" floppy and press Enter. After seeing a **SBAdmin** banner appear, you will be prompted to insert the "*Utilities*" diskettes, one at a time.

Hard Disk

To install from a hard disk configured as a system recovery boot disk, you must select to boot from the disk within the **BIOS**, **EFI** or **SMS** (*pSeries*) menus. Typically the BIOS can be accessed on most *Intel*-based (x86) systems by pressing the **Delete** key immediately after the display messages begin to appear.

Assuming your firmware is setup to boot by default from the correct media, just turn on or reset the system. The remainder of the boot process will complete without further interaction.

Network Boot

To network boot an *Intel-based* system with **BIOS**:

Most BIOS-based systems are not, themselves, network boot capable. However, if you have a network adapter card with network boot capabilities, you can have the system BIOS boot to the firmware on the network card. Therefore, the network card will be used to provide the network boot capabilities the system firmware does not.

To initiate a network boot, follow these steps:

1. When the system begins to display messages, press the **<Delete>** key several times until the setup menu appears.
2. Select **Advanced CMOS Setup** from the menu.
3. Instructions vary at this point. You should select an option such as "**Boot Sequence**" or "**1st Boot Device**" to change the device the system will boot from.
4. Select **Network**, or the specific network adapter to boot from.
5. Exit the setup menus to boot from the selected device

It may also be necessary to select the Network Boot Protocol to use. If this option is provided, select "**PXE**", unless you have manually configured a different boot loader on the **boot server**.

Depending on the firmware of your network adapter, you may be provided the option of entering the client and server IP address (and optional gateway address). If your boot server is configured with your *network adapter hardware (MAC) address*, you may perform a *broadcast boot* without entering the IP addresses. If not, you will need to enter this information. If you are booting across a gateway, you must enter the client, server and gateway addresses (in which case a broadcast boot is not possible).

If you follow the instructions provided here, and/or on the screen, and the boot process does not work (or no network boot option is provided), then neither the system nor your network adapter are boot-capable. You will need to use a network adapter that includes the **PXE network boot protocol**.

To network boot *IBM pSeries* systems using **System Management Services (SMS)**:

1. Initiate SMS by pressing **F1** (graphical display) or the "1" key (ASCII terminal) when the system configuration icons or messages begin to appear on the screen. After the system configuration completes, the SMS menu will appear (which differs on various models).

If your boot server is configured with your *network adapter hardware (MAC) address*, you may perform a *broadcast boot* without entering any IP addresses. If not, or if you are booting across a gateway, enter the **client, server and gateway IP addresses**. This is normally found under *Remote IPL, Network Boot, or BOOTP* settings. Note that the gateway address is usually left blank if none is used, but on some systems it should be set the same as the server address (indicating no gateway required).

2. Return to the main SMS menu, then select to return to the [Open Firmware \(OF\)](#) prompt.
3. Because pSeries systems network boot directly from OF without a boot loader, all necessary kernel command-line options must be entered manually at the OF prompt (on one line without line breaks):

```
ok> boot network_adapter_device_name console=tty0 maxcpus=1
      load_ramdisk=1 init=/linuxrc ramdisk_size=65536 rw selinux=0
      devfs=nomount raid=noautodetect
```

- a. For the **network_adapter_device_name**, use the device name of the network adapter you wish to boot from. To see a list of devices available on the system:

```
ok> show-devs
```

You may also use a device alias for **network_adapter_device_name**. To see a list of configured device aliases:

```
ok> devalias
```

To create a device alias **network** using the network adapter device name obtained from the “*show-devs*” command:

```
ok> devalias network network_adapter_device_name
```

To create a device alias that is retained across reboots, you should use the *nvalias* command:

```
ok> nvalias network network_adapter_device_name
```

You can then use the “network” alias you created in place of the **network_adapter_device_name** in the command above.

- b. For the **console** option, use **tty0** for a display attached to a graphics adapter, or **ttyS0** for a directly attached serial (ASCII) terminal. If installing onto an LPAR system, use **hvc0** (virtual console).
- c. The **selinux** option is needed only on systems with Security Enhanced Linux support, but will be ignored otherwise.
- d. The **devfs** option is needed only on systems with DEVFS support, but will be ignored otherwise.
- e. The **raid** option is needed only on systems with disks previously containing software RAID devices, but will be ignored otherwise.

To network boot an Intel IA/64 (HP Integrity) system with [EFI](#):

1. Select **Boot Option Maintenance Menu** from EFI Boot Manager boot option list when the system first boots up.
2. Select **Boot from a File** as the operation to perform.
3. Select the **Load File** line that represents the network interface you wish to boot from. Note, the *MAC address* of the device will be listed on lines which represent network adapters. For example:

```
Acpi(HWP0002,0)/Pci(3|0)/Mac(00306E4AE3B9)
```

Depending on the firmware of your network adapter, you may be provided the option of entering the client and server IP address (and optional gateway address). If your boot server is configured with your *network adapter hardware (MAC) address*, you may perform a *broadcast boot* without entering the IP addresses. If not, you will need to enter this information. If you are booting across a gateway, you must enter the client, server and gateway addresses (in which case a broadcast boot is not possible).

Tape Boot

Tape boot **IBM pSeries** systems from the [Open Firmware](#) prompt:

1. Because pSeries systems tape boot directly from OF without a boot loader, all necessary kernel command-line options must be entered manually at the OF prompt (on one line without line breaks):

```
ok> boot tape_device_name console=tty0 maxcpus=1 load_ramdisk=1  
init=/linuxrc ramdisk_size=65536 rw selinux=0 devfs=nomount  
raid=noautodetect
```

- a. For the **tape_device_name**, use the device name of the tape drive you wish to boot from. To see a list of devices available on the system:

```
ok> show-devs
```

You may also use a device alias for **tape_device_name**. To see a list of configured device aliases:

```
ok> devalias
```

To create a device alias **tape** using the network adapter device name obtained from the “*show-devs*” command:

```
ok> devalias tape tape_device_name
```

To create a device alias that is retained across reboots, you should use the *nvalias* command:

```
ok> nvalias tape tape_device_name
```

You can then use the “*tape*” alias you created in place of the **tape_device_name** in the command above.

- b. For the **console** option, use **tty0** for a display attached to a graphics adapter, or **ttyS0** for a directly attached serial (ASCII) terminal. If installing onto an LPAR system, use **hvc0** (virtual console).
- c. The **selinux** option is needed only on systems with Security Enhanced Linux support, but will be ignored otherwise.
- d. The **devfs** option is needed only on systems with DEVFS support, but will be ignored otherwise.
- e. The **raid** option is needed only on systems with disks previously containing software RAID devices, but will be ignored otherwise.

Completing the Boot Process

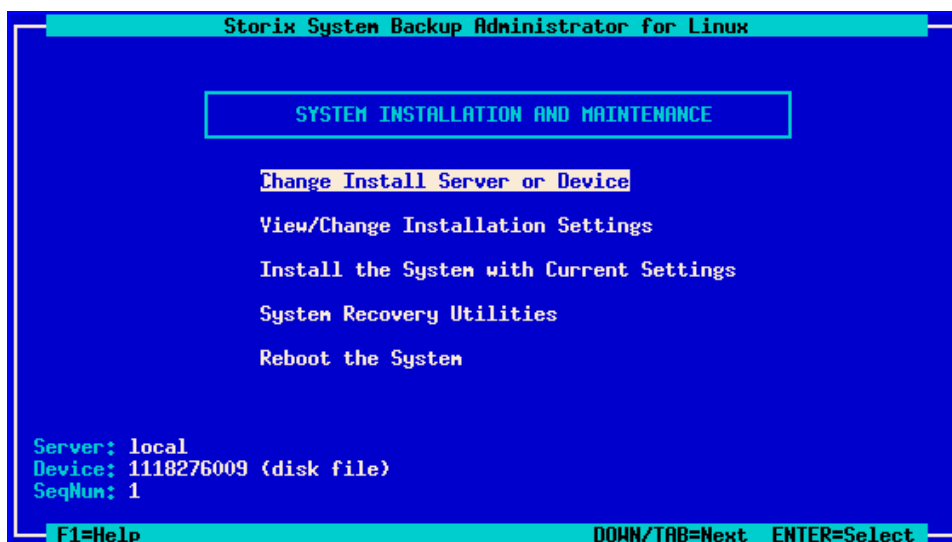
If booting from a network [boot server](#) and the client is configured for [no-prompt install](#), the installation will proceed without any user prompts. This assumes that a console and restore device was pre-determined and the LVM information on the backup media is compatible with the system being installed. Refer to the section [Enable Client for Network Installation](#) for details on the configuration of a no-prompt install.

Unless this is a no-prompt install, the following prompt will appear on the screen:

```
***** Please Define the System Console *****  
  
Type 1 at this terminal and press (Enter)  
if you want this display to be the System Console.
```

The above example is for an ASCII terminal. Note that the prompt "**Type 1**" will be shown as "**Press F1**" for graphical displays. If the console is an ASCII terminal, press "1" and Enter. If the console is a graphic display, press the "**F1**" key and press **Enter**.

After a short time, the following **Installation and Maintenance** screen will appear:



The detailed instructions for using the options on this menu are provided in the sections [Reinstall a System from a Backup](#) and [View/Change Installation Settings](#).

Troubleshooting a Network Boot

To boot from the network, a server must have first been configured to provide a network boot image to this client. Those steps are outlined in the section [Network Boot/Install Configuration](#).

To perform a network boot, SBAdmin Backup Administrator uses a standard network process called "**BOOTP**". BOOTP is initiated from the client and communicates with a BOOTP daemon on the boot server, who in turn provides the client with information needed to obtain and execute a network boot image.

You must refer to each of the sections above, depending on your platform type, for instructions on initiating the BOOTP process. If you are unable to boot the system to either the BOOTP Menu or System Management Services Menu, you should refer to your hardware documentation for instructions.

If you are able to initiate the BOOTP process, but the client still fails to get to the SBAAdmin Installation and Maintenance process, there may have been an error in network communication between the client and server or an error in the network boot configuration. Be sure to check the following:

1. Check that the settings in the [Enable Network Installation of a Client](#) process are configured properly. Specifically be sure that the client gateway, subnet mask, platform and adapter type are correct.
2. Some older RSPC models require the **Network Adapter Hardware (MAC) Address** be entered in the [Network Boot Settings](#), even when entering the client and server IP addresses. Refer to [Determining the Network Adapter Hardware Address](#) instructions below.
3. If you are booting an IBM pSeries and trying to perform a **broadcast BOOTP** (by leaving the client and server IP address fields blank), try filling out the client and server addresses instead. Note that a broadcast BOOTP cannot be performed if a gateway is used between the client and server. Also, BIOS and EFI-based systems will only support broadcast boot, so entering IP addresses is not an option.
4. Be sure that the **bootpd** or **dhcpd** daemons, as well as the **tftpd** daemons are enabled on the boot server. Specifics for checking for the availability and enabling the daemons differ with each Linux distribution, so details cannot be provided here.
5. Check that the server's IP address is correct, and that you specified the correct gateway and subnet mask (if needed). Keep in mind that the gateway address should be the gateway the client uses to connect to the server, not the other way around.
6. The **SMS** (pSeries) and many **PXE** boot menus have options to “ping” the boot server. This is handy to determine if the TCP/IP communication is valid between the systems, rather than a BOOTP configuration issue.
7. If you are entering a gateway address in the network boot screen on the client, be sure to enter the gateway address the client uses to reach the server, not the gateway address found on the server.
8. If you are attempting a *broadcast boot* and the boot fails, return to the network boot menu (if any) and make sure there are no IP addresses entered in the network boot settings. Remove any entries if they exist. If any entries are found, they will be used instead of a broadcast boot.

Determining the Network Adapter Hardware Address

Some systems require that the adapter hardware address, also referred to as the **MAC address**, be used to network boot a client. The MAC address is used to initiate a **broadcast boot**. In other words, the boot request is *broadcast* on the network, and each server running the **bootpd** or **dhcpd** daemon will examine the request to see if it is configured to respond to that MAC address.

A non-broadcast boot requires you enter the IP address of the server and the IP address assigned to the client you are booting. Since this request is sent directly to the server, and the server responds to the client IP, there is no need to know the MAC address.

Performing a broadcast boot, therefore, does not require that you enter the server or client IP addresses into the network boot screen (and for some systems this is not an option). The broadcast boot, however, requires that the MAC address be entered when [setting up the client for network installation](#). The steps to obtain the network adapter hardware address of the client differ widely depending on the platform and system model. If you do not know how to determine the adapter hardware address, you can usually find this information on the screen when initiating a network boot operation (even if the boot is unsuccessful) or when displaying the available network adapters to boot from.

5. Reinstall from a System Backup

A [System Backup](#) may be used to reinstall either the original system or a different system with either the same or different hardware configuration. To initiate the installation, you must first boot the client from either a network boot server or from the local tape using the instructions found in the section [Booting to the System Installation Process](#).

To setup a client system to be installed from a System Backup on a network install server, you must first configure it using the process described in the section [Enable/Disable Network Installation of a Client](#).

Cloning Systems

"Cloning" a system means to install a system from a backup originating on another system. The system from which the backup was made may be identical or completely different than the system you are installing.

If the system to be installed is identical in hardware type and configuration to the one the backup was made from, the installation may be performed with no customization required. However, if the systems differ, there may be changes required. For instance, if the disk configuration on which the volume groups were placed is not available on the new system, messages will be displayed that the original disks are not available and you must select new physical volumes into which the volume groups will be placed. See [View/Change Installation Settings](#).

No-Prompt Installation

If the system is set to [no-prompt installation](#), the [Installation and Maintenance Menu](#) will not appear (as described in the following section), but the installation will proceed without any input from the user. If your boot media was created for a no-prompt installation, a banner will display as follows:

```
=====
                        !!!! NO-PROMPT INSTALLATION !!!!
=====
The installation process was set to no-prompt mode. The installation
will continue with no prompts unless a problem occurs requiring user-
interaction.
      IF YOU DO NOT WANT THIS MACHINE TO INSTALL AT THIS TIME,
      YOU HAVE 60 SECONDS TO TURN OFF THE SYSTEM POWER!
++=====
```

As indicated, you will have 60 seconds to turn off the system to prevent the system recovery process from continuing (and possibly overwriting all data on the system). There is no way to manually interrupt an install process created for no-prompt installation and cause it to display the installation menus.

However, if any error occurs, such as an install server or device not being available, or if the backup data read from the installation media cannot be installed onto the detected hardware without user intervention, an error message will occur and the [System Installation Menus](#) will appear.

Refer to [Creating Boot Media](#) and [Enable/Disable Network Installation of a Client](#) for information how to pre-answer any questions normally asked during the install process which are required for a no-prompt installation. If configured for no-prompt installation, the installation process will proceed automatically as follows:

1. The defined install server and device will be checked to ensure they are available and readable

2. The selected backup will be read and the installation information will be extracted
3. The configuration information from the backup will be compared against the current system configuration to ensure the volume groups and logical volumes may be created according to the backup data. If there are non-fatal problems which can be corrected, they will be corrected automatically. For instance, if a prior LVM physical volume is not available on the new system, leaving only one physical volume in a volume group, mirroring and/or striping of all logical volumes in that volume group will need to be turned off to allow the installation to continue.

If there are any fatal problems, such as no disks on the new system that match the original system, or if the disks on the new system are not large enough to contain the original data, the system will enter prompted mode and the installation menus will appear in order for the user to make changes to correct the problems before continuing.

Installing from an Encrypted Backup

If the backup to be restored from was encrypted during the backup process, it will be necessary to decrypt the data during the restore. Unlike restoring data on a live system, where the encryption keys are available on the backup system, the encryption key must be entered manually during the system installation. The encryption keys are not stored in the boot media or the backup information as this might be penetrable to hackers.

NOTE

As warned during the backup process, an encrypted backup **cannot** be restored without the proper *encryption key*. This key may not be retrieved from the backup, nor can SBAdmin assist in providing the correct key. If you do not have the proper encryption key needed to decrypt this backup, you will **not** restore this data!

The encryption key is a value that the user defined prior to performing the backup. If the encryption key is not known, you will not be able to restore the system from this backup. However, to make encryption keys easier to remember and/or enter, it may be entered either as a hexadecimal number, or an ASCII text equivalent (if this was the form used to create the original key).

When selecting to install from an encrypted backup, the following message will appear:

```
=====
                          BACKUP DATA IS ENCRYPTED
=====
To read the backup data, an encryption key is required. You may supply
a 32-byte HEX key to decrypt the data. If you used a 16-byte
ASCII (text) key to generate the HEX key, you may also enter it here.

Select one of the following:
    1) Enter a HEX key
    2) Enter an ASCII (text) key
    3) Start a shell

==>
```

Select the appropriate option for entering either a HEX or ASCII encryption key. The third option may be used to start a shell to type commands at the command line should you need to perform system recovery without reading the backup data.

Enter a HEX Key

The length of the key will depend on the number of bits of encryption. For 128-bit encryption, a 32-byte hexadecimal number is required. For 192-bit encryption, a 48-byte number is needed, and for 256-bit

encryption, a 64-byte hex number is needed. Select option 1 from the list above, then when prompted to "Enter your 32-byte HEX key (or press Enter to reselect key type)", enter the key, or press Enter to return to the options above.

Enter an ASCII (text) Key

The length of the key will depend on the number of bits of encryption. For 128-bit encryption, a 16-byte ASCII string is required. For 192-bit encryption, a 24-byte string is needed, and for 256-bit encryption, a 32-byte string is needed. Select option 1 from the list above, then when prompted to "Enter your 16-byte ASCII (text) key (or press Enter to reselect key type)", enter the key, or press Enter to return to the options above.

The key you enter will be converted to an appropriate hexadecimal number and used to decrypt the data, just as if you entered the hex key yourself.

Upon entry of a valid key, the restoration of the data will continue. If an invalid key is entered, you will be informed so, and returned to the above menu of options.

System Installation Process

After booting from a network boot server

When the system is booted from the network, the client network installation options will also be copied from the boot server to the client. Any installation options setup when the client was configured for network boot (see [Enable/Disable Network Installation of a Client](#)) will be used by default for the installation. These pre-set defaults may include the install server and device, the console device and terminal type, the backup sequence number, or anything else required for the installation to proceed with no required input from the user. If the user selected a no-prompt installation (see [No-Prompt Installation](#) above) will the installation continue automatically. Otherwise, the installation menus will appear and the user may manually change any prior defaults, add any settings that were not pre-configured, or continue the installation process with the current settings.

Verifying the hardware configuration

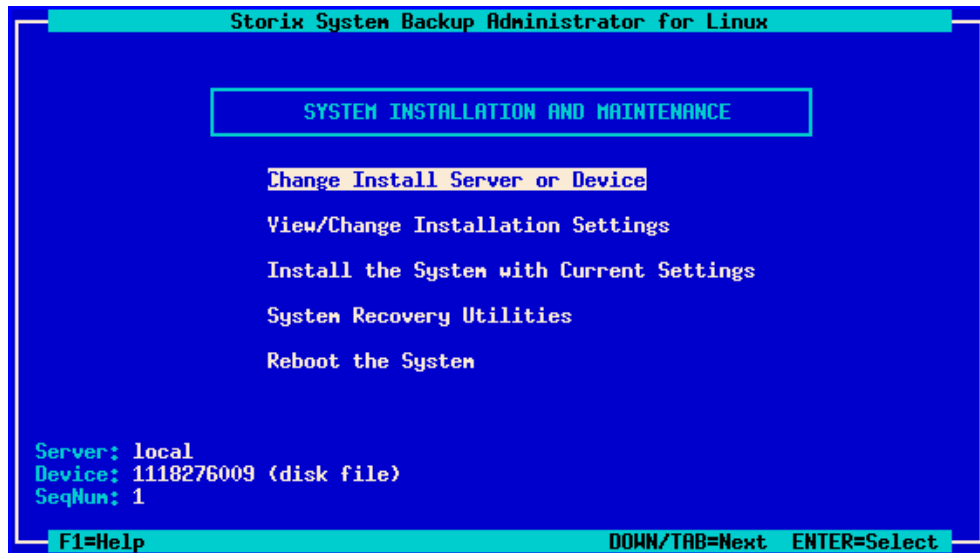
Once the backup media is selected, and you chose to either continue the installation with the current settings or to change the volume group, logical volume or filesystem information, the following will occur:

1. The disks defined on the backup are compared against the current system's hardware configuration. If there are problems that would prevent the backup from being installed onto the system, such as missing disks or disks that are too small to contain the backup data, a list of messages indicating the problems will be displayed and the user will be required to either make changes manually or may select to **automatically fix** any problems that are non-fatal.
2. Non-fatal errors are those that require changes to the configuration in order to allow the data to be restored, although some settings may differ from those of the original system. For instance, if there is only one remaining LVM physical volume that matches the original system configuration for a particular volume group, any mirroring and/or striping will need to be disabled for the logical volumes in that volume group since these features require at least two physical volumes. If such non-fatal errors occur when checking the system information, you will be provided the option of automatically fixing the errors. You may also change the volume group or logical volume information manually to either add more disk space or change other logical volume attributes manually that would allow the logical volume to be created as desired.

More details of the verification that takes place is described later in [Verification Process](#).

The System Installation and Maintenance Menu

When the boot process has completed, the **System Installation and Maintenance Menu** will appear:

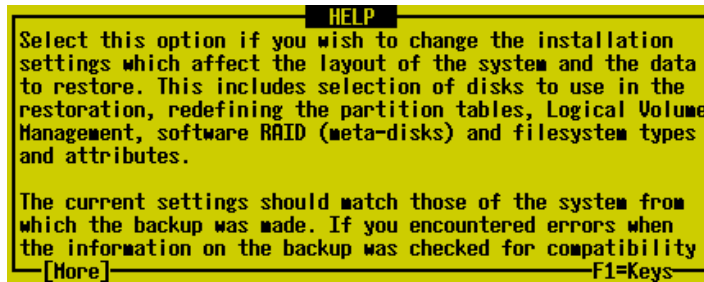


Using Keys and Getting Help

Because these menus are designed to appear on both graphic and serial (ASCII), the menus are provided in a form viewable on **ASCII terminals**. The use of the mouse is not available. Most keyboards will support arrow keys while others do not. Also, some keyboards have page up and page down keys, help keys, etc, that others do not. For this reason, there is a variety of methods which may be used to traverse the menus and options in the installation screens:

- To move between fields, use the **Up-arrow** and **Down-arrow** keys on the keyboard.
- To make a selection, press the **Enter** key, and
- To return to a previous screen, use the **F3** or **ESC** (escape) key
- For pop-up lists, help screens and other messages, you may use the arrow keys to move up and down the list or to scroll the text. You may also use the **Page-up** and **Page-down** keys, if available, or use **CTRL-N** for 'next page' and **CTRL-P** for 'previous page' if not.

Help Windows: The **F1** or **!"** key (shift/1) may be pressed at any field or menu item to obtain help instructions, detailing the use and options for the corresponding item. A help window will appear in the center of the screen as in the following example:



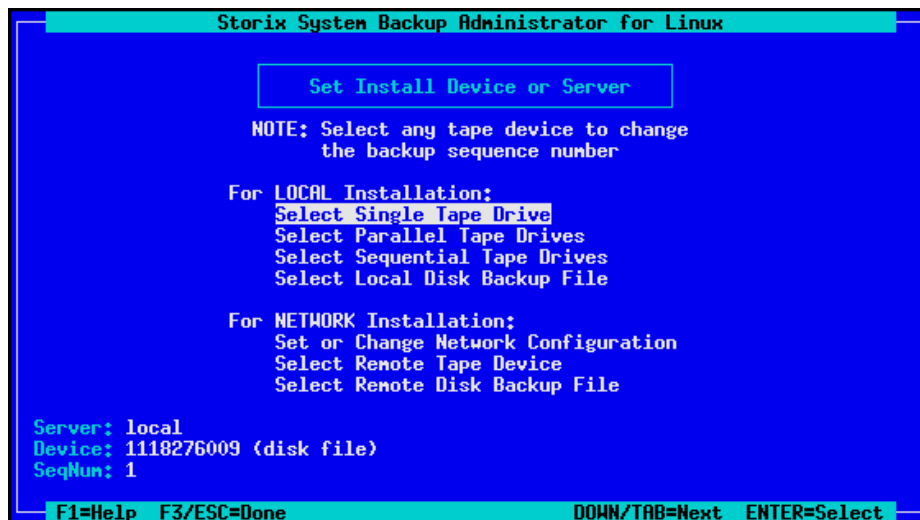
If the help information is lengthy for a particular option (indicated by **[more]** at the bottom), it may be necessary to page the message using the page or control keys described above. To remove the help window and return to the previous entry, press the **F3** or **ESC** key.

Pop-up List Options: Pop-up lists are available for many entry options. When supported, "List=F4" will appear at the bottom of the screen. At that field, you may press the **F4** or "**\$**" key (shift/4) to list the available options for the corresponding field and select an option from the list. To select an option, use the arrow keys to highlight the desired option and press **Enter**. The selected option will be placed in the entry field and the pop-up window will disappear.

Change Installation Server or Device

The default installation server and device, if any, will be displayed at the bottom of the screen. If the system was booted from the network, the install server will default to the boot server unless a different install server was defined when the client was configured for network boot. If the system was booted from a local tape, the server is assumed to be "local" (or none) and the installation device is assumed to be the tape drive the system was booted from.

Select the **Change Installation Server or Device** option if you wish to change the server on which the backup media is attached, or the remote or local installation device. You will only be able to select a remote server when using the **Network Administrator** license. After selecting option this option, you are presented with the following additional options:



Highlight the option you wish to select using the up and down arrow keys on the keyboard. Each option is described in detail below:

Select Local Tape Drive

Whether you booted from a network boot server or from a local tape device, you may change the installation settings to allow installation from a local tape drive, even a different drive than was booted from. When selecting this option, a list of local tape devices will be displayed and you may select one tape drive from the list. If the backup was created using a *parallel virtual device*, you must instead use the option below.

After selecting a tape device, the following window will pop up on the screen:

```
Change tape restore options as needed,  
then press F3 or ESC to continue:  
  
Autoloader used?      [n]  
Backup Sequence Number: 1
```

If an [Autoloader](#) is used with the device, select 'y' in the **Autoloader used?** field. If the backup you wish to install from is not the first backup on the media, type the [backup sequence number](#) in the **Backup Sequence Number** field. Refer to the backup sequence number in the backup label if you do not know the correct backup sequence number to use. Also refer to [Virtual Devices](#) for more information on the use of sequential autoloaders. Once you have selected the desired options, press **F3** or **ESC** to return to the [Change Installation Server or Device menu](#).

Select Local Parallel Tape Drives

If the backup was created using a [Parallel Virtual Device](#), you must use a parallel virtual device to restore from the backup as well. The virtual devices previously configured on the system are not known when booting in installation mode, so this option provides you a method of defining a parallel virtual device on the local system.

After selecting this option, you are provided a list of local tape drives. You must select at least two drives from the list. To do so, highlight the desired entry and press Enter. An arrow (==>) will appear next to each option selected.

NOTE

Important: You must select the same number of devices used to create the backup and you must select them in the same order as they were previously configured

When you have selected the desired devices, press **F3** or **ESC**. The following window will pop up on the screen:

```
Change tape restore options as needed,  
then press F3 or ESC to continue:  
  
Autoloader used?      [n]  
Backup Sequence Number: 1
```

If an [Autoloader](#) is used with the device, select 'y' in the **Autoloader used?** field. If the backup you wish to install from is not the first backup on the media, type the [backup sequence number](#) in the **Backup Sequence Number** field. Refer to the backup sequence number in the backup label if you do not know the correct backup sequence number to use. Also refer to [Virtual Devices](#) for more information on the use of [sequential autoloaders](#). Once you have selected the desired options, press **F3** or **ESC** to return to the [Change Installation Server or Device menu](#).

Select Local Sequential Tape Drives

You may also use a sequential tape devices to restore from the backup if the backup spans multiple tapes and you want the installation to automatically span the tapes inserted in different devices. This option is identical to the use of a [Sequential Virtual Device](#). The virtual devices previously configured on the system are not known when booting in installation mode, so this option provides you a method of defining sequential devices on the local system.

After selecting this option, you are provided a list of local tape drives. You must select at least two drives from the list. To do so, highlight the desired entry and press Enter. An arrow (==>) will appear next to each option selected.



Important: You must select the devices in the same order in which they will be read.

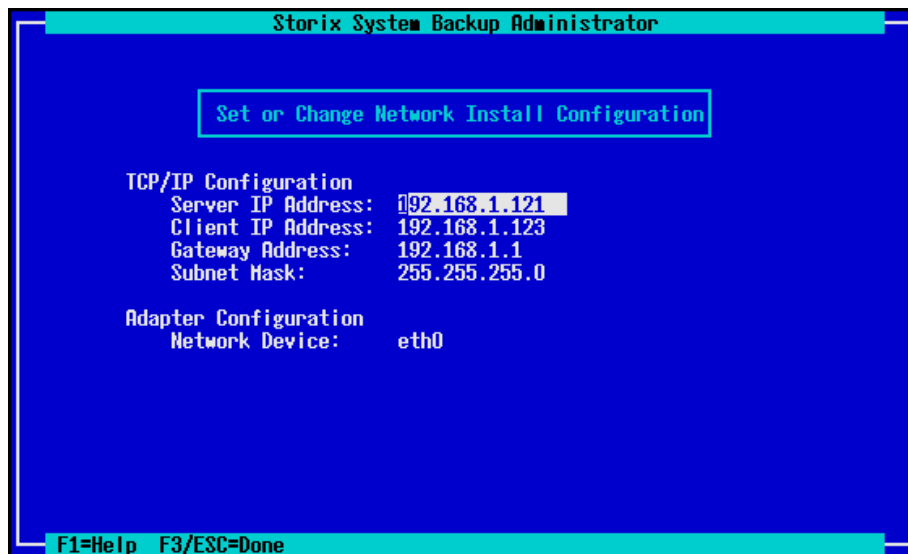
When you have selected the desired devices, press **F3** or **ESC**. The following window will pop up on the screen:

```
Change tape restore options as needed,  
then press F3 or ESC to continue:  
  
Autoloader used?      [n]  
Backup Sequence Number: 1
```

If an [Autoloader](#) is used with the devices, select 'y' in the **Autoloader used?** field. If the backup you wish to install from is not the first backup on the media, type the [backup sequence number](#) in the **Backup Sequence Number** field. Refer to the [backup sequence number](#) in the backup label if you do not know the correct backup sequence number to use. Also refer to [Virtual Devices](#) for more information on the use of [sequential autoloaders](#). Once you have selected the desired options, press **F3** or **ESC** to return to the [Change Installation Server or Device menu](#).

Set or Change Network Configuration

You may set or change the [network install server](#) from which to obtain the backup. The backup itself may be on a tape attached to the server or on the server's disk drive. Upon selecting this option, a screen similar to the following will be displayed:



To use a network install server, the **Server IP Address**, **Client IP Address** and **Network Device** fields must be filled in. If a gateway is required for the client to reach the install server, enter the gateway the client must use in the **Gateway Address** field. Under Adapter Configuration, press **F4** to list the devices available on the system.

NOTE

If no devices appear in the **Network Device** field, then you probably did not include network support when creating the boot media. If you included support, but the device still does not appear, then the device module may not have been included on the media. Look at the `/opt/storix/bin/bootlist_util` file for details.

Press the **F3** or **ESC** key to end and return to the [Change Installation Server or Device menu](#) once you have finished your selection. When you do so, the network will be configured according to the settings you chose, and the new server will be displayed at the bottom of the screen. If the server has changed, any previous device selection, if any, will be removed and you will be required to select a new installation device.

Select Remote Tape Device

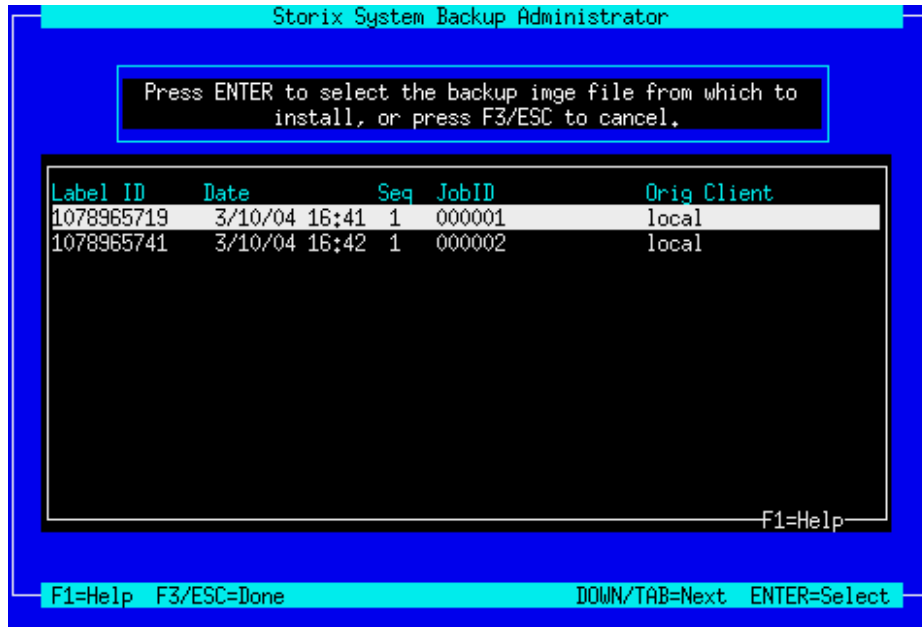
If a [network install server](#) is selected and available (indicated by the Server at the bottom of the screen), you may select to install from a backup in a tape drive attached to the remote server. Note that you may select a remote server and device even if you booted from a local tape, provided that you chose to include the network support on the tape when configuring the [System Backup Profile](#). When selecting this option, a list of tape drives on the server will be displayed and you may select a tape drive from the list.

Also, if there is a [parallel or sequential virtual device](#) configured on the server, the virtual devices will be displayed, and you may select one as well. Only select a parallel virtual device if the backup was made using the same parallel device. Refer to the [Virtual Devices](#) chapter for details.

Once you have made your selection, the drive will be checked to ensure that it is available and the name of the device will be displayed at the bottom of the screen, and you will be returned to the [Change Installation Server or Device menu](#).

Select Local Disk Backup File

If you configured a locally-attached (or SAN-attached) disk for system backup/recovery (refer to **SBAAdmin User Guide**), and you performed the System Backup to a configured **system backup disk**, you may reinstall the system using that backup. If you select this option, the system will be scanned for one or more system backup disks, and then the disks will be queried for available system backups. If any are found, a screen similar to the following will appear, from which you may select the backup to restore:

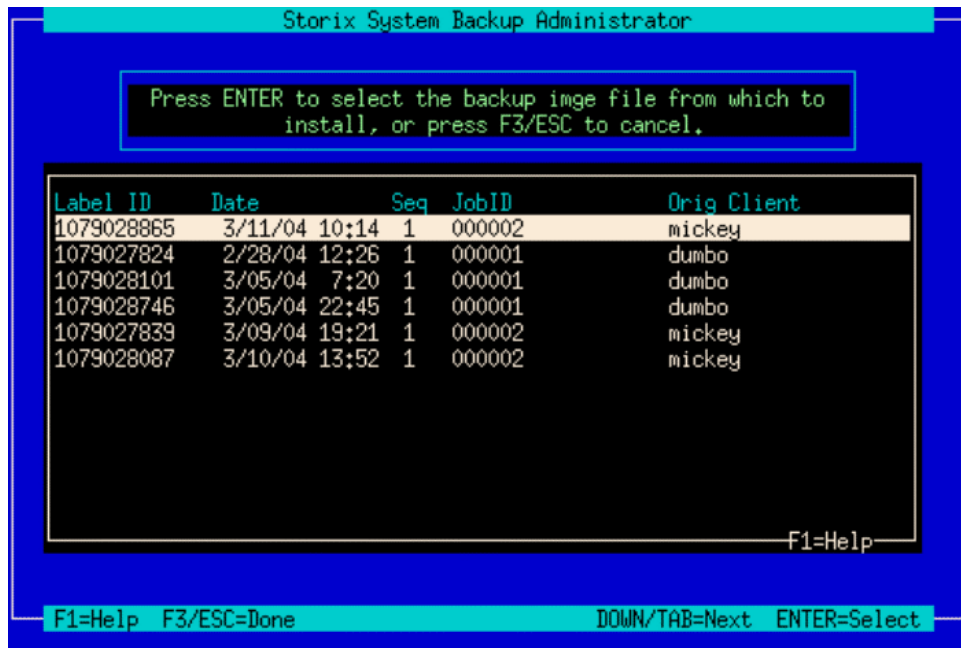


Select a backup by highlighting the desired line and pressing **ENTER**, or press **F3** or **ESC** key to cancel the selection. After making your selection, you are returned to the [Change Installation Server or Device menu](#).

Select Remote Disk Backup File

cp If a **network install server** is selected and available (indicated by the **Server** field at the bottom of the screen), you may select to install from a disk file backup available on the server. Note that you may select to install from a remote server and device even if you booted from a local tape, provided that you chose to include the network support on the tape when configuring the **System Backup Profile**. When selecting this option, a list of backup images on the server will be displayed, and you may select a backup from the list. The list will also display the client from which the backup was originally made, the date and backup job information.

The list will contain any backups that were written to the network install images directory (or directories) defined for the install server. Refer to **Configuring Backup Servers, Devices and Directories** for more information on setting the network install images directory.



If you expect a backup image to appear in the list that does not, it may be that the backup was written with permission for only the original client to read it. If the client to install is not the same as the original client (or the client is installing from a different network adapter and therefore has a different hostname), you must change the backup image to allow clients other than the originating client to read it. Refer to [Change Access Permission of a Disk Backup](#) for details.

Once you have made your selection, the **Backup ID** of the backup file will be displayed in the **Device** field at the bottom of the screen, and you will be returned to the [Change Installation Server or Device menu](#).

Once the installation server and/or device have been selected, press the **F3** or **ESC** key to return to the [Installation and Maintenance Menu](#).

Change the Installation Settings

The sizes, locations and all other attributes for [disks](#), [partitions](#), [volume groups](#), [logical volumes](#), [meta-disks](#), [swap spaces](#) and [filesystems](#) as defined on the backup may be changed using this option. If the backup settings had not been previously read from the backup, the backup will be read and the settings, according to the original system, will be extracted from the backup. The settings will then be verified to ensure they are compatible with the current system's hardware configuration. If the verification fails, you will be required to fix the information to accommodate installation of the backup onto the current system. This may be done either automatically or by changing the setting manually as described in the section [Verify the hardware configuration](#) above.

Upon selection of this option, a set of menus will appear that allow you to customize virtually any attribute of a partition, volume group, logical volume, meta-disk or filesystem defined on the backup. You may also choose to exclude certain of these elements from being created or restored, or may select to create them without actually restoring the data. These menus and options are numerous, and are described in detail in the chapter [View/Change Installation Settings](#).

Once you have completed all changes, press the **F3** or **ESC** key to return to the [Installation and Maintenance Menu](#).

Install the System with Current Settings

When you have completed all steps necessary prior to installing the system, such as changing the installation server, device or volume group information, you may select this option to begin the installation of the system using the current settings.

The backup settings will again be verified to ensure consistency with the current hardware configuration as described in [Verification Process](#). If any problems are found, you will be returned to the [Installation and Maintenance Menu](#).

If no problems were found in the system configuration preventing the installation from proceeding, a confirmation screen will appear, showing you the volume groups and disks that will be created or overwritten by the installation. You will be required to press Enter to continue. A final warning will appear and you must then press "y" to continue the installation or "n" to return to the Installation and Maintenance Menu.

Once you have selected to continue, the installation will proceed with no further user input. The partition tables, volume groups, logical volumes, meta-disks and filesystems will be created and restored from the backup as defined in the backup information, and as previously customized.

Upon completion of the installation, with the exception of any changes made within the installation menus, the new system will look identical to that of the original system from which the backup was made.

More details on the complete installation process are found in the [Install the System](#) chapter below.

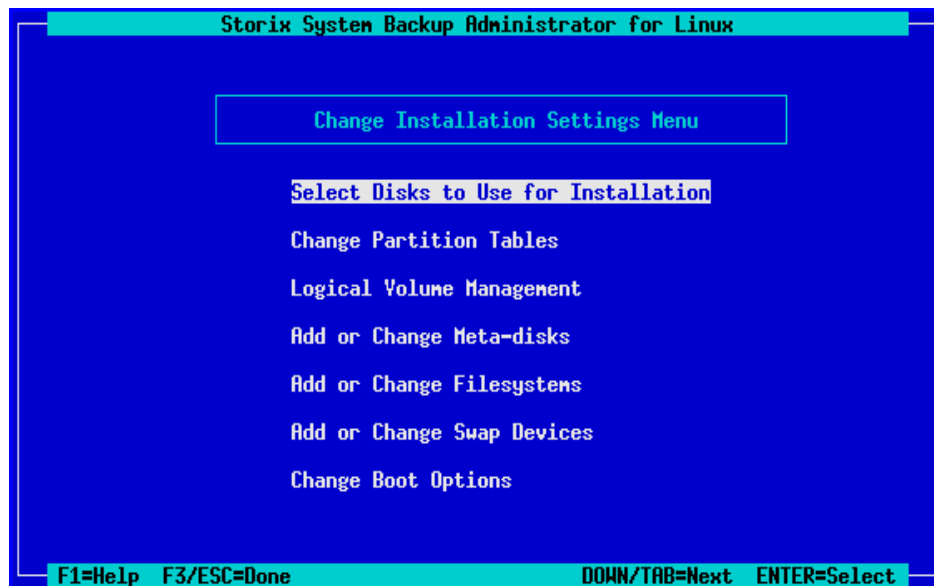
6. View/Change Installation Settings

From the **Main Menu**, select **View/Change Installation Settings**. The first time you enter this option, the backup information will be read from the installation media and compared with the system and disk configuration to ensure there is adequate space on the available disks to perform the installation. Checks will also be made to ensure you booted from boot media that supports all of the devices you will be restoring from the backup. If there are any inconsistencies, you will be required to make changes within these menus to correct the problem.

NOTE

It is important to note that any options or changes made in these selections have **NO AFFECT** on the actual disks or their contents until **AFTER** you begin the installation. If you change your mind at any time, you can cancel or change information without worry as to the state of the data on the disks!

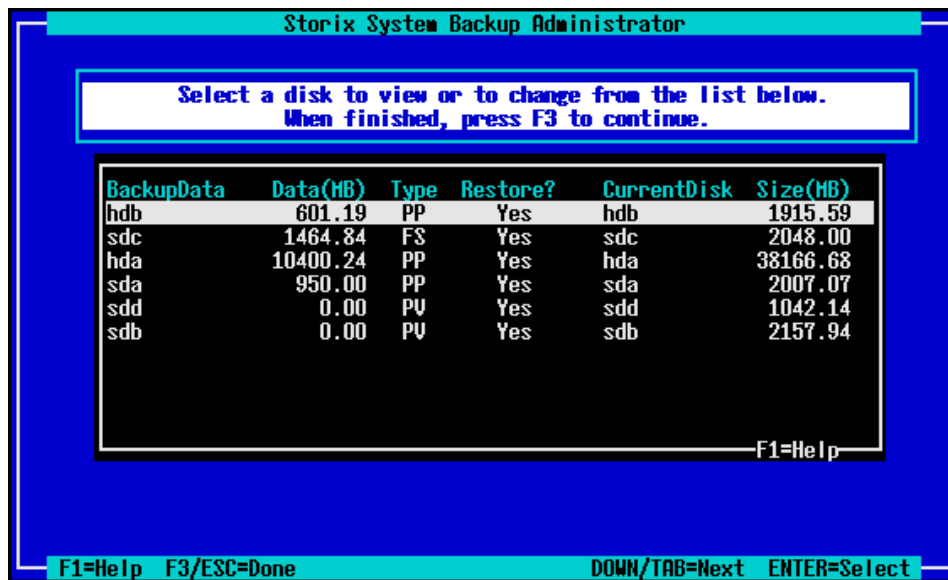
The following is the **Change Installation Settings Menu**:



At times, you may be required to make changes throughout these menus to correct problems that would prevent the devices from being created or the data from being restored. Only after returning to the [Main Menu](#) by pressing **F3** or **ESC**, and selecting to begin the installation, will the data be checked again for consistency and additional changes be required.

Select Disks to Use for Installation

If the disks detected on the system do not exactly match those described on the backup, this option will appear automatically. Otherwise, you can select this option from the [Settings Menu](#) to display a screen similar to the following. We will refer to this as the **Disk Table Menu**.



Many options are available from this screen for moving data between disks. This is necessary when the disks currently available don't match those defined on the backup, or if you simply want to reorganize the data on the disks for better performance, or to implement RAID striping or Logical Volume Management (all described later).

To return to the [Settings Menu](#), press **F3** or **ESC**. The backup data will again be checked to ensure you have enough room on the disks for the partitions or other data as you have defined them. If not, you will be warned, but can make changes in this or other settings to fix the problem before the installation is actually performed.

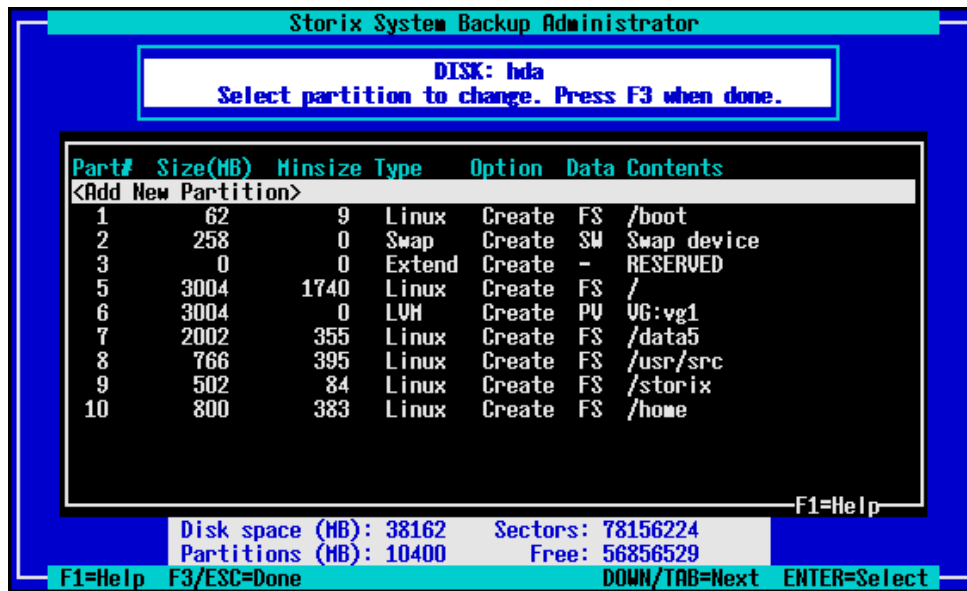
The above screen shows you the original disk the data resided on and the new disk that is assigned that data. There may be previous disks that are not assigned to a new disk, or even additional detected disks that have no data currently assigned to them. By selecting one of the lines on the screen, you are provided several options as shown below:



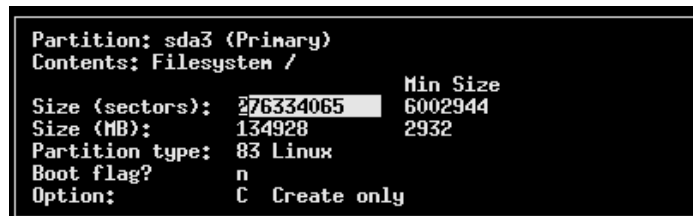
Note that the options for displaying or migrating partitions only appear if the selected disk was previously partitioned or you have chosen to create partitions on it. Each option is described below:

View/Change Partition Table

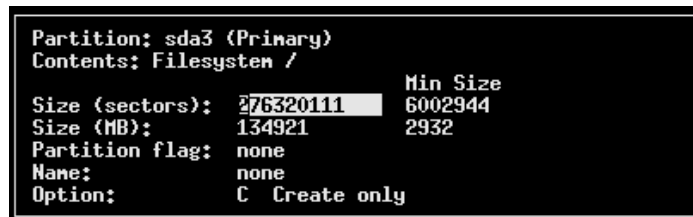
When selecting this option the partitions on the disk will be displayed as in this example:



You may select to add a new partition by pressing Enter at the highlighted line at the top, or move the highlighted line over the partition you wish to change. When adding a new partition you will be prompted where to insert the partition within the table. Then, when either adding or changing a partition, a window similar to the following will be displayed:



The above screen allows editing of partitions for *MSDOS partition tables*. Most systems only support these partition table types. If you are using an Intel IA/64 system which uses *GPT partition tables*, the options will differ slightly as follows:



You may change any of the options shown. The **Size** of the partition can be set by either entering the number of sectors (512-bytes each) or by entering the number of megabytes. In either case, the other will be adjusted accordingly. You normally will not need to change the **Partition type** or **Partition flag**, even if creating a RAID or LVM device on the partition because the software will automatically do that for you. The **Boot flag** is not used by the software, and need only be changed if the partition contains a non-Linux operating system that requires it. If your backup contains raw partition data, the **Option** will show **Create/Restore**. If you do not want to restore that data, change this to **Create only**.

When finished with your selections, press F3 or ESC to return to the [Change/View Partition Table](#) options.

Assign All Contents of a Disk to a Different Disk

Select this option only if you want to move all of the previously defined backup contents to a different disk. You will then be asked which disk to assign the data to. If you select a disk that is currently assigned other data, you'll be given the option of making the other data unassigned so that you can either move it to a different disk or choose not to restore it.

Migrate a Partition to a Different Disk

If you select this option, the [partition table](#) will be displayed where you can select a partition to be moved to a different disk. You will then be prompted for the location on the new disk to place the partition. If the disk you are moving to currently has no partitions assigned to it, you can select to make the new partition either a physical (partitions 1-3) or logical (partitions 5-16). Note that partition 4 is always reserved for the extended partition, on which all logical partitions are created.

Select Not to Restore Data to a Disk

By selecting this option, you are choosing not to restore the data that is assigned to the selected disk. By doing so, all previous contents will become undefined, and the disk will not be used when installing the system. Any data that actually resides on the disk at this time will not be overwritten.

If you choose not to restore a disk containing partitions, the partitions will be deleted as well as any contents of those partitions, whether they are filesystems, LVM physical volumes or software RAID devices. If selecting not to restore a disk's contents causes any problems which would prevent the installation from being performed (for instance, removing one partition of a striped meta-disk), you will be informed so and required to make additional changes before continuing the installation.

When you have finished all changes, press **F3** or **ESC** to return to the [Disk Table Menu](#) and **F3** or **ESC** again to return to the [Settings Menu](#).

Change Partition Tables

This option on the menu is really just a shortcut into the same options available when selecting disks to use for installation. You have the same options of changing partition information or adding new partitions to a disk, but must use the [Select Disks to Use for Installation](#) option to move partitions or other data between disks.

If your system supports both **MSDOS** and **GPT** partition tables, you will be provided the following option:



Select the first option to view or change the existing partition table. Refer to [View/Change Partition Table](#) for additional information. If you select to change the partition table type, you will be asked whether you want the partition table to be MSDOS or GPT format.

GPT partition tables have only one partition format, but MSDOS tables have *Primary* and *Logical* partitions (logical partitions are contained within an *Extended* partition).

When changing from MSDOS to GPT, the Extended Partition (only used in MSDOS tables) is removed and all partitions are changed to a "primary" type. When changing from GPT to MSDOS, the first 3 partitions are converted to a Primary partition, an Extended partition is created as partition 4 (if needed) and additional

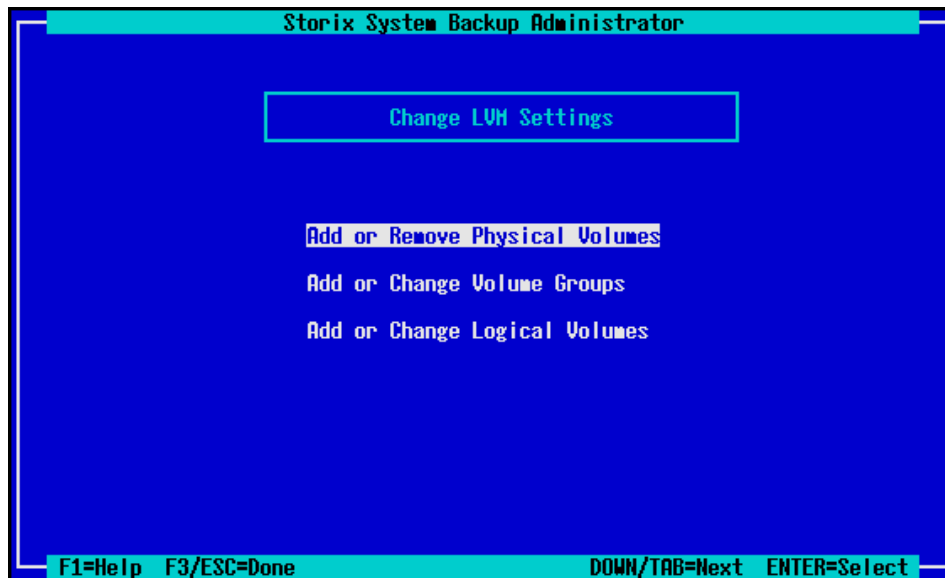
partitions are created as Logical. After the conversion takes place, the new partition table is displayed where you may change the partition information. Refer to [View/Change Partition Table](#) for additional information.

Logical Volume Management

The **Logical Volume Manager (LVM)** support is included with many distributions and provides the flexibility of logically managing multiple physical disks as one large logical disk. This allows, for instance, a filesystem to be spread sequentially across multiple disks, striped across disks, and the filesystem (contained in a logical volume) does not have to use contiguous segments of disk space. Therefore, you can expand and reduce the size of these containers even if there is not contiguous disk space available. Since LVM support in SBAdmin is quite extensive, we'll provide a quick lesson in LVM terminology, but you should refer to your LVM documentation and the "man" pages for the LVM commands for details:

- **Physical Volumes (PVs):** This is similar to a physical disk assigned to LVM, but may actually be other types of block devices, including hard disks, partitions and meta-disks. PVs are assigned to volume groups to group them into a single large "logical" disk.
- **Volume Groups (VGs):** This is basically the logical view of a disk, which actually contains one or more physical volumes. A volume group may then be split into smaller units which may be used for storing raw data or filesystems.
- **Logical Volumes (LVs) :** Volume groups are broken down into logical volumes, which is similar to a disk "partition". The difference is that the segments making up the logical volumes may actually exist on different disks and do not need to be contiguous. A logical volume may also be "striped", providing added I/O performance by making use of multiple physical volumes concurrently.
- **Physical Extents (PEs):** This is a unit a physical volume is divided into, each in size. A PE may be from 1 Kbyte up to 128 megabytes in size, and is the smallest unit of allocation for logical volumes. A logical volume might be made up of PEs existing on different physical volumes.
- **Logical Extents (LEs):** A logical volume is actually made up of LEs, which at this time is the same as a PE. We refer to PEs when talking of the physical units of allocation and LEs when talking of the logical units of allocation. The reason for the differentiation is for future support of mirrored logical volumes, where a 100 megabyte logical volume, made up of 25 4 megabyte LEs actually takes up 50 PEs (since every LE will be mirrored onto 2 PEs).

When selecting this option from the menu, you will be provided another list of options:

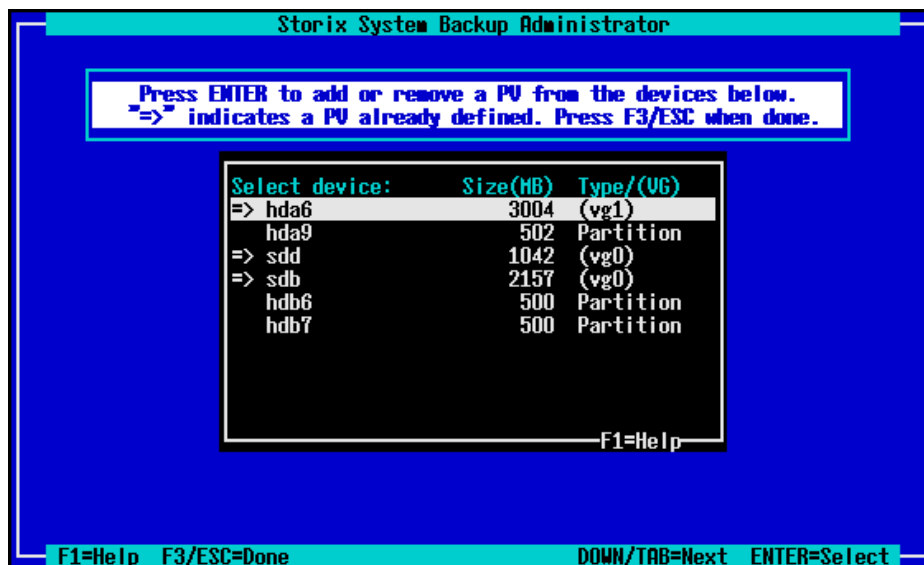


You will note that these options may not only be used to change settings of existing LVM definitions, but also for creating new PVs, VGs and LVs. After refining new logical volumes, you will be able to later either create a new filesystem in the logical volume or even move a filesystem previously residing on a disk partition into a logical volume!

You will also find that physical volumes may be created on meta-disks and meta-disks can be created from logical volumes. This will allow a

Add or Remove Physical Volumes

This option is used to define a block device as a physical volume for use with LVM. When selecting this option a list of potential physical volume devices as well as those currently defined is displayed:



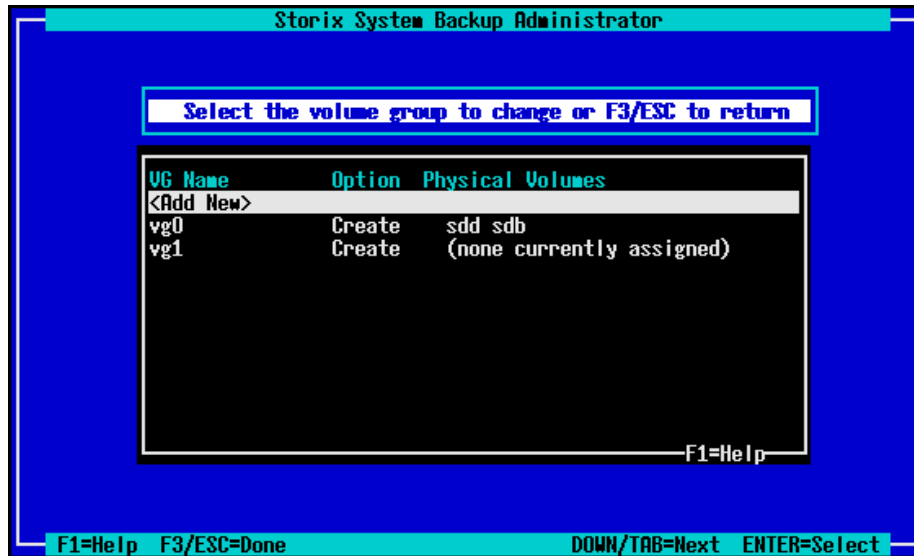
This list will only contain devices, such as *disks*, *partitions* or *meta-disks*, that do not already have other data assigned to them. Those indicated with => are currently physical volumes. You may select any line to either define or un-define this as a physical volume. The **Type/(VG)** column will display either the type of

device (it not currently a physical volume), or the volume group name (or none) the physical volume currently is assigned to.

When finished with your selections, press **F3** or **ESC** to return to the [LVM Settings Menu](#).

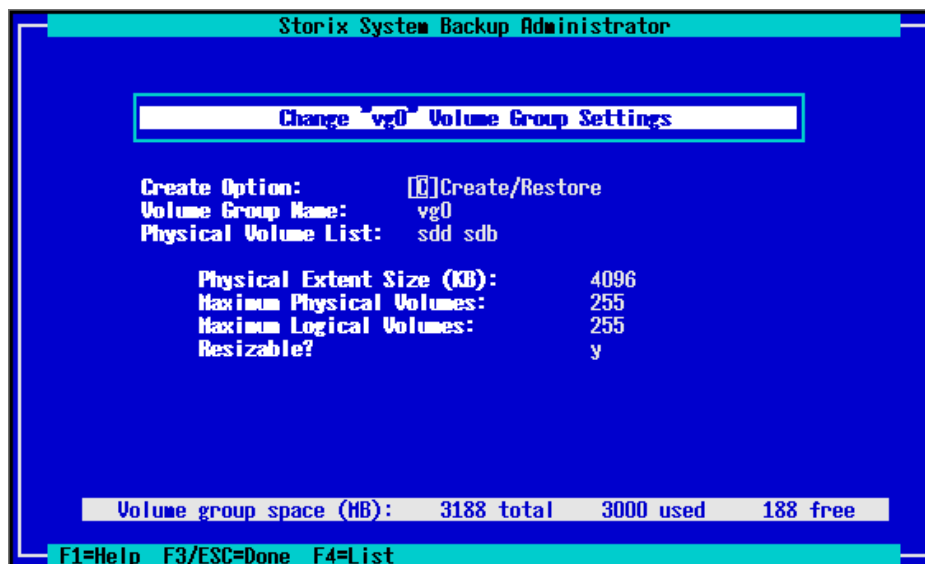
Add or Change Volume Groups

Use this option to change the attributes of a volume group, delete a volume group or to add a new volume group. When selecting this option, a screen similar to the following will first appear:



This will show the currently defined volume groups, if any. If you select the **<Add New>** option at the top, you can define a new volume group. You will be required in this case to have first defined at least one physical volume to assign to the volume group.

After making your selection, the following screen will be displayed:



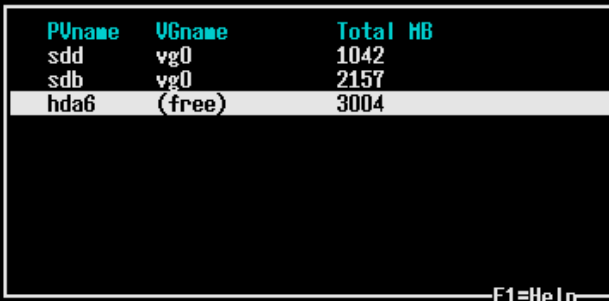
Remember to press **F1** at any time for detailed help on a particular field. Use **F4** in most fields to display a list of available choices. From this screen you can change the VG name, the physical volumes assigned to the VG, the PE size and other options.

Notice that the amount of space available in the volume group is shown at the bottom, as well as the amount of space used by current logical volumes.

The **Create Option** may be changed to either "**C**" (create) or "**D**" (delete). If you change the option to Delete, you will be given warning, and the volume group and any logical volumes assigned to it will be removed. Any physical volumes assigned to it will become available to assign to other volume groups, if any.

If you change the **PE size**, any logical volumes currently assigned to the volume groups will be adjusted to fit. The number of LEs assigned to each LV will change, and in some cases, the LV size may change slightly in order to round up to the new PE size.

To select physical volumes for the VG, press **F4** in the Physical Volume List field. A pop-up window will display similar to the following will be shown:

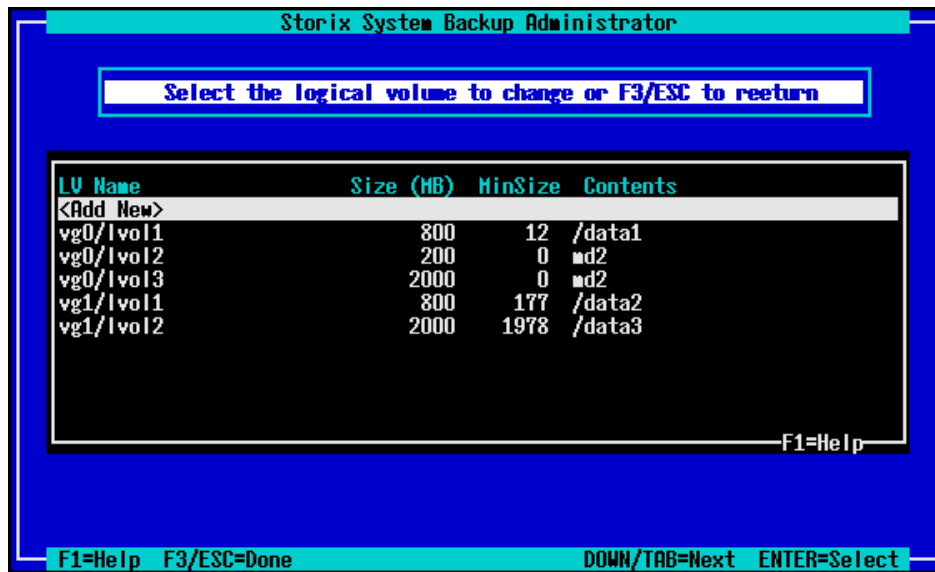


PVname	VGname	Total MB
sdd	vg0	1042
sdb	vg0	2157
hda6	(free)	3004

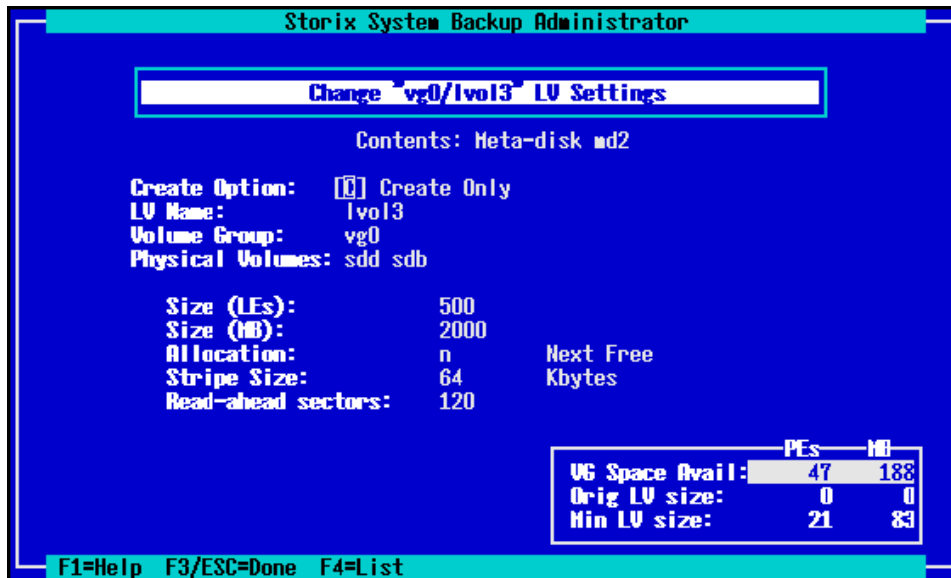
You may only select a physical volume that is either currently assigned to this VG (in order to un-assign it), or a physical volume listed as "free", indicating that it does not belong to a volume group. By selecting the line, the list will refresh showing the PV either assigned or unassigned. Press **F3** to return to the [Change Volume Group](#) screen.

Add or Change Logical Volumes

Select this option to add, delete or change logical volumes. When selecting this option, a screen containing the currently defined LVs is shown:



Select <Add New> to create a new logical volume or select a line containing a current logical volume to change or remove it. The logical volume settings can then be changed on the following screen:



Use the **F1** key for help on any field or the **F4** key to list current choices.

The amount of space available in the volume group, and the minimum LV size (if the LV previously contained data) is shown at the bottom of the screen. These numbers will be adjusted as you change the size of the LV, which may be specified in either LEs or megabytes.

You may also change the name of the volume group the LV is assigned to. Note that this will change the actual LV device name, since the name of the logical volume device is actually "/dev/VGname/LVname" (but we of course don't bother you with the /dev prefix).

To select the specific physical volumes within the volume group where you want this LV placed, move to the **Physical Volumes** field and press **F4**. It is not necessary to assign PVs to the LV unless you plan to stripe the LV or you have a desire to specify its location (you may want 2 LVs that perform different I/O

workloads located on different PVs, for example). A window will pop up showing the physical volumes currently assigned to the volume group, and you can select or deselect PVs from the list.

Note that you must select at least 2 PVs when you choose to stripe the logical volume data across PVs (by setting the **Stripe Size** value to any non-zero value).

When finished with your selections, press **F3** or **ESC** to return to the list of LVs, and F3 or ESC again to return the [Change LVM Settings](#) menu.

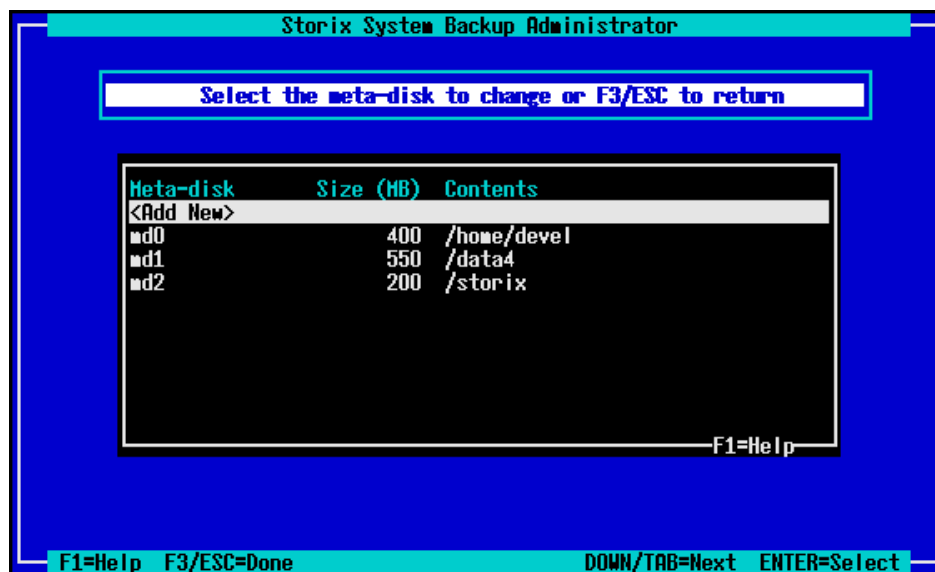
Add or Change Meta-disks

Use this option to add a new meta-disk (software RAID device) or to remove an existing meta-disk or change it's attributes. Details on the use of meta-disks can be found throughout the Linux documentation as well as in the **mkraid** and **raidstart** command manpages. A brief description is provided here.

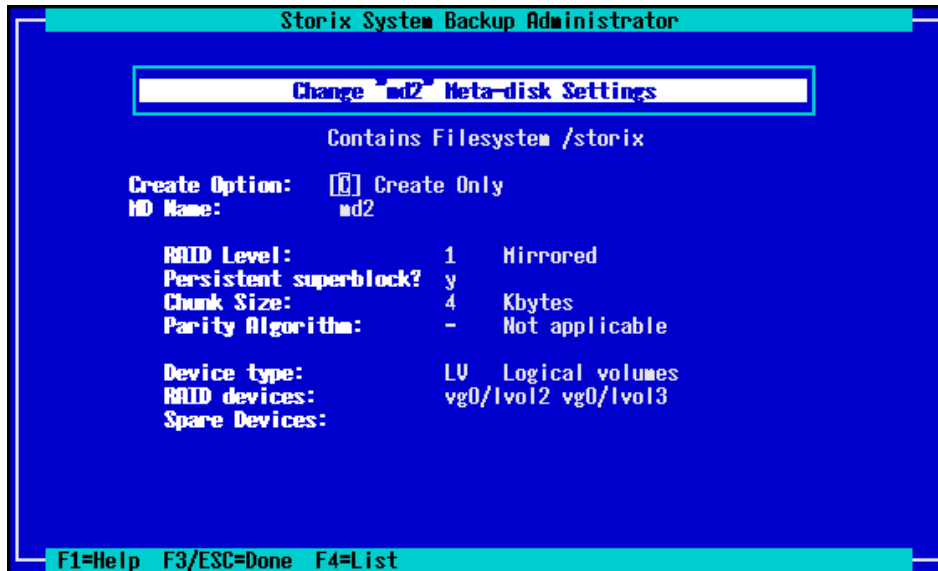
A meta-disk provides various levels of software RAID, otherwise referred to as "RAID levels". The levels are defined as follows:

- 0 (Striping)** The data is striped across 2 or more physical devices for better performance.
- 1 (Mirroring)** An identical copy of the data is stored in two or more physical devices.
- 4 (Striping/parity)** Same as 0, except a 3rd disk (or 4th, etc) is used to store parity information for use in reconstructing the data on the other disks in the event one of them fails.
- 5 (Striping/
striped parity)** This is the same as 4 except that rather than keeping all parity information on a separate disk, the parity information itself is striped across the disks. This provides much better performance, since level 4 requires the same disk to be written each time any other disk is written to.
- 9 (Linear)** OK, "9" was of our own choosing since we wanted to use a number for consistency. Linear means that there is no striping or mirroring, but multiple devices can be combined sequentially to provide a single larger-sized device.

When selecting this option you are first provided a list of meta-disks currently defined, if any, and an option to **<Add New>** meta-disks:



In any case, your next selection will take you the screen for adding, changing or removing meta-disk definitions as follows:

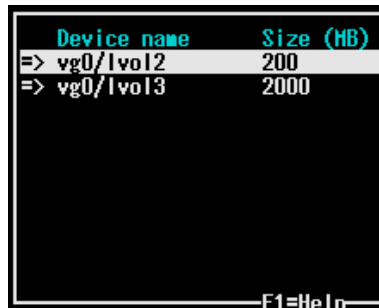


From this screen you can choose to **Create**, **Create and Restore**, or **Delete** a meta-disk. The option to **Create/Restore** is only available if this is a meta-disk whose raw data contents were included on the system backup. The **MD Name** must begin with “md” and is followed by a number between 0 and 31.

Specify the **RAID Level** as described above, keeping in mind the minimum number of devices that must be assigned to this meta-disk to accommodate the RAID level.

Information on the other options may be displayed by pressing the **F1** (help) key. For a list of selections for a particular field, press the **F4** key.

The **Device type** may be one of **DISK** (for whole disks), **PP** (for partitions), **LV** (for logical volumes) or **MD** (to build the meta-disk on other meta-disks). The **RAID devices** field may only be filled in with devices of the type. Press **F4** in the **RAID devices** field to list the devices available (of the type specified in the **Device type** field) and select from the list as shown:

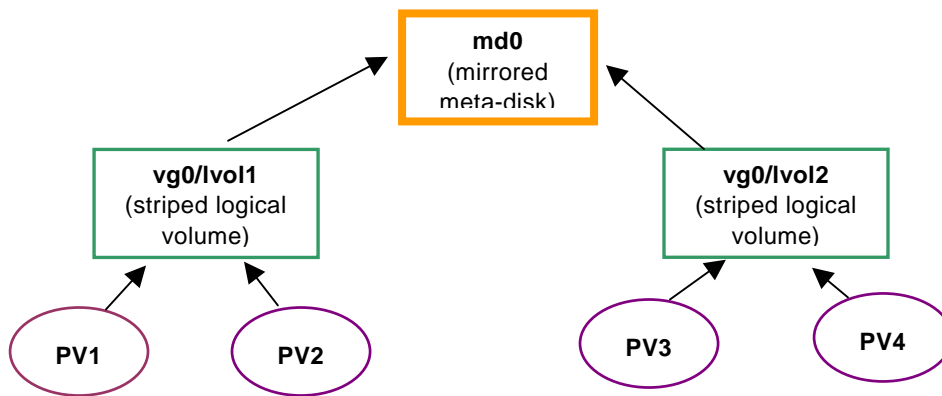


The example above shows logical volumes to be assigned. Note that the LVs shown are of varying sizes, which is not recommended for striped or mirrored meta-disks, since the maximum amount of space available would be that of the smallest disk (times the number of disks). This will work fine for linear meta-disks, however.

When finished with your selections, press **F3** or **ESC** to return to the [meta-disk list](#), and **F3** or **ESC** again to return to the [Change Settings](#) menu.

RAID 0+1

RAID 0+1 is both striping and mirrored. It means building a mirrored RAID device from striped RAID devices. Since mirroring usually causes I/O performance degradation, this design is typically used to get normal disk I/O performance while still having mirrored (redundant) data. Since both **Logical Volumes** and **meta-disks** can stripe data, and they are both block devices, they can both be used to build a mirrored meta-disk! Here's an example:



The **logical volumes** are striped across multiple physical volumes (PV) and then your striped logical volumes are combined into a mirrored meta-disk. This means that as data is written to the meta-disk (**md0**), an identical copy is written to both logical volumes **vg0/lvol1** and **vg0/lvol2**. Those logical volumes each stripe the data across 2 of the 4 physical volumes assigned to them, alleviating much of the performance hit taken by mirroring in the first place.

Refer to the [LVM Settings](#) section for more information on **logical volumes**.

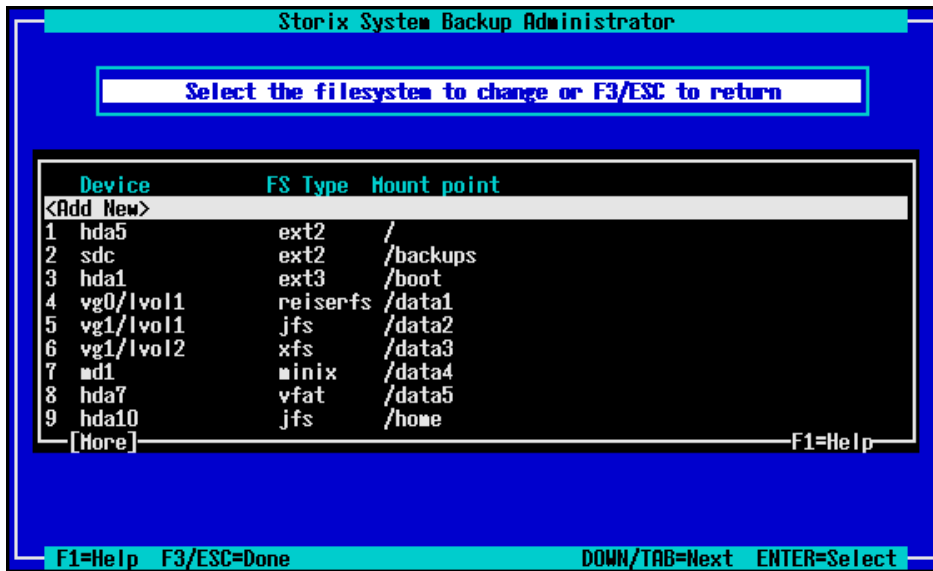
Add or Change Filesystems

This option may be used to change any of the settings for the filesystems, which vary depending on the filesystem type. SBAAdmin Backup Administrator supports the following most popular filesystem types at this time:

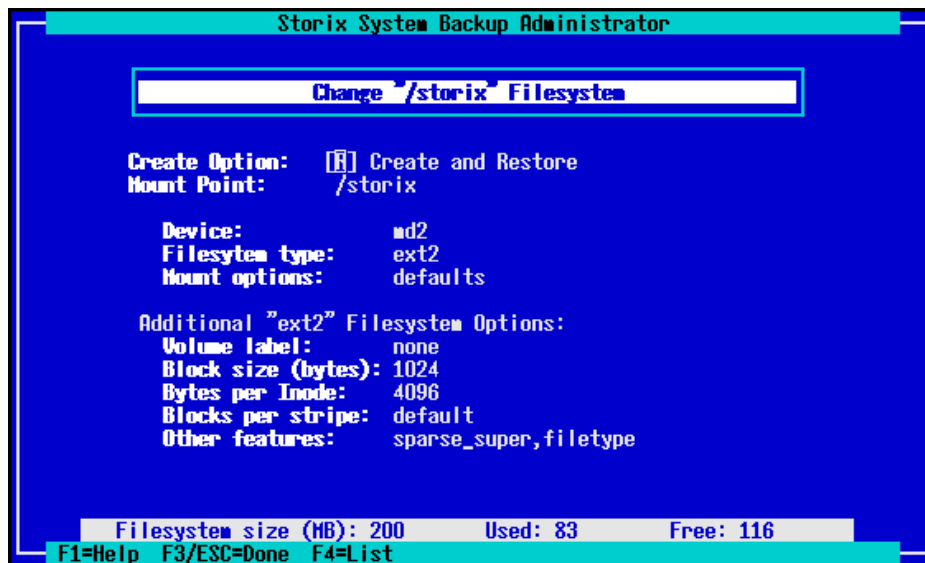
ext2	Linux Second Extended
ext3	Linux Journalled Second Extended
reiserfs	Reiser Filesystem
jfs	IBM Journalled Filesystem
xfs	SGI Extended Filesystem
vfat	MSDOS/Windows FAT Filesystem
minix	Old Linux Filesystem
msdos	MS/DOS FAT12 Filesystem

Virtually any of the attributes which are available for the filesystems above can be set or changed from the menus. Since some filesystems provide advanced features and performance not previously available on, for instance, an **ext2** filesystem, you can simply change the type of the filesystem to take advantage of the new features. You can even select external devices to use for journaling **ext3** and **xfs** data, adding performance by placing the journal on a separate disk than the filesystem.

When you select this option you will receive a list of filesystems currently defined, along with an **<Add New>** option:



Select **<Add New>** to add a new filesystem. You will be required to specify the new mount point, or directory, for this new filesystem. Then, the following options screen will appear:



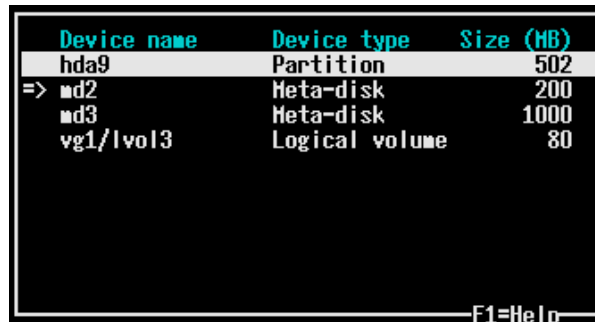
the options displayed here are for an "ext2" filesystem. If you change to a different filesystem type, the options will change as well. We won't describe the options in detail since you have much information available with the F1 (help) key. Also use the F4 key to show lists of available options.

The options common to all filesystems are:

Create Option – Here you can specify to Create the filesystem only, or Create it and restore the data. Although the filesystem data may be on the backup, you can choose to create the filesystem without actually restoring the data into it.

Mount point – You can change the directory where the filesystem will be mounted. The data is restored relative to this directory, so the contents, if any will not change. You cannot change the mount point of the root (/), /boot or /usr (if any) filesystems.

Device – Here you can select a new device where the filesystem should be created and/or restored. Possible filesystem devices are whole disks, partitions, meta-disks and logical volumes. When pressing F4 at this field, you will get a list of any devices that are not already assigned data as follows:



Device name	Device type	Size (MB)
hda9	Partition	502
=> md2	Meta-disk	200
md3	Meta-disk	1000
vg1/lvol3	Logical volume	80

Filesystem type – Here's where you can select the type of filesystem to create. Only the filesystem types supported by BOTH the boot media and the backup to be restored will be selectable within this field. Changing this field will change the options while appear in the **Additional options** section below.

NOTE Only filesystems supported by the boot loader will be available for the **root** filesystem UNLESS you have a /boot or /yaboot filesystem. In that case, the /boot or /yaboot filesystem will be limited to filesystem types supported by the boot loader.

Mount options – F4 at this field will display a lengthy list of mount options which apply to all filesystems as well as additional mount options specific to the selected filesystem type. You can combine them in most cases, and some options, when selected, will prompt you for additional input. In most cases, you can use "default". Don't change these unless you know what you're doing.

Additional Options – Various options such as *block size*, *fragment size*, *external journal device*, *label id*, etc, will appear, based on the **filesystem type** selected. The options vary for each filesystem, and the list of available selections under each option will also vary depending on both the filesystem type and the other options selected.

External Journals

Some filesystem types provide the ability to use external journals. In this case, you can select another device (same type as the filesystem itself) where the filesystem metadata will be journaled. Since journaling the metadata can be a bit performance hit, this allows you to keep the journal on a separate disk than the filesystem itself to ease the I/O workload.

Minimum Filesystem Size versus Device Size

The minimum filesystem size displayed in various places in the menus is the size of the data in the original filesystem that was backed up. The size of the device may have to be quite a bit larger depending on the amount of space the filesystem metadata and journaling requires.

The journal size can be specified in some cases. We generally recommend using the default size, which varies by filesystem type. If you change the journal size, more or less room in the device itself will be taken up by the journal. The size of the journal also varies in most cases based on the size of the filesystem.

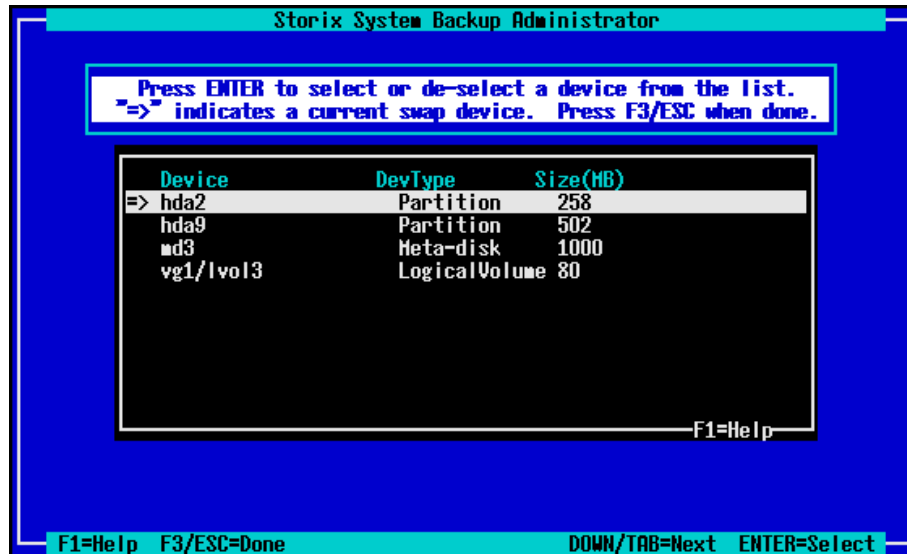
SBAdmin tries to keep track of the minimum size of the device based on the amount of data to be restored, and this calculation varies based on the filesystem type, the journal size, and many other options that are configurable here. If you change any of the options, such as the **number of inodes** in a filesystem, be sure

you have plenty of free space available (based on the size of the device) in case the change requires more space than the filesystem previously needed.

When you have finished your changes, press **F3** or **ESC** to return to the [filesystem selection screen](#) and **F3** or **ESC** again to return to the [Change Settings](#) menu.

Add or Change Swap Devices

Use this option to select the device or devices which should be used as swap devices (also known as *swap space* and *paging space*) on the system. Any raw device, including *partitions*, *logical volumes*, or *meta-disks* may be used for swap. When selecting this option, a screen similar to the following will appear:



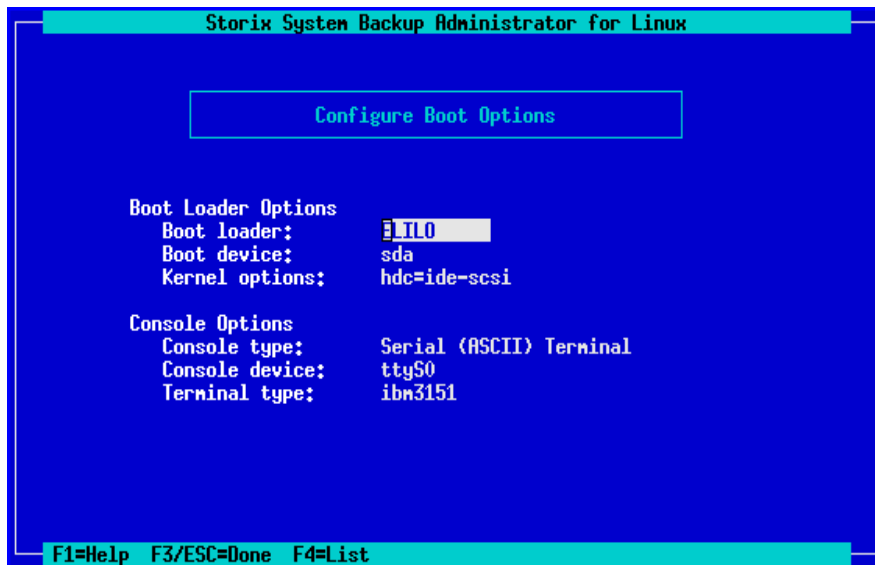
If an arrow (→) appears next to a device, then that device is currently configured as a swap device. To select an unselected device, highlight the desired line and press **Enter**. If you do not want to use that device for swap, press **Enter** and the arrow will disappear. This device will not be used, and may be instead used for other features, such as filesystem data.

When you've completed your selections, press **F3** or **ESC** to return to the [Change Settings](#) menu .

Change Boot Options

This option will allow you to select or change the boot loader that will be used to boot the system after the installation completes. By default, the boot loader used on the original system when the backup was made will be used (if it could be determined at the time of the backup). Refer to [Boot loaders](#) for additional information.

When selecting this option, a screen similar to the following will appear:



Each option is described below:

Boot loader – Press **F4** to select the boot loader to use. The only options provided are those available on the system and appropriate for the system type. The **LILLO** boot loader will always be available for *Intel 32-bit-based* systems, **ELILO** for *Intel IA64-based* systems, and the **Yaboot** boot loader will be the only available option for *IBM pSeries* systems.

Boot device – Press **F4** to list and select the name of the boot disk. For **LILLO** and **Yaboot**, this will always be the disk containing the boot filesystem. For **GRUB**, it can be any disk on the system (and need not contain the [boot filesystem](#)). The boot disk must be a disk containing a **partition table**. The boot device (disk) is the device you must later set your system firmware to boot from after the installation completes.

Kernel options – This field will display the kernel options used to boot the system when the backup was made. Some options specific to the boot process that do not apply after restoration of the system are removed. You may change the options that are passed to the kernel from the boot loader by editing this field. Anything you enter in this field will be available to the kernel and the system boot process, whether valid or not.

Console type – This field indicates if the system console will be a *graphical* display or a *serial* (ASCII/text) terminal. This field is filled in with the console type you booted from.

Console device – This field indicates the name of the device to use as the system console. The default will be the console device you booted from if known, “tty0” for graphical displays or “ttyS0” for serial terminals.

Terminal type – If using a serial terminal, you should specify the terminal type in this field. If you booted from a serial terminal you were asked to select a terminal type during the boot process, and this terminal type will be the default. You may set this to the terminal type that should be used after logging into the system console after system startup.

Also, refer to The [Boot loader](#) in **Making the System Bootable**. When you've completed your selections, press **F3** or **ESC** to return to the [Change Settings](#) menu .

7. Install the System

To install the system from the [SBAAdmin System Backup](#), you first must have selected the [Installation Device](#) (which may be located on a local or remote host). You then have the option [View/Change the Installation Settings](#), where you can make any changes to the backup information stored on the backup media. If you used that option, then the backup information was already restored from the backup, verified and modified as needed to ensure the installation can be started.

Verification Process

If you select the option **Install the System with Current Settings**, this backup data will be checked (again if necessary) to ensure the defined devices and filesystems can be created successfully. Here are a few things that are checked:

1. The devices and filesystems defined on the backup are checked to ensure the kernel and modules available from the boot media are adequate to create them. This includes ensuring that LVM and the various RAID levels are available if required.
2. Ensures any backup data previously residing on a disk is assigned to a new disk unless the user explicitly chose not to restore data.
3. Verifies that all devices assigned to meta-disks are valid and that there are enough devices assigned for the appropriate RAID level.
4. Verifies that the physical volumes assigned to both volume groups and logical volumes are valid.
5. Checks that volume groups are large enough to hold the logical volumes defined.
6. Verifies physical volumes assigned to logical volumes are adequate for striping, if defined.
7. Validates the partition table and automatically adds an extended partition if needed to allow future expansion into logical partitions. This is important also since the backup may be installed onto larger disks, and using all primary partitions would prevent the ability to expand onto them.
8. Verifies that partitions will fit onto their respective disks and that primary partition sizes are defined at disk track boundaries (in case the disk geometry has changed).
9. Checks that all filesystems are being created on devices large enough to restore the data. Even if a device has not changed, the requirements may change if, for instance, the filesystem type was changed to one which requires more space for filesystem metadata than was previously needed.
10. Verifies that the root filesystem is being restored and the device on which it is defined is still valid.
11. Verifies that the configuration conforms to boot loader requirements of the specific system type.

If any problems are detected, you will be informed of the problem and a recommended solution. In some cases the process will offer to fix the problem for you, or even automatically reduce the sizes of partitions containing filesystem data to make the partitions fit onto a disk. If problems persist, you will need to return to the [Change Settings](#) menu to make any changes required to restore the data (or select not to create certain devices or restore certain data).

Starting the Installation

If all checks out, you are given one final warning:

```
!! YOU HAVE SELETED TO INSTALL THE SYSTEM !!  
If you continue, all disks selected for the  
installation will be overwritten!  
Are you sure you want to continue with the system  
installation? (y/n) 
```

Press “y” to continue the installation or “n” to return to the [Main Menu](#).

If you choose to continue the install, the system will begin by reading additional information from the backup media, then creating the devices and filesystems that are defined. Devices are created in the correct order so that meta-disks created on logical volumes, for instance, are created after those logical volumes they depend on, etc. After the devices are created, all filesystems are created and mounted.

If the backup was **encrypted** when it was created, you will be asked to enter the *encryption key* to decrypt the data during the installation. If the correct key is not entered, you will not be able to continue the installation. Refer to [Installing from an Encrypted Backup](#) for more information.

As the data is restored from the backup, a progress indicator will appear showing the status of the restore including the estimated amount of data and time to completion. When all data for all filesystems, raw logical volumes, partitions or meta-disks (if included on the backup) is restored, the system will perform some cleanup and post-installation processing and attempt to make the system bootable.

Configuration Files

During the installation, a copy of any former configuration files that are modified by the installation will be saved into the `/tmp/storix_install` directory. This will include system files modified during the installation processs, such as the `/etc/fstab`, `/etc/raidtab` and `/etc/lilo.conf` files (if used). You should examine these files and compare to the modified files to verify the changes.

Making the System Bootable

When all data is restored and the installation processing is complete, the final, and very important step, is to make sure the system will now reboot successfully.

The Boot Loader

SBAAdmin uses one of the following as the **boot loader** to configure the system for boot-up, depending on the system type:

1. For *Intel-based* systems, SBAAdmin uses either:

GRUB – If the system previously had GRUB configured, a copy of the original GRUB configuration files `grub.conf`, `menu.lst`, and `device.map` will be copied into the `/tmp/storix_install` directory. The `grub.conf` file will be modified to add the new boot configuration as the default system to boot from.

LILO – If GRUB is not being used, LILO will be used instead. If there was a previous configuration in the `/etc/lilo.conf` file, that configuration is saved to the `/tmp/storix_install` directory. A new stanza with

the boot configuration will be added to the prior lilo.conf file, if any, or if the previous file was invalid (or unused) a new file will be created with only one stanza used to boot the system. If a previous file existed, the original copy will be saved in the `/tmp/stx_install` directory.

2. For *Intel IA64 (HP Itanium)* systems

ELILO – EFI firmware assumes the boot loader is named `*.efi` (typically `elilo.efi`) and is in the same directory as the kernel and initrd image. There will also exist an `elilo.conf` file in the same directory. SBAAdmin will modify this configuration file as needed to boot from the configured disk, and saves a copy of the original file in the `/tmp/stx_install` directory.

3. For *IBM pSeries* systems

Yaboot - SBAAdmin does not use the utilities that accompany this boot loader, as they differ greatly between distributions. Instead, SBAAdmin creates its own `/etc/yaboot.conf` file, then copies the yaboot boot loader (`yaboot.chrp`) to the **PREP Boot partition**. If a previous yaboot.conf file existed, it will be copied to the `/tmp/stx_install` directory before being changed.

Refer also to the [Boot loader](#) section.

Initial Ramdisk Image

SBAAdmin will attempt to determine if any device support is required to mount the root filesystem that is not already built into your kernel. This may include various filesystem support, LVM commands and modules, or software RAID commands and modules. If it is determined that device support is required that is not built into the kernel, then an Initial Ramdisk Image (`initrd`) is automatically created.

The `initrd` will contain the device support modules and programs, and a script for loading and initializing the modules. The `initrd` is loaded by the kernel prior to mounting the root filesystem. Therefore, the `initrd` will initialize any support needed to mount the root filesystem

The /boot filesystem

Boot loaders must be able to access information restored to the system during startup. This information is contained in the **/boot directory** (or sometimes `/yaboot` or `/boot/efi`) of a filesystem. The `/boot` directory may be in the **root** (`/`) filesystem or may be its own filesystem. We'll just refer to it as the "boot" filesystem here.

NOTE

The system recovery process will verify that your system configuration, boot loader and boot device are valid and will require you to make changes as necessary in the installation menus. In the installation menus, you will only be able to make selections that are valid, based on your system type, boot filesystem type, and support available on your system. The menus will also recommend creating a separate `/boot` filesystem when necessary.

The boot filesystem must be of a type that the boot loader recognizes. **LILO**, for instance, must map the physical disk blocks that make up the boot configuration files, kernel and `initrd` image. To do so, it must know the filesystem format. **Yaboot** and **GRUB** boot loaders must be able to mount the boot filesystem in order to find the config file, kernel and `initrd`. In any case, the boot filesystem must be a filesystem type that the boot loader supports.

Intel 32-bit (BIOS) systems using LILO or GRUB: In addition, the boot filesystem must be in a **primary disk partition (1-4)**, not in an **LVM logical volume** or a **striped software RAID (meta-disk)** device. The filesystem must be of type `ext2` or `ext3`.

Intel IA64 (EFI) systems using ELILO: The boot filesystem must be a VFAT filesystem which must reside on a **disk partition**, not an **LVM logical volume** or a **striped software RAID (meta-disk)** device. Since you're not likely to have a root filesystem of type VFAT, you should have a separate boot filesystem. This may be in an EFI or a DOS partition.

IBM pSeries (OpenPower) using Yaboot: These systems require that you have a **PREP boot** (type 41) partition on the boot disk, into which the **yaboot** boot loader is copied. Be careful to make this partition small (< 10 MB) since the entire partition is read into memory. The boot filesystem must also be in a primary (1-4) partition on the same disk, and contain an ext2, ext3, reiserfs or xfs filesystem.

It is sometimes advantageous to have the **root (/)** filesystem in a striped logical volume or software RAID, or be a **Reiserfs** filesystem, for instance. For this to be possible, you cannot use the root filesystem as the boot filesystem. Therefore, you can create a **/boot** (or **/yaboot** or **/boot/efi**) filesystem in addition to the root filesystem. This will become the boot filesystem, and may be of a size only large enough to contain the boot configuration files, kernel and initrd images. Since the root filesystem is no longer part of the boot process, there are no limitations on the type of container (LVM, RAID, partition, etc) of the root filesystem, nor its filesystem type.

Within the system installation menus, if you have no separate **/boot** filesystem and you attempt to configure the root filesystem on a device or filesystem that the boot loader does not support, you will see a warning message indicating that this is not supported, suggesting you create a **/boot** filesystem instead. If you choose to do so, refer to the requirements noted above for each system and boot loader type.

If these conditions are met, SBAAdmin will create this filesystem during the system install process and use it to store the boot configuration files, kernel and initrd image required to mount the "real" root filesystem. With all of the information and files required by the boot loader existing in this filesystem there are no longer ANY limitations on what device or filesystem the root filesystem can be created on!

Refer to the [Boot loader](#) section for additional information on each boot loader's requirements.

Doing it Yourself

In some cases, SBAAdmin may not be able to determine what device support is required or already built into the kernel. Therefore, at the end of the installation process, you are placed in a prompt (assuming this is not a **no-prompt installation**), where you can use your own commands for configuring a different boot loader as needed. At this point, you are given a message similar to the following:

```
=====
                THE SYSTEM HAS BEEN RESTORED SUCCESSFULLY!
=====
LILO has been configured as the boot loader. If you want to use a
different boot loader or require additional configuration prior to
rebooting the system, you may do so now.

The LILO boot configuration file is /etc/lilo.conf. Your original
lilo.conf, if any, has been saved as /tmp/storix_install/lilo.conf.
-----
Please remove any CDROM or floppies and be sure the
system firmware is configured to boot from "sda".
-----
===== "
When done, type "exit" to complete the installation process and reboot.
sh>
```

At this point, if no change is required, just type "exit" to allow the system to reboot. You can manually make any changes to your boot loader configuration and install your boot loader. This will override the boot loader

configuration that SBAdmin applied. If your previous boot loader configuration was overwritten by SBAdmin, the original copy of the config files are first copied to the `/tmp/storix_install` directory, from which you can copy the files back into place if you need to.

Only when you are sure you have correctly applied the boot configuration should you type “exit”. Once you do so the system will be rebooted normally.

Installation Errors

If any error occurs in creating the devices, creating or mounting the filesystems, or restoring the data, you will be provided a message containing the details and the failing command and asked to correct the process manually before continuing the installation. At this point you are placed at a shell prompts where you can diagnose and correct the problem. The command which failed must be completed before the installation can continue successfully. When the problem is corrected, type “exit” to exit the shell and continue the installation.

System Boot Problems

The SBAdmin installation process does its best to prevent you from making any changes that might prevent the system from booting. For example, you are not allowed to put the `/boot` filesystem on a logical volume since boot loaders can’t read the boot configuration or kernel from a logical volume.

The most common boot problem after an install is simply that your system firmware is trying to boot from the wrong device. First remove any removable boot media from the system and try again. If you changed the disk containing the `/boot` (or root if no `/boot`) filesystem, you may need to tell your firmware to boot from the new disk. Each firmware used has different menu options, and even names the disks differently, so you will have to refer to your system documentation for details.

SBAdmin takes care of ensuring that all devices, LVM and/or software RAID are running if they’re needed to access the root filesystem. Once the root filesystem is available, control is turned over to the normal system initialization procedures. Any errors that occur at this point will not usually render the system unusable, but may require additional customization (beyond the scope of SBAdmin) to restart all system processes in the correct order.

Should all else fail, at least we know that the system has been configured and restored successfully, so we just need to figure out how to get it to boot. Your SBAdmin Boot CDROM can help. You can boot from the CDROM, and when the menus appear, select “[Enter a Maintenance Shell](#)”. At this time, you can attempt to mount your root filesystem manually to the `/mnt` directory by typing (for example):

```
mount -t ext2 /dev/hda5 /mnt
```

If this succeeds, then you can usually change to that root filesystem by typing:

```
chroot /mnt /bin/sh
```

which will place you at a shell prompt under your newly mounted root filesystem. Now you should be able to use any commands needed to verify or configure your system to boot properly.

Should any system, even when changing the disk configuration, not startup at the end of the installation process the same as the original system, you should report the problem to SBAdmin immediately. With the vast number of Linux distributions changing daily, it’s virtually impossible for SBAdmin to test every scenario, but will ensure that your system gets up and running!

Network Re-configuration (avoiding conflicts)

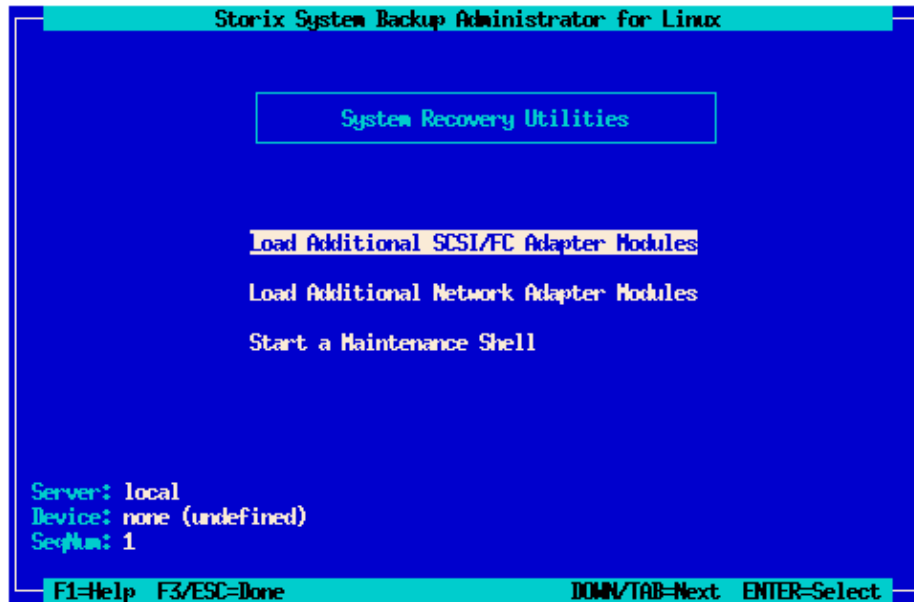
If the system is reinstalled from a remote install server, then you entered the client IP address when either booting the system, or when selecting to restore from a remote server. In either case, the client IP address entered will be used to reconfigure the network adapter information restored from the backup. In addition, any additional network adapter configurations restored from the backup will be disabled on reboot.

This is handy when a single backup is used to reinstall multiple clients, as each client will then reboot with its own customized network configuration, regardless of that on the backup. Network adapters not used during the installation are disabled on reboot to prevent any duplicate IP addresses (i.e. this system and that of the original client the backup was taken from).

If, however, you installed the system from local boot media (CDROM, diskettes or hard disk), then new network configuration, if different, is not known. It is assumed that the backup being restored came from the same system, and the network configuration is unchanged. Therefore, when the system reboots at the end of the install, it the network will configure with the original settings restored from the backup. If the backup contains IP addresses used by another system on the network, you should unplug the system from the network to prevent IP address conflicts until you have changed the network settings on the newly restored system.

8. System Recovery Utilities

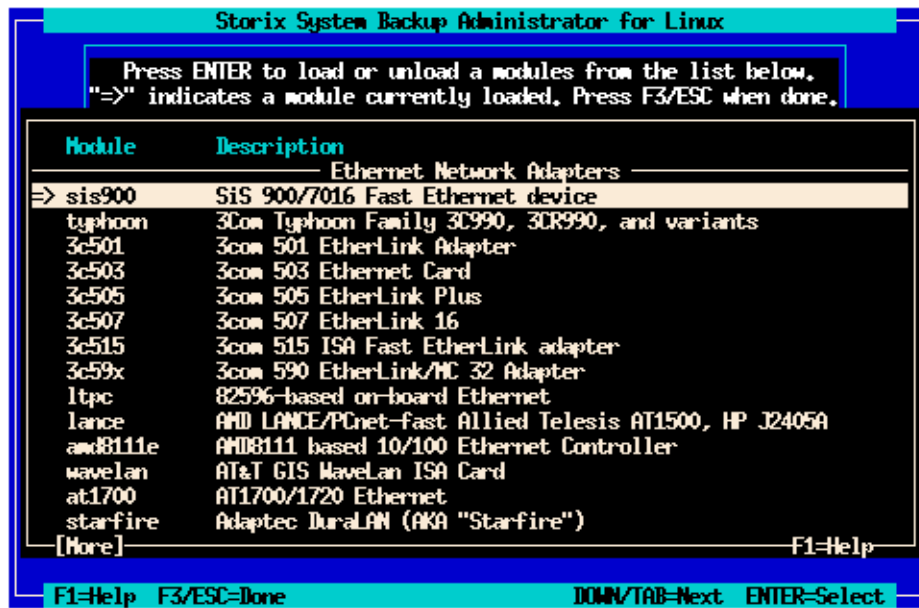
From the [System Installation and Maintenance Main Menu](#), select **System Recovery Utilities** to display the following options:



Load Additional Device Adapter Modules

This option is used to load *SCSI*, *Fibre-channel* or *Network* adapter modules that were not automatically loaded when the system was booted from the media. By default, only modules which were available on the system from which the boot media was created are automatically loaded. If you are installing onto a different system with different adapters, it may be necessary to load additional modules before all devices are detected.

For SCSI and Fibre-channel storage adapters, select **Load Additional SCSI/FC Adapter Modules**. For networks, select **Load Additional Network Adapter Modules**. As with the following (Network) example, a list of available modules and their descriptions will appear:



An arrow (=>) will appear next to the device modules that are currently loaded on the system. If you highlight and select a line for a module that is not currently loaded, a message will appear indicating that the module is being loaded. If the module is loaded successfully and new devices (or adapters) are detected, a message will appear showing you the names of the configured devices. If no new devices are detected, the module will be unloaded automatically and a message to that affect will appear on the screen.

If you move highlight a line containing an arrow and press enter, you will be informed that the module is currently loaded and asked if you want to unload the module. Note that unloading a module may cause devices currently configured to become unavailable (i.e. disk or tape drives), and some modules may not be unloaded if they are currently in use (i.e. network adapters for active networks).

When you have finished your selections, press **ESC** or **F3** to return to the [System Recovery Utilities menu](#).

Start a Maintenance Shell

Select this option to start a maintenance shell where you may perform various operations for performing system maintenance or recovery such as mounting and repairing disk filesystems, or reconfiguring the disk boot loader.

When entering the shell, no disk filesystems will be loaded, and only the command set available on the boot media for system recovery are available. The user will need to perform the manual tasks needed to mount the root (/) or other filesystems if access to the data stored on the disks is desired. The commands and options for doing this vary much too widely to be discussed here, as some filesystems reside in LVM, others are made from RAID devices, etc.

When you have finished the system maintenance tasks, you may reboot the system from the command line, or, if you wish to return to the system installation process, you may type "exit" at the prompt to return to the menus.

9. Commands

This section describes only the **stmakeboot** command, since this is the only command related to the creation of boot media. The system recovery options are only available after booting from this media.

stmakeboot command

Purpose:

Create SBAAdmin System Installation and Maintenance Boot Media or re-initialize the hard disk for booting.

Use on:

Any system

Syntax:

```
stmakeboot -t floppy -d dev [-fnC] [-r release] [-k kernel]  
stmakeboot -t cdrom -o output_file [-k kern][[-p platform]  
stmakeboot -t disk -d dev [-k kern][[-p platform]  
stmakeboot -t netboot -d -l imagename -s bootserver [-k kern][[-p platform]  
stmakeboot -t netclient [-r] -c client -l imagename [-s altservername]  
[-a hardwareAddr] [-m subnetMask] [-g gatewayAddr]
```

Options:

- C device** Console device name (i.e. ttyS0, hvc0). This is used only when the system is to be booted using a serial port.
- d device** Device name (i.e. **fd0** or **/dev/hda**) if creating boot floppies or boot disk
- f** Format floppies before writing. This is recommended if these diskettes have not been used as SBAAdmin boot diskettes before. Has no affect on CDROM images.
- l image** Name of **network** boot image name to create or update.
- k kernel** Kernel filename to use (default is to find kernel with matching *release* suffix).
- n** Include network device support. If you want to be able to install from a remove tape or disk image on a defined server, then you need to include network support on the floppies. The CDROM will always contain this support.
- o outfile** Output **cdrom** ISO image filename or **initrd** image name (if creating **disk** or **initrd** image).
- r** Option to unconfigure network boot for client images
- R release** Kernel release (suffix) to use. For **initrd** images, there must be a `/lib/modules/release` directory matching this entry. If omitted, the release the system is currently booted under will be used.
- s server** Name of the network boot server to store the netboot images

- S** Include SCSI CDROM modules (required only if booting SCSI CDROM). This option only applies when creating a CDROM ISO image.
- t type** Type of boot media to create.

Details:

This command is used to create various boot media, or to update the system, disk boot image or initrd (*Initial Ramdisk*) image.

CDROM images may be created from any defined client or server using the [Create System Installation Media](#) option from the *Administrator* application. However, creating floppies, updating the boot loader on the disk, or creating or updating an initrd image may only be done on a local system. Therefore, this command must be run on the client or server directly, if needed.

Refer to the [Create System Installation Media](#) option for more details on creating bootable CDROM and floppies using the *Administrator* application.

The **-t** option must be one of the following:

floppy: When creating floppies, between 3 and 5 diskettes are required. You can use the **-f** option to format each diskette before copying. If the diskettes are pre-formatted using the default (1.44 MB) format, it is best to allow this command to re-format the diskettes, since it does so at a greater density (1.7 MB). You will be prompted to insert each diskette which will be 1 Boot, 1 Root, and 1 to 3 Utility diskettes.

cdrom: This option does not write to the CDROM drive, and therefore no CDROM is required on the system. A CDROM "ISO" filesystem image will be created, which can be copied to another system, if needed, and copied to a CD writer using standard tools such as "cdrecord" (Linux) or various Windows utilities. If using cdrecord, you must copy to a SCSI cdrom or an IDE cdrom with the SCSI emulation (ide-scsi) enabled.

disk: This option will ensure the hard disk is bootable. It will search for a disk containing the kernel to boot from (making this the boot disk), create an initrd image (if modules or other software must be started in order to mount the root filesystem), and update the boot loader on the system (**LILLO** or **GRUB** if *Intel*-based systems, or **Yaboot** if *pSeries* systems).

initrd-disk: Same as "disk", but this option will create the initrd image without updating the boot loader. This is helpful if you want to create an initrd image and configure your boot loader manually. You may specify the name of the image to create (with the **-o** option), or SBAAdmin will create one as **/boot/initrd-storix-disk** (where *disk* is the hard disk to boot from).

netboot: Create network boot image. you must specify a name for the image using the **-l imagename** option. If the specified image already exists, it will be overwritten by the newly created image. If a *bootserver* is specified (with the **-s** option), the network boot images will be copied to the "Directory for CLIENT netboot images" configured on the *bootserver*.

netclient: Configure or unconfigure a client for network boot. This option must be performed on the network boot server. if configuring a network boot client, the **-l imagename** option is required as well as the **-c client** option. The imagename specified must have first been created using the **-t netboot** option in a separate **stmakeboot** command.

You may specify a specific kernel to use with the **-k** when creating CDROM or floppies, or when updating the disk boot loader. You may also use the **-R** option to specify the release level of the kernel to use. In this case, the command will search for a kernel which uses the specified release level as a suffix (in the /boot or /yaboot directories). If specifying a release level, there must be a matching modules directly as **/lib/modules/release**. If both **-k** and **-R** are omitted, the release level the system was booted under (displayed with "uname -m") will be used.

Specify the **-C** option only if you have a serial terminal attached to the first serial port of the system and wish to perform the system installation using that display. If **-C** is specified, the attached terminal must be set to 9600 baud, 8 bits, 1 stop bit and no parity for proper communication. Omit the **-C** option if you want to perform the installation using the graphical console attached to a graphics adapter.

There are a number of options which may be specified when configuring a network boot client. These are discussed in detail in the section [Enable/Disable a Network Boot Client](#). Keep in mind that booting a client over the network requires you run **stmakeboot -t netboot** once on the *client* (or similar client) to create the **netboot** image and copy to the server, then run **stmakeboot -t netclient** again on the *server* for each **netclient** you want to boot from that image.

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