



**Previous**  
**User's Manual**  
Covering version 0.5

Manual Written by-  
**Muhammad Mominul Huque**

Manual Version 0.1a

Previous on WWW - <http://previous.alternative-system.com/>

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## Introduction

### A Brief History Lesson



*This original NeXT Computer was used by Tim Berners-Lee at CERN, and became the world's first web server and ran the world's first web browser in 1990*

When NeXT released its first computer - NeXT Computer - It was very impressive. NeXT's first workstation was officially named the NeXT Computer, although it was widely referred to as "the cube" because of its distinctive case, a 1 ft x 1 ft x 1 ft magnesium cube, an edict of Jobs' designed by Apple IIc case designer Frogdesign.

The NeXT Computer was based on the new 25 MHz Motorola 68030 central processing unit (CPU). The Motorola 88000 RISC chip was originally considered, but was not available in sufficient quantities. It included between 8 and 64 MB of random access memory (RAM), a 256 MB magneto-optical (MO) drive, a 40 MB

(swap-only), 330 MB, or 660 MB hard drive, 10Base-2 Ethernet, NuBus and a 17-inch *MegaPixel* grayscale display measuring 1120 by 832 pixels. In 1989 a typical new PC, Macintosh, or Amiga computer included a few MB of RAM, a 640×480 16-color or 320x240 4000-color display, a 10 to 20 megabyte hard drive and few networking capabilities. It also was the first computer to ship with a general-purpose DSP chip (Motorola 56001) on the mother board. This was used to support sophisticated music and sound processing, including the Music Kit software.



*A NeXTstation with the original keyboard, mouse and the NeXT MegaPixel monitor*

NeXT released a second generation of workstations in 1990. The new range included a revised NeXT Computer, renamed the

NeXTcube, and the NeXTstation, nicknamed "the slab," which used a "pizza box" case form-factor. Jobs was explicit in ensuring NeXT staff did not use the latter terminology, lest the NeXT machines be compared to competing Sun workstations. The magneto-optical drive was replaced with a 2.88 MB floppy drive to offer users a way to use their floppy disks. However, individual 2.88 MB floppies were expensive and the technology did not supplant the 1.44 MB floppy. Realizing this, NeXT utilized the CD-ROM drive, which eventually became an industry standard for storage. Color graphics were available on the NeXTstation Color and the NeXTdimension graphics processor hardware for the NeXTcube. The new computers were cheaper and faster than their predecessors, with the new Motorola 68040 processor.

In 1992, NeXT launched "Turbo" variants of the NeXTcube and NeXTstation with a 33 MHz 68040 processor and maximum RAM capacity increased to 128 MB.

### **Introducing Previous**

Previous is an open source emulator of the proprietary 68k-based NeXT computer system family, aiming at emulating the original 68030-based NeXT Computer and the 68040-based NeXTstation and NeXTcube computers with all its peripheral.

Previous is based on the Atari emulator Hatari and it is distributed under the terms of the [GNU General Public License \(GPL\)](#). Previous uses the latest CPU emulation core from WinUAE. The

emulator was created with the goal to make the early versions of the NeXTSTEP operating systems (0.8, 0.9, 1.x, 2.x and 3.0) and original NeXT software (e.g. Lotus Improv and Altsys Virtuoso), that was never ported to the x86, available to the today's users.

Previous is currently developed on [Linux](#) and [Mac OS X](#) and has been reported to successfully compile on the [Windows](#) platform. It may also work on other systems which are supported by the SDL library, like FreeBSD, NetBSD and BeOS.

### **How the Dream Came True**

Building a NeXT Computer emulator was the dream of our NeXT International Forum and all the people who loves NeXT Computer. Many quotes come out in the forum like – “I guess if that guy could do it for the Lisa, someone can do it for a NeXT,” and “It would be great to have a NeXT hardware emulator!” But now the dream has come true by the NeXT hardware emulator Previous. Previous required the help and dedication of many people, including:

#### **Main Developers –**

1. Gilles Fétis
2. Andreas Grabher

#### **Contributors & Codes from Other Projects –**

1. Thomas Huth – The developer of Hatari. Without Hatari, the work of building Previous would have been much more difficult. Thomas has also helped in many situation throughout the development of Previous.
2. Toni Wilen – Thanks for his WinUAE project so we can have the new CPU emulation core! He has also helped us in many situations.

3. Olivier Galibert - He is working on the NeXT driver in MESS. He is helping us to improve Previous and contributed new ECC Code!
4. The NeXT International Forum – Thanks to all forum members. Without their help there would be no emulator called Previous! (<http://www.nextcomputers.org/forums/>)
5. Gavin Thomas Nicol, Piotr Twarecki, Michael Bosshard, Vaughan Kaufman, Jerome Vernet and Peter Leonard – They helped us in many situations.
6. Gaël Elegoët - Contributed new and nice icon for Previous!
7. Hatari - Hatari is an Atari ST/STE/TT/Falcon emulator. Previous is based on its source code. This User's Manual includes some information from the Hatari User's Manual. (<http://hatari.tuxfamily.org/>)
8. WinUAE – WinUAE is a Commodore Amiga Emulator for Windows. It is based on the Commodore Amiga Emulator called UAE. WinUAE has a new CPU core, which forms the basis of the CPU emulation in Previous. (<http://www.winuae.net/>)
9. NetBSD/next68k - NetBSD/next68k is a port of NetBSD to the 'black' 68k NeXT hardware. It is full of informations about 'black' 68k NeXT hardware. Without NetBSD/next68k, the work of building Previous would have been much more difficult. (<http://wiki.netbsd.org/ports/next68k/>)
10. SDL - Simple DirectMedia Layer is a cross-platform development library designed to provide low level access to audio, keyboard, mouse, joystick, and graphics hardware via OpenGL and Direct3D. Without SDL, the work of building



Previous would have been much more difficult.  
(<http://www.libSDL.org/>)

11. RSCODE - The RSCODE project is an implementation of a Reed-Solomon error correction algorithm. Previous uses this for emulating the NeXT's signature Magneto Optical Disk Drive. (<http://rscode.sourceforge.net/>)
12. QEMU NeXT - Bryce Lanham has been worked on adding NeXT emulation to QEMU for Google Summer of Code. But the project has been stopped. Previous use some of its code like DMA etc. You can see some information about it - (<http://www.nextcomputers.org/forums/viewtopic.php?t=2847>)
13. MESS - MESS (**M**ulti **E**mulator **S**uper **S**ystem) is a collection of many computer emulators. Previous contains some informations from MESS. like SCC etc. (<http://www.mess.org/>)

These items are listed in random order; if someone is missing here, please let me know!

## Features

Previous: All in one NeXT Computer emulator. It aims to emulate:

- NeXT Computer (original 68030 Cube)
- NeXTcube
- NeXTstation
- NeXTstation Color

And all its peripherals –

- Hard disk, CD-ROM, floppy
- MO Drive
- Sound
- Ethernet

- Printer
- NeXTdimension for NeXTcube etc.

And Previous will be able to run all versions of NeXTStep and OpenStep, and also NetBSD. (see [Missing Features & Known Issues](#) for details)

## Missing Features & Known Issues

### **WARNING:**

***This is software in an early development state. Always make sure you only work on copies of your images or other data. There is a risk of data loss.***

Previous is still work in progress. Some hardware is not yet emulated. The current status of emulation is:

Item	Status
CPU	Good
MMU	Good
FPU	Good
DSP	Missing
DMA	Partial
NeXTbus	Missing
Memory	Good
2 bit Graphics	Good
Color Graphics	Good
RTC	Good
Timers	Buggy
SCSI Drive	Good
Magneto Optical Disk Drive	Buggy
Floppy Drive	Missing
Ethernet	Dummy
Serial	Missing

Printer	Missing
Sound	Missing
Keyboard	Good
Mouse	Good
NeXTdimension	Missing

The Turbo chipset is not emulated. This limits the maximum RAM that can be assigned to the emulated system to 64MB.

There are remaining problems with the host to emulated machine interface for input devices, mainly keyboard.

As of version 0.4, Previous can successfully boot and install NeXTStep 0.8 – 3.3 and 4.0 beta, as well as OpenStep 4.0 – 4.2.

**Known Issues:**

1. Un-emulated hardware may cause problems in certain situations (see above).
2. The kernel sometimes hangs during the boot process after printing "root on" (this is called "root on hang"). NeXTstep 3.0 and later are affected.
3. The MO drive causes problems in certain situations. Diagnostics fail because of bad timings (sector and command delay too long).
4. Keys are not mapped correctly depending on the host keyboard layout.
5. Shortcuts do not work properly or overlap with host commands on some platforms.
6. The clock does not tick accurately. Real time clock power-on test may fail sporadically on fast host systems.
7. FPU only works on x86 hosts.

8. Mac OS X: When minimizing and maximizing the application window there might occur a blue layer above the window's contents. This is an SDL bug.
9. Mac OS X: The native GUI is still showing Hatari's preferences.

## System Requirements

Previous currently has the following minimum system requirements:

- A Fast PC
- SDL Library (<http://www.libsdl.org/>)
- zLib Library (<http://www.gzip.org/zlib/>)

In the course of time Previous has successfully been tested by various people on the following systems:

- MacOS X
- Windows XP, 7, 8
- Ubuntu
- Raspberry Pi

## Compiling and Running

### Compiling Previous

For compiling Previous, you need to have installed the following libraries:

Required:

- The SDL library v1.2.15 (v2.x won't work) (<http://www.libsdl.org/>)
- The zlib compression library (<http://www.gzip.org/zlib/>)

Don't forget to also install the header files of these libraries for compiling Previous (some Linux distributions use separate development packages for these header files)!

For compiling Previous, you need a C compiler (preferably GNU C), and a working CMake installation (see <http://www.cmake.org/> for details).

CMake can generate makefiles for various flavors of "Make" (like GNU Make) and various IDEs like Xcode on Mac OS X, and MSVC on Windows. To run CMake, you've got to pass the path to the sources of Previous as parameter, for example run the following if you are in the topmost directory of the Previous source tree:

```
cmake .
```

If you're tracking Previous version control, it's preferable to do the build in a separate build directory as above would overwrite the (non-CMake) Makefiles coming with Previous:

```
mkdir -p build
```

```
cd build
```

```
cmake ..
```

Have a look at the manual of CMake for other options. Alternatively, you can use the "cmake-gui" program to configure the sources with a graphical application.

After cmake finished the configuration successfully, you can compile Previous by typing "make". If all works fine, you'll get the executable "Previous" in the src/ subdirectory of the build tree.

## Running Previous

For running the emulator, you need an image of the boot ROM of the emulated machine.

While the emulator is running, you can open the configuration menu by pressing F12, toggle between fullscreen and windowed mode by pressing F11 and initiate a clean shut down by pressing F10 (emulates the power button). (see [Using Previous](#) for details.)

## Using Previous

Once you've started Previous successfully, you can use the emulator as an almost complete NeXT computer system.

## The GUI

Upon seeing the GUI, you will say, *"Oh, This is Hatari's Interface!"*

You are somewhat correct: the interface may be like Hatari, but it is not Hatari -- it is Previous!

If Previous does not launch into the configuration GUI, you can press F12 to enter it. Navigate it with the mouse. The GUI is rather self explanatory.

## The Main Menu



You can reach the other setup dialogs from the main menu by clicking on the appropriate buttons.

You can load the current settings from a configuration file by clicking on “*Load config.*” and you can save the current settings to a configuration file by clicking on “*Save config.*”.

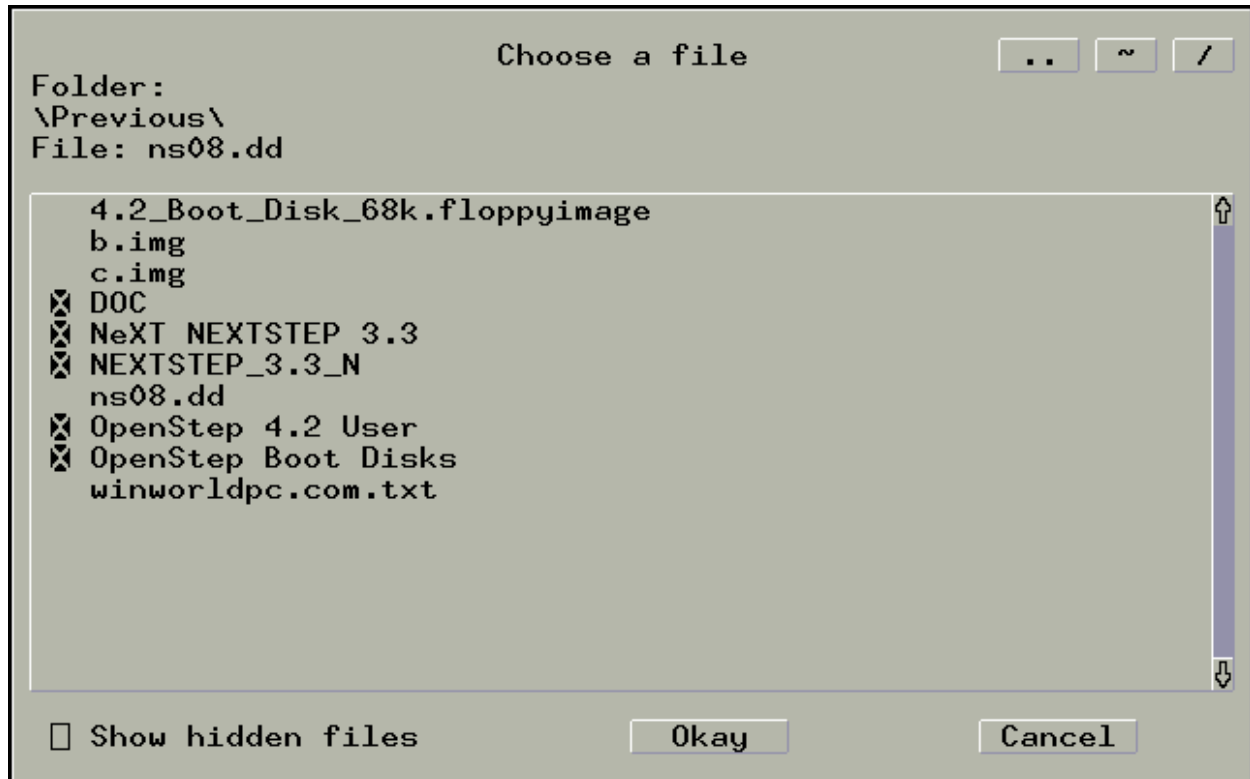
Click “*OK*” to go back and continue the emulation. All changed options will be applied.

Select the “*Reset machine*” option if you want the emulated machine to perform a cold reset. This is equal to power-cycling a real NeXT machine.

Click “*Quit*” to terminate Previous and return to the host OS.

Click “*Cancel*” to abandon any changes that you have made.

## The File Selector Dialog



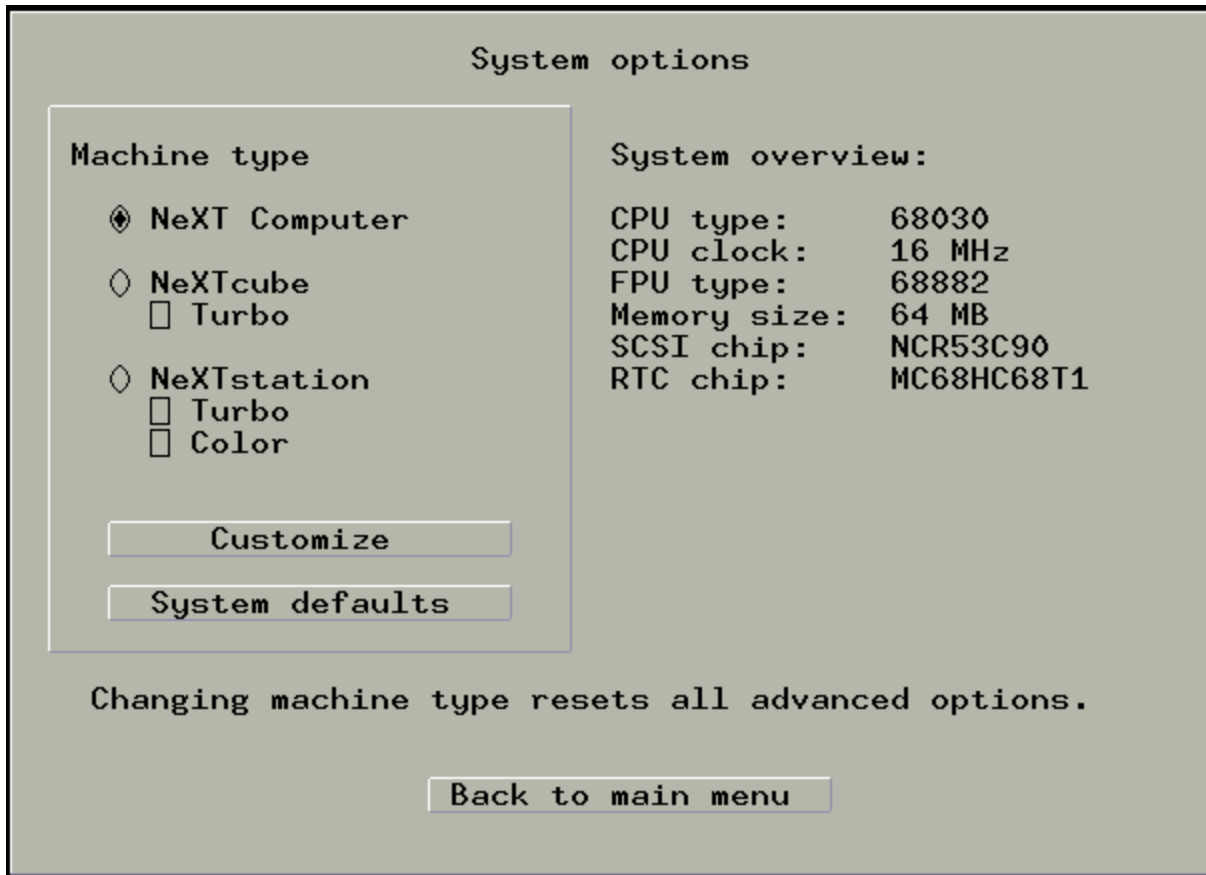
The file selector dialog appears whenever you are prompted to choose a file or folder.

To enter a folder or choose a file, simply click on the entry in the main box of the dialog. To navigate in the file list, you can use the scrollbar on the right with mouse, or use keyboard up + down arrow, page up + down, Home and End keys.

You can use the three buttons in the upper right corner for additional folder navigation. Click the “..” button to go up one level in the directory tree. Click the “~” button to return to your home directory. The “/” button can be clicked to go to the root directory of the file system.



## The System Dialog



In this dialog you can select what NeXT machine you want to emulate. The overview on the right side will show the settings that will be emulated for your selected machine.

Click "*Customize*" to see Advance System Dialog and customize your emulated hardware.

Click "*System defaults*" to use emulated system's defaults.

## The Advance System Dialog

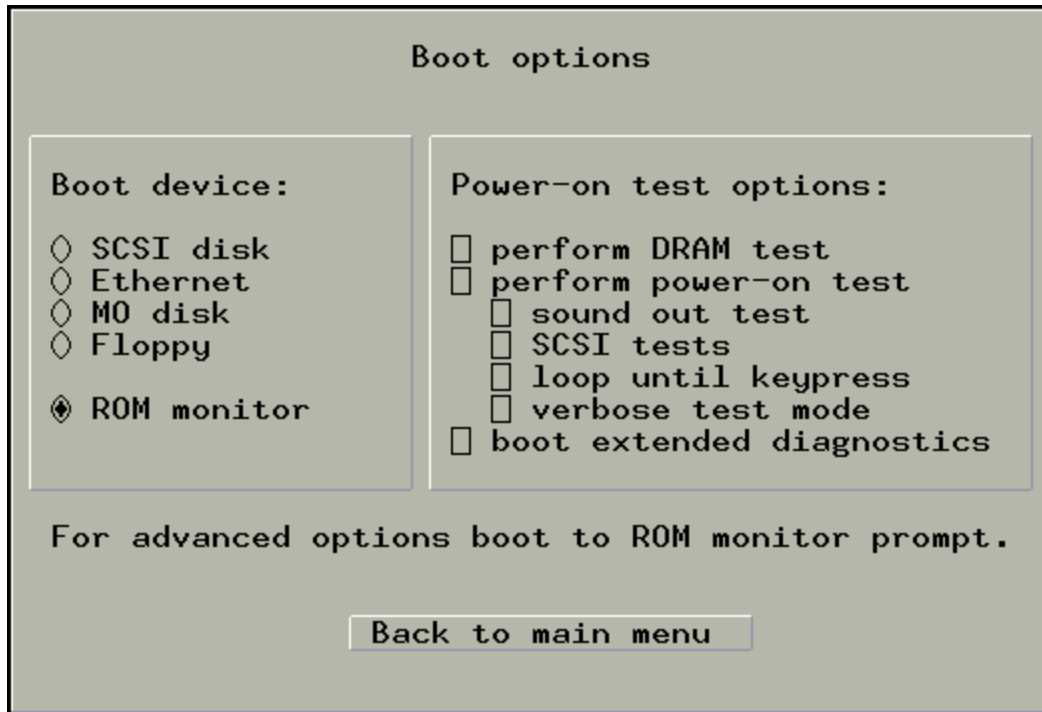
Advanced system options

<b>CPU type</b> <input checked="" type="radio"/> 68030 <input type="radio"/> 68040 <input type="radio"/> 68060	<b>CPU clock</b> <input checked="" type="radio"/> 16 MHz <input type="radio"/> 20 MHz <input type="radio"/> 25 MHz <input type="radio"/> 33 MHz <input type="radio"/> 40 MHz	<b>FPU type</b> <input type="radio"/> 68881 <input checked="" type="radio"/> 68882 <input type="radio"/> 68040 internal
<b>SCSI controller</b> <input checked="" type="radio"/> NCR53C90 <input type="radio"/> NCR53C90A	<b>RTC chip</b> <input checked="" type="radio"/> MC68HC68T1 <input type="radio"/> MCCS1850	<b>ADB</b> <input type="checkbox"/> Emulate ADB

Here you can customize your emulated hardware. You can change:

- CPU type
- CPU clock speed
- FPU type
- SCSI controller
- RTC chip
- ADB

## The Boot Dialog



Here you have to select Boot Device.

Click “*SCSI disk*” to boot from first SCSI Disk.

Click “*Ethernet*” to boot from Ethernet.

Click “*MO disk*” to boot from first connected MO Disk.

Click “*Floppy*” to boot from floppy.

Click “*ROM monitor*” to boot to the NeXT ROM monitor.

Check “*perform DRAM test*” if you want to perform DRAM test.

Check “*perform power-on test*” if you want to perform power on test.

Check “*sound out test*” if you want to perform sound out test.

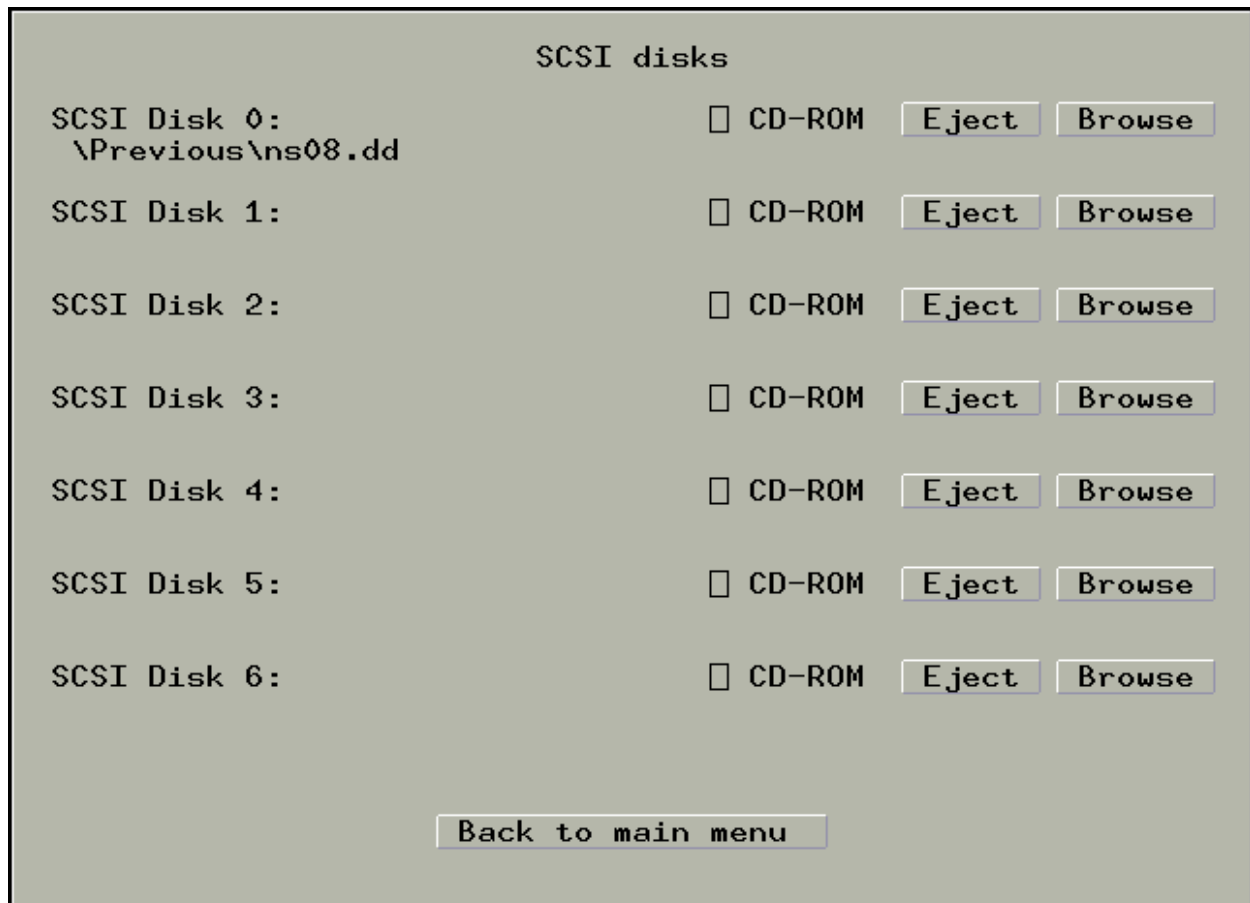
Check “*SCSI tests*” if you want to perform SCSI tests.

Check “*loop until keypress*” if you want to loop until keypress.

Check “*verbose text mode*” if you want to verbose text mode.

Check “*boot extended diagnostics*” if you want boot extended diagnostics.

### *The SCSI Disk Dialog*



Here you can add your disk images.

Click “*Eject*” to eject a disk image.

Click “*Browse*” to browse for a disk image.

Check “*CD-ROM*” to use the selected image as a CD-ROM.

## The MO Disk Dialog

The screenshot shows a dialog box titled "Magneto-optical drives". It contains two drive entries, "MO Drive 0" and "MO Drive 1". Each entry has a "Connected" checkbox, which is currently unchecked. Below each drive entry is a sub-dialog box containing an "Optical disk:" label, an "Insert" button, and a "Write protected" checkbox, which is also unchecked. At the bottom of the main dialog, there is a "Note: Magneto-optical drives only work with non-turbo Cubes." and a "Back to main menu" button.

Magneto-optical drives

MO Drive 0:  Connected

Optical disk:   Write protected

MO Drive 1:  Connected

Optical disk:   Write protected

Note: Magneto-optical drives only work with non-turbo Cubes.

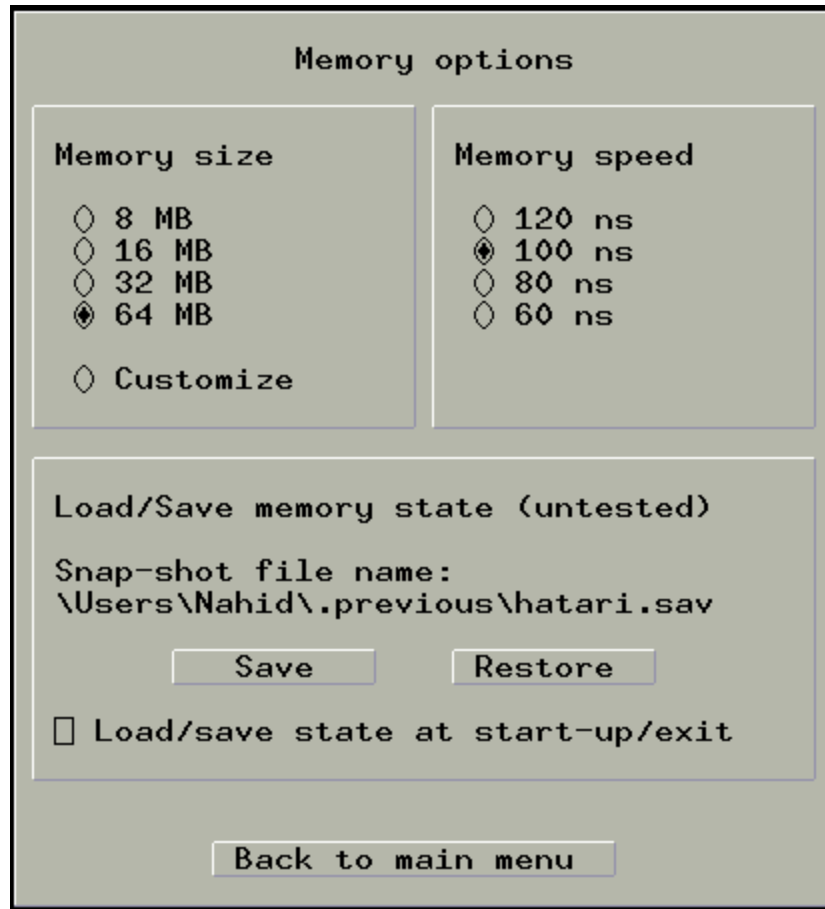
Here you can add your Magneto Optical Disks.

Check "*Connected*" to connect a MO Drive.

Click "*Insert*" to select a MO Disk image.

Check "*Write protected*" to use the disk in write protected mode.

## The Memory Dialog



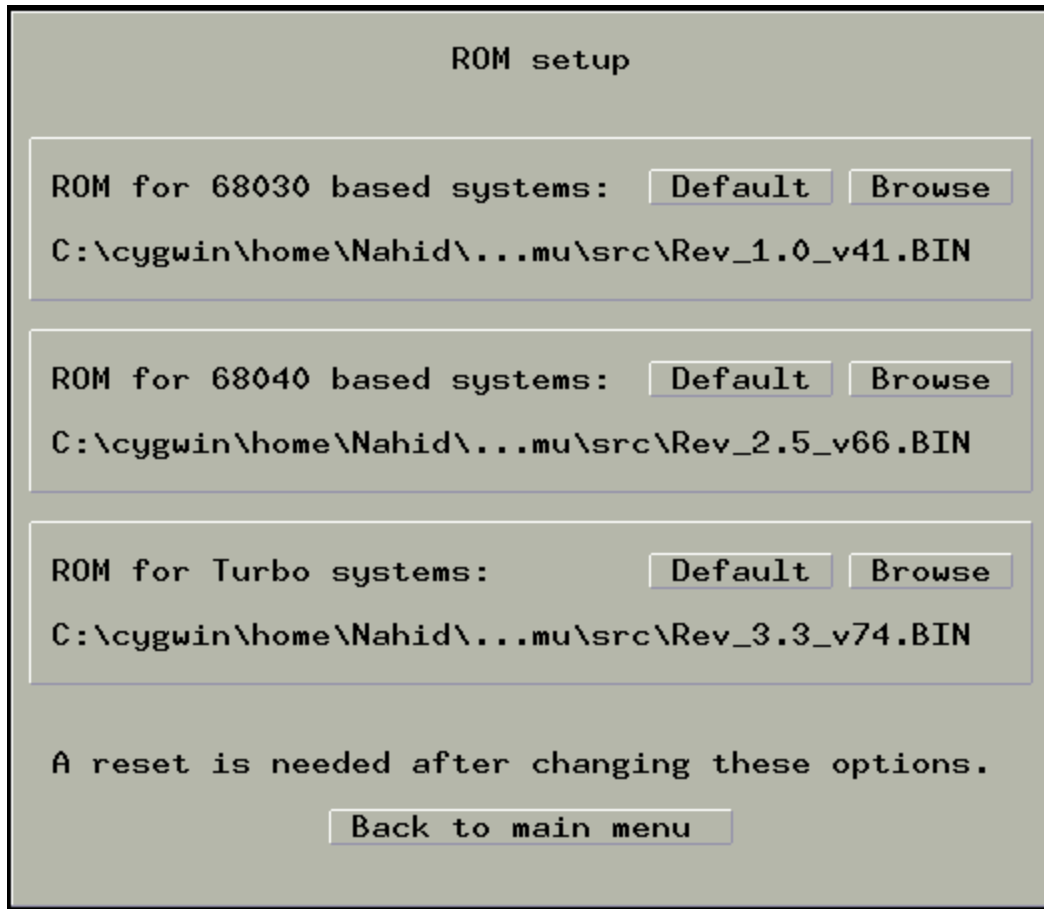
You can select the amount of RAM for the emulated NeXT here.

Here you will find the options to save & load memory snapshots as well.

Click "Save" & "Restore" to save & load memory state.

*Note: As version 0.4 Memory Snapshots are untested and may be not work well.*

## The ROM Dialog



Here you can what ROM images to use.

Click “*Default*” to use its defaults.

Click “*Browse*” to locate your ROMs.

## The Mouse Dialog

Mouse options

Mouse motion speed adjustment:

Linear adjustment (0.1 to 10.0):

Normal mode: 1.0      Locked mode: 1.0

Exponential adjustment (0.50 to 1.00):

Normal mode: 1.00      Locked mode: 1.00

Enable auto-locking

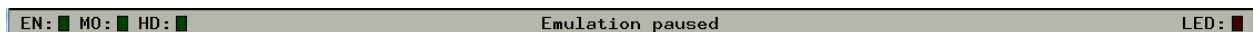
Back to main menu

Here you have to set your Mouse settings.

Set Linear adjustment and Exponential adjustment.

Check “*Enable auto-locking*” if you want to auto-lock the Mouse.

## The Status bar



The status bar shows-

- Status of Ethernet
- Status of Magneto Optical Disk Drives
- Status of Hard disks Drives & CD-ROM Drives
- What Machines are emulated
- Status of the Red LED.



## Emulated Keyboard & Mouse

Emulation of Keyboard & Mouse is in good stage. But the Mouse has some bugs like – Mouse is buggy & floaty. In Keyboard some special keys are not emulated- Sound Up Key, Sound Down Key, Brightness Up Key, Brightness Down Key, Power Key.

## SCSI Disk & MO Disk

The disk images are just raw files. The emulator uses a fixed block size in the SCSI Device emulation. On a Unix system (Linux and Mac OS X), you can create a suitable disk image by running the dd command in a terminal program. As an example, the following command will make a 1GB image file:

```
dd if=/dev/null of=NEXTSTEP_3.3_hard_drive.hd bs=1024 count=0 seek=1024000
```

You can make image files on Windows using Bochs's Bximage.

## Installing an OS on Previous

As version 0.4 Previous can boot & install NeXTstep 0.8 to 4.0 beta and well as well OpenStep 4.1 - 4.2.

There are some bugs in the MO Drive Emulation so may be you may be have some problems during installations of NeXTstep 0.8 - 2.1a.

You cannot install Netbsd on Previous because - "NetBSD/next68k 6.1.4 does not have any local disk support, so you must netboot and run diskless." and the Ethernet emulation in Previous is not complete.

## Installing NeXTstep/Openstep

At first you should read "Using Previous" if you don't do so.

We will install now NeXTstep 3.3. Follow this steps-

Open Previous, Set your Emulated machine NeXTstation and check Color. Set Boot method ROM-Monitor. Now go to SCSI Dialog-

Make a Disk image and set at SCSI 0

Set your boot disk at SCSI 1

Set your installation disk at SCSI 2

Save your settings and Quit. Open Previous and load the settings and press OK

You will see the ROM Monitor and type - 'bsd(1,0,0)'

After few seconds Installer will ask what language you want to use Type '1' for English language. after few seconds installer will ask select destination for installing type '1'. Installer will ask if you want to install NeXTstep type '1' then the file copying will started after few minutes the system will reboot and the reboot process will stop asking for Control C Press Control+C within few seconds a GUI will appear click on 'Install' then the installation will started after few minutes installation will completed and set the settings what you needed. You have installed NeXTstep 3.3!

Installing Openstep is same like as installing NeXTstep. This is a exam to install Openstep youself! For any question throw your question to the NeXT International Forum!

## Appendix

### Copying

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