Operating Systems Lab - CS 314

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January 15, 2021

1 Introduction

In this lab, the task was to setup up Minix3 Operating System in a VM (Virtual Machine) with a Linux based OS (Ubuntu 20.04 LTS here). After that, we had to deploy Version R3.3.0 of the Official Minix3 OS. Further in this report, each step towards the setup are explained in detail.

2 Getting Minix3 Release

With the Host OS (Ubuntu 20.04 LTS) as an environment and Virtual Box as a software dependency to setup Virtual Machine, latest Minix3 OS Release ISO was used during setup.

2.1 VM Setup

Some specifications of Minix VM setup:

- 1 GB RAM Allocation
- 20 GB Hard Disk Space Allocation
- 10 GB `/home` Space Allocation
- Network Adapter Setting Changed: Attachment set to Bridged Adapter from NAT.

2.2 Post Installation Configuration

Further more, in the Minix3, we had to configure the following things as mentioned in the problem statement:

- Set the root password
- Set the timezone

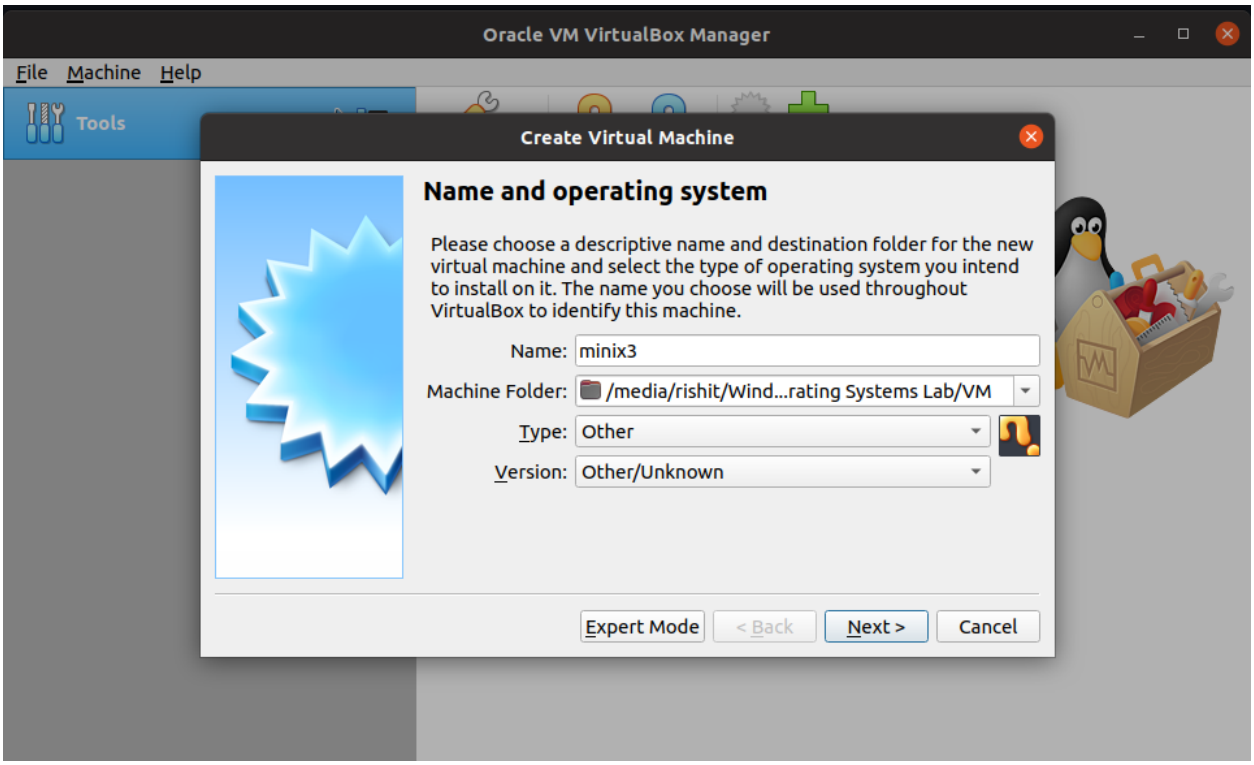

Figure 1: ISO File Loading in Virtual Box

- Setup openssh
- Update the packages, and run pkgin_sets to set up all typically useful packages

For configuration, the following script was used. [Source]

```
#! /bin/sh
passwd
echo export TZ=Asia/Kolkata > /etc/rc.timezone
pkgin update
pkgin install openssh
mkdir /etc/rc.d/
cp /usr/pkg/etc/rc.d/sshd /etc/rc.d/
printf 'sshd=YES\n' >> /etc/rc.conf
/etc/rc.d/sshd start
pkgin update
pkgin_sets
```

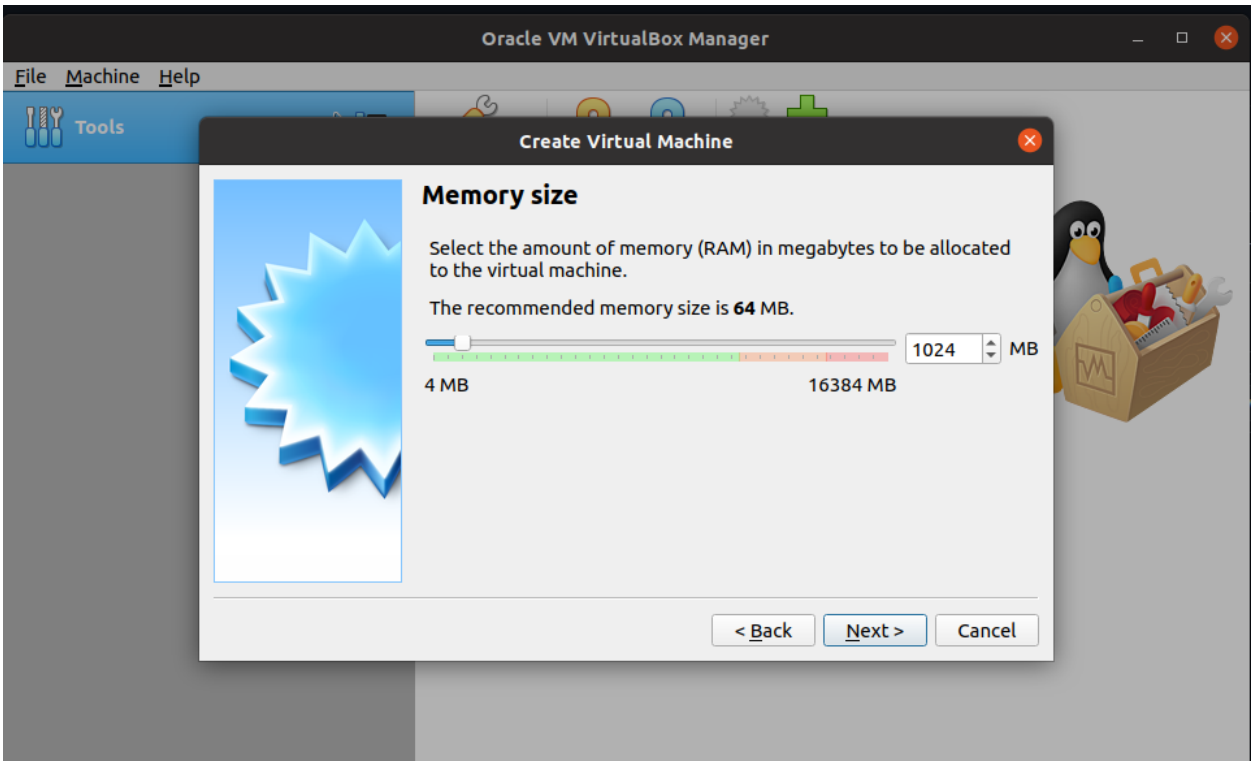

Figure 2: 1 GB RAM Allocation for Minix3

3 Getting Minix3 Source and Setting Up Development Environment

As instructed, Eclipse IDE for C/C++ Developers was installed in Host OS as a part of Development Environment.

Minix3 Source Code was obtained from the GitHub Repository. As instructed as a part of setting up the environment, the source code was opened in Eclipse.

4 Modifying, building, and testing Minix3

4.1 Host OS Git Configuration

The given document asks us to checkout into a particular commit namely `588a35b9293dcbc89a45881940d00c2ae6d13801` which essentially is the V3.3.0 version of Minix3 OS. So, to do that `git checkout 588a35b9293dcbc89a45881940d00c2ae6d13801` was used. Once in that commit, a new branch has to be created in order to differentiate each lab and maintain versions of each code. It can be done using `git checkout -b lab1`, where `lab1` is the new branch's name.

In order to verify, whether `lab1` branch is pointing to correct commit, `git log -3` can

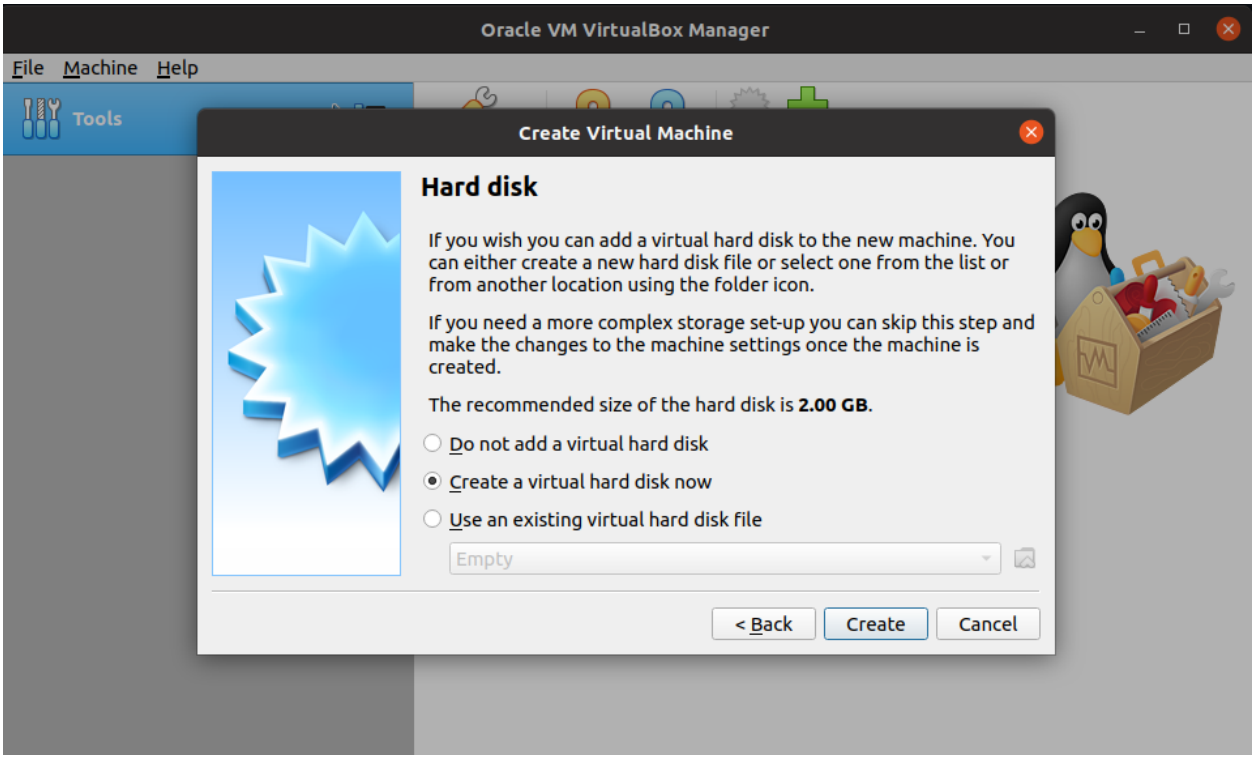

Figure 3: Creating a Virtual Hard Disk for recovery purposes

be used to see the latest 3 entries in the `git log`.

4.2 SCP Transfer

To begin with the Minix3 folder was zipped and named as `minix.zip`. Now, from the Host OS, SCP command was initiated as follows:
`scp minix.zip root@10.0.0.100:/usr/`. This essentially copies the zip from Host OS to `/usr/` location in Minix3 VM.

4.3 Guest OS Make Build Configuration

After the `minix.zip` is copied into the `/usr/` location, it was unzipped it there using `unzip minix.zip`. So, essentially now a directory called `minix` is made and it is supposed to be renamed as `src`. It can be done using `mv minix src`. Once it is done, get into `src/` directory. To build this version, `make build` was used.

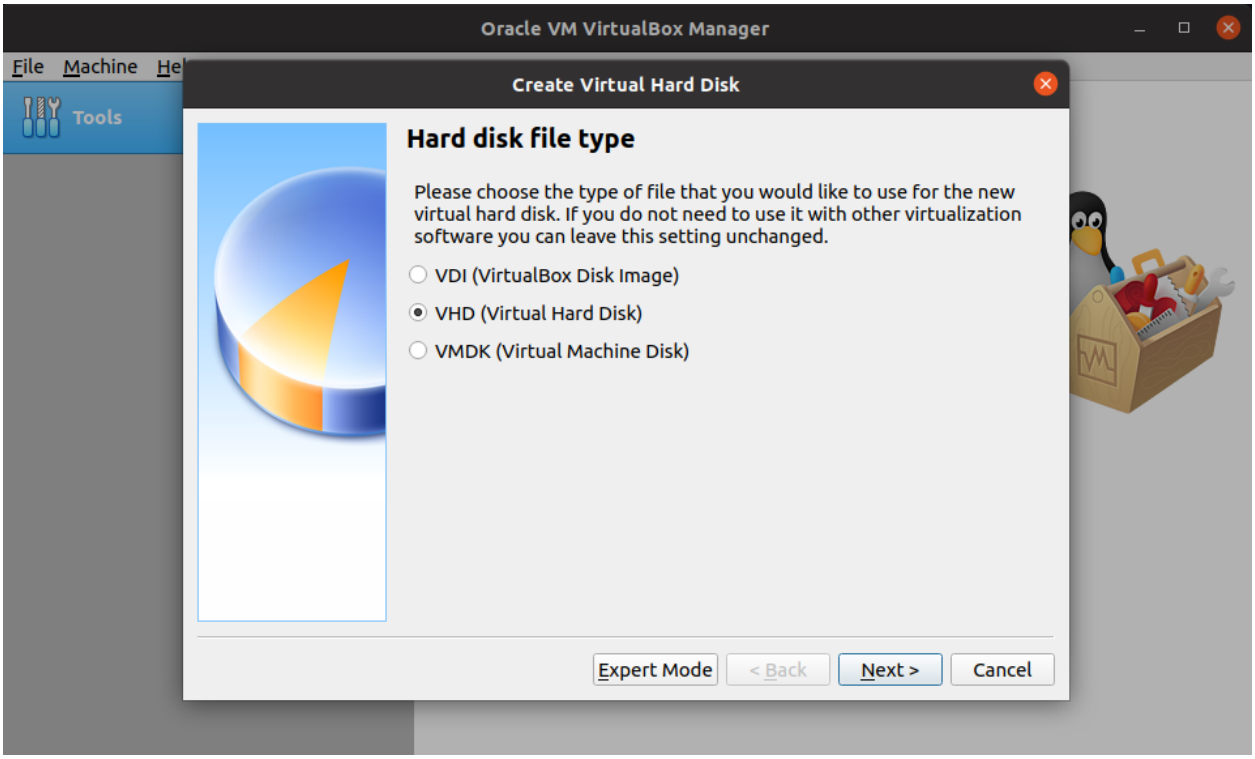

Figure 4: VHD Specifications Setting

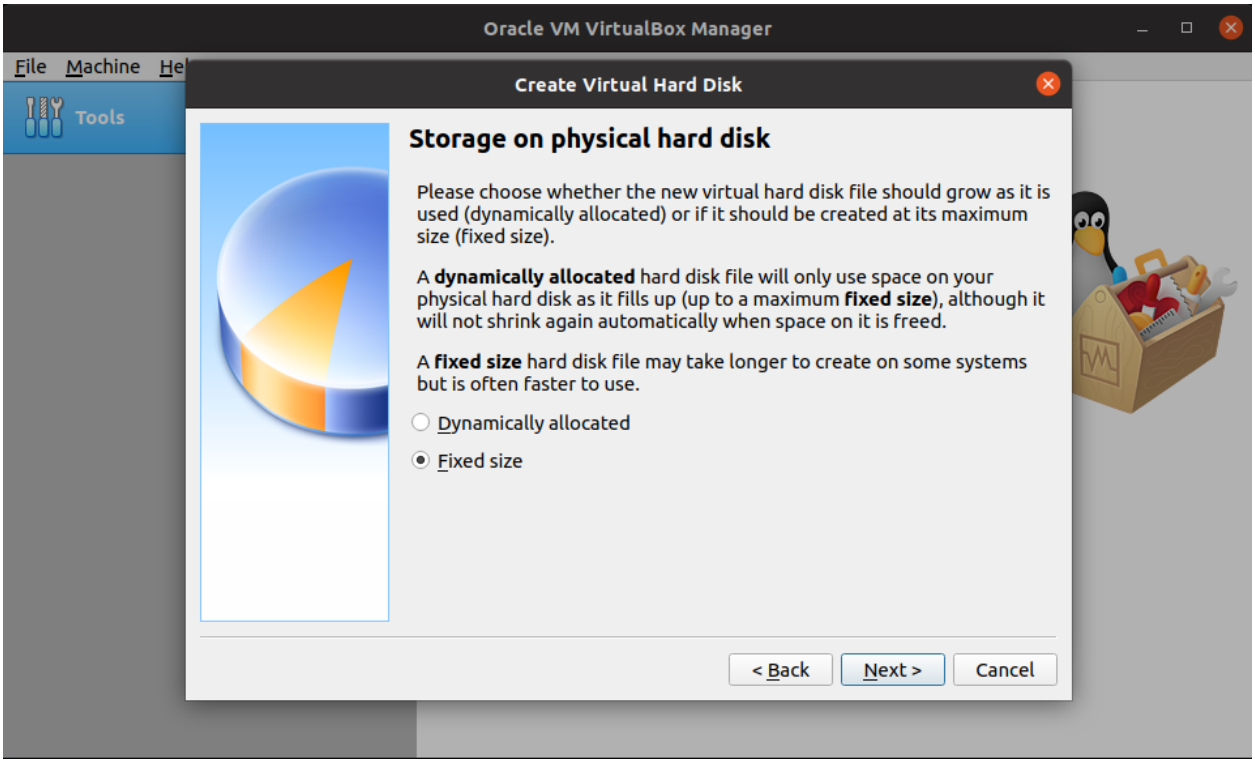

Figure 5: Size is fixed for VHD

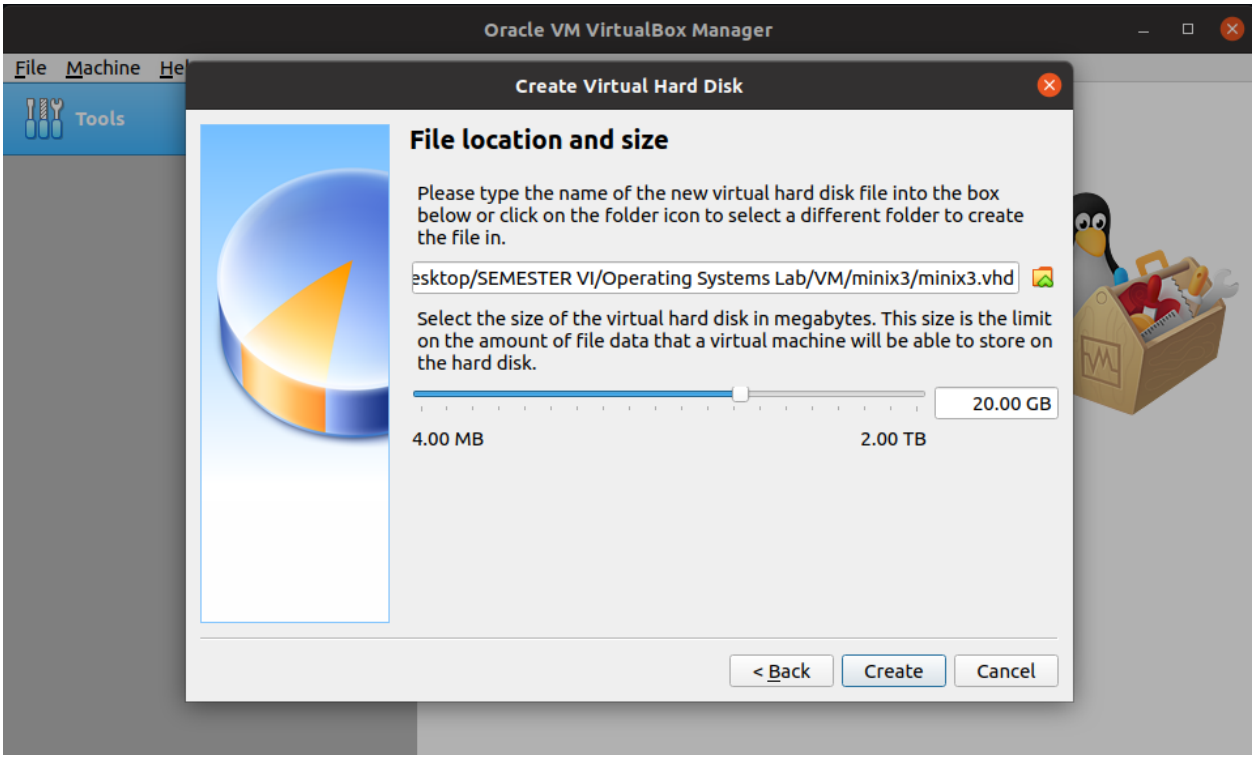

Figure 6: 20 GB Hard Disk Space Allocation

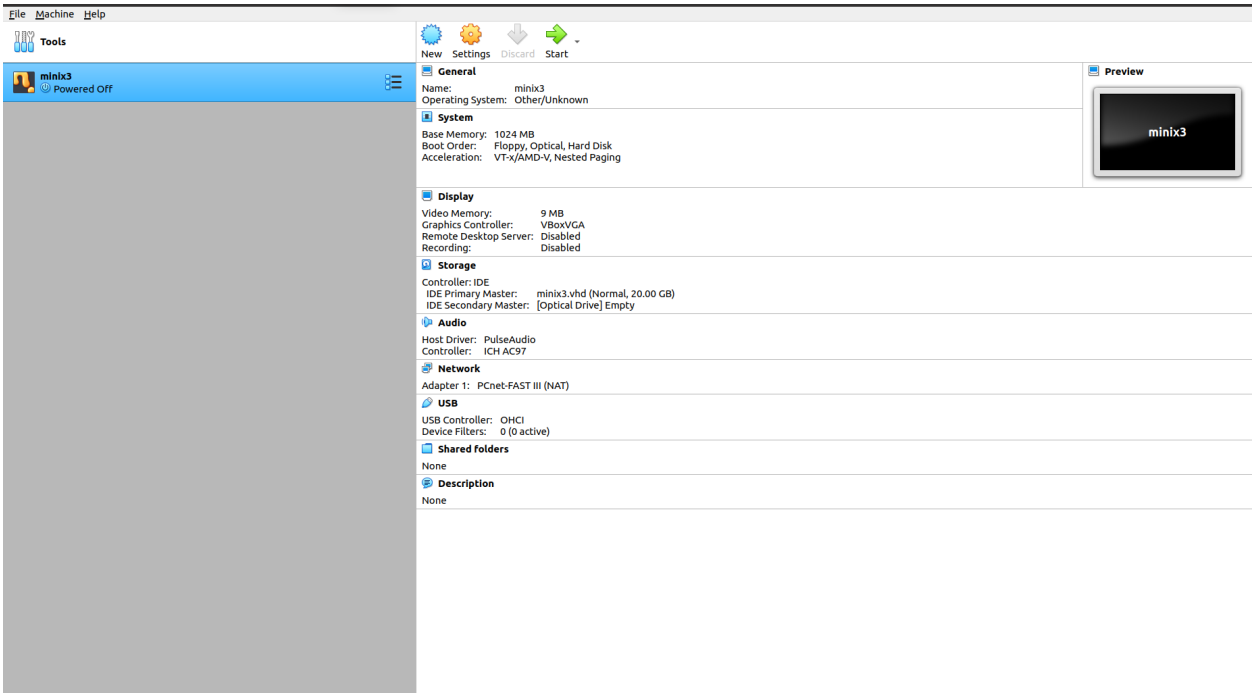

Figure 7: Virtual Box GUI

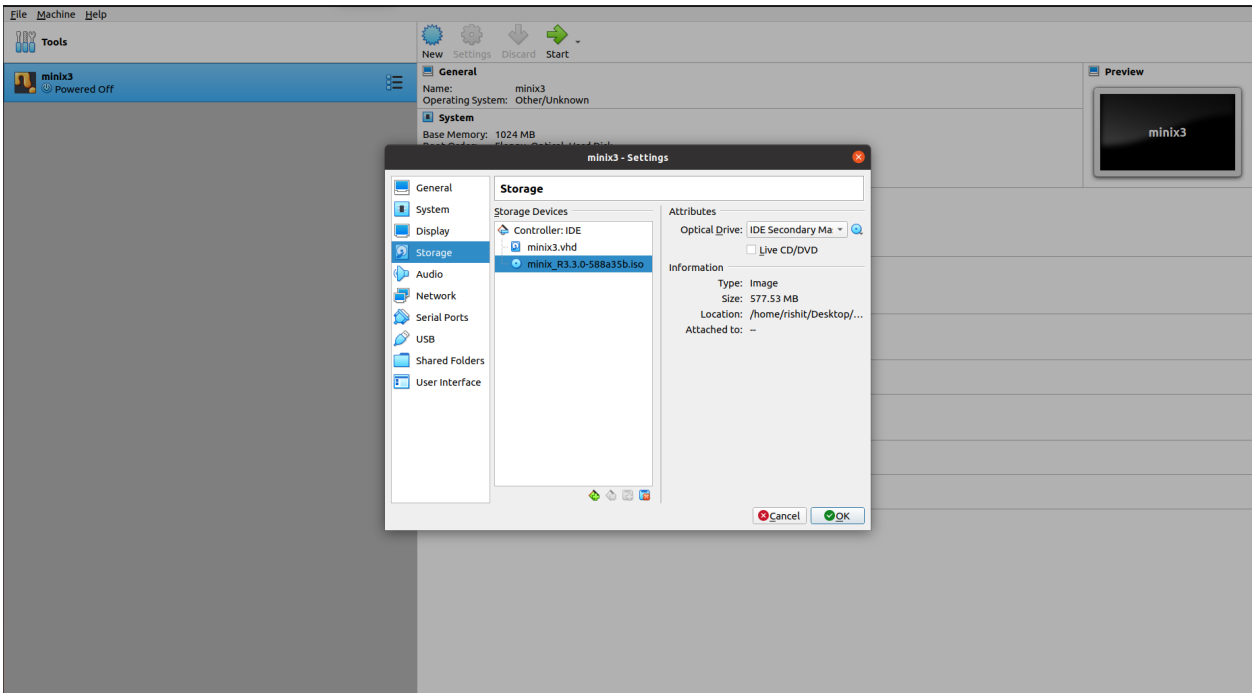

Figure 8: Removal of ISO file after setting up

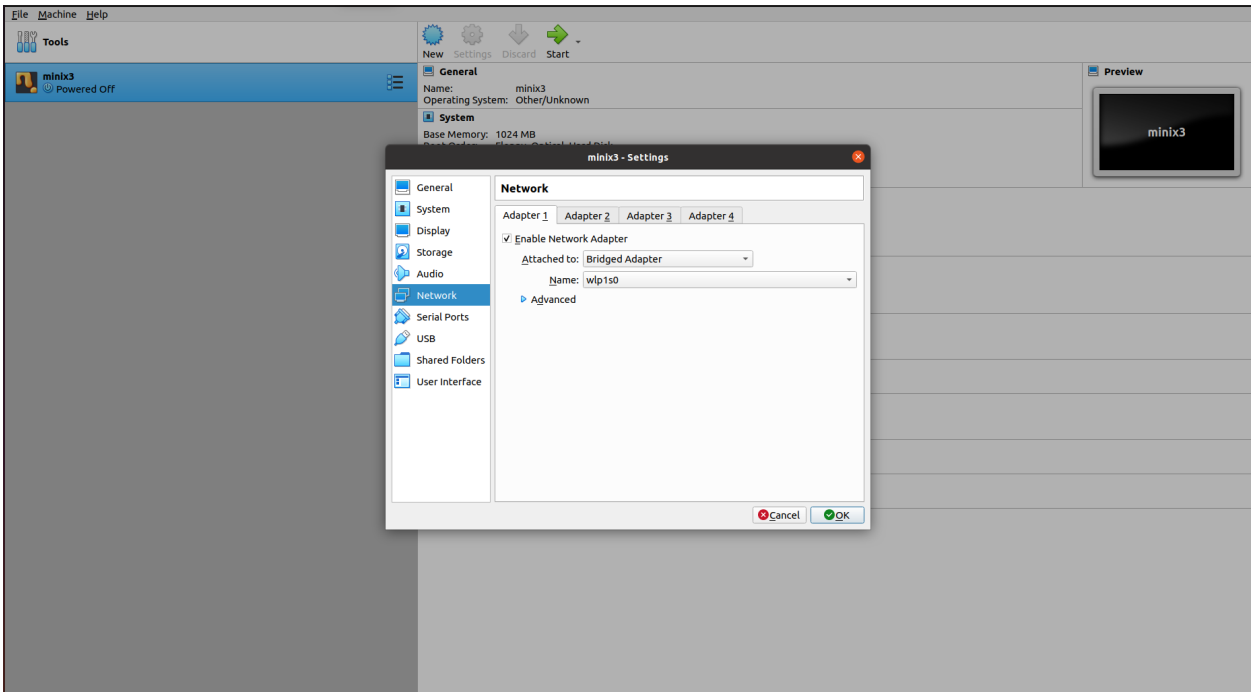

Figure 9: Network Setting in Minix3 VM

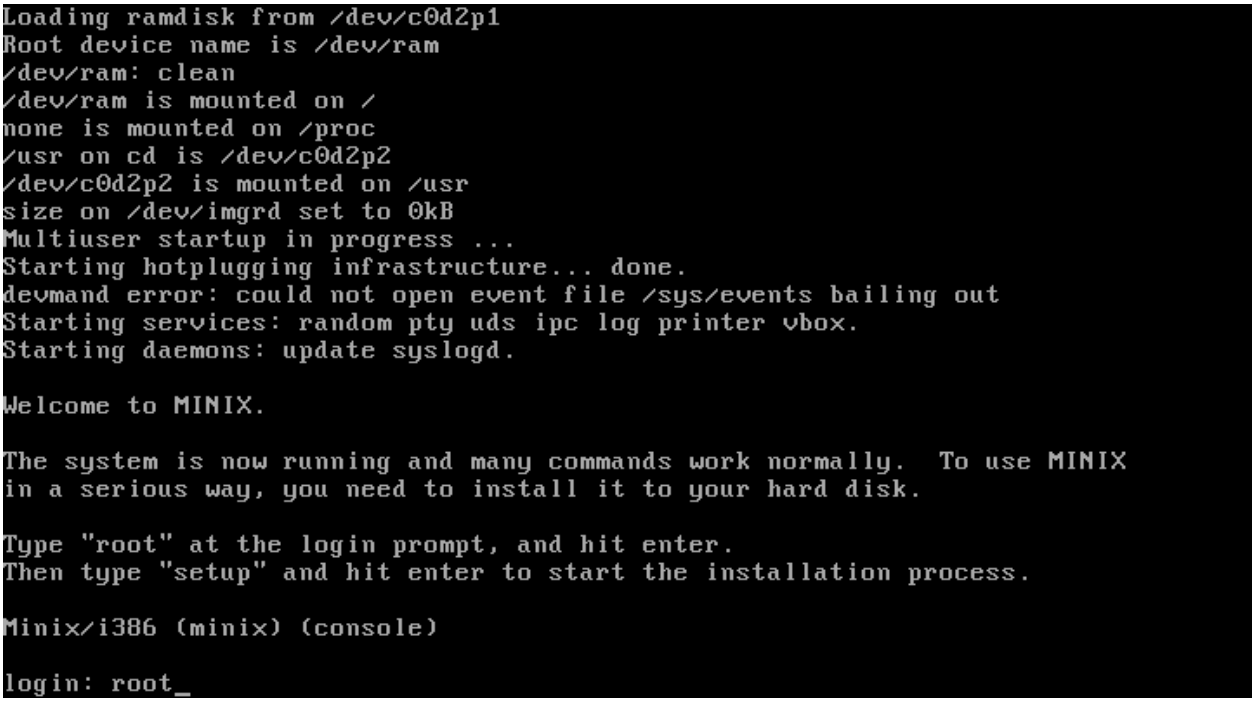

Figure 10: User Login before Configuration

Figure 11: Minix3 Setup

```
 --- Step 3: Create or select a partition for MINIX 3 -------------------

Now you need to create a MINIX 3 partition on your hard disk.
You can also select one that's already there.

If you have an existing installation, reinstalling will let you
keep your current partitioning and subpartitioning, and overwrite
everything except your s1 subpartition (/home). If you want to
reinstall, select your existing minix partition.

Unless you are an expert, you are advised to use the automated
step-by-step help in setting up.

Press ENTER for automatic mode, or type 'expert':

 --- Substep 3.1: Select a disk to install MINIX 3 ----------------------

Probing for disks. This may take a short while..... Probing done.
The following disk was found on your system:

  Disk [0]:  /dev/c0d0,   20 GB
        Free space            (  19 GB)

Enter the disk number to use: [0]
```

Figure 12: Disk Specifications

```
following region were found on the selected disk:

   [0]  Free space            (  19 GB)

Enter the region number to use or type 'delete':  [0]

 --- Substep 3.3: Confirm your choices ---------------------------------

This is the point of no return.  You have selected to install MINIX 3
into region 0 of disk /dev/c0d0.  Please confirm that you want
to use this selection to install MINIX 3.

Are you sure you want to continue?  Please enter 'yes' or 'no': yes

 --- Step 4: Reinstall choice ------------------------------------------

No old /home found. Doing full install.


 --- Step 5: Select the size of /home ----------------------------------

MINIX will take up 667 MB, without /home.
How big do you want your /home to be in MB (0-19806) ? [3961] 10240

10240 MB Ok? [Y] Y_
```

Figure 13: 10 GB Space Allocation in `/home`

```
Block size in kilobytes? [4]

You have selected to (re)install MINIX 3 in the partition /dev/c0d0p0.
The following subpartitions are now being created on /dev/c0d0p0:

    Root subpartition:  /dev/c0d0p0s0   128 MB
    /home subpartition: /dev/c0d0p0s1   10240 MB
    /usr subpartition:  /dev/c0d0p0s2   rest of c0d0p0

Creating /dev/c0d0p0s0 for / ..
Creating /dev/c0d0p0s1 for /home ..
Creating /dev/c0d0p0s2 for /usr ..

 --- Step 7: Wait for files to be copied ------------------------------

All files will now be copied to your hard disk. This may take a while.

Remaining: 2733 files.  [==================================|----------------]
/mnt/pkg/man/man3/RSA_get_default_method.3
/mnt/pkg/man/man3/RSA_get_ex_data.3
/mnt/pkg/man/man3/RSA_get_ex_new_index.3
/mnt/pkg/man/man3/RSA_get_method.3
/mnt/pkg/man/man3/RSA_new.3
/mnt/pkg/man/man3/RSA_new_method.3
```

Figure 14: Basic Setup Complete

```
13.   Different Ethernet card (no networking)

Ethernet card? [9]

Configure network using DHCP or manually?

1. Automatically using DHCP
2. Manually

Configure method? [1]
/dev/c0d0p0s2 unmounted from /mnt/usr
Unmounted c0d0p0s2
/dev/c0d0p0s0 unmounted from /mnt
Unmounted c0d0p0s0

Please type 'reboot' to exit MINIX 3 and reboot. To boot into your new
system, you might have to remove installation media.

This ends the MINIX 3 setup script.  You may want to take care of post
installation steps, such as local testing and configuration.

Please consult the user manual for more information.


# poweroff
```

Figure 15: Reboot

```
Minix/i386 (10.0.0.103) (console)

login: root
Copyright (c) 1996, 1997, 1998, 1999, 2000, 2001, 2002, 2003, 2004, 2005,
    2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013
    The NetBSD Foundation, Inc.  All rights reserved.
Copyright (c) 1982, 1986, 1989, 1991, 1993
    The Regents of the University of California.  All rights reserved.

For post-installation usage tips such as installing binary
packages, please see:
http://wiki.minix3.org/UsersGuide/PostInstallation

For more information on how to use MINIX 3, see the wiki:
http://wiki.minix3.org

We'd like your feedback: http://minix3.org/community/

# passwd
Changing local password for root.
New password:
Please enter a longer password.
New password:
Retype new password:
#
```

Figure 16: New Password Configuration

```
Copyright (c) 1996, 1997, 1998, 1999, 2000, 2001, 2002, 2003, 2004, 2005,
    2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013
    The NetBSD Foundation, Inc.  All rights reserved.
Copyright (c) 1982, 1986, 1989, 1991, 1993
    The Regents of the University of California.  All rights reserved.

For post-installation usage tips such as installing binary
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For more information on how to use MINIX 3, see the wiki:
http://wiki.minix3.org

We'd like your feedback: http://minix3.org/community/

# passwd
Changing local password for root.
New password:
Please enter a longer password.
New password:
Retype new password:
# echo export TZ=Asia/Kolkata > /etc/rc.timezone
# pkgin update
Database needs to be updated.
proceed ? [Y/n] Y
```

Figure 17: `pkgin` Updates

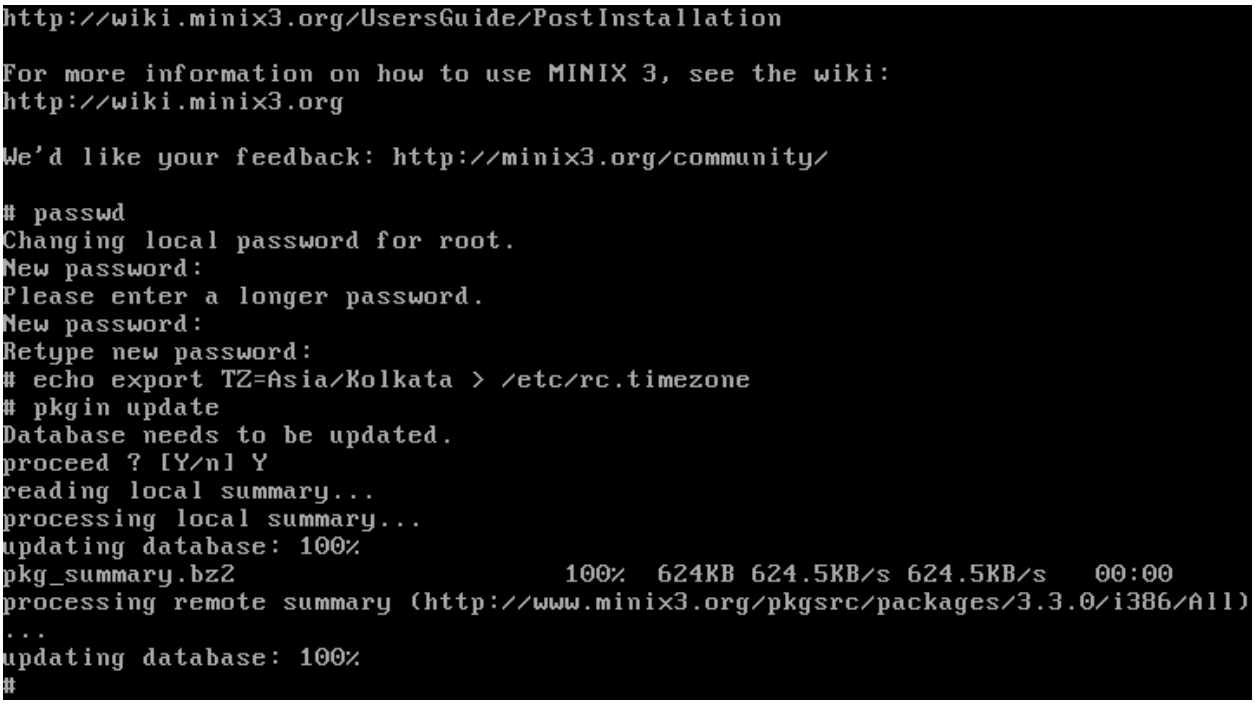

Figure 18: `pkgin` Update Complete

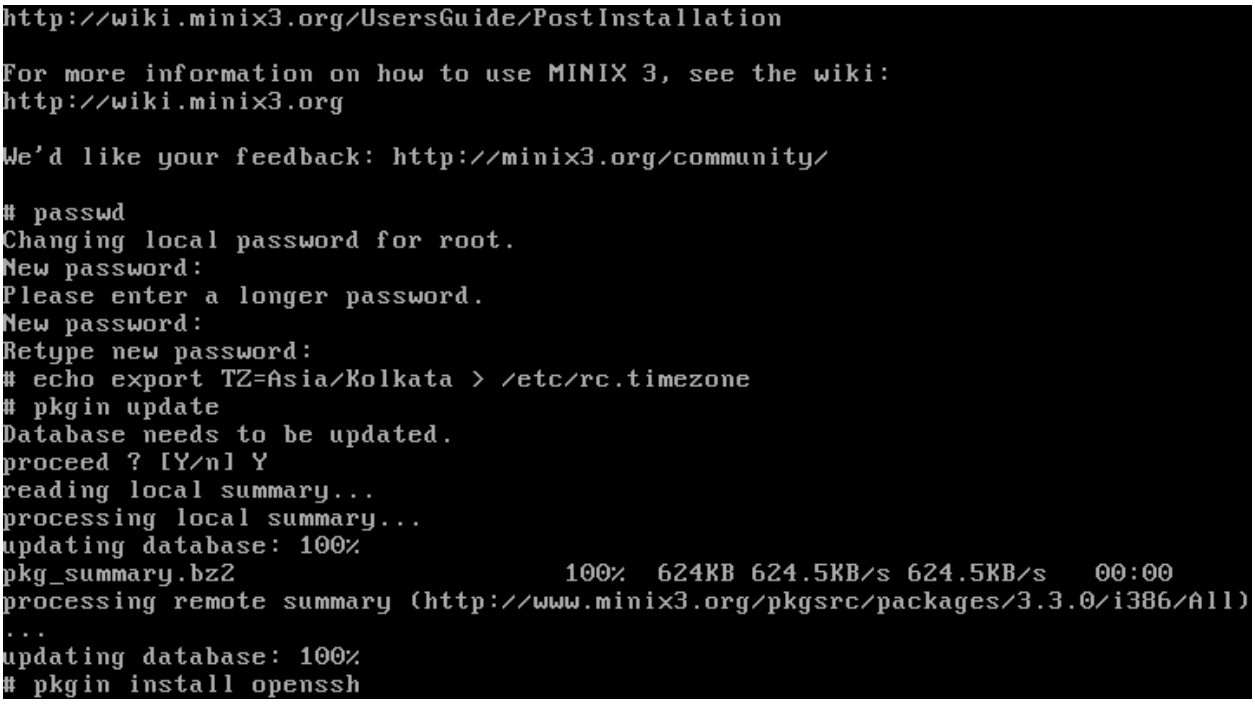

Figure 19: `SSH pkgin` Installation

```
installing packages...
installing tcp_wrappers-7.6.4...
installing openssh-6.6.1...
openssh-6.6.1: copying /usr/pkg/share/examples/rc.d/sshd to /usr/pkg/etc/rc.d/ss
hd
openssh-6.6.1: copying /usr/pkg/share/examples/openssh/moduli to /usr/pkg/etc/ss
h/moduli
openssh-6.6.1: copying /usr/pkg/share/examples/openssh/ssh_config to /usr/pkg/et
c/ssh/ssh_config
openssh-6.6.1: copying /usr/pkg/share/examples/openssh/sshd_config to /usr/pkg/e
tc/ssh/sshd_config
================================================================================
$NetBSD: MESSAGE.urandom,v 1.1 2002/02/05 04:17:31 jlam Exp $

You will need a working /dev/urandom.  Please make sure you have a kernel
compiled from a config file containing the line:

        pseudo-device   rnd
================================================================================
pkg_install warnings: 0, errors: 0
reading local summary...
processing local summary...
updating database: 100%
marking openssh-6.6.1 as non auto-removable
# _
```

Figure 20: SSH Installation Complete

```
|  + =    * .       |
|. B o * S          |
|  + o = = .        |
|. +  . o  .        |
|  o  .E.           |
|    ...            |
+-----------------+
Generating public/private ed25519 key pair.
Your identification has been saved in /usr/pkg/etc/ssh/ssh_host_ed25519_key.
Your public key has been saved in /usr/pkg/etc/ssh/ssh_host_ed25519_key.pub.
The key fingerprint is:
22:c5:64:6d:69:9b:8e:97:01:fb:92:28:6d:66:c4:da root@10.0.0.103
The key's randomart image is:
+--[ED25519  256--+
|       o. .      |
|      +. =       |
|    .  o= o      |
|     o.. +       |
|    =...=So      |
|   o E.+.=       |
|    =    o       |
|                 |
|                 |
+-----------------+
#
```

Figure 21: Further Dependencies Installed

```
reading local summary...
processing local summary...
updating database: 100%
marking git-base-1.9.0 as non auto-removable
marking bmake-20140314 as non auto-removable
marking gmake-4.0 as non auto-removable
marking binutils-2.23.2 as non auto-removable
marking clang-3.4nb1 as non auto-removable

Installing extras
=================

calculating dependencies... done.

nothing to upgrade.
18 packages to be installed: jpeg-9anb1 jbigkit-2.1 libpaper-1.1.24 ghostscript-
fonts-8.11nb3 freetype2-2.5.3nb1 fontconfig-2.11.0 ghostscript-gpl-9.05nb8 tiff-
4.0.3nb6 png-1.6.10 jasper-1.900.1nb7 bash-4.3 m4-1.4.17 psutils-1.17nb4 netpbm-
10.35.80nb7 libiconv-1.14nb2 ghostscript-9.05nb7 bison-3.0.2 groff-1.20.1nb12 (2
6M to download, 74M to install)

proceed ? [Y/n] Y
# ifconfig
/dev/ip: address 10.0.0.103 netmask 255.0.0.0 mtu 1500
#
```

Figure 22: IP Address - `ifconfig` Command

```
Minix/i386 (10.0.0.103) (console)

login: root
Copyright (c) 1996, 1997, 1998, 1999, 2000, 2001, 2002, 2003, 2004, 2005,
    2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013
    The NetBSD Foundation, Inc.  All rights reserved.
Copyright (c) 1982, 1986, 1989, 1991, 1993
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We'd like your feedback: http://minix3.org/community/

# passwd
Changing local password for root.
New password:
Please enter a longer password.
New password:
Retype new password:
# echo export TZ=Asia/Kolkata > /etc/rc.timezone_
```

Figure 23: Time Zone Set

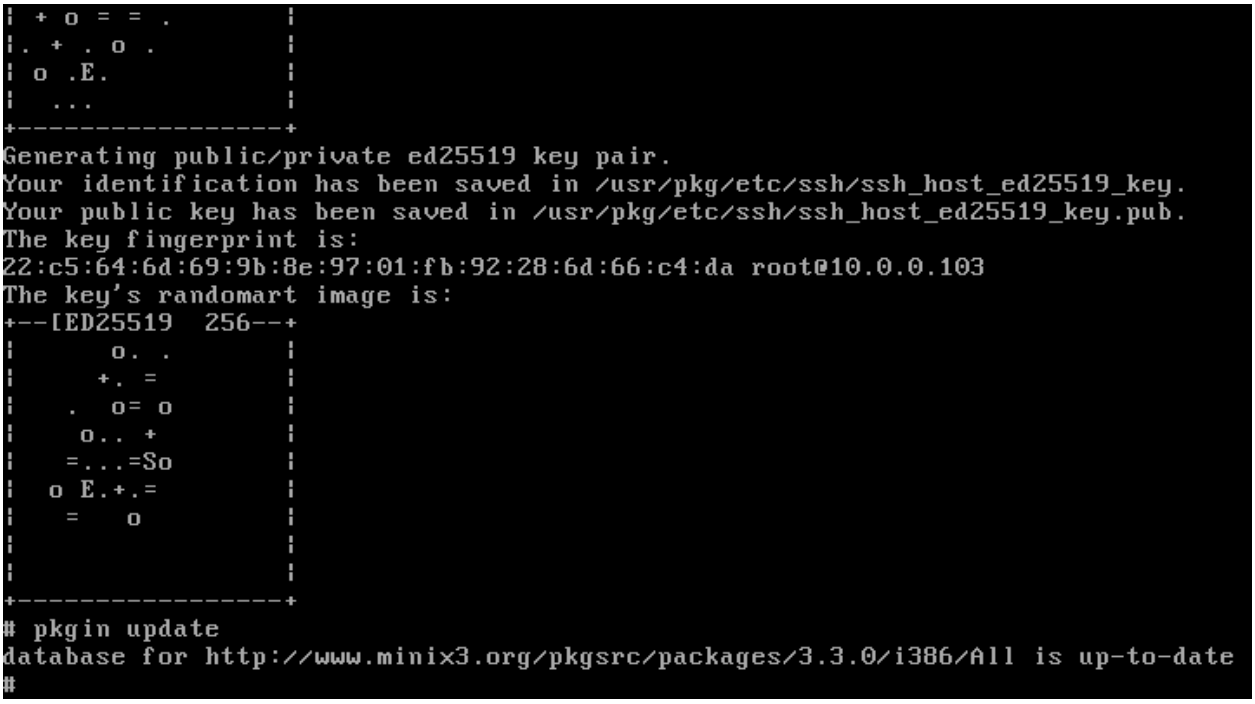

Figure 24: Pkgin Updates Done

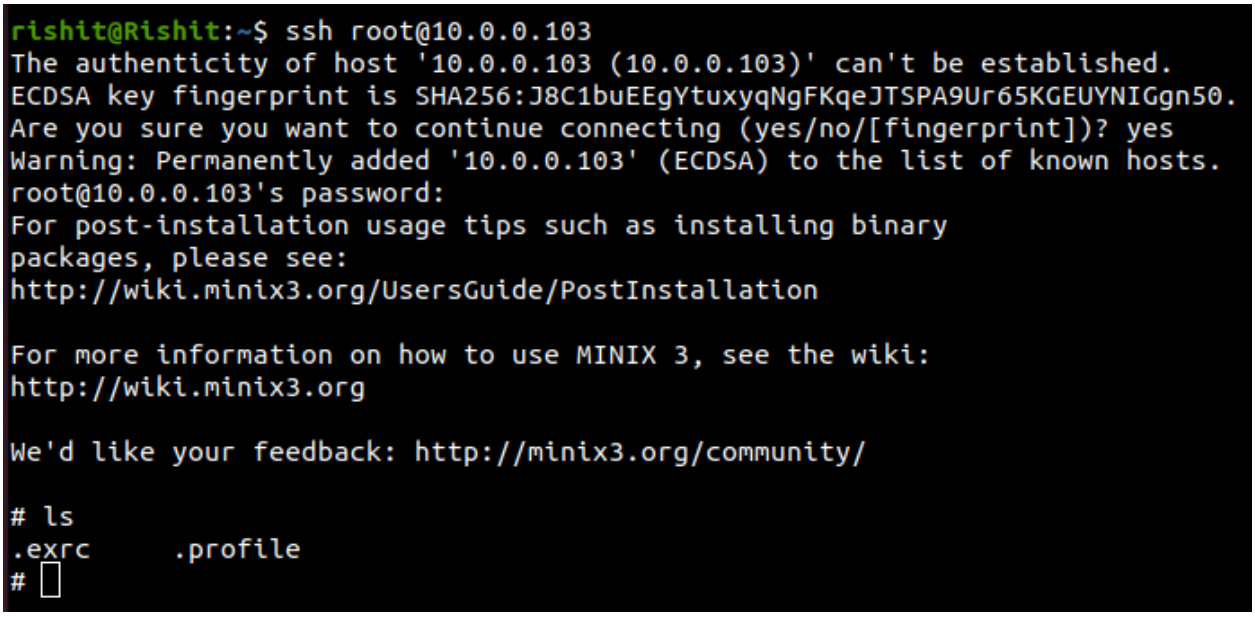

Figure 25: SSH Login through Host OS successful

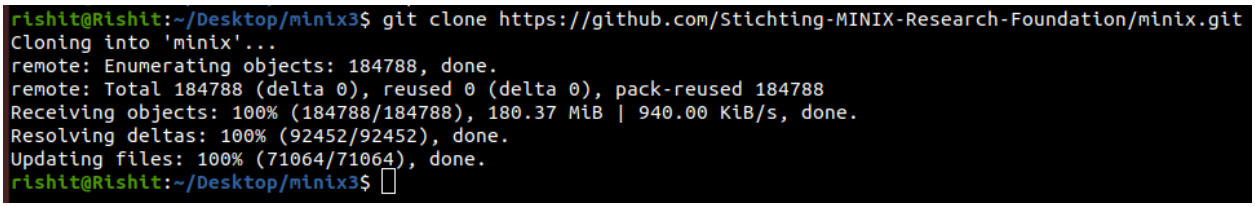

Figure 26: Minix3 Official Repository Cloned (Local Copy)

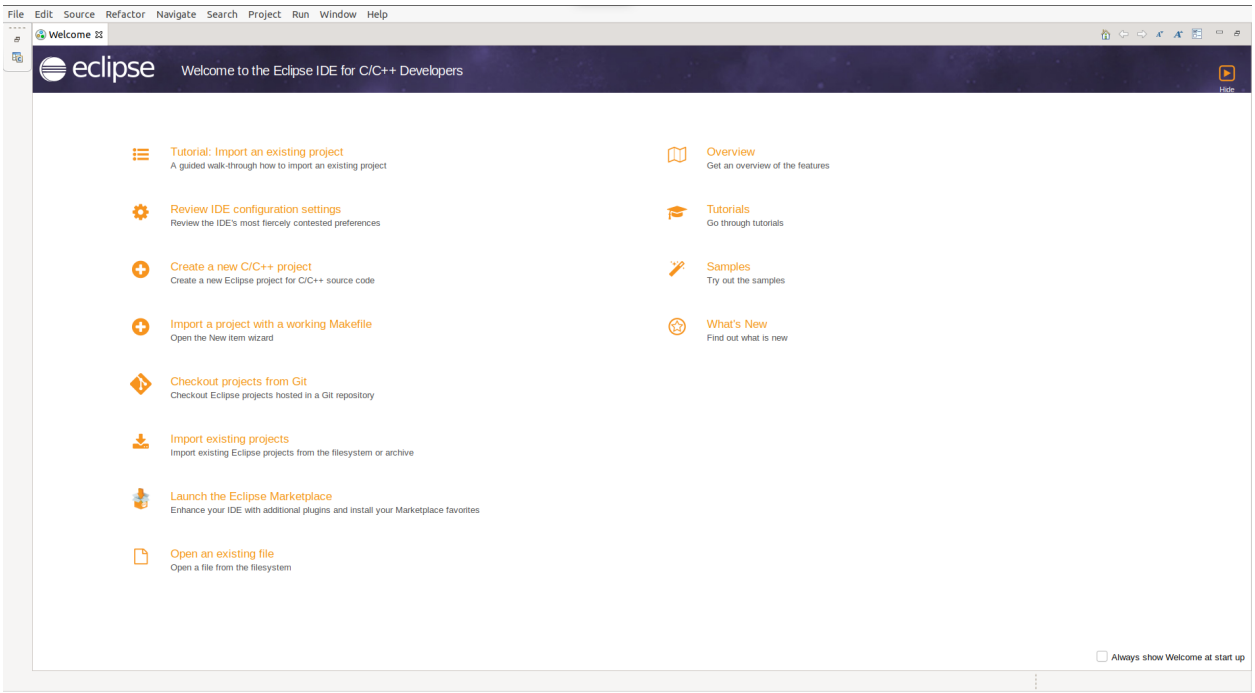

Figure 27: Eclipse Setup in Host OS

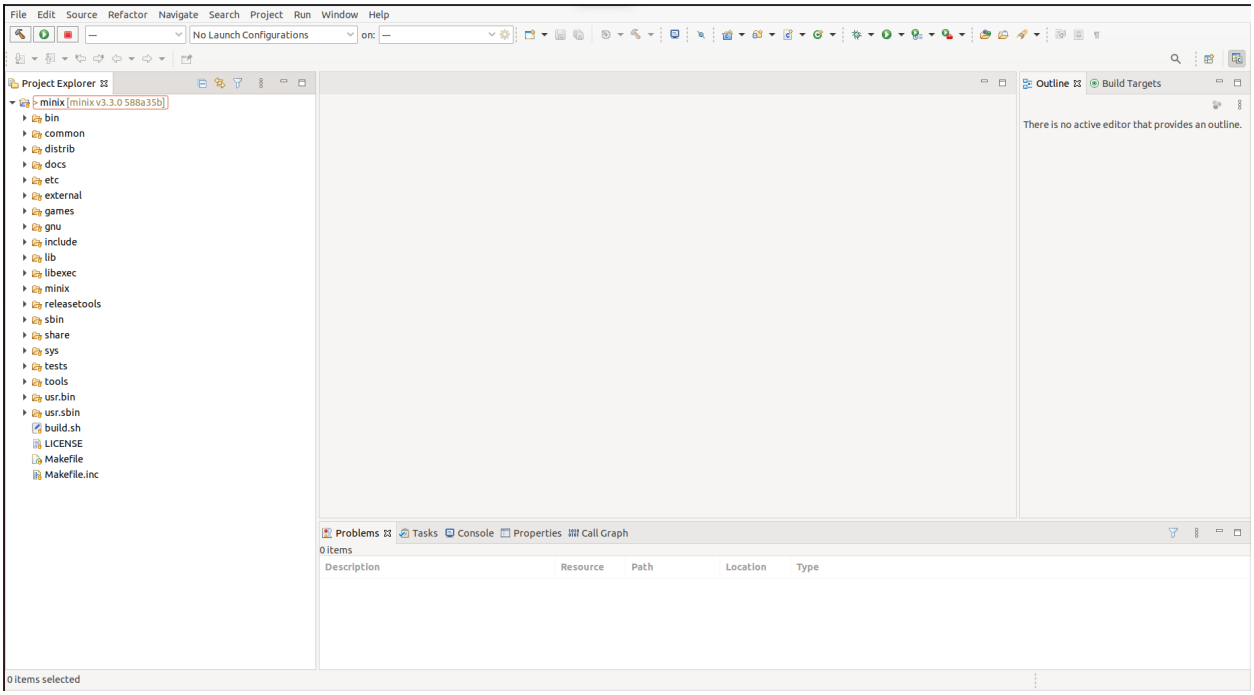

Figure 28: Project launched in Host OS

```
rishit@Rishit:~/Desktop/minix3/minix$ git checkout 588a35b9293dcbc89a45881940d00c2ae6d13801
Updating files: 100% (46473/46473), done.
Note: switching to '588a35b9293dcbc89a45881940d00c2ae6d13801'.

You are in 'detached HEAD' state. You can look around, make experimental
changes and commit them, and you can discard any commits you make in this
state without impacting any branches by switching back to a branch.

If you want to create a new branch to retain commits you create, you may
do so (now or later) by using -c with the switch command. Example:

  git switch -c <new-branch-name>

Or undo this operation with:

  git switch -

Turn off this advice by setting config variable advice.detachedHead to false

HEAD is now at 588a35b92 Set the motd to point to a wiki page.
```

Figure 29: V3.3.0 Commit checkout using Git

```
rishit@Rishit:~/Desktop/minix3/minix$ git status
HEAD detached at 588a35b92
nothing to commit, working tree clean
rishit@Rishit:~/Desktop/minix3/minix$ git branch
* (HEAD detached at 588a35b92)
  master
rishit@Rishit:~/Desktop/minix3/minix$ git checkout -b lab1
Switched to a new branch 'lab1'
```

Figure 30: New Branch named `lab1` created and switched

```
rishit@Rishit:~/Desktop/minix3/minix$ git status
On branch lab1
nothing to commit, working tree clean
rishit@Rishit:~/Desktop/minix3/minix$ git log -3
commit 588a35b9293dcbc89a45881940d00c2ae6d13801 (HEAD -> lab1, tag: v3.3.0, origin/R3.3.0)
Author: Ben Gras <ben@minix3.org>
Date:   Sat Sep 13 23:56:00 2014 +0200

    Set the motd to point to a wiki page.

    Change-Id: I12bc9d07c4d3d0bcb17a27521a0f06ad5abb5fda

commit 5457987d13f27c0334a6223021faee1398e0b526
Author: Ben Gras <ben@minix3.org>
Date:   Sat Sep 13 22:22:51 2014 +0200

    set reasonable packages list

            . clang, binutils and git and dependencies on CD
            . don't bzip .iso

    Change-Id: If43324b46289de5fd1ca7b64785f8ae6e97fd6b7

commit 43eceae54c3cff13e4da0b46445020f40ba192dc
Author: Ben Gras <ben@minix3.org>
Date:   Sat Sep 13 16:50:30 2014 +0200

    restore pkgin_cd

            . make release.sh put packages on the cd
            . make setup script produce a better rc.package file

    Change-Id: Ia4b7588975c2ddf630fa1c510715d82755f67f1e
```

Figure 31: Git Log Verification

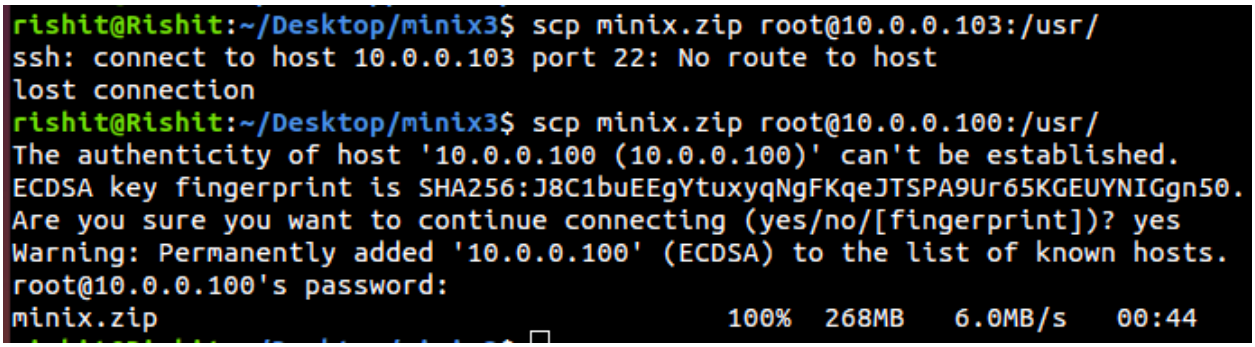

Figure 32: File Transfer using SCP Transfer

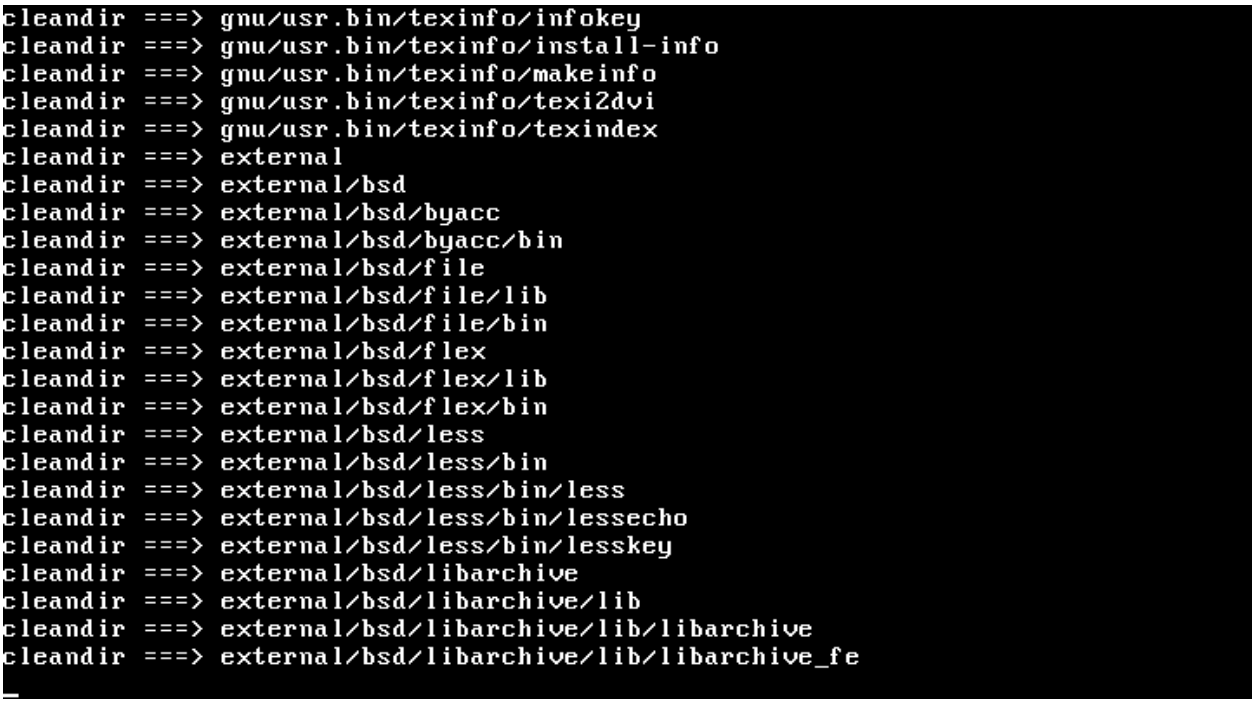

Figure 33: Make Build of V3.3.0 in progress

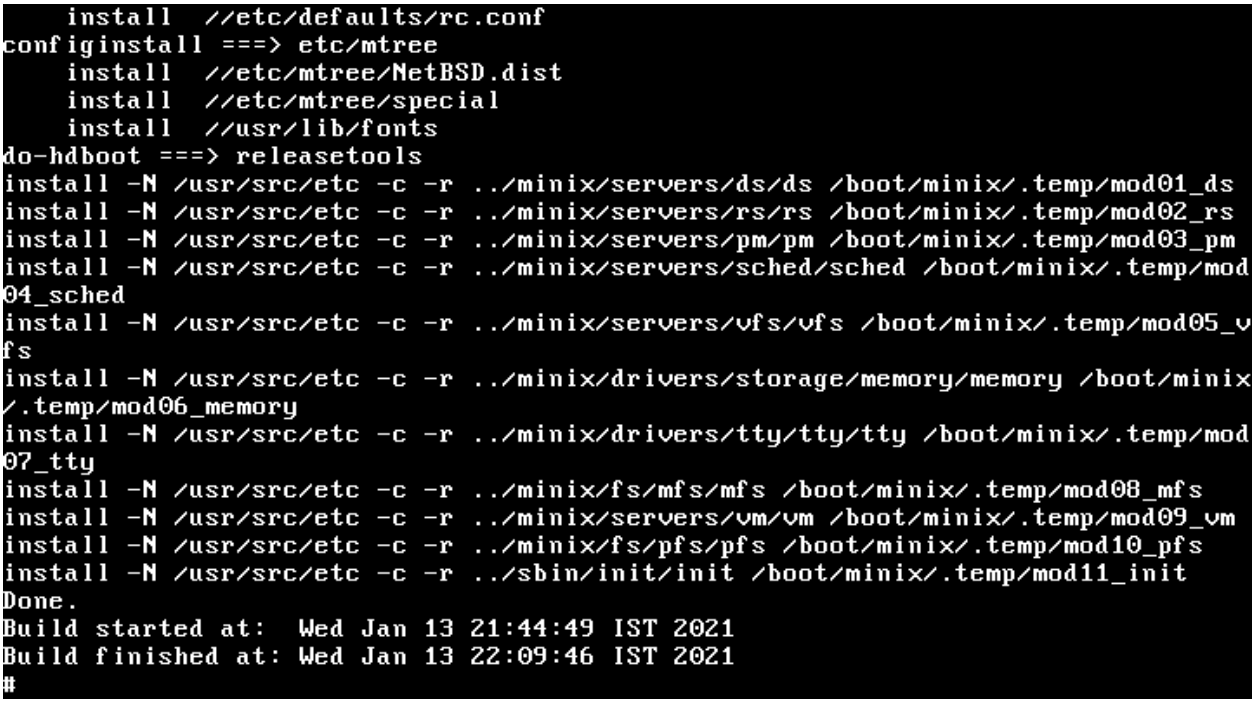

Figure 34: Make Build Complete