

CNEE 208

Linux Network Administration



Lab Manual

Steve Phillips
Jeff Fuller

September 2009

Table of Contents

Introduction	3
Tips & Tricks	4
Lab 1: Installing VirtualBox	6
Lab 2: Installing Ubuntu	10
Lab 3: DHCP Server	18
Lab 4: DNS Server	22
Lab 5: FTP Server	28
Lab 6: SSH Server	30
Lab 7: E-mail Server	32
Lab 8: Web Server & Blog	46
Additional Information	55
About the Authors	56
Acknowledgments	57

Introduction

This lab manual is intended to be a user-friendly guide to networking and configuring Linux servers. We will be using Ubuntu, though much of what you learn in this course can be applied to other Linux distributions as well.

After installing VirtualBox and Ubuntu, you will learn how to install and configure DHCP, DNS, FTP, SSH, e-mail, a webserver, and a WordPress blog.



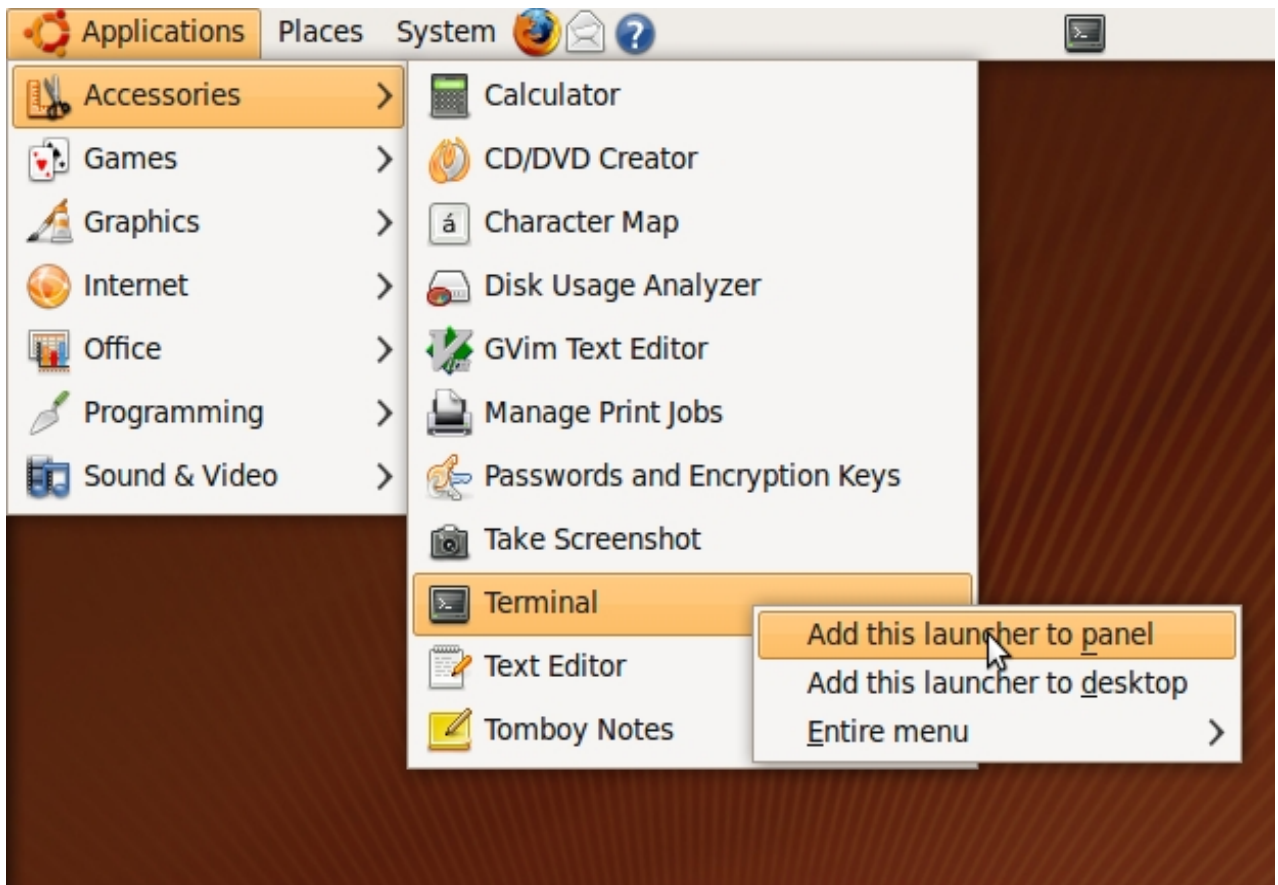
Tips & Tricks

Running Commands

When we say to run *sudo apt-get install apache2*, for instance, we mean to type the above command into a command prompt, also known as a terminal or CLI (command line interface). To open a new terminal, to go to Applications > Accessories > Terminal.

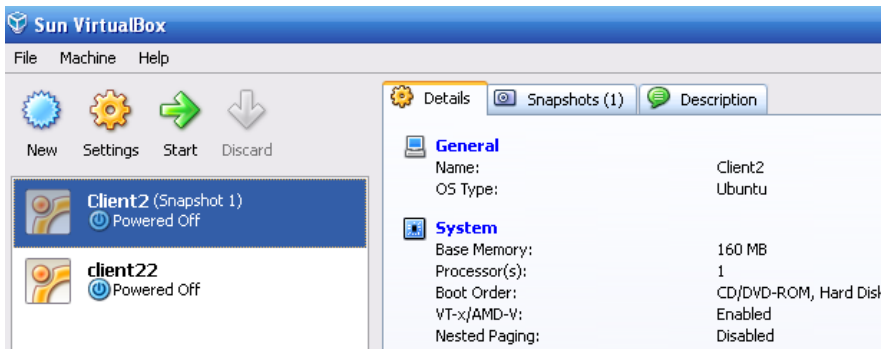


For convenience, you may want to add Terminal to your panel (the bar at the top of the screen) so you can access it with one click – by clicking on the icon – instead of finding it in the Applications menu every time you need to enter a command.



Lab 1

VirtualBox Installation

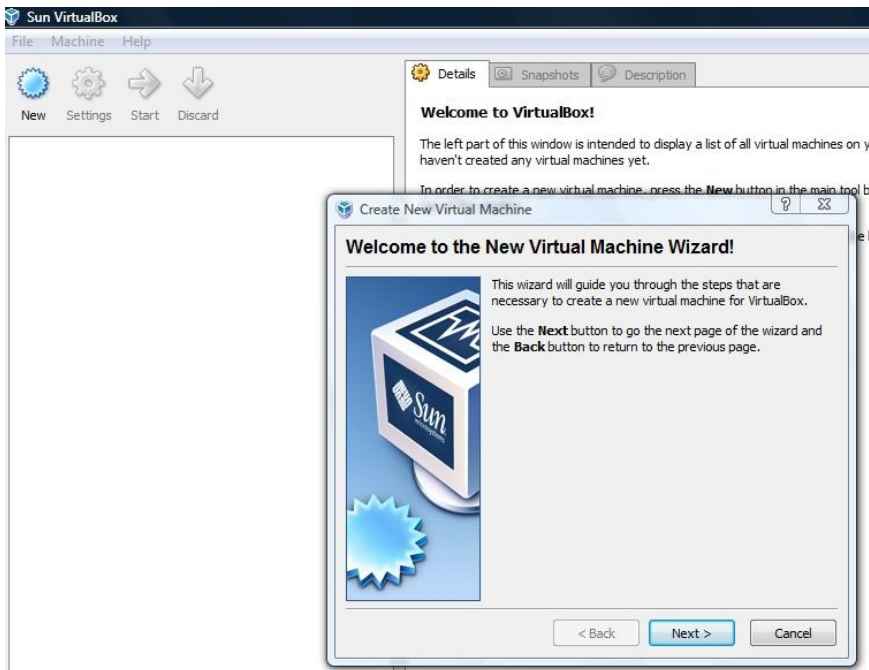


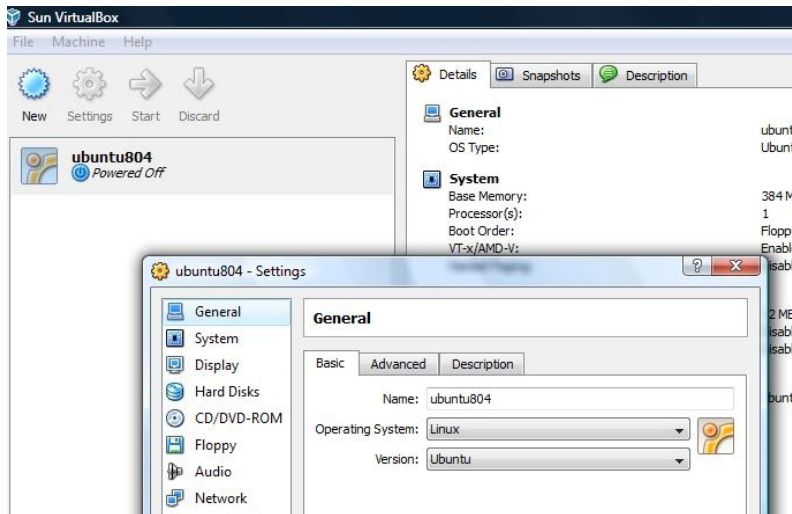
Objective

Virtualization uses software to emulate the functions of a computer. The main or "host" computer runs the virtualization software, which in turn runs a "guest" operating system. Think of it as a computer within a computer. This technique is useful for running multiple operating systems (a Windows host with a Linux guest) as well as for development, since the host PC is protected from OS crashes on the guest. In this lab, you will install Sun's virtualization product called Virtual Box.

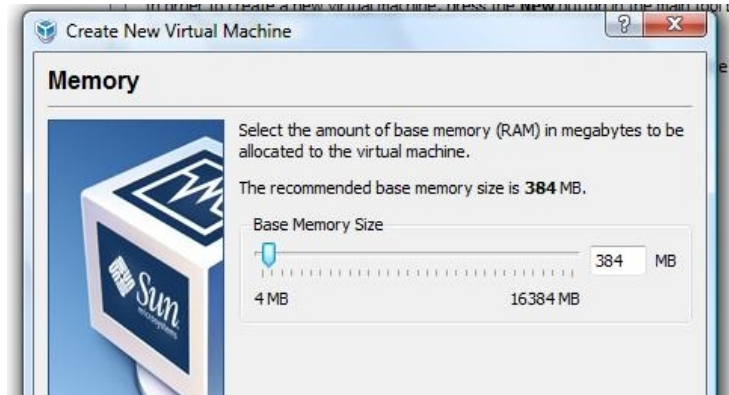
Procedure

- (1) Download the Windows version of Sun Virtual Box from the Sun or CNEE website as directed and install it on your PC.
- (2) Create a virtual machine to be used as a server for your labs, referring to the details in the following screen shots as required.

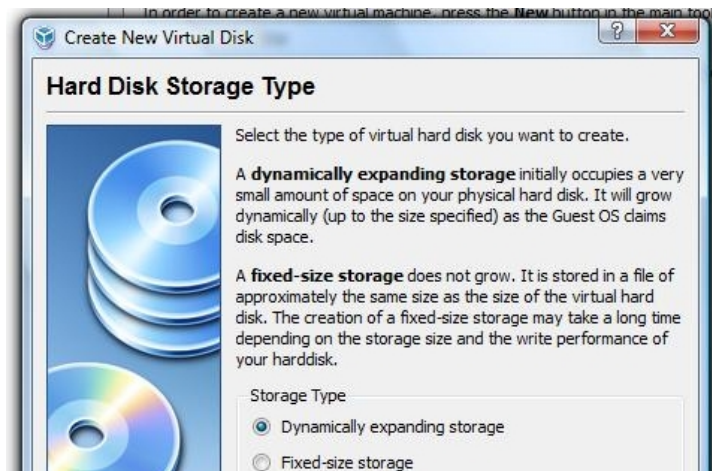




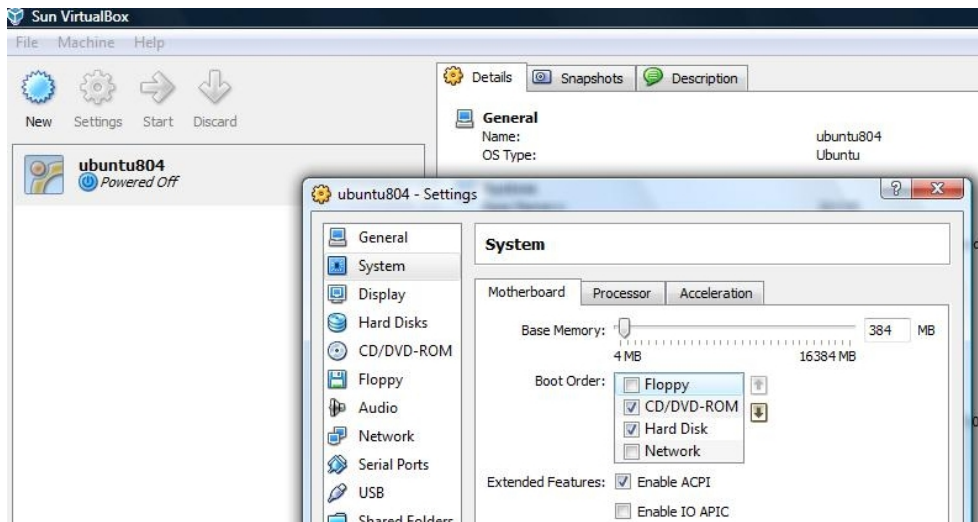
Linux operating system



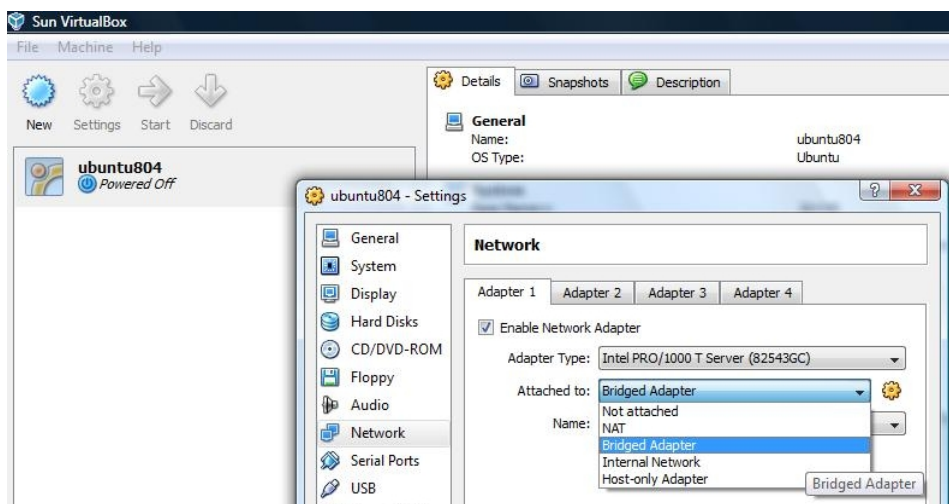
384M memory



Dynamic hard drive

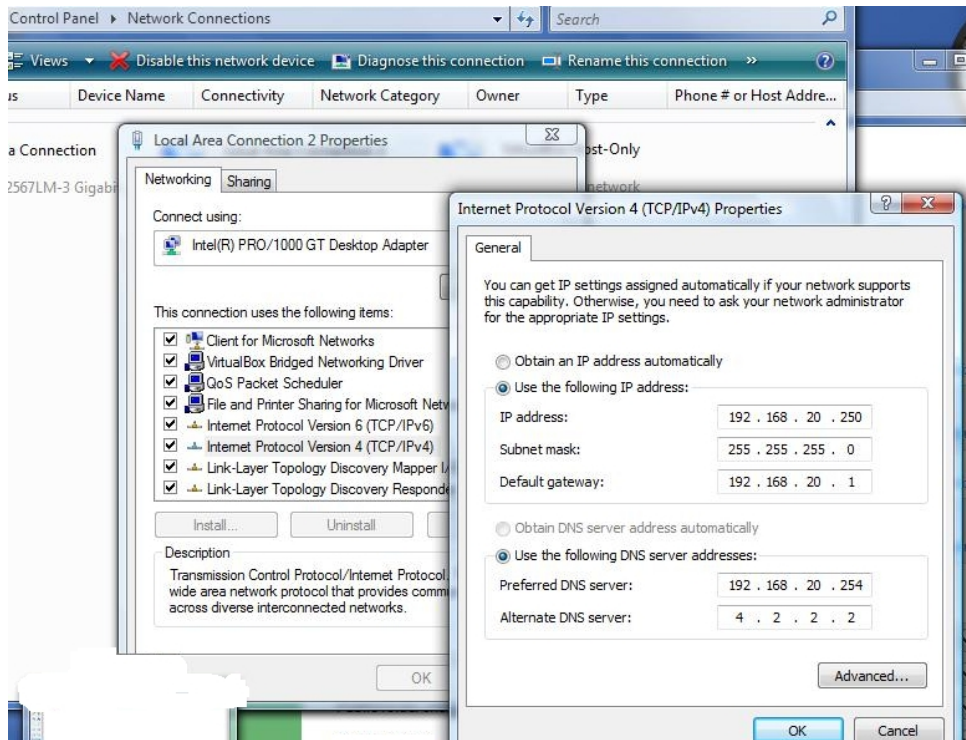


Boot from CD or hard drive



Network adapter in bridged mode

(3) After you've finished creating your virtual machine, you need to set up the network card on your Windows host PC.



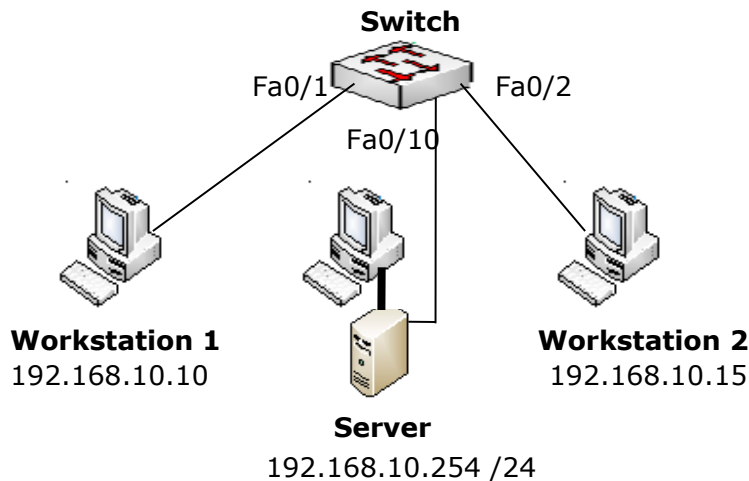
(a) Select the network connection associated with the CNEE Lab (not Internet).

(b) Choose a fixed network address which will be part of your workgroup's network but will not conflict with your DHCP range or other addresses. For example, if you group's network will be 192.168.20.0 /24, you might

- Assign 192.168.20.250 to the network card
- Assign 192.168.20.254 as a fixed address for your virtual server
- Assign 192.168.20.20 - 192.168.20.30 as a DHCP pool on your server

Lab 2

Installing Ubuntu

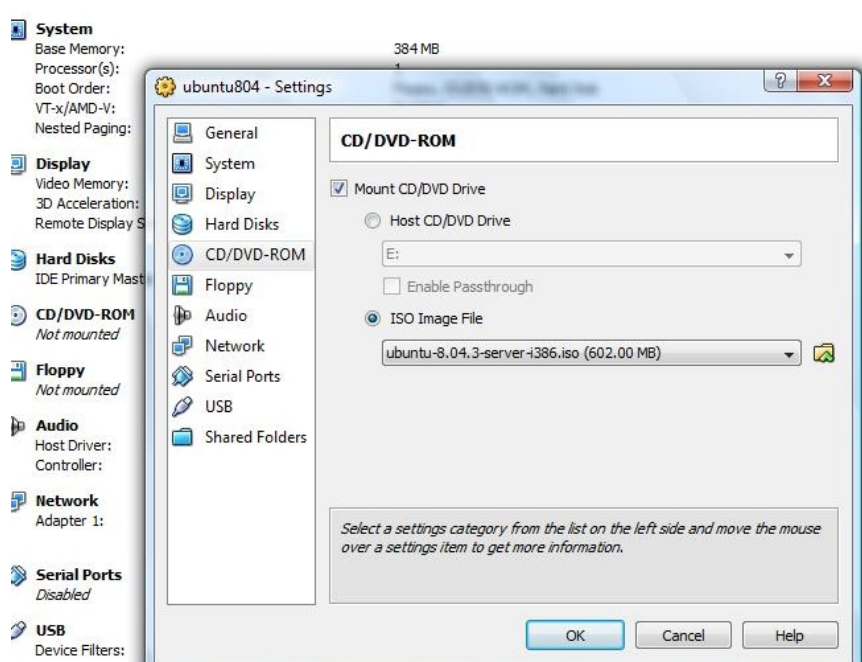


Objective

- (1) Install Ubuntu Server in Virtual Box on one of your work group's PCs.
- (2) Install Ubuntu Workstation in Virtual Box on one or more of your work group's PCs.

Procedure

- (1) Open the Virtual Box machine on the PC designated as your work group's server.
- (2) Mount the CD and select either a drive or an ISO image containing the Ubuntu Server installation file as shown below.
- (3) During the installation, enable the network on your host PC which has Internet access and disable access to the CNEE Lab network.



(3) After making sure that it is set up to boot from the location containing the Ubuntu installation file, start the virtual machine. Proceed with the server installation, referring to the screenshots below as required.



[!!] Configure the network

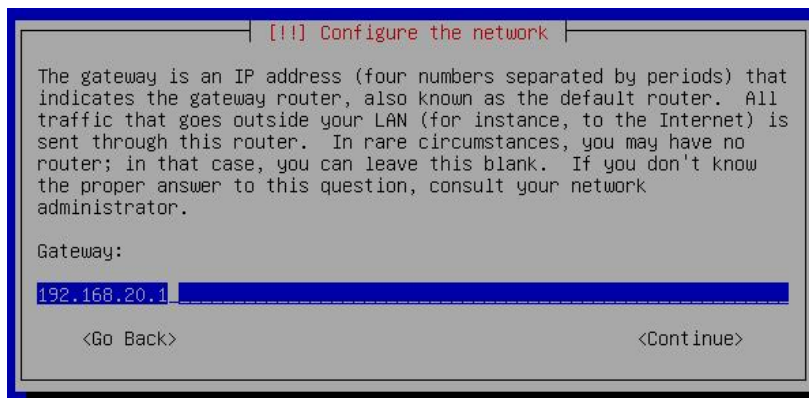
The IP address is unique to your computer and consists of four numbers separated by periods. If you don't know what to use here, consult your network administrator.

IP address:

192.168.20.254

<Go Back> <Continue>

Enter addresses and names within your group's assigned network.



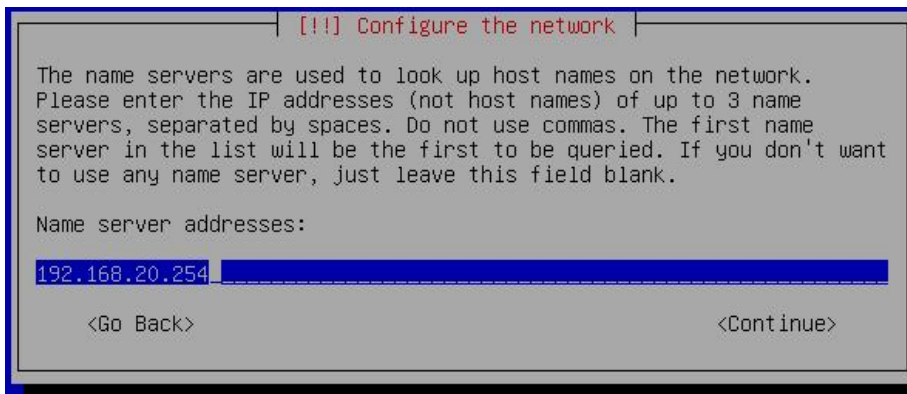
[!!] Configure the network

The gateway is an IP address (four numbers separated by periods) that indicates the gateway router, also known as the default router. All traffic that goes outside your LAN (for instance, to the Internet) is sent through this router. In rare circumstances, you may have no router; in that case, you can leave this blank. If you don't know the proper answer to this question, consult your network administrator.

Gateway:

192.168.20.1

<Go Back> <Continue>



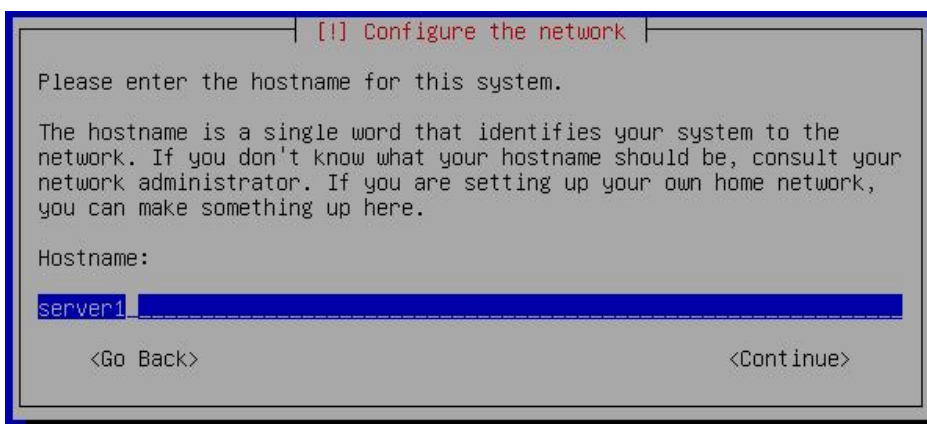
[!!] Configure the network

The name servers are used to look up host names on the network. Please enter the IP addresses (not host names) of up to 3 name servers, separated by spaces. Do not use commas. The first name server in the list will be the first to be queried. If you don't want to use any name server, just leave this field blank.

Name server addresses:

192.168.20.254

<Go Back> <Continue>



[!] Configure the network

Please enter the hostname for this system.

The hostname is a single word that identifies your system to the network. If you don't know what your hostname should be, consult your network administrator. If you are setting up your own home network, you can make something up here.

Hostname:

server1

<Go Back> <Continue>

[[!]] Configure the network

The domain name is the part of your Internet address to the right of your host name. It is often something that ends in .com, .net, .edu, or .org. If you are setting up a home network, you can make something up, but make sure you use the same domain name on all your computers.

Domain name:

ubuntulab.com

<Go Back> <Continue>

Partition your virtual drive

[[!]] Partition disks

The installer can guide you through partitioning a disk (using different standard schemes) or, if you prefer, you can do it manually. With guided partitioning you will still have a chance later to review and customise the results.

If you choose guided partitioning for an entire disk, you will next be asked which disk should be used.

Partitioning method:

- Guided - resize SCSI1 (0,0,0), partition #1 (sda) and use freed s
- Guided - use entire disk**
- Guided - use entire disk and set up LVM
- Guided - use entire disk and set up encrypted LVM
- Manual

<Go Back>

User accounts and passwords

[[!]] Set up users and passwords

A user account will be created for you to use instead of the root account for non-administrative activities.

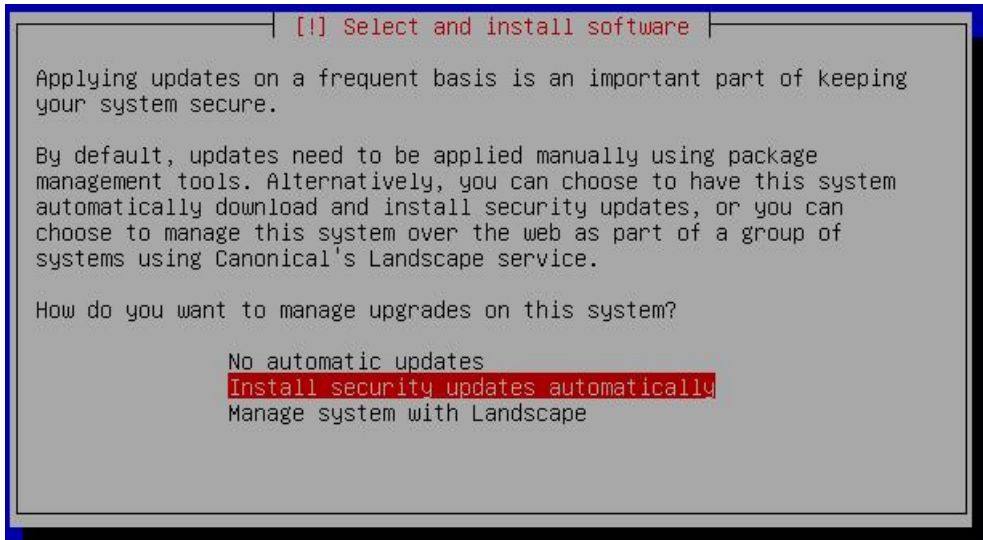
Please enter the real name of this user. This information will be used for instance as default origin for emails sent by this user as well as any program which displays or uses the user's real name. Your full name is a reasonable choice.

Full name for the new user:

server1

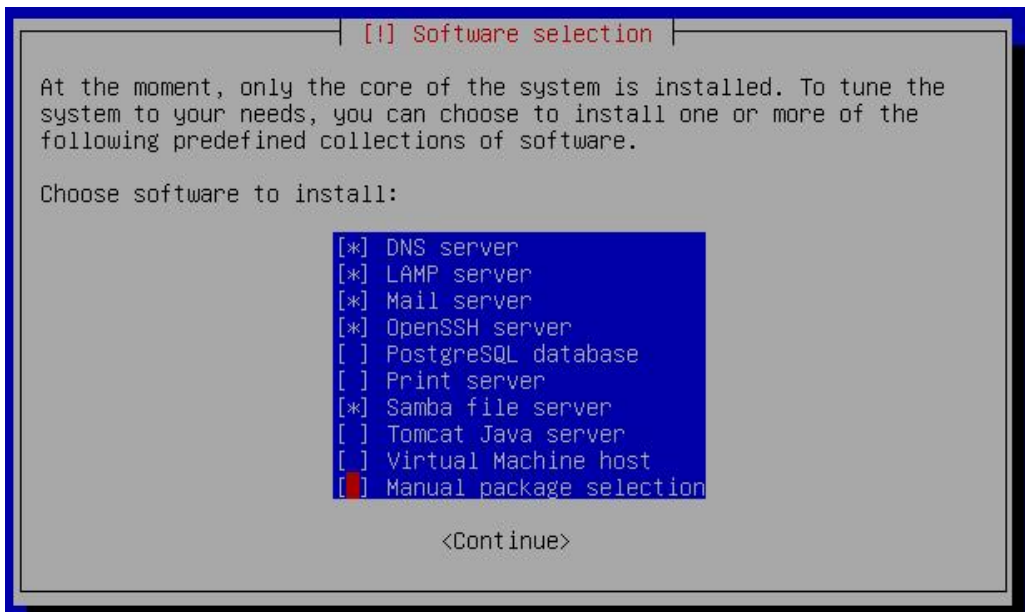
<Go Back> <Continue>

Internet access can provide automatic updates



Use the up and down arrows on your keyboard to navigate to the various options. Press <spacebar> to select the highlighted option, and <tab> to move to the next section.

Select these packages for installation



Mail server configuration

[!] Postfix Configuration

Please select the mail server configuration type that best meets your needs.

No configuration:
Should be chosen to leave the current configuration unchanged.

Internet site:
Mail is sent and received directly using SMTP.

Internet with smarthost:
Mail is received directly using SMTP or by running a utility such as fetchmail. Outgoing mail is sent using a smarthost.

Satellite system:
All mail is sent to another machine, called a 'smarthost', for delivery.

Local only:
The only delivered mail is the mail for local users. There is no network.

General type of mail configuration:

No configuration

Internet Site

[!] Postfix Configuration

The "mail name" is the domain name used to "qualify" _ALL_ mail addresses without a domain name. This includes mail to and from <root>: please do not make your machine send out mail from root@example.org unless root@example.org has told you to.

This name will also be used by other programs. It should be the single, fully qualified domain name (FQDN).

Thus, if a mail address on the local host is foo@example.org, the correct value for this option would be example.org.

System mail name:

server1.ubuntulab.com

<Continue>

Proceed with the remainder of the installation and reboot as directed.

Installing the Ubuntu Desktop GUI

- a. Reboot your virtual server and log in.
- b. Confirm that your server has Internet access by pinging a known site, such as the Verizon server at 4.2.2.2.
- c. Enter
`sudo apt-get install ubuntu-desktop`
as shown below.

```
Ubuntu 9.04 server1 tty1

server1 login: server1
Password:
Added user server1.

Linux server1 2.6.28-11-generic #42-Ubuntu SMP Fri Apr 17 01:57:59 UTC 2009

The programs included with the Ubuntu system are free software;
the exact distribution terms for each program are described in the
individual files in /usr/share/doc/*/copyright.

Ubuntu comes with ABSOLUTELY NO WARRANTY, to the extent permitted by
applicable law.

To access official Ubuntu documentation, please visit:
http://help.ubuntu.com/
To run a command as administrator (user "root"), use "sudo <command>".
See "man sudo_root" for details.

server1@server1:~$ sudo apt-get install ubuntu-desktop_
```

- d. Once the GUI has finished installing enter
`startx`
to start Ubuntu Desktop.

```
Setting up totem (2.26.1-0ubuntu5) ...
Setting up totem-mozilla (2.26.1-0ubuntu5) ...
Setting up tsclient (0.150-1ubuntu6) ...

Setting up update-notifier (0.76.7) ...

Setting up ubuntu-desktop (1.140) ...
Setting up vinagre (2.26.1-0ubuntu1) ...

Setting up vino (2.26.1-0ubuntu1) ...

Setting up evolution-documentation-en (2.26.1-0ubuntu2) ...

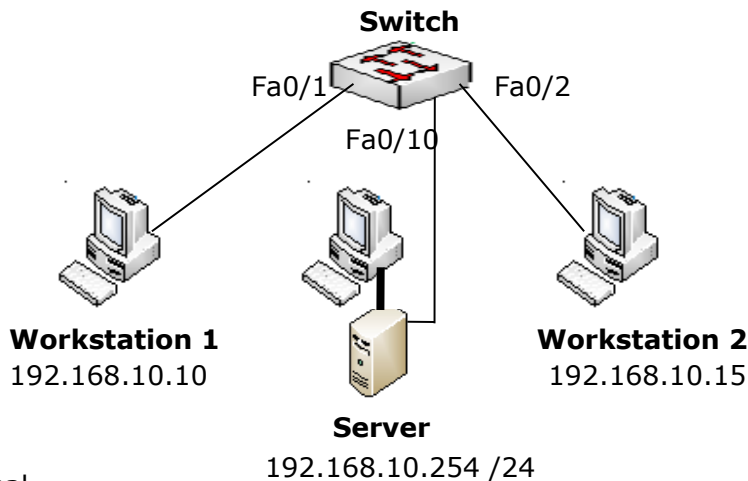
Setting up evolution-indicator (0.1.13-0ubuntu1) ...

Setting up gnome-pilot (2.0.17-0ubuntu1) ...

Setting up gnome-pilot-conduits (2.0.15-1.2) ...
Processing triggers for libc6 ...
ldconfig deferred processing now taking place
Processing triggers for python-support ...
Processing triggers for initramfs-tools ...
update-initramfs: Generating /boot/initrd.img-2.6.28-11-generic
server1@server1:~$ startx_
```

- e. Once you've successfully installed Ubuntu Desktop, your server will automatically boot into the GUI from now on.

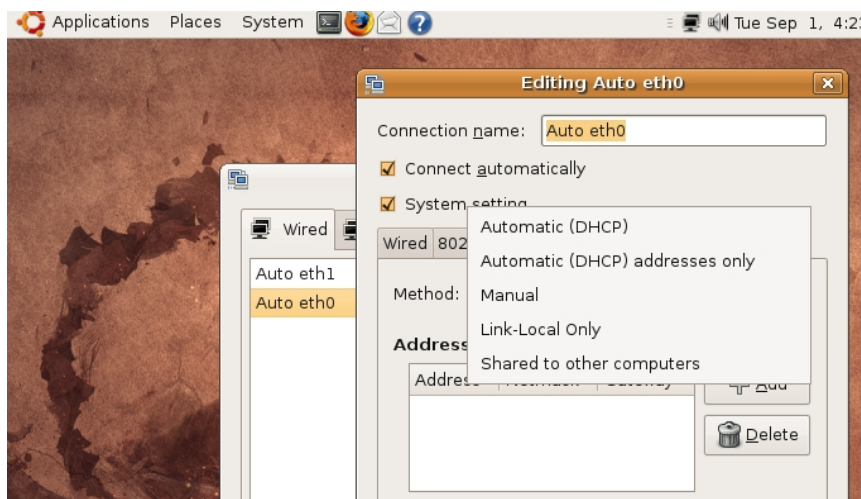
(4) Following the same procedure you used to install Ubuntu Server, install Ubuntu Workstation in Virtual Box on one or more of your other work group's PCs as directed. (You won't see the menus for installation of DNS, DHCP, or other services, but otherwise the Workstation installation will be very similar to that of the Server.)



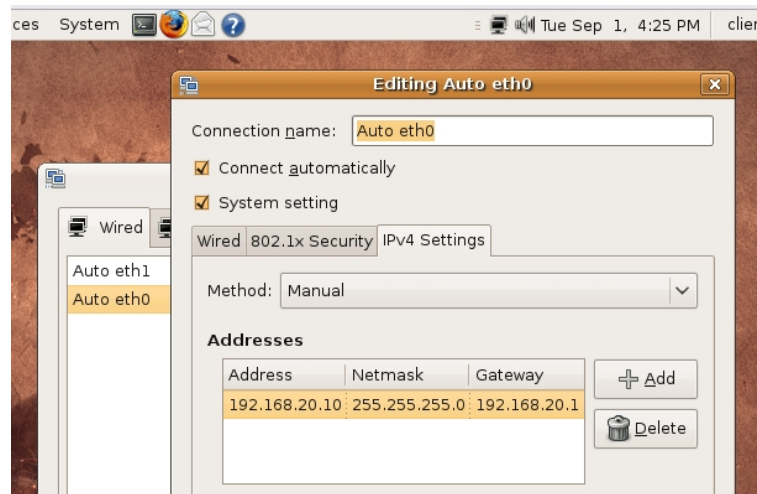
Optional

- (5) After installing Ubuntu Server and Workstation on your group's PCs
- On each PC, disable the network associated with Internet access and enable the CNEE Lab network.
 - Make sure that the Virtual Box network adapter for each machine is in the Bridged mode.
 - Use the Ubuntu GUI menu to assign fixed IP network addresses within your assigned network as shown in the screen shots below.

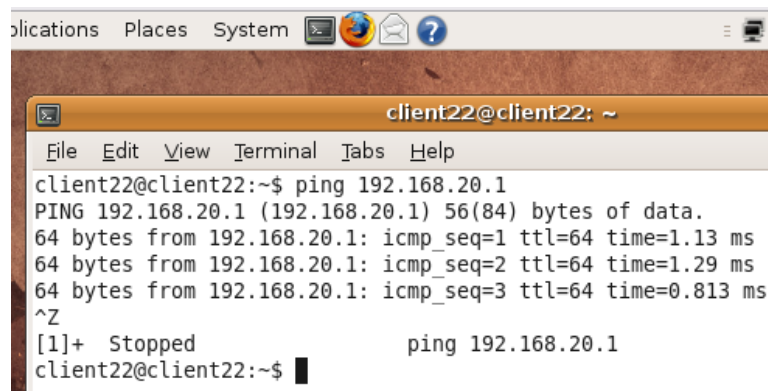




d. Select "Manual", followed by "+Add".



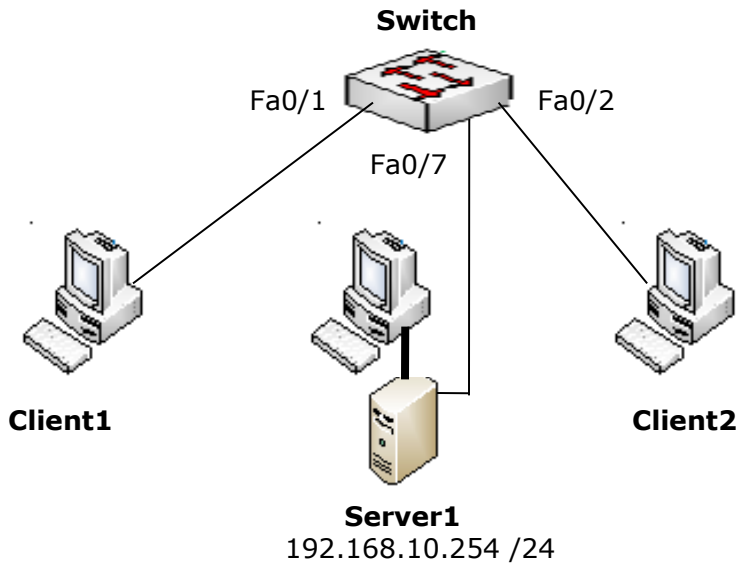
e. Enter your IP address, netmask, and gateway.



f. Use `ping` to verify connectivity among network members. To do so, open a terminal window and ping one of the other virtual machines on your network. (Unlike Windows, Linux pings continuously once started. You can stop the ping process by pressing `Control Z`).

Lab 3

DHCP Server



Objective

Learn how to configure `dhcp3`, a DHCP server.

What is DHCP?

Dynamic Host Control Protocol, or DHCP, allows IP addresses on the local network to be assigned dynamically, which means that a computer's IP can change over time (as opposed to being static, or fixed). The amount of time a host computer retains its IP address is determined by the duration of its *lease*, which is set by a DHCP server. DHCP is extremely popular largely because it provides a way to automatically assign IP addresses to hosts. If you can access the internet as soon as your computer starts without ever having to manually specify your IP address, chances are you're using DHCP. Many home "routers", such as those made by Linksys, Netgear, and D-Link, act as DHCP servers for added convenience. Sometimes we want Linux computers to act as DHCP servers, which is just what we'll be configuring today.

Procedure

- (1) Connect the network as shown in the above diagram.
- (2) Configure Server1 by running

```
sudo nano /etc/network/interfaces
```

and editing the file till it matches the following:

```
auto lo
iface lo inet loopback

auto eth0
iface eth0 inet static
    address 192.168.10.254
    netmask 255.255.255.0
    network 192.168.10.0
    broadcast 192.168.10.255
    gateway 192.168.10.1
```

Explanation:

auto eth0	Ensures that eth0 will be initialized at system startup
iface eth0 inet static	Says we're giving interface eth0 a static IP
address 192.168.10.254	Sets local IP
netmask 255.255.255.0	Sets network mask
network 192.168.10.0	Sets local network
broadcast 192.168.10.255	Specifies broadcast address
gateway 192.168.10.1	Specifies gateway to internet

Now run

```
sudo /etc/init.d/networking restart
```

to restart and reconfigure Server1's network interfaces using the information provided by the files we have just modified. To ensure your IP is 192.168.10.254, run

```
ifconfig eth0
```

(3) Now that the interfaces are set up properly, let's configure dhcp3, the DHCP server. (Make sure it's installed by running `sudo apt-get install dhcp3-server`.) dhcp3's configuration file is located at `/etc/dhcp3/dhcpd.conf`. Configure dhcp3 on Server1 by running

```
sudo nano /etc/dhcp3/dhcpd.conf
```

and adding the following text to the end of the file:

```
subnet 192.168.10.0 netmask 255.255.255.0 {
    range 192.168.10.20 192.168.10.30;
    option routers 192.168.10.1;
    option domain-name-servers 192.168.10.254;
}
```

Explanation:

`subnet 192.168.10.0 netmask 255.255.255.0` Specifies local subnet and network mask

`range 192.168.10.20 192.168.10.30;` Specifies DHCP IP pool

`option routers 192.168.10.1;` Specifies IP of network router,
which is often also your gateway

`option domain-name-servers 192.168.10.254;` Specifies local IP of DNS server

(4) After saving the file with your additions, reload DHCP by entering

```
sudo service dhcp3-server restart
```

You should see the service stop and then restart with no error messages.
If errors occur, check the files just edited for typos.

(5) Next, open a terminal in one of your client workstations and enter

```
sudo dhclient eth0
```

You should see something like the following as the workstation requests and obtains an IP address from the DHCP server.

```
client1@client1:~$ sudo dhclient eth0
[sudo] password for client1:
...
DHCPDISCOVER on eth0 to 255.255.255.255 port 67 interval 8
DHCPOFFER of 192.168.10.20 from 192.168.10.254
DHCPREQUEST of 192.168.10.20 on eth0 to 255.255.255.255 port 67
DHCPACK of 192.168.10.20 from 192.168.10.254
bound to 192.168.10.20 -- renewal in 281 seconds.
```


(6) Now open a terminal in your next client workstation and again enter

```
sudo dhclient
```

You should see the DHCP process assign the next available pool address to this workstation.

(7) The DHCP server stores its lease information in the file in
/var/lib/dhcp3/dhcpd.leases. Run

```
cat /var/lib/dhcp3/dhcpd.leases
```

to observe the leases which have been issued to your workstations. You should see something similar to the example below.

Example

```
server1@server1:/var/lib/dhcp3$ cat dhcpd.leases
```

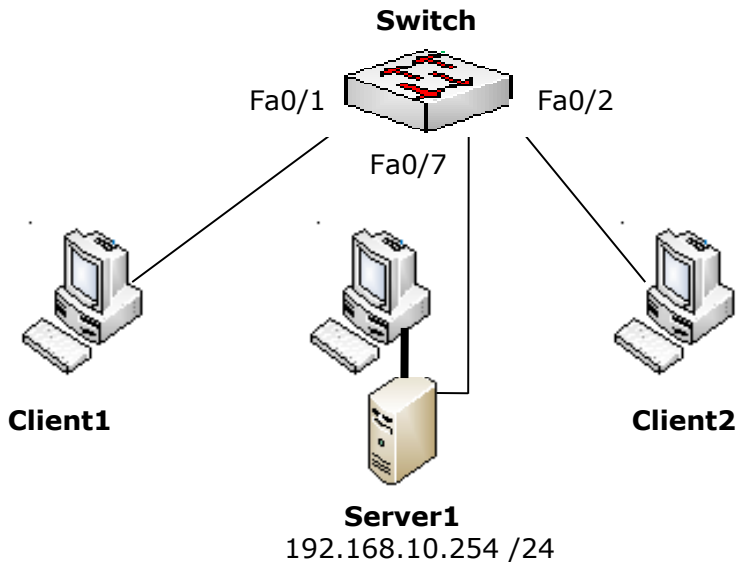
```
# The format of this file is documented in the dhcpd.leases(5) manual page.  
# This lease file was written by isc-dhcp-V3.1.1
```

```
lease 192.168.10.21 {  
    starts 4 2009/08/27 17:02:06;  
    ends 4 2009/08/27 17:12:06;  
    tstp 4 2009/08/27 17:12:06;  
    cltt 4 2009/08/27 17:02:06;  
    binding state active;  
    next binding state free;  
    hardware ethernet 08:00:27:c1:39:69;  
    client-hostname "client2";  
}
```

```
lease 192.168.10.20 {  
    starts 4 2009/08/27 17:02:43;  
    ends 4 2009/08/27 17:12:43;  
    tstp 4 2009/08/27 17:12:43;  
    cltt 4 2009/08/27 17:02:43;  
    binding state active;  
    next binding state free;  
    hardware ethernet 08:00:27:d0:0a:84;  
    client-hostname "client1";
```

Lab 4

DNS Server



Objective

Learn how to configure a DNS server.

What is DNS ?

Domain Name Service, or DNS, allows IP addresses in the familiar alphanumeric form such as `http://www.ubuntulab.com` to be converted or "resolved" to a routable numeric address like `192.168.10.254`. A DNS server with first hand knowledge of a given network's names and addresses is said to be "authoritative" over its "zone". In this lab you will configure the Linux DNS service, known as `bind9`, to create an authoritative server for the computers in your work group.

Procedure

- (1) Connect the network as shown in the above diagram.
- (2) Ensure that Clients 1 and 2 have received DHCP addresses and that all computers in your workgroup can ping each other by numeric IP address.
- (3) If you haven't already done so, install the `bind9` and DNS utilities on the server by entering

```
sudo apt-get install bind9 dnsutils
```

- (4) Next, configure the server's host name:

```
echo "server1.ubuntulab.com" > /etc/hostname
```

(5) Now edit `/etc/hosts` as follows:

```
127.0.0.1 localhost.localdomain localhost
192.168.10.254 server1.ubuntulab.com server1

# The following lines are desirable for IPv6 capable hosts
::1 ip6-localhost ip6-loopback
fe00::0 ip6-localnet
ff00::0 ip6-mcastprefix
ff02::1 ip6-allnodes
ff02::2 ip6-allrouters
ff02::3 ip6-allhosts
```

(6) and `/etc/resolv.conf`

```
search ubuntulab.com
nameserver 192.168.10.254
```

(7) Next edit `/etc/bind/named.conf.local` to include your forward and reverse lookup information:

```
//
// Do any local configuration here
//
// Consider adding the 1918 zones here, if they are not used in your
// organization
//include "/etc/bind/zones.rfc1918";

zone "ubuntulab.com" {
type master;
file "db.ubuntulab.com";
};

zone "10.168.192.in-addr.arpa" {
type master;
file "db.192.168.10";
};
```

(8) Now create the forward zone file `/var/cache/bind/db.ubuntulab.com` and edit it as follows. (Remember to increment the serial number each time you update this file.)

```
$TTL 604800
@ IN SOA server1.ubuntulab.com. root.ubuntulab.com. (
6 ;serial
04800 ;refresh
86400 ;retry
2419200 ;expire
604800 ;negative cache TTL
)
@ IN NS server.ubuntulab.com.
@ IN A 192.168.10.254
server1 IN A 192.168.10.254
www IN CNAME server1
```

(9) Then create the reverse zone lookup file `/var/cache/bind/db.192.168.10`

```
$TTL 604800
@ IN SOA server1.ubuntulab.com. root.ubuntulab.com. (
6                ;serial
604800           ;refresh
86400            ;retry
2419200          ;expire
604800           ;negative cache TTL
)
@      IN      NS      server1.ubuntulab.com.
@      IN      A       192.168.10.254
254    IN      PTR     server1.ubuntulab.com.
```

Comments:

*(a) The 254 in the last line is the last octet of your DNS server's IP address (192.168.10.**254** in this example).*

(b) Remember to increment the serial number each time you update this file and all other configuration files that contain the word "serial".

(10) Next make sure that your DHCP server is including the address of the DNS server(s) each time it hands out an address. For this example, `/etc/dhcp3/dhcpd.conf` would include:

```
subnet 192.168.10.0 netmask 255.255.255.0 {
    range 192.168.10.25 192.168.10.35;
    option routers 192.168.10.1;
    option domain-name-servers 192.168.10.254;
    option domain-name "ubuntulab.com";
}
```

(11) Now, for those clients and servers which have static IP addresses and don't interact with DHCP, edit their `/etc/resolv.conf` file as follows:

```
# Generated by NetworkManager

search ubuntulab.com
nameserver 127.0.0.1
nameserver 192.168.20.254
```

Comment: In this case, use the word "nameserver" as shown. Don't replace it with your server's info.

(12) Now restart the DHCP and DNS servers:

```
sudo service dhcp3-server restart
sudo service bind9 restart
```

On those clients using DHCP, restart this function by entering

```
sudo dhclient
```

and confirming that an address has been received from the server.

(13) You should now be able to use the nslookup function from one of your network clients to confirm that DNS is working:

```
client2@client2:~$ nslookup ubuntulab.com

Server:                192.168.10.254
Address:                192.168.10.254#53
Name:                   ubuntulab.com
Address:                192.168.10.254
client22@client22:~$ nslookup 192.168.10.254
Server:                192.168.10.254
Address:                192.168.10.254#53
```

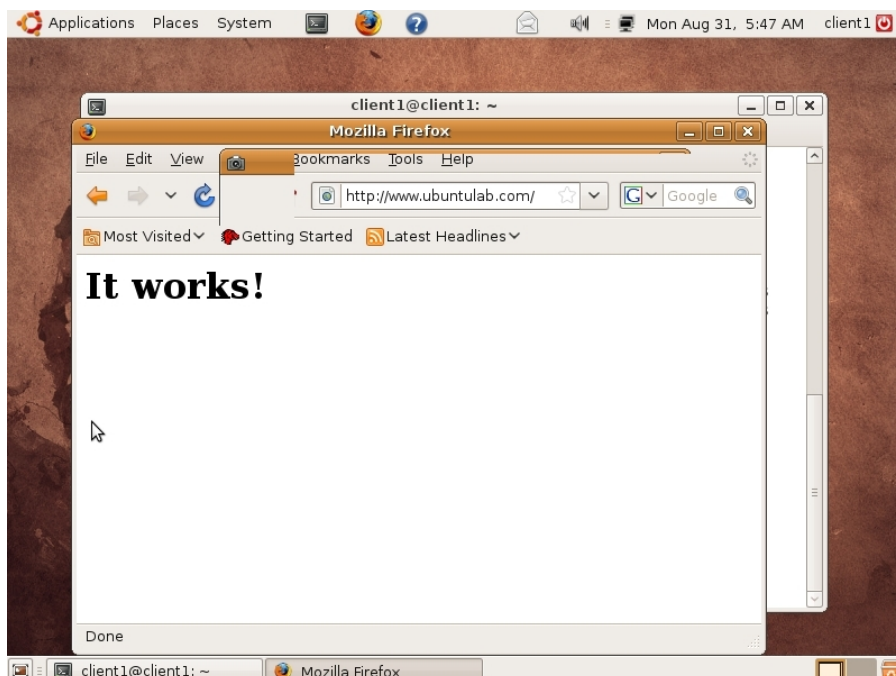
```
254.10.168.192.in-addr.arpa name = server.ubuntulab.com.
```

and check the resolv.conf file on the DHCP clients to make sure that they have received the correct information:

```
client2@client2:/etc$ cat resolv.conf
domain ubuntulab.com
search ubuntulab.com
nameserver 192.168.10.254

nameserver 192.168.20.254
```

(14) The server should now respond when pinged by name (server1.ubuntulab.com). If you have installed the Apache package on the web server, open Mozilla web browser in one of the clients and enter `http://www.ubuntulab.com`. You should see a display similar to the one below.



(15) Although you can now ping your server by name, you won't be able to ping by name those clients which have received their address via DHCP. You can fix this problem by installing dynamic dns.

(16) Begin by changing the owner of `/var/cache/bind` to `user:bind` and `group:bind`.

```
chown bind. /var/cache/bind
```

(17) Next edit the file `/etc/bind/named.conf.local` as shown:

```
//
// Do any local configuration here
//
// Consider adding the 1918 zones here, if they are not used in your
// organization
// include "/etc/bind/zones.rfc1918";

include "/etc/dhcp3/rndc.key";
controls {
inet 127.0.0.1 allow { localhost; } keys { "rndc-key"; };
};

zone "ubuntulab.com" {
type master;
file "db.ubuntulab.com";
allow-update { key "rndc-key"; };
};

zone "10.168.192.in-addr.arpa" {
type master;
file "db.192.168.10";
allow-update { key "rndc-key"; };
};
```

(18) Assuming your server's interface is `"eth0"`, edit the file `/etc/default/dhcp3-server` as follows:

```
# Defaults for dhcp initscript
# sourced by /etc/init.d/dhcp
# installed at /etc/default/dhcp3-server by the maintainer scripts
#
# This is a POSIX shell fragment
#
# On what interfaces should the DHCP server (dhcpd) serve DHCP requests?
# Separate multiple interfaces with spaces, e.g. "eth0 eth1".
INTERFACES="eth0"
```


(19) Now edit `/etc/dhcp3/dhcpd.conf`

```
ddns-update-style interim;
ignore client-updates;

include "/etc/bind/rndc.key";

zone ubuntulab.com. {
    primary 127.0.0.1;
    key "rndc-key";
}
authoritative;

subnet 192.168.10.0 netmask 255.255.255.0 {
    range 192.168.10.25 192.168.10.35;
    option domain-name-servers 192.168.10.254;
    option domain-name "ubuntulab.com";
    option routers 192.168.10.1;
    default-lease-time 600;
    max-lease-time 7200;

    zone server1.ubuntulab.com. {
        primary 192.168.10.254;
        key "rndc-key";
    }

    zone 10.168.192.in-addr.arpa. {
        primary 192.168.10.254;
        key "rndc-key";
    }
}
```

(20) Make a copy of the `rndc` file and place it in the `dhcp3` folder:

```
sudo cp /etc/bind/rndc.key /etc/dhcp3/rndc.key
```

(21) Now restart both the DNS and DHCP servers:

```
sudo service bind9 restart
sudo service dhcp3-server restart
```

You should see both services stop and then restart with no error messages.

(22) Have your client request a new DHCP address by entering

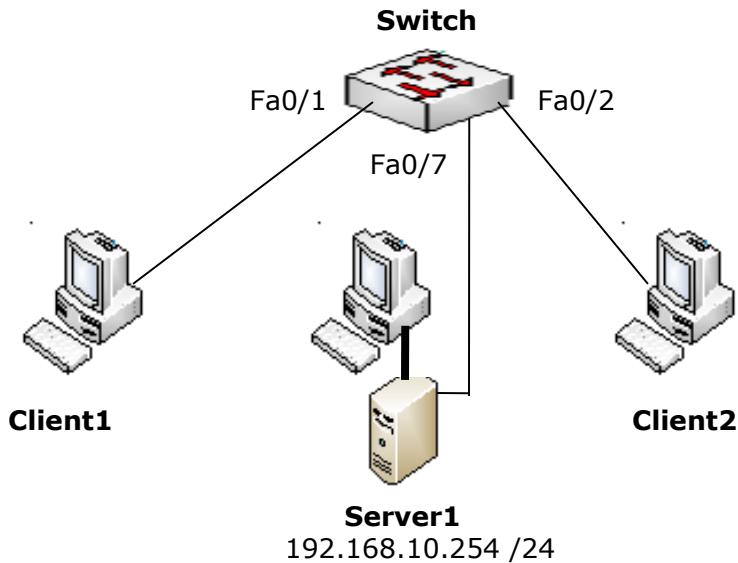
```
sudo dhclient
```

from the client.

(23) Once the new address has been obtained, you will be able to ping the client by FQDN.

Lab 5

FTP Server



Objective

Learn how to configure ProFTPD, an FTP server.

What is FTP?

File Transfer Protocol, or FTP, allows computers to exchange files. This can be done via HTTP, but FTP server software is particularly suited for this task. FTP servers can be either public, in which case they allow users to log in anonymously (or don't require them to log in at all), or they can be private, which means a user name and password are required for use.

Procedure

- (1) Connect the network as shown in the above diagram.
- (2) Once you've installed ProFTPD via the

```
sudo apt-get install proftpd
```

command, configure Server1 by running

```
sudo nano /etc/proftpd/proftpd.conf
```

and editing the config file as follows:

If you want to limit user access to their individual home directories, uncomment

```
# DefaultRoot ~
```

Set ServerName to "Server1".

To allow anonymous access, uncomment the last 40 lines or so till they read as:

```
<Anonymous ~ftp>
User ftp
Group nogroup
# We want clients to be able to login with "anonymous" as well as "ftp"
UserAlias anonymous ftp
# Cosmetic changes, all files belongs to ftp user
DirFakeUser on ftp
DirFakeGroup on ftp

RequireValidShell off

# Limit the maximum number of anonymous logins
MaxClients 10

# We want 'welcome.msg' displayed at login, and '.message' displayed
# in each newly chdired directory.
DisplayLogin welcome.msg
DisplayChdir .message

# Limit WRITE everywhere in the anonymous chroot
<Directory *>
  <Limit WRITE>
    DenyAll
  </Limit>
</Directory>

</Anonymous>
```

This configuration works best when your goal is to distribute files to others but do not want them to be able to upload files to your server.

To create a new user account for FTP login, run

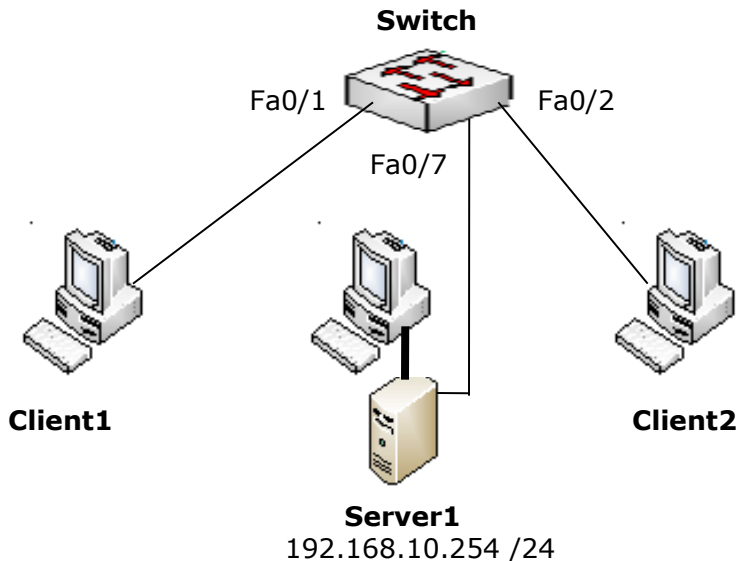
```
sudo adduser ftpuser
```

where "ftpuser" should be the name of the new username.

A word of caution: by today's standards, FTP is extremely insecure because user passwords are sent in plain text; no encryption is used. To securely transfer files from one computer to another, consider using scp (secure copy), which is built into the SSH client and server.

Lab 6

SSH Server



Objective

Learn how to configure SSHD, an SSH server.

What is SSH?

Secure Shell, or SSH, allows users to securely log into a remote computer. It may help to think of SSH as an encrypted version of telnet since, once logged in, the user experience is exactly what it would be if she were logged into a local machine, but without the GUI – it's just like using a computer but with only command line access. SSH can also be used to transfer files via the scp command. Today you will learn how to configure an SSH server so you can allow yourself or others to log into it remotely.

Procedure

(1) Connect the network as shown in the above diagram.

(2) Once you've installed sshd by running the

```
sudo apt-get install openssh-server
```

command, configure Server1 by running

```
sudo nano /etc/ssh/sshd_config
```

and editing the config file as follows:

For security purposes, set

`PermitRootLogin no`

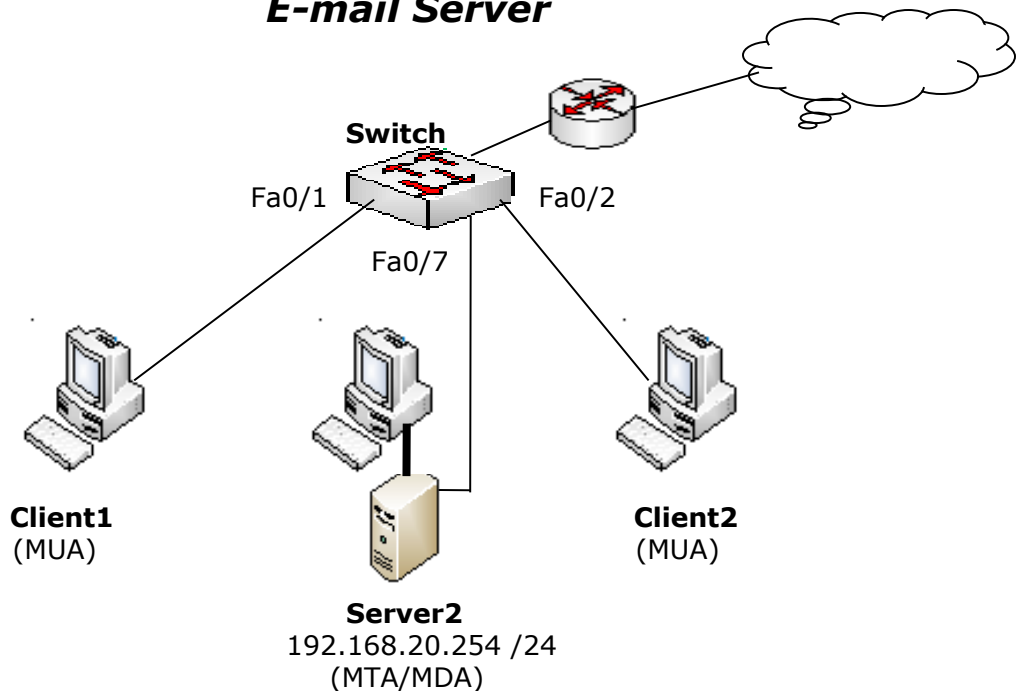
If you ever need to remotely run a command as root, ssh to the server you need to connect to using regular user credentials (and not as root), then use "sudo" as necessary.

If you need to change the default port that sshd runs on, which is sometimes helpful when your server is behind a firewall you'd like to avoid the restrictions of,

`Port 2222`

should do the trick.

Lab 7 E-mail Server



Objective

Learn how to configure a basic e-mail server and e-mail client.

E-mail Building Blocks

MUA - Mail User Agent software is used to download and generate e-mail for a given user account. In this lab, we'll use Evolution as the MUA. Other popular MUAs include Mozilla Thunderbird and Microsoft Outlook.

MDA - The Mail Delivery Agent on the server interacts with individual user accounts to upload and download e-mail. Dovecot will be the MDA for this lab.

MTA - The Mail Transfer Agent routes e-mail to/from other networks and the MDA. We'll use Postfix as the MTA for this lab.

Procedure

(1) During our explanation, we'll use `server2.ubuntulab2.com` at a fixed IP address of `192.168.20.254` as the mail server. Substitute the assigned server name, domain, and IP address for your workgroup during the actual installation.

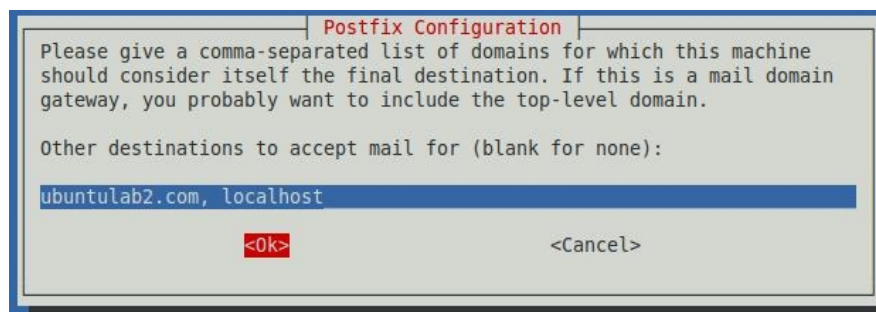
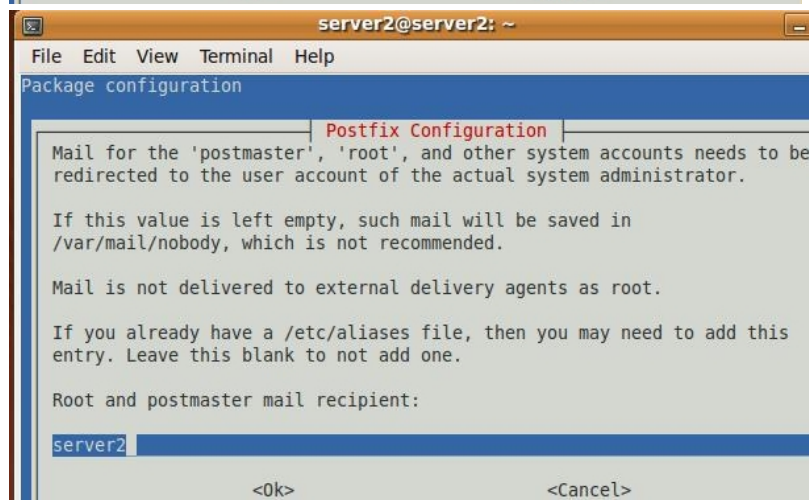
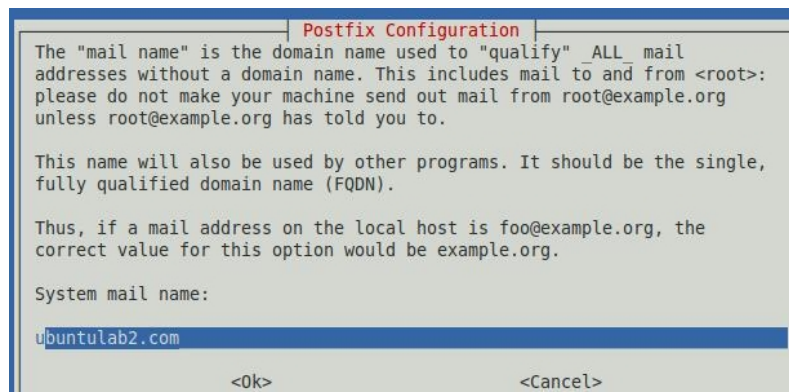
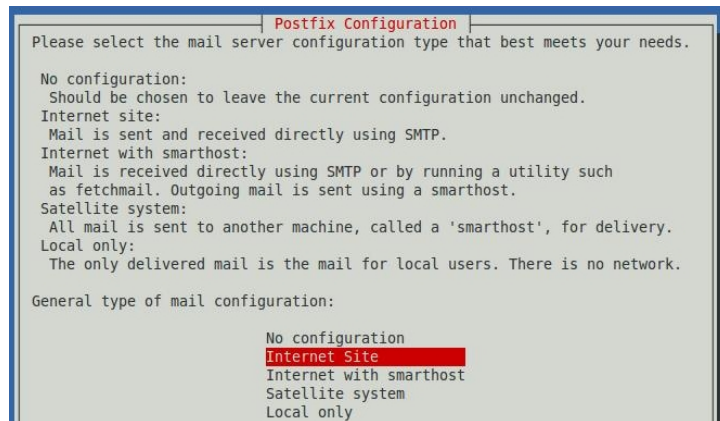
(2) Begin by making sure that Postfix is installed on your server. If not, run

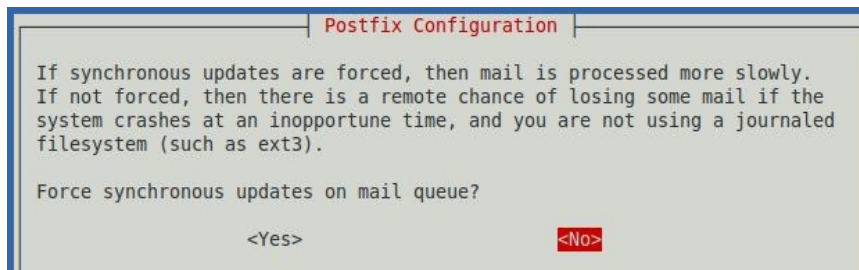
```
sudo apt-get install postfix
```

(3) If Postfix is already installed, it must be reconfigured by entering

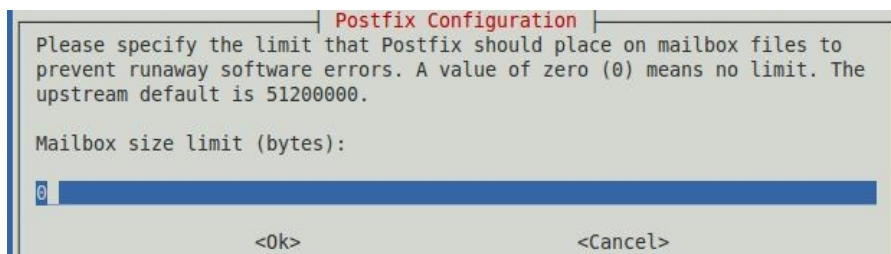
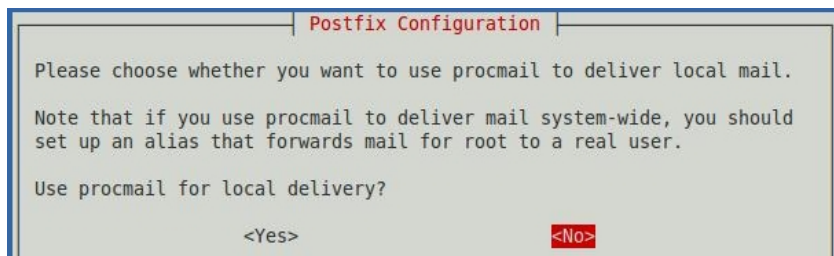
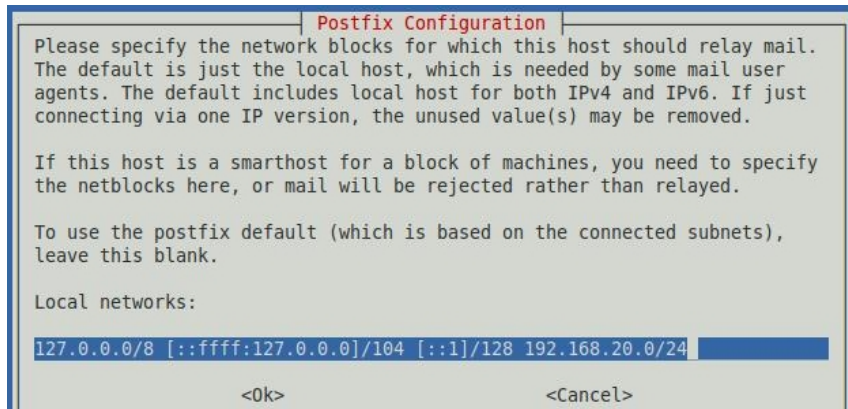
```
sudo dpkg-reconfigure postfix
```

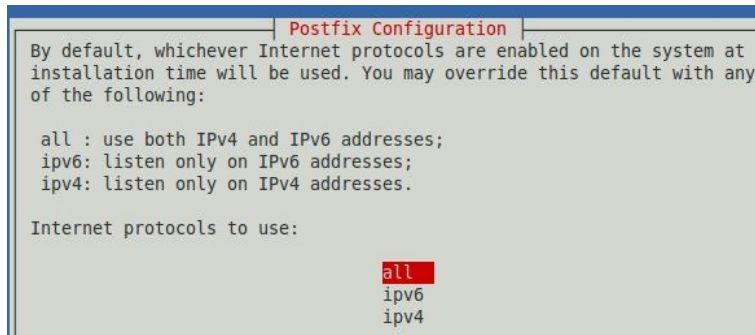
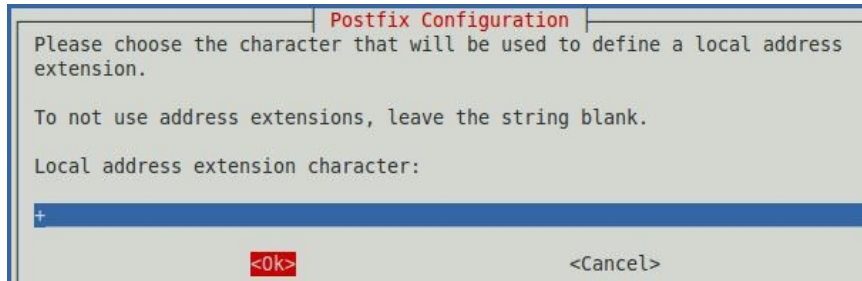

(4) The screen shots below follow the configuration process detailed in the Ubuntu 9.04 Server Guide.



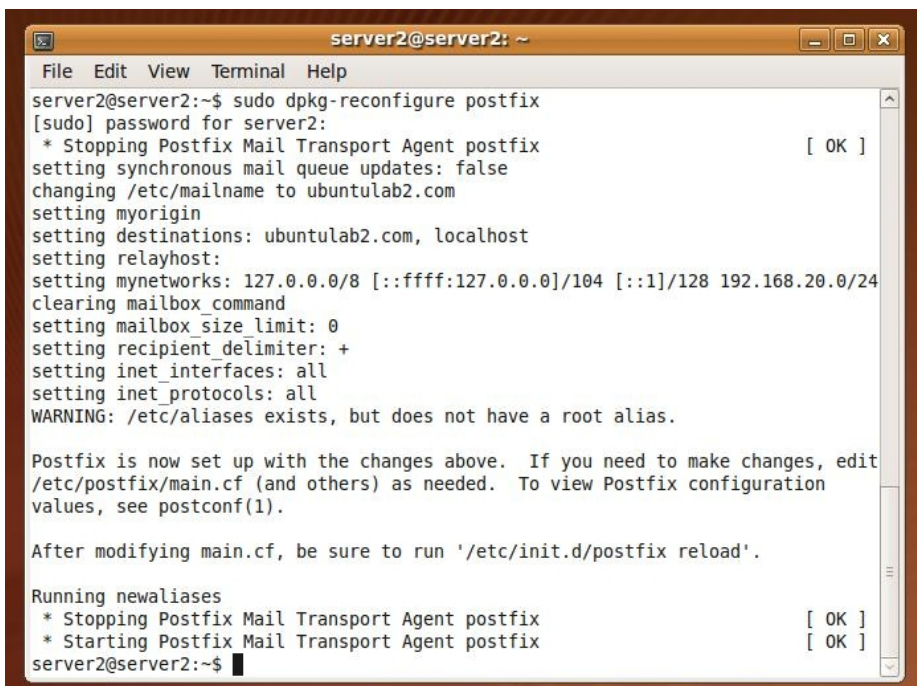


Enter your network's address last (192.168.20.0) , followed by the mask length (/24):



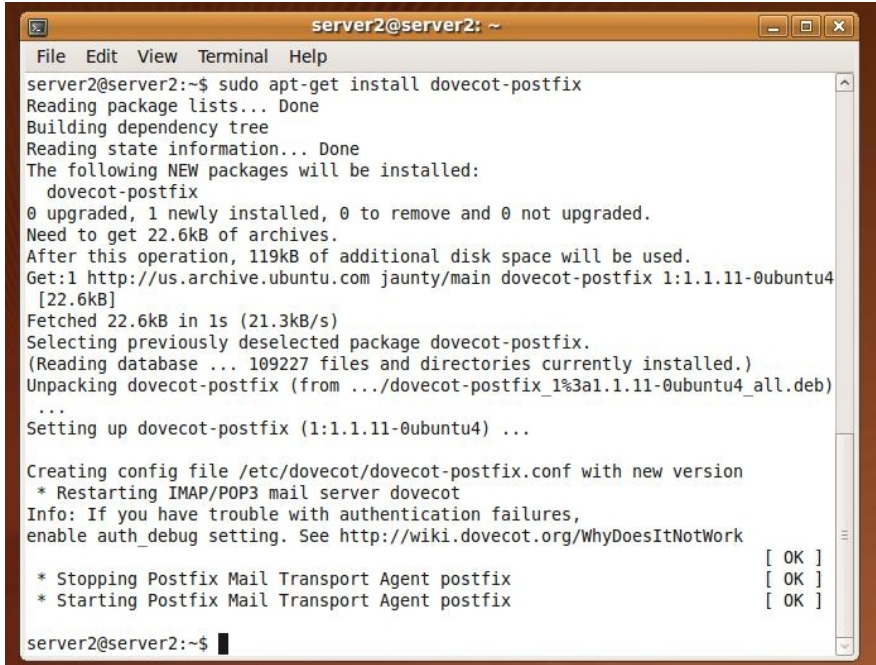


When the Postfix installer exits, your terminal window should appear similar to this one:



- (5) Now install the Dovecot MDA interface with Postfix.

```
sudo apt-get install dovecot-postfix
```

A terminal window titled 'server2@server2: ~' showing the output of the command 'sudo apt-get install dovecot-postfix'. The output includes package lists, dependency tree building, state information, and the installation of dovecot-postfix. It shows that 22.6kB of archives are needed and that the package is selected. The installation process is shown as 'Setting up dovecot-postfix (1:1.1.11-0ubuntu4) ...'. The terminal also shows the creation of a config file and the restarting of the IMAP/POP3 mail server dovecot. Finally, it shows the stopping and starting of the Postfix Mail Transport Agent postfix, with status indicators [OK] for each step.

```
server2@server2:~$ sudo apt-get install dovecot-postfix
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following NEW packages will be installed:
  dovecot-postfix
0 upgraded, 1 newly installed, 0 to remove and 0 not upgraded.
Need to get 22.6kB of archives.
After this operation, 119kB of additional disk space will be used.
Get:1 http://us.archive.ubuntu.com jaunty/main dovecot-postfix 1:1.1.11-0ubuntu4
[22.6kB]
Fetched 22.6kB in 1s (21.3kB/s)
Selecting previously deselected package dovecot-postfix.
(Reading database ... 109227 files and directories currently installed.)
Unpacking dovecot-postfix (from .../dovecot-postfix_1%3a1.1.11-0ubuntu4_all.deb)
...
Setting up dovecot-postfix (1:1.1.11-0ubuntu4) ...

Creating config file /etc/dovecot/dovecot-postfix.conf with new version
* Restarting IMAP/POP3 mail server dovecot
Info: If you have trouble with authentication failures,
enable auth_debug setting. See http://wiki.dovecot.org/WhyDoesItNotWork

* Stopping Postfix Mail Transport Agent postfix      [ OK ]
* Starting Postfix Mail Transport Agent postfix      [ OK ]

server2@server2:~$
```

- (6) Once the installation is complete, restart Postfix

```
sudo /etc/init.d/postfix restart
```

and use telnet to test the server as shown below.

A terminal window titled 'server2@server2: ~' showing the output of the command 'telnet ubuntu1ab2.com 25'. The output shows the connection attempt, the IP address 192.168.20.254, and the connection to ubuntu1ab2.com. The escape character is shown as '^]'. The terminal then shows the SMTP Postfix (Ubuntu) banner.

```
server2@server2:~$ telnet ubuntu1ab2.com 25
Trying 192.168.20.254...
Connected to ubuntu1ab2.com.
Escape character is '^]'.
220 server2.ubuntu1ab2.com ESMTP Postfix (Ubuntu)
```

- (7) Now restart Dovecot

```
sudo /etc/init.d/dovecot restart
```


(8) Next, create a user account and password on the server for each e-mail client. For example, `client2@ubuntulab2.com` would have a user account on `server2` with name `client2` and a password as shown below.



The 'New user account' dialog box is shown with the 'Account' tab selected. It contains sections for 'Basic Settings', 'Contact Information', and 'Password'. The 'Basic Settings' section has fields for 'Username' (client2), 'Real name' (client2), and 'Profile' (Desktop user). The 'Contact Information' section has fields for 'Office location', 'Work phone', and 'Home phone'. The 'Password' section has a radio button for 'Set password by hand' which is selected.

Section	Field	Value
Basic Settings	Username	client2
	Real name	client2
	Profile	Desktop user
Contact Information	Office location	
	Work phone	
	Home phone	
Password	Set password by hand	<input checked="" type="radio"/>



The 'Users Settings' dialog box shows a list of users with columns for Name, Login name, and Home directory. The list contains four users: client22, root, server2, and client2. To the right of the list are buttons for '+ Add User', 'Properties', 'Delete', and 'Manage Groups'. At the bottom are buttons for 'Help', 'Unlock', and 'Close'.

Name	Login name	Home directory
client22	client22	/home/client22
root	root	/root
server2	server2	/home/server2
client2	client2	/home/client2

The same task can be accomplished by running

```
sudo adduser client2
```

(9) Configure an Evolution e-mail account on each client (client1, client2, etc.) and on the server. The example below shows setup of an e-mail account for mail user "server2" on the server.

Evolution Setup Assistant

Identity

Please enter your name and email address below. The "optional" fields below do not need to be filled in, unless you wish to include this information in email you send.

Required Information

Full Name:

Email Address:

Optional Information

☒ Make this my default account

Evolution Setup Assistant

Receiving Email

Please select among the following options

Server Type:

Description: For reading and storing mail on IMAP servers.

Configuration

Server:

Username:

Security

Use Secure Connection:

Authentication Type

☐ Remember password

Evolution Setup Assistant

Receiving Options

Checking for New Mail

☒ Check for new messages every minutes

☒ Check for new messages in all folders

☒ Check for new messages in subscribed folders

Connection to Server

☐ Use custom command to connect to server

Command:

Folders

☐ Show only subscribed folders

☐ Override server-supplied folder namespace

Namespace:

Options

☐ Apply filters to new messages in INBOX on this server

☐ Check new messages for junk contents

☐ Only check for junk messages in the INBOX folder

☐ Automatically synchronize remote mail locally

Evolution Setup Assistant

Sending Email

Please enter information about the way you will send mail. If you are not sure, ask your system administrator or Internet Service Provider.

Server Type:

Description: For delivering mail by connecting to a remote mailhub using SMTP.

Server Configuration

Server:

☒ Server requires authentication

Security

Use Secure Connection:

Authentication

Type:

Username:

☐ Remember password

Evolution Setup Assistant

Account Management

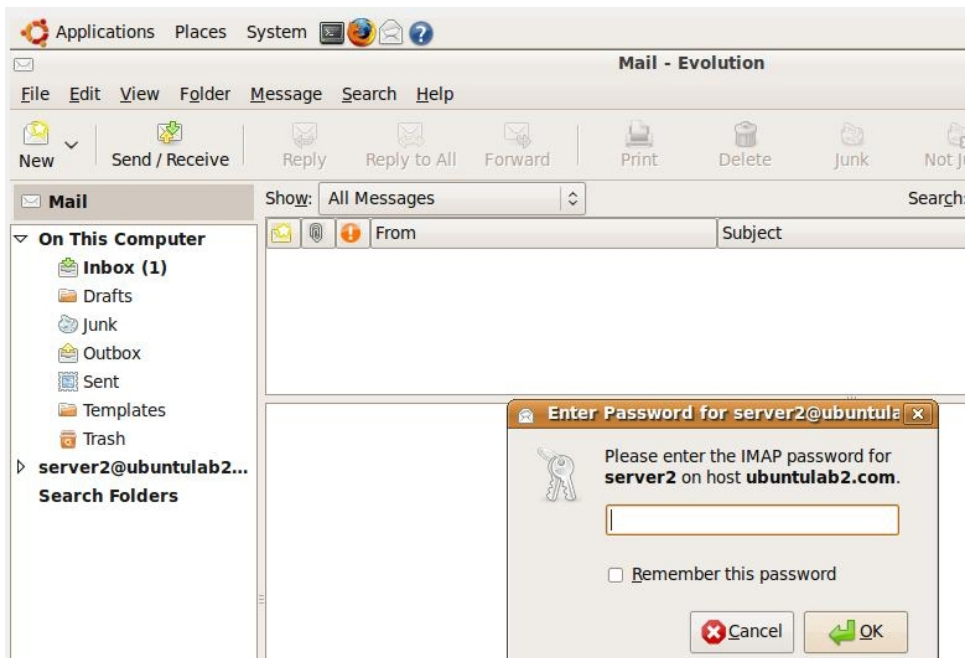
Please enter a descriptive name for this account in the space below. This name will be used for display purposes only.

Account Information

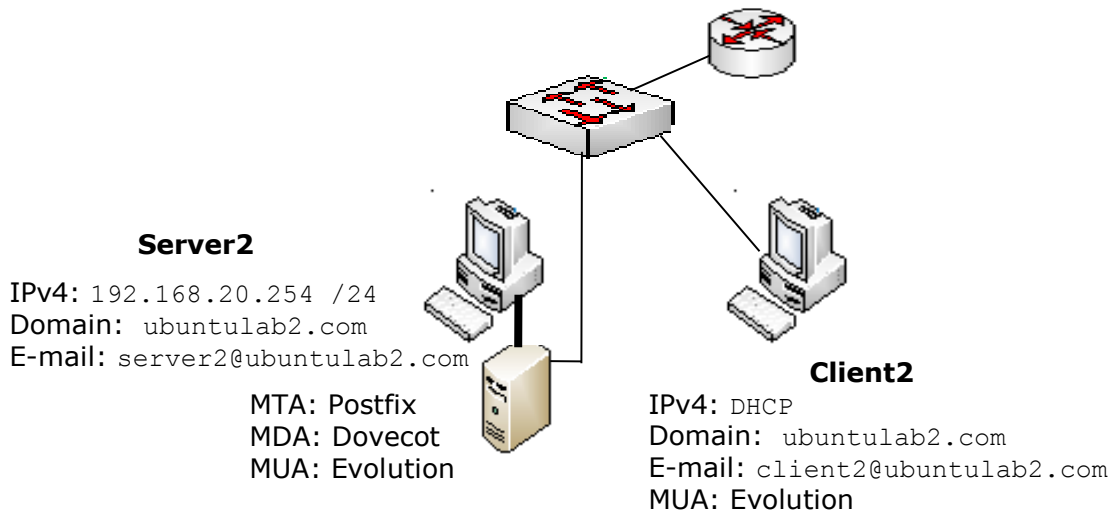
Type the name by which you would like to refer to this account. For example: "Work" or "Personal"

Name:

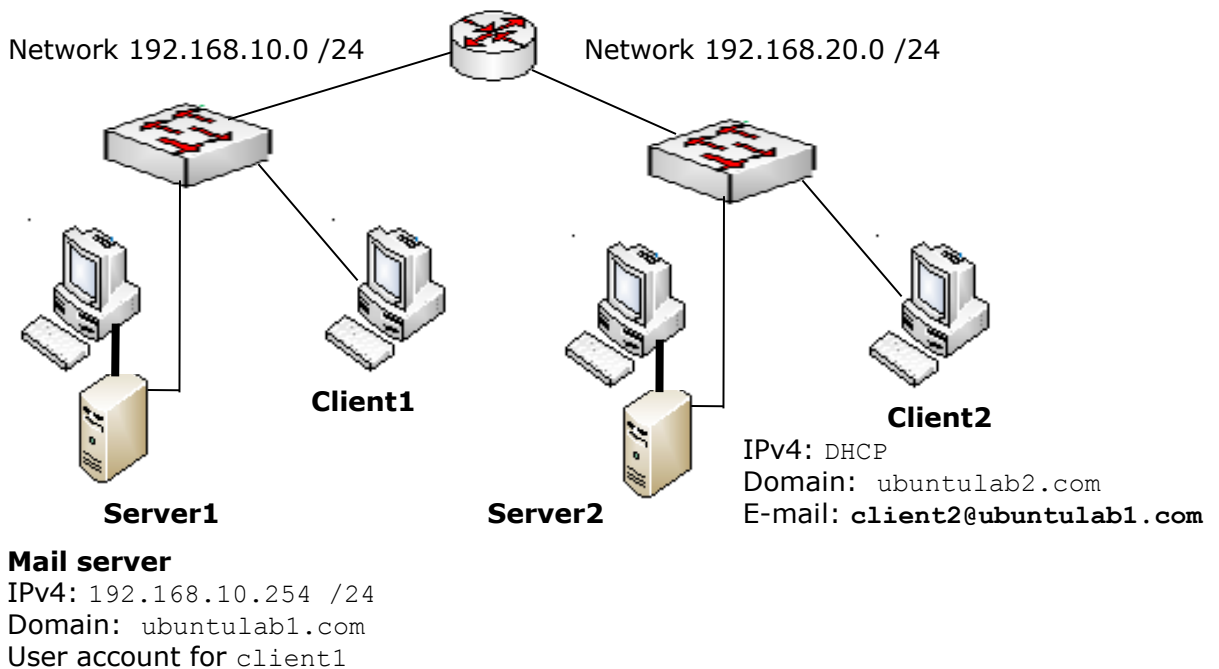
(10) Now test your newly created e-mail system by sending an e-mail from one user to another. (The password being requested in the screen shot below is the same one you created for this client's user account on the server.)



(11) Here's a summary of what we've assembled so far:



(12) What if the mail server and client are on different networks ?



In this case, `client2` on `ubuntu1ab2` needs an e-mail account. The account will be set up on the mail server, `Server1` on `ubuntu1ab1`, as follows:

- Set up a user account for `client2` on mail server `ubuntu1ab1.com`
- Set up the Evolution e-mail user account on `client2` with e-mail address `client2@ubuntu1ab1.com` as shown below:

Evolution Setup Assistant

Identity

Please enter your name and email address below. The "optional" fields below do not need to be filled in, unless you wish to include this information in email you send.

Required Information

Full Name:

Email Address:

Optional Information

☒ Make this my default account

Evolution Setup Assistant

Receiving Email

Please select among the following options

Server Type:

Description: For reading and storing mail on IMAP servers.

Configuration

Server:

Username:

Security

Use Secure Connection:

Authentication Type

☐ Remember password

Evolution Setup Assistant

Sending Email

Please enter information about the way you will send mail. If you are not sure, ask your system administrator or Internet Service Provider.

Server Type: SMTP

Description: For delivering mail by connecting to a remote mailhub using SMTP.

Server Configuration

Server:

☒ Server requires authentication

Security

Use Secure Connection: No encryption

Authentication

Type: PLAIN

Username:

☐ Remember password

Evolution Setup Assistant

Account Management

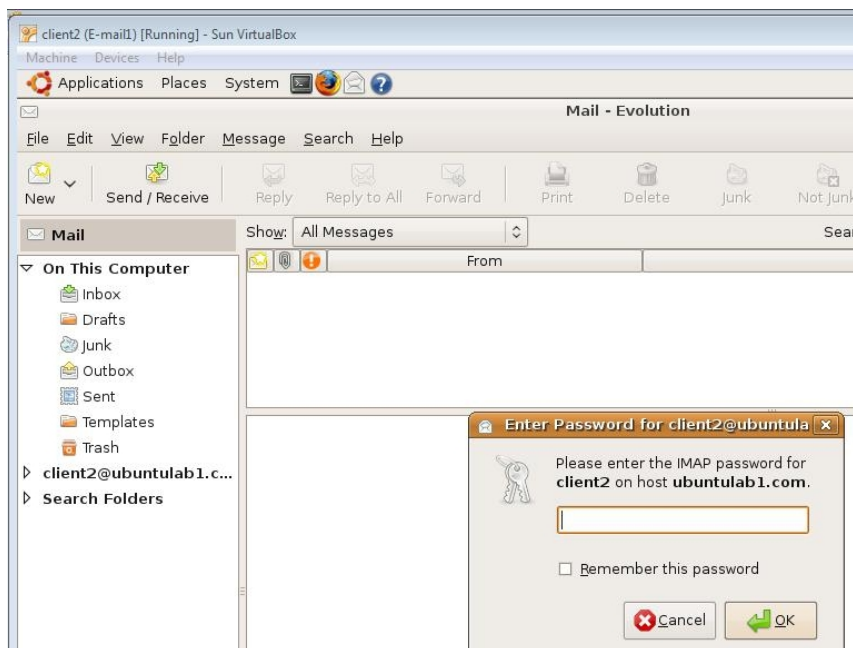
Please enter a descriptive name for this account in the space below.
This name will be used for display purposes only.

Account Information

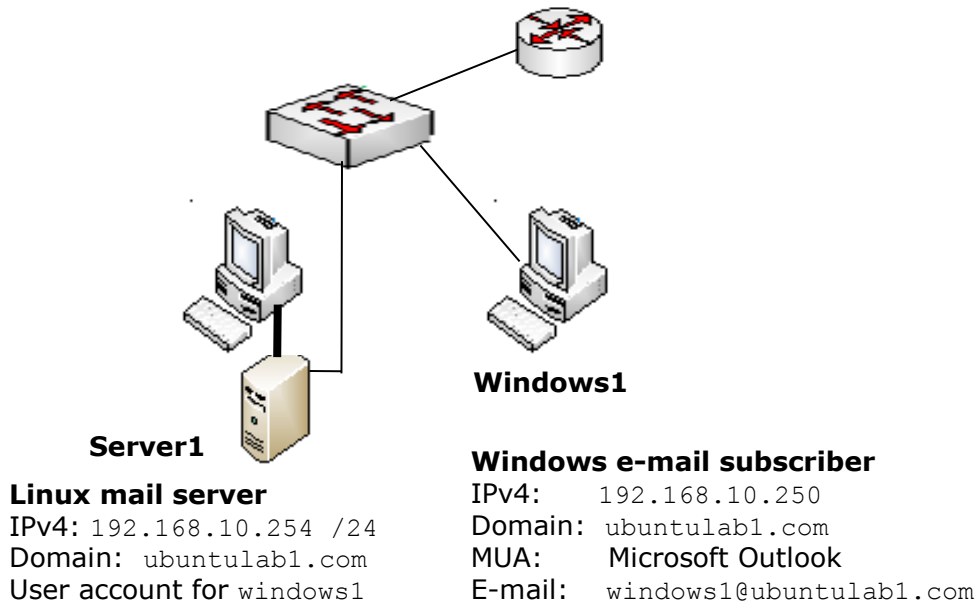
Type the name by which you would like to refer to this account.
For example: "Work" or "Personal"

Name:

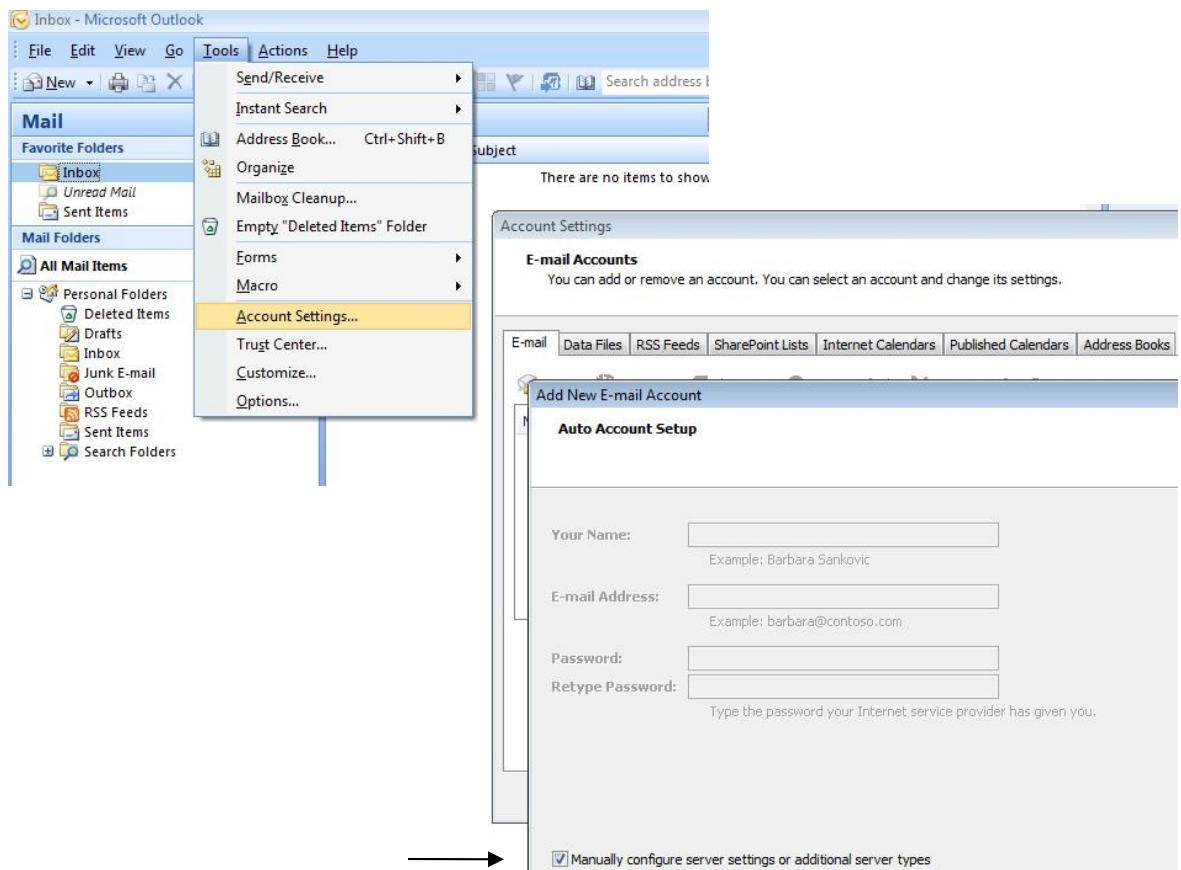
When client2 uses Evolution, the password requested is for the client2 user account on Server1 (ubuntulab1.com).

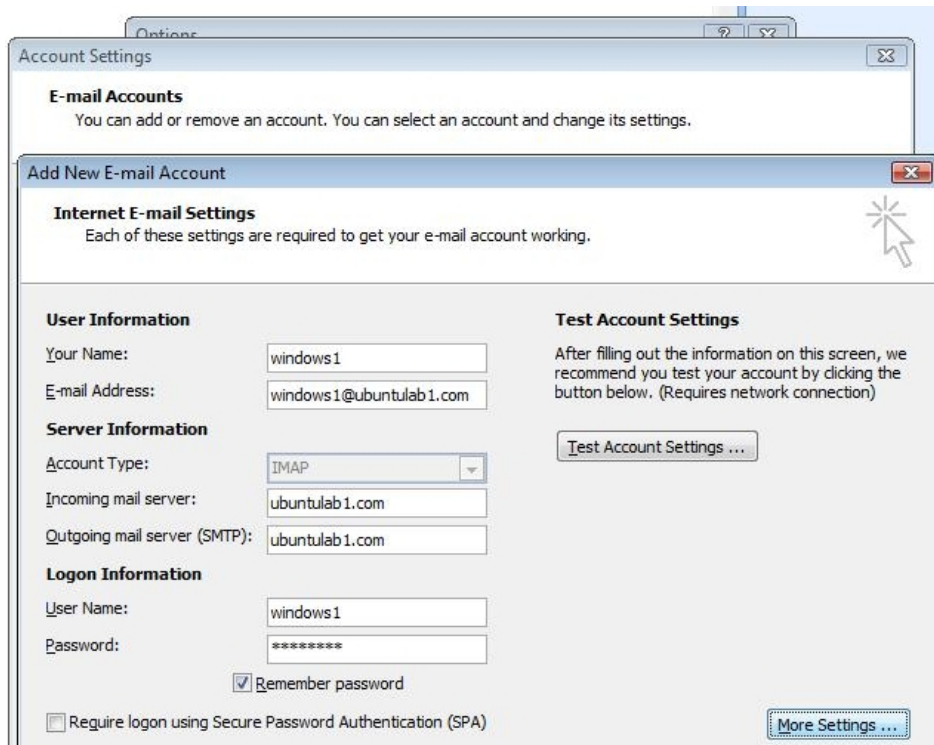
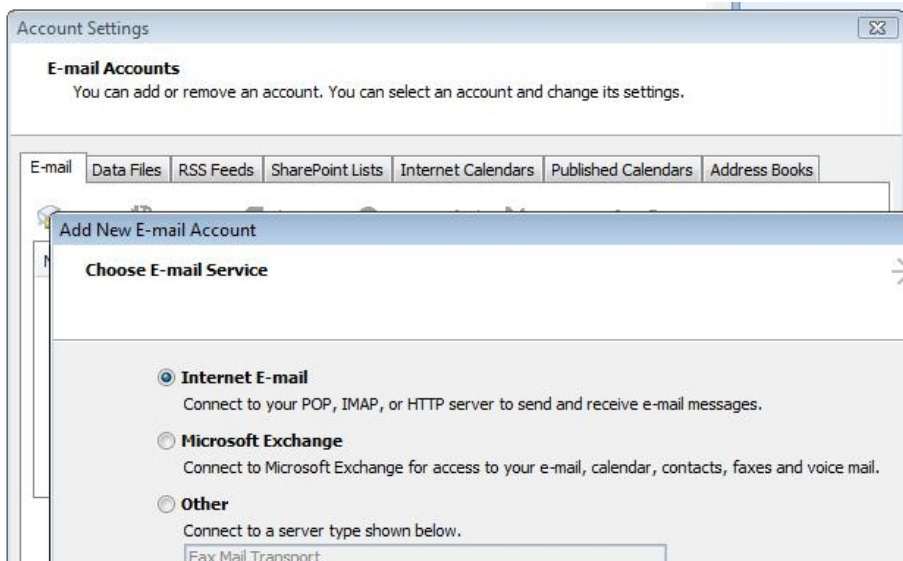


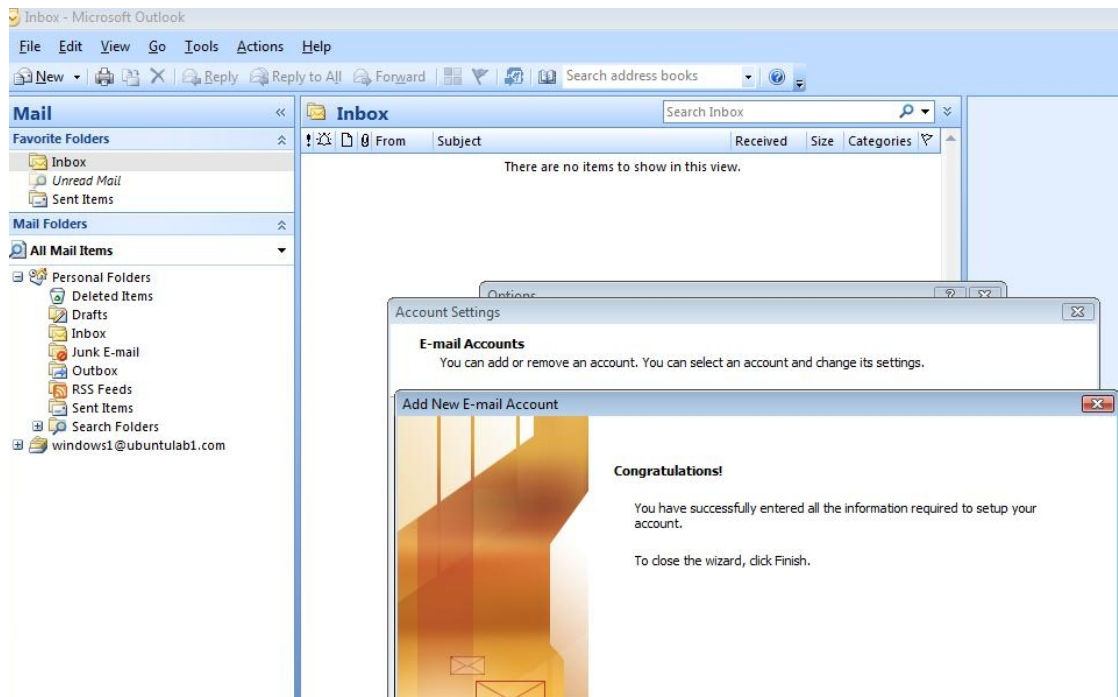
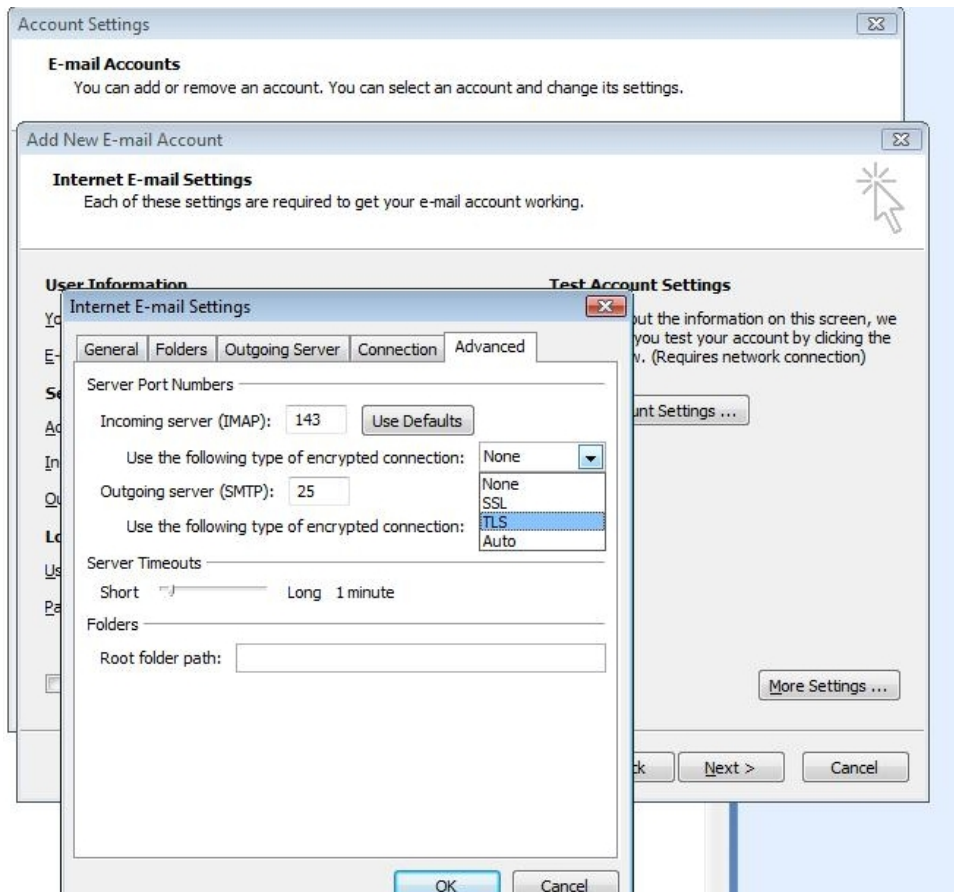
(13) Setting up an e-mail user account on a Windows PC with Outlook

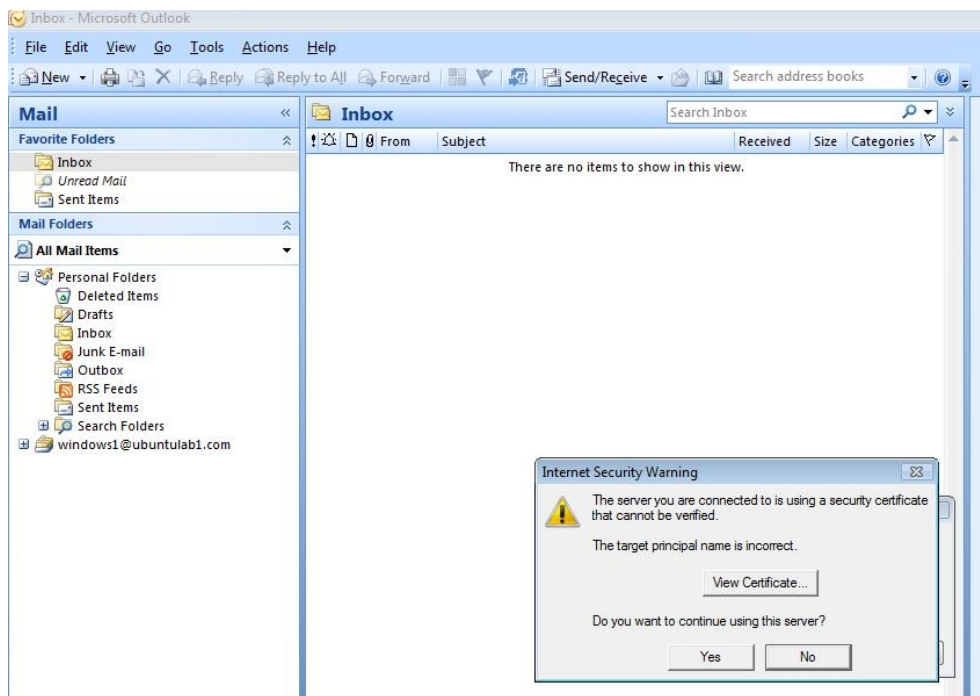


Begin by setting up a user account on the Linux mail server for the Windows PC (windows1 in this example). Then follow the screen shots below to set up the Outlook e-mail account on the Windows PC.

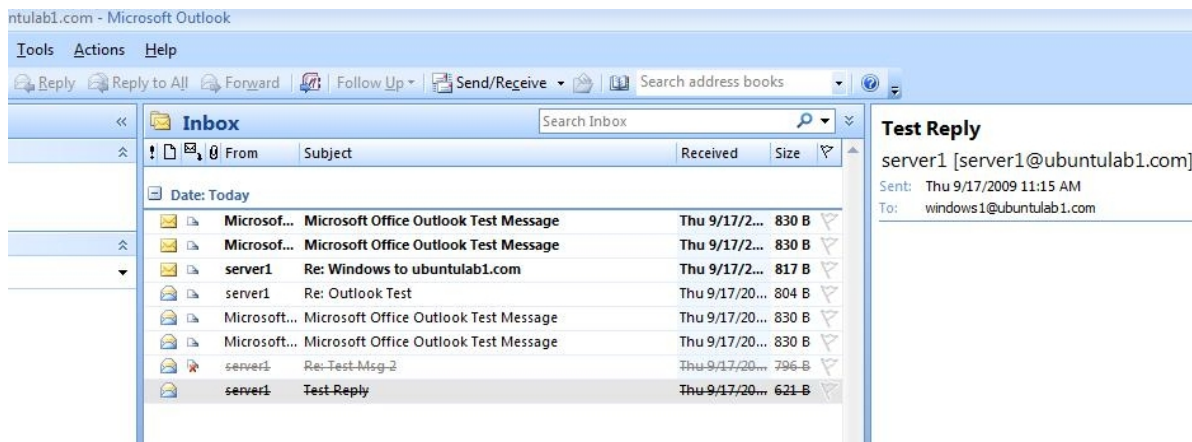








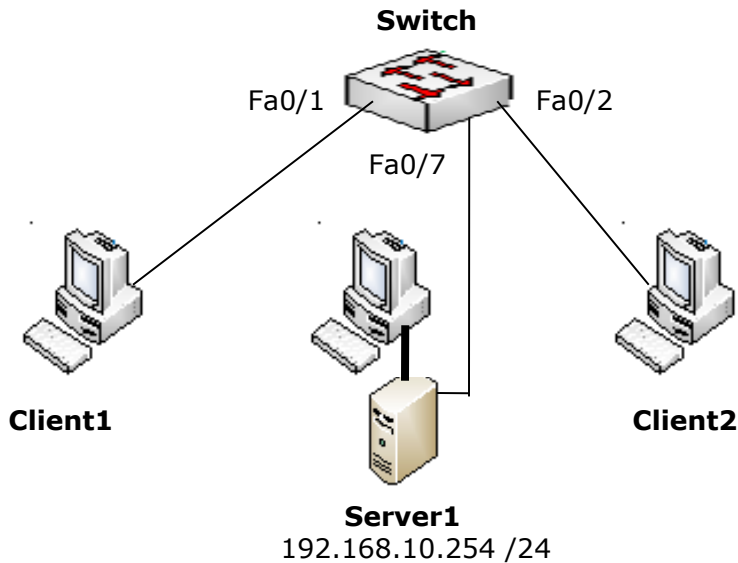
This message appears because the server is using a self-signed certificate. Choose Yes.



Sending a few e-mails back and forth across the network will confirm that your new e-mail client is working.

Lab 8

Webserver & Blog



Objective

Learn how to set up your very own blog using Linux, Apache, MySQL, and PHP – commonly called “LAMP” or “a LAMP stack” -- as well as WordPress, a content management system (CMS) with a built-in, user-friendly, pre-configured blog.

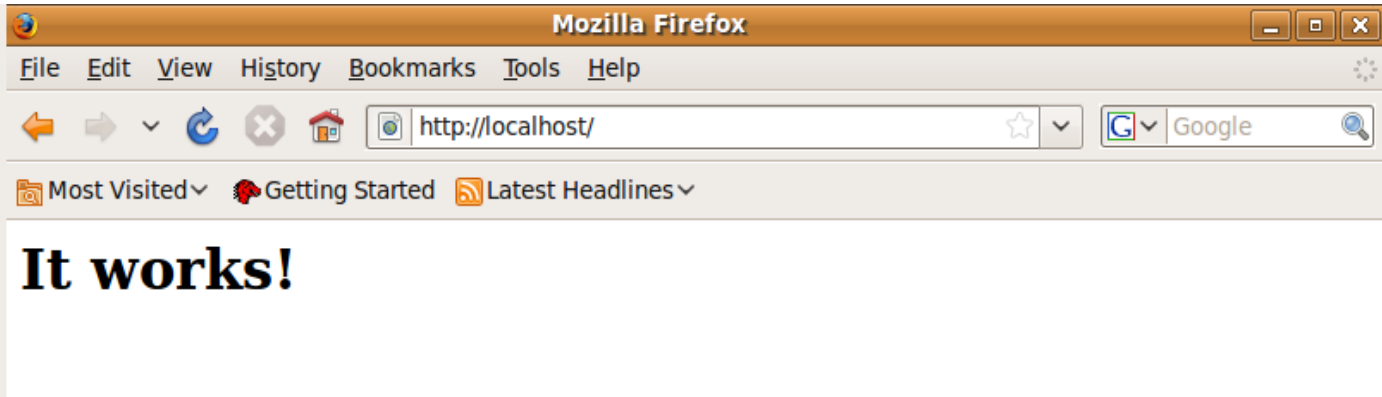
Procedure

- (1) Connect the network as shown in the above diagram.
- (2) Install Apache, MySQL, and PHP by running

```
sudo apt-get install apache2 mysql-server mysql-client php5 php5-mysql
```

```
server1@server1: ~
File Edit View Terminal Help
server1@server1:~$ sudo apt-get install apache2 mysql-client mysql-server php5 php5-mysql
```


3. Make sure that Apache is up and running by visiting “<http://localhost/>” in Firefox.

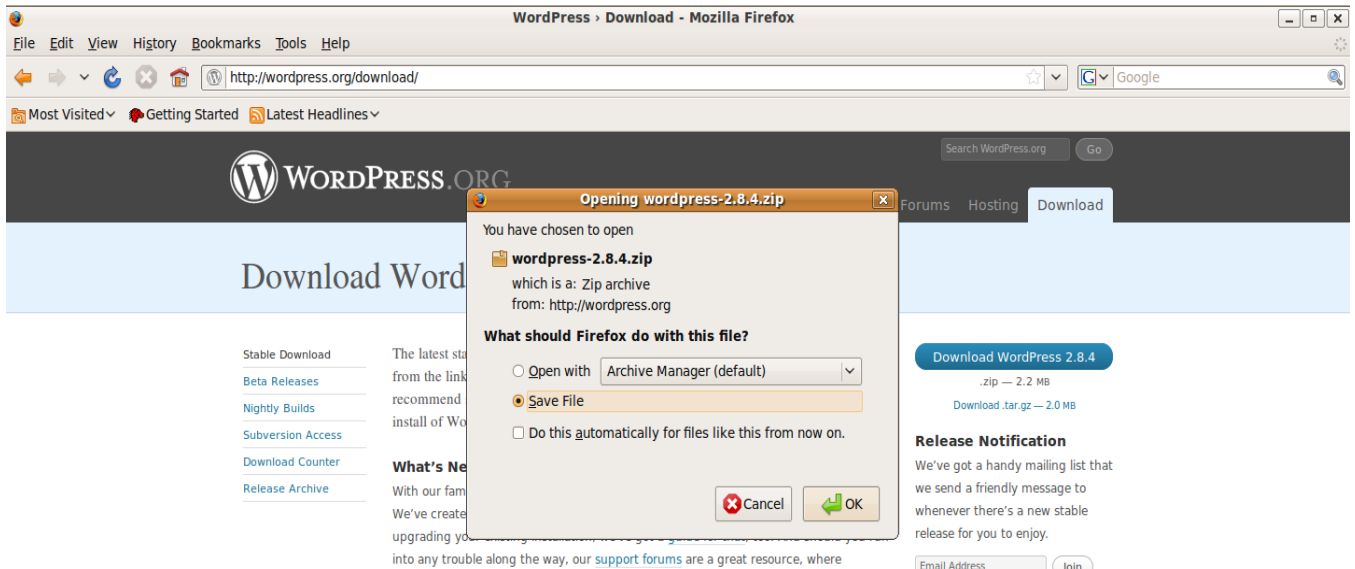


If Apache is not running, type

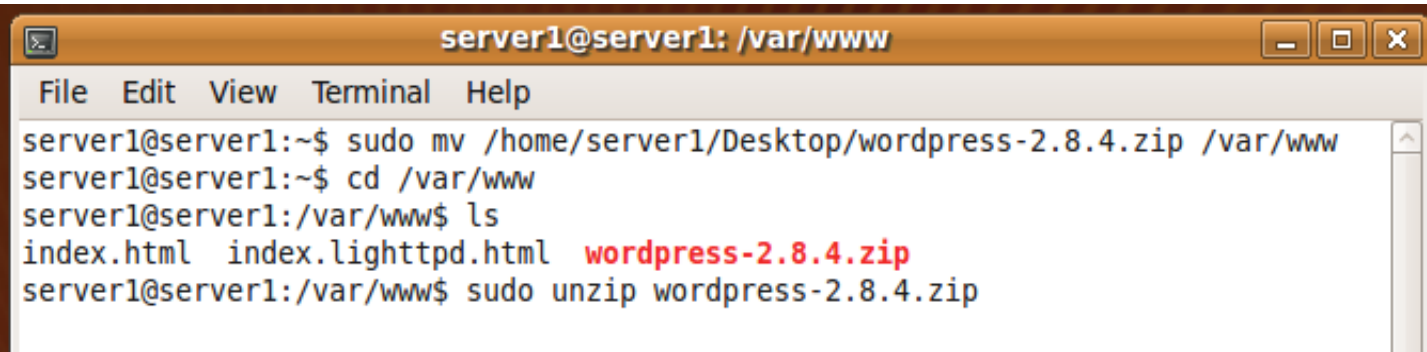
```
sudo /etc/init.d/apache2 start
```

to start it.

(4). Go to wordpress.org/download in Firefox, then click the “Download WordPress” button on the right side of the screen. Tell Firefox to save the file.

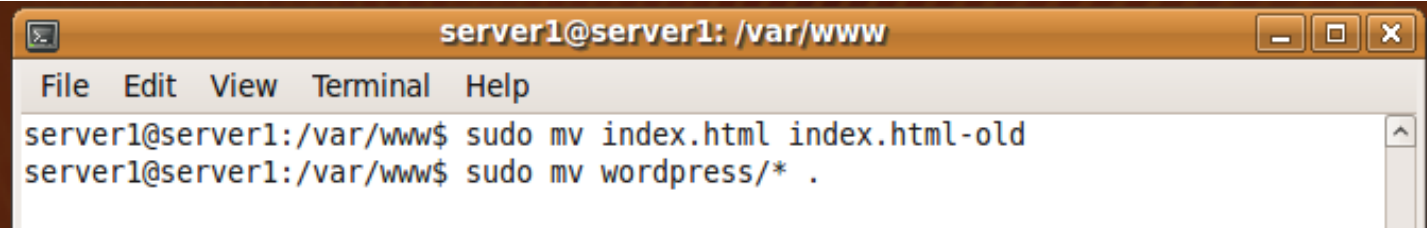


(5) Move the .zip file you've just downloaded from the location Firefox saved it to (usually ~/Desktop or the home directory) to /var/www, then unzip the file, like so. This will create the /var/www/wordpress directory.



```
server1@server1: /var/www
File Edit View Terminal Help
server1@server1:~$ sudo mv /home/server1/Desktop/wordpress-2.8.4.zip /var/www
server1@server1:~$ cd /var/www
server1@server1:/var/www$ ls
index.html  index.lighttpd.html  wordpress-2.8.4.zip
server1@server1:/var/www$ sudo unzip wordpress-2.8.4.zip
```

(6) Change the name of Apache's default index.html file; we chose index.html-old. Then, move everything in the wordpress/ directory to /var/www as shown below.

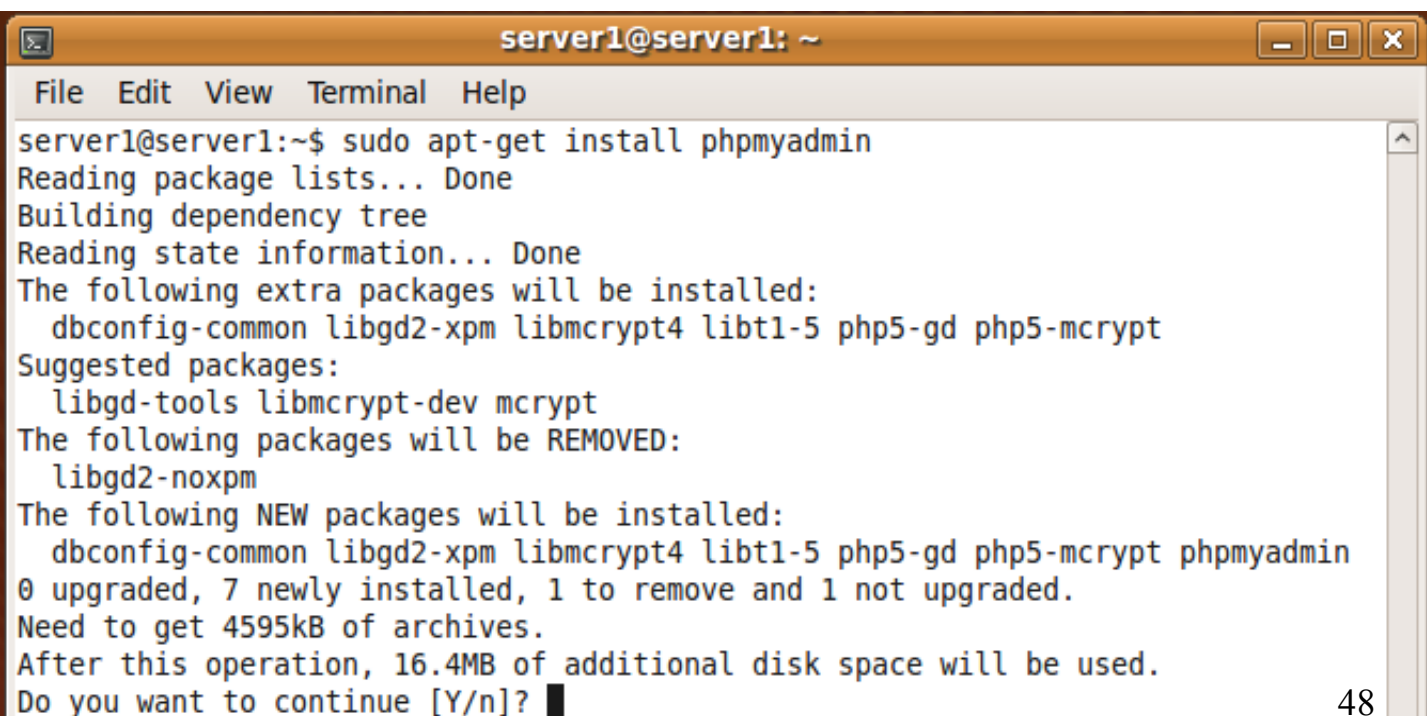


```
server1@server1: /var/www
File Edit View Terminal Help
server1@server1:/var/www$ sudo mv index.html index.html-old
server1@server1:/var/www$ sudo mv wordpress/* .
```

(7) Install phpmyadmin by running

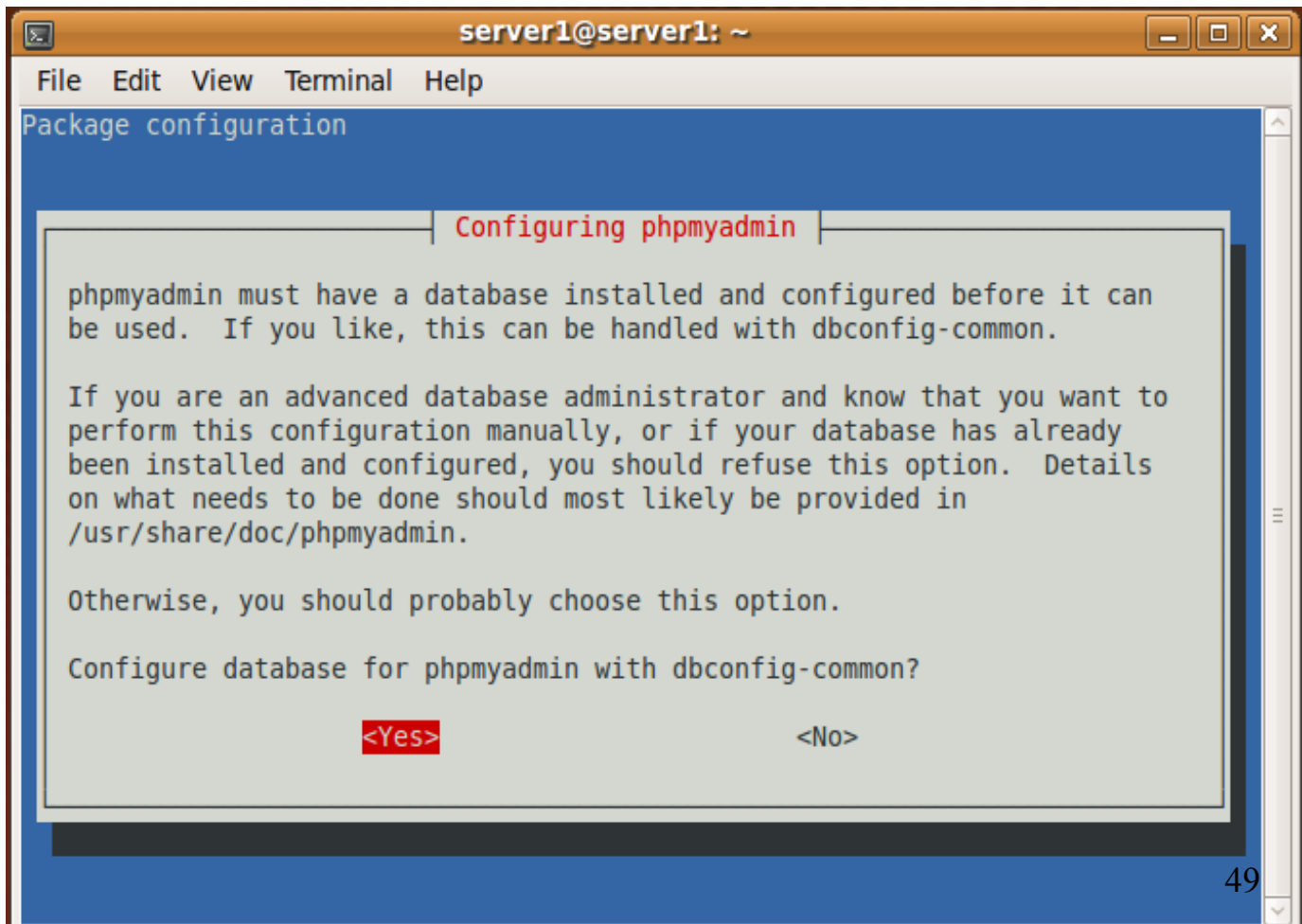
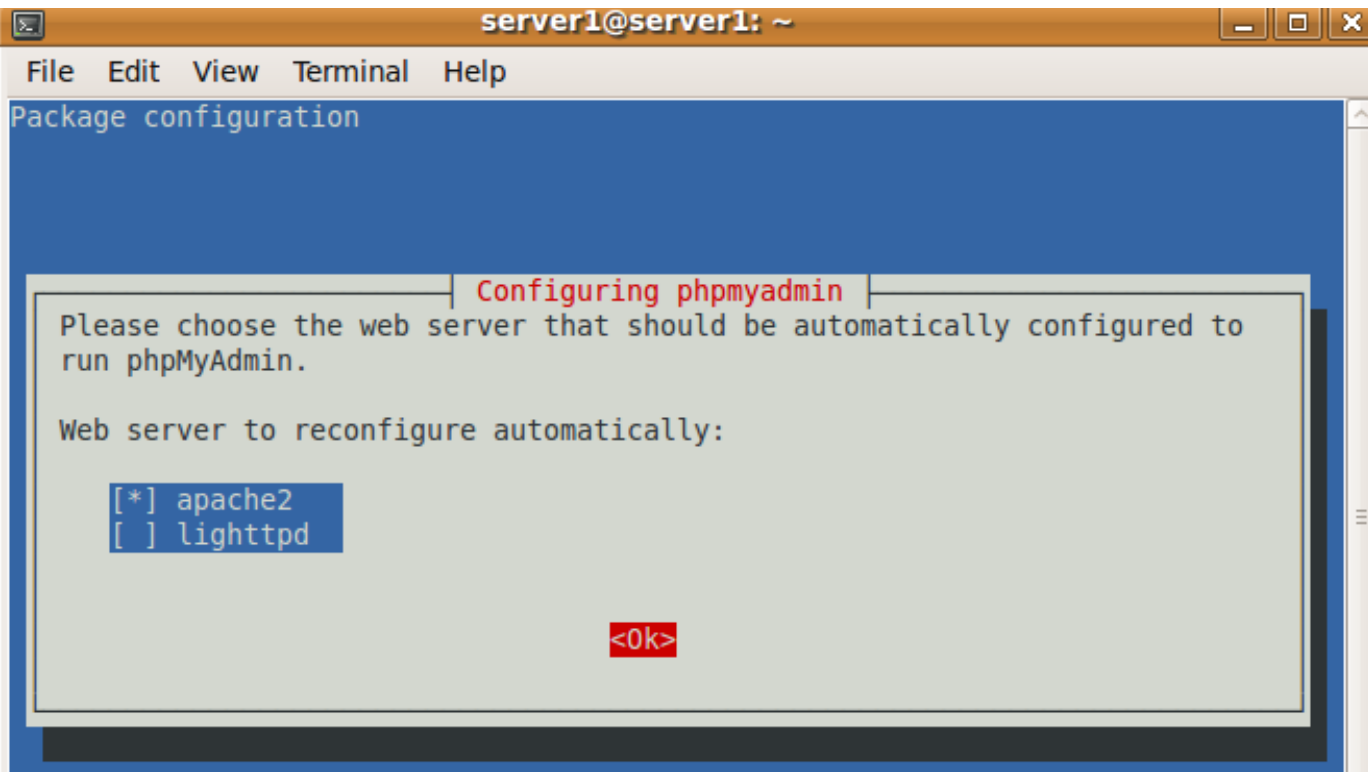
```
sudo apt-get install phpmyadmin
```

This will allow us to configure MySQL with a point-and-click GUI.

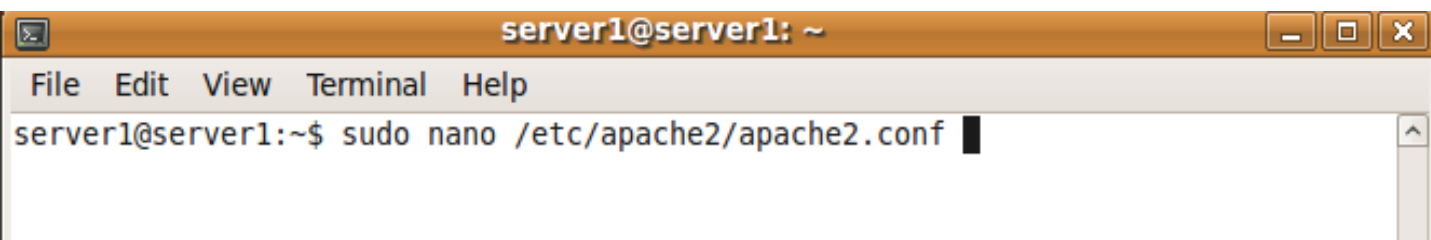


```
server1@server1: ~
File Edit View Terminal Help
server1@server1:~$ sudo apt-get install phpmyadmin
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following extra packages will be installed:
  dbconfig-common libgd2-xpm libmcrypt4 libt1-5 php5-gd php5-mcrypt
Suggested packages:
  libgd-tools libmcrypt-dev mcrypt
The following packages will be REMOVED:
  libgd2-noxpm
The following NEW packages will be installed:
  dbconfig-common libgd2-xpm libmcrypt4 libt1-5 php5-gd php5-mcrypt phpmyadmin
0 upgraded, 7 newly installed, 1 to remove and 1 not upgraded.
Need to get 4595kB of archives.
After this operation, 16.4MB of additional disk space will be used.
Do you want to continue [Y/n]? █
```


(7) Choose the indicated options when prompted by using <spacebar> to check "apache2" followed by <enter>.

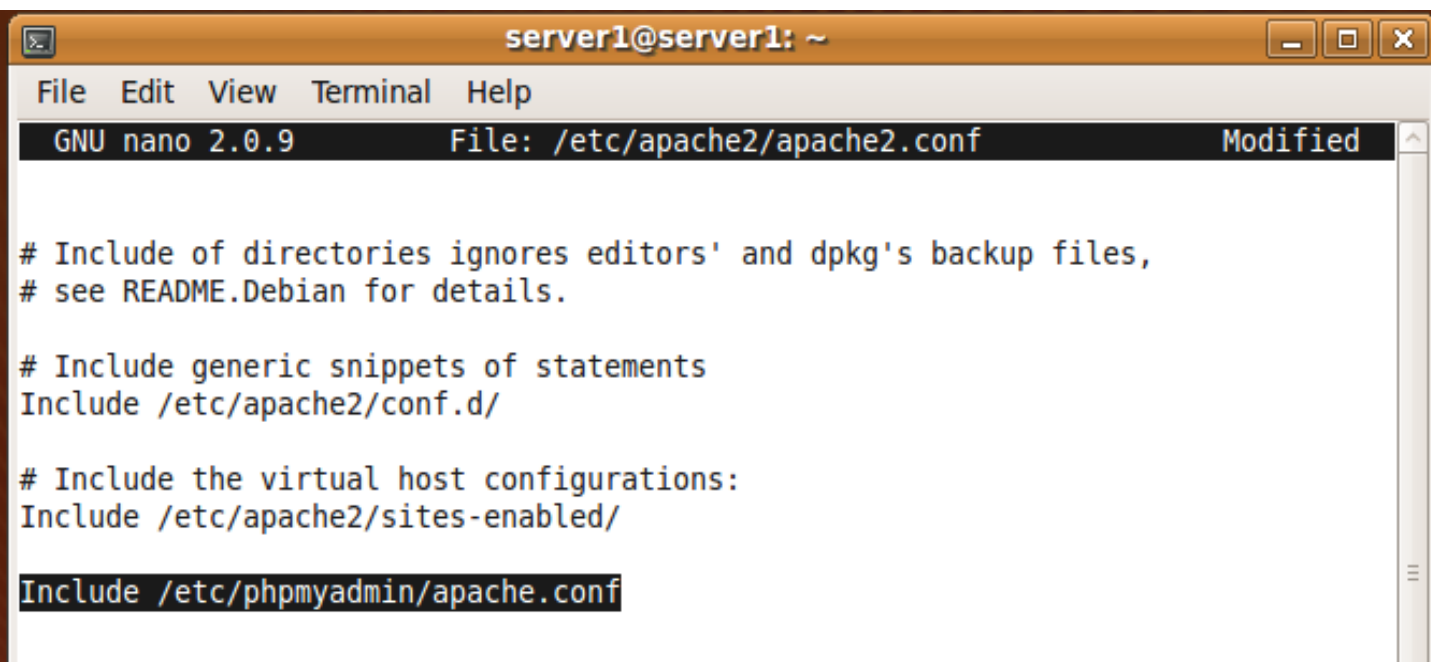


(8) Edit the /etc/apache2/apache2.conf file via nano

A terminal window titled 'server1@server1: ~' with a menu bar (File, Edit, View, Terminal, Help). The command 'server1@server1:~\$ sudo nano /etc/apache2/apache2.conf' is entered and executed, with the cursor at the end of the line.

```
server1@server1:~$ sudo nano /etc/apache2/apache2.conf
```

(9) Add "Include /etc/phpmyadmin/apache.conf" to the very end of the file as shown below. The added line is highlighted.

A terminal window titled 'server1@server1: ~' showing the nano editor interface. The status bar at the top indicates 'GNU nano 2.0.9', 'File: /etc/apache2/apache2.conf', and 'Modified'. The file content is displayed, and the line 'Include /etc/phpmyadmin/apache.conf' at the bottom is highlighted in black.

```
GNU nano 2.0.9      File: /etc/apache2/apache2.conf      Modified

# Include of directories ignores editors' and dpkg's backup files,
# see README.Debian for details.

# Include generic snippets of statements
Include /etc/apache2/conf.d/

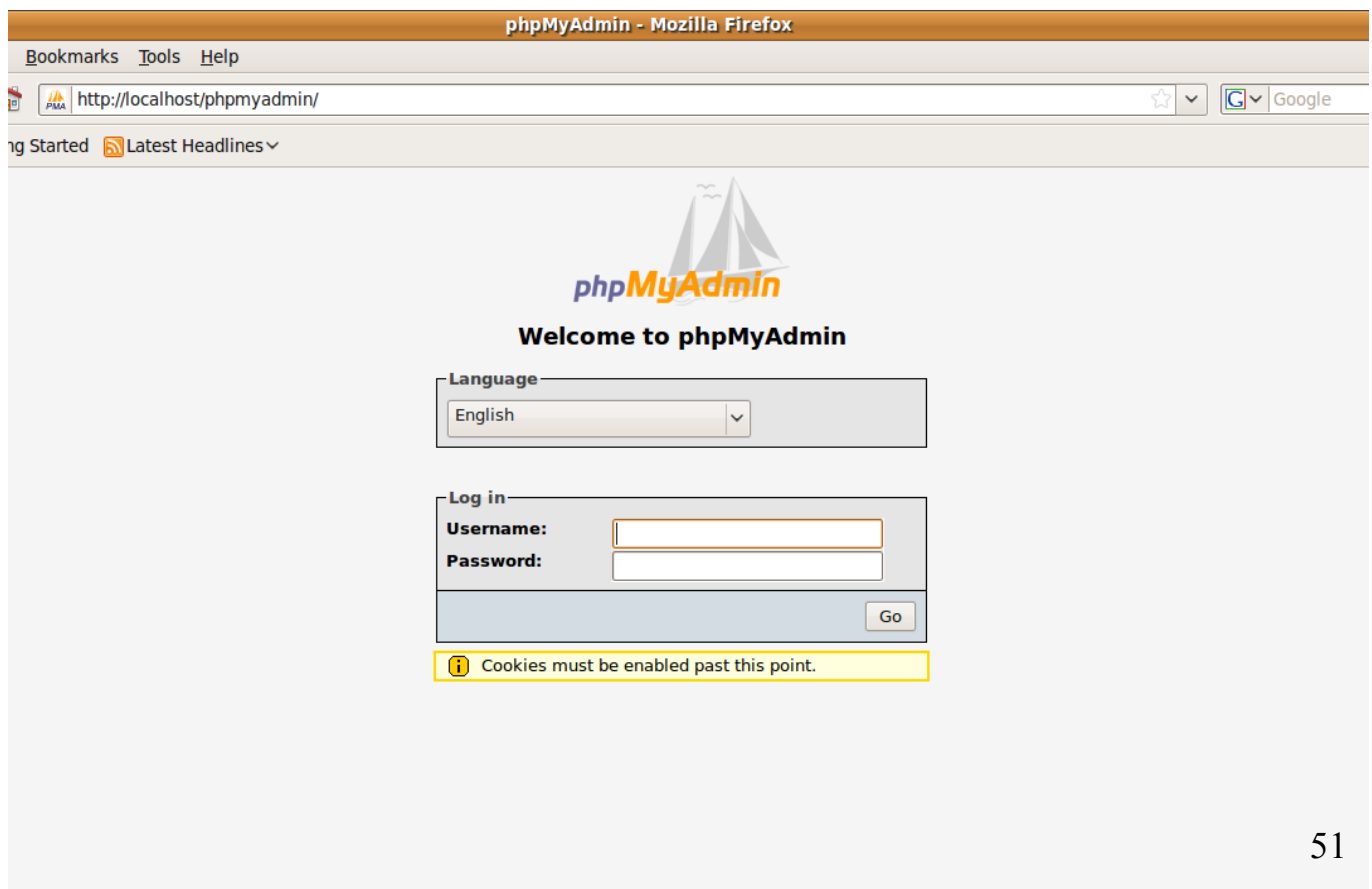
# Include the virtual host configurations:
Include /etc/apache2/sites-enabled/

Include /etc/phpmyadmin/apache.conf
```

(10) Restart apache

```
server1@server1: ~  
File Edit View Terminal Help  
server1@server1:~$ sudo nano /etc/apache2/apache2.conf  
server1@server1:~$ sudo /etc/init.d/apache2 restart  
* Restarting web server apache2  
[Wed Sep 16 23:29:24 2009] [warn] The Alias directive in /etc/phpmyadmin/apache.  
conf at line 3 will probably never match because it overlaps an earlier Alias.  
apache2: Could not reliably determine the server's fully qualified domain name,  
using 127.0.1.1 for ServerName  
... waiting [Wed Sep 16 23:29:25 2009] [warn] The Alias directive in /etc/phpmy  
admin/apache.conf at line 3 will probably never match because it overlaps an ear  
lier Alias.  
apache2: Could not reliably determine the server's fully qualified domain name,  
using 127.0.1.1 for ServerName  
[ OK ]  
server1@server1:~$
```

(11) Visit "<http://localhost/phpmyadmin/>" in Firefox. We will use these menus to configure MySQL. Now, log in using "root" as the username the password you specified when installing MySQL.



(12) Create a new database called "wp28" or something similar. (As of September 2009, the newest version of WordPress is 2.8, hence the name.) Type the database name in the text box, then press "Create".

The screenshot shows the phpMyAdmin 3.1.2deb1 web interface in a browser. The address bar shows the URL: `http://localhost/phpmyadmin/index.php?token=182b621be8b812a045d6917e5a...`. The interface has a top menu bar with File, Edit, View, History, Bookmarks, Tools, and Help. Below the menu bar is a navigation bar with icons for Home, Exit, SQL, and other functions. The main content area is divided into two columns. The left column contains a sidebar with the phpMyAdmin logo, a list of databases (information_schema (17), mysql (17), phpmyadmin (8)), and a prompt "Please select a database". The right column shows the "Server: localhost" section with tabs for Databases, SQL, Status, Variables, Charsets, and Engines. Under the "Actions" section, there are links for "Change password" and "Log out". Below this is the "MySQL localhost" section with a "Create new database" form. The form has a text input field containing "wp28", a "Collation" dropdown menu, and a "Create" button. Below the form, it shows "MySQL connection collation: utf8_general_ci". At the bottom of the right column is the "Interface" section with a "Language" dropdown set to "English", a "Theme / Style" dropdown set to "Original", a "Custom color" section with a "Reset" button, and a "Font size" dropdown set to "82%".

You should receive verification that the database was successfully created.

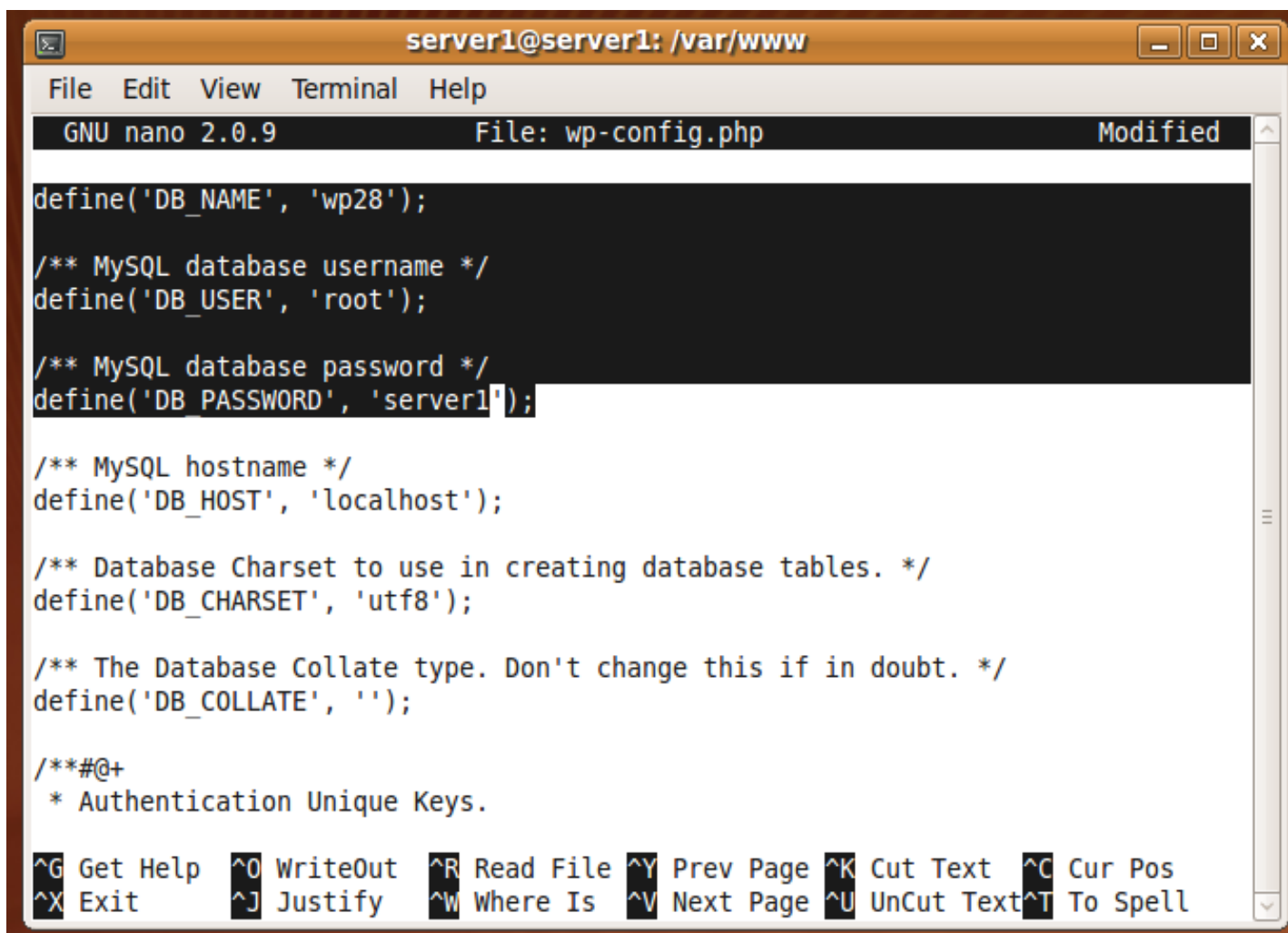
The screenshot shows the phpMyAdmin 3.1.2deb1ubuntu0.1 - Mozilla Firefox web interface. The address bar shows the URL: `http://localhost/phpmyadmin/index.php?token=182b621be8b812a045d6917e5abed6ad`. The interface has a top menu bar with File, Edit, View, History, Bookmarks, Tools, and Help. Below the menu bar is a navigation bar with icons for Home, Exit, SQL, and other functions. The main content area is divided into two columns. The left column contains a sidebar with the phpMyAdmin logo, a list of databases (wp28), and a prompt "Please select a database". The right column shows the "Server: localhost" section with a "Database: wp28" dropdown menu. Below this is a "Structure" tab with a "CREATE DATABASE 'wp28'" message. A green banner at the top of the right column says "Database wp28 has been created." Below this is a "Query" section with a "CREATE DATABASE 'wp28'" message.

(13) It is now time to configure WordPress to use the database we've just created for it. Run the indicated commands.



```
server1@server1: /var/www
File Edit View Terminal Help
server1@server1:~$ cd /var/www/
server1@server1:/var/www$ sudo mv wp-config-sample.php wp-config.php
server1@server1:/var/www$ sudo nano wp-config.php
```

(14) Scroll down till you see a line that begins with "define('DB_NAME',...". Fill in the database name, username, and MySQL password.



```
server1@server1: /var/www
File Edit View Terminal Help
GNU nano 2.0.9 File: wp-config.php Modified
define('DB_NAME', 'wp28');

/** MySQL database username */
define('DB_USER', 'root');

/** MySQL database password */
define('DB_PASSWORD', 'server1');

/** MySQL hostname */
define('DB_HOST', 'localhost');

/** Database Charset to use in creating database tables. */
define('DB_CHARSET', 'utf8');

/** The Database Collate type. Don't change this if in doubt. */
define('DB_COLLATE', '');

/**#@+
 * Authentication Unique Keys.

```

Save the file and exit nano.

(15) WordPress should now be installed and configured! Visit <http://localhost/wp-admin/install.php> in Firefox to make sure. Feel free to follow the WordPress instructions from this point on to customize your own personal blog.

WordPress > Installation - Mozilla Firefox

Bookmarks Tools Help

 http://localhost/wp-admin/install.php 

Started  Latest Headlines ▾

 **WORDPRESS**

Welcome

Welcome to the famous five minute WordPress installation process! You may want to browse the [ReadMe documentation](#) at your leisure. Otherwise, just fill in the information below and you'll be on your way to using the most extendable and powerful personal publishing platform in the world.

Information needed

Please provide the following information. Don't worry, you can always change these settings later.

Blog Title

Your E-mail

Double-check your email address before continuing.

☐ Allow my blog to appear in search engines like Google and Technorati.

Install WordPress

Further Information

Popular Linux Geek Hangouts

- slashdot.org
- reddit.com (especially reddit.com/r/programming, aka “proggit”)
- news.ycombinator.com
- The #linux IRC channel on freenode

Linux News

- distrowatch.com
- lxr.com
- linuxtoday.com
- lwn.net
- linuxjournal.com

Help

- <http://ubuntuforums.org/>
- Searching the internet for the exact error you receive is highly suggested

“Real” text editors*

- emacs
- vi and vim

* Hardcore Linux geeks make fun of nano, but we still recommend it to beginners

About the Authors

Steve Phillips has been using Linux since 2002 as a high school student in northern California. He attended UC Santa Barbara from 2004-2008 where he double-majored in Philosophy and Mathematics, but still found room for a few programming classes. He uses emacs for text editing and does almost all his programming in C or Python. When not using a computer, he writes Philosophy.

Feel free to send him feedback regarding this lab manual via email. His address is elimisteve@gmail.com.

Jeff Fuller is a returning student updating his computer skill set. His previous electronics experience includes work in both the wireless industry and the military.

Acknowledgments

SBCC

We would both like to thank the Computer Networking Engineering and Electronics (CNEE) department at Santa Barbara City College for allowing us to use their computer lab while designing this class for them.

Artwork

Cover: djust (

<http://djust.deviantart.com/art/Ubuntu-Dapper-Drake-34521915>)

Ubuntu Logo: grevenlx (<http://grevenlx.deviantart.com/art/Ubuntu-Linux-Logo-Icon-18879369>)