### Preamble

You must read the sections before Parts 1 – 4 before turning on your computers.

Domain Name Service (DNS) is an Internet service that maps IP addresses and fully qualified domain names (FQDN) to one another. In this way, DNS alleviates the need to remember IP addresses. Computers that run DNS are called name servers. Ubuntu ships with BIND (Berkley Internet Naming Daemon), the most common program used for maintaining a name server on Linux.

Do not start your machine until you have read the ***Procedure*** section below.

### Environment

We are again using the virtual environment provided by VMware Workstation to set up a virtual network of computers. The Ubuntu machine UbuntuServer will host the server for DNS and one of the Windows PE machines will be used to test the server.

### suAims

Lan Segment 1

VMWare environment

WINPE2

UbuntuServer

UbuntuServer communicates with outside world on eth0 interface via NAT on the host PC

Internet

Host PC

WINPE1

In this lab we set out to establish a DNS server. *BIND9* is the up to date version of BIND.

There are many ways to configure *BIND9*. Some of the most common configurations are

* Caching nameserver
  + When configured as a caching nameserver BIND9 will find the answer to name queries and remember the answer when the domain is queried again.
* Primary master
  + As a primary master server BIND9 reads the data for a zone from a file on it's host and is authoritative for that zone.
* Secondary master.
  + In a secondary master configuration BIND9 gets the zone data from another nameserver authoritative for the zone.

**We will be configuring a DNS server as a Primary Master**.

### Tools

Sudo will give you elevated privileges to run commands. On Ubuntu, these privileges are highly restricted. You may need to invoke elevated privileges by typing sudo ifconfig, this will allow access to sudo for a short while. You will probably need to do this every few minutes during the lab. A painful work-around, but it does work.

Ipconfig (on Windows) and ifconfig (on Linux) will show us the network configuration on our VMs. On the Windows machines we can also control the acquisition and renewal of IP addresses and display other network information.

Checking Syslog is very useful to help you understand why things are not working. Print out the last part of the syslog file with the following to see why something is not working…

* tail /var/log/syslog

Check out the tail command on the man pages. The man pages are a useful source of information on how things work, for instance.

Web pages such as **help.ubuntu.com** has all the help you will need to help you to download the software, configure the server, edit files and stare/stop the server as you progress.

Ping can be used to try to reach a host. Either an IP address can be used or the FQDN can be used. If the FQDN is used, then the resolver of the DNS is utilised to translate the FQDN into an IP address.

nslookup can be used to test the DNS server from one of the PCs or from the Ubuntu server. You will get helpful messages I either case.

dig is another DNS testing utility which can tell you if your DNS server is working.

Check out the **help.ubuntu.com** web pages for more information.

### Procedure

1. Power on your computer.
2. Log onto the machine as usual with your student login/password.
3. Launch VMWare Workstation from the start menu.
4. There are three virtual machines to work with on this exercise, the UbuntuServer (a Linux VM) and the Windows PE machines , named WINPE1 and WINPE2. Power up each of these machines in turn.
   1. If you are asked if you moved or copied any of the VMs, say “**I moved it**”.
   2. Cancel any other messages as they come by.
5. The UbuntuServer has an account set up on it with (all lower case)
   1. Username: student
   2. Password: **computing**

### Marking

* No marks for the first part, downloading and installing software.
* For 3 marks: part 2 involves getting the DNS server up and running on UbuntuServer and testing its operation from the WINPE1 machine to resolve the IP addresses of the named FQDNs listed below.
* For additional 2 marks: part 3 involves getting FQDNs resolved from both of the Windows machines, forward **and reverse** resolutions.
  + Hint: DNS can only resolve FQDNs from a PC which has been configured to know where the DNS server is. This is not a broadcast technology. The client must be configured correctly with DHCP in order for this to work. Check your DHCP configurations from last week. Some of you do not have a properly configured DHCP server, we know about it but did not tell you.

Part1: Installing DNS software

To ensure that all installed packages are up to date…

**sudo apt update**

Install BIND with the following command…

**sudo apt install bind9**

Install required utilities with …

**sudo apt install dnsutils**

See

<https://help.ubuntu.com/lts/serverguide/dns.html>

for online help on downloading, installing and configuring BIND9 the DNS server.

Part 2: Configuring the DNS server

The files that need to be edited using ***sudo*** to create the domain for our ‘computing.org’ are:

* /etc/bind/named.conf.local
* /etc/bind/db.computing.org
* /etc/bind/db.computing.org.192

Firstly, create a zone for our domain ‘computing.org’ in the main Bind DNS configuration file:

**sudo gedit /etc/bind/named.conf.local &**

Create a forward and reverse zone in this file for our ‘computing.org’ domain. The zone declarations should look like this:

// Our ‘computing.org’ forward domain zone

zone "computing.org" {

type master;

file "/etc/bind/db.computing.org";

};

// Our ‘computing.org’ reverse domain zone

zone "10.168.192.in-addr.arpa" {

type master;

file "/etc/bind/db.computing.org.192";

};

Copy an empty zone file and use it for our computing.org forward zone file:

**sudo cp /etc/bind/db.local /etc/bind/db.computing.org**

**sudo gedit /etc/bind/db.computing.org &**

**Note:** Don’t worry about the ‘DO NOT EDIT’ warnings in this file. These relate to the original db.empty file!

Check out the help.ubunty website for the following… Edit/Add the following record types:

**Notes:**

* **Fully Qualified Domain Names need a ‘.’ at the end of them**
* **Domain names in SOA and NS records must be Fully Qualified**

Add the following reckords…

* + SOA
  + NS
  + Add a **CNAME** record called **ns** that points to **UbuntuServer**
  + Add a **CNAME** record called **www** that points at **UbuntuServer** (we will use this for a webserver later)
  + Add a **CNAME** record called **results** that points at **UbuntuServer** (again we will use this for a webserver later)
  + Add an **A** record for the Ubuntu Server VM called **UbuntuServer** (the IP address of the DNS)
  + Add an **A** record for the WINPE2 VM called **fixed** (it has the fixed address, 192.168.10.11)

Now the forward domains may be resolved, e.g. fixed.computing.org will resolve to 192.168.10.11

If you like you can test this configuration first before proceeding to do the reverse lookup, supplying an IP address and finding out what URLs are associated with that IP address. See testing below in Part 3.

**Reverse lookup.**

We wish to be able to do a reverse lookup, e.g. we seek 192.168.10.11, and we an answer back fixed.computing.org. To do this we need to create a reverse zone file.

First copy from the template to create a file that we can edit…

**sudo cp /etc/bind/db.empty /etc/bind/db.computing.org.192**

And edit it…

**sudo gedit /etc/bind/db.computing.org.192 &**

Edit/Add the following record types in the computing.org reverse zone file:

**Note: same rules apply in this file as the forward file.**

* SOA
* NS
* Add a PTR record for the **UbuntuServer**
* Add a PTR record for the fixed.computing.org machine

Remember all FQDNs must end with a full-stop.

Now, you can restart your Bind name server:

**sudo service bind9 restart**

Test that the Ubuntu server can resolve the hosts in our own new domain:

* UbuntuServer.computing.org
* fixed.computing.org
* www.computing.org
* ns.computing.org
* results.computing.org
* 192.168.10.1
* 192.168.10.11

Part 3: Testing the DNS server

Go to the WINPE1 and WINPE2 machines in turn and use **nslookup** and/or **dig** to resolve the same hosts.

Or use ping to test the connectivity (remember, ping will first translate the URL using the DNS and then go on to ping the IP address provided by the DNS). Make sure that all of the following are working with nslookup or dig.

* UbuntuServer.computing.org
* fixed.computing.org
* www.computing.org
* ns.computing.org
* results.computing.org
* 192.168.10.1
* 192.168.10.11

If it does not all work on both machines, identify why WINPE1 and WINPE2 cannot **both** resolve all of the computing.org domain names and IP addresses.

**Hint**: study the output of ipconfig /all on WINPE1 and WINPE2 and the configurations that they got from DHCP in the previous lab. You may notice a discrepancy between the two machines!

Fix any problems for full marks.