PES UNIVERSITY

EC CAMPUS BANGALORE

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DATE: 21-02-2021

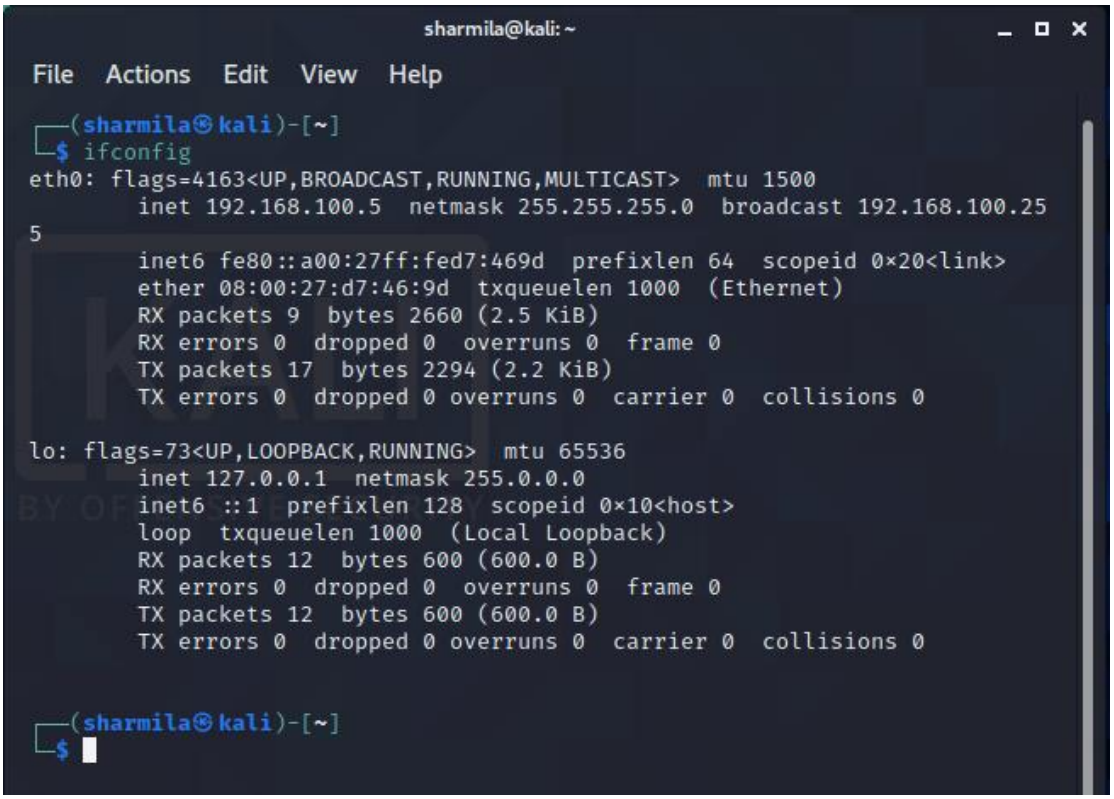
SUBJECT: Computer Network Laboratory

WEEK: 4

Implementation of a Local DNS Server and Authoritative NameServer

DNS (Domain Name System) is the Internet's phone book; it translates hostnames to IP addresses (and vice versa). This translation is through DNS resolution, which happens behind the scene.

CLIENT:

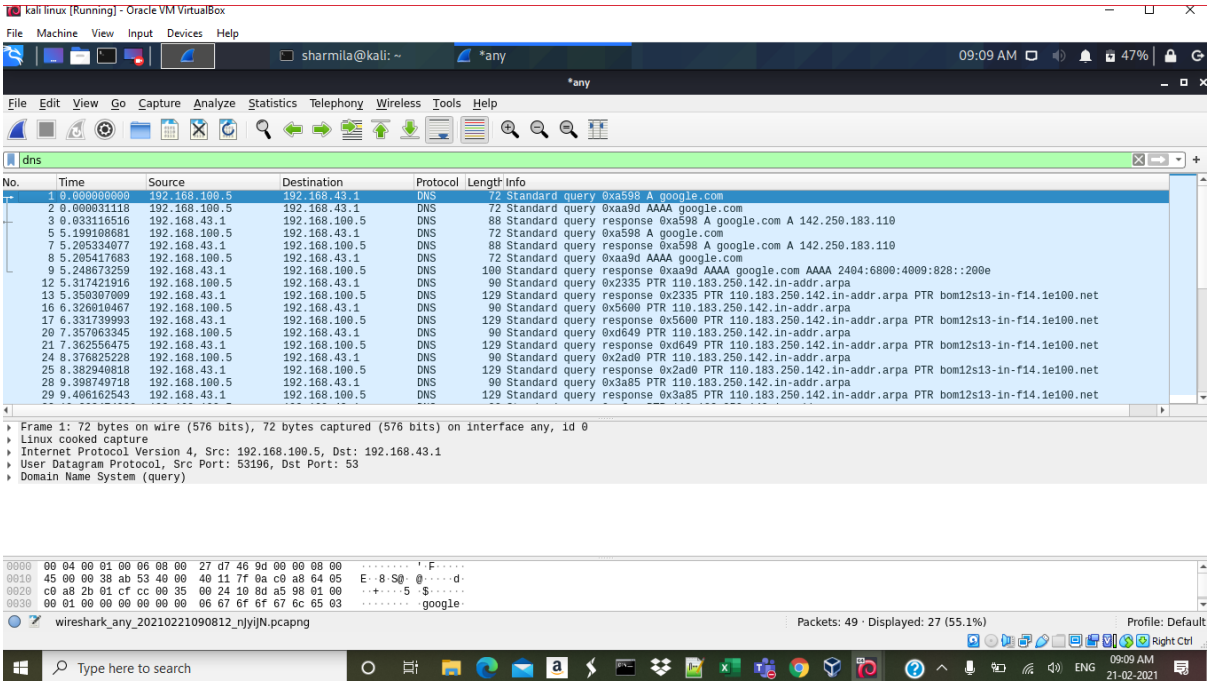


SERVER:

```
ubuntu@ubuntu-VirtualBox: ~
ubuntu@ubuntu-VirtualBox:~$ ip addr
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN group defaul
t qlen 1000
    link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00
    inet 127.0.0.1/8 scope host lo
       valid_lft forever preferred_lft forever
    inet6 ::1/128 scope host
       valid_lft forever preferred_lft forever
2: enp0s3: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel state UP gr
oup default qlen 1000
    link/ether 08:00:27:ae:91:37 brd ff:ff:ff:ff:ff:ff
    inet 192.168.100.4/24 brd 192.168.100.255 scope global dynamic noprefixroute
 enp0s3
       valid_lft 552sec preferred_lft 552sec
    inet6 fe80::e8d0:38eb:4580:462e/64 scope link noprefixroute
       valid_lft forever preferred_lft forever
ubuntu@ubuntu-VirtualBox:~$
```

Observation 1:

Ping a computer such as www.google.com (any domain). Please use Wireshark to show the DNS query triggered by your ping command and DNS response. Describe your observation.



OBSERVATION 2 : Configuring Client Machine

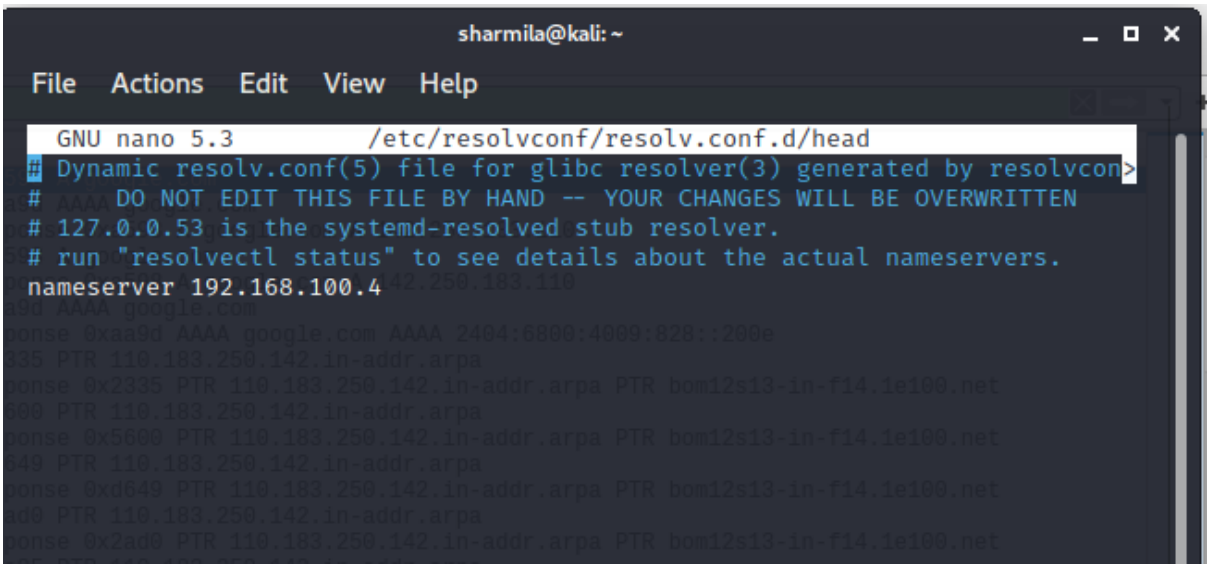
• The IP Address of the client machine is 192.168.100.5 and the IP Address of the server machine is 192.168.100.4

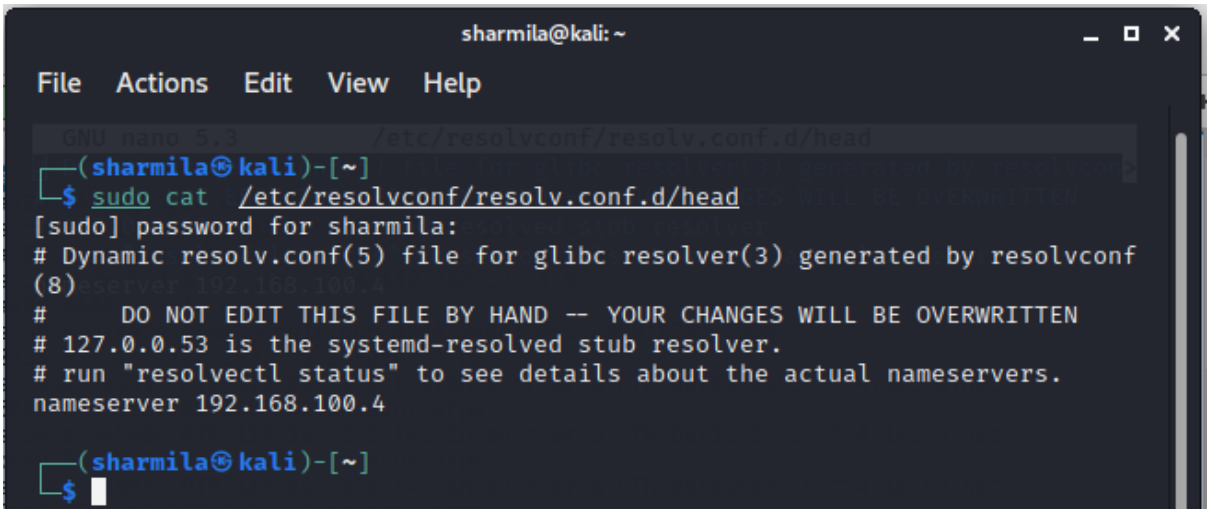
• We need to add the IP Address of the custom DNS server (192.168.100.4) to the client machine.

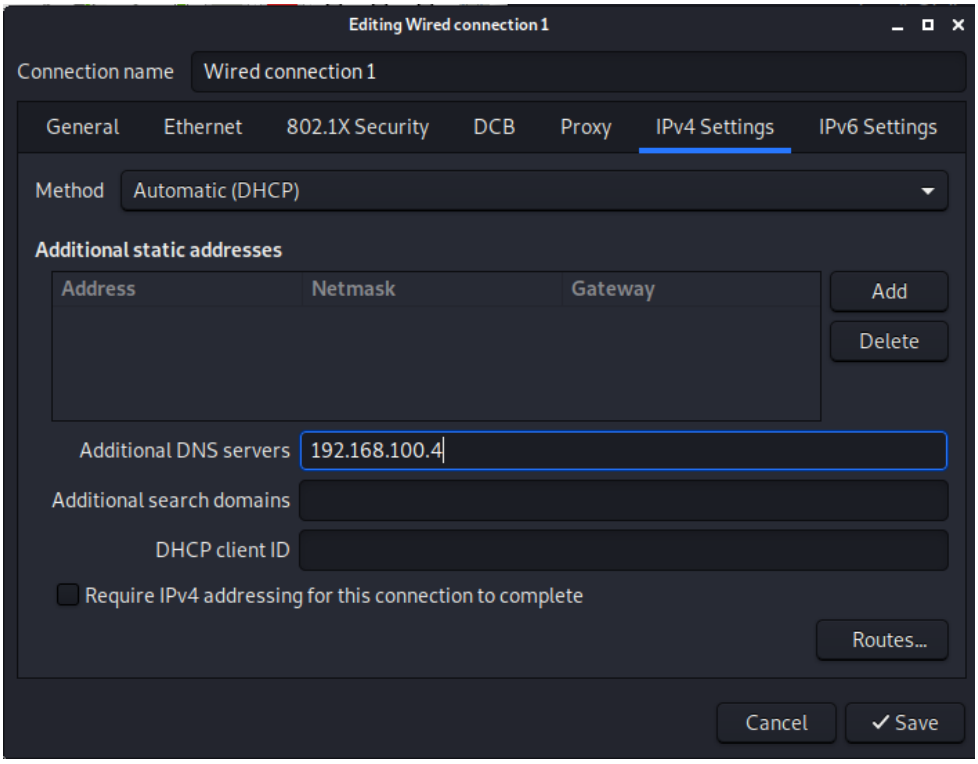
• This is done by adding the IP address of the server to the file ***/etc/resolvconf/resolv.conf.d/***head which stores the order of DNS server resolution. This ensures that the custom DNS server will be used to resolve names.

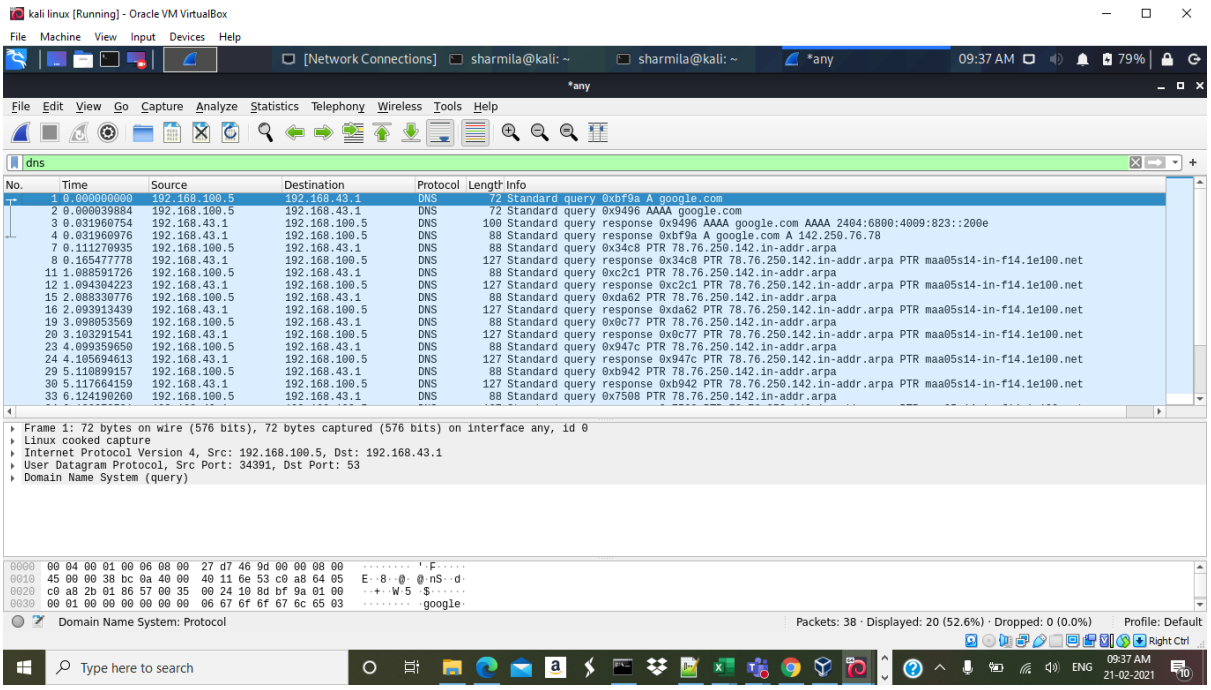
• The IP Address of the custom DNS server is also added to the DNS menu under theIPv4 Network Settings.

• The changes are applied by using the command ***sudo resolvconf -u***





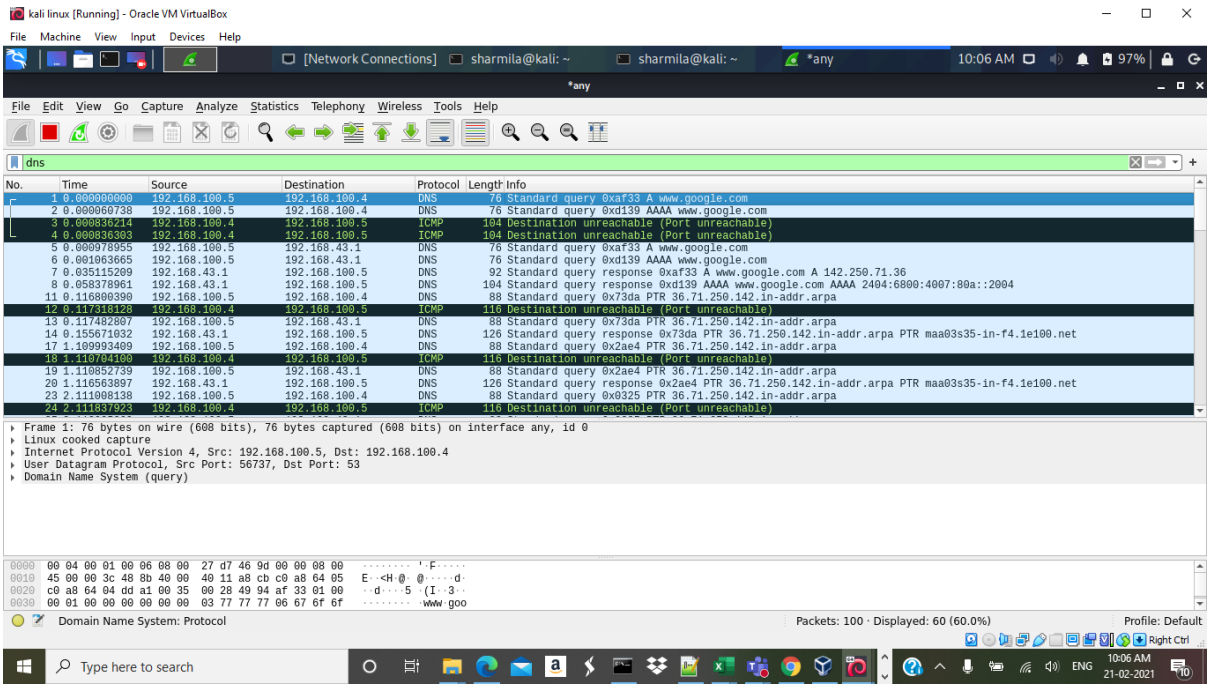




Observation 2:

Ping a computer such as www.google.com. Please use Wireshark to show the DNS query triggered by your ping command and DNS response.

- The google website is pinged again, and Wireshark is used to capture packets.
- We obtain a destination unreachable error in Wireshark as the server machine does not have a DNS server associated with it
- The client tries to obtain the DNS record from 192.168.100.4 but it does not receive any



Task 2:

Set Up a Local DNS Server Note: If bind9 server is not already installed, install using the command

$ sudo apt-get update

$ sudo apt-get install bind9

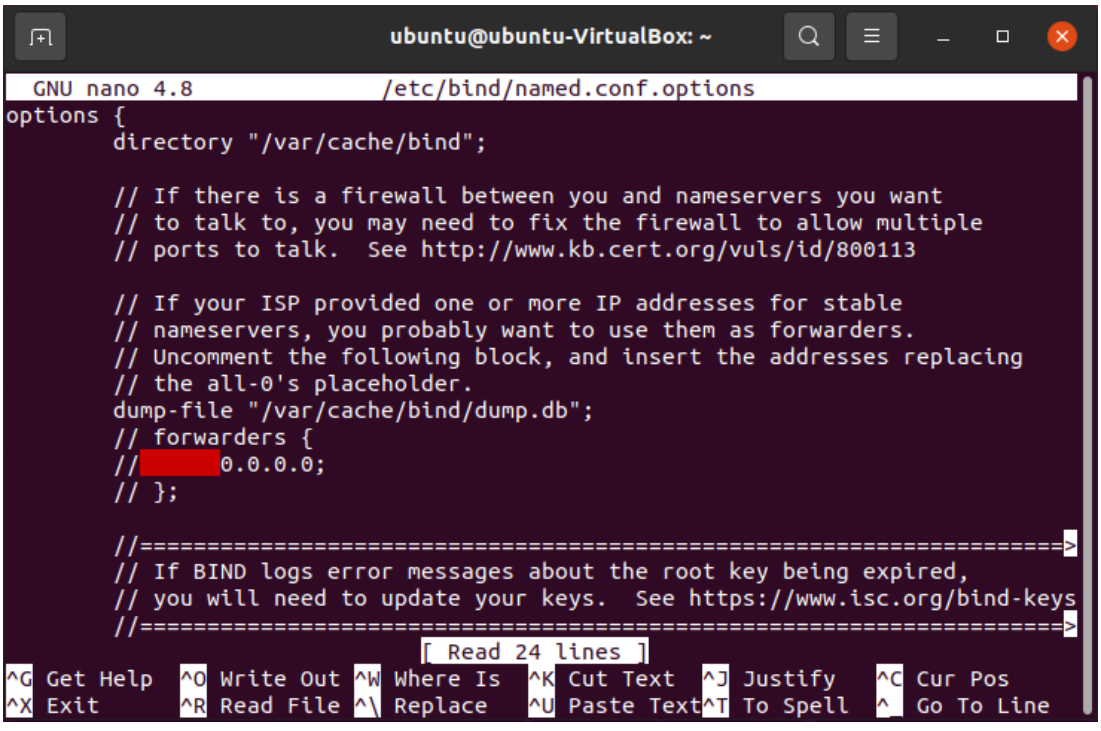
STEP 1 : CONFIGURING BIND9 SERVER

• BIND9 gets its configuration from a file called ***/etc/bind/named.conf***. This file is the primary configuration file, and it usually contains several “include” entries

• One of the included files is called /***etc/bind/named.conf.options***

• This is where we typically set up the configuration options.

• BIND dumps the cache to a default file called ***/var/cache/bind/dump.db.***



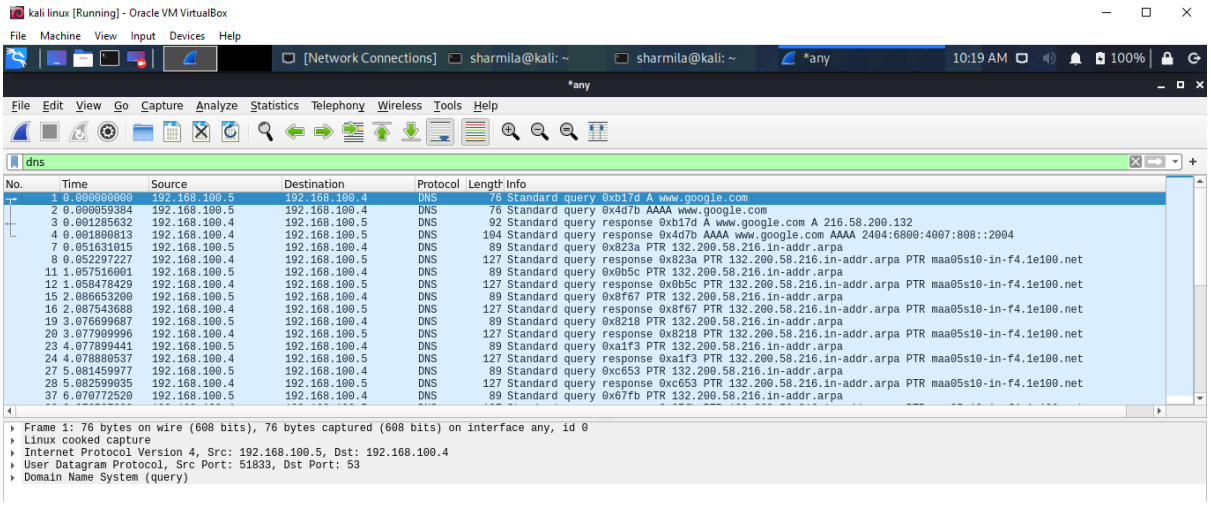
Step 2: Start DNS server:

$ sudo service bind9 restart

```
ubuntu@ubuntu-VirtualBox:~$  sudo service bind9 restart
ubuntu@ubuntu-VirtualBox:~$
```

Observation 3:

Now, go back to your user machine (192.168.100.4), and ping a computer such as www.google.com

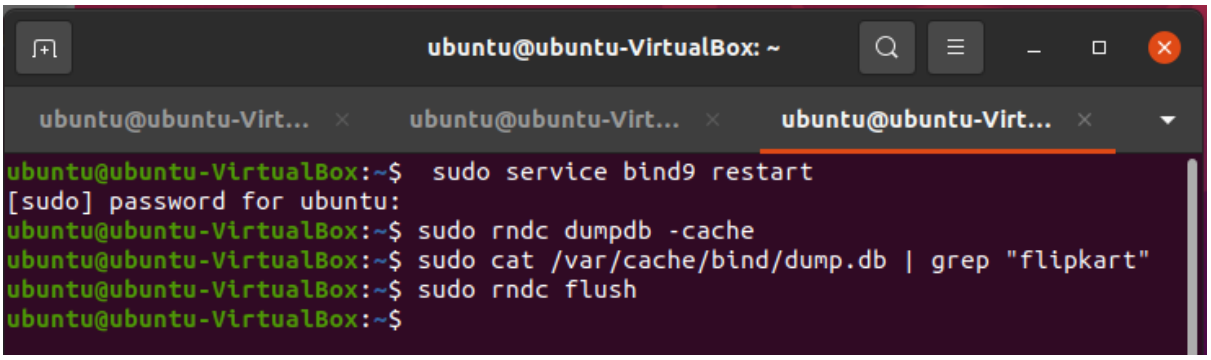


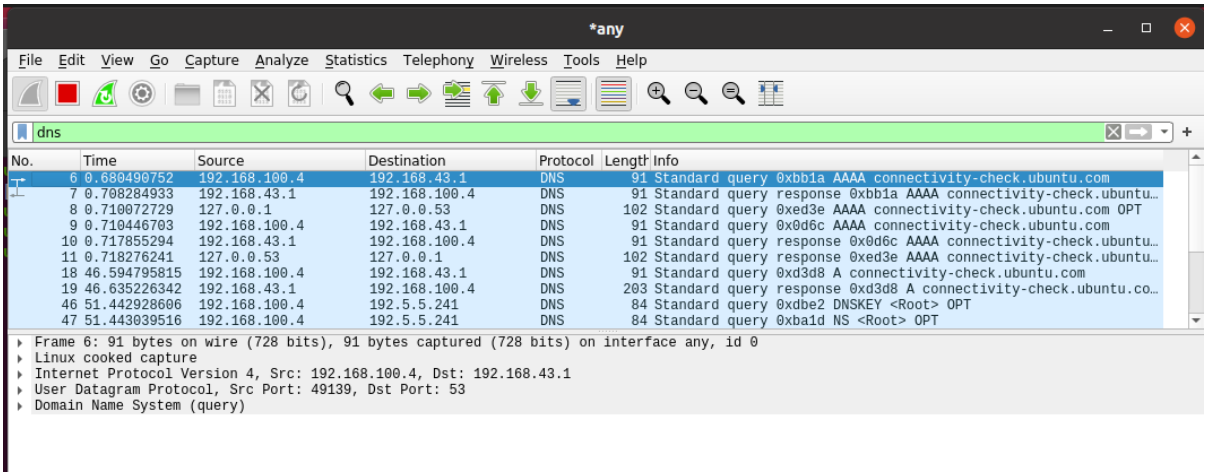
OBSERVATION 5 : Viewing the cache file

• The cache can be dumped into the file using sudo rndc dumpdb -cache and can be cleared or flushed out using sudo rndc flush.

• The linux command to extract cache for www.google.com from dump.db file,

• sudo ***cat /var/cache/bind/dump.db | grep "google***"



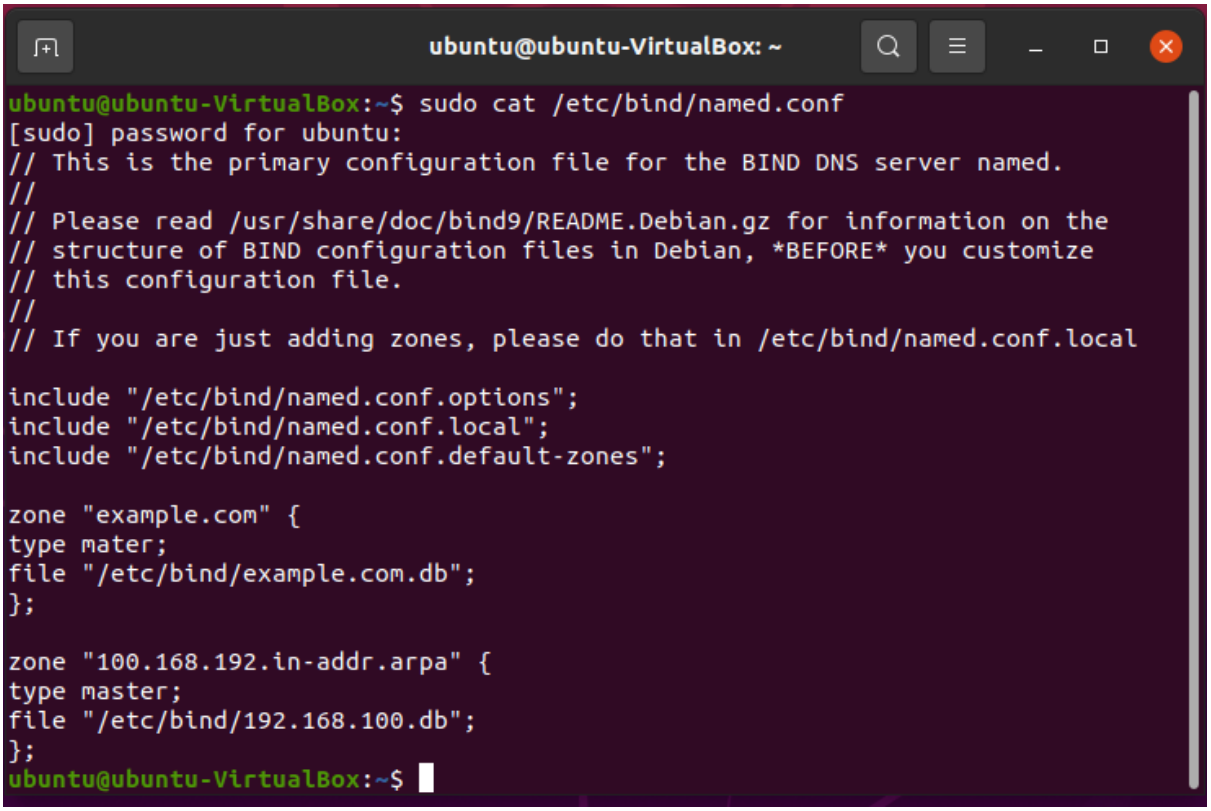


OBSERVATION 6 : Host a Zone in the Local DNS server

• We will use our local DNS server as the authoritative nameserver for the domain. In this lab, we will set up an authoritative server for the example.com domain. This domain name is reserved for use in documentation, and is not owned by anybody, so it is safe to use it.

Step 1: Create Zones

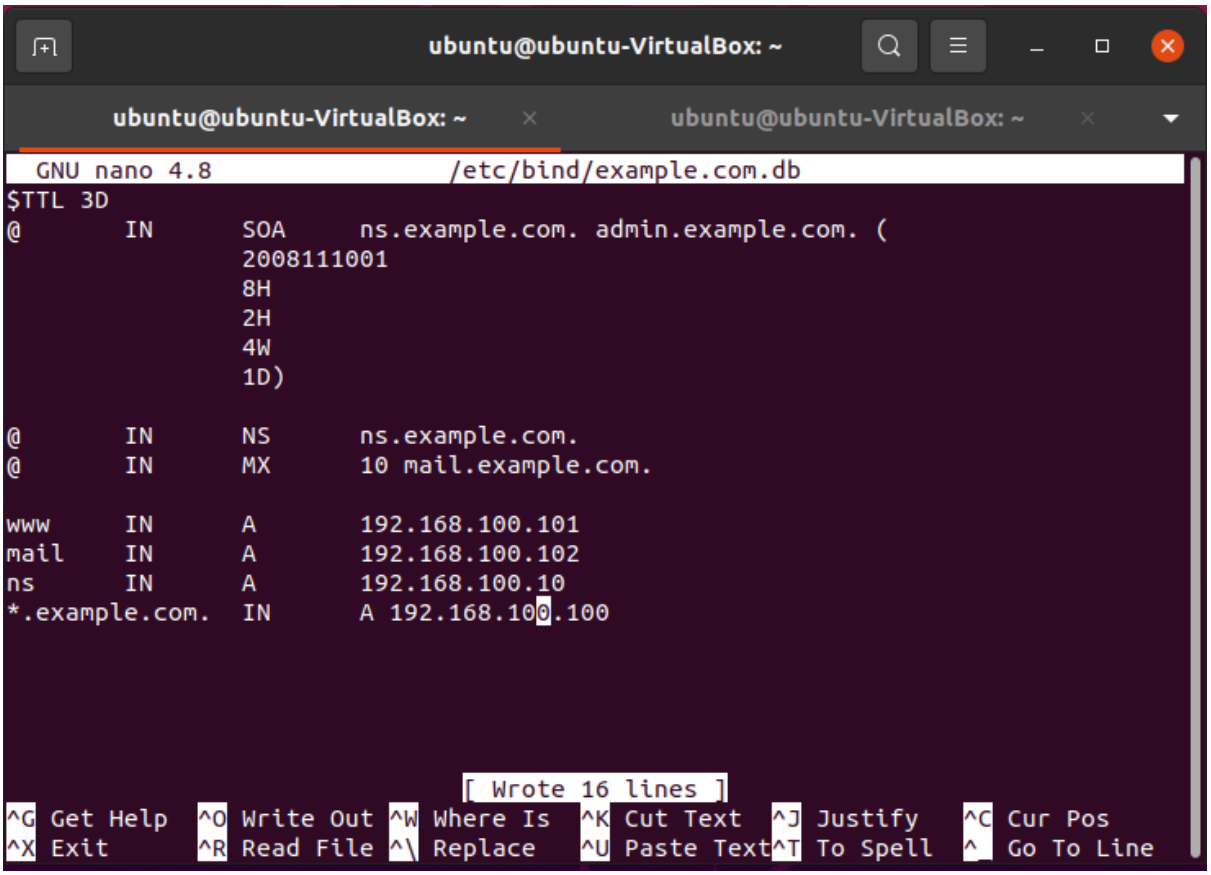
• We had two zone entries in the DNS server by adding the following contents to ***/etc/bind/named.conf*** as shown in the below screenshot. The first zone is for forward lookup (from hostname to IP), and the second zone is for reverse lookup (from IP to hostname).

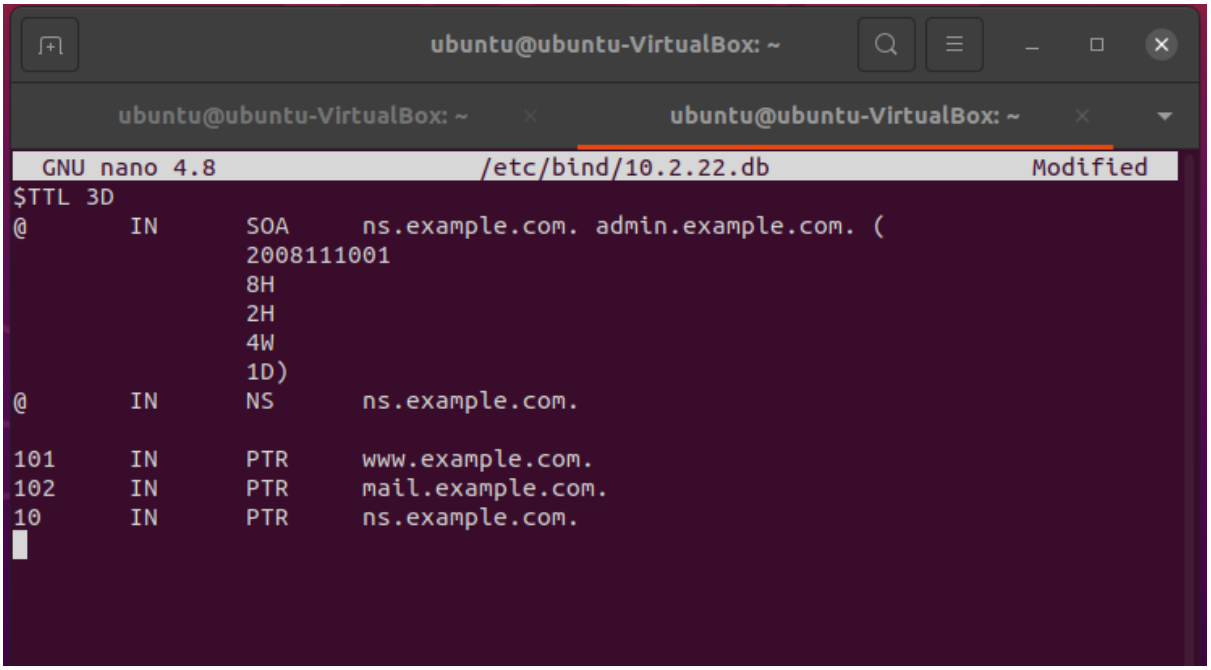


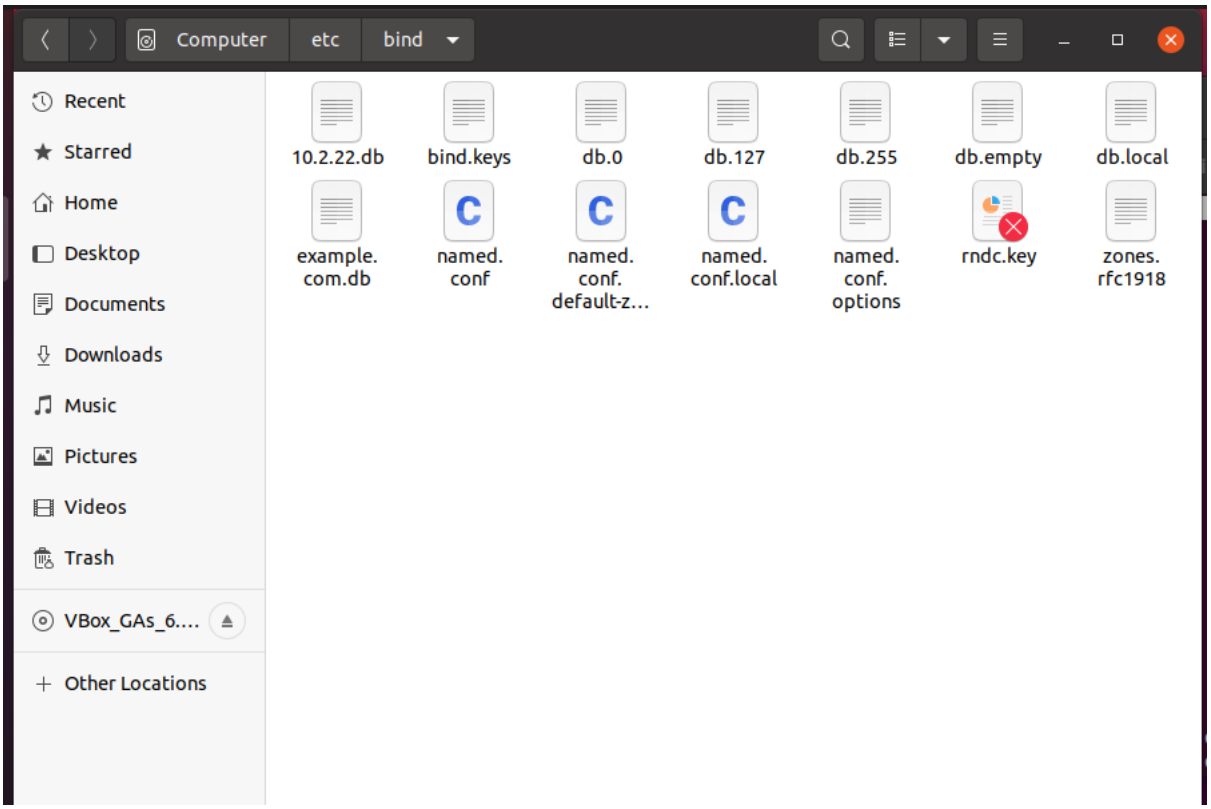
Step 2: Setup the forward lookup zone file

• We create example.com.db zone file with the following contents in the /etc/bind/ directory where the actual DNS resolution is stored.

• We create 10.2.22.db zone file with the following contents in the /etc/bind/ directory where the actual DNS resolution is stored.



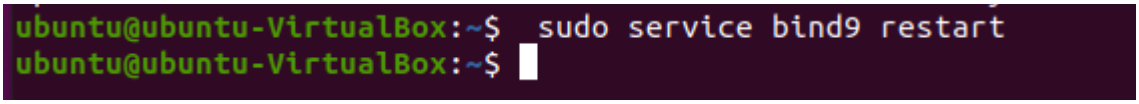


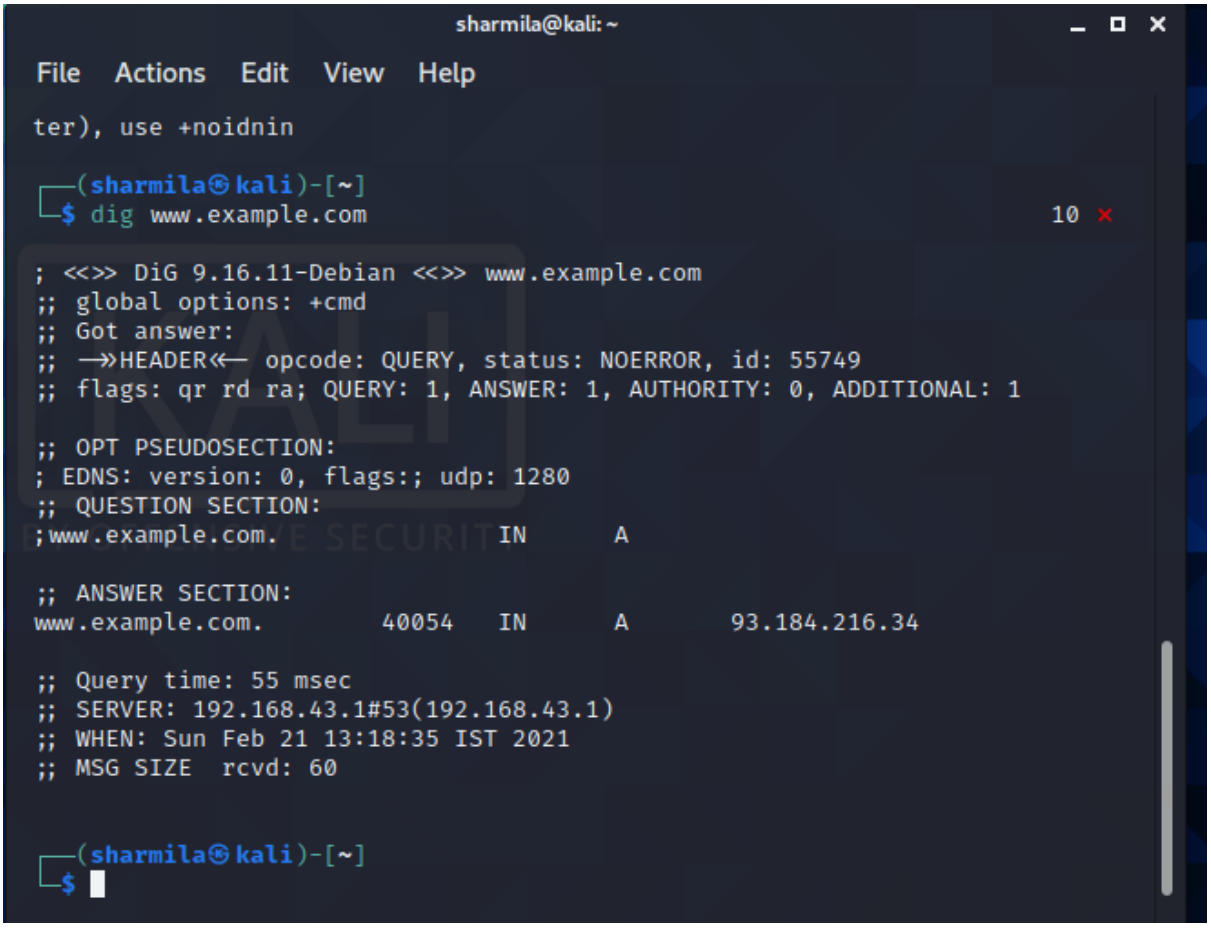


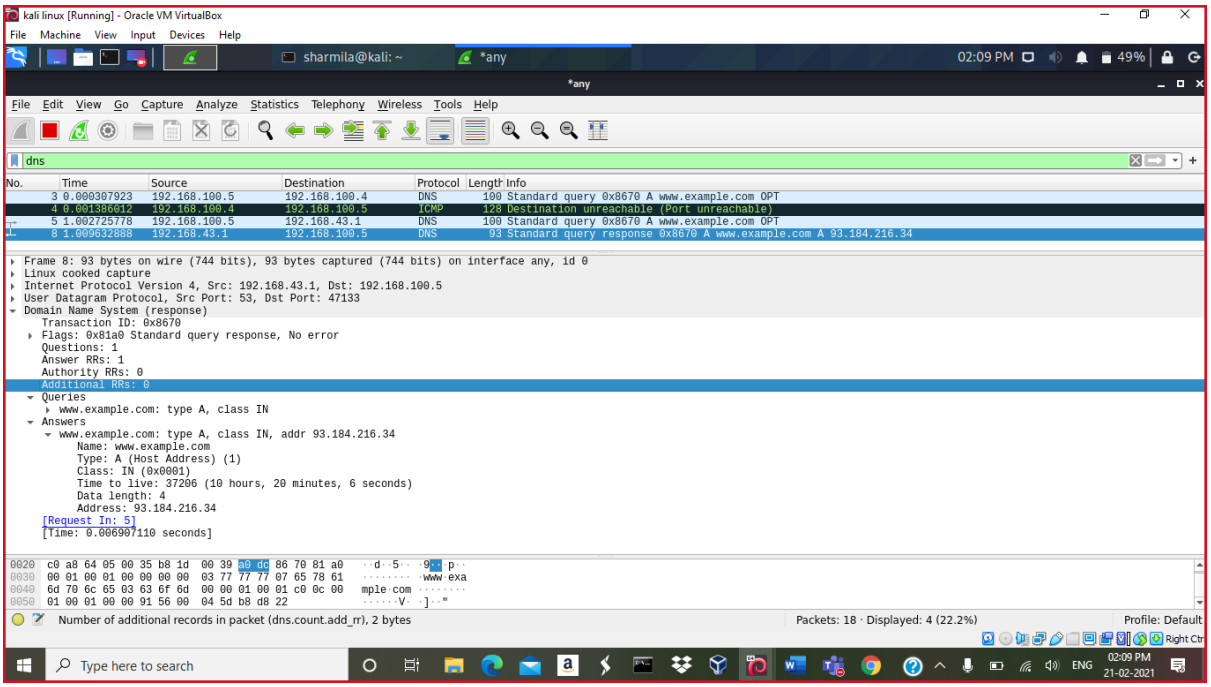
OBSERVATION 7 : Restart the BIND server and test

Step 1: When all the changes are made, remember to restart the BIND server. Now we will restart the DNS server using the following command: ***$ sudo service bind9 restart***

Step 2: Now, go back to the client machine and ask the local DNS server for the IP address of www.example.com using the dig command.




sharmila@kali: ~
File Actions Edit View Help
ter), use +noidnin
(sharmila㉿kali)-[~]
$ dig www.example.com
10
; <<>> DiG 9.16.11-Debian <<>> www.example.com
;; global options: +cmd
;; Got answer:
;; →→HEADER←← opcode: QUERY, status: NOERROR, id: 55749
;; flags: qr rd ra; QUERY: 1, ANSWER: 1, AUTHORITY: 0, ADDITIONAL: 1
;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags:; udp: 1280
;; QUESTION SECTION:
;www.example.com. IN A
;; ANSWER SECTION:
www.example.com. 40054 IN A 93.184.216.34
;; Query time: 55 msec
;; SERVER: 192.168.43.1#53(192.168.43.1)
;; WHEN: Sun Feb 21 13:18:35 IST 2021
;; MSG SIZE rcvd: 60
(sharmila㉿kali)-[~]
$


kali linux [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help
sharmila@kali: ~
*any
02:09 PM
49%
*any
File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help
dns
No. Time Source Destination Protocol Length Info
3 0.000307923 192.168.100.5 192.168.100.4 DNS 100 Standard query 0x8670 A www.example.com OPT
4 0.001386012 192.168.100.4 192.168.100.5 ICMP 128 Destination unreachable (Port unreachable)
5 1.002725778 192.168.100.5 192.168.43.1 DNS 100 Standard query 0x8670 A www.example.com OPT
8 1.009632888 192.168.43.1 192.168.100.5 DNS 93 Standard query response 0x8670 A www.example.com A 93.184.216.34
Frame 8: 93 bytes on wire (744 bits), 93 bytes captured (744 bits) on interface any, id 0
Linux cooked capture
Internet Protocol Version 4, Src: 192.168.43.1, Dst: 192.168.100.5
User Datagram Protocol, Src Port: 53, Dst Port: 47133
Domain Name System (response)
Transaction ID: 0x8670
Flags: 0x81a0 Standard query response, No error
Questions: 1
Answer RRs: 1
Authority RRs: 0
Additional RRs: 0
Queries
www.example.com: type A, class IN
Answers
www.example.com: type A, class IN, addr 93.184.216.34
Name: www.example.com
Type: A (Host Address) (1)
Class: IN (0x0001)
Time to live: 37206 (10 hours, 20 minutes, 6 seconds)
Data length: 4
Address: 93.184.216.34
[Request In: 5]
[Time: 0.006907110 seconds]
Number of additional records in packet (dns.count.add_rr), 2 bytes
Packets: 18 · Displayed: 4 (22.2%)
Profile: Default
Type here to search
ENG
02:09 PM
21-02-2021

QUESTIONS

1. Locate the DNS query and response messages. Are then sent over UDP or TCP?

The DNS Query and Response messages are visible in the screenshots. They are sent over UDP(User Datagram Protocol).

2. What is the destination port for the DNS query message? What is the source port of DNS response message?

The destination and source ports of the DNS query and response messages are the same. The port number for DNS protocol is 53.

3. To what IP address is the DNS query message sent? Use ipconfig to determine the IP address of your local DNS server. Are these two IP addresses the same?

The DNS query is made to server at the IP Address 192.168.100.4. This is the same as the local DNS server configured.

4. Examine the DNS query message. What “Type" of DNS query is it? Does the query message contain any “answers"?

The DNS Query is of type A since it requests for an authoritative record. The answer section is empty since it does not have any answer.

5. Examine the DNS response message. How many “answers" are provided? What do each of these answers contain?

The answer section of the DNS response message contains one Resource Record. A type RR: This provides the IP Address of the hostname

6. Consider the subsequent TCP SYN packet sent by your host. Does the destination IP address of the SYN packet correspond to any of the IP addresses provided in the DNS response message?

The destination IP Address of the SYN packet corresponds to the IP Address of hostname (www.google.com) retrieved from the response message.