

网络与信息安全课内实验 Host文件与DNS投毒

了解Hosts文件

实验环境

Ubuntu16 04

实验原理

hosts 文件是本地解析 DNS 的文件，它允许将特定的域名解析到指定的 IP 地址。将 `www.google.com` 映射到 `127.0.0.1`，使浏览器认为访问 `www.google.com` 实际上是在访问本地服务器。

而本地服务器运行了 Apache2，它在监听 `127.0.0.1` 的 HTTP 请求。当你在浏览器中访问 `www.google.com`，由于 hosts 文件的映射，DNS 查询返回 `127.0.0.1`，浏览器的请求被发送到本地服务器。本地的 Apache2 服务器接收到请求，并返回其默认页面。

通过修改 hosts 文件，将域名 `www.google.com` 解析到本地地址 `127.0.0.1`，而本地地址正运行着 Apache2 服务，默认显示的是其配置的默认页面。

实验过程

修改hosts文件，并安装apache2服务。

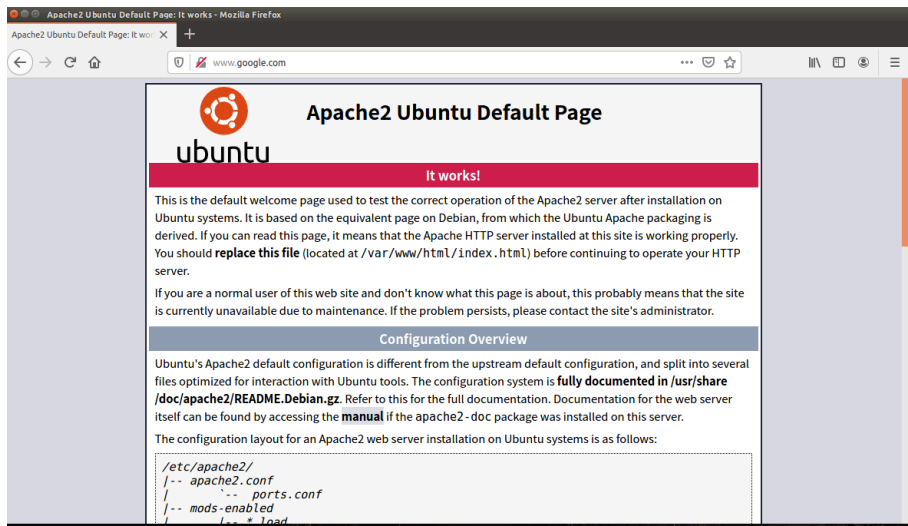
```
spwang@nsServer: /etc
127.0.0.1      localhost
127.0.1.1      nsServer

# The following lines are desirable for IPv6 capable hosts
::1          ip6-localhost ip6-loopback
fe00::0      ip6-localnet
ff00::0      ip6-mcastprefix
ff02::1      ip6-allnodes
ff02::2      ip6-allrouters

127.0.0.1 www.google.com

"hosts" [只读] 13L, 251C
```

打开 www.google.com 后结果如图



实验困难及解决方式

无。

使用 dig 工具查看网站域名解析过程

实验环境

Ubuntu16.04

实验原理

DNS 解析原理

- 1. **DNS 请求的过程：**
 - 用户输入域名（如 `www.example.com` ），操作系统首先检查本地缓存是否有解析结果。
 - 如果没有缓存，操作系统通过 DNS 服务器发起查询。
- 2. **递归查询：**
 - DNS 查询分为多个步骤：
 - a. **根域名服务器：**指向顶级域名服务器（如 `.com` ）。
 - b. **顶级域名服务器：**指向目标域名的权威名称服务器。
 - c. **权威名称服务器：**返回最终的 IP 地址。
- 3. **迭代查询：**
 - 客户端会自己查询每一级的 DNS 服务器。

dig 工具的工作原理

dig是用来查询 DNS 记录的工具，提供详细的 DNS 解析过程。

实验过程

查看dig命令用法

```
spwang@nsServer:~$ dig -h
Usage: dig [@global-server] [domain] [q-type] [q-class] [q-opt]
       {global-d-opt} host [@local-server] {local-d-opt}
       [ host [@local-server] {local-d-opt} [...] ]
where: domain is in the Domain Name System
       q-class is one of (in,hs,ch,...) [default: in]
       q-type is one of (a,any,mx,ns,soa,hinfo,axfr,txt,...) [default:a]
              (Use ixfr=version for type ixfr)
       q-opt is one of:
              -4 (use IPv4 query transport only)
              -6 (use IPv6 query transport only)
              -b address[#port] (bind to source address/port)
              -c class (specify query class)
              -f filename (batch mode)
              -i (use IP6.INT for IPv6 reverse lookups)
              -k keyfile (specify tsig key file)
              -m (enable memory usage debugging)
              -p port (specify port number)
              -q name (specify query name)
              -t type (specify query type)
              -u (display times in usec instead of msec)
              -x dot-notation (shortcut for reverse lookups)
              -y [mac:]name:key (specify named base64 tsig key)
       d-opt is of the form +keyword[=value], where keyword is:
              +[no]aaonly (Set AA flag in query (+[no]aaflag))
              +[no]additional (Control display of additional section)
              +[no]adflag (Set AD flag in query (default on))
              +[no]all (Set or clear all display flags)
              +[no]answer (Control display of answer section)
              +[no]authority (Control display of authority section)
              +[no]besteffort (Try to parse even illegal messages)
              +bufsize=### (Set EDNS0 Max UDP packet size)
              +[no]cdflag (Set checking disabled flag in query)
              +[no]cl (Control display of class in records)
              +[no]cmd (Control display of command line)
              +[no]comments (Control display of comment lines)
              +[no]crypto (Control display of cryptographic fields in records)
              +[no]defname (Use search list (+[no]search))
              +[no]dnssec (Request DNSSEC records)
              +domain=### (Set default domainname)
              +[no]edns[=###] (Set EDNS version) [0]
              +ednsflags=### (Set EDNS flag bits)
```

使用dig解析 www.baidu.com :

```
spwang@nsServer:~$ dig www.baidu.com
+ [no]recurse (Recursive mode)
+ retry=### (Set number of UDP retries) [2]
+ [no]rrcomments (Control display of per-record comments)
+ [no]search (Set whether to use searchlist)
+ [no]short (Display nothing except short form of answer)
+ [no]showsearch (Search with intermediate results)
+ [no]split=## (Split hex/base64 fields into chunks)
+ [no]stats (Control display of statistics)
+ subnet=addr (Set edns-client-subnet option)
+ [no]tcp (TCP mode (+[no]vc))
+ time=### (Set query timeout) [5]
+ [no]trace (Trace delegation down from root [+dnssec])
+ tries=### (Set number of UDP attempts) [3]
+ [no]ttlid (Control display of ttls in records)
+ [no]vc (TCP mode (+[no]tcp))
global d-opts and servers (before host name) affect all queries.
local d-opts and servers (after host name) affect only that lookup.
-h (print help and exit)
-v (print version and exit)

spwang@nsServer:~$ dig www.baidu.com
<<>> DiG 9.10.3-P4-Ubuntu <<>> www.baidu.com
; global options: +cmd
; Got answer:
; ->HEADER<- opcode: QUERY, status: NOERROR, id: 36526
; flags: qr rd ra; QUERY: 1, ANSWER: 3, AUTHORITY: 0, ADDITIONAL: 0

; QUESTION SECTION:
; www.baidu.com. IN A

; ANSWER SECTION:
www.baidu.com. 5 IN CNAME www.a.shifen.com.
www.a.shifen.com. 5 IN A 110.242.68.4
www.a.shifen.com. 5 IN A 110.242.68.3

; Query time: 5 msec
; SERVER: 127.0.1.1#53(127.0.1.1)
; WHEN: Sun Nov 10 18:27:54 CST 2024
; MSG SIZE rcvd: 90

spwang@nsServer:~$
```

使用dig +trace命令, 查看 www.bilibili.com 完整的解析过程:

第一步, 查询root根服务器

```

gongji@gongji-virtual-machine:~$ dig +trace www.bilibili.com

; <<>> DiG 9.18.28-0ubuntu0.22.04.1-Ubuntu <<>> +trace www.bilibili.com
;; global options: +cmd
.          5      IN      NS      e.root-servers.net.
.          5      IN      NS      g.root-servers.net.
.          5      IN      NS      l.root-servers.net.
.          5      IN      NS      m.root-servers.net.
.          5      IN      NS      f.root-servers.net.
.          5      IN      NS      j.root-servers.net.
.          5      IN      NS      i.root-servers.net.
.          5      IN      NS      d.root-servers.net.
.          5      IN      NS      h.root-servers.net.
.          5      IN      NS      b.root-servers.net.
.          5      IN      NS      c.root-servers.net.
.          5      IN      NS      a.root-servers.net.
.          5      IN      NS      k.root-servers.net.
;; Received 239 bytes from 127.0.0.53#53(127.0.0.53) in 5 ms

;; UDP setup with 2001:500:9f::42#53(2001:500:9f::42) for www.bilibili.com failed: network unreachable.
;; no servers could be reached

```

第二步，查询 .com 服务器

```

gongji@gongji-virtual-machine:~$ dig NS com

; <<>> DiG 9.18.28-0ubuntu0.22.04.1-Ubuntu <<>> NS com
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 30301
;; flags: qr rd ra; QUERY: 1, ANSWER: 13, AUTHORITY: 0, ADDITIONAL: 1

;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags:; udp: 65494
;; QUESTION SECTION:
;com.                IN      NS

;; ANSWER SECTION:
com.                 5      IN      NS      d.gtld-servers.net.
com.                 5      IN      NS      m.gtld-servers.net.
com.                 5      IN      NS      l.gtld-servers.net.
com.                 5      IN      NS      e.gtld-servers.net.
com.                 5      IN      NS      c.gtld-servers.net.
com.                 5      IN      NS      b.gtld-servers.net.
com.                 5      IN      NS      j.gtld-servers.net.
com.                 5      IN      NS      a.gtld-servers.net.
com.                 5      IN      NS      h.gtld-servers.net.
com.                 5      IN      NS      i.gtld-servers.net.
com.                 5      IN      NS      f.gtld-servers.net.
com.                 5      IN      NS      g.gtld-servers.net.
com.                 5      IN      NS      k.gtld-servers.net.

;; Query time: 7 msec
;; SERVER: 127.0.0.53#53(127.0.0.53) (UDP)
;; WHEN: Mon Nov 25 14:38:33 CST 2024
;; MSG SIZE rcvd: 256

```

第三步，查询 bilibili.com 服务器

```

gongji@gongji-virtual-machine:~$ dig NS bilibili.com

; <<>> DiG 9.18.28-0ubuntu0.22.04.1-Ubuntu <<>> NS bilibili.com
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 6093
;; flags: qr rd ra; QUERY: 1, ANSWER: 2, AUTHORITY: 0, ADDITIONAL: 1

;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags:; udp: 65494
;; QUESTION SECTION:
;bilibili.com.                IN      NS

;; ANSWER SECTION:
bilibili.com.                5       IN      NS      ns4.dnsv5.com.
bilibili.com.                5       IN      NS      ns3.dnsv5.com.

;; Query time: 5 msec
;; SERVER: 127.0.0.53#53(127.0.0.53) (UDP)
;; WHEN: Mon Nov 25 14:39:30 CST 2024
;; MSG SIZE rcvd: 83

```

第四步，查询 `www.bilibili.com` 服务器地址

```

gongji@gongji-virtual-machine:~$ dig www,bilibili.com

; <<>> DiG 9.18.28-0ubuntu0.22.04.1-Ubuntu <<>> www,bilibili.com
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NXDOMAIN, id: 37514
;; flags: qr rd ra; QUERY: 1, ANSWER: 0, AUTHORITY: 1, ADDITIONAL: 1

;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags:; udp: 65494
;; QUESTION SECTION:
;www,bilibili.com.            IN      A

;; AUTHORITY SECTION:
com.                5       IN      SOA      a.gtld-servers.net. nstld.verisign-g
rs.com. 1732516762 1800 900 604800 900

;; Query time: 164 msec
;; SERVER: 127.0.0.53#53(127.0.0.53) (UDP)
;; WHEN: Mon Nov 25 14:39:44 CST 2024
;; MSG SIZE rcvd: 118

```

使用dig+trace解析另一个域名，并写出每一步过程解释。

使用dig +trace命令，查看 `www.4399.com` 完整的解析过程：

第一步，查询root根服务器

```

gongji@gongji-virtual-machine:~$ dig +trace www.4399.com

; <<>> DiG 9.18.28-0ubuntu0.22.04.1-Ubuntu <<>> +trace www.4399.com
;; global options: +cmd
.          5      IN      NS      e.root-servers.net.
.          5      IN      NS      g.root-servers.net.
.          5      IN      NS      l.root-servers.net.
.          5      IN      NS      m.root-servers.net.
.          5      IN      NS      f.root-servers.net.
.          5      IN      NS      j.root-servers.net.
.          5      IN      NS      i.root-servers.net.
.          5      IN      NS      d.root-servers.net.
.          5      IN      NS      h.root-servers.net.
.          5      IN      NS      b.root-servers.net.
.          5      IN      NS      c.root-servers.net.
.          5      IN      NS      a.root-servers.net.
.          5      IN      NS      k.root-servers.net.
;; Received 239 bytes from 127.0.0.53#53(127.0.0.53) in 8 ms

www.4399.com.      60      IN      CNAME   www.4399.com.lxdns.com.
www.4399.com.lxdns.com. 60      IN      A       113.201.242.58
;; Received 79 bytes from 202.12.27.33#53(m.root-servers.net) in 3 ms

```

第二步，查询 .com 服务器

```

gongji@gongji-virtual-machine:~$ dig NS com

; <<>> DiG 9.18.28-0ubuntu0.22.04.1-Ubuntu <<>> NS com
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 30301
;; flags: qr rd ra; QUERY: 1, ANSWER: 13, AUTHORITY: 0, ADDITIONAL: 1

;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags:; udp: 65494
;; QUESTION SECTION:
;com.                IN      NS

;; ANSWER SECTION:
com.                 5      IN      NS      d.gtld-servers.net.
com.                 5      IN      NS      m.gtld-servers.net.
com.                 5      IN      NS      l.gtld-servers.net.
com.                 5      IN      NS      e.gtld-servers.net.
com.                 5      IN      NS      c.gtld-servers.net.
com.                 5      IN      NS      b.gtld-servers.net.
com.                 5      IN      NS      j.gtld-servers.net.
com.                 5      IN      NS      a.gtld-servers.net.
com.                 5      IN      NS      h.gtld-servers.net.
com.                 5      IN      NS      i.gtld-servers.net.
com.                 5      IN      NS      f.gtld-servers.net.
com.                 5      IN      NS      g.gtld-servers.net.
com.                 5      IN      NS      k.gtld-servers.net.

;; Query time: 7 msec
;; SERVER: 127.0.0.53#53(127.0.0.53) (UDP)
;; WHEN: Mon Nov 25 14:38:33 CST 2024
;; MSG SIZE rcvd: 256

```

第三步，查询 4399.com 服务器

```
gongji@gongji-virtual-machine:~$ dig NS 4399.com

; <<>> DiG 9.18.28-0ubuntu0.22.04.1-Ubuntu <<>> NS 4399.com
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 54912
;; flags: qr rd ra; QUERY: 1, ANSWER: 2, AUTHORITY: 0, ADDITIONAL: 1

;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags:; udp: 65494
;; QUESTION SECTION:
;4399.com.                IN      NS

;; ANSWER SECTION:
4399.com.                 5       IN      NS      ns1.dnsv5.com.
4399.com.                 5       IN      NS      ns2.dnsv5.com.

;; Query time: 4 msec
;; SERVER: 127.0.0.53#53(127.0.0.53) (UDP)
;; WHEN: Mon Nov 25 14:43:04 CST 2024
;; MSG SIZE rcvd: 79
```

第四步，查询 `www.4399.com` 服务器地址

```
gongji@gongji-virtual-machine:~$ dig www.4399.com

; <<>> DiG 9.18.28-0ubuntu0.22.04.1-Ubuntu <<>> www.4399.com
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 31339
;; flags: qr rd ra; QUERY: 1, ANSWER: 2, AUTHORITY: 0, ADDITIONAL: 1

;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags:; udp: 65494
;; QUESTION SECTION:
;www.4399.com.            IN      A

;; ANSWER SECTION:
www.4399.com.             5       IN      CNAME   www.4399.com.lxdns.com.
www.4399.com.lxdns.com.  5       IN      A       113.201.242.58

;; Query time: 7 msec
;; SERVER: 127.0.0.53#53(127.0.0.53) (UDP)
;; WHEN: Mon Nov 25 14:43:25 CST 2024
;; MSG SIZE rcvd: 90
```

实验困难及解决方式

无。

dns投毒实验

实验环境

服务器端ubuntu16.04，攻击端22.04，测试机22.04

实验原理

- 1.伪造DNS响应：攻击者发送包含虚假域名-IP映射关系的欺骗性响应数据包给DNS服务器。这些数据包中包含虚假的IP地址，目的是替换掉真实的IP地址。
- 2.利用DNS缓存漏洞：在某些情况下，如果DNS服务器未严格验证响应来源，可能会接受并缓存这些虚假信息。当有合法客户端请求相应域名解析时，DNS服务器会返回攻击者设定的错误IP地址

实验过程

配置服务器端

通过named.conf.options文件，实现修改DNS查询端口，以及关闭dnssec-validation服务。

```
spwang@nsServer: /etc/bind
options {
    directory "/var/cache/bind";
    dump-file "/var/cache/bind/dump.db";
    query-source port 33333;
    // If there is a firewall between you and nameservers you want
    // to talk to, you may need to fix the firewall to allow multiple
    // ports to talk. See http://www.kb.cert.org/vuls/id/800113

    // If your ISP provided one or more IP addresses for stable
    // nameservers, you probably want to use them as forwarders.
    // Uncomment the following block, and insert the addresses replacing
    // the all-0's placeholder.

    // forwarders {
    //     0.0.0.0;
    // };

    //=====
    // If BIND logs error messages about the root key being expired,
    // you will need to update your keys. See https://www.isc.org/bind-keys
    //=====
    // dnssec-validation auto;
    dnssec-enable no;
    auth-nxdomain no;          # conform to RFC1035
    listen-on-v6 { any; };
};
```

创建两个文件

[illegible]


```
spwang@nsServer: /etc/bind
$TTL 3D
@      IN      SOA      ns.example.com. admin.example.com. (
        2008111001
        8H
        2H
        4W
        1D)
@      IN      NS       ns.example.com
101    IN      PTR      www.example.com.
102    IN      PTR      mail.example.com.
10     IN      PTR      ns.example.com.
~
~
~
~
~
~
~
```

随后，重启bind9服务

```
spwang@nsServer:/etc/bind$ sudo rndc flush
spwang@nsServer:/etc/bind$ sudo service bind9 restart
spwang@nsServer:/etc/bind$
```

在Ubuntu攻击端

此时，可以执行一下dig www.example.com，可以看到返回的内容就是我们上述配置的内容

```
kehu@kehu:~$ dig www.example.com

; <<>> DiG 9.10.3-P4-Ubuntu <<>> www.example.com
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 10080
;; 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: 1 msec
;; SERVER: 192.168.109.130#53(192.168.109.130)
;; WHEN: Sun Nov 24 20:15:08 CST 2024
;; MSG SIZE rcvd: 93

kehu@kehu:~$
```

刷新DNS缓存，然后重启DNS服务器，将DNS数据导出并查看初始状态

```
spwang@nsServer:/etc/bind$ systemctl status bind9
● bind9.service - BIND Domain Name Server
   Loaded: loaded (/lib/systemd/system/bind9.service; enabled; vendor preset: en
   Drop-In: /run/systemd/generator/bind9.service.d
            └─50-insserv.conf-$named.conf
   Active: active (running) since 日 2024-11-24 20:17:45 CST; 6s ago
     Docs: man:named(8)
   Process: 83824 ExecStop=/usr/sbin/rndc stop (code=exited, status=0/SUCCESS)
    Main PID: 83829 (named)
      CGroup: /system.slice/bind9.service
              └─83829 /usr/sbin/named -f -u bind

11月 24 20:17:45 nsServer systemd[83829]: Created new service loaded on 11月 24
```

配置攻击端

先在服务端进行ip查询



再回到Ubuntu服务端，重新使用rndc生成日志记录，可以看到已经产生记录

```
spwang@nsServer:/var/cache/bind$ sudo rndc dumpdb
spwang@nsServer:/var/cache/bind$ cat dump.db | grep weibo
spwang@nsServer:/var/cache/bind$ sudo rndc dumpdb
spwang@nsServer:/var/cache/bind$ cat dump.db | grep weibo
tvax1.sinaimg.cn. 49 CNAME tvaxweibo.gslb.sinaedge.com.
tvax2.sinaimg.cn. 53 CNAME tvaxweibo.gslb.sinaedge.com.
tvax3.sinaimg.cn. 49 CNAME tvaxweibo.gslb.sinaedge.com.
tvax4.sinaimg.cn. 49 CNAME tvaxweibo.gslb.sinaedge.com.
wx1.sinaimg.cn. 49 CNAME weiboimgwx.gslb.sinaedge.com.
wx2.sinaimg.cn. 49 CNAME weiboimgwx.gslb.sinaedge.com.
wx3.sinaimg.cn. 49 CNAME weiboimgwx.gslb.sinaedge.com.
wx4.sinaimg.cn. 49 CNAME weiboimgwx.gslb.sinaedge.com.
tvaxweibo.grid.sinaedge.com. 49 CNAME ww1.sinaimg.cn.w.alikunlun.com.
weiboimgwx.grid.sinaedge.com. 49 CNAME sz-sina-img.volcgtm.com.
face.gslb.sinaedge.com. 49 CNAME weiboimgwx.grid.sinaedge.com.
h5sinaimg.gslb.sinaedge.com. 49 CNAME weiboimgwx.grid.sinaedge.com.
tvaxweibo.gslb.sinaedge.com. 49 CNAME tvaxweibo.grid.sinaedge.com.
weiboimgwx.gslb.sinaedge.com. 49 CNAME weiboimgwx.grid.sinaedge.com.
weibo.com. 48 A 123.125.107.13
```

Ubuntu测试机上分别先后执行 dig www.google.com 和dig www.baidu.com

```
ceshiji@ceshiji-virtual-machine:~$ dig www.google.com

; <<>> DiG 9.10.3-P4-Ubuntu <<>> www.google.com
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 234
;; flags: qr rd ra; QUERY: 1, ANSWER: 1, AUTHORITY: 0, ADDITIONAL: 0

;; QUESTION SECTION:
;www.google.com. IN A

;; ANSWER SECTION:
www.google.com. 5 IN A 31.13.68.169

;; Query time: 8 msec
;; SERVER: 127.0.1.1#53(127.0.1.1)
;; WHEN: Sun Nov 24 18:29:14 CST 2024
;; MSG SIZE rcvd: 48

ceshiji@ceshiji-virtual-machine:~$ dig www.baidu.com

; <<>> DiG 9.10.3-P4-Ubuntu <<>> www.baidu.com
;; global options: +cmd
```

此时Ubuntu攻击端显示如下

```
kehu@kehu: ~  
aa=0 tr=0 rd=1 ra=0 quest=1 answer=0 auth=0 add=1  
www.google.com. A  
. OPT UDPPl=4096 errcode=0 v=0 ...  
-----  
DNS_answer  
id=50935 rcode=OK opcode=QUERY  
aa=1 tr=0 rd=1 ra=1 quest=1 answer=1 auth=1 add=1  
www.google.com. A  
www.google.com. A 10 182.61.200.6  
ns.example.com. NS 10 ns.example.com.  
ns.example.com. A 10 192.168.0.10  
-----  
DNS_question  
id=58189 rcode=OK opcode=QUERY  
aa=0 tr=0 rd=1 ra=0 quest=1 answer=0 auth=0 add=1  
www.baidu.com. A  
. OPT UDPPl=4096 errcode=0 v=0 ...  
-----  
DNS_answer  
id=58189 rcode=OK opcode=QUERY  
aa=1 tr=0 rd=1 ra=1 quest=1 answer=1 auth=1 add=1  
www.baidu.com. A  
www.baidu.com. A 10 182.61.200.6  
ns.example.com. NS 10 ns.example.com.  
ns.example.com. A 10 192.168.0.10  
-----
```

dns投毒攻击

开启wireshark进行抓包，攻击成功后

```
1... DNS Standard query response 0x0019 A 9353411.example.com A 1.1.1.1  
1... DNS Standard query response 0x001a A 9353411.example.com A 1.1.1.1  
1... DNS Standard query response 0x001b A 9353411.example.com A 1.1.1.1  
1... DNS Standard query response 0x001c A 9353411.example.com A 1.1.1.1  
1... DNS Standard query response 0x001d A 9353411.example.com A 1.1.1.1  
1... DNS Standard query response 0x001e A 9353411.example.com A 1.1.1.1  
1... DNS Standard query response 0x001f A 9353411.example.com A 1.1.1.1  
1... DNS Standard query response 0x0020 A 9353411.example.com A 1.1.1.1  
1... DNS Standard query response 0x0021 A 9353411.example.com A 1.1.1.1  
1... DNS Standard query response 0x0022 A 9353411.example.com A 1.1.1.1  
1... DNS Standard query response 0x0023 A 9353411.example.com A 1.1.1.1  
1... DNS Standard query response 0x0024 A 9353411.example.com A 1.1.1.1  
1... DNS Standard query response 0x0025 A 9353411.example.com A 1.1.1.1  
1... DNS Standard query response 0x0026 A 9353411.example.com A 1.1.1.1  
1... DNS Standard query response 0x0027 A 9353411.example.com A 1.1.1.1  
1... DNS Standard query response 0x0028 A 9353411.example.com A 1.1.1.1  
1... DNS Standard query response 0x0029 A 9353411.example.com A 1.1.1.1  
1... DNS Standard query response 0x002a A 9353411.example.com A 1.1.1.1  
1... DNS Standard query response 0x002b A 9353411.example.com A 1.1.1.1  
1... DNS Standard query response 0x002c A 9353411.example.com A 1.1.1.1  
1... DNS Standard query response 0x002d A 9353411.example.com A 1.1.1.1  
1... DNS Standard query response 0x002e A 9353411.example.com A 1.1.1.1  
1... DNS Standard query response 0x002f A 9353411.example.com A 1.1.1.1  
1... DNS Standard query response 0x0030 A 9353411.example.com A 1.1.1.1  
1... DNS Standard query response 0x0031 A 9353411.example.com A 1.1.1.1  
79 DNS Standard query 0x0000 A 9353411.example.com
```

程序结束：

```
9353411.example.com
.
Sent 1 packets.
.....
.....
Sent 100 packets.
Begin emission

Finished sending 1 packets
*
Received 1 packets, got 1 answers, remaining 0 packets
1.1.1.1
1.1.1.1
```

这时，我们输入 `rndc dumpdb -cache`，然后查看server端的cache，发现已经被污染，再在服务端进行 `dig`，确实域名解析到了1.1.1.1。

```
; <<>> DiG 9.10.3-P4-Ubuntu <<>> 9353411.example.com
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 31863
;; flags: qr rd ra; QUERY: 1, ANSWER: 1, AUTHORITY: 2, ADDITIONAL: 5

;; OPT PSEUDOSECTION:
;; EDNS: version: 0, flags:; udp: 4096
;; QUESTION SECTION:
;9353411.example.com.      IN      A

;; ANSWER SECTION:
9353411.example.com.      7027    IN      A      1.1.1.1

;; AUTHORITY SECTION:
example.com.              86102   IN      NS      b.iana-servers.net.
example.com.              86102   IN      NS      a.iana-servers.net.

;; ADDITIONAL SECTION:
a.iana-servers.net.       1502    IN      A      199.43.135.53
a.iana-servers.net.       1502    IN      AAAA    2001:500:8f::53
b.iana-servers.net.       1502    IN      A      199.43.133.53
b.iana-servers.net.       1502    IN      AAAA    2001:500:8d::53

;; Query time: 0 msec
;; SERVER: 127.0.0.1#53(127.0.0.1)
;; WHEN: Sun Nov 24 22:29:30 PST 2024
;; MSG SIZE rcvd: 200
```

实验困难及解决方式

攻击端无法运行攻击脚本

一开始选用16.04作为攻击端，Ubuntu版本过旧，默认最高python版本为2.7。通过特殊方法安装python3.5后，版本仍然不够高来安装scapy包。最终解决方案是安装了一个ubuntu22.04的虚拟机来进行试验，重新配置攻击端。

服务端wireshark找不到接口

发现是由于权限不够高导致的。使用 `sudo wireshark` 解决了问题。

使用nslookup工具对MX记录进行观测

实验环境

ubuntu 22.04

实验原理

MX 记录概述

- **MX (Mail Exchange) 记录**：是 DNS 系统中专门用于指向邮件服务器的记录类型。当你发送电子邮件时，邮件客户端或邮件服务器会查询目标域名的 MX 记录，以便确定邮件应该发送到哪个邮件服务器。
- **功能**：MX 记录指定了一个域名的邮件交换服务器，并且通过优先级（优先级值越小，优先级越高）来确定哪个服务器应该先处理邮件。

nslookup 工具概述

nslookup 是一个用于查询 DNS 记录的命令行工具，可以帮助用户查看域名的相关信息，包括 A 记录、MX 记录、NS 记录等。通过 nslookup 查询 MX 记录，可以了解域名的邮件交换服务器及其优先级。

MX 记录查询原理

1. MX 记录查询过程：

- **查询流程**：当使用 nslookup 查询一个域名的 MX 记录时，DNS 服务器会返回该域名的邮件服务器地址。MX 记录不仅包含邮件服务器的域名，还包括该服务器的优先级值。多个 MX 记录可能会返回不同的邮件服务器地址，每个服务器有不同的优先级，优先级较小的服务器通常会被优先使用。

2. 解析步骤：

- 当执行查询时，nslookup 首先会联系配置的 DNS 服务器，然后查询目标域名的 MX 记录。
- 如果该域名有 MX 记录，DNS 服务器会返回所有相关的邮件服务器信息，并按优先级排序。

3. DNS 解析器与邮件发送：

- 当发送邮件时，邮件服务器根据 MX 记录选择优先级最低的邮件服务器（即优先级数字最小的）进行联系。如果该服务器不可用，邮件服务器会选择下一个优先级较高的服务器。

实验过程

打开终端，查看nslookup命令使用方法：


```
gongji@gongji-virtual-machine: ~  
NSLOOKUP(1) BIND 9 NSLOOKUP(1)  
  
NAME  
    nslookup - query Internet name servers interactively  
  
SYNOPSIS  
    nslookup [-option] [name | -] [server]  
  
DESCRIPTION  
    nslookup is a program to query Internet domain name servers. nslookup has two modes: interactive and non-interactive. Interactive mode allows the user to query name servers for information about various hosts and domains or to print a list of hosts in a domain. Non-interactive mode prints just the name and requested information for a host or domain.  
  
ARGUMENTS  
    Interactive mode is entered in the following cases:  
  
    a. when no arguments are given (the default name server is used);  
  
    b. when the first argument is a hyphen (-) and the second argument is the host name or Internet address of a name server.  
  
Manual page nslookup(1) line 1 (press h for help or q to quit)
```

进入交互模式：nslookup，设置资源记录类型为MX记录：

```
gongji@gongji-virtual-machine:~$ nslookup  
> set q=mx  
> 163.com  
Server:      127.0.0.53  
Address:     127.0.0.53#53  
  
Non-authoritative answer:  
163.com mail exchanger = 10 163mx03.mxmail.netease.com.  
163.com mail exchanger = 10 163mx02.mxmail.netease.com.  
163.com mail exchanger = 10 163mx01.mxmail.netease.com.  
163.com mail exchanger = 50 163mx00.mxmail.netease.com.  
  
Authoritative answers can be found from:
```

非交互模式进行查询：

```
gongji@gongji-virtual-machine:~$ nslookup -q=mx 163.com  
Server:      127.0.0.53  
Address:     127.0.0.53#53  
  
Non-authoritative answer:  
163.com mail exchanger = 10 163mx01.mxmail.netease.com.  
163.com mail exchanger = 10 163mx02.mxmail.netease.com.  
163.com mail exchanger = 50 163mx00.mxmail.netease.com.  
163.com mail exchanger = 10 163mx03.mxmail.netease.com.  
  
Authoritative answers can be found from:
```

此时通过向DNS服务器进行查询，可以知道163邮箱存储邮件的准确服务器地址。

```
gongji@gongji-virtual-machine:~$ nslookup 163mx02.mxmail.netease.com
Server:      127.0.0.53
Address:     127.0.0.53#53

Non-authoritative answer:
Name:   163mx02.mxmail.netease.com
Address: 220.197.33.203
```

实验困难及解决方式

无。

向SMTP服务器投递邮件实验

实验环境

Ubuntu 22.04

实验原理

SMTP 协议简介

- **SMTP (Simple Mail Transfer Protocol)** 是电子邮件发送的核心协议，用于在发件人客户端、发件人邮件服务器、收件人邮件服务器之间传输邮件。它定义了如何在邮件客户端和服务器之间建立通信并传输数据。
- **特点：**
 - 基于文本的协议，使用标准的命令和响应机制。
 - 工作在 TCP 25 或 587 端口（后者用于安全传输）。
 - 使用递归或中继方式将邮件从发送方传递到接收方服务器。

SMTP 投递邮件的原理

1. **建立连接：**
 - 发件人客户端（或本地邮件服务器）通过 TCP 协议连接到目标 SMTP 服务器。
 - 使用 SMTP 命令完成连接的握手过程。
2. **发送邮件：**
 - 使用一系列标准化的 SMTP 命令，与服务器交互以完成邮件的发送过程。

实验过程

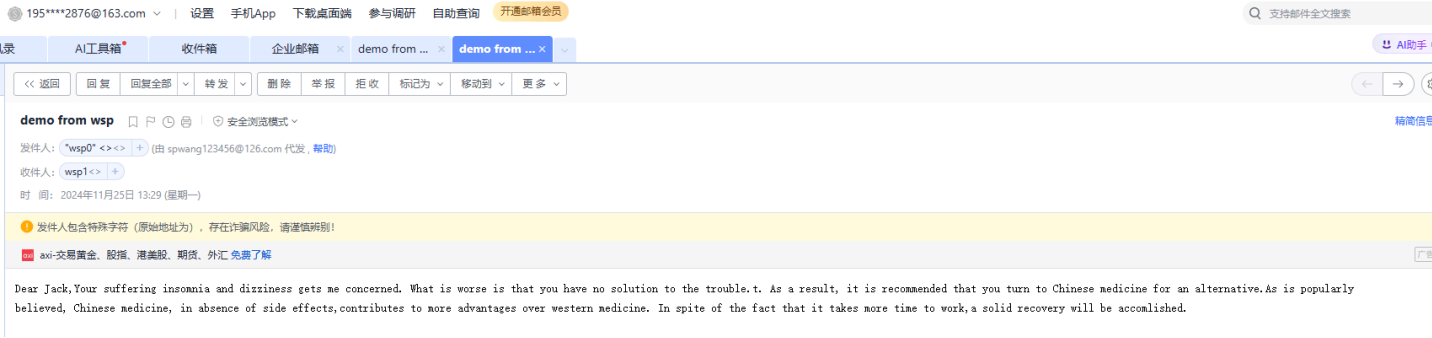
选择邮箱并启用SMTP协议：

我选择了126邮箱为发送邮箱，163邮箱为接收邮箱，并到对应邮箱启用SMTP协议。


```
gongji@gongji-virtual-machine:~$ telnet smtp.126.com 25
Trying 220.197.33.206...
Connected to smtp126.mail.ntes53.netease.com.
Escape character is '^]'.
220 126.com Anti-spam GT for Coremail System (126com[20140526])
helo wsp
250 OK
auth login
334 dXNlcm5hbWU6
c3B3YW5nMTIzNDU2QDEyNi5jb20=
334 UGFzc3dvcmQ6
VEQ1cHBVYW02bnQ4NUhVbQ==
235 Authentication successful
mail from:<spwang123456@126.com>
250 Mail OK
rcpt to:<19518832876@163.com>
250 Mail OK
data
354 End data with <CR><LF>.<CR><LF>
Subject: demo from wsp
To: wsp1
From: wsp0
Context-Type: text/plain; charset=utf-8
```

```
To: wsp1
From: wsp0
Context-Type: text/plain; charset=utf-8

Dear Jack,Your suffering insomnia and dizziness gets me concerned. What is worse
is that you have no solution to the trouble.t. As a result, it is recommended t
hat you turn to Chinese medicine for an alternative.As is popularly believed, Ch
inese medicine, in absence of side effects,contributes to more advantages over w
estern medicine. In spite of the fact that it takes more time to work,a solid re
covery will be accomplished.
.
250 Mail OK queued as gzsmtpl1,pSkvCgDnL9zTckRnXl_xBg--.237252 1732512592
```



尝试不使用任何邮件服务器账号，通过自己电脑直接向你所申请的163邮件服务器账号投递邮件，记录实验过程，要求收到邮件后显示发件人邮箱为：
2223211946@oaurewouerw.com。

- 1. 使用nslookup工具对MX记录进行观测

```
gongji@gongji-virtual-machine:~$ nslookup -type=mx 163.com
Server:          127.0.0.53
Address:         127.0.0.53#53

Non-authoritative answer:
163.com mail exchanger = 10 163mx02.mxmail.netease.com.
163.com mail exchanger = 10 163mx03.mxmail.netease.com.
163.com mail exchanger = 50 163mx00.mxmail.netease.com.
163.com mail exchanger = 10 163mx01.mxmail.netease.com.

Authoritative answers can be found from:
```

2. 使用telnet直接连接目标邮件服务器
3. 向SMTP服务器表明身份: helo + <任意字符串>
4. 申明邮件发送方: mail from:< 2223211946@oaurewouerw.com >
5. 申明邮件接收方: rcpt to:<接收邮箱>
6. 编辑发送信息: data+回车,data并回车之后, 及发送的内容, 可以申明subject, from, to等信息。输入“.”后回车, 即发送邮件。

```
gongji@gongji-virtual-machine:~$ telnet 163mx02.mxmail.netease.com 25
Trying 220.197.33.203...
Connected to 163mx02.mxmail.netease.com.
Escape character is '^]'.
220 163.com Anti-spam GT for Coremail System (163com[20141201])
helo spwang
250 OK
mail from:<2223211946@oaurewouerw.com>
250 Mail OK
rcpt to:<19518832876@163.com>
250 Mail OK
data
354 End data with <CR><LF>.<CR><LF>
subject: test email
to: wsp1
from: wsp0
Context-Type: text/plain; charset=utf-8

Dear Jack,Your suffering insomnia and dizziness gets me concerned. What is worse
is that you have no solution to the trouble.t. As a result, it is recommended t
hat you turn to Chinese medicine for an alternative.As is popularly believed, Ch
inese medicine, in absence of side effects,contributes to more advantages over w
estern medicine. In spite of the fact that it takes more time to work,a solid re
covery will be accomplished. I
.
250 Mail OK queued as gzmX11,rygvCgDXD8FPE0Rn4NAyAA--.2799052 1732514763
Connection closed by foreign host.
gongji@gongji-virtual-machine:~$
```

7. 邮箱收到邮件:

195****2876@163.com | 设置 手机App 下载桌面端 参与调研 自助查询 开通邮箱会员

录 AI工具箱 收件箱 企业邮箱 test email

<< 返回 回复 回复全部 转发 删除 举报 拒收 标记为 移动到 更多

test email 安全浏览模式

发件人: "wsp0" (由 2223211946@oaurewouerw.com 代发, 帮助)

收件人: wsp1

时间: 2024年11月25日 14:06 (星期一)

发件人包含特殊字符 (原始地址为), 存在诈骗风险, 请谨慎辨别!

axi-交易黄金, 脱指, 港美股, 期货, 外汇 免费了解

Dear Jack,Your suffering insomnia and dizziness gets me concerned. What is worse is that you have no solution to the trouble.t. As a result, it is recommended that you turn to Chinese medicine for an alternative.As is popularly believed, Chinese medicine, in absence of side effects,contributes to more advantages over western medicine. In spite of the fact that it takes more time to work,a solid recovery will be accomplished. I

实验困难及解决方式

发送邮件报554错误。

163等邮箱有垃圾邮件检测机制，如果被检测为垃圾邮件则无法发送。解决方法：上网搜索一篇英语小作文进行发送测试。

发送邮件正常，但接受邮箱收不到邮件。

服务器响应缓慢，或者进入了接受邮箱的垃圾箱中。解决方法：反复刷新，检查垃圾箱。

发送邮件正常，但接受邮箱收到的是空白邮件。

解决方法：在subject from to等信息后加一行换行即可正常发送内容。