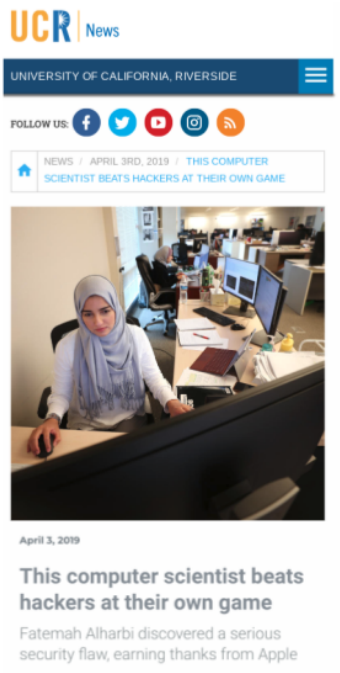
Fiddling with DNS

BACKGROUND



Recently, an article was published that featured a doctoral student named Fatemah Alharbi who successfully perpetrated a DNS hack while studying security.

DNS (domain name service) is a worldwide service that converts URLs into IP addresses (so when you type "`www.google.com`", a DNS server will convert that into the proper IP (`172.217.10.78`).

Computers have a few different ways to access DNS. It used to be the case that every computer had a file on it called "`hosts`", and that would map every computer in the world to a static IP address. That process became impractical as the number of computers proliferated, as everyone would have to update their "`hosts`" file every time a new computer became connected to the internet! Surprisingly, that's still the first place computers go to when trying to resolve a domain. This is true in Windows (`c:\Windows\System32\Drivers\etc\hosts`), MacOS (`/etc/hosts`) and Linux (`/etc/hosts`).

Since most hosts files do not have many entries, almost all DNS queries are retrieved from the DNS cache on the computer, the DNS cache of the ISP, or the DNS entries in a server. But it's important to note that the `hosts` file is really the first stop!

DNS lookup is an amazing process--much more detailed than we will go into in this class--but there are a few things to highlight from a security standpoint. Most DNS attacks are done at a DNS server level--DNS cache poisoning. This new attack exploited the fact that the DNS resolution (the answer to "What is the IP address of www.google.com?") is transmitted in plaintext, so it is fairly easy to intercept and spoof.

DESCRIPTION

What we will be doing today is working through how to change the `hosts` file entries to demonstrate what a DNS resolution attack might look like. Researchers have successfully changed DNS lookups on exposed routers, too (thanks, Shodan!). So make sure you lock your router down!

REQUIREMENTS

A web browser, a Linux install (VM), and an internet connection.

CC-BY-SA-NC Dave Ghidiu

PART I: Ping a known website

1. To establish a baseline, we will first send some `ping` requests to a known website:

   `ping -c 4 google.com`

   That will send four `pings` (where `-c` means "`count`" and "4" is the number of counts) to `google.com` and we can see the IP address.

EVIDENCE #1

```
root@kali:~# ping -c 4 www.google.com
PING google.com (172.217.12.142) 56(84) bytes of data.
64 bytes from lga34s19-in-f14.1e100.net (172.217.12.142): icmp_seq=1 ttl=52 time=24.2 ms
64 bytes from lga34s19-in-f14.1e100.net (172.217.12.142): icmp_seq=2 ttl=52 time=14.5 ms
64 bytes from lga34s19-in-f14.1e100.net (172.217.12.142): icmp_seq=3 ttl=52 time=14.4 ms
64 bytes from lga34s19-in-f14.1e100.net (172.217.12.142): icmp_seq=4 ttl=52 time=14.3 ms

--- google.com ping statistics ---
4 packets transmitted, 4 received, 0% packet loss, time 3005ms
rtt min/avg/max/mdev = 14.349/16.898/24.281/4.263 ms
```

PASTE THE IMAGE OF THE `ping` CALL

PART II: Modify the `hosts` file

1. Edit the `hosts` file (found in `/etc`):

   `nano /etc/hosts`

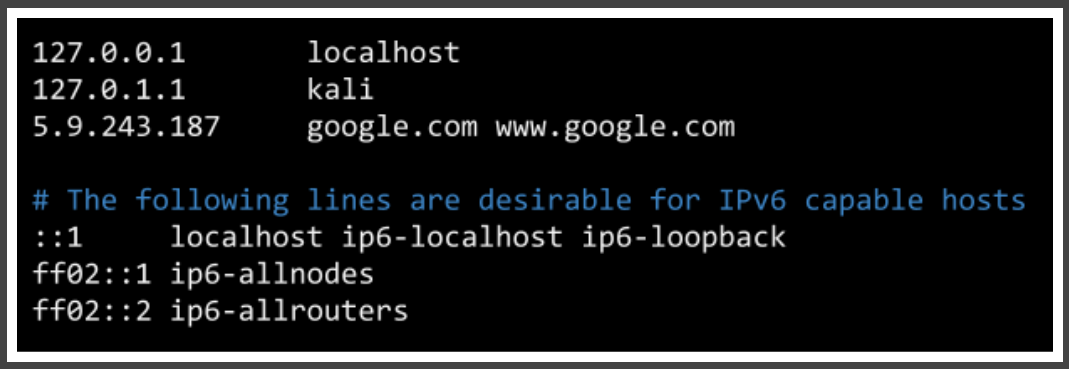
```
127.0.0.1       localhost
127.0.1.1       kali

# The following lines are desirable for IPv6 capable hosts
::1     localhost ip6-localhost ip6-loopback
ff02::1 ip6-allnodes
ff02::2 ip6-allrouters
```

2. Append a line at the end that will override a query to `google.com` (and `www.google.com`) to this IP:

   `5.9.243.187  google.com www.google.com`

EVIDENCE #2



PASTE THE IMAGE OF THE CONTENTS OF THE `hosts` FILE AFTER MODIFYING IT

PART III: See the results in your browser

1. We can't always rely on Firefox or Chrome to look at the `hosts` file first during DNS resolution, but we *can* use a text-based web browser to test this. Install `lynx` if it isn't installed:

   ```
   sudo apt update
   sudo apt install lynx
   ```

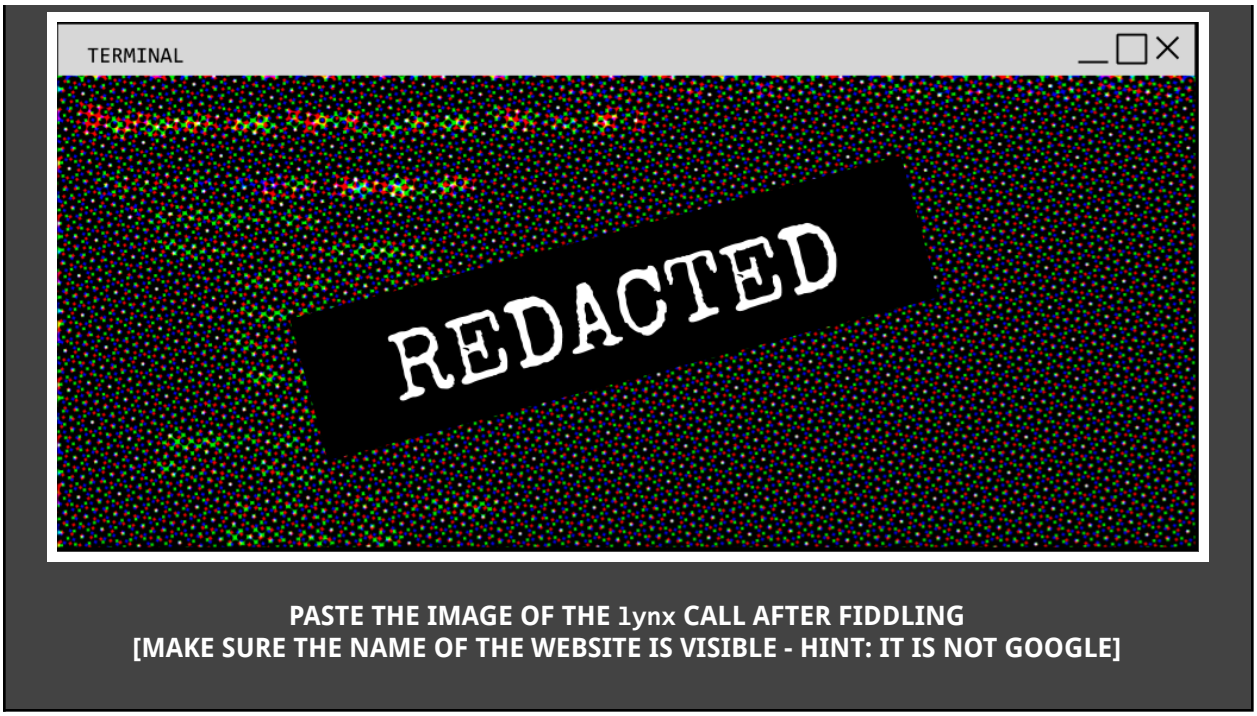
2. Use it to browse the internet! Try going to `google.com`:

   ```
   lynx google.com
   ```

   You might have to accept/reject cookies.

   You may have to accept the invalid certificate by pressing the 'y' key when prompted (normally this is not advisable, however, the certificate will necessarily NOT match google.com's certificate)

EVIDENCE #3



3. Go back into the `hosts` file and remove the portion you added so your computer will behave appropriately *and test the DNS.*

   `nano /etc/hosts`
   `ping -c 4 www.google.com`

```
root@kali:~# ping -c 4 www.google.com
PING google.com (172.217.12.142) 56(84) bytes of data.
64 bytes from lga34s19-in-f14.1e100.net (172.217.12.142): icmp_seq=1 ttl=52 time=24.2 ms
64 bytes from lga34s19-in-f14.1e100.net (172.217.12.142): icmp_seq=2 ttl=52 time=14.5 ms
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```

4. Recognize that modifying hosts file is not a popular attack (though it is probably effective because most users do not know how DNS resolution works). For it to happen, attackers need to have access to your computer.

   The point of this exercise, though, is to demonstrate how DNS resolution can be compromised and is one of the vectors that can be exploited. Had this been an intentional attack:

   - The redirect would not be benign
   - It probably would not have happened at the `hosts` file level (it would most likely be a consequence of DNS cache poisoning)

Note that changing the `hosts` file may not affect how browsers (like Firefox or Chrome) resolve domain names; that is, they may bypass the `hosts` file because of technologies like predictive

browsing. You can disable these features in the browser.