Anti Vm Techniques

1. Checking CPU Instructions:

The result of the following instructions with specific input can help malware identify virtual environments:

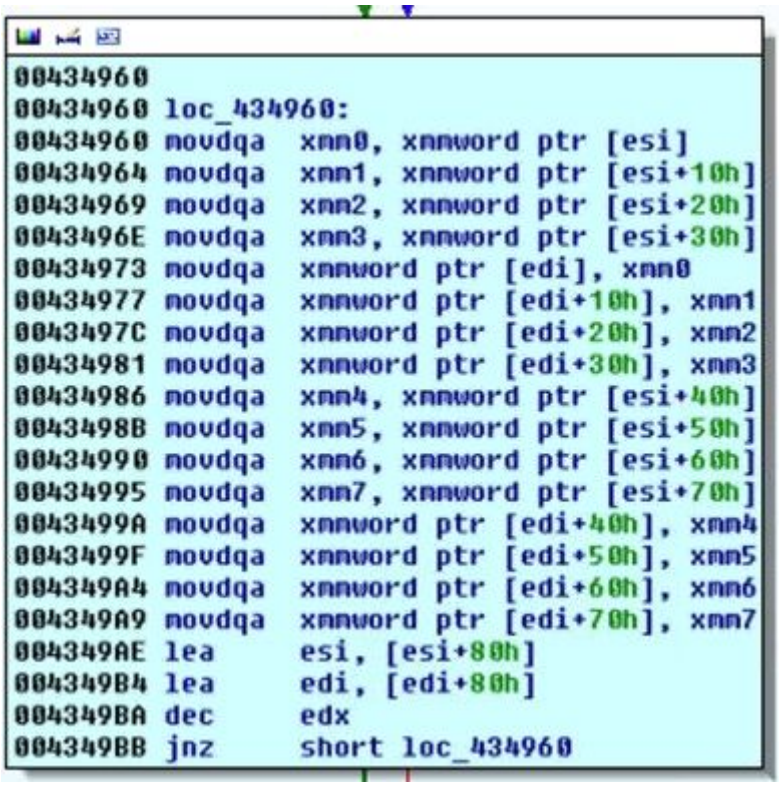
- *CPUID:* This instruction is executed with EAX=1 as input, the return value describes the processors features. The 31st bit of ECX on a physical machine will be equal to 0. On a guest VM it will equal to 1.

```
90          nop
90          nop
33c0        xor eax,eax
40          inc eax
0fa2        cpuid
0fbae11f    bt ecx, 0x1f
72f4        jb 0x1
90          nop
90          nop
```

- *"Hypervisor brand":* by calling CPUID with EAX=40000000 as input,1 the malware will get, as the return value, the virtualization vendor string in EAX, ECX, EDX.
  For example:
  - Microsoft: "Microsoft HV"
  - VMware : "VMwareVMware"

```
90                  nop
90                  nop
b8 000000040        mov eax, 40000000
0fa2                cpuid
90                  nop
90                  nop
```

- *MMX*: an Intel instruction set, designed for faster processing of graphical applications. These are usually not supported in Virtual Machines so their absence may indicate that the malware is running in a VM.
  For example:



```
00434960
00434960 loc_434960:
00434960 movdqa  xmm0, xmmword ptr [esi]
00434964 movdqa  xmm1, xmmword ptr [esi+10h]
00434969 movdqa  xmm2, xmmword ptr [esi+20h]
0043496E movdqa  xmm3, xmmword ptr [esi+30h]
00434973 movdqa  xmmword ptr [edi], xmm0
00434977 movdqa  xmmword ptr [edi+10h], xmm1
0043497C movdqa  xmmword ptr [edi+20h], xmm2
00434981 movdqa  xmmword ptr [edi+30h], xmm3
00434986 movdqa  xmm4, xmmword ptr [esi+40h]
0043498B movdqa  xmm5, xmmword ptr [esi+50h]
00434990 movdqa  xmm6, xmmword ptr [esi+60h]
00434995 movdqa  xmm7, xmmword ptr [esi+70h]
0043499A movdqa  xmmword ptr [edi+40h], xmm4
0043499F movdqa  xmmword ptr [edi+50h], xmm5
004349A4 movdqa  xmmword ptr [edi+60h], xmm6
004349A9 movdqa  xmmword ptr [edi+70h], xmm7
004349AE lea     esi, [esi+80h]
004349B4 lea     edi, [edi+80h]
004349BA dec     edx
004349BB jnz     short loc_434960
```

- *IN – "VMWare Magic Number": t*his technique is useful for detecting a VMware environment. In VMWare, communication with the host is done through a specific I/O port. The code below will execute successfully if running inside a VM. Otherwise it will fail.

```
mov eax, 0x564D5868;     'VMXh'
mov edx, 0x5658;         'VX(port)'
in eax, DX;              'Read input from that port'
CMP ebx, 0x564D5868
SETZ ecx;                'if successful -> flag = 0'
```

2. Checking for Known Mac Addresses:

Prefixes of MAC addresses indicate the network adapter's vendor. The MAC address can be retrieved in multiple ways, including the using of WMIC (wmic -> nic list)

- 00:05:69 (Vmware)
- 00:0C:29 (Vmware)
- 00:1C:14 (Vmware)
- 00:50:56 (Vmware)
- 08:00:27 (VirtualBox)

3. Checking for Registry Keys

The existence of the following registry entries indicates the existence of virtualization software:

- HKLM\SOFTWARE\Vmware Inc.\\\Vmware Tools
- HKEY_LOCAL_MACHINE\HARDWARE\DEVICEMAP\Scsi\Scsi Port 2\Scsi Bus 0\Target Id 0\Logical Unit Id 0\Identifier
- SYSTEM\CurrentControlSet\Enum\SCSI\Disk&Ven_VMware_&Prod_VMware_Virtual_S
- SYSTEM\CurrentControlSet\Control\CriticalDeviceDatabase\root#vmwvmcihostdev
- SYSTEM\CurrentControlSet\Control\VirtualDeviceDrivers

4. Checking for Processes Indicating a VM

Any of the following processes may indicate a virtual environment. Malware can retrieve this info in multiple ways like: WMIC, Win API and CMD. WMIC (wmic -> process list), Win API (Process32First, Process32Next), and Tasklist.exe.

- **Vmware**
  - Vmtoolsd.exe
  - Vmwaretrat.exe
  - Vmwareuser.exe
  - Vmacthlp.exe

- **VirtualBox**
    - vboxservice.exe
    - vboxtray.exe

5. Checking for Existence of Files Indicating a VM

When these files are found to exist in the file system, this may indicate the existence of virtualization software. These can also be retrieved in multiple ways like: WMIC, Win API and CMD.

- *VMware*

C:\windows\System32\Drivers\Vmmouse.sys
C:\windows\System32\Drivers\vm3dgl.dll
C:\windows\System32\Drivers\vmdum.dll
C:\windows\System32\Drivers\vm3dver.dll
C:\windows\System32\Drivers\vmtray.dll
C:\windows\System32\Drivers\VMToolsHook.dll
C:\windows\System32\Drivers\vmmousever.dll
C:\windows\System32\Drivers\vmhgfs.dll
C:\windows\System32\Drivers\vmGuestLib.dll
C:\windows\System32\Drivers\VmGuestLibJava.dll
C:\windows\System32\Driversvmhgfs.dll

- *VirtualBox*

C:\windows\System32\Drivers\VBoxMouse.sys
C:\windows\System32\Drivers\VBoxGuest.sys
C:\windows\System32\Drivers\VBoxSF.sys
C:\windows\System32\Drivers\VBoxVideo.sys
C:\windows\System32\vboxdisp.dll
C:\windows\System32\vboxhook.dll
C:\windows\System32\vboxmrxnp.dll
C:\windows\System32\vboxogl.dll
C:\windows\System32\vboxoglarrayspu.dll
C:\windows\System32\vboxoglcrutil.dll
C:\windows\System32\vboxoglerrorspu.dll
C:\windows\System32\vboxoglfeedbackspu.dll
C:\windows\System32\vboxoglpackspu.dll
C:\windows\System32\vboxoglpassthroughspu.dll
C:\windows\System32\vboxservice.exe
C:\windows\System32\vboxtray.exe
C:\windows\System32\VBoxControl.exe

6. Checking for Running Services

Identifying whether one the following processes is running indicates a virtual environment.These can also be retrieved in multiple ways WMIC, Win API and CMD

(wmic -> Service list, sc.exe /query)

- VMTools
- Vmhgfs
- VMMEMCTL
- Vmmouse
- Vmrawdsk
- Vmusbmouse
- Vmvss
- Vmscsi
- Vmxnet
- vmx_svga
- Vmware Tools
- Vmware Physical Disk Helper Service