

Talking Malware Analysis with MITRE

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Meet the MITRE Conversation Starters

We are Comp Sci Aggies

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 - BS and MS in Computer Science
- **Jonathan Jones**
 - Cyber Security Engineer
 - BS and MS (SFS) in Computer Science



Why we are here

- MITRE is looking to engage with Students at NCATSU with real world challenges and activities.
- Discuss high level topics with students in various areas related to Cyber Security/Cyber Operations

Initial topic: Malware Analysis

- We want to be able to explain the *who, what, how, and why* at a high level
- Assist in developing subject matter expertise among students who may be interested in this area of cyber security
- Any questions about malware analysis after presentation let us know!

Malware Analysis

The Syllabus

- 1. What is Malware Analysis & Why Does it exist?**
- 2. Malware Types**
- 3. How To Perform Analysis**
- 4. Static Analysis**
- 5. Dynamic Analysis**
- 6. More Tools**
- 7. Quick Tip**
- 8. Demo(s)**

Malware Analysis

What is Malware Analysis & Why Does it exist?

- **What**

- *“The art of dissecting malware to understand how it works, how to identify, and how to defeat or eliminate it”*
 - [Practical Malware Analysis](#): A Hands-On Guide to Dissecting Malicious Software 1st Edition (Michael Sikorski, Andrew Honing)
 - Studying the malicious behavior of software
 - Monitoring malicious software in a controlled environment

- **Why**

- To assess damage to systems
- Discover indicators of compromises
 - C2 (command-and-control)
- Understanding of intruders
 - Is this an advanced persistent threat (APT), or
 - Crimeware
- Determine the purpose of the malware

Malware Analysis

Malware Types

- Virus
- Worm
- Trojan
- Backdoor
- Remote Access Trojan (RAT)
- Ransomware
- Bot
- Downloader
- Dropper
- Potentially Unwanted Programs (PUP)
 - Adware
 - Spyware



Malware Analysis

How To Perform Analysis

Safety 1st: Controlled Environment = Safe Environment

- **Never use your everyday use computer(s)**
 - Use an old computer
 - Physical Machine where you can use clonezilla to restore to pristine state
 - Access to VirtualBox, VMWare?
 - VMs allow the use of snapshots and reverts
 - Access to an OS?
 - Windows, Linux
- **Analysis Type**
 - Static (code) Analysis
 - Examining file attributes
 - Examining disassembled code
 - Dynamic (behavioral) Analysis
 - Run the malware - observe its impacts on the system
 - Run the malware in a debugger to examine the malware's inner workings
 - Memory Analysis
 - Analyzing computer's RAM for artifacts

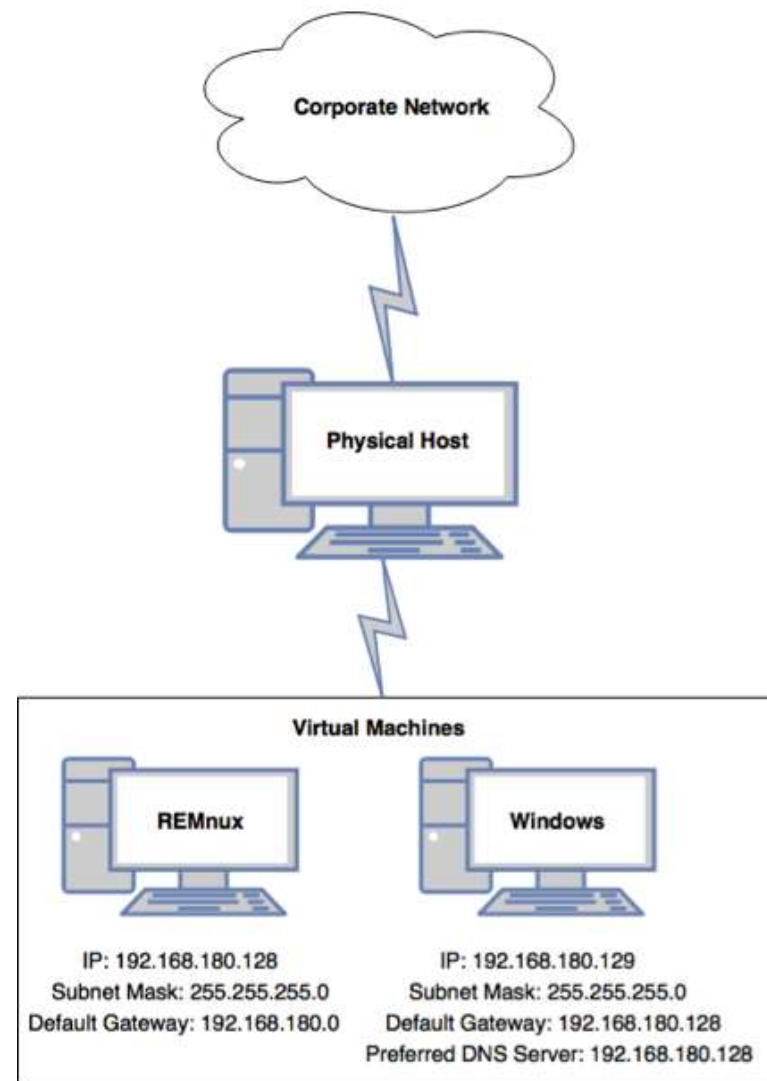
Malware Analysis

How To Perform Analysis

Safety 1st: Controlled Environment = Safe Environment

• Suggested Lab Environment

- **Physical Machine**
 - Host OS should not be Windows
- **Virtual Environment**
 - Windows VM
 - REMnux VM
 - Reverse-Engineering Malware Linux
- **Networking**
 - Only allow network connections between the VMs
 - Never allow traffic to go out
- **Tips**
 - Password protect malware samples in compressed file
 - Always take a snapshot of environment
 - Initial setup snapshot of VMs is ideal



Malware Analysis

How To Perform Analysis

Safety 1st: Controlled Environment = Safe Environment

- **Advanced static analysis**
 - Deep inspection of code to understand the inner workings of the malware
 - Reverse-engineering with a disassembler
 - Complex, requires understanding of assembly code

- **Advanced Dynamic Analysis**
 - Run code in a debugger
 - Examines internal state of a running malicious executable

Malware Analysis

Static Analysis

Safety 1st: Controlled Environment = Safe Environment

• Tools we can use

- Anti-Virus Engines
- Hash (md5, sha1, sha256)
- YARA
- Strings
- IDA Pro
- PEView
- PEiD
- And many more



IDA View-B

```
.text:00425690
.text:00425690 ; ::::::::::::::::::::::: S U B R O U T I N E :::::::::::::::::::::::
.text:00425690
.text:00425690 ; Attributes: library function bp-based frame
.text:00425690 ; char * _cdecl strdup(const char *s)
.text:00425690 _strdup proc near
.text:00425690 ; CODE XREF: sub_4116BC+134↑p
.text:00425690 ; sub_4116BC+167↑p ...
.text:00425690 s = dword ptr 8
.text:00425690
.text:00425690 push ebp
.text:00425690 mov ebp, esp
.text:00425690 push ebx
.text:00425690 push esi
.text:00425690 push edi
.text:00425690 mov edi, [ebp+s]
.text:00425690 push edi
.text:00425690 call _strlen
.text:00425690 pop ecx
.text:00425690 mov esi, eax
.text:00425690 inc esi
.text:00425690 push esi
.text:00425690 call _malloc
.text:00425690 pop ecx
.text:00425690 mov ebx, eax
.text:00425690 test eax, eax
.text:00425690 jz short end
.text:00425690 push esi
.text:00425690 push edi
.text:00425690 push ebx
.text:00425690 call _memcpy
.text:00425690 add esp, 0Ch
.text:00425690 end:
.text:00425690 mov eax, ebx
.text:00425690 pop edi
```

Function calls: _strdup

Address	Caller	Instruction
.text:004117F0	sub_4116BC	call _strdup
.text:00411823	sub_4116BC	call _strdup
.text:00429206	__setLocale32A	call _strdup
.text:0042A62E	__setMonetary	call _strdup
.text:0042AA39	__setTime	call _strdup
.text:0042AA62	__setTime	call _strdup
.text:0042AA8B	__setTime	call _strdup
.text:0042D815		call __win32DateTimeToPOSIX

Called function

Address	Called function
.text:0042569A	call _strlen
.text:004256A4	call _malloc
.text:004256B3	call _memcpy

```
call __win32DateTimeToPOSIX
add esp, 0Ch
mov ecx, [ebx+8]
push ecx ; block
call _free
pop ecx
lea eax, [ebp+s]
push eax ; s
call _strdup
pop ecx
mov [ebx+8], eax
push 40h ; n
lea edx, [ebp+s]
push edx ; s
mov ecx, [ebx+0Ch]
push ecx ; int
call __win32DateTimeToPOSIX
add esp, 0Ch
mov eax, [ebx+0Ch]
push eax ; block
call _free
```

Malware Analysis

Dynamic Analysis

Safety 1st: Controlled Environment = Safe Environment

• Tools

- FireEye (costs)
- Cuckoo (Free)
- WireShark (Free)
- SysInternals (Free)
- Process Hacker

• What we look for

- IP Addresses
- Services/Processes
- Registry Changes
- File System Changes



Malware Analysis

More Tools

- **Multiscanner**

- Developed by MITRE
- Combines Static and Behavioral Analysis
- Hosted on Github
 - It's **FREE!!!**

- **VirusTotal**

- Submit Files for Analysis
- Be careful for what you submit
 - Paid members can download
- Threat Actors submit samples

Malware Analysis

Quick Tip

- **Don't Get Caught in Details**
 - Focus on key features

- **Try Several Tools**
 - If one tool fails, try another
 - MITRE does not endorse a specific tool. Find one which works best for you.
 - Don't get stuck on a hard issue, move along

- **Malware authors are constantly raising the bar**
 - Malware Analysis requires continuous learning
 - Work with peers, public forums, research
 - Come to MITRE

DEMO

Resources

- **[Practical Malware Analysis](#), Black Hat 2007**
 - Kris Kendall and Chad McMillan

- **[Awesome-Malware-Analysis](#)**
 - A curated list of awesome malware analysis tools and resources
 - Github Project

- **[MITRE](#)**
 - [Solving Problems for a Safer World](#)
 - Do you have what it takes? [Apply here](#)

Resources

- **Free Training**
 - <http://opensecuritytraining.info/>
- **REMnux: A Linux Toolkit for Reverse-Engineering and Analyzing Malware**
 - <https://remnux.org/>
- **Lenny Zeltser**
 - <https://zeltser.com/>

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