

## FOR610: Reverse-Engineering Malware: Malware Analysis Tools & Techniques

This popular malware analysis course helps forensic investigators, incident responders, security engineers and IT administrators acquire practical skills for examining malicious programs that target and infect Windows systems. Knowing how to understand capabilities of malware is critical to an organization's ability to derive the threat intelligence it needs to respond to information security incidents and fortify defenses. The course builds a strong foundation for analyzing malicious software using a variety of system and network monitoring utilities, a disassembler, a debugger and other tools useful for turning malware inside-out.

The course begins by covering fundamental aspects of malware analysis. You will learn how to set up an inexpensive and flexible laboratory to understand the inner workings of malicious software and uncover characteristics of real-world malware samples. Then you will learn to examine the specimens' behavioral patterns and code. The course continues by discussing essential x86 assembly language concepts. You will examine malicious code to understand its key components and execution flow. Additionally, you will learn to identify common malware characteristics by looking at suspicious Windows API patterns employed by bots, rootkits, keyloggers, downloaders, and other types of malware.

This course will teach you how to handle self-defending malware, learning to bypass the protection offered by packers, and other anti-analysis methods.

In addition, given the frequent use of browser malware for targeting systems, you will learn practical approaches to analyzing malicious browser scripts and deobfuscating JavaScript and VBScript to understand the nature of the attack.

You will also learn how to analyze malicious documents that take the form of Microsoft Office and Adobe PDF files. Such documents act as a common infection vector and may need to be examined when dealing with large-scale infections as well as targeted attacks. The course also explores memory forensics approaches to examining malicious software, especially useful if it exhibits rootkit characteristics.

The course culminates with a series of capture-the-flag challenges designed to reinforce the techniques learned in class and to provide additional opportunities for learning practical malware analysis skills in a fun setting.

Hands-on workshop exercises are a critical aspect of this course and allow you to apply malware analysis techniques by examining malware in a lab that you control. When performing the exercises, you will study the supplied specimens' behavioral patterns and examine key portions of their code. To support these activities, you will receive pre-built Windows and Linux virtual machines that include tools for examining and interacting with malware.

*"The exercises and examples are very good and useful to get a better understanding of code analysis. Definitely one of the best courses I've attended on this topic."*

-THOR OLSEN,  
NORWEGIAN POLICE SECURITY SERVICES

*"This class gave me essential tools that I can immediately apply to protect my organization."*

-DON LOPEZ, VALLEY NATIONAL BANK



### Who Should Attend

- Professionals with responsibilities in the areas of incident response, forensic investigation, Windows security, and system administration
- Professionals who deal with incidents involving malware and would like to learn how to understand key aspects of malicious programs
- Individuals who attended the course have experimented with aspects of malware analysis prior to the course and were looking to formalize and expand their malware forensics expertise

### You Will Be Able To

- Build an isolated laboratory environment for analyzing code and behavior of malicious programs
- Employ network and system-monitoring tools to examine how malware interacts with the file system, the registry, the network and other processes on Microsoft Windows
- Uncover and analyze malicious JavaScript, VB Script and ActionScript components of web pages, which are often used as part of drive-by attacks
- Control some aspect of the malicious program's behavior through network traffic interception and code patching
- Use a disassembler and a debugger to examine inner workings of malicious Windows executables
- Bypass a variety of defensive mechanisms designed by malware authors to misdirect, confuse and otherwise slow down the analyst
- Recognize and understand common assembly-level patterns in malicious code, such as DLL injection
- Assess the threat associated with malicious documents, such as PDF and Microsoft Office files in the context of targeted attacks
- Derive Indicators of Compromise (IOCs) from malicious executables to contain and recover from the incident
- Utilize practical memory forensics techniques to examine capabilities of rootkits



digital-forensics.sans.org



giac.org



sans.edu

### 610.1 HANDS ON: Malware Analysis Fundamentals

Section one lays the groundwork for malware analysis by presenting the key tools and techniques useful for examining malicious programs. You will learn how to save time by exploring Windows malware in two phases. Behavioral analysis focuses on the program's interactions with its environment, such as the registry, the network, and the file system. Code analysis focuses on the specimen's code and makes use of a disassembler and debugger tools such as IDA Pro and OllyDbg. You will learn how to set up a flexible laboratory to perform such analysis in a controlled manner; and you will set up such a lab on your laptop using the supplied windows and Linux (REMnux) virtual machines. You will then learn how to use the key analysis tools by examining a malware sample in your lab – with guidance from the instructor – to reinforce the concepts discussed throughout the day.

**Topics:** Assembling a Toolkit for Effective Malware Analysis; Examining Static Properties of Suspicious Programs; Performing Behavioral Analysis of Malicious Windows Executables; Performing Static and Dynamic Code Analysis of Malicious Windows Executables; Contributing Insights to the Organization's Larger Incident Response Effort

### 610.2 HANDS ON: Malicious Code Analysis

Section two focuses on examining malicious Windows executables at the assembly level. You will discover approaches for studying inner workings of a specimen by looking at it through a disassembler and, at times, with the help of a debugger. The section begins with an overview of key code-reversing concepts and presents a primer on essential x86 Intel assembly concepts, such as instructions, function calls, variables, and jumps. You will also learn how to examine common assembly constructs, such as functions, loops, and conditional statements. The remaining part of the section discusses how malware implements common characteristics, such as keylogging and DLL injection, at the assembly level. You will learn how to recognize such characteristics in suspicious Windows executable files.

**Topics:** Core Concepts for Analyzing Malware at the Code Level; x86 Intel Assembly Language Primer for Malware Analysts; Identifying Key x86 Assembly Logic Structures with a Disassembler; Patterns of Common Malware Characteristics at the Windows API Level (DLL Injection, Function Hooking, Keylogging, Communicating over HTTP, etc.)

### 610.3 HANDS ON: In-Depth Malware Analysis

Section three builds upon the approaches to behavioral and code analysis introduced earlier in the course, exploring techniques for uncovering additional aspects of the functionality of malicious programs. You will learn about packers and the techniques that may help analysts bypass their defenses. Additionally, you will understand how to redirect network traffic in the lab to better interact with malware to understand its capabilities. You will also learn how to examine malicious websites and deobfuscate browser scripts, which often play a pivotal role in malware attacks.

**Topics:** Recognizing Packed Malware; Automated Malware Unpacking Tools and Approaches; Manual Unpacking of Using OllyDbg, Process Dumping Tools and Imports-Rebuilding Utilities; Intercepting Network Connections in the Malware Lab; Interacting with Malicious Websites to Examine their Nature; Deobfuscating Browser Scripts Using Debuggers and Runtime Interpreters; JavaScript Analysis Complications

### 610.4 HANDS ON: Self-Defending Malware

Section four focuses on the techniques malware authors commonly employ to protect malicious software from being examined, often with the help of packers. You will learn how to recognize and bypass anti-analysis measures, such as tool detection, string obfuscation, unusual jumps, breakpoint detection and so on. We will also discuss the role that shellcode plays in the context of malware analysis and will learn how to examine this aspect of attacks. As with the other topics covered throughout the course, you will be able to experiment with such techniques during hands-on exercises.

**Topics:** Bypassing Anti-Analysis Defenses; Recovering Concealed Malicious Code and Data; Unpacking More Sophisticated Packers to Locate the Original Entry Point (OEP); Identifying and Disabling Methods Employed by Malware to Detect Analysts' Tools; Analyzing Shellcode to Assist with the Examination of Malicious Documents and other Artifacts

### 610.5 HANDS ON: Malicious Documents and Memory Forensics

Section five starts by exploring common patterns of assembly instructions often used to gain initial access to the victim's computer. Next, we will learn how to analyze malicious Microsoft Office documents, covering tools such as OfficeMalScanner and exploring steps for analyzing malicious PDF documents with practical tools and techniques. Another major topic covered in this section is the reversing of malicious Windows executables using memory forensics techniques. We will explore this topic with the help of tools such as the Volatility Framework and associated plug-ins. The discussion of memory forensics will bring us deeper into the world of user and kernel-mode rootkits and allow us to use context of the infection to analyze malware more efficiently.

**Topics:** Analyzing Malicious Microsoft Office (Word, Excel, PowerPoint) Documents; Analyzing Malicious Adobe PDF Documents; Analyzing Memory to Assess Malware Characteristics and Reconstruct Infection Artifacts; Using Memory Forensics to Analyze Rootkit Infections

### 610.6 HANDS ON: Malware Reverse-Engineering Tournament

Section six assigns students to the role of a malware reverse engineer working as a member of an incident response and malware analysis team. Students are presented with a variety of hands-on challenges involving real-world malware in the context of a fun tournament. These challenges further a student's ability to respond to typical malware-reversing tasks in an instructor-led lab environment and offer additional learning opportunities. Moreover, the challenges are designed to reinforce skills covered in the first five sections of the course, making use of the hugely popular SANS NetWars tournament platform. By applying the techniques learned earlier in the course, students solidify their knowledge and can shore up skill areas where they feel they need additional practice. The students who score the highest in the malware reverse-engineering challenge will be awarded the coveted SANS' Digital Forensics Lethal Forensicator coin. Game on!

**Topics:** Behavioral Malware Analysis; Dynamic Malware Analysis (Using a Debugger); Static Malware Analysis (Using a Disassembler); JavaScript Deobfuscation; PDF Document Analysis; Office Document Analysis; Memory Analysis

## FOR610 Training Formats

(subject to change)



### Live Training

[sans.org/security-training/by-location/all](https://sans.org/security-training/by-location/all)



### Private Training

[sans.org/private-training](https://sans.org/private-training)



### vLive

[sans.org/vlive](https://sans.org/vlive)



### Simulcast

[sans.org/simulcast](https://sans.org/simulcast)



### OnDemand

[sans.org/ondemand](https://sans.org/ondemand)



### SelfStudy

[sans.org/selfstudy](https://sans.org/selfstudy)