B

TOOLS FOR MALWARE ANALYSIS

This appendix lists popular malware analysis tools, including tools discussed in the book and others that we did not cover. We have made this list somewhat comprehensive so that you can try a variety of tools and figure out which ones best suit your needs.

ApateDNS

ApateDNS is a tool for controlling DNS responses. Its interface is an easy-to-use GUI. As a phony DNS server, ApateDNS spoofs DNS responses to a user-specified IP address by listening on UDP port 53 on the local machine. ApateDNS also automatically configures the local DNS server to localhost. When you exit ApateDNS, it restores the original local DNS settings. Use ApateDNS during dynamic analysis, as described in Chapter 3. You can download ApateDNS for free from *http://www.mandiant.com/*.

Autoruns

Autoruns is a utility with a long list of autostarting locations for Windows. For persistence, malware often installs itself in a variety of locations, including the registry, startup folder, and so on. Autoruns searches various possible locations and reports to you in a GUI. Use Autoruns for dynamic analysis to see where malware installed itself. You can download Autoruns as part of the Sysinternals Suite of tools from *http://www.sysinternals.com/*.

BinDiff

BinDiff is a powerful binary comparison plug-in for IDA Pro that allows you to quickly compare malware variants. BinDiff lets you pinpoint new functions in a given malware variant and tells you if any functions are similar or missing. If the functions are similar, BinDiff indicates how similar they are and compares the two, as shown in Figure B-1.

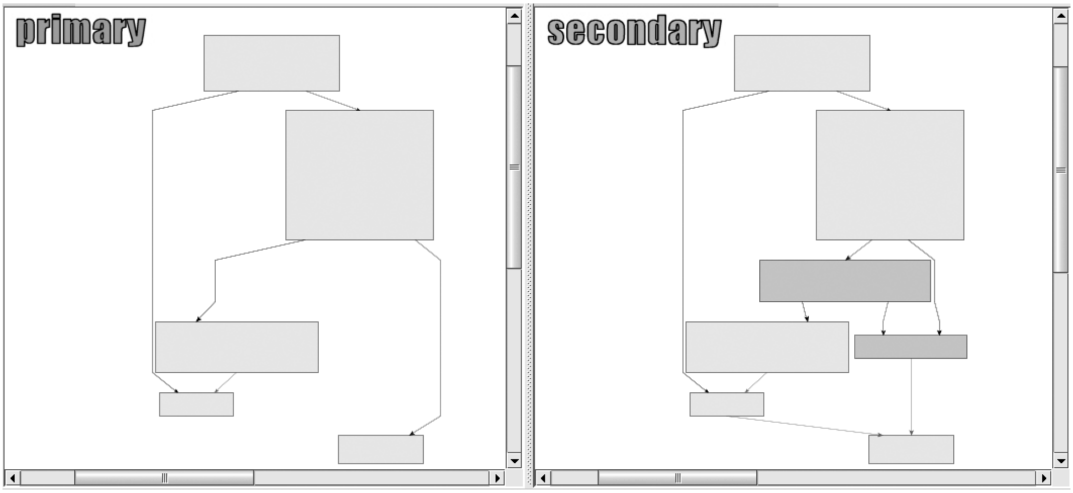


Figure B-1: BinDiff difference comparison showing code missing from the variant's function

As you can see in Figure B-1, the left side of the graph is missing two boxes that appear in the right side. You can zoom in and examine the missing instructions. BinDiff will also guess at how similar the overall binary is to one that you are comparing, though you must generate an IDB file for both the original and the variant malware for this to work. (If you have a fully labeled IDB file for the comparison, you will be able to more easily recognize what is actually similar in the binary.)

BinDiff is available for purchase from *http://www.zynamics.com/*.

BinNavi

BinNavi is a reverse-engineering environment similar to IDA Pro. Its strength lies in its graphical approach to reverse-engineering code. And, unlike IDA Pro, BinNavi can centrally manage your previously analyzed databases, which helps to track information; team members can easily work on the same project and share information and findings. BinNavi is available for purchase from *http://www.zynamics.com/*.

Bochs

Bochs is an open source debugger that simulates a complete x86 computer. Bochs is most useful when you want to debug a short code snippet in IDA Pro. IDA Pro supports a direct debugging mode of the IDB file using Bochs. When debugging in this mode, the input file format isn't important—it can be a DLL, shellcode dump, or any other database that contains x86 code. You can simply point to the code snippet and start debugging. This approach is often useful when dealing with encoded strings or configuration data. You can download Bochs for free from *http://bochs.sourceforge.net/*. A tutorial on installing and using Bochs in IDA Pro can be found at *http://www.hex-rays.com/products/ida/debugger/bochs_tut.pdf*.

Burp Suite

The Burp Suite is typically used for testing web applications. It can be configured to allow malware analysts to trap specific server requests and responses in order to manipulate what is being delivered to a system. When Burp is set up as a man-in-the-middle, you can modify HTTP or HTTPS requests by changing the headers, data, and parameters sent by the malware to a remote server in order to force the server to give you additional information. You can download the Burp Suite from *http://portswigger.net/burp/*.

Capture BAT

Capture BAT is a dynamic analysis tool used to monitor malware as it is running. Capture BAT will monitor the filesystem, registry, and process activity. You can use exclusion lists (including many preset ones) to remove the noise in order to focus on the malware you are analyzing. While Capture BAT doesn't have an extensive GUI like Process Monitor, it's open source, so you can modify it. You can download Capture BAT for free from *http://www.honeynet.org/*.

CFF Explorer

CFF Explorer is a tool designed to make PE editing easy. The tool is useful for editing resource sections, adding imports, or scanning for signatures. CFF Explorer supports x86 and x64 systems, and it can handle .NET files without having the .NET Framework installed. You can download CFF Explorer for free from *http://www.ntcore.com/*.

Deep Freeze

Deep Freeze from Faronics is a useful tool to use when performing malware analysis on physical hardware. It provides a VMware snapshotting capability for real hardware. You can run your malware, analyze it, and then just reboot. All the damage done by the malware will be undone, and your system will be back to a clean state. Deep Freeze is available for purchase from *http://www.faronics.com/*.

Dependency Walker

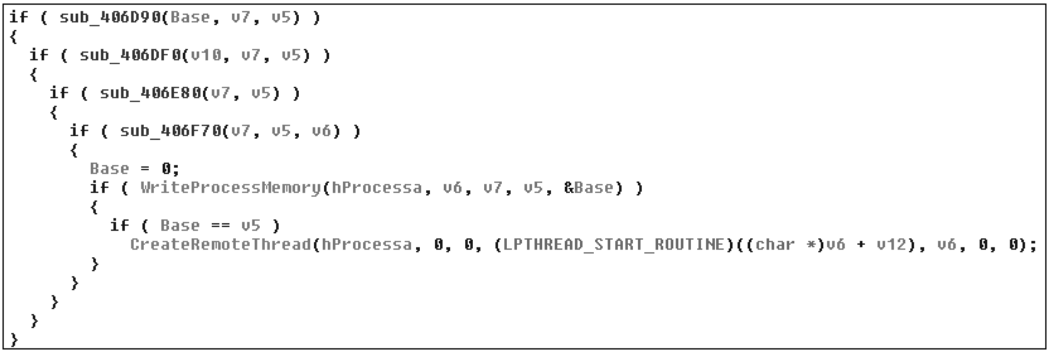
Dependency Walker is a static analysis tool used to explore DLLs and functions imported by a piece of malware. It works on both x86 and x64 binaries, and builds a hierarchical tree diagram of all DLLs that will be loaded into memory when the malware is run. We discuss Dependency Walker in Chapter 1. You can download it for free from *http://www.dependencywalker.com/*.

Hex Editors

Hex editors allow you to edit and view files containing binary data. Many hex editors are available, such as WinHex (our choice in this book), Hex Workshop, 010 Editor, HexEdit, Hex Editor Neo, FileInsight, and FlexHEX. When choosing a hex editor, look for features like a solid GUI, binary comparison, many data-decoding options (such as multibyte XOR), a built-in hash calculator, file format parsing, pattern searching, and so on. Many of these tools are available for purchase, but most come with a trial version.

Hex-Rays Decompiler

The Hex-Rays Decompiler is a powerful, but expensive, plug-in for IDA Pro that attempts to convert assembly code into human-readable, C-like pseudocode text. This tool installs an F5 “cheat button.” When you are looking at disassembly in IDA Pro, press F5 to have the plug-in open a new window with the C code. Figure B-2 shows what the pseudocode looks like for a code snippet from a piece of malware.



```
if ( sub_406D90(Base, v7, v5) )
{
  if ( sub_406DF0(v10, v7, v5) )
  {
    if ( sub_406E80(v7, v5) )
    {
      if ( sub_406F70(v7, v5, v6) )
      {
        Base = 0;
        if ( WriteProcessMemory(hProcessa, v6, v7, v5, &Base) )
        {
          if ( Base == v5 )
            CreateRemoteThread(hProcessa, 0, 0, (LPTHREAD_START_ROUTINE)((char *)v6 + v12), v6, 0, 0);
        }
      }
    }
  }
}
```

Figure B-2: Hex-Rays Decompiler showing C-like pseudocode generated from assembly

In the example in Figure B-2, the Hex-Rays Decompiler turned more than 100 assembly instructions into just eight lines of C code. Notice that the plug-in will use your renamed variable names from IDA Pro. In this example, you can easily see the parameters that are passed to a function, and nested `if` statements are more obvious.

We find this plug-in particularly useful when trying to decipher difficult encoding routines. In some cases, you can even copy and paste the decompiler’s output and use it to write a decoding tool. Hex-Rays Decompiler is the best tool on the market for decompiling, but it’s not without its flaws. The Hex-Rays Decompiler is available for purchase from *http://www.hex-rays.com/*.

IDA Pro

IDA Pro is the most widely used disassembler for malware analysis. We discuss IDA Pro extensively throughout the book, and Chapter 5 provides an in-depth introduction to the tool. We recommend the commercial version from *http://www.hex-rays.com/*. A freeware version is available from *http://www.hex-rays.com/products/ida/support/download_freeware.shtml*.

Immunity Debugger

Immunity Debugger (ImmDbg) is a freely available user-mode debugger. It is derived from the OllyDbg 1.1 source code, as we discuss in Chapter 9, except that ImmDbg has cosmetically modified the OllyDbg GUI and added a fully functional Python interpreter with an API. In "Scriptable Debugging" on page 200 and the Chapter 13 labs, we demonstrate how to use ImmDbg's Python scripting ability. You can download ImmDbg from *http://www.immunityinc.com/*.

Import REConstructor

Import REConstructor (ImpREC) is a useful tool when you are manually unpacking a piece of malware. The import address table (IAT) is often damaged when you dump memory while unpacking, and you can use ImpREC to repair the table. You provide the malware running in memory and a dumped version on disk, and ImpREC does its best to repair the binary. You can download ImpREC for free from *http://tuts4you.com/download.php?view.415*.

INetSim

INetSim is a Linux-based software suite for simulating common network services that we find useful for dynamic analysis. Be sure to install it on a Linux virtual machine, and set it up on the same virtual network as your malware analysis Windows VM. INetSim can emulate many popular services, such as a Microsoft Internet Information Services (IIS) web server, and can even listen on all ports for incoming connections. We discuss INetSim in Chapter 3. You can download it for free from *http://www.inetsim.org/*.

LordPE

LordPE is a free tool for dumping an executable from memory. It allows PE editing and can be used to repair a program you dumped from memory using another method. LordPE is most commonly used for unpacking malware. You can download it for free from *http://www.woodmann.com/collaborative/tools/index.php/LordPE*.

Malcode Analyst Pack

The Malcode Analyst Pack contains a series of utilities, one of which installs useful Windows shell extensions for strings, an MD5 hash calculator, and a CHM decompile option. The CHM decompile option is handy when dealing with malicious Windows help files. Also included is FakeDNS, a useful tool for spoofing DNS responses to a user-specified address. While these utilities are no longer officially supported, you might still be able to download them from *http://labs.idefense.com/software/download/?downloadID=8*.

Memoryze

Memoryze is a free memory forensic tool that enables you to dump and analyze live memory. You can use Memoryze to acquire all of live memory or just individual processes, as well as to identify all modules loaded on a given system, including drivers and kernel-level executables. Memoryze also can detect rootkits and the hooks they install. If you choose to use Memoryze, be sure to download Audit Viewer, a tool for visualizing Memoryze's output that makes the memory analysis process quicker and more intuitive. Audit Viewer includes a malware rating index to help you identify suspicious content in your memory dumps. You can download Memoryze and Audit Viewer for free from *http://www.mandiant.com/*.

Netcat

Netcat, known as the "TCP/IP Swiss Army knife," can be used to monitor or start inbound and outbound connections. Netcat is most useful during dynamic analysis for listening on ports that you know the malware connects to, because Netcat prints all the data it receives to the screen via standard output. We cover Netcat usage for dynamic analysis in Chapter 3 and also talk about how attackers use it in Chapter 11. Netcat is installed by default in Cygwin and on most Linux distributions. You can download the Windows version for free from *http://joncraton.org/media/files/nc111nt.zip*.

OfficeMalScanner

OfficeMalScanner is a free command-line tool for finding malicious code in Microsoft Office documents. It locates shellcode, embedded PE files, and OLE streams in Excel, Word, and PowerPoint documents, and can decompress the newer format of Microsoft Office documents. We recommend running OfficeMalScanner with the `scan` and `brute` options on pre–Office 2007 documents and with the `inflate` option on post–Office 2007 documents. You can download OfficeMalScanner from *http://www.reconstructer.org/*.

OllyDbg

OllyDbg is one of the most widely used debuggers for malware analysis. We discuss OllyDbg extensively throughout the book, and Chapter 9 provides an in-depth introduction to the tool. OllyDbg is a user-mode x86 debugger with a GUI. Several plug-ins are available for OllyDbg, such as OllyDump for use while unpacking (discussed in Chapter 18). You can download OllyDbg for free from *http://www.ollydbg.de/*.

OSR Driver Loader

OSR Driver Loader is a freely available tool for loading a device driver into memory. It is a GUI-based tool used for easily loading and starting a driver without rebooting. This is useful when you are dynamically analyzing a malicious device driver and don't have the installer. We discuss the OSR Driver Loader tool in Chapter 10. You can download it from *http://www.osronline.com/*.

PDF Dissector

PDF Dissector is a commercial GUI-based PDF analysis tool that graphically parses PDF elements and automatically decompresses objects, making it easy to extract malicious JavaScript. The program includes a JavaScript deobfuscator and interpreter to help you understand and execute malicious scripts. PDF Dissector can also be used to identify known vulnerabilities. This tool is available for purchase from *http://www.zynamics.com/*.

PDF Tools

PDF Tools is the classic tool kit for PDF analysis. The tool kit consists of two tools: *pdfid.py* and *pdf-parser.py*. *pdfid.py* scans a PDF for objects and tells you if it thinks a PDF contains JavaScript. Since most malicious PDFs use JavaScript, this information can help you quickly identify potentially risky PDFs. *pdf-parser.py* helps you examine the contents and important objects of a PDF file without rendering it. You can download the PDF tools for free from *http://blog.didierstevens.com/programs/pdf-tools/*.

PE Explorer

PE Explorer is a useful tool for viewing the PE header, sections, and import/export tables. It is more powerful than PEview because it allows you to edit structures. PE Explorer contains static unpackers for UPX-, Upack-, and NsPack-compressed files. This unpacking feature is seamless and saves a lot of time. You simply load the packed binary into PE Explorer, and it automatically unpacks the file. You can download a trial version or purchase the commercial version of PE Explorer from *http://www.heaventools.com/*.

PEiD

PEiD is a free static analysis tool used for packer and compiler detection. It includes more than 600 signatures for detecting packers, cryptors, and compilers in PE format files. PEiD also has plug-ins available for download, the most useful of which is Krypto ANALyzer (KANAL). KANAL can be used to find common cryptographic algorithms in PE files and provides the ability to export the information to IDA Pro. We discuss PEiD in Chapters 1, 13, and 18. Although the PEiD project has been discontinued, you should still be able to download the tool from *http://www.peid.info/*.

PEview

PEview is a freely available tool for viewing the PE file structure. You can view the PE header, individual sections, and the import/export tables. We use PEview throughout the book and discuss it in Chapter 1. You can download PEview from *http://www.magma.ca/~wjr/*.

Process Explorer

Process Explorer is a powerful task manager that is used in dynamic analysis to provide insight into processes currently running on a system. Process Explorer can show you the DLLs for individual processes, handles, events, strings, and so on. We discuss Process Explorer in Chapter 3. You can download Process Explorer as part of the Sysinternals Suite of tools from *http://www.sysinternals.com/*.

Process Hacker

Process Hacker is a powerful task manager similar to Process Explorer, but with many added features. It can scan for strings and regular expressions in memory, inject or unload a DLL, load a driver, create or start a service, and so on. You can download Process Hacker from *http://processhacker.sourceforge.net/*.

Process Monitor

Process Monitor (procmon) is a dynamic analysis tool useful for viewing real-time filesystem, registry, and process activity. You can filter its output to remove the noise. We discuss Process Monitor in Chapter 3. You can download Process Monitor as part of the Sysinternals Suite of tools from *http://www.sysinternals.com/*.

Python

The Python programming language allows you quickly code tasks when performing malware analysis. Throughout the book and labs, we use Python. As discussed in Chapters 5 and 9, IDA Pro and Immunity Debugger have built-in Python interpreters, allowing you to quickly automate tasks or change the interface. We recommend learning Python and installing it on your analysis machine. Download Python for free from *http://www.python.org/*.

Regshot

Regshot is a dynamic analysis tool that allows you to take and compare two registry snapshots. To use it, you simply take a snapshot of the registry, run the malware, wait for it to finish making any system changes, take the second snapshot, and then compare the two. Regshot can also be used for taking and comparing two snapshots of any filesystem directory you specify. You can download Regshot for free from *http://sourceforge.net/projects/regshot/*.

Resource Hacker

Resource Hacker is a useful static analysis utility for viewing, renaming, modifying, adding, deleting, and extracting resources for PE-formatted binaries. The tool works with both x86 and x64 architectures. Because malware often extracts more malware, a DLL, or a driver from its resource section at runtime, we find this tool useful for extracting those sections easily without running the malware. We discuss Resource Hacker in Chapter 1 and the Chapter 12 labs. You can download Resource Hacker from *http://www.angusj.com/resourcehacker/*.

Sandboxes

In Chapter 3, we discuss the pluses and minuses of using sandboxes. Many sandboxes are publicly available, and you can also write your own. Public sandboxes are a decent choice because they are always being developed in an effort to stay on top of the market. We demonstrate GFI Sandbox in Chapter 3, but there are many others, including Joe Sandbox, BitBlaze, Comodo, ThreatExpert, Anubis, Norman, Cuckoo, Zero Wine, Buster Sandbox, and Minibis. As with hex editors, everyone has a preference, so try a few to see what works for you.

Sandboxie and Buster Sandbox Analyzer

Sandboxie is a program that runs programs in an isolated environment to prevent them from making permanent changes to your system. Sandboxie was designed to allow secure web browsing, but its sandbox aspect makes it useful for malware analysis. For example, you can use it to capture filesystem and registry accesses of the program you are sandboxing. Buster Sandbox Analyzer (BSA) can be used with Sandboxie to provide automated analysis and reporting. Sandboxie and BSA can be downloaded from *http://www.sandboxie.com/* and *http://bsa.isoftware.nl/*.

Snort

Snort is the most popular open source network intrusion detection system (IDS). We discuss writing network-based signatures for Snort in Chapter 14. Snort can be run actively or offline against packet captures. If you write network signatures for malware, using Snort to test them is a good place to start. You can download Snort from *http://www.snort.org/*.

Strings

Strings is a useful static analysis tool for examining ASCII and Unicode strings in binary data. Using Strings is often a quick way to get a high-level overview of malware capability, but the program's usefulness can be thwarted by packing and string obfuscation. We discuss Strings in Chapter 1. You can download Strings as part of the Sysinternals Suite of tools from *http://www.sysinternals.com/*.

TCPView

TCPView is a tool for graphically displaying detailed listings of all TCP and UDP endpoints on your system. This tool is useful in malware analysis because it allows you to see which process owns a given endpoint. TCPView can help you track down a process name when your analysis machine connects over a port and you have no idea which process is responsible (as often happens with process injection, as discussed in Chapter 12). You can download TCPView as part of the Sysinternals Suite of tools from *http://www.sysinternals.com/*.

The Sleuth Kit

The Sleuth Kit (TSK) is a C library and set of command-line tools for forensic analysis that can be used to find alternate data streams and files hidden by rootkits. TSK does not rely on the Windows API to process NTFS and FAT filesystems. You can run TSK on Linux or using Cygwin in Windows. You can download TSK for free from *http://www.sleuthkit.org/*.

Tor

Tor is a freely available onion routing network, allowing you to browse anonymously over the Internet. We recommend using Tor whenever conducting research during analysis, such as checking IP addresses, performing Internet searches, accessing domains, or looking for any information you might not want exposed. We don't generally recommend letting malware connect over a network, but if you do, you should use a technology like Tor. After you install Tor, and before you start browsing, visit a site like *http://whatismyipaddress.com/* to confirm that the IP returned by the website is not your IP address. Tor can be downloaded for free from *https://www.torproject.org/*.

Truman

Truman is a tool for creating a safe environment without using virtual machines. It consists of a Linux server and a client machine running Windows. Like INetSim, Truman emulates the Internet, but it also provides functionality to easily grab memory from the Windows machine and reimage it quickly. Truman comes with scripts to emulate services and perform analysis on Linux. Even though this tool is no longer in development, it can help you understand how to set up your own bare-metal environment. You can download Truman for free from *http://www.secureworks.com/research/tools/truman/*.

WinDbg

WinDbg is the most popular all-around debugger, distributed freely by Microsoft. You can use it to debug user-mode, kernel-mode, x86, and x64 malware. WinDbg lacks OllyDbg's robust GUI, providing a command-line interface instead. In Chapter 10, we focus on the kernel-mode usage of WinDbg. Many malware analysts choose to use OllyDbg for user-mode debugging and WinDbg for kernel debugging. WinDbg can be downloaded independently or as part of the Windows SDK from *http://msdn.microsoft.com/*.

Wireshark

Wireshark is an open source network packet analyzer and useful tool for dynamic analysis. You can use it to capture network traffic generated by malware and to analyze many different protocols. Wireshark is the most popular freely available tool for packet capturing and has an easy-to-use GUI. We discuss Wireshark usage in Chapter 3. You can download Wireshark from *http://www.wireshark.org/*.

UPX

Ultimate Packer for eXecutables (UPX) is the most popular packer used by malware authors. In Chapters 1 and 18, we discuss how to automatically and manually unpack malware that uses UPX. If you encounter this packer in the wild, try to unpack the malware with `upx -d`. You can download this packer from *http://upx.sourceforge.net/*.

VERA

Visualizing Executables for Reversing and Analysis (VERA) is a tool for visualizing compiled executables for malware analysis. It uses the Ether framework to generate visualizations based on dynamic trace data to help with analysis. VERA gives you a high-level overview of malware and can help with unpacking. It can also interface with IDA Pro to help you browse between the VERA graphs and IDA Pro disassembly. You can download VERA from *http://www.offensivecomputing.net/*.

VirusTotal

VirusTotal is an online service that scans malware using many different antivirus programs. You can upload a file directly to VirusTotal, and it will check the file with more than 40 different antivirus engines. If you don't want to upload your malware, you can also search the MD5 hash to see if VirusTotal has seen the sample before. We discuss VirusTotal at the start of Chapter 1 since it is often a useful first step during malware analysis. You can access VirusTotal at *http://www.virustotal.com/*.

VMware Workstation

VMware Workstation is a popular desktop virtualization product. There are many alternatives to VMware, but we use it in this book due to its popularity. Chapter 2 highlights many VMware features, such as virtual networking, snapshotting (which allows you to save the current state of a virtual machine), and cloning an existing virtual machine. You can purchase VMware Workstation from *http://www.vmware.com/* or download VMware Player (with limited functionality) for free from the same site.

Volatility Framework

The Volatility Framework is an open source collection of tools written in Python for analyzing live memory captures. This suite of tools is useful for malware analysis, as you can use it to extract injected DLLs, perform rootkit detection, find hidden processes, and so on. This tool suite has many users and contributors, so new capabilities are constantly being developed. You can download the latest version from *http://code.google.com/p/volatility/*.

YARA

YARA is an open source project used to identify and classify malware samples that will allow you to create descriptions of malware families based on strings or any other binary patterns you find in them. These descriptions are called *rules*, and they consist of a set of strings and logic. Rules are applied to binary data like files or memory in order to classify a sample. This tool is useful for creating your own custom antivirus-like software and signatures. You can download YARA for free from *http://code.google.com/p/yara-project/*.

Zero Wine

Zero Wine is an open source malware sandbox that is distributed as a virtual machine running Debian Linux. Malware samples are executed using Zero Wine to emulate the Windows API calls, and the calls are logged to report on malicious activity. Zero Wine can even catch and defeat certain anti-virtual machine, anti-debugging, and anti-emulation techniques. You can download Zero Wine from *http://zerowine.sourceforge.net/*.