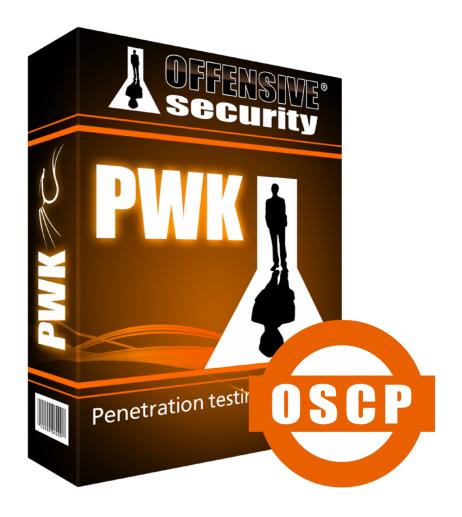


Penetration Testing with Kali Linux

Offensive Security





Copyright © 2020 Offensive Security Ltd. All rights reserved.

No part of this publication, in whole or in part, may be reproduced, copied, transferred or any other right reserved to its copyright owner, including photocopying and all other copying, any transfer or transmission using any network or other means of communication, any broadcast for distant learning, in any form or by any means such as any information storage, transmission or retrieval system, without prior written permission from the author.



Table of Contents

- 1 Penetration Testing with Kali Linux: General Course Information
 - 1.1 About The PWK Course
 - 1.1.1 PWK Course Materials
 - 1.1.2 Access to the Internal VPN Lab Network
 - 1.1.3 The Offensive Security Student Forum
 - 1.1.4 Live Support
 - 1.1.5 OSCP Exam Attempt
 - 1.2 Overall Strategies for Approaching the Course
 - 1.2.1 Welcome and Course Information Emails
 - 1.2.2 Course Materials
 - 1.2.3 Course Exercises
 - 1.2.4 PWK Labs
 - 1.3 Obtaining Support
 - 1.4 About Penetration Testing
 - 1.5 Legal
 - 1.6 The MegaCorpone.com and Sandbox.local Domains
 - 1.7 About the PWK VPN Labs
 - 1.7.1 Lab Warning
 - 1.7.2 Control Panel
 - 1.7.3 Reverts
 - 1.7.4 Client Machines
 - 1.7.5 Kali Virtual Machine
 - 1.7.6 Lab Behavior and Lab Restrictions
 - 1.8 Reporting
 - 1.8.1 Consider the Objective
 - 1.8.2 Consider the Audience
 - 1.8.3 Consider What to Include
 - 1.8.4 Consider the Presentation
 - 1.8.5 The PWK Report
 - 1.8.6 Note Taking
 - 1.9 About the OSCP Exam
 - 1.9.1 Metasploit Usage Lab vs Exam



- 1.10 Wrapping Up
- 2 Getting Comfortable with Kali Linux
 - 2.1 Booting Up Kali Linux
 - 2.2 The Kali Menu
 - 2.3 Kali Documentation
 - 2.3.1 The Kali Linux Official Documentation
 - 2.3.2 The Kali Linux Support Forum
 - 2.3.3 The Kali Linux Tools Site
 - 2.3.4 The Kali Linux Bug Tracker
 - 2.3.5 The Kali Training Site
 - 2.3.6 Exercises
 - 2.4 Finding Your Way Around Kali
 - 2.4.1 The Linux Filesystem
 - 2.4.2 Basic Linux Commands
 - 2.4.3 Finding Files in Kali Linux
 - 2.5 Managing Kali Linux Services
 - 2.5.1 SSH Service
 - 2.5.2 HTTP Service
 - 2.5.3 Exercises
 - 2.6 Searching, Installing, and Removing Tools
 - 2.6.1 apt update
 - 2.6.2 apt upgrade
 - 2.6.3 apt-cache search and apt show
 - 2.6.4 apt install
 - 2.6.5 apt remove –purge
 - 2.6.6 dpkg
 - 2.7 Wrapping Up
- 3 Command Line Fun
 - 3.1 The Bash Environment
 - 3.1.1 Environment Variables
 - 3.1.2 Tab Completion
 - 3.1.3 Bash History Tricks
 - 3.2 Piping and Redirection
 - 3.2.1 Redirecting to a New File



- 3.2.2 Redirecting to an Existing File
- 3.2.3 Redirecting from a File
- 3.2.4 Redirecting STDERR
- 3.2.5 Piping
- 3.3 Text Searching and Manipulation
 - 3.3.1 grep
 - 3.3.2 sed
 - 3.3.3 cut
 - 3.3.4 awk
 - 3.3.5 Practical Example
- 3.4 Editing Files from the Command Line
 - 3.4.1 nano
 - 3.4.2 vi
- 3.5 Comparing Files
 - 3.5.1 comm
 - 3.5.2 diff
 - 3.5.3 vimdiff
- 3.6 Managing Processes
 - 3.6.1 Backgrounding Processes (bg)
 - 3.6.2 Jobs Control: jobs and fg
 - 3.6.3 Process Control: ps and kill
- 3.7 File and Command Monitoring
 - 3.7.1 tail
 - 3.7.2 watch
- 3.8 Downloading Files
 - 3.8.1 wget
 - 3.8.2 curl
 - 3.8.3 axel
- 3.9 Customizing the Bash Environment
 - 3.9.1 Bash History Customization
 - 3.9.2 Alias
 - 3.9.3 Persistent Bash Customization
- 3.10 Wrapping Up
- 4 Practical Tools



4.1 Netcat

- 4.1.1 Connecting to a TCP/UDP Port
- 4.1.2 Listening on a TCP/UDP Port
- 4.1.3 Transferring Files with Netcat
- 4.1.4 Remote Administration with Netcat

4.2 Socat

- 4.2.1 Netcat vs Socat
- 4.2.2 Socat File Transfers
- 4.2.3 Socat Reverse Shells
- 4.2.4 Socat Encrypted Bind Shells

4.3 PowerShell and Powercat

- 4.3.1 PowerShell File Transfers
- 4.3.2 PowerShell Reverse Shells
- 4.3.3 PowerShell Bind Shells
- 4.3.4 Powercat
- 4.3.5 Powercat File Transfers
- 4.3.6 Powercat Reverse Shells
- 4.3.7 Powercat Bind Shells
- 4.3.8 Powercat Stand-Alone Payloads

4.4 Wireshark

- 4.4.1 Wireshark Basics
- 4.4.2 Launching Wireshark
- 4.4.3 Capture Filters
- 4.4.4 Display Filters
- 4.4.5 Following TCP Streams
- 4.5 Tcpdump
 - 4.5.2 Filtering Traffic
 - 4.5.3 Advanced Header Filtering
- 4.6 Wrapping Up
- 5 Bash Scripting
 - 5.1 Intro to Bash Scripting
 - 5.2 Variables
 - 5.2.1 Arguments
 - 5.2.2 Reading User Input



- 5.3 If, Else, Elif Statements
- 5.4 Boolean Logical Operations
- 5.5 Loops
 - 5.5.1 For Loops
 - 5.5.2 While Loops
- 5.6 Functions
- 5.7 Practical Examples
 - 5.7.1 Practical Bash Usage Example 1
 - 5.7.2 Practical Bash Usage Example 2
 - 5.7.3 Practical Bash Usage Example 3
- 5.8 Wrapping Up
- 6 Passive Information Gathering
 - 6.1 Taking Notes
 - 6.2 Website Recon
 - 6.3 Whois Enumeration
 - 6.4 Google Hacking
 - 6.5 Netcraft
 - 6.6 Recon-ng
 - 6.7 Open-Source Code
 - 6.8 Shodan
 - 6.9 Security Headers Scanner
 - 6.10 SSL Server Test
 - 6.11 Pastebin
 - 6.12 User Information Gathering
 - 6.12.1 Email Harvesting
 - 6.12.2 Password Dumps
 - 6.13 Social Media Tools
 - 6.13.2 Site-Specific Tools
 - 6.14 Stack Overflow
 - 6.15 Information Gathering Frameworks
 - 6.15.1 OSINT Framework
 - 6.15.2 Maltego
 - 6.16 Wrapping Up



7 Active Information Gathering

- 7.1 DNS Enumeration
 - 7.1.1 Interacting with a DNS Server
 - 7.1.2 Automating Lookups
 - 7.1.3 Forward Lookup Brute Force
 - 7.1.4 Reverse Lookup Brute Force
 - 7.1.5 DNS Zone Transfers
 - 7.1.6 Relevant Tools in Kali Linux
- 7.2 Port Scanning
 - 7.2.1 TCP / UDP Scanning
 - 7.2.2 Port Scanning with Nmap
 - 7.2.3 Masscan
- 7.3 SMB Enumeration
 - 7.3.1 Scanning for the NetBIOS Service
 - 7.3.2 Nmap SMB NSE Scripts
- 7.4 NFS Enumeration
 - 7.4.1 Scanning for NFS Shares
 - 7.4.2 Nmap NFS NSE Scripts
- 7.5 SMTP Enumeration
- 7.6 SNMP Enumeration
 - 7.6.1 The SNMP MIB Tree
 - 7.6.2 Scanning for SNMP
 - 7.6.3 Windows SNMP Enumeration Example
- 7.7 Wrapping Up
- 8 Vulnerability Scanning
 - 8.1 Vulnerability Scanning Overview and Considerations
 - 8.1.1 How Vulnerability Scanners Work
 - 8.1.2 Manual vs. Automated Scanning
 - 8.1.3 Internet Scanning vs Internal Scanning
 - 8.1.4 Authenticated vs Unauthenticated Scanning
 - 8.2 Vulnerability Scanning with Nessus
 - 8.2.1 Installing Nessus
 - 8.2.2 Defining Targets
 - 8.2.3 Configuring Scan Definitions



- 8.2.4 Unauthenticated Scanning With Nessus
- 8.2.5 Authenticated Scanning With Nessus
- 8.2.6 Scanning with Individual Nessus Plugins
- 8.3 Vulnerability Scanning with Nmap
- 8.4 Wrapping Up
- 9 Web Application Attacks
 - 9.1 Web Application Assessment Methodology
 - 9.2 Web Application Enumeration
 - 9.2.1 Inspecting URLs
 - 9.2.2 Inspecting Page Content
 - 9.2.3 Viewing Response Headers
 - 9.2.4 Inspecting Sitemaps
 - 9.2.5 Locating Administration Consoles
 - 9.3 Web Application Assessment Tools
 - 9.3.2 DIRB
 - 9.3.3 Burp Suite
 - 9.3.4 Nikto
 - 9.4 Exploiting Web-based Vulnerabilities
 - 9.4.1 Exploiting Admin Consoles
 - 9.4.2 Cross-Site Scripting (XSS)
 - 9.4.3 Directory Traversal Vulnerabilities
 - 9.4.4 File Inclusion Vulnerabilities
 - 9.4.5 SQL Injection
 - 9.5 Extra Miles
 - 9.5.1 Exercises
 - 9.6 Wrapping Up
- 10 Introduction to Buffer Overflows
 - 10.1 Introduction to the x Architecture
 - 10.1.1 Program Memory
 - 10.1.2 CPU Registers
 - 10.2 Buffer Overflow Walkthrough
 - 10.2.1 Sample Vulnerable Code
 - 10.2.2 Introducing the Immunity Debugger
 - 10.2.3 Navigating Code



- 10.2.4 Overflowing the Buffer
- 10.2.5 Exercises
- 10.3 Wrapping Up
- 11 Windows Buffer Overflows
 - 11.1 Discovering the Vulnerability
 - 11.1.1 Fuzzing the HTTP Protocol
 - 11.2 Win Buffer Overflow Exploitation
 - 11.2.1 A Word About DEP, ASLR, and CFG
 - 11.2.2 Replicating the Crash
 - 11.2.3 Controlling EIP
 - 11.2.4 Locating Space for Our Shellcode
 - 11.2.5 Checking for Bad Characters
 - 11.2.6 Redirecting the Execution Flow
 - 11.2.7 Finding a Return Address
 - 11.2.8 Generating Shellcode with Metasploit
 - 11.2.9 Getting a Shell
 - 11.2.10 Improving the Exploit
 - 11.3 Wrapping Up
- 12 Linux Buffer Overflows
 - 12.1 About DEP, ASLR, and Canaries
 - 12.2 Replicating the Crash
 - 12.3 Controlling EIP
 - 12.4 Locating Space for Our Shellcode
 - 12.5 Checking for Bad Characters
 - 12.6 Finding a Return Address
 - 12.7 Getting a Shell
 - 12.8 Wrapping Up
- 13 Client-Side Attacks
 - 13.1 Know Your Target
 - 13.1.1 Passive Client Information Gathering
 - 13.1.2 Active Client Information Gathering
 - 13.2 Leveraging HTML Applications
 - 13.2.1 Exploring HTML Applications
 - 13.2.2 HTA Attack in Action



- 13.3 Exploiting Microsoft Office
 - 13.3.1 Installing Microsoft Office
 - 13.3.2 Microsoft Word Macro
 - 13.3.3 Object Linking and Embedding
 - 13.3.4 Evading Protected View
- 13.4 Wrapping Up
- 14 Locating Public Exploits
 - 14.1 A Word of Caution
 - 14.2 Searching for Exploits
 - 14.2.1 Online Exploit Resources
 - 14.2.2 Offline Exploit Resources
 - 14.3 Putting It All Together
 - 14.4 Wrapping Up
- 15 Fixing Exploits
 - 15.1 Fixing Memory Corruption Exploits
 - 15.1.1 Overview and Considerations
 - 15.1.2 Importing and Examining the Exploit
 - 15.1.3 Cross-Compiling Exploit Code
 - 15.1.4 Changing the Socket Information
 - 15.1.5 Changing the Return Address
 - 15.1.6 Changing the Payload
 - 15.1.7 Changing the Overflow Buffer
 - 15.2 Fixing Web Exploits
 - 15.2.1 Considerations and Overview
 - 15.2.2 Selecting the Vulnerability
 - 15.2.3 Changing Connectivity Information
 - 15.2.4 Troubleshooting the "index out of range" Error
 - 15.3 Wrapping Up
- 16 File Transfers
 - 16.1 Considerations and Preparations
 - 16.1.1 Dangers of Transferring Attack Tools
 - 16.1.2 Installing Pure-FTPd
 - 16.1.3 The Non-Interactive Shell
 - 16.2 Transferring Files with Windows Hosts



- 16.2.1 Non-Interactive FTP Download
- 16.2.2 Windows Downloads Using Scripting Languages
- 16.2.3 Windows Downloads with exe2hex and PowerShell
- 16.2.4 Windows Uploads Using Windows Scripting Languages
- 16.2.5 Uploading Files with TFTP
- 16.3 Wrapping Up
- 17 Antivirus Evasion
 - 17.1 What is Antivirus Software
 - 17.2 Methods of Detecting Malicious Code
 - 17.2.1 Signature-Based Detection
 - 17.2.2 Heuristic and Behavioral-Based Detection
 - 17.3 Bypassing Antivirus Detection
 - 17.3.1 On-Disk Evasion
 - 17.3.2 In-Memory Evasion
 - 17.3.3 AV Evasion: Practical Example
 - 17.4 Wrapping Up
- 18 Privilege Escalation
 - 18.1 Information Gathering
 - 18.1.1 Manual Enumeration
 - 18.1.2 Automated Enumeration
 - 18.2 Windows Privilege Escalation Examples
 - 18.2.1 Understanding Windows Privileges and Integrity Levels
 - 18.2.2 Introduction to User Account Control (UAC)
 - 18.2.3 User Account Control (UAC) Bypass: fodhelper.exe Case Study
 - 18.2.4 Insecure File Permissions: Serviio Case Study
 - 18.2.5 Leveraging Unquoted Service Paths
 - 18.2.6 Windows Kernel Vulnerabilities: USBPcap Case Study
 - 18.3 Linux Privilege Escalation Examples
 - 18.3.1 Understanding Linux Privileges
 - 18.3.2 Insecure File Permissions: Cron Case Study
 - 18.3.3 Insecure File Permissions: /etc/passwd Case Study
 - 18.3.4 Kernel Vulnerabilities: CVE-7-2 Case Study
 - 18.4 Wrapping Up
- 19 Password Attacks



- 19.1 Wordlists
 - 19.1.1 Standard Wordlists
- 19.2 Brute Force Wordlists
- 19.3 Common Network Service Attack Methods
 - 19.3.1 HTTP htaccess Attack with Medusa
 - 19.3.2 Remote Desktop Protocol Attack with Crowbar
 - 19.3.3 SSH Attack with THC-Hydra
 - 19.3.4 HTTP POST Attack with THC-Hydra
- 19.4 Leveraging Password Hashes
 - 19.4.1 Retrieving Password Hashes
 - 19.4.2 Passing the Hash in Windows
 - 19.4.3 Password Cracking
- 19.5 Wrapping Up
- 20 Port Redirection and Tunneling
 - 20.1 Port Forwarding
 - 20.1.1 RINETD
 - 20.2 SSH Tunneling
 - 20.2.1 SSH Local Port Forwarding
 - 20.2.2 SSH Remote Port Forwarding
 - 20.2.3 SSH Dynamic Port Forwarding
 - 20.3 PLINK.exe
 - 20.4 NETSH
 - 20.5 HTTPTunnel-ing Through Deep Packet Inspection
 - 20.6 Wrapping Up
- 21 Active Directory Attacks
 - 21.1 Active Directory Theory
 - 21.2 Active Directory Enumeration
 - 21.2.1 Traditional Approach
 - 21.2.2 A Modern Approach
 - 21.2.3 Resolving Nested Groups
 - 21.2.4 Currently Logged on Users
 - 21.2.5 Enumeration Through Service Principal Names
 - 21.3 Active Directory Authentication
 - 21.3.1 NTLM Authentication



- 21.3.2 Kerberos Authentication
- 21.3.3 Cached Credential Storage and Retrieval
- 21.3.4 Service Account Attacks
- 21.3.5 Low and Slow Password Guessing
- 21.4 Active Directory Lateral Movement
 - 21.4.1 Pass the Hash
 - 21.4.2 Overpass the Hash
 - 21.4.3 Pass the Ticket
 - 21.4.4 Distributed Component Object Model
- 21.5 Active Directory Persistence
 - 21.5.1 Golden Tickets
 - 21.5.2 Domain Controller Synchronization
- 21.6 Wrapping Up
- 22 The Metasploit Framework
 - 22.1 Metasploit User Interfaces and Setup
 - 22.1.1 Getting Familiar with MSF Syntax
 - 22.1.2 Metasploit Database Access
 - 22.1.3 Auxiliary Modules
 - 22.2 Exploit Modules
 - 22.2.1 SyncBreeze Enterprise
 - 22.3 Metasploit Payloads
 - 22.3.1 Staged vs Non-Staged Payloads
 - 22.3.2 Meterpreter Payloads
 - 22.3.3 Experimenting with Meterpreter
 - 22.3.4 Executable Payloads
 - 22.3.5 Metasploit Exploit Multi Handler
 - 22.3.6 Client-Side Attacks
 - 22.3.7 Advanced Features and Transports
 - 22.4 Building Our Own MSF Module
 - 22.5 Post-Exploitation with Metasploit
 - 22.5.1 Core Post-Exploitation Features
 - 22.5.2 Migrating Processes
 - 22.5.3 Post-Exploitation Modules
 - 22.5.4 Pivoting with the Metasploit Framework



- 22.6 Metasploit Automation
- 22.7 Wrapping Up
- 23 PowerShell Empire
 - 23.1 Installation, Setup, and Usage
 - 23.1.1 PowerShell Empire Syntax
 - 23.1.2 Listeners and Stagers
 - 23.1.3 The Empire Agent
 - 23.2 PowerShell Modules
 - 23.2.1 Situational Awareness
 - 23.2.2 Credentials and Privilege Escalation
 - 23.2.3 Lateral Movement
 - 23.3 Switching Between Empire and Metasploit
 - 23.4 Wrapping Up
- 24 Assembling the Pieces: Penetration Test Breakdown
 - 24.1 Public Network Enumeration
 - 24.2 Targeting the Web Application
 - 24.2.1 Web Application Enumeration
 - 24.2.2 SQL Injection Exploitation
 - 24.2.3 Cracking the Password
 - 24.2.4 Enumerating the Admin Interface
 - 24.2.5 Obtaining a Shell
 - 24.2.6 Post-Exploitation Enumeration
 - 24.2.7 Creating a Stable Pivot Point
 - 24.3 Targeting the Database
 - 24.3.1 Enumeration
 - 24.3.2 Attempting to Exploit the Database
 - 24.4 Deeper Enumeration of the Web Application Server
 - 24.4.1 More Thorough Post Exploitation
 - 24.4.2 Privilege Escalation
 - 24.4.3 Searching for DB Credentials
 - 24.5 Targeting the Database Again
 - 24.5.1 Exploitation
 - 24.5.2 Post-Exploitation Enumeration
 - 24.5.3 Creating a Stable Reverse Tunnel



- 24.6 Targeting Poultry
 - 24.6.2 Enumeration
 - 24.6.3 Exploitation (Or Just Logging In)
 - 24.6.4 Post-Exploitation Enumeration
 - 24.6.5 Unquoted Search Path Exploitation
 - 24.6.6 Post-Exploitation Enumeration
- 24.7 Internal Network Enumeration
 - 24.7.1 Reviewing the Results
- 24.8 Targeting the Jenkins Server
 - 24.8.1 Application Enumeration
 - 24.8.2 Exploiting Jenkins
 - 24.8.3 Post Exploitation Enumeration
 - 24.8.4 Privilege Escalation
 - 24.8.5 Post Exploitation Enumeration
- 24.9 Targeting the Domain Controller
 - 24.9.1 Exploiting the Domain Controller
- 24.10 Wrapping Up
- 25 Trying Harder: The Labs
 - 25.1 Real Life Simulations
 - 25.2 Machine Dependencies
 - 25.3 Cloned Lab Machines
 - 25.4 Unlocking Networks
 - 25.5 Routing
 - 25.6 Machine Ordering & Attack Vectors
 - 25.7 Firewall / Routers / NAT
 - 25.8 Passwords