Mastering Modern Web Penetration Testing

Master the art of conducting modern pen testing attacks and techniques on your web application before the hacker does!

Prakhar Prasad



Mastering Modern Web Penetration Testing

Copyright © 2016 Packt Publishing

All rights reserved. No part of this book may be reproduced, stored in a retrieval system, or transmitted in any form or by any means, without the prior written permission of the publisher, except in the case of brief quotations embedded in critical articles or reviews.

Every effort has been made in the preparation of this book to ensure the accuracy of the information presented. However, the information contained in this book is sold without warranty, either express or implied. Neither the author, nor Packt Publishing, and its dealers and distributors will be held liable for any damages caused or alleged to be caused directly or indirectly by this book.

Packt Publishing has endeavored to provide trademark information about all of the companies and products mentioned in this book by the appropriate use of capitals. However, Packt Publishing cannot guarantee the accuracy of this information.

First published: October 2016

Production reference: 1251016

Published by Packt Publishing Ltd. Livery Place 35 Livery Street Birmingham B3 2PB, UK.

ISBN 978-1-78528-458-8

www.packtpub.com

Credits

Author

Prakhar Prasad

Reviewer

Kubilay Onur Gungor

Commissioning Editor

Julian Ursell

Acquisition Editor

Rahul Nair

Content Development Editor

Amrita Noronha

Technical Editors

Manthan Raja

Copy Editor

Safis Editing

Project Coordinator

Shweta H Birwatkar

Proofreader

Safis Editing

Indexer

Mariammal Chettiyar

Graphics

Disha Haria

Production Coordinator

Arvindkumar Gupta

Cover Work

Arvindkumar Gupta

About the Author

Prakhar Prasad is a web application security researcher and penetration tester from India. He has been a successful participant in various bug bounty programs and has discovered security flaws on websites such as Google, Facebook, Twitter, PayPal, Slack, and many more. He secured the tenth position worldwide in the year 2014 at HackerOne's platform. He is OSCP and OSWP certified, which are some of the most widely respected certifications in the information security industry. He occasionally performs training and security assessment for various government, non-government, and educational organizations.

I am thankful from the bottom of my heart to the editors of this book, Kajal Thapar, Amrita Noronha, and Manthan Raja, for helping and assisting me at various stages of this book. The kick starter behind this book is my dear friend Rafay Baloch, a known name in the ethical-hacking community; he has been a constant source of encouragement and motivation.

The last chapter of this book on API testing is written entirely by Pranav Hivarekar, a renowned researcher in the domain of web application security, who is a very good friend of mine and a down-to-earth human being. I'm immensely thankful to him for coming up with and authoring a guest chapter for this book.

I'll do injustice if I don't mention my family, friends, and loved ones, who have always worked behind the scenes to keep me pumped up and motivated at different stages of this book. This book wouldn't be possible without their efforts.

About the Reviewer

Kubilay Onur Gungor has been working in the cyber security field for more than 8 years. He started his professional career with crypt analysis of encrypted images using chaotic logistic maps.

After working as a QA tester in the Netsparker project, he continued his career in the penetration testing field. He performed many penetration tests and consultancies for the IT infrastructure of many large clients, such as banks, government institutions, and telecommunication companies. After pen testing activities, he worked as a web application security expert and incident management and response expert in Sony Europe and Global Sony Electronics.

He believes in multidisciplinary approach on cyber security and defines it as a struggle. With this approach, he has developed his own unique certification and training program, including penetration testing, malware analysis, incident management and response, cyber terrorism, criminal profiling, unorthodox methods, perception management, and international relations. Currently, this certification program is up and running in Istanbul in the name of Cyber Struggle (https://cyberstruggle.org).

Besides security, he holds certificates in foreign policy, brand management, surviving in extreme conditions, international cyber conflicts, anti-terrorism accreditation board, terrorism and counter-terrorism comparing studies.

www.PacktPub.com

eBooks, discount offers, and more

Did you know that Packt offers eBook versions of every book published, with PDF and ePub files available? You can upgrade to the eBook version at www.PacktPub.com and as a print book customer, you are entitled to a discount on the eBook copy. Get in touch with us at customercare@packtpub.com for more details.

At www.PacktPub.com, you can also read a collection of free technical articles, sign up for a range of free newsletters and receive exclusive discounts and offers on Packt books and eBooks.



https://www.packtpub.com/mapt

Get the most in-demand software skills with Mapt. Mapt gives you full access to all Packt books and video courses, as well as industry-leading tools to help you plan your personal development and advance your career.

Why subscribe?

- Fully searchable across every book published by Packt
- Copy and paste, print, and bookmark content
- On demand and accessible via a web browser

Table of Contents

| Pretace | IX |
|--|----|
| Chapter 1: Common Security Protocols | 1 |
| SOP | 1 |
| Demonstration of the same-origin policy in Google Chrome | 2 |
| Switching origins | 3 |
| Quirks with Internet Explorer | 4 |
| Cross-domain messaging | 4 |
| AJAX and the same-origin policy | 5 |
| CORS | 6 |
| CORS headers | 7 |
| Pre-flight request | 7 |
| Simple request | 8 |
| URL encoding – percent encoding | 8 |
| Unrestricted characters | 9 |
| Restricted characters | 9 |
| Encoding table | 10 |
| Encoding unrestricted characters | 11 |
| Double encoding | 11 |
| Introducing double encoding | 11 |
| IIS 5.0 directory traversal code execution – CVE-2001-0333 | 12 |
| Using double encoding to evade XSS filters | 13 |
| Base64 encoding | 14 |
| Character set of Base64 encoding | 14 |
| The encoding process | 15 |
| Padding in Base64 | 16 |
| Summary | 17 |

| Chapter 2: Information Gathering | 19 |
|---|----------|
| Information gathering techniques | 19 |
| Active techniques | 20 |
| Passive techniques | 20 |
| Enumerating Domains, Files, and Resources | 20 |
| Fierce | 21 |
| theHarvester | 26 |
| SubBrute | 27 |
| CeWL | 28 |
| DirBuster | 30 |
| WhatWeb | 32 |
| Maltego | 32 |
| Wolfram Alpha | 36 |
| Shodan | 37 |
| DNSdumpster | 41 |
| Reverse IP Lookup – YouGetSignal | 42 |
| Pentest-Tools | 43 |
| Google Advanced Search | 43 |
| Summary | 49 |
| Chapter 3: Cross-Site Scripting | 51 |
| Reflected XSS | 52 |
| Demonstrating reflected XSS vulnerability | 52 |
| Reflected XSS – case study 1 | 53 |
| Reflected XSS – case study 2 | 55 |
| Stored XSS | 58 |
| Demonstrating stored XSS | 58 |
| Stored XSS through Markdown | 60 |
| Stored XSS through APIs | 61 |
| Stored XSS through spoofed IP addresses | 64 |
| Flash-based XSS – ExternalInterface.call() | 67 |
| HttpOnly and secure cookie flags | 70 |
| DOM-based XSS | 71 |
| XSS exploitation – The BeEF | 74 |
| Setting Up BeEF | 74 |
| Demonstration of the BeEF hook and its components | 76 |
| Logs | 78 |
| Commands Rider | 78 80 |
| Xssrays | 80 |
| IPec | 80 |
| Network | 81 |
| Summary | 81 |
| [ii] | |

| Chapter 4: Cross-Site Request Forgery | 83 |
|--|-----|
| Introducing CSRF | 84 |
| Exploiting POST-request based CSRF | 86 |
| How developers prevent CSRF? | 86 |
| PayPal's CSRF vulnerability to change phone numbers | 87 |
| Exploiting CSRF in JSON requests | 90 |
| Using XSS to steal anti-CSRF tokens | 92 |
| Exploring pseudo anti-CSRF tokens | 93 |
| Flash comes to the rescue | 94 |
| Rosetta Flash | 97 |
| Defeating XMLHTTPRequest-based CSRF protection | 98 |
| Summary | 99 |
| Chapter 5: Exploiting SQL Injection | 101 |
| Installation of SQLMap under Kali Linux | 102 |
| Introduction to SQLMap | 103 |
| Injection techniques | 106 |
| Dumping the data – in an error-based scenario | 107 |
| Interacting with the wizard | 110 |
| Dump everything! | 112 |
| SQLMap and URL rewriting | 112 |
| Speeding up the process! | 113 |
| Multi-threading | 113 |
| NULL connection | 114 |
| HTTP persistent connections | 114 |
| Output prediction | 114 |
| Basic optimization flags | 115 |
| Dumping the data – in blind and time-based scenarios | 115 |
| Reading and writing files | 117 |
| Checking privileges | 118 |
| Reading files | 118 |
| Writing files | 119 |
| Handling injections in a POST request | 122 |
| SQL injection inside a login-based portal | 125 |
| SQL shell | 125 |
| Command shell | 127 |
| Evasion – tamper scripts | 128 |
| Configuring with proxies | 132 |
| Summary | 133 |

| Chapter 6: File Upload Vulnerabilities | 135 |
|---|-------------------|
| Introducing file upload vulnerability | 136 |
| Remote code execution | 137 |
| Multi-functional web shells | 139 |
| Netcat accessible reverse shell | 142 |
| The return of XSS | 143 |
| SWF – the flash | 143 |
| SVG images | 145 |
| Denial of Service | 146 |
| Malicious JPEG file – pixel flood | 146 |
| Malicious GIF file – frame flood | 146 |
| Malicious zTXT field of PNG files | 146 |
| Bypassing upload protections | 147 |
| Case-sensitive blacklist extension check bypass | 147 |
| MIME content type verification bypass | 149 |
| Apache's htaccess trick to execute benign files as PHP | 151 |
| SetHandler method | 152 |
| The AddType method | 152 |
| Bypassing image content verification | 153 |
| Summary | 156 |
| Chapter 7: Metasploit and Web | 157 |
| Discovering Metasploit modules | 158 |
| Interacting with Msfconsole | 160 |
| Using Auxiliary Modules related to Web Applications Understanding WMAP – Metasploit's Web Application | 162 |
| Security Scanner | 167 |
| Generating Web backdoor payload with Metasploit | 171 |
| Summary | 178 |
| Chapter 8: XML Attacks | 179 |
| XML 101 – the basics | 180 |
| XML elements | 180 |
| XML Attributes | 181 |
| XML DTD and entities | 181 |
| Internal DTD | 181 |
| External DTD | 182 |
| Entities | 183 |
| Entity declaration XXE attack | 183 184 |
| Reading files | 186 |
| PHP Base64 conversion URI as an alternative | 187 |

| The application | 234 |
|---|-----|
| Redirect URI | 235 |
| Access token | 235 |
| Client ID | 235 |
| Client secret | 235 |
| Receiving grants | 236 |
| Authorization grant | 236 |
| Implicit grant | 239 |
| Exploiting OAuth for fun and profit | 239 |
| Open redirect – the malformed URL | 240 |
| Hijacking the OAuth flow – fiddling with redirect URI | 241 |
| Directory traversal tricks | 241 |
| Domain tricks | 242 |
| Flow hijack through open redirect on client | 243 |
| Force a malicious app installation | 244 |
| Summary | 245 |
| Chapter 11: API Testing Methodology | 247 |
| Understanding REST APIs | 247 |
| REST API concepts | 247 |
| URIs | 248 |
| URI format | 248 |
| Modelling of resource | 248 |
| Stitching things together | 248 |
| REST API and HTTP | 249 |
| Request methods | 250 |
| Response codes | 250 |
| Headers | 251 |
| Setting up the testing environment | 252 |
| Analyzing the API | 252 |
| Basic HTTP authentication | 252 |
| Access token | 253 |
| Cookies | 253 |
| Tools | 254 |
| Burp Suite | 254 |
| REST API clients | 254 |
| Custom API explorers | 255 |
| Learning the API | 255 |
| Developer documentation | 255 |
| Understanding requests/responses | 257 |
| Learning scopes | 258 |
| Learning roles | 260 |