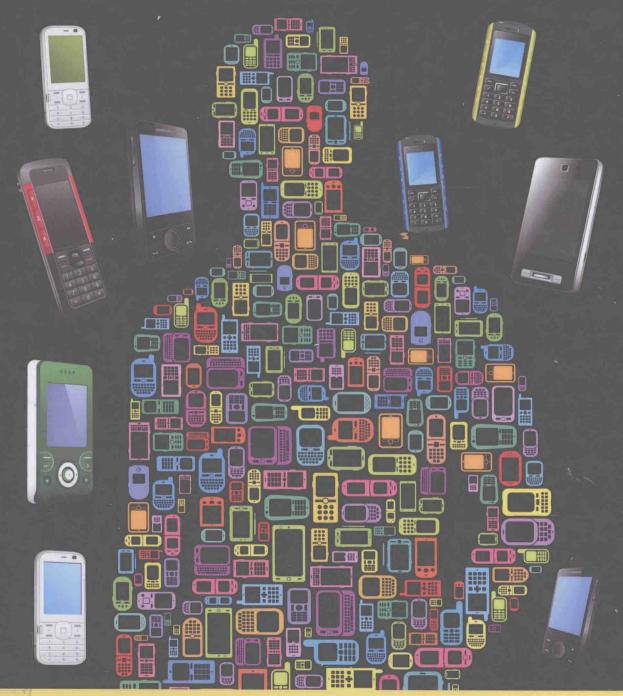
Digital Forensics for Handheld Devices



Eamon P. Doherty



Digital Forensics for Handheld Devices

Eamon P. Doherty



CRC Press Taylor & Francis Group 6000 Broken Sound Parkway NW, Suite 300 Boca Raton, FL 33487-2742

© 2013 by Taylor & Francis Group, LLC CRC Press is an imprint of Taylor & Francis Group, an Informa business

No claim to original U.S. Government works

Version Date: 20120626

International Standard Book Number: 978-1-4398-9877-2 (Hardback)

This book contains information obtained from authentic and highly regarded sources. Reasonable efforts have been made to publish reliable data and information, but the author and publisher cannot assume responsibility for the validity of all materials or the consequences of their use. The authors and publishers have attempted to trace the copyright holders of all material reproduced in this publication and apologize to copyright holders if permission to publish in this form has not been obtained. If any copyright material has not been acknowledged please write and let us know so we may rectify in any future reprint.

Except as permitted under U.S. Copyright Law, no part of this book may be reprinted, reproduced, transmitted, or utilized in any form by any electronic, mechanical, or other means, now known or hereafter invented, including photocopying, microfilming, and recording, or in any information storage or retrieval system, without written permission from the publishers.

For permission to photocopy or use material electronically from this work, please access www.copyright.com (http://www.copyright.com/) or contact the Copyright Clearance Center, Inc. (CCC), 222 Rosewood Drive, Danvers, MA 01923, 978-750-8400. CCC is a not-for-profit organization that provides licenses and registration for a variety of users. For organizations that have been granted a photocopy license by the CCC, a separate system of payment has been arranged.

Trademark Notice: Product or corporate names may be trademarks or registered trademarks, and are used only for identification and explanation without intent to infringe.

Visit the Taylor & Francis Web site at http://www.taylorandfrancis.com

and the CRC Press Web site at http://www.crcpress.com

This book is dedicated to my lovely wife Ester, my mom, my sister-in-law Elly, and the memory of my dad, Edward T. Doherty

Preface

This book was written to teach someone about all the areas of mobile device forensics, which include topics from the legal, technical, academic, and social aspects of the discipline. It is hoped that the reader will now have an idea how to use a variety of digital forensic tools to examine flash drives, cell phones, PDAs, digital cameras, and netbooks. It is also hoped that the reader will understand the differences between a corporate investigation and a criminal investigation as well as some of the issues regarding privacy and the Fourth Amendment. The book ends with a discussion of the education and certifications that one needs for many possible careers in mobile device forensics.

Disclaimer

The views expressed in this book are Dr. Doherty's own views and ideas and do not necessarily represent the ideas and viewpoints of his employer or any organization he is associated with. This is an academic book that explores ideas, mobile device forensic techniques, and tools. This book is not a forensic manual or a legal manual. Dr. Doherty is not endorsing any products and was not paid to endorse any products. One should consult their organization's general counsel and follow the policies of the organization before attempting anything from the book.

Author

Eamon P. Doherty, PhD, CCE, SSCP, CPP, is an associate professor and the Cybercrime Training Lab director at Fairleigh Dickinson University (FDU), New Jersey. Dr. Doherty is a member of the High Tech Crimes Investigative Association, ASIS International, the FBI Infraguard, the American College of Forensic Examiners Institute, the FDU Digital Forensics Club, the IACSP, and the American Society of Digital Forensics & eDiscovery. Dr. Doherty has also assisted with some law enforcement cell phone investigations and is the chairman of the New Jersey Regional Homeland Security Technology Committee. Dr. Doherty previously worked for Morris County Government in their M.I.S./I.S.D. section. Presently, Dr. Doherty has developed and taught many continuing education classes for FDU on the subjects of cell phone forensics, PDA forensics, and digital camera forensics.

An environmentally friendly book printed and bound in England by www.printondemand-worldwide.com





This book is made entirely of sustainable materials; FSC paper for the cover and PEFC paper for the text pages.

Contents

	Preface	xxiii
	Disclaimer	XXV
	Author	xxvii
Chapter 1	The Cell Phone	1
	The Cell Phone Is Invented	1
	Cell Phone Models and Cell Phone Museums	2
	Cell Phone Protocols and Operating Systems	4
	Cell Phone Operating Systems: Finding the ESN and IMEI	4
	Cell Phone Operating Systems and Protocols: Synchronization	6
	Cell Phone Differences Worldwide	7
	Cell Phone Differences Worldwide: Various Bands	8
	Cell Phone Internal and External Storage	10
	Internal Cards: SIM Cards/Locked and Unlocking	12
	The Need for a Faraday Bag	13
	Survey of Tools to Investigate a Cell Phone	14
	Examining Cell Phones with Operating Systems Unsupported by Your Tools	1.5
	Cell Phone Forensic Tools: Mobil Edit	17
	Survey of Cell Phone Forensic Tools: Paraben Device Seizure	18
	Susteen Secure View	19
	Chinese Cell Phone Examination Tools	21
	Translation of Chinese Calling Codes and Documents within a Phone	22
	Validating Your Chinese Cell Phone Examination Tools	23
	Paraben's Deployable Device Seizure	2.3
	Paraben's SIM Card Seizure Version 3.1	25
	Replacing the USB Mini Port on a Cell Phone	26
	Paraben's Link2 V2.5	28
	Elcomsoft Phone Password Breaker	28

viii Contents

	Investigative Computer and Precautions to Take	29
	Precautions: Examining Phone—High-Profile Case	30
	Precautions: Protecting Equipment from Static Electricity	31
	GPS Camera Phones	32
	GPS Data in Picture	32
	GPS Data and Crimes	33
	GPS Accuracy and Variables	34
	Metadata: Linking Picture to Google Maps	35
	Faking GPS Data Using Picasa 3 and Google Earth	36
	Putting It All Together: Cell Phone Hardware	36
	References	37
Chapter 2	Digital Camera Forensics	41
	The History of the Digital Camera	41
	Digital Camera History: Conversion of Analog Pictures to Digital Signals	41
	Digital Camera History: The Transmission of Digital Images	42
	Digital Camera History: Kodak's 1.4 Megapixel Sensor	42
	Digital Camera History: The Apple Quick Take 100	42
	Digital Camera History: The Webcam	42
	Digital Camera History: dSLR	44
	Getting to Understand Digital Camera Hardware	44
	History of the Digital Camera: Criminal Activity	45
	Digital Camera Operating Systems	46
	Digital Camera File Systems: FAT	46
	External Media	47
	Survey of Tools to Investigate a Digital Camera	47
	Survey of Tools: Forensic Professional Kiosk Card Reader EX-3U Read Only	48
	New 3.5" All-in-One Internal Card Reader USB Flash Memory Metal Silver	50
	The 26-in-1 USB Card Reader by DZ-Tech	51
	Digital Image Recovery	51
	Zero Assumption Recovery Toolkit	52
	Disk Space Visualizer Version 1.2	52
	Zero Assumption Recovery Tutorials	52
	EXIF Data Standards	53
	EXIF Field Types	53
	GPS EXIF Data	54

Contents		
COLIECTIO		

ix

EXIF Reader	54
PixelZap and PZapGui	54
Thumber	54
Framer	55
File Lister	55
MinUpTime	56
HideWin	56
FileMonitor	56
CamWork	56
CRead	57
Tools for the Camera Investigator: X-Ways "Forensic Software"	57
Tools for the Camera Investigator: Recover My Files	57
Tools for the Camera Investigator: ProDiscover Basic	57
Tools for the Digital Camera Phone Investigator: Susteen Secure View	58
Tools for the Digital Camera Phone Investigator: Guidance Software Encase	58
Tools for the Digital Camera Phone Investigator: ILook Investigator Software	58
Tools for the Digital Camera Phone Investigator: Paraben's Device Seizure	58
Survey of Tools: ABC Amber Image Converter	59
Thumbnails and Thumbnail Viewer: DM Thumbs	59
Survey of Tools to Investigate Camera: Case Study of Advanced Import Camera (2009)	59
Case Study: Data Carving with Data Lifter 2	61
Case Study: Determining the Level of Resolution Loss of the Recovered Pictures	61
Case Study: Survey of Tools to Investigate a Digital Camera	62
Case Study: Use of USB Write Blocker	62
Case Study: Access Data FTK	62
Case Study: Determining if a Picture Was Created with the Binocular Camera	63
Case Study: Each Camera Has Imperfections and Limitations That Impact the Picture	63
The Investigative Machine: Digital Camera Forensics	64
Black Hole Faraday Bag	66
Incident Response Tools and Services	67
CasesNotes Lite	67
FragView	67
GigaView	67

x Contents

VideoTriage

	My Thoughts on the Need for Time-Saving Video Investigation Tools	68
	The Investigative Computer and Precautions to Take	68
	Precautions: Be Prepared to Answer Most Basic Questions for a Deposition	68
	Precautions: Get Certified (ACE, CCE, CISSP, etc.)	69
	Precautions: Handling Evidence and Static Electricity	70
	Precautions: Get a Good Image of the External Media and/or Internal Media	70
	Precautions: Finding Experts for Specialized Old Digital Cameras	70
	Precautions: Posting Questions on Blogs or List Servers	71
	Precautions: Find Digital Pictures with Wrong File Extensions	71
	Precautions: No Breaks of Custodianship of Evidence	72
	Precautions: Do Not Just Rely on Automated Tools!	72
	Precautions: Using Other Investigative Tools Such as Biometrics to Solve the Case	7.3
	Precautions: Check HR for a Signed Camera Policy	73
	Precautions: Know When to Invoke the Silver Platter Doctrine	73
	Precautions: Check for Counterfeit American Money at Crime Scene	74
	Precautions: Wet Batteries and Camera Phones/Digital Cameras	74
	Why Steganography Is Important to Digital Camera Forensic Examiners	74
	Precautions: Use the Best Evidence Rule	75
	Precautions: Weeding Out the Wrong Types as Investigators	75
	Precautions: Keeping Current on Digital Camera Forensics	76
	References	76
Chapter 3	PDAs and Digital Forensics	79
	PDA History	79
	History of PDA and Pocket Size Organizer	80
	PDA History: PDA Phone	81
	Learning about PDAs/Museums	81
	Learning about PDAs: PDA Hardware	82
	PDA Protocols Connectivity and Operating Systems	83
	PDA Connectivity: Infrared	83
	PDA Connectivity: Wireless	84
	PDA Connectivity: Bluetooth	85
	PDA Connectivity: Cable	8.5
	PDA Operating Systems: Microsoft Windows Mobile 5.0 Premium Edition	86

67

Contents xi

	PDA Operating Systems: Palm	86
	Learning about New Operating Systems	87
	Investigative Computer and Precautions to Take	88
	Investigative Computer and Policy Precautions to Take	88
	Precaution: Use Forensic Sterile Media	89
	Precaution: Get PDA Examiner Certifications	90
	Precaution: What about Americans Taking Their PDAs to Other Countries?	91
	Precaution: PDA Examination and Disease	92
	Precaution: Encountering Prima Facie Evidence on the PDA	92
	Survey of Tools to Investigate a PDA: Paraben Device Seizure	93
	Survey of Tools to Investigate a PDA: Paraben PDA Seizure	94
	Survey of Tools to Investigate a PDA: Avanquest's Data Recovery Professional	94
	Survey of Tools to Investigate a PDA: Recover My Files	95
	Survey of Tools to Investigate a PDA: Guidance Software's Encase	95
	Survey of Tools to Investigate a PDA: Palm PDD	96
	Survey of Tools to Investigate a PDA: XRY Forensics	96
	PDA Forensics and Intelligence: Clearwell eDiscovery Software	97
	e2Retrieve	97
	e2fsck	98
	Pilot Link	98
	PPWDump	98
	Hardware Write Blockers for USB Ports and PDAs	98
	The Digital Forensics Framework	99
	Write Blockers for PDAs with 9 Pin Serial Ports	100
	Using Virtual Machines for Demonstrating the Accused's PDA in Court	101
	Final Thoughts on PDA Investigation	101
	Suggested Further Reading	101
	References	101
Chapter 4	GPS Devices	105
	Introduction	105
	GPS Device History	105
	GPS Device History: Multienvironment GPS Tracking Devices	106
	GPS Device History: GPS Tracking and Warrants	107
	GPS Device History: Braille GPS Devices	107
	GPS Device History: Military-Grade GPS Jammers	108
	GPS Device History: Civilian-Grade GPS Jammers	108

xii Contents

Systems	108
GPS Device History: GPS Spoofing Devices and Truck Hijacking	109
GPS Device History: GPS Fishfinder Devices	109
GPS Operating Systems	109
Survey of Tools to Investigate GPS Navigation Devices	111
Need to Investigate GPS Tracking Devices	111
Need to Investigate GPS Navigation Devices	111
Example of Paraben Version 4 and a Garmin Nuvi 1300	111
Access Data FTK Imager and FTK 1.8	112
Helix 3 and TomTology and the Tom Tom	112
Blackthorn 2 GPS Forensic Software System	113
Porn Detection Stick	114
Survey of GPS Forensic Tools: Networking with GPS Forensic Investigators	115
GPS Tools and Education	115
Outfitting a Lab with GPS Forensic Tools	116
GPS Devices, Training Labs, and Privacy Issues	117
Learning about Low-Budget Tools for GPS Forensics	118
Map Send Lite	118
Easy GPS	118
GPS Utility	119
GPS Babel	119
QuakeMap	120
DSI USB Write Blocker	120
Virtual GPS 1.39: GPS Simulator	120
Discussion with a Mobile Device and Computer Forensic Investigator	120
Examining a Tom Tom Go 700	121
Best Practices for Seizing Electronic Evidence and Radio Signals	122
GPS Forensic Credentials	123
Geographic Information Systems Training	123
Mobile Forensics Certified Examiner	124
Graduate Certificate in Digital Forensics: RWU	124
Masters in Digital Forensics at the University of Central Florida	124
Certified Electronic Evidence Collection Specialist Certification	12.
SANS: Mobile Device Forensics (Forensics 563)—Certificate of Attendance	12.
Suggested Further Reading and Reference Sources for GPS	120
References	127

Contents xiii

Chapter 5	Corporate Investigations on a Netbook	129
	Authorized Requestor Leads Investigations	129
	AR Asks, "What Is a Netbook? Handtop? Subnotebook? Palmtop?"	130
	HR, General Counsel, CIO	130
	Incident Response Team	131
	Incident Response Teams with Specializations	132
	Incident Response Teams (Law Enforcement) and Dangerous Environments	133
	Incident Response Teams Need a Photographer	135
	Incident Response Teams (Resilience Training)	135
	Incident Response Team Skills	136
	Incident Response Team's Digital Forensics Lab	138
	Incident Response Team's Toolkit	139
	OSForensics: A Computer/Computer Media Forensic Analysis Tool	139
	OSForensics as a Tool to Ensure Integrity of Examination Machine	140
	Web-Based Training That Is "On Demand" for OSForensics	140
	Password Recovery in OSForensics	140
	OSForensics Case Management	141
	Bootable Versions of OSForensics	141
	OSFClone	141
	cs2025 Forensic Software and Recovery Software for Unix, Linux, Windows, and Mac OS X	142
	Network Miner	143
	Mac-Robber	143
	PLAC	143
	Rdd Forensic Copy Program	143
	AIR	143
	TULP2G	143
	ODESSA	143
	Sleuth Kit	144
	Maresware Linux Forensics	144
	Drive Prophet	145
	Elcomsoft: Advanced PDF Password Recovery	146
	Advanced Sage Password Recovery	147
	Elcomsoft Internet Password Breaker	147
	Elcomsoft Wireless Security Auditor	148
	Advanced Archive Password Recovery	149
	Advanced Office Password Breaker	149

xiv Contents

Instant Facebook Password Recovery	150
Zeitline	151
ProDiscover IR Smart Agent Version 6.7	151
ZeroView	151
X1 Professional Client	152
Windows Grep	152
WinFingerprint	152
Safari Books	152
Silent Runner Mobile	153
UnHide	154
Forensic Soft: Windows Forensic Boot Disk	154
Windows Forensic Tool Chest	156
Paraben's Shuttle	156
BackTrack 5 Forensic Tools	1.57
RkHunter: Backtrack Forensics Tools	157
Mork.PI	158
HexEdit	158
ExifTool	158
Evtparse.pl	158
Missidentify	158
RegLookup	159
ReadPst	159
Pref.pl	159
Ptk	159
StegDetect	159
Vinetto	159
FatBack	160
Foremost	160
RecoverJPG	160
Safecopy	160
Scalpel	160
Scrounge-NTFS	160
TestDisk	160
HashDeep	161
MD5Deep	161
TigerDeep	161
ddRescue	161

Contents xv

EWFacquire	161
DriftNet	161
TcpReplay	162
WireShark	162
CmosPWD	162
fCrackZip	162
Samdump	162
PDF-ID	162
PDF-Parser	163
PeepDF	163
pdfbook.py	163
Pdgmail	163
Volatility	163
Paraben's Windows Breaker	163
LogicCube Forensic Talon Enhanced	164
Advanced EFS Data Recovery	165
PsLoggedOn (Incident Response Tool)	166
WebJob (Incident Response Tool)	166
AIR: Automated Image and Restore	167
Runtime Software	168
DriveLook Version 1	168
Drivelmage XML V2.30	169
GetDataBack for NTFS V4.25	169
GetDataBack for FAT V4.25	169
Captain Nemo Pro V5.05	169
Disk Digger V1.0	169
ShadowCopy V2.0	170
RemoteByMail V1.01	170
Pythía V1.02	170
Ultimate Toolkit	170
eDiscovery Software	171
ChRootKit	172
Knoppix	173
Knoppix Security Tools Distribution	173
Password Recovery Toolkit	174
Distributed Network Attack	174
ISO Buster	175