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Entitled
AN EXPLORATORY FORENSIC ACQUISITION AND ANALYSIS OF DIGITAL EVIDENCE ON
THE AMAZON KINDLE

For the degree of Master of Science 

Is approved by the final examining committee:

Dr. Samuel Liles _____

Dr. Marcus Rogers _____

Professor Raymond Hansen _____

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Approved by: Professor Jeffrey Whitten 04/23/2014

Head of the Department Graduate Program

Date

AN EXPLORATORY FORENSIC ACQUISITION AND ANALYSIS OF DIGITAL EVIDENCE ON THE
AMAZON KINDLE

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Submitted to the Faculty

of

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by

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Requirements for the Degree

of

Master of Science

May 2014

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This research is dedicated to my bicycle, The Bat Bike. Without her, I would not have gone so far.

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GLOSSARY

- Acquisition – physically seizing electronic media and creating a forensic image of it (Daniel & Daniel, 2011)
- Analysis – “the process of locating and collecting evidentiary items from evidence that has been collected in a case” (Daniel & Daniel, 2011)
- Artifact – plain text, obscured, or encrypted operating system generated information about a user’s actions, preferences, and credentials often in “the form of logs, files, lists, passwords, caches, history, recently used lists, and other data” used as digital evidence (Bunting, 2008)
- Associative evidence – “assisting to prove or disprove a link between people and object with places or with other people” (Horrocks, Coulson, & Walsh, 1998)
- Chip-off forensics – “physically [removing] a flash memory chip from a [printed circuit board] and [reading the] flash memory chip with a memory chip programmer or reader.” (Breeuwsma, Jongh, Klaver, Knijff, & Roeloffs, 2007)
- Cluster – “the smallest unit the file system can use for saving data” (Daniel & Daniel, 2011)
- Digital evidence – “any data stored or transmitted using a computer that support or refute a theory of how an offense occurred or that address critical elements of the offense such as intent or alibi” (Casey, 2004)
- Digital forensics – “application of computer technology to a matter of law where the evidence includes both items that are created by people and items that are created by technology as the result of the interaction with a person” (Daniel & Daniel, 2011)

- Directory entry – “The basic concept of a FAT file system is that each file and directory is allocated a data structure, called a directory entry, that contains the file name, size, starting address of the file content, and other metadata” (Carrier, 2005, p. 156)
- File – a stream of allocated or unallocated, consecutive or fragmented digital data on storage media (Carrier, 2003; Carrier, 2005)
- File allocation table (FAT) – “used to determine the allocation status of a cluster and to find the next allocated cluster in a file or directory” (Carrier, 2005, p. 190)
- File system – a method to organize a volume “for the long-term storage and retrieval of data” (Carrier, 2005, p. 125)
- Forensic considerations – “data integrity, authentication, reproducibility, non-interference and the ability of proposed techniques to comply with federal minimization requirements.” (Garfinkel, 2010)
- Forensic image – an exact bit for bit copy of unaltered digital evidence, usually a physical or logical drive
- Flasher tool – a “non-invasive way to read flash data [...] by using a simple hardware interface and software [to copy] all flash memory data from the target system to another system for further analysis [...] These tools mainly originate from two sources: manufacturers or service centers who use these tools for debugging and diagnostics and sometimes for in field software updates, and hackers who use these tools for checking and changing device functionality.” (Breeuwsma, Jongh, Klaver, Knijff, & Roeloffs, 2007)
- Joint Test Action Group (JTAG) port – “normally used to test or debug embedded systems but can also be used to access flash memory” (Breeuwsma, Jongh, Klaver, Knijff, & Roeloffs, 2007)
- Kindle Active Content – user added “software--such as games--to [the] Kindle” (“Kindle Active Content,” n.d.)
- Kindle Archived Content – “All books you purchase are automatically backed up on Amazon.com. When you remove a book from your Kindle, it appears in your Archived Items” (“Organizing Your Kindle Content,” n.d.)
- Partition – a method to divide storage media to allow varying formats on each partition (Daniel & Daniel, 2011). “A collection of consecutive sectors in a volume” (Carrier, 2005, p. 58)

Sector – “the smallest addressable storage unit in the hard disk and is typically 512 bytes”
(Carrier, 2005, p. 31)

Unallocated space – the state of a cluster in a file system when a file or directory is not assigned to that cluster in the file allocation table (Carrier, 2005)

Volume – “a collection of addressable sectors that an Operating System (OS) or application can use for data storage” (Carrier, 2005, p. 57)

ABSTRACT

Thompson, Marcus A. M.S., Purdue University, May 2014. An Exploratory Forensic Acquisition and Analysis of Digital Evidence on the Amazon Kindle. Major Professor: Dr. Samuel Liles.

The Amazon Kindle is becoming a popular e-book reader. This popularity will lead criminals to use the Kindle as an accessory to their crime. Very few Kindle publications in the digital forensics domain exist at the time of this writing. Various blogs on the Internet currently provide some of the foundation for Kindle forensics. For this research each fifth generation Kindle was populated with various types of files a typical user may introduce using one method, the USB interface. The Kindle was forensically imaged with AccessData's Forensic Toolkit Imager before and after each Kindle was populated. Each file was deleted through the USB interface. Files were retrieved and recovered through the USB interface before and after file deletion. These two sets of files were compared to the original set of files. All files retrieved before deletion matched their original counterpart. Not all files recovered after deletion matched their original counterpart. These steps and procedures followed a similar methodology developed by Leshney (2008) for virtual machines.

CHAPTER 1. INTRODUCTION

1.1 Introduction

According to Garfinkel (2010), digital forensics is about 40 years old with 2007 ending the “Golden Age for digital forensics” (p. S66). The Golden Age included few operating systems, few file formats of investigative interest, and single device investigations. Daniel and Daniel (2011) declare the digital forensics field was created while personal computers were becoming commonplace during the 1980s with the establishment of the Federal Bureau of Investigation’s Magnetic Media Program in 1984. Investigations only began using forensic tools such as SafeBack and DIBS to collect unaltered digital evidence in the 1990s (Casey, 2004). Garfinkel (2010) foresees a crisis in the digital forensics community that is in part due to increased use of embedded flash memory, expansion of interest in other file formats, and cross-device analysis (p. S66). In a previous paper from Garfinkel (2006), he states, “[t]oday’s forensic examiners have become the victims of their own success. Digital storage devices such as hard drives and flash memory are such valuable sources of information that they are now routinely seized in many investigations” (p. S71). These devices should be seized, but investigators will begin to feel the impact of the crisis as they seize additional digital evidence.

The Amazon Kindle synchronizes across a user's devices: Kindle, mobile phone, and computer. This will assist the investigator because multiple sources will point to the user, but it requires correlation of large amounts of evidence from the investigator, which increases "system and human processing time associated with data analysis" with current methods (Beebe & Clark, 2005, 3).

The digital forensics community is very familiar with iPod forensics and mobile device forensics. iPods are a very popular device to store and play music for users, and they have large storage capacities that can hold other files in addition to music. This leads some to use iPods in manners other than originally intended by the manufacturer. Users can boot into Windows or Linux using their iPods (Marsico & Rogers, 2005). Like many mobile devices, the Kindle contains a Subscriber Identity Module (SIM) card and has 3G network connectivity. In some respects it should be treated as a mobile device. It may need to be removed from any network connectivity with a Faraday bag (Daniel & Daniel, 2011).

Investigators know "[c]ell phones can tell you a lot about a person: likes, dislikes, vices, habits, secret fetishes, [and] secret personalities..." (Slovenski, 2012). Many cell phones can outperform computers of yesteryear facilitating increased complexity of features and functions that will store more data about its user (Daniel & Daniel, 2011). The ability for users to create and store collections may contribute to behavior profiling. Time to Read may be a factor in user attribution. The Amazon Kindle has increased functionality like the iPod or other mobile devices. A user can read books, listen to music,

search the Internet, play games, and share content with social media web sites and other users.

Unexpected functionality is a forensic challenge for investigators. Major feature differences between iPods, mobile devices, and the Kindle are narrowing. Mobile device forensic methods should be taken into consideration when encountering these devices. Forensic artifacts remain on computers where iPods have been connected. Investigators should be conscious of these facts to conduct a thorough investigation because many of these ideas may apply to the Kindle as well. Investigators also need to be aware of the differences between operating systems. For example, Windows forensics does not match one to one with Linux forensics (Craig, 2005). This will affect the appearance of Kindle artifacts on each operating system and other devices. Investigators can extrapolate what they have learned about previous devices such as the iPod, mobile devices, and operating systems to apply forensic practices with the Amazon Kindle.

1.2 Statement of the Problem

The Kindle line of products has extended functionality that one may not expect. A Kindle user can play music, play games, browse the web, and depending on the model, store two or four gigabytes of data and not necessarily e-books. It supports conversion of personal documents through email for the file extensions in Table 1 (Amazon.com, 2011).

Table 1: Supported Formats for Personal Document Conversion

Format	File Extension
Unprotected Microsoft Word Documents	.doc, .docx
Text and Rich Text Format	.txt, .rtf
Structured HyperText Markup Language	.html, .htm
Joint Photographic Expert Group	.jpeg, .jpg
Graphics Interchange Format	.gif
Portable Network Graphics	.png
Bitmap Images	.bmp
Compression	.zip

It also has native support for Portable Document Format (PDF) files and can store any other file much like other storage devices. The Kindle Development Kit (KDK) is in beta testing providing “rich APIs, tools, and documentation” to allow United States users to develop their own active content, such as games, calendars, or photo galleries (“Kindle Development,” n.d.; “Kindle Active Content,” n.d.). This will give the Kindle even more functionality in the future, narrowing the differences between an e-reader and other devices such as the iPod Touch, PDAs, and mobile devices. According to Marsico and Rogers (2005), as features are added to iPods “to make life more convenient for its users, some decide to use these conveniences to further their criminal trade craft.” These assertions lead the author to conclude it is a matter of time before Kindles are used as a means of criminal activity and become valuable sources of evidence. Without research, documentation and testing of the forensic process for Kindles, examiners may “overlook areas of evidence or may not know how to analyze the information” from a Kindle (Leshney, 2008). This could lead to an incorrect analysis,

misrepresenting “the true actions of the user and will affect the overall outcome of an investigation,” producing bad case law (Leshney, 2008)

1.3 Research Question and Hypotheses

The primary goal of this research is to answer the question, “Can files from the Amazon Kindle be forensically acquired reliably?” The answer is important to investigators so they may forensically process a Kindle in a manner meeting the rules of evidence for a court of law in criminal and civil cases.

The hypotheses of this study are stated as follows:

H₁: There is no difference between the MD5 hashes of the original files and the files retrieved through the forensic process from the Amazon Kindle.

H₂: There is no difference between the MD5 hashes of the original files and the deleted files retrieved through the forensic process from the Amazon Kindle.

1.4 Significance of the Problem

Jeff Bezos, the founder, president, CEO, and chairman of the board of Amazon.com, reports that the Kindle is the bestselling, most wished for, and most gifted product on Amazon.com (Amazon.com, June 15, 2010). He also reported that Kindle books outsold paper books for the first time on Christmas Day 2009 (Amazon.com, December 26, 2009). Bezos says he will not release sales figures because it is a trade secret, but most estimates put Kindle sales in the millions (Arrington, 2010; Bezos, 2010; Baig, 2010; Ratcliffe, 2009; Wilhelm, 2010). In addition to its sales, millions of books are available to

purchase of which 1,500,000 are less than 10 dollars and 1,000,000 are less than five dollars (“Kindle wireless reading device, Wi-Fi,” n.d.). This does not include newspapers, magazines, blogs, and another two million out-of-copyright e-books available for download. Furthermore, a user can download in over 100 countries and territories and synchronize to other Kindle applications for phones and computers using Amazon’s Whispernet through AT&T’s 3G cellular networks (“Kindle wireless reading device, Wi-Fi,” n.d.). It seems the Kindle is well grounded and will not disappear from the consumer market in the near future.

Research of the Kindle is important for law enforcement investigators who have seized a Kindle who then wish to process the electronic evidence forensically. Books and other files contained in the Kindle can be considered associative evidence, which can give insight to a suspect, victim, or person of interest and can help build a case in conjunction with other evidence. The content of the Kindle may reveal many characteristics of an active user. The Kindle can contain more than 3500 books, hundreds of .mp3 songs, or other files (“Kindle wireless reading device, Wi-Fi,” n.d.).

1.5 Statement of Purpose

The purpose of this research is to determine the validity of the forensic process on each fifth generation Kindle. Kindle forensics is a new undocumented area. As such, other devices and forensic processes should be considered in order to create a methodology for examining an Amazon Kindle. The National Institute of Standards and Technology has created standards for mobile device forensics. Combined with

computers, these devices create the field of digital forensics (Bishop, Hay, & Nance, 2009). This expansion of included devices into the field encompasses many electronics that store data, including the Amazon Kindle. Investigators can reference older devices to learn about and prepare for new sources of evidence like the Amazon Kindle. The forensic acquisition of flash memory can be conducted through a few techniques, including the Joint Test Action Group (JTAG) port, flasher tools, and chip-off (Breeuwsma, Jongh, Klaver, Knijff, & Roeloffs, 2007). This research was limited to one technique. The Universal Serial Bus (USB) port was used for each Kindle to access the user partition. These techniques followed standard forensic considerations.

1.6 Assumptions

The assumptions associated with this research include properly working hardware and software. Multiple Kindles of each individual model behaved identically. AccessData's Forensic Toolkit (FTK) Imager 3.1.0.1514 and AccessData's Forensic Toolkit 5.1 accurately represented the file system and data on each Kindle. Windows 7 Enterprise with Service Pack 1 installed on a 21.5 inch Late 2009 iMac ran FTK Imager and FTK as intended by AccessData. The Tableau T8 Forensic USB Bridge correctly blocked all write operations and correctly transmitted the read data to the iMac. It was assumed new Kindles have never been used prior to this research or contain data extraneous to Amazon's production. The method and results of this research can be applied to other Kindles and other devices, including devices not located in a laboratory setting.

1.7 Limitations

The research included each model of the fifth generation: Kindle Paperwhite 3G, Kindle Paperwhite 3G with Special Offers, Kindle Paperwhite, Kindle Paperwhite with Special Offers, Kindle 5, Kindle 5 with Special Offers, Kindle Keyboard 3G, and Kindle Keyboard 3G with Special Offers. Each Kindle was populated through the USB interface with PowerShell 2.0 on Windows 7. The population file set only included natively supported file formats, excluding .azw1, and audio formats: Kindle (.azw, .azw2, .azw3), text (.txt), Mobipocket (.mobi, .prc), and Portable Document Format (.pdf). After each Kindle was populated and acquired, the population file set was deleted. Deletion of the files only occurred through the computer host in PowerShell 2.0 with Windows 7. Acquisition of data required the device to be powered on where the operating system could have made changes. AccessData's Forensic Toolkit Imager 3.1.0.1514 was the sole software package for acquisition, and AccessData's Forensic Toolkit 5.1 was the sole software package for analysis. Several avenues of acquisition and analysis were not included in this research. Analysis of the Kindle application on synchronized devices was not conducted due to a lack of financial and schedule feasibility. Chip-off forensics procedures for physical extraction of flash memory was not performed due to a lack of technology feasibility. Volatile memory was not acquired and analyzed.

1.8 Delimitations

There are several delimitations associated with this research. Privilege escalation processes are acknowledged but were not studied. The Kindle file population processes

did not include wireless download purchases, wireless download of archived content, or downloaded documents through Amazon's Kindle Personal Document Service. These population processes are discussed in the literature review. Windows 7 with PowerShell 2.0 was used to populate each Kindle. No other operating system or process was used to copy files to each Kindle. Unprotected Microsoft Word (.doc, .docx), Rich Text Format (.rtf), HyperText Markup Language (.html, .htm), Joint Photographic Expert Group (.jpeg, .jpg), Graphics Interchange Format (.gif), Portable Network Graphics (.png), Bitmap (.bmp), compressed (.zip), and other file extensions were not included in this research as they are not natively supported by the Kindle through the USB interface. The natively supported .azw1 file format was not included due to scarcity of available files. Audio formats (.aa, .aax, and .mp3) were also not included in the sample as the Kindle Paperwhite and Kindle 5 does not support audio files. Acquisition of the flash memory was not conducted using the Joint Test Action Group (JTAG) port or any flasher tools. This research did not include other methods of file deletion: hardware deletion, Amazon.com deletion, reset to factory defaults, and formatting through the computer host. It also did not include an analysis of the security of the Kindle and identifying and mitigating methods of data obfuscation. Multiple Kindles of the same model were not tested nor were other generations of Kindles tested. Only one version of FTK Imager and FTK were used. This software was only used on a 21.5 inch Late 2009 iMac with Windows 7 Enterprise with Service Pack 1 installed. The Tableau T8 Forensic USB Bridge was the only write blocker used in this research. As of this writing the latest firmware

update is v6.87 released February 15, 2012. MD5 hashes were not compared among Kindles in the results section.

1.9 Chapter Summary

This research was motivated by the limited body of knowledge of the forensic process on the Amazon Kindle and the proliferation of the device amongst users. The outcomes of this research are important to law enforcement who may need to forensically process a Kindle during an investigation. The answer to the research question will determine the validity of the forensic process on each fifth generation Kindle. The focus of the research was provided through assumptions, limitations, and delimitations. The next chapter provides the history and functionality of the Amazon Kindle and an overview of related research to justify the gap this research intends to fill.

CHAPTER 2. REVIEW OF RELEVANT LITERATURE

This chapter summarizes the available literature relevant to Amazon Kindle forensics. The first section provides a historical background of the Amazon Kindle. The following section describes sources of content, recognized file types, and supported devices and applications. The next section of this chapter describes digital forensics methodologies, and it continues by describing the importance of forensic analysis of the Amazon Kindle. Finally, this chapter describes one methodology for conducting a forensic analysis of a device.

2.1 Approach

A limited number of peer reviewed publications exist at the time of this writing on Amazon Kindle forensics. Various blogs on the Internet also provide some of the current foundation of Kindle forensics. These writings are references in this paper due to the lack of high quality sources. High quality sources include journal articles, conference proceedings, dissertations, theses, edited books, white papers, technical reports, educational books, trade books, and trade magazines (Creswell, 2009). Related high quality sources are available for Linux forensics, Android forensics, embedded device forensics, data carving, mobile device forensics, and small-scale digital device

forensics, which are also referenced in this paper. The history of the Amazon Kindle in this section is compiled from Amazon.com's press releases.

2.2 Kindle History

The Amazon Kindle was introduced to the consumer market on November 19, 2007. The Kindle brand is in its sixth year, which includes a tablet device based on the Android operating system. All other Kindle devices have been a form of embedded Linux.

The first generation Kindle was introduced as a six-inch display e-reader with the capability of wirelessly downloading content in less than 60 seconds from a selection of over 90,000 books, 250 blogs, and many newspapers (Amazon.com, November 19, 2007; February 9, 2009). Nearly five years later the Amazon Kindle's the fifth generation includes expanded content and feature set. Over 1.5 million books and hundreds of newspapers and magazines are accessible from each of the six models: the Kindle Paperwhite, the Kindle Paperwhite with Special Offers, the 3G Kindle Paperwhite, the 3G Kindle Paperwhite with Special Offers, the Kindle 5, and the Kindle 5 with Special Offers (Amazon.com, September 6, 2012; Amazon.com, September 6, 2012; Amazon.com, October 25, 2012).

On Christmas Day 2009, Kindle book purchases surpassed physical book purchases for the first time (Amazon.com, December 26, 2009). On December 26, 2009, Amazon also announced the Kindle had become the most gifted item in the company's history (Amazon.com, December 26, 2009). In July 2010 Kindle books outsold hardcover books and then paperback books six months later (Amazon.com, May 19, 2011). In April

2011 Kindle books outsold the collective sum of hardcover and paperback books at a rate of 105 to 100 (Amazon.com, May 19, 2011). The number of books available during the Kindle's first five years is shown in Figure 1. This chart was created from the number of books available as reported in Amazon's press releases. A timeline of major events in the Kindle's history is shown in Figure 2. This figure was created from Amazon's timeline document in addition to select press releases.

Notable features added since the inception of the Kindle are the experimental web browser, Whispersync, social networking, bookmarks, annotations, highlights, Collections, password protection, native PDF reader, Special Offers, Time to Read, and Parental Controls (Amazon.com, September 6, 2012). Amazon added the ability for the user to access the Kindle's experimental web browser to search Wikipedia through Whispernet (Amazon.com, November 19, 2007). Users could search across their library or individual titles including the built-in dictionary (Amazon.com, 2007). The Kindle featured user added bookmarks, annotations, and highlights to books (Amazon.com, 2007). Amazon's Whispersync technology was introduced the ability to synchronize bookmarks and furthest page read across multiple Kindle devices and future mobile devices (Amazon.com, February 9, 2009; "Wireless, Whispernet," n.d.). The entire Kindle family of devices is shown in Figure 3. Social networks could be connected and associated with the Kindle device allowing the user to post content directly to Facebook or Twitter ("Kindle wireless reading device, free 3G," n.d.). Collections allowed users' books to be able to be organized into categories ("Kindle wireless reading device, free 3G," n.d.). A user can place their books in zero or multiple collections. Users were also

given the ability to lock their Kindle with a password (“Kindle wireless reading device, free 3G,” n.d.). Adobe Reader Mobile technology was added to natively read more structurally complex .pdf documents (Amazon.com, May 6, 2009). Special Offers places ads and other sponsored screensavers on the home screen and on the Kindle screensaver (Amazon.com, April 11, 2011). Time to Read calculates the user’s reading speed (Amazon.com, September 6, 2012). The Kindle Store, archived content, and browser access can be limited with Parental Controls (Amazon.com, September 6, 2012). Internal flash memory allows storage of about 1100 books in each model of the fifth generation (“Kindle Paperwhite,” n.d.).

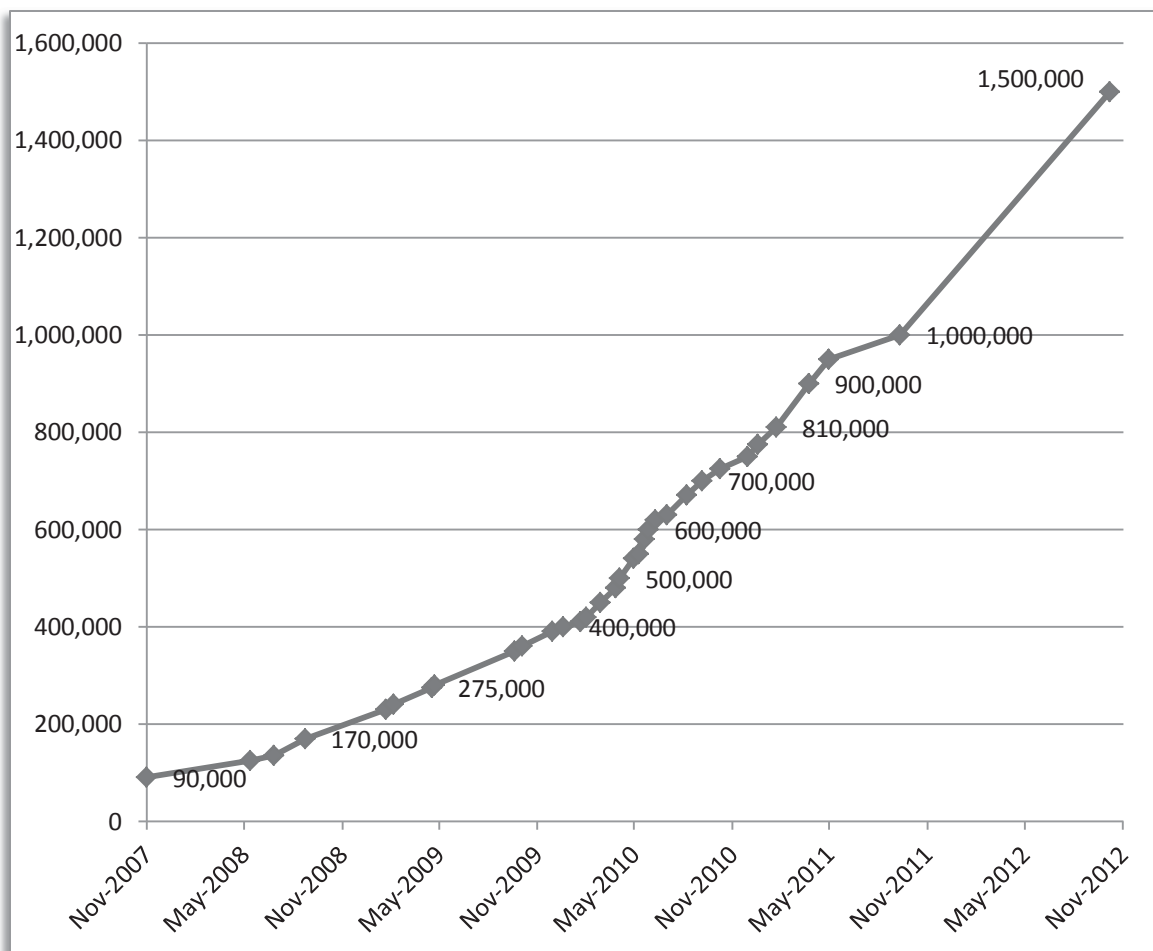


Figure 1: Number of Books Available in the U.S. Kindle Store (Amazon.com)

Note: All data points were retrieved from individual Amazon press releases. Each is cited in the References section.

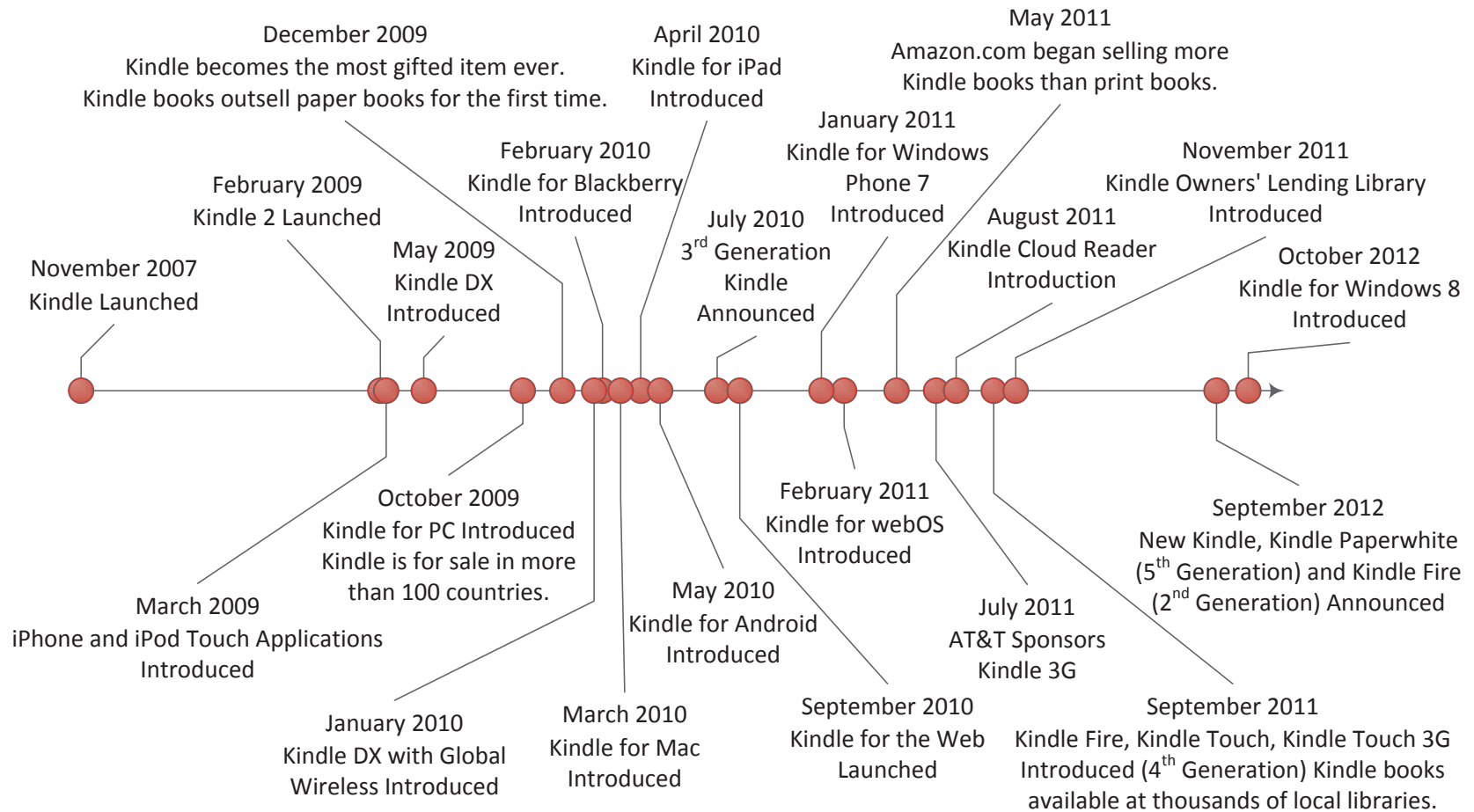


Figure 2: Major Events in the History of the Amazon Kindle (Amazon.com Timeline, 2012)

Amazon Kindle Family

Cloud Reader	Smartphones	Computers	Tablets	Kindle Fire	Kindle
<ul style="list-style-type: none">•Chrome 20+•Firefox 10+•Safari 5+•Safari for iPad iOS 4+	<ul style="list-style-type: none">•iPhone iOS 5+•iPod Touch iOS 3.2+•Android OS 2.2+•Windows Phone 7.5+•BlackBerry<ul style="list-style-type: none">•9630 (Tour)•9000, 9700 (Bold)•8900, 8520 (Curve)•9500/9530 (Storm)•9550 (Storm 2)•9800 (Torch)	<ul style="list-style-type: none">•Macintosh<ul style="list-style-type: none">•OS X 10.6+•Windows<ul style="list-style-type: none">•XP SP 2+•Vista<ul style="list-style-type: none">•7•8	<ul style="list-style-type: none">•iPad•Android•Windows 8•webOS<ul style="list-style-type: none">•HP TouchPad	<ul style="list-style-type: none">•Fire 8.9" HD 4G LTE•Fire HD 8.9"•Fire HD•Fire	<ul style="list-style-type: none">•Paperwhite 3G•Paperwhite•Kindle•Keyboard 3G

Figure 3: Kindle Supported Devices and Applications (“Free Kindle reading apps,” n.d.; “Getting started with the Kindle app,” n.d.; “Kindle – read books,” n.d.; “Kindle for Android phones,” n.d.; “Kindle for Android tablets,” n.d.; “Getting started with Kindle for Android,” n.d.; “Getting started,” n.d.; “Amazon Kindle | Windows Phone,” n.d.; “Getting started with Kindle for PC,” n.d.; “Getting started with Kindle for Mac,” n.d.; “Getting started with Kindle for webOS,” n.d.; “Getting started with Kindle Cloud Reader,” n.d.; “Kindle Cloud Reader,” n.d.)

2.3 Kindle Content Sources

Content is not limited to the Kindle Store. Users can take advantage of the Kindle Personal Documents Service to add personal documents to their device, Kindle reading application, or Kindle Library using their Send-to-Kindle email address, the Send to Kindle application, or their computer via USB (“Transferring, downloading,” n.d.). This research only studied the USB interface.

Transferring content via USB is similar to copying files to a flash drive. After connecting the Kindle to a computer, it changes to USB drive mode and disable wireless service (“Kindle Personal,” n.d.). If the user wishes to transfer content via USB and manage it on their device, they must transfer it into the correct folder (“Kindle Personal,” n.d.). According to a Kindle Keyboard support web site the “documents” folder supports Kindle (.azw, .azw1, .azw3), text (.txt), and Mobipocket (.mobi,.prc) files (“Transferring, downloading,” n.d.). The “audible” folder supports audio book (.aa, .aax) files (“Transferring, downloading,” n.d.). The “music” folder supports .mp3 files (“Transferring, downloading,” n.d.). Unlike the Kindle keyboard support web site, the Kindle Keyboard User Guide does not list .azw3, but additionally lists .azw2 (Amazon.com, 2011). These supported files are shown in Figure 4 in addition to other sources of Kindle content. Supported file extensions are shown in Table 2.

Content can be deleted from the Kindle in a few methods. The user can delete content on their Kindle. When the Kindle is confirming the deletion, a message box appears stating the selection will be permanently deleted. This removes it from the device, but it remains in their Kindle Library as archived content and can be replaced. All

content including archived content can be deleted from the Kindle in the “Manage Your Kindle” section on Amazon.com of the user’s account. The Kindle can be reset to factory defaults within the menus of the device. A computer host can format the Kindle or delete files when the Kindle is USB drive mode. This research is limited to deleting files through the USB drive mode.

Table 2: Kindle Supported File Formats

Physical Medium	Source	Type	Supported File Extensions as Documented by Amazon
802.11b/g/n	Send-to-Kindle Email Address	Documents	.doc, .docx, .pdf, .rtf
		HTML	.html, .htm
		Images	.jpeg, .jpg, .gif, .png, .bmp
		Books	.azw, .mobi
	Compressed	.zip	
	Public Library	Books	.azw
USB	Windows Explorer	Documents	.azw, .azw1, .azw2, .azw3, .txt, .mobi, .prc, .pdf
		Audible	.aa, .aax
		Music	.mp3
Whispernet (3G)	U.S. Kindle Store	Books	undocumented
		Audible	undocumented
		Active Content	undocumented
		Newspapers	undocumented
		Blogs	undocumented
		Magazines	undocumented

Table 2 continued

Whispernet (3G)	Kindle Owners' Lending Library	Books	undocumented
	Send-to-Kindle Application for PC	Documents	.doc, .docx, .pdf, .rtf, .txt
		Images	.jpeg, .jpg, .gif, .png, .bmp
		Books	.mobi
	Send-to-Kindle Application for MAC	Documents	.doc, .docx, .pdf, .rtf, .txt
		Images	.jpeg, .jpg, .gif, .png, .bmp
		Books	.mobi
	Send-to-Kindle Application for Google Chrome	News Articles	undocumented
		Blog Posts	undocumented
	Send-to-Kindle Application for Mozilla Firefox	News Articles	undocumented
		Blog Posts	undocumented
	Send-to-Kindle Application for Android	Documents	.doc, .docx, .pdf
		Images	.jpeg, .jpg, .gif, .png, .bmp
		Books	.azw, .mobi
	Kindle Library	Archived Content	undocumented
	Send-to-Kindle Email Address	Documents	.doc, .docx, .pdf, .rtf
		HTML	.html, .htm
		Images	.jpeg, .jpg, .gif, .png, .bmp
		Books	.azw, .mobi
		Compressed	.zip

Amazon Kindle

802.11b/g/n

- Send-to-Kindle Email Address
- Public Library

USB

- Documents
- Audible
- Music

Whispernet (3G)

U.S. Kindle Store

- Books
- Audio Books
- Active Content
- Subscriptions
- Newspapers
- Blogs
- Magazines

Kindle Personal Documents Service

- Android
- iPad
- iPhone
- iPod Touch

Kindle Owners' Lending Library

Send to Kindle Application

- PC
- MAC
- Google Chrome

User's Kindle Library

- Archived Content

Send-to-Kindle Email Address

- Documents
- HTML
- Images
- Books
- Compressed

Figure 4: Amazon Kindle Supported Content Sources and Recognized File Types (“Transferring, downloading,” n.d.; “Kindle Personal,” n.d.; Amazon.com, 2011; “Kindle Owners’ Lending,” n.d.; “Public library books,” n.d.; “Connecting your Kindle,” n.d.)

2.4 Digital Forensics Methodologies

The General Test Methodology for Computer Forensic Tools was published by the National Institute of Standards and Technology (NIST) of the United States Department of Commerce in 2001 to evaluate forensic software tools to provide investigators a measure of quality, specifically for the judicial process (National Institute of Standards and Technology, 2001). It includes seven stages in its approach: establish categories of forensic requirements, identify requirements for a specific category, develop test assertions based on requirements, develop test code for assertions, identify relevant test cases, develop testing procedures and method, and report test results (National Institute of Standards and Technology, 2001).

Expert determined categories of forensic categories group forensic functions to narrow the scope of requirements for each grouping (National Institute of Standards and Technology, 2001). Technical and functional requirements for specific categories are identified by law enforcement and community experts using the tools (National Institute of Standards and Technology, 2001). Each test assertion is an independent statement that tests or measures a behavior, action, or condition (National Institute of Standards and Technology, 2001). Computer science experts, forensic practitioners, and public review limit the environments of the test cases (National Institute of Standards and Technology, 2001). Testing procedures and method describes the software and steps to complete the test (National Institute of Standards and Technology, 2001). Recorded test results are required to be repeatable and reproducible (National Institute of Standards and Technology, 2001).

Some research has been performed using these methods. Leshney (2008) adapted this methodology for his research on digital evidence on virtual machines. Due to the exploratory nature of his work, he did not include all stages of NIST's test methodology and redefined some (Leshney, 2008). Five of the seven stages were included: establish categories of forensic requirements, identify test assertions/variables, develop test cases, develop testing procedures and methods, and report results. Leshney identified three categories of forensic requirements from Burchett: file/directory recovery, file/directory analysis, and log analysis. Leshney divided his research into two phases. In the first phase he identified, recovered, and analyzed evidence, and in the second phase he performed log analysis. This research is based on Leshney's adaptation of the test methodology.

2.5 Chapter Summary

Amazon Kindle forensics has little history as of this writing, but investigators can look to previous work in other devices and operating systems to move forward into this area. This work is important because of the proliferation of the device and its capabilities similar to flash drives as well as the ability to browse the Internet. The Kindle will appear in crime scenes, and investigators will need to proceed with the forensic process, which may give the investigator much more insight into the case. Other areas should be researched to be fully understood, and limitations should be identified to prevent any accidental data loss.

CHAPTER 3. METHODOLOGY

This chapter explains the research methodology based on Leshney's research on virtual machines. The sample set included 210 natively supported files for each Kindle. MD5 hashes were calculated throughout the experiment and were compared. The comparison is described in terms of successes and failures and creates the results of this research.

3.1 Research Approach

This thesis was an exploratory study to analyze the effect of individual Amazon Kindles on a known file set during the forensic process. The research followed an experimental design with the Kindle model and file type as the independent variables and the file hashes as the dependent variable. The research included each model of the fifth generation: Kindle Paperwhite 3G, Kindle Paperwhite 3G with Special Offers, Kindle Paperwhite, Kindle Paperwhite with Special Offers, Kindle 5, Kindle 5 with Special Offers, Kindle Keyboard 3G, and Kindle Keyboard 3G with Special Offers. Each model was newly purchased from Amazon.com. The Kindles were populated with a known sample file set with known MD5 hashes as shown in the next section. This process was automated with

a script through Windows PowerShell 2.0 as shown in Appendix B. The sample file set was acquired from each Kindle for analysis through one technique using the USB interface. The retrieved files were hashed. The sample was deleted from each Kindle through one process: deletion through the computer host in Windows using a PowerShell script as shown in Appendix D. Data was again acquired through the USB interface. The files were hashed a second time resulting in three sets of file hashes. These sets of file hashes were compared and analyzed and comprised the results of this research.

3.2 Sample

The sample included 30 files of each type from each source shown in Table 3. These file types are listed as natively supported in Amazon documentation.

Table 3: Research Sample

Physical Medium	Source	Type	Supported File Extensions as Documented by Amazon
USB	Windows Explorer	Documents	.azw, .azw1, .azw2, .azw3, .txt, .mobi, .prc, .pdf

3.3 Forensic Method

The methodology for this study was based on Leshney's (2008) adaptation of the National Institute for Standards and Technology General Test Methodology for Computer Forensic Tools. Leshney's adaptation includes five stages: establish categories

of forensic requirements, identify test assertions/variables, develop test cases, develop testing procedures and methods, and report results. These stages are discussed in more detail in the literature review.

3.3.1 Establish Categories of Forensic Requirements

Two of the three categories identified by Leshney were considered: file/directory recovery and file/directory analysis (2008). The third category of log analysis was foregone as virtual machines produce vast user accessible logs unlike the Kindle.

3.3.2 Identify Test Assertions

Test assertions were developed based on two potential actions a user could perform through the USB interface: adding content and removing content. Amazon supports user added documents, audible books, and music through the USB interface. A user can delete these files through several processes. The USB interface in Windows PowerShell was the only medium used to perform deletion.

3.3.3 Test Cases

The purpose of the first test was to determine differences between files retrieved and the original files. The purpose of the second test was to determine differences between deleted files and the original files. Table 4 displays how many files of each extension were added to each Kindle.

Table 4: Files to Add to Each Kindle

Physical Medium	File Source	Type	File	Number of Files
USB	Windows Explorer	Documents	.azw	30
			.azw2	30
			.azw3	30
			.txt	30
			.mobi	30
			.prc	30
			.pdf	30

3.3.4 Apparatus and Testing Procedures

The forensic analysis of the Amazon Kindle flash memory can be conducted through a few physical techniques. This research was limited to one technique to access the Kindle flash memory, the USB interface. The technique in this study duplicated the Kindle flash memory with AccessData's Forensic Toolkit (FTK) Imager 3.1.0.1514 using a Tableau T8 Forensic USB Bridge with firmware update 6.87 to prevent tampering of evidence. The duplicates were analyzed using AccessData's Forensic Toolkit 5.1 software on Windows 7 Service Pack 1. These processes followed forensic practices: "data integrity, authentication, reproducibility, non-interference and the ability of proposed techniques to comply with federal minimization requirements." (Garfinkel, 2010, S65)

In phase I the MD5 hash of each file in the sample was calculated using FTK. This was completed by selecting "Add/Remove..." in the menu bar under "Evidence." The

“Add” button was clicked once the “Manage Evidence” window appeared. The source evidence type selected was “Contents of a Directory.” The folder containing the sample was chosen. The resulting MD5 hash of each file calculated by FTK is shown in Appendix F. These values were exported from FTK by right-clicking in the file list pane, selecting “Copy Special...,” selecting the “All” radio button, and clicking “OK.” This procedure copied the file list values to the Windows clipboard. The values were pasted into Microsoft Excel for ease of comparison of phase II and phase III results. To conclude phase I each Kindle was imaged in its factory state using a Tableau write blocker and FTK Imager on Windows 7. These steps are shown in Appendix A. The Kindles were modified in one way in order for them to mount as an accessible drive in Windows. Each Kindle Paperwhite required a user language be selected before it was able to be mounted and imaged. The research design for phase I is shown visually in Figure 5.

In phase II Each Kindle was populated with files listed in Table 4 through USB with a Windows PowerShell script as shown in Appendix B. The successful output of the try block is shown in Appendix C. There were no failures during the execution of the script, producing no output from the catch block. There was a failure produced in the original procedures of this research. Audio files were included in the sample in the original protocol. The script pointed the copy procedure for those files to the Audio and Music folders. The Kindle Paperwhite does not support audio books or music files and does not include Audio or Music directories. The result of the script was a creation of a flat file of the Audio and Music directory and not the intended file structure. To correct this the research protocol was altered by removing the audio files from the sample.

Three Kindles having the original sample were restored to factory defaults. Once each Kindle was populated without audio files, they were imaged a second time with the same steps as in phase I shown in Appendix A. The MD5 hash of the original files was compared to the MD5 hash of the files retrieved from the second image. The research design for phase II is shown visually in Figure 6.

Phase III deleted all 210 files placed on each Kindle during phase I through the USB interface using a Windows PowerShell script as shown in Appendix D while not deleting any files or directories included in their factory state. The successful output of the try block is shown in Appendix E. There were no failures during the execution of the script, producing no output from the catch block. The script was modified after it was realized the script deleted the Kindle user guide and dictionary. These extraneous deletions did not affect the experiment. Each Kindle was imaged a third and final time with the same steps as in phase I and phase II shown in Appendix A. The image was opened and processed in FTK in the same manner as phase II. Each file was attempted to be recovered through AccessData's Forensic Toolkit software. The MD5 hashes were exported to Microsoft Excel with the same steps in phase I and phase II. The MD5 hash of the original files was compared to the MD5 hash of the deleted files. The research design for phase III is shown visually in Figure 7.

3.3.5 Reporting

Results were gathered through the research design process as shown in Figure 6 and Figure 7. The comparisons between file sets created the results for phase II and

phase III. The MD5 hashes of the original files were compared to the files retrieved from each Kindle in phase II. The MD5 hashes of the original files were compared to the recovered files from each Kindle in phase III. Matching MD5 hashes were considered a success while conflicting hashes were considered a failure. Missing MD5 hashes in phase III from recovered or non-recovered files were also considered a failure.



Figure 5: Research Design for Phase I

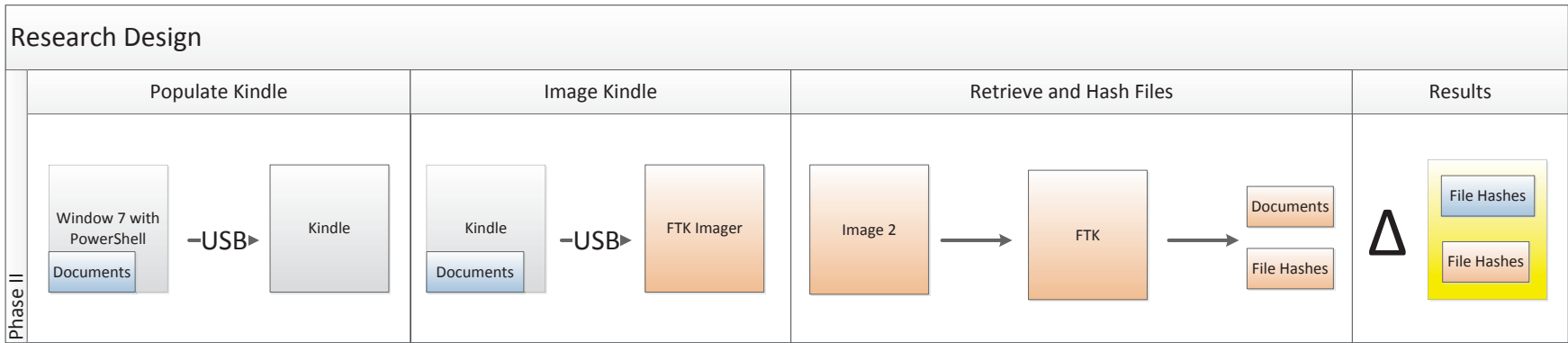


Figure 6: Research Design for Phase II

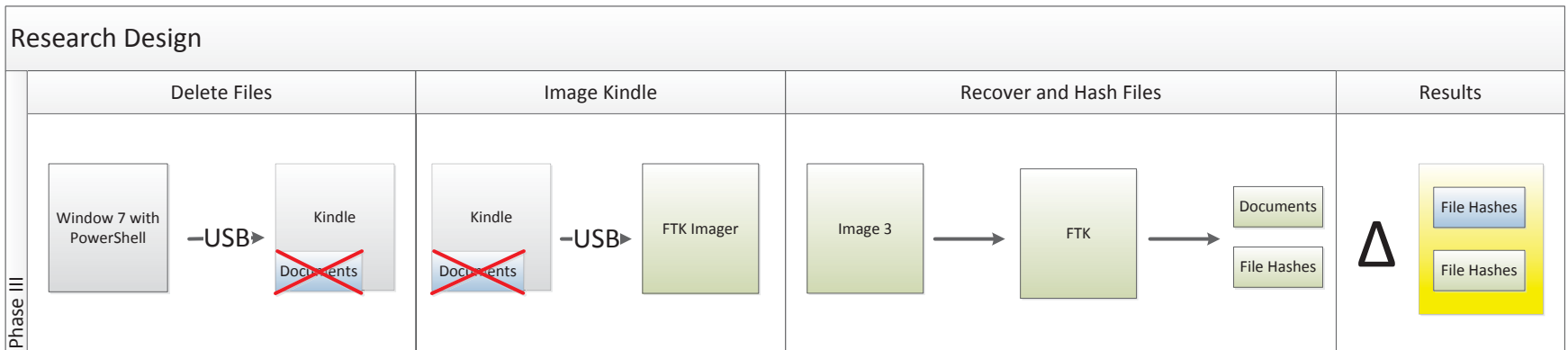


Figure 7: Research Design for Phase III

3.4 Threshold

Success for this study was measured through its ability to meet stated goals. The goal of this research was to show no differences between the original files and retrieved files and the original files and deleted files. Meeting these goals demonstrates the forensic process can be applied to the Amazon Kindle.

CHAPTER 4. RESULTS

This chapter presents the data of the procedures executed in chapter three. It summarizes the raw results, outcomes, and trends. Interpretation, analysis, conclusions, and recommendations are discussed in chapter five.

4.1 Hypothesis One

Each Kindle image was opened and processed in FTK to calculate the MD5 hashes of the sample. The hashes were exported to Microsoft Excel in the same manner as in phase I. The hashes from the original files and the retrieved files were compared. Every MD5 hash of each file retrieved from each Kindle matched the MD5 hash of its original counterpart listed in Appendix F. The first hypothesis of this study: “There is no difference between the MD5 hashes of the original files and the files retrieved through the forensic process from the Amazon Kindle.” In this research there were no missing MD5 hashes or mismatched MD5 hashes, supporting the first hypothesis. Phase II had a 100% success rate as shown in Table 5.

Table 5: Success Rate in Phase II

Model	Number of Failures	Success Rate
Kindle Keyboard Without Special Offers	0	100%
Kindle Keyboard With Special Offers	0	100%
Kindle Paperwhite With Special Offers	0	100%
Kindle Paperwhite 3G	0	100%
Kindle Paperwhite 3G With Special Offers	0	100%
Kindle Paperwhite	0	100%
Kindle 5	0	100%
Kindle 5 With Special Offers	0	100%

4.2 Hypothesis Two

The second hypothesis of this study: “There is no difference between the MD5 hashes of the original files and the deleted files retrieved through the forensic process from the Amazon Kindle.” 292 of 1680 MD5 hashes in Phase III did not match the original file or was missing altogether, failing to support the second hypothesis of this research. Phase III had an 82.62% success rate. The MD5 hash of B000JML3IW_EBOK.azw was mismatched or missing in every Kindle except the Kindle 5 with Special Offers. The MD5 hash of B000JML7EC_EBOK.azw was mismatched on three Kindle Paperwhites. 25344-h.prc, 26491-h.prc, 29239-h.prc, and 6130-h.prc had mismatched MD5 hashes on every Kindle. An additional ten MD5 hashes of .prc files were mismatched on the Kindle 5. Every MD5 hash of .txt files were mismatched on every Kindle. A summary of failures per Kindle is shown in Table 6. A summary of failures per file type is shown in Table 7.

Table 6: Failure Rate in Phase III by Kindle

Model	Number of Failures	Success Rate
Kindle Keyboard Without Special Offers	35	83.33%
Kindle Keyboard With Special Offers	35	83.33%
Kindle Paperwhite With Special Offers	36	82.86%
Kindle Paperwhite 3G	36	82.86%
Kindle Paperwhite 3G With Special Offers	36	82.86%
Kindle Paperwhite	35	83.33%
Kindle 5	45	21.43%
Kindle 5 With Special Offers	34	83.81%

Table 7: Failure Rate in Phase III by File Type

File Extension	Number of Failures	Success Rate
.azw	10	95.83%
.azw2	0	100%
.azw3	0	100%
.mobi	0	100%
.pdf	0	100%
.prc	42	82.5%
.txt	240	0%

CHAPTER 5. DISCUSSION

This chapter interprets and draws conclusions from the results as shown in chapter four. Recommendations follow for future related research.

5.1 Research Question

The research question of this study was “Can files from the Amazon Kindle be forensically acquired reliably?” The results of phase II were expected as such. No failures occurred during this phase. The operating system or file system of each Kindle had no effect on files copied to them. Files from the Amazon Kindle can be acquired reliably per procedures in phase II. The results of phase III contained unexpected missing and mismatched MD5 hashes showing that deleted files cannot be forensically acquired reliably from the Amazon Kindle using the procedures of this study. The failures of phase III do not appear to be random and are fairly consistent among each Kindle. To investigate this further the author briefly analyzed one Kindle image in Autopsy 3.0.9. The analysis yielded the same results showing AccessData’s forensic image processing may not have been the cause of failure.

The failures could be an indication of how the Kindle file system and operating system handles the process of deletion. Unexpected changes appeared to have occurred

to directory entries after deletion of some files. The file content of the .prc and .txt files on the image created in phase II and the image in phase III were compared. The file content in phase III remained intact in their original phase II sectors. Analysis of the phase II image shows the designated starting cluster in phase III of .prc and .txt files points to preexisting data, meaning new data was not written to the starting clusters of the directory entries in phase III. The directory entry and file allocation table (FAT) may have changed during or after the deletion process. It is expected for the FAT file system to change the allocation status of the directory entry of a file or directory and its entry in the FAT when said file or directory is deleted. Carrier (2005) states:

When a file is deleted, the first byte of the directory entry is set to 0xe5.

Windows does not change any other values in the directory entry but other OSes might. The clusters that were allocated for the file are unallocated by setting their corresponding entries in the FAT structure to 0. Fortunately, Windows keeps the starting cluster of the cluster chain in the directory entry so some file recovery can be performed until the clusters are allocated to new files and overwritten (p. 172)

It is not expected for the FAT file system to change the starting cluster address of the in the directory entry of a file as well as the FAT when deleting said file. Carrier (2005) later states, “[T]he metadata associated with a file name will not become out of sync after the file is deleted. The metadata associated with an unallocated file name will be accurate until both are overwritten” (p. 177). Contrary to this statement, this seems to have occurred for each .prc and .txt file, which may fall under the caveat Carrier

mentioned on page 172: a non-Windows operating system might change other directory entry values. This might explain why even though the files on each Kindle were deleted in a Windows environment, the Kindle operating system may have made further changes upon being unmounted from Windows.

The failures among the .azw files appear to be caused by a similar processes. On the Kindle Keyboard with Special Offers, B000JML3IW_EBOK.azw has 846 bytes prepended to the where the file once began. Unexpectedly, the 846 bytes appears to contain a copy of the user preferences file, reader.pref. On each other Kindle, the sectors where B000JML3IW_EBOK.azw once resided have been written to with new data. On the Kindle Paperwhite with Special Offers, B000JML7EC_EBOK.azw remains mostly intact. Most of the first 200 bytes have been erased. On the Kindle Paperwhite 3G, B000JML7EC_EBOK.azw has been replaced with new data as shown in Figure 8. This same data was located on the phase II image in unallocated space as designated by FTK as shown in Figure 9. The original file content of the .azw files with failed MD5 hashes do not exist elsewhere on the disk. The failures occur at the beginning and ending sectors of the Kindle. No failures occurred in the middle of the sample. Only MD5 hashes of .azw files at the beginning sectors and .prc and .txt files at the ending sectors failed. This shows the Kindle operating system and file system may not have been consistent in how it deleted files.

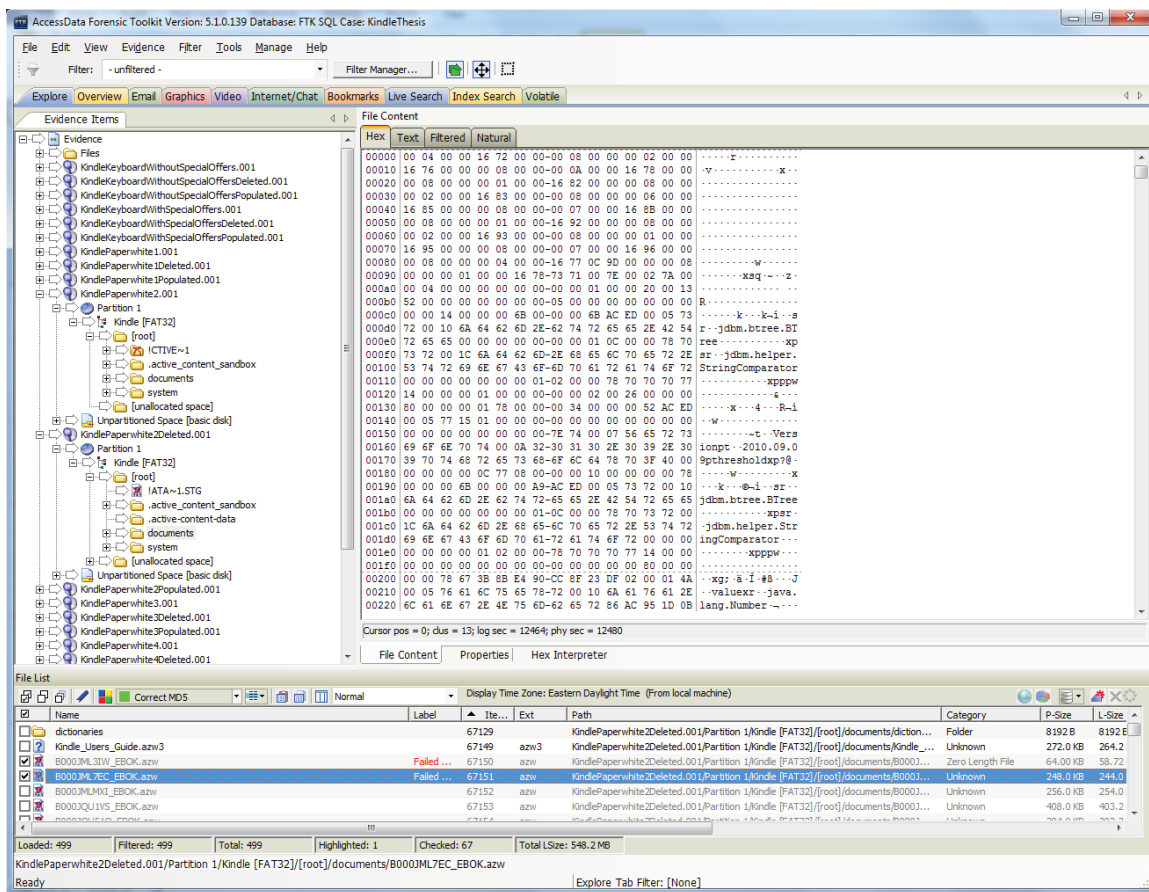


Figure 8: File content of B000JML7EC_EBOK.awz on the Kindle Paperwhite 3G phase III image

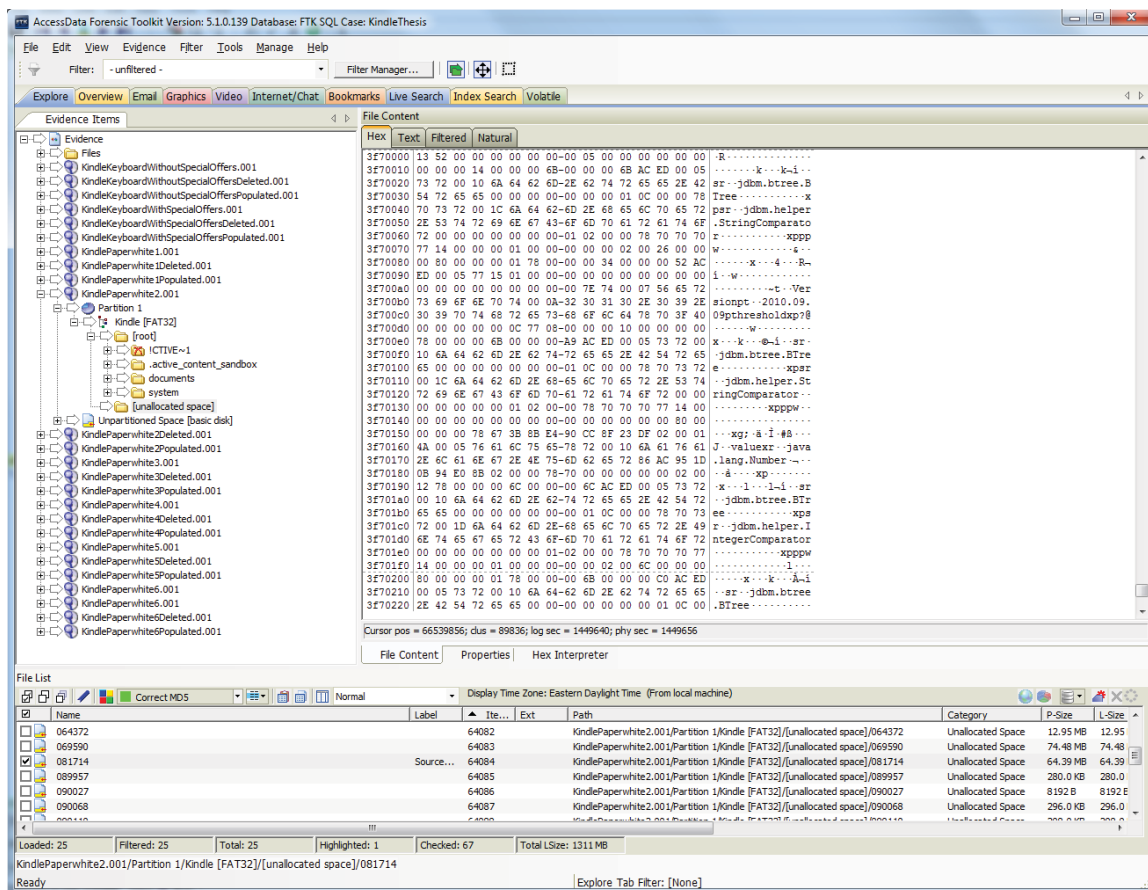


Figure 9: Similar content of B000JML7EC_EBOK.awz on the Kindle Paperwhite 3G phase III image located in unallocated space on the phase II image

The results of the research produced six files with a blank hash field. The FTK User Guide (2013) explains “a blank hash field appears for unallocated space files, the same as if the files had not been hashed at all” (p. 102).

More research was conducted after the experiment was completed to investigate the unexpected results further. The author contacted AccessData regarding the possible directory entry changes, conjecturing a possible bug in FTK. AccessData referred the author to their online forums and their sales department for training. Four additional

follow up tests were held to determine the cause of the failed MD5 hashes. Possible causes hypothesized included the process of garbage collection on flash based storage, wear leveling processes, the Kindle file system, the Kindle operating system, and the Windows operating system. The Kindle underwent a format through Windows 7 and a factory reset before each test.

In the first test the original experiment was replicated in all aspects on the Kindle Paperwhite 3G with the exception of the order of the files copied to the Kindle. The PowerShell script was modified to copy .azw2 files first and .pdf last. Like the .azw files in the original experiment on the Kindle Paperwhite 3G, the first .azw2 MD5 hash was missing. The last 20 .pdf files MD5 hashes did not match the original files. This behavior was similar to the original experiment where the 30 .txt files, the last files in the sample, had mismatched MD5 hashes. The failures of this follow up test seemed to have the same location and cause of the failures in the original experiment showing the Kindle file system may not be responsible for the changes.

The second test replicated the original experiment in all aspects on the Kindle Paperwhite 3G with the exception of the method of deletion. Each file on the Kindle was individually deleted within the Kindle device rather than through Windows PowerShell. All files recovered from this test matched the original files showing the Windows operating system is likely responsible for the mismatched MD5 hashes in the original experiment.

A third test replicated the original experiment in all aspects on the Kindle Paperwhite 3G with the alteration of the operating system to Windows XP Service Pack

3 rather than Windows 7. As previously noted Carrier (2005) stated “Windows does not change any other values in the directory entry” (p. 172). The original protocol of the experiment required Windows 7. The most recent version of the Windows operating system at the time Carrier published his book was Windows XP. The results of this test were the same of the original experiment showing the Windows 7 deletion processes are similar to Windows XP.

A fourth test replicated the original experiment in all aspects on the Kindle Paperwhite 3G with the alteration of the operating system to Windows 8 rather than Windows 7. The results of this test were the same of the original experiment showing the Windows 7 deletion processes are similar to Windows 8.

Directory entries were viewed in DiskExplorer for FAT V4.32 to easily analyze the images from the original experiment and the additional tests at the hexadecimal level. The failed .prc and .txt files were unable to be manually located in the deletion image in phase III or the populated image from phase II. Despite the success of the alternate method of deletion test, the directory entries for all files were not located in the populated image and the deletion image. This shows more research must be conducted in order to understand directory entries on the Amazon Kindle.

5.2 Significance

This research is important for the digital forensics community. The results of phase II confirm standard forensic considerations and practices are applicable to the Amazon Kindle. Researchers and practitioners should be aware of the phase III failure

rate of deleted file acquisition from the Amazon Kindle and should not assume a zero failure rate in any future research or investigation until procedures show repeatable successful results. The results of phase III produce many unanswered questions regarding directory entries during file deletion using a Windows environment. The follow up tests show that the forensic process may be reliable if the user deletes files without using a Windows operating system. There is no method to determine what environment or process was used to delete a file resulting in the conclusion deleted files cannot be reliably recovered from the Amazon Kindle.

5.3 Limitations

This research was not perfect or ideal for all circumstances everywhere all the time. The Kindle Keyboards natively support audio files. Those files were removed from the sample because the Kindle Paperwhite and the Kindle 5 does not natively support audio. This research was limited by time and money. As such only eight Kindles were included in this research. Each of the 292 MD5 hash failures were not analyzed due to time constraints. The follow up tests were very brief using only one Kindle. Not all files were analyzed during the follow up tests due to time constraints. The newest Kindle models were not tested. The sixth generation Kindles were available for purchase after this research began. The sixth generation did not update the Kindle 5 or include a new Kindle Keyboard.

5.4 Future Work

Future work on the Amazon Kindle may consider extending this research based on the delimitations in chapter one. As previously stated, privilege escalation procedures were acknowledged but were not studied. Artifacts located within the system partitions could be useful in an investigation. The Kindle file population processes in the execution of the research did not include wireless download purchases, wireless download of archived content, or downloaded documents through Amazon's Kindle Personal Document Service. These population processes may yield different results. Unprotected Microsoft Word (.doc, .docx), Rich Text Format (.rtf), HyperText Markup Language (.html, .htm), Joint Photographic Expert Group (.jpeg, .jpg), Graphics Interchange Format (.gif), Portable Network Graphics (.png), Bitmap (.bmp), compressed (.zip), and other file extensions may need to be studied in order to fully understand how the Kindle operating system handles all files. Hardware deletion, Amazon.com deletion, reset to factory defaults, and formatting through the computer host processes can be studied to understand their effects. The security of the Kindle and identifying and mitigating methods of data obfuscation can be researched. Other obfuscation and security issues should be explored, specifically with files appearing as downloaded books and the security of Whispernet. Other imaging software and analysis software can be compared in future research. A future concern that must be researched is the Kindle Development Kit (KDK). Unknown and undocumented content will enter the market when the KDK is released to the public. The KDK has produced active content of evidentiary value such as calendars and photo galleries. These items will need to be tested and researched. The

wireless capabilities can be turned off within the Kindle settings, but a Kindle should be shielded if its wireless state is unknown.

Other future work may be based on the results and discussion of this research. Directory entries within the Kindle file system and operating system need further analysis and testing because the expected results do not align with the results of this research. Windows may have different effects when using another file system such as NTFS. The challenges are many, but this paper has provided an introduction to the forensics of the Kindle, which the author hopes the reader finds useful.

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REFERENCES

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APPENDICES

Appendix A Steps to Image the Amazon Kindle in FTK

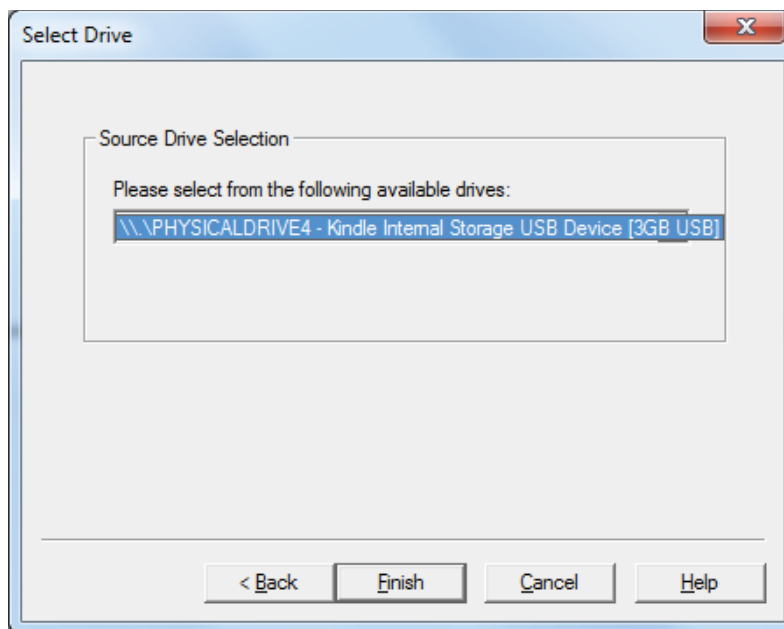


Figure 10: Selection of the Amazon Kindle Source

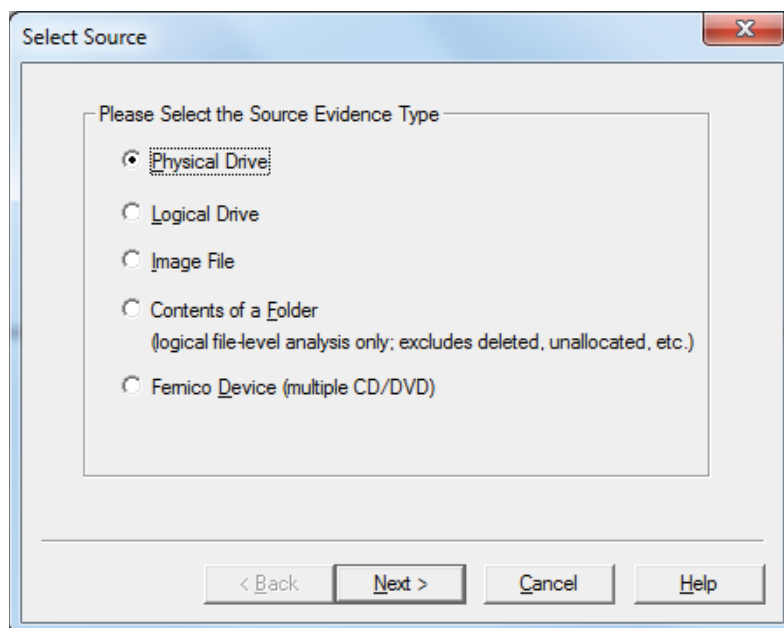


Figure 112: Selection of Evidence Type

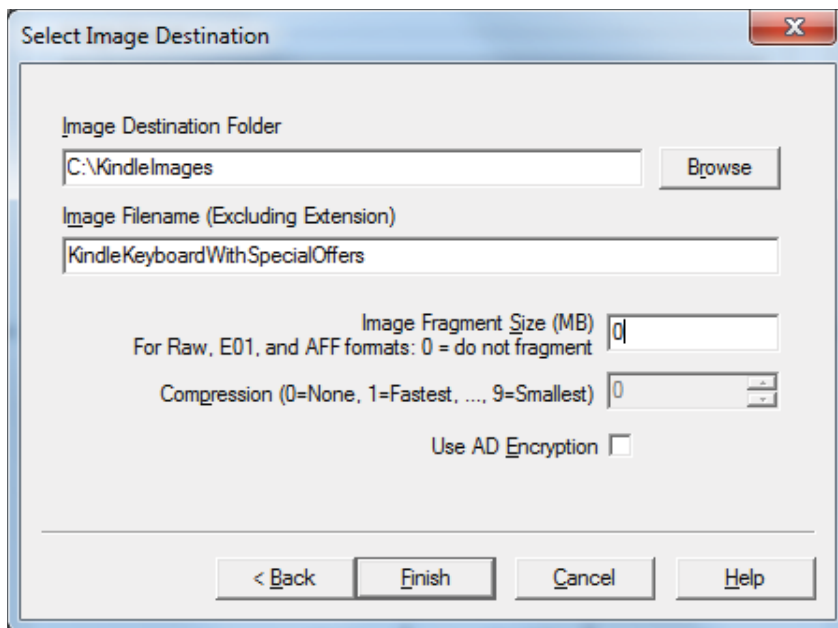


Figure 12: Designation of Image Destination

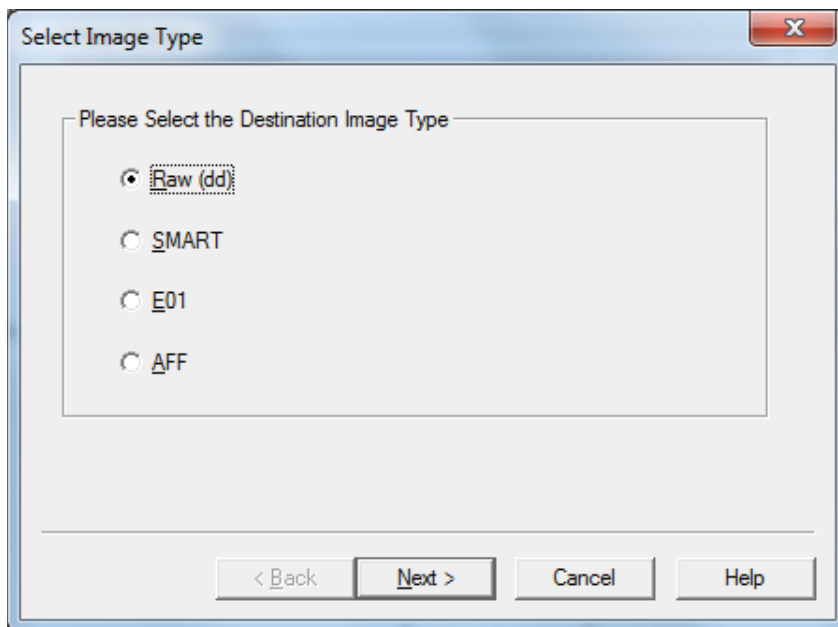


Figure 13: Selection of Image Type

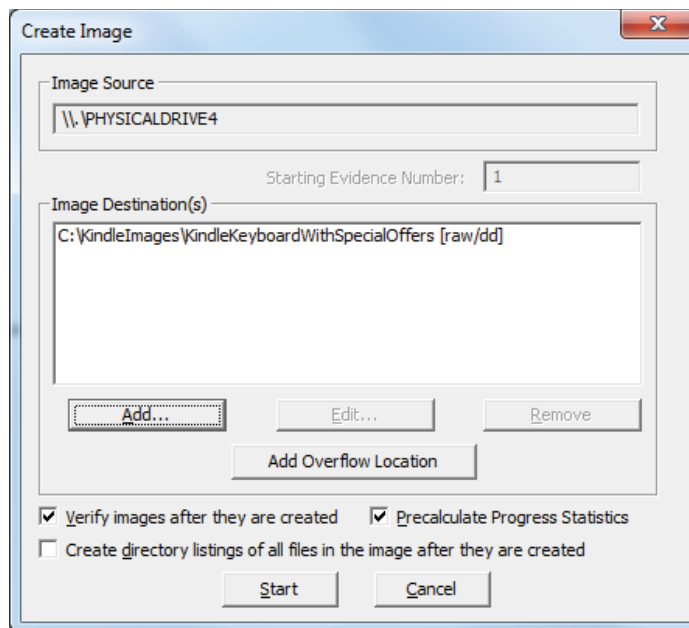


Figure 14: Selection of Image Creation Options

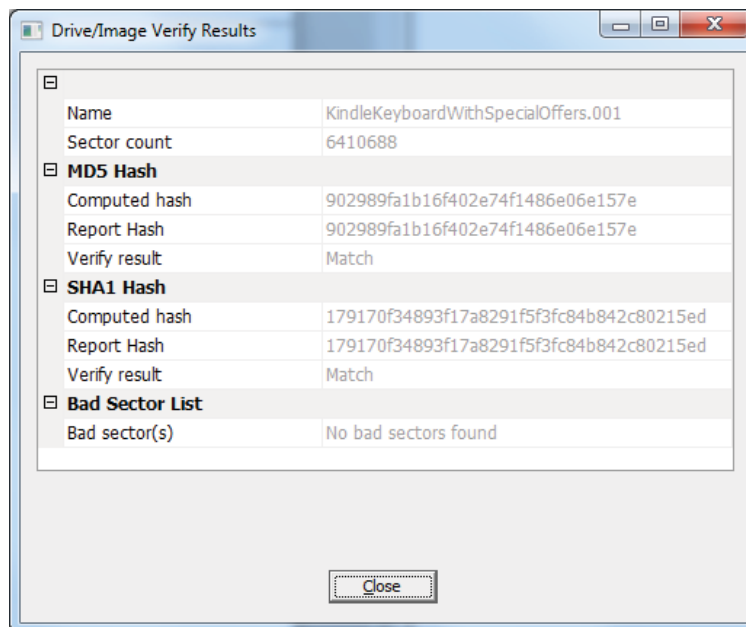


Figure 15: Image Verification Results

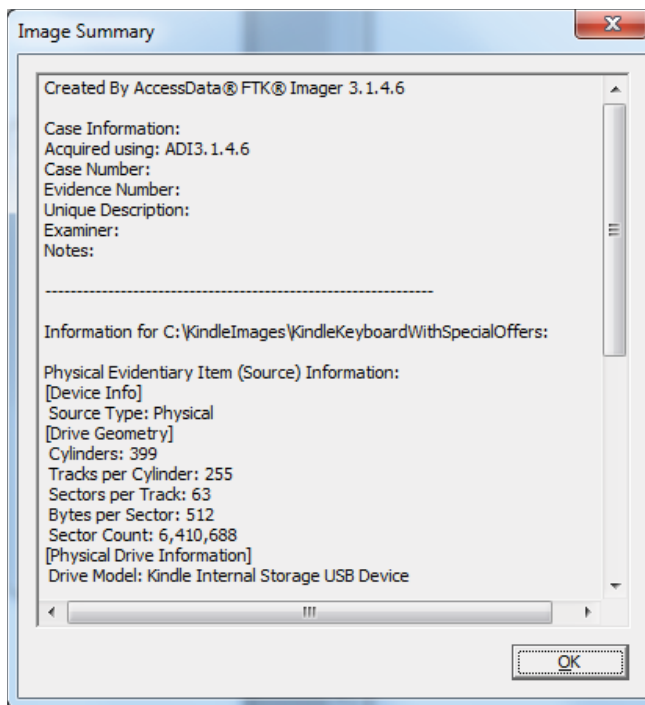


Figure 16: Image Summary

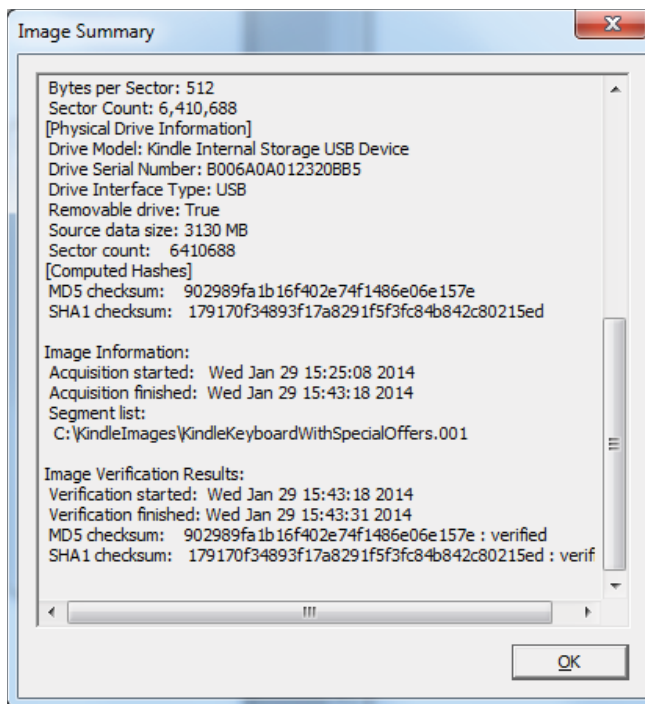


Figure 17: Image Summary (continued)

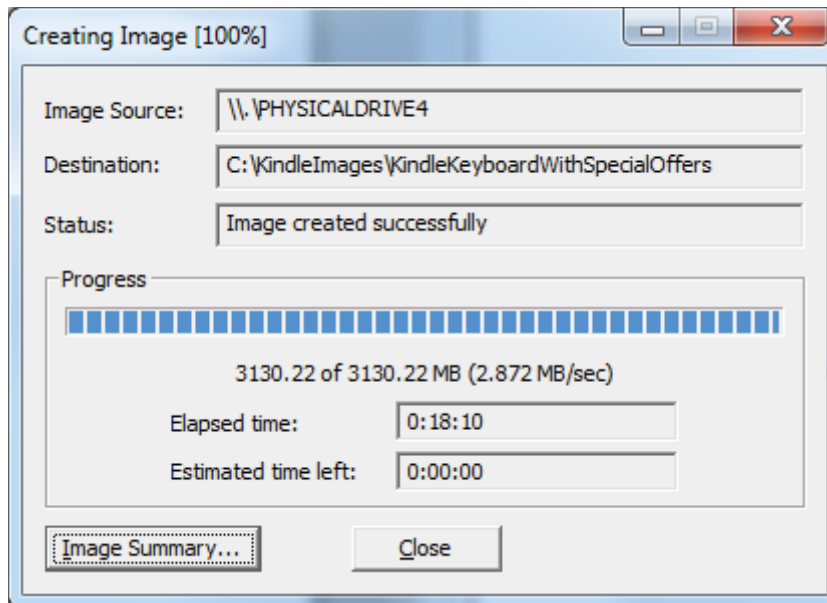


Figure 18: Image Completion Time

Appendix B File Population Script

```
Try {  
  
Copy-Item C:\KindleFiles\azw\*.azw -Destination J:\documents -verbose -PassThru  
>>C:\KindleFiles\KindleKeyboardWithSpecialOffersLogSuccesses.txt  
  
Copy-Item C:\KindleFiles\azw2\*.azw2 -Destination J:\documents -verbose -PassThru  
>>C:\KindleFiles\KindleKeyboardWithSpecialOffersLogSuccesses.txt  
  
Copy-Item C:\KindleFiles\azw3\*.azw3 -Destination J:\documents -verbose -PassThru  
>>C:\KindleFiles\KindleKeyboardWithSpecialOffersLogSuccesses.txt  
  
Copy-Item C:\KindleFiles\mobi\*.mobi -Destination J:\documents -verbose -PassThru  
>>C:\KindleFiles\KindleKeyboardWithSpecialOffersLogSuccesses.txt  
  
Copy-Item C:\KindleFiles\pdf\*.pdf -Destination J:\documents -verbose -PassThru  
>>C:\KindleFiles\KindleKeyboardWithSpecialOffersLogSuccesses.txt  
  
Copy-Item C:\KindleFiles\prc\*.prc -Destination J:\documents -verbose -PassThru  
>>C:\KindleFiles\KindleKeyboardWithSpecialOffersLogSuccesses.txt  
  
Copy-Item C:\KindleFiles\txt\*.txt -Destination J:\documents -verbose -PassThru  
>>C:\KindleFiles\KindleKeyboardWithSpecialOffersLogSuccesses.txt  
  
}  
  
Catch {  
  
write "Error: copy-item:  
$_">>C:\KindleFiles\KindleKeyboardWithSpecialOffersLogFailures.txt  
  
}
```


Appendix C File Population Script Success Output

Directory: J:\documents

Mode	LastWriteTime	Length	Name
----	-----	-----	----
-a---	12/7/2013 12:49 PM	60130	B000JML3IW_EBOK.azw
-a---	12/7/2013 12:49 PM	249840	B000JML7EC_EBOK.azw
-a---	12/7/2013 12:50 PM	260117	B000JMLMXI_EBOK.azw
-a---	12/7/2013 12:48 PM	412852	B000JQU1VS_EBOK.azw
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-a---	12/5/2012 6:02 PM	2984640	B005JRHYYY_EBOK.azw
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Directory: J:\documents

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-a--- 12/7/2013 1:06 PM 1128260 5231-h.mobi
-a--- 12/7/2013 1:06 PM 370296 541-h.mobi
-a--- 12/7/2013 1:04 PM 816660 583-h.mobi
-a--- 12/7/2013 1:02 PM 510400 74.mobi
-a--- 12/7/2013 1:01 PM 262636 84-h.mobi
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-a--- 12/7/2013 12:35 PM 7711246
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20Pages-TravellingTwo.pdf
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Breeuwsma2007ForensicDataRecoveryFromFlashMemory.pdf
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-a--- 9/17/2010 11:34 AM 1631329 Digital forensics research The next 10
years.pdf
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20121202-BN.pdf
-a--- 11/13/2013 4:11 PM 1050190 KindleAcquisitionAndAnalysis.pdf
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-a--- 12/9/2013  2:48 PM    2940904 14591-h.prc
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-a--- 12/9/2013 2:43 PM 7453272 19994-h.prc
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-a--- 12/9/2013 9:47 PM 208300 The_Art_of_War.txt
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Appendix D File Deletion Script

```
Try {  
  
Get-ChildItem J:\documents\* -exclude Kindle_Users_Guide.azw,  
Kindle_Users_Guide.mbp | Tee-Object -FilePath  
C:\KindleFiles\KindleKeyboardWithSpecialOffersDeleteLogSuccesses.txt | Remove-Item  
-Force  
  
}  
  
Catch {  
  
write "Error: remove-item:  
$_">>C:\KindleFiles\KindleKeyboardWithSpecialOffersDeleteLogFailures.txt  
  
}
```

Appendix E File Deletion Script Success Output

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-a---	12/7/2013 12:48 PM	412852	B000JQU1VS_EBOK.azw
-a---	12/7/2013 12:49 PM	309520	B000JQU51O_EBOK.azw
-a---	12/7/2013 12:48 PM	39736	B000JQUXXY_EBOK.azw
-a---	12/7/2013 12:44 PM	5763967	B000OZON9O_EBOK.azw
-a---	2/7/2013 1:37 AM	714712	B000XPPW50_EBOK.azw
-a---	12/7/2013 12:46 PM	485248	B001EODY36_EBOK.azw
-a---	10/29/2010 10:46 AM	13367820	B001H01MMW_EBOK.azw
-a---	12/7/2013 12:43 PM	549928	B001IZC3VA_EBOK.azw
-a---	12/7/2013 12:49 PM	237332	B001M60BKU_EBOK.azw
-a---	12/7/2013 12:49 PM	42160	B002RKS77Y_EBOK.azw
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-a---	12/7/2013 12:46 PM	381328	B003EY7JE4_EBOK.azw
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-a---	12/7/2013 12:41 PM	848612	B00DBBAE2O_EBOK.azw
-a---	12/11/2013 6:41 PM	666985	Blackjack-asin_B004DWLGG5-type_AZW2-v_0.azw2
-a---	12/11/2013 6:42 PM	482781	Dots and Boxes-asin_B004TCSMQY-type_AZW2-v_0.azw2

-a---	12/11/2013	1:49 PM	482781 Dots-and-Boxes.azw2
-a---	12/11/2013	6:42 PM	547243 Every Word Crossings-asin_B005CXI8I6-type_AZW2-v_0.azw2
-a---	12/11/2013	6:29 PM	508050 Every Word-asin_B003P37FW0-type_AZW2-v_0.azw2
-a---	12/11/2013	1:30 PM	508050 Every-Word.azw2
-a---	12/11/2013	6:42 PM	609506 Grid Detective-asin_B005OR9H5S-type_AZW2-v_0.azw2
-a---	12/11/2013	6:42 PM	668962 Hamster Habitat-asin_B006YUTO70-type_AZW2-v_0.azw2
-a---	12/11/2013	6:42 PM	595253 Jigsaw Words Volume 2-asin_B00688970M-type_AZW2-v_0.azw2
-a---	12/11/2013	6:42 PM	539180 Jigsaw Words-asin_B005IQHS7E-type_AZW2-v_0.azw2
-a---	12/11/2013	1:48 PM	595253 Jigsaw-Words-Volume-2.azw2
-a---	12/11/2013	1:48 PM	539180 Jigsaw-Words.azw2
-a---	12/11/2013	6:41 PM	424683 Jumble 3 Free Puzzles-asin_B004FOUMPA-type_AZW2-v_0.azw2
-a---	12/11/2013	1:49 PM	424683 Jumble-3-Free-Puzzles.azw2
-a---	12/11/2013	6:42 PM	574469 Math Blender-asin_B007R5QAXM-type_AZW2-v_0.azw2
-a---	12/11/2013	6:29 PM	559676 Mine Sweeper-asin_B003P3BCVA-type_AZW2-v_0.azw2
-a---	12/11/2013	1:30 PM	559676 Mine-Sweeper.azw2
-a---	12/11/2013	6:42 PM	426604 My Checklist-asin_B007L78Z7K-type_AZW2-v_0.azw2
-a---	12/11/2013	6:41 PM	488837 Number Slide-asin_B004OTWKNS-type_AZW2-v_0.azw2
-a---	12/11/2013	1:49 PM	488837 Number-Slide.azw2
-a---	12/11/2013	6:42 PM	627588 Pirate Stash-asin_B00501DMFY-type_AZW2-v_0.azw2
-a---	12/11/2013	6:42 PM	686836 Pixel Perfect Holiday Puzzles-asin_B0063GIIKY-type_AZW2-v_0.azw2
-a---	12/11/2013	6:42 PM	537966 Pixel Perfect Puzzles-asin_B0055PNM78-type_AZW2-v_0.azw2
-a---	12/11/2013	1:49 PM	686836 Pixel-Perfect-Holiday-Puzzles.azw2
-a---	12/11/2013	1:49 PM	537966 Pixel-Perfect-Puzzles.azw2
-a---	12/11/2013	6:42 PM	1141387 Puzzazz Holiday Gift-asin_B006NZIYWC-type_AZW2-v_0.azw2
-a---	12/11/2013	6:29 PM	687874 Shuffled Row-asin_B003P38AAG-type_AZW2-v_0.azw2
-a---	12/11/2013	1:30 PM	687874 Shuffled-Row.azw2

-a--- 12/11/2013 6:42 PM 602191 Thread Words-asin_B004Y51PW4-type_AZW2-v_0.azw2

-a--- 12/11/2013 6:41 PM 657242 Video Poker-asin_B004C6S25I-type_AZW2-v_0.azw2

-a--- 12/11/2013 6:27 AM 239047 A Christmas Carol-asin_B0084BMUFA-type_EBOK-v_0.azw3

-a--- 12/11/2013 6:26 AM 287018 A Portrait of the Artist as a Yo-
asin_B0082XUOCQ-type_EBOK-v_0.azw3

-a--- 9/10/2013 11:05 PM 848612 Bicycle Touring How To What We L-
asin_B00DBBAE2O-type_EBOK-v_0.azw3

-a--- 12/11/2013 5:28 PM 441815 Bicycle Voyages Elements of a Su-
asin_B00800X1F4-type_EBOK-v_0.azw3

-a--- 12/11/2013 5:51 PM 412748 Cool Heat Action Packed Crime Th-
asin_B00DX38S3C-type_EBOK-v_0.azw3

-a--- 12/11/2013 12:26 PM 185935 Cycle Touring - Your Guide to Everything Bike
Touring.azw3

-a--- 9/10/2013 4:30 AM 185935 Cycle Touring Your Guide to Ever-
asin_B00BDOFG1A-type_EBOK-v_0.azw3

-a--- 12/5/2012 5:50 PM 2984640 Digital Forensics for Legal Prof-
asin_B005JRHYYY-type_EBOK-v_0.azw3

-a--- 12/11/2013 5:52 PM 724620 Executive Actions The Executive-
asin_B00G3UXLZM-type_EBOK-v_0.azw3

-a--- 12/11/2013 5:51 PM 1525852 Farm Girl Country Cooking Hearty-
asin_B00D18H3TE-type_EBOK-v_0.azw3

-a--- 12/11/2013 5:51 PM 478287 Flash Bang-asin_B00DFCWMQK-type_EBOK-
v_0.azw3

-a--- 12/11/2013 6:27 AM 254546 Heart of Darkness-asin_B0084AMNWQ-
type_EBOK-v_0.azw3

-a--- 1/14/2013 12:32 AM 18129636 Malware Forensics Field Guide fo-
asin_B0085TMYL6-type_EBOK-v_0.azw3

-a--- 1/14/2013 12:48 AM 23631432 Mastering Windows Network Forens-
asin_B008RO92J6-type_EBOK-v_0.azw3

-a--- 12/11/2013 5:15 PM 175932 Mockingjay The Final Book of The-
asin_B003XF1XOQ-type_EBSP-v_0.azw3

-a--- 1/14/2013 12:28 AM 22611112 Network Forensics Tracking Hacke-
asin_B008CG8CYU-type_EBOK-v_0.azw3

-a--- 12/11/2013 5:51 PM 446704 Quicksilver The Forensic Geology-
asin_B00FL4VVK6-type_EBOK-v_0.azw3

-a--- 12/11/2013 5:51 PM 894984 ROLLING THUNDER Wings of War-
asin_B0019LNUVA-type_EBOK-v_0.azw3

-a--- 12/11/2013 5:51 PM 920368 Stress Busters Stress Management-
asin_B00ET9VIZE-type_EBOK-v_0.azw3

-a--- 12/11/2013 6:26 AM 415249 The Adventures of Huckleberry Fi-
asin_B004UJISMY-type_EBOK-v_0.azw3

-a--- 12/11/2013 5:29 PM 323260 The Cyclist s Training Bible-
asin_B00AWE96CW-type_EBSP-v_0.azw3

-a--- 12/11/2013 6:27 AM 441091 The Fortunes and Misfortunes of-
asin_B0083ZFQXA-type_EBOK-v_0.azw3

-a--- 12/11/2013 5:55 PM 502340 The L I P S Career Advancement M-
asin_B00H2A2I2O-type_EBOK-v_0.azw3

-a--- 9/10/2013 4:27 AM 699508 The Phoenix Project A Novel Abou-
asin_B00AZRBLHO-type_EBOK-v_0.azw3

-a--- 12/11/2013 5:29 PM 1012891 The Practical Guide to Bicycle T-
asin_B008QEVX8A-type_EBOK-v_0.azw3

-a--- 12/11/2013 5:52 PM 570848 Time Release-asin_B00H7P47OQ-type_EBOK-
v_0.azw3

-a--- 12/11/2013 5:29 PM 816276 Tom Danielson s Core Advantage C-
asin_B00D616QPI-type_EBSP-v_0.azw3

-a--- 12/11/2013 5:53 PM 507843 Unconventional-asin_B002QHVV1G-
type_EBOK-v_0.azw3

-a--- 12/11/2013 5:54 PM 667180 World of Jesus The Making Sense-
asin_B00B85M3UG-type_EBOK-v_0.azw3

-a--- 12/11/2013 6:04 PM 279408 Zeru-asin_B00FX7G7D4-type_EBOK-v_0.azw3

-a--- 12/7/2013 12:59 PM 186160 131-h.mobi

-a--- 12/7/2013 1:05 PM 1623896 14838-h.mobi

-a--- 12/7/2013 12:59 PM 250488 160-h.mobi

-a--- 12/7/2013 1:00 PM 833496 1musk12.mobi

-a--- 12/7/2013 1:01 PM 688328 203-h.mobi

-a--- 12/7/2013 1:00 PM 120228 215-h.mobi

-a--- 12/7/2013 1:00 PM 743348 2554-h.mobi

-a--- 12/7/2013 1:06 PM 73396 2ws3410.mobi

-a--- 12/7/2013 1:06 PM 504752 345-h.mobi

-a--- 12/7/2013 1:06 PM 123488 35.mobi

-a--- 12/7/2013 1:06 PM 214132 36-h.mobi

-a--- 12/7/2013 1:06 PM 1128260 5231-h.mobi

-a--- 12/7/2013 1:06 PM 370296 541-h.mobi

-a--- 12/7/2013 1:04 PM 816660 583-h.mobi

-a--- 12/7/2013 1:02 PM 510400 74.mobi

-a--- 12/7/2013 1:01 PM 262636 84-h.mobi

-a--- 12/7/2013 12:58 PM 875344 8bwlf10h.mobi

-a--- 12/7/2013 12:59 PM 556884 940-h.mobi

-a--- 12/7/2013 12:59 PM 93768 alice30.mobi

-a--- 12/7/2013 1:04 PM 988148 cbt1s12.mobi

-a--- 12/7/2013 12:35 PM 7711246
digital_forensics_with_open_source_tools_Marcus Thompson.mobi

-a--- 12/7/2013 1:05 PM 652700 feder16.mobi
 -a--- 12/7/2013 1:01 PM 89784 hydea10.mobi
 -a--- 12/7/2013 1:01 PM 767712 moby11.mobi
 -a--- 12/7/2013 1:04 PM 702144 otoos610.mobi
 -a--- 12/7/2013 1:04 PM 437364 pandp12.mobi
 -a--- 12/7/2013 1:05 PM 394000 repub13.mobi
 -a--- 12/7/2013 1:06 PM 254304 slgln10.mobi
 -a--- 12/7/2013 1:04 PM 299632 tarzn10.mobi
 -a--- 12/7/2013 12:35 PM 5022439 windows_registry_forensics_Marcus
 Thompson.mobi
 -a--- 12/7/2013 11:59 AM 1623962 201004_HowToPhotoTour_Teasdale.pdf
 -a--- 4/29/2013 11:12 PM 3956099 2013_OOR.pdf
 -a--- 12/6/2013 6:48 PM 5158021 2014 Brochure.pdf
 -a--- 9/26/2013 1:02 AM 68372 4786284907-208708731-tickets.pdf
 -a--- 12/6/2013 6:55 PM 1161446 811557.pdf
 -a--- 12/6/2013 6:56 PM 735833 811743.pdf
 -a--- 11/13/2013 4:15 PM 252591 AmazonKindleFire.pdf
 -a--- 1/22/2010 12:28 AM 15624161 Asterisk.pdf
 -a--- 10/12/2012 6:07 PM 68797 bicycle sizing chart.pdf
 -a--- 1/17/2012 7:22 PM 5073892 BikeTouringBasics-v2-TravellingTwo.pdf
 -a--- 1/17/2012 7:22 PM 4936734 BikeTouringSurvivalGuide-v1-Preview-
 20Pages-TravellingTwo.pdf
 -a--- 10/3/2011 9:30 PM 2276123
 Breeuwsm2007ForensicDataRecoveryFromFlashMemory.pdf
 -a--- 11/24/2013 4:27 PM 1235590 COT_MS_Graduate_Handbook_Aug_2012.pdf
 -a--- 9/22/2011 10:32 PM 8046947 CoverIndiana.pdf
 -a--- 2/20/2011 3:53 PM 1850659 Cyberdeterrence And Cyberwar.pdf
 -a--- 9/17/2010 11:34 AM 1631329 Digital forensics research The next 10
 years.pdf
 -a--- 8/5/2011 12:02 PM 3201221 ips-dummies.pdf
 -a--- 12/2/2012 11:17 PM 895781 Jackcr Forensic Challenge report - ver2-
 20121202-BN.pdf
 -a--- 11/13/2013 4:11 PM 1050190 KindleAcquisitionAndAnalysis.pdf
 -a--- 10/17/2013 6:15 PM 3676118 lilesdissertation.pdf
 -a--- 9/11/2013 1:02 AM 275574 Natchitoches_to_Alexandria.pdf
 -a--- 9/2/2009 1:37 PM 6619934 O'Reilly - Network Warrior.pdf
 -a--- 11/20/2013 12:44 AM 990015 Participant Manual 2013 P.pdf
 -a--- 1/30/2012 11:35 PM 2857343 Road cycling & Triathlon.pdf
 -a--- 12/7/2013 11:59 AM 240410 RoadTripList.pdf
 -a--- 10/8/2010 3:45 PM 78212 Rogers2005iPodForensics.pdf
 -a--- 9/19/2013 11:58 PM 225082 TippecanoeCounty.pdf
 -a--- 8/29/2012 7:46 PM 146930 TM-1 Tension Meter Conversion Table.pdf
 -a--- 11/29/2011 2:25 PM 2006857 VMDED.pdf

-a--- 10/3/2011 10:15 PM 335154
WillassenForensicAnalysisOfMobilePhoneInternalMemory.pdf
-a--- 12/9/2013 2:51 PM 4411840 10609-h.prc
-a--- 12/9/2013 2:43 PM 2860282 11339-h.prc
-a--- 12/7/2013 1:05 PM 6759440 135-h.prc
-a--- 12/9/2013 2:52 PM 10640060 14264-h.prc
-a--- 12/9/2013 2:44 PM 2080360 14298-h.prc
-a--- 12/9/2013 2:48 PM 2940904 14591-h.prc
-a--- 12/9/2013 2:47 PM 8027036 14742-h.prc
-a--- 12/9/2013 2:46 PM 7738008 16593-h.prc
-a--- 12/9/2013 2:51 PM 4235056 16653-h.prc
-a--- 12/9/2013 2:48 PM 9678176 16713-h.prc
-a--- 12/9/2013 2:44 PM 8891936 16960-h.prc
-a--- 12/9/2013 2:44 PM 655000 17396-h.prc
-a--- 12/9/2013 2:43 PM 3668140 17860-h.prc
-a--- 12/9/2013 2:50 PM 3663136 18274-h.prc
-a--- 12/9/2013 2:52 PM 9289360 18503-h.prc
-a--- 12/9/2013 2:52 PM 10557980 18900-h.prc
-a--- 12/9/2013 2:49 PM 9220212 19068-h.prc
-a--- 12/9/2013 2:48 PM 5214712 19499-h.prc
-a--- 12/9/2013 2:52 PM 6690112 19694-h.prc
-a--- 12/9/2013 2:43 PM 7453272 19994-h.prc
-a--- 12/9/2013 2:45 PM 5533336 20390-h.prc
-a--- 12/9/2013 2:51 PM 3483492 20740-h.prc
-a--- 12/9/2013 2:48 PM 4580432 20959-h.prc
-a--- 12/9/2013 2:46 PM 3414724 21660-h.prc
-a--- 12/9/2013 2:47 PM 6502504 22042-h.prc
-a--- 12/9/2013 2:50 PM 6994348 22153-h.prc
-a--- 12/9/2013 2:49 PM 3765156 25344-h.prc
-a--- 12/9/2013 2:44 PM 1626028 26491-h.prc
-a--- 12/9/2013 2:52 PM 7270228 29239-h.prc
-a--- 12/9/2013 2:49 PM 4880112 6130-h.prc
-a--- 12/9/2013 9:47 PM 518485 20000_Leagues_Under_the_Sea.txt
-a--- 12/9/2013 9:49 PM 584463 Adventures_of_Huckleberry_Fi.txt
-a--- 12/9/2013 9:49 PM 121715 Alice_in_Wonderland.txt
-a--- 12/9/2013 9:49 PM 815194 Analyzing_Character.txt
-a--- 12/9/2013 9:48 PM 972201 Aylwin.txt
-a--- 12/9/2013 9:49 PM 852744 Dracula.txt
-a--- 12/9/2013 9:48 PM 824787 Great_Expectations.txt
-a--- 12/9/2013 9:49 PM 181895 Hamlet.txt
-a--- 12/9/2013 9:47 PM 366676 Kashmir.txt
-a--- 12/9/2013 9:49 PM 826573 Les_Misérables.txt
-a--- 12/9/2013 9:50 PM 120953 Macbeth.txt

-a--- 12/9/2013 9:49 PM 550531 Recollections_of_Abraham_Lin.txt
-a--- 12/9/2013 9:48 PM 154858 Romeo_and_Juliet.txt
-a--- 12/9/2013 9:48 PM 587557 The_Adventures_of_Huckleberr.txt
-a--- 12/9/2013 9:47 PM 579397 The_Adventures_of_Sherlock_H.txt
-a--- 12/9/2013 9:48 PM 405429 The_Age_of_Reason.txt
-a--- 12/9/2013 9:48 PM 924011 The_Art_of_Public_Speaking.txt
-a--- 12/9/2013 9:47 PM 208300 The_Art_of_War.txt
-a--- 12/9/2013 9:49 PM 445239 The_Best_Ghost_Stories.txt
-a--- 12/9/2013 9:47 PM 925489 The_Best_Short_Stories_of_19.txt
-a--- 12/9/2013 9:50 PM 281782 The_Bungalow_Boys_Along_the_.txt
-a--- 12/9/2013 9:50 PM 70134 The_Call_of_Cthulhu.txt
-a--- 12/9/2013 9:48 PM 61791 The_Communist_Manifesto.txt
-a--- 12/9/2013 9:42 PM 2311302 The_Grammar_of_English_Gramm.txt
-a--- 12/9/2013 9:48 PM 1077659 The_Iliad_of_Homer.txt
-a--- 12/9/2013 9:49 PM 320542 The_Pilgrims_Progress.txt
-a--- 12/9/2013 9:48 PM 291320 The_Runaways.txt
-a--- 12/9/2013 9:50 PM 193897 The_Time_Machine.txt
-a--- 12/9/2013 9:47 PM 130507 Think_and_Grow_Rich!.txt
-a--- 12/9/2013 9:47 PM 243243 Whilomville_Stories.txt

Appendix F MD5 Hashes of Original Files

Table 8th: MD5 Hashes of Original Files

File Name	MD5 Hash
B000JML3IW_EBOK.azw	9beb79766845a2203987c83c56f2d55d
B000JML7EC_EBOK.azw	0bf5784a0013ba3a56a08d5ec1a9f653
B000JMLMXI_EBOK.azw	35bf464ec25c02c4a91eacd863463a57
B000JQU1VS_EBOK.azw	f2737d68378082672b622d7783913abf
B000JQU51O_EBOK.azw	bcca285557add4091ec5fc51e4714de4
B000JQUXXY_EBOK.azw	c6635e06ec6fabbd0df5a54676c44f4b
B000OZ0N9O_EBOK.azw	fa0105d33f9311676d3d3b2ec817a8b6
B000XPPW50_EBOK.azw	2449a2aa350dc48392d39adcb7178402
B001EODY36_EBOK.azw	7b356b7405edd05a8063e574cbebd516
B001H01MMW_EBOK.azw	b625d0eeddbf41a2bff707a295c04749
B001IZC3VA_EBOK.azw	1b32416aaac5bdd4c5d32603ee0a4588
B001M60BKU_EBOK.azw	341f75b0237ac1257ce37109ce68fd39
B002RKS77Y_EBOK.azw	479721a07b824bfb22c9337b9fb439be
B002RKSDTG_EBOK.azw	c7d2a4884525a929dd76bdc33228af11
B002RKSV9S_EBOK.azw	414888e34f42c75bda466e10b7f68cc5
B002ZJSV00_EBOK.azw	84ad2cd10d84ed44afd13de83a052b1d
B002ZJSW5Y_EBOK.azw	d775449baf615003226118470d1aaaf06
B003EY7JE4_EBOK.azw	9d451fbbdfd223fd0ab7eed5cdcaef9
B0045U9UES_EBOK.azw	5e906fe6da1e9e885bbac2ca9a3f1d58
B004DCBBX6_EBOK.azw	449f363baa3587860b27b60b321c0a53
B004EYSPQE_EBOK.azw	02a51e96feb10ec19fdfd7823d2041af
B004I6DD6U_EBOK.azw	f62c4650ce009e19fb9ac1026b06f00b
B005JRHYYY_EBOK.azw	98d74f060abba92b5943127593dc887f
B005PLWT0S_EBOK.azw	68cbb5431923fcbdee3b5072954bb105
B006XJR5ZA_EBOK.azw	88a1897809de3ba8e90c1b8473b7f03f
B007N15E6E_EBOK.azw	fdefb824ae23c9f66e6e0e7f83e5c5ec
B0085TMYL6_EBOK.azw	970d76fc8b76d69d07c437e960108e10
B008CG8CYU_EBOK.azw	d6e46d7216e5516b5fbd20db49ee5e23
B008RO92J6_EBOK.azw	18d80463829b78187d2a56cd78109b7f
B00DBBAE2O_EBOK.azw	90f1f679b9ae94a38c46c0db755848cc
Blackjack-asin_B004DWLGGs-type_AZW2-v_0.azw2	ecb115b4b761c1c00dd854fc594b83ab
Dots and Boxes-asin_B004TCSMQY-type_AZW2-v_0.azw2	baa184a6dc2344b47a8ba3c135bf7709
Dots-and-Boxes.azw2	baa184a6dc2344b47a8ba3c135bf7709
Every Word Crossings-asin_B005CXI8I6-type_AZW2-v_0.azw2	36cd8c21e6a18f04737a2496e06ae9eb
Every Word-asin_B003P37FW0-type_AZW2-v_0.azw2	36cd8c21e6a18f04737a2496e06ae9eb
Every-Word.azw2	d44ebcd543335ccc581c973461ff5af0

Table F.1 continued

Grid Detective-asin_B005OR9H5S-type_AZW2-v_0.azw2	44bc5beea95ab195209103a664dbacf0
Hamster Habitat-asin_B006YUTO70-type_AZW2-v_0.azw2	2925c8ec2ab54f9218a165b06688abfa
Jigsaw Words Volume 2-asin_B00688970M-type_AZW2-v_0.azw2	f835f5df98eac49596bd140a23ff1727
Jigsaw Words-asin_B005IQHS7E-type_AZW2-v_0.azw2	3c2d189c656c0e211d892854332a8579
Jigsaw-Words-Volume-2.azw2	3c2d189c656c0e211d892854332a8579
Jigsaw-Words.azw2	f835f5df98eac49596bd140a23ff1727
Jumble 3 Free Puzzles-asin_B004FOUMPA-type_AZW2-v_0.azw2	b1b33a50f1d8308d1cb5bace1d0e84aa
Jumble-3-Free-Puzzles.azw2	b1b33a50f1d8308d1cb5bace1d0e84aa
Math Blender-asin_B007R5QAXM-type_AZW2-v_0.azw2	381691a22211059947ea468c788cbba4
Mine Sweeper-asin_B003P3BCVA-type_AZW2-v_0.azw2	587a6af84acf4d745149c5b1edcffb35
Mine-Sweeper.azw2	587a6af84acf4d745149c5b1edcffb35
My Checklist-asin_B007L78Z7K-type_AZW2-v_0.azw2	2b42daa67da0443cf756b187793fb6dc
Number Slide-asin_B004OTWKNS-type_AZW2-v_0.azw2	f1c900753ffe1ea337124f5f42cc8128
Number-Slide.azw2	f1c900753ffe1ea337124f5f42cc8128
Pirate Stash-asin_B00501DMFY-type_AZW2-v_0.azw2	2dd4e8a94886a34ca1b12aed8764fbaa
Pixel Perfect Holiday Puzzles-asin_B0063GIIKY-type_AZW2-v_0.azw2	15a978d92baa17175d9fb323f7f33188
Pixel Perfect Puzzles-asin_B0055PNM78-type_AZW2-v_0.azw2	2ff821b6c2778ad072114691f0e6f098
Pixel-Perfect-Holiday-Puzzles.azw2	15a978d92baa17175d9fb323f7f33188
Pixel-Perfect-Puzzles.azw2	2ff821b6c2778ad072114691f0e6f098
Puzzazz Holiday Gift-asin_B006NZIYWC-type_AZW2-v_0.azw2	c0f9e00a1112e6af7f31cbe96731aa26
Shuffled Row-asin_B003P38AAG-type_AZW2-v_0.azw2	b6769fb58b60fdf544d60a3497e6d19d
Shuffled-Row.azw2	b6769fb58b60fdf544d60a3497e6d19d
Thread Words-asin_B004Y51PW4-type_AZW2-v_0.azw2	5f454d20b5298fcfecc7c9a5ff9ce76d
Video Poker-asin_B004C6S25I-type_AZW2-v_0.azw2	3a95e2671551ab90643961c0cc4a997c
A Christmas Carol-asin_B0084BMUFA-type_EBOK-v_0.azw3	87748a4ad54f9d3c7de117820625138c
A Portrait of the Artist as a Yo-asin_B0082XUOCQ-type_EBOK-v_0.azw3	1ebe43ff40b6bf8176e5a2804c3bd4a2

Table F.1 continued

Bicycle Touring How To What We L- asin_B00DBBAE2O-type_EBOK-v_0.azw3	c72ff58a1e611cbc3e6e6befe3f3323b
Bicycle Voyages Elements of a Su- asin_B008O0X1F4- type_EBOK-v_0.azw3	719f318ffff5f0638a3b5ee141abe5fd
Cool Heat Action Packed Crime Th- asin_B00DX38S3C-type_EBOK-v_0.azw3	9206a200790a96a9aaa3f75439e4410e
Cycle Touring - Your Guide to Everything Bike Touring.azw3	b8cfb5d1d8b211e38e329d39fc548cbf
Cycle Touring Your Guide to Ever- asin_B00BDOFG1A-type_EBOK-v_0.azw3	6807bb95561eeb9480228ad6b5f31e1b
Digital Forensics for Legal Prof- asin_B005JRHYYY- type_EBOK-v_0.azw3	44cf728121ea269d1bf8b27f42a21150
Executive Actions The Executive- asin_B00G3UXLZM- type_EBOK-v_0.azw3	eda24128deef61bc2701348abe78505b
Farm Girl Country Cooking Hearty- asin_B00D18H3TE-type_EBOK-v_0.azw3	5cf3364d51ffac13bc7be23bc20dac7a
Flash Bang- asin_B00DFCWMQK-type_EBOK- v_0.azw3	28ad5673d8470fa8fa228510c9bc5fd1
Heart of Darkness- asin_B0084AMNWQ-type_EBOK- v_0.azw3	8f8074591a1b50bff9df247bed937f87
Malware Forensics Field Guide fo- asin_B0085TMYL6- type_EBOK-v_0.azw3	47a6ac9737ef5bd9c097866e170cbdae
Mastering Windows Network Forens- asin_B008RO92J6-type_EBOK-v_0.azw3	e9c4d3fc3e4ec148e750bffed8d2c194
Mockingjay The Final Book of The- asin_B003XF1XOQ-type_EBSP-v_0.azw3	3e6ff674bea2d14d815b9d37d4411e30
Network Forensics Tracking Hacke- asin_B008CG8CYU-type_EBOK-v_0.azw3	89c027de0794b0a161cf695146665da9
Quicksilver The Forensic Geology- asin_B00FL4VDK6- type_EBOK-v_0.azw3	1cdfee4e3fe84a84ea242128766c4a8e
ROLLING THUNDER Wings of War- asin_B0019LNUVA-type_EBOK-v_0.azw3	1def9e48524980639939b3e236bb04d2
Stress Busters Stress Management- asin_B00ET9VIZE- type_EBOK-v_0.azw3	7a6365f7efe82480c9fe1a0e8c4baa3f
The Adventures of Huckleberry Fi- asin_B004UJISMY- type_EBOK-v_0.azw3	830682a31e0e1ff7fb042132cb440fed
The Cyclist s Training Bible- asin_B00AWE96CW- type_EBSP-v_0.azw3	154864cf3080457ee1dad0c1d5b0a047
The Fortunes and Misfortunes of- asin_B0083ZFQXA- type_EBOK-v_0.azw3	5a79af225e6748aaeed6d55ffccb151e
The L I P S Career Advancement M- asin_B00H2A212O-type_EBOK-v_0.azw3	809484d86f339d06ed0284fd3a2b512f
The Phoenix Project A Novel Abou- asin_B00AZRBLHO-type_EBOK-v_0.azw3	e5841eae44942d1557f8efb63a72016

Table F.1 continued

The Practical Guide to Bicycle T- asin_B008QEVX8A- type_EBOK-v_0.azw3	aabb0d7f0d5225be3bbcefb085008869
Time Release- asin_B00H7P47OQ-type_EBOK- v_0.azw3	ed85f638eee2ba8257bd276f8c44ac92
Tom Danielson s Core Advantage C- asin_B00D616QPI-type_EBSP-v_0.azw3	129e9c3eac2d093722349b6c27dafec
Unconventional- asin_B002QHVV1G-type_EBOK- v_0.azw3	99b240b108bceddde5fddd90bf2f6c62
World of Jesus The Making Sense- asin_B00B85M3UG-type_EBOK-v_0.azw3	11d79c46c5207a63c2975f68297ac898
Zeru- asin_B00FX7G7D4-type_EBOK-v_0.azw3	ea8e09180aa849e4a5e39eb9ebe0a454
131-h.mobi	2e78b40d16d381243e90d41d644d63a3
14838-h.mobi	725cde66873b09792c4651103412ac64
160-h.mobi	11adea57fa47bab49da0cec9f7b1422f
1musk12.mobi	920f664a7896e217fdcee2df951172dc
203-h.mobi	c818e3bbf5bed151ff688b34ee196b61
215-h.mobi	34366ab68610f8ff008550ae803a9895
2554-h.mobi	98fb36288d837321ce61636ab0333184
2ws3410.mobi	abd2c9dd7d09e547c456e9492573c80f
345-h.mobi	3a63fd6307050e9895fea36dbfd9f7bc
35.mobi	b0a394ded6f799c13152f1503af11a45
36-h.mobi	75a8a72fdcf647b8cd6ca5e77a594ac8
5231-h.mobi	ee9bcc974e448a27ff9203f1f7c17873
541-h.mobi	6471abd2ced23f9367627d8f30bfa630
583-h.mobi	606dda10dfa2651e78c5c4c43b555a08
74.mobi	f4ee04054efea1c9d9d19b741729f755
84-h.mobi	3dfc6e501293474e27a4063d7878b076
8bwlf10h.mobi	e5360517a354176c3c697dad6d83df93
940-h.mobi	2dc08d78c297dcb147b9269d9450ed16
alice30.mobi	78f527026a7e278322bf85c6b5bbddce
cbtls12.mobi	e031eabe99a0c2533ee9788bfa1bb9e2
digital_forensics_with_open_source_tools_Marcus Thompson.mobi	1162a673b003b5291053718d07b0506b
feder16.mobi	b81cc04a12b40445fc1214834d31b1ed
hydea10.mobi	5037a73c62a3c03294b0780bc2729034
moby11.mobi	fd6177c3622cf2852f9fc4419e3ed4be
otoos610.mobi	01df21851b25eaf2ff700bfa38a80439
pandp12.mobi	726d73cac920bd50e31ddb2da0435465
repub13.mobi	9690c6c51a19a3a02164f214e5795848
slgln10.mobi	4bb9c60508f5becd586d689afc0b3aee
tarzn10.mobi	12203a68ae6edcf742801b704a36dae1
windows_registry_forensics_Marcus Thompson.mobi	9fccc34e28e004f1984e719dee3aa92f
201004_HowToPhotoTour_Teasdale.pdf	0f3de364cd7a9e5cae4a049c69890a65

Table F.1 continued

2013_OOR.pdf	dd40a564c450b18337cf3c267e0e2055
2014 Brochure.pdf	ecf6a7d63e33a1d19f1d7e2f6417eba1
4786284907-208708731-tickets.pdf	f3bea920bccf27f4b5679217906ee818
811557.pdf	2a4a3846f6e28a5969f24e121e8503d5
811743.pdf	211647a72e2427a2e572b856a0ee335c
AmazonKindleFire.pdf	668422e087d9246804dfe9be02a4325e
Asterisk.pdf	d6815084b6706ee56ebca030d0ed4abd
bicycle sizing chart.pdf	0a7c058349fb506d0e0332c51c432c9d
BikeTouringBasics-v2-TravellingTwo.pdf	cb8462b42bc120cb1186c457b40584e6
BikeTouringSurvivalGuide-v1-Preview-20Pages-TravellingTwo.pdf	33d3c11ebdb1043e2690dca812761c5f
Breeuwsma2007ForensicDataRecoveryFromFlashMemory.pdf	82525bbb6f0588fc76e31b798ef944ba
COT_MS_Graduate_Handbook_Aug_2012.pdf	ef7007ecbff7970b5b5996c6fe3ca462
CoverIndiana.pdf	487ee5c2b01f0ef5a9e5278e64d0a80e
Cyberdeterrence And Cyberwar.pdf	97e3de5f4901f81ef2808f850f4391a1
Digital forensics research The next 10 years.pdf	be776e75be4007cb23713d7a73c2ad1f
ips-dummies.pdf	aeb2873804aa46993330853a9fc660ac
Jackcr Forensic Challenge report - ver2-20121202-BN.pdf	5db86449eaa1007a057aa767a70af6d5
KindleAcquisitionAndAnalysis.pdf	1dff7e49c1a530472cc62e13cce85628
lilesdissertation.pdf	e724a4ff128a8bb5b0dab9eca8f3fa31
Natchitoches_to_Alexandria.pdf	08ca9cc295b032245f8fe60406cc9473
O'Reilly - Network Warrior.pdf	1918ab3a59783ab968506d76dad9decb
Participant Manual 2013 P.pdf	24e67310c4fed0edcdfb374afcf3f088
Road cycling & Triathlon.pdf	e30ee8fd56efed770189ad6de4625ff7
RoadTripList.pdf	8446e2456e0751354cfa3773c45e736d
Rogers2005iPodForensics.pdf	0fbaa0fc024c3126328417260a70a270
TippecanoeCounty.pdf	1939ffd06e1525190ed91a61a831eb4c
TM-1 Tension Meter Conversion Table.pdf	ab2d708bfefad4015bb2b847bdab94f6
VMDED.pdf	3ccd962ae2ec13efdfbbe680ed592c7c
WillassenForensicAnalysisOfMobilePhoneInternalMemory.pdf	51322db91d9ba02b3420473ee30b8b1d
10609-h.prc	5143a7022ba33abc81334d5d8ed89111
11339-h.prc	9539ddd978b53bec2a31d26f0d4ca72e
135-h.prc	9c5213ab7e1033f97170f4185142e46a
14264-h.prc	e1cfc572d98779b0c16b5eb403ee8878
14298-h.prc	bc435a8b55adfd08e0dc0a189412d38e
14591-h.prc	dad92ca65ff09c65aeabb78a548f2900
14742-h.prc	52ae5a3f65fc6bd34d8bf0684ccb953d
16593-h.prc	125eacf7479af77b771068feee6f8dcc
16653-h.prc	b5b17322a6f7639652075cda6ddf5
16713-h.prc	4c4bb6117c8b84b33f4859401dbeb549

Table F.1 continued

16960-h.prc	2e3515ec4337299ece053518209bb29e
17396-h.prc	b3d5110f0a0bb6086d1debd2bd31438b
17860-h.prc	eba1dcd41d99536e02cab9475b3b2a10
18274-h.prc	20d33baba11dbb9edaef9b5ff717ebe2
18503-h.prc	f603f26bd3171370623ac037f1d8e964
18900-h.prc	d0625e83aabd2907e5896c7df0554064
19068-h.prc	be525589a319e3a63815cc36ebefc111
19499-h.prc	38913d7529955440790e68a375165953
19694-h.prc	1283f014769101320ff0373aebaa0d5c
19994-h.prc	2a632c9538fc22f8426440e6257802ac
20390-h.prc	3d70dbc80a1d80158ee75c04cbb4b95f
20740-h.prc	1c8eb03475997d0536c8cae6e9b4df09
20959-h.prc	1b33cea255246d64b50f0d34cc5d6e21
21660-h.prc	aa903279fa53963f6339dc728145580e
22042-h.prc	f3c9e49c5c14c38d60a3d5160c48b30e
22153-h.prc	64ef53c194aad317af48c10ff286f5dd
25344-h.prc	0f5d8107e6b7200b2c61e4babfb9fb95
26491-h.prc	d7969f9798e727f5ad5bbd8517997c93
29239-h.prc	166c77ff389e15cf911a9af4e09edb09
6130-h.prc	89cf92a1baf99a1feef885daabb5ee05
20000_Leagues_Under_the_Sea.txt	90d6ba2989e421d2d1c65b239bc5de5f
Adventures_of_Huckleberry_Fi.txt	66fd9146835fa455c9ab7c562fd6a834
Alice_in_Wonderland.txt	3cbf7cce177f5b883a1a131267e6c2f6
Analyzing_Character.txt	1d57a86ae6c6cc16f1d6564d31a4c86c
Aylwin.txt	c4b0b0daec0fd7a5b3c4b5986a750a42
Dracula.txt	e74b9ae42d6997aecb37eee3b4bd0e07
Great_Expectations.txt	3df3cb2084cd56a3ce9e630861122fb3
Hamlet.txt	9c25d3d9d4d4a9b46d4e4acffb9b2b22
Kashmir.txt	79685b7e163672081cff5572f1e93233
Les_Misérables.txt	381d9192ab546446062189868a64c401
Macbeth.txt	01ef37ca6907f4adeed6b63cb700b24c
Recollections_of_Abraham_Lin.txt	9ddb1c26c57adde05982388258a1625d
Romeo_and_Juliet.txt	a7a9ac1bb7a61eee4e32640ffcbf55cf
The_Adventures_of_Huckleberr.txt	c9615977e9e43c53b36be51a47dde279
The_Adventures_of_Sherlock_H.txt	7de8338a7bb4ab54f07cdedcf4d36db9
The_Age_of_Reason.txt	8f99384a63fcf69d99b620fb94fa2d57
The_Art_of_Public_Speaking.txt	d86658987bd9d902307324c11afc52b9
The_Art_of_War.txt	dc3e69c836649f2bba21be7b1f030d31
The_Best_Ghost_Stories.txt	86fedaba6f1a68b58282b457b1e0c01e
The_Best_Short_Stories_of_19.txt	15ec2c683bf3abd98ebe79c99b453cc6
The_Bungalow_Boys_Along_the_.txt	59a34a378449f35f92ceeeb29ccb7e10
The_Call_of_Cthulhu.txt	89a38b9702ee23521ba3ffe97fb72738
The_Communist_Manifesto.txt	da3a63facfb7e542653c3767a70dbfa3
The_Grammar_of_English_Gramm.txt	1494ad9e3a44fdb6aaf5fae0dd9e2cb3

Table F.1 continued

The_Iliad_of_Homer.txt	96958fc0001cfb6dc7a06ef383586252
The_Pilgrims_Progress.txt	632185470f02de9a0e36c89742250b26
The_Runaways.txt	2e303bd45c8c74993b1e5975ed675760
The_Time_Machine.txt	efa73f6c1698454b7a042b3d8095d86e
Think_and_Grow_Rich!.txt	6ff1e6ddf7797df6e822b6107d7e5658
Whilomville_Stories.txt	853ebd51fe9d865d3f0c18d34083e8c1

Appendix G Missing or Mismatched MD5 Hashes

Table 9th: Missing or Mismatched MD5 Hashes from Deleted Files on the Kindle

Keyboard Without Special Offers

File Name	MD5 Hash
B000JML3IW_EBOK.awz	missing
25344-h.prc	81521895f66f99b2793503cd1896a6e9
26491-h.prc	7529a64cb9af7e662c387e562c280661
29239-h.prc	8cb9d1cb60afe813600773c34b6162e3
6130-h.prc	aa84077667bc009322d91f3a3fdc0ac2
20000_Leagues_Under_the_Sea.txt	cc81a9cf8e1ba18dfbffd313a69bd3a
Adventures_of_Huckleberry_Fi.txt	a8dfe7f0da19ca7b894329a8d1658279
Alice_in_Wonderland.txt	69e952e1186e34131e24b4341a06ad9d
Analyzing_Character.txt	68240842c1e4bd48559323d19dd1b694
Aylwin.txt	aa777286d22b2e5a8a645525cd8d2724
Dracula.txt	50a333a10ee40b23f61e8bb5de8bd9a7
Great_Expectations.txt	c83c11a770e3e5c21fb3ab95d75501c0
Hamlet.txt	ff77c9eaa83f8b9e4b49795f7ef6eba9
Kashmir.txt	b62b235fd536331e4937c7351533627b
Les_Misérables.txt	3918899ec2fb3808537ad35daaac7c09
Macbeth.txt	4adf8787523b15614dc6b1a804f53ea9
Recollections_of_Abraham_Lin.txt	0a993411035a7f5e1dfbcb674ab30f9d
Romeo_and_Juliet.txt	5befb75c20f0bf7aacb626b73ab6b872
The_Adventures_of_Huckleberr.txt	fb5a259b3a932bc9b857d1e97eacab4
The_Adventures_of_Sherlock_H.txt	d9231923f603f2ce48035aab300e018c
The_Age_of_Reason.txt	c7087c0afdd9eb5b9d44c70d9ccd80de
The_Art_of_Public_Speaking.txt	31313e895d5812bfcd254e0145b1d0dd
The_Art_of_War.txt	576f0eb41228e58d8d3ee6ef477b8dca
The_Best_Ghost_Stories.txt	ac0bb0a2ad8fef57ecaa8a48de007343
The_Best_Short_Stories_of_19.txt	7d1bb54889cdbc84d445aa894b3dd3d0
The_Bungalow_Boys_Alone_the_.txt	570a346c0a997e808fd4a5399eb28b9a
The_Call_of_Cthulhu.txt	ac41fe838a440a34f1c635e55e97c560
The_Communist_Manifesto.txt	95a258715207ebaf8071e335eddb3034
The_Grammar_of_English_Gramm.txt	0969cec01081b6412ca7e031b878abb9
The_Iliad_of_Homer.txt	43aded89acff0746103bbf5c568c21d0
The_Pilgrims_Progress.txt	f0051e651320ed1a04f349ba8ff0ee19
The_Runaways.txt	daac4acea4338417fbcfa6b4c4e999a4
The_Time_Machine.txt	a7bc23d7068041c67bd3460d03e64a88
Think_and_Grow_Rich!.txt	7e4c2dfbc2300992652731130438c063
Whilomville_Stories.txt	563579229a7671bae9162d5ac1b51cef

Table 10th: Missing or Mismatched MD5 Hashes from Deleted Files on the Kindle Keyboard With Special Offers

File Name	MD5 Hash
B000JML3IW_EBOK.azw	fe2585af10826a8ec2aaa581ebf06f2d
25344-h.prc	81521895f66f99b2793503cd1896a6e9
26491-h.prc	328fd57a9b9ba5ba0cdcbafd395b7e33
29239-h.prc	8cb9d1cb60afe813600773c34b6162e3
6130-h.prc	aa84077667bc009322d91f3a3fdc0ac2
20000_Leagues_Under_the_Sea.txt	cc81a9cf8e1ba18dfbffed313a69bd3a
Adventures_of_Huckleberry_Fi.txt	d26f101d02e18a5ec5a08e3f74a5980e
Alice_in_Wonderland.txt	69e952e1186e34131e24b4341a06ad9d
Analyzing_Character.txt	6b3402fa51afd1cecebcf16a17088a16
Aylwin.txt	aa777286d22b2e5a8a645525cd8d2724
Dracula.txt	439c11fec62b608f8c631badf116c876
Great_Expectations.txt	c83c11a770e3e5c21fb3ab95d75501c0
Hamlet.txt	ff77c9eaa83f8b9e4b49795f7ef6eba9
Kashmir.txt	b62b235fd536331e4937c7351533627b
Les_Misérables.txt	3918899ec2fb3808537ad35daaac7c09
Macbeth.txt	4adf8787523b15614dc6b1a804f53ea9
Recollections_of_Abraham_Lin.txt	0a993411035a7f5e1dfbcb674ab30f9d
Romeo_and_Juliet.txt	5befb75c20f0bf7aacb626b73ab6b872
The_Adventures_of_Huckleberr.txt	fb5a259b3a932bc9b857d1e97eacab4
The_Adventures_of_Sherlock_H.txt	d9231923f603f2ce48035aab300e018c
The_Age_of_Reason.txt	c7087c0afdd9eb5b9d44c70d9ccd80de
The_Art_of_Public_Speaking.txt	31313e895d5812bfcd254e0145b1d0dd
The_Art_of_War.txt	576f0eb41228e58d8d3ee6ef477b8dca
The_Best_Ghost_Stories.txt	ac0bb0a2ad8fef57ecaa8a48de007343
The_Best_Short_Stories_of_19.txt	7d1bb54889cbbd84d445aa894b3dd3d0
The_Bungalow_Boys_Along_the_.txt	570a346c0a997e808fd4a5399eb28b9a
The_Call_of_Cthulhu.txt	ac41fe838a440a34f1c635e55e97c560
The_Communist_Manifesto.txt	95a258715207ebaf8071e335eddb3034
The_Grammar_of_English_Gramm.txt	0969cec01081b6412ca7e031b878abb9
The_Iliad_of_Homer.txt	43aded89acff0746103bbf5c568c21d0
The_Pilgrims_Progress.txt	f0051e651320ed1a04f349ba8ff0ee19
The_Runaways.txt	daac4acea4338417bcfa6b4c4e999a4
The_Time_Machine.txt	a7bc23d7068041c67bd3460d03e64a88
Think_and_Grow_Rich!.txt	7e4c2dfbc2300992652731130438c063
Whilomville_Stories.txt	563579229a7671bae9162d5ac1b51cef

Table 11: Missing or Mismatched MD5 Hashes from Deleted Files on the Kindle

Paperwhite With Special Offers

File Name	MD5 Hash
B000JML3IW_EBOK.azw	missing
B000JML7EC_EBOK.azw	d25d5389bc6d431af0d66d645cd9785d
25344-h.prc	8aa0b13a296407402b56324b68c60d31
26491-h.prc	ca96b10c837e4ef601803932a756a8e2
29239-h.prc	cc1cc0beb32944c00b800fc1f33f2bac
6130-h.prc	e07278e38ae7e7c2a5a847ec8cc119df
20000_Leagues_Under_the_Sea.txt	48ebc75478b6aba5126ca442879651b2
Adventures_of_Huckleberry_Fi.txt	70710c9e7f51905ed28769a564bea963
Alice_in_Wonderland.txt	e0ac77d09d038db8f53cbc3c20b5dda0
Analyzing_Character.txt	05b0cf6884dff35c2499a14c4345c219
Aylwin.txt	c15d4a275c7bfcd393193ec043474f9
Dracula.txt	efb7b6dbd395152ee4e055827aa44826
Great_Expectations.txt	4b5c1bd2f2532a62be78a62984fce357
Hamlet.txt	925c26f644b3c4ff258c95af180ca614
Kashmir.txt	d9b455bb2a3db1c825af9603e4013759
Les_Misérables.txt	ee093dfcab32bc62271a90090f6f3ece
Macbeth.txt	9b4909ff6cf8555c73dc6b1895dd4733
Recollections_of_Abraham_Lin.txt	91c30b131725e27cc026b08fca0e753c
Romeo_and_Juliet.txt	583253aad84d50ef3d1f73467b8039c1
The_Adventures_of_Huckleberr.txt	52d9af0ab2204c105fff901c7ecc5659
The_Adventures_of_Sherlock_H.txt	95857735dcdf10e1c2fec3b7b17f0328
The_Age_of_Reason.txt	240d3f0748a4435d695bbe51d4c7df61
The_Art_of_Public_Speaking.txt	c329a3ab800f31f690436444eff11fba
The_Art_of_War.txt	d16751769ff74a31a51335a1472354e2
The_Best_Ghost_Stories.txt	0c5efcb7e1b8989d85a35e9f757ce471
The_Best_Short_Stories_of_19.txt	8d8d230f82b7d6ba271cb046afd3bc64
The_Bungalow_Boys_Along_the_.txt	99ebb9e44f2b958730014246a5bbe809
The_Call_of_Cthulhu.txt	fd6be9e9d9198b776f78dd86ccd8393b
The_Communist_Manifesto.txt	36e931010c05d2bffd1b4e2ad1df0d89
The_Grammar_of_English_Gramm.txt	b0ac1cf83730e0d72ea5f8baae00751c
The_Iliad_of_Homer.txt	74f65a2d9f19bfb94d7d68cfaa7b6639
The_Pilgrims_Progress.txt	2648703419fa3d585b6e65097cadd353
The_Runaways.txt	bea65aae4d9ce954a55067b79350e9ca
The_Time_Machine.txt	48250dcc2c6b5171e3087f86cd533ad3
Think_and_Grow_Rich!.txt	3b3c49d3289420d0c524f909d0a3289a
Whilomville_Stories.txt	096f0d3b4e15343c9af9e8124bfd8d3a

Table 12: Missing or Mismatched MD5 Hashes from Deleted Files on the Kindle

Paperwhite 3G

File Name	MD5 Hash
B000JML3IW_EBOK.azw	missing
B000JML7EC_EBOK.azw	f3fd8ebefbb066f0d3757e60efe6d3a3
25344-h.prc	73234fa05364de4bfe16ad63e1c7e228
26491-h.prc	5146e30bc9bb28aa8c07c50c90b8755e
29239-h.prc	5f14c43446ad495728b8fb407a822e95
6130-h.prc	93a27952fca4d365de49078b9c01b0e3
20000_Leagues_Under_the_Sea.txt	3f43948eee97dadd7ee62cbe1096adba
Adventures_of_Huckleberry_Fi.txt	71e0df75013ef66a4b46dba1e3e01edf
Alice_in_Wonderland.txt	3a5bc5be7bced0a0eb03c2796621832
Analyzing_Character.txt	a4b1809cbdf62241d9e482a0c8947a4
Aylwin.txt	4cbfa464a184878d5f8140d69b45ae25
Dracula.txt	43d192ebdcb8497908abf84aa16639cf
Great_Expectations.txt	d468bdd6950c1f825af1670361290f2b
Hamlet.txt	8356f5660692dc1915215783ad7e2235
Kashmir.txt	57e5cb956cc12a8424af5026eebfe37d
Les_Misérables.txt	f8295e1f3e2c7f60a1097fd30e8fe12a
Macbeth.txt	962824f6221ea7a0eb5bb3a119104c5d
Recollections_of_Abraham_Lin.txt	e6d368986c2e2021be22d742c1aa13c6
Romeo_and_Juliet.txt	c7d5bc9cf6058760b82c722e134ca065
The_Adventures_of_Huckleberr.txt	447192a50bb627a55caeff71b4ca2f0d
The_Adventures_of_Sherlock_H.txt	f07e2ab68a39360b3bd935a097375616
The_Age_of_Reason.txt	a296689c2afec761c5dab6f006de37de
The_Art_of_Public_Speaking.txt	99bf333dc5507ea39f37ef28216a91a3
The_Art_of_War.txt	b91eff20932fef4e0d06b7bdf4352e65
The_Best_Ghost_Stories.txt	357071e2a20857a4f80c93e36e95f3c2
The_Best_Short_Stories_of_19.txt	68e447b67fe7baca0c6e390e0678d17b
The_Bungalow_Boys_Along_the_.txt	c21205ee9eed1a44b1b6004c1df6da37
The_Call_of_Cthulhu.txt	bfcc83b1488f213d348bea7ce1b0de91
The_Communist_Manifesto.txt	978f06eef091ef5d966e7b4dcc84d887
The_Grammar_of_English_Gramm.txt	0dd4c72f71f6895afa30ff4cc6ffb8b6
The_Iliad_of_Homer.txt	a9e5fcebaa47896d5c5449921f1856ad
The_Pilgrims_Progress.txt	cffe82af3c3e89cebd6e98b09301fb5f
The_Runaways.txt	4368d7955361ec827544bd5cf2a440a6
The_Time_Machine.txt	b15317c54ead43ca6d4fe2e6c95f19e3
Think_and_Grow_Rich!.txt	d6a0e170c6ef4d00087e13ca12c9a86f
Whilomville_Stories.txt	4bf3905da7613ec4999bc625a3632a99

Table 13: Missing or Mismatched MD5 Hashes from Deleted Files on the Kindle

Paperwhite 3G With Special Offers

File Name	MD5 Hash
B000JML3IW_EBOK.azw	missing
B000JML7EC_EBOK.azw	021dec2c38c692e0d31026dcaeccc249
25344-h.prc	f2996d1909feeebb3624167510f8168d
26491-h.prc	2e379739638f1262468d639af2b7507d
29239-h.prc	fc37e3d46f48df0376be21b34f42a8d4
6130-h.prc	3cc9cbd179f9e6088473cd39de1ede67
20000_Leagues_Under_the_Sea.txt	eb1634ade71ddda949481f7ebbe2e82f
Adventures_of_Huckleberry_Fi.txt	ae363c87d397de2c6df845d7ec0e6a7c
Alice_in_Wonderland.txt	89b530e2f4a86c5c217c2f5a7dac6e88
Analyzing_Character.txt	6b27efc1dffbb9a72929798d23cf11c1
Aylwin.txt	e03d87139a29644c721178cdd27c3bfa
Dracula.txt	3db13df055b6a4e5d9efedbe3726819f
Great_Expectations.txt	8a7d411cf65b453317202c98dd1a0f93
Hamlet.txt	2e445ea5d8c5cde90eb60330cd7814bb
Kashmir.txt	7efc2f875dddb277178181cf8c257fdd
Les_Misérables.txt	1e8be8cb7dbb92177f0fe56823416022
Macbeth.txt	e7bd88634d7fc863566258cc315ae4b5
Recollections_of_Abraham_Lin.txt	e69ce9a53e7bf455614d81e5a6e3ead0
Romeo_and_Juliet.txt	e896ebf0f2d0e3ee1617552b3670d0a0
The_Adventures_of_Huckleberr.txt	726bb8818c5b0c4b47d705170eac738b
The_Adventures_of_Sherlock_H.txt	b7e99944cc245325348701644ef1e4de
The_Age_of_Reason.txt	d6730220cb51397cf90de99f970c8999
The_Art_of_Public_Speaking.txt	2fd54ca48dc1543257586a3bbb904438
The_Art_of_War.txt	021b87c9336068eb764e2483ca37fcc6
The_Best_Ghost_Stories.txt	bab62d42152e5228e82f6bc52c5dc0c3
The_Best_Short_Stories_of_19.txt	d6686caf6a01c0a5f74a460b604f421a
The_Bungalow_Boys_Along_the_.txt	859c753505a866f6a1db5c0bf1a32d9c
The_Call_of_Cthulhu.txt	99b2ea9d4b29926828a872be675e91ae
The_Communist_Manifesto.txt	b603a724d21ecda4d76331cb7f979b7b
The_Grammar_of_English_Gramm.txt	5c3f12e010ab51657ff45994eccfa991
The_Iliad_of_Homer.txt	43d31e40cb212ccc3fd2f8d7178d02a0
The_Pilgrims_Progress.txt	f8fd0292e96fa576c833f5c5fb9a20ce
The_Runaways.txt	8d963d9a8538f819593066a013d5c7c6
The_Time_Machine.txt	d57c7814037e14f3685c43968481f178
Think_and_Grow_Rich!.txt	d37b0759ca534ceb5abb499d02eac13d
Whilomville_Stories.txt	e47f3f9871500880f3dc7b27325f19ce

Table 14: Missing or Mismatched MD5 Hashes from Deleted Files on the Kindle

Paperwhite

File Name	MD5 Hash
B000JML3IW_EBOK.azw	missing
25344-h.prc	0c2197cd438eefceb15fed46f4cde076
26491-h.prc	9f5e6ddc25d38f31110051662c5eacaa
29239-h.prc	1e00b395f97b122a5801ab09bc961d90
6130-h.prc	b326820a25ff35757c333bf2c48ae6bd
20000_Leagues_Under_the_Sea.txt	485a4a8047fe033437eb4646de9c0ec9
Adventures_of_Huckleberry_Fi.txt	ca84a3a85a04d0ac8e5ad9eb16e5fde7
Alice_in_Wonderland.txt	1d69c7eaad3b178f71457af503bc97c3
Analyzing_Character.txt	76cb3a7d56316dfeed95ab22beec9ace
Aylwin.txt	b08d0346fb057a15ec4f02720e4772fb
Dracula.txt	41cf2ab068f8499c555a3e2c239d5c11
Great_Expectations.txt	7af1f97cf2d408a18cae6997ea21ae55
Hamlet.txt	0a3f0d4b15e55dee80b361bae2caf4f3
Kashmir.txt	be2f5d9fb819ecf3af08ef9a6067556a
Les_Misérables.txt	eac50ebcd47fb390798313d1c9bc46a0
Macbeth.txt	eec9987ae03e97a25bc4d25d9c246c1a
Recollections_of_Abraham_Lin.txt	62e2425475040a8c4faa67ca2d3de747
Romeo_and_Juliet.txt	b5092c843ea35ddd0ffd3efd15da4919
The_Adventures_of_Huckleberr.txt	281b2b9490dcc46866ba819167a6b11f
The_Adventures_of_Sherlock_H.txt	7cee74de4b4cc6bb6a7f3c2aacd80fcc
The_Age_of_Reason.txt	8d4bf98ccb513c3e47b7a868f0918bc4
The_Art_of_Public_Speaking.txt	42dde48eb4f1f76766753d89dcb5320d
The_Art_of_War.txt	e11b7863d3432f7c6df4ff65f22a3bac
The_Best_Ghost_Stories.txt	0c7a357cae8a32ffe7f3ac0b709f022f
The_Best_Short_Stories_of_19.txt	2cb85d7f46d286e50f04e3a6049f50e2
The_Bungalow_Boys_Along_the_.txt	1653e00dd27164ede5385ea039f50277
The_Call_of_Cthulhu.txt	aa8d83d6df480799c3c71bf50fc47ffe
The_Communist_Manifesto.txt	bb445eec4d9232ee75b9aadb872e5470
The_Grammar_of_English_Gramm.txt	b1469a93a74ee23820f6b537a89a17c5
The_Iliad_of_Homer.txt	948afc5aed2611936d37f68d504e0bc1
The_Pilgrims_Progress.txt	7b0e41088f36518b8f6df0bd72215d9c
The_Runaways.txt	cafbdb254e8a968f454ea2e1bc3941b1
The_Time_Machine.txt	69b39a767b194126a0643ce74cdf713
Think_and_Grow_Rich!.txt	02d852538238467f07e16291060220b5
Whilomville_Stories.txt	f316b865e369674ea774404921f2ef0f

Table 157: Missing or Mismatched MD5 Hashes from Deleted Files on the Kindle 5

File Name	MD5 Hash
B000JML3IW_EBOK.azw	missing
19068-h.prc	9adad955476565dd91eee8979b8f8e7c
19499-h.prc	2d0209feb908098fcb762b1c3955fcbc
19694-h.prc	fd761d1847280ac6c9b08a12906f3b5a
19994-h.prc	ef645b4d5ef10940a7bb53133a0bb169
20390-h.prc	efefcc5888324b25e2a2647e80efa8b5
20740-h.prc	7ce30e0deabe387e8433493ebc20bdd4
20959-h.prc	577c1823b8754d241c77d9d655d6b125
21660-h.prc	1a8dd5d722cbe7e9f7806b86de4b18ee
22042-h.prc	72d286e16349699b95f49455565b9c29
22153-h.prc	f21c2b1cc3f2238ea70a745174b1552d
25344-h.prc	0b23d5ec0e06171b81270399525c4378
26491-h.prc	6a45c3ef228d9db31ecc6db941944336
29239-h.prc	59b58d5f4536556d44eb9ca8d9fa3eba
6130-h.prc	80fd42e6073c07c085ff6624b5e239bd
20000_Leagues_Under_the_Sea.txt	58836fb6a7f6b903a880070100c4dcf8
Adventures_of_Huckleberry_Fi.txt	50f772cbb0d866d1c6e777624b3327e4
Alice_in_Wonderland.txt	6b5e10b1d07216d9c755a002cebfb35d
Analyzing_Character.txt	494eedaaf8ec2018c79ddad3def35196
Aylwin.txt	84cfb24d6144be535054a983549f2770
Dracula.txt	c9d8f5ffc3940356c37c5bd69c06515a
Great_Expectations.txt	71641a766143eac84589cbbc8652ed37
Hamlet.txt	0ec30c0f63f6f3a06121ec00fa787bad
Kashmir.txt	81bdc8e596d8a5a216f5720ab4ecc0e3
Les_Misérables.txt	fd3e71def4d5c3ca0428715724157618
Macbeth.txt	2b40f3eceb0cf6206fecfba47a01cf9f
Recollections_of_Abraham_Lin.txt	8fe4595f8a44a9e5223de680509542b1
Romeo_and_Juliet.txt	c8b04ede88f481eb4ea63702176ccc1a
The_Adventures_of_Huckleberr.txt	789457edaaab35af9ef71883f1be78ad
The_Adventures_of_Sherlock_H.txt	06bd19e5d17a175ecf5c47ffff60e930
The_Age_of_Reason.txt	431c85cb26a701d2cc0d4d795d7a960b
The_Art_of_Public_Speaking.txt	e9eb8c607b086c1f7b4e93c409ed8143
The_Art_of_War.txt	bf82a28bd276551ecb048fda02fa8878
The_Best_Ghost_Stories.txt	e64725e055a968d766773c59e5d3e1e6
The_Best_Short_Stories_of_19.txt	6f88d032589ccdd342f3ea717ea7c9d4
The_Bungalow_Boys_Along_the_.txt	ac43115f601628382db933f3e6ae25b8
The_Call_of_Cthulhu.txt	98c5cde6d3666ae0ddd587a6b2d10708
The_Communist_Manifesto.txt	aae74556710ff9f65a1a4bd74a8e2970
The_Grammar_of_English_Gramm.txt	0c89b9f3fed7b10463d4b16025292620
The_Iliad_of_Homer.txt	68e53e7b0d7d98beedd0027efff6a1d6
The_Pilgrims_Progress.txt	da514b2dc4b2f139c47c51a5851ed0b4
The_Runaways.txt	44b705c4b5d854a6eed4cdfb04020943

Table G.7 continued

The_Time_Machine.txt	414fc598e4bdb56a811426b5a7a29c37
Think_and_Grow_Rich!.txt	ad189251bfefc2886e60eacada8d09c6
Whilomville_Stories.txt	411c75e3b584d72e33532eb83b595572

Table 16: Missing or Mismatched MD5 Hashes from Deleted Files on the Kindle 5 With
Special Offers

File Name	MD5 Hash
25344-h.prc	81521895f66f99b2793503cd1896a6e9
26491-h.prc	220fc05c501cf08c557fd53030626220
29239-h.prc	8cb9d1cb60afe813600773c34b6162e3
6130-h.prc	aa84077667bc009322d91f3a3fdc0ac2
20000_Leagues_Under_the_Sea.txt	cc81a9cf8e1ba18dfbffd313a69bd3a
Adventures_of_Huckleberry_Fi.txt	6845509c218e12d6be51d3e8806d14cb
Alice_in_Wonderland.txt	69e952e1186e34131e24b4341a06ad9d
Analyzing_Character.txt	8b985ab7585b0cfec29dbe2c994dd994
Aylwin.txt	aa777286d22b2e5a8a645525cd8d2724
Dracula.txt	6f2706223b6fada7acc73dbd45c3cbf6
Great_Expectations.txt	c83c11a770e3e5c21fb3ab95d75501c0
Hamlet.txt	ff77c9eaa83f8b9e4b49795f7ef6eba9
Kashmir.txt	b62b235fd536331e4937c7351533627b
Les_Misérables.txt	3918899ec2fb3808537ad35daaac7c09
Macbeth.txt	4adf8787523b15614dc6b1a804f53ea9
Recollections_of_Abraham_Lin.txt	0a993411035a7f5e1dfbcb674ab30f9d
Romeo_and_Juliet.txt	5befb75c20f0bf7aacb626b73ab6b872
The_Adventures_of_Huckleberr.txt	fb5a259b3a932bc9b857d1e97eacab4
The_Adventures_of_Sherlock_H.txt	d9231923f603f2ce48035aab300e018c
The_Age_of_Reason.txt	c7087c0afdd9eb5b9d44c70d9ccd80de
The_Art_of_Public_Speaking.txt	31313e895d5812bfcd254e0145b1d0dd
The_Art_of_War.txt	576f0eb41228e58d8d3ee6ef477b8dca
The_Best_Ghost_Stories.txt	ac0bb0a2ad8fef57ecaa8a48de007343
The_Best_Short_Stories_of_19.txt	7d1bb54889cddb84d445aa894b3dd3d0
The_Bungalow_Boys_Along_the_.txt	570a346c0a997e808fd4a5399eb28b9a
The_Call_of_Cthulhu.txt	ac41fe838a440a34f1c635e55e97c560
The_Communist_Manifesto.txt	95a258715207ebaf8071e335eddb3034
The_Grammar_of_English_Gramm.txt	0969cec01081b6412ca7e031b878abb9
The_Iliad_of_Homer.txt	43aded89acff0746103bbf5c568c21d0
The_Pilgrims_Progress.txt	f0051e651320ed1a04f349ba8ff0ee19
The_Runaways.txt	daac4acea4338417bcfa6b4c4e999a4
The_Time_Machine.txt	a7bc23d7068041c67bd3460d03e64a88
Think_and_Grow_Rich!.txt	7e4c2dfbc2300992652731130438c063
Whilomville_Stories.txt	563579229a7671bae9162d5ac1b51cef