



Cellebrite_PA Version 7.62.2.9

Test Results for File Carving Tool

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1 Introduction

The Computer Forensics Tool Testing (CFTT) program is a joint project of the U.S. Department of Homeland Security's (DHS) Science and Technology Directorate (S&T), the National Institute of Justice, and the National Institute of Standards and Technology's (NIST) Special Programs Office and Information Technology Laboratory. CFTT is supported by other organizations, including the Federal Bureau of Investigation, the U.S. Department of Defense Cyber Crime Center, the U.S. Internal Revenue Service's Criminal Investigation Division Electronic Crimes Program, and DHS' U.S. Immigration and Customs Enforcement, U.S. Customs and Border Protection and the U.S. Secret Service. The objective of the CFTT program is to provide measurable assurance to practitioners, researchers, and other applicable users that the tools used in computer forensics investigations provide accurate results. Accomplishing this requires the development of specifications and test methods for computer forensics tools and subsequent testing of specific tools against those specifications.

Test results provide the information necessary for developers to improve tools, users to make informed choices, and the legal community and others to understand the tools' capabilities. The CFTT approach to testing computer forensics tools is based on well-recognized methodologies for conformance and quality testing. Interested parties in the computer forensics community can review and comment on the specifications and test methods posted on the CFTT website (<https://www.cftt.nist.gov/>).

This document reports the results from testing Cellebrite_PA Version 7.62.2.9.

Test results from other tools can be found on the DHS S&T-sponsored digital forensics webpage, <http://www.dhs.gov/science-and-technology/nist-cftt-reports>.

2 How to Read This Report

This report is organized into the following sections:

1. **Introduction:** This section presents a brief introduction to the CFTT project.
2. **How to read this report:** This section lists the main sections in the report.
3. **Tested Tool Description:** This section lists the tool name, version, and vendor information.
4. **Testing Organization:** This section includes the name and contact information for the organization testing the tool.
5. **Results Summary:** This section provides a summary of the major results revealed by the testing.
6. **Testing Environment:** This section provides a description of the hardware used for testing the tool.

7. **Appendix -- Test Results Details:** This appendix presents the details of each test run as a series of tables. The appendix is the raw data that is used as a basis for the conclusions presented in the Results Summary section. For each file type there is a subsection with one table to describe all the source files of the given type. Then there are several variations on arranging chunks of the source files in the test image file. There is a table describing the layout of each image file, a summary table of the carved results and an analysis table of the carved results.

Test Results for File Carving Tool

3 Tested Tool Description

Tested Tool Name: Cellebrite_PA

Tool Version: 7.62.2.9

Supplier: Cellebrite

Contact Information:

8065 Leesburg Pike, Suite T3-302

Vienna, VA 22182

USA

Web Site: <https://cellebrite.com/>

Tool Description: Cellebrite is a multi-function digital forensic tool for mobile devices that provides a variety of forensic functions for the tool user with file carving just one of the provided functions. This report only addresses testing the file carving feature of graphic files.

4 Testing Organization

Testing Organization: NIST/CFTT

Contact Information: cftt@nist.gov

5 Results Summary

The tool was tested for carving graphic files from an unformatted image file in various layouts. The following file types of files were tested: HEIC, PNG, JPG, BMP, TIFF, and GIF. Three layouts were tested for each file type:

1. Contiguous: layout of six files separated with various amounts of benign fill between files. All files are aligned on sector boundaries within the image file.
2. Non-aligned: layout of six files separated with various amounts of benign fill between files. None of the source files are aligned on sector boundaries within the image file.
3. Fragmented: layout of six files separated with various amounts of benign fill between files. In addition, each file is fragmented into several fragments with benign fill inserted between them. Details of the fragmentation are presented in the Appendix (section 7). All files are aligned on sector boundaries within the image file.

5.1 Observations and Anomalies

- PNG and JPG files had no anomalies for the contiguous and non-aligned layouts.
- PNG files carved from a fragmented layout included only the first fragment of the source files and a few (from 2 to 13) blocks of fill along with a single block of unknown origin.
- JPG files carved from a fragmented layout included all the blocks from the original source files plus the fill blocks between pairs of fragments.
- Carving HEIC, BMP, TIFF, and GIF files was not supported.

5.2 Optional Features

6 Test Environment and Test Cases

This section describes the test hardware, test data sets and tool settings used.

6.1 Test Hardware Used

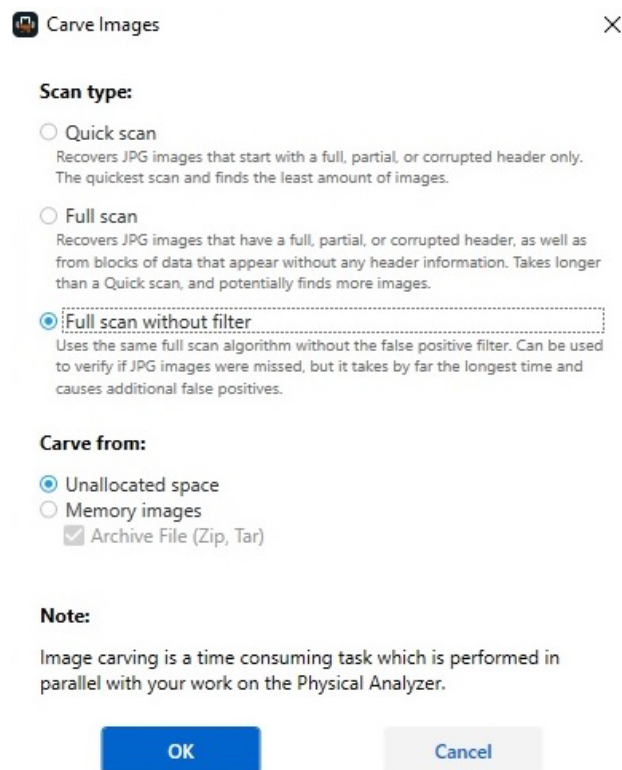
Test Hardware was a PC running Windows 10 Pro version 10.0.19042.1586.

6.2 Test Data Sets Used

The test data is a set of image files that can be found in the CFReDS repository (<https://cfreds.nist.gov/>) under the title **File Carving Graphic Files** with date of **2023**.

6.3 Tool Settings Used

The following figure presents a screen capture of the tool settings used.



7 Appendix: Test Result Details

This section describes the test results more in depth using a series of tables:

For each type of file to be carved there is a table of source file profiles to describe the size of each source file of the given file type.

Each image file to be carved is made up of the source files in one of several possible layouts. The layout table describes the layout of each image file used as input to the carving tool.

The analysis of the file carving is presented in three tables:

The first table presents the results of a manual inspection and classification of each carved file.

A second table presents a summary of the characteristics of the carved files.

A third table presents a detailed analysis of the source of the content for each carved file.

7.1 Results for carving HEIC

No HEIC files were carved for any layout.

7.2 Results for carving PNG

This section describes details on how the PNG data set images were created. The section also includes a description of the source files used, the layout of each image file used, and an analysis of carved files returned by the tested tool from each image file.

7.2.1 Source File Profile for PNG

This section describes the source files used to build the image files for testing carving of PNG files. The block size is 512 bytes. Spill is the number of data bytes in the last block. Slack is the number of bytes remaining in the last block. Spill + Slack = 512. If the Thumb source file has an embedded thumbnail in the Exif data, the Thumb column has a "yes."

PNG Source File Size in Bytes & 512 Byte Blocks

Source File	Size in Bytes	Blocks	Spill	Slack	Thumb
cactus.png	6,164,389	12,040	421	91	no
cave.png	8,182,655	15,982	383	129	no
forsythia.png	8,107,995	15,836	475	37	no
lavender.png	11,067,334	21,616	454	58	no
log.png	11,592,240	22,642	48	464	no
orchid.png	8,455,527	16,515	359	153	no

7.2.2 Image Layout for PNG Contiguous

The following table describes the layout of an image file. The image file is constructed from chunks of data from the source files, separated by chunks of fill data. All chunks are multiples of 512 bytes.

The Chunk column is the chunk identifier. The Source File column is the name of the file providing data. The Bytes column is the size of the chunk in bytes. The Spill column is the number of data bytes in the last block in the chunk (if less than 512). The Blocks column is the number of blocks in the chunk. The "%" column is the percentage of the file in the chunk. The Fill Blocks column is the number of blocks of fill data in the next chunk.

Layout for Contiguous Image of PNG Files

Chunk	Source_file	Bytes	Spill	Blocks	%	Fill_Blocks
0	cactus.png	6,164,389	421	12,040	100.00	1
2	cave.png	8,182,655	383	15,982	100.00	2
4	forsythia.png	8,107,995	475	15,836	100.00	0
6	lavender.png	11,067,334	454	21,616	100.00	5
8	log.png	11,592,240	48	22,642	100.00	34
10	orchid.png	8,455,527	359	16,515	100.00	21

7.2.3 Analysis of Carving Results for PNG Contiguous

The following table presents the results of the manual inspection of carved files. The Tool Generated File Name column presents the names of the carved files as assigned by the tested tool. Because the name assigned to each carved file may be rather long, a short abbreviation is assigned to each file name. The abbreviation presented in the Abbreviation column is used to identify each carved file in the following two tables. The Evaluation column presents the evaluation assigned to the carved file during a manual examination of the file. A value of "pending" is given if the file has not yet been examined.

Inspection Results for Contiguous Image of PNG Files

Tool Generated File Name	Abbreviation	Evaluation
image-contig-png.dd embedded 1.png	C001	Complete no flaws
image-contig-png.dd embedded 2.png	C002	Complete no flaws
image-contig-png.dd embedded 3.png	C003	Complete no flaws
image-contig-png.dd embedded 4.png	C004	Complete no flaws
image-contig-png.dd embedded 5.png	C005	Complete no flaws
image-contig-png.dd embedded 6.png	C006	Complete no flaws

The following table presents the size in bytes and 512-byte blocks of each carved file. The source of the first block is also noted. The file is identified by the short abbreviation defined in the table above.

Description of Carved Files From Contiguous Image of PNG Files

File_Abbreviation	Bytes	Spill	Blocks	fill	unknown	FirstSource
C001	6,164,389	421	12,040	0	0	cactus.png
C002	8,182,655	383	15,982	0	0	cave.png
C003	8,107,995	475	15,836	0	0	forsythia.png
C004	11,067,334	454	21,616	0	0	lavender.png

File_Abbreviation	Bytes	Spill	Blocks	fill	unknown	FirstSource
C005	11,592,240	48	22,642	0	0	log.png
C006	8,455,527	359	16,515	0	0	orchid.png

6 PNG signatures were found in the Contiguous image, 6 expected, no file signatures from an unknown source. No files were missed.

0 EXIF embedded thumbnails found, 0 expected.

The following table presents a detailed analysis of the content of each carved file. For each carved file one or more rows follow with an analysis of each source that contributed to the carved file (identified by the file name abbreviation). The source file name is in the column labeled Src. The number of bytes from that source is listed in the Bytes_seen column. The number of 512-byte blocks from that source is in the Blocks column. The percent of the source file included in the carved file is in the "%" column. A count of ambiguous blocks that could belong to more than one source file is in the Multi column. The number of blocks missing from the source file, i.e., not carved, is in the Missing column.

Detailed Analysis of Carved Files From Contiguous Image of PNG Files

Carved	Src	Bytes_seen	Blocks	%	Multi	Missing
C001	cactus.png	6,164,480	12,040	100.00	0	0
C002	cave.png	8,182,784	15,982	100.00	0	0
C003	forsythia.png	8,108,032	15,836	100.00	0	0
C004	lavender.png	11,067,392	21,616	100.00	0	0
C005	log.png	11,592,704	22,642	100.00	0	0
C006	orchid.png	8,455,680	16,515	100.00	0	0

7.2.4 Image Layout for PNG Non-Aligned on Clusters

The following table describes the layout of an image file. The image file is constructed from chunks of data from the source files, separated by chunks of fill data. All chunks are multiples of 512 bytes.

The Chunk column is the chunk identifier. The Source File column is the name of the file providing data. The Bytes column is the size of the chunk in bytes. The Spill column is the number of data bytes in the last block in the chunk (if less than 512). The Blocks column is the number of blocks in the chunk. The "%" column is the percentage of the file in the chunk. The Fill Blocks column is the number of blocks of fill data in the next chunk.

Layout for Non-Aligned on Clusters Image (Offset 313 bytes) of PNG Files

Chunk	Source_file	Bytes	Spill	Blocks	%	Fill_Blocks
0	cactus.png	6,164,389	421	12,040	100.00	1
2	cave.png	8,182,655	383	15,982	100.00	2
4	forsythia.png	8,107,995	475	15,836	100.00	0
6	lavender.png	11,067,334	454	21,616	100.00	5

Chunk	Source_file	Bytes	Spill	Blocks	%	Fill_Blocks
8	log.png	11,592,240	48	22,642	100.00	34
10	orchid.png	8,455,527	359	16,515	100.00	21

7.2.5 Analysis of Carving Results for PNG Non-Aligned on Clusters

The following table presents the results of the manual inspection of carved files. The Tool Generated File Name column presents the names of the carved files as assigned by the tested tool. Because the name assigned to each carved file may be rather long, a short abbreviation is assigned to each file name. The abbreviation presented in the Abbreviation column is used to identify each carved file in the following two tables. The Evaluation column presents the evaluation assigned to the carved file during a manual examination of the file. A value of "pending" is given if the file has not yet been examined.

Inspection Results for Non-Aligned on Clusters Image of PNG Files

Tool Generated File Name	Abbreviation	Evaluation
image-non-png.dd embedded 1.png	C001	Complete no flaws
image-non-png.dd embedded 2.png	C002	Complete no flaws
image-non-png.dd embedded 3.png	C003	Complete no flaws
image-non-png.dd embedded 4.png	C004	Complete no flaws
image-non-png.dd embedded 5.png	C005	Complete no flaws
image-non-png.dd embedded 6.png	C006	Complete no flaws

The following table presents the size in bytes and 512-byte blocks of each carved file. The source of the first block is also noted. The file is identified by the short abbreviation defined in the table above.

Description of Carved Files From Non-Aligned on Clusters Image of PNG Files

File_Abbreviation	Bytes	Spill	Blocks	fill	unknown	FirstSource
C001	6,164,389	421	12,040	0	0	cactus.png
C002	8,182,655	383	15,982	0	0	cave.png
C003	8,107,995	475	15,836	0	0	forsythia.png
C004	11,067,334	454	21,616	0	0	lavender.png
C005	11,592,240	48	22,642	0	0	log.png
C006	8,455,527	359	16,515	0	0	orchid.png

6 PNG signatures were found in the Non-Aligned on Clusters image, 6 expected, no file signatures from an unknown source. No files were missed.

0 EXIF embedded thumbnails found, 0 expected.

The following table presents a detailed analysis of the content of each carved file. For each carved file one or more rows follow with an analysis of each source that contributed to the carved file (identified by the file name abbreviation). The source file name is in the column labeled Src. The number of bytes from that source is listed in the Bytes_seen column. The

number of 512-byte blocks from that source is in the Blocks column. The percent of the source file included in the carved file is in the "%" column. A count of ambiguous blocks that could belong to more than one source file is in the Multi column. The number of blocks missing from the source file, i.e., not carved, is in the Missing column.

Detailed Analysis of Carved Files From Non-Aligned on Clusters Image of PNG Files

Carved	Src	Bytes_seen	Blocks	%	Multi	Missing
C001	cactus.png	6,164,480	12,040	100.00	0	0
C002	cave.png	8,182,784	15,982	100.00	0	0
C003	forsythia.png	8,108,032	15,836	100.00	0	0
C004	lavender.png	11,067,392	21,616	100.00	0	0
C005	log.png	11,592,704	22,642	100.00	0	0
C006	orchid.png	8,455,680	16,515	100.00	0	0

7.2.6 Image Layout for PNG Fragmented in Order

The following table describes the layout of an image file. The image file is constructed from chunks of data from the source files, separated by chunks of fill data. All chunks are multiples of 512 bytes.

The Chunk column is the chunk identifier. The Source File column is the name of the file providing data. The Bytes column is the size of the chunk in bytes. The Spill column is the number of data bytes in the last block in the chunk (if less than 512). The Blocks column is the number of blocks in the chunk. The "%" column is the percentage of the file in the chunk. The Fill Blocks column is the number of blocks of fill data in the next chunk.

Layout for Fragmented in Order Image of PNG Files

Chunk	Seq	Source_file	Bytes	Spill	Blocks	%	Fill_Blocks
0	1	cactus.png	5,547,520	0	10,835	89.99	100
2	2	cactus.png	616,869	421	1,205	10.01	2
4	1	cave.png	4,090,880	0	7,990	49.99	300
6	2	cave.png	4,091,775	383	7,992	50.00	50
8	1	forsythia.png	1,621,504	0	3,167	20.00	80
10	2	forsythia.png	6,486,491	475	12,669	80.00	13
12	1	lavender.png	2,766,336	0	5,403	25.00	210
14	2	lavender.png	3,319,808	0	6,484	30.00	100
16	3	lavender.png	4,426,752	0	8,646	40.00	2
18	4	lavender.png	554,438	454	1,083	5.01	300
20	1	log.png	10,432,512	0	20,376	89.99	50
22	2	log.png	1,159,728	48	2,266	10.00	80
24	1	orchid.png	4,227,584	0	8,257	50.00	13
26	2	orchid.png	4,227,943	359	8,258	50.00	210

7.2.7 Analysis of Carving Results for PNG Fragmented in Order

The following table presents the results of the manual inspection of carved files. The Tool Generated File Name column presents the names of the carved files as assigned by the tested tool. Because the name assigned to each carved file may be rather long, a short abbreviation is assigned to each file name. The abbreviation presented in the Abbreviation column is used to identify each carved file in the following two tables. The Evaluation column presents the evaluation assigned to the carved file during a manual examination of the file. A value of "pending" is given if the file has not yet been examined.

Inspection Results for Fragmented in Order Image of PNG Files

Tool Generated File Name	Abbreviation	Evaluation
image-frag-png.dd embedded 1 partial.png	C001	Usable minor flaws
image-frag-png.dd embedded 2 partial.png	C002	Incomplete major flaws
image-frag-png.dd embedded 3 partial.png	C003	Incomplete major flaws
image-frag-png.dd embedded 4 partial.png	C004	Incomplete major flaws
image-frag-png.dd embedded 5 partial.png	C005	Usable minor flaws
image-frag-png.dd embedded 6 partial.png	C006	Usable minor flaws

The following table presents the size in bytes and 512-byte blocks of each carved file. The source of the first block is also noted. The file is identified by the short abbreviation defined in the table above.

Description of Carved Files From Fragmented in Order Image of PNG Files

File_Abbreviation	Bytes	Spill	Blocks	fill	unknown	FirstSource
C001	5,554,194	18	10,849	13	1	cactus.png
C002	4,093,882	442	7,996	5	1	cave.png
C003	1,624,478	414	3,173	5	1	forsythia.png
C004	2,773,038	46	5,417	13	1	lavender.png
C005	10,433,807	271	20,379	2	1	log.png
C006	4,233,350	134	8,269	11	1	orchid.png

6 PNG signatures were found in the Fragmented in Order image, 6 expected, no file signatures from an unknown source. No files were missed.

0 EXIF embedded thumbnails found, 0 expected.

The following table presents a detailed analysis of the content of each carved file. For each carved file one or more rows follow with an analysis of each source that contributed to the carved file (identified by the file name abbreviation). The source file name is in the column labeled Src. The number of bytes from that source is listed in the Bytes_seen column. The number of 512-byte blocks from that source is in the Blocks column. The percent of the source file included in the carved file is in the "%" column. A count of ambiguous blocks that could belong to more than one source file is in the Multi column. The number of blocks missing from

the source file, i.e., not carved, is in the Missing column.

Detailed Analysis of Carved Files From Fragmented in Order Image of PNG Files

Carved	Src	Bytes_seen	Blocks	%	Multi	Missing
C001	cactus.png	5,547,520	10,835	90.00	0	1,205
C002	cave.png	4,090,880	7,990	50.00	0	7,992
C003	forsythia.png	1,621,504	3,167	20.00	0	12,669
C004	lavender.png	2,766,336	5,403	25.00	0	16,213
C005	log.png	10,432,512	20,376	90.00	0	2,266
C006	orchid.png	4,227,584	8,257	50.00	0	8,258

7.3 Results for carving JPG

This section describes details on how the JPG data set images were created. The section also includes a description of the source files used, the layout of each image file used, and an analysis of carved files returned by the tested tool from each image file.

7.3.1 Source File Profile for JPG

This section describes the source files used to build the image files for testing carving of JPG files. The block size is 512 bytes. Spill is the number of data bytes in the last block. Slack is the number of bytes remaining in the last block. Spill + Slack = 512. If the Thumb source file has an embedded thumbnail in the Exif data, the Thumb column has a "yes."

JPG Source File Size in Bytes & 512 Byte Blocks

Source File	Size in Bytes	Blocks	Spill	Slack	Thumb
dino.jpg	3,424,980	6,690	212	300	no
grizzly.jpg	2,785,455	5,441	175	337	no
jump.jpg	2,015,880	3,938	136	376	no
leaf.jpg	798,064	1,559	368	144	yes
oak-snow.jpg	1,370,140	2,677	28	484	yes
stonehenge.jpg	1,236,401	2,415	433	79	yes

7.3.2 Image Layout for JPG Contiguous

The following table describes the layout of an image file. The image file is constructed from chunks of data from the source files, separated by chunks of fill data. All chunks are multiples of 512 bytes.

The Chunk column is the chunk identifier. The Source File column is the name of the file providing data. The Bytes column is the size of the chunk in bytes. The Spill column is the number of data bytes in the last block in the chunk (if less than 512). The Blocks column is the number of blocks in the chunk. The "%" column is the percentage of the file in the chunk. The Fill Blocks column is the number of blocks of fill data in the next chunk.

Layout for Contiguous Image of JPG Files

Chunk	Source_file	Bytes	Spill	Blocks	%	Fill_Blocks
0	dino.jpg	3,424,980	212	6,690	100.00	1
2	grizzly.jpg	2,785,455	175	5,441	100.00	2
4	jump.jpg	2,015,880	136	3,938	100.00	0
6	leaf.jpg	798,064	368	1,559	100.00	5
8	oak-snow.jpg	1,370,140	28	2,677	100.00	34
10	stonehenge.jpg	1,236,401	433	2,415	100.00	21

7.3.3 Analysis of Carving Results for JPG Contiguous

The following table presents the results of the manual inspection of carved files. The Tool Generated File Name column presents the names of the carved files as assigned by the tested tool. Because the name assigned to each carved file may be rather long, a short abbreviation is assigned to each file name. The abbreviation presented in the Abbreviation column is used to identify each carved file in the following two tables. The Evaluation column presents the evaluation assigned to the carved file during a manual examination of the file. A value of "pending" is given if the file has not yet been examined.

Inspection Results for Contiguous Image of JPG Files

Tool Generated File Name	Abbreviation	Evaluation
image-contig-jpg.dd embedded 1.jpg	C001	Complete no flaws
image-contig-jpg.dd embedded 2.jpg	C002	Complete no flaws
image-contig-jpg.dd embedded 3.jpg	C003	Complete no flaws
image-contig-jpg.dd embedded 4.jpg	C004	Complete no flaws
image-contig-jpg.dd embedded 5.jpg	C005	Complete no flaws
image-contig-jpg.dd embedded 6.jpg	C006	Complete no flaws

The following table presents the size in bytes and 512-byte blocks of each carved file. The source of the first block is also noted. The file is identified by the short abbreviation defined in the table above.

Description of Carved Files From Contiguous Image of JPG Files

File_Abbreviation	Bytes	Spill	Blocks	fill	unknown	FirstSource
C001	3,424,980	212	6,690	0	0	dino.jpg
C002	2,785,455	175	5,441	0	0	grizzly.jpg
C003	2,015,880	136	3,938	0	0	jump.jpg
C004	798,064	368	1,559	0	0	leaf.jpg
C005	1,370,140	28	2,677	0	0	oak-snow.jpg
C006	1,236,401	433	2,415	0	0	stonehenge.jpg

6 JPG signatures were found in the Contiguous image, 6 expected, no file signatures from an unknown source. No files were missed.

0 EXIF embedded thumbnails found, 3 expected.

The following table presents a detailed analysis of the content of each carved file. For each carved file one or more rows follow with an analysis of each source that contributed to the carved file (identified by the file name abbreviation). The source file name is in the column labeled Src. The number of bytes from that source is listed in the Bytes_seen column. The number of 512-byte blocks from that source is in the Blocks column. The percent of the source file included in the carved file is in the "%" column. A count of ambiguous blocks that could belong to more than one source file is in the Multi column. The number of blocks missing from the source file, i.e., not carved, is in the Missing column.

Detailed Analysis of Carved Files From Contiguous Image of JPG Files

Carved	Src	Bytes_seen	Blocks	%	Multi	Missing
C001	dino.jpg	3,425,280	6,690	100.00	0	0
C002	grizzly.jpg	2,785,792	5,441	100.00	0	0
C003	jump.jpg	2,016,256	3,938	100.00	0	0
C004	leaf.jpg	797,696	1,558	100.00	1	0
C005	oak-snow.jpg	1,370,112	2,676	100.00	1	0
C006	stonehenge.jpg	1,235,968	2,414	100.00	1	0

7.3.4 Image Layout for JPG Non-Aligned on Clusters

The following table describes the layout of an image file. The image file is constructed from chunks of data from the source files, separated by chunks of fill data. All chunks are multiples of 512 bytes.

The Chunk column is the chunk identifier. The Source File column is the name of the file providing data. The Bytes column is the size of the chunk in bytes. The Spill column is the number of data bytes in the last block in the chunk (if less than 512). The Blocks column is the number of blocks in the chunk. The "%" column is the percentage of the file in the chunk. The Fill Blocks column is the number of blocks of fill data in the next chunk.

Layout for Non-Aligned on Clusters Image (Offset 313 bytes) of JPG Files

Chunk	Source_file	Bytes	Spill	Blocks	%	Fill_Blocks
0	dino.jpg	3,424,980	212	6,690	100.00	1
2	grizzly.jpg	2,785,455	175	5,441	100.00	2
4	jump.jpg	2,015,880	136	3,938	100.00	0
6	leaf.jpg	798,064	368	1,559	100.00	5
8	oak-snow.jpg	1,370,140	28	2,677	100.00	34
10	stonehenge.jpg	1,236,401	433	2,415	100.00	21

7.3.5 Analysis of Carving Results for JPG Non-Aligned on Clusters

The following table presents the results of the manual inspection of carved files. The Tool Generated File Name column presents the names of the carved files as assigned by the tested tool. Because the name assigned to each carved file may be rather long, a short abbreviation is

assigned to each file name. The abbreviation presented in the Abbreviation column is used to identify each carved file in the following two tables. The Evaluation column presents the evaluation assigned to the carved file during a manual examination of the file. A value of "pending" is given if the file has not yet been examined.

Inspection Results for Non-Aligned on Clusters Image of JPG Files

Tool Generated File Name	Abbreviation	Evaluation
image-non-jpg.dd embedded 1.jpg	C001	Complete no flaws
image-non-jpg.dd embedded 2.jpg	C002	Complete no flaws
image-non-jpg.dd embedded 3.jpg	C003	Complete no flaws
image-non-jpg.dd embedded 4.jpg	C004	Complete no flaws
image-non-jpg.dd embedded 5.jpg	C005	Complete no flaws
image-non-jpg.dd embedded 6.jpg	C006	Complete no flaws

The following table presents the size in bytes and 512-byte blocks of each carved file. The source of the first block is also noted. The file is identified by the short abbreviation defined in the table above.

Description of Carved Files From Non-Aligned on Clusters Image of JPG Files

File_Abbreviation	Bytes	Spill	Blocks	fill	unknown	FirstSource
C001	3,424,980	212	6,690	0	0	dino.jpg
C002	2,785,455	175	5,441	0	0	grizzly.jpg
C003	2,015,880	136	3,938	0	0	jump.jpg
C004	798,064	368	1,559	0	0	leaf.jpg
C005	1,370,140	28	2,677	0	0	oak-snow.jpg
C006	1,236,401	433	2,415	0	0	stonehenge.jpg

6 JPG signatures were found in the Non-Aligned on Clusters image, 6 expected, no file signatures from an unknown source. No files were missed.
0 EXIF embedded thumbnails found, 3 expected.

The following table presents a detailed analysis of the content of each carved file. For each carved file one or more rows follow with an analysis of each source that contributed to the carved file (identified by the file name abbreviation). The source file name is in the column labeled Src. The number of bytes from that source is listed in the Bytes_seen column. The number of 512-byte blocks from that source is in the Blocks column. The percent of the source file included in the carved file is in the "%" column. A count of ambiguous blocks that could belong to more than one source file is in the Multi column. The number of blocks missing from the source file, i.e., not carved, is in the Missing column.

Detailed Analysis of Carved Files From Non-Aligned on Clusters Image of JPG Files

Carved	Src	Bytes_seen	Blocks	%	Multi	Missing
C001	dino.jpg	3,425,280	6,690	100.00	0	0

Carved	Src	Bytes_seen	Blocks	%	Multi	Missing
C002	grizzly.jpg	2,785,792	5,441	100.00	0	0
C003	jump.jpg	2,016,256	3,938	100.00	0	0
C004	leaf.jpg	797,696	1,558	100.00	1	0
C005	oak-snow.jpg	1,370,112	2,676	100.00	1	0
C006	stonehenge.jpg	1,235,968	2,414	100.00	1	0

7.3.6 Image Layout for JPG Fragmented in Order

The following table describes the layout of an image file. The image file is constructed from chunks of data from the source files, separated by chunks of fill data. All chunks are multiples of 512 bytes.

The Chunk column is the chunk identifier. The Source File column is the name of the file providing data. The Bytes column is the size of the chunk in bytes. The Spill column is the number of data bytes in the last block in the chunk (if less than 512). The Blocks column is the number of blocks in the chunk. The "%" column is the percentage of the file in the chunk. The Fill Blocks column is the number of blocks of fill data in the next chunk.

Layout for Fragmented in Order Image of JPG Files

Chunk	Seq	Source_file	Bytes	Spill	Blocks	%	Fill_Blocks
0	1	dino.jpg	3,082,240	0	6,020	89.99	100
2	2	dino.jpg	342,740	212	670	10.01	2
4	1	grizzly.jpg	1,392,640	0	2,720	49.99	300
6	2	grizzly.jpg	1,392,815	175	2,721	50.00	50
8	1	jump.jpg	402,944	0	787	19.98	80
10	2	jump.jpg	1,612,936	136	3,151	80.00	13
12	1	leaf.jpg	199,168	0	389	24.95	210
14	2	leaf.jpg	239,104	0	467	29.96	100
16	3	leaf.jpg	318,976	0	623	39.96	2
18	4	leaf.jpg	40,816	368	80	5.11	300
20	1	oak-snow.jpg	1,232,896	0	2,408	89.95	50
22	2	oak-snow.jpg	137,244	28	269	10.01	80
24	1	stonehenge.jpg	617,984	0	1,207	49.98	13
26	2	stonehenge.jpg	618,417	433	1,208	50.01	210

7.3.7 Analysis of Carving Results for JPG Fragmented in Order

The following table presents the results of the manual inspection of carved files. The Tool Generated File Name column presents the names of the carved files as assigned by the tested tool. Because the name assigned to each carved file may be rather long, a short abbreviation is assigned to each file name. The abbreviation presented in the Abbreviation column is used to identify each carved file in the following two tables. The Evaluation column presents the evaluation assigned to the carved file during a manual examination of the file. A value of

"pending" is given if the file has not yet been examined.

Inspection Results for Fragmented in Order Image of JPG Files

Tool Generated File Name	Abbreviation	Evaluation
image-frag-jpg.dd embedded 1.jpg	C001	Usable minor flaws
image-frag-jpg.dd embedded 2.jpg	C002	Usable minor flaws
image-frag-jpg.dd embedded 3.jpg	C003	Incomplete major flaws
image-frag-jpg.dd embedded 4.jpg	C004	Incomplete major flaws
image-frag-jpg.dd embedded 5.jpg	C005	Usable minor flaws
image-frag-jpg.dd embedded 6.jpg	C006	Usable minor flaws

The following table presents the size in bytes and 512-byte blocks of each carved file. The source of the first block is also noted. The file is identified by the short abbreviation defined in the table above.

Description of Carved Files From Fragmented in Order Image of JPG Files

File_Abbreviation	Bytes	Spill	Blocks	fill	unknown	FirstSource
C001	3,476,180	212	6,790	100	0	dino.jpg
C002	2,939,055	175	5,741	300	0	grizzly.jpg
C003	2,056,840	136	4,018	80	0	jump.jpg
C004	957,808	368	1,871	312	0	leaf.jpg
C005	1,395,740	28	2,727	50	0	oak-snow.jpg
C006	1,243,057	433	2,428	13	0	stonehenge.jpg

6 JPG signatures were found in the Fragmented in Order image, 6 expected, no file signatures from an unknown source. No files were missed.

0 EXIF embedded thumbnails found, 3 expected.

The following table presents a detailed analysis of the content of each carved file. For each carved file one or more rows follow with an analysis of each source that contributed to the carved file (identified by the file name abbreviation). The source file name is in the column labeled Src. The number of bytes from that source is listed in the Bytes_seen column. The number of 512-byte blocks from that source is in the Blocks column. The percent of the source file included in the carved file is in the "%" column. A count of ambiguous blocks that could belong to more than one source file is in the Multi column. The number of blocks missing from the source file, i.e., not carved, is in the Missing column.

Detailed Analysis of Carved Files From Fragmented in Order Image of JPG Files

Carved	Src	Bytes_seen	Blocks	%	Multi	Missing
C001	dino.jpg	3,425,280	6,690	100.00	0	0
C002	grizzly.jpg	2,785,792	5,441	100.00	0	0
C003	jump.jpg	2,016,256	3,938	100.00	0	0
C004	leaf.jpg	797,696	1,558	100.00	1	0

Carved	Src	Bytes_seen	Blocks	%	Multi	Missing
C005	oak-snow.jpg	1,370,112	2,676	100.00	1	0
C006	stonehenge.jpg	1,235,968	2,414	100.00	1	0

7.4 Results for carving BMP

No BMP files were carved for any layout.

7.5 Results for carving TIFF

No TIFF files were carved for any layout.

7.6 Results for carving GIF

No GIF files were carved for any layout.