Funky File Formats

2014/12 31C3

ANGE ALBERTINI

ANGE ALBERTINI

reverse engineering

VISUAL DOCUMENTATIONS

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a file is:

So, this talk is about files… what are the usual files’ categories?

?

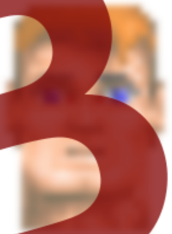
✓ VALID

✗ CORRUPTED

EXPLOIT

It depends if you're a newbie, a user, a dev, a hacker...

?



✓ VALID

BORING

...but in general, valid files aren’t very sexy!

✓ VALID

✗ CORRUPTED

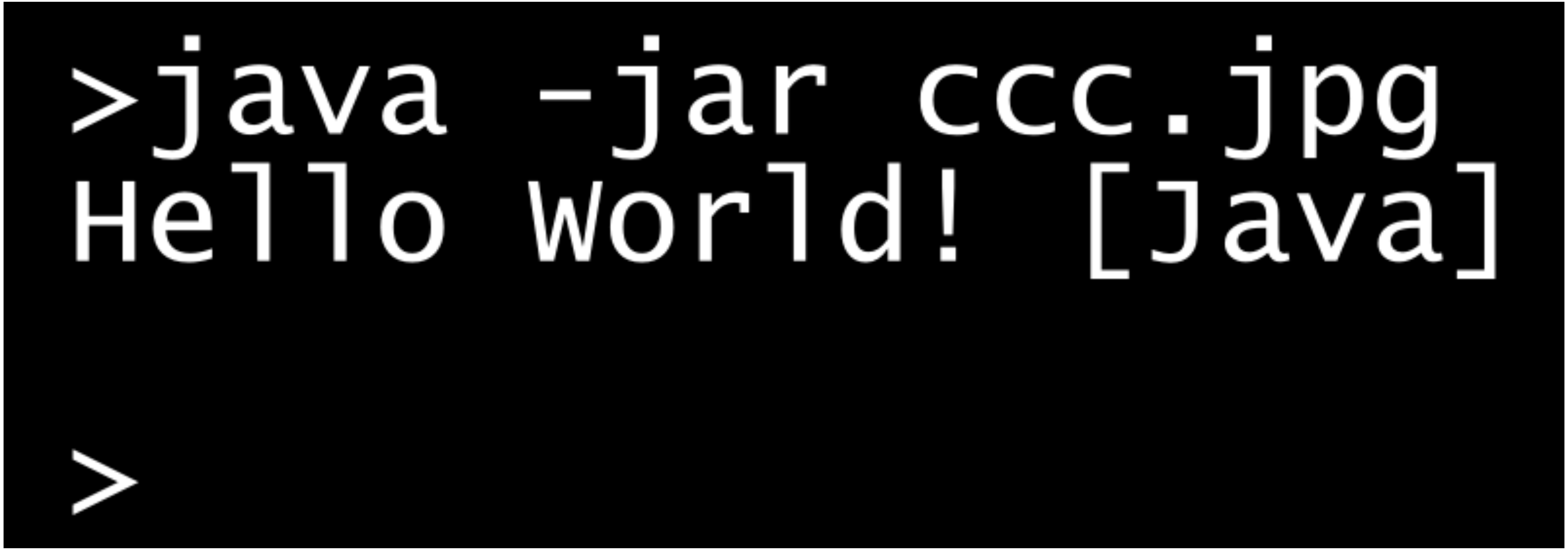
However, the frontier between valid and corrupted is not straight and clear !

Here is a *valid* file…

f76f5dafdcf0818c457e6ffb50ea61a67196dcd4 *ccc.jpg

(ok, maybe not a *standard* file)

This is a JPEG picture...

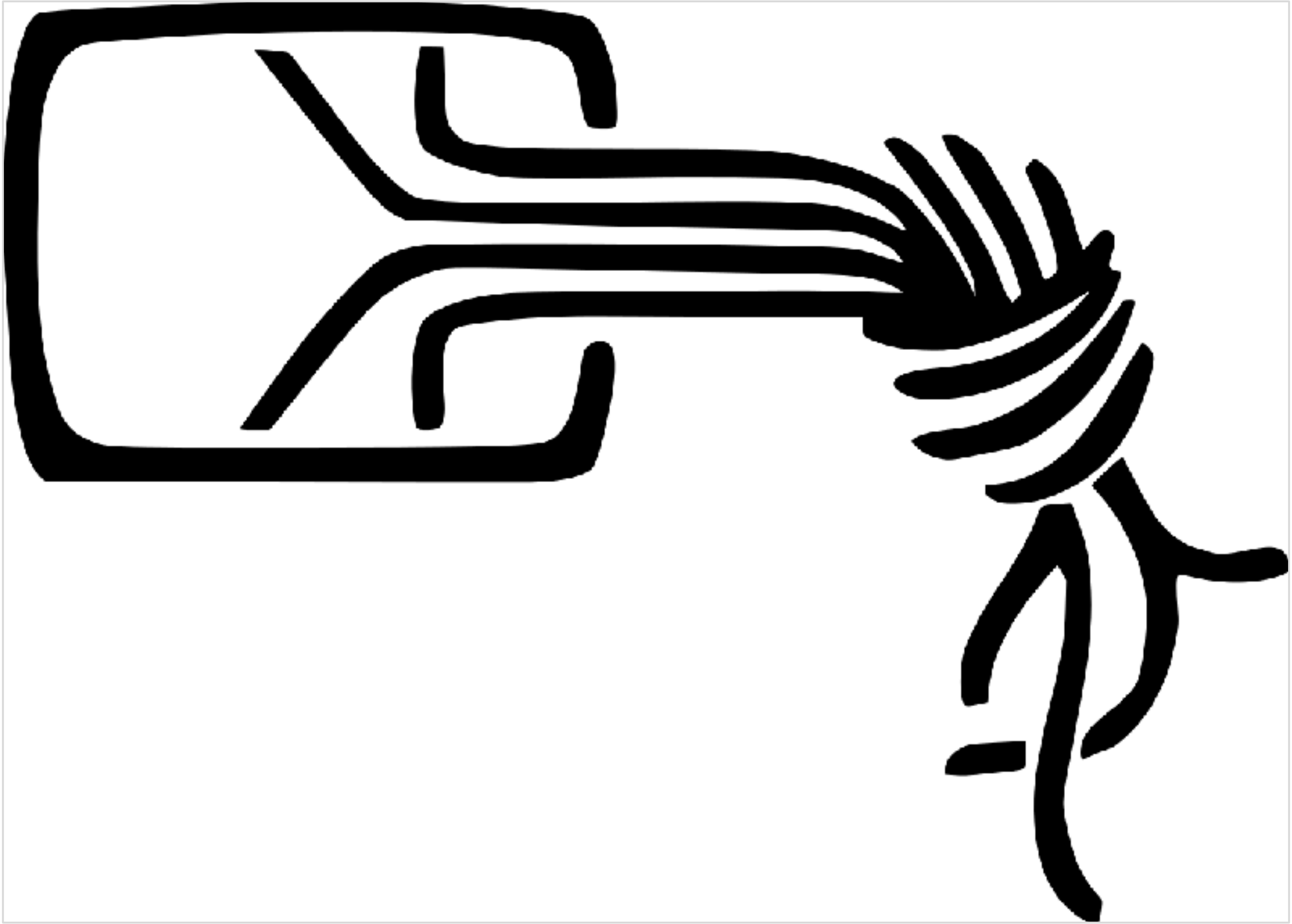


```
>java -jar ccc.jpg
Hello World! [Java]


>
```

...that’s also a Java file.

AES( )

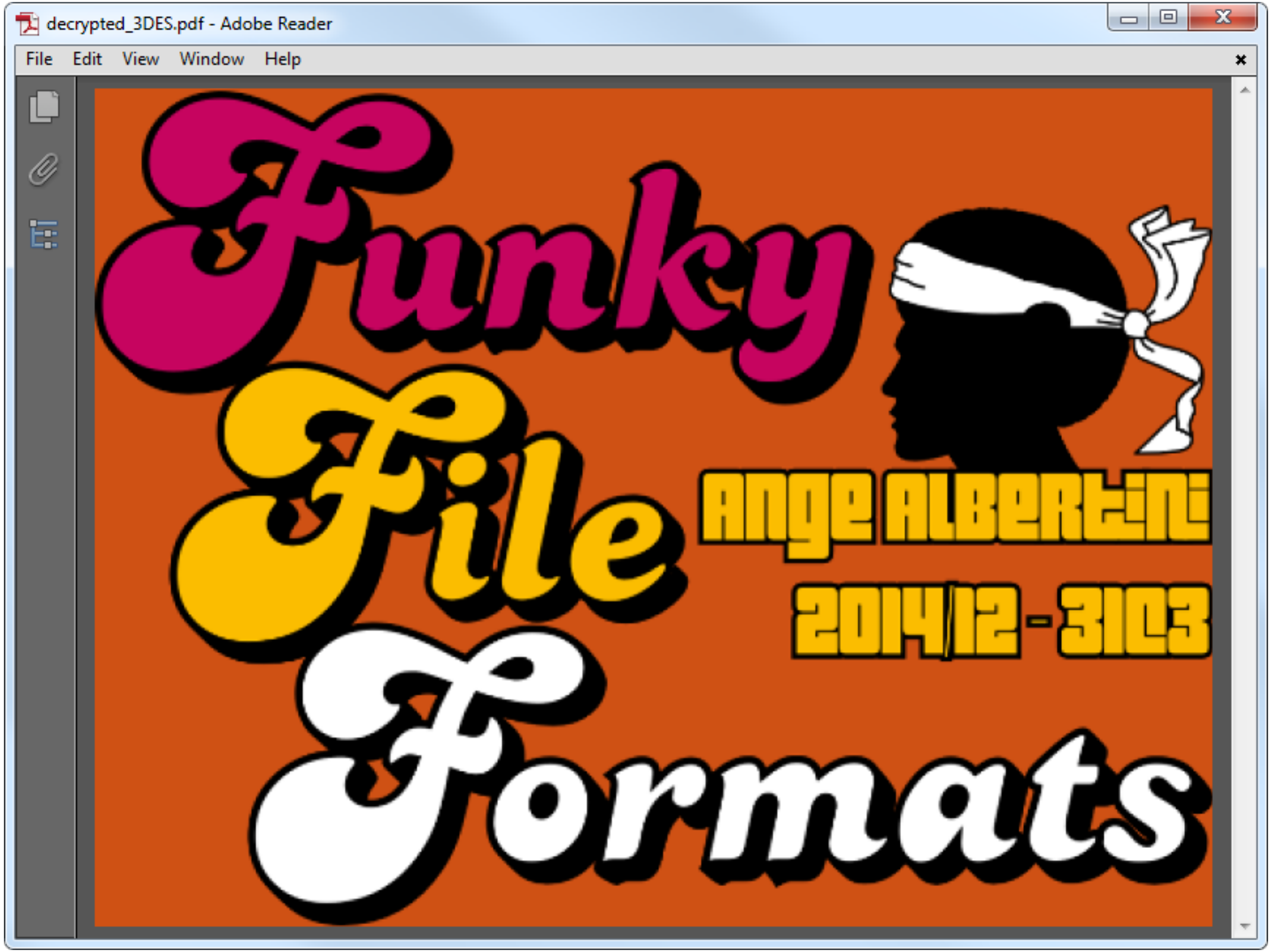
If you encrypt it with AES...



… you get a PNG picture.

3DES( )

If you ***de***crypt it with ***Triple DES***...

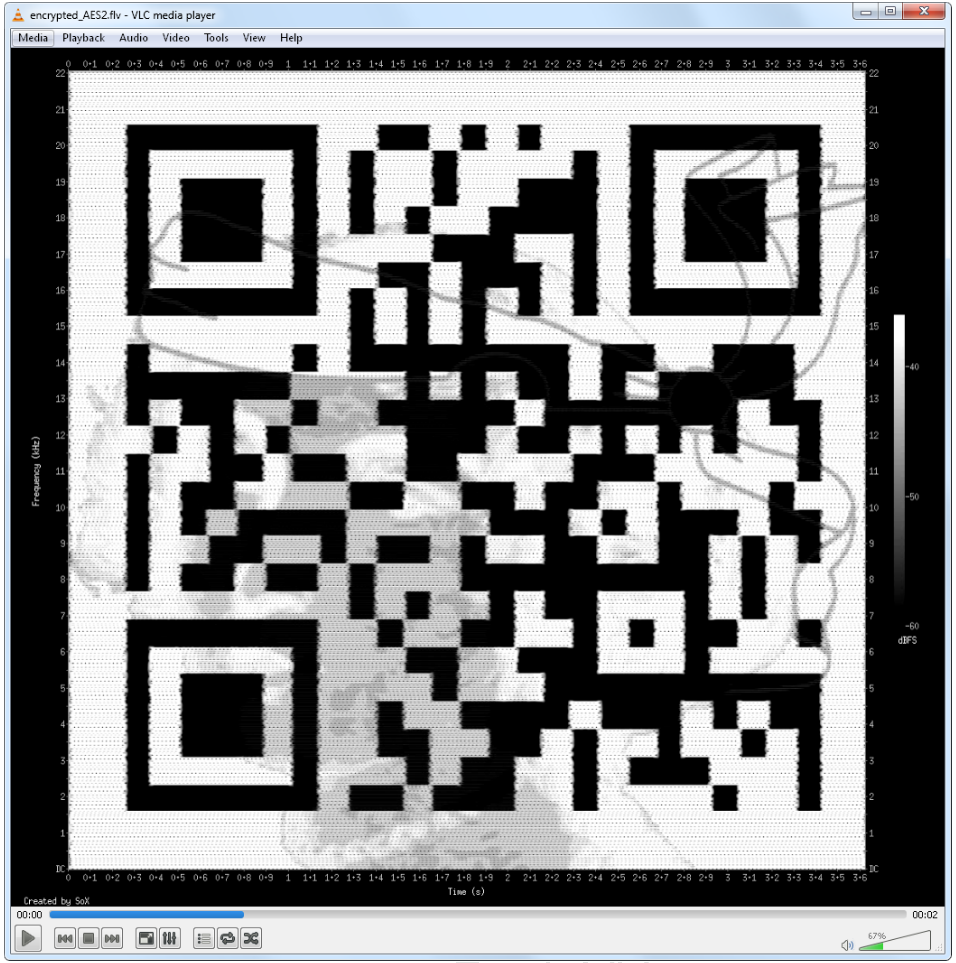


...you get a PDF document.

AES_{K_2} (

)

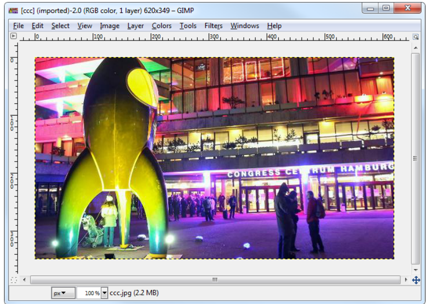
If you encrypt the original file with AES again, but with a **different key**...



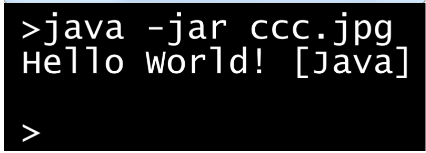
...you get a Flash Video…

..that … oh well, nevermind, I could go on for hours...

JPG

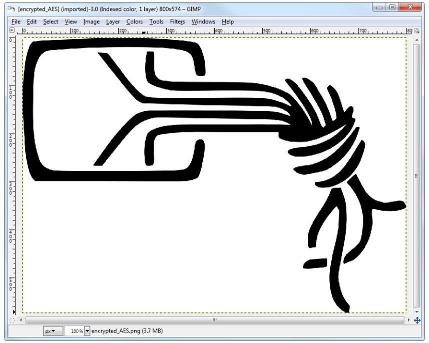

[ccc] (imported)-2.0 (RGB color, 1 layer) 620x349 – GIMP
File Edit Select View Image Layer Colors Tools Filters Windows Help
ccc.jpg (2.2 MB)

JAR
(ZIP + CLASS)



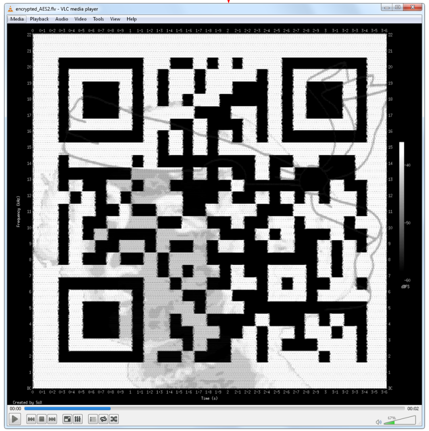
```
>java -jar ccc.jpg
Hello World! [Java]

>
```

AES_{K_1}


[encrypted_AES] (imported)-3.0 (Indexed color, 1 layer) 800x574 – GIMP
File Edit Select View Image Layer Colors Tools Filters Windows Help
encrypted_AES.png (3.7 MB)

PNG

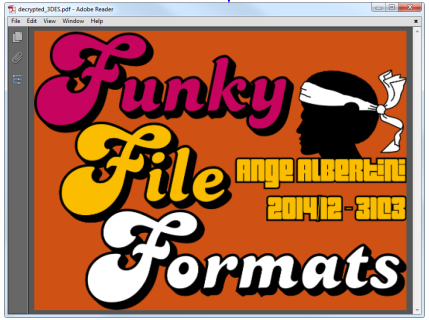
AES_{K_2}


encrypted_AES2.flv - VLC media player
Media Playback Audio Video Tools View Help

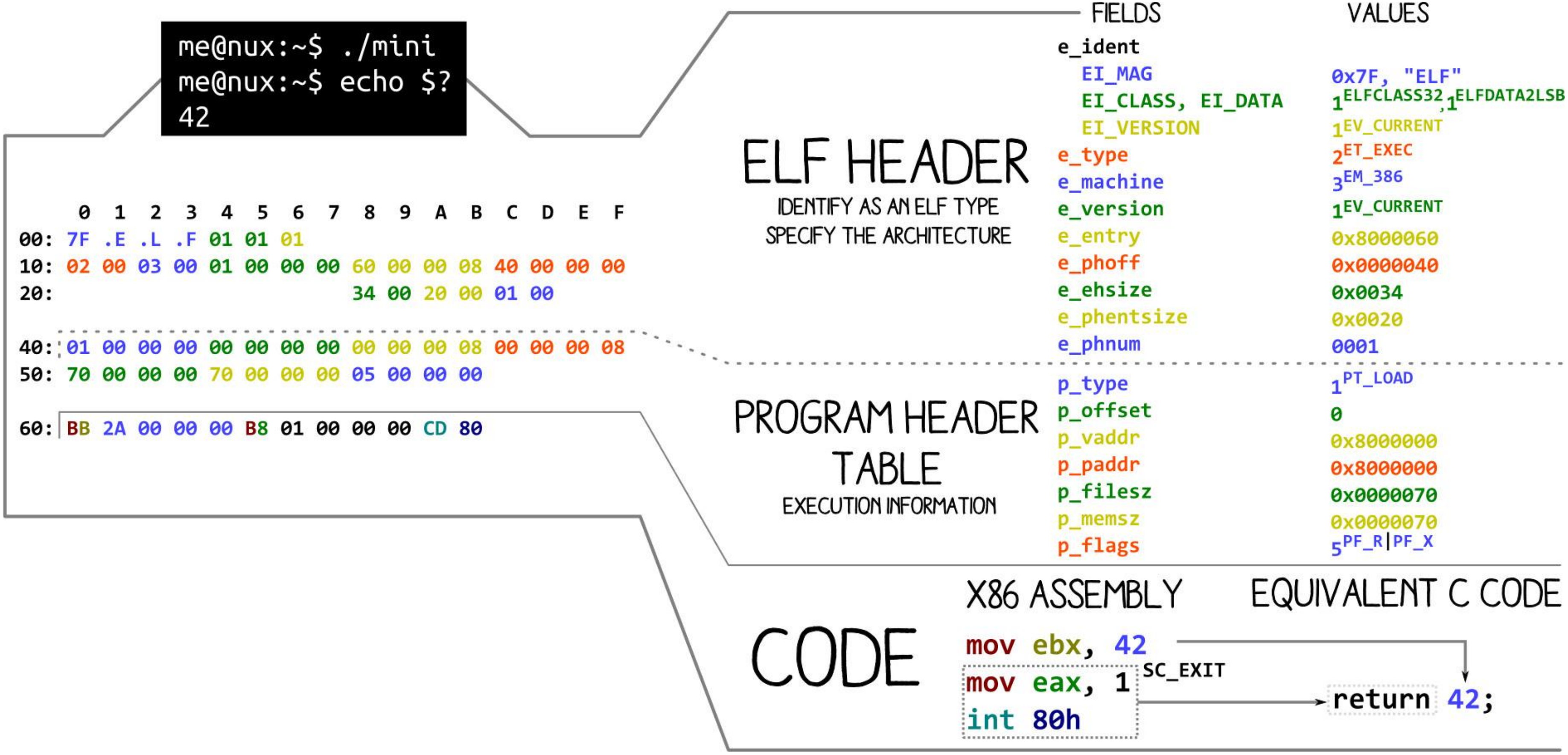
FLV

3DES

PDF



So, as you can see, I'm just a normal guy (who likes to play with binary).



```
me@nux:~$ ./mini
me@nux:~$ echo $?
42
```

```
     0  1  2  3  4  5  6  7  8  9  A  B  C  D  E  F
00: 7F .E .L .F 01 01 01
10: 02 00 03 00 01 00 00 00 60 00 00 08 40 00 00 00
20:                         34 00 20 00 01 00

40: 01 00 00 00 00 00 00 00 00 00 00 08 00 00 00 08
50: 70 00 00 00 70 00 00 00 05 00 00 00

60: BB 2A 00 00 00 B8 01 00 00 00 CD 80
```

ELF HEADER

IDENTIFY AS AN ELF TYPE
SPECIFY THE ARCHITECTURE

FIELDS	VALUES
e_ident	
EI_MAG	0x7F, "ELF"
EI_CLASS, EI_DATA	$1^{\text{ELFCLASS32}}$, $1^{\text{ELFDATA2LSB}}$
EI_VERSION	$1^{\text{EV\_CURRENT}}$
e_type	$2^{\text{ET\_EXEC}}$
e_machine	$3^{\text{EM\_386}}$
e_version	$1^{\text{EV\_CURRENT}}$
e_entry	0x8000060
e_phoff	0x0000040
e_ehsize	0x0034
e_phentsize	0x0020
e_phnum	0001

PROGRAM HEADER TABLE

EXECUTION INFORMATION

p_type	$1^{\text{PT\_LOAD}}$
p_offset	0
p_vaddr	0x8000000
p_paddr	0x8000000
p_filesz	0x0000070
p_memsz	0x0000070
p_flags	$5^{\text{PF\_R\|PF\_X}}$

CODE

X86 ASSEMBLY

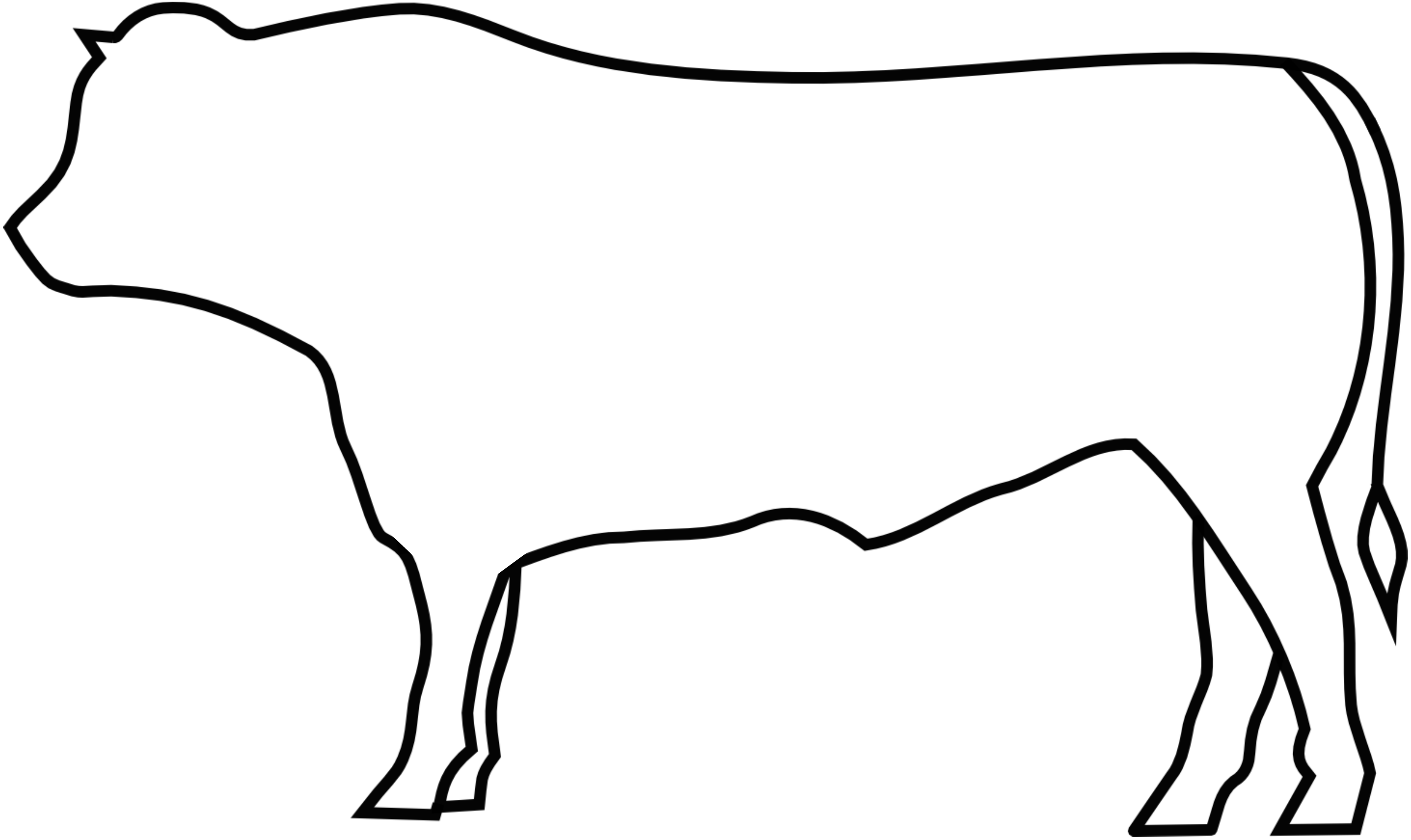
```
mov ebx, 42
mov eax, 1    SC_EXIT
int 80h
```

EQUIVALENT C CODE

```
return 42;
```

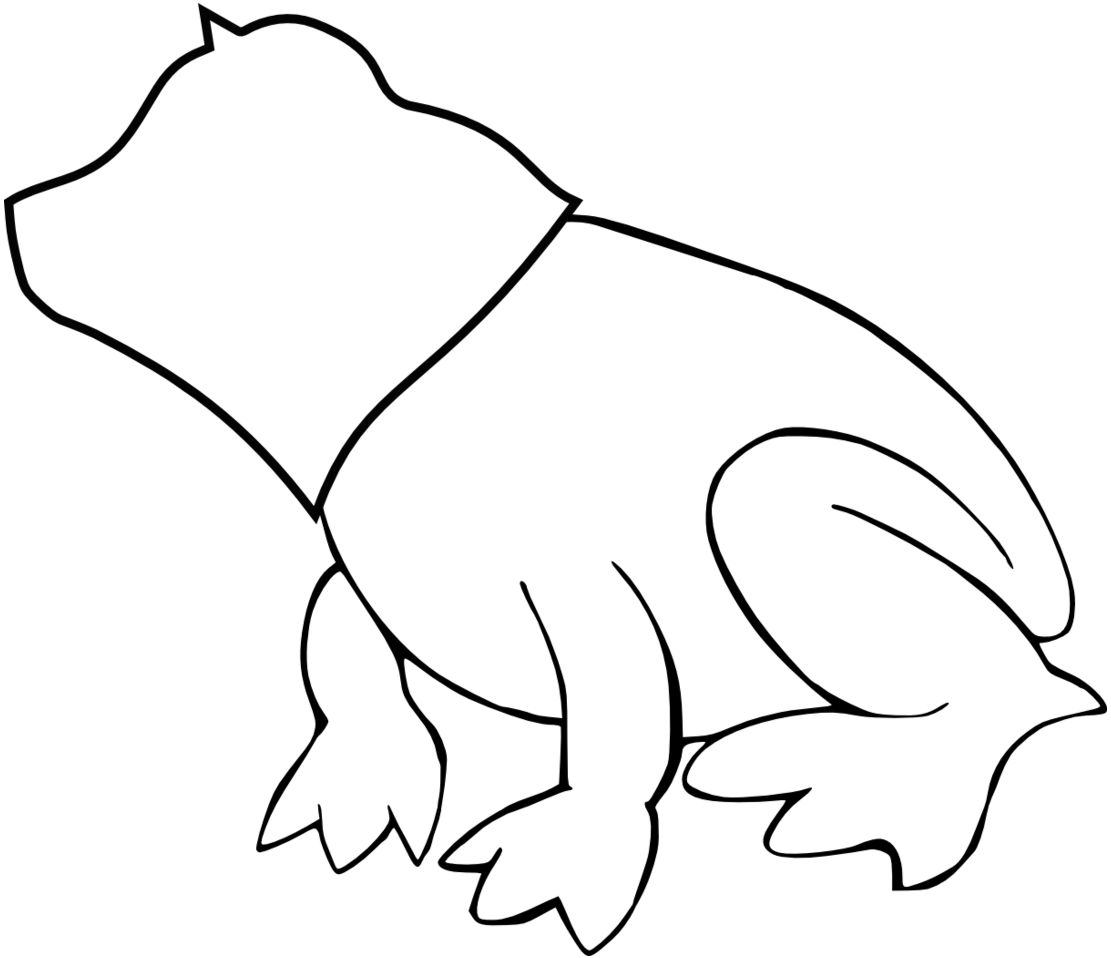
I also like to explain binary ⇒ pics.corkami.com / prints.corkami.com

Let’s talk about...

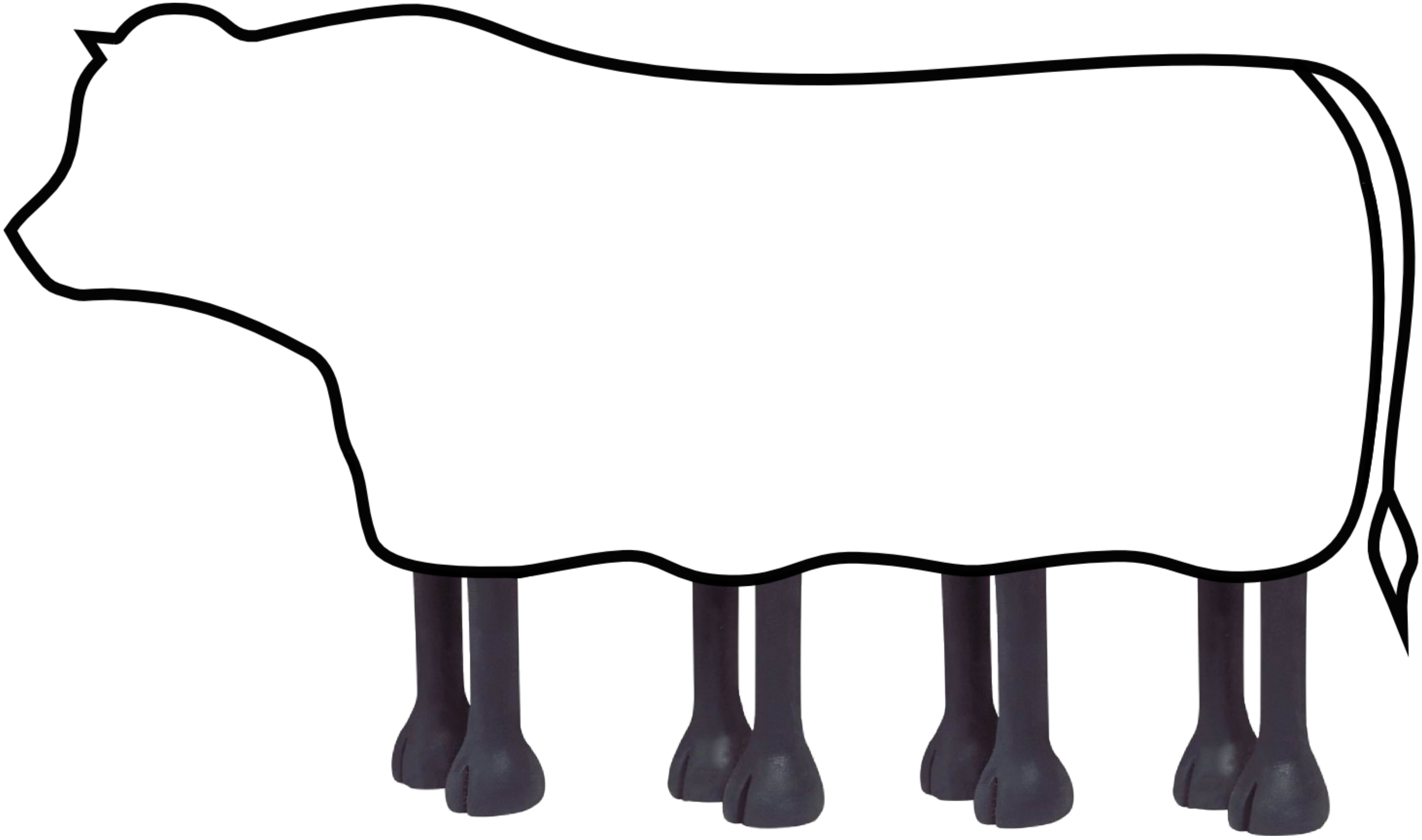


Identification

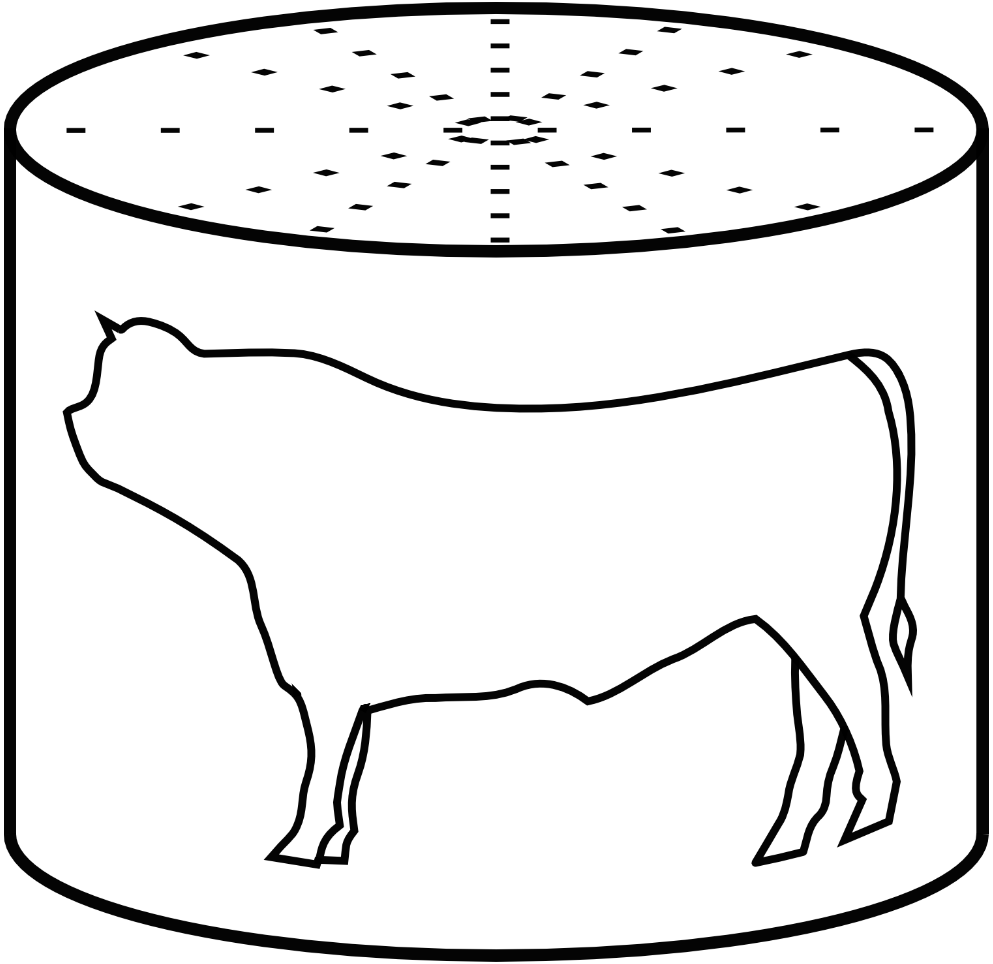
How do you identify a cow?



By its head?



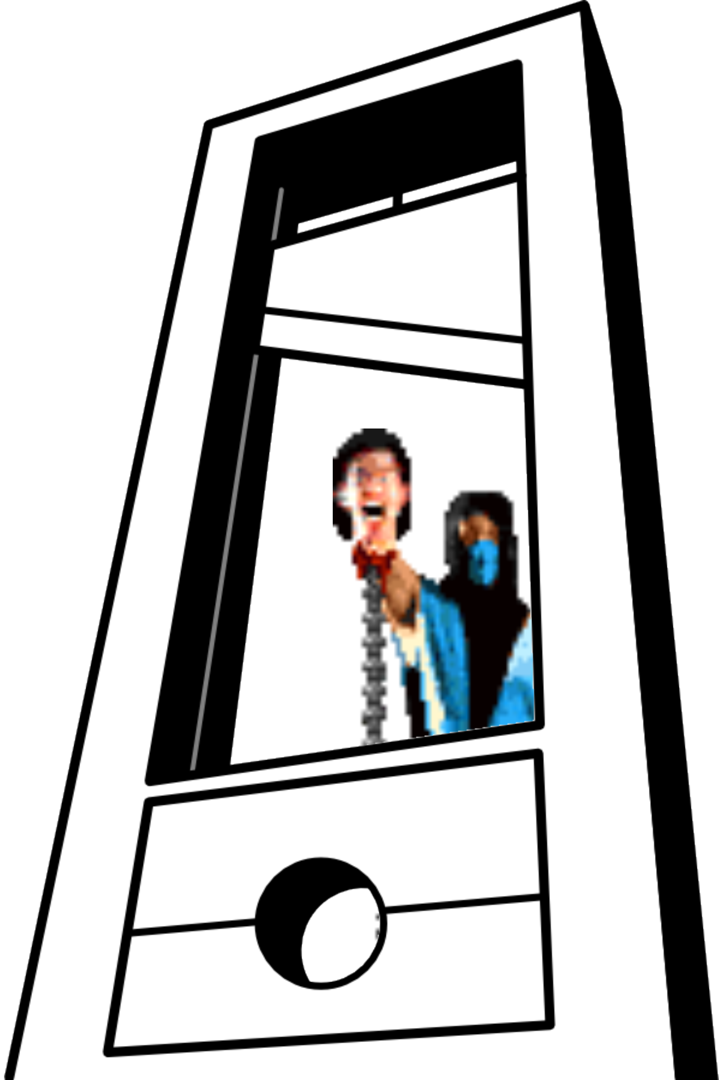
By its body?



By sound?

in practice…

early filetype identifier



Obvious

PE\0\0   \x7FELF   BPG\xFB

\x89PNG\x0D\x0A\x1A\x0A

dex\n035\0   RAR\x1a\7\0   BZ

GIF89a   BM   RIFF

Not obvious

GZip	1F 8B
JPG	FF D8

Not obvious, but l33tsp34k ^_^

CAFEBABE	Java / universal (old) Mach-O
DOCF11E0	Office
FEEDFACE	Mach-O
FEEDFACF	Mach-O (64b)

Egocentric

MZ (DOS header)	Mark Zbikowski
PK\3\4 (ZIP)	Philip Katz
BPG\xFB	Fabrice Bellard

Specific logic

TIFF:

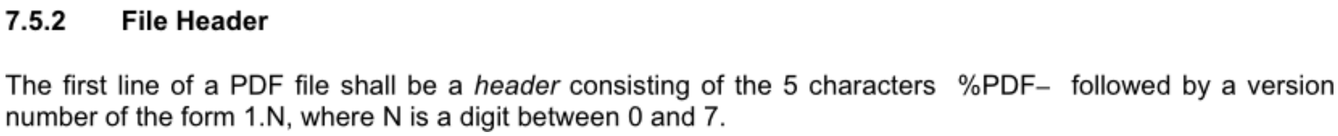
II	Intel (little) endianness
MM	Motorola (big) endianness

Flash:

FWS	ShockWave Flash (Flat)
CWS	(zlib) compressed
ZWS	LZMA compressed

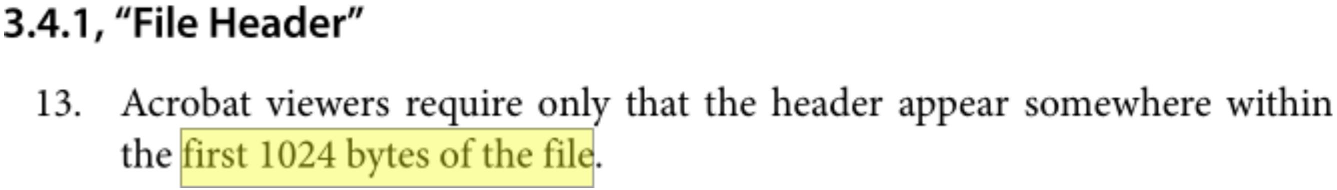
“Magic” signatures, enforced at offset 0

not enforcing signature at offset 0: **ZIP**, 7z, RAR, HTML
actually enforcing signature at offset 0: bzip2, GZip



7.5.2 File Header

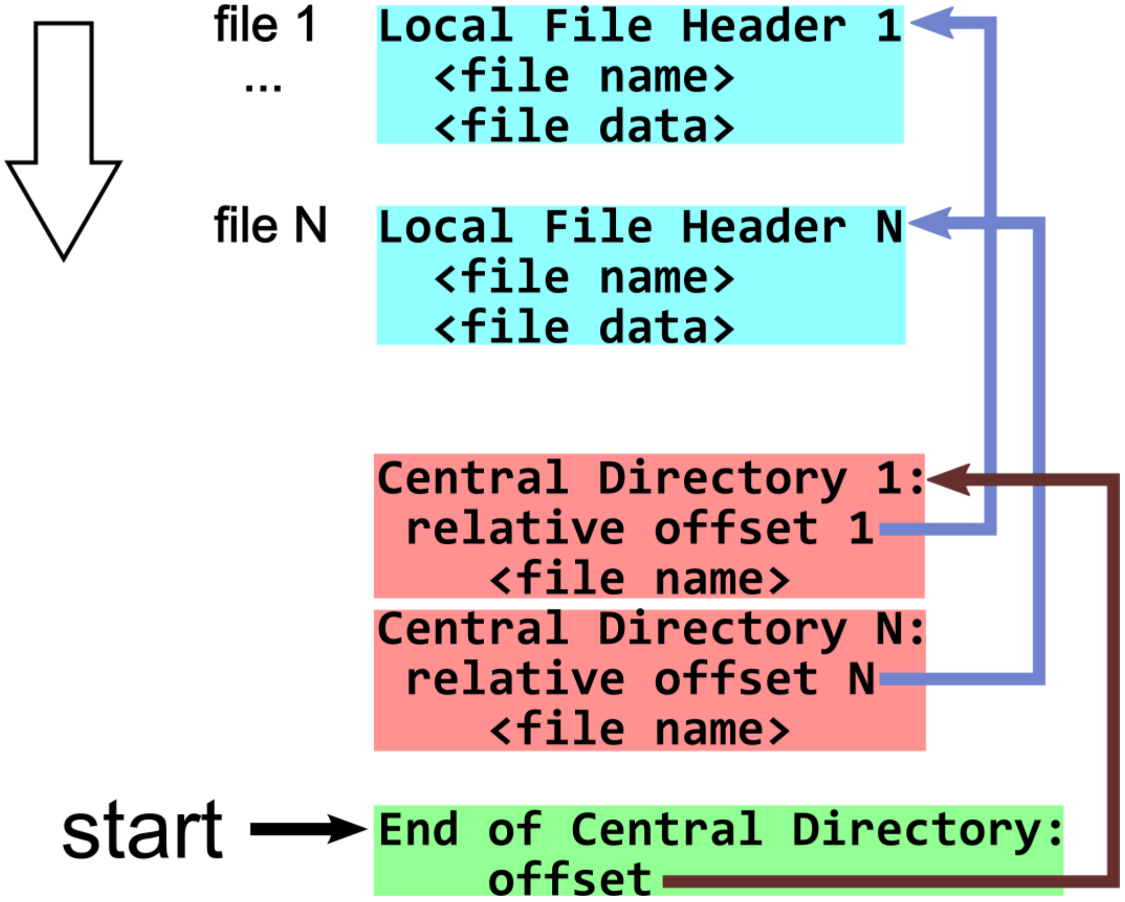
The first line of a PDF file shall be a *header* consisting of the 5 characters %PDF– followed by a version number of the form 1.N, where N is a digit between 0 and 7.



3.4.1, "File Header"

13. Acrobat viewers require only that the header appear somewhere within the first 1024 bytes of the file.

File formats not enforcing signature at offset 0
(ZIP is used in **many** formats: APK, ODT, DOCX, JAR…)



file 1

Local File Header 1
  <file name>
  <file data>

...

file N

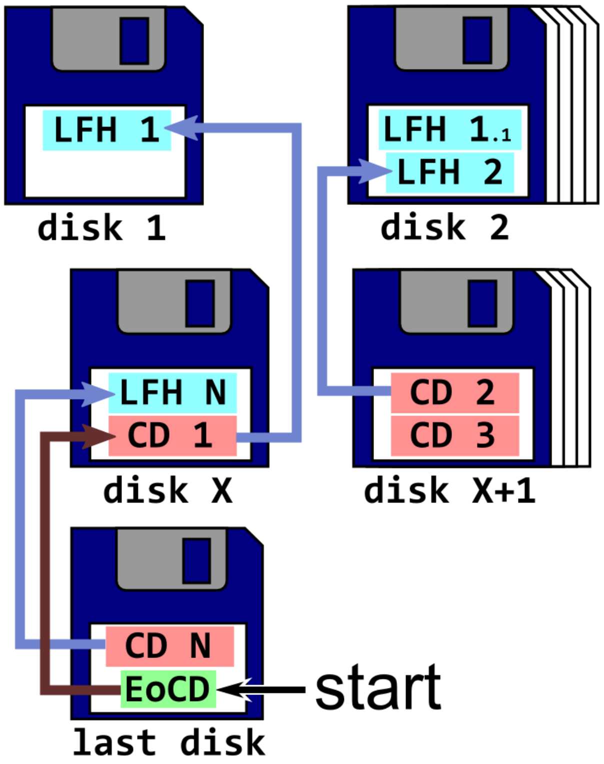
Local File Header N
  <file name>
  <file data>

Central Directory 1:
 relative offset 1
  <file name>

Central Directory N:
 relative offset N
  <file name>

start

End of Central Directory:
  offset



ZIP actually enforces “finishing” near the end of the file.

- TAR: Tape Archive
- Disk images: ISO, Master Boot Record
- TGA (image)
- (Console) roms

Hardware-bound formats: code/data at offset 0
‘header’ often (optionally) later in the memory space

a good magic signature:

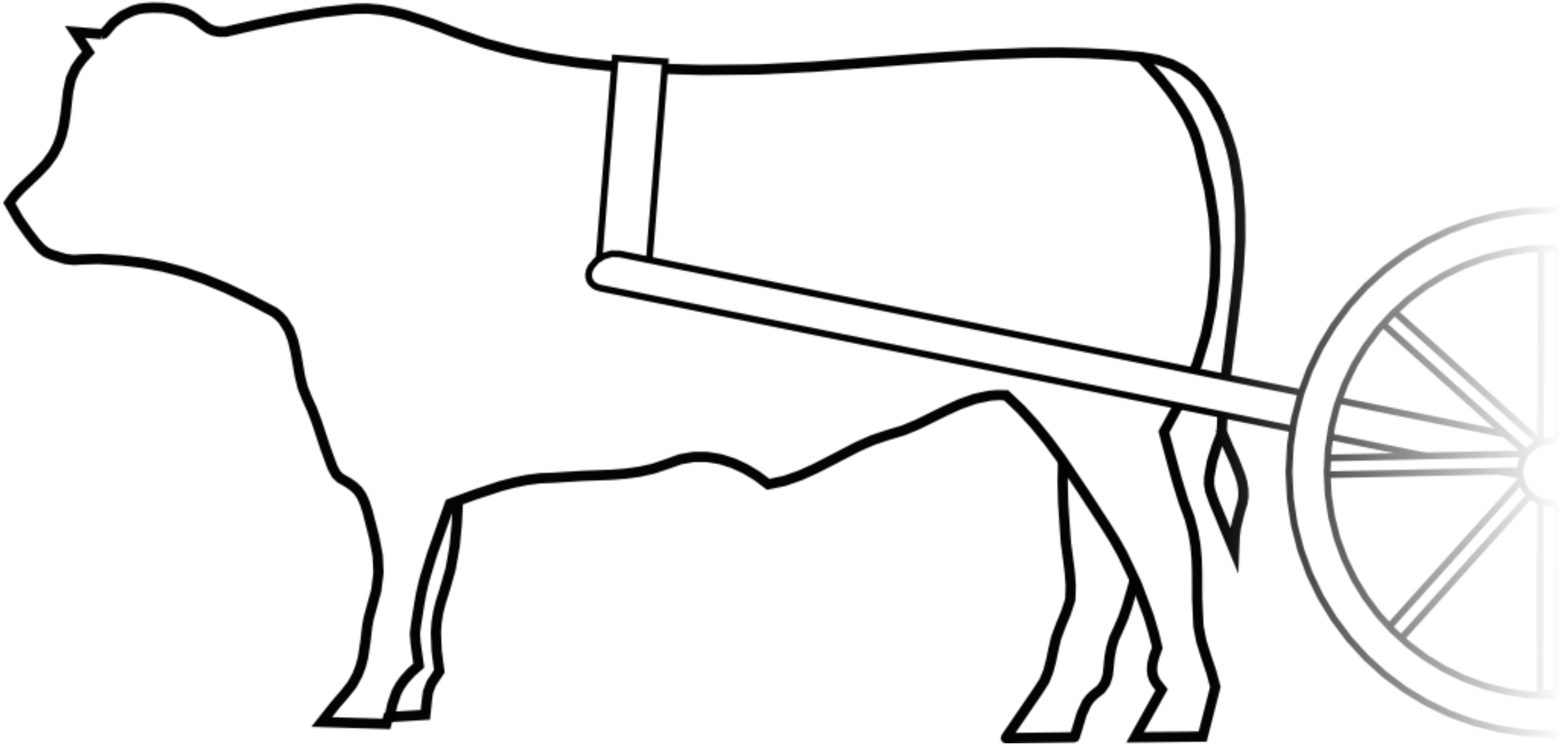
- **enforced at offset 0**
- **unique**

no magic ⇒ no excuse

Standard tool: checks magic, chooses path, never returns...

Another common yet important property

(useful for abuses)



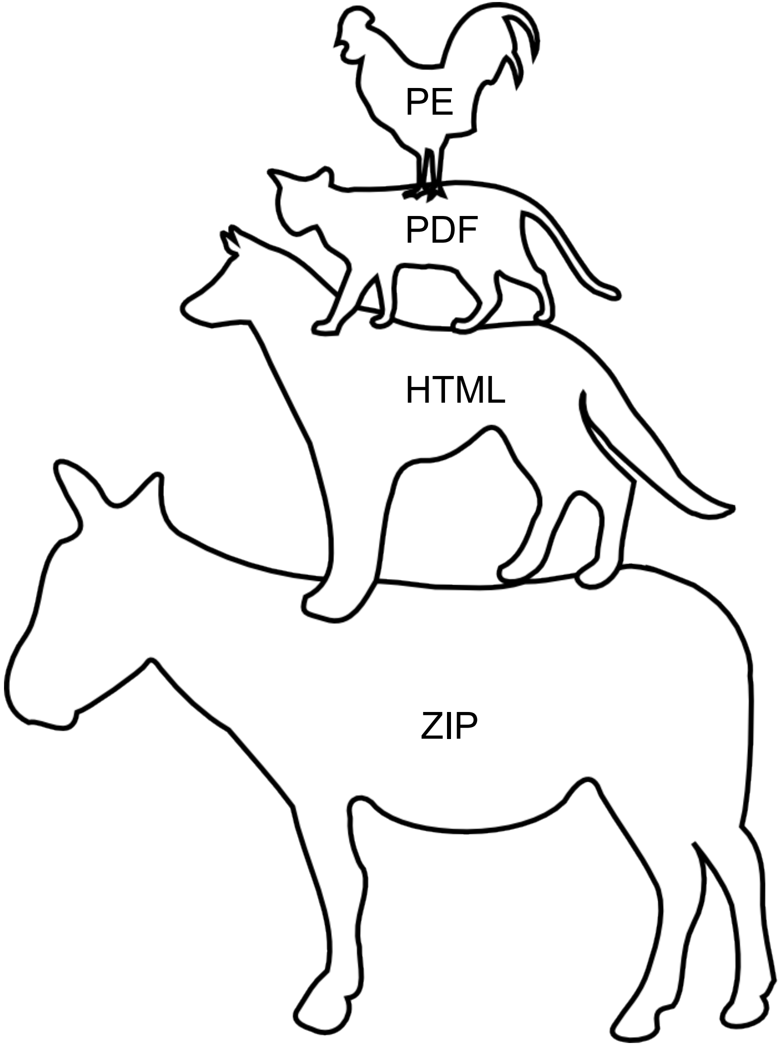
It’s a complete cow (you can see its whole body), with something next: appending something doesn’t invalidate the start.

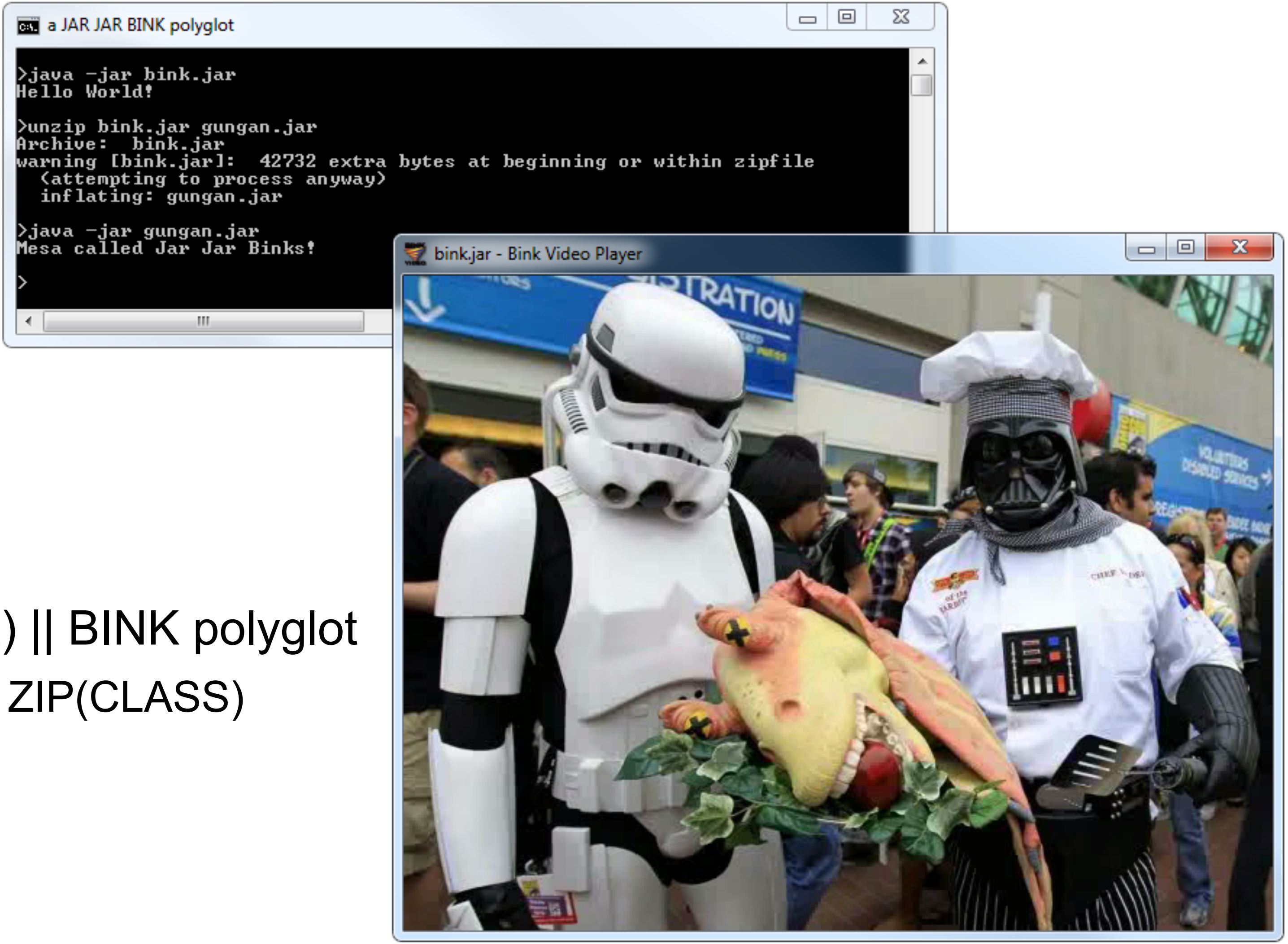
Remember:
there’s nothing to parse
after the terminator.

formats not enforced at offset 0

+ tolerating appended data

= **polyglots by concatenation**



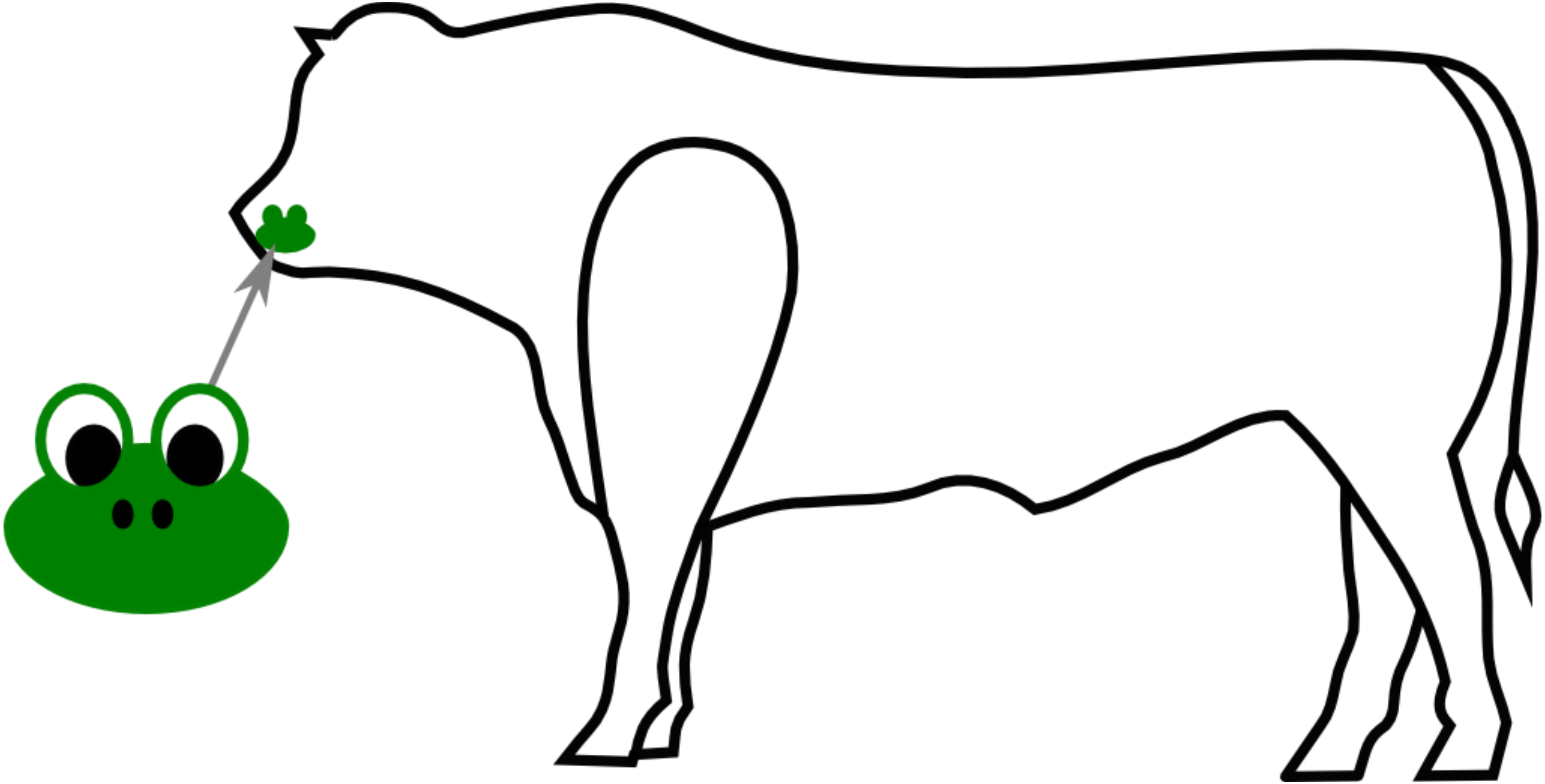


```
>java -jar bink.jar
Hello World!

>unzip bink.jar gungan.jar
Archive:  bink.jar
warning [bink.jar]:  42732 extra bytes at beginning or within zipfile
  (attempting to process anyway)
  inflating: gungan.jar

>java -jar gungan.jar
Mesa called Jar Jar Binks!

>
```

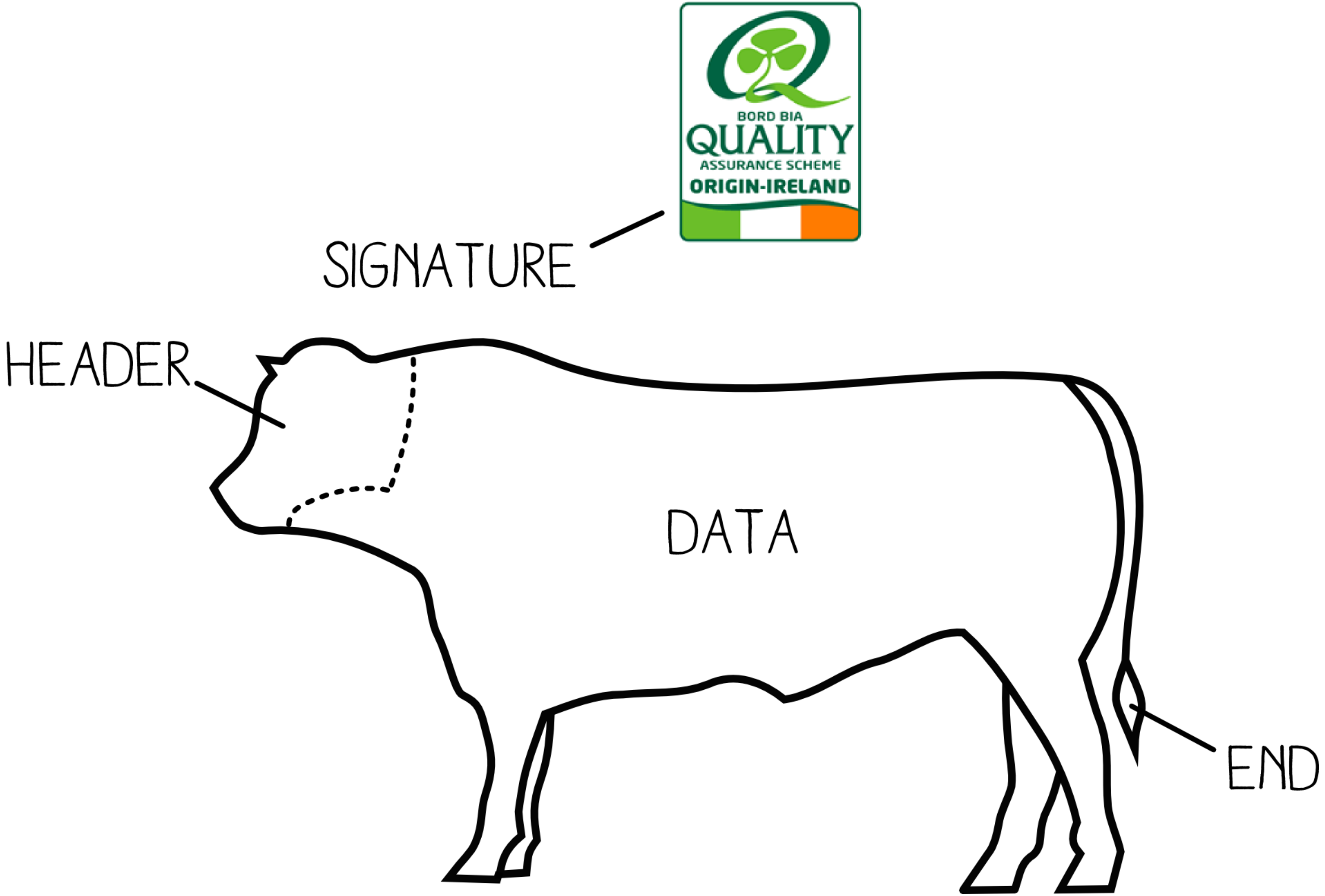
a JAR(JAR) || BINK polyglot

JAR = ZIP(CLASS)

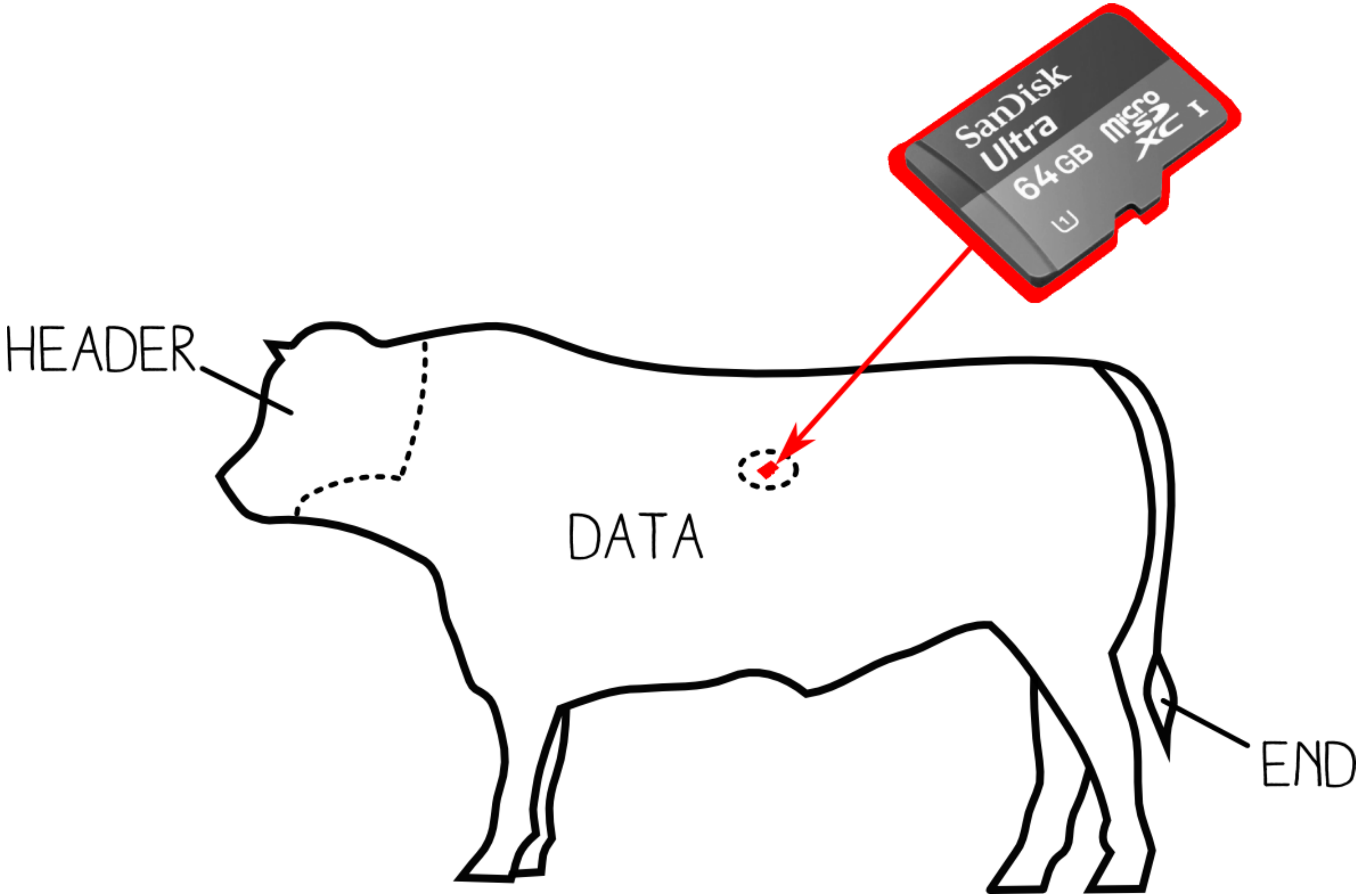
“host/parasite” polyglots



If a cow keeps a frog in its mouth, it can also speak 2 languages!
(the outer leaves space for an inner)

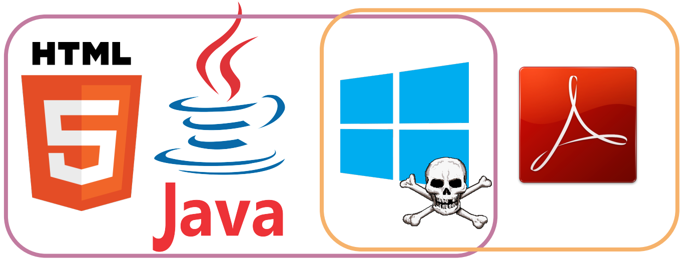


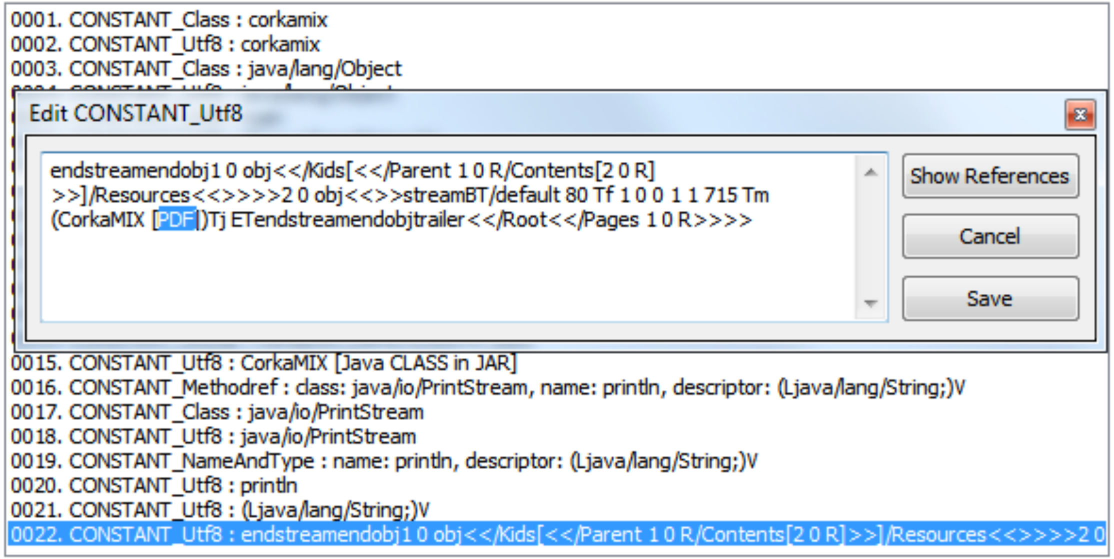
Ok, I know… here is a more realistic analogy...



...if our cow swallows a microSD, it’s still a valid cow!
Even if it contains foreign data, that is tolerated by the system.

2 infection chains in one file:





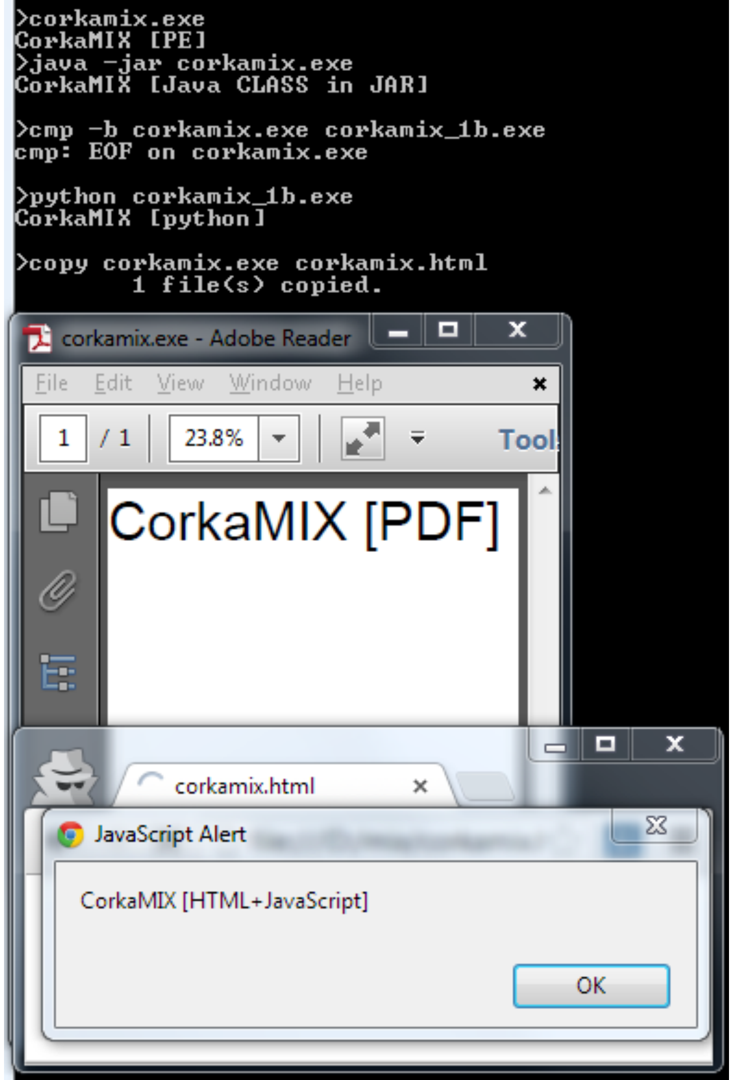
```
0001. CONSTANT_Class : corkamix
0002. CONSTANT_Utf8 : corkamix
0003. CONSTANT_Class : java/lang/Object
```

Edit CONSTANT_Utf8

```
endstreamendobj1 0 obj<</Kids[<</Parent 1 0 R/Contents[2 0 R]
>>]/Resources<<>>>>2 0 obj<<>>streamBT/default 80 Tf 1 0 0 1 1 715 Tm
(CorkaMIX [PDF])Tj ETendstreamendobjtrailer<</Root<</Pages 1 0 R>>>>
```

```
0015. CONSTANT_Utf8 : CorkaMIX [Java CLASS in JAR]
0016. CONSTANT_Methodref : class: java/io/PrintStream, name: println, descriptor: (Ljava/lang/String;)V
0017. CONSTANT_Class : java/io/PrintStream
0018. CONSTANT_Utf8 : java/io/PrintStream
0019. CONSTANT_NameAndType : name: println, descriptor: (Ljava/lang/String;)V
0020. CONSTANT_Utf8 : println
0021. CONSTANT_Utf8 : (Ljava/lang/String;)V
0022. CONSTANT_Utf8 : endstreamendobj1 0 obj<</Kids[<</Parent 1 0 R/Contents[2 0 R]>>]/Resources<<>>>>2 0
```

the PDF part is stored in a Java buffer



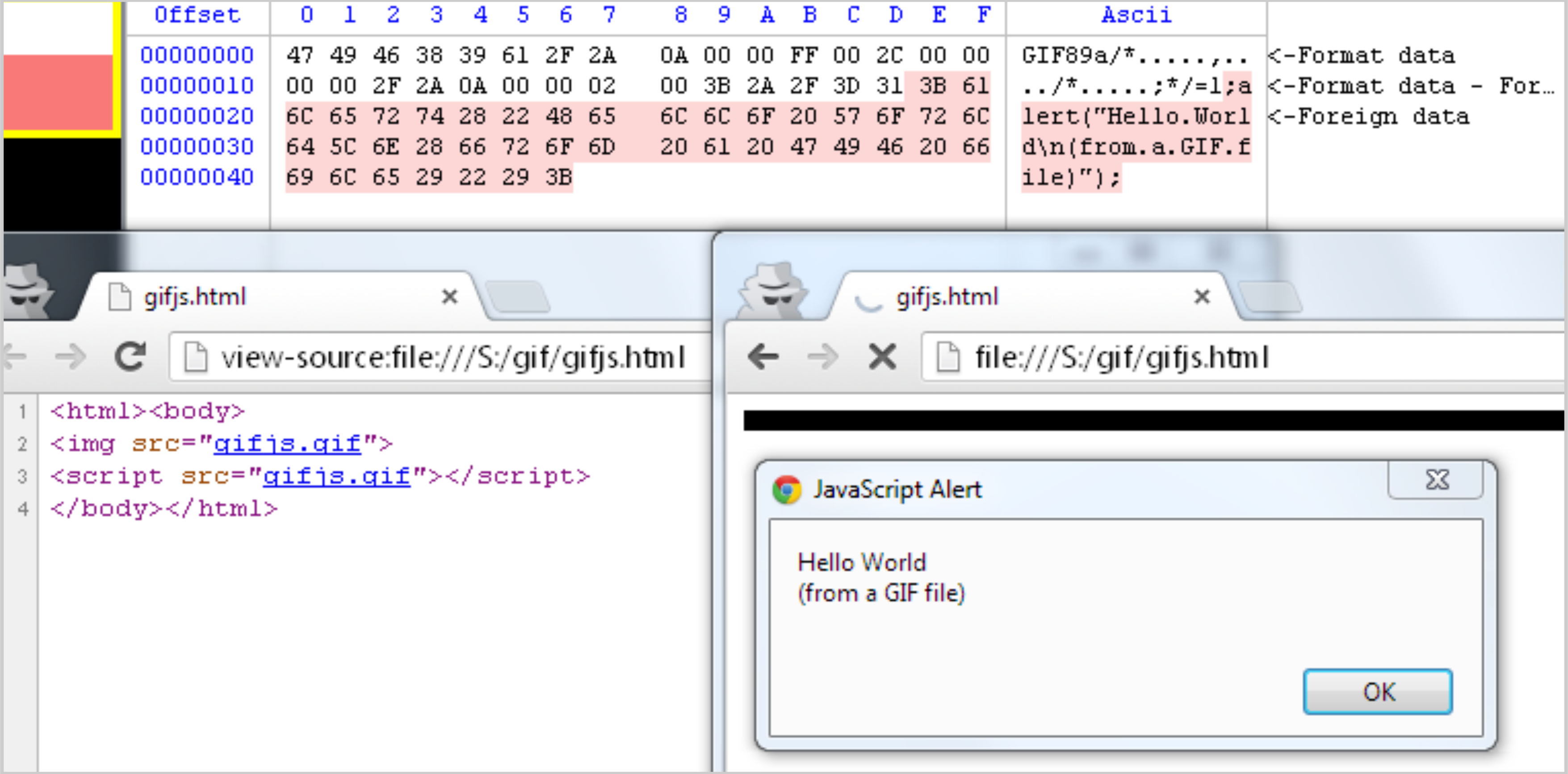
```
>corkamix.exe
CorkaMIX [PE]
>java -jar corkamix.exe
CorkaMIX [Java CLASS in JAR]

>cmp -b corkamix.exe corkamix_1b.exe
cmp: EOF on corkamix.exe

>python corkamix_1b.exe
CorkaMIX [python]

>copy corkamix.exe corkamix.html
        1 file(s) copied.
```

corkamix.exe - Adobe Reader

CorkaMIX [PDF]

JavaScript Alert

CorkaMIX [HTML+JavaScript]



```
Offset    0  1  2  3  4  5  6  7   8  9  A  B  C  D  E  F   Ascii
00000000  47 49 46 38 39 61 2F 2A  0A 00 00 FF 00 2C 00 00  GIF89a/*.....,..  <-Format data
00000010  00 00 2F 2A 0A 00 00 02  00 3B 2A 2F 3D 31 3B 61  ../*.....;*/=1;a  <-Format data - For…
00000020  6C 65 72 74 28 22 48 65  6C 6C 6F 20 57 6F 72 6C  lert("Hello.Worl  <-Foreign data
00000030  64 5C 6E 28 66 72 6F 6D  20 61 20 47 49 46 20 66  d\n(from.a.GIF.f
00000040  69 6C 65 29 22 29 3B                              ile)");
```

gifjs.html
view-source:file:///S:/gif/gifjs.html

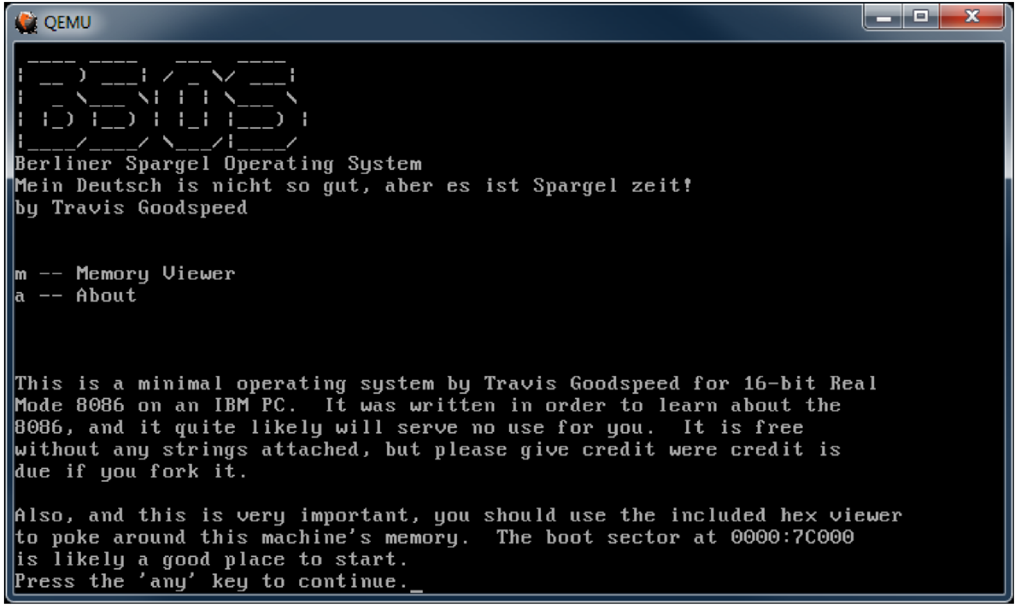
```
<html><body>
<img src="gifjs.gif">
<script src="gifjs.gif"></script>
</body></html>
```

gifjs.html
file:///S:/gif/gifjs.html
JavaScript Alert

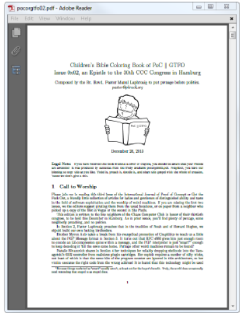
Hello World
(from a GIF file)

a JavaScript || GIF polyglot (useful for pwning - also in BMP flavor)

Such parasites exist already in the wild
(they just use unallocated space)



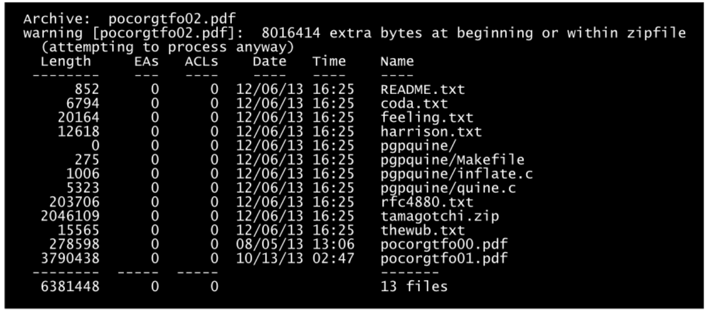
```
 ____  ____   ___  ____
| __ )  ___|/ _ \/ ___|
|  _ \___ \| | | \___ \
| |_) |__) | |_| |___) |
|____/____/ \___/|____/
Berliner Spargel Operating System
Mein Deutsch is nicht so gut, aber es ist Spargel zeit!
by Travis Goodspeed


m -- Memory Viewer
a -- About




This is a minimal operating system by Travis Goodspeed for 16-bit Real
Mode 8086 on an IBM PC.  It was written in order to learn about the
8086, and it quite likely will serve no use for you.  It is free
without any strings attached, but please give credit were credit is
due if you fork it.

Also, and this is very important, you should use the included hex viewer
to poke around this machine's memory.  The boot sector at 0000:7C000
is likely a good place to start.
Press the 'any' key to continue._
```



Children's Bible Coloring Book of PoC ‖ GTFO
Issue 0x02, an Epistle to the 30th CCC Congress in Hamburg

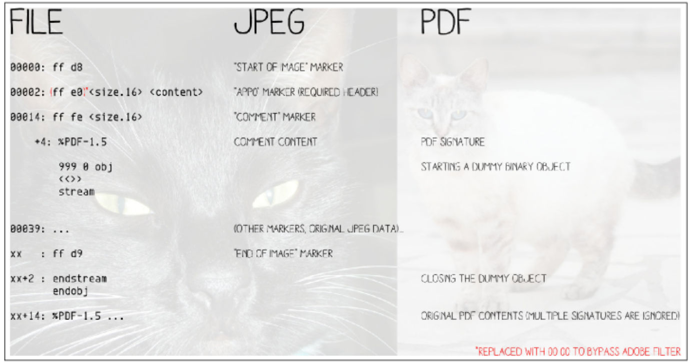
December 28, 2013

1 Call to Worship



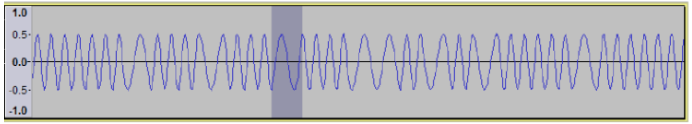
```
Archive:  pocorgtfo02.pdf
warning [pocorgtfo02.pdf]:  8016414 extra bytes at beginning or within zipfile
  (attempting to process anyway)
 Length     EAs   ACLs    Date   Time    Name
--------    ---   ----    ----   ----    ----
     852      0      0  12/06/13 16:25   README.txt
    6794      0      0  12/06/13 16:25   coda.txt
   20164      0      0  12/06/13 16:25   feeling.txt
   12618      0      0  12/06/13 16:25   harrison.txt
       0      0      0  12/06/13 16:25   pgpquine/
     275      0      0  12/06/13 16:25   pgpquine/Makefile
    1006      0      0  12/06/13 16:25   pgpquine/inflate.c
    5323      0      0  12/06/13 16:25   pgpquine/quine.c
  203706      0      0  12/06/13 16:25   rfc4880.txt
 2046109      0      0  12/06/13 16:25   tamagotchi.zip
   15565      0      0  12/06/13 16:25   thewub.txt
  278598      0      0  08/05/13 13:06   pocorgtfo00.pdf
 3790438      0      0  10/13/13 02:47   pocorgtfo01.pdf
--------  -----  -----                   -------
 6381448      0      0                   13 files
```

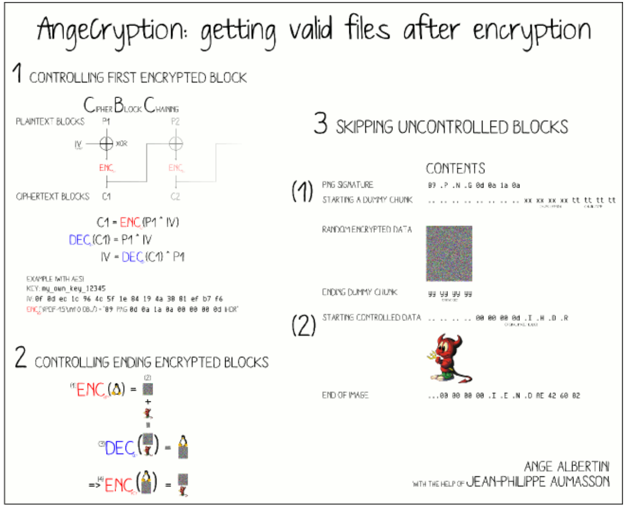
PoC||GTFO 0x2: MBR || PDF || ZIP



FILE	JPEG	PDF
00000: ff d8	"START OF IMAGE" MARKER	
00002: ff e0*<size.16> <content>	"APP0" MARKER (REQUIRED HEADER)	
00014: ff fe <size.16>	"COMMENT" MARKER	
+4: %PDF-1.5	COMMENT CONTENT	PDF SIGNATURE
999 0 obj <<>> stream		STARTING A DUMMY BINARY OBJECT
00039: ...	(OTHER MARKERS, ORIGINAL JPEG DATA)...	
xx : ff d9	"END OF IMAGE" MARKER	
xx+2 : endstream endobj		CLOSING THE DUMMY OBJECT
xx+14: %PDF-1.5 ...		ORIGINAL PDF CONTENTS (MULTIPLE SIGNATURES ARE IGNORED)

*REPLACED WITH 00 00 TO BYPASS ADOBE FILTER





AngeCryption: getting valid files after encryption

1 CONTROLLING FIRST ENCRYPTED BLOCK

C1 = ENC(P1 ^ IV)
DEC(C1) = P1 ^ IV
IV = DEC(C1) ^ P1

EXAMPLE WITH AES:
KEY: my_own_key_12345
IV: 0f 0d ec 1c 96 4c 5f 1e 04 19 4a 30 01 ef b7 f6
ENC("%PDF-1.5\n1 0 OBJ") = "89 PNG 0d 0a 1a 0a 00 00 00 0d IHDR"

2 CONTROLLING ENDING ENCRYPTED BLOCKS

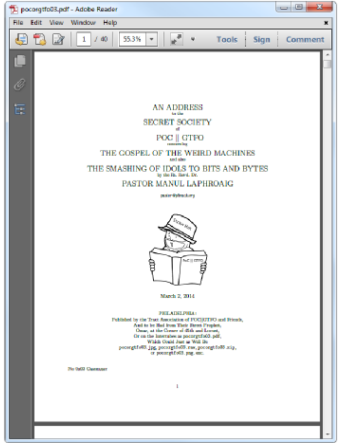
(1)ENC(△) = ▨ + ▨
(3)DEC(▨) = △
=> (4)ENC(△) = ▨

3 SKIPPING UNCONTROLLED BLOCKS

		CONTENTS
(1)	PNG SIGNATURE	89 .P .N .G 0d 0a 1a 0a
	STARTING A DUMMY CHUNK	.. .. xx xx xx xx tt tt tt tt
	RANDOM ENCRYPTED DATA	▨
	ENDING DUMMY CHUNK	yy yy yy yy
(2)	STARTING CONTROLLED DATA	.. .. 00 00 00 0d .I .H .D .R
	END OF IMAGE	...00 00 00 00 .I .E .N .D AE 42 60 82

ANGE ALBERTINI
WITH THE HELP OF JEAN-PHILIPPE AUMASSON

by Travis Goodspeed



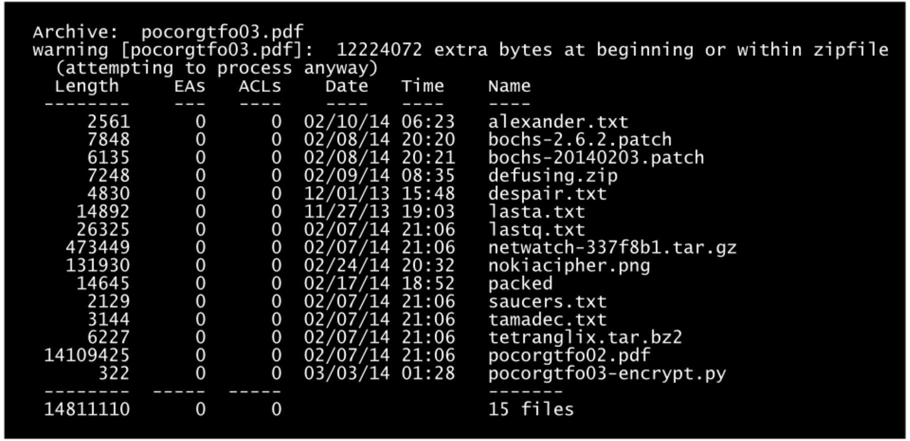
AN ADDRESS
to the
SECRET SOCIETY
of
POC || GTFO
concerning
THE GOSPEL OF THE WEIRD MACHINES
and also
THE SMASHING OF IDOLS TO BITS AND BYTES
by the Rt. Revd. Dr.
PASTOR MANUL LAPHROAIG
pastor@phrack.org

March 2, 2014

PHILADELPHIA:
Published by the Tract Association of POC||GTFO and Friends,
And to be Had from Their Street Prophet,
Omar, at the Corner of 45th and Locust,
Or on the Internetz as pocorgtfo03.pdf,
Which Could Just as Well Be
pocorgtfo03.jpg, pocorgtfo03.raw, pocorgtfo03.zip,
or pocorgtfo03.png, etc.

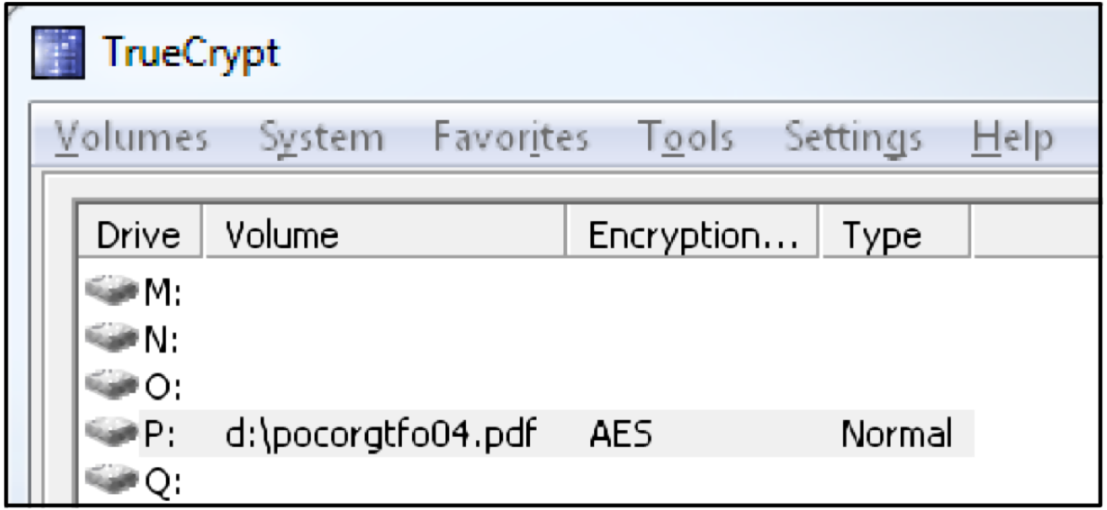
No 0x03 Clearance

1

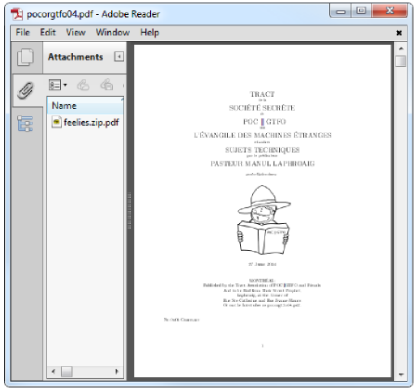


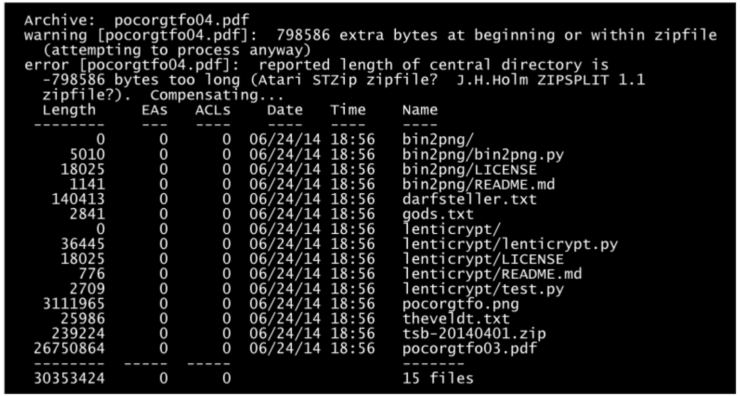
```
Archive:  pocorgtfo03.pdf
warning [pocorgtfo03.pdf]:  12224072 extra bytes at beginning or within zipfile
  (attempting to process anyway)
 Length     EAs   ACLs    Date    Time    Name
 --------   ---   ----    ----    ----    ----
     2561     0      0  02/10/14 06:23   alexander.txt
     7848     0      0  02/08/14 20:20   bochs-2.6.2.patch
     6135     0      0  02/08/14 20:21   bochs-20140203.patch
     7248     0      0  02/09/14 08:35   defusing.zip
     4830     0      0  12/01/13 15:48   despair.txt
    14892     0      0  11/27/13 19:03   lasta.txt
    26325     0      0  02/07/14 21:06   lastq.txt
   473449     0      0  02/07/14 21:06   netwatch-337f8b1.tar.gz
   131930     0      0  02/24/14 20:32   nokiacipher.png
    14645     0      0  02/17/14 18:52   packed
     2129     0      0  02/07/14 21:06   saucers.txt
     3144     0      0  02/07/14 21:06   tamadec.txt
     6227     0      0  02/07/14 21:06   tetranglix.tar.bz2
 14109425     0      0  02/07/14 21:06   pocorgtfo02.pdf
      322     0      0  03/03/14 01:28   pocorgtfo03-encrypt.py
 --------  -----  -----                   -------
 14811110     0      0                   15 files
```

PoC||GTFO 0x3: JPG || AFSK || AES(PNG) || PDF || ZIP



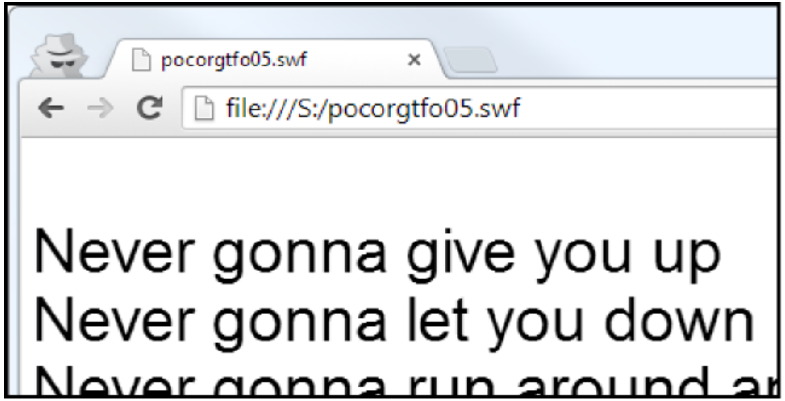
Drive	Volume	Encryption…	Type
M:			
N:			
O:			
P:	d:\pocorgtfo04.pdf	AES	Normal
Q:			



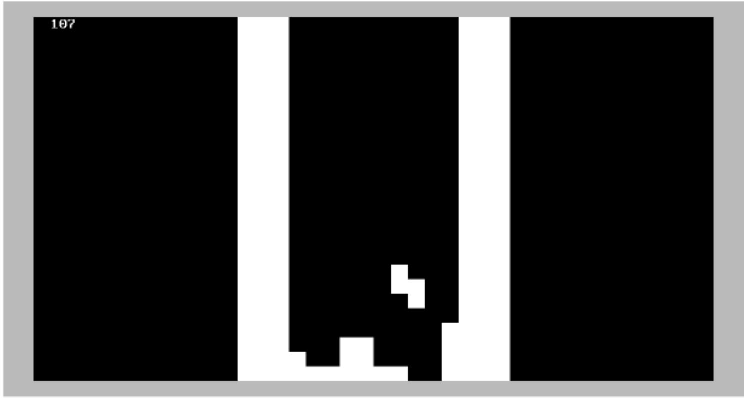


```
Archive:  pocorgtfo04.pdf
warning [pocorgtfo04.pdf]:  798586 extra bytes at beginning or within zipfile
  (attempting to process anyway)
error [pocorgtfo04.pdf]:  reported length of central directory is
  -798586 bytes too long (Atari STZip zipfile?  J.H.Holm ZIPSPLIT 1.1
  zipfile?).  Compensating...
 Length     EAs   ACLs    Date    Time     Name
 --------   ---   ----    ----    ----     ----
        0     0      0  06/24/14 18:56   bin2png/
     5010     0      0  06/24/14 18:56   bin2png/bin2png.py
    18025     0      0  06/24/14 18:56   bin2png/LICENSE
     1141     0      0  06/24/14 18:56   bin2png/README.md
   140413     0      0  06/24/14 18:56   darfsteller.txt
     2841     0      0  06/24/14 18:56   gods.txt
        0     0      0  06/24/14 18:56   lenticrypt/
    36445     0      0  06/24/14 18:56   lenticrypt/lenticrypt.py
    18025     0      0  06/24/14 18:56   lenticrypt/LICENSE
      776     0      0  06/24/14 18:56   lenticrypt/README.md
     2709     0      0  06/24/14 18:56   lenticrypt/test.py
  3111965     0      0  06/24/14 18:56   pocorgtfo.png
    25986     0      0  06/24/14 18:56   theveldt.txt
   239224     0      0  06/24/14 18:56   tsb-20140401.zip
 26750864     0      0  06/24/14 18:56   pocorgtfo03.pdf
 --------  -----  -----                  -------
 30353424     0      0                   15 files
```

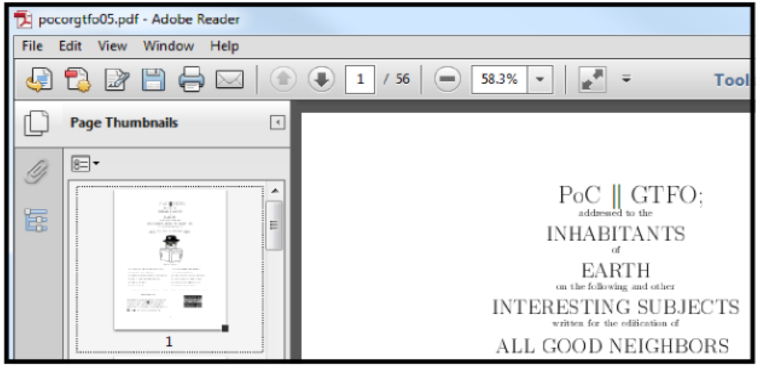
PoC||GTFO 0x4: TrueCrypt || PDF || ZIP



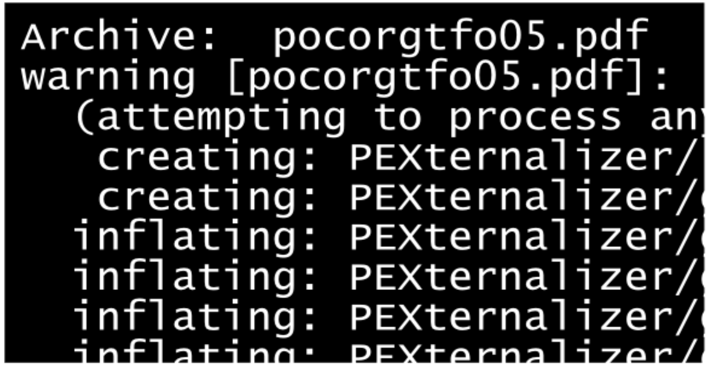
Never gonna give you up
Never gonna let you down
Never gonna run around ar



by Alex Inführ



PoC || GTFO;
addressed to the
INHABITANTS
of
EARTH
on the following and other
INTERESTING SUBJECTS
written for the edification of
ALL GOOD NEIGHBORS



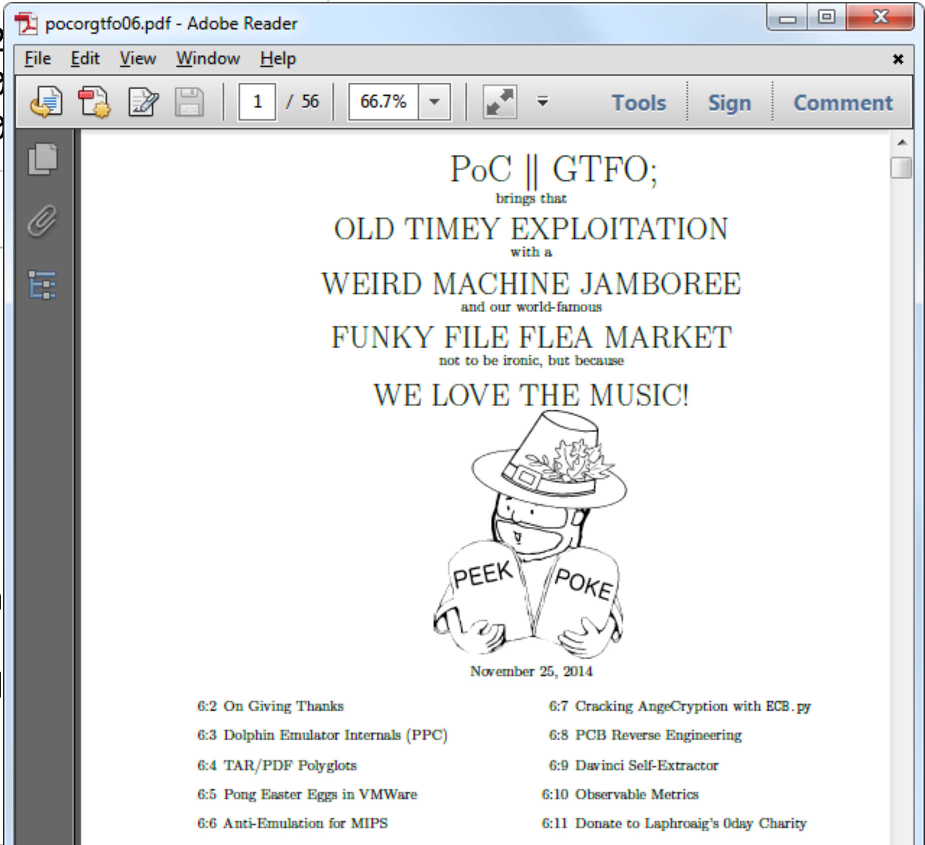
```
Archive:  pocorgtfo05.pdf
warning [pocorgtfo05.pdf]:
   (attempting to process an
    creating: PEXternalizer/
    creating: PEXternalizer/
   inflating: PEXternalizer/
   inflating: PEXternalizer/
   inflating: PEXternalizer/
   inflating: PEXternalizer/
```

PoC||GTFO 0x5: Flash || ISO || PDF || ZIP

PoC||GTFO 0x6: TAR || PDF || ZIP

```
$ tar -tvf pocorgtfo06.pdf
-rw-r--r-- Manul/Laphroaig   0 2014-10-06 2
-rw-r--r-- Manul/Laphroaig 525849 2014-10-0
-rw-r--r-- Manul/Laphroaig 273658 2014-10-0
```

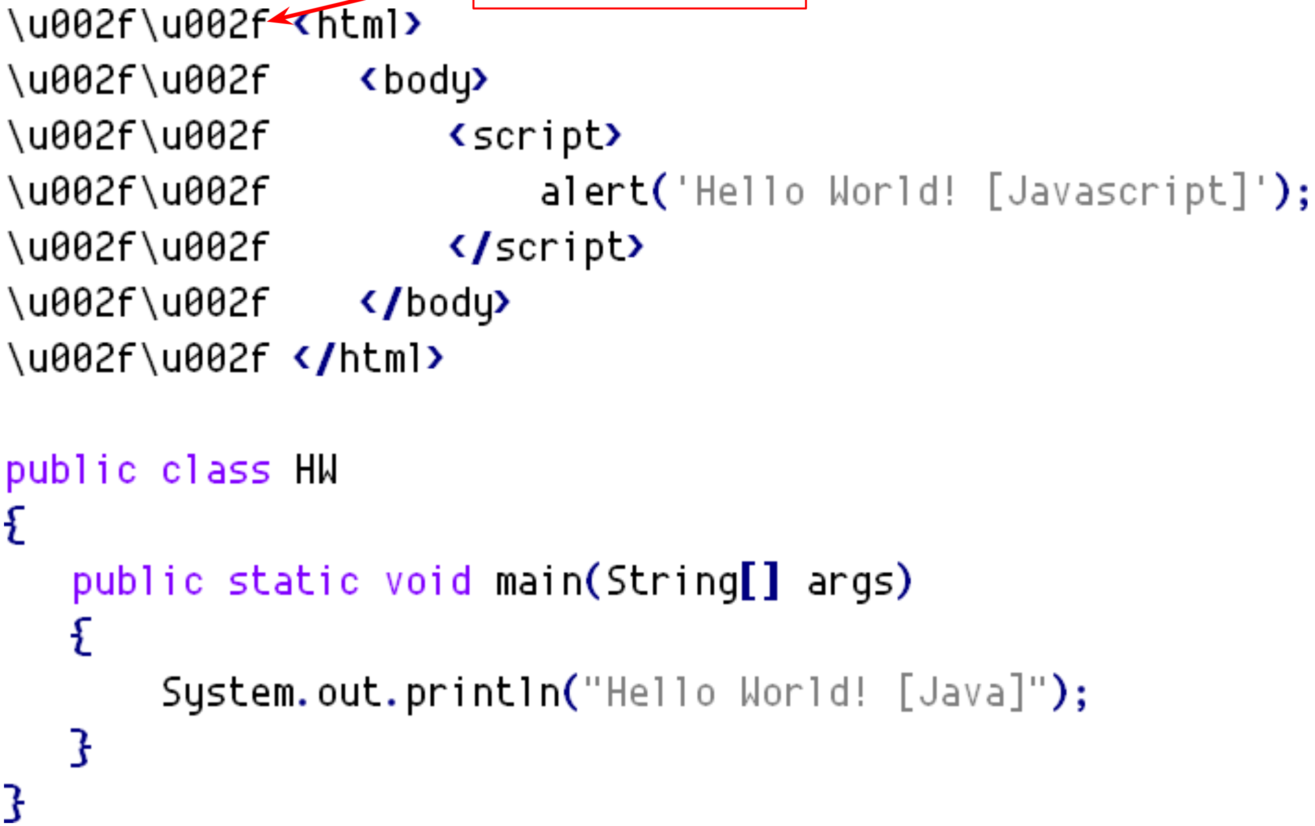
```
$ unzip -l pocorgtfo06.pdf
Archive:  pocorgtfo06.pdf
warning [pocorgtfo06.pdf]:  10672929 extra
  (attempting to process anyway)
  Length      Date    Time    Name
---------  ---------- -----   ----
     4095  11/24/2014 23:44   64k.txt
   818941  08/18/2014 23:28   acsac13_zadda
     4564  10/05/2014 00:06   burn.txt
   342232  11/24/2014 23:44   davinci.tgz.d
     3785  11/24/2014 23:44   davinci.txt
     5111  09/28/2014 21:05   declare.txt
        0  08/23/2014 19:21   ecb2/
```



PoC || GTFO;
brings that
OLD TIMEY EXPLOITATION
with a
WEIRD MACHINE JAMBOREE
and our world-famous
FUNKY FILE FLEA MARKET
not to be ironic, but because
WE LOVE THE MUSIC!

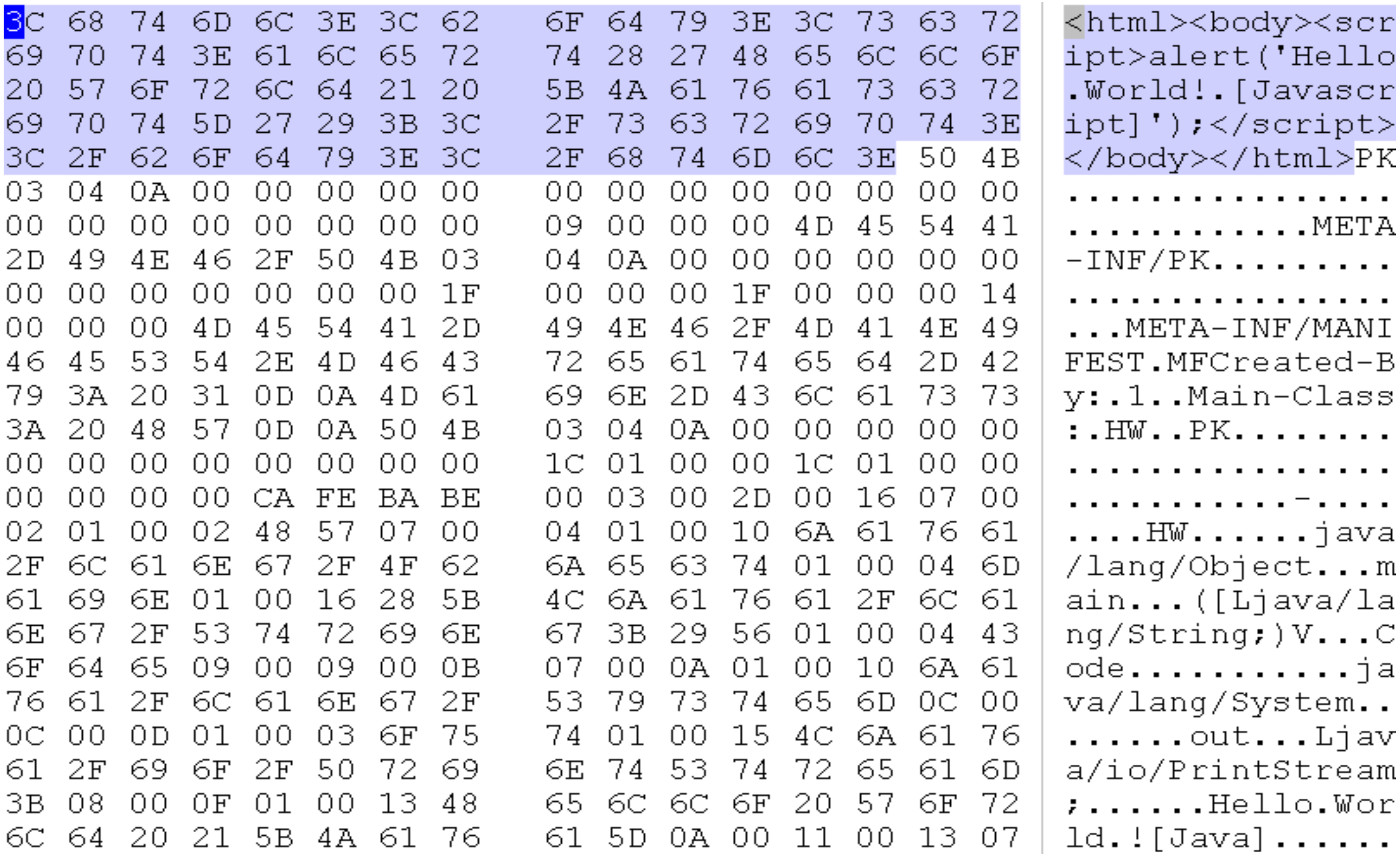
November 25, 2014

unicode //



```
\u002f\u002f <html>
\u002f\u002f    <body>
\u002f\u002f        <script>
\u002f\u002f            alert('Hello World! [Javascript]');
\u002f\u002f        </script>
\u002f\u002f    </body>
\u002f\u002f </html>

public class HW
{
   public static void main(String[] args)
   {
       System.out.println("Hello World! [Java]");
   }
}
```

a Java || JavaScript polyglot (at source level)



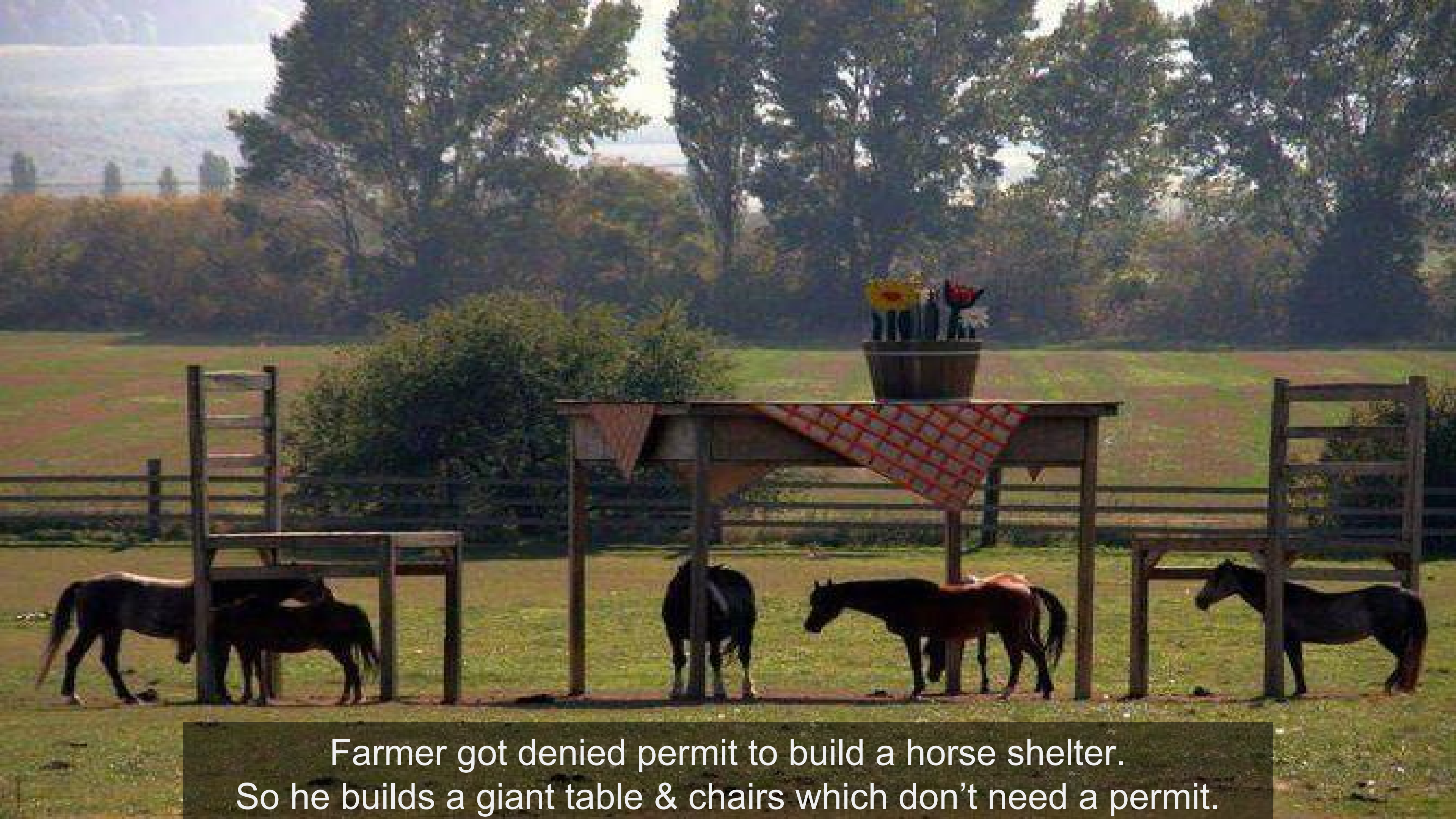
```
3C 68 74 6D 6C 3E 3C 62  6F 64 79 3E 3C 73 63 72  <html><body><scr
69 70 74 3E 61 6C 65 72  74 28 27 48 65 6C 6C 6F  ipt>alert('Hello
20 57 6F 72 6C 64 21 20  5B 4A 61 76 61 73 63 72  .World!.[Javascr
69 70 74 5D 27 29 3B 3C  2F 73 63 72 69 70 74 3E  ipt]');</script>
3C 2F 62 6F 64 79 3E 3C  2F 68 74 6D 6C 3E 50 4B  </body></html>PK
03 04 0A 00 00 00 00 00  00 00 00 00 00 00 00 00  ................
00 00 00 00 00 00 00 00  09 00 00 00 4D 45 54 41  ............META
2D 49 4E 46 2F 50 4B 03  04 0A 00 00 00 00 00 00  -INF/PK.........
00 00 00 00 00 00 00 1F  00 00 00 1F 00 00 00 14  ................
00 00 00 4D 45 54 41 2D  49 4E 46 2F 4D 41 4E 49  ...META-INF/MANI
46 45 53 54 2E 4D 46 43  72 65 61 74 65 64 2D 42  FEST.MFCreated-B
79 3A 20 31 0D 0A 4D 61  69 6E 2D 43 6C 61 73 73  y:.1..Main-Class
3A 20 48 57 0D 0A 50 4B  03 04 0A 00 00 00 00 00  :.HW..PK........
00 00 00 00 00 00 00 00  1C 01 00 00 1C 01 00 00  ................
00 00 00 00 CA FE BA BE  00 03 00 2D 00 16 07 00  ............-...
02 01 00 02 48 57 07 00  04 01 00 10 6A 61 76 61  ....HW......java
2F 6C 61 6E 67 2F 4F 62  6A 65 63 74 01 00 04 6D  /lang/Object...m
61 69 6E 01 00 16 28 5B  4C 6A 61 76 61 2F 6C 61  ain...([Ljava/la
6E 67 2F 53 74 72 69 6E  67 3B 29 56 01 00 04 43  ng/String;)V...C
6F 64 65 09 00 09 00 0B  07 00 0A 01 00 10 6A 61  ode...........ja
76 61 2F 6C 61 6E 67 2F  53 79 73 74 65 6D 0C 00  va/lang/System..
0C 00 0D 01 00 03 6F 75  74 01 00 15 4C 6A 61 76  ......out...Ljav
61 2F 69 6F 2F 50 72 69  6E 74 53 74 72 65 61 6D  a/io/PrintStream
3B 08 00 0F 01 00 13 48  65 6C 6C 6F 20 57 6F 72  ;.......Hello.Wor
6C 64 20 21 5B 4A 61 76  61 5D 0A 00 11 00 13 07  ld.![Java]......
```

a Java || JavaScript polyglot (at binary level)

⇒ Java = JavaScript

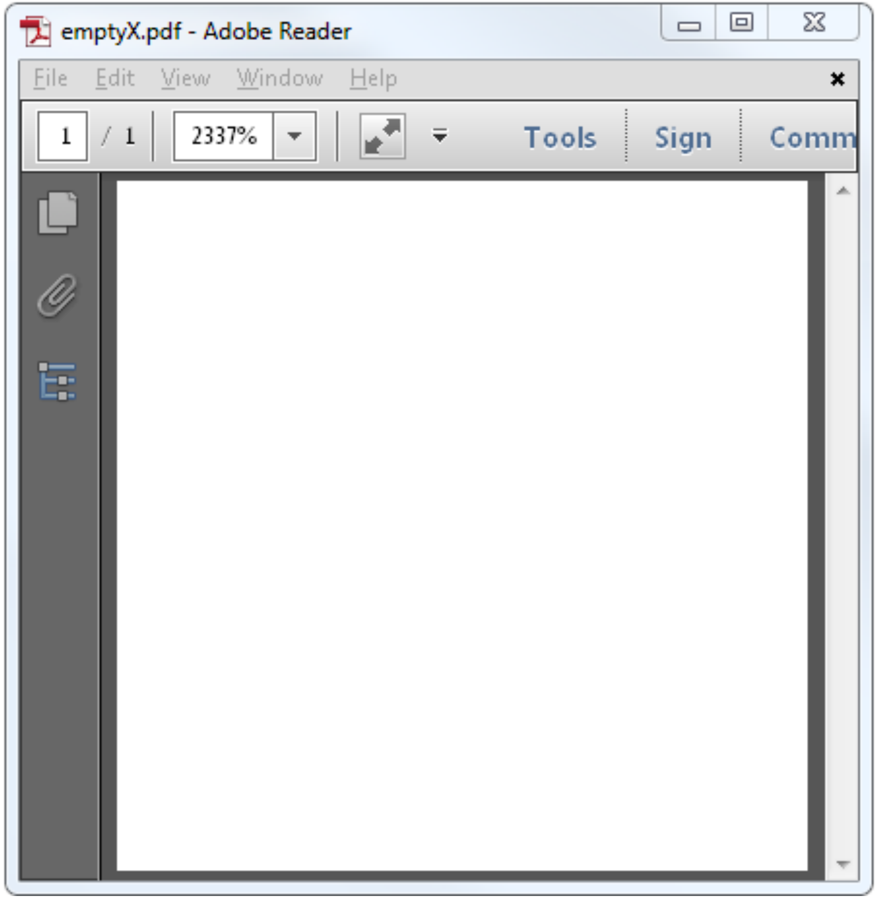
Yes, your management was right all along ;)

Extreme files bypass filters

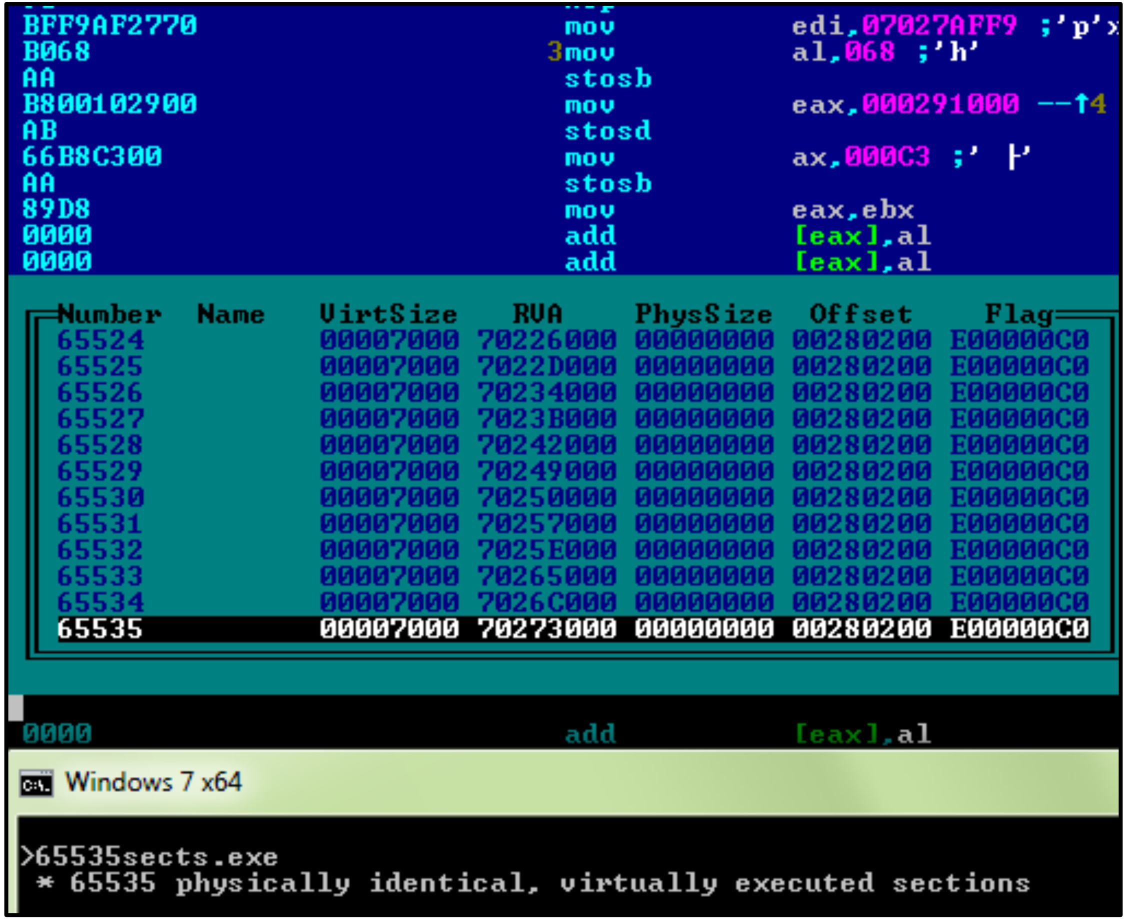


Farmer got denied permit to build a horse shelter.
So he builds a giant table & chairs which don’t need a permit.

```
%PDF-NULtrailer<</Root<</Pages<<>>>>>>
```



a mini PDF (Adobe-only, 36 bytes) ⇒ skipped by scanners yet valid !



```
BFF9AF2770                    mov       edi,07027AFF9 ;'p'x
B068                         3mov       al,068 ;'h'
AA                            stosb
B800102900                    mov       eax,000291000 --↑4
AB                            stosd
66B8C300                      mov       ax,000C3 ;' ├'
AA                            stosb
89D8                          mov       eax,ebx
0000                          add       [eax],al
0000                          add       [eax],al
```

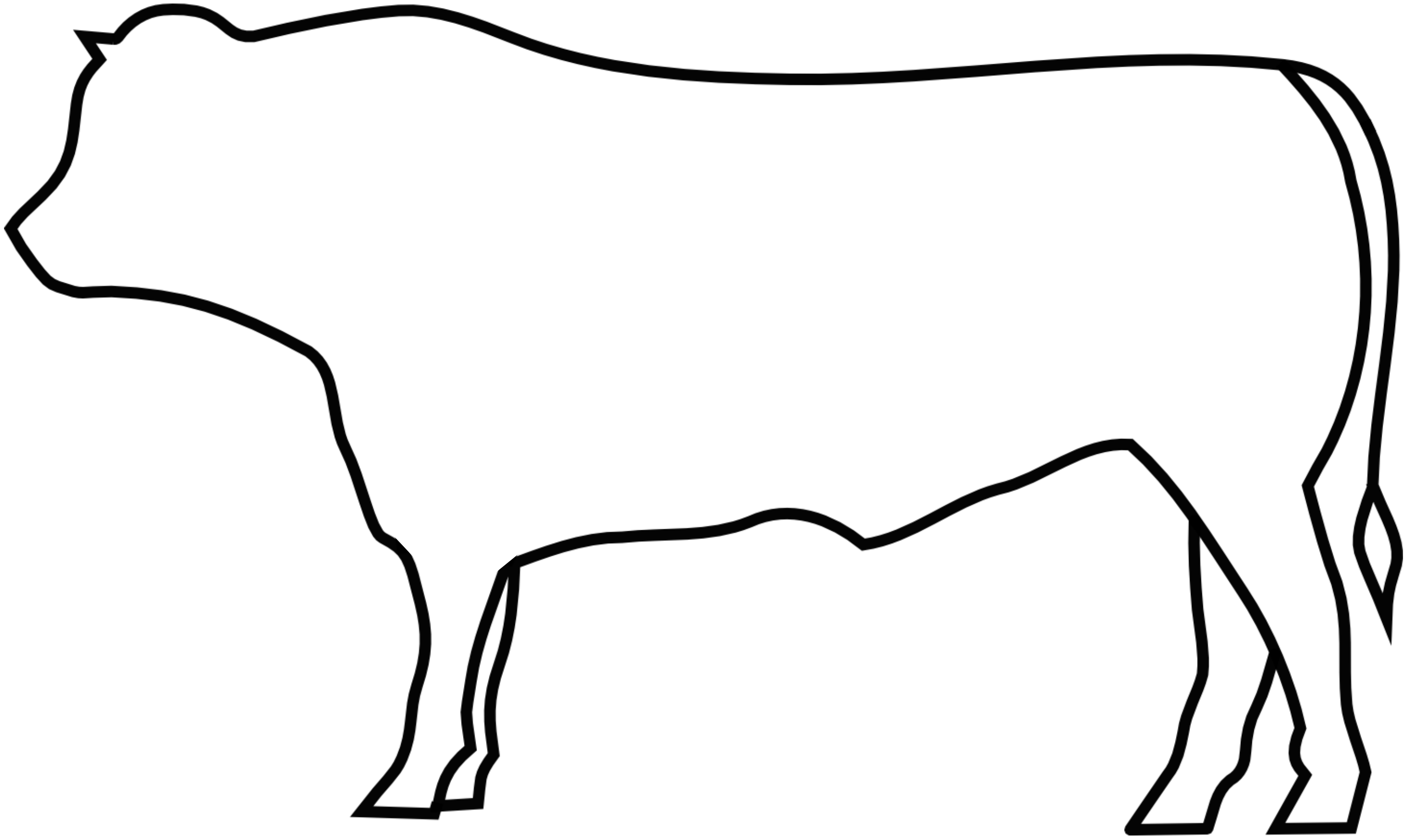
```
 Number  Name    VirtSize  RVA      PhysSize  Offset    Flag
 65524           00007000 70226000 00000000 00280200 E00000C0
 65525           00007000 7022D000 00000000 00280200 E00000C0
 65526           00007000 70234000 00000000 00280200 E00000C0
 65527           00007000 7023B000 00000000 00280200 E00000C0
 65528           00007000 70242000 00000000 00280200 E00000C0
 65529           00007000 70249000 00000000 00280200 E00000C0
 65530           00007000 70250000 00000000 00280200 E00000C0
 65531           00007000 70257000 00000000 00280200 E00000C0
 65532           00007000 7025E000 00000000 00280200 E00000C0
 65533           00007000 70265000 00000000 00280200 E00000C0
 65534           00007000 7026C000 00000000 00280200 E00000C0
 65535           00007000 70273000 00000000 00280200 E00000C0
```

```
0000                          add       [eax],al
```

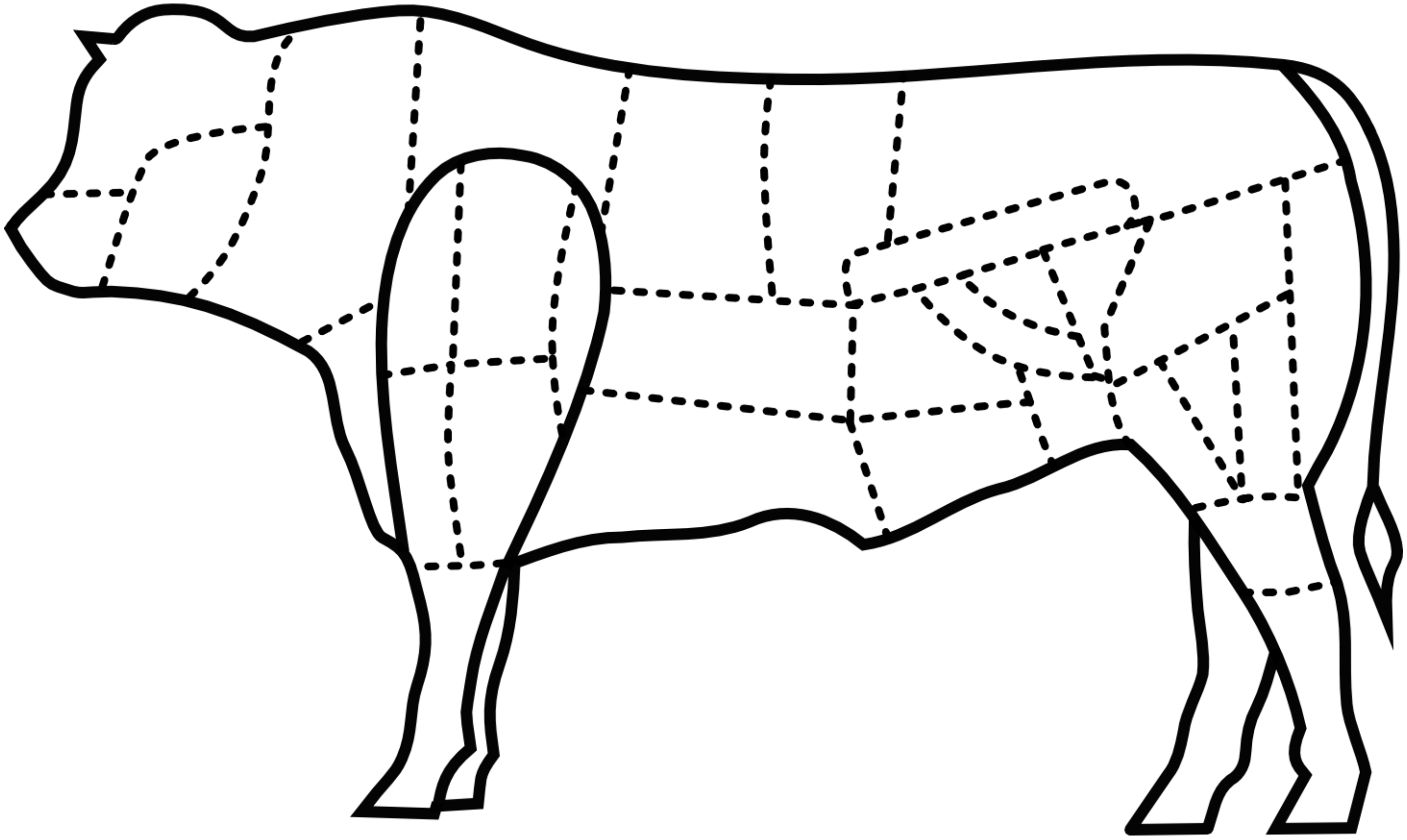
```
>65535sects.exe
 * 65535 physically identical, virtually executed sections
```

a 64K sections PE (all executed) ⇒ crashes many softwares, evades scanning

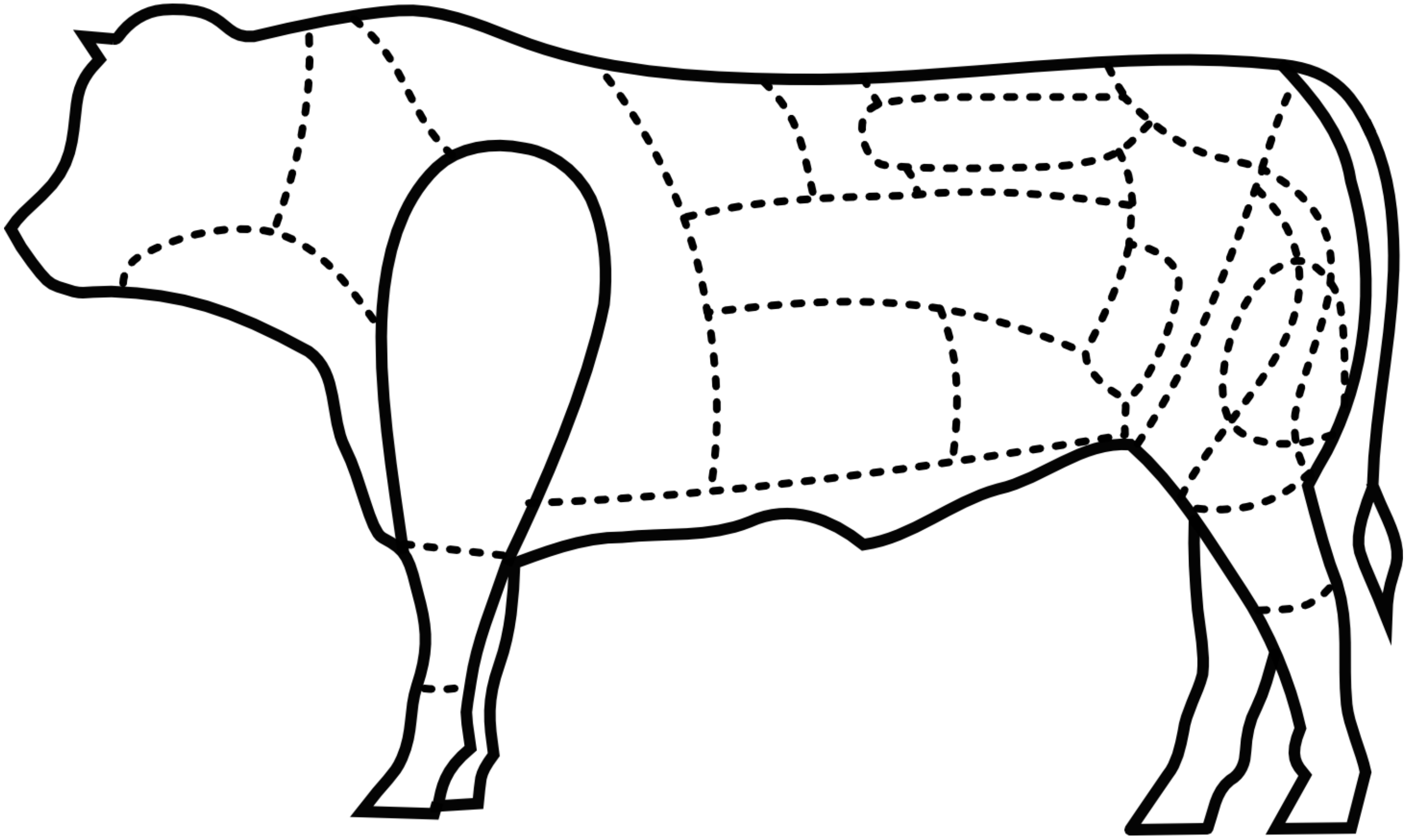
Parsing



This is a how a **user** sees a cow.



This is how a **dev** sees a cow…



This is how **another** dev sees a cow !

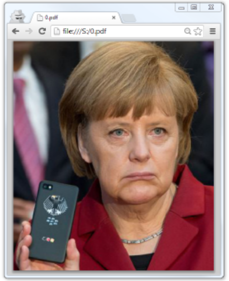
(this one: brazilian beef cut - previous: french beef cut)

Same data, different parsers

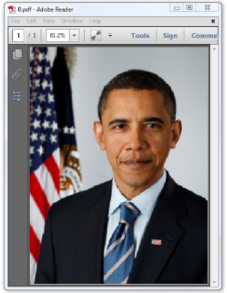
it would have been too easy ;)

commented line

```
% trailer <</Root ...>>
```

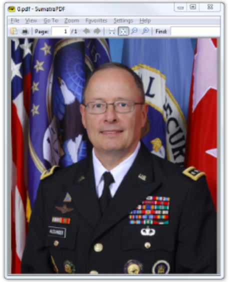


```
trailer <</Root ...>>
```

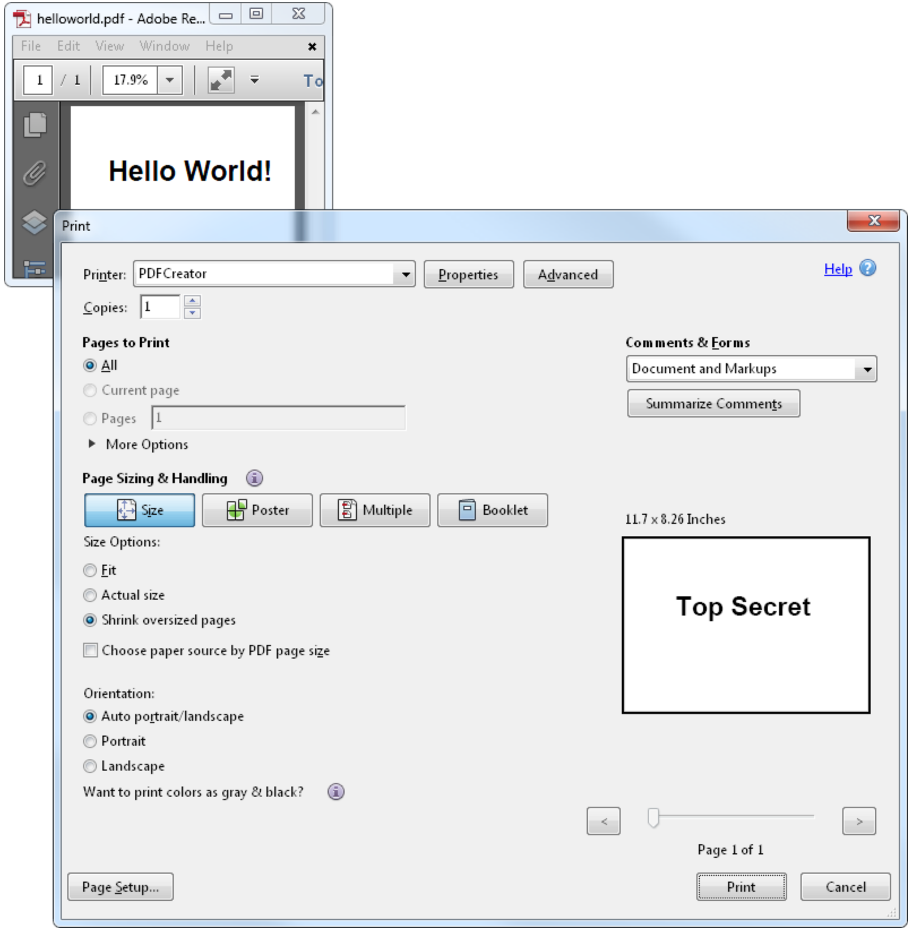


missing trailer keyword

```
<</Root ...>>
```



a schizophrenic PDF: 3 different trailers, seen by 3 different readers



helloworld.pdf - Adobe Re...

File Edit View Window Help

1 / 1 17.9%

Hello World!

Print

Printer: PDFCreator

Copies: 1

Pages to Print

● All

○ Current page

○ Pages 1

More Options

Page Sizing & Handling

Size Options:

○ Fit

○ Actual size

● Shrink oversized pages

□ Choose paper source by PDF page size

Orientation:

● Auto portrait/landscape

○ Portrait

○ Landscape

Want to print colors as gray & black?

Comments & Forms

Document and Markups

11.7 x 8.26 Inches

Top Secret

Page 1 of 1

a schizophrenic PDF (screen ⇔ printer)

PDF viewer

Messing with binary formats

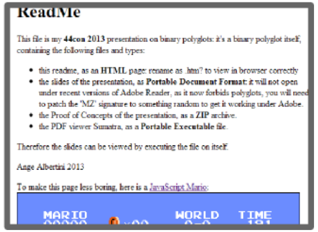
44CON

Ange Albertini

44con, London

2013/09/12

PDF slides



ReadMe

This file is my **44con 2013** presentation on binary polyglots: it's a binary polyglot itself, containing the following files and types:

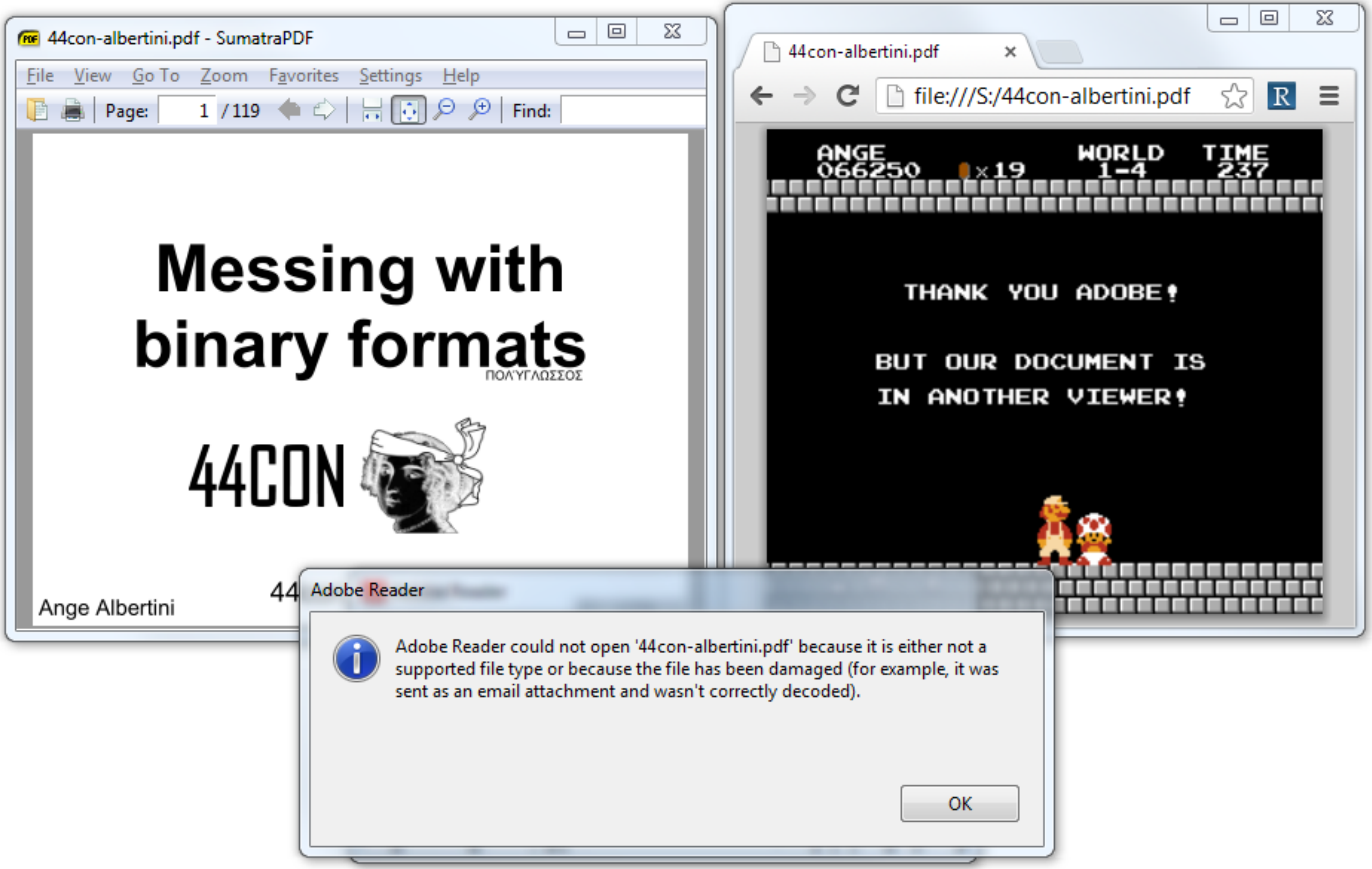
- this readme, as an **HTML** page: rename as .htm? to view in browser correctly
- the slides of the presentation, as **Portable Document Format**: it will not open under recent versions of Adobe Reader, as it now forbids polyglots, you will need to patch the 'MZ' signature to something random to get it working under Adobe.
- the Proof of Concepts of the presentation, as a **ZIP** archive.
- the PDF viewer Sumatra, as a **Portable Executable** file.

Therefore the slides can be viewed by executing the file on itself.

Ange Albertini 2013

To make this page less boring, here is a JavaScript Mario:

a (generated) PDF || PE || JAR [JAVA+ZIP] || HTML polyglot...


44con-albertini.pdf - SumatraPDF
File View Go To Zoom Favorites Settings Help
Page: 1 / 119
Find:
Messing with binary formats
ΠΟΛΥΓΛΩΣΣΟΣ
44CON
Ange Albertini
44con-albertini.pdf
file:///S:/44con-albertini.pdf
ANGE
066250
x19
WORLD
1-4
TIME
237
Adobe Reader
OK

THANK YOU ADOBE!

BUT OUR DOCUMENT IS IN ANOTHER VIEWER!

Adobe Reader could not open '44con-albertini.pdf' because it is either not a supported file type or because the file has been damaged (for example, it was sent as an email attachment and wasn't correctly decoded).

...which is also a schizophrenic PDF

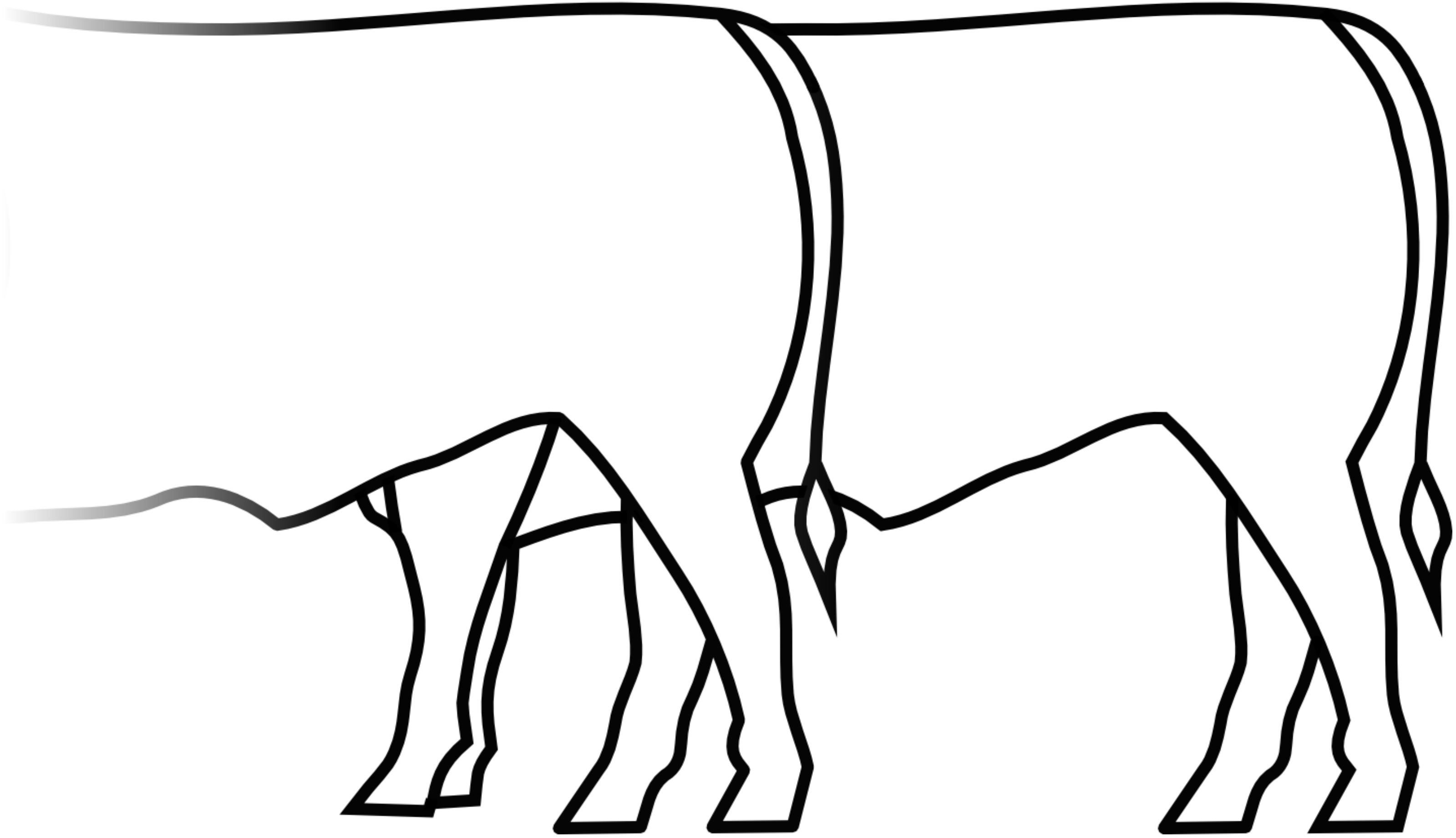
```
$ du -h stringme
141     stringme

$ strings stringme
Segmentation fault (core dumped)
```

Extra problem: parsers can be present in unexpected places

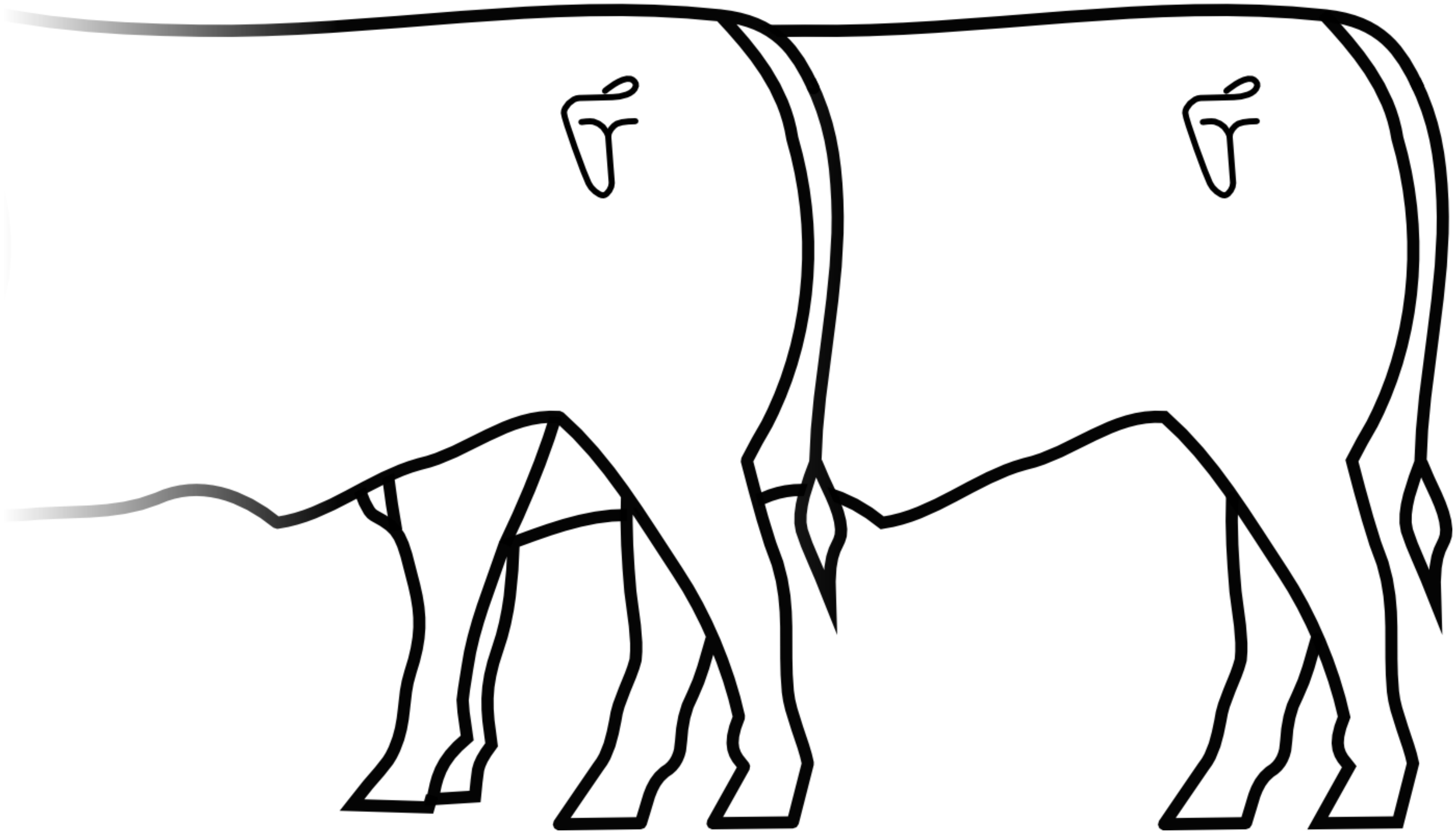
http://lcamtuf.blogspot.de/2014/10/psa-dont-run-strings-on-untrusted-files.html (CVE-2014-8485)

metadata

Who’s the owner?



A hidden cow just looks like another cow...

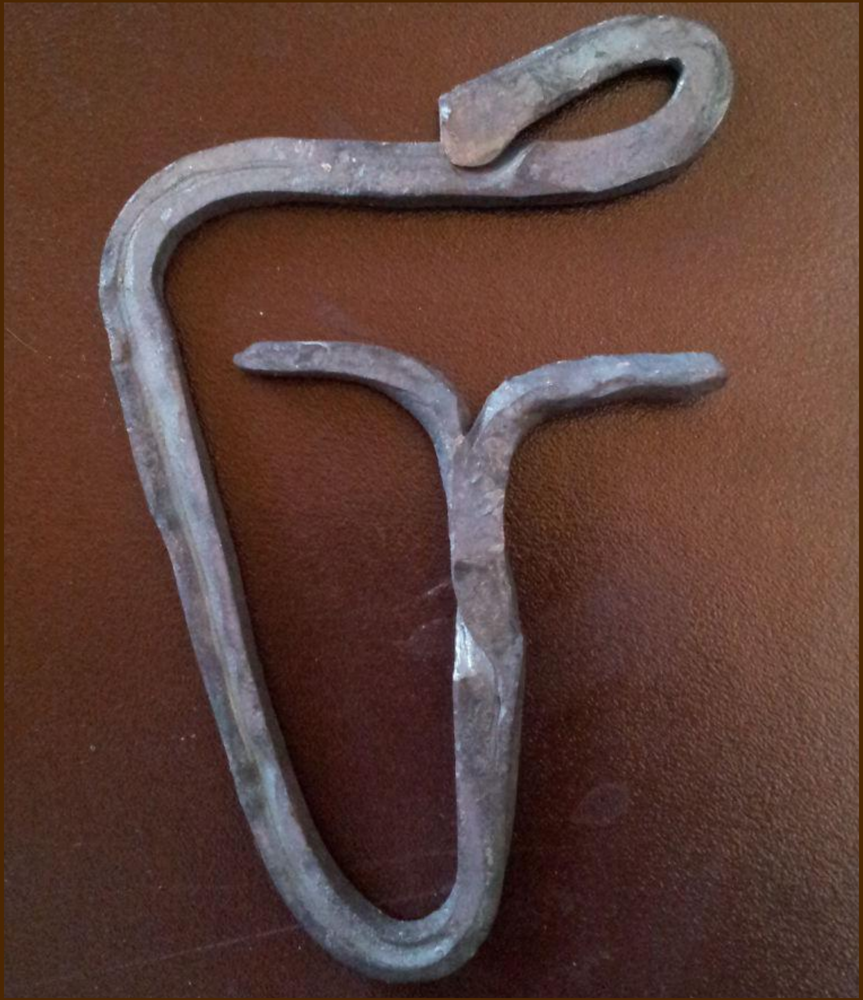


… so cattle is branded.

But brandings can be faked!

or “patched” into another symbol
⇒ attribution is hard

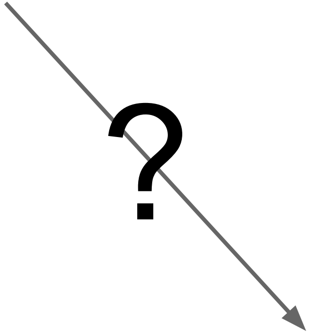
… and in a pure PoC||GTFO fashion,
@munin forged a branding iron !



an *encrypted* file is not always “*encrypted*”
⇒ encrypt(file) is not always “random”

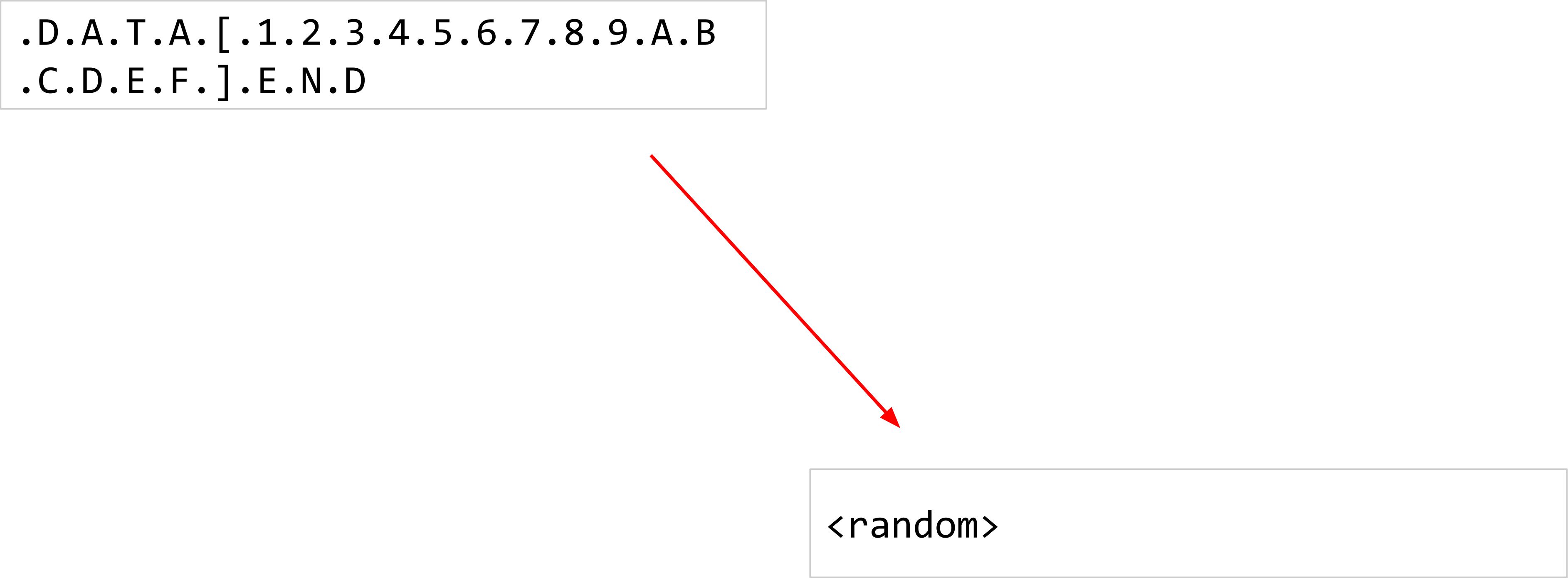
encrypt(file) can be *valid*

```
.D.A.T.A.[.1.2.3.4.5.6.7.8.9.A.B
.C.D.E.F.].E.N.D
```



```
.T.E.X.T0A.t.h.i.s. .i.s. .a. .t
.e.x.t0A
```

We want to encrypt a DATA file to a TEXT file.
DATA tolerates appended data after it’s END marker
TEXT accepts /* */ comments chunk (think ‘parasite in a host’)



```
.D.A.T.A.[.1.2.3.4.5.6.7.8.9.A.B
.C.D.E.F.].E.N.D
```

```
<random>
```

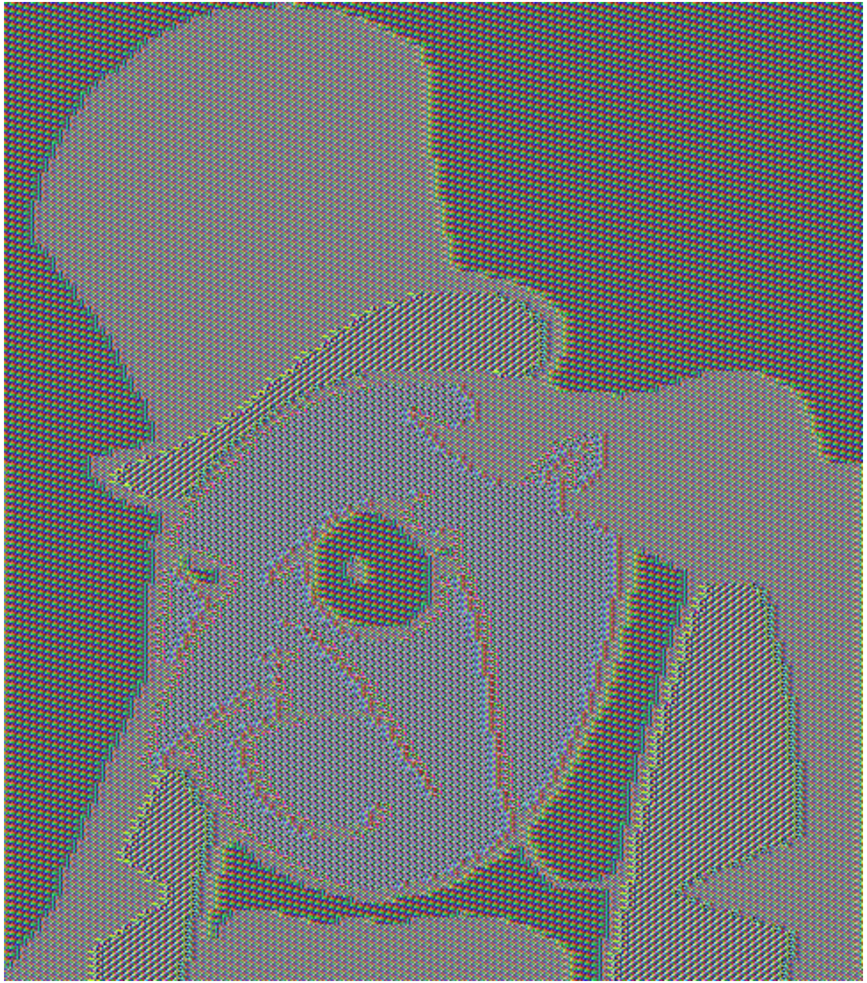
if we encrypt, we get random result. we can’t control AES output & input together.

AES works with blocks

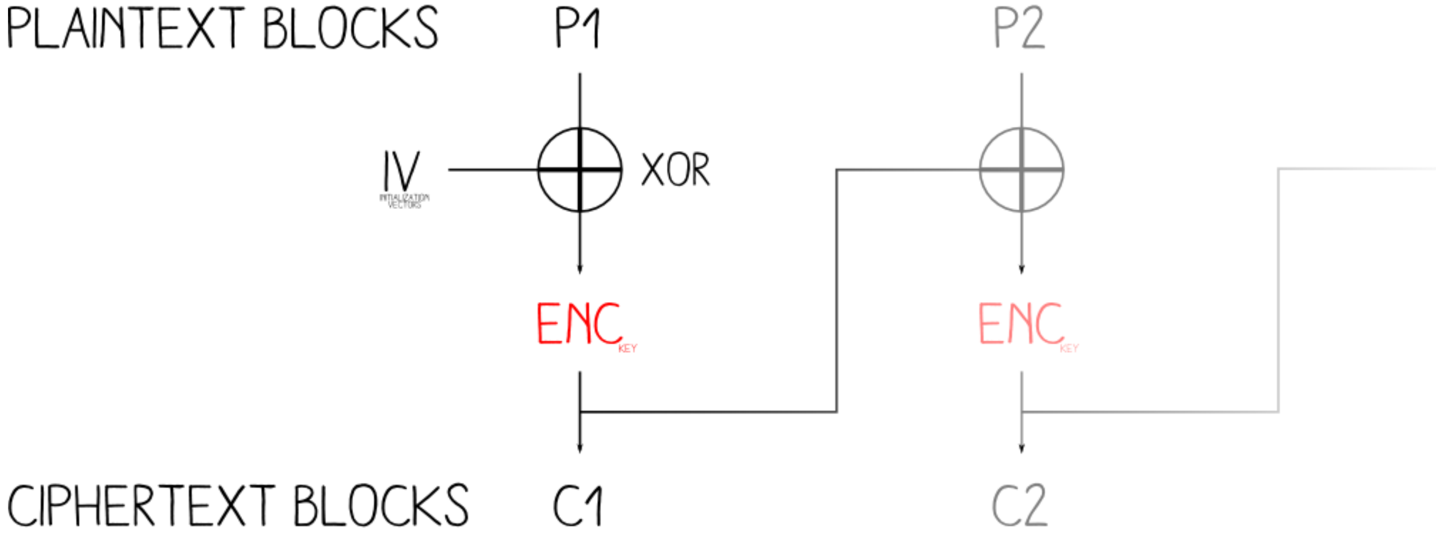
File encryption applies AES via a mode of operation

Electronic ***C***ode ***B***ook:

penguin = bad



CIPHER BLOCK CHAINING

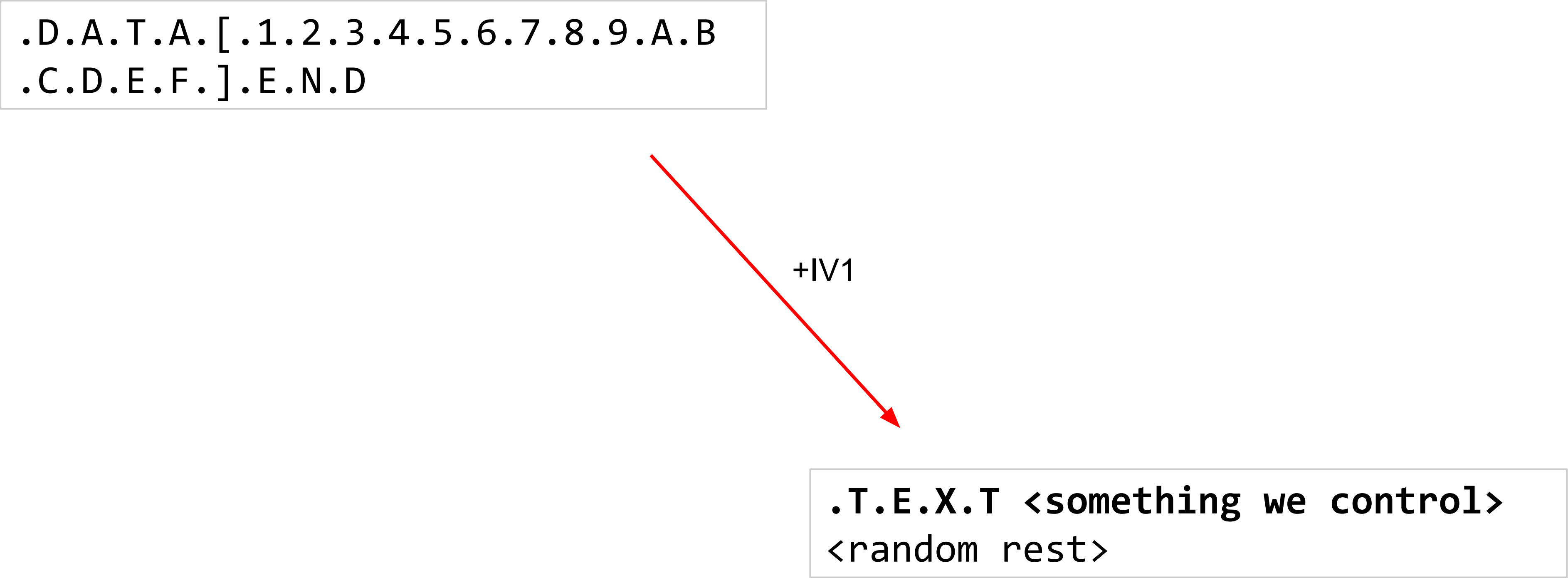


$$C1 = ENC_{KEY}(P1 \hat{} IV)$$

$$DEC_{KEY}(C1) = P1 \hat{} IV$$

$$IV = DEC_{KEY}(C1) \hat{} P1$$

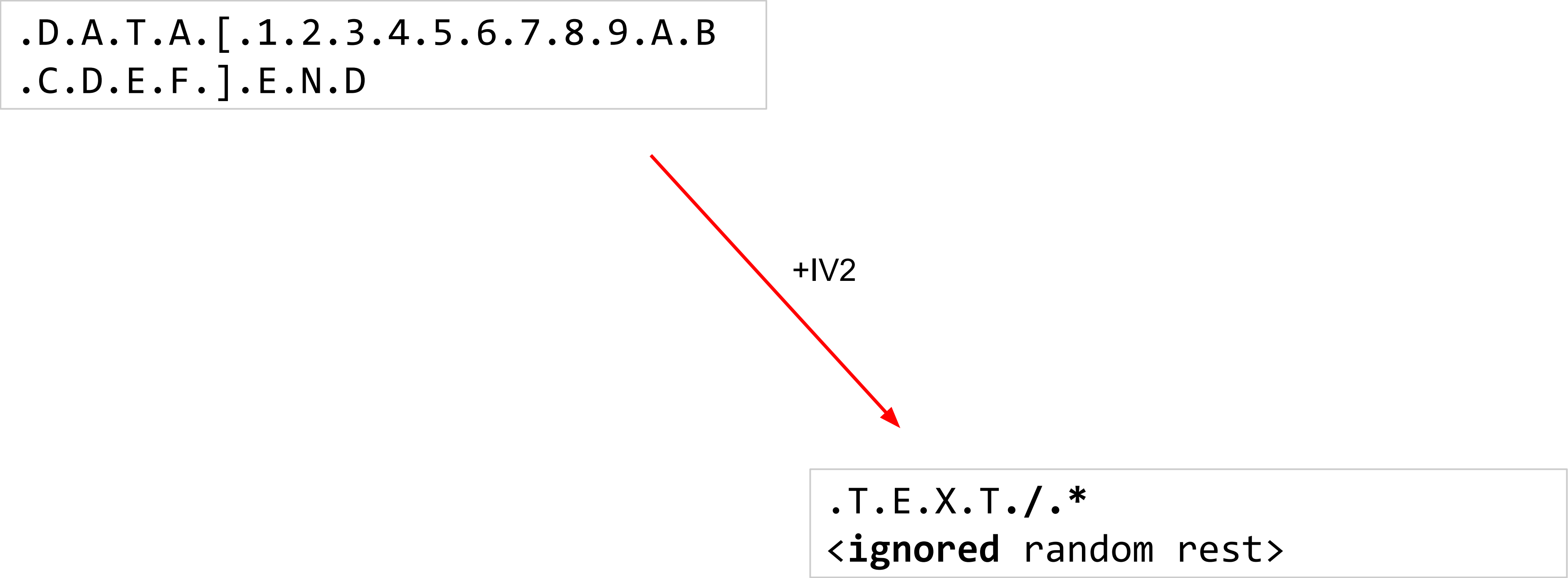
choose the IV to control both first blocks (P1 & C1)



```
.D.A.T.A.[.1.2.3.4.5.6.7.8.9.A.B
.C.D.E.F.].E.N.D
```

```
.T.E.X.T <something we control>
<random rest>
```

Encrypt with pure AES, then determine IV to control the output block



```
.D.A.T.A.[.1.2.3.4.5.6.7.8.9.A.B
.C.D.E.F.].E.N.D
```

+IV2

```
.T.E.X.T./.*
<ignored random rest>
```

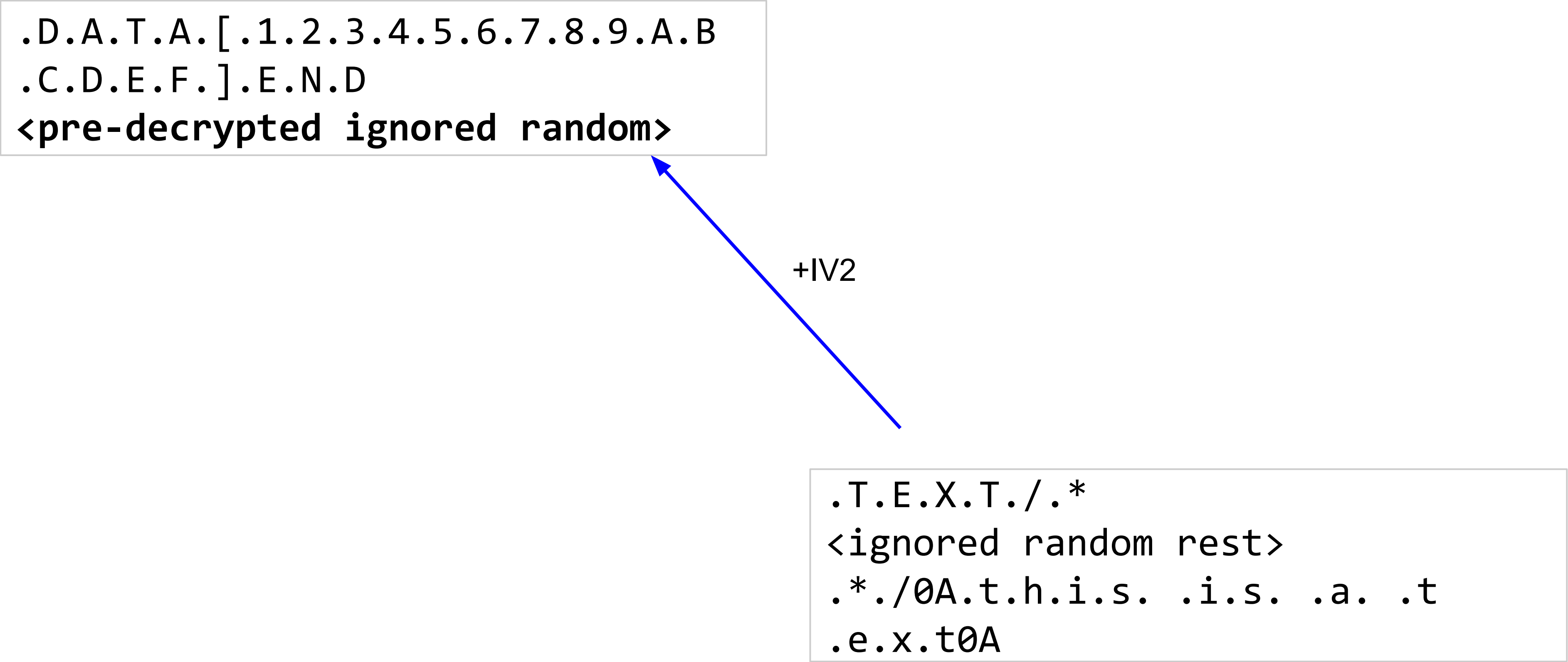
We can’t control the rest of the garbage… so let’s put a comment start in the first block

```
.D.A.T.A.[.1.2.3.4.5.6.7.8.9.A.B
.C.D.E.F.].E.N.D
```

```
.T.E.X.T./.*
<ignored random rest>
.*./0A.t.h.i.s. .i.s. .a. .t
.e.x.t0A
```

If we close the comment and append the target file’s data in the encrypted file.

then this file is valid and equivalent to our initial target.



```
.D.A.T.A.[.1.2.3.4.5.6.7.8.9.A.B
.C.D.E.F.].E.N.D
```

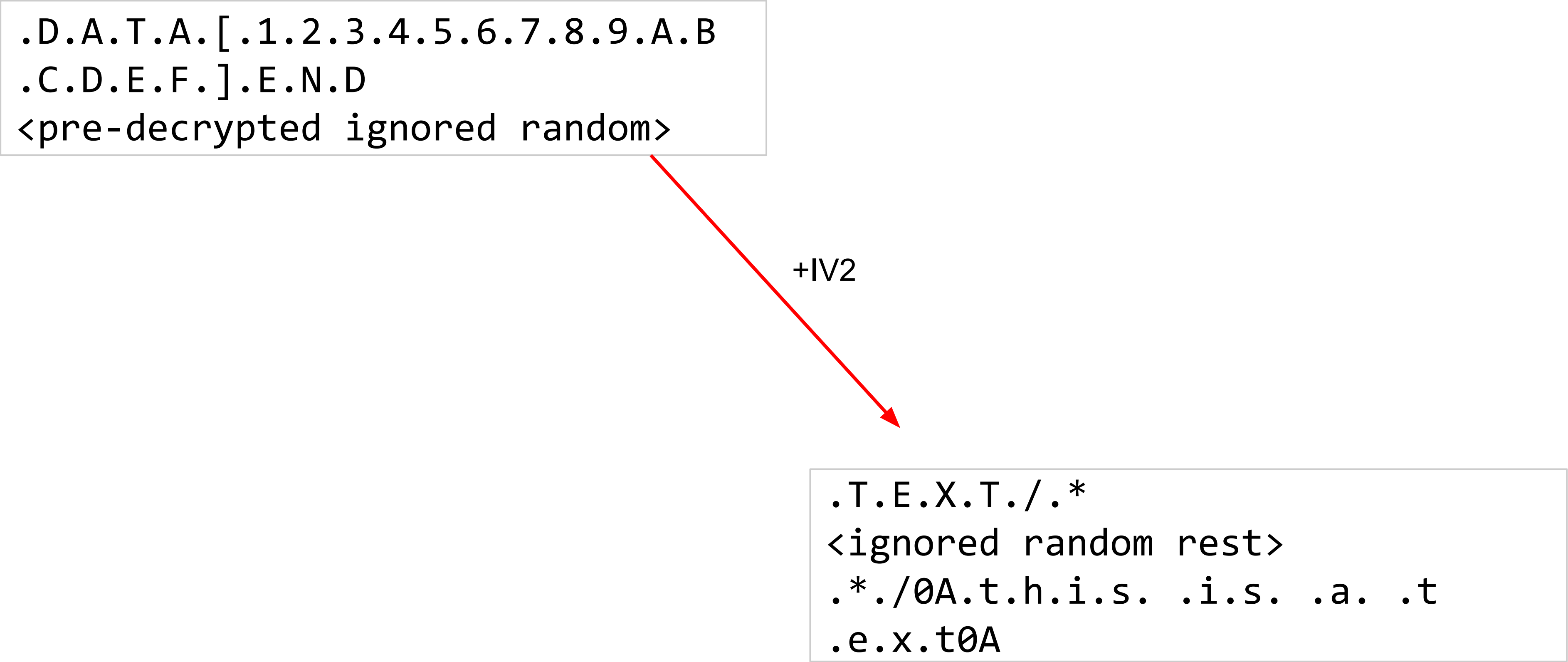
<pre-decrypted ignored random>

+IV2

```
.T.E.X.T./.*
<ignored random rest>
.*./0A.t.h.i.s. .i.s. .a. .t
.e.x.t0A
```

...then we decrypt that file: we get the original source file,

with some random data, that will be ignored since it’s appended data.



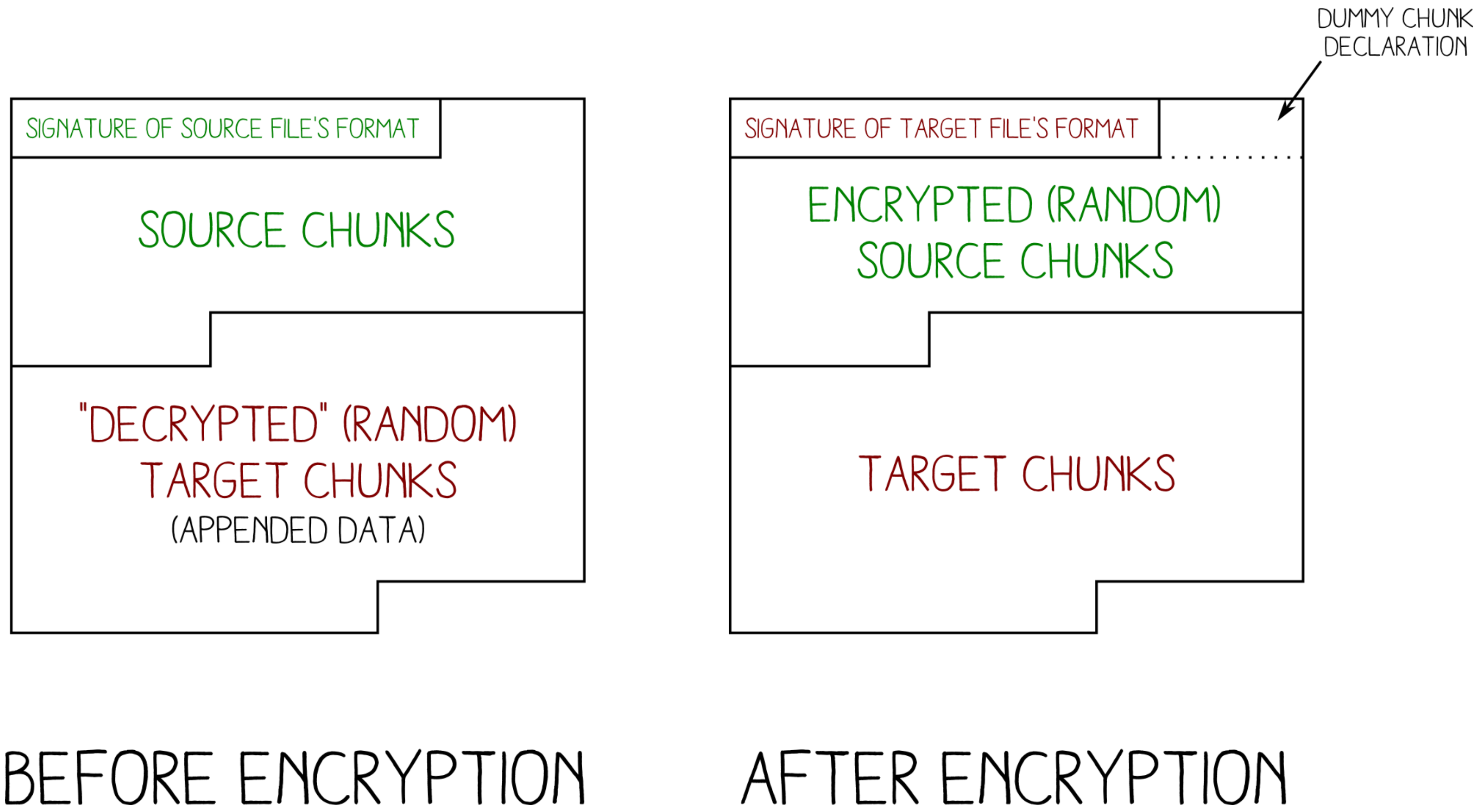
```
.D.A.T.A.[.1.2.3.4.5.6.7.8.9.A.B
.C.D.E.F.].E.N.D
<pre-decrypted ignored random>
```

+IV2

```
.T.E.X.T./.*
<ignored random rest>
.*./0A.t.h.i.s. .i.s. .a. .t
.e.x.t0A
```

Since AES CBC only depends on **previous** blocks,

this DATA file will indeed encrypt to a TEXT file.


DUMMY CHUNK DECLARATION
SIGNATURE OF SOURCE FILE'S FORMAT
SOURCE CHUNKS
"DECRYPTED" (RANDOM) TARGET CHUNKS
(APPENDED DATA)
SIGNATURE OF TARGET FILE'S FORMAT
ENCRYPTED (RANDOM) SOURCE CHUNKS
TARGET CHUNKS
BEFORE ENCRYPTION
AFTER ENCRYPTION

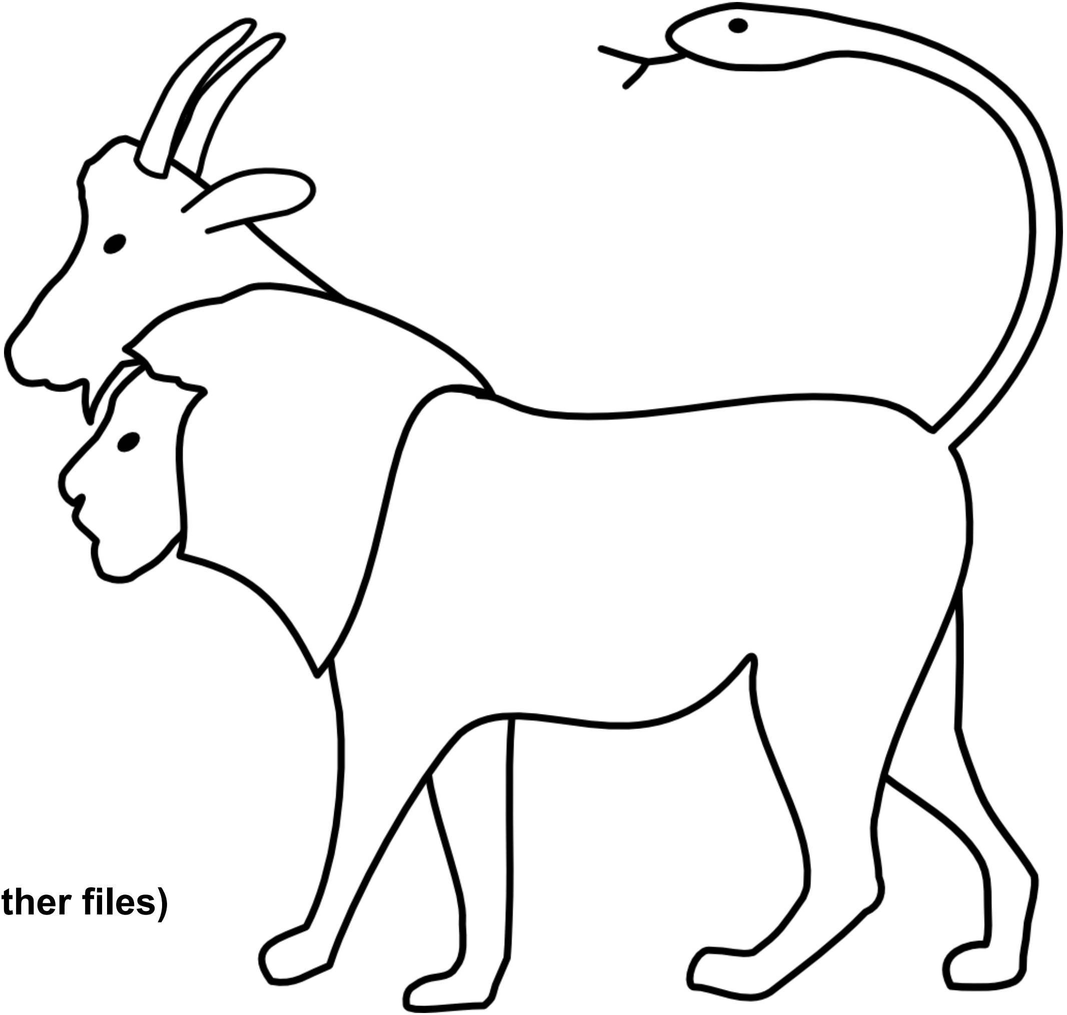
AngeCryption PoC layout

```
00: 4441 5441 5b31 3233 3435 3637 3839 4142  DATA[123456789AB
10: 4344 4546 5d45 4e44 0000 0000 0000 0000  CDEF]END........
20: f6fe 17cf 0802 7449 58de cdf2 f9c4 45ce  ......tIX.....E.
30: 2e8e 6996 5854 824c c09c 1b7d 4898 a29e  ..i.XT.L...}H...
```

```
openssl enc -aes-128-cbc -nopad
        -K `echo OurEncryptionKey|xxd -p`
        -iv A37A69F13417F5AB3CC4A1546B97FD76
```

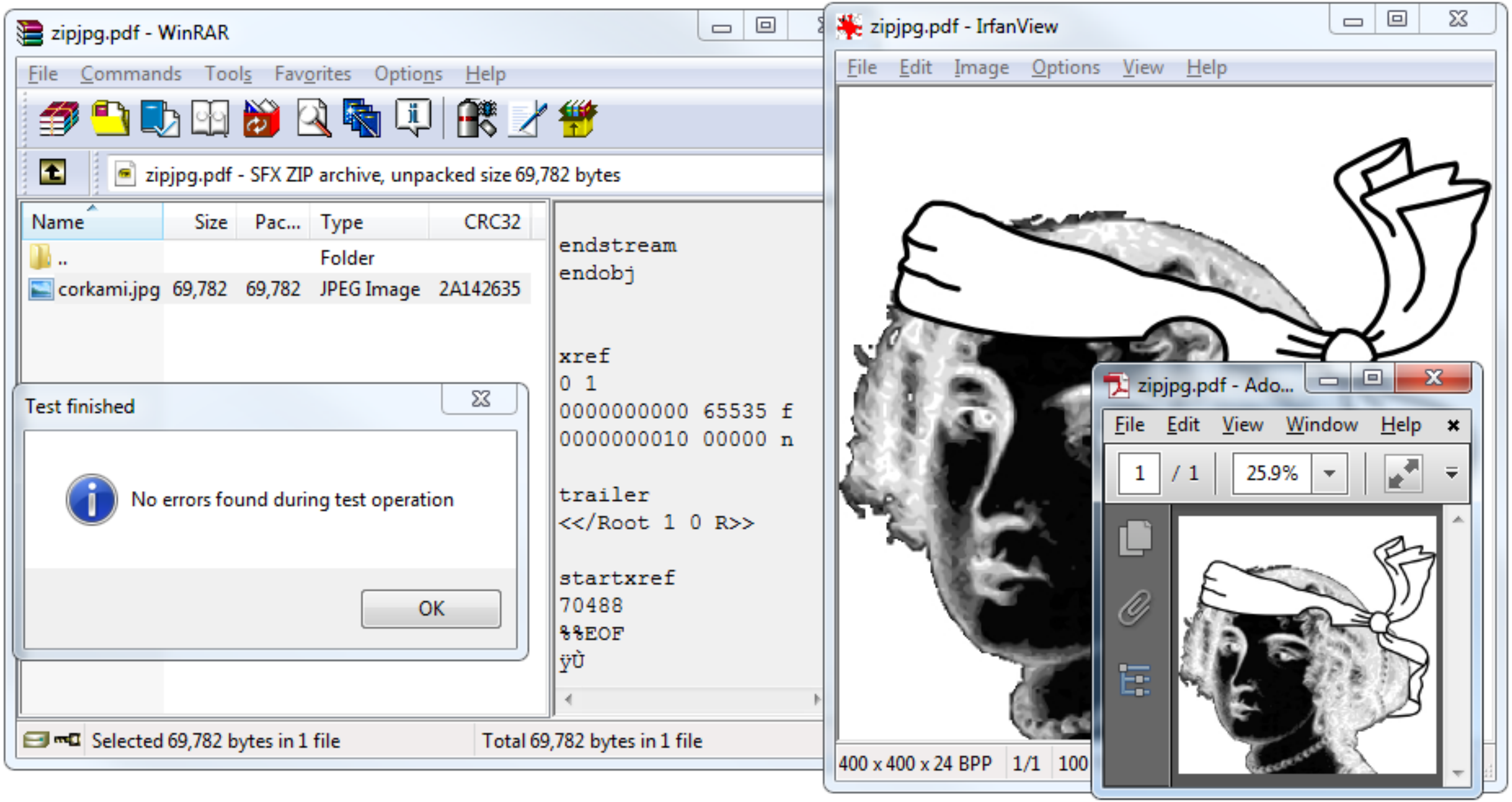
```
00: 5445 5854 2f2a 0000 0000 0000 0000 0000  TEXT/*..........
10: 3f81 11a9 2540 ded5 096a 83c9 f191 d8bb  ?...%@...j......
20: 2a2f 0a74 6869 7320 6973 2061 2074 6578  */.this is a tex
30: 740a 454e 4400 0000 0000 0000 0000 0000  t.END...........
```

You can even try it at home :)



Chimera

(if you skip identified bodies, you’ll miss other files)



zipjpg.pdf - WinRAR
File Commands Tools Favorites Options Help
zipjpg.pdf - IrfanView
File Edit Image Options View Help
zipjpg.pdf - Ado...
File Edit View Window Help
1 / 1
25.9%
OK

zipjpg.pdf - SFX ZIP archive, unpacked size 69,782 bytes

Name	Size	Pac...	Type	CRC32
..			Folder	
corkami.jpg	69,782	69,782	JPEG Image	2A142635

Test finished

No errors found during test operation

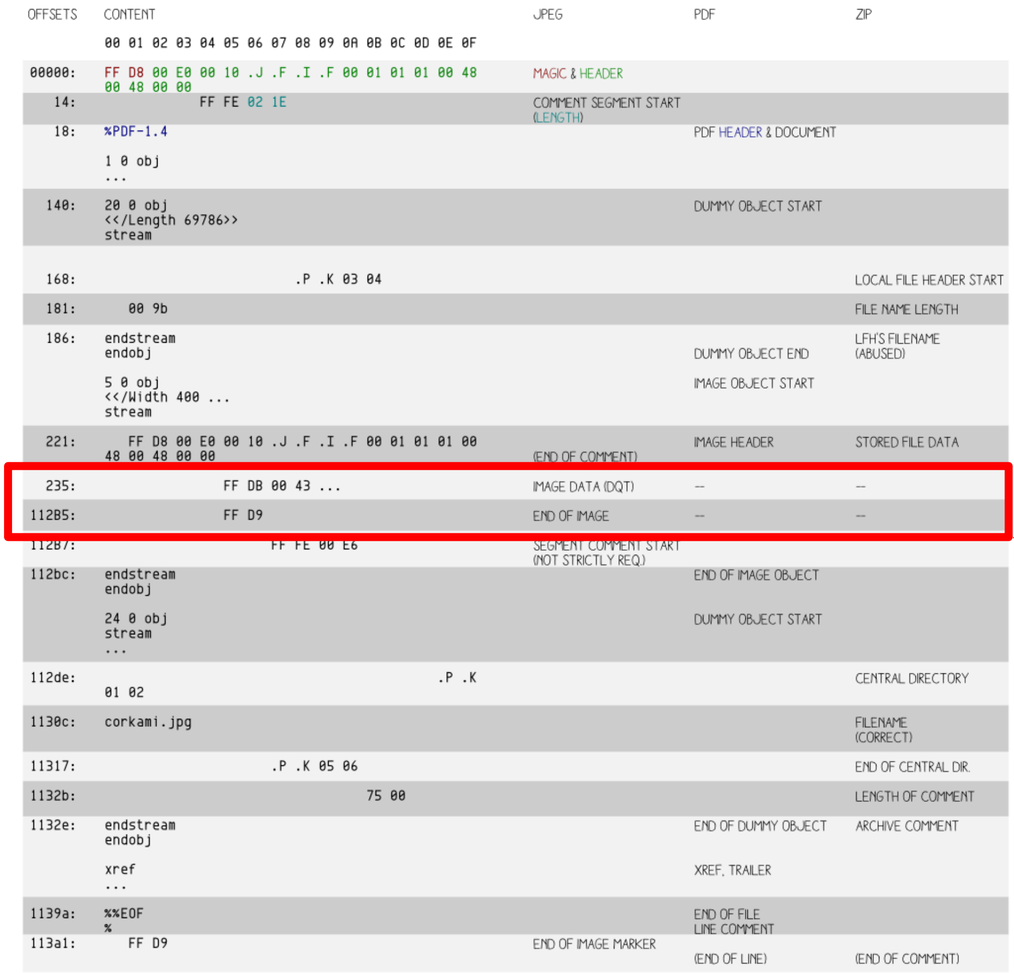
```
endstream
endobj


xref
0 1
0000000000 65535 f
0000000010 00000 n

trailer
<</Root 1 0 R>>

startxref
70488
%%EOF
ÿÙ
```

Selected 69,782 bytes in 1 file

Total 69,782 bytes in 1 file

400 x 400 x 24 BPP 1/1 100

a JPEG || ZIP || PDF Chimera



OFFSETS	CONTENT	JPEG	PDF	ZIP
	00 01 02 03 04 05 06 07 08 09 0A 0B 0C 0D 0E 0F			
00000:	FF D8 00 E0 00 10 .J .F .I .F 00 01 01 01 00 48 00 48 00 00	MAGIC & HEADER		
14:	FF FE 02 1E	COMMENT SEGMENT START (LENGTH)		
18:	%PDF-1.4 1 0 obj ...		PDF HEADER & DOCUMENT	
140:	20 0 obj <</Length 69786>> stream		DUMMY OBJECT START	
168:	.P .K 03 04			LOCAL FILE HEADER START
181:	00 9b			FILE NAME LENGTH
186:	endstream endobj 5 0 obj <</Width 400 ... stream		DUMMY OBJECT END IMAGE OBJECT START	LFH'S FILENAME (ABUSED)
221:	FF D8 00 E0 00 10 .J .F .I .F 00 01 01 01 00 48 00 48 00 00	(END OF COMMENT)	IMAGE HEADER	STORED FILE DATA
235:	FF DB 00 43 ...	IMAGE DATA (DQT)	--	--
112B5:	FF D9	END OF IMAGE	--	--
112B7:	FF FE 00 E6	SEGMENT COMMENT START (NOT STRICTLY REQ.)		
112bc:	endstream endobj 24 0 obj stream ...		END OF IMAGE OBJECT DUMMY OBJECT START	
112de:	.P .K 01 02			CENTRAL DIRECTORY
1130c:	corkami.jpg			FILENAME (CORRECT)
11317:	.P .K 05 06			END OF CENTRAL DIR.
1132b:	75 00			LENGTH OF COMMENT

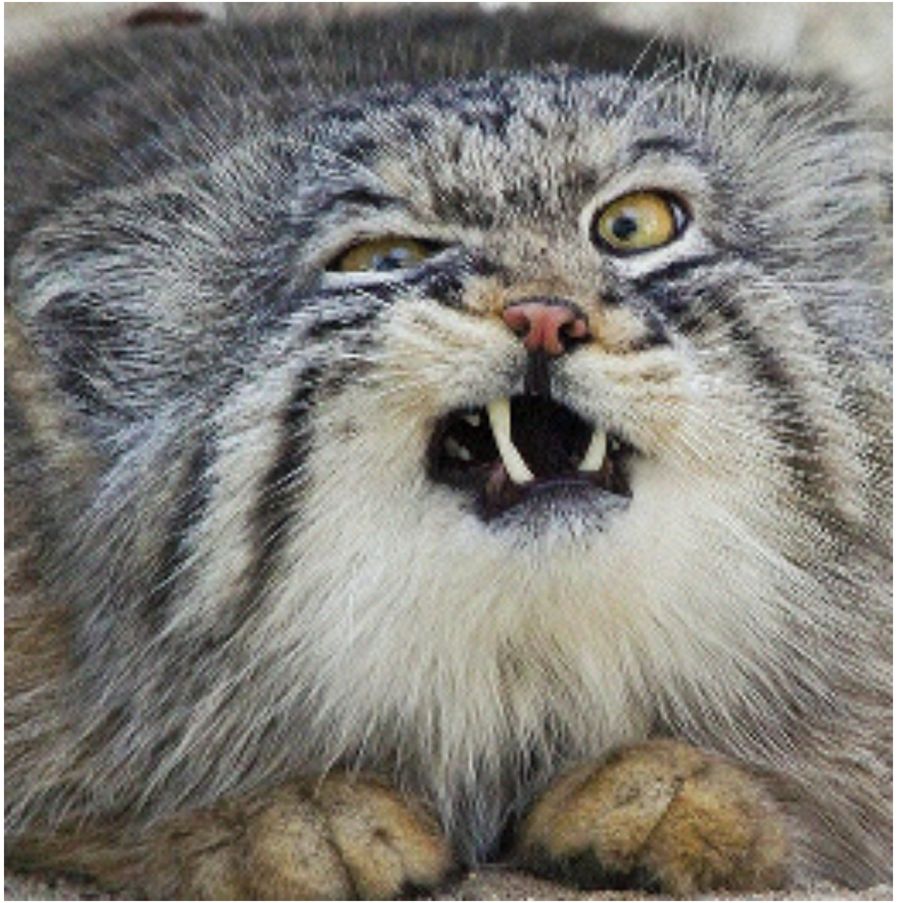
1132e:	endstream
	endobj
	
	xref
	...
			END OF DUMMY OBJECT
			
			XREF, TRAILER
				ARCHIVE COMMENT

1139a:	%%EOF %		END OF FILE LINE COMMENT	
113a1:	FF D9	END OF IMAGE MARKER	(END OF LINE)	(END OF COMMENT)

image data

a chimera defeats sequential parsing with optimization a ***P***icture ***o***f ***C***at

(BMP ! uncompressed ! OMG)



BMP let us define bit masks for each color:

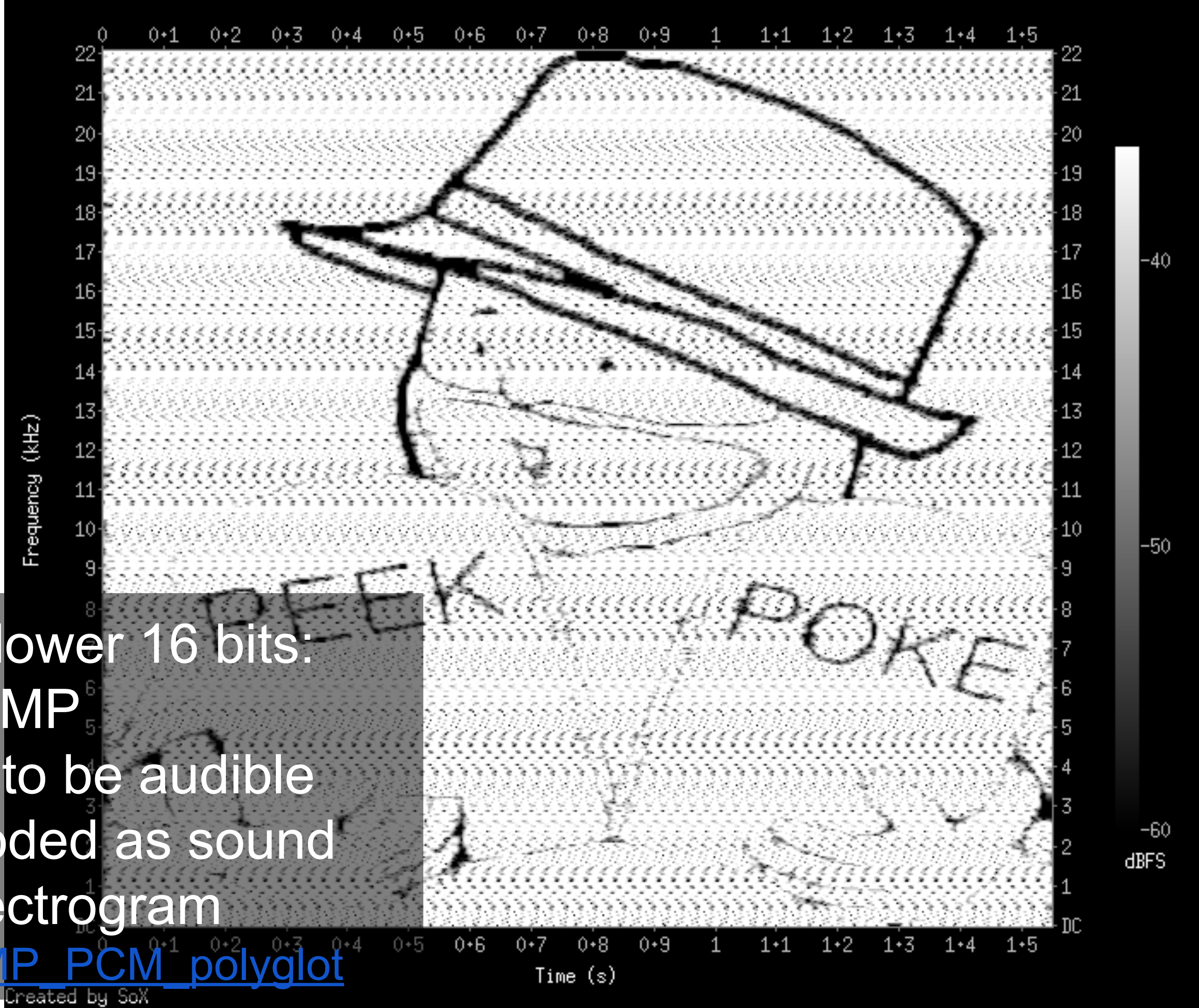
32 bits: `0000000000000000rrrrrggggggbbbbb (no alpha)`

⇒ 16 bits of free space!

let’s ***play*** the picture!

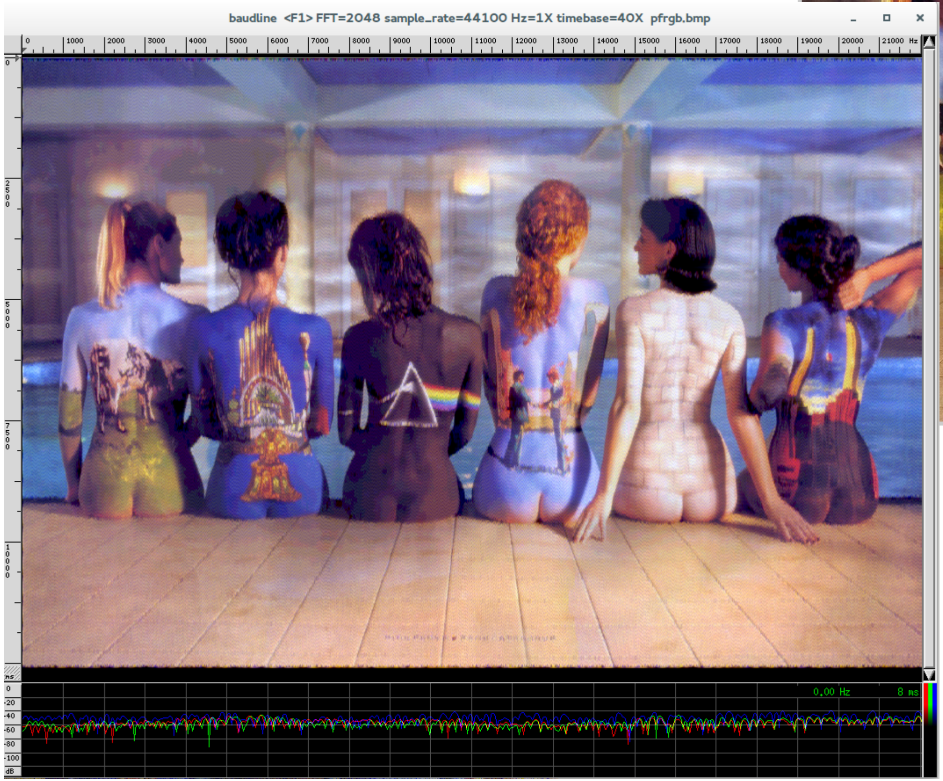
no, seriously :)

Consider the BMP as RAW 32b PCM



1. store ***sound*** in the lower 16 bits:
   sound ignored by BMP
   image data too low to be audible
2. store a picture encoded as sound
   - viewable as spectrogram

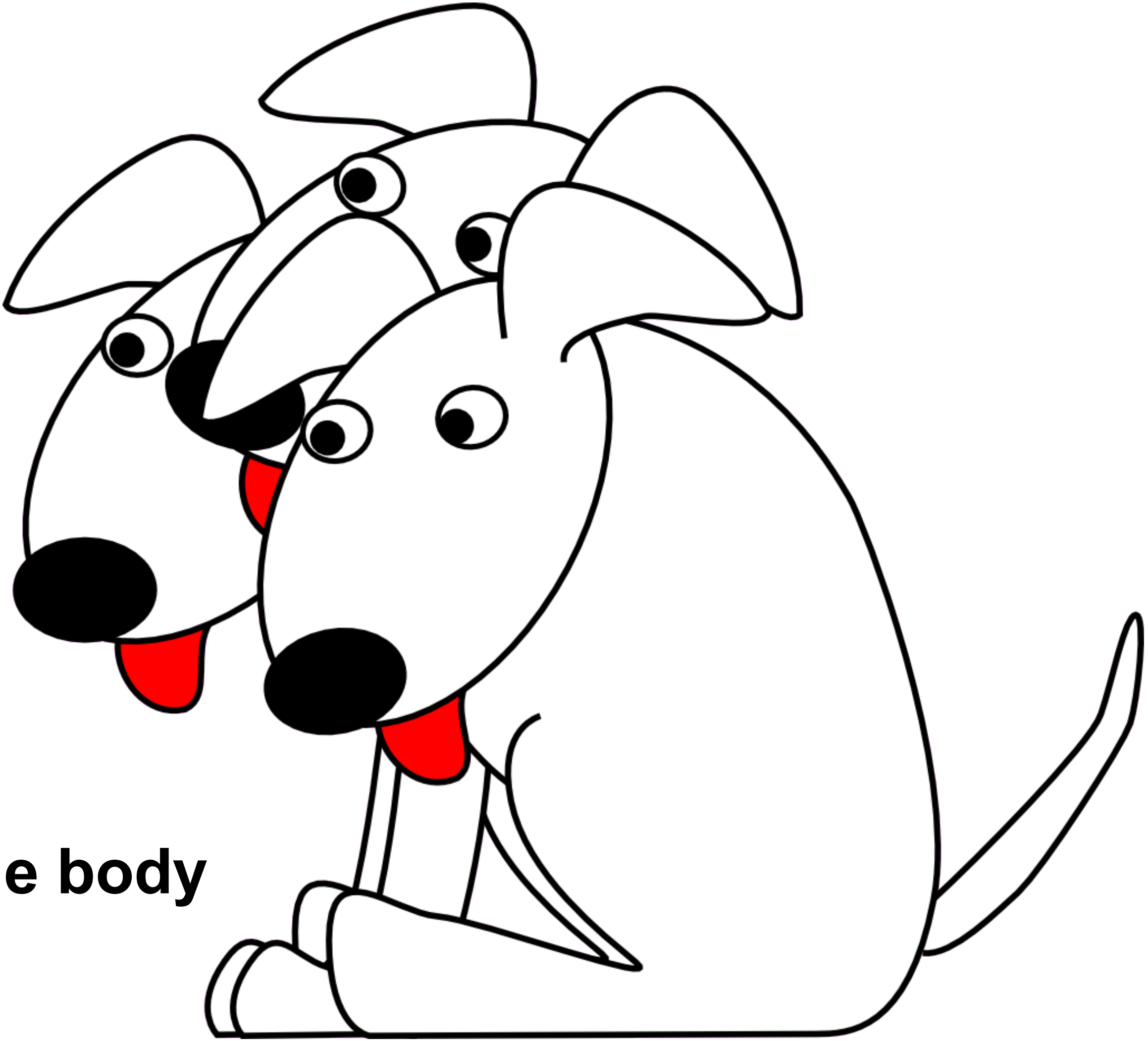
http://wiki.yobi.be/wiki/BMP_PCM_polyglot


baudline <F1> FFT=2048 sample_rate=44100 Hz=1X timebase=40X pfrgb.bmp

an RGB BMP || raw (3-channel spectrogram) polyglot by @doegox

Cerbero

same type of heads, one body

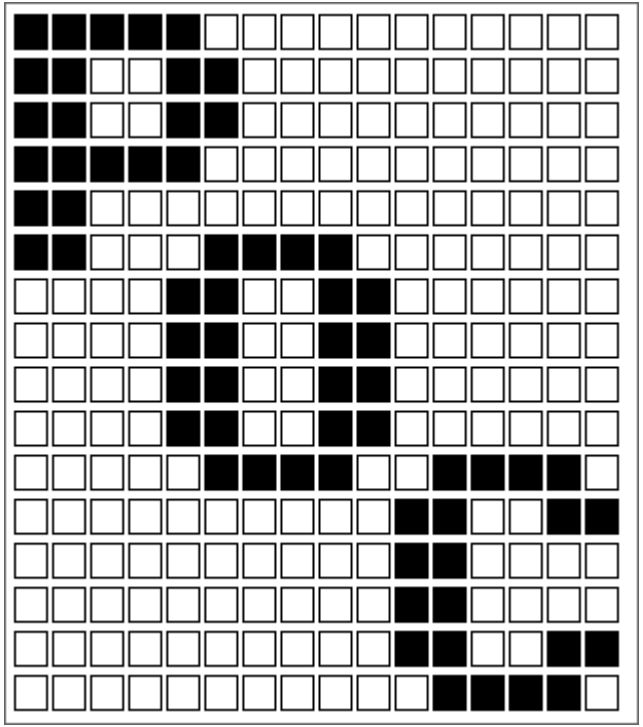


an RGB picture...

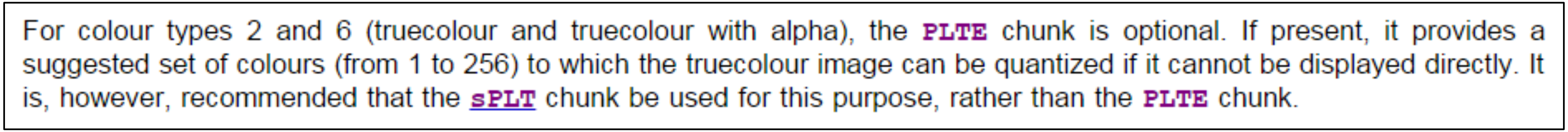
RGB picture data = bytes triplets for R, G, B colors

...with an unused palette

palette picture data = each byte is an index in the palette



in theory, it could be used:



For colour types 2 and 6 (truecolour and truecolour with alpha), the **PLTE** chunk is optional. If present, it provides a suggested set of colours (from 1 to 256) to which the truecolour image can be quantized if it cannot be displayed directly. It is, however, recommended that the **sPLT** chunk be used for this purpose, rather than the **PLTE** chunk.

How to make a pic-ception

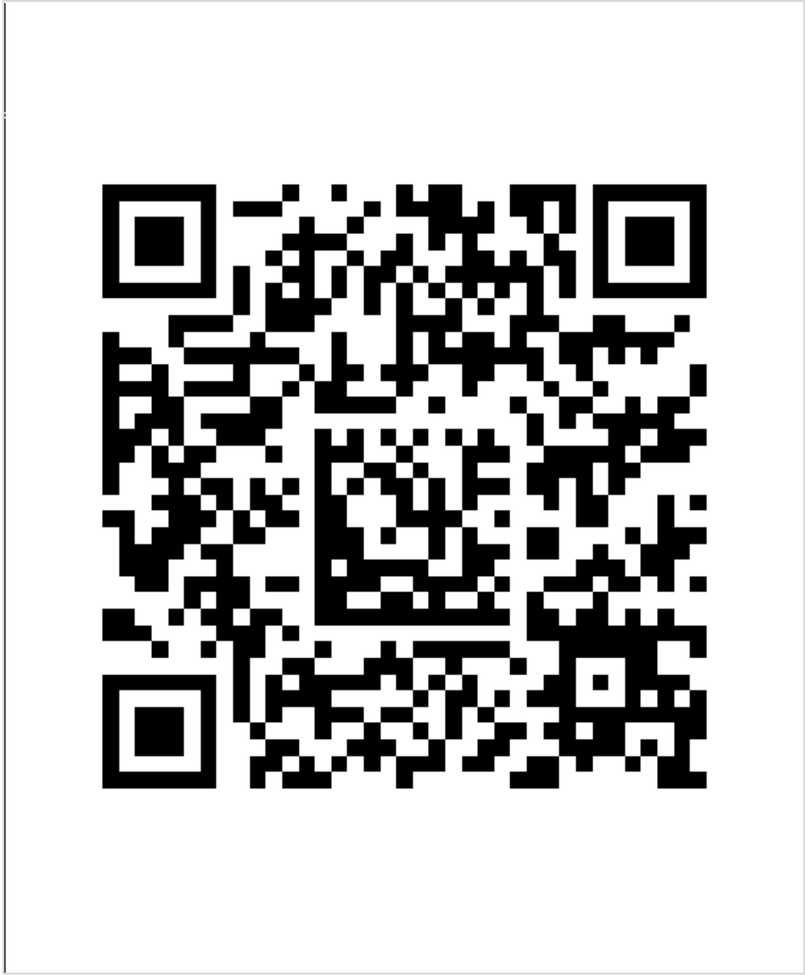
adjust each RGB value to the closest palette index

⇒ store a ***second*** picture with the ***same*** data….

(original idea by @reversity)

We get another picture of the same type from the same data!

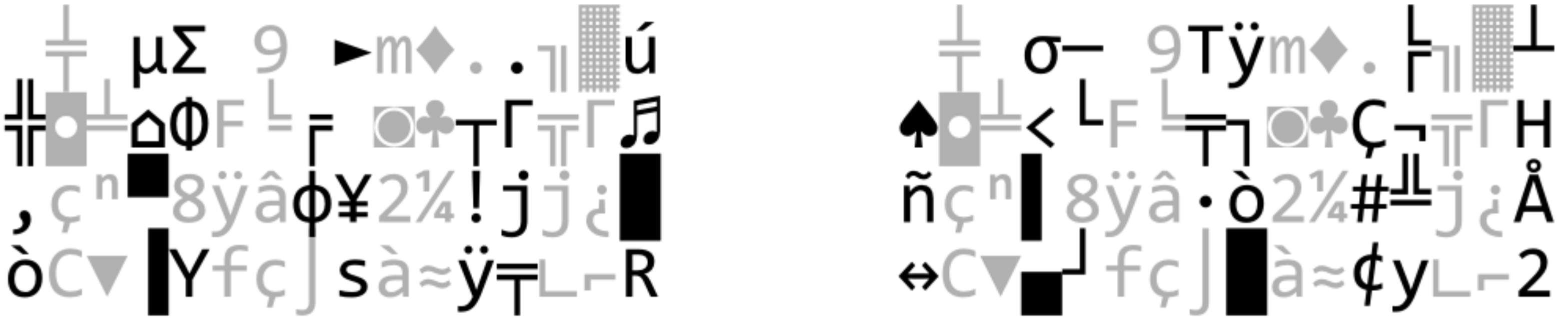
BTW, that's a barcode inception:
a DataMatrix barcode inside a QRCode, both valid
https://www.iseclab.org/people/atrox/qrinception.pdf



Malicious Hashing: Eve's Variant of SHA-1

Ange Albertini[1], Jean-Philippe Aumasson[2], Maria Eichlseder[3], Florian Mendel[3], and Martin Schläffer[3]

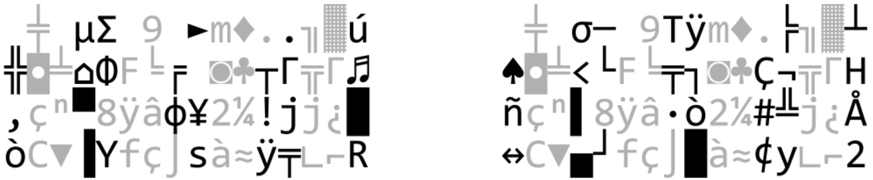
This is the actual SHA-1 with only 4 of its 5 constants modified
This doesn't give a collision in the actual SHA-1



2 colliding blocks: mostly random and unpredictable

At most three consecutive bytes without a difference.

Typically, in every dword, only the middle two bytes have no differences.



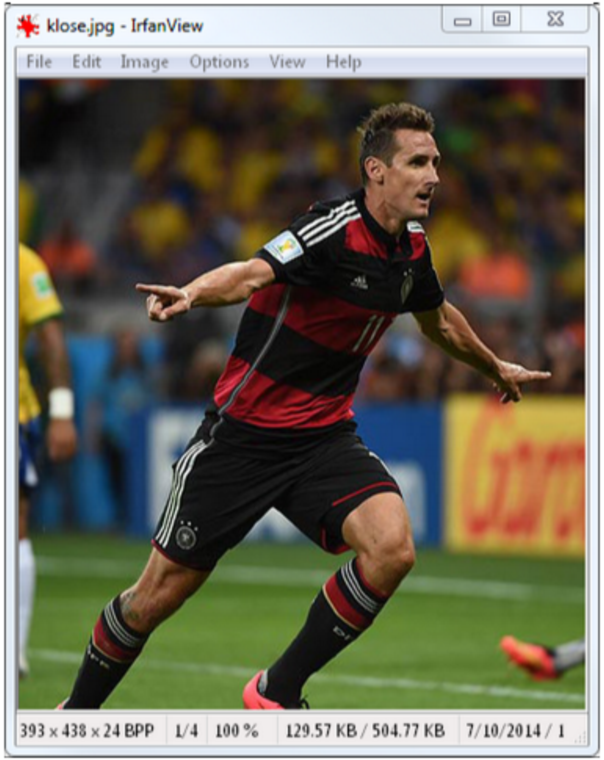
JPEG signature

Chunk marker
- ff e5 in block 1
- ff e6 in block 2

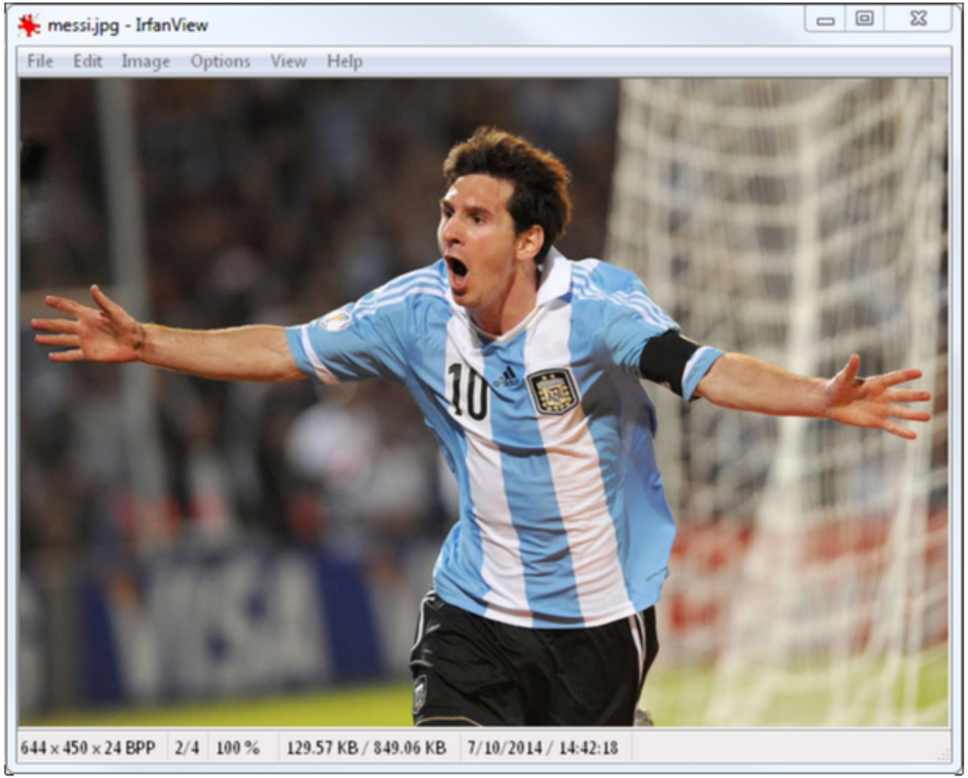
Chunk length
- c4 00 in block 1
- e4 00 in block 2

```
00000: ff d8 ff e? ?4 00 39 54 ?? 6d 04 2e ?? b7 b2 ??
       ?? 08 cf ?? ?? 46 d4 ?? ?? 0a 05 ?? ?? cb e2 ??  (contains no 0xff)
       ?? 87 fc ?? 38 98 83 ?? ?? 32 ac ?? ?? 6a a8 ??
       ?? 43 1f ?? ?? 66 87 f5 ?? 85 f7 ?? ?? 1c a9 ??


0c404: ff fe b5 e9      <COMment chunk covering Image 1>

0e404: ff e0            <start of Image 1>

       ...
       ff d9            <end of Image 1> <end of comment>

179ed: ff e0            <start of Image 2>

1b0d7: ff d9            <end of Image 2>
```

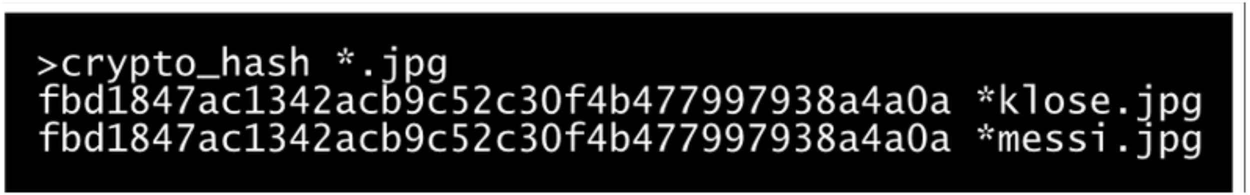
Abusing JPEG’s multiple unused APPx (FF Ex) markers



393 x 438 x 24 BPP | 1/4 | 100 % | 129.57 KB / 504.77 KB | 7/10/2014 / 1

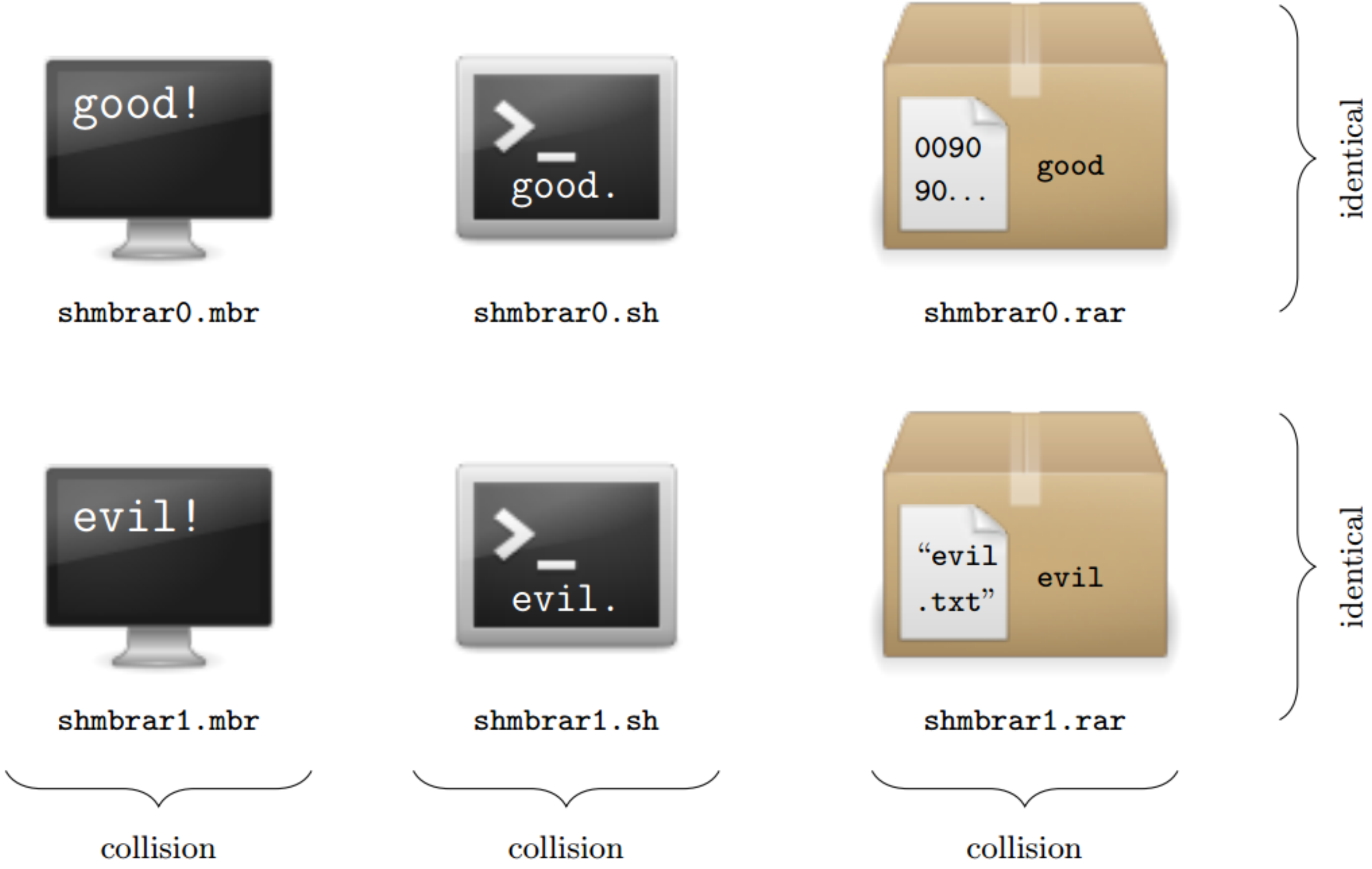


644 x 450 x 24 BPP | 2/4 | 100 % | 129.57 KB / 849.06 KB | 7/10/2014 / 14:42:18



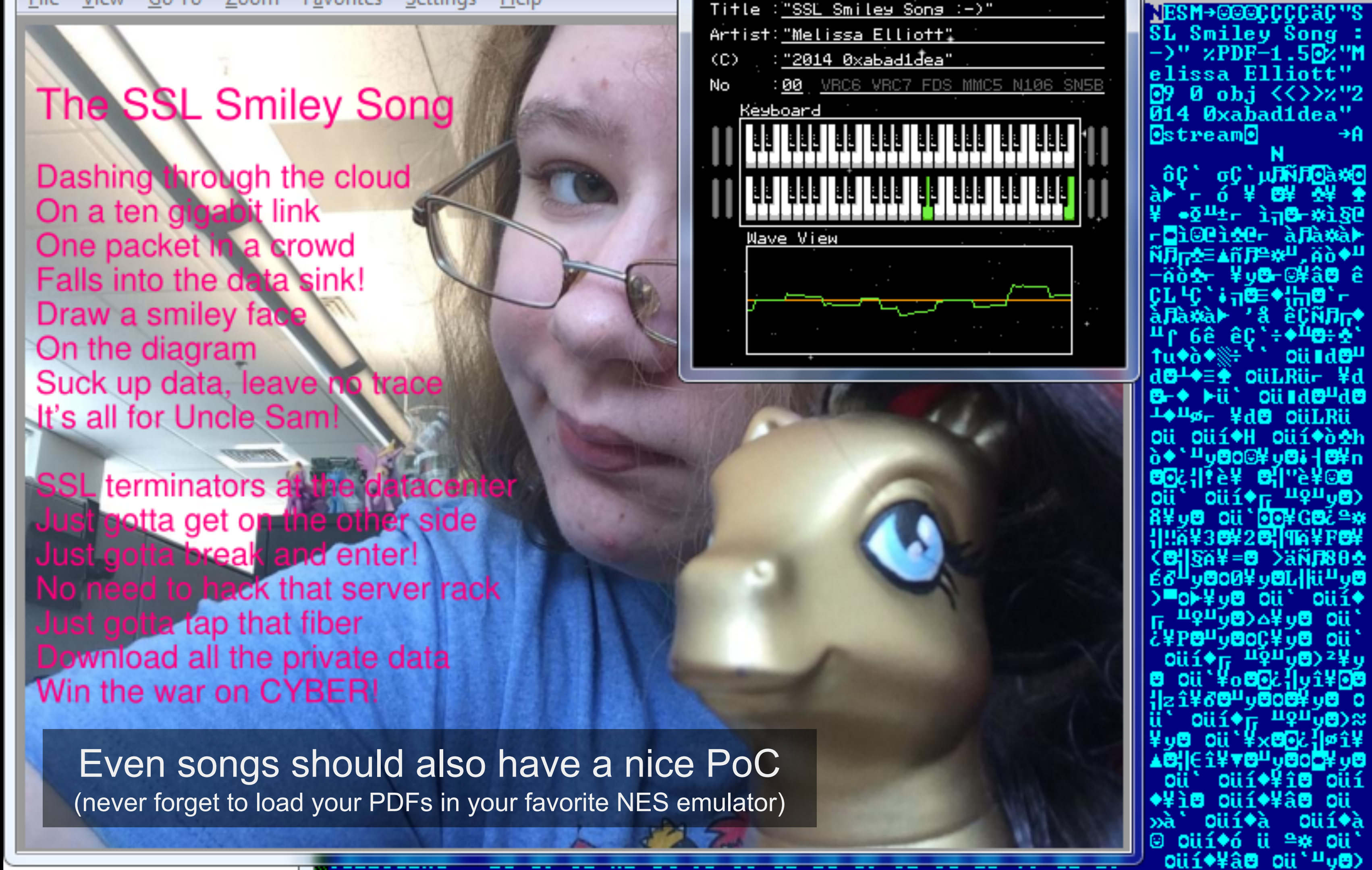
```
>crypto_hash *.jpg
fbd1847ac1342acb9c52c30f4b477997938a4a0a *klose.jpg
fbd1847ac1342acb9c52c30f4b477997938a4a0a *messi.jpg
```

Much better! (images chosen at random)



a polyglot collision (multiple use for a single backdoor)

Pwnie award… for the best song! err… what is it pwning exactly ?


File View Go To Zoom Favorites Settings Help
Keyboard
Wave View
VRC6 VRC7 FDS MMC5 N106 SN5B

The SSL Smiley Song

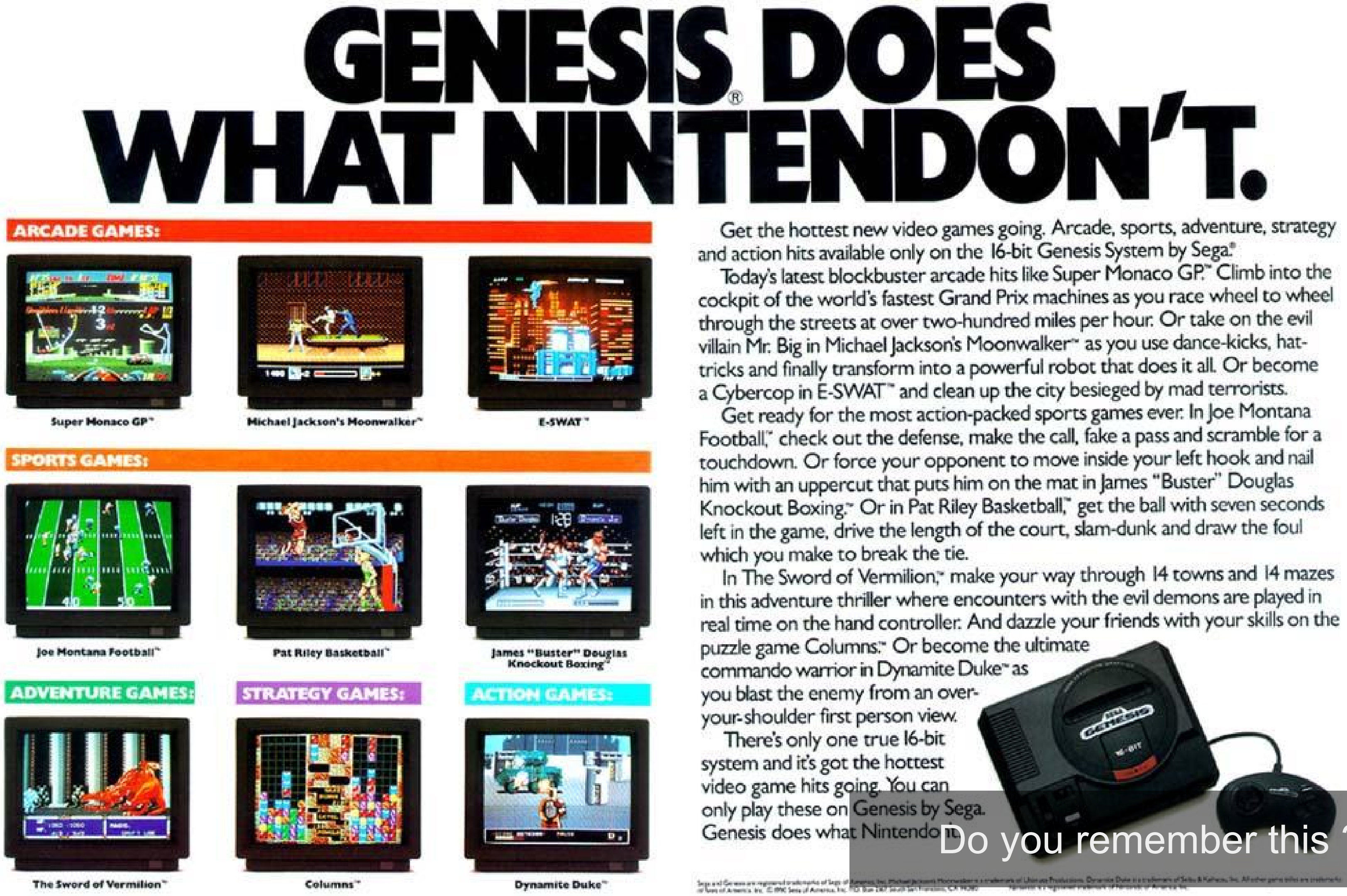
Dashing through the cloud
On a ten gigabit link
One packet in a crowd
Falls into the data sink!
Draw a smiley face
On the diagram
Suck up data, leave no trace
It's all for Uncle Sam!

SSL terminators at the datacenter
Just gotta get on the other side
Just gotta break and enter!
No need to hack that server rack
Just gotta tap that fiber
Download all the private data
Win the war on CYBER!

```
Title  :"SSL Smiley Song :-)"
Artist :"Melissa Elliott"
(C)    :"2014 0xabad1dea"
No     :00
```

```
NESM→
"SSL Smiley Song :-)" %PDF-1.5 "Melissa Elliott"
9 0 obj <<>>%"2014 0xabad1dea"
stream
```

Even songs should also have a nice PoC
(never forget to load your PDFs in your favorite NES emulator)



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Michael Jackson's Moonwalker™

E-SWAT™

SPORTS GAMES:

Joe Montana Football™

Pat Riley Basketball™

James "Buster" Douglas Knockout Boxing™

ADVENTURE GAMES:

The Sword of Vermilion™

STRATEGY GAMES:

Columns™

ACTION GAMES:

Dynamite Duke™

Get the hottest new video games going. Arcade, sports, adventure, strategy and action hits available only on the 16-bit Genesis System by Sega®

Today's latest blockbuster arcade hits like Super Monaco GP™ Climb into the cockpit of the world's fastest Grand Prix machines as you race wheel to wheel through the streets at over two-hundred miles per hour. Or take on the evil villain Mr. Big in Michael Jackson's Moonwalker™ as you use dance-kicks, hat-tricks and finally transform into a powerful robot that does it all. Or become a Cybercop in E-SWAT™ and clean up the city besieged by mad terrorists.

Get ready for the most action-packed sports games ever. In Joe Montana Football™ check out the defense, make the call, fake a pass and scramble for a touchdown. Or force your opponent to move inside your left hook and nail him with an uppercut that puts him on the mat in James "Buster" Douglas Knockout Boxing™ Or in Pat Riley Basketball™ get the ball with seven seconds left in the game, drive the length of the court, slam-dunk and draw the foul which you make to break the tie.

In The Sword of Vermilion™ make your way through 14 towns and 14 mazes in this adventure thriller where encounters with the evil demons are played in real time on the hand controller. And dazzle your friends with your skills on the puzzle game Columns™ Or become the ultimate commando warrior in Dynamite Duke™ as you blast the enemy from an over-your-shoulder first person view.

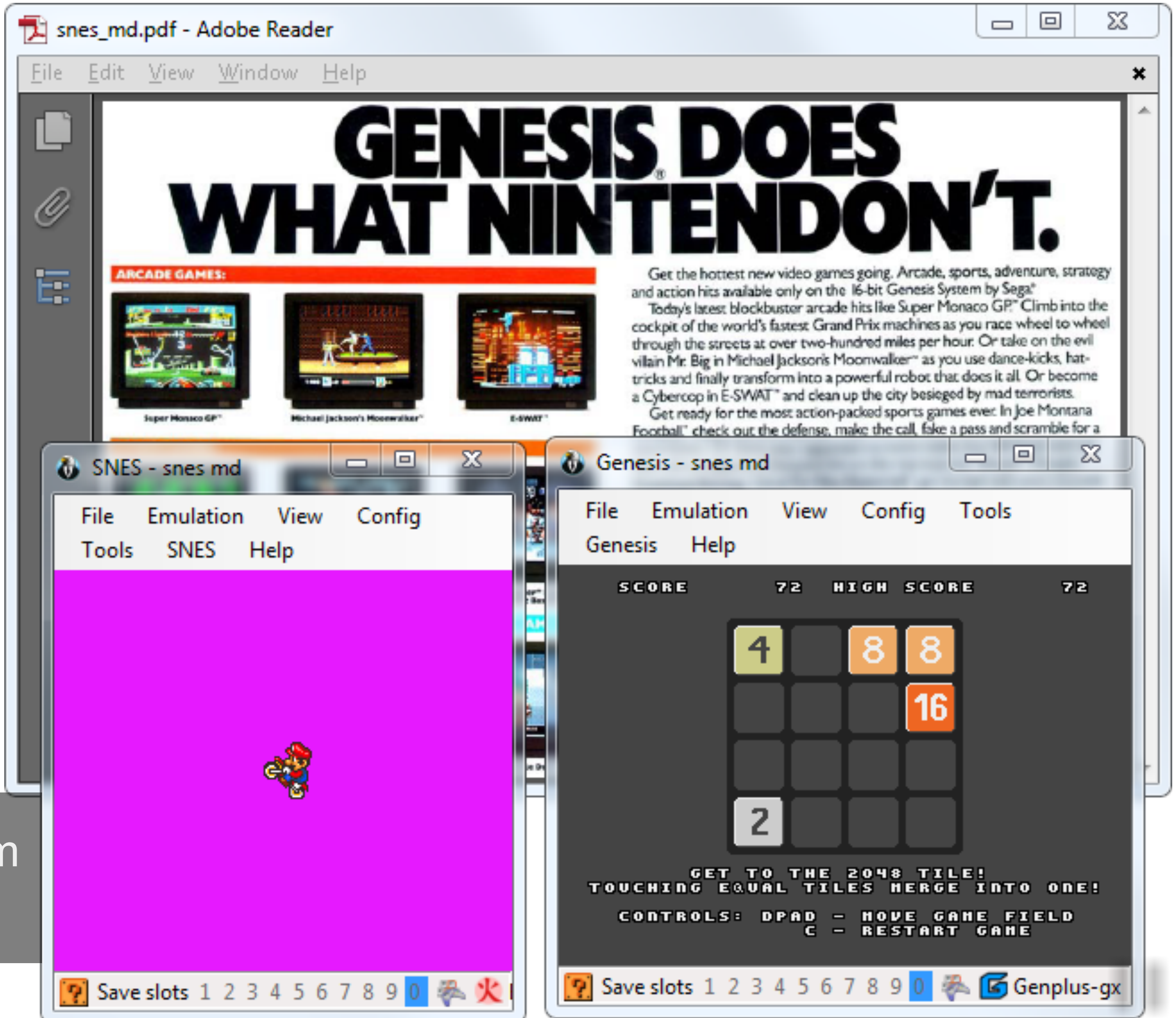
There's only one true 16-bit system and it's got the hottest video game hits going. You can only play these on Genesis by Sega. Genesis does what Nintendon't.

Sega and Genesis are registered trademarks of Sega of America, Inc. Michael Jackson's Moonwalker is a trademark of Ultimate Productions. Dynamite Duke is a trademark of Seibu & Kaihatsu, Inc. All other game titles are trademarks of Sega of America, Inc. © 1990 Sega of America, Inc. P.O. Box 2167 South San Francisco, CA 94080 Nintendo is a registered trademark of Nintendo of America Inc.

Do you remember this ?

NINTENDO

Sega®


snes_md.pdf - Adobe Reader
File Edit View Window Help
SNES - snes md
File Emulation View Config
Tools SNES Help
Save slots 1 2 3 4 5 6 7 8 9 0
Genesis - snes md
File Emulation View Config Tools
Genesis Help
Save slots 1 2 3 4 5 6 7 8 9 0
Genplus-gx
4
8
8
16
2

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Super Monaco GP™

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E-SWAT™

Get the hottest new video games going. Arcade, sports, adventure, strategy and action hits available only on the 16-bit Genesis System by Sega®

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Get ready for the most action-packed sports games ever. In Joe Montana Football™ check out the defense, make the call, fake a pass and scramble for a

```
SCORE        72   HIGH SCORE        72

       GET TO THE 2048 TILE!
TOUCHING EQUAL TILES MERGE INTO ONE!

   CONTROLS: DPAD - MOVE GAME FIELD
                C - RESTART GAME
```

A Super NES & Megadrive rom (and PDF at the same time)

Conclusion

Ange’s recipes :)

Never forget to:

- open your PDFs in a hex editor
- open your pictures in a sound player
- run your documents in a console emulator
- encrypt/decrypt with any cipher
- double-check what you printed

Security advice:

DON’T *

It’s easy to blame others - new insecure paths appear everyday

Research advice:

DO *

PoC||GTFO ! stop the marketing! cheap blamers ⇔ blatant marketers?

F.F.F. conclusion

- many abuses of the specs
  - specs often are wrong or misleading
- few parsers, even fewer dissectors
- standard tools evolve the wrong way
  - try to repair ‘corrupted’ file outside the specs
  - standard and recovery mode

For technical details, check my previous talks.

ACK

@doegox @pdfkungfoo @veorq @reversity
@travisgoodspeed @sergeybratus qkumba
@internot @gynvael @munin
@solardiz @0xabadidea @ashutoshmehra

lytron @JacobTorrey @thicenl

…and anybody who gave me feedback!

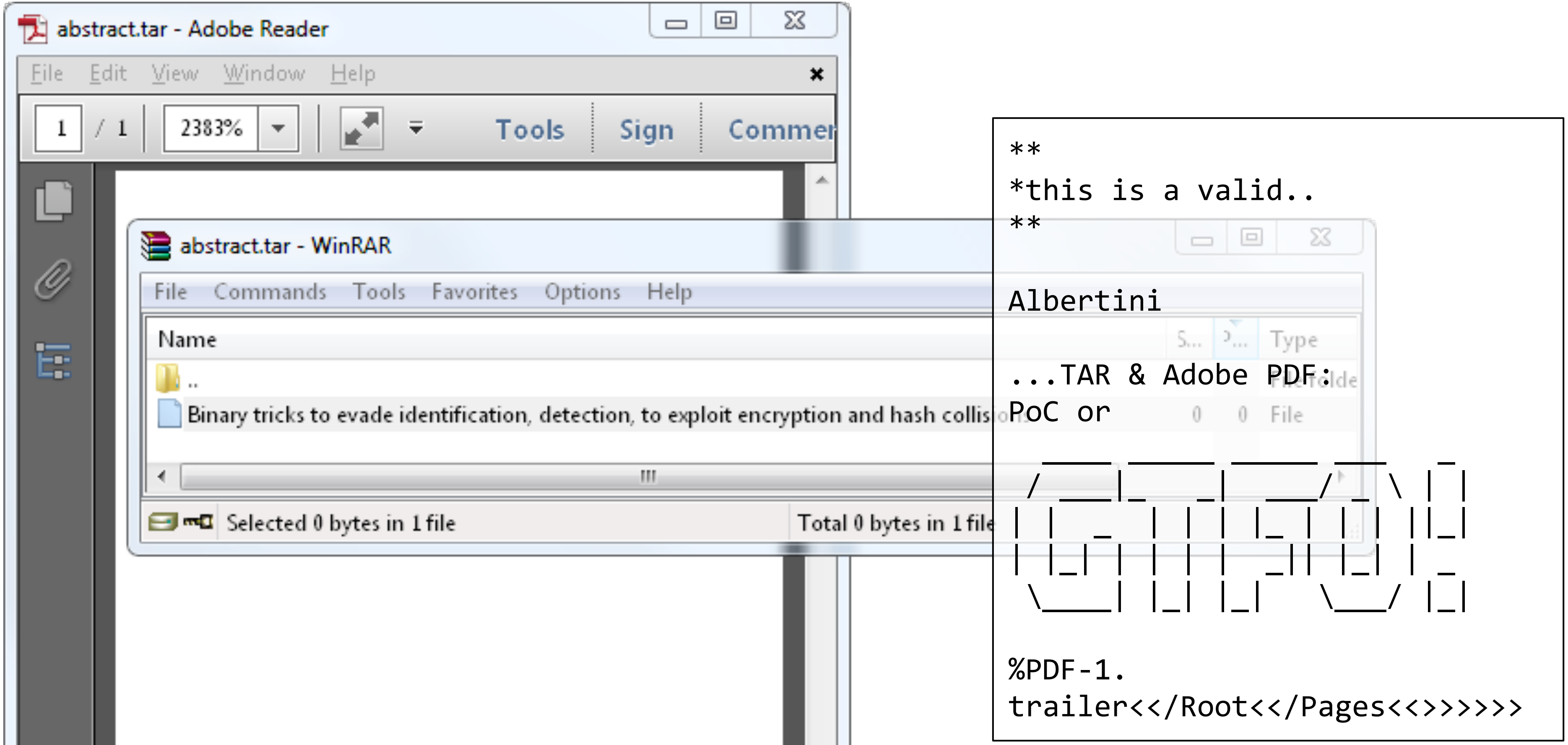
Bonus

after the talk, we tried some PoCs on professional (very expensive!) forensic softwares:

- polyglot files
  - a single file format found + no warning whatsoever
- schizophrenic files:
  - no warning yet different tabs of the same software showing different content :D

BIG FAIL - yet we **trust** them for court cases ?

00000
RYU
40
BONUS
STAGE
IC29461?


abstract.tar - Adobe Reader
File Edit View Window Help
1 / 1
2383%
Tools
Sign
Commer
abstract.tar - WinRAR
File Commands Tools Favorites Options Help
Name
S...
P...
Type
File folde

..

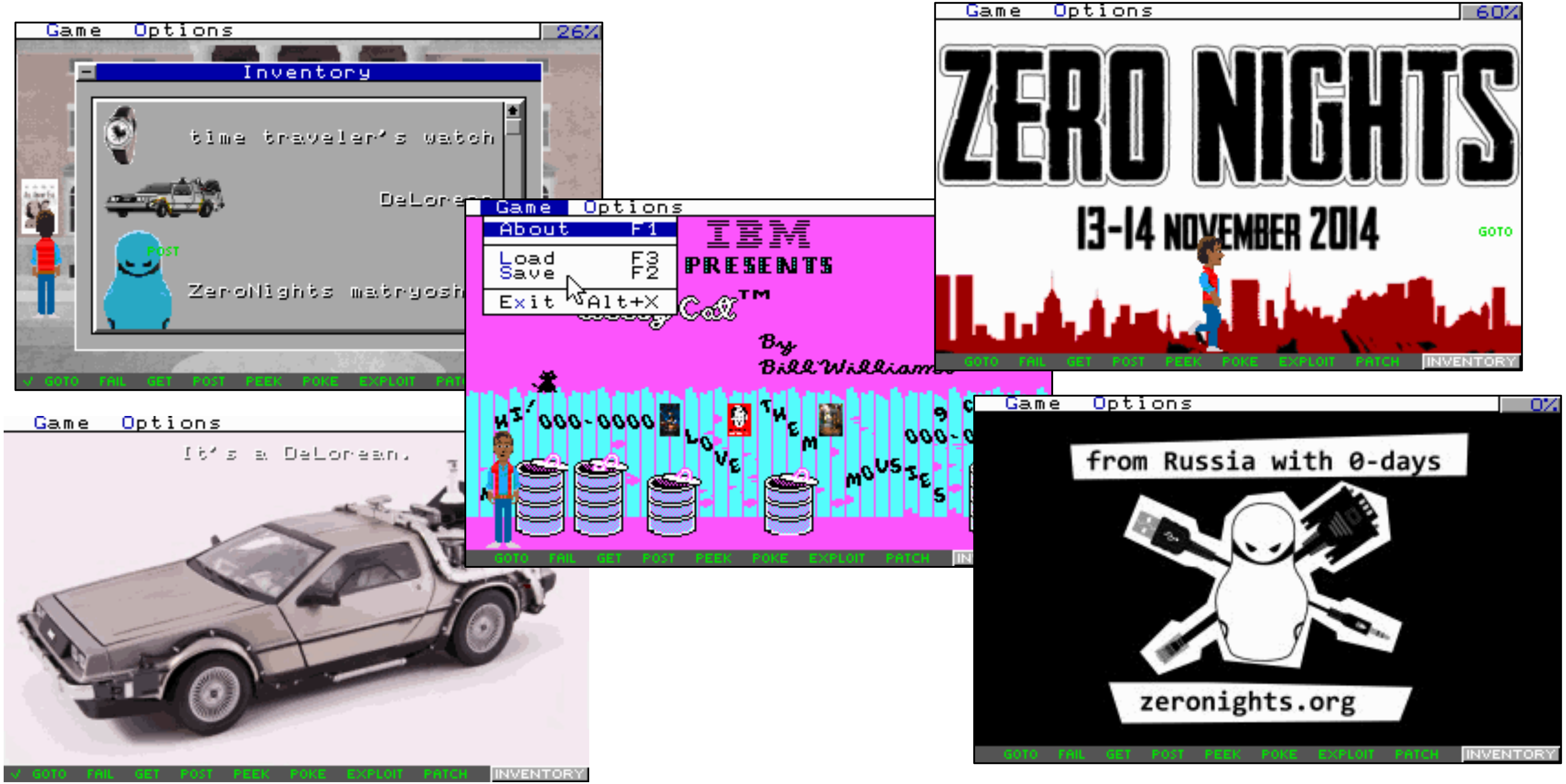
Binary tricks to evade identification, detection, to exploit encryption and hash collisi 0 0 File

Selected 0 bytes in 1 file

Total 0 bytes in 1 file

```
**
*this is a valid..
**


Albertini

...TAR & Adobe PDF:
PoC or

  ____ _____ _____ ___   _
 / ___|_   _|  ___/ _ \ | |
| |  _  | | | |_ | | | | ||_|
| |_| | | | | |  _|| |_| | _
 \____| |_| |_|   \___/ |_|

%PDF-1.
trailer<</Root<</Pages<<>>>>>>
```

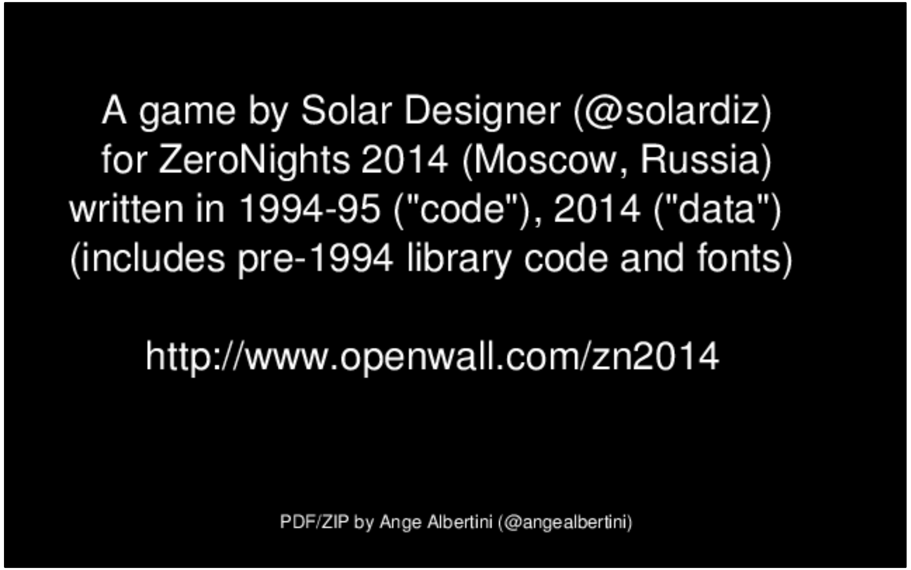
The initial abstract of this talk:
ASCII-only, PDF/TAR polyglot



It's a DeLorean.

Game Options 26%
Inventory
time traveler's watch
DeLorean
ZeroNights matryoshka
POST
✓ GOTO FAIL GET POST PEEK POKE EXPLOIT PATCH
Game Options
About F1
Load F3
Save F2
Exit Alt+X
IBM PRESENTS
Alley Cat™
By Bill Williams
HI! 000-0000 LOVE THEM MOUSIES 9 000-0
GOTO FAIL GET POST PEEK POKE EXPLOIT PATCH IN
Game Options 60%
ZERO NIGHTS
13-14 NOVEMBER 2014
GOTO
GOTO FAIL GET POST PEEK POKE EXPLOIT PATCH INVENTORY
Game Options
✓ GOTO FAIL GET POST PEEK POKE EXPLOIT PATCH INVENTORY
Game Options 0%
from Russia with 0-days
zeronights.org
GOTO FAIL GET POST PEEK POKE EXPLOIT PATCH INVENTORY

Solar Designer made a great keynote - that's actually a real game to play!
But one have to load and play through the game - not so accessible!
http://openwall.com/presentations/ZeroNights2014-Is-Infosec-A-Game/



A game by Solar Designer (@solardiz)
for ZeroNights 2014 (Moscow, Russia)
written in 1994-95 ("code"), 2014 ("data")
(includes pre-1994 library code and fonts)

http://www.openwall.com/zn2014

PDF/ZIP by Ange Albertini (@angealbertini)

a PDF:

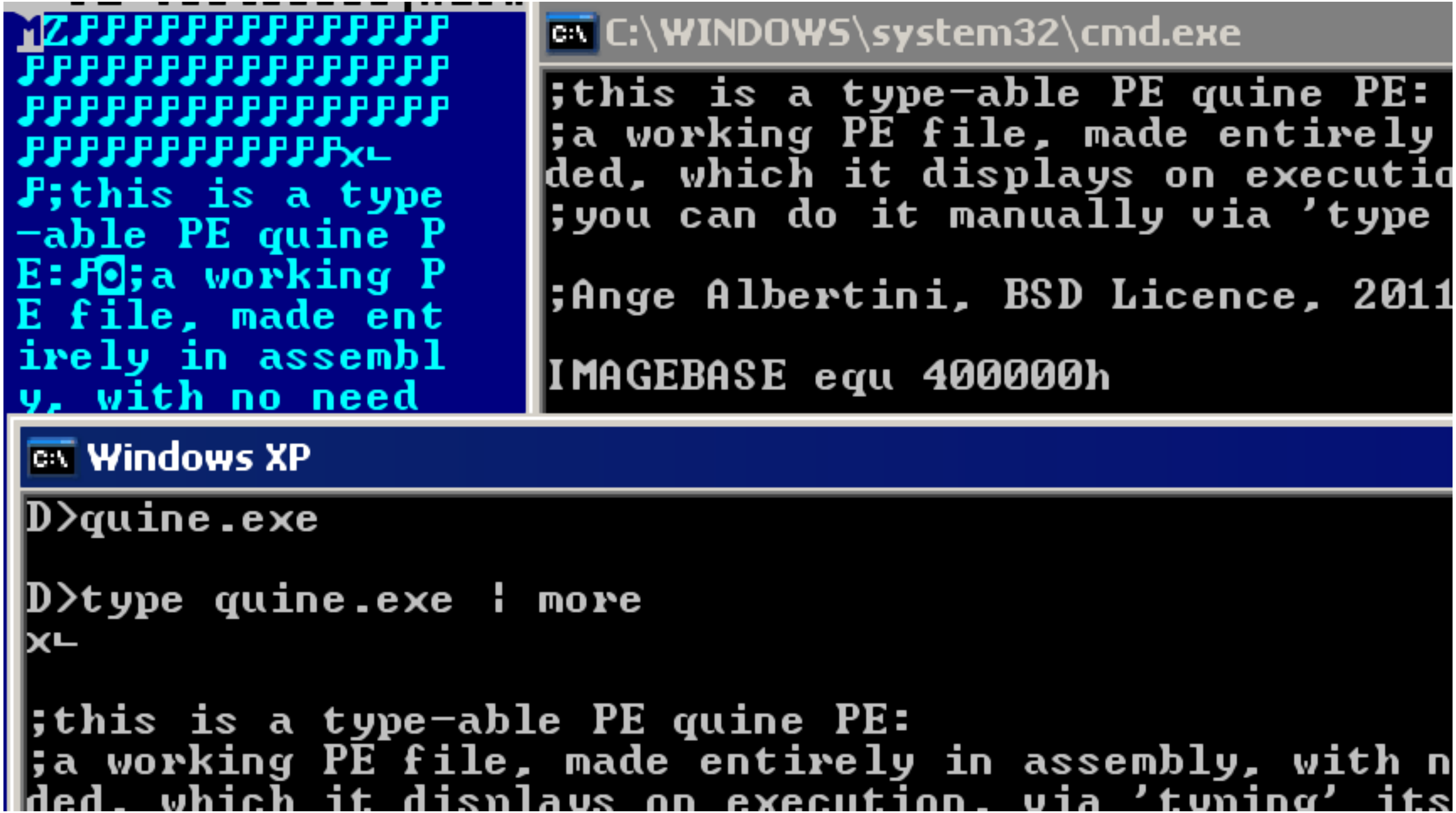
- containing the game as ZIP
- hand-written
  - with walkthrough's screenshots (in original resolution)
  - a lightweight title
  - while maintaining compatibility

a good way to distribute as a single file!

```
$ unzip -t ZeroNights2014-Is-Infosec-A-Game.pdf
Archive:  ZeroNights2014-Is-Infosec-A-Game.pdf
warning [ZeroNights2014-Is-Infosec-A-Game.pdf]:  6381506 extra bytes
  (attempting to process anyway)
    testing: ZN14GAME/                     OK
    testing: ZN14GAME/COMMON/              OK
...
```

Quine

prints its own source



```
MZƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒ
ƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒ
ƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒ
ƒƒƒƒƒƒƒƒƒƒƒƒƒx└
ƒ;this is a type
-able PE quine P
E:ƒ◙;a working P
E file, made ent
irely in assembl
y, with no need
```

```
;this is a type-able PE quine PE:
;a working PE file, made entirely
ded, which it displays on executio
;you can do it manually via 'type

;Ange Albertini, BSD Licence, 2011

IMAGEBASE equ 400000h
```

```
D>quine.exe

D>type quine.exe | more
x└

;this is a type-able PE quine PE:
;a working PE file, made entirely in assembly, with n
ded, which it displays on execution, via 'typing' its
```

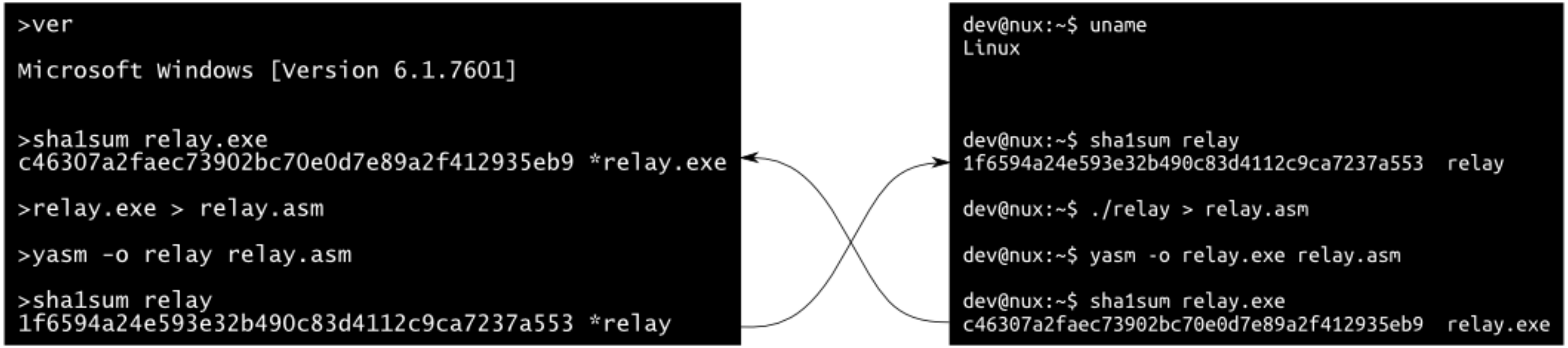
a PE quine (in assembler, no linker)

Most quines aren’t very sexy

Using a compiler is cheap :p

Quine Relay

A prints B’s source
B prints A’s source

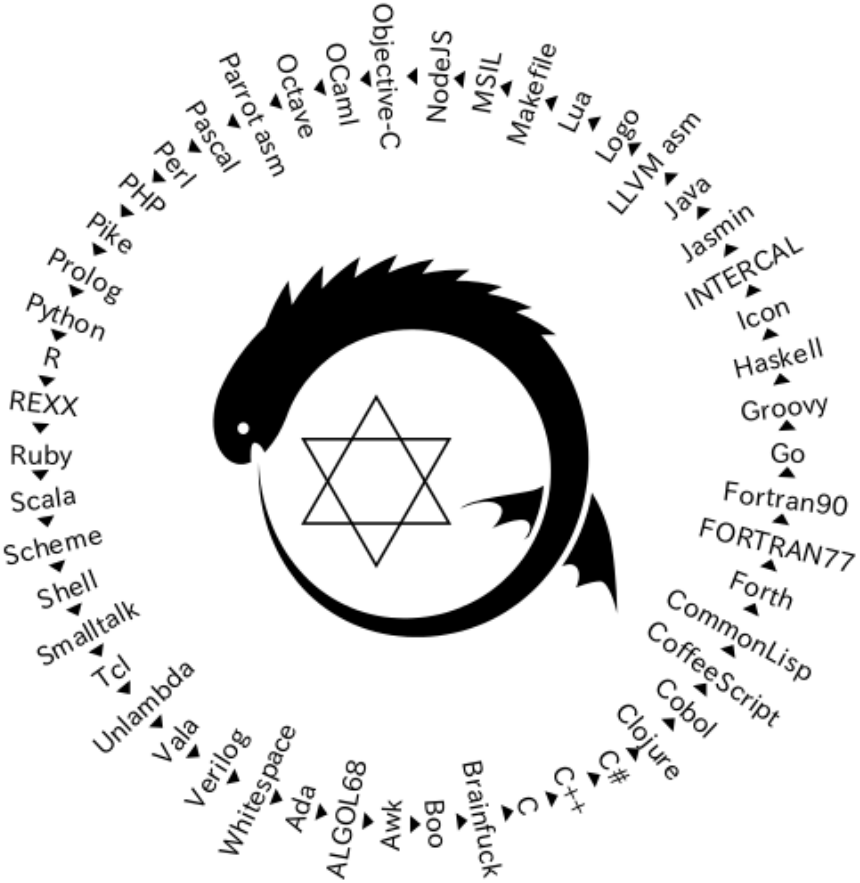


```
>ver

Microsoft Windows [Version 6.1.7601]


>sha1sum relay.exe
c46307a2faec73902bc70e0d7e89a2f412935eb9 *relay.exe

>relay.exe > relay.asm

>yasm -o relay relay.asm

>sha1sum relay
1f6594a24e593e32b490c83d4112c9ca7237a553 *relay
```

```
dev@nux:~$ uname
Linux



dev@nux:~$ sha1sum relay
1f6594a24e593e32b490c83d4112c9ca7237a553  relay

dev@nux:~$ ./relay > relay.asm

dev@nux:~$ yasm -o relay.exe relay.asm

dev@nux:~$ sha1sum relay.exe
c46307a2faec73902bc70e0d7e89a2f412935eb9  relay.exe
```

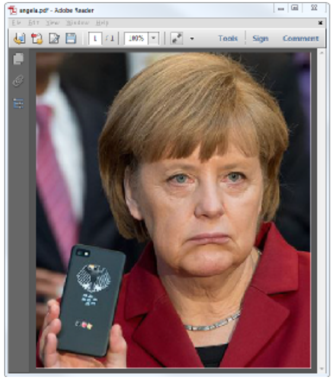
a PE ⇔ ELF quine relay

(no linker)

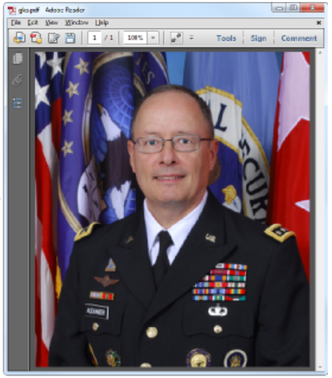


a 50-languages quine relay

https://github.com/mame/quine-relay

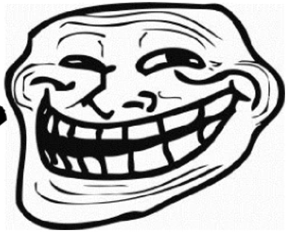


=>



=>

=>



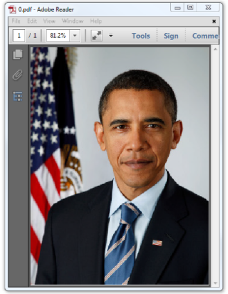
other AngeCryption PoCs (PDF, PNG, JPG)

Schizophrenics

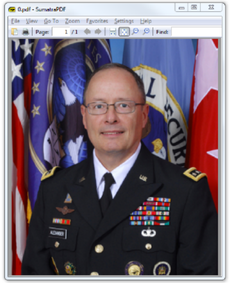
different contents with different tools

(both files)

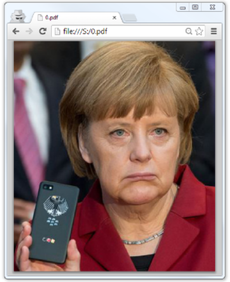
PDF via Adobe



PDF via Sumatra



PDF via Chrome



Fraternal twins

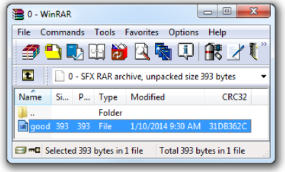
hash collision

SHA-1 with modified K* constants

```
> m_sha1sum.exe *
10382a6d3c949408d7cafaaf6d110a9e23230416 *0
10382a6d3c949408d7cafaaf6d110a9e23230416 *1
```

0

1

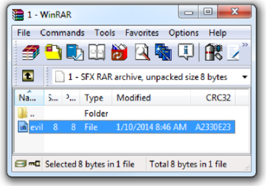

0 - WinRAR
File Commands Tools Favorites Options Help
Name Si... P... Type Modified CRC32

0 - SFX RAR archive, unpacked size 393 bytes

```
..                    Folder
good  393  393  File  1/10/2014 9:30 AM  31DB362C
```

Selected 393 bytes in 1 file   Total 393 bytes in 1 file

RAR


1 - WinRAR
File Commands Tools Favorites Options Help
Na... S... P... Type Modified CRC32

1 - SFX RAR archive, unpacked size 8 bytes

```
..                Folder
evil  8  8  File  1/10/2014 8:46 AM  A2330E23
```

Selected 8 bytes in 1 file   Total 8 bytes in 1 file

```
Booting from Floppy...
good!
```

MBR

```
Booting from Floppy...
evil!
```

```
./0.sh
good.
```

shell script

```
./1.sh
evil.
```

Polyglots

multiple file formats

A bit of everything

@angealbertini

corkami.com

Funky
File
Formats