



UNIVERSITÀ
DEGLI STUDI
DI PADOVA

The PNG format for digital images encoding

Mobile Programming & Multimedia exam presentation

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Let's talk about GIF first



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- Released in 1987
- First format for image transmission over a network
- Provides animations and transparency
- Indexed colors (8 bits - 256 colors)
- Lossless compression using LZW



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Everything was great

Everything was great, until it wasn't



Licensing

In 1994 Unisys patented the LZW algorithm

⇒ **pay royalties** to support the format!



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Time to PING!

- Users started to plan a **free** alternative



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- GIF's lack of true color support



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“PING Is Not GIF” was born!

Later renamed to “Portable Network Graphics” (PNG)



Features

- True color, grayscale and indexed colors support
- Optional alpha channel
- Lossless (*non-patented!*) compression algorithm
- Interlacing for low-resolution image earlier in the transfer
- Gamma correction
- Extensible (e.g. add different chunks)



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Color depth

True color has 8/16 bits per channel



Figure 1: GIF vs PNG

Color depth

Also supports indexed colors (1-8 bits - max 256 colors)



Figure 2: GIF vs PNG with indexed colors

Color depth

Grayscale also supported (1-16 bits per pixel)



Figure 3: Grayscale PNG



Color model

Either RGB or RGBA for transparency, focus on artificial images

Human color perception out of PNG scope → no YUV / YCbCr with specific optimizations (see JPEG)



Compression

- Uses DEFLATE algorithm
- Combination of LZ77 (or LZ1) and Huffman
- Also implemented in zlib and default compression method in `zip` utility:

```
$ zip --compression-method=deflate archive.zip dir/*
```

Interlacing

- Optional 2-dimensions, 7-pass algorithm (Adam7)
- Allows low-resolution preview of the image
- For slower connections

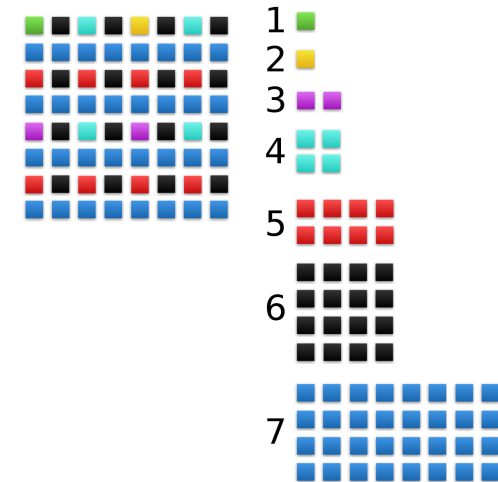


Figure 4: Adam7 algorithm visualization

Interlacing

- Optional 2-dimensions, 7-pass algorithm (Adam7)
- Allows low-resolution preview of the image
- For slower connections
- **Worse compression performances**

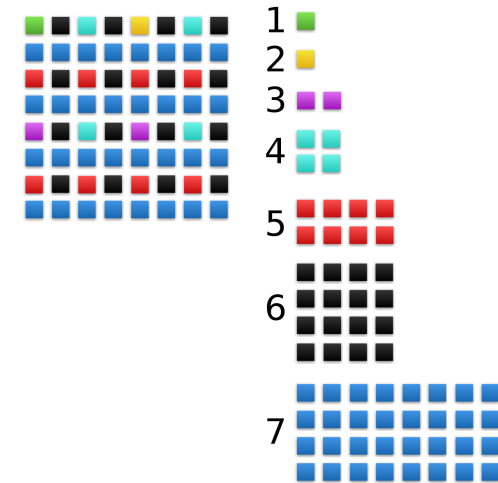


Figure 5: Adam7 algorithm visualization



Interlacing - example

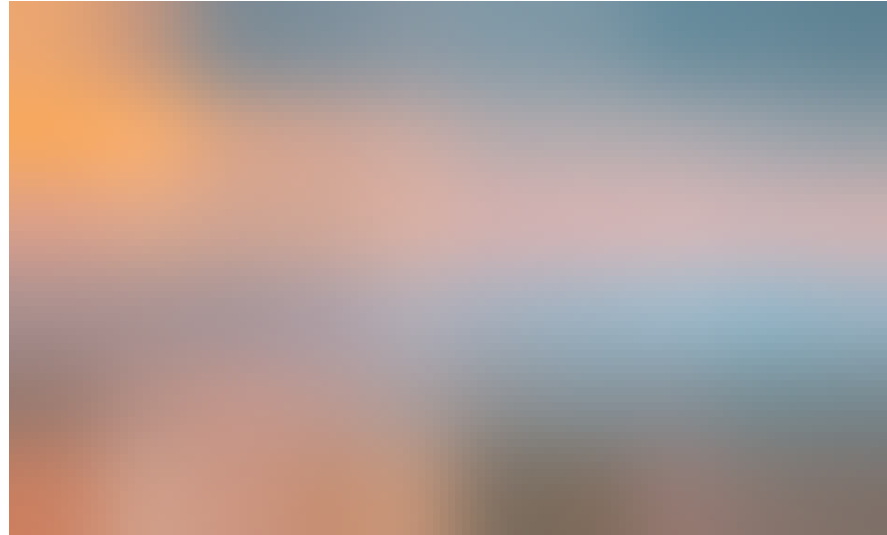


Figure 6: Pass 1



Interlacing - example

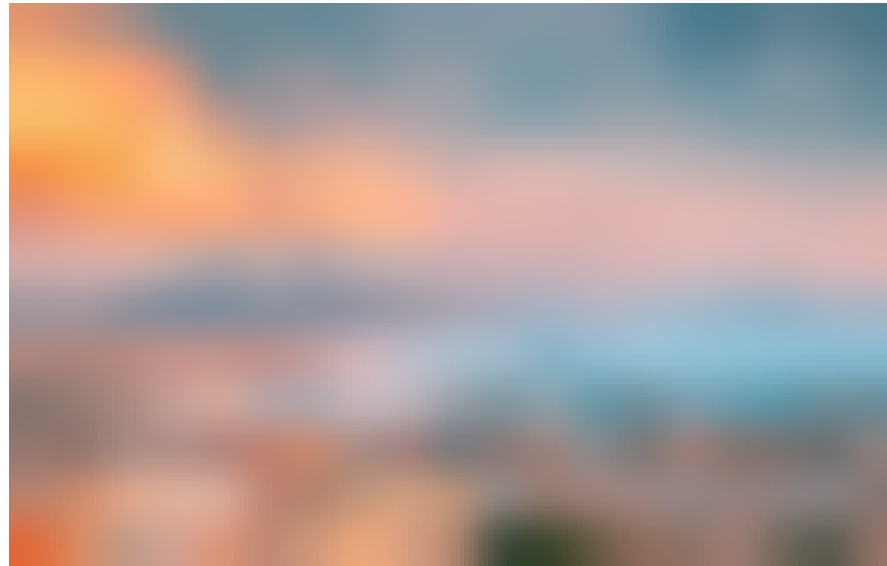


Figure 7: Pass 2



Interlacing - example



Figure 8: Pass 3



Interlacing - example



Figure 9: Pass 4



Interlacing - example



Figure 10: Pass 5



Interlacing - example



Figure 11: Pass 6



Interlacing - example



Figure 12: Pass 7



What about animations?

MNG (Multiple-image Network Graphics)

First attempt to mimic GIF's animated pictures



What about animations?

MNG (Multiple-image Network Graphics)

First attempt to mimic GIF's animated pictures

Complex and different file signature \Rightarrow never widely adopted



APNG (Animated PNG)

- Proposed by Mozilla developers
- PNG-compatible
- Lighter than MNG
- Support by most browsers
- Not officially embraced by PNG Group



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Future of PNG?

WebP aims to replace PNG, JPEG and GIF:

- Both lossy and lossless compression
- Animation and transparency support
- Great compression performances
- Actively promoted by Google
- Still not widespread

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Thanks for your attention!