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Png File Format

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Introduction

- PNG stands for Portable Network Graphics. Uses extension .png
- Supports lossless data compression
- Developed as a replacement for the GIF file format
- Format aimed towards internet transfer, rather than professional quality prints
- Supports 24 bit RGB, 32 bit RGBA. Greyscale, and full color RGB/RGBA
- A PNG file contains a single image in an extensible structure of "chunks"

Development of PNG

- Compression algorithm used in the GIF file format was patented, along with its limitations in only supporting 256 colours at a time
- PNG was developed in 1995 to remedy these issues, by a usenet newsgroup
- Did not adopt the animation support of GIFs, single format only

PNG File Format

- The PNG file format contains a series of chunks that contain different information about the image
- Chunk types are given four letter case sensitive ASCII name
- The case of each letter in the name provides the decoder with some information
- A decoder must be able to interpret these critical chunks in order to render a PNG file

Types of Chunks

PNG signature/ File header - 8 Bytes

Critical chunks:

- PLTE - contains the palette or list of colors

- IHDR(Image Header) - 13 bytes

- IDAT(Image data) - contains the image, size dependent on image, can be split across multiple IDAT chunks

- IEND(Image End) - marks the end of the image

Ancillary chunks:

- bKGD - gives the default background color

- dSIG - for storing digital signatures

- tEXt - stores the text

PNG Signature/File Header and Image Header

- The file signature contains 8 bytes
- These 8 bytes are: 89 50 4E 47 0D 0A 1A 0A
- The values 50 4E 47 identify the PNG file type
- Image header contains 13 bytes, the order of bytes are as follows:
 - 4 bytes - image width
 - 4 bytes - image height
 - 1 byte - bit depth
 - 1 byte - color type
 - 1 byte - compression method
 - 1 byte - filter method
 - 1 byte - interlace method

Example of PNG File Format

Structure of a very simple PNG file

89 50 4E 47 0D 0A 1A 0A PNG signature	IHDR Image header	IDAT Image data	IEND Image end
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Contents of a minimal PNG file representing just one red pixel

Hex	As characters
89 50 4E 47 0D 0A 1A 0A 00 00 00 0D 49 48 44 52	.PNG.....IHDR
00 00 00 01 00 00 00 01 08 02 00 00 00 90 77 53wS
DE 00 00 00 0E 49 44 41 54 78 DA 62 F8 CF C0 00	p....IDATxÚbøIÀ.
10 60 00 03 01 01 00 66 FD 9F 24 00 00 00 00 49	.`.....fÿ.\$....I
45 4E 44 AE 42 60 82	END®B`.

Compression

- Uses a 2 stage process:
 - Filtering, or prediction
 - Compression
- Lossless compression using a non-patented algorithm called DEFLATE
- A combination of LZ77 and Huffman coding



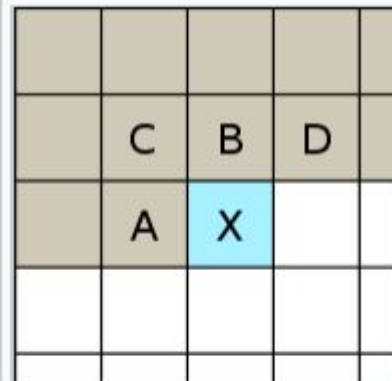
Lossy JPEG vs Lossless
PNG

Filtering

- Before compression is applied, the data is transformed via a prediction method
- Single filter method is used for entire image while for each image line, filter type is chosen to make it more efficiently compressible
- Only one filter method available i.e., method 0
- Five filter types available
- The filter predicts the value of each pixel based on the values of previous neighbouring pixels and subtracts the predicted color from actual value

Filter types

Type byte	Filter name	Predicted value
0	None	Zero (so that the raw byte value passes through unaltered)
1	Sub	Byte <i>A</i> (to the left)
2	Up	Byte <i>B</i> (above)
3	Average	Mean of bytes <i>A</i> and <i>B</i> , rounded down
4	Paeth	<i>A</i> , <i>B</i> , or <i>C</i> , whichever is closest to $p = A + B - C$



PNG's filter method 0 can use the data in pixels *A*, *B*, and *C* to predict the value for *X*.

Animation

- MNG is extension to PNG which supports animation
- It also shares the basic structure and chunks with PNG but its complex and has a different file signature
- APNG was developed due to the complexity of MNG which is also based on PNG
- Neither of these formats are widely supported

Questions?