Netpbm format

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A **Netpbm format** is any graphics format used and defined by the Netpbm project. The **portable pixmap format** (**PPM**), the **portable graymap format** (**PGM**) and the **portable bitmap format** (**PBM**) are image file formats designed to be easily exchanged between platforms. They are also sometimes referred to collectively as the **portable anymap format** (**PNM**),[4][5] not to be confused with the related portable arbitrary map format.

Portable pixmap

Filename extension	`.pbm, .pgm, .ppm, .pnm`
Internet media type	`image/x-portable-bitmap`[1]
	`image/x-portable-graymap`[2]
	`image/x-portable-pixmap`[3]
	`image/x-portable-anymap`[4]
Developed by	Jef Poskanzer
Type of format	Image file formats
Extended to	Portable Arbitrary Map (PAM)
Open format?	yes

Contents

History

The PBM format was invented by Jef Poskanzer in the 1980s as a format that allowed monochrome bitmaps to be transmitted within an email message as plain ASCII text, allowing it to survive any changes in text formatting.[5] Poskanzer developed the first library of tools to handle the PBM format, Pbmplus, released in 1988. It mainly contained tools to convert between PBM and other graphics formats. By the end of 1988, Poskanzer had developed the PGM and PPM formats along with their associated tools and added them to Pbmplus. The final release of Pbmplus was December 10, 1991.

In 1993, the Netpbm library was developed to replace the unmaintained Pbmplus. It was simply a repackaging of Pbmplus with additions and fixes submitted by people all over the world.[6]

File format description

Each file starts with a two-byte magic number (in ASCII) that identifies the type of file it is (PBM, PGM, and PPM) and its encoding (ASCII or binary). The magic number is a capital P followed by a single-digit number.

Type		Magic number		Magic number		Extension	Colors
Portable BitMap	[1]	P1	ASCII	P4	binary	.pbm	0–1 (black & white)
Portable GrayMap	[2]	P2	ASCII	P5	binary	.pgm	0–255 (gray scale)
Portable PixMap	[3]	P3	ASCII	P6	binary	.ppm	0–255 (RGB)

A value of P7 refers to the PAM file format that is covered as well by the netpbm library.[7]

The ASCII formats allow for human readability and easy transfer to other platforms; the binary formats are more efficient in file size but may have native byte-order issues.

In the binary formats, PBM uses 1 bit per pixel, PGM uses 8 bits per pixel, and PPM uses 24 bits per pixel: 8 for red, 8 for green, 8 for blue.

PBM example

A simple example of the PBM format is as follows (there is a newline character at the end of each line):

```
P1
# This is an example bitmap of the letter "J"
6 10
0 0 0 0 1 0
0 0 0 0 1 0
0 0 0 0 1 0
0 0 0 0 1 0
0 0 0 0 1 0
0 0 0 0 1 0
1 0 0 0 1 0
0 1 1 1 0 0
0 0 0 0 0 0
0 0 0 0 0 0
```

The string *P1* identifies the file format. The hash sign introduces a comment. The next two numbers give the width and the height. Then follows the matrix with the pixel values (in the monochrome case here, only zeros and ones).

Here is the resulting image: ⌟

Here it is again magnified 20 times:

Note that a 0 signifies a white pixel, and a 1 signifies a black pixel. This is in contrast to the other formats, where higher values signify brighter pixels.

The P4 binary format of the same image represents each pixel with a single bit, packing 8 pixels per byte, with the first pixel as the most significant bit. Extra bits are added at the end of each row to fill a whole byte.

PGM example

The PGM and PPM formats (both ASCII and binary versions) have an additional parameter for the maximum value (numbers of grey between black and white) after the X and Y dimensions and before the actual pixel data. Black is 0 and max value is white. There is a newline character at the end of each line.

```
P2
# Shows the word "FEEP" (example from Netpbm man page on PGM)
24 7
20
0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
0  3  3  3  3  0  0  7  7  7  7  0  0 11 11 11 11  0  0 15 15 15 15  0
0  3  0  0  0  0  0  7  0  0  0  0  0 11  0  0  0  0  0 15  0  0 15  0
0  3  3  3  0  0  0  7  7  7  0  0  0 11 11 11  0  0  0 15 15 15 15  0
0  3  0  0  0  0  0  7  0  0  0  0  0 11  0  0  0  0  0 15  0  0  0  0
0  3  0  0  0  0  0  7  7  7  7  0  0 11 11 11 11  0  0 15  0  0  0  0
0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
```


Example (magnified)

PPM example

This is an example of a color RGB image stored in PPM format. There is a newline character at the end of each line.

```
P3
3 2
255
# The part above is the header
# "P3" means this is a RGB color image in ASCII
# "3 2" is the width and height of the image in pixels
# "255" is the maximum value for each color
# The part below is image data: RGB triplets
255   0   0     0 255   0     0   0 255
255 255   0   255 255 255     0   0   0
```


Image (magnified)
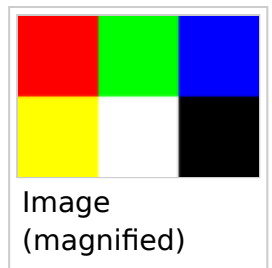
The P6 binary format of the same image represents each color component of each pixel with one byte (thus three bytes per pixel) in the order red, green, then blue. The file is smaller, but the color information is difficult to read by humans.

The PPM format is not compressed, and thus requires more space and bandwidth than a compressed format would. For example, the above 192x128 PNG (Portable Network Graphics) image has a file size of 166 bytes. When converted to a 192x128 PPM image, the file size is 73,848 bytes. The PPM format is generally an intermediate format used for image work before converting to a more efficient format, for example the PNG format, without any loss of information in the intermediate step.

The image shown above using only **0** or the maximal value for the **r**ed-**g**reen-**b**lue channels can be also encoded as:

```
P3
# The same image with width 3 and height 2,
# using 0 or 1 per color (red, green, blue)
3 2 1
1 0 0   0 1 0   0 0 1
1 1 0   1 1 1   0 0 0
```

White space including line ends and comment lines is syntactically equivalent to a single space within the PNM headers. For the plain formats P1...P3 this also affects the pixmap lines; in fact lines should be limited to 70 characters:

```
P3 3 2 1  1 0 0   0 1 0   0 0 1  1 1 0   1 1 1   0 0 0
```

16-bit extensions

The original definition of the PGM and the PPM binary formats (the P5 and P6 formats) did not allow bit depths greater than 8 bits. One can of course use the ASCII format, but this format both slows down reading and makes the files much larger. Accordingly, many programmers extended the format to allow higher bit depths. Using higher bit depths encounters the problem of having to decide on the endianness of the file. The various implementations could not agree on which byte order to use, and some connected the 16-bit endianness to the pixel packing order.[8] In Netpbm, the *de facto* standard implementation of the PNM formats, the most significant byte is first.[9]

Common RGB color depths include 24=3×8, 30=3×10, 32=4×8, 36=3×12, 48=3×16, and 64=4×16 (with three **r**ed–**g**reen–**b**lue channels, and a fourth unused or RGBA **a**lpha channel, respectively). Classic XnView can read *rgb48be* PPM, FFmpeg can also create *rgb48be* PPM.[10]

While 30=3×10 could fit into 32 bits this is not supported by the binary PNM and PAM formats. All PPM bit depths with more than 8 bits are encoded in 64 bits. More than 8 gray bits end up as 16 bits without transparency (FFmpeg PGM or PAM pix_fmt *gray16be*).

PGMYUV is a PGM variant only used by FFmpeg.

See also

- PAM (P7, portable arbitrary map)
- X PixMap (comparison of PBM and XPM)

References

1. .pbm (http://netpbm.sourceforge.net/doc/pbm.html) MIME type not registered (http://www.iana.org/assignments/media-types/media-types.xhtml#image) at IANA
2. .pgm (http://netpbm.sourceforge.net/doc/pgm.html) MIME type not registered (http://www.iana.org/assignments/media-types/media-types.xhtml#image) at IANA
3. .ppm (http://netpbm.sourceforge.net/doc/ppm.html) MIME type not registered (http://www.iana.org/assignments/media-types/media-types.xhtml#image) at IANA
4. .pnm (http://netpbm.sourceforge.net/doc/pnm.html) MIME type not registered (http://www.iana.org/assignments/media-types/media-types.xhtml#image) at IANA

5. James D. Murray, William van Ryper (1996-04). "Encyclopedia of Graphics File Formats, Second Edition". O'Reilly. ISBN 1-56592-161-5. Retrieved 2014-02-27. Check date values in: |date= (help)
6. "Netpbm history". Retrieved March 17, 2010.
7. Layout of the PAM file format (http://netpbm.sourceforge.net/doc/pam.html#layout), netpbm documentation
8. "Pnmtotiff User Manual". *netpbm doc at SourceForge*. 27 March 2005.
9. "pamendian man page". *netpbm doc at SourceForge*. 10 October 2012.
10. "Image Formats". *FFmpeg General Documentation*. 2014. Retrieved 2014-02-23.

External links

- Examples of ppm files in various formats (http://people.sc.fsu.edu/~jburkardt/data/data.html)

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