

GIF FORMAT

Synonyms: *Color palette-based lossless image compression format.*

Definition: *Popular image format that encodes in a lossless way color-mapped images with no more than 256 distinct colors.*

The Graphics Interchange Format (GIF) is an image format introduced by CompuServe in 1987 [1]. The format uses a palette of up to 256 distinct colors from the 24-bit red-green-blue (RGB) color space. It also supports animations obtained by displaying each single shot for a short time, which allows using a separate palette for each frame. The limited number of colors makes the GIF format well-suited for simple images such as graphics or logos although it shows some drawbacks (the limited number of colors introduces visible color artifacts) when used to reproduce color photographs.

GIF images are compressed using the Lempel-Ziv-Welch (LZW) lossless data compression technique to reduce the file size without degrading the visual quality [2]. This technique belongs to a group of dictionary compression algorithms, meaning that codes in the compressed data stream represent symbol sequences that have previously occurred in the uncompressed data stream. The algorithm is asymmetrical (encoding is slower than decoding). LZW technique was patented in 1985 (the patent has already expired) and a controversy over the licensing agreement between the patent holder, Unisys, and CompuServe in 1994 led to the development of the Portable Network Graphics (PNG) standard [3].

The original version of the GIF format was called 87a. In 1989, an enhanced version, called 89°, was released. The enhanced version supports multiple images in a stream, interlacing, and storage of application-specific metadata. The two versions can be distinguished by looking at the first six bytes of the file, which, when interpreted as ASCII, read as "GIF87a" and "GIF89a", respectively. The GIF89a feature of storing multiple images in one file, accompanied by control data, is used extensively on the Web to produce simple animations. Also the interlacing option and transparency are vastly used.

In interlaced GIF files the image data is stored in a format that allows interlaced GIF-supporting browsers to begin building a low-resolution version of the full-sized GIF picture on the screen while the file is downloading. The most important benefit of interlacing is that it gives the reader a preview of the full area of the picture while the picture is downloading into the browser. Interlacing is best for larger GIF images such as illustrations and photographs. In general, interlacing has no significant effect on the file size of GIF graphics.

The GIF format allows for picking colors from the color lookup table of the GIF to be transparent. Usually the color selected for transparency is the background color in the graphic. Unfortunately, the transparent property is not selective; making a color transparent all pixels in the graphic that share that particular color selected for transparency.

The typical compression ratios achieved by the GIF format span between 4:1 and 10:1. The overwhelming majority of images on the Web are in GIF format, and virtually all Web browsers that support graphics can display GIF files. However, in the last few years, PNG format has been gradually replacing GIF images due to its superior performances and flexibility [3].

See: Color-mapped imaging, Color quantization, Dithering, Lossless compression, Entropy encoding.

References

1. J. Miano, "Compressed Image File Formats", ACM Press, Addison-Wesley Professional, 1999.
2. T. Welch, "A Technique for High-Performance Data Compression", IEEE Computer Magazine, vol. 17, no. 6, pp. 8-19, June 1984.

3. G. Roleof, "PNG: The Definitive Guide", Second Edition,
<http://www.libpng.org/pub/png/book/>, 2003.