XPM Manual

The X PixMap Format

Version: 3.4i

September 10th 1996

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Acknowledgments

First I want to thank my team partner and friend Colas Nahaboo who proposed me this project, and who actively participated to its design.

My thanks also go to my friend Lionel Mallet (Simulog) who heavily tested XPM by writing a dedicated icon editor called pixmap, and who often helped me making up my mind through long discussions when facing difficulties.

Finally I want to thank all the users who helped me to improve the library by giving feedback, sending bug reports with often patches to fix them, and even sometimes sending new chunks of code. It is also clear that the XPM library code would have never been so easy to compile on most of the today computers and operating systems without them.

Support

You can mail any question or suggestion relative to XPM by electronic mail to lehors@sophia.inria.fr. However you should first look at the FAQ (Frequently Asked Questions) where you might find the solution to your problem and there is a mailing list, please mail requests to xpm-talk-request@sophia.inria.fr to subscribe. You can find the latest release by anonymous ftp on koala.inria.fr (138.96.24.30) or ftp.x.org (198.112.44.100), and an archive of the mailing list on koala or on the WEB as http://zenon.inria.fr/koala/xpm-talk-hypermail.

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Chapter 1

Introduction & History

First, why another image format? We (Koala team at Bull Research, France) felt that most images bundled with X applications will be small "icons", and that since many applications are color-customizable, existing image formats such as gif, tiff, iff, etc... were intended for big images with well-defined colors and so weren’t adapted to the task. So XPM was designed with these criterions in mind:

- be editable by hand (under emacs, vi...). Although this sounds pretty weird today.
- be includable in C code. It may be unreasonable to load 1000 pixmap files on each start of an application.
- be a portable, mailable ascii format.
- provide defaults for monochrome/color/grayscale renderings.
- provide overriding of colors. This way if the user wants your application to be bluish instead of greenish, you can use the SAME icon files.
- allow comments to be included in the file.
- compression must be managed apart of the format.

The original idea of this format comes from Daniel Dardailler and Colas Nahaboo who designed the first version in 1989. While Daniel wanted to take out from UIL\(^1\) [Motif] the icon format, Colas thought it would be nice to do this in a way allowing to include the pixmap files in a C program just like XBM\(^2\) files. Thus, Daniel developed and distributed in February 1989 the first version of the XPM library.

Then Daniel left for OSF\(^3\) and I was hired by BULL. Colas told me about XPM and the need of a new version supporting symbolic colors to allow overriding of colors at load time, and different color defaults depending on the type of display the pixmap was rendered on. I liked the idea and worked on designing the new format with Colas and developed a new version of the library which I distributed in August 1990. In addition to the improvements mentioned above, this new version of the format had the nice feature of supporting several programming language syntaxes. Indeed we thought it would be fair to let people include pixmap files in Lisp or any other language programs as well as in C programs. Actually that was really fun, interesting, and quite satisfactory from a research point of view, but on the other hand, while people needed to have a standard format this was more like "n" different formats. More over, it appeared that really few people were using syntaxes different from C. So we decided to remove this multi-syntax feature from the format and we settled the C syntax to come up with XPM version 3. This last version also supports hotspot coordinates, transparent color, and possible extensions.

Since August 1990, the XPM library has been released at various rhythms depending on the need and the time I could spend on it (this work having never been my main task), in order to always provide more features and to improve the code regarding both speed and robustness. Thanks also to the users community, which often provided me with bug reports, fixes, and even sometimes new code, the XPM library is, today, very stable and compiles and runs without any problem on most Unix systems, on VMS, and even on Microsoft Windows and Windows NT.

---

1. User Interface Language - OSF/Motif.
2. X BitMap format.
3. Open Software Foundation.
Chapter 2

The XPM Format

The XPM format presents a C syntax, in order to provide the ability to include XPM files in C and C++ programs. It is in fact an array of strings composed of six different sections as follows:

/* XPM */
static char* <variable_name>[]= {
    <Values>
    <Colors>
    <Pixels>
    <Extensions>
};

The words are separated by a white space which can be composed of space and tabulation characters.

The <Values> section is a string containing four or six integers in base 10 that correspond to: the pixmap width and height, the number of colors, the number of characters per pixel (so there is no limit on the number of colors), and, optionally the hotspot coordinates and the XPMEXT tag if there is any extension following the <Pixels> section.

<width> <height> <ncolors> <cpp> [ [<x_hotspot> <y_hotspot>] ] [XPMEXT]

The Colors section contains as many strings as there are colors, and each string is as follows:

<chars> { <key> <color> }+

Where <chars> is the <chars_per_pixel> length string (not surrounded by anything) representing the pixels, <color> is the specified color, and <key> is a keyword describing in which context this color should be used. Currently the keys may have the following values:

m for mono visual
s for symbolic name
g4 for 4-level grayscale
g for grayscale with more than 4 levels
c for color visual

Colors can be specified by giving the colorname, a # followed by the RGB code in hexadecimal, or a % followed by the HSV code (not implemented). The symbolic name provides the ability of specifying the colors at load time and not to hard-code them in the file.

Also the string None can be given as a colorname to mean “transparent”. Transparency is supported by the XPM library by providing a masking bitmap in addition to the pixmap. This mask can then be used either as a clip-mask of
an Xlib GC, or a shape-mask of a window using the X11 Nonrectangular Window Shape Extension [XShape].

The `<Pixels>` section is composed by `<height>` strings of `<width> * `<chars_per_pixel>` characters, where every `<chars_per_pixel>` length string must be one of the previously defined groups in the `<Colors>` section.

Then follows the `<Extensions>` section which must be labeled, if not empty, in the `<Values>` section as previously described. This section may be composed by several `<Extension>` subsections which may be of two types:

- one stand alone string composed as follows:
  
  XPMEXT `<extension-name>` `<extension-data>`

- or a block composed by several strings:
  
  XPMEXT `<extension-name>`
  
  `<related extension-data composed of several strings>`

Finally, if not empty, this section must end by the following string:

XPMENDEXT

Extensions can be used to store any type of data one might want to store along with a pixmap, as long as they are properly encoded so they do not conflict with the general syntax. To avoid possible conflicts with extension names in shared files, they should be prefixed by the name of the company. This would ensure uniqueness.
Below is an example which is the XPM file of a plaid pixmap. This is a 22x22 pixmap, with 4 colors and 2 characters per pixel. The hotspot coordinates are (0, 0). There are symbols and default colors for color and monochrome visuals. Finally there are two extensions.

```c
/* XPM */
static char *plaid[] = {
    /* width height ncolors chars_per_pixel */
    "22 22 4 2 0 0 XPMEXT",
    /* colors */
    " c red  m white  s light_color ",
    "Y c green  m black  s lines_in_mix ",
    "+ c yellow m white  s lines_in_dark ",
    "x m black  s dark_color ",
    /* pixels */
    "x x x x x x x x x + x x x x x ",
    " x x x x x x x x x x x x x x ",
    " x x x x x x x x x + x x x x x ",
    " x x x x x x x x x x x x x x ",
    "Y Y Y Y x Y Y Y Y + x + x + x + x + ",
    "x x x x x x x x x x x x x x x ",
    " x x x x x x x x x x x x x x x ",
    " x x x x x x x x x + x x x x x ",
    " x x x x x x x x x x x x x x x ",
    "x x x x x x x x x + x x x x x ",
    " x x x x x x x x x x x x x x x ",
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    " x x x x x x x x x x x x x x x ",
    "x x x x x x x x x + x x x x x ",
    " x x x x x x x x x x x x x x x ",
    "x x x x x x x x x + x x x x x ",
    " x x x x x x x x x x x x x x x ",
    "x x x x x x x x x + x x x x x ",
    " x x x x x x x x x x x x x x x ",
    "XPMEXT ext1 data1",
    "XPMEXT ext2",
    "data2_1",
    "data2_2",
    "XPMENDEXT"
};
The XPM library basically provides two sets of Xlib-level functions in the C language. Most people should only know about the first one since it provides what most likely one need with a simple interface. The second set, which stands as a lower level called from the first one, is designed to be used from within applications which have more specific needs such as a pixmap editor or applications which needs to cache data such as XPM files.

3.1 The Basic Level Interface

The basic level interface allows to deal with XImage, Pixmap, XPM file, data (included XPM file), buffer (XPM file in memory), and in many ways.

The following subsections describe these functions and how to use them.

3.1.1 The structures

To provide a simple interface all the functions take, in addition to their main arguments such as a filename, a structure called XpmAttributes. This structure is composed of attributes to pass data such as colormap, visual, and attributes to retrieve returned data such as pixmap’s width and height. The XpmAttributes structure is defined as follows:

typedef struct {
    unsigned long valuemask;        /* Specifies which attributes are defined */

    /* Image/Pixmap Creation Directives */
    Visual *visual;                  /* Specifies the visual to use */
    Colormap colormap;              /* Specifies the colormap to use */
    unsigned int depth;             /* Specifies the depth */
    int bitmap_format;              /* 1bit depth images format: ZPixmap or XYBitmap*/

    /* Data related to the XPM file */
    unsigned int width;             /* Returns the width of the read pixmap */
    unsigned int height;            /* Returns the height of the read pixmap */
    unsigned int x_hotspot;         /* Returns the x hotspot’s coordinate */
    unsigned int y_hotspot;         /* Returns the y hotspot’s coordinate */
    unsigned int cpp;               /* Specifies the number of char per pixel */
    unsigned int nextensions;       /* Number of extensions */
    XpmExtension *extensions;       /* List of extensions */
    char *hints_cmt;                /* Comment of the hints section */
    char *colors_cmt;               /* Comment of the colors section */
} XpmAttributes;
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char *pixels_cmt; /* Comment of the pixels section */
XpmColor *colorTable; /* List of colors */
int ncolors; /* Number of colors */
unsigned int mask_pixel; /* Color table index of transparent color */
char *rgb_fname; /* RGB text file name from which to get color names */

/* Data related to the Image/Pixmap */
Pixel *pixels; /* List of used color pixels */
unsigned int npixels; /* Number of used color pixels */
Pixel *alloc_pixels; /* List of alloc’ed color pixels */
unsigned int nalloc_pixels; /* Number of alloc’ed color pixels */

/* Color Allocation Directives */
XpmColorSymbol *colorsymbols; /* List of color symbols to override */
unsigned int numsymbols; /* Number of symbols */

Bool exactColors; /* Only use exact colors for visual */
unsigned int red_closeness; /* Allowable red deviation */
unsigned int green_closeness; /* Allowable green deviation */
unsigned int blue_closeness; /* Allowable blue deviation */

int color_key; /* Use colors from this color set */
Bool alloc_close_colors; /* Whether close colors should be allocated or not */

XpmAllocColorFunc alloc_color; /* Application color allocator */
XpmFreeColorsFunc free_colors; /* Application color de-allocator */
void *color_closure; /* Application data to pass to alloc_color and free_colors */

} XpmAttributes;

The valuemask is the bitwise inclusive OR of the valid attribute mask bits. If the valuemask is zero, the attributes are ignored and not referenced and default values are taken for needed attributes which are not specified. This valuemask had to be part of the structure to let XPM functions modify its value when returning possible data such as hotspot co-ordinates or when requested data cannot be returned. In fact, the XPM library functions will automatically return as many data as possible as long as this doesn’t lead to some memory allocation. Otherwise data are returned only on request.

To set an attribute, set the appropriate member of the XpmAttributes structure and OR in the corresponding value bitmask in the valuemask member. The symbols for the value mask bits and XpmAttributes structure are:

<table>
<thead>
<tr>
<th>Symbol Name</th>
<th>Symbol Value</th>
<th>Related Members</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>XpmVisual</td>
<td>(1L&lt;&lt;0)</td>
<td>visual</td>
<td>Default value is: DefaultVisual(display, DefaultScreen(display))</td>
</tr>
</tbody>
</table>
### Symbol Name
### Symbol Value
### Related Members
### Comments

<table>
<thead>
<tr>
<th>Symbol Name</th>
<th>Symbol Value</th>
<th>Related Members</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>XpmColormap</td>
<td>(1L&lt;&lt;1)</td>
<td>colormap</td>
<td>Default value is: DefaultColorMap(display, DefaultScreen(display))</td>
</tr>
<tr>
<td>XpmDepth</td>
<td>(1L&lt;&lt;2)</td>
<td>depth</td>
<td>Default value is: DefaultDepth(display, DefaultScreen(display))</td>
</tr>
<tr>
<td>XpmBitmapFormat</td>
<td>(1L&lt;&lt;18)</td>
<td>bitmap_format</td>
<td>Possible values are ZPixmap or XYBitmap.</td>
</tr>
<tr>
<td>XpmSize</td>
<td>(1L&lt;&lt;3)</td>
<td>width, height</td>
<td>Set when creating an XImage or aPixmap</td>
</tr>
<tr>
<td>XpmHotspot</td>
<td>(1L&lt;&lt;4)</td>
<td>x_hotspot, y_hotspot</td>
<td>Set if hotspot coordinates are found when parsing</td>
</tr>
<tr>
<td>XpmCharsPerPixel</td>
<td>(1L&lt;&lt;5)</td>
<td>cpp</td>
<td></td>
</tr>
<tr>
<td>XpmRgbFilename</td>
<td>(1L&lt;&lt;7)</td>
<td>rgb_fname</td>
<td></td>
</tr>
<tr>
<td>XpmInfos</td>
<td>(1L&lt;&lt;8)</td>
<td>cpp, pixels, npixels, colorTable, ncolors, hints_cmt, colors_cmt, pixels_cmt, mask_pixel</td>
<td>Obsolete; colorTable cast to (XpmColor **)</td>
</tr>
<tr>
<td>XpmReturnInfos</td>
<td>idem</td>
<td>idem</td>
<td>Obsolete; unset in case of memory allocation failure</td>
</tr>
<tr>
<td>XpmExtensions</td>
<td>(1L&lt;&lt;10)</td>
<td>extensions, nextensions</td>
<td></td>
</tr>
<tr>
<td>XpmReturnExtensions</td>
<td>idem</td>
<td>idem</td>
<td>Unset in case of memory allocation failure.</td>
</tr>
<tr>
<td>XpmPixels</td>
<td>(1L&lt;&lt;9)</td>
<td>pixels, npixels</td>
<td>npxels differs from ncolors if several colors are bound to the same pixel, and if there is a mask (color = None)</td>
</tr>
<tr>
<td>XpmReturnPixels</td>
<td>idem</td>
<td>idem</td>
<td></td>
</tr>
<tr>
<td>XpmReturnAllocPixels</td>
<td>(1L&lt;&lt;16)</td>
<td>alloc_pixels, nalloc_pixels</td>
<td>nalloc_pixels differs from npixels when one pixel, given through the XpmColorSymbols, is used</td>
</tr>
<tr>
<td>XpmColorSymbols</td>
<td>(1L&lt;&lt;6)</td>
<td>colorsymbols, numcolorsymbols</td>
<td></td>
</tr>
<tr>
<td>XpmExactColors</td>
<td>(1L&lt;&lt;11)</td>
<td>exactColors</td>
<td>Possible values are False (0) or True (1)</td>
</tr>
</tbody>
</table>
NOTE: In any case the XpmAttributes valuemask must be set to some valid value, at least zero, otherwise unpredictable errors can occur.

The colorTable field of the XpmAttributes structure is an array of XpmColor (page 27) which is compatible with an XpmImage colortable (page 27) and should be used with the corresponding flags: XpmColorTable and XpmReturnColorTable. But in order to be backward compatible this field is cast to (XpmColor **), which is equivalent to (char **), when it is used with the old flags: XpmInfos and XpmReturnInfos. In this case the colorTable is a two dimensional array of strings, organized as follows:

colorTable[color#][0] points to the character string associated to the color.
colorTable[color#][1] points to the symbolic name of the color.
colorTable[color#][2] points to the default color for monochrome visuals.
colorTable[color#][3] points to the default color for 4-level grayscale visuals.
colorTable[color#][4] points to the default color for other grayscale visuals.
colorTable[color#][5] points to the default color for color visuals.

Note that this can also be seen as an array of pointers to XpmColor structures which is then organized as follows:

colorTable[#color] points to the XpmColor structure retaining related data.

Comments are limited to a single comment string by section. If more exist in the read file, then only the last comment of each section will be stored.

To get information back while writing out to a file, you can just set the mask bits XpmReturnInfos to the valuemask.

### Symbol Table

<table>
<thead>
<tr>
<th>Symbol Name</th>
<th>Symbol Value</th>
<th>Related Members</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>XpmCloseness</td>
<td>(1L&lt;&lt;12)</td>
<td>closeness</td>
<td>Possible values are integers within the range: 0 to 65535</td>
</tr>
<tr>
<td>XpmRGBCloseness</td>
<td>(1L&lt;&lt;13)</td>
<td>red_closeness, green_closeness, blue_closeness</td>
<td>Possible values are integers within the range: 0 to 65535</td>
</tr>
<tr>
<td>XpmAllocCloseColors</td>
<td>(1L&lt;&lt;17)</td>
<td>alloc_close_colors</td>
<td>Possible values are False (0) or True (1)</td>
</tr>
<tr>
<td>XpmColorKey</td>
<td>(1L&lt;&lt;14)</td>
<td>color_key</td>
<td>Possible values are: XPM_MONO, XPM_GRAY4, XPM_GRAY, XPM_COLOR</td>
</tr>
<tr>
<td>XpmColorTable</td>
<td>(1L&lt;&lt;15)</td>
<td>colorTable, ncolors</td>
<td></td>
</tr>
<tr>
<td>XpmReturnColorTable</td>
<td>idem</td>
<td>idem</td>
<td>Unset in case of memory allocation failure</td>
</tr>
<tr>
<td>XpmAllocColor</td>
<td>(1L&lt;&lt;19)</td>
<td>alloc_color</td>
<td></td>
</tr>
<tr>
<td>XpmFreeColors</td>
<td>(1L&lt;&lt;20)</td>
<td>free_colors</td>
<td></td>
</tr>
<tr>
<td>XpmColorClosure</td>
<td>(1L&lt;&lt;21)</td>
<td>color_closure</td>
<td></td>
</tr>
</tbody>
</table>
of an XpmAttributes structure that you pass to the XpmReadFileToPixmap (page 18) function while reading the file, and then give the structure back to the XpmWriteFileFromPixmap (page 20) function while writing. However this method should be considered as obsolete since the advanced level interface provides a cleaner way to do so.

To allow overriding of colors at load time the XPM library defines the XpmColorSymbol structure which contains:

typedef struct {
    char *name; /* Symbolic color name */
    char *value; /* Color value */
    Pixel pixel; /* Color pixel */
} XpmColorSymbol;

So, to override default colors at load time, you just have to pass, via the XpmAttributes structure, a list of XpmColorSymbol elements containing the desired colors to the XpmReadFileToPixmap or XpmCreatePixmapFromData (page 21) functions. These colors can be specified by giving the color name in the value member or directly by giving the corresponding pixel in the pixel member. In the latter case the value member must be set to NULL otherwise the given pixel will not be considered.

In addition, it is possible to set the pixel for a specific color value at load time by setting the color name to NULL, and setting the value and pixel fields appropriately. For example, by setting the color name to NULL and the pixel to 51, all symbolic colors that are assigned to “red” will be set to pixel 51. It is even possible to specify the pixel used for the transparent color “none” when no mask is required.

By default the XPM library uses XParseColor and XAllocColor to resolve color names and allocate colors. Thereafter it is expected, as documented, that the caller will free the allocated colors by calling XFreeColors. Which is what the XPM library does in case an error occurs while some colors have already been allocated. However, it is also possible for the application to pass its own functions to be called instead of the standard Xlib functions. This is done by setting the alloc_color, free_colors, and color_closure attributes and ORing in the related mask bits XpmAllocColor, XpmFreeColors, and XpmColorClosure.

The two functions must correspond to the following types and specifications.

typedef int (*XpmAllocColorFunc)(display, colormap, colormap, colormap, xcolor, closure);
        Display *display;
        Colormap colormap;
        char *colormap;
        XColor *xcolor;
        void *closure;

typedef int (*XpmFreeColorsFunc)(display, colormap, pixels, npixels, closure);
        Display *display;
        Colormap colormap;
        Pixel *pixels;
        int npixels;
        void *closure;

display Specifies the connection to the X server.
colormap Specifies the colormap to use.
colormap Specifies the name of the color to allocate, or NULL.
xcolor  Specifies the RGB components of the color to allocate.
closure  A pointer to some application private data.
pixels  List of color pixels to deallocate.
npixels  Number of color pixels to free.

If colorname is not NULL, AllocColor does the allocation based on the name (calling XParseColor or a similar function). If this fails it returns a negative value. If it succeeds it allocates the color (using XAllocColor or a similar function) and returns zero on error, or a positive value on success. On success AllocColor then fills in the given XColor object just like XAllocColor does. If colorname is NULL, AllocColor performs the color allocation based on the rgb values specified through the given XColor object, and return the same way as above.

The FreeColors function simply frees the given list of pixels (using XFreeColors or a similar function).

The default functions used by the library are:

```c
/* default AllocColor function:
 * call XParseColor if colorname is given, return negative value if failure
 * call XAllocColor and return 0 if failure, positive otherwise
 */
static int
AllocColor(display, colormap, colorname, xcolor, closure)
    Display *display;
    Colormap colormap;
    char *colorname;
    XColor *xcolor;
    void *closure; /* not used */
{
    int status;
    if (colorname)
        if (!XParseColor(display, colormap, colorname, xcolor))
            return -1;
        status = XAllocColor(display, colormap, xcolor);
    return status != 0 ? 1 : 0;
}
/* default FreeColors function, simply call XFreeColors */
static int
FreeColors(display, colormap, pixels, n, closure)
    Display *display;
    Colormap colormap;
    Pixel *pixels;
    int n;
    void *closure; /* not used */
{
    return XFreeColors(display, colormap, pixels, n, 0);
}
```

The last thing one can do using the XpmAttributes structure is to pass and retrieve extension data, which is any type of data an application might want to store along with the pixmap, using the XpmExtension structure which is defined below:

typedef struct {

To retrieve possible extension data stored in an XPM file or data, you must set the mask bits XpmReturnExtensions to the valuemask of an XpmAttributes structure that you pass to the read function you use. Then the same structure may be passed the same way to any write function if you set the mask bits XpmExtensions to the valuemask, so the extension data is written back.

### 3.1.2 Functions to deal with XPM files

To create an XImage from an XPM file, use XpmReadFileToImage.

```c
int XpmReadFileToImage(display, filename, image_return, shapeimage_return, attributes)
```

- **display** Specifies the connection to the X server.
- **filename** Specifies the file name to use.
- **image_return** Returns the image which is created.
- **shapeimage_return** Returns the shape mask image which is created if the color None is used.
- **attributes** Specifies the location of a structure to get and store information (or NULL).

The XpmReadFileToImage function reads in a file in the XPM format. If the file cannot be opened it returns XpmOpenFailed. If the file can be opened but does not contain valid XPM data, it returns XpmFileInvalid. If insufficient working storage is allocated, it returns XpmNoMemory.

If the passed XpmAttributes structure pointer is not NULL, XpmReadFileToImage looks for the following attributes: XpmVisual, XpmColormap, XpmDepth, XpmColorSymbols, XpmExactColors, XpmCloseness, XpmRGBCloseness, XpmAllocCloseColors, XpmReturnPixels, XpmReturnAllocPixels, XpmAllocColor, XpmFreeColors, XpmColorClosure, XpmReturnExtensions, XpmReturnColorTable, XpmBitmapFormat, sets the XpmSize, the XpmCharsPerPixel, and possibly the XpmHotspot attributes when returning. As a backward compatibility feature, XpmReadFileToImage also looks for the XpmReturnInfos attributes. As specified in the table (page 12), if the data related to the attributes XpmReturnExtensions, XpmReturnColorTable, and XpmReturnInfos cannot be returned as requested because of insufficient memory storage, XpmReadFileToImage will change the valuemask to mention this and will try to continue. So the caller should check on this before accessing this data.

Note: The valuemask of the passed XpmAttributes must be set to some valid value, at least zero, otherwise unpredictable errors can occur.

XpmReadFileToImage allocates colors, as read from the file or possibly overridden as specified in the XpmColorSymbols attributes. The colors are allocated using the color settings for the visual specified by the XpmColorKey attribute, which has the value XPM_MONO, XPM_GRAY4, XPM_GRAY, or XPM_COLOR. If the XpmColor-
**Key** attribute is not set it is determined by examining the type of visual.

If no default value exists for the specified visual, it first looks for other defaults nearer to the monochrome visual type and secondly nearer to the color visual type. If the color which is found is not valid (cannot be parsed), it looks for another default one according to the same algorithm.

If allocating a color fails, and the **closeness** attribute is set, it tries to find a color already in the colormap that is closest to the desired color, and uses that. If the alloc_close_colors attribute is set to False, the found close color is not allocated but it is used anyway. This is especially useful for applications which use a private colormap containing read/write cells and have complete control over the colormap. On the other hand, since in such a case there is no guarantee that the color pixel will not change any time, this should be avoided when using the default colormap. If no color can be found that is within **closeness** of the Red, Green and Blue components of the desired color, it reverts to trying other default values as explained above. For finer control over the closeness requirements of a particular icon, the **red_closeness**, **green_closeness**, and **blue_closeness** attributes may be used instead of the more general **closeness** attribute.

The RGB components are integers within the range 0 (black) to 65535 (white). A closeness of less than 10000, for example, will cause only quite close colors to be matched, while a closeness of more than 50000 will allow quite dissimilar colors to match. Specifying a closeness of more than 65535 will allow any color to match, thus forcing the icon to be drawn in color no matter how bad the colormap is. The value 40000 seems to be about right for many situations requiring reasonable but not perfect matches. With this setting the color must only be within the same general area of the RGB cube as the desired color.

If the **exactColors** attribute is set it then returns XpmColorError, otherwise it creates the images and returns XpmSuccess. If no color is found, and no close color exists or is wanted, and all visuals have been exhausted, XpmColorFailed is returned.

XpmReadFileToImage returns the created image to image_return if not NULL and possibly the created shapemask to shapeimage_return if not NULL and the color None is used. If required it stores into the XpmAttributes structure the list of the used pixels. When the image depth is one, the image format is either as specified by the bitmap_format attribute if set or ZPixmap. When the depth is different from one the image format is always ZPixmap.

When finished the caller must free the images using XDestroyImage, the allocated colors using XFreeColors or the application equivalent function when the standard Xlib functions are not used, and possibly the data returned into the XpmAttributes using XpmFreeAttributes (page 25).

In addition, on systems which support such features XpmReadFileToImage deals with compressed files by forking an uncompressed or gzip process and reading from the piped result. It assumes that the specified file is compressed if the given file name ends by `.Z' or `.gz'. In case the file name does not end so, XpmReadFileToImage looks for the given file name assuming it is not a compressed file. And if instead of a file name NULL is passed to XpmReadFileToImage, it reads from the standard input.

To create a Pixmap from an XPM file, use XpmReadFileToPixmap.

```c
int XpmReadFileToPixmap(display, d, filename, pixmap_return, shapemask_return, attributes)
  Display *display;
  Drawable d;
  char *filename;
 Pixmap * pixmap_return;
```

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Pixmap *shapemask_return;
XpmAttributes *attributes;

display Specifies the connection to the X server.

d Specifies which screen the pixmap is created on.

filename Specifies the file name to use.

pixmap_return Returns the pixmap which is created.

shapemask_return Returns the shapemask which is created if the color None is used.

attributes Specifies the location of a structure to get and store information (or NULL).

The `XpmReadFileToPixmap` function creates X images using `XpmReadFileToImage` (page 17) and thus returns the same errors. In addition on success it then creates the related pixmaps, using `XPutImage`, which are returned to pixmap_return and shapemask_return if not NULL, and finally destroys the created images using `XDestroyImage`.

When finished the caller must free the pixmaps using `XFreePixmap`, the allocated colors using `XFreeColors` or the application equivalent function when the standard `Xlib` functions are not used, and possibly the data returned into the `XpmAttributes` using `XpmFreeAttributes`.

`XpmWriteFileFromImage` writes out an `XImage` to an XPM file.

```c
int XpmWriteFileFromImage(display, filename, image, shapeimage, attributes)
    Display *display;
    char *filename;
    XImage *image;
    XImage *shapeimage;
    XpmAttributes *attributes;

display Specifies the connection to the X server.

filename Specifies the file name to use.

image Specifies the image.

shapeimage Specifies the shape mask image.

attributes Specifies the location of a structure containing information (or NULL).
```

The `XpmWriteFileFromImage` function writes an image and its possible shapeimage out to a file in the XPM format. If the file cannot be opened, it returns `XpmOpenFailed`. If insufficient working storage is allocated, it returns `XpmNoMemory`. If no error occurs then it returns `XpmSuccess`.

If the passed `XpmAttributes` structure pointer is not NULL, `XpmWriteFileFromImage` looks for the following attributes: `XpmColormap`, `XpmHotspot`, `XpmCharsPerPixel`, `XpmRgbFilename`, and `XpmExtensions`. As a backward compatibility feature, `XpmWriteFileFromImage` also looks for the `XpmInfos` attributes.

If the filename contains an extension such as “.xpm”, in order to get a valid C variable name, the dot character is replaced by an underscore '_' when writing out. As a backward compatibility feature, if the `XpmInfos` attributes are defined it writes out possible stored information such as comments, color defaults and symbol. Finally, if the `XpmRgbFilename` attribute is defined, `XpmWriteFileFromImage` searches for color names in this file and if found writes them out instead of the rgb values.
In addition on systems which support such features if the given file name ends by `.Z' or `.gz' it is assumed to be a compressed file. Then, \texttt{XpmWriteFileFromImage} writes to a piped \texttt{compress} or \texttt{gzip} process. And if instead of a file name \texttt{NULL} is passed to \texttt{XpmWriteFileFromImage}, it writes to the standard output.

To write out a \texttt{Pixmap} to an \texttt{XPM} file, use \texttt{XpmWriteFileFromPixmap}.

\begin{verbatim}
int XpmWriteFileFromPixmap(display, filename, pixmap, shapemask, attributes)
    Display *display;
    char *filename;
    Pixmap pixmap;
    Pixmap shapemask;
    XpmAttributes *attributes;

    display      Specifies the connection to the X server.
    filename     Specifies the file name to use.
    pixmap       Specifies the pixmap.
    shapemask    Specifies the shape mask pixmap.
    attributes   Specifies the location of a structure containing information (or NULL).

    If the passed \texttt{XpmAttributes} structure pointer is not \texttt{NULL}, \texttt{XpmWriteFileFromPixmap} looks for the following attributes: \texttt{XpmSize}. If they are not defined it performs an \texttt{XGetGeometry} operation. Then it uses \texttt{XGetImage} to get from the given pixmaps the related X images which are passed to \texttt{XpmWriteFileFromImage}. Finally \texttt{XpmWriteFileFromPixmap} destroys the created images using \texttt{XDestroyImage}. The \texttt{XpmWriteFileFromPixmap} function returns the same errors as \texttt{XpmWriteFileFromImage}.
\end{verbatim}

\subsection*{3.1.3 Functions to deal with XPM data}

An \texttt{XPM} data is an array of character strings which may be obtained by simply including an \texttt{XPM} file into a C program.

To create an \texttt{XImage} from an \texttt{XPM} data, use \texttt{XpmCreateImageFromData}.

\begin{verbatim}
int XpmCreateImageFromData(display, data, image_return, shapeimage_return, attributes)
    Display *display;
    char **data;
    XImage **image_return;
    XImage **shapeimage_return;
    XpmAttributes *attributes;

    display    Specifies the connection to the X server.
    data       Specifies the location of the data.
    image_return Returns the image which is created.
    shapeimage_return Returns the shape mask image which is created if the color None is used.
    attributes Specifies the location of a structure to get and store information (or NULL).

    The \texttt{XpmCreateImageFromData} function allows you to include in your C program an \texttt{XPM} file which was written
\end{verbatim}
out by functions such as XpmWriteFileFromImage or XpmWriteFileFromPixmap without reading in the file.

XpmCreateImageFromData exactly works as XpmReadFileToImage (page 17) does and returns the same way. It just reads data instead of a file. Here again, it is the caller’s responsibility to free the returned images, the colors and possibly the data returned into the XpmAttributes structure.

To create a Pixmap from an XPM data, use XpmCreatePixmapFromData.

int XpmCreatePixmapFromData(display, d, data, pixmap_return, shapemask_return, attributes)

Display *display;
Drawable d;
char **data;
Pixmap * pixmap_return;
Pixmap * shapemask_return;
XpmAttributes * attributes;

display Specifies the connection to the X server.
d Specifies which screen the pixmap is created on.
data Specifies the location of the data.
pixmap_return Returns the pixmap which is created.
shapemask_return Returns the shape mask pixmap which is created if the color None is used.
attributes Specifies the location of a structure to get and store information (or NULL).

The XpmCreatePixmapFromData function creates X images using XpmCreateImageFromData (page 20) and thus returns the same errors. In addition on success it then creates the related pixmaps, using XPutImage, which are returned to pixmap_return and shapemask_return if not NULL, and finally destroys the created images using XDestroyImage.

Do not forget to free the returned pixmaps, the colors, and possibly the data returned into the XpmAttributes structure when done.

In some cases, one may want to create an XPM data from an XImage, to do so use XpmCreateDataFromImage.

int XpmCreateDataFromImage(display, data_return, image, shapeimage, attributes)

Display *display;
char ***data_return;
XImage *image;
XImage * shapeimage;
XpmAttributes * attributes;

display Specifies the connection to the X server.
data_return Returns the data which is created.
image Specifies the image.
shapeimage Specifies the shape mask image.
attributes Specifies the location of a structure containing information (or NULL).

The XpmCreateDataFromImage function exactly works as XpmWriteFileFromImage (page 19) does and returns
the same way. It just writes to a single block malloc’ed data instead of to a file. It is the caller’s responsibility to free the data, using XpmFree when finished.

**XpmCreateDataFromPixmap** creates an XPM data from aPixmap.

```c
int XpmCreateDataFromPixmap(display, data_return, pixmap, shapemask, attributes)
    Display *display;
    char ***data_return;
   Pixmap pixmap;
    Pixmap shapemask;
    XpmAttributes *attributes;
```

- `display` specifies the connection to the X server.
- `data_return` returns the data which is created.
- `pixmap` specifies the pixmap.
- `shapemask` specifies the shape mask pixmap.
- `attributes` specifies the location of a structure containing information (or NULL).

The XpmCreateDataFromPixmap function uses XGetImage to get from the given pixmaps the related X images which are passed to XpmCreateDataFromImage. Then it destroys the created images using XDestroyImage. XpmCreateDataFromPixmap returns the same errors as XpmCreateDataFromImage.

### 3.1.4 Functions to deal with XPM files and data

To directly transform an XPM file to and from an XPM data array, without requiring an open X display, use XpmReadFileToData and XpmWriteFileFromData.

**XpmReadFileToData** allocates and fills an XPM data array from an XPM file.

```c
int XpmReadFileToData(filename, data_return)
    char *filename;
    char ***data_return;
```

- `filename` specifies the file name to read.
- `data_return` returns the data array created.

XpmReadFileToData returns XpmOpenFailed if it cannot open the file, XpmNoMemory if insufficient working storage is allocated, XpmFileInvalid if this is not a valid XPM file, and XpmSuccess otherwise. The allocated data returned by XpmReadFileToData should be freed with XpmFree when done.

**XpmWriteFileFromData** writes an XPM data array to an XPM file.

```c
int XpmWriteFileFromData(filename, data)
    char *filename;
    char **data;
```

- `filename` specifies the file name to write.
3.1.5 Functions to deal with XPM buffers

An XPM buffer is a character string which may be obtained by simply making the exact copy of an XPM file into memory.

To create an XImage from an XPM buffer, use XpmCreateImageFromBuffer.

```c
int XpmCreateImageFromBuffer(display, buffer, image_return, shapeimage_return, attributes)
    Display *display;
    char *buffer;
    XImage **image_return;
    XImage **shapeimage_return;
    XpmAttributes *attributes;
```

- `display` Specifies the connection to the X server.
- `buffer` Specifies the location of the buffer.
- `image_return` Returns the image which is created.
- `shapeimage_return` Returns the shape mask image which is created if the color None is used.
- `attributes` Specifies the location of a structure to get and store information (or NULL).

The XpmCreateImageFromBuffer works the same way as XpmReadFileToImage (page 17), it just parses the buffer instead of the file. Be aware that the feature provided on some systems by XpmReadFileToImage to deal with compressed files is not available here.

To create a Pixmap from an XPM buffer, use XpmCreatePixmapFromBuffer.

```c
int XpmCreatePixmapFromBuffer(display, d, buffer, pixmap_return, shapemask_return, attributes)
    Display *display;
    Drawable d;
    char *buffer;
    Pixmap * pixmap_return;
    Pixmap *shapemask_return;
    XpmAttributes *attributes;
```

- `display` Specifies the connection to the X server.
- `d` Specifies which screen the pixmap is created on.
- `buffer` Specifies the location of the buffer.
- `pixmap_return` Returns the pixmap which is created if the color None.
- `shapemask_return` Returns the shape mask pixmap which is created if the color None is used.
- `attributes` Specifies the location of a structure to get and store information.
The `XpmCreatePixmapFromBuffer` function works the same way as `XpmReadFileToPixmap` (page 18), it just calls `XpmCreateImageFromBuffer` instead of `XpmReadFileToImage`.

To create an XPM buffer from an XImage, use `XpmCreateBufferFromImage`.

```c
int XpmCreateBufferFromImage(display, buffer_return, image, shapeimage, attributes)
    Display *display;
    char **buffer_return;
    XImage *image;
    XImage *shapeimage;
    XpmAttributes *attributes;

    display Specifies the connection to the X server.
    buffer_return Returns the buffer which is created.
    image Specifies the image.
    shapeimage Specifies the shape mask image.
    attributes Specifies the location of a structure containing information (or NULL).
```

The `XpmCreateBufferFromImage` works as `XpmWriteFileFromImage` (page 19), it just writes to a malloc’ed buffer instead of to a file. The caller should free the buffer using `XpmFree` when finished.

`XpmCreateBufferFromPixmap` creates an XPM buffer from a Pixmap.

```c
int XpmCreateBufferFromPixmap(display, buffer_return, pixmap, shapemask, attributes)
    Display *display;
    char **buffer_return;
    Pixmap pixmap;
    Pixmap shapemask;
    XpmAttributes *attributes;

    display Specifies the connection to the X server.
    buffer_return Returns the buffer which is created.
    pixmap Specifies the pixmap.
    shapemask Specifies the shape mask pixmap.
    attributes Specifies the location of a structure containing information (or NULL).
```

The `XpmCreateBufferFromPixmap` function works as `XpmWriteFileFromPixmap` (page 20), it just calls `XpmCreateBufferFromImage` instead of `XpmWriteFileFromImage`. Once again, the caller should free the buffer using `XpmFree` when finished.

### 3.1.6 Functions to deal with XPM files and buffers

As a convenience, the `XpmReadFileToBuffer` and `XpmWriteFileFromBuffer` are provided to copy a file to a buffer and to write a file from a buffer. Thus for instance one may decide to use `XpmReadFileToBuffer`, `XpmCreatePixmapFromBuffer`, and `XpmFree` instead of `XpmReadFileToPixmap`. On some systems this may lead to a performance improvement, since the parsing will be performed in memory, but it uses more memory.
XpmReadFileToBuffer allocates and fills a buffer from a file.

```c
int XpmReadFileToBuffer(filename, buffer_return)
    char *filename;
    char **buffer_return;

    filename Specifies the file name to read.
    buffer_return Returns the buffer created.
```

XpmReadFileToBuffer returns XpmOpenFailed if it cannot open the file, returns XpmNoMemory if insufficient working storage is allocated, and XpmSuccess otherwise. The allocated buffer returned by XpmReadFileToBuffer should be freed with XpmFree when done.

XpmWriteFileFromBuffer writes a buffer to a file.

```c
int XpmWriteFileFromBuffer(filename, data)
    char *filename;
    char *buffer;

    filename Specifies the file name to write.
    buffer Specifies the buffer to read.
```

XpmWriteFileFromBuffer returns XpmOpenFailed if it cannot open the file, and XpmSuccess otherwise.

### 3.1.7 Miscellaneous functions

To free possible data stored into an XpmAttributes structure use XpmFreeAttributes.

```c
int XpmFreeAttributes(attributes)
    XpmAttributes *attributes;

attributes Specifies the structure to free.
```

The XpmFreeAttributes frees the structure members which have been malloc’ed such as the pixels list.

To dynamically allocate an XpmAttributes structure use the XpmAttributesSize function.

```c
int XpmAttributesSize()
```

The XpmAttributesSize function provides application using dynamic libraries with a safe way to allocate and then refer to an XpmAttributes structure, disregarding whether the XpmAttributes structure size has changed or not since compiled.

To free data possibly stored into an array of XpmExtension use XpmFreeExtensions.

```c
int XpmFreeExtensions/extensions, nextensions)
    XpmExtension *extensions;
    int nextensions;

extensions Specifies the array to free.
```
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nextensions       Specifies the number of extensions.

This function frees all data stored in every extension and the array itself. Note that XpmFreeAttributes call this func-
tion and thus most of the time it should not need to be explicitly called.

To free any data allocated by an XPM function use the XpmFree function.

```c
int XpmFree(ptr)
    char *ptr;
ptr       Specifies the data to free.
```

The current distribution of the XPM library uses the standard memory allocation functions and thus XpmFree is noth-
ing else than a define to the standard free. However since these functions may be redefined in specific environments it is wise to use XpmFree.

To get data when building an error message, one can use XpmGetErrorString

```c
char *XpmGetErrorString(errorcode)
    int errorcode;
errorcode  Specifies the XPM error.
```

XpmGetErrorString returns a string related to the given XPM error code.

The XpmLibraryVersion can be used when one needs to figure out which version of the library is in use.

```c
int XpmLibraryVersion()
```

The value returned by XpmLibraryVersion can be compared to the value of XpmIncludeVersion which is defined in the header file "xpm.h". These numbers are computed with the following formula:

```c
(XpmFormat * 100 + XpmVersion) * 100 + XpmRevision
```

Where XpmFormat is the version number of the format, XpmVersion is the library version number (which changes only if the API changes), and XpmRevision is the library minor version number.

3.2 The Advanced Level Interface

The advanced level interface is a set of functions that applications, such as icon editors, which needs to retrieve all the information stored in an XPM file and applications which perform data caching can use.

The following subsections describe these functions and how to use them.

3.2.1 The structures

The purpose of the structures defined in this section is to be able to store XPM images in memory to avoid any
additional parsing without losing information such as color defaults, symbolic color names, and comments.

Indeed, considering the XPM format one can see that there is a lot more information related to a color than just an rgb value or a colormap index, the XpmColor structure allows to store the different color defaults, the symbolic name of a color, and the characters string which represents it.

typedef struct {
    char *string; /* characters string */
    char *symbolic; /* symbolic name */
    char *m_color; /* monochrome default */
    char *g4_color; /* 4 level grayscale default */
    char *g_color; /* other level grayscale default */
    char *c_color; /* color default */
} XpmColor;

The XpmImage structure is defined to store the image data definition with its size, the length of the characters strings representing each color, and the related color table.

typedef struct {
    unsigned int width; /* image width */
    unsigned int height; /* image height */
    unsigned int cpp; /* number of characters per pixel */
    unsigned int ncolors; /* number of colors */
    XpmColor *colorTable; /* list of related colors */
    unsigned int *data; /* image data */
} XpmImage

The XpmImage data is an array of width*height color indexes, each color index referencing the related color in the colortable.

In addition, to store all the possible optional data which an XPM file may contain, an XpmInfo structure can be passed to the reading function. This structure can then be given back to the writing function. Comments are limited to a single strings by XPM format section. If more exist in the read file, then only the last comment of each section will be stored.

typedef struct {
    unsigned long valuemask; /* Specifies which attributes are defined */
    char *hints_cmt; /* comment of the hints section */
    char *colors_cmt; /* comment of the colors section */
    char *pixels_cmt; /* comment of the pixels section */
    unsigned int x_hotspot; /* Returns the x hotspot’s coordinate */
    unsigned int y_hotspot; /* Returns the y hotspot’s coordinate */
    unsigned int nextensions; /* number of extensions */
    XpmExtension *extensions; /* pointer to array of extensions */
} XpmInfo;

The valuemask is the bitwise inclusive OR of the valid attribute mask bits. If the valuemask is zero, the attributes are ignored and not referenced. This valuemask had to be part of the structure to let XPM functions modify its value when returning possible data such as hotspot coordinates or when requested data cannot be returned. In fact, the XPM library functions will automatically return the hotspot coordinates since this doesn’t lead to any memory allocation. On the other hand, comments and extensions are returned only on request.
To set an attribute, set the appropriate member of the `XpmInfo` structure and OR in the corresponding value bitmask in the `valuemask` member. The symbols for the value mask bits and `XpmInfo` structure are:

<table>
<thead>
<tr>
<th>Symbol Name</th>
<th>Symbol Value</th>
<th>Related Members</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>XpmComments</code></td>
<td><code>(1L&lt;&lt;(8))</code></td>
<td><code>hints_cmt, colors_cmt, pixels_cmt</code></td>
<td></td>
</tr>
<tr>
<td><code>XpmReturnComments</code></td>
<td><em>idem</em></td>
<td><em>idem</em></td>
<td>Will be unset in case of memory allocation failure.</td>
</tr>
<tr>
<td><code>XpmColorTable</code></td>
<td><code>(1L&lt;&lt;(15))</code></td>
<td><code>colorTable, ncolors</code></td>
<td></td>
</tr>
<tr>
<td><code>XpmReturnColorTable</code></td>
<td><em>idem</em></td>
<td><em>idem</em></td>
<td>Will be unset in case of memory allocation failure.</td>
</tr>
<tr>
<td><code>XpmExtensions</code></td>
<td><code>(1L&lt;&lt;(10))</code></td>
<td><code>extensions, nextensions</code></td>
<td></td>
</tr>
<tr>
<td><code>XpmReturnExtensions</code></td>
<td><em>idem</em></td>
<td><em>idem</em></td>
<td>Will be unset in case of memory allocation failure.</td>
</tr>
</tbody>
</table>

NOTE: In any case the `XpmInfo` structure `valuemask` must be set to some valid value, at least zero, otherwise unpredictable errors can occur.

### 3.2.2 Functions to deal with XPM files

To create an `XpmImage` from an XPM file, use `XpmReadFileToXpmImage`.

```c
int XpmReadFileToXpmImage(filename, image, info)
    char *filename;
    XpmImage *image;
    XpmInfo *info;
filename        Specifies the file name to read from.
image          Specifies the image structure location.
info            Specifies the location of a structure to store possible information (or NULL).
```

The `XpmReadFileToXpmImage` function reads in a file in the XPM format. If the file cannot be opened it returns `XpmOpenFailed`. If the file can be opened but does not contain valid XPM data, it returns `XpmFileInvalid`. If insufficient working storage is allocated, it returns `XpmNoMemory`. On success it fills in the given `XpmImage` structure and returns `XpmSuccess`.

If the passed `XpmInfo` structure pointer is not `NULL`, `XpmReadFileToXpmImage` looks for the following attributes: `XpmReturnComments` and `XpmReturnExtensions`, and sets possibly the `XpmHotspot` attribute when returning. As specified in the table (page 28), if the data related to the attributes `XpmReturnComments` and `XpmReturnExtensions` cannot be returned as requested because of insufficient memory storage, `XpmReadFileToXpmImage` will change the `valuemask` to mention this and will try to continue. So the caller should check on this before accessing requested data.
Note: The valuemask of the passed XpmInfo structure must be set to some valid value, at least zero, otherwise unpredictable errors can occur.

In addition on systems which support such features XpmReadFileToXpmImage deals with compressed files by forking an uncompress or gzip process and reading from the piped result. It assumes that the specified file is compressed if the given file name ends by 'Z' or 'gz'. In case the file name does not end so, XpmReadFileToXpmImage looks for the given file name assuming it is not a compressed file. And if instead of a file name NULL is passed to XpmReadFileToXpmImage, it reads from the standard input.

To write out an XpmImage to an XPM file, use XpmWriteFileFromXpmImage

int XpmWriteFileFromXpmImage(filename, image, shapeimage, info)
    char *filename;
    XpmImage *image;
    XpmInfo *info;

filename Specifies the file name to use.
image Specifies the image.
info Specifies the location of a structure to get information from (or NULL).

The XpmWriteFileFromXpmImage function writes an image out to a file in the XPM format. If the file cannot be opened, it returns XpmOpenFailed. If insufficient working storage is allocated, it returns XpmNoMemory. If no error occurs then it returns XpmSuccess.

If the passed XpmInfo structure pointer is not NULL, XpmWriteFileFromXpmImage looks for the following attributes: XpmComments, XpmExtensions, and XpmHotspot, and writes the related information out as well.

In addition on systems which support such features if the given file name ends by '.Z' or '.gz' it is assumed to be a compressed file. Then, XpmWriteFileFromXpmImage writes to a piped compress or gzip process. And if instead of a file name NULL is passed to XpmWriteFileFromXpmImage, it writes to the standard output.

### 3.2.3 Functions to deal with XPM data

To create an XpmImage from an XPM data, use XpmCreateXpmImageFromData.

int XpmCreateXpmImageFromData(data, image, info)
    char *data;
    XpmImage *image;
    XpmInfo *info;

data Specifies the location of the data.
image Specifies the image structure location.
info Specifies the location of an XpmInfo structure to get and store information (or NULL).

XpmCreateXpmImageFromData fills in the given XpmImage structure from the given data. If the data does not contain valid XPM data, it returns XpmFileInvalid. If insufficient working storage is allocated, it returns XpmNoMemory, on success it returns XpmSuccess.
If the passed `XpmInfo` structure pointer is not NULL, `XpmCreateXpmImageFromData` looks for the following attributes: `XpmReturnExtensions`, and sets possibly the `XpmHotspot` attribute when returning. As specified in the table (page 28), if the data related to the attribute `XpmReturnExtensions` cannot be returned as requested because of insufficient memory storage, `XpmCreateXpmImageFromData` will change the valuemask to mention this and will try to continue. So the caller should check on this before accessing requested data.

Note: The valuemask of the passed `XpmInfo` structure must be set to some valid value, at least zero, otherwise unpredictable errors can occur.

`XpmCreateDataFromXpmImage` creates an XPM data from an `XmImage`.

```c
int XpmCreateDataFromXpmImage(data_return, image, info)
    char ***data_return;
    XxpmImage *image;
    XpmInfo *info;

data_return  Returns the data which is created.
image        Specifies the image.
info         Specifies the location of a structure to get information.
```

The `XpmCreateDataFromXpmImage` function writes out the given `image` to a single block malloc’ed data in XPM format. If insufficient working storage is allocated, it returns `XpmNoMemory`, and returns `XpmSuccess` on success.

If the passed `XpmInfo` structure pointer is not NULL, `XpmCreateDataFromXpmImage` looks for the following attributes: `XpmExtensions`, and `XpmHotspot`, and writes the related information out as well.

It is the caller’s responsibility to free the data, using `XpmFree` when finished.

### 3.2.4 Functions to deal with XPM buffers

To create an `XpmImage` from an XPM buffer, use `XpmCreateXpmImageFromBuffer`.

```c
int XpmCreateXpmImageFromBuffer(buffer, image, info)
    char *buffer;
    XpmImage *image;
    XpmInfo *info;

buffer       Specifies the location of the buffer.
image        Specifies the image structure location.
info         Specifies the location of a structure to store possible information (or NULL).
```

The `XpmCreateXpmImageFromBuffer` reads the given `buffer` to fill in the given `XpmImage` structure. If the buffer does not contain valid XPM data, it returns `XpmFileInvalid`. If insufficient working storage is allocated, it returns `XpmNoMemory`, and returns `XpmSuccess` on success.

If the passed `XpmInfo` structure pointer is not NULL, `XpmCreateXpmImageFromBuffer` looks for the following attributes: `XpmReturnComments` and `XpmReturnExtensions`, and sets possibly the `XpmHotspot` attribute when returning. As specified in the table (page 28), if the data related to the attributes `XpmReturnComments` and `XpmReturnExtensions` cannot be returned as requested because of insufficient memory storage, `XpmCreateXpmImage-
FromBuffer will change the valuemask to mention this and will try to continue. So the caller should check on this before accessing requested data.

Note: The valuemask of the passed XpmInfo structure must be set to some valid value, at least zero, otherwise unpredictable errors can occur.

To create an XPM buffer from an XpmImage, use XpmCreateBufferFromXpmImage.

```c
int XpmCreateBufferFromXpmImage(buffer_return, image, info)
    char **buffer_return;
    XpmImage *image;
    XpmInfo *info;
buffer_return Returns the buffer which is created.
image Specifies the image.
info Specifies the location of a structure to get possible information (or NULL).
```

The XpmCreateBufferFromXpmImage writes out the given image to a single block malloc’ed buffer in XPM format. If insufficient working storage is allocated, it returns XpmNoMemory, and returns XpmSuccess on success.

If the passed XpmInfo structure pointer is not NULL, XpmCreateBufferFromXpmImage looks for the following attributes: XpmComments, XpmExtensions, and XpmHotspot, and writes the related information out as well.

The caller should free the buffer using XpmFree when finished.

### 3.2.5 Functions to deal with X images

To create an XImage from an XpmImage, use XpmCreateImageFromXpmImage.

```c
int XpmCreateImageFromXpmImage(display, image, image_return, shapeimage_return, attributes)
    Display *display;
    XpmImage *image;
    XImage *image_return;
    XImage *shapeimage_return;
    XpmAttributes *attributes;
display Specifies the connection to the X server.
image Specifies the XpmImage.
image_return Returns the image which is created.
shapeimage_return Returns the shape mask image which is created if any.
attributes Specifies the location of a structure containing information (or NULL).
```

From the given XpmImage and XpmAttributes if not NULL, XpmCreateImageFromXpmImage allocates colors and creates X images following the same mechanism as XpmReadFileToImage (page 17).

When finished the caller must free the images using XDestroyImage, the colors using XFreeColors, and possibly the data returned into the XpmAttributes using XpmFreeAttributes (page 25).
To create an XpmImage from an XImage, use XpmCreateXpmImageFromImage.

```c
int XpmCreateXpmImageFromImage(display, image, shapeimage, xpmimage, attributes)
    Display *display;
    XImage *image;
    XImage *shapeimage;
    XpmImage *xpmimage
    XpmAttributes *attributes;

display Specifies the connection to the X server.
image Specifies the image which is created.
shapeimage Specifies the shape mask image which is created if any.
xpmimage Specifies the location of an XpmImage structure.
attributes Specifies the location of a structure containing information (or NULL).
```

From the given X images and XpmAttributes if not NULL, XpmCreateXpmImageFromImage creates an XpmImage following the same mechanism as XpmWriteFileFromImage.

### 3.2.6 Functions to deal with X pixmaps

To create a Pixmap with its possible related shapemask from an XpmImage, use XpmCreatePixmapFromXpmImage.

```c
int XpmCreatePixmapFromXpmImage(display, d, image, pixmap_return, shapemask_return, attributes)
    Display *display;
    Drawable d;
    XpmImage *image;
    Pixmap *pixmap_return;
    Pixmap *shapemask_return;
    XpmAttributes *attributes;

display Specifies the connection to the X server.
d Specifies which screen the pixmap is created on.
image Specifies the XpmImage.
pixmap_return Returns the pixmap which is created.
shapemask_return Returns the shape mask which is created if any.
attributes Specifies the location of a structure to get and store information (or NULL).
```

XpmCreatePixmapFromXpmImage creates X images calling XpmCreateImageFromXpmImage (page 31) with the given XpmImage and XpmAttributes, then it creates the related pixmaps which are returned to pixmap_return and shapemask_return using XPutImage. Finally it destroys the X images with XDestroyImage.

When finished the caller must free the pixmaps using XFreePixmap, the colors using XFreeColors or the application equivalent function when the standard Xlib functions are not used, and possibly the data returned into the XpmAttributes using XpmFreeAttributes.
To create an XpmImage from a Pixmap, use XpmCreateXpmImageFromPixmap.

```c
int XpmCreateXpmImageFromPixmap(display, pixmap, shapemask, xpmimage, attributes)
    Display *display;
   Pixmap *pixmap;
   Pixmap *shapemask;
   XpmImage *xpmimage
   XpmAttributes *attributes;

    display Specifies the connection to the X server.
    pixmap Specifies the pixmap.
    shapemask Specifies the shape mask pixmap.
    xpmimage Specifies the location of an XpmImage structure.
    attributes Specifies the location of a structure containing information (or NULL).
```

From the given pixmaps and XpmAttributes if not NULL, XpmCreateXpmImageFromPixmap gets the related X images by calling XGetImage, then it gives them to XpmCreateXpmImageFromImage (page 32) to create an XpmImage which is returned to xpmimage. Finally it destroys the created X images using XDestroyImage.

### 3.2.7 Miscellaneous functions

To free possible data stored into an XpmImage structure use XpmFreeXpmImage.

```c
int XpmFreeXpmImage(image)
    XpmImage *image;
```

`image` Specifies the structure to free.

The XpmFreeXpmImage frees the structure members which are not NULL, but not the structure itself.

To free possible data stored into an XpmInfo structure use XpmFreeXpmInfo.

```c
int XpmFreeXpmInfo(info)
    XpmInfo *info;
```

`info` Specifies the structure to free.

The XpmFreeXpmInfo frees the structure members which are not NULL, but not the structure itself.
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Bibliography

[Motif] OSF/Motif Programmer’s Reference

[Xlib] James Gettys and Robert W. Scheifler
Xlib - C Language X interface

[XPonent] Arnaud Le Hors
XPM - The Format and the Library
XPONENT, summer 1994. The X Professional Organization

[XResource] Arnaud Le Hors
The XPM Format and Library: A Tutorial

[XShape] Keith Packard
X11 Nonrectangular Window Shape Extension