

# Strategies for including graphics in L<sup>A</sup>T<sub>E</sub>X documents

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# Overview of graphics formats

Classification of graphics formats:

**Vector graphics** set up by geometrical elements like lines, curves, polygons, circles, . . .

**Bitmap graphics** store image information as a set of colored pixels with a given resolution and color depth.

Different compression methods exist:

- bitmaps with data compression only
- bitmaps with lossy compression

# Example: vector drawing



- Vector drawings are fine for geometrical drawings
- Advantage: Easily scaleable
- Advantage: Optimal quality independent of resolution of output device

# Example: bitmap



a bitmap with few colors and sharp borders

- Sometimes you have to use bitmaps when you don't have a mathematical representation of your drawing (e. g. no data set for land and political borders in shown example)
- Disadvantage: Loss of quality when scaling or zooming
- Disadvantage: Loss of quality when image resolution doesn't fit to resolution of output device

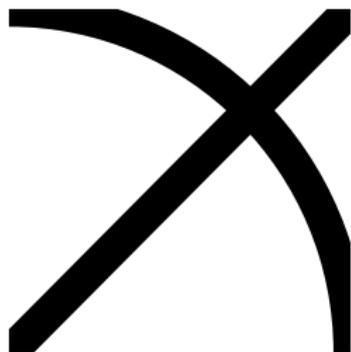
# Example: photo



a photograph

- A photograph has many colors (typically 16 mio) and smooth transitions
- No mathematical representation
- Again: Loss of quality when zooming into the photo (low resolution photo of big size)

# Comparison



vector drawing



low resolution  
bitmap  
(pixels visible)



artifacts in a  
bitmap with lossy  
compression

# Graphic formats in detail

- EPS** encapsulated postscript can contain vector drawings and bitmaps
- PNG** bitmapped portable network graphics format is a successor of GIF, supporting both compression with and without lossy compression
- JPG** bitmap format with lossy compression, often used for photographs (e. g. digital cameras)
- TIFF** a bitmap format often used for high quality DTP, supports CMYK color space

# Guidelines

- For geometrical drawings (e. g. technical drawings, data plots) use a vector format like EPS or PDF
- If you have a bitmap with sharp borders, use PNG
- For photographs with high color depth and smooth transitions use JPEG (100–150 dpi are enough in most cases)
- In high quality DTP, use TIFF for photographs (especially if you need to support CMYK color space)

# L<sup>A</sup>T<sub>E</sub>X graphicx package

- Including graphics in L<sup>A</sup>T<sub>E</sub>X documents is supported by the packages `graphics` and `graphicx`
- `graphicx` is an extension of `graphics` supporting key-value-options for e. g. scaling and rotating
- Load `graphicx` package with

```
\usepackage{graphicx}
```

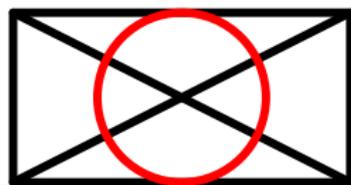
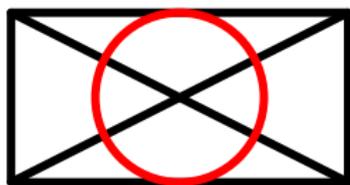
- Modern T<sub>E</sub>X systems assume `dvips` as backend when using latex as compiler and `pdftex` as backend when using pdflatex
- For other backends use

```
\usepackage[backend]{graphicx}
```

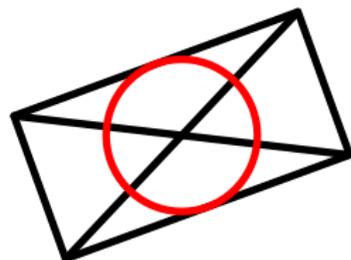
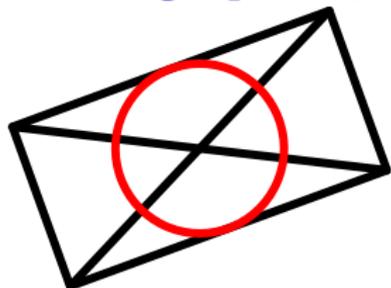
# Including a graphics file

- You can include an image in its natural size with `\includegraphics{sample}`
- Use options as key-value-pairs (`graphicx`): `\includegraphics[key1=opt1,key2=opt2,...]{sample}`
- Common options are:
  - `scale` to scale the image by a factor
  - `width` to scale the image to fit a width
  - `height` to scale the image to fit a height
  - `angle` to rotate the image by an angle with the lower left corner as fix point (positive: counter-clockwise)
  - `keepaspectratio` scale uniquely in x- and y-direction even if both width and height are given

# Examples



```
\includegraphics[width=.3\linewidth]{sample}
```

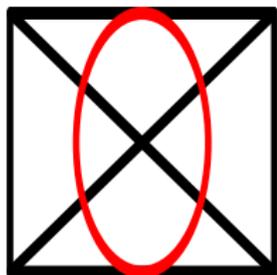


```
\includegraphics[width=.3\linewidth,angle=20]{sample}
```

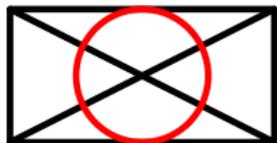
≠

```
\includegraphics[angle=20,width=.3\linewidth]{sample}
```

# More examples



```
\includegraphics[width=1in,height=1in]{sample}
```



```
\includegraphics[width=1in,height=1in,%  
keepaspectratio]{sample}
```

# Supported graphics formats

- Support for graphics file formats and support for features like scaling and rotating depend on the used backend
- Both `dvips` and `pdftex` support scaling and rotating
- `dvips` supports EPS
- `pdftex` supports
  - PNG
  - PDF
  - JPEG
  - MPS (METAPOST output)
- Include images without extension and the backend driver will look for a supported format (so it's easy to switch between `latex` and `pdflatex` without changing the document)

# Converting to a supported format

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|        | latex+dvips |                           | pdflatex |                  |
|--------|-------------|---------------------------|----------|------------------|
| Source | Target      | Tool                      | Target   | Tool             |
| EPS    | ✓           | –                         | PDF      | epstopdf         |
| PDF    | EPS         | gs                        | ✓        | –                |
| PNG    | EPS         | ImageMagick               | ✓        | –                |
| JPEG   | EPS         | ImageMagick               | ✓        | –                |
| TIFF   | EPS         | ImageMagick<br>or tif2eps | PNG      | ImageMagick      |
|        |             |                           | PDF      | tif2eps+epstopdf |

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# Tools for graphics conversion

- ImageMagick** command line tool for graphics conversion and manipulation (changing size, gamma correction, ...), available for Unix and Windows
- netpbm** command line conversion tools, mainly on Unix but Windows binaries exist
- gs** Ghostscript is a PostScript interpreter available for various OS
- epstopdf** is a Perl script to convert EPS to PDF using gs
- tif2eps** by Bogusław Jackowski et al. uses gs to convert TIFF to EPS. Nice tool, also supporting CMYK color space.
- GUI tools** like Gimp, Adobe Photoshop, Corel Draw, ...

## Additional tools: potrace

- potrace is a tool to trace a pure black and white bitmap and produce a vector drawing
- potrace is a command line tool, binaries available for Unix, Mac OSX and Windows
- input formats are PBM, PGM, PPM
- output format is EPS
- Cool!

# Example



original bitmap



traced vector drawing

## Additional tool: package overpic

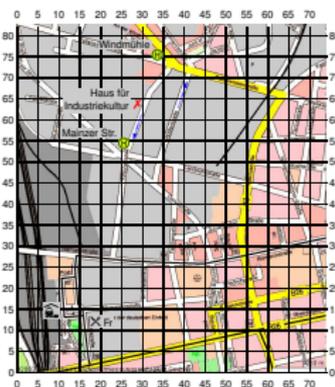
- L<sup>A</sup>T<sub>E</sub>X package written by Rolf Niepraschk
- overlays an image with a L<sup>A</sup>T<sub>E</sub>X picture environment
- you can add new elements to the picture (text, symbols, ...)
- Example:

```
\begin{overpic}[grid,tics=5]{map}
\put(32,74){\includegraphics[scale=.3]
  {busstop.mps}}
\put(32,77){\llap{\scriptsize%
  \colorbox{back}{Windm\"uhle}}}
\put(28,63){\small\textcolor{red}{\ding{55}}}
...
\put(6.3,13){\colorbox{back}{\Pisymbol{ftsy}{68}}}
\put(29.8,61.4){\color{blue}\vector(-1,-3){2}}
\put(38.6,63){\color{blue}\vector(1,3){2}}
\end{overpic}
```

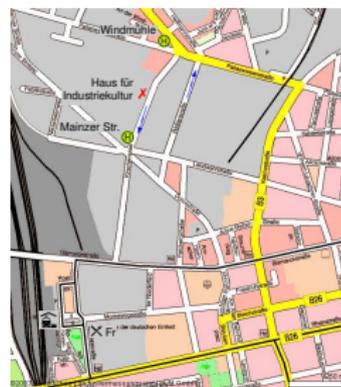
# Example



original



with grid



final