Including Graphics In Documents

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1 Overview

Including graphics in a document is a very common task. One of the easier ways, and the one I use most frequently, is to use the `graphicx` package[1]. This document will present some common examples on how to use it. For demonstration purposes, we are going to be using two images: A PDF document of size 8 cm by 8 cm, and a PNG version of the same image with different dimensions (see Section 6).

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[1]For the full documentation, see http://ctan.org/pkg/graphicx

2   Including an Image Without Additional Options

The following code includes the PDF file as-is as an image[2]:

```
\includegraphics{images/grid8cm.pdf}
```

56	57	58	59	60	61	62	63
48	49	50	51	52	53	54	55
40	41	42	43	44	45	46	47
32	33	34	35	36	37	38	39
24	25	26	27	28	29	30	31
16	17	18	19	20	21	22	23
8	9	10	11	12	13	14	15
0	1	2	3	4	5	6	7

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[2] *Note:* The extension is not strictly necessary. But in this case, since we have both a file `grid8cm.pdf` and `grid8cm.png`, the PNG version would get included (at least on my machine) if the extension is omitted. Personally, I never omit the extension.

3 Centering a Picture

We can center the included picture by using[3]:

```
\begin{center}
    \includegraphics{images/grid8cm.pdf}
\end{center}
```

56	57	58	59	60	61	62	63
48	49	50	51	52	53	54	55
40	41	42	43	44	45	46	47
32	33	34	35	36	37	38	39
24	25	26	27	28	29	30	31
16	17	18	19	20	21	22	23
8	9	10	11	12	13	14	15
0	1	2	3	4	5	6	7

4 Scaling a Picture

Scaling a picture (or text, for that matter) can be achieved via the `scalebox` command, which scales by a horizontal, and optionally a vertical, factor:

```
\scalebox{0.75}[0.5]{\includegraphics{images/grid8cm.pdf}}
```

56	57	58	59	60	61	62	63
48	49	50	51	52	53	54	55
40	41	42	43	44	45	46	47
32	33	34	35	36	37	38	39
24	25	26	27	28	29	30	31
16	17	18	19	20	21	22	23
8	9	10	11	12	13	14	15
0	1	2	3	4	5	6	7

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[3] In the common case of using floats via the `figure` environment, this code would look a bit different, but we're primarily interested in the mechanism of including graphics here, not the rabbit hole which is floats. That's for a different time.

Negative factors work as well[4]:

```
\scalebox{-0.5}[-0.5]{\includegraphics{images/grid8cm.pdf}}
```

7	6	5	4	3	2	1	0
15	14	13	12	11	10	9	8
23	22	21	20	19	18	17	16
31	30	29	28	27	26	25	24
39	38	37	36	35	34	33	32
47	46	45	44	43	42	41	40
55	54	53	52	51	50	49	48
63	62	61	60	59	58	57	56

Alternatively, one may specify a desired size with the `\resizebox` command:

```
\resizebox{4cm}{!}{\includegraphics{images/grid8cm.pdf}}
```

The `!` in the second argument means that the box should be scaled proportionally by whatever factor results from the other length. `\resizebox{!}{4cm}` would yield the same result in this instance, as would `\resizebox{4cm}{4cm}`.

56	57	58	59	60	61	62	63
48	49	50	51	52	53	54	55
40	41	42	43	44	45	46	47
32	33	34	35	36	37	38	39
24	25	26	27	28	29	30	31
16	17	18	19	20	21	22	23
8	9	10	11	12	13	14	15
0	1	2	3	4	5	6	7

Note that everything inside these boxes is scaled, including text. This means that if consistent font sizes are desired throughout a document, this approach is not optimal. Such a situation might for example arise when including a TikZ picture.

Still, as long as such things do not matter, these are easy-to-use and versatile commands which are good to know.

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[4]There also exists the `\reflectbox` command, which is an abbreviation for `\scalebox{-1}[1]`.

5 Rotating a Picture

A picture can be rotate with the `angle` option. Note that options in the graphicx package are parsed left to right, so the following two lines produce different results. The first line resizes the picture to 40 mm width and then rotates it by 45 degrees (resulting in a horizontal width of 56.6 mm), while the second line rotates the picture by 45 degrees first, and then scales the result to 40 mm in width, yielding a horizontal width of actually 40 mm.

```
\includegraphics[width=40mm,angle=45]{images/grid8cm.pdf}
\includegraphics[angle=45,width=40mm]{images/grid8cm.png}
```
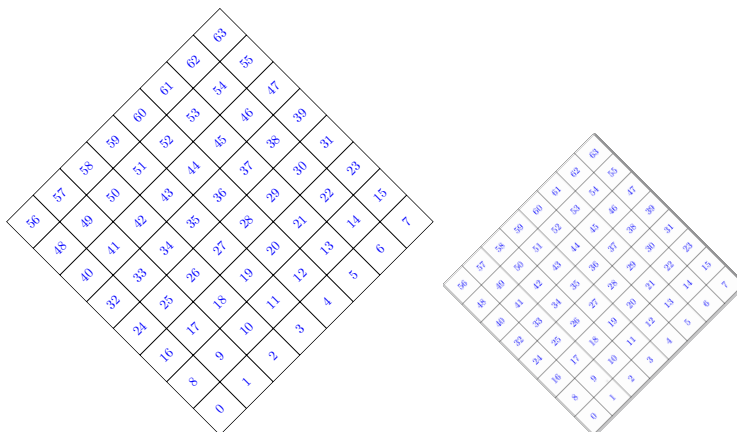
Also note that depending on the resolution and zoom at which you are viewing this document, the lines in the left image (which is the PDF version) may or may not show up on your screen. The PNG version on the right does not seem to suffer from this issue (at least for me).

For more options on rotations, consult the graphix manual.

6   Getting an Image's True Size

Knowing the true size of a picture can relevant when trying to clip it, so a quick overview on the issue is presented here. A way around this by using relative coordinates is presented in Section 10.

There are several ways which can be used to determine the size of a picture as it would be on the page. One option is to open the file in an image editor such as Gimp, Photoshop or similar, and view its properties. For example, the PNG version of the grid image from above, `grid8cm.png`, opened in Gimp, gives the following properties as displayed in the picture to the right.

Alternatively, one can use the `extractbb` command from the command line:

```
$ extractbb imgages/grid8cm.png -O
```
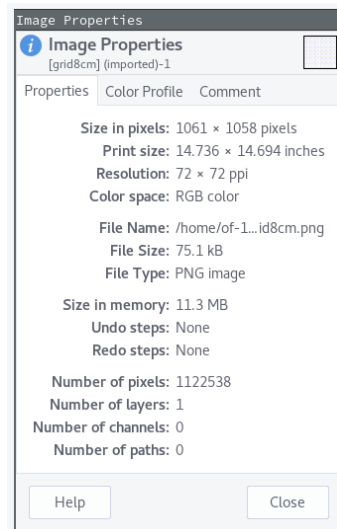
Which will yield:

```
%%Title: images/grid8cm.png
%%Creator: extractbb 20160307
%%BoundingBox: 0 0 1061 1058
%%HiResBoundingBox: 0.000000 0.000000 1061.000000 1058.000000
%%CreationDate: Tue Mar 21 22:14:38 2017
```

 `extractbb` also has other options; type `extractbb -h` for a list. The `HiResBoundingBox` line in `extractbb`'s output will gives the bounding box in points[5]. For the PNG version of our grid, this amounts to:

0 pt	0 pt	1061 pt	1058 pt
0 mm	0 mm	374.3 mm	373.2 mm

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[5]$1\,\mathrm{pt} = 1/72\,\mathrm{in} \approx 0.352\overline{7}\,\mathrm{mm}$

6

7   The `clip` Option

If parts of a picture are to be hidden (either through use of the `viewport` or the `trim` option[6]), the `clip` option needs to be enabled:

`\includegraphics[clip,viewport=0 0 109 109]{images/grid8cm.pdf}`

24	25	26	27
16	17	18	19
8	9	10	11
0	1	2	3

56	57	58	59	60	61	62	63
48	49	50	51	52	53	54	55
40	41	42	43	44	45	46	47
32	33	34	35	36	37	38	39
24	25	26	27	28	29	30	31
16	17	18	19	20	21	22	23
8	9	10	11	12	13	14	15
0	1	2	3	4	5	6	7

Without the `clip` option set to `true`, this is what happens:

`\includegraphics[bb=3cm 3cm 5cm 5cm]{images/grid8cm.pdf}`

Note where the next line of text continues.

With the `clip` option, we get the desired result:

`\includegraphics[clip,bb=3cm 3cm 5cm 5cm]{images/grid8cm.pdf}`

35	36
27	28

---

[6]There exists also the `bb` option, but at least in my TeX installation, I tended to get an error message in my compile log about it not making sense and it was replaced on-the-fly with the `viewport` option. Probably I'm simply not smart enough to use it right.

8 The `viewport` Option

As seen above, the `viewport` option can be used to select a region of the included document's bounding box which is to be shown:

`\includegraphics[clip=true,viewport=2cm 2cm 6cm 6cm]{images/grid8cm.pdf}`

49	50	51	52	53	54
41	42	43	44	45	46
33	34	35	36	37	38
25	26	27	28	29	30
17	18	19	20	21	22
9	10	11	12	13	14

The first, last, top and bottom rows and columns have been cut off. The lines at the top and bottom are not or only partially displayed because they are just slightly outside the 7 cm bounding box as we've defined it.

Because the frame of reference is the included document's bounding box, an optional `width` or `height` argument can be placed either before or after the `viewport` option. The result will be the same.

`\includegraphics[width=30mm,clip=true,viewport=1cm 1cm 7cm 7cm]{images/grid8cm.pdf}`
`\includegraphics[clip=true,viewport=1cm 1cm 7cm 7cm,width=30mm]{images/grid8cm.pdf}`

49	50	51	52	53	54		49	50	51	52	53	54
41	42	43	44	45	46		41	42	43	44	45	46
33	34	35	36	37	38		33	34	35	36	37	38
25	26	27	28	29	30		25	26	27	28	29	30
17	18	19	20	21	22		17	18	19	20	21	22
9	10	11	12	13	14		9	10	11	12	13	14

Another effect of the `viewport` argument being in relation to the included document's bounding box is that in case of the PNG version, we get a rather different result, because it is significantly larger, as we found in Section 6.

`\includegraphics[clip=true,viewport=1cm 1cm 7cm 7cm,width=30mm]{images/grid8cm.png}`
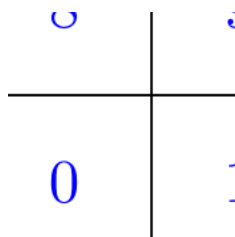
9   The `trim` Option

The `trim` option, instead of selecting a region from an included document which is to be shown, selects regions of said document which are to be cut off. Also, again, the parameters passed to the `trim` option are in relation to the included document's size, and we get different results for the PDF and PNG versions due to their different sizes. However, both have 1 cm clipped on all four sides.

```
\includegraphics[width=0.5\textwidth,clip=true,trim=1cm 1cm 1cm 1cm]{images/grid8cm.pdf}
\includegraphics[width=0.5\textwidth,clip=true,trim=1cm 1cm 1cm 1cm]{images/grid8cm.png}
```

49	50	51	52	53	54
41	42	43	44	45	46
33	34	35	36	37	38
25	26	27	28	29	30
17	18	19	20	21	22
9	10	11	12	13	14

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0	1	2	3	4	5	6	7

10 The `rviewport` Package

The `rviewport`[7] package allows to use relative coordinates instead of absolute coordinates to specify the areas which are to be clipped.

```
% Preamble:
\usepackage{rviewport}
% Document
\includegraphics[clip,rviewport=0.125 0.125 0.875 0.875]{images/grid8cm.pdf}
\includegraphics[width=6cm,clip,rviewport=0.125 0.125 0.875 0.875]{images/grid8cm.png}
```

49	50	51	52	53	54	49	50	51	52	53	54
41	42	43	44	45	46	41	42	43	44	45	46
33	34	35	36	37	38	33	34	35	36	37	38
25	26	27	28	29	30	25	26	27	28	29	30
17	18	19	20	21	22	17	18	19	20	21	22
9	10	11	12	13	14	9	10	11	12	13	14

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[7] Package documentation available at: https://www.ctan.org/pkg/rviewport