PDF

merging, embedding, fixing
and messing a bit around

in context lmtx

The three graphic formats that make most sense for inclusion in pdf are png, jpg, and pdf. The easiest if these is jpg because basically the binary blob get transferred to the result file. A png graphic might need more work because what actually is supported is basic png inclusion. It means that often the image data has to be unpacked and split into pdf counterparts that get embedded. The pdf format is quite convenient because basically we only need to copy the used objects to the result, so when those object are for instance png encoded images, we gain runtime, but when we're talking pages of documents it might take some more. Nevertheless, in practice it is still quite efficient.

Here we focus on pdf inclusion where we have sereral scenarios to deal with:

- A straightforward inclusion of a single page pdf file.
- Inclusion of a specific page from a pdf file.
- Inclusion of several pages from a pdf file.
- Inclusion of one or more pages from several pdf files.

To this we can add:

- Inclusion of one or more pages from pdf files that are generated independently (subruns) for instance in the process of writing a manual about something ConTeXt. Think of externaly processed buffers.

When we include more than one page from a file, we only need to embed shared objects once. Of course it demands some object management but that has to be done anyway. We could share objects across files but that demands more memory and runtime and the saving are likely to be small, with one exception: fonts. It would be nice if we can embed missing fonts and also merge fonts that are the same. This can make the result much smaller, especially when we're talking of including examples of typesetting in a manual that uses the same fonts.

Another aspect of inclusion is the quality of the to be embedded page. Here you can think of errors in the page stream, color spaces that don't match, missing properties, invalid metadata, etc. Often there's not much we can do about it, but sometimes we can. However, it has to happen under user control and the outcome has to be checked, although often a visual check is good enough.

The `compact` parameter of `\externalfigure` controls the embedding of pdf content. When set to 'yes' it will merge fonts but only when the file is produced by ConTeXt LMTX. The reason for not checking all fonts by default comes from the fact that references from the page stream to glyphs in the font depend on the application that made the pdf. In some cases the mapping is using the original glyph index, but one can never be sure. Using the `tounicode` map to go from page stream index to glyph index is also not reliable because multiple glyphs can have the same Unicode slot and when font features are applied (say small caps) you actually don't know that.

The mentioned `yes` option is a preset that has been defined like:

```
\startluacode
graphics.registerpdfcompactor ( "yes", {
    merge = {
        lmtx = true,
    },
} )
\stopluacode
```

Another preset is `merge`:

```
\startluacode
graphics.registerpdfcompactor ( "merge", {
    merge = {
        type0    = true,
```

```
        truetype = true,
        type1    = true,
        lmtx     = true,
    },
} )
\stopluacode
```

Currently we don't support Type3 optimization. It is doable but probably not worth the effort.

We can also force embedding of fonts that are not included in the document that we get the page from. This is unlikely unless you have old documents.

```
embed = {
    type0    = true,
    truetype = true,
    type1    = true,
}
```

References to glyphs in the page stream use an eight bit string encoding or an hexadecimal byte pairs. Depending on the font type we have upto 256 references (using one character or two hex bytes) or at most 65536 references (using two characters or 4 hex bytes). We normalize everything to hex encoding. That way we get rid of the ugly escapes and exceptions in page stream glyph string.

There are two trackers:

```
\enabletrackers[graphics.fonts]
\enabletrackers[graphics.fixes]
```

The first one reports what is done with fonts. When embedding of merging is not possible you can try to remap the found font onto one on your system. Here are some examples:

```
graphics.registerpdffont {
    source = "arial",
    target = "file:arial.ttf",
}
graphics.registerpdffont {
    source = "arial-bold",
    target = "file:arialbd.ttf",
}
graphics.registerpdffont {
    source = "arial,bold",
    target = "file:arialbd.ttf",
}
graphics.registerpdffont {
    source = "helvetica",
    target = "file:arial.ttf",
 -- unicode = true,
}
graphics.registerpdffont {
    source = "helvetica-bold",
    target = "file:arialbd.ttf",
 -- unicode = true,
}
graphics.registerpdffont {
    source = "courier",
```

```
    target = "file:cour.ttf",
}
graphics.registerpdffont {
    source  = "ms-pgothic",
    unicode = true, -- via unicode (false for composite)
}
```

The `unicode` key needed when you get rubish due to the indices in the page stream being different from glyph indices in the used font. In that case we go via the `tounicode` vector which works ok for the average simple document not using special font features. There is some trial and error involved but that is probably worth the effort when you have to manipulate many documents.

There are two activities when we compact: fonts and content. When content is handled additional parsing of the page stream has to happen. What gets processed it determined by the `identify` table:

```
identify = {
    content   = true,
    resources = true,
    page      = true,
}
```

although this is equivalent:

```
identify = "all"
```

As a proof of concept we can recolor an included file. Of course this assumes a rather simple use of color. Here is an example:

```
\startluacode
    graphics.registerpdfcompactor ( "preset:demo-1", {
        identify = {
            content   = true,
            resources = true,
            page      = true,
        },
        merge = {
            type0    = true,
            truetype = true,
            type1    = true,
            lmtx     = true,
        },
        recolor = {
            viagray = { 1, 0, 0 },
         -- viagray = { 0, 1, 0 },
         -- viagray = { 0, 1, 0, .5 },
         -- viagray = { .75 },
        }
    } )
\stopluacode
\setupexternalfigures[compact=preset:demo-1]
\startTEXpage
    \startcombination[3*4]
        {\externalfigure[test-000.pdf][frame=on]}        {\LUAMETATEX\ 0}
        {\externalfigure[test-001.pdf][frame=on]}        {\LUATEX\ 1}
        {\externalfigure[test-002.pdf][frame=on]}        {\LUATEX\ 2}
```

```
        {\externalfigure[test-003.pdf][frame=on,page=1]} {\LUATEX\ 3.1}
        {\externalfigure[test-003.pdf][frame=on,page=2]} {\LUATEX\ 3.2}
        {\externalfigure[test-003.pdf][frame=on,page=3]} {\LUATEX\ 3.3}
        {\externalfigure[test-004.pdf][frame=on,page=1]} {\PDFTEX\ 4.1}
        {\externalfigure[test-004.pdf][frame=on,page=2]} {\PDFTEX\ 4.2}
        {\externalfigure[test-004.pdf][frame=on,page=3]} {\PDFTEX\ 4.3}
        {\externalfigure[test-005.pdf][frame=on,page=1]} {\PDFTEX\ 4.1}
        {\externalfigure[test-005.pdf][frame=on,page=2]} {\PDFTEX\ 5.2}
        {\externalfigure[test-005.pdf][frame=on,page=3]} {\PDFTEX\ 5.3}
    \stopcombination
\stopTEXpage
```

In figure 1 we make a single page document that embeds 12 pages from six files made by several engines. The six files have a total of about 114K but the single page combination is only 19K. The test files are:

```
% \nopdfcompression

\starttext
    \startTEXpage[offset=1ex]
        test \type {some} more
    \stopTEXpage
\stoptext
```

So this one is an LMTX produced file. The next two files:

```
% engine=luatex

% \nopdfcompression

\starttext
    \startTEXpage[offset=1ex]
        test \type {test}
    \stopTEXpage
\stoptext
```

and

```
% engine=luatex

% \nopdfcompression

\starttext
    \startTEXpage[offset=1ex]
        last \type {last}
    \stopTEXpage
\stoptext
```

are done by LuaTEX with MkIV and

```
% engine=luatex

% \nopdfcompression

\starttext
    \startTEXpage[offset=1ex]
```

```
        rest \type {rest}
    \stopTEXpage
    \startTEXpage[offset=1ex]
        whatever \type {whatever}
    \stopTEXpage
    \startTEXpage[offset=1ex]
        more \type {more}
    \stopTEXpage
\stoptext
```

as well as

```
% engine=pdftex

% \nopdfcompression

\starttext
    \startTEXpage[offset=1ex]
        rest \type {rest}
    \stopTEXpage
    \startTEXpage[offset=1ex]
        whatever \type {whatever}
    \stopTEXpage
    \startTEXpage[offset=1ex]
        more \type {more}
    \stopTEXpage
\stoptext
```

and

```
% engine=pdftex

% \nopdfcompression

\starttext
    \startTEXpage[offset=1ex]
       rest \type {rest}
    \stopTEXpage
    \startTEXpage[offset=1ex]
       whatever \type {whatever}
    \stopTEXpage
    \startTEXpage[offset=1ex]
       more \type {more}
    \stopTEXpage
\stoptext
```

are typeset with pdfTEX and MkII so they have the Type1 instead of the OpenType Latin Modern file embedded (in fact, the MkII and MkIV files use the twelve point variant and LMTX the upscaled ten point, so if those were the same we would have an even smaller final file.

A useful manipulation is removing tags. The fact that the content is tagged doesn't mean that tagging has any use, certainly not if it relates to editing specific for some application. Maybe at some point I'll add a retagging option but for now we just strip:

```
strip = {
```

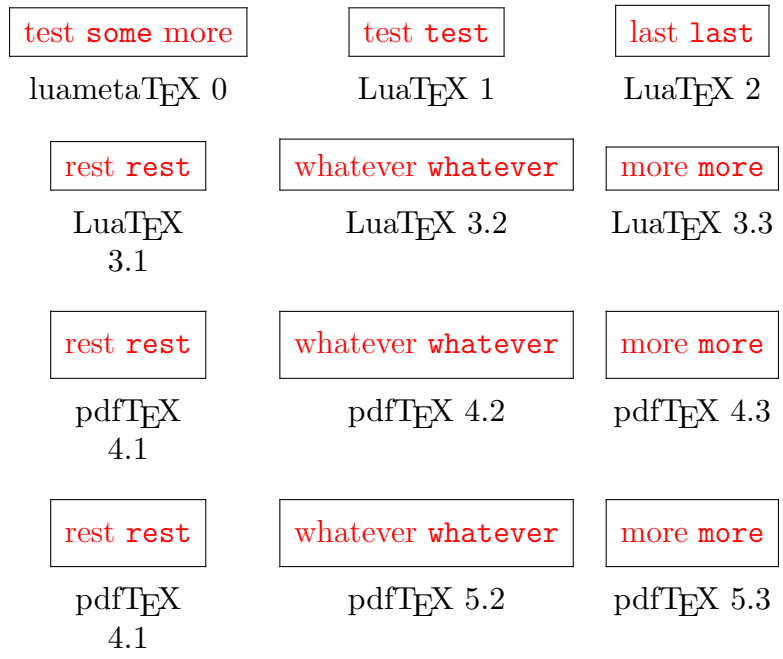


Figure 1 An example of content manipulation.

```
    marked    = true,
 -- group     = true,
 -- extgstate = true,
}
```

The other two are sort of special and might be needed too, especially when for instance the states are just there because the producer wasn't clever enough to leave them out when not applicable.

It happens that producers use color while actually gray scales are meant. In that case one can use these:

```
reduce = {
    color = true, -- both rgb and cmyk
    rgb   = true,
    cmyk  = true,
}
```

Using a gray scale is more efficient and in the case of cmyk a sloppy `.5 .5 .5 0 K` quite likely is meant to be `0 0 0 0.5 K` or just `.5 G`.

Remapping rgb to cmyk (or gray if applicable) is done with:

```
convert = {
    rgb  = true,
 -- cmyk = true,
}
```

and of course one can also remap cmyk to rgb.

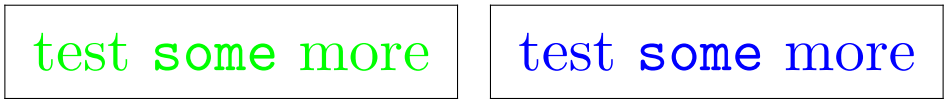
I want to stress that manipulating the content stream has some limitations. For instance because objects are shared including a page a second time will reuse the already converted page. However, you can try the next trick:

```
\startluacode
    graphics.registerpdfcompactor ( "preset:demo-2", {
        identify =  "all",
```

```
        merge    = { lmtx = true },
        recolor  = { viagray = { 0, 1, 0 } },
    } )
    graphics.registerpdfcompactor ( "preset:demo-3", {
        identify =  "all",
        merge    = { lmtx = true },
        recolor  = { viagray = { 0, 0, 1 } },
    } )

\stopluacode
\setupexternalfigures[compact=preset:demo-1]
\startTEXpage
    \startcombination[2*1]
        {\externalfigure
            [test-000.pdf]
            [frame=on,compact=preset:demo-2,width=6cm,object=no,arguments=1]}
            {demo-2}
        {\externalfigure
            [test-000.pdf]
            [frame=on,compact=preset:demo-3,width=6cm,object=no,arguments=2]}
            {demo-3}
    \stopcombination
\stopTEXpage
```

In figure 2 we see that indeed a different compactor is used. We need to disable sharing by setting `object` to `no`. However, this will still share some but we abuse the arguments key to create a different sharing hash (normally that key is used to pass arguments to converters).



demo-2 demo-3

Figure 2 An example of manipulation content twice.

I cases where color conversion is problematic (or critical) you can remap specific colors. Especially cmyk is sensitive for conversion because there we have four color components while in rgb we have only three. Also watching on a display (rgb) is different from looking at a print (cmyk) and who knows what transfer function gets applied in the former. Here is how remapping works:

```
local cmykmap = {
    { 100, 100, 55, 0, 57, 0, 22, 40.8 }
}
graphics.registerpdfcompactor ( "preset:demo-5", {
    identify =  "all",
    merge    = { lmtx = true },
    convert  = { cmyk = cmykmap },
} )
```

Here the entries in a cmyk map are:

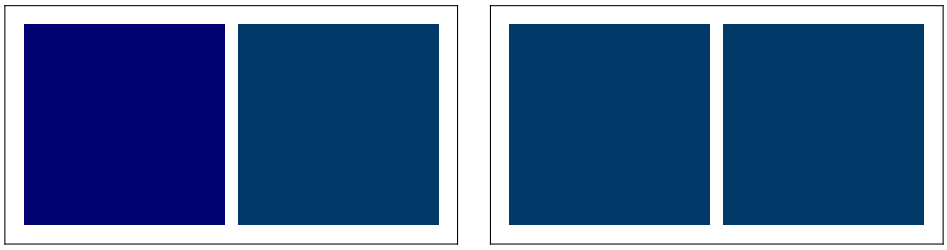
```
    { factor, c, m, y, k, r, g, b }
```

In this case values are multiplied by 100 which makes sure that we catch rounding errors in the pdf definitions. Keep in mind that colors in many applications have at most 256 values per component. Also, even quality lcd displays can use less than eight bits per component.

In figure 3 we show an example. The file used looks like:

```
% \nopdfcompression

\starttext
    \definecolor[one][c=1.000,m=0.550,y=0.000,k=0.57]
    \definecolor[two][r=0.000,g=0.22,b=0.408]          % h=003868
    \startTEXpage[offset=1ex]
        \blackrule[color=one,height=2cm,width=2cm,depth=0cm]
        \blackrule[color=two,height=2cm,width=2cm,depth=0cm]
    \stopTEXpage
\stoptext
```



demo-4 demo-5

Figure 3 An example of remapping colors.

I want to stress that you need to check the outcome. Often a visual check is enough. Extending the compactor beyond what MkIV provided was to a large extend facilitated by a cooperation with Tan, Syabil M. and Ser, Zheng Y. of 'Team Ramkumar' who did extensive testing and gave enjoyable feedback. In the process a test script was made that can help with experiments. We assume that `qpdf`, `mutool` and `graphicmagic` abd `verapdf` are installed.

```
mtxrun --script fixpdf --uncompress                          foo
mtxrun --script fixpdf --convert    --compactor=preset:test foo
mtxrun --script fixpdf --validate                            foo
mtxrun --script fixpdf --check                               foo
mtxrun --script fixpdf --compare    --resolution=300         foo
```

Here we produce an uncompressed version (so that we can see what we deal with), convert the original into a new one, validate (and check the outcome) and create a version for visual comparison. It's just an example of usage and here the focus was on fixing existing documents (six digit numbers so the workflow needs to be carefully checked) and not so much on single page inclusion.

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