

The **l3pdf**file module

Embedding and referencing files in a PDF

L^AT_EX PDF management testphase bundle

The L^AT_EX Project*

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1 **l3pdf**file documentation

1.1 Introduction

1.1.1 Background

External files can be referenced from a PDF in three ways:

1. through an annotation of type Link,
2. by referencing a local file in the file system,
3. by embedding the file directly into the PDF

Case 1 (Links) are created with the `\pdfannot` commands. This module handles the two other cases. Actually from the view of the PDF format they are quite similar: Case 2 is case 3 without the stream object and without the `/EF` entry in the `/Filespec` dictionary (this points to the stream object of the file). Not embedding the file makes the PDF smaller. But it is also less portable: the files can only be found if they are in the right location relative to the PDF. The normal case is to embed the file.

The tasks to embed and reference such a file are

1. Embed the file in a stream.
2. Create a Filespec dictionary which references the stream object in the `/EF` dictionary:

```
<<
  /Type /Filespec
  /F (l3pdffile.dtx)
  /UF (l3pdffile.dtx)
  /AFRelationship /Source
  /EF <</F 21 0 R /UF 21 0 R>>   %case 3, embedded file
>>
```

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The file names in the `/UF` and `/F` value don't need to be identical to the name of file on the disc. It is quite possible to embed a `zzz.tex` and name it `blub.tex`. The second name is then what the user will see in the attachment list or in the properties of an annotation.

3. Reference the `Filespec` dictionary so that the user can access the file. This can be done in various way:

- (a) With an annotation (`/Subtype/FileAttachment`). This is done by `attachfile`, `attachfile2` and `intopdf`. Typical entries of such an annotation are:

key	value type	notes
<code>/FS</code>	object reference	(<code>Filespec</code> dictionary)
<code>/Name</code>	name	<code>/Graph</code> , <code>/PushPin</code> , <code>/Paperclip</code> , <code>/Tag</code>
<code>/Contents</code>	text string	optional but recommended
<code>/F</code>	integer	Flags
<code>/AP</code>	dictionary	Appearance (required if <code>rectangle > 0</code>)
<code>/AS</code>	name	

The `/AP` takes precedence over `Border` and similar keys.

- (b) Through an entry in the `/EmbeddedFiles` name tree. This is what `embedfiles` does.

```
20 0 obj %Document Name tree
<</EmbeddedFiles 21 0 R>>
endobj
21 0 obj %Embedded Files Name dictionary
<</Names [(AcmeCustomCrypto Protected PDF.pdf) 17 0 R]>>
endobj
```

The strings (keys) in the `/Names` dictionary must be sorted lexically. But they don't have to be the file name or anything related to the file name. The resource management code uses `l3ef0001`, `l3ef0002` ..., which allows up to 9999 files. The key can be needed to identify the start file in a collection, so their relation to the files are stored in a property list.

- (c) Through the `/AF` key in various objects (pdf 2.0). The value is normally an array of object references, but it can also be a name which is mapped to an array in `/Properties`:

```
/AF /NamedAF BDC
/Properties <</NamedAF [12 0 R]
```

The related `/Filespec` dictionary should contain an `/AFRelationship` key in this case (but it doesn't harm to add it by default anyway). The values of this key is describe in table 1.

1.1.2 Task 1: Embedding a file

Embedding an existing file is in most cases quite straightforward. This module offers commands, but it can also be done with the basic commands from the `l3pdf` module `\pdf_object_unnamed_write:nn` or `\pdf_object_new:nn/\pdf_object_write:nn` or primitive commands to create objects. The object number should be stored for the reference in the `/Filespec` dictionary.

Table 1: Values of the `/AFRelationship` key

Source	shall be used if this file specification is the original source material for the associated content.
Data	shall be used if this file specification represents information used to derive a visual presentation – such as for a table or a graph.
Alternative	shall be used if this file specification is an alternative representation of content, for example audio.
Supplement	shall be used if this file specification represents a supplemental representation of the original source or data that may be more easily consumable (e.g., A MathML version of an equation).
EncryptedPayload	shall be used if this file specification is an encrypted payload document that should be displayed to the user if the PDF processor has the cryptographic filter needed to decrypt the document.
FormData	shall be used if this file specification is the data associated with the AcroForm (see 12.7.3, “Interactive form dictionary”) of this PDF.
Schema	shall be used if this file specification is a schema definition for the associated object (e.g. an XML schema associated with a metadata stream).
Unspecified	(default value) shall be used when the relationship is not known or cannot be described using one of the other values.
Other names	Second-class names (see Annex E, “(normative) PDF Name Registry”) should be used to represent other types of relationships.

```

\pdf_object_unnamed_write:nx {fstream}
{
  {
    /Type /EmbeddedFile
    /Subtype /application\c_hash_str2Fpostscript
    /Params
    <<
      /ModDate ~ (\file_timestamp:n{example-image.eps})
      /Size ~ \file_size:n {example-image.eps}
      /Checksum ~ (\file_md5five_hash:n {example-image.eps})
    >>
  }
  {example-image.eps}
}
\tl_set:Nx \l_my_fileobj_tl {\pdf_object_ref_last:}

```

- The `/Params` dictionary is not always required, but the commands of these module will prefill them as shown in the examples. A `/CreationDate` entry has to be added explicitly as there is no sensible way to retrieve this automatically.
- The mimetype (in the `/Subtype`) should be properly escaped. This module contains a property list with maps a number of file extensions to mimetypes and the commands try to detect and fill the mimetype automatically.
- The dictionary can contain additional keys (`/Filter`, `/DecodeParms`), see the pdf reference.

1.1.3 Task 2: Creating the `/Filespec` dictionary

The `/Filespec` dictionary is a simple dictionary object, and can also be created in various ways. If it refers to an embedded file it should reference it in the `/EF` key.

1.1.4 Task 3: Referencing the `/Filespec` dictionary

Using the dictionary reference in annotations and `/AF` keys is unproblematic.



But to add it to the `/EmbeddedFiles` name tree so that it appears in the attachment panel requires special care: This name tree is a global resource and uncoordinated access can lead to clashes and files that are not visible or inaccessible. The access here is managed by the `l3pdfmanagement` module:

```

\pdfmanagement_add:nnx{Catalog/Names}{EmbeddedFiles}{\objref}

```

1.2 Commands and tools of these module

`file`
`file/Params`
`file/streamParams`
`file/Filespec`

The module predefines and uses a number of local dictionaries for the components of the stream and the `/Filespec` object. These dictionaries are then used by the `\pdffile_embed_XX`. The content of these dictionaries can be changed by users with the commands from the `l3pdfdict` module, but it should be done only locally to avoid side effects on uses by other packages/commands.

The preset values of these dictionaries are shown in table 2.

Table 2: Preset values in the file dictionaries

dictionary	key	value
<code>l_pdffile</code>	Type	/EmbeddedFile
<code>l_pdffile/Params</code>	Size	<code>\file_size:n{\l_pdffile_source_name_str}</code>
<code>l_pdffile/Params</code>	ModDate	<code>(\file_timestamp:n {\l_pdffile_source_name_str})</code>
<code>l_pdffile/Params</code>	Checksum	<code>(\file_md5five_hash:n{\l_pdffile_source_name_str})</code>
<code>l_pdffile/streamParams</code>		a /ModDate entry with year/month/date (used with <code>\pdffile_embed_stream:nnn</code>)
<code>l_pdffile/Filespec</code>	Type	/Filespec
<code>l_pdffile/Filespec</code>	AFRelationship	Unspecified

`\pdffile_embed_file:nnn` `\pdffile_embed_file:nnn {<source filename>} {<target filename>} {<object name >}`

This commands embeds the file *<source filename>* in the PDF, and creates a /Filespec dictionary object named *<object name>*. The object name must be unique, it should start with the module name, so e.g. `module/name`. The command uses the content of the local dictionaries `l_pdffile`, `l_pdffile/Params` and `l_pdffile/Filespec` to setup the dictionary entries of the stream object and the /Filespec dictionary. The /F and /UF entry are filled with *<target filename>*.

It is an error if both *<target filename>* and *<source filename>* are empty.

If *<target filename>* is empty *<source filename>* is used instead.

If *<source filename>* is empty, only a /Filespec dictionary is created.

If the `l_pdffile` dictionary doesn't contain a Subtype entry with the mimetype, the command tries to guess it from the file extension of *<source filename>*. Unknown file extensions can be added (or known extension be changed) by adding to or changing the value in the property `\g_pdffile_mimetypes_prop`, see below.

When using `dvips` and `pstopdf` the actual embedding is done by `pstopdf`. `pstopdf` will embed files only if used with the option `-dNOSAFER` and will not be able to use files which are found with `kpathsea`.

<target filename> doesn't need to be a file name with an extension, but it is recommended as security settings in the pdf viewer can restrict access to known file types.

`\pdffile_embed_stream:nnn` `\pdffile_embed_stream:nnn {<content>} {<target filename>} {<object name >}`

This commands embeds the *<content>* in the PDF in a stream objects and creates a /Filespec dictionary object named *<object name>*. *<content>* is wrapped in a `\exp_not:n`. The object name must be unique. The command uses the content of the local dictionaries `l_pdffile`, `l_pdffile/streamParams` and `l_pdffile/Filespec` to setup the dictionary entries of the stream object and the /Filespec dictionary. The /F and /UF entry are filled with *<target filename>*. If *<target filename>* is empty the fix name `stream.txt` is used instead.

If the `l_pdffile` dictionary doesn't contain a Subtype entry with the mimetype, the command tries to guess it from the file extension of *<target filename>*.

<target filename> doesn't need to be a file name with an extension, but it is recommended as security settings in the pdf viewer can restrict access to known file types.

The stream should not be too long, at least PS imposes a size limit for strings.

`\pdffile_filespec:nnn` \ pdffile_filespec:nnn {<object name>}{<file name>}stream object reference

`\pdffile_filespec:nnx`

The previous commands are fine if stream and filespec dictionary can be created together. But there are cases where the `filespec` dictionary should be referenced when the stream object doesn't exist yet. For example in the `AF` key of a structure at the begin of an environment where the stream is created from the body.

This command allows to write a filespec dictionary alone and reference a previously created stream.

```
\pdf_object_new:nn{module/filespec/A}{dict} % a new filespec object
\pdf_object_ref:n {module/filespec/A} % a reference
\pdf_object_unnamed_write:nn { stream }{ {...}{content} } %writing the stream
% filling and writing the filespec dictionary:
\pdffile_filespec:nnn {module/filespec/A}{A.xml}{\pdf_object_ref_last:}
```

`\g_pdffile_mimetypes_prop`

This property contains a list of extensions and their mimetypes. Values can be added or changed with the standard commands:

```
\prop_gput:Nnn \g_pdffile_mimetypes_prop {.abc}{text/plain}
```

The extension should start with a period, the mimetype should be given as plain text (it will be escaped internally). Extensions with two periods are not supported.

`\l_pdffile_source_name_str`

This variable is set at the begin of `\pdffile_embed_file:nnn`. It can be (and is) used in the file dictionaries, see table 2 for examples.

`\g_pdffile_embed_prop`

This property holds a list of embedded files. It is used by the following show command. The keys are the object names, the argument holds a key word, the source file name and the target file name.

`\pdffile_embed_show:`

This shows the embedded files with their source and target name.

1.3 Example

```
\group_begin:
%set the relationship:
\pdfdict_put:nnn {\l_pdffile/Filespec} {AFRelationship}{/Source}
%set the description key. The text must first be converted:
\pdf_string_from_unicode:nnN {utf16/string}
  {this~is~an~odd~description~with~öäü}
  \l_tmpa_str
\pdfdict_put:nnx {\l_pdffile/Filespec} {Desc}{\l_tmpa_str}
%embeds testinput.txt and calls it grüße.txt
\pdffile_embed_file:nnn {testinput.txt}{grüße.txt}{mymodule/example1}
%reference it in the panel
\pdfmanagement_add:nnx
  {Catalog/Names}
```

```

{EmbeddedFiles}
{\pdf_object_ref:n{mymodule/example1}}
\group_end:

```

2 l3pdffile implementation

```

1 <*header>
2 \ProvidesExplPackage{l3pdffile}{2022-02-16}{0.951}
3   {embedding and referencing files in PDF---LaTeX PDF management testphase bundle}
4 \RequirePackage{l3pdfptools} %temporarily!!
5 </header>
6 <*package>
7 <@@=pdffile>
8 \cs_new_protected:Npn \__pdffile_filename_convert_to_print:nN #1 #2
9   {\pdf_string_from_unicode:nnN {utf16/hex}{#1}{#2}}

```

2.1 Messages

```

10 \msg_new:nnn { pdffile } { file-not-found }
11   {
12     File~'\tl_to_str:n{#1}'~not~found
13   }
14
15 \msg_new:nnn { pdffile } { mimetype-missing }
16   {
17     Mime~type~not~set~for~file~'\tl_to_str:n{#1}'
18   }
19
20 \msg_new:nnn { pdffile } { target-name-missing }
21   {
22     a~target~name~for~the~/Filespec~dictionary~is~missing.
23   }
24
25 \msg_new:nnn { pdffile } { object-exists }
26   {
27     object~name~'#1'~is~already~used.
28   }
29
30 \msg_new:nnn { pdffile } { show-files }
31   {
32     The~following~files~have~been~embedded\\
33     #1
34   }

```

\l__pdffile_tmpa_tl temporary variables: generic, for extension, subtype, to store the ref.

\l__pdffile_tmpb_tl (End definition for \l__pdffile_tmpa_tl and others.)

```

\l__pdffile_tmpa_str
\l__pdffile_tmpb_str
\l__pdffile_ext_str
\l__pdffile_automimetype_tl
\l__pdffile_embed_ref_tl
35 \tl_new:N \l__pdffile_tmpa_tl
36 \tl_new:N \l__pdffile_tmpb_tl
37 \str_new:N \l__pdffile_tmpa_str
38 \str_new:N \l__pdffile_tmpb_str
39 \str_new:N \l__pdffile_ext_str
40 \tl_new:N \l__pdffile_automimetype_tl
41 \tl_new:N \l__pdffile_embed_ref_tl

```

`\g_pdffile_mimetypes_prop` This variable holds common mimetypes. The key is an extension with (one) period, the value the description, e.g. `text/csv`.

(End definition for \g_pdffile_mimetypes_prop. This variable is documented on page 6.)

```

42 \prop_new:N \g_pdffile_mimetypes_prop
43 \prop_gset_from_keyval:Nn \g_pdffile_mimetypes_prop
44 {
45   ,.css = text/css
46   ,.csv = text/csv
47   ,.html= text/html
48   ,.dtx = text/plain %or application/x-tex, not in iana.org list
49   ,.eps = application/postscript
50   ,.jpg = image/jpeg
51   ,.mp4 = video/mp4
52   ,.pdf = application/pdf
53   ,.png = image/png
54   ,.tex = text/plain %or application/x-tex, not in iana.org list
55   ,.txt = text/plain
56   ,.sty = text/plain
57   ,.xml = text/xml
58 }

```

`\l_pdffile_source_name_str` `\l_pdffile_source_name_str` will be set at the begin of the command and contains the full file name and can be used e.g. with `\file_timestamp:n`.

(End definition for \l_pdffile_source_name_str. This variable is documented on page 6.)

```

59 \str_new:N \l_pdffile_source_name_str

```

Here we define and setup the local dictionaries. We add a `ModDate` to ensure that there is an entry if associated files are used.

```

60 \pdfdict_new:n { l_pdffile }
61 \pdfdict_put:nnn { l_pdffile }{Type}{/EmbeddedFile}
62 \pdfdict_new:n { l_pdffile/Params }
63 \pdfdict_put:nnn { l_pdffile/Params }
64   {ModDate} { (\file_timestamp:n { \l_pdffile_source_name_str }) }
65 \pdfdict_put:nnn { l_pdffile/Params }
66   {Size} { \file_size:n { \l_pdffile_source_name_str } }
67 \pdfdict_put:nnn { l_pdffile/Params }
68   {Checksum} { (\file_md5_hash:n { \l_pdffile_source_name_str }) }
69 \pdfdict_new:n { l_pdffile/streamParams }
70 \pdfdict_put:nnn { l_pdffile/streamParams }
71   {ModDate} {
72     (
73       D:\int_use:N\c_sys_year_int
74       \int_compare:nNnT{\c_sys_month_int}<{10}{0}
75       \int_use:N\c_sys_month_int
76       \int_compare:nNnT{\c_sys_day_int}<{10}{0}
77       \int_use:N\c_sys_day_int
78     )
79   }
80 \pdfdict_new:n { l_pdffile/Filespec }
81 \pdfdict_put:nnn { l_pdffile/Filespec }
82   {Type} { /Filespec }
83 \pdfdict_put:nnn { l_pdffile/Filespec }

```



```

84 {AFRelationship} { /Unspecified }
85

```

`\g_pdffile_embed_prop` we record here the relation
 $\langle object\ name \rangle \Rightarrow \{ \langle file/stream\ or\ empty \rangle \} \{ \langle sourcename \rangle \} \{ \langle targetname \rangle \}$

```

86 \prop_new:N \g_pdffile_embed_prop

```

(End definition for `\g_pdffile_embed_prop`. This variable is documented on page 6.)

`\pdffile_embed_show:`

```

87 \cs_new_protected:Npn \pdffile_embed_show:
88 {
89   \msg_show:nnx
90   {pdffile}{show-files}
91   {
92     \prop_map_function:NN {\g_pdffile_embed_prop} \msg_show_item:nn
93   }
94 }

```

(End definition for `\pdffile_embed_show:`. This function is documented on page 6.)

`\pdffile_embed_file:nnn` At first a command to set the mimetype. It either uses the current value in the file
`\pdffile_embed_stream:nnn` dictionary, or tries to guess it from the extension.

```

95 % #1 file name,
96 % #2 tl to return the (printed) value for the guessed mimetype
97 \cs_new_protected:Npn \__pdffile_mimetype_set:nN #1 #2
98 {
99   \file_parse_full_name:nNNN
100   {#1}
101   \l__pdffile_tmpa_str %unused
102   \l__pdffile_tmpb_str %unused
103   \l__pdffile_ext_str
104   %check if Subtype has been set
105   \pdfdict_get:nnN { l__pdffile } {Subtype} \l__pdffile_tmpa_tl
106   %if not look up in the prop:
107   \quark_if_no_value:NT \l__pdffile_tmpa_tl
108   {
109     \prop_get:NVNTF
110     \g_pdffile_mimetypes_prop
111     \l__pdffile_ext_str
112     \l__pdffile_tmpb_tl
113     {
114       \tl_set:Nx #2 { /Subtype~\pdf_name_from_unicode_e:V \l__pdffile_tmpb_tl }
115     }
116     {
117       \msg_warning:nnx { pdffile } { mimetype-missing } {#1}
118       \tl_clear:N #2
119     }
120   }
121 }
122
123 \cs_generate_variant:Nn \__pdffile_mimetype_set:nN {VN}

```

```

124
125 %#1 file name,
126 %#2 tl, should be empty or contain /Subtype /mimetype
127 % e.g. result from \_pdffile_mimetype_set:NN
128 \cs_new_protected:Npn \_pdffile_fstream_write:nN #1 #2
129 {
130   \pdf_object_unnamed_write:nx { fstream }
131   {
132     {
133       #2
134       \pdfdict_use:n { l_pdffile}
135       \pdfdict_if_empty:nF { l_pdffile/Params}
136       {
137         /Params
138         <<
139         \pdfdict_use:n { l_pdffile/Params}
140         >>
141       }
142     }
143     { #1 }
144   }
145   \tl_clear:N \l__pdffile_automimetype_tl
146 }
147
148 \cs_generate_variant:Nn \_pdffile_fstream_write:nN {VN}
149
150 %#1 file content
151 %#2 tl, should be empty or contain /Subtype /mimtype
152 % e.g. result from \_pdffile_mimetype_set:NN
153 \cs_new_protected:Npn \_pdffile_stream_write:nN #1 #2
154 {
155   \pdf_object_unnamed_write:nx { stream }
156   {
157     {
158       #2
159       \pdfdict_use:n { l_pdffile}
160       \pdfdict_if_empty:nF { l_pdffile/streamParams}
161       {
162         /Params
163         <<
164         \pdfdict_use:n { l_pdffile/streamParams}
165         >>
166       }
167     }
168     { \exp_not:n { #1 } }
169   }
170   \tl_clear:N \l__pdffile_automimetype_tl
171 }
172
173 \cs_generate_variant:Nn \_pdffile_stream_write:nN {VN}
174
175 %#1 symbolic name of dict object
176 %#2 target file name,
177 %#3 object ref of the file stream.

```

```

178 \cs_new_protected:Npn \__pdffile_filespec_write:nnn #1 #2 #3
179 {
180   \tl_if_blank:nT { #2 }
181   {
182     \msg_error:nn {pdffile}{target-name-missing}
183   }
184   {
185     \group_begin:
186     \__pdffile_filename_convert_to_print:nN { #2 } \l__pdffile_tmpa_str
187     \pdfdict_put:nnx {l_pdffile/Filespec}{F} { \l__pdffile_tmpa_str }
188     \pdfdict_put:nnx {l_pdffile/Filespec}{UF}{ \l__pdffile_tmpa_str }
189     \pdf_object_write:nx { #1 }
190     {
191       \pdfdict_use:n { l_pdffile/Filespec}
192       \tl_if_empty:nF { #3 }
193       {
194         /EF <</F~#3 /UF~#3>>
195       }
196     }
197     \group_end:
198   }
199 }
200
201 \cs_set_eq:NN \pdffile_filespec:nnn \__pdffile_filespec_write:nnn
202 \cs_generate_variant:Nn \pdffile_filespec:nnn {nnx}
203 % #1 {source filename}
204 % #2 {target filename}
205 % #3 { filespec object name } (will internally get a prefix! ??)
206 \cs_new_protected:Npn \pdffile_embed_file:nnn #1 #2 #3
207 { % if #1 empty => only filespec
208   % if #2 empty => = #1
209   \pdf_object_if_exist:nTF { #3 }
210   {
211     \msg_error:nnn { pdffile }{ object-exists } { #3 }
212   }
213   {
214     \tl_if_blank:nTF { #1 }
215     {
216       \tl_set:Nn \l__pdffile_embed_ref_tl {}
217     }
218     {
219       \file_get_full_name:nNTF {#1} \l_pdffile_source_name_str
220       {
221         \__pdffile_mimetype_set:VN
222         \l_pdffile_source_name_str
223         \l__pdffile_automimetype_tl
224         \__pdffile_fstream_write:VN
225         \l_pdffile_source_name_str
226         \l__pdffile_automimetype_tl
227         \tl_set:Nx \l__pdffile_embed_ref_tl { \pdf_object_ref_last: }
228       }
229       {
230         \msg_error:nnn { pdffile }{ file-not-found }{ #1 }
231       }

```

```

232     }
233   }
234   \prop_gput:Nnx
235   \g_pdffile_embed_prop
236   { #3 }
237   {
238     { \tl_if_blank:nTF { #1 } {filespec}{file} }
239     {\l_pdffile_source_name_str}
240     {
241       \tl_if_blank:nTF { #2 }
242       { \l_pdffile_source_name_str }
243       { \tl_to_str:n{#2}}
244     }
245   }
246   \tl_if_blank:nTF { #2 }
247   {
248     \pdf_object_new:nn { #3 } {dict}
249     \exp_args:Nnnx
250     \__pdffile_filespec_write:nnn
251     %#1 dict, #2 target file name, #3 object ref
252     { #3 }
253     { #1 }
254     {\l__pdffile_embed_ref_tl}
255   }
256   {
257     \pdf_object_new:nn { #3 } {dict}
258     \exp_args:Nnnx
259     \__pdffile_filespec_write:nnn
260     %#1 dict, #2 target file name, #3 object ref
261     { #3 }
262     { #2 }
263     {\l__pdffile_embed_ref_tl}
264   }
265 }
266 }
267
268
269 % #1{stream content}
270 % #2{target filename}
271 % #3{file object name }
272 \cs_new_protected:Npn \pdffile_embed_stream:nnn #1 #2 #3
273 {
274   % if #2 empty => error
275   \pdf_object_if_exist:nTF { #3 }
276   {
277     \msg_error:nnn { pdffile }{ object-exists } { #3 }
278   }
279   {
280     \prop_gput:Nnx
281     \g_pdffile_embed_prop
282     { #3 }
283     {{stream}}{\tl_if_blank:nTF {#2}{stream.txt}{\exp_not:n{#2}}}}
284   \tl_if_blank:nTF {#2}
285   { \__pdffile_mimetype_set:nN {stream.txt}\l__pdffile_automimetype_tl}

```

```

286     { \_pdffile_mimetype_set:nN { #2 } \l\_pdffile_automimetype_tl }
287 \_pdffile_stream_write:nN
288   { #1 }
289   \l\_pdffile_automimetype_tl
290 \tl_set:Nx \l\_pdffile_embed_ref_tl { \pdf_object_ref_last: }
291 \pdf_object_new:nn { #3 } {dict}
292 \exp_args:Nnxx
293 \_pdffile_filespec_write:nnn
294   %#1 dict, #2 target file name, #3 object ref
295   { #3 }
296   { \tl_if_blank:nTF {#2}{stream.txt}{\exp_not:n{#2}} }
297   {\l\_pdffile_embed_ref_tl}
298 }
299 }
300
301

```

(End definition for \pdffile_embed_file:nnn and others. These functions are documented on page 5.)

302 \endpackage

Index

The italic numbers denote the pages where the corresponding entry is described, numbers underlined point to the definition, all others indicate the places where it is used.

Symbols		
\\	32	\file_size:n 66
		\file_timestamp:n 8, 64
		file/Filespec 4
		file/Params 4
		file/streamParams 4
pdf file commands:		
_pdffile_filespec:nnn	6	
C		G
cs commands:		group commands:
\cs_generate_variant:Nn	123, 148, 173, 202	\group_begin: 185
\cs_new_protected:Npn	8, 87, 97, 128, 153, 178, 206, 272	\group_end: 197
\cs_set_eq:NN	201	
E		I
exp commands:		int commands:
\exp_args:Nnxx	249, 258	\int_compare:nNnTF 74, 76
\exp_args:Nxxx	292	\int_use:N 73, 75, 77
\exp_not:n	5, 168, 283, 296	
F		M
file	4	msg commands:
file commands:		\msg_error:nn 182
\file_get_full_name:nNTF	219	\msg_error:nnn 211, 230, 277
\file_md5five_hash:n	68	\msg_new:nnn 10, 15, 20, 25, 30
\file_parse_full_name:nNNN	99	\msg_show:nnn 89
		\msg_show_item:nn 92
		\msg_warning:nnn 117
		P
		pdf commands:
		\pdf_name_from_unicode_e:n 114

