

# tagpdf – A package to experiment with pdf tagging<sup>\*</sup>

Ulrike Fischer<sup>†</sup>

Released 2023-05-16

## Contents

<b>1</b>	<b>Initialization and test if pdfmanagement is active.</b>	<b>7</b>
<b>2</b>	<b>base package</b>	<b>7</b>
<b>3</b>	<b>Package options</b>	<b>8</b>
<b>4</b>	<b>Packages</b>	<b>8</b>
	4.1 a LastPage label . . . . .	8
<b>5</b>	<b>Variables</b>	<b>9</b>
<b>6</b>	<b>Variants of l3 commands</b>	<b>11</b>
<b>7</b>	<b>Setup label attributes</b>	<b>11</b>
<b>8</b>	<b>Label commands</b>	<b>11</b>
<b>9</b>	<b>Commands to fill seq and prop</b>	<b>12</b>
<b>10</b>	<b>General tagging commands</b>	<b>12</b>
<b>11</b>	<b>Keys for tagpdfsetup</b>	<b>13</b>
<b>12</b>	<b>loading of engine/more dependent code</b>	<b>15</b>
<b>I</b>	<b>The tagpdf-checks module</b>	
	Messages and check code	
	Part of the tagpdf package	<b>16</b>
<b>1</b>	<b>Commands</b>	<b>16</b>

---

<sup>\*</sup>This file describes v0.98g, last revised 2023-05-16.

<sup>†</sup>E-mail: [fischer@troubleshooting-tex.de](mailto:fischer@troubleshooting-tex.de)

<b>2</b>	<b>Description of log messages</b>	<b>16</b>
2.1	\ShowTagging command . . . . .	16
2.2	Messages in checks and commands . . . . .	16
2.3	Messages from the ptagging code . . . . .	17
2.4	Warning messages from the lua-code . . . . .	17
2.5	Info messages from the lua-code . . . . .	17
2.6	Debug mode messages and code . . . . .	18
2.7	Messages . . . . .	18
<b>3</b>	<b>Messages</b>	<b>19</b>
3.1	Messages related to mc-chunks . . . . .	19
3.2	Messages related to structures . . . . .	20
3.3	Attributes . . . . .	21
3.4	Roles . . . . .	21
3.5	Miscellaneous . . . . .	22
<b>4</b>	<b>Retrieving data</b>	<b>22</b>
<b>5</b>	<b>User conditionals</b>	<b>23</b>
<b>6</b>	<b>Internal checks</b>	<b>23</b>
6.1	checks for active tagging . . . . .	23
6.2	Checks related to structures . . . . .	24
6.3	Checks related to roles . . . . .	25
6.4	Check related to mc-chunks . . . . .	26
6.5	Checks related to the state of MC on a page or in a split stream . . . . .	28
<b>II The tagpdf-user module</b>		
Code related to L <sup>A</sup> T <sub>E</sub> X2e user commands and document commands		
Part of the tagpdf package		<b>32</b>
<b>1</b>	<b>Setup commands</b>	<b>32</b>
<b>2</b>	<b>Commands related to mc-chunks</b>	<b>32</b>
<b>3</b>	<b>Commands related to structures</b>	<b>33</b>
<b>4</b>	<b>Debugging</b>	<b>33</b>
<b>5</b>	<b>Extension commands</b>	<b>33</b>
5.1	Fake space . . . . .	34
5.2	Paratagging . . . . .	34
5.3	Header and footer . . . . .	34
5.4	Link tagging . . . . .	35
<b>6</b>	<b>User commands and extensions of document commands</b>	<b>35</b>
<b>7</b>	<b>Setup and preamble commands</b>	<b>35</b>
<b>8</b>	<b>Commands for the mc-chunks</b>	<b>36</b>

<b>9</b>	<b>Commands for the structure</b>	<b>36</b>
<b>10</b>	<b>Debugging</b>	<b>37</b>
<b>11</b>	<b>Commands to extend document commands</b>	<b>40</b>
11.1	Document structure . . . . .	40
11.2	Structure destinations . . . . .	40
11.3	Fake space . . . . .	41
11.4	Paratagging . . . . .	41
11.5	Header and footer . . . . .	44
11.6	Links . . . . .	46
<b>III</b>	<b>The <code>tagpdf-tree</code> module</b>	
	<b>Commands trees and main dictionaries</b>	
	<b>Part of the <code>tagpdf</code> package</b>	<b>48</b>
<b>1</b>	<b>Trees, pdfmanagement and finalization code</b>	<b>48</b>
1.1	Check structure . . . . .	48
1.2	Catalog: MarkInfo and StructTreeRoot . . . . .	49
1.3	Writing the IDtree . . . . .	49
1.4	Writing structure elements . . . . .	50
1.5	ParentTree . . . . .	51
1.6	Rolemap dictionary . . . . .	54
1.7	Classmap dictionary . . . . .	55
1.8	Namespaces . . . . .	55
1.9	Finishing the structure . . . . .	56
1.10	StructParents entry for Page . . . . .	57
<b>IV</b>	<b>The <code>tagpdf-mc-shared</code> module</b>	
	<b>Code related to Marked Content (mc-chunks), code shared by</b>	
	<b>all modes</b>	
	<b>Part of the <code>tagpdf</code> package</b>	<b>58</b>
<b>1</b>	<b>Public Commands</b>	<b>58</b>
<b>2</b>	<b>Public keys</b>	<b>59</b>
<b>3</b>	<b>Marked content code – shared</b>	<b>59</b>
3.1	Variables and counters . . . . .	60
3.2	Functions . . . . .	61
3.3	Keys . . . . .	63
<b>V</b>	<b>The <code>tagpdf-mc-generic</code> module</b>	
	<b>Code related to Marked Content (mc-chunks), generic mode</b>	
	<b>Part of the <code>tagpdf</code> package</b>	<b>65</b>

<b>1</b>	<b>Marked content code – generic mode</b>	<b>65</b>
1.1	Variables . . . . .	65
1.2	Functions . . . . .	66
1.3	Looking at MC marks in boxes . . . . .	69
1.4	Keys . . . . .	76
<b>VI</b>	<b>The <code>tagpdf-mc-luacode</code> module</b>	
	Code related to Marked Content (mc-chunks), luamode-specific	
	Part of the tagpdf package	<b>78</b>
<b>1</b>	<b>Marked content code – luamode code</b>	<b>78</b>
1.1	Commands . . . . .	79
1.2	Key definitions . . . . .	83
<b>VII</b>	<b>The <code>tagpdf-struct</code> module</b>	
	Commands to create the structure	
	Part of the tagpdf package	<b>86</b>
<b>1</b>	<b>Public Commands</b>	<b>86</b>
<b>2</b>	<b>Public keys</b>	<b>87</b>
2.1	Keys for the structure commands . . . . .	87
2.2	Setup keys . . . . .	89
<b>3</b>	<b>Variables</b>	<b>89</b>
3.1	Variables used by the keys . . . . .	91
3.2	Variables used by tagging code of basic elements . . . . .	92
<b>4</b>	<b>Commands</b>	<b>92</b>
4.1	Initialization of the StructTreeRoot . . . . .	93
4.2	Adding the /ID key . . . . .	94
4.3	Filling in the tag info . . . . .	94
4.4	Handlings kids . . . . .	95
4.5	Output of the object . . . . .	98
<b>5</b>	<b>Keys</b>	<b>101</b>
<b>6</b>	<b>User commands</b>	<b>106</b>
<b>7</b>	<b>Attributes and attribute classes</b>	<b>114</b>
7.1	Variables . . . . .	114
7.2	Commands and keys . . . . .	114
<b>VIII</b>	<b>The <code>tagpdf-luatex.def</code></b>	
	Driver for luatex	
	Part of the tagpdf package	<b>117</b>
<b>1</b>	<b>Loading the lua</b>	<b>117</b>

<b>2</b>	<b>Logging functions</b>	<b>121</b>
<b>3</b>	<b>Helper functions</b>	<b>123</b>
3.1	Retrieve data functions . . . . .	123
3.2	Functions to insert the pdf literals . . . . .	125
<b>4</b>	<b>Function for the real space chars</b>	<b>126</b>
<b>5</b>	<b>Function for the tagging</b>	<b>129</b>
<b>6</b>	<b>Parenttree</b>	<b>134</b>
<b>IX</b>	<b>The tagpdf-roles module</b>	
	<b>Tags, roles and namespace code</b>	
	<b>Part of the tagpdf package</b>	<b>136</b>
<b>1</b>	<b>Code related to roles and structure names</b>	<b>136</b>
1.1	Variables . . . . .	137
1.2	Namespaces . . . . .	139
1.3	Adding a new tag . . . . .	140
1.3.1	pdf 1.7 and earlier . . . . .	141
1.3.2	The pdf 2.0 version . . . . .	143
1.4	Helper command to read the data from files . . . . .	144
1.5	Reading the default data . . . . .	146
1.6	Parent-child rules . . . . .	146
1.6.1	Reading in the csv-files . . . . .	147
1.6.2	Retrieving the parent-child rule . . . . .	149
1.7	Remapping of tags . . . . .	153
1.8	Key-val user interface . . . . .	155
<b>X</b>	<b>The tagpdf-space module</b>	
	<b>Code related to real space chars</b>	
	<b>Part of the tagpdf package</b>	<b>157</b>
<b>1</b>	<b>Code for interword spaces</b>	<b>157</b>
	<b>Index</b>	<b>160</b>

---

<code>\ref_value:nnn</code>	<code>\ref_value:nnn{&lt;label&gt;}{&lt;attribute&gt;}{&lt;fallback default&gt;}</code>
-----------------------------	---

---

This is a temporary definition which will have to move to l3ref. It allows to locally set a default value if the label or the attribute doesn't exist. See issue #4 in Accessible-xref.

---

<code>\tag_stop_group_begin:</code>	We need commands to stop tagging in some places. They simply switches the two local booleans. The grouping commands can be used to group the effect.
<code>\tag_stop_group_end:</code>	
<code>\tag_stop:</code>	
<code>\tag_start:</code>	

---



---

<code>\tag_stop:n</code>	<code>\tag_stop:n{&lt;label&gt;}</code>
<code>\tag_start:n</code>	<code>\tag_start:n{&lt;label&gt;}</code>

---

This commands are intended as a pair. The start command will only restart tagging if the previous stop command with the same label actually stopped tagging.

---

<code>activate-space_&lt;setup-key&gt;</code>	<code>activate-space</code> activates the additional parsing needed for interword spaces. It is not documented, the parsing is currently implicitly activated by the known key <code>interwordspace</code> , as the code will perhaps move to some other place, now that it is better separated.
---	--

---



---

<code>activate-mc_&lt;setup-key&gt;</code>
<code>activate-tree_&lt;setup-key&gt;</code>
<code>activate-struct_&lt;setup-key&gt;</code>
<code>activate-all_&lt;setup-key&gt;</code>

---

Keys to activate the various tagging steps

---

<code>no-struct-dest_&lt;setup-key&gt;</code>	The key allows to suppress the creation of structure destinations
---	---

---



---

<code>log_&lt;setup-key&gt;</code>	The <code>log</code> takes currently the values <code>none</code> , <code>v</code> , <code>vv</code> , <code>vvv</code> , <code>all</code> . More details are in <code>tagpdf-checks</code> .
------------------------------------	---

---



---

<code>tagunmarked_&lt;setup-key&gt;</code>	This key allows to set if (in <code>luamode</code> ) unmarked text should be marked up as artifact. The initial value is <code>true</code> .
--	--

---



---

<code>tabsorder_&lt;setup-key&gt;</code>	This sets the <code>tabsorder</code> on a page. The values are <code>row</code> , <code>column</code> , <code>structure</code> (default) or <code>none</code> . Currently this is set more or less globally. More finer control can be added if needed.
--	---

---



---

<code>tagstruct</code>	These are attributes used by the label/ref system.
<code>tagstructobj</code>	
<code>tagabspage</code>	
<code>tagmcabs</code>	
<code>tagmcid</code>	

---

# 1 Initialization and test if pdfmanagement is active.

```

1 <@@=tag>
2 <*package>
3 \ProvidesExplPackage {tagpdf} {2023-05-16} {0.98g}
4 { A package to experiment with pdf tagging }
5
6 \bool_if:nF
7 {
8   \bool_lazy_and_p:nn
9     {\cs_if_exist_p:N \pdfmanagement_if_active_p:}
10    { \pdfmanagement_if_active_p: }
11 }
12 { %error for now, perhaps warning later.
13   \PackageError{tagpdf}
14     {
15       PDF~resource~management~is~no~active!\MessageBreak
16       tagpdf~will~no~work.
17     }
18     {
19       Activate~it~with \MessageBreak
20       \string\RequirePackage{pdfmanagement-testphase}\MessageBreak
21       \string\DocumentMetadata{<options>}\MessageBreak
22       before~\string\documentclass
23     }
24 }
25 </package>
26
27 <*debug>
28 \ProvidesExplPackage {tagpdf-debug} {2023-05-16} {0.98g}
29 { debug code for tagpdf }
30 \@ifpackageloaded{tagpdf}{\PackageWarning{tagpdf-debug}{tagpdf~not~loaded,~quitting}\endinput}{}
31 </debug> We map the internal module name “tag” to “tagpdf” in messages.
32 <*package>
33 \prop_gput:Nnn \g_msg_module_name_prop { tag }{ tagpdf }
34 </package>
35
36 Debug mode has its special mapping:
37 <*debug>
38 \prop_gput:Nnn \g_msg_module_type_prop { tag / debug } {}
39 \prop_gput:Nnn \g_msg_module_name_prop { tag / debug }{tagpdf~DEBUG}
40 </debug>

```

## 2 base package

To avoid to have to test everywhere if tagpdf has been loaded and is active, we define a base package with dummy functions

```

36 <*base>
37 \ProvidesExplPackage {tagpdf-base} {2023-05-16} {0.98g}
38 {part of tagpdf - provide base, no-op versions of the user commands }
39 </base>

```

### 3 Package options

There are only two options to switch for luatex between generic and luamode, TODO try to get rid of them.

```
40 <*package>
41 \bool_new:N\g__tag_mode_lua_bool
42 \DeclareOption {luamode} { \sys_if_engine luatex:T { \bool_gset_true:N \g__tag_mode_lua_bo
43 \DeclareOption {genericmode}{ \bool_gset_false:N\g__tag_mode_lua_bool }
44 \ExecuteOptions{luamode}
45 \ProcessOptions
```

### 4 Packages

We need the temporary version of l3ref until this is in the kernel.

```
46 \RequirePackage{l3ref-tmp}
```

To be on the safe side for now, load also the base definitions

```
47 \RequirePackage{tagpdf-base}
48 </package>
```

The no-op version should behave a near enough to the real code as possible, so we define a command which a special in the relevant backends:

```
49 <*base>
50 \AddToHook{begindocument}
51 {
52   \str_case:N\F \c_sys_backend_str
53   {
54     { luatex } { \cs_new_protected:Npn \__tag_whatsits: {} }
55     { dvisvgm } { \cs_new_protected:Npn \__tag_whatsits: {} }
56   }
57   {
58     \cs_new_protected:Npn \__tag_whatsits: {\tex_special:D {}}
59   }
60 }
61 </base>
```

#### 4.1 a LastPage label

See also issue #2 in Accessible-xref

\\_\_tag\_lastpagelabel:

```
62 <*package>
63 \cs_new_protected:Npn \__tag_lastpagelabel:
64 {
65   \legacy_if:nT { @files }
66   {
67     \exp_args:NNnx \exp_args:NNx\iow_now:Nn \@auxout
68     {
69       \token_to_str:N \newlabeldata
70       {__tag_LastPage}
71       {
72         {abspage} { \int_use:N \g_shipout_readonly_int}
73         {tagmcabs}{ \int_use:N \c@g__tag_MCID_abs_int }
```





`\c__tag_refmc_clist`  
`\c__tag_refstruct_clist` 112 `\clist_const:Nn \c__tag_refmc_clist {tagabspage,tagmcabs,tagmcid}`  
113 `\clist_const:Nn \c__tag_refstruct_clist {tagstruct,tagstructobj}`  
*(End definition for \c\_\_tag\_refmc\_clist and \c\_\_tag\_refstruct\_clist.)*

`\l__tag_loglevel_int` This integer hold the log-level and so allows to control the messages. TODO: a list which log-level shows what is needed. The current behaviour is quite ad-hoc.  
114 `\int_new:N \l__tag_loglevel_int`  
*(End definition for \l\_\_tag\_loglevel\_int.)*

`\g__tag_active_space_bool` These booleans should help to control the global behaviour of tagpdf. Ideally it should  
`\g__tag_active_mc_bool` more or less do nothing if all are false. The space-boolean controles the interword space  
`\g__tag_active_tree_bool` code, the mc-boolean activates `\tag_mc_begin:n`, the tree-boolean activates writing the  
`\g__tag_active_struct_bool` finish code and the pdfmanagement related commands, the struct-boolean activates the  
`\g__tag_active_struct_dest_bool` storing of the structure data. In a normal document all should be active, the split is only  
there for debugging purpose. Structure destination will be activated automatically if pdf  
version 2.0 is detected, but with the boolean struct-dest-boolean one can suppress them.  
Also we assume currently that they are set only at begin document. But if some control  
passing over groups are needed they could be perhaps used in a document too. TODO:  
check if they are used everywhere as needed and as wanted.  
115 `\bool_new:N \g__tag_active_space_bool`  
116 `\bool_new:N \g__tag_active_mc_bool`  
117 `\bool_new:N \g__tag_active_tree_bool`  
118 `\bool_new:N \g__tag_active_struct_bool`  
119 `\bool_new:N \g__tag_active_struct_dest_bool`  
120 `\bool_gset_true:N \g__tag_active_struct_dest_bool`  
*(End definition for \g\_\_tag\_active\_space\_bool and others.)*

`\l__tag_active_mc_bool` These booleans should help to control the *local* behaviour of tagpdf. In some cases it  
`\l__tag_active_struct_bool` could e.g. be necessary to stop tagging completely. As local booleans they respect groups.  
TODO: check if they are used everywhere as needed and as wanted.  
121 `\bool_new:N \l__tag_active_mc_bool`  
122 `\bool_set_true:N \l__tag_active_mc_bool`  
123 `\bool_new:N \l__tag_active_struct_bool`  
124 `\bool_set_true:N \l__tag_active_struct_bool`  
*(End definition for \l\_\_tag\_active\_mc\_bool and \l\_\_tag\_active\_struct\_bool.)*

`\g__tag_tagunmarked_bool` This boolean controls if the code should try to automatically tag parts not in mc-chunk.  
It is currently only used in luamode. It would be possible to used it in generic mode, but  
this would create quite a lot empty artifact mc-chunks.  
125 `\bool_new:N \g__tag_tagunmarked_bool`  
*(End definition for \g\_\_tag\_tagunmarked\_bool.)*

## 6 Variants of l3 commands

```

126 \prg_generate_conditional_variant:Nnn \pdf_object_if_exist:n {e}{T,F}
127 \cs_generate_variant:Nn \pdf_object_ref:n {e}
128 \cs_generate_variant:Nn \pdfannot_dict_put:nnn {nnx}
129 \cs_generate_variant:Nn \pdffile_embed_stream:nnn {nxx,oxx}
130 \cs_generate_variant:Nn \prop_gput:Nnn {Nxx,Nen}
131 \cs_generate_variant:Nn \prop_put:Nnn {Nxx}
132 \cs_generate_variant:Nn \prop_item:Nn {No,Ne}
133 \cs_generate_variant:Nn \ref_label:nn { nv }
134 \cs_generate_variant:Nn \seq_set_split:Nnn{Nne}
135 \cs_generate_variant:Nn \str_set_convert:Nnnn {Nonn, Noon, Nnon }
136 \cs_generate_variant:Nn \clist_map_inline:nn {on}

```

## 7 Setup label attributes

**tagstruct** This are attributes used by the label/ref system. With structures we store the structure number **tagstruct** and the object reference **tagstructobj**. The second is needed to be able to reference a structure which hasn't been created yet. The alternative would be to create the object in such cases, but then we would have to check the object existence all the time.

With mc-chunks we store the absolute page number **tagabspage**, the absolute id **tagmcabc**, and the id on the page **tagmcid**.

```

137 \ref_attribute_gset:nnnn { tagstruct } {0} { now }
138 { \int_use:N \c@g__tag_struct_abs_int }
139 \ref_attribute_gset:nnnn { tagstructobj } {} { now }
140 {
141   \pdf_object_if_exist:eT {__tag/struct/\int_use:N \c@g__tag_struct_abs_int}
142   {
143     \pdf_object_ref:e{__tag/struct/\int_use:N \c@g__tag_struct_abs_int}
144   }
145 }
146 \ref_attribute_gset:nnnn { tagabspage } {0} { shipout }
147 { \int_use:N \g_shipout_readonly_int }
148 \ref_attribute_gset:nnnn { tagmcabs } {0} { now }
149 { \int_use:N \c@g__tag_MCID_abs_int }
150 \ref_attribute_gset:nnnn {tagmcid } {0} { now }
151 { \int_use:N \g__tag_MCID_tmp_bypage_int }

```

*(End definition for tagstruct and others. These functions are documented on page 6.)*

## 8 Label commands

```

\__tag_ref_label:nn A version of \ref_label:nn to set a label which takes a keyword mc or struct to call
the relevant lists. TODO: check if \@bsphack and \@esphack make sense here.
152 \cs_new_protected:Npn \__tag_ref_label:nn #1 #2 %#1 label, #2 name of list mc or struct
153 {
154   \@bsphack
155   \ref_label:nv {#1}{c__tag_ref#2_clist}
156   \@esphack
157 }
158 \cs_generate_variant:Nn \__tag_ref_label:nn {en}

```

(End definition for `\_tag_ref_label:nn`.)

`\_tag_ref_value:nnn` A local version to retrieve the value. It is a direct wrapper, but to keep naming consistent .... It uses the variant defined temporarily above.

```

159 \cs_new:Npn \_tag_ref_value:nnn #1 #2 #3 % #1 label, #2 attribute, #3 default
160 {
161     \ref_value:nnn {#1}{#2}{#3}
162 }
163 \cs_generate_variant:Nn \_tag_ref_value:nnn {enn}

```

(End definition for `\_tag_ref_value:nnn`.)

`\_tag_ref_value_lastpage:nn` A command to retrieve the lastpage label, this will be adapted when there is a proper, kernel lastpage label.

```

164 \cs_new:Npn \_tag_ref_value_lastpage:nn #1 #2
165 {
166     \ref_value:nnn {\_tag_LastPage}{#1}{#2}
167 }

```

(End definition for `\_tag_ref_value_lastpage:nn`.)

## 9 Commands to fill seq and prop

With most engines these are simply copies of the expl3 commands, but luatex will overwrite them, to store the data also in lua tables.

```

\_tag_prop_new:N
\_tag_seq_new:N
\_tag_prop_gput:Nnn
\_tag_seq_gput_right:Nn
\_tag_seq_item:cn
\_tag_prop_item:cn
\_tag_seq_show:N
\_tag_prop_show:N
168 \cs_set_eq:NN \_tag_prop_new:N \prop_new:N
169 \cs_set_eq:NN \_tag_seq_new:N \seq_new:N
170 \cs_set_eq:NN \_tag_prop_gput:Nnn \prop_gput:Nnn
171 \cs_set_eq:NN \_tag_seq_gput_right:Nn \seq_gput_right:Nn
172 \cs_set_eq:NN \_tag_seq_item:cn \seq_item:cn
173 \cs_set_eq:NN \_tag_prop_item:cn \prop_item:cn
174 \cs_set_eq:NN \_tag_seq_show:N \seq_show:N
175 \cs_set_eq:NN \_tag_prop_show:N \prop_show:N
176
177 \cs_generate_variant:Nn \_tag_prop_gput:Nnn { Nxn , Nxx , Nnx , cnn , cxn , cnx , cno }
178 \cs_generate_variant:Nn \_tag_seq_gput_right:Nn { Nx , No , cn , cx }
179 \cs_generate_variant:Nn \_tag_prop_new:N { c }
180 \cs_generate_variant:Nn \_tag_seq_new:N { c }
181 \cs_generate_variant:Nn \_tag_seq_show:N { c }
182 \cs_generate_variant:Nn \_tag_prop_show:N { c }

```

(End definition for `\_tag_prop_new:N` and others.)

## 10 General tagging commands

`\tag_stop_group_begin:` We need commands to stop tagging in some places. This simply switches the two local  
`\tag_stop_group_end:` booleans. In some cases tagging should only restart, if it actually was stopped before.  
`\tag_stop:` For this it is possible to label a stop.  
`\tag_start:`  
`\tag_stop:n`  
`\tag_start:n`

```

185     \group_begin:
186     \bool_set_false:N \l__tag_active_struct_bool
187     \bool_set_false:N \l__tag_active_mc_bool
188   }
189 \cs_set_eq:NN \tag_stop_group_end: \group_end:
190 \cs_set_protected:Npn \tag_stop:
191   {
192     \bool_set_false:N \l__tag_active_struct_bool
193     \bool_set_false:N \l__tag_active_mc_bool
194   }
195 \cs_set_protected:Npn \tag_start:
196   {
197     \bool_set_true:N \l__tag_active_struct_bool
198     \bool_set_true:N \l__tag_active_mc_bool
199   }
200 \prop_new:N\g__tag_state_prop
201 \cs_set_protected:Npn \tag_stop:n #1
202   {
203     \tag_if_active:TF
204     {
205       \bool_set_false:N \l__tag_active_struct_bool
206       \bool_set_false:N \l__tag_active_mc_bool
207       \prop_gput:Nnn \g__tag_state_prop { #1 }{ 1 }
208     }
209     {
210       \prop_gremove:Nn \g__tag_state_prop { #1 }
211     }
212   }
213 \cs_set_protected:Npn \tag_start:n #1
214   {
215     \prop_gpop:NnN \g__tag_state_prop {#1}\l__tag_tmpa_tl
216     \quark_if_no_value:NF \l__tag_tmpa_tl
217     {
218       \bool_set_true:N \l__tag_active_struct_bool
219       \bool_set_true:N \l__tag_active_mc_bool
220     }
221   }
222 </package>
223 <*base>
224 \cs_new_protected:Npn \tag_stop:{}
225 \cs_new_protected:Npn \tag_start:{}
226 \cs_new_protected:Npn \tag_stop:n #1 {}
227 \cs_new_protected:Npn \tag_start:n #1 {}
228 </base>

```

(End definition for `\tag_stop_group_begin:` and others. These functions are documented on page 6.)

## 11 Keys for tagpdfsetup

TODO: the log-levels must be sorted

<code>activate-space<sub>□</sub>(setup-key)</code> <code>activate-mc<sub>□</sub>(setup-key)</code> <code>activate-tree<sub>□</sub>(setup-key)</code> <code>activate-struct<sub>□</sub>(setup-key)</code> <code>activate-all<sub>□</sub>(setup-key)</code> <code>no-struct-dest<sub>□</sub>(setup-key)</code>	Keys to (globally) activate tagging. <code>activate-space</code> activates the additional parsing needed for interword spaces. It is not documented, the parsing is currently implicitly
---	--

activated by the known key `interwordspace`, as the code will perhaps move to some other place, now that it is better separated. `no-struct-dest` allows to suppress structure destinations.

```

229 (*package)
230 \keys_define:nn { __tag / setup }
231 {
232   activate-space .bool_gset:N = \g__tag_active_space_bool,
233   activate-mc    .bool_gset:N = \g__tag_active_mc_bool,
234   activate-tree  .bool_gset:N = \g__tag_active_tree_bool,
235   activate-struct.bool_gset:N = \g__tag_active_struct_bool,
236   activate-all  .meta:n =
237     {activate-mc={#1},activate-tree={#1},activate-struct={#1}},
238   activate-all  .default:n = true,
239   no-struct-dest .bool_gset_inverse:N = \g__tag_active_struct_dest_bool,
240 }

```

*(End definition for activate-space (setup-key) and others. These functions are documented on page 6.)*

**log<sub>␣</sub>(setup-key)** The log takes currently the values `none`, `v`, `vv`, `vvv`, `all`. The description of the log levels is in `tagpdf-checks`.

```

241   log          .choice:,
242   log / none    .code:n = {\int_set:Nn \l__tag_loglevel_int { 0 }},
243   log / v       .code:n =
244     {
245       \int_set:Nn \l__tag_loglevel_int { 1 }
246       \cs_set_protected:Nn \__tag_check_typeout_v:n { \iow_term:x {##1} }
247     },
248   log / vv      .code:n = {\int_set:Nn \l__tag_loglevel_int { 2 }},
249   log / vvv     .code:n = {\int_set:Nn \l__tag_loglevel_int { 3 }},
250   log / all     .code:n = {\int_set:Nn \l__tag_loglevel_int { 10 }},

```

*(End definition for log (setup-key). This function is documented on page 6.)*

**tagunmarked<sub>␣</sub>(setup-key)** This key allows to set if (in `luamode`) unmarked text should be marked up as artifact. The initial value is `true`.

```

251   tagunmarked .bool_gset:N = \g__tag_tagunmarked_bool,
252   tagunmarked .initial:n = true,

```

*(End definition for tagunmarked (setup-key). This function is documented on page 6.)*

**tabsorder<sub>␣</sub>(setup-key)** This sets the `tabsorder` on a page. The values are `row`, `column`, `structure` (default) or `none`. Currently this is set more or less globally. More finer control can be added if needed.

```

253   tabsorder .choice:,
254   tabsorder / row .code:n =
255     \pdfmanagement_add:nnn { Page } {Tabs}{/R},
256   tabsorder / column .code:n =
257     \pdfmanagement_add:nnn { Page } {Tabs}{/C},
258   tabsorder / structure .code:n =
259     \pdfmanagement_add:nnn { Page } {Tabs}{/S},
260   tabsorder / none .code:n =
261     \pdfmanagement_remove:nn {Page} {Tabs},
262   tabsorder .initial:n = structure,

```

```

263     uncompress      .code:n = { \pdf_uncompress: },
264   }

```

*(End definition for tabsorder (setup-key). This function is documented on page 6.)*

## 12 loading of engine/more dependent code

```

265 \sys_if_engine luatex:T
266   {
267     \file_input:n {tagpdf-luatex.def}
268   }
269 </package>

270 <*mcloading>
271 \bool_if:NTF \g__tag_mode_lua_bool
272   {
273     \RequirePackage {tagpdf-mc-code-lua}
274   }
275   {
276     \RequirePackage {tagpdf-mc-code-generic} %
277   }
278 </mcloading>

279 <*debug>
280 \bool_if:NTF \g__tag_mode_lua_bool
281   {
282     \RequirePackage {tagpdf-debug-lua}
283   }
284   {
285     \RequirePackage {tagpdf-debug-generic} %
286   }
287 </debug>

```

## Part I

# The tagpdf-checks module

## Messages and check code

## Part of the tagpdf package

### 1 Commands

---

`\tag_if_active_p:` ★ This command tests if tagging is active. It only gives true if all tagging has been activated, `\tag_if_active:` *TF* ★ *and* if tagging hasn't been stopped locally.

---

---

`\tag_get:n` ★ `\tag_get:n{<keyword>}`

---

This is a generic command to retrieve data for the current structure or mc-chunk. Currently the only sensible values for the argument *<keyword>* are `mc_tag`, `struct_tag`, `struct_id` and `struct_num`.

### 2 Description of log messages

#### 2.1 \ShowTagging command

Argument	type	note
<code>\ShowTaggingmc-data = num</code>	log+term	lua-only
<code>\ShowTaggingmc-current</code>	log+term	
<code>\ShowTaggingstruck-stack= [log show]</code>	log or term+stop	

#### 2.2 Messages in checks and commands

command	message	action
<code>\@@_check_structure_has_tag:n</code>	struct-missing-tag	error
<code>\@@_check_structure_tag:N</code>	role-unknown-tag	warning
<code>\@@_check_info_closing_struct:n</code>	struct-show-closing	info
<code>\@@_check_no_open_struct:</code>	struct-faulty-nesting	error
<code>\@@_check_struct_used:n</code>	struct-used-twice	warning
<code>\@@_check_add_tag_role:nn</code>	role-missing, role-tag, role-unknown	warning, info (>0), warning
<code>\@@_check_mc_if_nested:</code>	mc-nested	warning
<code>\@@_check_mc_if_open:</code>	mc-not-open	warning
<code>\@@_check_mc_pushed_popped:nn</code>	mc-pushed, mc-popped	info (2), info+seq_log (>2)
<code>\@@_check_mc_tag:N</code>	mc-tag-missing, role-unknown-tag	error (missing), warning (unknown).
<code>\@@_check_mc_used:n</code>	mc-used-twice	warning
<code>\@@_check_show_MCID_by_page:</code>		
<code>\tag_mc_use:n</code>	mc-label-unknown, mc-used-twice	warning
<code>\role_add_tag:nn</code>	new-tag	info (>0)
	sys-no-interwordspace	warning
<code>\@@_struct_write_obj:n</code>	struct-no-objnum	error
<code>\tag_struct_begin:n</code>	struct-faulty-nesting	error
<code>\@@_struct_insert_annot:nn</code>	struct-faulty-nesting	error
<code>tag_struct_use:n</code>	struct-label-unknown	warning
<code>attribute-class, attribute</code>	attr-unknown	error
<code>\@@_tree_fill_parenttree:</code>	tree-mcid-index-wrong	warning TODO: should trigger a standard rerun m
<code>in enddocument/info-hook</code>	para-hook-count-wrong	error (warning?)



## 2.3 Messages from the ptagging code

A few messages are issued in generic mode from the code which reinserts missing TMB/TME. This is currently done if log-level is larger than zero. TODO: reconsider log-level and messages when this code settles down.

## 2.4 Warning messages from the lua-code

The messages are triggered if the log-level is at least equal to the number.

message	log-level	remark
WARN TAG-NOT-TAGGED:	1	
WARN TAG-OPEN-MC:	1	
WARN SHIPOUT-MC-OPEN:	1	
WARN SHIPOUT-UPS:	0	shouldn't happen
WARN TEX-MC-INSERT-MISSING:	0	shouldn't happen
WARN TEX-MC-INSERT-NO-KIDS:	2	e.g. from empty hbox

## 2.5 Info messages from the lua-code

The messages are triggered if the log-level is at least equal to the number. TAG messages are from the traversing function, TEX from code used in the tagpdf-mc module. PARENTREE is the code building the parenttree.

message	log-level	remark
INFO SHIPOUT-INSERT-LAST-EMC	3	finish of shipout code
INFO SPACE-FUNCTION-FONT	3	interwordspace code
INFO TAG-ABSPAGE	3	
INFO TAG-ARGS	4	
INFO TAG-ENDHEAD	4	
INFO TAG-ENDHEAD	4	
INFO TAG-HEAD	3	
INFO TAG-INSERT-ARTIFACT	3	
INFO TAG-INSERT-BDC	3	
INFO TAG-INSERT-EMC	3	
INFO TAG-INSERT-TAG	3	
INFO TAG-KERN-SUBTYPE	4	
INFO TAG-MATH-SUBTYPE	4	
INFO TAG-MC-COMPARE	4	
INFO TAG-MC-INTO-PAGE	3	
INFO TAG-NEW-MC-NODE	4	
INFO TAG-NODE	3	
INFO TAG-NO-HEAD	3	
INFO TAG-NOT-TAGGED	2	replaced by artifact
INFO TAG-QUITTING-BOX	4	
INFO TAG-STORE-MC-KID	4	
INFO TAG-TRAVERSING-BOX	3	
INFO TAG-USE-ACTUALTEXT	3	
INFO TAG-USE-ALT	3	
INFO TAG-USE-RAW	3	
INFO TEX-MC-INSERT-KID	3	

message	log-level	remark
INFO TEX-MC-INSERT-KID-TEST	4	
INFO TEX-MC-INTO-STRUCT	3	
INFO TEX-STORE-MC-DATA	3	
INFO TEX-STORE-MC-KID	3	
INFO PARENTTREE-CHUNKS	3	
INFO PARENTTREE-NO-DATA	3	
INFO PARENTTREE-NUM	3	
INFO PARENTTREE-NUMENTRY	3	
INFO PARENTTREE-STRUCT-OBJREF	4	

## 2.6 Debug mode messages and code

If the package tagpdf-debug is loaded a number of commands are redefined and enhanced with additional commands which can be used to output debug messages or collect statistics. The commands are present but do nothing if the log-level is zero.

command	name	action	remark
\tag_mc_begin:n	mc-begin-insert	msg	
	mc-begin-ignore	msg	if inactive

## 2.7 Messages

---

mc-nested  
mc-tag-missing  
mc-label-unknown  
mc-used-twice  
mc-not-open  
mc-pushed  
mc-popped  
mc-current

---

Various messages related to mc-chunks. TODO document their meaning.

---

struct-no-objnum  
struct-faulty-nesting  
struct-missing-tag  
struct-used-twice  
struct-label-unknown  
struct-show-closing

---

Various messages related to structure. TODO document their meaning.

---

attr-unknown

---

Message if an attribute is unknown.

---

role-missing  
role-unknown  
role-unknown-tag  
role-tag  
new-tag

---

Messages related to role mapping.

<hr/> <hr/> <b>tree-mcid-index-wrong</b>	Used in the tree code, typically indicates the document must be rerun.
<hr/> <hr/> <b>sys-no-interwordspace</b>	Message if an engine doesn't support inter word spaces
<hr/> <hr/> <b>para-hook-count-wrong</b>	Message if the number of begin paragraph and end paragraph differ. This normally means faulty structure.
	<pre> 1 &lt;@@=tag&gt; 2 &lt;*header&gt; 3 \ProvidesExplPackage {tagpdf-checks-code} {2023-05-16} {0.98g} 4 {part of tagpdf - code related to checks, conditionals, debugging and messages} 5 &lt;/header&gt; </pre>

## 3 Messages

### 3.1 Messages related to mc-chunks

**mc-nested** This message is issue is a mc is opened before the previous has been closed. This is not relevant for luamode, as the attributes don't care about this. It is used in the `\@@_check_mc_if_nested`: test.

```

6 <*package>
7 \msg_new:nnn { tag } {mc-nested} { nested-marked-content-found~~mcid~#1 }

```

*(End definition for mc-nested. This function is documented on page 18.)*

**mc-tag-missing** If the tag is missing

```

8 \msg_new:nnn { tag } {mc-tag-missing} { required-tag-missing~~mcid~#1 }

```

*(End definition for mc-tag-missing. This function is documented on page 18.)*

**mc-label-unknown** If the label of a mc that is used in another place is not known (yet) or has been undefined as the mc was already used.

```

9 \msg_new:nnn { tag } {mc-label-unknown}
10 { label~#1~unknown~or~has~been~already~used.\\
11   Either~rerun~or~remove~one~of~the~uses. }

```

*(End definition for mc-label-unknown. This function is documented on page 18.)*

**mc-used-twice** An mc-chunk can be inserted only in one structure. This indicates wrong coding and so should at least give a warning.

```

12 \msg_new:nnn { tag } {mc-used-twice} { mc~#1~has~been~already~used }

```

*(End definition for mc-used-twice. This function is documented on page 18.)*

**mc-not-open** This is issued if a `\tag_mc_end`: is issued wrongly, wrong coding.

```

13 \msg_new:nnn { tag } {mc-not-open} { there-is-no-mc-to-end-at~#1 }

```

*(End definition for mc-not-open. This function is documented on page 18.)*

**mc-pushed** Informational messages about mc-pushing.  
**mc-popped** 14 \msg\_new:nnn { tag } {mc-pushed} { #1~has~been~pushed~to~the~mc~stack}  
15 \msg\_new:nnn { tag } {mc-popped} { #1~has~been~removed~from~the~mc~stack }  
(End definition for mc-pushed and mc-popped. These functions are documented on page 18.)

**mc-current** Informational messages about current mc state.  
16 \msg\_new:nnn { tag } {mc-current}  
17 { current~MC:~  
18 \bool\_if:NTF\g\_\_tag\_in\_mc\_bool  
19 {abscnt=\\_\_tag\_get\_mc\_abs\_cnt:,~tag=\g\_\_tag\_mc\_key\_tag\_tl}  
20 {no~MC~open,~current~abscnt=\\_\_tag\_get\_mc\_abs\_cnt:"}  
21 }  
(End definition for mc-current. This function is documented on page 18.)

### 3.2 Messages related to structures

**struct-unknown** if for example a parent key value points to structure that doesn't exist (yet)  
22 \msg\_new:nnn { tag } {struct-unknown}  
23 { structure~with~number~#1~doesn't~exist\\ #2 }  
(End definition for struct-unknown. This function is documented on page ??.)

**struct-no-objnum** Should not happen ...  
24 \msg\_new:nnn { tag } {struct-no-objnum} { objnum~missing~for~structure~#1 }  
(End definition for struct-no-objnum. This function is documented on page 18.)

**struct-faulty-nesting** This indicates that there is somewhere one \tag\_struct\_end: too much. This should be normally an error.  
25 \msg\_new:nnn { tag }  
26 {struct-faulty-nesting}  
27 { there~is~no~open~structure~on~the~stack }  
(End definition for struct-faulty-nesting. This function is documented on page 18.)

**struct-missing-tag** A structure must have a tag.  
28 \msg\_new:nnn { tag } {struct-missing-tag} { a~structure~must~have~a~tag! }  
(End definition for struct-missing-tag. This function is documented on page 18.)

**struct-used-twice**  
29 \msg\_new:nnn { tag } {struct-used-twice}  
30 { structure~with~label~#1~has~already~been~used }  
(End definition for struct-used-twice. This function is documented on page 18.)

**struct-label-unknown** label is unknown, typically needs a rerun.  
31 \msg\_new:nnn { tag } {struct-label-unknown}  
32 { structure~with~label~#1~is~unknown~rerun }  
(End definition for struct-label-unknown. This function is documented on page 18.)

**struct-show-closing** Informational message shown if log-mode is high enough

```
33 \msg_new:nnn { tag } {struct-show-closing}
34 { closing-structure-#1~tagged~\use:e{\prop_item:cn{g__tag_struct_#1_prop}{S}} }
```

(End definition for struct-show-closing. This function is documented on page 18.)

**tree-struct-still-open** Message issued at the end if there are beside Root other open structures on the stack.

```
35 \msg_new:nnn { tag } {tree-struct-still-open}
36 {
37   There~are~still~open~structures~on~the~stack!\\
38   The~stack~contains~\seq_use:Nn\g__tag_struct_tag_stack_seq{,}.\\
39   The~structures~are~automatically~closed,\\
40   but~their~nesting~can~be~wrong.
41 }
```

(End definition for tree-struct-still-open. This function is documented on page ??.)

### 3.3 Attributes

Not much yet, as attributes aren't used so much.

**attr-unknown**

```
42 \msg_new:nnn { tag } {attr-unknown} { attribute-#1~is~unknown }
```

(End definition for attr-unknown. This function is documented on page 18.)

### 3.4 Roles

**role-missing** Warning message if either the tag or the role is missing

```
43 \msg_new:nnn { tag } {role-missing} { tag-#1~has~no~role~assigned }
```

```
44 \msg_new:nnn { tag } {role-unknown} { role-#1~is~not~known }
```

```
45 \msg_new:nnn { tag } {role-unknown-tag} { tag-#1~is~not~known }
```

(End definition for role-missing, role-unknown, and role-unknown-tag. These functions are documented on page 18.)

**role-parent-child** This is info and warning message about the containment rules between child and parent tags.

```
46 \msg_new:nnn { tag } {role-parent-child}
47 { Rule-`#1'--->`#2'~is~#3~\msg_line_context: }
```

(End definition for role-parent-child. This function is documented on page ??.)

**role-parent-child** This is info and warning message about the containment rules between child and parent tags.

```
48 \msg_new:nnn { tag } {role-remapping}
49 { remapping~tag~to~#1 }
```

(End definition for role-parent-child. This function is documented on page ??.)

**role-tag** Info messages.

```
new-tag 50 \msg_new:nnn { tag } {role-tag}          { mapping~tag~#1~to~role~#2  }
51 \msg_new:nnn { tag } {new-tag}             { adding~new~tag~#1  }
52 \msg_new:nnn { tag } {read-namespace}      { reading~namespace~definitions~tagpdf~ns~
#1.def  }
53 \msg_new:nnn { tag } {namespace-missing}{ namespace~definitions~tagpdf~ns~#1.def~not~found }
54 \msg_new:nnn { tag } {namespace-unknown}{ namespace~#1~is~not~declared }
```

*(End definition for role-tag and new-tag. These functions are documented on page 18.)*

### 3.5 Miscellaneous

**tree-mcid-index-wrong** Used in the tree code, typically indicates the document must be rerun.

```
55 \msg_new:nnn { tag } {tree-mcid-index-wrong}
56 {something-is-wrong-with-the-mcid--rerun}
```

*(End definition for tree-mcid-index-wrong. This function is documented on page 19.)*

**sys-no-interwordspace** Currently only pdf<sub>l</sub>at<sub>e</sub>x and lua<sub>l</sub>at<sub>e</sub>x have some support for real spaces.

```
57 \msg_new:nnn { tag } {sys-no-interwordspace}
58 {engine/output-mode~#1~doesn't~support~the~interword~spaces}
```

*(End definition for sys-no-interwordspace. This function is documented on page 19.)*

**\\_\_tag\_check\_typeout\_v:n** A simple logging function. By default it gobbles its argument, but the log-keys sets it to typeout.

```
59 \cs_set_eq:NN \__tag_check_typeout_v:n \use_none:n
```

*(End definition for \\_\_tag\_check\_typeout\_v:n.)*

**para-hook-count-wrong** At the end of the document we check if the count of para-begin and para-end is identical. If not we issue a warning: this is normally a coding error and breaks the structure.

```
60 \msg_new:nnnn { tag } {para-hook-count-wrong}
61 {The~number~of~automatic~begin~(#1)~and~end~(#2)~#3~para~hooks~differ!}
62 {This~quite~probably~a~coding~error~and~the~structure~will~be~wrong!}
63 </package>
```

*(End definition for para-hook-count-wrong. This function is documented on page 19.)*

## 4 Retrieving data

**\tag\_get:n** This retrieves some data. This is a generic command to retrieve data. Currently the only sensible values for the argument are mc\_tag, struct\_tag and struct\_num.

```
64 <base>\cs_new:Npn \tag_get:n #1 { \use:c {__tag_get_data_#1: } }
```

*(End definition for \tag\_get:n. This function is documented on page 16.)*

## 5 User conditionals

`\tag_if_active_p:` This is a test if tagging is active. This allows packages to add conditional code. The test is true if all booleans, the global and the two local one are true.  
`\tag_if_active:TF`

```
65 <*base>
66 \prg_new_conditional:Npnn \tag_if_active: { p , T , TF, F }
67 { \prg_return_false: }
68 </base>
69 <*package>
70 \prg_set_conditional:Npnn \tag_if_active: { p , T , TF, F }
71 {
72   \bool_lazy_all:nTF
73   {
74     {\g__tag_active_struct_bool}
75     {\g__tag_active_mc_bool}
76     {\g__tag_active_tree_bool}
77     {\l__tag_active_struct_bool}
78     {\l__tag_active_mc_bool}
79   }
80   {
81     \prg_return_true:
82   }
83   {
84     \prg_return_false:
85   }
86 }
```

(End definition for `\tag_if_active:TF`. This function is documented on page 16.)

## 6 Internal checks

These are checks used in various places in the code.

### 6.1 checks for active tagging

```
\__tag_check_if_active_mc:TF This checks if mc are active.
\__tag_check_if_active_struct:TF
87 \prg_new_conditional:Npnn \__tag_check_if_active_mc: {T,F,TF}
88 {
89   \bool_lazy_and:nnTF { \g__tag_active_mc_bool } { \l__tag_active_mc_bool }
90   {
91     \prg_return_true:
92   }
93   {
94     \prg_return_false:
95   }
96 }
97 \prg_new_conditional:Npnn \__tag_check_if_active_struct: {T,F,TF}
98 {
99   \bool_lazy_and:nnTF { \g__tag_active_struct_bool } { \l__tag_active_struct_bool }
100   {
101     \prg_return_true:
102   }
```

```

103     {
104         \prg_return_false:
105     }
106 }

```

(End definition for \\_tag\\_check\\_if\\_active\\_mc:TF and \\_tag\\_check\\_if\\_active\\_struct:TF.)

## 6.2 Checks related to structures

\\_tag\\_check\\_structure\\_has\\_tag:n Structures must have a tag, so we check if the S entry is in the property. It is an error if this is missing. The argument is a number. The tests for existence and type is split in structures, as the tags are stored differently to the mc case.

```

107 \cs_new_protected:Npn \_tag\_check\_structure\_has\_tag:n #1 %#1 struct num
108 {
109     \prop_if_in:cnF { g\_tag\_struct\_#1\_prop }
110     {S}
111     {
112         \msg_error:nn { tag } {struct-missing-tag}
113     }
114 }

```

(End definition for \\_tag\\_check\\_structure\\_has\\_tag:n.)

\\_tag\\_check\\_structure\\_tag:N This checks if the name of the tag is known, either because it is a standard type or has been rolemapped.

```

115 \cs_new_protected:Npn \_tag\_check\_structure\_tag:N #1
116 {
117     \prop_if_in:NoF \g\_tag\_role\_tags\_NS\_prop {#1}
118     {
119         \msg_warning:nnx { tag } {role-unknown-tag} {#1}
120     }
121 }

```

(End definition for \\_tag\\_check\\_structure\\_tag:N.)

\\_tag\\_check\\_info\\_closing\\_struct:n This info message is issued at a closing structure, the use should be guarded by log-level.

```

122 \cs_new_protected:Npn \_tag\_check\_info\_closing\_struct:n #1 %#1 struct num
123 {
124     \int_compare:nNnT {\l\_tag\_loglevel\_int} > { 0 }
125     {
126         \msg_info:nnn { tag } {struct-show-closing} {#1}
127     }
128 }

```

```

129
130 \cs_generate_variant:Nn \_tag\_check\_info\_closing\_struct:n {o,x}

```

(End definition for \\_tag\\_check\\_info\\_closing\\_struct:n.)

\\_tag\\_check\\_no\\_open\\_struct: This checks if there is an open structure. It should be used when trying to close a structure. It errors if false.

```

131 \cs_new_protected:Npn \_tag\_check\_no\_open\_struct:
132 {
133     \msg_error:nn { tag } {struct-faulty-nesting}
134 }

```



(End definition for `\_tag\_check\_no\_open\_struct:.`)

`\_tag\_check\_struct\_used:n` This checks if a stashed structure has already been used.

```

135 \cs_new_protected:Npn \_tag\_check\_struct\_used:n #1 %#1 label
136 {
137   \prop_get:cnNT
138     {g__tag\_struct\_\_tag\_ref\_value:enn{tagpdfstruct-#1}{tagstruct}{unknown}_prop}
139     {P}
140     \l__tag\_tmpa\_tl
141     {
142       \msg_warning:nnn { tag } {struct-used-twice} {#1}
143     }
144 }
```

(End definition for `\_tag\_check\_struct\_used:n.`)

### 6.3 Checks related to roles

`\_tag\_check\_add\_tag\_role:nn` This check is used when defining a new role mapping.

```

145 \cs_new_protected:Npn \_tag\_check\_add\_tag\_role:nn #1 #2 %#1 tag, #2 role
146 {
147   \tl_if_empty:nTF {#2}
148   {
149     \msg_error:nnn { tag } {role-missing} {#1}
150   }
151   {
152     \prop_get:NnNTF \g__tag\_role\_tags\_NS\_prop {#2} \l_tmpa\_tl
153     {
154       \int_compare:nNnT {\l__tag\_loglevel\_int} > { 0 }
155       {
156         \msg_info:nnnn { tag } {role-tag} {#1} {#2}
157       }
158     }
159     {
160       \msg_error:nnn { tag } {role-unknown} {#2}
161     }
162   }
163 }
```

Similar with a namespace

```

164 \cs_new_protected:Npn \_tag\_check\_add\_tag\_role:nnn #1 #2 #3 %#1 tag/NS, #2 role #3 namespace
165 {
166   \tl_if_empty:nTF {#2}
167   {
168     \msg_error:nnn { tag } {role-missing} {#1}
169   }
170   {
171     \prop_get:cnNTF { g__tag\_role\_NS\_#3\_prop } {#2} \l_tmpa\_tl
172     {
173       \int_compare:nNnT {\l__tag\_loglevel\_int} > { 0 }
174       {
175         \msg_info:nnnn { tag } {role-tag} {#1} {#2/#3}
176       }
177     }
178   }
```

```

178         {
179             \msg_error:nnn { tag } {role-unknown} {#2/#3}
180         }
181     }
182 }

```

(End definition for \\_tag\\_check\\_add\\_tag\\_role:nn.)

## 6.4 Check related to mc-chunks

\\_tag\\_check\\_mc\\_if\\_nested: Two tests if a mc is currently open. One for the true (for begin code), one for the false part (for end code).

```

183 \cs_new_protected:Npn \_tag\_check\_mc\_if\_nested:
184 {
185     \_tag\_mc\_if\_in:T
186     {
187         \msg_warning:nnx { tag } {mc-nested} { \_tag\_get\_mc\_abs\_cnt: }
188     }
189 }
190
191 \cs_new_protected:Npn \_tag\_check\_mc\_if\_open:
192 {
193     \_tag\_mc\_if\_in:F
194     {
195         \msg_warning:nnx { tag } {mc-not-open} { \_tag\_get\_mc\_abs\_cnt: }
196     }
197 }

```

(End definition for \\_tag\\_check\\_mc\\_if\\_nested: and \\_tag\\_check\\_mc\\_if\\_open:.)

\\_tag\\_check\\_mc\\_pushed\\_popped:nn This creates an information message if mc's are pushed or popped. The first argument is a word (pushed or popped), the second the tag name. With larger log-level the stack is shown too.

```

198 \cs_new_protected:Npn \_tag\_check\_mc\_pushed\_popped:nn #1 #2
199 {
200     \int_compare:nNnT
201         { \l__tag_loglevel_int } = { 2 }
202         { \msg_info:nnx {tag}{mc-#1}{#2} }
203     \int_compare:nNnT
204         { \l__tag_loglevel_int } > { 2 }
205         {
206             \msg_info:nnx {tag}{mc-#1}{#2}
207             \seq_log:N \g__tag_mc_stack_seq
208         }
209 }

```

(End definition for \\_tag\\_check\\_mc\\_pushed\\_popped:nn.)

\\_tag\\_check\\_mc\\_tag:N This checks if the mc has a (known) tag.

```

210 \cs_new_protected:Npn \_tag\_check\_mc\_tag:N #1 %#1 is var with a tag name in it
211 {
212     \tl_if_empty:NT #1
213     {
214         \msg_error:nnx { tag } {mc-tag-missing} { \_tag\_get\_mc\_abs\_cnt: }

```

```

215     }
216     \prop_if_in:NoF \g__tag_role_tags_NS_prop {#1}
217     {
218         \msg_warning:nnx { tag } {role-unknown-tag} {#1}
219     }
220 }

```

(End definition for \\_\_tag\_check\_mc\_tag:N.)

\g\_\_tag\_check\_mc\_used\_intarray  
\\_\_tag\_check\_init\_mc\_used:

This variable holds the list of used mc numbers. Everytime we store a mc-number we will add one the relevant array index. If everything is right at the end there should be only 1 until the max count of the mcid. 2 indicates that one mcid was used twice, 0 that we lost one. In engines other than luatex the total number of all intarray entries are restricted so we use only a rather small value of 65536, and we initialize the array only at first used, guarded by the log-level. This check is probably only needed for debugging. TODO does this really make sense to check? When can it happen??

```

221 \cs_new_protected:Npn \__tag_check_init_mc_used:
222 {
223     \intarray_new:Nn \g__tag_check_mc_used_intarray { 65536 }
224     \cs_gset_eq:NN \__tag_check_init_mc_used: \prg_do_nothing:
225 }

```

(End definition for \g\_\_tag\_check\_mc\_used\_intarray and \\_\_tag\_check\_init\_mc\_used:.)

\\_\_tag\_check\_mc\_used:n

This checks if a mc is used twice.

```

226 \cs_new_protected:Npn \__tag_check_mc_used:n #1 %#1 mcid abscent
227 {
228     \int_compare:nNnT {\l__tag_loglevel_int} > { 2 }
229     {
230         \__tag_check_init_mc_used:
231         \intarray_gset:Nnn \g__tag_check_mc_used_intarray
232             {#1}
233             { \intarray_item:Nn \g__tag_check_mc_used_intarray {#1} + 1 }
234         \int_compare:nNnT
235             {
236                 \intarray_item:Nn \g__tag_check_mc_used_intarray {#1}
237             }
238             >
239             { 1 }
240             {
241                 \msg_warning:nnn { tag } {mc-used-twice} {#1}
242             }
243     }
244 }

```

(End definition for \\_\_tag\_check\_mc\_used:n.)

\\_\_tag\_check\_show\_MCID\_by\_page:

This allows to show the mc on a page. Currently unused.

```

245 \cs_new_protected:Npn \__tag_check_show_MCID_by_page:
246 {
247     \tl_set:Nx \l__tag_tmpa_tl
248     {
249         \__tag_ref_value_lastpage:nn
250         {abspage}

```

```

251         {-1}
252     }
253     \int_step_inline:nnnn {1}{1}
254     {
255         \l__tag_tmpa_tl
256     }
257     {
258         \seq_clear:N \l_tmpa_seq
259         \int_step_inline:nnnn
260         {1}
261         {1}
262         {
263             \__tag_ref_value_lastpage:nn
264             {tagmcabs}
265             {-1}
266         }
267         {
268             \int_compare:nT
269             {
270                 \__tag_ref_value:enn
271                 {mcid-###1}
272                 {tagabspage}
273                 {-1}
274                 =
275                 ##1
276             }
277             {
278                 \seq_gput_right:Nx \l_tmpa_seq
279                 {
280                     Page##1-###1-
281                     \__tag_ref_value:enn
282                     {mcid-###1}
283                     {tagmcid}
284                     {-1}
285                 }
286             }
287         }
288         \seq_show:N \l_tmpa_seq
289     }
290 }

```

(End definition for `\__tag_check_show_MCID_by_page:.`)

## 6.5 Checks related to the state of MC on a page or in a split stream

The following checks are currently only usable in generic mode as they rely on the marks defined in the `mc-generic` module. They are used to detect if a `mc-chunk` has been split by a page break or similar and additional end/begin commands are needed.

`\__tag_check_mc_in_galley_p:` At first we need a test to decide if `\tag_mc_begin:n` (`tmb`) and `\tag_mc_end:` (`tme`) has been used at all on the current galley. As each command issues two slightly different marks we can do it by comparing firstmarks and botmarks. The test assumes that

`\__tag_check_mc_in_galley:` **TF**

the marks have been already mapped into the sequence with `\@@_mc_get_marks:`. As `\seq_if_eq:NNTF` doesn't exist we use the `tl-test`.

```

291 \prg_new_conditional:Npnn \__tag_check_if_mc_in_galley: { T,F,TF }
292 {
293   \tl_if_eq:NNTF \l__tag_mc_firstmarks_seq \l__tag_mc_botmarks_seq
294   { \prg_return_false: }
295   { \prg_return_true: }
296 }

```

*(End definition for \\_\_tag\_check\_mc\_in\_galley:TF.)*

`\__tag_check_if_mc_tmb_missing_p:` This checks if a extra top mark (“extra-tmb”) is needed. According to the analysis this  
`\__tag_check_if_mc_tmb_missing:TF` the case if the firstmarks start with `e-` or `b+`. Like above we assume that the marks content is already in the seq's.

```

297 \prg_new_conditional:Npnn \__tag_check_if_mc_tmb_missing: { T,F,TF }
298 {
299   \bool_if:nTF
300   {
301     \str_if_eq_p:ee {\seq_item:Nn \l__tag_mc_firstmarks_seq {1}}{e-}
302     ||
303     \str_if_eq_p:ee {\seq_item:Nn \l__tag_mc_firstmarks_seq {1}}{b+}
304   }
305   { \prg_return_true: }
306   { \prg_return_false: }
307 }

```

*(End definition for \\_\_tag\_check\_if\_mc\_tmb\_missing:TF.)*

`\__tag_check_if_mc_tme_missing_p:` This checks if a extra bottom mark (“extra-tme”) is needed. According to the analysis  
`\__tag_check_if_mc_tme_missing:TF` this the case if the botmarks starts with `b+`. Like above we assume that the marks content is already in the seq's.

```

308 \prg_new_conditional:Npnn \__tag_check_if_mc_tme_missing: { T,F,TF }
309 {
310   \str_if_eq:eeTF {\seq_item:Nn \l__tag_mc_botmarks_seq {1}}{b+}
311   { \prg_return_true: }
312   { \prg_return_false: }
313 }

```

*(End definition for \\_\_tag\_check\_if\_mc\_tme\_missing:TF.)*

```

314 \endpackage

```

```

315 \ifx\tagpdf-debug\tagpdf-debug

```

Code for `tagpdf-debug`. This will probably change over time. At first something for the `mc` commands.

```

316 \msg_new:nnn { tag / debug } {mc-begin} { MC~begin~#1~with~options~\tl_to_str:n{#2}~[\msg_line_no] }
317 \msg_new:nnn { tag / debug } {mc-end} { MC~end~#1~[\msg_line_context:] }
318
319 \cs_new_protected:Npn \__tag_debug_mc_begin_insert:n #1
320 {
321   \int_compare:nNnT { \l__tag_loglevel_int } > {0}
322   {
323     \msg_note:nnnn { tag / debug } {mc-begin} {inserted} { #1 }
324   }

```

```

325 }
326 \cs_new_protected:Npn \__tag_debug_mc_begin_ignore:n #1
327 {
328   \int_compare:nNnT { \l__tag_loglevel_int } > {0}
329   {
330     \msg_note:nnnn { tag / debug } {mc-begin } {ignored} { #1 }
331   }
332 }
333 \cs_new_protected:Npn \__tag_debug_mc_end_insert:
334 {
335   \int_compare:nNnT { \l__tag_loglevel_int } > {0}
336   {
337     \msg_note:nnn { tag / debug } {mc-end} {inserted}
338   }
339 }
340 \cs_new_protected:Npn \__tag_debug_mc_end_ignore:
341 {
342   \int_compare:nNnT { \l__tag_loglevel_int } > {0}
343   {
344     \msg_note:nnn { tag / debug } {mc-end } {ignored}
345   }
346 }

```

And now something for the structures

```

347 \msg_new:nnn { tag / debug } {struct-begin}
348 {
349   Struct~\tag_get:n{struct_num}~begin~#1~with~options::~~\tl_to_str:n{#2}~[\msg_line_context:]
350 }
351 \msg_new:nnn { tag / debug } {struct-end}
352 {
353   Struct~end~#1~[\msg_line_context:]
354 }
355 \msg_new:nnn { tag / debug } {struct-end-wrong}
356 {
357   Struct~end~'#1'~doesn't~fit~start~'#2'~[\msg_line_context:]
358 }
359
360 \cs_new_protected:Npn \__tag_debug_struct_begin_insert:n #1
361 {
362   \int_compare:nNnT { \l__tag_loglevel_int } > {0}
363   {
364     \msg_note:nnnn { tag / debug } {struct-begin} {inserted} { #1 }
365     \seq_log:N \g__tag_struct_tag_stack_seq
366   }
367 }
368 \cs_new_protected:Npn \__tag_debug_struct_begin_ignore:n #1
369 {
370   \int_compare:nNnT { \l__tag_loglevel_int } > {0}
371   {
372     \msg_note:nnnn { tag / debug } {struct-begin } {ignored} { #1 }
373   }
374 }
375 \cs_new_protected:Npn \__tag_debug_struct_end_insert:
376 {
377   \int_compare:nNnT { \l__tag_loglevel_int } > {0}

```

```

378     {
379         \msg_note:nnn { tag / debug } {struct-end} {inserted}
380         \seq_log:N \g__tag_struct_tag_stack_seq
381     }
382 }
383 \cs_new_protected:Npn \__tag_debug_struct_end_ignore:
384 {
385     \int_compare:nNnT { \l__tag_loglevel_int } > {0}
386     {
387         \msg_note:nnn { tag / debug } {struct-end } {ignored}
388     }
389 }
390 \cs_new_protected:Npn \__tag_debug_struct_end_check:n #1
391 {
392     \int_compare:nNnT { \l__tag_loglevel_int } > {0}
393     {
394         \seq_get:NNT \g__tag_struct_tag_stack_seq \l__tag_tmpa_tl
395         {
396             \str_if_eq:eeF
397             {#1}
398             {\exp_last_unbraced:NV\use_i:nn \l__tag_tmpa_tl}
399             {
400                 \msg_warning:nnxx { tag/debug }{ struct-end-wrong }
401                 {#1}
402                 {\exp_last_unbraced:NV\use_i:nn \l__tag_tmpa_tl}
403             }
404         }
405     }
406 }
407
408 </debug>

```

## Part II

# The **tagpdf-user** module

## Code related to L<sup>A</sup>T<sub>E</sub>X2e user commands and document commands

### Part of the tagpdf package

#### 1 Setup commands

---

<code>\tagpdfsetup</code>	<code>\tagpdfsetup{\key val list}</code>
---------------------------	--

---

This is the main setup command to adapt the behaviour of tagpdf. It can be used in the preamble and in the document (but not all keys make sense there).

---

<code>activate_␣(setup-key)</code>	And additional setup key which combine the other activate keys <code>activate-mc</code> , <code>activate-tree</code> , <code>activate-struct</code> and additionally add a document structure.
------------------------------------	--

---

---

<code>\tag_tool:n</code>	<code>\tag_tool:n{\key val}</code>
<code>\tagtool</code>	

---

The tagging of basic document elements will require a variety of small commands to configure and adapt the tagging. This command will collect them under a command interface. The argument is *one* key-value like string. This is work in progress and both syntax, known arguments and implementation can change!

#### 2 Commands related to mc-chunks

---

<code>\tagmcbegin</code>	<code>\tagmcbegin {\key-val}</code>
<code>\tagmcend</code>	<code>\tagmcend</code>
<code>\tagmcuse</code>	<code>\tagmcuse{\label}</code>

---

These are wrappers around `\tag_mc_begin:n`, `\tag_mc_end:` and `\tag_mc_use:n`. The commands and their argument are documented in the `tagpdf-mc` module. In difference to the `expl3` commands, `\tagmcbegin` issues also an `\ignorespaces`, and `\tagmcend` will issue in horizontal mode an `\unskip`.

---

<code>\tagmcifinTF</code>	<code>\tagmcifin {\true code}{\false code}</code>
---------------------------	---

---

This is a wrapper around `\tag_mc_if_in:TF`. and tests if an mc is open or not. It is mostly of importance for `pdflatex` as `lualatex` doesn't mind much if a mc tag is not correctly closed. Unlike the `expl3` command it is not expandable.

The command is probably not of much use and will perhaps disappear in future versions. It normally makes more sense to push/pop an mc-chunk.



### 3 Commands related to structures

---

<code>\tagstructbegin</code>	<code>\tagstructbegin {⟨key-val⟩}</code>
<code>\tagstructend</code>	<code>\tagstructend</code>
<code>\tagstructuse</code>	<code>\tagstructuse{⟨label⟩}</code>

---

These are direct wrappers around `\tag_struct_begin:n`, `\tag_struct_end:` and `\tag_struct_use:n`. The commands and their argument are documented in the `tagpdf-struct` module.

### 4 Debugging

---

<code>\ShowTagging</code>	<code>\ShowTagging {⟨key-val⟩}</code>
---------------------------	---------------------------------------

---

This is a generic function to output various debugging helps. It not necessarily stops the compilation. The keys and their function are described below.

---

<code>mc-data<sub>␣</sub>(show-key)</code>	<code>mc-data = ⟨number⟩</code>
--	---------------------------------

---

This key is (currently?) relevant for lua mode only. It shows the data of all mc-chunks created so far. It is accurate only after shipout (and perhaps a second compilation), so typically should be issued after a newpage. The value is a positive integer and sets the first mc-shown. If no value is given, 1 is used and so all mc-chunks created so far are shown.

---

<code>mc-current<sub>␣</sub>(show-key)</code>	<code>mc-current</code>
---	-------------------------

---

This key shows the number and the tag of the currently open mc-chunk. If no chunk is open it shows only the state of the abs count. It works in all mode, but the output in luamode looks different.

---

<code>mc-marks<sub>␣</sub>(show-key)</code>	<code>mc-marks = show use</code>
---	----------------------------------

---

This key helps to debug the page marks. It should only be used at shipout in header or footer.

---

<code>struct-stack<sub>␣</sub>(show-key)</code>	<code>struct-stack = log show</code>
---	--------------------------------------

---

This key shows the current structure stack. With `log` the info is only written to the log-file, `show` stops the compilation and shows on the terminal. If no value is used, then the default is `show`.

### 5 Extension commands

The following commands and code parts are not core command of tagpdf. They either provide work-arounds for missing functionality elsewhere, or do a first step to apply tagpdf commands to document commands.

The commands and keys should be view as experimental!

This part will be regularly revisited to check if the code should go to a better place or can be improved and so can change easily.

## 5.1 Fake space

---

`\pdffakespace` (lua-only) This provides a lua-version of the `\pdffakespace` primitive of pdftex.

---

## 5.2 Paratagging

This is a first try to make use of the new paragraph hooks in a current LaTeX to automate the tagging of paragraph. It requires sane paragraph nesting, faulty code, e.g. a missing `\par` at the end of a low-level vbox can highly confuse the tagging. The tags should be carefully checked if this is used.

---

<code>paratagging_␣(setup-key)</code>	<code>paratagging = true false</code>
<code>paratagging-show_␣(setup-key)</code>	<code>paratagging-show = true false</code>

---

This keys can be used in `\tagpdfsetup` and enable/disable paratagging. `paratagging-show` puts small red numbers at the begin and end of a paragraph. This is meant as a debugging help. The number are boxes and have a (tiny) height, so they can affect typesetting.

---

<code>\tagpdfparaOn</code>	These commands allow to enable/disable para tagging too and are a bit faster then <code>\tagpdfsetup</code> . But I'm not sure if the names are good.
<code>\tagpdfparaOff</code>	

---

---

<code>\tagpdfsuppressmarks</code>	This command allows to suppress the creation of the marks. It takes an argument which should normally be one of the mc-commands, puts a group around it and suppress the marks creation in this group. This command should be used if the begin and end command are at different boxing levels. E.g.
-----------------------------------	--

---

```
\@hangfrom
{
  \tagstructbegin{tag=H1}%
  \tagmcbegin    {tag=H1}%
  #2
}
{#3\tagpdfsuppressmarks{\tagmcend}\tagstructend}%
```

## 5.3 Header and footer

Header and footer are automatically excluded from tagging. This can be disabled with the following key. If some real content is in the header and footer, tagging must be restarted there explicitly. The key accepts the values `true` which surrounds the header with an artifact mc-chunk, `false` which disables the automatic tagging, and `pagination` which additionally adds an artifact structure with an pagination attribute.

---

<code>exclude-header-footer_␣(setup-key)</code>	<code>exclude-header-footer = true false pagination</code>
---	--

---

## 5.4 Link tagging

Links need a special structure and cross reference system. This is added through hooks of the l3pdfannot module and will work automatically if tagging is activated.

Links should (probably) have an alternative text in the Contents key. It is unclear which text this should be and how to get it. Currently the code simply adds the fix texts `url` and `ref`. Another text can be added by changing the dictionary value:

```
\pdfannot_dict_put:nnn
{ link/GoTo }
{ Contents }
{ (ref) }
```

## 6 User commands and extensions of document commands

```
1 <@@=tag>
2 <*header>
3 \ProvidesExplPackage {tagpdf-user} {2023-05-16} {0.98g}
4 {tagpdf - user commands}
5 </header>
```

## 7 Setup and preamble commands

`\tagpdfsetup`

```
6 <base>\NewDocumentCommand \tagpdfsetup { m }{}
7 <*package>
8 \RenewDocumentCommand \tagpdfsetup { m }
9 {
10   \keys_set:nn { __tag / setup } { #1 }
11 }
12 </package>
```

*(End definition for \tagpdfsetup. This function is documented on page 32.)*

`\tag_tool:n`  
`\tagtool`

This is a first definition of the tool command. Currently it uses `key-val`, but this should be probably be flattened to speed it up.

```
13 <base>\cs_new_protected:Npn\tag_tool:n #1 {}
14 <base>\cs_set_eq:NN\tagtool\tag_tool:n
15 <*package>
16 \cs_set_protected:Npn\tag_tool:n #1
17 {
18   \tag_if_active:T { \keys_set:nn {tag / tool}{#1} }
19 }
20 \cs_set_eq:NN\tagtool\tag_tool:n
21 </package>
```

*(End definition for \tag\_tool:n and \tagtool. These functions are documented on page 32.)*

## 8 Commands for the mc-chunks

```

\tagmcbegin
\tagmcend
\tagmcuse
22 < *base>
23 \NewDocumentCommand \tagmcbegin { m }
24 {
25   \tag_mc_begin:n {#1}
26 }
27
28
29 \NewDocumentCommand \tagmcend { }
30 {
31   \tag_mc_end:
32 }
33
34 \NewDocumentCommand \tagmcuse { m }
35 {
36   \tag_mc_use:n {#1}
37 }
38 < /base>

```

(End definition for `\tagmcbegin`, `\tagmcend`, and `\tagmcuse`. These functions are documented on page 32.)

`\tagmcifinTF` This is a wrapper around `\tag_mc_if_in:` and tests if an mc is open or not. It is mostly of importance for pdf<sub>l</sub>atex as lua<sub>l</sub>atex doesn't mind much if a mc tag is not correctly closed. Unlike the expl3 command it is not expandable.

```

39 < *package>
40 \NewDocumentCommand \tagmcifinTF { m m }
41 {
42   \tag_mc_if_in:TF { #1 } { #2 }
43 }
44 < /package>

```

(End definition for `\tagmcifinTF`. This function is documented on page 32.)

## 9 Commands for the structure

`\tagstructbegin` `\tagstructend` `\tagstructuse` These are structure related user commands. There are direct wrapper around the expl3 variants.

```

45 < *base>
46 \NewDocumentCommand \tagstructbegin { m }
47 {
48   \tag_struct_begin:n {#1}
49 }
50
51 \NewDocumentCommand \tagstructend { }
52 {
53   \tag_struct_end:
54 }
55
56 \NewDocumentCommand \tagstructuse { m }
57 {

```

```

58   \tag_struct_use:n {#1}
59   }
60 </base>

```

(End definition for `\tagstructbegin`, `\tagstructend`, and `\tagstructuse`. These functions are documented on page 33.)

## 10 Debugging

**\ShowTagging** This is a generic command for various show commands. It takes a keyval list, the various keys are implemented below.

```

61 <*package>
62 \NewDocumentCommand\ShowTagging { m }
63 {
64   \keys_set:nn { __tag / show }{ #1}
65
66 }

```

(End definition for `\ShowTagging`. This function is documented on page 33.)

**mc-data\_␣(show-key)** This key is (currently?) relevant for lua mode only. It shows the data of all mc-chunks created so far. It is accurate only after shipout, so typically should be issued after a newpage. With the optional argument the minimal number can be set.

```

67 \keys_define:nn { __tag / show }
68 {
69   mc-data .code:n =
70   {
71     \sys_if_engine luatex:T
72     {
73       \lua_now:e{!tx.__tag.trace.show_all_mc_data(#1,\__tag_get_mc_abs_cnt:,0)}
74     }
75   }
76   ,mc-data .default:n = 1
77 }
78

```

(End definition for `mc-data (show-key)`. This function is documented on page 33.)

**mc-current\_␣(show-key)** This shows some info about the current mc-chunk. It works in generic and lua-mode.

```

79 \keys_define:nn { __tag / show }
80 { mc-current .code:n =
81   {
82     \bool_if:NTF \g__tag_mode_lua_bool
83     {
84       \sys_if_engine luatex:T
85       {
86         \int_compare:nNnTF
87         { -2147483647 }
88         =
89         {
90           \lua_now:e
91           {
92             tex.print

```

```

93         (tex.getattribute
94         (luatexbase.attributes.g__tag_mc_cnt_attr))
95     }
96 }
97 {
98     \lua_now:e
99     {
100         ltx.__tag.trace.log
101         (
102             "mc-current:~no~MC~open,~current~absent
103             =\__tag_get_mc_abs_cnt:"
104             ,0
105         )
106         texio.write_nl("")
107     }
108 }
109 {
110     \lua_now:e
111     {
112         ltx.__tag.trace.log
113         (
114             "mc-current:~absent=\__tag_get_mc_abs_cnt:=="
115             ..
116             tex.getattribute(luatexbase.attributes.g__tag_mc_cnt_attr)
117             ..
118             "~=>tag="
119             ..
120             tostring
121             (ltx.__tag.func.get_tag_from
122             (tex.getattribute
123             (luatexbase.attributes.g__tag_mc_type_attr)))
124             ..
125             "="
126             ..
127             tex.getattribute
128             (luatexbase.attributes.g__tag_mc_type_attr)
129             ,0
130         )
131         texio.write_nl("")
132     }
133 }
134 }
135 }
136 {
137     \msg_note:nn{ tag }{ mc-current }
138 }
139 }
140 }

```

(End definition for `mc-current` (`show-key`). This function is documented on page 33.)

`mc-marks_␣(show-key)` It maps the mc-marks into the sequences and then shows them. This allows to inspect the first and last mc-Mark on a page. It should only be used in the shipout (header/footer).

```

141 \keys_define:nn { __tag / show }

```

```

142 {
143   mc-marks .choice: ,
144   mc-marks / show .code:n =
145   {
146     \__tag_mc_get_marks:
147     \__tag_check_if_mc_in_galley:TF
148     {
149       \iow_term:n {Marks~from~this~page:~}
150     }
151     {
152       \iow_term:n {Marks~from~a~previous~page:~}
153     }
154     \seq_show:N \l__tag_mc_firstmarks_seq
155     \seq_show:N \l__tag_mc_botmarks_seq
156     \__tag_check_if_mc_tmb_missing:T
157     {
158       \iow_term:n {BDC~missing~on~this~page!}
159     }
160     \__tag_check_if_mc_tme_missing:T
161     {
162       \iow_term:n {EMC~missing~on~this~page!}
163     }
164   },
165   mc-marks / use .code:n =
166   {
167     \__tag_mc_get_marks:
168     \__tag_check_if_mc_in_galley:TF
169     { Marks~from~this~page:~}
170     { Marks~from~a~previous~page:~}
171     \seq_use:Nn \l__tag_mc_firstmarks_seq {,~}\quad
172     \seq_use:Nn \l__tag_mc_botmarks_seq {,~}\quad
173     \__tag_check_if_mc_tmb_missing:T
174     {
175       BDC~missing~
176     }
177     \__tag_check_if_mc_tme_missing:T
178     {
179       EMC~missing
180     }
181   },
182   mc-marks .default:n = show
183 }

```

(End definition for `mc-marks` (`show-key`). This function is documented on page 33.)

#### `struct-stack_␣(show-key)`

```

184 \keys_define:nn { __tag / show }
185 {
186   struct-stack .choice:
187   ,struct-stack / log .code:n = \seq_log:N \g__tag_struct_tag_stack_seq
188   ,struct-stack / show .code:n = \seq_show:N \g__tag_struct_tag_stack_seq
189   ,struct-stack .default:n = show
190 }

```

(End definition for `struct-stack` (`show-key`). This function is documented on page 33.)

## 11 Commands to extend document commands

The following commands and code parts are not core command of tagpdf. They either provide work-arounds for missing functionality elsewhere, or do a first step to apply tagpdf commands to document commands. This part should be regularly revisited to check if the code should go to a better place or can be improved.

### 11.1 Document structure

```
\g__tag_root_default_tl
activate_␣(setup-key)
191 \tl_new:N\g__tag_root_default_tl
192 \tl_gset:Nn\g__tag_root_default_tl {Document}
193
194 \hook_gput_code:nnn{begindocument}{tagpdf}{\tagstructbegin{tag=\g__tag_root_default_tl}}
195 \hook_gput_code:nnn{tagpdf/finish/before}{tagpdf}{\tagstructend}
196
197 \keys_define:nn { __tag / setup }
198 {
199   activate .code:n =
200   {
201     \keys_set:nn { __tag / setup }
202     { activate-mc,activate-tree,activate-struct }
203     \tl_gset:Nn\g__tag_root_default_tl {#1}
204   },
205   activate .default:n = Document
206 }
207
```

*(End definition for \g\_\_tag\_root\_default\_tl and activate (setup-key). This function is documented on page 32.)*

### 11.2 Structure destinations

In TeXlive 2022 pdfTeX and LuaTeX will offer support for structure destinations. The pdfmanagement has already backend support. We activate them if the prerequisites are there: structures should be activated, the code in the pdfmanagement must be there. Structure destinations are actually PDF 2.0 only but they don't harm in older PDF and can improve HTML export.

```
208 \AddToHook{begindocument/before}
209 {
210   \bool_lazy_all:nT
211   {
212     { \g__tag_active_struct_dest_bool }
213     { \g__tag_active_struct_bool }
214     { \cs_if_exist_p:N \pdf_activate_structure_destination: }
215   }
216   {
217     \tl_set:Nn \l_pdf_current_structure_destination_tl { __tag/struct/\g__tag_struct_stack
218     \pdf_activate_structure_destination:
219   }
220 }
```



## 11.3 Fake space

`\pdffakespace` We need a luatex variant for `\pdffakespace`. This should probably go into the kernel at some time. We also provide a no-op version for dvi mode

```

221 \sys_if_engine_luatex:T
222 {
223     \NewDocumentCommand\pdffakespace { }
224     {
225         \__tag_fakespace:
226     }
227 }
228 \providecommand\pdffakespace{}

```

(End definition for `\pdffakespace`. This function is documented on page 34.)

## 11.4 Paratagging

The following are some simple commands to enable/disable paratagging. Probably one should add some checks if we are already in a paragraph.

```

\l__tag_para_bool
\l__tag_para_flattened_bool
\l__tag_para_show_bool
\g__tag_para_begin_int
\g__tag_para_end_int
\g__tag_para_main_begin_int
\g__tag_para_main_end_int
\l__tag_para_tag_default_tl
\l__tag_para_tag_tl
\l__tag_para_main_tag_tl

```

At first some variables.

```

229 \bool_new:N \l__tag_para_bool
230 </package>
231 \base\bool_new:N \l__tag_para_flattened_bool
232 *package>
233 \bool_new:N \l__tag_para_show_bool
234 \int_new:N \g__tag_para_begin_int
235 \int_new:N \g__tag_para_end_int
236 \int_new:N \g__tag_para_main_begin_int
237 \int_new:N \g__tag_para_main_end_int
238 \tl_new:N \l__tag_para_tag_default_tl
239 \tl_set:Nn \l__tag_para_tag_default_tl { text }
240 \tl_new:N \l__tag_para_tag_tl
241 \tl_set:Nn \l__tag_para_tag_tl { \l__tag_para_tag_default_tl }
242 \tl_new:N \l__tag_para_main_tag_tl
243 \tl_set:Nn \l__tag_para_main_tag_tl {text-unit}

```

(End definition for `\l__tag_para_bool` and others.)

```

paratagging_␣(setup-key)
paratagging-show_␣(setup-key)
paratag_␣(setup-key)
paratag_␣(tool-key)
unittag_␣(tool-key)
para-flattened_␣(tool-key)

```

These keys enable/disable locally paratagging, and the debug modus. It can affect the typesetting if `paratagging-show` is used. The small numbers are boxes and they have a (small) height. The `paratag` key sets the tag used by the next automatic paratagging, it can also be changed with `\tag_tool:n`

```

244 \keys_define:nn { __tag / setup }
245 {
246     paratagging .bool_set:N = \l__tag_para_bool,
247     paratagging-show .bool_set:N = \l__tag_para_show_bool,
248     paratag .tl_set:N = \l__tag_para_tag_tl
249 }
250 \keys_define:nn { tag / tool}
251 {
252     paratag .tl_set:N = \l__tag_para_tag_tl,
253     unittag .tl_set:N = \l__tag_para_main_tag_tl,
254     para-flattened .bool_set:N = \l__tag_para_flattened_bool
255 }

```

(End definition for paratagging (setup-key) and others. These functions are documented on page 34.)

This fills the para hooks with the needed code.

```

256 \cs_new_protected:Npn \__tag_check_para_begin_show:nn #1 #2
257   {%#1 color, #2 prefix
258   {
259     \bool_if:NT \l__tag_para_show_bool
260     {
261       \tag_mc_begin:n{artifact}
262       \llap{\color_select:n{#1}\tiny#2\int_use:N\g__tag_para_begin_int\ }
263       \tag_mc_end:
264     }
265   }
266
267 \cs_new_protected:Npn \__tag_check_para_end_show:nn #1 #2
268   {%#1 color, #2 prefix
269   {
270     \bool_if:NT \l__tag_para_show_bool
271     {
272       \tag_mc_begin:n{artifact}
273       \rlap{\color_select:n{#1}\tiny\ #2\int_use:N\g__tag_para_end_int}
274       \tag_mc_end:
275     }
276   }
277
278 \AddToHook{para/begin}
279 {
280   \bool_if:NT \l__tag_para_bool
281   {
282     \bool_if:NF \l__tag_para_flattened_bool
283     {
284       \int_gincr:N \g__tag_para_main_begin_int
285       \tag_struct_begin:n
286       {
287         tag=\l__tag_para_main_tag_tl,
288       }
289     }
290     \int_gincr:N \g__tag_para_begin_int
291     \tag_struct_begin:n {tag=\l__tag_para_tag_tl}
292     \__tag_check_para_begin_show:nn {green}{}
293     \tag_mc_begin:n {}
294   }
295 }
296 \AddToHook{para/end}
297 {
298   \bool_if:NT \l__tag_para_bool
299   {
300     \int_gincr:N \g__tag_para_end_int
301     \tag_mc_end:
302     \__tag_check_para_end_show:nn {red}{}
303     \tag_struct_end:
304     \bool_if:NF \l__tag_para_flattened_bool
305     {
306       \int_gincr:N \g__tag_para_main_end_int
307       \tag_struct_end:

```

```

308     }
309   }
310 }

```

We check the para count at the end. If tagging is not active it is not a error, but we issue a warning as it perhaps indicates that the testphase code didn't guard everything correctly.

```

311 \AddToHook{enddocument/info}
312 {
313   \tag_if_active:F
314   {
315     \msg_redirect_name:nnn { tag } { para-hook-count-wrong } { warning }
316   }
317   \int_compare:nNnF {\g__tag_para_main_begin_int}={\g__tag_para_main_end_int}
318   {
319     \msg_error:nnxxx
320     {tag}
321     {para-hook-count-wrong}
322     {\int_use:N\g__tag_para_main_begin_int}
323     {\int_use:N\g__tag_para_main_end_int}
324     {text-unit}
325   }
326   \int_compare:nNnF {\g__tag_para_begin_int}={\g__tag_para_end_int}
327   {
328     \msg_error:nnxxx
329     {tag}
330     {para-hook-count-wrong}
331     {\int_use:N\g__tag_para_begin_int}
332     {\int_use:N\g__tag_para_end_int}
333     {text}
334   }
335 }

```

In generic mode we need the additional code from the ptagging tests.

```

336 \AddToHook{begindocument/before}
337 {
338   \@ifundefined{@mult@ptagging@hook}{\RequirePackage{output-patches-tmp-ltx}}{} %
339   \bool_if:NF \g__tag_mode_lua_bool
340   {
341     \cs_if_exist:NT \@kernel@before@footins
342     {
343       \tl_put_right:Nn \@kernel@before@footins
344       { \__tag_add_missing_mcs_to_stream:Nn \footins {footnote} }
345       \tl_put_right:Nn \@kernel@before@cclv
346       {
347         \__tag_check_typeout_v:n {===>~In~\token_to_str:N \@makecol\c_space_tl\the\c@p
348         \__tag_add_missing_mcs_to_stream:Nn \@cclv {main}
349       }
350       \tl_put_right:Nn \@mult@ptagging@hook
351       {
352         \__tag_check_typeout_v:n {===>~In~\string\page@sofar}
353         \process@cols\mult@firstbox
354         {
355           \__tag_add_missing_mcs_to_stream:Nn \count@ {multicol}
356         }
357       }
358     }
359   }
360 }

```

```

357         \__tag_add_missing_mcs_to_stream:Nn \mult@rightbox {multicol}
358     }
359 }
360 }
361 }
362 \endpackage

```

**\tagpdfparaOn** This two command switch para mode on and off. **\tagpdfsetup** could be used too but is longer. An alternative is **\tag\_tool:n{para=false}**

**\tagpdfparaOff**

```

363 \base\newcommand\tagpdfparaOn {}
364 \base\newcommand\tagpdfparaOff{}
365 \endpackage
366 \renewcommand\tagpdfparaOn {\bool_set_true:N \l__tag_para_bool}
367 \renewcommand\tagpdfparaOff{\bool_set_false:N \l__tag_para_bool}
368 \keys_define:nn { tag / tool}
369 {
370     para .bool_set:N = \l__tag_para_bool,
371     para-flattened .bool_set:N = \l__tag_para_flattened_bool,
372 }

```

*(End definition for \tagpdfparaOn and \tagpdfparaOff. These functions are documented on page 34.)*

**\tagpdfsuppressmarks** This command allows to suppress the creation of the marks. It takes an argument which should normally be one of the mc-commands, puts a group around it and suppress the marks creation in this group. This command should be used if the begin and end command are at different boxing levels. E.g.

```

\@hangfrom
{
    \tagstructbegin{tag=H1}%
    \tagmcbegin {tag=H1}%
    #2
}
{\#3\tagpdfsuppressmarks{\tagmcend}\tagstructend}%

373 \NewDocumentCommand\tagpdfsuppressmarks{m}
374 {\use:c{__tag_mc_disable_marks:} #1}}

```

*(End definition for \tagpdfsuppressmarks. This function is documented on page 34.)*

## 11.5 Header and footer

Header and footer should normally be tagged as artifacts. The following code requires the new hooks. For now we allow to disable this function, but probably the code should always be there at the end. TODO check if Pagination should be changeable.

```

375 \cs_new_protected:Npn\__tag_hook_kernel_before_head:{}
376 \cs_new_protected:Npn\__tag_hook_kernel_after_head:{}
377 \cs_new_protected:Npn\__tag_hook_kernel_before_foot:{}
378 \cs_new_protected:Npn\__tag_hook_kernel_after_foot:{}
379
380 \AddToHook{begindocument}
381 {
382     \cs_if_exist:NT \@kernel@before@head
383     {

```

```

384     \tl_put_right:Nn \@kernel@before@head {\__tag_hook_kernel_before_head:}
385     \tl_put_left:Nn \@kernel@after@head {\__tag_hook_kernel_after_head:}
386     \tl_put_right:Nn \@kernel@before@foot {\__tag_hook_kernel_before_foot:}
387     \tl_put_left:Nn \@kernel@after@foot {\__tag_hook_kernel_after_foot:}
388   }
389 }
390
391 \bool_new:N \g__tag_saved_in_mc_bool
392 \cs_new_protected:Npn \__tag_exclude_headfoot_begin:
393 {
394   \bool_set_false:N \l__tag_para_bool
395   \bool_if:NTF \g__tag_mode_lua_bool
396   {
397     \tag_mc_end_push:
398   }
399   {
400     \bool_gset_eq:NN \g__tag_saved_in_mc_bool \g__tag_in_mc_bool
401     \bool_gset_false:N \g__tag_in_mc_bool
402   }
403   \tag_mc_begin:n {artifact}
404 }
405 \cs_new_protected:Npn \__tag_exclude_headfoot_end:
406 {
407   \tag_mc_end:
408   \bool_if:NTF \g__tag_mode_lua_bool
409   {
410     \tag_mc_begin_pop:n{ }
411   }
412   {
413     \bool_gset_eq:NN \g__tag_in_mc_bool \g__tag_saved_in_mc_bool
414   }
415 }

```

This version allows to use an Artifact structure

```

416 \__tag_attr_new_entry:nn {\__tag/attr/pagination}{/0/Artifact/Type/Pagination}
417 \cs_new_protected:Npn \__tag_exclude_struct_headfoot_begin:n #1
418 {
419   \bool_set_false:N \l__tag_para_bool
420   \bool_if:NTF \g__tag_mode_lua_bool
421   {
422     \tag_mc_end_push:
423   }
424   {
425     \bool_gset_eq:NN \g__tag_saved_in_mc_bool \g__tag_in_mc_bool
426     \bool_gset_false:N \g__tag_in_mc_bool
427   }
428   \tag_struct_begin:n{tag=Artifact,attribute-class=__tag/attr/#1}
429   \tag_mc_begin:n {artifact=#1}
430 }
431
432 \cs_new_protected:Npn \__tag_exclude_struct_headfoot_end:
433 {
434   \tag_mc_end:
435   \tag_struct_end:
436   \bool_if:NTF \g__tag_mode_lua_bool

```

```

437     {
438       \tag_mc_begin_pop:n{
439     }
440     {
441       \bool_gset_eq:NN \g__tag_in_mc_bool\g__tag_saved_in_mc_bool
442     }
443   }

```

And now the keys

`exclude-header-footer␣(setup-key)`

```

444 \keys_define:nn { __tag / setup }
445 {
446   exclude-header-footer .choice:,
447   exclude-header-footer / true .code:n =
448   {
449     \cs_set_eq:NN \__tag_hook_kernel_before_head: \__tag_exclude_headfoot_begin:
450     \cs_set_eq:NN \__tag_hook_kernel_before_foot: \__tag_exclude_headfoot_begin:
451     \cs_set_eq:NN \__tag_hook_kernel_after_head: \__tag_exclude_headfoot_end:
452     \cs_set_eq:NN \__tag_hook_kernel_after_foot: \__tag_exclude_headfoot_end:
453   },
454   exclude-header-footer / pagination .code:n =
455   {
456     \cs_set:Nn \__tag_hook_kernel_before_head: { \__tag_exclude_struct_headfoot_begin:n {p
457     \cs_set:Nn \__tag_hook_kernel_before_foot: { \__tag_exclude_struct_headfoot_begin:n {p
458     \cs_set_eq:NN \__tag_hook_kernel_after_head: \__tag_exclude_struct_headfoot_end:
459     \cs_set_eq:NN \__tag_hook_kernel_after_foot: \__tag_exclude_struct_headfoot_end:
460   },
461   exclude-header-footer / false .code:n =
462   {
463     \cs_set_eq:NN \__tag_hook_kernel_before_head: \prg_do_nothing:
464     \cs_set_eq:NN \__tag_hook_kernel_before_foot: \prg_do_nothing:
465     \cs_set_eq:NN \__tag_hook_kernel_after_head: \prg_do_nothing:
466     \cs_set_eq:NN \__tag_hook_kernel_after_foot: \prg_do_nothing:
467   },
468   exclude-header-footer .default:n = true,
469   exclude-header-footer .initial:n = true
470 }

```

*(End definition for `exclude-header-footer` (setup-key). This function is documented on page 34.)*

## 11.6 Links

We need to close and reopen mc-chunks around links. Currently we handle URI and GoTo (internal) links. Links should have an alternative text in the Contents key. It is unclear which text this should be and how to get it.

```

471 \hook_gput_code:nnn
472 {pdfannot/link/URI/before}
473 {tagpdf}
474 {
475   \tag_mc_end_push:
476   \tag_struct_begin:n { tag=Link }
477   \tag_mc_begin:n { tag=Link }
478   \pdfannot_dict_put:nnx
479   { link/URI }

```

```

480     { StructParent }
481     { \tag_struct_parent_int: }
482 }
483
484 \hook_gput_code:nnn
485 {pdfannot/link/URI/after}
486 {tagpdf}
487 {
488     \tag_struct_insert_annot:xx {\pdfannot_link_ref_last:}{\tag_struct_parent_int:}
489     \tag_mc_end:
490     \tag_struct_end:
491     \tag_mc_begin_pop:n{ }
492 }
493
494 \hook_gput_code:nnn
495 {pdfannot/link/GoTo/before}
496 {tagpdf}
497 {
498     \tag_mc_end_push:
499     \tag_struct_begin:n{tag=Link}
500     \tag_mc_begin:n{tag=Link}
501     \pdfannot_dict_put:nnx
502     { link/GoTo }
503     { StructParent }
504     { \tag_struct_parent_int: }
505 }
506
507 \hook_gput_code:nnn
508 {pdfannot/link/GoTo/after}
509 {tagpdf}
510 {
511     \tag_struct_insert_annot:xx {\pdfannot_link_ref_last:}{\tag_struct_parent_int:}
512     \tag_mc_end:
513     \tag_struct_end:
514     \tag_mc_begin_pop:n{ }
515 }
516 }
517
518 % "alternative descriptions " for PAX3. How to get better text here??
519 \pdfannot_dict_put:nnn
520 { link/URI }
521 { Contents }
522 { (url) }
523
524 \pdfannot_dict_put:nnn
525 { link/GoTo }
526 { Contents }
527 { (ref) }
528
</package>

```

## Part III

# The tagpdf-tree module

## Commands trees and main dictionaries

## Part of the tagpdf package

```
1 <@@=tag>
2 <*header>
3 \ProvidesExplPackage {tagpdf-tree-code} {2023-05-16} {0.98g}
4 {part of tagpdf - code related to writing trees and dictionaries to the pdf}
5 </header>
```

### 1 Trees, pdfmanagement and finalization code

The code to finish the structure is in a hook. This will perhaps at the end be a kernel hook. TODO check right place for the code The pdfmanagement code is the kernel hook after shipout/lastpage so all code affecting it should be before. Objects can be written later, at least in pdf mode.

```
6 <*package>
7 \hook_gput_code:nnn{begindocument}{tagpdf}
8 {
9   \bool_if:NT \g__tag_active_tree_bool
10   {
11     \sys_if_output_pdf:TF
12     {
13       \AddToHook{enddocument/end} { \__tag_finish_structure: }
14     }
15     {
16       \AddToHook{shipout/lastpage} { \__tag_finish_structure: }
17     }
18   }
19 }
```

#### 1.1 Check structure

\\_\_tag\_tree\_final\_checks:

```
20 \cs_new_protected:Npn \__tag_tree_final_checks:
21 {
22   \int_compare:nNnF {\seq_count:N\g__tag_struct_stack_seq}={1}
23   {
24     \msg_warning:nn {tag}{tree-struct-still-open}
25     \int_step_inline:nnn{2}{\seq_count:N\g__tag_struct_stack_seq}
26     {\tag_struct_end:}
27   }
28 }
```

(End definition for \\_\_tag\_tree\_final\_checks:.)



## 1.2 Catalog: MarkInfo and StructTreeRoot

The StructTreeRoot and the MarkInfo entry must be added to the catalog. We do it late so that we can win, but before the pdfmanagement hook.

```

__tag/struct/0 This is the object for the root object, the StructTreeRoot
29 \pdf_object_new:n { __tag/struct/0 }
(End definition for __tag/struct/0.)
30 \hook_gput_code:nnn{shipout/lastpage}{tagpdf}
31 {
32   \bool_if:NT \g__tag_active_tree_bool
33   {
34     \pdfmanagement_add:nnn { Catalog / MarkInfo } { Marked } { true }
35     \pdfmanagement_add:nnx
36       { Catalog }
37       { StructTreeRoot }
38     { \pdf_object_ref:n { __tag/struct/0 } }
39   }
40 }

```

## 1.3 Writing the IDtree

The ID are currently quite simple: every structure has an ID build from the prefix ID together with the structure number padded with enough zeros to that we get directly an lexical order. We ship them out in bundles At first a seq to hold the references for the kids

```

\g__tag_tree_id_pad_int
41 \int_new:N\g__tag_tree_id_pad_int
(End definition for \g__tag_tree_id_pad_int.)
Now we get the needed padding
42 \cs_generate_variant:Nn \tl_count:n {e}
43 \hook_gput_code:nnn{begindocument}{tagpdf}
44 {
45   \int_gset:Nn\g__tag_tree_id_pad_int
46   {\tl_count:e { \__tag_ref_value_lastpage:nn{tagstruct}{1000}}+1}
47 }
48

```

This is the main code to write the tree it basically splits the existing structure numbers in chunks of length 50 TODO consider is 50 is a good length.

```

49 \cs_new_protected:Npn \__tag_tree_write_idtree:
50 {
51   \tl_clear:N \l__tag_tmpa_tl
52   \tl_clear:N \l__tag_tmpb_tl
53   \int_zero:N \l__tag_tmpa_int
54   \int_step_inline:nn {\c@g__tag_struct_abs_int}
55   {
56     \int_incr:N\l__tag_tmpa_int
57     \tl_put_right:Nx \l__tag_tmpa_tl
58     {
59       \__tag_struct_get_id:n{##1}~\pdf_object_ref:n{__tag/struct/##1}~

```

```

60     }
61     \int_compare:nNnF {\l__tag_tmpa_int}<{50} %
62     {
63         \pdf_object_unnamed_write:nx {dict}
64         { /Limits~[\__tag_struct_get_id:n{##1-\l__tag_tmpa_int+1}~\__tag_struct_get_id:n{##2-\l__tag_tmpa_int+1}~
65           /Names~[\l__tag_tmpa_tl]
66         }
67         \tl_put_right:Nx\l__tag_tmpb_tl {\pdf_object_ref_last:\c_space_tl}
68         \int_zero:N \l__tag_tmpa_int
69         \tl_clear:N \l__tag_tmpa_tl
70     }
71 }
72 \tl_if_empty:NF \l__tag_tmpa_tl
73 {
74     \pdf_object_unnamed_write:nx {dict}
75     {
76         /Limits~
77         [\__tag_struct_get_id:n{\c@g__tag_struct_abs_int-\l__tag_tmpa_int+1}~
78         \__tag_struct_get_id:n{\c@g__tag_struct_abs_int}]
79         /Names~[\l__tag_tmpa_tl]
80     }
81     \tl_put_right:Nx\l__tag_tmpb_tl {\pdf_object_ref_last:}
82 }
83 \pdf_object_unnamed_write:nx {dict}{/Kids~[\l__tag_tmpb_tl]}
84 \__tag_prop_gput:cnx
85   { g__tag_struct_0_prop }
86   { IDTree }
87   { \pdf_object_ref_last: }
88 }

```

## 1.4 Writing structure elements

The following commands are needed to write out the structure.

```

\__tag_tree_write_structtreeroot: This writes out the root object.
89 \pdf_version_compare:NnTF < {2.0}
90 {
91     \cs_new_protected:Npn \__tag_tree_write_structtreeroot:
92     {
93         \__tag_prop_gput:cnx
94         { g__tag_struct_0_prop }
95         { ParentTree }
96         { \pdf_object_ref:n { __tag/tree/parenttree } }
97         \__tag_prop_gput:cnx
98         { g__tag_struct_0_prop }
99         { RoleMap }
100        { \pdf_object_ref:n { __tag/tree/rolemap } }
101        \__tag_struct_fill_kid_key:n { 0 }
102        \__tag_struct_get_dict_content:nN { 0 } \l__tag_tmpa_tl
103        \pdf_object_write:nnx
104        { __tag/struct/0 }
105        {dict}
106        {
107            \l__tag_tmpa_tl

```

```

108         }
109     }
110 }
no RoleMap in pdf 2.0
111 {
112     \cs_new_protected:Npn \__tag_tree_write_structtreeroot:
113     {
114         \__tag_prop_gput:cnx
115         { g__tag_struct_0_prop }
116         { ParentTree }
117         { \pdf_object_ref:n { __tag/tree/parenttree } }
118         \__tag_struct_fill_kid_key:n { 0 }
119         \__tag_struct_get_dict_content:nN { 0 } \l__tag_tmpa_tl
120         \pdf_object_write:nnx
121         { __tag/struct/0 }
122         {dict}
123         {
124             \l__tag_tmpa_tl
125         }
126     }
127 }

```

(End definition for \\_\_tag\_tree\_write\_structtreeroot:.)

\\_\_tag\_tree\_write\_structelements: This writes out the other struct elems, the absolute number is in the counter.

```

128 \cs_new_protected:Npn \__tag_tree_write_structelements:
129 {
130     \int_step_inline:nnnn {1}{1}{\c@g__tag_struct_abs_int}
131     {
132         \__tag_struct_write_obj:n { ##1 }
133     }
134 }

```

(End definition for \\_\_tag\_tree\_write\_structelements:.)

## 1.5 ParentTree

\_\_tag/tree/parenttree The object which will hold the parenttree

```

135 \pdf_object_new:n { __tag/tree/parenttree }

```

(End definition for \_\_tag/tree/parenttree.)

The ParentTree maps numbers to objects or (if the number represents a page) to arrays of objects. The numbers refer to two distinct types of entries: page streams and real objects like annotations. The numbers must be distinct and ordered. So we rely on abspage for the pages and put the real objects at the end. We use a counter to have a chance to get the correct number if code is processed twice.

\c@g\_\_tag\_parenttree\_obj\_int This is a counter for the real objects. It starts at the absolute last page value. It relies on l3ref.

```

136 \newcounter { g__tag_parenttree_obj_int }
137 \hook_gput_code:nnn{begindocument}{tagpdf}
138 {
139     \int_gset:Nn

```

```

140 \c@g__tag_parenttree_obj_int
141 { \_tag_ref_value_lastpage:nn{abspage}{100} }
142 }

```

(End definition for \c@g\_\_tag\_parenttree\_obj\_int.)

We store the number/object references in a tl-var. If more structure is needed one could switch to a seq.

\g\_\_tag\_parenttree\_objr\_tl

```

143 \tl_new:N \g__tag_parenttree_objr_tl

```

(End definition for \g\_\_tag\_parenttree\_objr\_tl.)

\\_tag\_parenttree\_add\_objr:nn

This command stores a StructParent number and a objref into the tl var. This is only for objects like annotations, pages are handled elsewhere.

```

144 \cs_new_protected:Npn \_tag_parenttree_add_objr:nn #1 #2 %1 StructParent number, #2 objref
145 {
146   \tl_gput_right:Nx \g__tag_parenttree_objr_tl
147   {
148     #1 \c_space_tl #2 ^^J
149   }
150 }

```

(End definition for \\_tag\_parenttree\_add\_objr:nn.)

\l\_\_tag\_parenttree\_content\_tl

A tl-var which will get the page related parenttree content.

```

151 \tl_new:N \l__tag_parenttree_content_tl

```

(End definition for \l\_\_tag\_parenttree\_content\_tl.)

\\_tag\_tree\_fill\_parenttree:

This is the main command to assemble the page related entries of the parent tree. It wanders through the pages and the mcid numbers and collects all mcid of one page.

```

152 \cs_new_protected:Npn \_tag_tree_parenttree_rerun_msg: {}
153 \cs_new_protected:Npn \_tag_tree_fill_parenttree:
154 {
155   \int_step_inline:nnnn{1}{1}{\_tag_ref_value_lastpage:nn{abspage}{-1}} %not quite clear if
156   { %page ##1
157     \prop_clear:N \l__tag_tmpa_prop
158     \int_step_inline:nnnn{1}{1}{\_tag_ref_value_lastpage:nn{tagmcabs}{-1}}
159     {
160       %mcid###1
161       \int_compare:nT
162       {\_tag_ref_value:enn{mcid-###1}{tagabspage}{-1}=##1} %mcid is on current page
163       {% yes
164         \prop_put:Nxx
165         \l__tag_tmpa_prop
166         {\_tag_ref_value:enn{mcid-###1}{tagmcid}{-1}}
167         {\prop_item:Nn \g__tag_mc_parenttree_prop {###1}}
168       }
169     }
170     \tl_put_right:Nx\l__tag_parenttree_content_tl
171     {
172       \int_eval:n {##1-1}\c_space_tl
173       [\c_space_tl %]
174     }

```

```

175 \int_step_inline:nnnn
176 {0}
177 {1}
178 { \prop_count:N \l__tag_tmpa_prop -1 }
179 {
180   \prop_get:NnNTF \l__tag_tmpa_prop {###1} \l__tag_tmpa_tl
181   {% page#1:mcid##1:\l__tag_tmpa_tl :content
182     \tl_put_right:Nx \l__tag_parenttree_content_tl
183     {
184       \pdf_object_if_exist:eT { __tag/struct/\l__tag_tmpa_tl }
185       {
186         \pdf_object_ref:e { __tag/struct/\l__tag_tmpa_tl }
187       }
188       \c_space_tl
189     }
190   }
191   {
192     \cs_set_protected:Npn \__tag_tree_parenttree_rerun_msg:
193     {
194       \msg_warning:nn { tag } {tree-mcid-index-wrong}
195     }
196   }
197 }
198 \tl_put_right:Nn
199 \l__tag_parenttree_content_tl
200 {%[
201   ]^^J
202 }
203 }
204 }

```

(End definition for \\_\_tag\_tree\_fill\_parenttree:.)

\\_\_tag\_tree\_lua\_fill\_parenttree: This is a special variant for luatex. lua mode must/can do it differently.

```

205 \cs_new_protected:Npn \__tag_tree_lua_fill_parenttree:
206 {
207   \tl_set:Nn \l__tag_parenttree_content_tl
208   {
209     \lua_now:e
210     {
211       ltx.__tag.func.output_parenttree
212       (
213         \int_use:N\g_shipout_readonly_int
214       )
215     }
216   }
217 }

```

(End definition for \\_\_tag\_tree\_lua\_fill\_parenttree:.)

\\_\_tag\_tree\_write\_parenttree: This combines the two parts and writes out the object. TODO should the check for lua be moved into the backend code?

```

218 \cs_new_protected:Npn \__tag_tree_write_parenttree:
219 {

```

```

220     \bool_if:NTF \g__tag_mode_lua_bool
221     {
222       \__tag_tree_lua_fill_parenttree:
223     }
224     {
225       \__tag_tree_fill_parenttree:
226     }
227     \__tag_tree_parenttree_rerun_msg:
228     \tl_put_right:NV \l__tag_parenttree_content_tl\g__tag_parenttree_objr_tl
229     \pdf_object_write:nmx { __tag/tree/parenttree }{dict}
230     {
231       /Nums\c_space_tl [\l__tag_parenttree_content_tl]
232     }
233   }

```

(End definition for \\_\_tag\_tree\_write\_parenttree:.)

## 1.6 Rolemap dictionary

The Rolemap dictionary describes relations between new tags and standard types. The main part here is handled in the role module, here we only define the command which writes it to the PDF.

```

__tag/tree/rolemap At first we reserve again an object.
234 \pdf_version_compare:NnT < {2.0}
235 {
236   \pdf_object_new:n { __tag/tree/rolemap }
237 }

```

(End definition for \_\_tag/tree/rolemap.)

\\_\_tag\_tree\_write\_rolemap: This writes out the rolemap, basically it simply pushes out the dictionary which has been filled in the role module.

```

238 \pdf_version_compare:NnTF < {2.0}
239 {
240   \cs_new_protected:Npn \__tag_tree_write_rolemap:
241   {
242     \prop_map_inline:Nn\g__tag_role_rolemap_prop
243     {
244       \tl_if_eq:nnF {##1}{##2}
245       {
246         \pdfdict_gput:nmx {g__tag_role/RoleMap_dict}
247         {##1}
248         {\pdf_name_from_unicode_e:n{##2}}
249       }
250     }
251     \pdf_object_write:nmx { __tag/tree/rolemap }{dict}
252     {
253       \pdfdict_use:n{g__tag_role/RoleMap_dict}
254     }
255   }
256 }
257 {
258   \cs_new_protected:Npn \__tag_tree_write_rolemap: {}

```

```
259     }
```

```
260
```

(End definition for `\_tag_tree_write_rolemap:.`)

## 1.7 Classmap dictionary

Classmap and attributes are setup in the struct module, here is only the code to write it out. It should only done if values have been used.

```
\_tag_tree_write_classmap:
```

```
261 \cs_new_protected:Npn \_tag_tree_write_classmap:
262 {
263   \tl_clear:N \l__tag_tmpa_tl
264   \seq_gremove_duplicates:N \g__tag_attr_class_used_seq
265   \seq_set_map:NNn \l__tag_tmpa_seq \g__tag_attr_class_used_seq
266   {
267     ##1\c_space_tl
268     <<
269     \prop_item:Nn
270     \g__tag_attr_entries_prop
271     {##1}
272     >>
273   }
274   \tl_set:Nx \l__tag_tmpa_tl
275   {
276     \seq_use:Nn
277     \l__tag_tmpa_seq
278     { \iow_newline: }
279   }
280   \tl_if_empty:NF
281   \l__tag_tmpa_tl
282   {
283     \pdf_object_new:n { __tag/tree/classmap }
284     \pdf_object_write:nxx
285     { __tag/tree/classmap }
286     {dict}
287     { \l__tag_tmpa_tl }
288     \_tag_prop_gput:cnx
289     { g__tag_struct_0_prop }
290     { ClassMap }
291     { \pdf_object_ref:n { __tag/tree/classmap } }
292   }
293 }
```

(End definition for `\_tag_tree_write_classmap:.`)

## 1.8 Namespaces

Namespaces are handle in the role module, here is the code to write them out. Namespaces are only relevant for pdf2.0.

```
__tag/tree/namespaces
```

```
294 \pdf_object_new:n { __tag/tree/namespaces }
```

(End definition for `__tag/tree/namespaces`.)

`__tag_tree_write_namespaces:`

```

295 \cs_new_protected:Npn \__tag_tree_write_namespaces:
296 {
297   \pdf_version_compare:NnF < {2.0}
298   {
299     \prop_map_inline:Nn \g__tag_role_NS_prop
300     {
301       \pdfdict_if_empty:nF {g__tag_role/RoleMapNS_##1_dict}
302       {
303         \pdf_object_write:nxx {__tag/RoleMapNS/##1}{dict}
304         {
305           \pdfdict_use:n {g__tag_role/RoleMapNS_##1_dict}
306         }
307         \pdfdict_gput:nxx{g__tag_role/namespace_##1_dict}
308         {RoleMapNS}{\pdf_object_ref:n {__tag/RoleMapNS/##1}}
309       }
310       \pdf_object_write:nxx{tag/NS/##1}{dict}
311       {
312         \pdfdict_use:n {g__tag_role/namespace_##1_dict}
313       }
314     }
315     \pdf_object_write:nxx {__tag/tree/namespaces}{array}
316     {
317       \prop_map_tokens:Nn \g__tag_role_NS_prop{\use_ii:nn}
318     }
319   }
320 }

```

(End definition for `__tag_tree_write_namespaces:.`)

## 1.9 Finishing the structure

This assembles the various parts. TODO (when tabular are done or if someone requests it): IDTree

`__tag_finish_structure:`

```

321 \hook_new:n {tagpdf/finish/before}
322 \cs_new_protected:Npn \__tag_finish_structure:
323 {
324   \bool_if:NT\g__tag_active_tree_bool
325   {
326     \hook_use:n {tagpdf/finish/before}
327     \__tag_tree_final_checks:
328     \__tag_tree_write_parenttree:
329     \__tag_tree_write_idtree:
330     \__tag_tree_write_rolemap:
331     \__tag_tree_write_classmap:
332     \__tag_tree_write_namespaces:
333     \__tag_tree_write_structelements: %this is rather slow!!
334     \__tag_tree_write_structtreeroot:
335   }
336 }

```



(End definition for `\_tag_finish_structure:.`)

## 1.10 StructParents entry for Page

We need to add to the Page resources the `StructParents` entry, this is simply the absolute page number.

```
337 \hook_gput_code:nnn{begindocument}{tagpdf}  
338 {  
339   \bool_if:NT\g__tag_active_tree_bool  
340   {  
341     \hook_gput_code:nnn{shipout/before} { tagpdf/structparents }  
342     {  
343       \pdfmanagement_add:nnx  
344       { Page }  
345       { StructParents }  
346       { \int_eval:n { \g_shipout_readonly_int } }  
347     }  
348   }  
349 }  
350 </package>
```

## Part IV

# The **tagpdf-mc-shared** module

## Code related to Marked Content (mc-chunks), code shared by all modes

## Part of the tagpdf package

### 1 Public Commands

---

<code>\tag_mc_begin:n</code>	<code>\tag_mc_begin:n{&lt;key-values&gt;}</code>
<code>\tag_mc_end:</code>	<code>\tag_mc_end:</code>

---

These commands insert the end code of the marked content. They don't end a group and in generic mode it doesn't matter if they are in another group as the starting commands. In generic mode both commands check if they are correctly nested and issue a warning if not.

---

<code>\tag_mc_use:n</code>	<code>\tag_mc_use:n{&lt;label&gt;}</code>
----------------------------	---

---

These command allow to record a marked content that was stashed away before into the current structure. A marked content can be used only once – the command will issue a warning if an mc is use a second time.

---

<code>\tag_mc_artifact_group_begin:n</code>	<code>\tag_mc_artifact_group_begin:n {&lt;name&gt;}</code>
<code>\tag_mc_artifact_group_end:</code>	<code>\tag_mc_artifact_group_end:</code>

---

New: 2019-11-20

This command pair creates a group with an artifact marker at the begin and the end. Inside the group the tagging commands are disabled. It allows to mark a complete region as artifact without having to worry about user commands with tagging commands. `<name>` should be a value allowed also for the **artifact** key. It pushes and pops mc-chunks at the begin and end. TODO: document is in tagpdf.tex

---

<code>\tag_mc_end_push:</code>	<code>\tag_mc_end_push:</code>
<code>\tag_mc_begin_pop:n</code>	<code>\tag_mc_begin_pop:n{&lt;key-values&gt;}</code>

---

New: 2021-04-22

If there is an open mc chunk, `\tag_mc_end_push:` ends it and pushes its tag of the (global) stack. If there is no open chunk, it puts `-1` on the stack (for debugging) `\tag_mc_begin_pop:n` removes a value from the stack. If it is different from `-1` it opens a tag with it. The reopened mc chunk loses info like the alt text for now.

---

<code>\tag_mc_if_in_p: *</code>	<code>\tag_mc_if_in:TF {&lt;true code&gt;} {&lt;false code&gt;}</code>
<code>\tag_mc_if_in:TF *</code>	Determines if a mc-chunk is open.

---

## 2 Public keys

The following keys can be used with `\tag_mc_begin:n`, `\tagmcbegin`, `\tag_mc_begin_pop:n`,

---

---

**`tag_␣(mc-key)`** This key is required, unless artifact is used. The value is a tag like P or H1 without a slash at the begin, this is added by the code. It is possible to setup new tags. The value of the key is expanded, so it can be a command. The expansion is passed unchanged to the PDF, so it should with a starting slash give a valid PDF name (some ascii with numbers like H4 is fine).

---

---

**`artifact_␣(mc-key)`** This will setup the marked content as an artifact. The key should be used for content that should be ignored. The key can take one of the values **pagination**, **layout**, **page**, **background** and **notype** (this is the default).

---

---

**`raw_␣(mc-key)`** This key allows to add more entries to the properties dictionary. The value must be correct, low-level PDF. E.g. `raw=/Alt (Hello)` will insert an alternative Text.

---

---

**`alt_␣(mc-key)`** This key inserts an `/Alt` value in the property dictionary of the BDC operator. The value is handled as verbatim string, commands are not expanded. The value will be expanded first once. If it is empty, nothing will happen.

---

---

**`actualtext_␣(mc-key)`** This key inserts an `/ActualText` value in the property dictionary of the BDC operator. The value is handled as verbatim string, commands are not expanded. The value will be expanded first once. If it is empty, nothing will happen.

---

---

**`label_␣(mc-key)`** This key sets a label by which one can call the marked content later in another structure (if it has been stashed with the **stash** key). Internally the label name will start with `tagpdf-`.

---

---

**`stash_␣(mc-key)`** This “stashes” an mc-chunk: it is not inserted into the current structure. It should be normally be used along with a label to be able to use the mc-chunk in another place.

The code is splitted into three parts: code shared by all engines, code specific to luamode and code not used by luamode.

## 3 Marked content code – shared

```

1 <@@=tag>
2 <*header>
3 \ProvidesExplPackage {tagpdf-mc-code-shared} {2023-05-16} {0.98g}
4   {part of tagpdf - code related to marking chunks -
5     code shared by generic and luamode }
6 </header>

```

### 3.1 Variables and counters

MC chunks must be counted. I use a latex counter for the absolute count, so that it is added to `\cl@@ckpt` and restored e.g. in tabulars and align. `\int_new:N \c@g_@@_MCID_int` and `\tl_put_right:Nn\cl@@ckpt{\@elt{g_uf_test_int}}` would work too, but as the name is not expl3 then too, why bother? The absolute counter can be used to label and to check if the page counter needs a reset.

`g__tag_MCID_abs_int`

```
7 (*shared)
8 \newcounter { g__tag_MCID_abs_int }
```

(End definition for `g__tag_MCID_abs_int`.)

`__tag_get_mc_abs_cnt:` A (expandable) function to get the current value of the cnt.

```
9 \cs_new:Npn __tag_get_mc_abs_cnt: { \int_use:N \c@g__tag_MCID_abs_int }
```

(End definition for `__tag_get_mc_abs_cnt:`.)

`g__tag_MCID_tmp_bypage_int`

The following hold the temporary by page number assigned to a mc. It must be defined in the shared code to avoid problems with labels.

```
10 \int_new:N g__tag_MCID_tmp_bypage_int
```

(End definition for `g__tag_MCID_tmp_bypage_int`.)

`g__tag_in_mc_bool`

This booleans record if a mc is open, to test nesting.

```
11 \bool_new:N g__tag_in_mc_bool
```

(End definition for `g__tag_in_mc_bool`.)

`g__tag_mc_parenttree_prop`

For every chunk we need to know the structure it is in, to record this in the parent tree. We store this in a property.

key: absolute number of the mc (tagmcabs)

value: the structure number the mc is in

```
12 __tag_prop_new:N g__tag_mc_parenttree_prop
```

(End definition for `g__tag_mc_parenttree_prop`.)

`g__tag_mc_parenttree_prop`

Some commands (e.g. links) want to close a previous mc and reopen it after they did their work. For this we create a stack:

```
13 \seq_new:N g__tag_mc_stack_seq
```

(End definition for `g__tag_mc_parenttree_prop`.)

`l__tag_mc_artifact_type_tl`

Artifacts can have various types like Pagination or Layout. This stored in this variable.

```
14 \tl_new:N l__tag_mc_artifact_type_tl
```

(End definition for `l__tag_mc_artifact_type_tl`.)

`l__tag_mc_key_stash_bool`

This booleans store the stash and artifact status of the mc-chunk.

`l__tag_mc_artifact_bool`

```
15 \bool_new:N l__tag_mc_key_stash_bool
```

```
16 \bool_new:N l__tag_mc_artifact_bool
```

(End definition for `l__tag_mc_key_stash_bool` and `l__tag_mc_artifact_bool`.)

`\l__tag_mc_key_tag_tl` Variables used by the keys. `\l_@@mc_key_properties_tl` will collect a number of values. TODO: should this be a pdfdict now?  
`\g__tag_mc_key_tag_tl`  
`\l__tag_mc_key_label_tl` `\tl_new:N \l__tag_mc_key_tag_tl`  
`\l__tag_mc_key_properties_tl` `\tl_new:N \g__tag_mc_key_tag_tl`  
`\tl_new:N \l__tag_mc_key_label_tl`  
`\tl_new:N \l__tag_mc_key_properties_tl`  
*(End definition for \l\_\_tag\_mc\_key\_tag\_tl and others.)*

## 3.2 Functions

`\__tag_mc_handle_mc_label:n` The commands labels a mc-chunk. It is used if the user explicitly labels the mc-chunk with the `label` key. The argument is the value provided by the user. It stores the attributes  
`tagabspace`: the absolute page, `\g_shipout_readonly_int`,  
`tagmcabs`: the absolute mc-counter `\c@g_@@MCID_abs_int`,  
`tagmcid`: the ID of the chunk on the page `\g_@@MCID_tmp_bypage_int`, this typically settles down after a second compilation. The reference command is defined in `tagpdf.dtx` and is based on `l3ref`.  
`\cs_new:Nn \__tag_mc_handle_mc_label:n`  
`{`  
`\__tag_ref_label:en{tagpdf-#1}{mc}`  
`}`  
*(End definition for \\_\_tag\_mc\_handle\_mc\_label:n.)*

`\__tag_mc_set_label_used:n` Unlike with structures we can't check if a labeled mc has been used by looking at the P key, so we use a dedicated csname for the test  
`\cs_new_protected:Npn \__tag_mc_set_label_used:n #1 %#1 labelname`  
`{`  
`\tl_new:c { g__tag_mc_label_\tl_to_str:n{#1}_used_tl }`  
`}`  
`</shared>`  
*(End definition for \\_\_tag\_mc\_set\_label\_used:n.)*

`\tag_mc_use:n` These command allow to record a marked content that was stashed away before into the current structure. A marked content can be used only once – the command will issue a warning if an mc is use a second time. The argument is a label name set with the `label` key.

TODO: is testing for struct the right test?

`<base>\cs_new_protected:Npn \tag_mc_use:n #1 { \__tag_whatsits: }`  
`<shared>`  
`\cs_set_protected:Npn \tag_mc_use:n #1 %#1: label name`  
`{`  
`\__tag_check_if_active_struct:T`  
`{`  
`\tl_set:Nx \l__tag_tmpa_tl { \__tag_ref_value:nnn{tagpdf-#1}{tagmcabs}{ } }`  
`\tl_if_empty:NTF\l__tag_tmpa_tl`  
`{`  
`\msg_warning:nnn {tag} {mc-label-unknown} {#1}`  
`}`  
`}`  
`{`

```

42         \cs_if_free:cTF { g__tag_mc_label_\tl_to_str:n{#1}_used_tl }
43         {
44             \__tag_mc_handle_stash:x { \l__tag_tmpa_tl }
45             \__tag_mc_set_label_used:n {#1}
46         }
47         {
48             \msg_warning:nnn {tag}{mc-used-twice}{#1}
49         }
50     }
51 }
52 }
53 </shared>

```

(End definition for \tag\_mc\_use:n. This function is documented on page 58.)

**\tag\_mc\_artifact\_group\_begin:n** This opens an artifact of the type given in the argument, and then stops all tagging. It creates a group. It pushes and pops mc-chunks at the begin and end.

**\tag\_mc\_artifact\_group\_end:**

```

54 <base>\cs_new_protected:Npn \tag_mc_artifact_group_begin:n #1 {}
55 <base>\cs_new_protected:Npn \tag_mc_artifact_group_end: {}
56 <*shared>
57 \cs_set_protected:Npn \tag_mc_artifact_group_begin:n #1
58 {
59     \tag_mc_end_push:
60     \tag_mc_begin:n {artifact=#1}
61     \tag_stop_group_begin:
62 }
63
64 \cs_set_protected:Npn \tag_mc_artifact_group_end:
65 {
66     \tag_stop_group_end:
67     \tag_mc_end:
68     \tag_mc_begin_pop:n {}
69 }
70 </shared>

```

(End definition for \tag\_mc\_artifact\_group\_begin:n and \tag\_mc\_artifact\_group\_end:. These functions are documented on page 58.)

**\tag\_mc\_end\_push:**

**\tag\_mc\_begin\_pop:n**

```

71 <base>\cs_new_protected:Npn \tag_mc_end_push: {}
72 <base>\cs_new_protected:Npn \tag_mc_begin_pop:n #1 {}
73 <*shared>
74 \cs_set_protected:Npn \tag_mc_end_push:
75 {
76     \__tag_check_if_active_mc:T
77     {
78         \__tag_mc_if_in:TF
79         {
80             \seq_gpush:Nx \g__tag_mc_stack_seq { \tag_get:n {mc_tag} }
81             \__tag_check_mc_pushed_popped:nn
82             { pushed }
83             { \tag_get:n {mc_tag} }
84             \tag_mc_end:
85         }
86     }

```

```

87         \seq_gpush:Nn \g__tag_mc_stack_seq {-1}
88         \__tag_check_mc_pushed_popped:nn { pushed }{-1}
89     }
90 }
91 }
92
93 \cs_set_protected:Npn \tag_mc_begin_pop:n #1
94 {
95     \__tag_check_if_active_mc:T
96     {
97         \seq_gpop:NNTF \g__tag_mc_stack_seq \l__tag_tmpa_tl
98         {
99             \tl_if_eq:NnTF \l__tag_tmpa_tl {-1}
100             {
101                 \__tag_check_mc_pushed_popped:nn {popped}{-1}
102             }
103             {
104                 \__tag_check_mc_pushed_popped:nn {popped}{\l__tag_tmpa_tl}
105                 \tag_mc_begin:n {tag=\l__tag_tmpa_tl,#1}
106             }
107         }
108         {
109             \__tag_check_mc_pushed_popped:nn {popped}{empty~stack,~nothing}
110         }
111     }
112 }

```

(End definition for \tag\_mc\_end\_push: and \tag\_mc\_begin\_pop:n. These functions are documented on page 58.)

### 3.3 Keys

This are the keys where the code can be shared between the modes.

**stash\_(mc-key)** the two internal artifact keys are use to define the public artifact. For now we add support for the subtypes Header and Footer. Watermark,PageNum, LineNum,Redaction,Bates will be added if some use case emerges. If some use case for /BBox and /Attached emerges, it will be perhaps necessary to adapt the code.

```

113 \keys_define:nn { __tag / mc }
114 {
115     stash .bool_set:N = \l__tag_mc_key_stash_bool,
116     __artifact-bool .bool_set:N = \l__tag_mc_artifact_bool,
117     __artifact-type .choice:,
118     __artifact-type / pagination .code:n =
119     {
120         \tl_set:Nn \l__tag_mc_artifact_type_tl { Pagination }
121     },
122     __artifact-type / pagination/header .code:n =
123     {
124         \tl_set:Nn \l__tag_mc_artifact_type_tl { Pagination/Subtype/Header }
125     },
126     __artifact-type / pagination/footer .code:n =
127     {
128         \tl_set:Nn \l__tag_mc_artifact_type_tl { Pagination/Subtype/Footer }

```

```

129     },
130     __artifact-type / layout      .code:n    =
131     {
132         \tl_set:Nn \l__tag_mc_artifact_type_tl { Layout }
133     },
134     __artifact-type / page        .code:n    =
135     {
136         \tl_set:Nn \l__tag_mc_artifact_type_tl { Page }
137     },
138     __artifact-type / background .code:n    =
139     {
140         \tl_set:Nn \l__tag_mc_artifact_type_tl { Background }
141     },
142     __artifact-type / notype      .code:n    =
143     {
144         \tl_set:Nn \l__tag_mc_artifact_type_tl {}
145     },
146     __artifact-type /           .code:n    =
147     {
148         \tl_set:Nn \l__tag_mc_artifact_type_tl {}
149     },
150 }

```

(End definition for stash (mc-key), \_\_artifact-bool, and \_\_artifact-type. This function is documented on page 59.)

```

151 </shared>

```



## Part V

# The tagpdf-mc-generic module

## Code related to Marked Content (mc-chunks), generic mode

### Part of the tagpdf package

#### 1 Marked content code – generic mode

```
1 <@@=tag>
2 <*generic>
3 \ProvidesExplPackage {tagpdf-mc-code-generic} {2023-05-16} {0.98g}
4 {part of tagpdf - code related to marking chunks - generic mode}
5 </generic>
6 <*debug>
7 \ProvidesExplPackage {tagpdf-debug-generic} {2023-05-16} {0.98g}
8 {part of tagpdf - debugging code related to marking chunks - generic mode}
9 </debug>
```

##### 1.1 Variables

`\g__tag_MCID_byabspage_prop` This property will hold the current maximum on a page it will contain key-value of type  $\langle abspagenum \rangle = \langle max\ mcid \rangle$

```
10 <*generic>
11 \__tag_prop_new:N \g__tag_MCID_byabspage_prop
```

(End definition for `\g__tag_MCID_byabspage_prop`.)

`\l__tag_mc_ref_abspage_tl` We need a ref-label system to ensure that the MCID cnt restarts at 0 on a new page This will be used to store the tagabspage attribute retrieved from a label.

```
12 \tl_new:N \l__tag_mc_ref_abspage_tl
```

(End definition for `\l__tag_mc_ref_abspage_tl`.)

`\l__tag_mc_tmpa_tl` temporary variable

```
13 \tl_new:N \l__tag_mc_tmpa_tl
```

(End definition for `\l__tag_mc_tmpa_tl`.)

`\g__tag_mc_marks` a marks register to keep track of the mc's at page breaks and a sequence to keep track of the data for the continuation extra-tmb. We probably will need to track mc-marks in more than one stream, so the seq contains the name of the stream.

```
14 \newmarks \g__tag_mc_marks
```

(End definition for `\g__tag_mc_marks`.)

`\g__tag_mc_main_marks_seq` Each stream has an associated global seq variable holding the bottom marks from the/a previous chunk in the stream. We provide three by default: main, footnote and multicol.  
`\g__tag_mc_footnote_marks_seq`   
`\g__tag_mc_multicol_marks_seq` TODO: perhaps an interface for more streams will be needed.

```
15 \seq_new:N \g__tag_mc_main_marks_seq
16 \seq_new:N \g__tag_mc_footnote_marks_seq
17 \seq_new:N \g__tag_mc_multicol_marks_seq
```

(End definition for `\g__tag_mc_main_marks_seq`, `\g__tag_mc_footnote_marks_seq`, and `\g__tag_mc_multicol_marks_seq`.)

`\l__tag_mc_firstmarks_seq` The marks content contains a number of data which we will have to access and compare, so we will store it locally in two sequences. topmarks is unusable in LaTeX so we ignore it.  
`\l__tag_mc_botmarks_seq`

```
18 \seq_new:N \l__tag_mc_firstmarks_seq
19 \seq_new:N \l__tag_mc_botmarks_seq
```

(End definition for `\l__tag_mc_firstmarks_seq` and `\l__tag_mc_botmarks_seq`.)

## 1.2 Functions

`\__tag_mc_begin_marks:nn` Generic mode need to set marks for the page break and split stream handling. We always set two marks to be able to detect the case when no mark is on a page/galley. MC-begin commands will set (b,-,data) and (b+,data), MC-end commands will set (e,-,data) and (e+,data).

```
20 \cs_new_protected:Npn \__tag_mc_begin_marks:nn #1 #2 % #1 tag, #2 label
21 {
22   \tex_marks:D \g__tag_mc_marks
23   {
24     b-, %first of begin pair
25     \int_use:N\c@g__tag_MCID_abs_int, %mc-num
26     \g__tag_struct_stack_current_tl, %structure num
27     #1, %tag
28     \bool_if:NT \l__tag_mc_key_stash_bool{stash}, % stash info
29     #2, %label
30   }
31   \tex_marks:D \g__tag_mc_marks
32   {
33     b+, % second of begin pair
34     \int_use:N\c@g__tag_MCID_abs_int, %mc-num
35     \g__tag_struct_stack_current_tl, %structure num
36     #1, %tag
37     \bool_if:NT \l__tag_mc_key_stash_bool{stash}, % stash info
38     #2, %label
39   }
40 }
41 \cs_generate_variant:Nn \__tag_mc_begin_marks:nn {oo}
42 \cs_new_protected:Npn \__tag_mc_artifact_begin_marks:n #1 % #1 type
43 {
44   \tex_marks:D \g__tag_mc_marks
45   {
46     b-, %first of begin pair
47     \int_use:N\c@g__tag_MCID_abs_int, %mc-num
48     -1, %structure num
```

```

49     #1 %type
50   }
51   \tex_marks:D \g__tag_mc_marks
52   {
53     b+, %first of begin pair
54     \int_use:N\c@g__tag_MCID_abs_int, %mc-num
55     -1, %structure num
56     #1 %Type
57   }
58 }
59
60 \cs_new_protected:Npn \__tag_mc_end_marks:
61 {
62   \tex_marks:D \g__tag_mc_marks
63   {
64     e-, %first of end pair
65     \int_use:N\c@g__tag_MCID_abs_int, %mc-num
66     \g__tag_struct_stack_current_tl, %structure num
67   }
68   \tex_marks:D \g__tag_mc_marks
69   {
70     e+, %second of end pair
71     \int_use:N\c@g__tag_MCID_abs_int, %mc-num
72     \g__tag_struct_stack_current_tl, %structure num
73   }
74 }

```

(End definition for `\__tag_mc_begin_marks:nn`, `\__tag_mc_artifact_begin_marks:n`, and `\__tag_mc_end_marks:.`)

`\__tag_mc_disable_marks:` This disables the marks. They can't be reenabled, so it should only be used in groups.

```

75 \cs_new_protected:Npn \__tag_mc_disable_marks:
76 {
77   \cs_set_eq:NN \__tag_mc_begin_marks:nn \use_none:nn
78   \cs_set_eq:NN \__tag_mc_artifact_begin_marks:n \use_none:n
79   \cs_set_eq:NN \__tag_mc_end_marks: \prg_do_nothing:
80 }

```

(End definition for `\__tag_mc_disable_marks:.`)

`\__tag_mc_get_marks:` This stores the current content of the marks in the sequences. It naturally should only be used in places where it makes sense.

```

81 \cs_new_protected:Npn \__tag_mc_get_marks:
82 {
83   \exp_args:NNx
84   \seq_set_from_clist:Nn \l__tag_mc_firstmarks_seq
85   { \tex_firstmarks:D \g__tag_mc_marks }
86   \exp_args:NNx
87   \seq_set_from_clist:Nn \l__tag_mc_botmarks_seq
88   { \tex_botmarks:D \g__tag_mc_marks }
89 }

```

(End definition for `\__tag_mc_get_marks:.`)

`\__tag_mc_store:nnn` This inserts the mc-chunk  $\langle mc-num \rangle$  into the structure `struct-num` after the  $\langle mc-prev \rangle$ . The structure must already exist. The additional mcid dictionary is stored in a property. The item is retrieved when the kid entry is built. We test if there is already an addition and append if needed.

```

90 \cs_new_protected:Npn \__tag_mc_store:nnn #1 #2 #3 % #1 mc-prev, #2 mc-num #3 structure-
    num
91 {
92   %\prop_show:N \g__tag_struct_cont_mc_prop
93   \prop_get:NnTF \g__tag_struct_cont_mc_prop {#1} \l__tag_tmpa_tl
94   {
95     \prop_gput:Nnx \g__tag_struct_cont_mc_prop {#1}{ \l__tag_tmpa_tl \__tag_struct_mcid_d
96   }
97   {
98     \prop_gput:Nnx \g__tag_struct_cont_mc_prop {#1}{ \__tag_struct_mcid_dict:n {#2}}
99   }
100   \prop_gput:Nxx \g__tag_mc_parenttree_prop
101     {#2}
102     {#3}
103 }
104 \cs_generate_variant:Nn \__tag_mc_store:nnn {xxx}

```

(End definition for `\__tag_mc_store:nnn`.)

`\__tag_mc_insert_extra_tmb:n` `\__tag_mc_insert_extra_tme:n` These two functions should be used in the output routine at the place where a mc-literal could be missing due to a page break or some other split. They check (with the help of the marks) if a extra-tmb or extra-tme is needed. The tmb command stores also the mc into the structure, the tme has to store the data for a following extra-tmb. The argument takes a stream name like main or footnote to allow different handling there. The content of the marks must be stored before (with `\@@_mc_get_marks:` or manually) into `\l_@@_mc_firstmarks_seq` and `\l_@@_mc_botmarks_seq` so that the tests can use them.

```

105 \cs_new_protected:Npn \__tag_mc_insert_extra_tmb:n #1 % #1 stream: e.g. main or footnote
106 {
107   \__tag_check_typeout_v:n {>~ first~ \seq_use:Nn \l__tag_mc_firstmarks_seq {,~}}
108   \__tag_check_typeout_v:n {>~ bot~ \seq_use:Nn \l__tag_mc_botmarks_seq {,~}}
109   \__tag_check_if_mc_tmb_missing:TF
110   {
111     \__tag_check_typeout_v:n {>~ TMB~ ~ missing~ --- inserted}
112     %test if artifact
113     \int_compare:nNnTF { \seq_item:cn { g__tag_mc_#1_marks_seq } {3} } = {-
114       1}
115       {
116         \tl_set:Nx \l__tag_tmpa_tl { \seq_item:cn { g__tag_mc_#1_marks_seq } {4} }
117         \__tag_mc_handle_artifact:N \l__tag_tmpa_tl
118       }
119       {
120         \exp_args:Nx
121         \__tag_mc_bdc_mcid:n
122         {
123           \seq_item:cn { g__tag_mc_#1_marks_seq } {4}
124         }
125         \str_if_eq:eeTF

```

```

126         \seq_item:cn { g__tag_mc_#1_marks_seq } {5}
127     }
128     {}
129     {
130         %store
131         \__tag_mc_store:xxx
132         {
133             \seq_item:cn { g__tag_mc_#1_marks_seq } {2}
134         }
135         { \int_eval:n{\c@g__tag_MCID_abs_int} }
136         {
137             \seq_item:cn { g__tag_mc_#1_marks_seq } {3}
138         }
139     }
140     {
141         %stashed -> warning!!
142     }
143 }
144 }
145 {
146     \__tag_check_typeout_v:n {=>~ TMB~ not~ missing}
147 }
148 }
149
150 \cs_new_protected:Npn \__tag_mc_insert_extra_tme:n #1 % #1 stream, eg. main or footnote
151 {
152     \__tag_check_if_mc_tme_missing:TF
153     {
154         \__tag_check_typeout_v:n {=>~ TME~ ~ missing~ --- inserted}
155         \__tag_mc_emc:
156         \seq_gset_eq:cN
157         { g__tag_mc_#1_marks_seq }
158         \l__tag_mc_botmarks_seq
159     }
160     {
161         \__tag_check_typeout_v:n {=>~ TME~ not~ missing}
162     }
163 }

```

(End definition for \\_\_tag\_mc\_insert\_extra\_tmb:n and \\_\_tag\_mc\_insert\_extra\_tme:n.)

### 1.3 Looking at MC marks in boxes

\\_\_tag\_add\_missing\_mcs:Nn Assumptions:

- test for tagging active outside;
- mark retrieval also outside.

This takes a box register as its first argument (or the register number in a count register, as used by `multicol`). It adds an extra tmb at the top of the box if necessary and similarly an extra tme at the end. This is done by adding hboxes in a way that the positioning and the baseline of the given box is not altered. The result is written back to the box.

The second argument is the stream this box belongs to and is currently either `main` for the main galley, `footnote` for footnote text, or `multicol` for boxes produced for columns in that environment. Other streams may follow over time.

```

164 \cs_new_protected:Npn \__tag_add_missing_mcs:Nn #1 #2 {
165   \vbadness \@M
166   \vfuzz      \c_max_dim
167   \vbox_set_to_ht:Nnn #1 { \box_ht:N #1 } {
168     \hbox_set:Nn \l__tag_tmpa_box { \__tag_mc_insert_extra_tmb:n {#2} }
169     \hbox_set:Nn \l__tag_tmpb_box { \__tag_mc_insert_extra_tme:n {#2} }
170     \int_compare:nNnT {\l__tag_loglevel_int} > { 0 }
171     {
172       \seq_log:c { g__tag_mc_#2_marks_seq}
173     }

```

The box placed on the top gets zero size and thus will not affect the box dimensions of the box we are modifying.

```

174   \box_set_ht:Nn \l__tag_tmpa_box \c_zero_dim
175   \box_set_dp:Nn \l__tag_tmpa_box \c_zero_dim

```

The box added at the bottom will get the depth of the original box. This way we can arrange that from the outside everything looks as before.

```

176   \box_set_ht:Nn \l__tag_tmpb_box \c_zero_dim
177   \box_set_dp:Nn \l__tag_tmpb_box { \box_dp:N #1 }

```

We need to set `\boxmaxdepth` in case the original box has an unusually large depth, otherwise that depth is not preserved when we string things together.

```

178   \boxmaxdepth \@maxdepth
179   \box_use_drop:N      \l__tag_tmpa_box
180   \vbox_unpack_drop:N  #1

```

Back up by the depth of the box as we add that later again.

```

181   \tex_kern:D -\box_dp:N \l__tag_tmpb_box

```

And we don't want any glue added when we add the box.

```

182   \nointerlineskip
183   \box_use_drop:N \l__tag_tmpb_box
184 }
185 }

```

(End definition for `\__tag_add_missing_mcs:Nn`.)

`\__tag_add_missing_mcs_to_stream:Nn` This is the main command to add mc to the stream. It is therefor guarded by the mc-boolean.

If we aren't in the main stream then processing is a bit more complicated because to get at the marks in the box we need to artificially split it and then look at the split marks.

First argument is the box to update and the second is the "stream". In lua mode the command is a no-op.

```

186 \cs_new_protected:Npn \__tag_add_missing_mcs_to_stream:Nn #1#2
187 {
188   \__tag_check_if_active_mc:T {

```

First set up a temp box for trial splitting.

```

189   \vbadness\maxdimen
190   \box_set_eq:NN \l__tag_tmpa_box #1

```

Split the box to the largest size available. This should give us all content (but to be sure that there is no issue we could test out test box is empty now (not done).

```
191 \vbox_set_split_to_ht:NNn \l__tag_tmpa_box \l__tag_tmpa_box \c_max_dim
```

As a side effect of this split we should now have the first and bottom split marks set up. We use this to set up `\l__tag_mc_firstmarks_seq`

```
192 \exp_args:NNx
193 \seq_set_from_clist:Nn \l__tag_mc_firstmarks_seq
194 { \tex_splitfirstmarks:D \g__tag_mc_marks }
```

Some debugging info:

```
195 % \iow_term:n { First~ mark~ from~ this~ box: }
196 % \seq_log:N \l__tag_mc_firstmarks_seq
```

If this mark was empty then clearly the bottom mark will too be empty. Thus in this case we make use of the saved bot mark from the previous chunk. Note that if this is the first chunk in the stream the global seq would contain a random value, but then we can't end in this branch because the basis assumption is that streams are properly marked up so the first chunk would always have a mark at the beginning!

```
197 \seq_if_empty:NTF \l__tag_mc_firstmarks_seq
198 {
199   \__tag_check_typeout_v:n
200   {
201     No~ marks~ so~ use~ saved~ bot~ mark:~
202     \seq_use:cn {g__tag_mc_#2_marks_seq} {,~} \iow_newline:
203   }
204   \seq_set_eq:Nc \l__tag_mc_firstmarks_seq {g__tag_mc_#2_marks_seq}
```

We also update the bot mark to the same value so that we can later apply `\__tag_add_missing_mcs:Nn` with the data structures in place (see assumptions made there).

```
205 \seq_set_eq:NN \l__tag_mc_botmarks_seq \l__tag_mc_firstmarks_seq
206 }
```

If there was a first mark then there is also a bot mark (and it can't be the same as our marks always come in pairs). So if that branch is chosen we update `\l__tag_mc_botmarks_seq` from the bot mark.

```
207 {
208   \__tag_check_typeout_v:n
209   {
210     Pick~ up~ new~ bot~ mark!
211   }
212   \exp_args:NNx
213   \seq_set_from_clist:Nn \l__tag_mc_botmarks_seq
214   { \tex_splitbotmarks:D \g__tag_mc_marks }
215 }
```

Finally we call `\__tag_add_missing_mcs:Nn` to add any missing tmb/tme as needed,

```
216 \__tag_add_missing_mcs:Nn #1 {#2}
217 %%
218 \seq_gset_eq:cN {g__tag_mc_#2_marks_seq} \l__tag_mc_botmarks_seq
219 %%
220 }
221 }
```

(End definition for `\__tag_add_missing_mcs_to_stream:Nn`.)

`\_tag_mc_if_in_p:` This is a test if a mc is open or not. It depends simply on a global boolean: mc-chunks are added linearly so nesting should not be relevant.

`\_tag_mc_if_in:TF` One exception are header and footer (perhaps they are more, but for now it doesn't seem so, so there are no dedicated code to handle this situation): When they are built and added to the page we could be both inside or outside a mc-chunk. But header and footer should ignore this and not push/pop or warn about nested mc. It is therefore important there to set and reset the boolean manually. See the tagpddocu-patches.sty for an example.

```

222 \prg_new_conditional:Nnn \_tag_mc_if_in: {p,T,F,TF}
223 {
224   \bool_if:NTF \g__tag_in_mc_bool
225   { \prg_return_true: }
226   { \prg_return_false: }
227 }

```

```

228
229 \prg_new_eq_conditional:Nnn \tag_mc_if_in: \_tag_mc_if_in: {p,T,F,TF}

```

(End definition for `\_tag_mc_if_in:TF` and `\tag_mc_if_in:TF`. This function is documented on page 58.)

`\_tag_mc_bmc:n` These are the low-level commands. There are now equal to the pdfmanagement commands generic mode, but we use an indirection in case luamode need something else.

`\_tag_mc_emc:` change 04.08.2018: the commands do not check the validity of the arguments or try to escape them, this should be done before using them.

`\_tag_mc_bdc:nn`

`\_tag_mc_bdc:nx`

```

230 % #1 tag, #2 properties
231 \cs_set_eq:NN \_tag_mc_bmc:n \pdf_bmc:n
232 \cs_set_eq:NN \_tag_mc_emc: \pdf_emc:
233 \cs_set_eq:NN \_tag_mc_bdc:nn \pdf_bdc:nn
234 \cs_generate_variant:Nn \_tag_mc_bdc:nn {nx}

```

(End definition for `\_tag_mc_bmc:n`, `\_tag_mc_emc:`, and `\_tag_mc_bdc:nn`.)

`\_tag_mc_bdc_mcid:nn` This create a BDC mark with an /MCID key. Most of the work here is to get the current number value for the MCID: they must be numbered by page starting with 0 and then successively. The first argument is the tag, e.g. P or Span, the second is used to pass more properties. We also define a wrapper around the low-level command as luamode will need something different.

`\_tag_mc_bdc_mcid:n`

`\_tag_mc_handle_mcid:nn`

`\_tag_mc_handle_mcid:VV`

```

235 \cs_new_protected:Npn \_tag_mc_bdc_mcid:nn #1 #2
236 {
237   \int_gincr:N \c@g__tag_MCID_abs_int
238   \tl_set:Nx \l__tag_mc_ref_abbrev_t1
239   {
240     \_tag_ref_value:enn %3 args
241     {
242       mcid-\int_use:N \c@g__tag_MCID_abs_int
243     }
244     { tagabbrev }
245     {-1}
246   }
247   \prop_get:NoNTF
248   \g__tag_MCID_byabbrev_prop
249   {
250     \l__tag_mc_ref_abbrev_t1

```



```

251     }
252     \l__tag_mc_tmpa_tl
253     {
254         %key already present, use value for MCID and add 1 for the next
255         \int_gset:Nn \g__tag_MCID_tmp_bypage_int { \l__tag_mc_tmpa_tl }
256         \__tag_prop_gput:Nxx
257             \g__tag_MCID_byabspage_prop
258             { \l__tag_mc_ref_abspage_tl }
259             { \int_eval:n { \l__tag_mc_tmpa_tl +1 } }
260     }
261     {
262         %key not present, set MCID to 0 and insert 1
263         \int_gzero:N \g__tag_MCID_tmp_bypage_int
264         \__tag_prop_gput:Nxx
265             \g__tag_MCID_byabspage_prop
266             { \l__tag_mc_ref_abspage_tl }
267             { 1 }
268     }
269     \__tag_ref_label:en
270     {
271         mcid-\int_use:N \c@g__tag_MCID_abs_int
272     }
273     { mc }
274     \__tag_mc_bdc:nx
275     { #1 }
276     { /MCID~\int_eval:n { \g__tag_MCID_tmp_bypage_int } ~ \exp_not:n { #2 } }
277 }
278 \cs_new_protected:Npn \__tag_mc_bdc_mcid:n #1
279 {
280     \__tag_mc_bdc_mcid:nn {#1} {}
281 }
282
283 \cs_new_protected:Npn \__tag_mc_handle_mcid:nn #1 #2 % #1 tag, #2 properties
284 {
285     \__tag_mc_bdc_mcid:nn {#1} {#2}
286 }
287
288 \cs_generate_variant:Nn \__tag_mc_handle_mcid:nn {VV}

```

(End definition for \\_\_tag\_mc\_bdc\_mcid:nn, \\_\_tag\_mc\_bdc\_mcid:n, and \\_\_tag\_mc\_handle\_mcid:nn.)

\\_\_tag\_mc\_handle\_stash:n This is the handler which puts a mc into the the current structure. The argument is the number of the mc. Beside storing the mc into the structure, it also has to record the structure for the parent tree. The name is a bit confusing, it does *not* handle mc with the stash key .... TODO: why does luamode use it for begin + use, but generic mode only for begin?

```

289 \cs_new_protected:Npn \__tag_mc_handle_stash:n #1 %1 mcidnum
290 {
291     \__tag_check_mc_used:n {#1}
292     \__tag_struct_kid_mc_gput_right:nn
293         { \g__tag_struct_stack_current_tl }
294         { #1 }
295     \prop_gput:Nxx \g__tag_mc_parenttree_prop
296         { #1 }

```

```

297     { \g__tag_struct_stack_current_tl }
298   }
299   \cs_generate_variant:Nn \__tag_mc_handle_stash:n { x }

```

(End definition for \\_\_tag\_mc\_handle\_stash:n.)

\\_\_tag\_mc\_bmc\_artifact: Two commands to create artifacts, one without type, and one with. We define also a wrapper handler as luamode will need a different definition. TODO: perhaps later: more properties for artifacts

```

300 \cs_new_protected:Npn \__tag_mc_bmc_artifact:
301   {
302     \__tag_mc_bmc:n {Artifact}
303   }
304 \cs_new_protected:Npn \__tag_mc_bmc_artifact:n #1
305   {
306     \__tag_mc_bdc:nn {Artifact}{/Type/#1}
307   }
308 \cs_new_protected:Npn \__tag_mc_handle_artifact:N #1
309   % #1 is a var containing the artifact type
310   {
311     \int_gincr:N \c@g__tag_MCID_abs_int
312     \tl_if_empty:NTF #1
313       { \__tag_mc_bmc_artifact: }
314       { \exp_args:NV\__tag_mc_bmc_artifact:n #1 }
315   }

```

(End definition for \\_\_tag\_mc\_bmc\_artifact:, \\_\_tag\_mc\_bmc\_artifact:n, and \\_\_tag\_mc\_handle\_artifact:N.)

\\_\_tag\_get\_data\_mc\_tag: This allows to retrieve the active mc-tag. It is use by the get command.

```

316 \cs_new:Nn \__tag_get_data_mc_tag: { \g__tag_mc_key_tag_tl }
317 </generic>

```

(End definition for \\_\_tag\_get\_data\_mc\_tag:.)

\tag\_mc\_begin:n These are the core public commands to open and close an mc. They don't need to be in the same group or grouping level, but the code expect that they are issued linearly. The tag and the state is passed to the end command through a global var and a global boolean.

\tag\_mc\_end:

```

318 <base>\cs_new_protected:Npn \tag_mc_begin:n #1 { \__tag_whatsits: }
319 <base>\cs_new_protected:Nn \tag_mc_end:{ \__tag_whatsits: }
320 <*generic | debug>
321 <*generic>
322 \cs_set_protected:Npn \tag_mc_begin:n #1 %#1 keyval
323   {
324     \__tag_check_if_active_mc:T
325     {
326       </generic>
327       <*debug>
328     }
329   }
330 \cs_set_protected:Npn \tag_mc_begin:n #1 %#1 keyval
331   {
332     \__tag_check_if_active_mc:TF
333     {
334       \__tag_debug_mc_begin_insert:n { #1 }

```

```

333 </debug>
334     \group_begin: %hm
335     \__tag_check_mc_if_nested:
336     \bool_gset_true:N \g__tag_in_mc_bool
337
338 set default MC tags to structure:
339
340     \tl_set_eq:NN \l__tag_mc_key_tag_tl \g__tag_struct_tag_tl
341     \tl_gset_eq:NN \g__tag_mc_key_tag_tl \g__tag_struct_tag_tl
342     \keys_set:nn { __tag / mc } {#1}
343     \bool_if:NTF \l__tag_mc_artifact_bool
344     { %handle artifact
345       \__tag_mc_handle_artifact:N \l__tag_mc_artifact_type_tl
346       \exp_args:NV
347       \__tag_mc_artifact_begin_marks:n \l__tag_mc_artifact_type_tl
348     }
349     { %handle mcid type
350       \__tag_check_mc_tag:N \l__tag_mc_key_tag_tl
351       \__tag_mc_handle_mcid:VV
352         \l__tag_mc_key_tag_tl
353         \l__tag_mc_key_properties_tl
354       \__tag_mc_begin_marks:oof{\l__tag_mc_key_tag_tl}{\l__tag_mc_key_label_tl}
355       \tl_if_empty:NF {\l__tag_mc_key_label_tl}
356       {
357         \exp_args:NV
358         \__tag_mc_handle_mc_label:n \l__tag_mc_key_label_tl
359       }
360       \bool_if:NF \l__tag_mc_key_stash_bool
361       {
362         \exp_args:NV \__tag_struct_get_parentrole:nNN
363         \g__tag_struct_stack_current_tl
364         \l__tag_get_parent_tmpa_tl
365         \l__tag_get_parent_tmpb_tl
366         \__tag_check_parent_child:VVnnN
367         \l__tag_get_parent_tmpa_tl
368         \l__tag_get_parent_tmpb_tl
369         {MC}{ }
370         \l__tag_parent_child_check_tl
371         \int_compare:nNnT {\l__tag_parent_child_check_tl}<{0}
372         {
373           \prop_get:cnN
374           { g__tag_struct_ \g__tag_struct_stack_current_tl _prop }
375           { S }
376           \l__tag_tmpa_tl
377           \msg_warning:nnxxx
378           { tag }
379           { role-parent-child }
380           { \l__tag_get_parent_tmpa_tl/\l__tag_get_parent_tmpb_tl }
381           { MC~(real content) }
382           { not~allowed~
383             (struct~\g__tag_struct_stack_current_tl,~\l__tag_tmpa_tl)
384           }
385         }
386       }
387       \__tag_mc_handle_stash:x { \int_use:N \c@g__tag_MCID_abs_int }
388     }
389   }

```

```

386     \group_end:
387   }
388   <*debug>
389   {
390     \__tag_debug_mc_begin_ignore:n { #1 }
391   }
392   </debug>
393   }
394   <*generic>
395   \cs_set_protected:Nn \tag_mc_end:
396   {
397     \__tag_check_if_active_mc:T
398     {
399       </generic>
400       <*debug>
401       \cs_set_protected:Nn \tag_mc_end:
402       {
403         \__tag_check_if_active_mc:TF
404         {
405           \__tag_debug_mc_end_insert:
406           </debug>
407           \__tag_check_mc_if_open:
408           \bool_gset_false:N \g__tag_in_mc_bool
409           \tl_gset:Nn \g__tag_mc_key_tag_tl { }
410           \__tag_mc_emc:
411           \__tag_mc_end_marks:
412         }
413         <*debug>
414         {
415           \__tag_debug_mc_end_ignore:
416         }
417       </debug>
418     }
419   </generic | debug>

```

(End definition for \tag\_mc\_begin:n and \tag\_mc\_end:. These functions are documented on page 58.)

## 1.4 Keys

Definitions are different in luamode. `tag` and `raw` are expanded as `\lua_now:e` in lua does it too and we assume that their values are safe.

```

tag_␣(mc-key)
raw_␣(mc-key) 420 <*generic>
alt_␣(mc-key) 421 \keys_define:nn { __tag / mc }
actualtext_␣(mc-key) 422 {
label_␣(mc-key) 423   tag .code:n = % the name (H,P,Span) etc
artifact_␣(mc-key) 424   {
425     \tl_set:Nx \l__tag_mc_key_tag_tl { #1 }
426     \tl_gset:Nx \g__tag_mc_key_tag_tl { #1 }
427   },
428   raw .code:n =
429   {
430     \tl_put_right:Nx \l__tag_mc_key_properties_tl { #1 }

```

```

431     },
432     alt .code:n      = % Alt property
433     {
434         \str_set_convert:Noon
435         \l__tag_tmpa_str
436         { #1 }
437         { default }
438         { utf16/hex }
439         \tl_put_right:Nn \l__tag_mc_key_properties_tl { /Alt~< }
440         \tl_put_right:No \l__tag_mc_key_properties_tl { \l__tag_tmpa_str>~ }
441     },
442     alttext .meta:n = {alt=#1},
443     actualtext .code:n      = % ActualText property
444     {
445         \tl_if_empty:oF{#1}
446         {
447             \str_set_convert:Noon
448             \l__tag_tmpa_str
449             { #1 }
450             { default }
451             { utf16/hex }
452             \tl_put_right:Nn \l__tag_mc_key_properties_tl { /ActualText~< }
453             \tl_put_right:No \l__tag_mc_key_properties_tl { \l__tag_tmpa_str>~ }
454         }
455     },
456     label .tl_set:N      = \l__tag_mc_key_label_tl,
457     artifact .code:n     =
458     {
459         \exp_args:Nnx
460         \keys_set:nn
461         { __tag / mc }
462         { __artifact-bool, __artifact-type=#1 }
463     },
464     artifact .default:n  = {notype}
465 }
466 </generic>

```

(End definition for tag (mc-key) and others. These functions are documented on page 59.)

## Part VI

# The **tagpdf-mc-luacode** module

## Code related to Marked Content (mc-chunks), luamode-specific

## Part of the tagpdf package

The code is splitted into three parts: code shared by all engines, code specific to luamode and code not used by luamode.

### 1 Marked content code – luamode code

luamode uses attributes to mark mc-chunks. The two attributes used are defined in the backend file. The backend also load the lua file, as it can contain functions needed elsewhere. The attributes for mc are global (between 0.6 and 0.81 they were local but this was reverted). The attributes are setup only in lua, and one should use the lua functions to set and get them.

`g_@@_mc_type_attr`: the value represent the type

`g_@@_mc_cnt_attr`: will hold the `\c@g_@@_MCID_abs_int` value

Handling attribute needs a different system to number the page wise mcid's: a `\tagmcbegin ... \tagmcend` pair no longer surrounds exactly one mc chunk: it can be split at page breaks. We know the included mcid(s) only after the shipout. So for the `struct -> mcid` mapping we need to record `struct -> mc-cnt` (in `\g_@@_mc_parenttree_prop` and/or a lua table and at shipout `mc-cnt-> {mcid, mcid, ...}` and when building the trees connect both.

Key definitions are overwritten for luatex to store that data in lua-tables. The data for the mc are in `ltx.@@.mc[absnum]`. The fields of the table are:

`tag` : the type (a string)

`raw` : more properties (string)

`label`: a string.

`artifact`: the presence indicates an artifact, the value (string) is the type.

`kids`: a array of tables

`{1={kid=num2,page=pagenum1}, 2={kid=num2,page=pagenum2},...}`,

this describes the chunks the mc has been split to by the traversing code

`parent`: the number of the structure it is in. Needed to build the parent tree.

```
1 <@@=tag>
2 <*luamode>
3 \ProvidesExplPackage {tagpdf-mc-code-lua} {2023-05-16} {0.98g}
4   {tagpdf - mc code only for the luamode }
5 </luamode>
```

The main function which wanders through the shipout box to inject the literals. if the new callback is there, it is used.

```
6 <*luamode>
7 \hook_gput_code:nnn{begindocument}{tagpdf/mc}
8 {
```

```

9      \bool_if:NT\g__tag_active_space_bool
10      {
11          \lua_now:e
12          {
13              if~luatexbase.callbacktypes.pre_shipout_filter~then~
14                  luatexbase.add_to_callback("pre_shipout_filter", function(TAGBOX)~
15                      ltx.__tag.func.space_chars_shipout(TAGBOX)~return~true~
16                      end, "tagpdf")~
17              end
18          }
19      \lua_now:e
20      {
21          if~luatexbase.callbacktypes.pre_shipout_filter~then~
22              token.get_next()~
23              end
24          }~\@secondoftwo~\@gobble
25          {
26              \hook_gput_code:nnn{shipout/before}{tagpdf/lua}
27              {
28                  \lua_now:e
29                  { ltx.__tag.func.space_chars_shipout (tex.box["ShipoutBox"]) }
30              }
31          }
32      }
33      \bool_if:NT\g__tag_active_mc_bool
34      {
35          \lua_now:e
36          {
37              if~luatexbase.callbacktypes.pre_shipout_filter~then~
38                  luatexbase.add_to_callback("pre_shipout_filter", function(TAGBOX)~
39                      ltx.__tag.func.mark_shipout(TAGBOX)~return~true~
40                      end, "tagpdf")~
41              end
42          }
43      \lua_now:e
44      {
45          if~luatexbase.callbacktypes.pre_shipout_filter~then~
46              token.get_next()~
47              end
48          }~\@secondoftwo~\@gobble
49          {
50              \hook_gput_code:nnn{shipout/before}{tagpdf/lua}
51              {
52                  \lua_now:e
53                  { ltx.__tag.func.mark_shipout (tex.box["ShipoutBox"]) }
54              }
55          }
56      }
57  }

```

## 1.1 Commands

`\_tag_add_missing_mcs_to_stream:Nn`

This command is used in the output routine by the ptagging code. It should do nothing in luamode.

```
58 \cs_new_protected:Npn \__tag_add_missing_mcs_to_stream:Nn #1#2 {}
```

(End definition for \\_\_tag\_add\_missing\_mcs\_to\_stream:Nn.)

\\_\_tag\_mc\_if\_in\_p: This tests, if we are in an mc, for attributes this means to check against a number.

```
\__tag_mc_if_in:TF 59 \prg_new_conditional:Nnn \__tag_mc_if_in: {p,T,F,TF}
```

```
\tag_mc_if_in_p: 60 {
\tag_mc_if_in:TF 61 \int_compare:nNnTF
```

```
62 { -2147483647 }
```

```
63 =
```

```
64 {\lua_now:e
```

```
65 {
```

```
66 tex.print(\int_use:N \c_document_cctab,tex.getattribute(luatexbase.attributes.g__ta
```

```
67 }
```

```
68 }
```

```
69 { \prg_return_false: }
```

```
70 { \prg_return_true: }
```

```
71 }
```

```
72
```

```
73 \prg_new_eq_conditional:NNn \tag_mc_if_in: \__tag_mc_if_in: {p,T,F,TF}
```

(End definition for \\_\_tag\_mc\_if\_in:TF and \tag\_mc\_if\_in:TF. This function is documented on page 58.)

\\_\_tag\_mc\_lua\_set\_mc\_type\_attr:n This takes a tag name, and sets the attributes globally to the related number.

```
\__tag_mc_lua_set_mc_type_attr:o 74 \cs_new:Nn \__tag_mc_lua_set_mc_type_attr:n % #1 is a tag name
```

```
\__tag_mc_lua_unset_mc_type_attr:
```

```
75 {
76 %TODO ltx.__tag.func.get_num_from("#1") seems not to return a suitable number??
```

```
77 \tl_set:Nx\l__tag_tmpa_tl{\lua_now:e{ltx.__tag.func.output_num_from ("#1")}} }
```

```
78 \lua_now:e
```

```
79 {
```

```
80 tex.setattribute
```

```
81 (
```

```
82 "global",
```

```
83 luatexbase.attributes.g__tag_mc_type_attr,
```

```
84 \l__tag_tmpa_tl
```

```
85 )
```

```
86 }
```

```
87 \lua_now:e
```

```
88 {
```

```
89 tex.setattribute
```

```
90 (
```

```
91 "global",
```

```
92 luatexbase.attributes.g__tag_mc_cnt_attr,
```

```
93 \__tag_get_mc_abs_cnt:
```

```
94 )
```

```
95 }
```

```
96 }
```

```
97
```

```
98 \cs_generate_variant:Nn\__tag_mc_lua_set_mc_type_attr:n { o }
```

```
99
```

```
100 \cs_new:Nn \__tag_mc_lua_unset_mc_type_attr:
```

```
101 {
```

```
102 \lua_now:e
```

```
103 {
```



```

104         tex.setattribute
105         (
106             "global",
107             luatexbase.attributes.g__tag_mc_type_attr,
108             -2147483647
109         )
110     }
111     \lua_now:e
112     {
113         tex.setattribute
114         (
115             "global",
116             luatexbase.attributes.g__tag_mc_cnt_attr,
117             -2147483647
118         )
119     }
120 }
121

```

(End definition for \\_tag\_mc\_lua\_set\_mc\_type\_attr:n and \\_tag\_mc\_lua\_unset\_mc\_type\_attr:.)

\\_tag\_mc\_insert\_mcid\_kids:n These commands will in the finish code replace the dummy for a mc by the real mcid  
\\_tag\_mc\_insert\_mcid\_single\_kids:n kids we need a variant for the case that it is the only kid, to get the array right

```

122 \cs_new:Nn \_tag_mc_insert_mcid_kids:n
123 {
124     \lua_now:e { ltx.__tag.func.mc_insert_kids (#1,0) }
125 }
126
127 \cs_new:Nn \_tag_mc_insert_mcid_single_kids:n
128 {
129     \lua_now:e { ltx.__tag.func.mc_insert_kids (#1,1) }
130 }

```

(End definition for \\_tag\_mc\_insert\_mcid\_kids:n and \\_tag\_mc\_insert\_mcid\_single\_kids:n.)

\\_tag\_mc\_handle\_stash:n This is the lua variant for the command to put an mcid absolute number in the current  
\\_tag\_mc\_handle\_stash:x structure.

```

131 \cs_new:Nn \_tag_mc_handle_stash:n %1 mcidnum
132 {
133     \_tag_check_mc_used:n { #1 }
134     \seq_gput_right:cn % Don't fill a lua table due to the command in the item,
135                       % so use the kernel command
136     { g__tag_struct_kids \g__tag_struct_stack_current_tl _seq }
137     {
138         \_tag_mc_insert_mcid_kids:n {#1}%
139     }
140     \lua_now:e
141     {
142         ltx.__tag.func.store_struct_mcabs
143         (
144             \g__tag_struct_stack_current_tl,#1
145         )
146     }
147     \prop_gput:Nxx

```

```

148     \g__tag_mc_parenttree_prop
149     { #1 }
150     { \g__tag_struct_stack_current_tl }
151 }
152
153 \cs_generate_variant:Nn \__tag_mc_handle_stash:n { x }

(End definition for \__tag_mc_handle_stash:n.)

```

**\tag\_mc\_begin:n** This is the lua version of the user command. We currently don't check if there is nesting as it doesn't matter so much in lua.

```

154 \cs_set_protected:Nn \tag_mc_begin:n
155 {
156     \__tag_check_if_active_mc:T
157     {
158         \group_begin:
159         %\__tag_check_mc_if_nested:
160         \bool_gset_true:N \g__tag_in_mc_bool
161         \bool_set_false:N \l__tag_mc_artifact_bool
162         \tl_clear:N \l__tag_mc_key_properties_tl
163         \int_gincr:N \c@g__tag_MCID_abs_int
164
165         set the default tag to the structure:
166         \tl_set_eq:NN \l__tag_mc_key_tag_tl \g__tag_struct_tag_tl
167         \tl_gset_eq:NN \g__tag_mc_key_tag_tl \g__tag_struct_tag_tl
168         \lua_now:e
169         {
170             ltx.__tag.func.store_mc_data(\__tag_get_mc_abs_cnt:,"tag"," \g__tag_struct_tag_tl",
171             }
172             \keys_set:nn { __tag / mc }{ label={}, #1 }
173             %check that a tag or artifact has been used
174             \__tag_check_mc_tag:N \l__tag_mc_key_tag_tl
175             %set the attributes:
176             \__tag_mc_lua_set_mc_type_attr:o { \l__tag_mc_key_tag_tl }
177             \bool_if:NF \l__tag_mc_artifact_bool
178             { % store the absolute num name in a label:
179                 \tl_if_empty:NF {\l__tag_mc_key_label_tl}
180                 {
181                     \exp_args:NV
182                     \__tag_mc_handle_mc_label:n \l__tag_mc_key_label_tl
183                 }
184             }
185             % if not stashed record the absolute number
186             \bool_if:NF \l__tag_mc_key_stash_bool
187             {
188                 \exp_args:NV \__tag_struct_get_parentrole:nNN
189                 \g__tag_struct_stack_current_tl
190                 \l__tag_get_parent_tmpa_tl
191                 \l__tag_get_parent_tmpb_tl
192                 \__tag_check_parent_child:VVnnN
193                 \l__tag_get_parent_tmpa_tl
194                 \l__tag_get_parent_tmpb_tl
195                 {MC}{ }
196                 \l__tag_parent_child_check_tl
197                 \int_compare:nNnT {\l__tag_parent_child_check_tl}<{0}
198                 {

```

```

196         \prop_get:cnN
197         { g__tag_struct_ \g__tag_struct_stack_current_tl _prop}
198         {S}
199         \l__tag_tmpa_tl
200         \msg_warning:nnxxx
201         { tag }
202         {role-parent-child}
203         { \l__tag_get_parent_tmpa_tl/\l__tag_get_parent_tmpb_tl }
204         { MC~(real content) }
205         {
206             not-allowed~
207             (struct~\g__tag_struct_stack_current_tl,~\l__tag_tmpa_tl)
208         }
209     }
210     \__tag_mc_handle_stash:x { \__tag_get_mc_abs_cnt: }
211 }
212 }
213 \group_end:
214 }
215 }

```

(End definition for \tag\_mc\_begin:n. This function is documented on page 58.)

**\tag\_mc\_end:** TODO: check how the use command must be guarded.

```

216 \cs_set_protected:Nn \tag_mc_end:
217 {
218     \__tag_check_if_active_mc:T
219     {
220         %\__tag_check_mc_if_open:
221         \bool_gset_false:N \g__tag_in_mc_bool
222         \bool_set_false:N\l__tag_mc_artifact_bool
223         \__tag_mc_lua_unset_mc_type_attr:
224         \tl_set:Nn \l__tag_mc_key_tag_tl { }
225         \tl_gset:Nn \g__tag_mc_key_tag_tl { }
226     }
227 }

```

(End definition for \tag\_mc\_end:. This function is documented on page 58.)

**\\_\_tag\_get\_data\_mc\_tag:** The command to retrieve the current mc tag. TODO: Perhaps this should use the attribute instead.

```

228 \cs_new:Npn \__tag_get_data_mc_tag: { \g__tag_mc_key_tag_tl }

```

(End definition for \\_\_tag\_get\_data\_mc\_tag:.)

## 1.2 Key definitions

**tag\_␣(mc-key)** TODO: check conversion, check if local/global setting is right.

**raw\_␣(mc-key)**

```
229 \keys_define:nn { __tag / mc }
```

**alt\_␣(mc-key)**

```
230 {
```

**actualtext\_␣(mc-key)**

```
231     tag .code:n = %
```

**label\_␣(mc-key)**

```
232     {
```

**artifact\_␣(mc-key)**

```
233         \tl_set:Nx \l__tag_mc_key_tag_tl { #1 }
234         \tl_gset:Nx \g__tag_mc_key_tag_tl { #1 }
```

```

235     \lua_now:e
236     {
237         ltx.__tag.func.store_mc_data(\__tag_get_mc_abs_cnt:,"tag","#1")
238     }
239 },
240 raw .code:n =
241 {
242     \tl_put_right:Nx \l__tag_mc_key_properties_tl { #1 }
243     \lua_now:e
244     {
245         ltx.__tag.func.store_mc_data(\__tag_get_mc_abs_cnt:,"raw","#1")
246     }
247 },
248 alt .code:n      = % Alt property
249 {
250     \tl_if_empty:oF{#1}
251     {
252         \str_set_convert:Noon
253         \l__tag_tmpa_str
254         { #1 }
255         { default }
256         { utf16/hex }
257         \tl_put_right:Nn \l__tag_mc_key_properties_tl { /Alt~< }
258         \tl_put_right:No \l__tag_mc_key_properties_tl { \l__tag_tmpa_str>~ }
259         \lua_now:e
260         {
261             ltx.__tag.func.store_mc_data
262             (
263                 \__tag_get_mc_abs_cnt:,"alt","/Alt~<\str_use:N \l__tag_tmpa_str>"
264             )
265         }
266     }
267 },
268 alttext .meta:n = {alt=#1},
269 actualtext .code:n      = % Alt property
270 {
271     \tl_if_empty:oF{#1}
272     {
273         \str_set_convert:Noon
274         \l__tag_tmpa_str
275         { #1 }
276         { default }
277         { utf16/hex }
278         \tl_put_right:Nn \l__tag_mc_key_properties_tl { /Alt~< }
279         \tl_put_right:No \l__tag_mc_key_properties_tl { \l__tag_tmpa_str>~ }
280         \lua_now:e
281         {
282             ltx.__tag.func.store_mc_data
283             (
284                 \__tag_get_mc_abs_cnt:,
285                 "actualtext",
286                 "/ActualText~<\str_use:N \l__tag_tmpa_str>"
287             )
288         }

```

```

289     }
290   },
291   label .code:n =
292   {
293     \tl_set:Nn\l__tag_mc_key_label_tl { #1 }
294     \lua_now:e
295     {
296       ltx.__tag.func.store_mc_data
297       (
298         \__tag_get_mc_abs_cnt:,"label","#1"
299       )
300     }
301   },
302   __artifact-store .code:n =
303   {
304     \lua_now:e
305     {
306       ltx.__tag.func.store_mc_data
307       (
308         \__tag_get_mc_abs_cnt:,"artifact","#1"
309       )
310     }
311   },
312   artifact .code:n      =
313   {
314     \exp_args:Nnx
315     \keys_set:nn
316     { __tag / mc }
317     { __artifact-bool, __artifact-type=#1, tag=Artifact }
318     \exp_args:Nnx
319     \keys_set:nn
320     { __tag / mc }
321     { __artifact-store=\l__tag_mc_artifact_type_tl }
322   },
323   artifact .default:n    = { notype }
324 }
325
326 </luamode>

```

(End definition for tag (mc-key) and others. These functions are documented on page 59.)

## Part VII

# The tagpdf-struct module

## Commands to create the structure

## Part of the tagpdf package

### 1 Public Commands

---

<code>\tag_struct_begin:n</code>	<code>\tag_struct_begin:n{&lt;key-values&gt;}</code>
<code>\tag_struct_end:</code>	<code>\tag_struct_end:</code>
<code>\tag_struct_end:n</code>	<code>\tag_struct_end:n{&lt;tag&gt;}</code>

---

These commands start and end a new structure. They don't start a group. They set all their values globally. `\tag_struct_end:n` does nothing special normally (apart from swallowing its argument, but if `tagpdf-debug` is loaded, it will check if the `{<tag>}` (after expansion) is identical to the current structure on the stack. The tag is not role mapped!

---

<code>\tag_struct_use:n</code>	<code>\tag_struct_use:n{&lt;label&gt;}</code>
--------------------------------	---

---

These commands insert a structure previously stashed away as kid into the currently active structure. A structure should be used only once, if the structure already has a parent a warning is issued.

---

<code>\tag_struct_object_ref:n</code>	<code>\tag_struct_object_ref:n{&lt;struct number&gt;}</code>
<code>\tag_struct_object_ref:e</code>	

---

This is a small wrapper around `\pdf_object_ref:n` to retrieve the object reference of the structure with the number `<struct number>`. This number can be retrieved and stored for the current structure for example with `\tag_get:n{<structnum>}`. Be aware that it can only be used if the structure has already been created and that it doesn't check if the object actually exists!

The following two functions are used to add annotations. They must be used together and with care to get the same numbers. Perhaps some improvements are needed here.

---

<code>\tag_struct_insert_annot:nn</code>	<code>\tag_struct_insert_annot:nn{&lt;object reference&gt;}{&lt;struct parent number&gt;}</code>
--	--

---

This inserts an annotation in the structure. `<object reference>` is there reference to the annotation. `<struct parent number>` should be the same number as had been inserted with `\tag_struct_parent_int:` as `StructParent` value to the dictionary of the annotation. The command will increase the value of the counter used by `\tag_struct_parent_int:`.

---

<code>\tag_struct_parent_int:</code>	<code>\tag_struct_parent_int:</code>
--------------------------------------	--------------------------------------

---

This gives back the next free `/StructParent` number (assuming that it is together with `\tag_struct_insert_annot:nn` which will increase the number.

## 2 Public keys

### 2.1 Keys for the structure commands

<u>tag<sub>□</sub>(struct-key)</u>	This is required. The value of the key is normally one of the standard types listed in the main tagpdf documentation. It is possible to setup new tags/types. The value can also be of the form <b>type/NS</b> , where NS is the shorthand of a declared name space. Currently the names spaces <b>pdf</b> , <b>pdf2</b> , <b>mathml</b> and <b>user</b> are defined. This allows to use a different name space than the one connected by default to the tag. But normally this should not be needed.
<u>stash<sub>□</sub>(struct-key)</u>	Normally a new structure inserts itself as a kid into the currently active structure. This key prohibits this. The structure is nevertheless from now on “the current active structure” and parent for following marked content and structures.
<u>label<sub>□</sub>(struct-key)</u>	This key sets a label by which one can refer to the structure. It is e.g. used by <b>\tag_struct_use:n</b> (where a real label is actually not needed as you can only use structures already defined), and by the <b>ref</b> key (which can refer to future structures). Internally the label name will start with <b>tagpdfstruct-</b> and it stores the two attributs <b>tagstruct</b> (the structure number) and <b>tagstructobj</b> (the object reference).
<u>parent<sub>□</sub>(struct-key)</u>	By default a structure is added as kid to the currently active structure. With the parent key one can choose another parent. The value is a structure number which must refer to an already existing, previously created structure. Such a structure number can for example be have been stored with <b>\tag_get:n</b> , but one can also use a label on the parent structure and then use <b>\ref_value:nn{tagpdfstruct-label}{tagstruct}</b> to retrieve it.
<u>title<sub>□</sub>(struct-key)</u> <u>title-o<sub>□</sub>(struct-key)</u>	This keys allows to set the dictionary entry <b>/Title</b> in the structure object. The value is handled as verbatim string and hex encoded. Commands are not expanded. <b>title-o</b> will expand the value once.
<u>alt<sub>□</sub>(struct-key)</u>	This key inserts an <b>/Alt</b> value in the dictionary of structure object. The value is handled as verbatim string and hex encoded. The value will be expanded first once. If it is empty, nothing will happen.
<u>actualtext<sub>□</sub>(struct-key)</u>	This key inserts an <b>/ActualText</b> value in the dictionary of structure object. The value is handled as verbatim string and hex encoded. The value will be expanded first once. If it is empty, nothing will happen.
<u>lang<sub>□</sub>(struct-key)</u>	This key allows to set the language for a structure element. The value should be a bcp-identifier, e.g. <b>de-De</b> .

---

**ref<sub>□</sub>(struct-key)** This key allows to add references to other structure elements, it adds the */Ref* array to the structure. The value should be a comma separated list of structure labels set with the *label* key. e.g. `ref={label1,label2}`.

---

**E<sub>□</sub>(struct-key)** This key sets the */E* key, the expanded form of an abbreviation or an acronym (I couldn't think of a better name, so I stucked to E).

---

**AF<sub>□</sub>(struct-key)** `AF = <object name>`

**AFinline<sub>□</sub>(struct-key)** `AF-inline = <text content>`

---

**AFinline-o<sub>□</sub>(struct-key)** These keys allows to reference an associated file in the structure element. The value *<object name>* should be the name of an object pointing to the */Filespec* dictionary as expected by `\pdf_object_ref:n` from a current `l3kernel`.

The value **AF-inline** is some text, which is embedded in the PDF as a text file with mime type `text/plain`. **AF-inline-o** is like **AF-inline** but expands the value once.

Future versions will perhaps extend this to more mime types, but it is still a research task to find out what is really needed.

**AF** can be used more than once, to associate more than one file. The inline keys can be used only once per structure. Additional calls are ignored.

---

**attribute<sub>□</sub>(struct-key)** This key takes as argument a comma list of attribute names (use braces to protect the commas from the external key-val parser) and allows to add one or more attribute dictionary entries in the structure object. As an example

`\tagstructbegin{tag=TH,attribute= TH-row}`

Attribute names and their content must be declared first in `\tagpdfsetup`.

---

**attribute-class<sub>□</sub>(struct-key)**

This key takes as argument a comma list of attribute class names (use braces to protect the commas from the external key-val parser) and allows to add one or more attribute classes to the structure object.

Attribute class names and their content must be declared first in `\tagpdfsetup`.



## 2.2 Setup keys

---

`newattribute_␣(setup-key)` `newattribute = {⟨name⟩}{⟨Content⟩}`

---

This key can be used in the setup command `\tagpdfsetup` and allow to declare a new attribute, which can be used as attribute or attribute class. The value are two brace groups, the first contains the name, the second the content.

```
\tagpdfsetup
{
  newattribute =
    {TH-col}{/O /Table /Scope /Column},
  newattribute =
    {TH-row}{/O /Table /Scope /Row},
}
```

---

`root-AF_␣(setup-key)` `root-AF = ⟨object name⟩`

---

This key can be used in the setup command `\tagpdfsetup` and allows to add associated files to the root structure. Like `AF` it can be used more than once to add more than one file.

```
1 <@@=tag>
2 <*header>
3 \ProvidesExplPackage {tagpdf-struct-code} {2023-05-16} {0.98g}
4 {part of tagpdf - code related to storing structure}
5 </header>
```

## 3 Variables

`\c@g__tag_struct_abs_int` Every structure will have a unique, absolute number. I will use a latex counter for the structure count to have a chance to avoid double structures in align etc.

```
6 <base>\newcounter { g__tag_struct_abs_int }
7 <base>\int_gzero:N \c@g__tag_struct_abs_int
```

*(End definition for \c@g\_\_tag\_struct\_abs\_int.)*

`\g__tag_struct_objR_seq` a sequence to store mapping between the structure number and the object number. We assume that structure numbers are assign consecutively and so the index of the seq can be used. A seq allows easy mapping over the structures.

```
8 <*package>
9 \__tag_seq_new:N \g__tag_struct_objR_seq
```

*(End definition for \g\_\_tag\_struct\_objR\_seq.)*

`\g__tag_struct_cont_mc_prop` in generic mode it can happen after a page break that we have to inject into a structure sequence an additional mc after. We will store this additional info in a property. The key is the absolut mc num, the value the pdf directory.

```
10 \__tag_prop_new:N \g__tag_struct_cont_mc_prop
```

*(End definition for \g\_\_tag\_struct\_cont\_mc\_prop.)*

`\g__tag_struct_stack_seq` A stack sequence for the structure stack. When a sequence is opened it's number is put on the stack.

```
11 \seq_new:N      \g__tag_struct_stack_seq
12 \seq_gpush:Nn   \g__tag_struct_stack_seq {0}
```

(End definition for `\g__tag_struct_stack_seq`.)

`\g__tag_struct_tag_stack_seq` We will perhaps also need the tags. While it is possible to get them from the numbered stack, lets build a tag stack too.

```
13 \seq_new:N      \g__tag_struct_tag_stack_seq
14 \seq_gpush:Nn   \g__tag_struct_tag_stack_seq {{Root}}{StructTreeRoot}}
```

(End definition for `\g__tag_struct_tag_stack_seq`.)

`\g__tag_struct_stack_current_tl` The global variable will hold the current structure number. It is already defined in `tagpdf-base`. The local temporary variable will hold the parent when we fetch it from the stack.

```
15 </package>
16 <base>\tl_new:N   \g__tag_struct_stack_current_tl
17 <base>\tl_gset:Nn \g__tag_struct_stack_current_tl {\int_use:N\c@g__tag_struct_abs_int}
18 <*package>
19 \tl_new:N        \l__tag_struct_stack_parent_tmpa_tl
```

(End definition for `\g__tag_struct_stack_current_tl` and `\l__tag_struct_stack_parent_tmpa_tl`.)

I will need at least one structure: the StructTreeRoot normally it should have only one kid, e.g. the document element.

The data of the StructTreeRoot and the StructElem are in properties: `\g_@@_struct_0_prop` for the root and `\g_@@_struct_N_prop`,  $N \geq 1$  for the other.

This creates quite a number of properties, so perhaps we will have to do this more efficiently in the future.

All properties have at least the keys

### Type StructTreeRoot or StructElem

and the keys from the two following lists (the root has a special set of properties). the values of the prop should be already escaped properly when the entries are created (title,lang,alt,E,actualtext)

`\c__tag_struct_StructTreeRoot_entries_seq` These seq contain the keys we support in the two object types. They are currently no longer used, but are provided as documentation and for potential future checks. They should be adapted if there are changes in the PDF format.

```
20 \seq_const_from_clist:Nn \c__tag_struct_StructTreeRoot_entries_seq
21   {%p. 857/858
22     Type,                % always /StructTreeRoot
23     K,                   % kid, dictionary or array of dictionaries
24     IDTree,              % currently unused
25     ParentTree,          % required,obj ref to the parent tree
26     ParentTreeNextKey,   % optional
27     RoleMap,
28     ClassMap,
29     Namespaces,
30     AF                   %pdf 2.0
31   }
32
```

```

33 \seq_const_from_clist:Nn \c__tag_struct_StructElem_entries_seq
34   {%p 858 f
35     Type,           %always /StructElem
36     S,             %tag/type
37     P,             %parent
38     ID,            %optional
39     Ref,           %optional, pdf 2.0 Use?
40     Pg,            %obj num of starting page, optional
41     K,             %kids
42     A,             %attributes, probably unused
43     C,             %class ""
44     %R,            %attribute revision number, irrelevant for us as we
45                   % don't update/change existing PDF and (probably)
46                   % deprecated in PDF 2.0
47     T,             %title, value in () or <>
48     Lang,          %language
49     Alt,           % value in () or <>
50     E,             % abbreviation
51     ActualText,
52     AF,            %pdf 2.0, array of dict, associated files
53     NS,            %pdf 2.0, dict, namespace
54     PhoneticAlphabet, %pdf 2.0
55     Phoneme        %pdf 2.0
56   }

```

(End definition for \c\_\_tag\_struct\_StructTreeRoot\_entries\_seq and \c\_\_tag\_struct\_StructElem\_entries\_seq.)

### 3.1 Variables used by the keys

<pre> \g__tag_struct_tag_tl \g__tag_struct_tag_NS_tl \l__tag_struct_roletag_tl \g__tag_struct_roletag_NS_tl </pre>	<p>Use by the tag key to store the tag and the namespace. The role tag variables will hold locally rolemapping info needed for the parent-child checks</p> <pre> 57 \tl_new:N \g__tag_struct_tag_tl 58 \tl_new:N \g__tag_struct_tag_NS_tl 59 \tl_new:N \l__tag_struct_roletag_tl 60 \tl_new:N \l__tag_struct_roletag_NS_tl </pre> <p>(End definition for \g__tag_struct_tag_tl and others.)</p>
<pre> \l__tag_struct_key_label_tl </pre>	<p>This will hold the label value.</p> <pre> 61 \tl_new:N \l__tag_struct_key_label_tl </pre> <p>(End definition for \l__tag_struct_key_label_tl.)</p>
<pre> \l__tag_struct_elem_stash_bool </pre>	<p>This will keep track of the stash status</p> <pre> 62 \bool_new:N \l__tag_struct_elem_stash_bool </pre> <p>(End definition for \l__tag_struct_elem_stash_bool.)</p>

### 3.2 Variables used by tagging code of basic elements

`\g__tag_struct_dest_num_prop` This variable records for (some or all, not clear yet) destination names the related structure number to allow to reference them in a Ref. The key is the destination. It is currently used by the toc-tagging and sec-tagging code.

```

63 \endpackage
64 \base\prop_new:N \g__tag_struct_dest_num_prop
65 \endpackage

```

*(End definition for \g\_\_tag\_struct\_dest\_num\_prop.)*

`\g__tag_struct_ref_by_dest_prop` This variable contains structures whose Ref key should be updated at the end to point to structured related with this destination. As this is probably need in other places too, it is not only a toc-variable.

```

66 \prop_new:N \g__tag_struct_ref_by_dest_prop

```

*(End definition for \g\_\_tag\_struct\_ref\_by\_dest\_prop.)*

## 4 Commands

The properties must be in some places handled expandably. So I need an output handler for each prop, to get expandable output see <https://tex.stackexchange.com/questions/424208>. There is probably room here for a more efficient implementation. TODO check if this can now be implemented with the pdfdict commands. The property contains currently non pdf keys, but e.g. object numbers are perhaps no longer needed as we have named object anyway.

```

\__tag_struct_output_prop_aux:nn
\__tag_new_output_prop_handler:n
67 \cs_new:Npn \__tag_struct_output_prop_aux:nn #1 #2 % #1 num, #2 key
68 {
69   \prop_if_in:cnT
70     { \g__tag_struct_#1_prop }
71     { #2 }
72   {
73     \c_space_tl/#2~ \prop_item:cn{ \g__tag_struct_#1_prop } { #2 }
74   }
75 }
76
77 \cs_new_protected:Npn \__tag_new_output_prop_handler:n #1
78 {
79   \cs_new:cn { \__tag_struct_output_prop_#1:n }
80   {
81     \__tag_struct_output_prop_aux:nn {#1}{##1}
82   }
83 }

```

*(End definition for \\_\_tag\_struct\_output\_prop\_aux:nn and \\_\_tag\_new\_output\_prop\_handler:n.)*

## 4.1 Initialization of the StructTreeRoot

The first structure element, the StructTreeRoot is special, so created manually. The underlying object is @@/struct/0 which is currently created in the tree code (TODO move it here). The ParentTree and RoleMap entries are added at begin document in the tree code as they refer to object which are setup in other parts of the code. This avoid timing issues.

```

84 \tl_gset:Nn \g__tag_struct_stack_current_tl {0}

\__tag_pdf_name_e:n

85 \cs_new:Npn \__tag_pdf_name_e:n #1{\pdf_name_from_unicode_e:n{#1}}

(End definition for \__tag_pdf_name_e:n.)

g__tag_struct_0_prop
g__tag_struct_kids_0_seq
86 \__tag_prop_new:c { g__tag_struct_0_prop }
87 \__tag_new_output_prop_handler:n {0}
88 \__tag_seq_new:c { g__tag_struct_kids_0_seq }
89
90 \__tag_prop_gput:cnx
91 { g__tag_struct_0_prop }
92 { Type }
93 { \pdf_name_from_unicode_e:n {StructTreeRoot} }
94
95 \__tag_prop_gput:cnx
96 { g__tag_struct_0_prop }
97 { S }
98 { \pdf_name_from_unicode_e:n {StructTreeRoot} }
99
100 \__tag_prop_gput:cnx
101 { g__tag_struct_0_prop }
102 { rolemap }
103 { {StructTreeRoot}{pdf} }
104
105 \__tag_prop_gput:cnx
106 { g__tag_struct_0_prop }
107 { parentrole }
108 { {StructTreeRoot}{pdf} }
109

Namespaces are pdf 2.0. If the code moves into the kernel, the setting must be probably
delayed.

110 \pdf_version_compare:NnF < {2.0}
111 {
112   \__tag_prop_gput:cnx
113   { g__tag_struct_0_prop }
114   { Namespaces }
115   { \pdf_object_ref:n { __tag/tree/namespaces } }
116 }

(End definition for g__tag_struct_0_prop and g__tag_struct_kids_0_seq.)

```

## 4.2 Adding the /ID key

Every structure gets automatically an ID which is currently simply calculated from the structure number.

```

__tag_struct_get_id:n
117 \cs_new:Npn __tag_struct_get_id:n #1 %#1=struct num
118 {
119   (
120     ID.
121     \prg_replicate:nn
122     { \int_abs:n{\g__tag_tree_id_pad_int - \tl_count:e { \int_to_arabic:n { #1 } }} }
123     { 0 }
124     \int_to_arabic:n { #1 }
125   )
126 }

(End definition for __tag_struct_get_id:n.)

```

## 4.3 Filling in the tag info

This adds or updates the tag info to a structure given by a number. We need also the original data, so we store both.

```

127 \pdf_version_compare:NnTF < {2.0}
128 {
129   \cs_new_protected:Npn __tag_struct_set_tag_info:nnn #1 #2 #3
130   %#1 structure number, #2 tag, #3 NS
131   {
132     __tag_prop_gput:cnx
133     { g__tag_struct_#1_prop }
134     { S }
135     { \pdf_name_from_unicode_e:n {#2} } %
136   }
137 }
138 {
139   \cs_new_protected:Npn __tag_struct_set_tag_info:nnn #1 #2 #3
140   {
141     __tag_prop_gput:cnx
142     { g__tag_struct_#1_prop }
143     { S }
144     { \pdf_name_from_unicode_e:n {#2} } %
145     \prop_get:NnNT \g__tag_role_NS_prop {#3} \l__tag_get_tmpc_tl
146     {
147       __tag_prop_gput:cnx
148       { g__tag_struct_#1_prop }
149       { NS }
150       { \l__tag_get_tmpc_tl } %
151     }
152   }
153 }
154 \cs_generate_variant:Nn __tag_struct_set_tag_info:nnn {eVV}

(End definition for __tag_struct_set_tag_info:nnn.)

```

`\_tag_struct_get_parentrole:nNN`

We also need a way to get the tag info needed for parent child check from parent structures.

```
155 \cs_new_protected:Npn \_tag_struct_get_parentrole:nNN #1 #2 #3
156   {%#1 struct num, #2 tlvvar for tag , #3 tlvvar for NS
157   {
158     \prop_get:cnNTF
159     { g__tag_struct_#1_prop }
160     { parentrole }
161     \l__tag_get_tmpc_tl
162     {
163       \tl_set:Nx #2{\exp_last_unbraced:NV\use_i:nn \l__tag_get_tmpc_tl}
164       \tl_set:Nx #3{\exp_last_unbraced:NV\use_ii:nn \l__tag_get_tmpc_tl}
165     }
166     {
167       \tl_clear:N#2
168       \tl_clear:N#3
169     }
170   }
171 \cs_generate_variant:Nn\_tag_struct_get_parentrole:nNN {eNN}

(End definition for \_tag_struct_get_parentrole:nNN.)
```

## 4.4 Handlings kids

Commands to store the kids. Kids in a structure can be a reference to a mc-chunk, an object reference to another structure element, or a object reference to an annotation (through an OBJR object).

`\_tag_struct_kid_mc_gput_right:nn`

`\_tag_struct_kid_mc_gput_right:nx`

The command to store an mc-chunk, this is a dictionary of type MCR. It would be possible to write out the content directly as unnamed object and to store only the object reference, but probably this would be slower, and the PDF is more readable like this. The code doesn't try to avoid the use of the /Pg key by checking page numbers. That imho only slows down without much gain. In generic mode the page break code will perhaps have to insert an additional mcid after an existing one. For this we use a property list At first an auxiliary to write the MCID dict. This should normally be expanded!

```
172 \cs_new:Npn \_tag_struct_mcid_dict:n #1 {%#1 MCID absnum
173   {
174     <<
175     /Type \c_space_tl /MCR \c_space_tl
176     /Pg
177     \c_space_tl
178     \pdf_pageobject_ref:n { \_tag_ref_value:enn{mcid-#1}{tagabspage}{1} }
179     /MCID \c_space_tl \_tag_ref_value:enn{mcid-#1}{tagmcid}{1}
180     >>
181   }
182 \cs_new_protected:Npn \_tag_struct_kid_mc_gput_right:nn #1 #2 {%#1 structure num, #2 MCID abs
183   {
184     \_tag_seq_gput_right:cx
185     { g__tag_struct_kids_#1_seq }
186     {
187       \_tag_struct_mcid_dict:n {#2}
188     }
189     \_tag_seq_gput_right:cn
```

```

190     { g__tag_struct_kids_#1_seq }
191     {
192       \prop_item:Nn \g__tag_struct_cont_mc_prop {#2}
193     }
194   }
195   \cs_generate_variant:Nn \__tag_struct_kid_mc_gput_right:nn {nx}
196

```

(End definition for \\_\_tag\_struct\_kid\_mc\_gput\_right:nn.)

\\_\_tag\_struct\_kid\_struct\_gput\_right:nn  
 \\_\_tag\_struct\_kid\_struct\_gput\_right:xx

This commands adds a structure as kid. We only need to record the object reference in the sequence.

```

197   \cs_new_protected:Npn \__tag_struct_kid_struct_gput_right:nn #1 #2 %#1 num of parent struct, #
198   {
199     \__tag_seq_gput_right:cx
200     { g__tag_struct_kids_#1_seq }
201     {
202       \pdf_object_ref:n { __tag/struct/#2 }
203     }
204   }
205
206   \cs_generate_variant:Nn \__tag_struct_kid_struct_gput_right:nn {xx}

```

(End definition for \\_\_tag\_struct\_kid\_struct\_gput\_right:nn.)

\\_\_tag\_struct\_kid\_OBJR\_gput\_right:nnn  
 \\_\_tag\_struct\_kid\_OBJR\_gput\_right:xxx

At last the command to add an OBJR object. This has to write an object first. The first argument is the number of the parent structure, the second the (expanded) object reference of the annotation. The last argument is the page object reference

```

207   \cs_new_protected:Npn \__tag_struct_kid_OBJR_gput_right:nnn #1 #2 #3 %#1 num of parent struct,
208                                     %#2 obj reference
209                                     %#3 page object reference
210   {
211     \pdf_object_unnamed_write:nn
212     { dict }
213     {
214       /Type/OBJR/Obj~#2/Pg~#3
215     }
216     \__tag_seq_gput_right:cx
217     { g__tag_struct_kids_#1_seq }
218     {
219       \pdf_object_ref_last:
220     }
221   }
222
223   \cs_generate_variant:Nn \__tag_struct_kid_OBJR_gput_right:nnn { xxx }
224

```

(End definition for \\_\_tag\_struct\_kid\_OBJR\_gput\_right:nnn.)

\\_\_tag\_struct\_exchange\_kid\_command:N  
 \\_\_tag\_struct\_exchange\_kid\_command:c

In luamode it can happen that a single kid in a structure is split at a page break into two or more mcid. In this case the lua code has to convert put the dictionary of the kid into an array. See issue 13 at tagpdf repo. We exchange the dummy command for the kids to mark this case.

```

225   \cs_new_protected:Npn \__tag_struct_exchange_kid_command:N #1 %#1 = seq var

```



```

226 {
227   \seq_gpop_left:NN #1 \l__tag_tmpa_tl
228   \regex_replace_once:nnN
229     { \c{\__tag_mc_insert_mcid_kids:n} }
230     { \c{\__tag_mc_insert_mcid_single_kids:n} }
231     \l__tag_tmpa_tl
232   \seq_gput_left:NV #1 \l__tag_tmpa_tl
233 }
234
235 \cs_generate_variant:Nn\__tag_struct_exchange_kid_command:N { c }

```

(End definition for \\_\_tag\_struct\_exchange\_kid\_command:N.)

\\_\_tag\_struct\_fill\_kid\_key:n This command adds the kid info to the K entry. In lua mode the content contains commands which are expanded later. The argument is the structure number.

```

236 \cs_new_protected:Npn \__tag_struct_fill_kid_key:n #1 %#1 is the struct num
237 {
238   \bool_if:NF\g__tag_mode_lua_bool
239   {
240     \seq_clear:N \l__tag_tmpa_seq
241     \seq_map_inline:cn { g__tag_struct_kids_#1_seq }
242       { \seq_put_right:Nx \l__tag_tmpa_seq { ##1 } }
243     %\seq_show:c { g__tag_struct_kids_#1_seq }
244     %\seq_show:N \l__tag_tmpa_seq
245     \seq_remove_all:Nn \l__tag_tmpa_seq {}
246     %\seq_show:N \l__tag_tmpa_seq
247     \seq_gset_eq:cN { g__tag_struct_kids_#1_seq } \l__tag_tmpa_seq
248   }
249
250   \int_case:nnF
251   {
252     \seq_count:c
253     {
254       g__tag_struct_kids_#1_seq
255     }
256   }
257   {
258     { 0 }
259     { } %no kids, do nothing
260     { 1 } % 1 kid, insert
261     {
262       % in this case we need a special command in
263       % luamode to get the array right. See issue #13
264       \bool_if:NT\g__tag_mode_lua_bool
265       {
266         \__tag_struct_exchange_kid_command:c
267         {g__tag_struct_kids_#1_seq}
268       }
269       \__tag_prop_gput:cnx { g__tag_struct_#1_prop } {K}
270       {
271         \seq_item:cn
272         {
273           g__tag_struct_kids_#1_seq
274         }

```

```

275         {1}
276     }
277 } %
278 }
279 { %many kids, use an array
280   \__tag_prop_gput:cnx { g__tag_struct_#1_prop } {K}
281   {
282     [
283       \seq_use:cn
284       {
285         g__tag_struct_kids_#1_seq
286       }
287       {
288         \c_space_tl
289       }
290     ]
291   }
292 }
293 }
294

```

(End definition for \\_\_tag\_struct\_fill\_kid\_key:n.)

## 4.5 Output of the object

\\_\_tag\_struct\_get\_dict\_content:nN This maps the dictionary content of a structure into a tl-var. Basically it does what \pdfdict\_use:n does. TODO!! this looks over-complicated. Check if it can be done with pdfdict now.

```

295 \cs_new_protected:Npn \__tag_struct_get_dict_content:nN #1 #2 %#1: structure num
296 {
297   \tl_clear:N #2
298   \seq_map_inline:cn
299   {
300     c__tag_struct_
301     \int_compare:nNnTF{#1}={0}{StructTreeRoot}{StructElem}
302     _entries_seq
303   }
304   {
305     \tl_put_right:Nx
306     #2
307     {
308       \prop_if_in:cnT
309       { g__tag_struct_#1_prop }
310       { ##1 }
311       {
312         \c_space_tl/##1~

```

Some keys needs the option to format the key, e.g. add brackets for an array

```

313     \cs_if_exist_use:cTF {__tag_struct_format_##1:e}
314     {
315       { \prop_item:cn{ g__tag_struct_#1_prop } { ##1 } }
316     }
317     {
318       \prop_item:cn{ g__tag_struct_#1_prop } { ##1 }

```

```

319         }
320     }
321 }
322 }
323 }

```

(End definition for `\__tag_struct_get_dict_content:nN`.)

`\__tag_struct_format_Ref:n` Ref is an array, we store only the content to be able to extend it so the formatting command adds the brackets:

```

324 \cs_new:Nn\__tag_struct_format_Ref:n{[#1]}
325 \cs_generate_variant:Nn\__tag_struct_format_Ref:n{e}

```

(End definition for `\__tag_struct_format_Ref:n`.)

`\__tag_struct_write_obj:n` This writes out the structure object. This is done in the finish code, in the tree module and guarded by the tree boolean.

```

326 \cs_new_protected:Npn \__tag_struct_write_obj:n #1 % #1 is the struct num
327 {
328     \pdf_object_if_exist:nTF { __tag/struct/#1 }
329     {
330         \__tag_struct_fill_kid_key:n { #1 }
331         \__tag_struct_get_dict_content:nN { #1 } \l__tag_tmpa_tl
332         \exp_args:Nx
333         \pdf_object_write:nmx
334         { __tag/struct/#1 }
335         {dict}
336         {
337             \l__tag_tmpa_tl\c_space_tl
338             /ID~\__tag_struct_get_id:n{#1}
339         }
340     }
341     {
342         \msg_error:nnn { tag } { struct-no-objnum } { #1}
343     }
344 }

```

(End definition for `\__tag_struct_write_obj:n`.)

`\__tag_struct_insert_annot:nn` This is the command to insert an annotation into the structure. It can probably be used for xform too.

Annotations used as structure content must

1. add a StructParent integer to their dictionary
2. push the object reference as OBJR object in the structure
3. Add a Structparent/obj-nr reference to the parent tree.

For a link this looks like this

```

(1) \tag_struct_begin:n { tag=Link }
    \tag_mc_begin:n { tag=Link }
    \pdfannot_dict_put:nmx
        { link/URI }

```

```

        { StructParent }
        { \int_use:N\c@g_@@_parenttree_obj_int }
    <start link> link text <stop link>
(2+3) \@@_struct_insert_annot:nn {obj ref}{parent num}
    \tag_mc_end:
    \tag_struct_end:

345 \cs_new_protected:Npn \__tag_struct_insert_annot:nn #1 #2 %#1 object reference to the annotat
346                                     %#2 structparent number
347 {
348     \bool_if:NT \g__tag_active_struct_bool
349     {
350         %get the number of the parent structure:
351         \seq_get:NNF
352             \g__tag_struct_stack_seq
353             \l__tag_struct_stack_parent_tmpa_tl
354             {
355                 \msg_error:nn { tag } { struct-faulty-nesting }
356             }
357         %put the obj number of the annot in the kid entry, this also creates
358         %the OBJR object
359         \ref_label:nn {__tag_objr_page_#2 }{ tagabspage }
360         \__tag_struct_kid_OBJR_gput_right:xxx
361         {
362             \l__tag_struct_stack_parent_tmpa_tl
363         }
364         {
365             #1 %
366         }
367         {
368             \pdf_pageobject_ref:n { \__tag_ref_value:nnn {__tag_objr_page_#2 }{ tagabspage } }{
369         }
370         % add the parent obj number to the parent tree:
371         \exp_args:Nnx
372         \__tag_parenttree_add_objr:nn
373         {
374             #2
375         }
376         {
377             \pdf_object_ref:e { __tag/struct/\l__tag_struct_stack_parent_tmpa_tl }
378         }
379         % increase the int:
380         \stepcounter{ g__tag_parenttree_obj_int }
381     }
382 }

```

(End definition for \\_\_tag\_struct\_insert\_annot:nn.)

\\_\_tag\_get\_data\_struct\_tag: this command allows \tag\_get:n to get the current structure tag with the keyword **struct\_tag**.

```

383 \cs_new:Npn \__tag_get_data_struct_tag:
384 {
385     \exp_args:Ne
386     \tl_tail:n

```

```

387     {
388       \prop_item:cn {g__tag_struct_\g__tag_struct_stack_current_tl _prop}{S}
389     }
390   }

```

(End definition for \\_\_tag\_get\_data\_struct\_tag:.)

\\_\_tag\_get\_data\_struct\_id: this command allows \tag\_get:n to get the current structure id with the keyword **struct\_id**.

```

391 \cs_new:Npn \__tag_get_data_struct_id:
392 {
393   \__tag_struct_get_id:n {\g__tag_struct_stack_current_tl}
394 }
395 \</package>

```

(End definition for \\_\_tag\_get\_data\_struct\_id:.)

\\_\_tag\_get\_data\_struct\_num: this command allows \tag\_get:n to get the current structure number with the keyword **struct\_num**. We will need to handle nesting

```

396 \< *base>
397 \cs_new:Npn \__tag_get_data_struct_num:
398 {
399   \g__tag_struct_stack_current_tl
400 }
401 \</base>

```

(End definition for \\_\_tag\_get\_data\_struct\_num:.)

## 5 Keys

This are the keys for the user commands. we store the tag in a variable. But we should be careful, it is only reliable at the begin.

```

label_(struct-key)
stash_(struct-key)
parent_(struct-key)
tag_(struct-key)
title_(struct-key)
title-o_(struct-key)
alt_(struct-key)
actualtext_(struct-key)
lang_(struct-key)
ref_(struct-key)
E_(struct-key)
402 \< *package>
403 \keys_define:nn { __tag / struct }
404 {
405   label .tl_set:N      = \l__tag_struct_key_label_tl,
406   stash .bool_set:N    = \l__tag_struct_elem_stash_bool,
407   parent .code:n       =
408     {
409       \bool_lazy_and:nnTF
410       {
411         \prop_if_exist_p:c { g__tag_struct_\int_eval:n {#1}_prop }
412       }
413       {
414         \int_compare_p:nNn {#1}<{\c@g__tag_struct_abs_int}
415       }
416       { \tl_set:Nx \l__tag_struct_stack_parent_tmpa_tl { \int_eval:n {#1} } }
417     }
418   \msg_warning:nnxx { tag } { struct-unknown }
419     { \int_eval:n {#1} }
420     { parent-key-ignored }
421 }

```

```

422     },
423     parent .default:n      = {-1},
424     tag    .code:n         = % S property
425     {
426         \seq_set_split:Nne \l__tag_tmpa_seq { / } {#1/\prop_item:Ne\g__tag_role_tags_NS_prop{
427         \tl_gset:Nx \g__tag_struct_tag_tl { \seq_item:Nn\l__tag_tmpa_seq {1} }
428         \tl_gset:Nx \g__tag_struct_tag_NS_tl{ \seq_item:Nn\l__tag_tmpa_seq {2} }
429         \__tag_check_structure_tag:N \g__tag_struct_tag_tl
430     },
431     title .code:n          = % T property
432     {
433         \str_set_convert:Nnnn
434         \l__tag_tmpa_str
435         { #1 }
436         { default }
437         { utf16/hex }
438         \__tag_prop_gput:cnx
439         { g__tag_struct_\int_eval:n {\c@g__tag_struct_abs_int}_prop }
440         { T }
441         { <\l__tag_tmpa_str> }
442     },
443     title-o .code:n        = % T property
444     {
445         \str_set_convert:Nonn
446         \l__tag_tmpa_str
447         { #1 }
448         { default }
449         { utf16/hex }
450         \__tag_prop_gput:cnx
451         { g__tag_struct_\int_eval:n {\c@g__tag_struct_abs_int}_prop }
452         { T }
453         { <\l__tag_tmpa_str> }
454     },
455     alt .code:n            = % Alt property
456     {
457         \tl_if_empty:oF{#1}
458         {
459             \str_set_convert:Noon
460             \l__tag_tmpa_str
461             { #1 }
462             { default }
463             { utf16/hex }
464             \__tag_prop_gput:cnx
465             { g__tag_struct_\int_eval:n {\c@g__tag_struct_abs_int}_prop }
466             { Alt }
467             { <\l__tag_tmpa_str> }
468         }
469     },
470     alttext .meta:n = {alt=#1},
471     actualtext .code:n = % ActualText property
472     {
473         \tl_if_empty:oF{#1}
474         {
475             \str_set_convert:Noon

```

```

476         \l__tag_tmpa_str
477         { #1 }
478         { default }
479         { utf16/hex }
480     \__tag_prop_gput:cnx
481     { g__tag_struct_\int_eval:n {\c@g__tag_struct_abs_int}_prop }
482     { ActualText }
483     { <\l__tag_tmpa_str>}
484 }
485 },
486 lang .code:n          = % Lang property
487 {
488     \__tag_prop_gput:cnx
489     { g__tag_struct_\int_eval:n {\c@g__tag_struct_abs_int}_prop }
490     { Lang }
491     { (#1) }
492 },

```

Ref is an array, the brackets are added through the formatting command.

```

493     ref .code:n          = % ref property
494     {
495         \tl_clear:N\l__tag_tmpa_tl
496         \clist_map_inline:on {#1}
497         {
498             \tl_put_right:Nx \l__tag_tmpa_tl
499             {\ref_value:nn{tagpdfstruct-##1}{tagstructobj} }
500         }
501         \__tag_struct_gput_data_ref:ee { \int_eval:n {\c@g__tag_struct_abs_int} } {\l__tag_tmpa_tl}
502     },
503     E .code:n          = % E property
504     {
505         \str_set_convert:Nnon
506         \l__tag_tmpa_str
507         { #1 }
508         { default }
509         { utf16/hex }
510         \__tag_prop_gput:cnx
511         { g__tag_struct_\int_eval:n {\c@g__tag_struct_abs_int}_prop }
512         { E }
513         { <\l__tag_tmpa_str> }
514     },
515 }

```

(End definition for label (struct-key) and others. These functions are documented on page 87.)

**AF<sub>⊔</sub>(struct-key)** keys for the AF keys (associated files). They use commands from l3pdffile! The stream variants use txt as extension to get the mimetype. TODO: check if this should be configurable. For math we will perhaps need another extension. AF is an array and can be used more than once, so we store it in a tl. which is expanded. AFinline currently uses the fix extension txt. texsource is a special variant which creates a tex-file, it expects a tl-var as value (e.g. from math grabbing)

This variable is used to number the AF-object names

```

516 \int_new:N\g__tag_struct_AFobj_int

```

```

\g__tag_struct_AFobj_int

```

```

517 \cs_if_free:NTF \pdffile_embed_stream:nnN
518 {
519   \cs_new_protected:Npn \__tag_struct_add_inline_AF:nn #1 #2
520     % #1 content, #2 extension
521     {
522       \group_begin:
523       \int_gincr:N \g__tag_struct_AFobj_int
524       \pdf_object_if_exist:eF {__tag/fileobj\int_use:N\g__tag_struct_AFobj_int}
525       {
526         \pdffile_embed_stream:nxx
527         {#1}
528         {tag-AFfile\int_use:N\g__tag_struct_AFobj_int.#2}
529         {__tag/fileobj\int_use:N\g__tag_struct_AFobj_int}
530         \__tag_struct_add_AF:ee
531         { \int_eval:n {\c@g__tag_struct_abs_int} }
532         { \pdf_object_ref:e {__tag/fileobj\int_use:N\g__tag_struct_AFobj_int} }
533         \__tag_prop_gput:cnx
534         { g__tag_struct_\int_use:N\c@g__tag_struct_abs_int _prop }
535         { AF }
536         {
537           [
538             \tl_use:c
539             { g__tag_struct_\int_eval:n {\c@g__tag_struct_abs_int}_AF_tl }
540           ]
541         }
542       }
543       \group_end:
544     }
545   }
546   {
547     \cs_generate_variant:Nn \pdffile_embed_stream:nnN {nxN}
548     \cs_new_protected:Npn \__tag_struct_add_inline_AF:nn #1 #2
549       % #1 content, #2 extension
550       {
551         \group_begin:
552         \int_gincr:N \g__tag_struct_AFobj_int
553         \pdffile_embed_stream:nxN
554         {#1}
555         {tag-AFfile\int_use:N\g__tag_struct_AFobj_int.#2}
556         \l__tag_tmpa_tl
557         \__tag_struct_add_AF:ee
558         { \int_eval:n {\c@g__tag_struct_abs_int} }
559         { \l__tag_tmpa_tl }
560         \__tag_prop_gput:cnx
561         { g__tag_struct_\int_use:N\c@g__tag_struct_abs_int _prop }
562         { AF }
563         {
564           [
565             \tl_use:c
566             { g__tag_struct_\int_eval:n {\c@g__tag_struct_abs_int}_AF_tl }
567           ]
568         }
569         \group_end:
570       }

```



```

571     }
572 \cs_generate_variant:Nn \__tag_struct_add_inline_AF:nn {on}
573 \cs_new_protected:Npn \__tag_struct_add_AF:nn #1 #2 % #1 struct num #2 object reference
574 {
575     \tl_if_exist:cTF
576     {
577         g__tag_struct_#1_AF_tl
578     }
579     {
580         \tl_gput_right:cx
581         { g__tag_struct_#1_AF_tl }
582         { \c_space_tl #2 }
583     }
584     {
585         \tl_new:c
586         { g__tag_struct_#1_AF_tl }
587         \tl_gset:cx
588         { g__tag_struct_#1_AF_tl }
589         { #2 }
590     }
591 }
592 \cs_generate_variant:Nn \__tag_struct_add_AF:nn {en,ee}
593 \keys_define:nn { __tag / struct }
594 {
595     AF .code:n      = % AF property
596     {
597         \pdf_object_if_exist:nTF {#1}
598         {
599             \__tag_struct_add_AF:ee { \int_eval:n {\c@g__tag_struct_abs_int} }{\pdf_object_re
600             \__tag_prop_gput:cnx
601             { g__tag_struct_\int_eval:n {\c@g__tag_struct_abs_int}_prop }
602             { AF }
603             {
604                 [
605                     \tl_use:c
606                     { g__tag_struct_\int_eval:n {\c@g__tag_struct_abs_int}_AF_tl }
607                 ]
608             }
609         }
610         {
611             }
612         }
613     },
614     ,AFinline .code:n =
615     {
616         \__tag_struct_add_inline_AF:nn {#1}{txt}
617     }
618     ,AFinline-o .code:n =
619     {
620         \__tag_struct_add_inline_AF:on {#1}{txt}
621     }
622     ,texsource .code:n =
623     {
624         \group_begin:

```

```

625 \pdfdict_put:nnn { l_pdffile/Filespec }{AFRelationship} { /Source }
we set the mime type as pdfresources uses currently text/plain
626 \pdfdict_put:nnx
627 { l_pdffile }{Subtype}
628 { \pdf_name_from_unicode_e:n{application/x-tex} }
629 \__tag_struct_add_inline_AF:on {#1}{tex}
630 \group_end:
631 }
632 }

```

(End definition for AF (struct-key) and others. These functions are documented on page 88.)

**root-AF<sub>␣</sub>(setup-key)** The root structure can take AF keys too, so we provide a key for it. This key is used with `\tagpdfsetup`, not in a structure!

```

633 \keys_define:nn { __tag / setup }
634 {
635   root-AF .code:n =
636   {
637     \pdf_object_if_exist:nTF {#1}
638     {
639       \__tag_struct_add_AF:ee { 0 }{\pdf_object_ref:n {#1}}
640       \__tag_prop_gput:cnx
641       { g__tag_struct_0_prop }
642       { AF }
643       {
644         [
645           \tl_use:c
646           { g__tag_struct_0_AF_tl }
647         ]
648       }
649     }
650     {
651     }
652   },
653 }
654 }
655 \</package>

```

(End definition for root-AF (setup-key). This function is documented on page 89.)

## 6 User commands

```

\tag_struct_begin:n
\tag_struct_end:
656 <base>\cs_new_protected:Npn \tag_struct_begin:n #1 {\int_gincr:N \c@g__tag_struct_abs_int}
657 <base>\cs_new_protected:Npn \tag_struct_end: {}
658 <base>\cs_new_protected:Npn \tag_struct_end:n {}
659 *package| debug>
660 <package>\cs_set_protected:Npn \tag_struct_begin:n #1 %#1 key-val
661 <debug>\cs_set_protected:Npn \tag_struct_begin:n #1 %#1 key-val
662 {
663 <package>\__tag_check_if_active_struct:T
664 <debug>\__tag_check_if_active_struct:TF

```

```

665     {
666         \group_begin:
667         \int_gincr:N \c@g__tag_struct_abs_int
668         \__tag_prop_new:c { g__tag_struct \int_eval:n { \c@g__tag_struct_abs_int }_prop }
669         \__tag_new_output_prop_handler:n { \int_eval:n { \c@g__tag_struct_abs_int } }
670         \__tag_seq_new:c { g__tag_struct_kids \int_eval:n { \c@g__tag_struct_abs_int }_seq }
671         \exp_args:Ne
672             \pdf_object_new:n
673             { __tag/struct/\int_eval:n { \c@g__tag_struct_abs_int } }
674         \__tag_prop_gput:cno
675             { g__tag_struct \int_eval:n { \c@g__tag_struct_abs_int }_prop }
676             { Type }
677             { /StructElem }
678         \tl_set:Nn \l__tag_struct_stack_parent_tmpa_tl {-1}
679         \keys_set:nn { __tag / struct } { #1 }
680         \__tag_struct_set_tag_info:eVV
681             { \int_eval:n { \c@g__tag_struct_abs_int } }
682             \g__tag_struct_tag_tl
683             \g__tag_struct_tag_NS_tl
684         \__tag_check_structure_has_tag:n { \int_eval:n { \c@g__tag_struct_abs_int } }
685         \tl_if_empty:NF
686             \l__tag_struct_key_label_tl
687             {
688                 \__tag_ref_label:en{tagpdfstruct-\l__tag_struct_key_label_tl}{struct}
689             }

```

The structure number of the parent is either taken from the stack or has been set with the parent key.

```

690         \int_compare:nNnT { \l__tag_struct_stack_parent_tmpa_tl } = { -1 }
691         {
692             \seq_get:NNF
693                 \g__tag_struct_stack_seq
694                 \l__tag_struct_stack_parent_tmpa_tl
695                 {
696                     \msg_error:nn { tag } { struct-faulty-nesting }
697                 }
698         }
699         \seq_gpush:NV \g__tag_struct_stack_seq \c@g__tag_struct_abs_int
700         \__tag_role_get:VVNN
701             \g__tag_struct_tag_tl
702             \g__tag_struct_tag_NS_tl
703             \l__tag_struct_roletag_tl
704             \l__tag_struct_roletag_NS_tl

```

to target role and role NS

```

705         \__tag_prop_gput:cnx
706             { g__tag_struct \int_eval:n { \c@g__tag_struct_abs_int }_prop }
707             { rolemap }
708             {
709                 { \l__tag_struct_roletag_tl } { \l__tag_struct_roletag_NS_tl }
710             }

```

we also store which role to use for parent/child test. If the role is one of Part, Div, NonStruct we have to retrieve it from the parent. If the structure is stashed, this must be updated!

```

711 \str_case:VnTF \l__tag_struct_roletag_tl
712 {
713   {Part} {}
714   {Div} {}
715   {NonStruct} {}
716 }
717 {
718   \prop_get:cnNT
719   { g__tag_struct_ \l__tag_struct_stack_parent_tmpa_tl _prop }
720   { parentrole }
721   \l__tag_get_tmpc_tl
722   {
723     \__tag_prop_gput:cno
724     { g__tag_struct_ \int_eval:n {\c@g__tag_struct_abs_int}_prop }
725     { parentrole }
726     {
727       \l__tag_get_tmpc_tl
728     }
729   }
730 }
731 {
732   \__tag_prop_gput:cnx
733   { g__tag_struct_ \int_eval:n {\c@g__tag_struct_abs_int}_prop }
734   { parentrole }
735   {
736     {\l__tag_struct_roletag_tl}{\l__tag_struct_roletag_NS_tl}
737   }
738 }
739 \seq_gpush:Nx \g__tag_struct_tag_stack_seq
740 {{\g__tag_struct_tag_tl}{\l__tag_struct_roletag_tl}}
741 \tl_gset:NV \g__tag_struct_stack_current_tl \c@g__tag_struct_abs_int
742 %\seq_show:N \g__tag_struct_stack_seq
743 \bool_if:NF
744 \l__tag_struct_elem_stash_bool
745 {

```

check if the tag can be used inside the parent. It only makes sense, if the structure is actually used here, so it is guarded by the stash boolean. For now we ignore the namespace!

```

746   \__tag_struct_get_parentrole:eNN
747   {\l__tag_struct_stack_parent_tmpa_tl}
748   \l__tag_get_parent_tmpa_tl
749   \l__tag_get_parent_tmpb_tl
750   \__tag_check_parent_child:VVVVN
751   \l__tag_get_parent_tmpa_tl
752   \l__tag_get_parent_tmpb_tl
753   \g__tag_struct_tag_tl
754   \g__tag_struct_tag_NS_tl
755   \l__tag_parent_child_check_tl
756   \int_compare:nNnT {\l__tag_parent_child_check_tl}<0
757   {
758     \prop_get:cnN
759     { g__tag_struct_ \l__tag_struct_stack_parent_tmpa_tl _prop }
760     {S}

```

```

761         \l__tag_tmpa_tl
762         \msg_warning:nnxxx
763         { tag }
764         {role-parent-child}
765         { \l__tag_get_parent_tmpa_tl/\l__tag_get_parent_tmpb_tl }
766         { \g__tag_struct_tag_tl/\g__tag_struct_tag_NS_tl }
767         { not~allowed~
768           (struct~\l__tag_struct_stack_parent_tmpa_tl,~\l__tag_tmpa_tl
769             \c_space_tl-->~struct~\int_eval:n {\c@g__tag_struct_abs_int})
770         }
771         \cs_set_eq:NN \l__tag_role_remap_tag_tl \g__tag_struct_tag_tl
772         \cs_set_eq:NN \l__tag_role_remap_NS_tl \g__tag_struct_tag_NS_tl
773         \__tag_role_remap:
774         \cs_gset_eq:NN \g__tag_struct_tag_tl \l__tag_role_remap_tag_tl
775         \cs_gset_eq:NN \g__tag_struct_tag_NS_tl \l__tag_role_remap_NS_tl
776         \__tag_struct_set_tag_info:eVV
777         { \int_eval:n {\c@g__tag_struct_abs_int} }
778         \g__tag_struct_tag_tl
779         \g__tag_struct_tag_NS_tl
780     }

```

Set the Parent.

```

781     \__tag_prop_gput:cnx
782     { g__tag_struct_\int_eval:n {\c@g__tag_struct_abs_int}_prop }
783     { P }
784     {
785       \pdf_object_ref:e { __tag/struct/\l__tag_struct_stack_parent_tmpa_tl }
786     }
787     %record this structure as kid:
788     %\tl_show:N \g__tag_struct_stack_current_tl
789     %\tl_show:N \l__tag_struct_stack_parent_tmpa_tl
790     \__tag_struct_kid_struct_gput_right:xx
791     { \l__tag_struct_stack_parent_tmpa_tl }
792     { \g__tag_struct_stack_current_tl }
793     %\prop_show:c { g__tag_struct_\g__tag_struct_stack_current_tl _prop }
794     %\seq_show:c {g__tag_struct_kids_\l__tag_struct_stack_parent_tmpa_tl _seq}
795     }
796     %\prop_show:c { g__tag_struct_\g__tag_struct_stack_current_tl _prop }
797     %\seq_show:c {g__tag_struct_kids_\l__tag_struct_stack_parent_tmpa_tl _seq}
798     <debug> \__tag_debug_struct_begin_insert:n { #1 }
799     \group_end:
800     }
801     <debug>{ \__tag_debug_struct_begin_ignore:n { #1 }}
802     }
803     <package>\cs_set_protected:Nn \tag_struct_end:
804     <debug>\cs_set_protected:Nn \tag_struct_end:
805     { %take the current structure num from the stack:
806       %the objects are written later, lua mode hasn't all needed info yet
807       %\seq_show:N \g__tag_struct_stack_seq
808     <package>\__tag_check_if_active_struct:T
809     <debug>\__tag_check_if_active_struct:TF
810     {
811       \seq_gpop:NN \g__tag_struct_tag_stack_seq \l__tag_tmpa_tl
812       \seq_gpop:NNTF \g__tag_struct_stack_seq \l__tag_tmpa_tl
813       {

```

```

814         \__tag_check_info_closing_struct:o { \g__tag_struct_stack_current_tl }
815     }
816     { \__tag_check_no_open_struct: }
817     % get the previous one, shouldn't be empty as the root should be there
818     \seq_get:NNTF \g__tag_struct_stack_seq \l__tag_tmpa_tl
819     {
820         \tl_gset:NV \g__tag_struct_stack_current_tl \l__tag_tmpa_tl
821     }
822     {
823         \__tag_check_no_open_struct:
824     }
825     \seq_get:NNT \g__tag_struct_tag_stack_seq \l__tag_tmpa_tl
826     {
827         \tl_gset:Nx \g__tag_struct_tag_tl
828         { \exp_last_unbraced:NV\use_i:nn \l__tag_tmpa_tl }
829     }
830     (debug)\__tag_debug_struct_end_insert:
831     }
832     (debug){\__tag_debug_struct_end_ignore:}
833     }
834
835     \cs_set_protected:Npn \tag_struct_end:n #1
836     {
837         (debug)\__tag_debug_struct_end_check:n{#1}
838         \tag_struct_end:
839     }
840     </package|debug>

```

(End definition for \tag\_struct\_begin:n and \tag\_struct\_end:. These functions are documented on page 86.)

**\tag\_struct\_use:n** This command allows to use a stashed structure in another place. TODO: decide how it should be guarded. Probably by the struct-check.

```

841     (base)\cs_new_protected:Npn \tag_struct_use:n #1 {}
842     <*package>
843     \cs_set_protected:Npn \tag_struct_use:n #1 % #1 is the label
844     {
845         \__tag_check_if_active_struct:T
846         {
847             \prop_if_exist:cTF
848             { \g__tag_struct_\__tag_ref_value:enn{tagpdfstruct-#1}{tagstruct}{unknown}_prop } %
849             {
850                 \__tag_check_struct_used:n {#1}
851                 %add the label structure as kid to the current structure (can be the root)
852                 \__tag_struct_kid_struct_gput_right:xx
853                 { \g__tag_struct_stack_current_tl }
854                 { \__tag_ref_value:enn{tagpdfstruct-#1}{tagstruct}{0} }
855                 %add the current structure to the labeled one as parents
856                 \__tag_prop_gput:cnx
857                 { \g__tag_struct_\__tag_ref_value:enn{tagpdfstruct-#1}{tagstruct}{0}_prop }
858                 { P }
859                 {
860                     \pdf_object_ref:e { __tag/struct/\g__tag_struct_stack_current_tl }
861                 }
862             }
863         }
864     }

```

check if the tag is allowed as child. Here we have to retrieve the tag info for the child, while the data for the parent is in the global tl-vars:

```

862         \__tag_struct_get_parentrole:eNN
863         {\__tag_ref_value:enn{tagpdfstruct-#1}{tagstruct}{0}}
864         \l__tag_tmpa_tl
865         \l__tag_tmpb_tl
866     \__tag_check_parent_child:VVVVN
867     \g__tag_struct_tag_tl
868     \g__tag_struct_tag_NS_tl
869     \l__tag_tmpa_tl
870     \l__tag_tmpb_tl
871     \l__tag_parent_child_check_tl
872     \int_compare:nNnT {\l__tag_parent_child_check_tl}<0
873     {
874         \cs_set_eq:NN \l__tag_role_remap_tag_tl \g__tag_struct_tag_tl
875         \cs_set_eq:NN \l__tag_role_remap_NS_tl \g__tag_struct_tag_NS_tl
876         \__tag_role_remap:
877         \cs_gset_eq:NN \g__tag_struct_tag_tl \l__tag_role_remap_tag_tl
878         \cs_gset_eq:NN \g__tag_struct_tag_NS_tl \l__tag_role_remap_NS_tl
879         \__tag_struct_set_tag_info:eVV
880         { \int_eval:n {\c@g__tag_struct_abs_int} }
881         \g__tag_struct_tag_tl
882         \g__tag_struct_tag_NS_tl
883     }
884 }
885 {
886     \msg_warning:nnn{ tag }{struct-label-unknown}{#1}
887 }
888 }
889 }
890 \end{package}

```

(End definition for `\tag_struct_use:n`. This function is documented on page 86.)

`\tag_struct_use_num:n` This command allows to use a stashed structure in another place. differently to the previous command it doesn't use a label but directly a structure number to find the parent. TODO: decide how it should be guarded. Probably by the struct-check.

```

891 (base)\cs_new_protected:Npn \tag_struct_use_num:n #1 {}
892 \end{package}
893 \cs_set_protected:Npn \tag_struct_use_num:n #1 %#1 is structure number
894 {
895     \__tag_check_if_active_struct:T
896     {
897         \prop_if_exist:cTF
898         { g__tag_struct_#1_prop } %
899         {
900             \prop_get:cnNT
901             {g__tag_struct_#1_prop}
902             {P}
903             \l__tag_tmpa_tl
904             {
905                 \msg_warning:nnn { tag } {struct-used-twice} {#1}
906             }
907             %add the label structure as kid to the current structure (can be the root)

```

```

908     \_tag_struct_kid_struct_gput_right:xx
909     { \g__tag_struct_stack_current_tl }
910     { #1 }
911 %add the current structure to the labeled one as parents
912 \_tag_prop_gput:cnx
913 { g__tag_struct_#1_prop }
914 { P }
915 {
916     \pdf_object_ref:e { __tag/struct/\g__tag_struct_stack_current_tl }
917 }

```

check if the tag is allowed as child. Here we have to retrieve the tag info for the child, while the data for the parent is in the global tl-vars:

```

918     \_tag_struct_get_parentrole:eNN
919     {#1}
920     \l__tag_tmpa_tl
921     \l__tag_tmpb_tl
922 \_tag_check_parent_child:VVVVN
923 \g__tag_struct_tag_tl
924 \g__tag_struct_tag_NS_tl
925 \l__tag_tmpa_tl
926 \l__tag_tmpb_tl
927 \l__tag_parent_child_check_tl
928 \int_compare:nNnT {\l__tag_parent_child_check_tl}<0
929 {
930     \cs_set_eq:NN \l__tag_role_remap_tag_tl \g__tag_struct_tag_tl
931     \cs_set_eq:NN \l__tag_role_remap_NS_tl \g__tag_struct_tag_NS_tl
932     \_tag_role_remap:
933     \cs_gset_eq:NN \g__tag_struct_tag_tl \l__tag_role_remap_tag_tl
934     \cs_gset_eq:NN \g__tag_struct_tag_NS_tl \l__tag_role_remap_NS_tl
935     \_tag_struct_set_tag_info:eVV
936     { \int_eval:n {\c@g__tag_struct_abs_int} }
937     \g__tag_struct_tag_tl
938     \g__tag_struct_tag_NS_tl
939 }
940 }
941 {
942     \msg_warning:nnn{ tag }{struct-label-unknown}{#1}
943 }
944 }
945 }
946 \end{package}

```

(End definition for \tag\_struct\_use\_num:n. This function is documented on page ??.)

**\tag\_struct\_object\_ref:n** This is a command that allows to reference a structure. The argument is the number which can be get for the current structure with \tag\_get:n{struct\_num} TODO check if it should be in base too.

```

947 \begin{package}
948 \cs_new:Npn \tag_struct_object_ref:n #1
949 {
950     \pdf_object_ref:n {__tag/struct/#1}
951 }
952 \cs_generate_variant:Nn \tag_struct_object_ref:n {e}

```



(End definition for `\tag_struct_object_ref:n`. This function is documented on page 86.)

`\tag_struct_gput:nnn` This is a command that allows to update the data of a structure. The first argument is the number of the structure, the second a keyword referring to a function, the third the value. Currently the only keyword is `ref`

```

953 \cs_new_protected:Npn \tag_struct_gput:nnn #1 #2 #3
954 {
955   \cs_if_exist_use:cF {__tag_struct_gput_data_#2:nn}
956   { %warning??
957     \use_none:nn
958   }
959   {#1}{#3}
960 }
961 \cs_generate_variant:Nn \tag_struct_gput:nnn {ene,nne}

```

(End definition for `\tag_struct_gput:nnn`. This function is documented on page ??.)

`\__tag_struct_gput_data_ref:nn`

```

962 \cs_new_protected:Npn \__tag_struct_gput_data_ref:nn #1 #2
963   % #1 receiving struct num, #2 list of object ref
964   {
965     \prop_get:cnN
966     { g__tag_struct_#1_prop }
967     {Ref}
968     \l__tag_get_tmpc_tl
969     \__tag_prop_gput:cnx
970     { g__tag_struct_#1_prop }
971     { Ref }
972     { \quark_if_no_value:NF\l__tag_get_tmpc_tl { \l__tag_get_tmpc_tl\c_space_tl }#2 }
973   }
974 \cs_generate_variant:Nn \__tag_struct_gput_data_ref:nn {ee}

```

(End definition for `\__tag_struct_gput_data_ref:nn`.)

`\tag_struct_insert_annot:nn` This are the user command to insert annotations. They must be used together to get the numbers right. They use a counter to the `StructParent` and `\tag_struct_insert_annot:nn` increases the counter given back by `\tag_struct_parent_int:.`

`\tag_struct_insert_annot:xx`

`\tag_struct_parent_int:`

It must be used together with `\tag_struct_parent_int:` to insert an annotation. TODO: decide how it should be guarded if tagging is deactivated.

```

975 \cs_new_protected:Npn \tag_struct_insert_annot:nn #1 #2 %#1 should be an object reference
976                                     %#2 struct parent num
977 {
978   \__tag_check_if_active_struct:T
979   {
980     \__tag_struct_insert_annot:nn {#1}{#2}
981   }
982 }
983
984 \cs_generate_variant:Nn \tag_struct_insert_annot:nn {xx}
985 \cs_new:Npn \tag_struct_parent_int: {\int_use:c { c@g__tag_parenttree_obj_int }}
986
987 \</package>
988

```

(End definition for `\tag_struct_insert_annot:nn` and `\tag_struct_parent_int:.` These functions are documented on page 86.)

## 7 Attributes and attribute classes

```

989 \<header>
990 \ProvidesExplPackage {tagpdf-attr-code} {2023-05-16} {0.98g}
991 {part of tagpdf - code related to attributes and attribute classes}
992 \</header>

```

### 7.1 Variables

`\g__tag_attr_entries_prop` `\g__@@_attr_entries_prop` will store attribute names and their dictionary content.  
`\g__tag_attr_class_used_seq` `\g__@@_attr_class_used_seq` will hold the attributes which have been used as class name. `\l__@@_attr_value_tl` is used to build the attribute array or key. Everytime an attribute is used for the first time, and object is created with its content, the name-object reference relation is stored in `\g__@@_attr_objref_prop`

```

993 \<package>
994 \prop_new:N \g__tag_attr_entries_prop
995 \seq_new:N \g__tag_attr_class_used_seq
996 \tl_new:N \l__tag_attr_value_tl
997 \prop_new:N \g__tag_attr_objref_prop %will contain obj num of used attributes

(End definition for \g__tag_attr_entries_prop and others.)

```

### 7.2 Commands and keys

`\__tag_attr_new_entry:nn` This allows to define attributes. Defined attributes are stored in a global property.  
`newattribute_␣(setup-key)` `newattribute` expects two brace group, the name and the content. The content typically needs an `/O` key for the owner. An example look like this.

```

\tagpdfsetup
{
  newattribute =
    {TH-col}{/O /Table /Scope /Column},
  newattribute =
    {TH-row}{/O /Table /Scope /Row},
}

998 \cs_new_protected:Npn \__tag_attr_new_entry:nn #1 #2 %#1:name, #2: content
999 {
1000   \prop_gput:Nen \g__tag_attr_entries_prop
1001   {\pdf_name_from_unicode_e:n{#1}}{#2}
1002 }
1003
1004 \keys_define:nn { __tag / setup }
1005 {
1006   newattribute .code:n =
1007   {
1008     \__tag_attr_new_entry:nn #1
1009   }
1010 }

```

(End definition for `\__tag_attr_new_entry:nn` and `newattribute (setup-key)`. This function is documented on page 89.)

`attribute-class_(struct-key)` attribute-class has to store the used attribute names so that they can be added to the ClassMap later.

```

1011 \keys_define:nn { __tag / struct }
1012 {
1013   attribute-class .code:n =
1014   {
1015     \clist_set:Nx \l__tag_tmpa_clist { #1 }
1016     \seq_set_from_clist:NN \l__tag_tmpb_seq \l__tag_tmpa_clist
1017     \seq_set_map_x:NNN \l__tag_tmpa_seq \l__tag_tmpb_seq
1018     {
1019       \pdf_name_from_unicode_e:n {##1}
1020     }
1021     \seq_map_inline:Nn \l__tag_tmpa_seq
1022     {
1023       \prop_if_in:NnF \g__tag_attr_entries_prop {##1}
1024       {
1025         \msg_error:nnn { tag } { attr-unknown } { ##1 }
1026       }
1027       \seq_gput_left:Nn\g__tag_attr_class_used_seq { ##1}
1028     }
1029     \tl_set:Nx \l__tag_tmpa_tl
1030     {
1031       \int_compare:nT { \seq_count:N \l__tag_tmpa_seq > 1 }{[]}
1032       \seq_use:Nn \l__tag_tmpa_seq { \c_space_tl }
1033       \int_compare:nT { \seq_count:N \l__tag_tmpa_seq > 1 }{[]}
1034     }
1035     \int_compare:nT { \seq_count:N \l__tag_tmpa_seq > 0 }
1036     {
1037       \__tag_prop_gput:cnx
1038       { g__tag_struct_\int_eval:n {\c@g__tag_struct_abs_int}_prop }
1039       { C }
1040       { \l__tag_tmpa_tl }
1041       %\prop_show:c { g__tag_struct_\int_eval:n {\c@g__tag_struct_abs_int}_prop }
1042     }
1043   }
1044 }

```

(End definition for attribute-class (struct-key). This function is documented on page 88.)

`attribute_(struct-key)`

```

1045 \keys_define:nn { __tag / struct }
1046 {
1047   attribute .code:n = % A property (attribute, value currently a dictionary)
1048   {
1049     \clist_set:Nx          \l__tag_tmpa_clist { #1 }
1050     \clist_if_empty:NF \l__tag_tmpa_clist
1051     {
1052       \seq_set_from_clist:NN \l__tag_tmpb_seq \l__tag_tmpa_clist
1053       \seq_set_map_x:NNN \l__tag_tmpa_seq \l__tag_tmpb_seq
1054       {
1055         \pdf_name_from_unicode_e:n {##1}

```

```

1056     }
1057     \tl_set:Nx \l__tag_attr_value_tl
1058     {
1059         \int_compare:nT { \seq_count:N \l__tag_tmpa_seq > 1 }{[]}%
1060     }
1061     \seq_map_inline:Nn \l__tag_tmpa_seq
1062     {
1063         \prop_if_in:NnF \g__tag_attr_entries_prop {##1}
1064         {
1065             \msg_error:nnn { tag } { attr-unknown } { ##1 }
1066         }
1067         \prop_if_in:NnF \g__tag_attr_objref_prop {##1}
1068         {%\prop_show:N \g__tag_attr_entries_prop
1069         \pdf_object_unnamed_write:nx
1070         { dict }
1071         {
1072             \prop_item:Nn\g__tag_attr_entries_prop {##1}
1073         }
1074         \prop_gput:Nnx \g__tag_attr_objref_prop {##1} {\pdf_object_ref_last:}
1075     }
1076     \tl_put_right:Nx \l__tag_attr_value_tl
1077     {
1078         \c_space_tl
1079         \prop_item:Nn \g__tag_attr_objref_prop {##1}
1080     }
1081 %     \tl_show:N \l__tag_attr_value_tl
1082     }
1083     \tl_put_right:Nx \l__tag_attr_value_tl
1084     { %[
1085         \int_compare:nT { \seq_count:N \l__tag_tmpa_seq > 1 }{[]}%
1086     }
1087 %     \tl_show:N \l__tag_attr_value_tl
1088     \__tag_prop_gput:cnx
1089     { g__tag_struct_\int_eval:n {\c@g__tag_struct_abs_int}_prop }
1090     { A }
1091     { \l__tag_attr_value_tl }
1092 }
1093 },
1094 }
1095 \end{package}

```

(End definition for attribute (struct-key). This function is documented on page 88.)

## Part VIII

# The tagpdf-luatex.def Driver for luatex Part of the tagpdf package

```
1 <@@=tag>
2 <*luatex>
3 \ProvidesExplFile {tagpdf-luatex.def} {2023-05-16} {0.98g}
4 {tagpdf~driver~for~luatex}
```

## 1 Loading the lua

The space code requires that the fall back font has been loaded and initialized, so we force that first. But perhaps this could be done in the kernel.

```
5 {
6   \fontencoding{TU}\fontfamily{lmr}\fontseries{m}\fontshape{n}\fontsize{10pt}{10pt}\selectfont
7 }
8 \lua_now:e { tagpdf=require('tagpdf.lua') }
```

The following defines wrappers around prop and seq commands to store the data also in lua tables. I probably want also lua tables I put them in the ltx.@@.tables namespaces. The tables will be named like the variables but without backslash. To access such a table with a dynamical name create a string and then use ltx.@@.tables[string]. Old code, I'm not quite sure if this was a good idea. Now I have mix of table in ltx.@@.tables and ltx.@@.mc/struct. And a lot is probably not needed. TODO: this should be cleaned up, but at least roles are currently using the table!

```

    \__tag_prop_new:N
    \__tag_seq_new:N
    \__tag_prop_gput:Nnn
    \__tag_seq_gput_right:Nn
    \__tag_seq_item:cn
    \__tag_prop_item:cn
    \__tag_seq_show:N
    \__tag_prop_show:N
9 \cs_set_protected:Npn \__tag_prop_new:N #1
10 {
11   \prop_new:N #1
12   \lua_now:e { ltx.__tag.tables.\cs_to_str:N#1 = {} }
13 }
14
15
16 \cs_set_protected:Npn \__tag_seq_new:N #1
17 {
18   \seq_new:N #1
19   \lua_now:e { ltx.__tag.tables.\cs_to_str:N#1 = {} }
20 }
21
22
23 \cs_set_protected:Npn \__tag_prop_gput:Nnn #1 #2 #3
24 {
25   \prop_gput:Nnn #1 { #2 } { #3 }
26   \lua_now:e { ltx.__tag.tables.\cs_to_str:N#1 ["#2"] = "#3" }
27 }
28
29
```

```

30 \cs_set_protected:Npn \__tag_seq_gput_right:Nn #1 #2
31 {
32   \seq_gput_right:Nn #1 { #2 }
33   \lua_now:e { table.insert(ltx.__tag.tables.\cs_to_str:N#1, "#2") }
34 }
35
36 %Hm not quite sure about the naming
37
38 \cs_set:Npn \__tag_seq_item:cn #1 #2
39 {
40   \lua_now:e { tex.print(ltx.__tag.tables.#1[#2]) }
41 }
42
43 \cs_set:Npn \__tag_prop_item:cn #1 #2
44 {
45   \lua_now:e { tex.print(ltx.__tag.tables.#1["#2"]) }
46 }
47
48 %for debugging commands that show both the seq/prop and the lua tables
49 \cs_set_protected:Npn \__tag_seq_show:N #1
50 {
51   \seq_show:N #1
52   \lua_now:e { ltx.__tag.trace.log ("lua~sequence~array~\cs_to_str:N#1",1) }
53   \lua_now:e { ltx.__tag.trace.show_seq (ltx.__tag.tables.\cs_to_str:N#1) }
54 }
55
56 \cs_set_protected:Npn \__tag_prop_show:N #1
57 {
58   \prop_show:N #1
59   \lua_now:e {ltx.__tag.trace.log ("lua~property~table~\cs_to_str:N#1",1) }
60   \lua_now:e {ltx.__tag.trace.show_prop (ltx.__tag.tables.\cs_to_str:N#1) }
61 }

```

(End definition for \\_\_tag\_prop\_new:N and others.)

62  $\langle$ /luatex $\rangle$

The module declaration

```

63  $\langle$ *lua $\rangle$ 
64 -- tagpdf.lua
65 -- Ulrike Fischer
66
67 local ProvidesLuaModule = {
68   name      = "tagpdf",
69   version   = "0.98g",      --TAGVERSION
70   date      = "2023-05-16", --TAGDATE
71   description = "tagpdf lua code",
72   license    = "The LATEX Project Public License 1.3c"
73 }
74
75 if luatexbase and luatexbase.provides_module then
76   luatexbase.provides_module (ProvidesLuaModule)
77 end
78
79 --[[

```

```

80 The code has quite probably a number of problems
81 - more variables should be local instead of global
82 - the naming is not always consistent due to the development of the code
83 - the traversing of the shipout box must be tested with more complicated setups
84 - it should probably handle more node types
85 -
86 --]]
87

```

Some comments about the lua structure.

```

88 --[[
89 the main table is named ltx.__tag. It contains the functions and also the data
90 collected during the compilation.
91
92 ltx.__tag.mc      will contain mc connected data.
93 ltx.__tag.struct  will contain structure related data.
94 ltx.__tag.page    will contain page data
95 ltx.__tag.tables  contains also data from mc and struct (from older code). This needs cleaning
96                 There are certainly dublettes, but I don't dare yet ...
97 ltx.__tag.func    will contain (public) functions.
98 ltx.__tag.trace   will contain tracing/logging functions.
99 local funktions  starts with __
100 functions meant for users will be in ltx.tag
101
102 functions
103 ltx.__tag.func.get_num_from (tag):   takes a tag (string) and returns the id number
104 ltx.__tag.func.output_num_from (tag): takes a tag (string) and prints (to tex) the id number
105 ltx.__tag.func.get_tag_from (num):   takes a num and returns the tag
106 ltx.__tag.func.output_tag_from (num): takes a num and prints (to tex) the tag
107 ltx.__tag.func.store_mc_data (num,key,data): stores key=data in ltx.__tag.mc[num]
108 ltx.__tag.func.store_mc_label (label,num): stores label=num in ltx.__tag.mc.labels
109 ltx.__tag.func.store_mc_kid (mcnum,kid,page): stores the mc-kids of mcnum on page page
110 ltx.__tag.func.store_mc_in_page(mcnum,mcpagecnt,page): stores in the page table the number of
111 ltx.__tag.func.store_struct_mcabs (structnum,mcnum): stores relations structnum<->mcnum (abs)
112 ltx.__tag.func.mc_insert_kids (mcnum): inserts the /K entries for mcnum by wandering through
113 ltx.__tag.func.mark_page_elements(box,mcpagecnt,mccntprev,mcopen,name,mctypeprev) : the main
114 ltx.__tag.func.mark_shipout (): a wrapper around the core function which inserts the last EM
115 ltx.__tag.func.fill_parent_tree_line (page): outputs the entries of the parenttree for this p
116 ltx.__tag.func.output_parenttree(): outputs the content of the parenttree
117 ltx.__tag.func.pdf_object_ref(name): outputs the object reference for the object name
118 ltx.__tag.func.markspaceon(), ltx.__tag.func.markspaceoff(): (de)activates the marking of pos
119 ltx.__tag.trace.show_mc_data (num,loglevel): shows ltx.__tag.mc[num] is the current log leve
120 ltx.__tag.trace.show_all_mc_data (max,loglevel): shows a maximum about mc's if the current l
121 ltx.__tag.trace.show_seq: shows a sequence (array)
122 ltx.__tag.trace.show_struct_data (num): shows data of structure num
123 ltx.__tag.trace.show_prop: shows a prop
124 ltx.__tag.trace.log
125 ltx.__tag.trace.showspace : boolean
126 --]]
127

```

This set-ups the main attribute registers. The mc\_type attribute stores the type (P, Span etc) encoded as a num, The mc\_cnt attribute stores the absolute number and allows so to see if a node belongs to the same mc-chunk.

The interwordspace attr is set by the function @@\_mark\_spaces, and marks the place where spaces should be inserted. The interwordfont attr is set by the function @@\_mark\_spaces too and stores the font, so that we can decide which font to use for the real space char.

```
128 local mctypeattributeid = luatexbase.new_attribute ("g__tag_mc_type_attr")
129 local mcntattributeid   = luatexbase.new_attribute ("g__tag_mc_cnt_attr")
130 local iwspaceattributeid = luatexbase.new_attribute ("g__tag_interwordspace_attr")
131 local iwfontattributeid  = luatexbase.new_attribute ("g__tag_interwordfont_attr")
```

with this token we can query the state of the boolean and so detect if unmarked nodes should be marked as attributes

```
132 local tagunmarkedbool= token.create("g__tag_tagunmarked_bool")
133 local truebool       = token.create("c_true_bool")
```

Now a number of local versions from global tables. Not all is perhaps needed, most node variants were copied from lua-debug.

```
134 local catlatex      = luatexbase.registernumber("catcodetable@latex")
135 local tableinsert    = table.insert
136 local nodeid         = node.id
137 local nodecopy       = node.copy
138 local nodegetattribute = node.get_attribute
139 local nodesetattribute = node.set_attribute
140 local nodehasattribute = node.has_attribute
141 local nodenew        = node.new
142 local nodetail       = node.tail
143 local nodeslide      = node.slide
144 local noderemove     = node.remove
145 local nodetraverseid = node.traverse_id
146 local nodetraverse   = node.traverse
147 local nodeinsertafter = node.insert_after
148 local nodeinsertbefore = node.insert_before
149 local pdfpageref     = pdf.pageref
150
151 local HLIST          = node.id("hlist")
152 local VLIST          = node.id("vlist")
153 local RULE           = node.id("rule")
154 local DISC           = node.id("disc")
155 local GLUE           = node.id("glue")
156 local GLYPH          = node.id("glyph")
157 local KERN           = node.id("kern")
158 local PENALTY        = node.id("penalty")
159 local LOCAL_PAR      = node.id("local_par")
160 local MATH           = node.id("math")
```

Now we setup the main table structure. ltx is used by other latex code too!

```
161 ltx          = ltx          or { }
162 ltx.__tag     = ltx.__tag     or { }
163 ltx.__tag.mc  = ltx.__tag.mc  or { } -- mc data
164 ltx.__tag.struct = ltx.__tag.struct or { } -- struct data
165 ltx.__tag.tables = ltx.__tag.tables or { } -- tables created with new prop and new seq.
166                                     -- wasn't a so great idea ...
167                                     -- g__tag_role_tags_seq used by tag<-> is in this table
168                                     -- used for pure lua tables too now!
169 ltx.__tag.page = ltx.__tag.page or { } -- page data, currently only i->{0->mcnum,1->mcnum}
170 ltx.__tag.trace = ltx.__tag.trace or { } -- show commands
```



```

171 ltx.__tag.func      = ltx.__tag.func    or { } -- functions
172 ltx.__tag.conf      = ltx.__tag.conf    or { } -- configuration variables

```

## 2 Logging functions

`__tag_log` This rather simple log function takes as argument a message (string) and a number and will output the message to the log/terminal if the current loglevel is greater or equal than num.

```

173 local __tag_log =
174   function (message,loglevel)
175     if (loglevel or 3) <= tex.count["l__tag_loglevel_int"] then
176       texio.write_nl("tagpdf: ".. message)
177     end
178   end
179
180 ltx.__tag.trace.log = __tag_log

```

(End definition for `__tag_log` and `ltx.__tag.trace.log`.)

`ltx.__tag.trace.show_seq` This shows the content of a seq as stored in the tables table. It is used by the `\@@_seq_show:N` function. It is not used in user commands, only for debugging, and so requires log level >0.

```

181 function ltx.__tag.trace.show_seq (seq)
182   if (type(seq) == "table") then
183     for i,v in ipairs(seq) do
184       __tag_log ("[" .. i .. "]" => " .. tostring(v),1)
185     end
186   else
187     __tag_log ("sequence " .. tostring(seq) .. " not found",1)
188   end
189 end

```

(End definition for `ltx.__tag.trace.show_seq`.)

`__tag_pairs_prop` This shows the content of a prop as stored in the tables table. It is used by the `\@@_prop_show:N` function.

```

190 local __tag_pairs_prop =
191   function (prop)
192     local a = {}
193     for n in pairs(prop) do tableinsert(a, n) end
194     table.sort(a)
195     local i = 0           -- iterator variable
196     local iter = function () -- iterator function
197       i = i + 1
198       if a[i] == nil then return nil
199       else return a[i], prop[a[i]]
200     end
201   end
202   return iter
203 end
204
205
206 function ltx.__tag.trace.show_prop (prop)

```

```

207 if (type(prop) == "table") then
208   for i,v in __tag_pairs_prop (prop) do
209     __tag_log ("[" .. i .. "] => " .. tostring(v),1)
210   end
211 else
212   __tag_log ("prop " .. tostring(prop) .. " not found or not a table",1)
213 end
214 end

```

(End definition for \_\_tag\_pairs\_prop and ltx.\_\_tag.trace.show\_prop.)

ltx.\_\_tag.trace.show\_mc\_data This shows some data for a mc given by num. If something is shown depends on the log level. The function is used by the following function and then in \ShowTagging

```

215 function ltx.__tag.trace.show_mc_data (num,loglevel)
216 if ltx.__tag and ltx.__tag.mc and ltx.__tag.mc[num] then
217   for k,v in pairs(ltx.__tag.mc[num]) do
218     __tag_log ("mc"..num..": " ..tostring(k)..=>" ..tostring(v),loglevel)
219   end
220   if ltx.__tag.mc[num]["kids"] then
221     __tag_log ("mc" .. num .. " has " .. #ltx.__tag.mc[num]["kids"] .. " kids",loglevel)
222     for k,v in ipairs(ltx.__tag.mc[num]["kids"]) do
223       __tag_log ("mc " .. num .. " kid "..k.." =>" .. v.kid.." on page " ..v.page,loglevel)
224     end
225   end
226 else
227   __tag_log ("mc"..num.." not found",loglevel)
228 end
229 end

```

(End definition for ltx.\_\_tag.trace.show\_mc\_data.)

ltx.\_\_tag.trace.show\_all\_mc\_data This shows data for the mc's between min and max (numbers). It is used by the \ShowTagging function.

```

230 function ltx.__tag.trace.show_all_mc_data (min,max,loglevel)
231   for i = min, max do
232     ltx.__tag.trace.show_mc_data (i,loglevel)
233   end
234   texio.write_nl("")
235 end

```

(End definition for ltx.\_\_tag.trace.show\_all\_mc\_data.)

ltx.\_\_tag.trace.show\_struct\_data This function shows some struct data. Unused but kept for debugging.

```

236 function ltx.__tag.trace.show_struct_data (num)
237 if ltx.__tag and ltx.__tag.struct and ltx.__tag.struct[num] then
238   for k,v in ipairs(ltx.__tag.struct[num]) do
239     __tag_log ("struct "..num..": " ..tostring(k)..=>" ..tostring(v),1)
240   end
241 else
242   __tag_log ("struct "..num.." not found ",1)
243 end
244 end

```

(End definition for ltx.\_\_tag.trace.show\_struct\_data.)

## 3 Helper functions

### 3.1 Retrieve data functions

`__tag_get_mc_cnt_type_tag` This takes a node as argument and returns the mc-cnt, the mc-type and and the tag (calculated from the mc-cnt.

```

245 local __tag_get_mc_cnt_type_tag = function (n)
246   local mccnt      = nodegetattribute(n,mccntattributeid) or -1
247   local mctype     = nodegetattribute(n,mctypeattributeid) or -1
248   local tag        = ltx.__tag.func.get_tag_from(mctype)
249   return mccnt,mctype,tag
250 end

```

(End definition for `__tag_get_mc_cnt_type_tag`.)

`__tag_get_mathsubtype` This function allows to detect if we are at the begin or the end of math. It takes as argument a mathnode.

```

251 local function __tag_get_mathsubtype (mathnode)
252   if mathnode.subtype == 0 then
253     subtype = "beginmath"
254   else
255     subtype = "endmath"
256   end
257   return subtype
258 end

```

(End definition for `__tag_get_mathsubtype`.)

`ltx.__tag.tables.role_tag_attribute` The first is a table with key a tag and value a number (the attribute) The second is an array with the attribute value as key.

```

259 ltx.__tag.tables.role_tag_attribute = {}
260 ltx.__tag.tables.role_attribute_tag = {}

```

(End definition for `ltx.__tag.tables.role_tag_attribute`.)

`ltx.__tag.func.alloctag`

```

261 local __tag_alloctag =
262   function (tag)
263     if not ltx.__tag.tables.role_tag_attribute[tag] then
264       table.insert(ltx.__tag.tables.role_attribute_tag,tag)
265       ltx.__tag.tables.role_tag_attribute[tag]=#ltx.__tag.tables.role_attribute_tag
266       __tag_log ("Add " ..tag.." " ..ltx.__tag.tables.role_tag_attribute[tag],3)
267     end
268   end
269 ltx.__tag.func.alloctag = __tag_alloctag

```

(End definition for `ltx.__tag.func.alloctag`.)

`__tag_get_num_from` These functions take as argument a string `tag`, and return the number under which is it recorded (and so the attribute value). The first function outputs the number for lua, while the `output` function outputs to tex.

```

270 local __tag_get_num_from =
271   function (tag)
272     if ltx.__tag.tables.role_tag_attribute[tag] then

```

```

273     a = ltx.__tag.tables.role_tag_attribute[tag]
274     else
275         a = -1
276     end
277     return a
278 end
279
280 ltx.__tag.func.get_num_from = __tag_get_num_from
281
282 function ltx.__tag.func.output_num_from (tag)
283     local num = __tag_get_num_from (tag)
284     tex.sprint(catlatex,num)
285     if num == -1 then
286         __tag_log ("Unknown tag "..tag.." used")
287     end
288 end

```

(End definition for \_\_tag\_get\_num\_from, ltx.\_\_tag.func.get\_num\_from, and ltx.\_\_tag.func.output\_num\_from.)

\_\_tag\_get\_tag\_from These functions are the opposites to the previous function: they take as argument a number (the attribute value) and return the string tag. The first function outputs the string for lua, while the output function outputs to tex.

```

289 local __tag_get_tag_from =
290 function (num)
291     if ltx.__tag.tables.role_attribute_tag[num] then
292         a = ltx.__tag.tables.role_attribute_tag[num]
293     else
294         a = "UNKNOWN"
295     end
296     return a
297 end
298
299 ltx.__tag.func.get_tag_from = __tag_get_tag_from
300
301 function ltx.__tag.func.output_tag_from (num)
302     tex.sprint(catlatex,__tag_get_tag_from (num))
303 end

```

(End definition for \_\_tag\_get\_tag\_from, ltx.\_\_tag.func.get\_tag\_from, and ltx.\_\_tag.func.output\_tag\_from.)

ltx.\_\_tag.func.store\_mc\_data This function stores for key=data for mc-chunk num. It is used in the tagpdf-mc code, to store for example the tag string, and the raw options.

```

304 function ltx.__tag.func.store_mc_data (num,key,data)
305     ltx.__tag.mc[num] = ltx.__tag.mc[num] or { }
306     ltx.__tag.mc[num][key] = data
307     __tag_log ("INFO TEX-STORE-MC-DATA: "..num.." => "..tostring(key).. " => "..tostring(data),3)
308 end

```

(End definition for ltx.\_\_tag.func.store\_mc\_data.)

ltx.\_\_tag.func.store\_mc\_label This function stores the label=num relationship in the labels subtable. TODO: this is probably unused and can go.

```

309 function ltx.__tag.func.store_mc_label (label,num)

```

```

310 ltx.__tag.mc["labels"] = ltx.__tag.mc["labels"] or { }
311 ltx.__tag.mc.labels[label] = num
312 end

```

*(End definition for ltx.\_\_tag.func.store\_mc\_label.)*

`ltx.__tag.func.store_mc_kid` This function is used in the traversing code. It stores a sub-chunk of a mc mcnum into the kids table.

```

313 function ltx.__tag.func.store_mc_kid (mcnum,kid,page)
314 ltx.__tag.trace.log("INFO TAG-STORE-MC-KID: "..mcnum.." => " .. kid.." on page " .. page,3)
315 ltx.__tag.mc[mcnum]["kids"] = ltx.__tag.mc[mcnum]["kids"] or { }
316 local kidtable = {kid=kid,page=page}
317 tableinsert(ltx.__tag.mc[mcnum]["kids"], kidtable )
318 end

```

*(End definition for ltx.\_\_tag.func.store\_mc\_kid.)*

`ltx.__tag.func.mc_num_of_kids` This function returns the number of kids a mc mcnum has. We need to account for the case that a mc can have no kids.

```

319 function ltx.__tag.func.mc_num_of_kids (mcnum)
320 local num = 0
321 if ltx.__tag.mc[mcnum] and ltx.__tag.mc[mcnum]["kids"] then
322     num = #ltx.__tag.mc[mcnum]["kids"]
323 end
324 ltx.__tag.trace.log ("INFO MC-KID-NUMBERS: " .. mcnum .. "has " .. num .. "KIDS",4)
325 return num
326 end

```

*(End definition for ltx.\_\_tag.func.mc\_num\_of\_kids.)*

### 3.2 Functions to insert the pdf literals

`__tag_insert_emc_node` This insert the emc node.

```

327 local function __tag_insert_emc_node (head,current)
328 local emcnode = nodenew("whatsit","pdf_literal")
329     emcnode.data = "EMC"
330     emcnode.mode=1
331     head = node.insert_before(head,current,emcnode)
332 return head
333 end

```

*(End definition for \_\_tag\_insert\_emc\_node.)*

`__tag_insert_bmc_node` This inserts a simple bmc node

```

334 local function __tag_insert_bmc_node (head,current,tag)
335 local bmcnode = nodenew("whatsit","pdf_literal")
336     bmcnode.data = "/"..tag.." BMC"
337     bmcnode.mode=1
338     head = node.insert_before(head,current,bmcnode)
339 return head
340 end

```

*(End definition for \_\_tag\_insert\_bmc\_node.)*

`__tag_insert_bdc_node` This inserts a bcd node with a fix dict. TODO: check if this is still used, now that we create properties.

```

341 local function __tag_insert_bdc_node (head,current,tag,dict)
342   local bdcnode = nodenew("whatsit","pdf_literal")
343   bdcnode.data = "/"..tag.."<"..dict..">> BDC"
344   bdcnode.mode=1
345   head = node.insert_before(head,current,bdcnode)
346   return head
347 end

```

*(End definition for \_\_tag\_insert\_bdc\_node.)*

`__tag_pdf_object_ref` This allows to reference a pdf object reserved with the l3pdf command by name. The return value is `n 0 R`, if the object doesn't exist, `n` is 0. TODO: is uses internal l3pdf commands, this should be properly supported by l3pdf

`ltx.__tag.func.pdf_object_ref`

```

348 local function __tag_pdf_object_ref (name)
349   local tokenname = 'c__pdf_backend_object_'..name..'__int'
350   local object = token.create(tokenname).index..' 0 R'
351   return object
352 end
353 ltx.__tag.func.pdf_object_ref=__tag_pdf_object_ref

```

*(End definition for \_\_tag\_pdf\_object\_ref and ltx.\_\_tag.func.pdf\_object\_ref.)*

## 4 Function for the real space chars

`__tag_show_spacemark` A debugging function, it is used to inserts red color markers in the places where space chars can go, it can have side effects so not always reliable, but ok.

```

354 local function __tag_show_spacemark (head,current,color,height)
355   local markcolor = color or "1 0 0"
356   local markheight = height or 10
357   local pdfstring = node.new("whatsit","pdf_literal")
358   pdfstring.data =
359     string.format("q "..markcolor.." RG "..markcolor.." rg 0.4 w 0 %g m 0 %g l S Q",-
360       3,markheight)
361   head = node.insert_after(head,current,pdfstring)
362   return head
363 end

```

*(End definition for \_\_tag\_show\_spacemark.)*

`__tag_fakespace` This is used to define a lua version of `\pdffakespace`

`ltx.__tag.func.fakespace`

```

363 local function __tag_fakespace()
364   tex.setattribute(iwspaceattributeid,1)
365   tex.setattribute(iwfontattributeid,font.current())
366 end
367 ltx.__tag.func.fakespace = __tag_fakespace

```

*(End definition for \_\_tag\_fakespace and ltx.\_\_tag.func.fakespace.)*

`--tag_mark_spaces` a function to mark up places where real space chars should be inserted. It only sets attributes, these are then be used in a later traversing which inserts the actual spaces. When space handling is activated this function is inserted in some callbacks.

```

368 --[[ a function to mark up places where real space chars should be inserted
369      it only sets an attribute.
370 --]]
371
372 local function __tag_mark_spaces (head)
373     local inside_math = false
374     for n in nodetraverse(head) do
375         local id = n.id
376         if id == GLYPH then
377             local glyph = n
378             if glyph.next and (glyph.next.id == GLUE)
379                 and not inside_math and (glyph.next.width > 0)
380             then
381                 nodesetattribute(glyph.next,iwspaceattributeid,1)
382                 nodesetattribute(glyph.next,iwfontattributeid,glyph.font)
383                 -- for debugging
384                 if ltx.__tag.trace.showspace then
385                     __tag_show_spacemark (head,glyph)
386                 end
387             elseif glyph.next and (glyph.next.id==KERN) and not inside_math then
388                 local kern = glyph.next
389                 if kern.next and (kern.next.id== GLUE) and (kern.next.width > 0)
390                 then
391                     nodesetattribute(kern.next,iwspaceattributeid,1)
392                     nodesetattribute(kern.next,iwfontattributeid,glyph.font)
393                 end
394             end
395             -- look also back
396             if glyph.prev and (glyph.prev.id == GLUE)
397                 and not inside_math
398                 and (glyph.prev.width > 0)
399                 and not nodehasattribute(glyph.prev,iwspaceattributeid)
400             then
401                 nodesetattribute(glyph.prev,iwspaceattributeid,1)
402                 nodesetattribute(glyph.prev,iwfontattributeid,glyph.font)
403                 -- for debugging
404                 if ltx.__tag.trace.showspace then
405                     __tag_show_spacemark (head,glyph)
406                 end
407             end
408             elseif id == PENALTY then
409                 local glyph = n
410                 -- ltx.__tag.trace.log ("PENALTY " .. n.subtype .. "VALUE" .. n.penalty,3)
411                 if glyph.next and (glyph.next.id == GLUE)
412                     and not inside_math and (glyph.next.width > 0) and n.subtype==0
413                 then
414                     nodesetattribute(glyph.next,iwspaceattributeid,1)
415                     -- nodesetattribute(glyph.next,iwfontattributeid,glyph.font)
416                     -- for debugging
417                     if ltx.__tag.trace.showspace then
418                         __tag_show_spacemark (head,glyph)

```

```

419         end
420     end
421     elseif id == MATH then
422         inside_math = (n.subtype == 0)
423     end
424 end
425 return head
426 end

```

(End definition for `__tag_mark_spaces`.)

```

__tag_activate_mark_space  These functions add/remove the function which marks the spaces to the callbacks
ltx.__tag.func.markspaceon pre_linebreak_filter and hpack_filter
ltx.__tag.func.markspaceoff

427 local function __tag_activate_mark_space ()
428     if not luatexbase.in_callback ("pre_linebreak_filter","markspaces") then
429         luatexbase.add_to_callback("pre_linebreak_filter",__tag_mark_spaces,"markspaces")
430         luatexbase.add_to_callback("hpack_filter",__tag_mark_spaces,"markspaces")
431     end
432 end
433
434 ltx.__tag.func.markspaceon=__tag_activate_mark_space
435
436 local function __tag_deactivate_mark_space ()
437     if luatexbase.in_callback ("pre_linebreak_filter","markspaces") then
438         luatexbase.remove_from_callback("pre_linebreak_filter","markspaces")
439         luatexbase.remove_from_callback("hpack_filter","markspaces")
440     end
441 end
442
443 ltx.__tag.func.markspaceoff=__tag_deactivate_mark_space

(End definition for __tag_activate_mark_space, ltx.__tag.func.markspaceon, and ltx.__tag.func.markspaceoff.)

We need two local variable to setup a default space char.

444 local default_space_char = node.new(GLYPH)
445 local default_fontid      = font.id("TU/lmr/m/n/10")
446 default_space_char.char   = 32
447 default_space_char.font   = default_fontid

```

`__tag_space_chars_shipout` These is the main function to insert real space chars. It inserts a glyph before every glue which has been marked previously. The attributes are copied from the glue, so if the tagging is done later, it will be tagged like it.

```

448 local function __tag_space_chars_shipout (box)
449     local head = box.head
450     if head then
451         for n in node.traverse(head) do
452             local spaceattr = node.getattribute(n,iwspaceattributeid) or -1
453             if n.id == HLIST then -- enter the hlist
454                 __tag_space_chars_shipout (n)
455             elseif n.id == VLIST then -- enter the vlist
456                 __tag_space_chars_shipout (n)
457             elseif n.id == GLUE then
458                 if ltx.__tag.trace.showspaces and spaceattr==1 then
459                     __tag_show_spacemark (head,n,"0 1 0")
460                 end

```



```

461     if spaceattr==1 then
462         local space
463         local space_char = node.copy(default_space_char)
464         local curfont = node.get_attribute(n, i, font_attribute_id)
465         ltx.__tag.trace.log("INFO SPACE-FUNCTION-FONT: ".. tostring(curfont), 3)
466         if curfont and luaotfload.aux.slot_of_name(curfont, "space") then
467             space_char.font = curfont
468         end
469         head, space = node.insert_before(head, n, space_char) --
470         n.width = n.width - space.width
471         space.attr = n.attr
472     end
473 end
474 end
475 box.head = head
476 end
477 end
478
479 function ltx.__tag.func.space_chars_shipout (box)
480     __tag_space_chars_shipout (box)
481 end

```

(End definition for `__tag_space_chars_shipout` and `ltx.__tag.func.space_chars_shipout`.)

## 5 Function for the tagging

`ltx.__tag.func.mc_insert_kids` This is the main function to insert the K entry into a StructElem object. It is used in `tagpdf-mc-luacode` module. The `single` attribute allows to handle the case that a single mc on the tex side can have more than one kid after the processing here, and so we get the correct array/non array setup.

```

482 function ltx.__tag.func.mc_insert_kids (mcnum, single)
483     if ltx.__tag.mc[mcnum] then
484         ltx.__tag.trace.log("INFO TEX-MC-INSERT-KID-TEST: " .. mcnum, 4)
485         if ltx.__tag.mc[mcnum]["kids"] then
486             if #ltx.__tag.mc[mcnum]["kids"] > 1 and single==1 then
487                 tex.sprint("")
488             end
489             for i, kidstable in ipairs( ltx.__tag.mc[mcnum]["kids"] ) do
490                 local kidnum = kidstable["kid"]
491                 local kidpage = kidstable["page"]
492                 local kidpageobjnum = pdfpageref(kidpage)
493                 ltx.__tag.trace.log("INFO TEX-MC-INSERT-KID: " .. mcnum ..
494                     " insert KID " .. i ..
495                     " with num " .. kidnum ..
496                     " on page " .. kidpage.." / ".. kidpageobjnum, 3)
497                 tex.sprint(catlatex, "<</Type /MCR /Pg ".. kidpageobjnum .. " 0 R /MCID " .. kidnum .. ">> ")
498             end
499             if #ltx.__tag.mc[mcnum]["kids"] > 1 and single==1 then
500                 tex.sprint("")
501             end
502         else
503             -- this is typically not a problem, e.g. empty hbox in footer/header can
504             -- trigger this warning.

```

```

505     ltx.__tag.trace.log("WARN TEX-MC-INSERT-NO-KIDS: "..mcnum.." has no kids",2)
506     if single==1 then
507         tex.sprint("null")
508     end
509 end
510 else
511     ltx.__tag.trace.log("WARN TEX-MC-INSERT-MISSING: "..mcnum.." doesn't exist",0)
512 end
513 end

```

(End definition for ltx.\_\_tag.func.mc\_insert\_kids.)

ltx.\_\_tag.func.store\_struct\_mcabs This function is used in the tagpdf-mc-luacode. It store the absolute count of the mc into the current structure. This must be done ordered.

```

514 function ltx.__tag.func.store_struct_mcabs (structnum,mcnum)
515     ltx.__tag.struct[structnum]=ltx.__tag.struct[structnum] or { }
516     ltx.__tag.struct[structnum]["mc"]=ltx.__tag.struct[structnum]["mc"] or { }
517     -- a structure can contain more than on mc chunk, the content should be ordered
518     tableinsert(ltx.__tag.struct[structnum]["mc"],mcnum)
519     ltx.__tag.trace.log("INFO TEX-MC-INTO-STRUCT: "..
520         mcnum.." inserted in struct "..structnum,3)
521     -- but every mc can only be in one structure
522     ltx.__tag.mc[mcnum]= ltx.__tag.mc[mcnum] or { }
523     ltx.__tag.mc[mcnum]["parent"] = structnum
524 end
525

```

(End definition for ltx.\_\_tag.func.store\_struct\_mcabs.)

ltx.\_\_tag.func.store\_mc\_in\_page This is used in the traversing code and stores the relation between abs count and page count.

```

526 -- pay attention: lua counts arrays from 1, tex pages from one
527 -- mcid and arrays in pdf count from 0.
528 function ltx.__tag.func.store_mc_in_page (mcnum,mcpagencnt,page)
529     ltx.__tag.page[page] = ltx.__tag.page[page] or {}
530     ltx.__tag.page[page][mcpagencnt] = mcnum
531     ltx.__tag.trace.log("INFO TAG-MC-INTO-PAGE: page " .. page ..
532         ": inserting MCID " .. mcpagencnt .. " => " .. mcnum,3)
533 end

```

(End definition for ltx.\_\_tag.func.store\_mc\_in\_page.)

ltx.\_\_tag.func.mark\_page\_elements This is the main traversing function. See the lua comment for more details.

```

534 --[[
535     Now follows the core function
536     It wades through the shipout box and checks the attributes
537     ARGUMENTS
538     box: is a box,
539     mcpagencnt: num, the current page cnt of mc (should start at -1 in shipout box), needed for
540     mcntprev: num, the attribute cnt of the previous node/whatever - if different we have a c
541     mcopy: num, records if some bdc/emc is open
542     These arguments are only needed for log messages, if not present are replaces by fix string
543     name: string to describe the box
544     mctypeprev: num, the type attribute of the previous node/whatever
545

```

```

546     there are lots of logging messages currently. Should be cleaned up in due course.
547     One should also find ways to make the function shorter.
548 --]]
549
550 function ltx.__tag.func.mark_page_elements (box,mcpagencnt,mccntprev,mcopen,name,mctypeprev)
551     local name = name or ("SOMEBBOX")
552     local mctypeprev = mctypeprev or -1
553     local abspage = status.total_pages + 1 -- the real counter is increased
554                                           -- inside the box so one off
555                                           -- if the callback is not used. (???)
556     ltx.__tag.trace.log ("INFO TAG-ABSPAGE: " .. abspage,3)
557     ltx.__tag.trace.log ("INFO TAG-ARGS: pagencnt".. mcpagencnt..
558                         " prev "..mccntprev ..
559                         " type prev "..mctypeprev,4)
560     ltx.__tag.trace.log ("INFO TAG-TRAVERSING-BOX: ".. tostring(name)..
561                         " TYPE ".. node.type(node.getid(box)),3)
562     local head = box.head -- ShipoutBox is a vlist?
563     if head then
564         mccnthead, mctypehead,taghead = __tag_get_mc_cnt_type_tag (head)
565         ltx.__tag.trace.log ("INFO TAG-HEAD: " ..
566                             node.type(node.getid(head))..
567                             " MC"..tostring(mccnthead)..
568                             " => TAG " .. tostring(mctypehead)..
569                             " => ".. tostring(taghead),3)
570     else
571         ltx.__tag.trace.log ("INFO TAG-NO-HEAD: head is "..
572                             tostring(head),3)
573     end
574     for n in node.traverse(head) do
575         local mccnt, mctype, tag = __tag_get_mc_cnt_type_tag (n)
576         local spaceattr = nodegetattribute(n,iwspaceattributeid) or -1
577         ltx.__tag.trace.log ("INFO TAG-NODE: "..
578                             node.type(node.getid(n))..
579                             " MC".. tostring(mccnt)..
580                             " => TAG ".. tostring(mctype)..
581                             " => " .. tostring(tag),3)
582         if n.id == HLIST
583         then -- enter the hlist
584             mcopen,mcpagencnt,mccntprev,mctypeprev=
585                 ltx.__tag.func.mark_page_elements (n,mcpagencnt,mccntprev,mcopen,"INTERNAL HLIST",mctypeprev)
586         elseif n.id == VLIST then -- enter the vlist
587             mcopen,mcpagencnt,mccntprev,mctypeprev=
588                 ltx.__tag.func.mark_page_elements (n,mcpagencnt,mccntprev,mcopen,"INTERNAL VLIST",mctypeprev)
589         elseif n.id == GLUE and not n.leader then -- at glue real space chars are inserted, but tl
590                                           -- been done if the previous shipout wandering, so here it
591         elseif n.id == LOCAL_PAR then -- local_par is ignored
592         elseif n.id == PENALTY then -- penalty is ignored
593         elseif n.id == KERN then -- kern is ignored
594             ltx.__tag.trace.log ("INFO TAG-KERN-SUBTYPE: "..
595                                 node.type(node.getid(n)).." "..n.subtype,4)
596         else
597             -- math is currently only logged.
598             -- we could mark the whole as math
599             -- for inner processing the mlist_to_hlist callback is probably needed.

```

```

600 if n.id == MATH then
601   ltx.__tag.trace.log("INFO TAG-MATH-SUBTYPE: "..
602     node.type(node.getid(n)).." " ..__tag_get_mathsubtype(n),4)
603 end
604 -- endmath
605 ltx.__tag.trace.log("INFO TAG-MC-COMPARE: current "..
606   mccnt.." prev "..mccntprev,4)
607 if mccnt~=mccntprev then -- a new mc chunk
608   ltx.__tag.trace.log ("INFO TAG-NEW-MC-NODE: "..
609     node.type(node.getid(n))..
610     " MC"..tostring(mccnt)..
611     " <=> PREVIOUS "..tostring(mccntprev),4)
612 if mcpopen~=0 then -- there is a chunk open, close it (hope there is only one ...
613   box.list=__tag_insert_emc_node (box.list,n)
614   mcpopen = mcpopen - 1
615   ltx.__tag.trace.log ("INFO TAG-INSERT-EMC: " ..
616     mcpagecnt .. " MCOPEN = " .. mcpopen,3)
617 if mcpopen ~=0 then
618   ltx.__tag.trace.log ("WARN TAG-OPEN-MC: " .. mcpopen,1)
619 end
620 end
621 if ltx.__tag.mc[mccnt] then
622   if ltx.__tag.mc[mccnt]["artifact"] then
623     ltx.__tag.trace.log("INFO TAG-INSERT-ARTIFACT: "..
624       tostring(ltx.__tag.mc[mccnt]["artifact"]),3)
625   if ltx.__tag.mc[mccnt]["artifact"] == "" then
626     box.list = __tag_insert_bmc_node (box.list,n,"Artifact")
627   else
628     box.list = __tag_insert_bdc_node (box.list,n,"Artifact", "/Type /"..ltx.__tag.mc[mccnt]
629   end
630 else
631   ltx.__tag.trace.log("INFO TAG-INSERT-TAG: "..
632     tostring(tag),3)
633   mcpagecnt = mcpagecnt +1
634   ltx.__tag.trace.log ("INFO TAG-INSERT-BDC: "..mcpagecnt,3)
635   local dict= "/MCID "..mcpagecnt
636   if ltx.__tag.mc[mccnt]["raw"] then
637     ltx.__tag.trace.log("INFO TAG-USE-RAW: "..
638       tostring(ltx.__tag.mc[mccnt]["raw"]),3)
639     dict= dict .. " " .. ltx.__tag.mc[mccnt]["raw"]
640   end
641   if ltx.__tag.mc[mccnt]["alt"] then
642     ltx.__tag.trace.log("INFO TAG-USE-ALT: "..
643       tostring(ltx.__tag.mc[mccnt]["alt"]),3)
644     dict= dict .. " " .. ltx.__tag.mc[mccnt]["alt"]
645   end
646   if ltx.__tag.mc[mccnt]["actualtext"] then
647     ltx.__tag.trace.log("INFO TAG-USE-ACTUALTEXT: "..
648       tostring(ltx.__tag.mc[mccnt]["actualtext"]),3)
649     dict= dict .. " " .. ltx.__tag.mc[mccnt]["actualtext"]
650   end
651   box.list = __tag_insert_bdc_node (box.list,n,tag, dict)
652   ltx.__tag.func.store_mc_kid (mccnt,mcpagecnt,abspage)
653   ltx.__tag.func.store_mc_in_page(mccnt,mcpagecnt,abspage)

```

```

654     ltx.__tag.trace.show_mc_data (mccnt,3)
655     end
656     mcopen = mcopen + 1
657   else
658     if tagunmarkedbool.mode == truebool.mode then
659       ltx.__tag.trace.log("INFO TAG-NOT-TAGGED: this has not been tagged, using artifact",2)
660       box.list = __tag_insert_bmc_node (box.list,n,"Artifact")
661       mcopen = mcopen + 1
662     else
663       ltx.__tag.trace.log("WARN TAG-NOT-TAGGED: this has not been tagged",1)
664     end
665   end
666   mccntprev = mccnt
667 end
668 end -- end if
669 end -- end for
670 if head then
671   mccnthead, mctypehead, taghead = __tag_get_mc_cnt_type_tag (head)
672   ltx.__tag.trace.log ("INFO TAG-ENDHEAD: " ..
673     node.type(node.getid(head))..
674     " MC"..tostring(mccnthead)..
675     " => TAG "..tostring(mctypehead)..
676     " => "..tostring(taghead),4)
677 else
678   ltx.__tag.trace.log ("INFO TAG-ENDHEAD: ".. tostring(head),4)
679 end
680 ltx.__tag.trace.log ("INFO TAG-QUITTING-BOX "..
681   tostring(name)..
682   " TYPE ".. node.type(node.getid(box)),4)
683 return mcopen,mcpagecnt,mccntprev,mctypeprev
684 end
685

```

(End definition for ltx.\_\_tag.func.mark\_page\_elements.)

ltx.\_\_tag.func.mark\_shipout This is the function used in the callback. Beside calling the traversing function it also checks if there is an open MC-chunk from a page break and insert the needed EMC literal.

```

686 function ltx.__tag.func.mark_shipout (box)
687   mcopen = ltx.__tag.func.mark_page_elements (box,-1,-100,0,"Shipout",-1)
688   if mcopen~=0 then -- there is a chunk open, close it (hope there is only one ...
689     local emcnode = nodenew("whatsit","pdf_literal")
690     local list = box.list
691     emcnode.data = "EMC"
692     emcnode.mode=1
693     if list then
694       list = node.insert_after (list,node.tail(list),emcnode)
695       mcopen = mcopen - 1
696       ltx.__tag.trace.log ("INFO SHIPOUT-INSERT-LAST-EMC: MCOPEN " .. mcopen,3)
697     else
698       ltx.__tag.trace.log ("WARN SHIPOUT-UPS: this shouldn't happen",0)
699     end
700     if mcopen ~=0 then
701       ltx.__tag.trace.log ("WARN SHIPOUT-MC-OPEN: " .. mcopen,1)

```

```

702     end
703   end
704 end

```

(End definition for ltx.\_\_tag.func.mark\_shipout.)

## 6 Parenttree

```

ltx.__tag.func.fill_parent_tree_line
ltx.__tag.func.output_parenttree

```

These functions create the parent tree. The second, main function is used in the tagpdf-tree code. TODO check if the tree code can move into the backend code.

```

705 function ltx.__tag.func.fill_parent_tree_line (page)
706   -- we need to get page-> i=kid -> mcnum -> structnum
707   -- pay attention: the kid numbers and the page number in the parent tree start with 0!
708   local numsentry = ""
709   local pdfpage = page-1
710   if ltx.__tag.page[page] and ltx.__tag.page[page][0] then
711     mcchunks=#ltx.__tag.page[page]
712     ltx.__tag.trace.log("INFO PARENTTREE-NUM: page "..
713       page.." has "..mcchunks.." +1 Elements ",4)
714     for i=0,mcchunks do
715       -- what does this log??
716       ltx.__tag.trace.log("INFO PARENTTREE-CHUNKS:  "..
717         ltx.__tag.page[page][i],4)
718     end
719     if mcchunks == 0 then
720       -- only one chunk so no need for an array
721       local mcnum = ltx.__tag.page[page][0]
722       local structnum = ltx.__tag.mc[mcnum]["parent"]
723       local propname = "g__tag_struct"..structnum.."_prop"
724       --local objref = ltx.__tag.tables[propname]["objref"] or "XXXX"
725       local objref = __tag_pdf_object_ref('__tag/struct/'..structnum)
726       ltx.__tag.trace.log("INFO PARENTTREE-STRUCT-OBJREF:  =====>"..
727         tostring(objref),5)
728       numsentry = pdfpage .. " [".. objref .. "]"
729       ltx.__tag.trace.log("INFO PARENTTREE-NUMENTRY: page " ..
730         page.. " num entry = ".. numsentry,3)
731     else
732       numsentry = pdfpage .. " ["
733       for i=0,mcchunks do
734         local mcnum = ltx.__tag.page[page][i]
735         local structnum = ltx.__tag.mc[mcnum]["parent"] or 0
736         local propname = "g__tag_struct"..structnum.."_prop"
737         --local objref = ltx.__tag.tables[propname]["objref"] or "XXXX"
738         local objref = __tag_pdf_object_ref('__tag/struct/'..structnum)
739         numsentry = numsentry .. " ".. objref
740       end
741       numsentry = numsentry .. "]"
742       ltx.__tag.trace.log("INFO PARENTTREE-NUMENTRY: page " ..
743         page.. " num entry = ".. numsentry,3)
744     end
745   else
746     ltx.__tag.trace.log ("INFO PARENTTREE-NO-DATA: page "..page,3)
747   end

```

```

748     return numsentry
749 end
750
751 function ltx.__tag.func.output_parenttree (abspage)
752   for i=1,abspage do
753     line = ltx.__tag.func.fill_parent_tree_line (i) .. "^^J"
754     tex.sprint(catlatex,line)
755   end
756 end

(End definition for ltx.__tag.func.fill_parent_tree_line and ltx.__tag.func.output_parenttree.)

757 </lua>

```

## Part IX

# The tagpdf-roles module

## Tags, roles and namespace code

### Part of the tagpdf package

---

```
add-new-tag_(setup-key)
tag_(rolemap-key)
namespace_(rolemap-key)
role_(rolemap-key)
role-namespace_(rolemap-key)
```

---

The **add-new-tag** key can be used in `\tagpdfsetup` to declare and rolemap new tags. It takes as value a key-value list or a simple **new-tag/old-tag**.

The key-value list knows the following keys:

**tag** This is the name of the new tag as it should then be used in `\tagstructbegin`.

**namespace** This is the namespace of the new tag. The value should be a shorthand of a namespace. The allowed values are currently **pdf**, **pdf2**, **mathml**, **latex**, **latex-book** and **user**. The default value (and recommended value for a new tag) is **user**. The public name of the user namespace is **tag/NS/user**. This can be used to reference the namespace e.g. in attributes.

**role** This is the tag the tag should be mapped too. In a PDF 1.7 or earlier this is normally a tag from the **pdf** set, in PDF 2.0 from the **pdf**, **pdf2** and **mathml** set. It can also be a user tag. The tag must be declared before, as the code retrieves the class of the new tag from it. The PDF format allows mapping to be done transitively. But tagpdf can't/won't check such unusual role mapping.

**role-namespace** If the role is a known tag the default value is the default namespace of this tag. With this key a specific namespace can be forced.

Namespaces are mostly a PDF 2.0 property, but it doesn't harm to set them also in a PDF 1.7 or earlier.

---

```
\tag_check_child:nnTF \tag_check_child:nn{<tag>}{<namespace>} {<true code>} {<false code>}
```

---

This checks if the tag `<tag>` from the name space `<namespace>` can be used at the current position. In tagpdf-base it is always true.

```
1 <@@=tag>
2 <*header>
3 \ProvidesExplPackage {tagpdf-roles-code} {2023-05-16} {0.98g}
4 {part of tagpdf - code related to roles and structure names}
5 </header>
```

## 1 Code related to roles and structure names



6 `\package`

## 1.1 Variables

Tags are used in structures (`\tagstructbegin`) and mc-chunks (`\tagmcbegin`).

They have a name (a string), in lua a number (for the lua attribute), and in PDF 2.0 belong to one or more name spaces, with one being the default name space.

Tags of structures are classified, e.g. as grouping, inline or block level structure (and a few special classes like lists and tables), and must follow containments rules depending on their classification (for example a inline structure can not contain a block level structure). New tags inherit their classification from their rolemapping to the standard namespaces (`pdf` and/or `pdf2`). We store this classification as it will probably be needed for tests but currently the data is not much used. The classification for math (and the containment rules) is unclear currently and so not set.

The attribute number is only relevant in lua and only for the MC chunks (so tags with the same name from different names spaces can have the same number), and so only stored if luatex is detected.

Due to the namespaces the storing and processing of tags and there data are different in various places for PDF 2.0 and PDF <2.0, which makes things a bit difficult and leads to some duplications. Perhaps at some time there should be a clear split.

This are the main variables used by the code:

`\g__tag_role_tags_NS_prop` This is the core list of tag names. It uses tags as keys and the shorthand (e.g. `pdf2`, or `mathml`) of the default name space as value.

In pdf 2.0 the value is needed in the structure dictionaries.

`\g__tag_role_tags_class_prop` This contains for each tag a classification type. It is used in pdf <2.0.

`\g__tag_role_NS_prop` This contains the names spaces. The values are the object references. They are used in pdf 2.0.

`\g__tag_role_rolemap_prop` This contains for each tag the role to a standard tag. It is used in pdf<2.0 for tag checking and to fill at the end the RoleMap dictionary.

`g_@@_role/RoleMap_dict` This dictionary contains the standard rolemaps. It is relevant only for pdf <2.0.

`\g__tag_role_NS_<ns>_prop` This prop contains the tags of a name space and their role. The props are also use for remapping. As value they contain two brace groups: tag and namespace. In pdf <2.0 the namespace is empty.

`\g__tag_role_NS_<ns>_class_prop` This prop contains the tags of a name space and their type. The value is only needed for pdf 2.0.

`\g__tag_role_index_prop` This prop contains the standard tags (pdf in pdf<2.0, pdf, pdf2 + mathml in pdf 2.0) as keys, the values are a two-digit number. These numbers are used to get the containment rule of two tags from the intarray.

`\l__tag_role_debug_prop` This property is used to pass some info around for info messages or debugging.

`\g__tag_role_tags_NS_prop` This is the core list of tag names. It uses tags as keys and the shorthand (e.g. pdf2, or mathml) of the default name space as value. We store the default name space also in pdf <2.0, even if not needed: it doesn't harm and simplifies the code. There is no need to access this from lua, so we use the standard prop commands.

```
7 \prop_new:N \g__tag_role_tags_NS_prop
```

(End definition for `\g__tag_role_tags_NS_prop`.)

`\g__tag_role_tags_class_prop` With pdf 2.0 we store the class in the NS dependant props. With pdf <2.0 we store for now the type(s) of a tag in a common prop. Tags that are rolemapped should get the type from the target.

```
8 \prop_new:N \g__tag_role_tags_class_prop
```

(End definition for `\g__tag_role_tags_class_prop`.)

`\g__tag_role_NS_prop` This holds the list of supported name spaces. The keys are the name tagpdf will use, the values the object reference. The urls identifier are stored in related dict object.

**mathml** <http://www.w3.org/1998/Math/MathML>

**pdf2** <http://iso.org/pdf2/ssn>

**pdf** <http://iso.org/pdf/ssn> (default)

**user** `\c__tag_role_userNS_id_str` (random id, for user tags)

**latex** <https://www.latex-project.org/ns/dft/2022>

**latex-book** <https://www.latex-project.org/ns/book/2022>

**latex-inline** <https://www.latex-project.org/ns/inline/2022>

More namespaces are possible and their objects references and their rolemaps must be collected so that an array can be written to the StructTreeRoot at the end (see tagpdf-tree). We use a prop to store the object reference as it will be needed rather often.

```
9 \prop_new:N \g__tag_role_NS_prop
```

(End definition for `\g__tag_role_NS_prop`.)

`\g__tag_role_index_prop` This prop contains the standard tags (pdf in pdf<2.0, pdf,pdf2 + mathml in pdf 2.0) as keys, the values are a two-digit number. These numbers are used to get the containment rule of two tags from the intarray.

```
10 \prop_new:N \g__tag_role_index_prop
```

(End definition for `\g__tag_role_index_prop`.)

`\l__tag_role_debug_prop` This variable is used to pass more infos to debug messages.

```
11 \prop_new:N \l__tag_role_debug_prop
```

(End definition for `\l__tag_role_debug_prop`.)

We need also a bunch of temporary variables.

```
\l__tag_role_tag_tmpa_tl
```

```
\l__tag_role_tag_namespace_tmpa_tl
```

```
12 \tl_new:N \l__tag_role_tag_tmpa_tl
```

```
\l__tag_role_role_tmpa_tl
```

```
13 \tl_new:N \l__tag_role_tag_namespace_tmpa_tl
```

```
\l__tag_role_role_namespace_tmpa_tl
```

```
14 \tl_new:N \l__tag_role_role_tmpa_tl
```

```
\l__tag_role_role_namespace_tmpa_seq
```

```
15 \tl_new:N \l__tag_role_role_namespace_tmpa_tl
```

```
16 \seq_new:N \l__tag_role_role_tmpa_seq
```

(End definition for `\l__tag_role_tag_tmpa_tl` and others.)

## 1.2 Namespaces

The following commands setups a name space. With pdf version <2.0 this is only a prop with the rolemap. With pdf 2.0 a dictionary must be set up. Such a name space dictionaries can contain an optional /Schema and /RoleMapNS entry. We only reserve the objects but delay the writing to the finish code, where we can test if the keys and the name spaces are actually needed. This commands setups objects for the name space and its rolemap. It also initialize a dict to collect the rolemaps if needed, and a property with the tags of the name space and their rolemapping for loops. It is unclear if a reference to a schema file will be ever needed, but it doesn't harm ....

`g__tag_role/RoleMap_dict` This is the object which contains the normal RoleMap. It is probably not needed in pdf  
`\g__tag_role_rolemap_prop` 2.0 but currently kept.

```
17 \pdfdict_new:n {g__tag_role/RoleMap_dict}
18 \prop_new:N \g__tag_role_rolemap_prop
```

(End definition for `g__tag_role/RoleMap_dict` and `\g__tag_role_rolemap_prop`.)

---

```
\__tag_role_NS_new:nnn \__tag_role_NS_new:nnn{<shorthand>}{<URI-ID>}Schema
```

---

```
\__tag_role_NS_new:nnn
```

```
19 \pdf_version_compare:NnTF < {2.0}
20 {
21   \cs_new_protected:Npn \__tag_role_NS_new:nnn #1 #2 #3
22   {
23     \prop_new:c { g__tag_role_NS_#1_prop }
24     \prop_new:c { g__tag_role_NS_#1_class_prop }
25     \prop_gput:Nnx \g__tag_role_NS_prop {#1}{ }
26   }
27 }
28 {
29   \cs_new_protected:Npn \__tag_role_NS_new:nnn #1 #2 #3
30   {
31     \prop_new:c { g__tag_role_NS_#1_prop }
32     \prop_new:c { g__tag_role_NS_#1_class_prop }
33     \pdf_object_new:n {tag/NS/#1}
34     \pdfdict_new:n {g__tag_role/Namespace_#1_dict}
35     \pdf_object_new:n {__tag/RoleMapNS/#1}
36     \pdfdict_new:n {g__tag_role/RoleMapNS_#1_dict}
37     \pdfdict_gput:nnn
38       {g__tag_role/Namespace_#1_dict}
39       {Type}
40       {/Namespace}
41     \pdf_string_from_unicode:nnN{utf8/string}{#2}\l__tag_tmpa_str
42     \tl_if_empty:NF \l__tag_tmpa_str
43     {
44       \pdfdict_gput:nnx
45         {g__tag_role/Namespace_#1_dict}
46         {NS}
47         {\l__tag_tmpa_str}
48     }
49     %RoleMapNS is added in tree
50     \tl_if_empty:nF {#3}
```

```

51     {
52       \pdfdict_gput:nnx{g__tag_role/Namespace_#1_dict}
53       {Schema}{#3}
54     }
55     \prop_gput:Nnx \g__tag_role_NS_prop {#1}{\pdf_object_ref:n{tag/NS/#1}~}
56   }
57 }

```

(End definition for `\_tag_role_NS_new:nnn`.)

We need an id for the user space. For the tests it should be possible to set it to a fix value. So we use random numbers which can be fixed by setting a seed. We fake a sort of GUID but do not try to be really exact as it doesn't matter ...

`\c__tag_role_userNS_id_str`

```

58 \str_const:Nx \c__tag_role_userNS_id_str
59 { data:,
60   \int_to_Hex:n{\int_rand:n {65535}}
61   \int_to_Hex:n{\int_rand:n {65535}}
62   -
63   \int_to_Hex:n{\int_rand:n {65535}}
64   -
65   \int_to_Hex:n{\int_rand:n {65535}}
66   -
67   \int_to_Hex:n{\int_rand:n {65535}}
68   -
69   \int_to_Hex:n{\int_rand:n {16777215}}
70   \int_to_Hex:n{\int_rand:n {16777215}}
71 }

```

(End definition for `\c__tag_role_userNS_id_str`.)

Now we setup the standard names spaces. The mathml space is currently only loaded for pdf 2.0.

```

72 \_tag_role_NS_new:nnn {pdf} {http://iso.org/pdf/ssn}{ }
73 \_tag_role_NS_new:nnn {pdf2} {http://iso.org/pdf2/ssn}{ }
74 \pdf_version_compare:NnF < {2.0}
75 {
76   \_tag_role_NS_new:nnn {mathml}{http://www.w3.org/1998/Math/MathML}{ }
77 }
78 \_tag_role_NS_new:nnn {latex} {https://www.latex-project.org/ns/dflt/2022}{ }
79 \_tag_role_NS_new:nnn {latex-book} {https://www.latex-project.org/ns/book/2022}{ }
80 \_tag_role_NS_new:nnn {latex-inline} {https://www.latex-project.org/ns/inline/2022}{ }
81 \exp_args:Nnx
82   \_tag_role_NS_new:nnn {user}{\c__tag_role_userNS_id_str}{ }

```

### 1.3 Adding a new tag

Both when reading the files and when setting up a tag manually we have to store data in various places.

`\_tag_role_alloctag:nnn`

This command allocates a new tag without role mapping. In the lua backend it will also record the attribute value.

```

83 \pdf_version_compare:NnTF < {2.0}
84 {

```

```

85 \sys_if_engine luatex:TF
86 {
87   \cs_new_protected:Npn \__tag_role_alloctag:nnn #1 #2 #3 % #1 tagname, ns, type
88   {
89     \lua_now:e { ltx.__tag.func.alloctag ('#1') }
90     \prop_gput:Nnn \g__tag_role_tags_NS_prop {#1}{#2}
91     \prop_gput:cnn {g__tag_role_NS_#2_prop} {#1}{{}}{}
92     \prop_gput:Nnn \g__tag_role_tags_class_prop {#1}{#3}
93     \prop_gput:cnn {g__tag_role_NS_#2_class_prop} {#1}{--UNUSED--}
94   }
95 }
96 {
97   \cs_new_protected:Npn \__tag_role_alloctag:nnn #1 #2 #3
98   {
99     \prop_gput:Nnn \g__tag_role_tags_NS_prop {#1}{#2}
100    \prop_gput:cnn {g__tag_role_NS_#2_prop} {#1}{{}}{}
101    \prop_gput:Nnn \g__tag_role_tags_class_prop {#1}{#3}
102    \prop_gput:cnn {g__tag_role_NS_#2_class_prop} {#1}{--UNUSED--}
103  }
104 }
105 }
106 {
107   \sys_if_engine luatex:TF
108   {
109     \cs_new_protected:Npn \__tag_role_alloctag:nnn #1 #2 #3 % #1 tagname, ns, type
110     {
111       \lua_now:e { ltx.__tag.func.alloctag ('#1') }
112       \prop_gput:Nnn \g__tag_role_tags_NS_prop {#1}{#2}
113       \prop_gput:cnn {g__tag_role_NS_#2_prop} {#1}{{}}{}
114       \prop_gput:Nnn \g__tag_role_tags_class_prop {#1}{--UNUSED--}
115       \prop_gput:cnn {g__tag_role_NS_#2_class_prop} {#1}{#3}
116     }
117   }
118   {
119     \cs_new_protected:Npn \__tag_role_alloctag:nnn #1 #2 #3
120     {
121       \prop_gput:Nnn \g__tag_role_tags_NS_prop {#1}{#2}
122       \prop_gput:cnn {g__tag_role_NS_#2_prop} {#1}{{}}{}
123       \prop_gput:Nnn \g__tag_role_tags_class_prop {#1}{--UNUSED--}
124       \prop_gput:cnn {g__tag_role_NS_#2_class_prop} {#1}{#3}
125     }
126   }
127 }
128 \cs_generate_variant:Nn \__tag_role_alloctag:nnn {nnV}

```

(End definition for \\_\_tag\_role\_alloctag:nnn.)

### 1.3.1 pdf 1.7 and earlier

`\__tag_role_add_tag:nn` The pdf 1.7 version has only two arguments: new and rolemap name. The role must be an existing tag and should not be empty. We allow to change the role of an existing tag: as the rolemap is written at the end not confusion can happen.

```

129 \cs_new_protected:Nn \__tag_role_add_tag:nn % (new) name, reference to old
130 {

```

checks and messages

```

131  \__tag_check_add_tag_role:nn {#1}{#2}
132  \prop_if_in:NnF \g__tag_role_tags_NS_prop {#1}
133  {
134    \int_compare:nNnT {\l__tag_loglevel_int} > { 0 }
135    {
136      \msg_info:nnn { tag }{new-tag}{#1}
137    }
138  }

```

now the addition

```

139  \prop_get:NnN \g__tag_role_tags_class_prop {#2}\l__tag_tmpa_tl
140  \quark_if_no_value:NT \l__tag_tmpa_tl
141  {
142    \tl_set:Nn\l__tag_tmpa_tl{--UNKNOWN--}
143  }
144  \__tag_role_alloctag:nnV {#1}{user}\l__tag_tmpa_tl

```

We resolve rolemapping recursively so that all targets are stored as standard tags.

```

145  \tl_if_empty:nF { #2 }
146  {
147    \prop_get:NnN \g__tag_role_rolemap_prop {#2}\l__tag_tmpa_tl
148    \quark_if_no_value:NTF \l__tag_tmpa_tl
149    {
150      \prop_gput:Nnx \g__tag_role_rolemap_prop {#1}{\tl_to_str:n{#2}}
151    }
152    {
153      \prop_gput:NnV \g__tag_role_rolemap_prop {#1}\l__tag_tmpa_tl
154    }
155  }
156  }
157  \cs_generate_variant:Nn \__tag_role_add_tag:nn {VV,ne}

```

(End definition for \\_\_tag\_role\_add\_tag:nn.)

For the parent-child test we must be able to get the role. We use the same number of arguments as for the 2.0 command. If there is no role, we assume a standard tag.

\\_\_tag\_role\_get:nnNN

```

158  \pdf_version_compare:NnT < {2.0}
159  {
160    \cs_new:Npn \__tag_role_get:nnNN #1#2#3#4 {%#1 tag, #2 NS, #3 tlvar which hold the role tag
161    {
162      \prop_get:NnNF \g__tag_role_rolemap_prop {#1}#3
163      {
164        \tl_set:Nn #3 {#1}
165      }
166      \tl_set:Nn #4 {}
167    }
168    \cs_generate_variant:Nn \__tag_role_get:nnNN {VVNN}
169  }
170

```

(End definition for \\_\_tag\_role\_get:nnNN.)

### 1.3.2 The pdf 2.0 version

`\_tag_role_add_tag:nnnn` The pdf 2.0 version takes four arguments: tag/namespace/role/namespace

```

171 \cs_new_protected:Nn \_tag_role_add_tag:nnnn %tag/namespace/role/namespace
172 {
173   \_tag_check_add_tag_role:nnn {#1/#2}{#3}{#4}
174   \int_compare:nNnT {\l__tag_loglevel_int} > { 0 }
175   {
176     \msg_info:nnn { tag }{new-tag}{#1}
177   }
178   \prop_get:cnN { g__tag_role_NS_#4_class_prop } {#3}\l__tag_tmpa_tl
179   \quark_if_no_value:NT \l__tag_tmpa_tl
180   {
181     \tl_set:Nn\l__tag_tmpa_tl{--UNKNOWN--}
182   }
183   \_tag_role_alloctag:nnV {#1}{#2}\l__tag_tmpa_tl

```

Do not remap standard tags. TODO add warning?

```

184   \tl_if_in:nnF {-pdf-pdf2-mathml-}{-#2-}
185   {
186     \pdfdict_gput:nnx {g__tag_role/RoleMapNS_#2_dict}{#1}
187     {
188       [
189         \pdf_name_from_unicode_e:n{#3}
190         \c_space_tl
191         \pdf_object_ref:n {tag/NS/#4}
192       ]
193     }
194   }

```

We resolve rolemapping recursively so that all targets are stored as standard tags for the tests.

```

195   \tl_if_empty:nF { #2 }
196   {
197     \prop_get:cnN { g__tag_role_NS_#4_prop } {#3}\l__tag_tmpa_tl
198     \quark_if_no_value:NTF \l__tag_tmpa_tl
199     {
200       \prop_gput:cnx { g__tag_role_NS_#2_prop } {#1}
201       {\tl_to_str:n{#3}}{\tl_to_str:n{#4}}
202     }
203     {
204       \prop_gput:cno { g__tag_role_NS_#2_prop } {#1}{\l__tag_tmpa_tl}
205     }
206   }
207 }
208 \cs_generate_variant:Nn \_tag_role_add_tag:nnnn {VVVV}

```

(End definition for `\_tag_role_add_tag:nnnn`.)

For the parent-child test we must be able to get the role. We use the same number of arguments as for the <2.0 command (and assume that we don't need a name space)

```

\_tag_role_get:nnNN
209 \pdf_version_compare:NnF < {2.0}
210 {
211   \cs_new:Npn \_tag_role_get:nnNN #1#2#3#4

```

```

212     %1 tag, #2 NS,
213     %3 tlvar which hold the role tag
214     %4 tlvar which hold the name of the target NS
215     {
216         \prop_get:cnNTF {g__tag_role_NS_#2_prop} {#1}\l__tag_tmpa_tl
217         {
218             \tl_set:Nx #3 {\exp_last_unbraced:NV\use_i:nn \l__tag_tmpa_tl}
219             \tl_set:Nx #4 {\exp_last_unbraced:NV\use_ii:nn \l__tag_tmpa_tl}
220         }
221         {
222             \tl_set:Nn #3 {#1}
223             \tl_set:Nn #4 {#2}
224         }
225     }
226     \cs_generate_variant:Nn \__tag_role_get:nnNN {VVNN}
227 }

```

(End definition for \\_\_tag\_role\_get:nnNN.)

## 1.4 Helper command to read the data from files

In this section we setup the helper command to read namespace files.

\\_\_tag\_role\_read\_namespace\_line:nw

This command will process a line in the name space file. The first argument is the name of the name space. The definition differ for pdf 2.0. as we have proper name spaces there. With pdf<2.0 not special name spaces shouldn't update the default role or add to the rolemap again. We use a boolean here.

```

228 \bool_new:N\l__tag_role_update_bool
229 \bool_set_true:N \l__tag_role_update_bool
230 \pdf_version_compare:NnTF < {2.0}
231 {
232     \cs_new_protected:Npn \__tag_role_read_namespace_line:nw #1#2,#3,#4,#5,#6\q_stop %
233     % #1 NS, #2 tag, #3 rolemap, #4 NS rolemap #5 type
234     {
235         \tl_if_empty:nF { #2 }
236         {
237             \bool_if:NTF \l__tag_role_update_bool
238             {
239                 \tl_if_empty:nTF {#5}
240                 {
241                     \prop_get:NnN \g__tag_role_tags_class_prop {#3}\l__tag_tmpa_tl
242                     \quark_if_no_value:NT \l__tag_tmpa_tl
243                     {
244                         \tl_set:Nn\l__tag_tmpa_tl{--UNKNOWN--}
245                     }
246                 }
247                 {
248                     \tl_set:Nn \l__tag_tmpa_tl {#5}
249                 }
250             }
251             \__tag_role_alloctag:nnV {#2}{#1}\l__tag_tmpa_tl
252             \tl_if_eq:nnF {#2}{#3}
253             {
254                 \__tag_role_add_tag:nn {#2}{#3}
255             }
256         }
257     }

```



```

255     \prop_gput:cnn {g__tag_role_NS_#1_prop} {#2}{{#3}{}}
256   }
257   {
258     \prop_gput:cnn {g__tag_role_NS_#1_prop} {#2}{{#3}{}}
259     \prop_gput:cnn {g__tag_role_NS_#1_class_prop} {#2}{--UNUSED--}
260   }
261 }
262 }
263 }
264 {
265   \cs_new_protected:Npn \__tag_role_read_namespace_line:nw #1#2,#3,#4,#5,#6\q_stop %
266   % #1 NS, #2 tag, #3 rolemap, #4 NS rolemap #5 type
267   {
268     \tl_if_empty:nF {#2}
269     {
270       \tl_if_empty:nTF {#5}
271       {
272         \prop_get:cnN { g__tag_role_NS_#4_class_prop } {#3}\l__tag_tmpa_tl
273         \quark_if_no_value:NT \l__tag_tmpa_tl
274         {
275           \tl_set:Nn\l__tag_tmpa_tl{--UNKNOWN--}
276         }
277       }
278       {
279         \tl_set:Nn \l__tag_tmpa_tl {#5}
280       }
281       \__tag_role_alloctag:nnV {#2}{#1}\l__tag_tmpa_tl
282       \bool_lazy_and:nnT
283       { ! \tl_if_empty_p:n {#3} }{! \str_if_eq_p:nn {#1}{pdf2}}
284       {
285         \__tag_role_add_tag:nnnn {#2}{#1}{#3}{#4}
286       }
287       \prop_gput:cnn {g__tag_role_NS_#1_prop} {#2}{{#3}{#4}}
288     }
289   }
290 }

```

(End definition for \\_\_tag\_role\_read\_namespace\_line:nw.)

\\_\_tag\_role\_read\_namespace:n This command reads the namespace file.

```

291 \cs_new_protected:Npn \__tag_role_read_namespace:n #1 %name of namespace
292 {
293   \prop_if_exist:cF {g__tag_role_NS_#1_prop}
294   { \msg_warning:nnn {tag}{namespace-unknown}{#1} }
295   \file_if_exist:nTF { tagpdf-ns-#1.def}
296   {
297     \ior_open:Nn \g_tmpa_ior {tagpdf-ns-#1.def}
298     \msg_info:nnn {tag}{read-namespace}{#1}
299     \ior_map_inline:Nn \g_tmpa_ior
300     {
301       \__tag_role_read_namespace_line:nw {#1} ##1,,,\q_stop
302     }
303     \ior_close:N\g_tmpa_ior
304   }

```

```

305     {
306       \msg_warning:nnn{tag}{namespace-missing}{#1}
307     }
308   }
309

```

(End definition for `\__tag_role_read_namespace:n`.)

## 1.5 Reading the default data

The order is important as we want pdf2 and latex as default.

```

310 \__tag_role_read_namespace:n {pdf}
311 \__tag_role_read_namespace:n {pdf2}
312 \pdf_version_compare:NnF < {2.0}
313   {\__tag_role_read_namespace:n {mathml}}
314 \bool_set_false:N\l__tag_role_update_bool
315 \__tag_role_read_namespace:n {latex-inline}
316 \__tag_role_read_namespace:n {latex-book}
317 \bool_set_true:N\l__tag_role_update_bool
318 \__tag_role_read_namespace:n {latex}
319 \__tag_role_read_namespace:n {pdf}
320 \__tag_role_read_namespace:n {pdf2}

```

But is the class provides a `\chapter` command then we switch

```

321 \pdf_version_compare:NnTF < {2.0}
322   {
323     \hook_gput_code:nnn {begindocument}{tagpdf}
324     {
325       \cs_if_exist:NT \chapter
326       {
327         \prop_map_inline:cn{g__tag_role_NS_latex-book_prop}
328         {
329           \__tag_role_add_tag:ne {#1}{\use_i:nn #2\c_empty_tl\c_empty_tl}
330         }
331       }
332     }
333   }
334   {
335     \hook_gput_code:nnn {begindocument}{tagpdf}
336     {
337       \cs_if_exist:NT \chapter
338       {
339         \prop_map_inline:cn{g__tag_role_NS_latex-book_prop}
340         {
341           \prop_gput:Nnn \g__tag_role_tags_NS_prop { #1 }{ latex-book }
342         }
343       }
344     }
345   }

```

## 1.6 Parent-child rules

PDF define various rules about which tag can be a child of another tag. The following code implements the matrix to allow to use it in tests.

`\g_tag_role_parent_child_intarray` This intarray will store the rule as a number. For parent nm and child ij (n,m,i,j digits) the rule is at position nmij. As we have around 56 tags, we need roughly a size 6000.

```
346 \intarray_new:Nn \g_tag_role_parent_child_intarray {6000}
```

(End definition for `\g_tag_role_parent_child_intarray`.)

`\c_tag_role_rules_prop` `\c_tag_role_rules_num_prop` These two properties map the rule strings to numbers and back. There are in tagpdf-data.dtx near the csv files for easier maintenance.

(End definition for `\c_tag_role_rules_prop` and `\c_tag_role_rules_num_prop`.)

`\_tag_store_parent_child_rule:nnn` The helper command is used to store the rule. It assumes that parent and child are given as 2-digit number!

```
347 \cs_new_protected:Npn \_tag_store_parent_child_rule:nnn #1 #2 #3 % num parent, num child, #3
348 {
349   \intarray_gset:Nnn \g_tag_role_parent_child_intarray
350     { #1#2 }{0\prop_item:Nn\c_tag_role_rules_prop{#3}}
351 }
```

(End definition for `\_tag_store_parent_child_rule:nnn`.)

### 1.6.1 Reading in the csv-files

This counter will be used to identify the first (non-comment) line

```
352 \int_zero:N \l_tag_tmpa_int
```

Open the file depending on the PDF version

```
353 \pdf_version_compare:NnTF < {2.0}
354 {
355   \ior_open:Nn \g_tmpa_ior {tagpdf-parent-child.csv}
356 }
357 {
358   \ior_open:Nn \g_tmpa_ior {tagpdf-parent-child-2.csv}
359 }
```

Now the main loop over the file

```
360 \ior_map_inline:Nn \g_tmpa_ior
361 {
```

ignore lines containing only comments

```
362 \tl_if_empty:nF{#1}
363 {
```

count the lines ...

```
364 \int_incr:N\l_tag_tmpa_int
```

put the line into a seq. Attention! empty cells are dropped.

```
365 \seq_set_from_clist:Nn\l_tag_tmpa_seq { #1 }
366 \int_compare:nNnTF {\l_tag_tmpa_int}=1
```

This handles the header line. It gives the tags 2-digit numbers

```
367 {
368   \seq_map_indexed_inline:Nn \l_tag_tmpa_seq
369   {
370     \prop_gput:Nnx\g_tag_role_index_prop
371       {##2}
372     {\int_compare:nNnT{##1}<{10}{0}##1}
373   }
374 }
```

now the data lines.

```

375         {
376             \seq_set_from_clist:Nn\l__tag_tmpa_seq { #1 }
get the name of the child tag from the first column
377             \seq_pop_left:NN\l__tag_tmpa_seq\l__tag_tmpa_tl
get the number of the child, and store it in \l__tag_tmpb_tl
378             \prop_get:NVN \g__tag_role_index_prop \l__tag_tmpa_tl \l__tag_tmpb_tl
remove column 2+3
379             \seq_pop_left:NN\l__tag_tmpa_seq\l__tag_tmpa_tl
380             \seq_pop_left:NN\l__tag_tmpa_seq\l__tag_tmpa_tl
Now map over the rest. The index ##1 gives us the number of the parent, ##2 is the
data.
381             \seq_map_indexed_inline:Nn \l__tag_tmpa_seq
382             {
383                 \exp_args:Nnx
384                 \__tag_store_parent_child_rule:nnn {##1}{\l__tag_tmpb_tl}{ ##2 }
385             }
386         }
387     }
388 }

```

close the read handle.

```

389 \ior_close:N\g_tmpa_ior

```

The Root, Hn and mathml tags are special and need to be added explicitly

```

390 \prop_get:NnN\g__tag_role_index_prop{StructTreeRoot}\l__tag_tmpa_tl
391 \prop_gput:Nnx\g__tag_role_index_prop{Root}{\l__tag_tmpa_tl}
392 \prop_get:NnN\g__tag_role_index_prop{Hn}\l__tag_tmpa_tl
393 \pdf_version_compare:NnTF < {2.0}
394 {
395     \int_step_inline:nn{6}
396     {
397         \prop_gput:Nnx\g__tag_role_index_prop{H#1}{\l__tag_tmpa_tl}
398     }
399 }
400 {
401     \int_step_inline:nn{10}
402     {
403         \prop_gput:Nnx\g__tag_role_index_prop{H#1}{\l__tag_tmpa_tl}
404     }

```

all mathml tags are currently handled identically

```

405     \prop_get:NnN\g__tag_role_index_prop {mathml}\l__tag_tmpa_tl
406     \prop_get:NnN\g__tag_role_index_prop {math}\l__tag_tmpb_tl
407     \prop_map_inline:Nn \g__tag_role_NS_mathml_prop
408     {
409         \prop_gput:NnV\g__tag_role_index_prop{#1}\l__tag_tmpa_tl
410     }
411     \prop_gput:NnV\g__tag_role_index_prop{math}\l__tag_tmpb_tl
412 }

```

## 1.6.2 Retrieving the parent-child rule

This command retrieves the rule (as a number) and stores it in the tl-var. It assumes that the tag in #1 is a standard tag after role mapping for which a rule exist and is *not* one of Part, Div, NonStruct as the real parent has already been identified. #3 can be used to pass along data about the original tags and is only used in messages.

TODO check temporary variables. Check if the tl-var should be fix.

```

413 \tl_new:N \l__tag_parent_child_check_tl
414 \cs_new_protected:Npn \__tag_role_get_parent_child_rule:nnnN #1 #2 #3 #4
415   % #1 parent (string) #2 child (string) #3 text for messages (eg. about Div or Rolemapping)
416   % #4 tl for state
417   {
418     \prop_get:NnN \g__tag_role_index_prop{#1}\l__tag_tmpa_tl
419     \prop_get:NnN \g__tag_role_index_prop{#2}\l__tag_tmpb_tl
420     \bool_lazy_and:nnTF
421     { ! \quark_if_no_value_p:N \l__tag_tmpa_tl }
422     { ! \quark_if_no_value_p:N \l__tag_tmpb_tl }
423     {

```

Get the rule from the intarray

```

424     \tl_set:Nx#4
425     {
426       \intarray_item:Nn
427       \g__tag_role_parent_child_intarray
428       {\l__tag_tmpa_tl\l__tag_tmpb_tl}
429     }

```

If the state is something is wrong ...

```

430     \int_compare:nNnT
431     {#4} = {\prop_item:Nn\c__tag_role_rules_prop{}}
432     {
433       %warn ?

```

we must take the current child from the stack if is already there, depending on location the check is called, this could also remove the parent, but that is ok too.

```

434     }

```

This is the message, this can perhaps go into debug mode.

```

435     \group_begin:
436     \int_compare:nNnT {\l__tag_tmpa_int*\l__tag_loglevel_int} > { 0 }
437     {
438       \prop_get:NVNF\c__tag_role_rules_num_prop #4 \l__tag_tmpa_tl
439       {
440         \tl_set:Nn \l__tag_tmpa_tl {unknown}
441       }
442       \tl_set:Nn \l__tag_tmpb_tl {#1}
443       \msg_note:nnxxx
444       { tag }
445       { role-parent-child }
446       { #1 }
447       { #2 }
448       {
449         #4~(=\l__tag_tmpa_tl')
450         \iow_newline:
451         #3

```

```

452         }
453     }
454     \group_end:
455 }
456 {
457     \tl_set:Nn#4 {0}
458     \msg_warning:nnxxx
459     { tag }
460     {role-parent-child}
461     { #1 }
462     { #2 }
463     { unknown! }
464 }
465 }
466 \cs_generate_variant:Nn\__tag_role_get_parent_child_rule:nnnN {VVVN,VVnN}
(End definition for \__tag_role_get_parent_child_rule:nnnN.)

```

\_\_tag\_check\_parent\_child:nnnnN

This commands translates rolemaps its arguments and then calls `\__tag_role_get-parent_child_rule:nnnN`. It does not try to resolve inheritance of Div etc but instead warns that the rule can not be detected in this case. In pdf 2.0 the name spaces of the tags are relevant, so we have arguments for them, but in pdf <2.0 they are ignored and can be left empty.

```

467 \pdf_version_compare:NnTF < {2.0}
468 {
469     \cs_new_protected:Npn \__tag_check_parent_child:nnnnN #1 #2 #3 #4 #5
470     {%#1 parent tag, #2 NS, #3 child tag, #4 NS, #5 tl var
471     {

```

for debugging messages we store the arguments.

```

472         \prop_put:Nnn \l__tag_role_debug_prop {parent} {#1}
473         \prop_put:Nnn \l__tag_role_debug_prop {child} {#3}
get the standard tags through rolemapping if needed at first the parent
474         \prop_get:NnNTF \g__tag_role_index_prop {#1}\l__tag_tmpa_tl
475         {
476             \tl_set:Nn \l__tag_tmpa_tl {#1}
477         }
478         {
479             \prop_get:NnNF \g__tag_role_rolemap_prop {#1}\l__tag_tmpa_tl
480             {
481                 \tl_set:Nn \l__tag_tmpa_tl {\q_no_value}
482             }
483         }

```

now the child

```

484         \prop_get:NnNTF \g__tag_role_index_prop {#3}\l__tag_tmpb_tl
485         {
486             \tl_set:Nn \l__tag_tmpb_tl {#3}
487         }
488         {
489             \prop_get:NnNF \g__tag_role_rolemap_prop {#3}\l__tag_tmpb_tl
490             {
491                 \tl_set:Nn \l__tag_tmpb_tl {\q_no_value}
492             }
493         }

```

if we got tags for parent and child we call the checking command

```

494     \bool_lazy_and:nnTF
495     { ! \quark_if_no_value_p:N \l__tag_tmpa_tl }
496     { ! \quark_if_no_value_p:N \l__tag_tmpb_tl }
497     {
498         \__tag_role_get_parent_child_rule:VVnN
499         \l__tag_tmpa_tl \l__tag_tmpb_tl
500         {Rolemapped~from:~'#1'~-->~'#3'}
501         #5
502     }
503     {
504         \tl_set:Nn #5 {0}
505         \msg_warning:nnxxx
506         { tag }
507         {role-parent-child}
508         { #1 }
509         { #3 }
510         { unknown! }
511     }
512 }
513 \cs_new_protected:Npn \__tag_check_parent_child:nnN #1#2#3
514 {
515     \__tag_check_parent_child:nnnnN {#1}{#2}{#3}
516 }
517 }

```

and now the pdf 2.0 version The version with three arguments retrieves the default names space and then calls the full command. Not sure if this will ever be needed but we leave it for now.

```

518 {
519     \cs_new_protected:Npn \__tag_check_parent_child:nnN #1 #2 #3
520     {
521         \prop_get:NnN\g__tag_role_tags_NS_prop {#1}\l__tag_role_tag_namespace_tmpa_tl
522         \prop_get:NnN\g__tag_role_tags_NS_prop {#2}\l__tag_role_tag_namespace_tmpb_tl
523         \str_if_eq:nnT{#2}{MC}{\tl_clear:N \l__tag_role_tag_namespace_tmpb_tl}
524         \bool_lazy_and:nnTF
525         { ! \quark_if_no_value_p:N \l__tag_role_tag_namespace_tmpa_tl }
526         { ! \quark_if_no_value_p:N \l__tag_role_tag_namespace_tmpb_tl }
527         {
528             \__tag_check_parent_child:nVnVN
529             {#1}\l__tag_role_tag_namespace_tmpa_tl
530             {#2}\l__tag_role_tag_namespace_tmpb_tl
531             #3
532         }
533         {
534             \tl_set:Nn #3 {0}
535             \msg_warning:nnxxx
536             { tag }
537             {role-parent-child}
538             { #1 }
539             { #2 }
540             { unknown! }
541         }
542     }

```

and now the real command.

```

543     \cs_new_protected:Npn \__tag_check_parent_child:nnnnN #1 #2 #3 #4 #5 %tag,NS,tag,NS, t1 va
544     {
545         \prop_put:Nnn \l__tag_role_debug_prop {parent} {#1/#2}
546         \prop_put:Nnn \l__tag_role_debug_prop {child} {#3/#4}

```

If the namespace is empty, we assume a standard tag, otherwise we retrieve the rolemapping from the namespace

```

547         \tl_if_empty:nTF {#2}
548         {
549             \tl_set:Nn \l__tag_tmpa_tl {#1}
550         }
551         {
552             \prop_get:cnNTF
553             { g__tag_role_NS_#2_prop }
554             {#1}
555             \l__tag_tmpa_tl
556             {
557                 \tl_set:Nx \l__tag_tmpa_tl {\tl_head:N\l__tag_tmpa_tl}
558                 \tl_if_empty:NT\l__tag_tmpa_tl
559                 {
560                     \tl_set:Nn \l__tag_tmpa_tl {#1}
561                 }
562             }
563             {
564                 \tl_set:Nn \l__tag_tmpa_tl {\q_no_value}
565             }
566         }

```

and the same for the child If the namespace is empty, we assume a standard tag, otherwise we retrieve the rolemapping from the namespace

```

567         \tl_if_empty:nTF {#4}
568         {
569             \tl_set:Nn \l__tag_tmpb_tl {#3}
570         }
571         {
572             \prop_get:cnNTF
573             { g__tag_role_NS_#4_prop }
574             {#3}
575             \l__tag_tmpb_tl
576             {
577                 \tl_set:Nx \l__tag_tmpb_tl { \tl_head:N\l__tag_tmpb_tl }
578                 \tl_if_empty:NT\l__tag_tmpb_tl
579                 {
580                     \tl_set:Nn \l__tag_tmpb_tl {#3}
581                 }
582             }
583             {
584                 \tl_set:Nn \l__tag_tmpb_tl {\q_no_value}
585             }
586         }

```

and now get the relation

```

587         \bool_lazy_and:nnTF
588         { ! \quark_if_no_value_p:N \l__tag_tmpa_tl }

```



```

589     { ! \quark_if_no_value_p:N \l__tag_tmpb_tl }
590     {
591         \__tag_role_get_parent_child_rule:VVnN
592         \l__tag_tmpa_tl \l__tag_tmpb_tl
593         {Rolemapped~from~'#1/#2'--->~'#3\str_if_empty:nF{#4}{/#4}'}
594         #5
595     }
596     {
597         \tl_set:Nn #5 {0}
598         \msg_warning:nnxxx
599         { tag }
600         {role-parent-child}
601         { #1 }
602         { #3 }
603         { unknown! }
604     }
605 }
606 }
607 \cs_generate_variant:Nn\__tag_check_parent_child:nnN {VVN}
608 \cs_generate_variant:Nn\__tag_check_parent_child:nnnnN {VVVVN,nVnVN,VVnnN}
609 \endpackage

```

(End definition for `\__tag_check_parent_child:nnnnN`.)

`\tag_check_child:nnTF`

```

610 \base\prg_new_protected_conditional:Npnn \tag_check_child:nn #1 #2 {T,F,TF}{\prg_return_true:}
611 \*package
612 \prg_set_protected_conditional:Npnn \tag_check_child:nn #1 #2 {T,F,TF}
613 {
614     \seq_get:NN\g__tag_struct_stack_seq\l__tag_tmpa_tl
615     \__tag_struct_get_parentrole:eNN
616     {\l__tag_tmpa_tl}
617     \l__tag_get_parent_tmpa_tl
618     \l__tag_get_parent_tmpb_tl
619     \__tag_check_parent_child:VVnnN
620     \l__tag_get_parent_tmpa_tl
621     \l__tag_get_parent_tmpb_tl
622     {#1}{#2}
623     \l__tag_parent_child_check_tl
624     \int_compare:nNnTF { \l__tag_parent_child_check_tl } < {0}
625     {\prg_return_false:}
626     {\prg_return_true:}
627 }

```

(End definition for `\tag_check_child:nnTF`. This function is documented on page 136.)

## 1.7 Remapping of tags

In some context it can be necessary to remap or replace the tags. That means instead of `tag=H1` or `tag=section` one wants the effect of `tag=Span`. Or instead of `tag=P` one wants `tag=Code`.

The following command provide some general interface for this. The core idea is that before a tag is set it is fed through a function that can change it. We want to be able to chain such functions, so all of them manipulate the same variables.

```

\l__tag_role_remap_tag_tl
\l__tag_role_remap_NS_tl
628 \tl_new:N \l__tag_role_remap_tag_tl
629 \tl_new:N \l__tag_role_remap_NS_tl

(End definition for \l__tag_role_remap_tag_tl and \l__tag_role_remap_NS_tl.)

\__tag_role_remap: This function is used in the structure and the mc code before using a tag. By default it
does nothing with the tl vars. Perhaps this should be a hook?
630 \cs_new_protected:Npn \__tag_role_remap: { }

(End definition for \__tag_role_remap:.)

\__tag_role_remap_id: This is copy in case we have to restore the main command.
631 \cs_set_eq:NN \__tag_role_remap_id: \__tag_role_remap:

(End definition for \__tag_role_remap_id:.)

\__tag_role_remap_inline: The mapping is meant to “degrade” tags, e.g. if used inside some complex object. The
pdf<2.0 code maps the tag to the new role, the pdf 2.0 code only switch the NS.
632 \pdf_version_compare:NnTF < {2.0}
633 {
634   \cs_new_protected:Npn \__tag_role_remap_inline:
635   {
636     \prop_get:cVNT { g__tag_role_NS_latex-inline_prop } \l__tag_role_remap_tag_tl \l__tag_role_remap_NS_tl
637     {
638       \tl_set:Nx \l__tag_role_remap_tag_tl
639       {
640         \exp_last_unbraced:NV \use_i:nn \l__tag_tmpa_tl
641       }
642       \tl_set:Nx \l__tag_role_remap_NS_tl
643       {
644         \exp_last_unbraced:NV \use_ii:nn \l__tag_tmpa_tl
645       }
646     }
647     \int_compare:nNnT {\l__tag_loglevel_int} > { 0 }
648     {
649       \msg_note:nxx { tag } { role-remapping } { \l__tag_role_remap_tag_tl }
650     }
651   }
652 }
653 {
654   \cs_new_protected:Npn \__tag_role_remap_inline:
655   {
656     \prop_get:cVNT { g__tag_role_NS_latex-inline_prop } \l__tag_role_remap_tag_tl \l__tag_role_remap_NS_tl
657     {
658       \tl_set:Nn \l__tag_role_remap_NS_tl {latex-inline}
659     }
660     \int_compare:nNnT {\l__tag_loglevel_int} > { 0 }
661     {
662       \msg_note:nxx { tag } { role-remapping } { \l__tag_role_remap_tag_tl/latex-
inline }
663     }
664   }
665 }

(End definition for \__tag_role_remap_inline:.)

```

## 1.8 Key-val user interface

The user interface uses the key `add-new-tag`, which takes either a keyval list as argument, or a tag/role.

```
tag_(rolemap-key)
tag-namespace_(rolemap-key) 666 \keys_define:nn { __tag / tag-role }
role_(rolemap-key)          667 {
role-namespace_(rolemap-key) 668   ,tag .tl_set:N = \l__tag_role_tag_tmpa_tl
add-new-tag_(setup-key)      669   ,tag-namespace .tl_set:N = \l__tag_role_tag_namespace_tmpa_tl
                             670   ,role .tl_set:N = \l__tag_role_role_tmpa_tl
                             671   ,role-namespace .tl_set:N = \l__tag_role_role_namespace_tmpa_tl
                             672 }
                             673
                             674 \keys_define:nn { __tag / setup }
                             675 {
                             676   add-new-tag .code:n =
                             677   {
                             678     \keys_set_known:nnnN
                             679     {__tag/tag-role}
                             680     {
                             681       tag-namespace=user,
                             682       role-namespace=, %so that we can test for it.
                             683       #1
                             684     }{__tag/tag-role}\l_tmpa_tl
                             685     \tl_if_empty:NF \l_tmpa_tl
                             686     {
                             687       \exp_args:NNno \seq_set_split:Nnn \l_tmpa_seq { / } {\l_tmpa_tl/}
                             688       \tl_set:Nx \l__tag_role_tag_tmpa_tl { \seq_item:Nn \l_tmpa_seq {1} }
                             689       \tl_set:Nx \l__tag_role_role_tmpa_tl { \seq_item:Nn \l_tmpa_seq {2} }
                             690     }
                             691     \tl_if_empty:NT \l__tag_role_role_namespace_tmpa_tl
                             692     {
                             693       \prop_get:NVNTF
                             694       \g__tag_role_tags_NS_prop
                             695       \l__tag_role_role_tmpa_tl
                             696       \l__tag_role_role_namespace_tmpa_tl
                             697       {
                             698         \prop_if_in:NVF\g__tag_role_NS_prop \l__tag_role_role_namespace_tmpa_tl
                             699         {
                             700           \tl_set:Nn \l__tag_role_role_namespace_tmpa_tl {user}
                             701         }
                             702       }
                             703       {
                             704         \tl_set:Nn \l__tag_role_role_namespace_tmpa_tl {user}
                             705       }
                             706     }
                             707     \pdf_version_compare:NnTF < {2.0}
                             708     {
                             709       %TODO add check for emptyness?
                             710       \__tag_role_add_tag:VV
                             711       \l__tag_role_tag_tmpa_tl
                             712       \l__tag_role_role_tmpa_tl
                             713     }

```

```

714     {
715         \__tag_role_add_tag:VVVV
716         \l__tag_role_tag_tmpa_tl
717         \l__tag_role_tag_namespace_tmpa_tl
718         \l__tag_role_role_tmpa_tl
719         \l__tag_role_role_namespace_tmpa_tl
720     }
721 }
722 }
723 \</package>

```

*(End definition for tag (rolemap-key) and others. These functions are documented on page 136.)*

## Part X

# The tagpdf-space module

## Code related to real space chars

## Part of the tagpdf package

---

`interwordspace_␣(setup-key)` This key allows to activate/deactivate the real space chars if the engine supports it. The allowed values are `true`, `on`, `false`, `off`.

---

`show-spaces_␣(setup-key)` This key works only with luatex and shows with small red bars where spaces have been inserted. This is only for debugging and is not completely reliable (and change affect other literals and tagging), so it should be used with care.

```
1 <@@=tag>
2 <*header>
3 \ProvidesExplPackage {tagpdf-space-code} {2023-05-16} {0.98g}
4 {part of tagpdf - code related to real space chars}
5 </header>
```

## 1 Code for interword spaces

The code is engine/backend dependant. Basically only pdftex and luatex support real space chars. Most of the code for luatex which uses attributes is in the lua code, here are only the keys.

```
interwordspace_␣(setup-key)
show-spaces_␣(setup-key)
6 (*package)
7 \keys_define:nn { __tag / setup }
8 {
9     interwordspace .choices:nn = { true, on }
10     { \msg_warning:nnx {tag}{sys-no-interwordspace}{\c_sys_engine_str} },
11     interwordspace .choices:nn = { false, off }
12     { \msg_warning:nnx {tag}{sys-no-interwordspace}{\c_sys_engine_str} },
13     interwordspace .default:n = true,
14     show-spaces .bool_set:N = \l__tag_showspaces_bool
15 }
16 \sys_if_engine_pdftex:T
17 {
18     \sys_if_output_pdf:TF
19     {
20         \pdfglyptounicode{space}{0020}
21         \keys_define:nn { __tag / setup }
22         {
23             interwordspace .choices:nn = { true, on } { \pdfinterwordspaceon },
24             interwordspace .choices:nn = { false, off } { \pdfinterwordspaceon },
25             interwordspace .default:n = true,
```

```

26         show-spaces .bool_set:N = \l__tag_showspaces_bool
27     }
28 }
29 {
30     \keys_define:nn { __tag / setup }
31     {
32         interwordspace .choices:nn = { true, on, false, off }
33         { \msg_warning:nnn {tag}{sys-no-interwordspace}{dvi} },
34         interwordspace .default:n = true,
35         show-spaces .bool_set:N = \l__tag_showspaces_bool
36     }
37 }
38 }
39
40
41 \sys_if_engine luatex:T
42 {
43     \keys_define:nn { __tag / setup }
44     {
45         interwordspace .choices:nn =
46             { true, on }
47         {
48             \bool_gset_true:N \g__tag_active_space_bool
49             \lua_now:e{\ltx.__tag.func.markspaceon()}
50         },
51         interwordspace .choices:nn =
52             { false, off }
53         {
54             \bool_gset_false:N \g__tag_active_space_bool
55             \lua_now:e{\ltx.__tag.func.markspaceoff()}
56         },
57         interwordspace .default:n = true,
58         show-spaces .choice:,
59         show-spaces / true .code:n =
60             {\lua_now:e{\ltx.__tag.trace.showspaces=true}},
61         show-spaces / false .code:n =
62             {\lua_now:e{\ltx.__tag.trace.showspaces=nil}},
63         show-spaces .default:n = true
64     }
65 }

```

(End definition for `interwordspace` (setup-key) and `show-spaces` (setup-key). These functions are documented on page 157.)

`\__tag_fakespace:` For luatex we need a command for the fake space as equivalent of the pdftex primitive.

```

66 \sys_if_engine luatex:T
67 {
68     \cs_new_protected:Nn \__tag_fakespace:
69     {
70         \group_begin:
71         \lua_now:e{\ltx.__tag.func.fakespace()}
72         \skip_horizontal:n{\c_zero_skip}
73         \group_end:
74     }

```

```
75 }  
76 \end{package}  
  
(End definition for \_tag_fakespace:.)
```

# 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	
<code>\</code>	10, 23, 37, 38, 39
<code>\_</code>	262, 273
A	
<code>activate_␣(setup-key)</code>	32, <u>191</u>
<code>activate-all_␣(setup-key)</code>	6, <u>229</u>
<code>activate-mc_␣(setup-key)</code>	6, <u>229</u>
<code>activate-space_␣(setup-key)</code>	6, <u>229</u>
<code>activate-struct_␣(setup-key)</code>	6, <u>229</u>
<code>activate-tree_␣(setup-key)</code>	6, <u>229</u>
<code>actualtext_␣(mc-key)</code>	59, <u>229</u> , <u>420</u>
<code>actualtext_␣(struct-key)</code>	87, <u>402</u>
<code>add-new-tag_␣(setup-key)</code>	136, <u>666</u>
<code>\AddToHook</code>	13, 16, 50, 80, 208, 278, 296, 311, 336, 380
<code>AF_␣(struct-key)</code>	88, <u>516</u>
<code>AInline_␣(struct-key)</code>	88, <u>516</u>
<code>AInline-o_␣(struct-key)</code>	88, <u>516</u>
<code>alt_␣(mc-key)</code>	59, <u>229</u> , <u>420</u>
<code>alt_␣(struct-key)</code>	87, <u>402</u>
<code>artifact_␣(mc-key)</code>	59, <u>229</u> , <u>420</u>
artifact-bool internal commands:	
<code>__artifact-bool</code>	113
artifact-type internal commands:	
<code>__artifact-type</code>	113
<code>attr-unknown</code>	18, <u>42</u>
<code>attribute_␣(struct-key)</code>	88, <u>1045</u>
<code>attribute-class_␣(struct-key)</code>	88, <u>1011</u>
B	
bool commands:	
<code>\bool_gset_eq:Nn</code>	400, 413, 425, 441
<code>\bool_gset_false:N</code>	43, 54, 221, 401, 408, 426
<code>\bool_gset_true:N</code>	42, 48, 120, 160, 336
<code>\bool_if:NTF</code>	9, 9, 18, 28, 32, 33, 37, 82, 175, 183, 220, 224, 237, 238, 259, 264, 270, 271, 280, 280, 282, 298, 304, 324, 339, 339, 340, 348, 357, 395, 408, 420, 436, 743
<code>\bool_if:nTF</code>	6, 299
<code>\bool_lazy_all:nTF</code>	72, 210
<code>\bool_lazy_and:nnTF</code>	89, 99, 282, 409, 420, 494, 524, 587
<code>\bool_lazy_and_p:nn</code>	8
<code>\bool_new:N</code>	11, 15, 16, 41, 62, 115, 116, 117, 118, 119, 121, 123, 125, 228, 229, 231, 233, 391
<code>\bool_set_false:N</code>	161, 186, 187, 192, 193, 205, 206, 222, 314, 367, 394, 419
<code>\bool_set_true:N</code>	122, 124, 197, 198, 218, 219, 229, 317, 366
box commands:	
<code>\box_dp:N</code>	177, 181
<code>\box_ht:N</code>	167
<code>\box_new:N</code>	110, 111
<code>\box_set_dp:Nn</code>	175, 177
<code>\box_set_eq:NN</code>	190
<code>\box_set_ht:Nn</code>	174, 176
<code>\box_use_drop:N</code>	179, 183
<code>\boxmaxdepth</code>	70, 178
C	
<code>\c</code>	229, 230
c@g internal commands:	
<code>\c@__tag_MCID_abs_int</code>	9, 25, 34, 47, 54, 65, 71, 73, 135, 149, 163, 237, 242, 271, 311, 383
<code>\c@__tag_parenttree_obj_int</code>	136
<code>\c@__tag_struct_abs_int</code>	6, 17, 54, 74, 77, 78, 130, 138, 141, 143, 414, 439, 451, 465, 481, 489, 501, 511, 531, 534, 539, 558, 561, 566, 599, 601, 606, 656, 667, 668, 669, 670, 673, 675, 681, 684, 699, 706, 724, 733, 741, 769, 777, 782, 880, 936, 1038, 1041, 1089
cctab commands:	
<code>\c_document_cctab</code>	66
<code>\chapter</code>	146, 325, 337
clist commands:	
<code>\clist_const:Nn</code>	112, 113
<code>\clist_if_empty:NTF</code>	1050
<code>\clist_map_inline:nn</code>	136, 496
<code>\clist_new:N</code>	108
<code>\clist_set:Nn</code>	1015, 1049
color commands:	
<code>\color_select:n</code>	262, 273
cs commands:	
<code>\cs_generate_variant:Nn</code>	41, 42, 98, 104, 127, 128, 128, 129, 130, 130, 131, 132, 133, 134, 135, 136, 153, 154, 157, 158, 163, 168, 171, 177, 178, 179, 180, 181, 182, 195, 206, 208, 223, 226,



234, 235, 288, 299, 325, 466, 547, 572, 592, 607, 608, 952, 961, 974, 984	
\cs_gset_eq:NN	224, 774, 775, 877, 878, 933, 934
\cs_if_exist:NTF	82, 325, 337, 341, 382
\cs_if_exist_p:N	9, 214
\cs_if_exist_use:NTF	313, 955
\cs_if_free:NTF	42, 517
\cs_new:Nn	21, 74, 79, 100, 122, 127, 131, 316, 324
\cs_new:Npn	9, 64, 67, 84, 85, 90, 117, 159, 160, 164, 172, 211, 228, 383, 391, 397, 948, 985
\cs_new_protected:Nn	68, 129, 171, 319
\cs_new_protected:Npn	13, 20, 20, 21, 25, 29, 30, 42, 49, 54, 54, 55, 55, 58, 58, 60, 63, 71, 72, 75, 77, 81, 87, 90, 91, 97, 105, 107, 109, 112, 115, 119, 122, 128, 129, 131, 135, 139, 144, 145, 150, 152, 152, 153, 155, 164, 164, 182, 183, 183, 186, 191, 197, 198, 205, 207, 210, 218, 221, 224, 225, 225, 226, 226, 227, 232, 235, 236, 240, 245, 256, 258, 261, 265, 267, 278, 283, 289, 291, 295, 295, 300, 304, 308, 318, 319, 322, 326, 326, 333, 340, 345, 347, 360, 368, 375, 375, 376, 377, 378, 383, 390, 392, 405, 414, 417, 432, 469, 513, 519, 519, 543, 548, 573, 630, 634, 654, 656, 657, 658, 841, 891, 953, 962, 975, 998
\cs_set:Nn	456, 457
\cs_set:Npn	38, 43
\cs_set_eq:NN	14, 20, 59, 77, 78, 79, 168, 169, 170, 171, 172, 173, 174, 175, 189, 231, 232, 233, 449, 450, 451, 452, 458, 459, 463, 464, 465, 466, 631, 771, 772, 874, 875, 930, 931
\cs_set_protected:Nn	154, 216, 246, 395, 401, 803, 804
\cs_set_protected:Npn	9, 16, 16, 23, 30, 32, 49, 56, 57, 64, 74, 93, 190, 192, 195, 201, 213, 322, 328, 660, 661, 835, 843, 893
\cs_to_str:N	12, 19, 26, 33, 52, 53, 59, 60
<b>D</b>	
\DeclareOption	42, 43
dim commands:	
\c_max_dim	166, 191
\c_zero_dim	174, 175, 176
\documentclass	22
\DocumentMetadata	21
<b>E</b>	
E <sub>␣</sub> (struct-key)	88, 402
\endinput	28
exclude-header-footer <sub>␣</sub> (setup-key)	34, 444
\ExecuteOptions	44
exp commands:	
\exp_args:Ne	385, 671
\exp_args:Nee	86
\exp_args:NNno	687
\exp_args:NNnx	67
\exp_args:NNx	67, 83, 86, 192, 212
\exp_args:Nnx	81, 314, 318, 371, 383, 459
\exp_args:NV	179, 185, 314, 343, 354, 359
\exp_args:Nx	119, 332
\exp_last_unbraced:NV	163, 164, 218, 219, 398, 402, 640, 644, 828
\exp_not:n	276
<b>F</b>	
file commands:	
\file_if_exist:nTF	295
\file_input:n	267
\fontencoding	6
\fontfamily	6
\fontseries	6
\fontshape	6
\fontsize	6
\footins	344
<b>G</b>	
group commands:	
\group_begin:	70, 158, 185, 334, 435, 522, 551, 624, 666
\group_end:	73, 189, 213, 386, 454, 543, 569, 630, 799
<b>H</b>	
hbox commands:	
\hbox_set:Nn	168, 169
hook commands:	
\hook_gput_code:nnn	7, 7, 26, 30, 43, 50, 137, 194, 195, 323, 335, 337, 341, 471, 484, 494, 507
\hook_new:n	321
\hook_use:n	326
<b>I</b>	
\ignorespaces	32
int commands:	
\int_abs:n	122
\int_case:nnTF	250
\int_compare:nNnTF	22, 61, 61, 86, 113, 124, 134, 154, 170, 173, 174, 194, 200, 203, 228, 234, 301, 317,

321, 326, 328, 335, 342, 362, 366, 368, 370, 372, 377, 385, 392, 430, 436, 624, 647, 660, 690, 756, 872, 928	230, 244, 250, 368, 403, 421, 444, 593, 633, 666, 674, 1004, 1011, 1045
\int_compare:nTF . . . . .	\keys_set:nn . . . . . 10,
161, 268, 1031, 1033, 1035, 1059, 1085	18, 64, 170, 201, 315, 319, 339, 460, 679
\int_compare_p:nNn . . . . . 414	\keys_set_known:nnnN . . . . . 678
\int_eval:n 135, 172, 259, 276, 346, 411, 416, 419, 439, 451, 465, 481, 489, 501, 511, 531, 539, 558, 566, 599, 601, 606, 668, 669, 670, 673, 675, 681, 684, 706, 724, 733, 769, 777, 782, 880, 936, 1038, 1041, 1089	<b>L</b>
\int_gincr:N . . . . . 163, 237, 284, 290, 300, 306, 311, 523, 552, 656, 667	label_(mc-key) . . . . . 59, 229, 420
\int_gset:Nn . . . . . 45, 139, 255	label_(struct-key) . . . . . 87, 402
\int_gzero:N . . . . . 7, 263	lang_(struct-key) . . . . . 87, 402
\int_incr:N . . . . . 56, 364	legacy commands:
\int_new:N . . . . . 10, 41, 109, 114, 234, 235, 236, 237, 516	\legacy_if:nTF . . . . . 65
\int_rand:n . . . . . 60, 61, 63, 65, 67, 69, 70	\llap . . . . . 262
\int_set:Nn . . . . . 242, 245, 248, 249, 250	log_(setup-key) . . . . . 6, 241
\int_step_inline:nn . . . . . 54, 395, 401	ltx. internal commands:
\int_step_inline:nnn . . . . . 25	ltx.__tag.func.alloctag . . . . . 261
\int_step_inline:nnnn . . . . . . . . . . 130, 155, 158, 175, 253, 259	ltx.__tag.func.fakespace . . . . . 363
\int_to_arabic:n . . . . . 122, 124	ltx.__tag.func.fill_parent_tree_- line . . . . . 705
\int_to_Hex:n 60, 61, 63, 65, 67, 69, 70	ltx.__tag.func.get_num_from . . . 270
\int_use:N . . . . . 9, 17, 25, 34, 47, 54, 65, 66, 71, 72, 73, 74, 138, 141, 143, 147, 149, 151, 213, 242, 262, 271, 273, 322, 323, 331, 332, 383, 524, 528, 529, 532, 534, 555, 561, 985	ltx.__tag.func.get_tag_from . . . 289
\int_zero:N . . . . . 53, 68, 352	ltx.__tag.func.mark_page_- elements . . . . . 534
intarray commands:	ltx.__tag.func.mark_shipout . . . 686
\intarray_gset:Nnn . . . . . 231, 349	ltx.__tag.func.markspaceoff . . . 427
\intarray_item:Nn . . . . . 233, 236, 426	ltx.__tag.func.markspaceon . . . . 427
\intarray_new:Nn . . . . . 223, 346	ltx.__tag.func.mc_insert_kids . . . 482
interwordspace_(setup-key) . . . . . 157, 6	ltx.__tag.func.mc_num_of_kids . . . 319
ior commands:	ltx.__tag.func.output_num_from . . 270
\ior_close:N . . . . . 303, 389	ltx.__tag.func.output_parenttree . 705
\ior_map_inline:Nn . . . . . 299, 360	ltx.__tag.func.output_tag_from . . 289
\ior_open:Nn . . . . . 297, 355, 358	ltx.__tag.func.pdf_object_ref . . . 348
\g_tmpa_ior . . . . . . . . . . 297, 299, 303, 355, 358, 360, 389	ltx.__tag.func.space_chars_- shipout . . . . . 448
iow commands:	ltx.__tag.func.store_mc_data . . . 304
\iow_newline: . . . . . 202, 278, 450	ltx.__tag.func.store_mc_in_page . . 526
\iow_now:Nn . . . . . 67	ltx.__tag.func.store_mc_kid . . . . 313
\iow_term:n 149, 152, 158, 162, 195, 246	ltx.__tag.func.store_mc_label . . . 309
<b>K</b>	ltx.__tag.func.store_struct_- mcabs . . . . . 514
keys commands:	ltx.__tag.tables.role_tag_- attribute . . . . . 259
\keys_define:nn . . . . . 7, 21, 30, 43, 67, 79, 113, 141, 184, 197, 229,	ltx.__tag.trace.log . . . . . 173
	ltx.__tag.trace.show_all_mc_data . 230
	ltx.__tag.trace.show_mc_data . . . 215
	ltx.__tag.trace.show_prop . . . . . 190
	ltx.__tag.trace.show_seq . . . . . 181
	ltx.__tag.trace.show_struct_data . 236
	lua commands:
	\lua_now:n . . . . . 8, 11, 12, 19, 19, 26, 28, 33, 35, 40, 43, 45, 49, 52, 52, 53, 55, 59, 60, 60, 62, 64, 71, 73, 77, 78, 87, 89, 90, 98,

102, 110, 111, 111, 124, 129, 140, 166, 209, 235, 243, 259, 280, 294, 304		\NewDocumentCommand ..... 6, 23, 29, 34, 40, 46, 51, 56, 62, 223, 373
		\newlabeldata ..... 69
		\newmarks ..... 14
		no-struct-dest <sub>␣</sub> (setup-key) ..... 6, 229
		\nointerlineskip ..... 182
	<b>M</b>	<b>P</b>
\maxdimen ..... 189		\PackageError ..... 13
mc-current ..... 18, 16		\PackageWarning ..... 28
mc-current <sub>␣</sub> (show-key) ..... 33, 79		para-flattened <sub>␣</sub> (tool-key) ..... 244
mc-data <sub>␣</sub> (show-key) ..... 33, 67		para-hook-count-wrong ..... 19, 60
mc-label-unknown ..... 18, 9		paratag <sub>␣</sub> (setup-key) ..... 244
mc-marks <sub>␣</sub> (show-key) ..... 33, 141		paratag <sub>␣</sub> (tool-key) ..... 244
mc-nested ..... 18, 6		paratagging <sub>␣</sub> (setup-key) ..... 34, 244
mc-not-open ..... 18, 13		paratagging-show <sub>␣</sub> (setup-key) ... 34, 244
mc-popped ..... 18, 14		parent <sub>␣</sub> (struct-key) ..... 87, 402
mc-pushed ..... 18, 14		pdf commands:
mc-tag-missing ..... 18, 8		\pdf_activate_structure_destination: ..... 214, 218
mc-used-twice ..... 18, 12		\pdf_bdc:nn ..... 233
\MessageBreak ..... 15, 19, 20, 21		\pdf_bmc:n ..... 231
msg commands:		\l_pdf_current_structure_ destination_tl ..... 217
\msg_error:nn ..... 112, 133, 355, 696		\pdf_emc: ..... 232
\msg_error:nnn ..... 149, 160, 168, 179, 214, 342, 1025, 1065		\pdf_name_from_unicode_e:n ..... ..... 85, 93, 98, 135, 144, 189, 248, 628, 1001, 1019, 1055
\msg_error:nnnn ..... 319, 328		\pdf_object_if_exist:n ..... 126
\msg_info:nn ..... ..... 126, 136, 176, 202, 206, 298		\pdf_object_if_exist:nTF ..... ..... 141, 184, 328, 524, 597, 637
\msg_info:nnn ..... 156, 175		\pdf_object_new:n ..... ... 29, 33, 35, 135, 236, 283, 294, 672
\msg_line_context: ..... ..... 47, 316, 317, 349, 353, 357		\pdf_object_ref:n ..... .... 38, 55, 59, 96, 100, 115, 117, 127, 143, 186, 191, 202, 291, 308, 377, 532, 599, 639, 785, 860, 916, 950
\g_msg_module_name_prop ..... 30, 34		\pdf_object_ref_last: ..... ..... 67, 81, 87, 219, 1074
\g_msg_module_type_prop ..... 33		\pdf_object_unnamed_write:nn ... ..... 63, 74, 83, 211, 1069
\msg_new:nn ..... 7, 8, 9, 12, 13, 14, 15, 16, 22, 24, 25, 28, 29, 31, 33, 35, 42, 43, 44, 45, 46, 48, 50, 51, 52, 53, 54, 55, 57, 316, 317, 347, 351, 355		\pdf_object_write:nnn ..... 103, 120, 229, 251, 284, 303, 310, 315, 333
\msg_new:nnnn ..... 60		\pdf_pageobject_ref:n ..... 178, 368
\msg_note:nn ..... 137		\pdf_string_from_unicode:nnN ... 41
\msg_note:nnn ..... ..... 337, 344, 379, 387, 649, 662		\pdf_uncompress: ..... 263
\msg_note:nnnn ..... 323, 330, 364, 372		\pdf_version_compare:NnTF ..... ..... 19, 74, 83, 89, 110, 127, 158, 209, 230, 234, 238, 297, 312, 321, 353, 393, 467, 632, 707
\msg_note:nnnnn ..... 443		pdfannot commands:
\msg_redirect_name:nnn ..... 315		\pdfannot_dict_put:nnn ..... ..... 128, 478, 501, 519, 524
\msg_warning:nn ..... 24, 194		\pdfannot_link_ref_last: ... 488, 511
\msg_warning:nnn ..... ... 10, 12, 33, 39, 48, 119, 142, 187, 195, 218, 241, 294, 306, 886, 905, 942		
\msg_warning:nnnn ..... 400, 418		
\msg_warning:nnnnn ..... .... 200, 374, 458, 505, 535, 598, 762		
	<b>N</b>	
namespace <sub>␣</sub> (rolemap-key) ..... 136		
new-tag ..... 18, 50		
newattribute <sub>␣</sub> (setup-key) ..... 89, 998		
\newcommand ..... 363, 364		
\newcounter ..... 6, 8, 136		

pdfdict commands:

- \pdfdict\_gput:nnn ..... 37, 44, 52, 186, 246, 307
- \pdfdict\_if\_empty:nTF ..... 301
- \pdfdict\_new:n ..... 17, 34, 36
- \pdfdict\_put:nnn ..... 625, 626
- \pdfdict\_use:n ..... 253, 305, 312
- \pdffakespace ..... 34, 221

pdffile commands:

- \pdffile\_embed\_stream:nnN ..... 517, 547, 553
- \pdffile\_embed\_stream:nnn .. 129, 526
- \pdfglyphtounicode ..... 20
- \pdfinterwordspaceon ..... 23, 24

pdfmanagement commands:

- \pdfmanagement\_add:nnn ..... 34, 35, 255, 257, 259, 343
- \pdfmanagement\_if\_active\_p: .. 9, 10
- \pdfmanagement\_remove:nn ..... 261

prg commands:

- \prg\_do\_nothing: ..... 79, 224, 463, 464, 465, 466
- \prg\_generate\_conditional\_variant:Nnn ..... 126
- \prg\_new\_conditional:Nnn .... 59, 222
- \prg\_new\_conditional:Npnn ..... 66, 87, 97, 291, 297, 308
- \prg\_new\_eq\_conditional:NNn . 73, 229
- \prg\_new\_protected\_conditional:Npnn ..... 610
- \prg\_replicate:nn ..... 121
- \prg\_return\_false: ..... 67, 69, 84, 94, 104, 226, 294, 306, 312, 625
- \prg\_return\_true: ..... 70, 81, 91, 101, 225, 295, 305, 311, 610, 626
- \prg\_set\_conditional:Npnn ..... 70
- \prg\_set\_protected\_conditional:Npnn ..... 612

\ProcessOptions ..... 45

prop commands:

- \prop\_clear:N ..... 157
- \prop\_count:N ..... 178
- \prop\_get:NnN .. 139, 147, 178, 196, 197, 241, 272, 370, 378, 390, 392, 405, 406, 418, 419, 521, 522, 758, 965
- \prop\_get:NnNTF ..... 93, 137, 145, 152, 158, 162, 171, 180, 216, 247, 438, 474, 479, 484, 489, 552, 572, 636, 656, 693, 718, 900
- \prop\_gpop:NnN ..... 215
- \prop\_gput:Nnn ..... 25, 25, 30, 33, 34, 55, 90, 91, 92, 93, 95, 98, 99, 100, 100, 101, 102, 112, 113, 114, 115, 121, 122, 123, 124, 130, 147, 150, 153, 170, 200, 204, 207, 255, 258, 259, 287, 295, 341, 370, 391, 397, 403, 409, 411, 1000, 1074

- \prop\_gremove:Nn ..... 210
- \prop\_if\_exist:NTF .... 293, 847, 897
- \prop\_if\_exist\_p:N ..... 411
- \prop\_if\_in:NnTF .... 69, 109, 117, 132, 216, 308, 698, 1023, 1063, 1067
- \prop\_item:Nn ..... 34, 73, 132, 167, 173, 192, 269, 315, 318, 350, 388, 426, 431, 1072, 1079
- \prop\_map\_inline:Nn ..... 242, 299, 327, 339, 407
- \prop\_map\_tokens:Nn ..... 317
- \prop\_new:N ..... 8, 9, 10, 11, 11, 18, 23, 24, 31, 32, 64, 66, 105, 168, 200, 994, 997
- \prop\_put:Nnn ..... 131, 164, 472, 473, 545, 546
- \prop\_show:N ..... 58, 92, 175, 793, 796, 1041, 1068

\providecommand ..... 228

\ProvidesExplFile ..... 3

\ProvidesExplPackage ..... 3, 3, 3, 3, 3, 3, 3, 3, 7, 26, 37, 990

## Q

\quad ..... 171, 172

quark commands:

- \q\_no\_value ..... 481, 491, 564, 584
- \quark\_if\_no\_value:NTF ..... 140, 148, 179, 198, 216, 242, 273, 972
- \quark\_if\_no\_value\_p:N ..... 421, 422, 495, 496, 525, 526, 588, 589
- \q\_stop ..... 232, 265, 301

## R

raw<sub>␣</sub>(mc-key) ..... 59, 229, 420

ref<sub>␣</sub>(struct-key) ..... 88, 402

ref commands:

- \ref\_attribute\_gset:nnnn ..... 137, 139, 146, 148, 150
- \ref\_label:nn ..... 133, 155, 359
- \ref\_value:nn ..... 87, 499
- \ref\_value:nnn . 6, 82, 82, 84, 161, 166

ref internal commands:

- \\_\_ref\_value:nnn ..... 87, 90

regex commands:

- \regex\_replace\_once:nnN ..... 228

\renewcommand ..... 366, 367

\RenewDocumentCommand ..... 8

\RequirePackage ..... 20, 46, 47, 273, 276, 282, 285, 338

\rlap ..... 273

role <sub>␣</sub> (rolemap-key) . . . . .	<a href="#">136</a> , <a href="#">666</a>
role-missing . . . . .	<a href="#">18</a> , <a href="#">43</a>
role-namespace <sub>␣</sub> (rolemap-key) . .	<a href="#">136</a> , <a href="#">666</a>
role-parent-child . . . . .	<a href="#">46</a> , <a href="#">48</a>
role-tag . . . . .	<a href="#">18</a> , <a href="#">50</a>
role-unknown . . . . .	<a href="#">18</a> , <a href="#">43</a>
role-unknown-tag . . . . .	<a href="#">18</a> , <a href="#">43</a>
root-AF <sub>␣</sub> (setup-key) . . . . .	<a href="#">89</a> , <a href="#">633</a>

  

<b>S</b>	
\selectfont . . . . .	<a href="#">6</a>
seq commands:	
\seq_clear:N . . . . .	<a href="#">240</a> , <a href="#">258</a>
\seq_const_from_clist:Nn . . . .	<a href="#">20</a> , <a href="#">33</a>
\seq_count:N . . . . .	<a href="#">22</a> , <a href="#">25</a> , <a href="#">252</a> , <a href="#">1031</a> , <a href="#">1033</a> , <a href="#">1035</a> , <a href="#">1059</a> , <a href="#">1085</a>
\seq_get:NN . . . . .	<a href="#">614</a>
\seq_get:NNTF . . . . .	<a href="#">351</a> , <a href="#">394</a> , <a href="#">692</a> , <a href="#">818</a> , <a href="#">825</a>
\seq_gpop:NN . . . . .	<a href="#">811</a>
\seq_gpop:NNTF . . . . .	<a href="#">97</a> , <a href="#">812</a>
\seq_gpop_left:NN . . . . .	<a href="#">227</a>
\seq_gpush:Nn . . . . .	<a href="#">12</a> , <a href="#">14</a> , <a href="#">80</a> , <a href="#">87</a> , <a href="#">699</a> , <a href="#">739</a>
\seq_gput_left:Nn . . . . .	<a href="#">232</a> , <a href="#">1027</a>
\seq_gput_right:Nn . . . . .	<a href="#">32</a> , <a href="#">134</a> , <a href="#">171</a> , <a href="#">278</a>
\seq_gremove_duplicates:N . . . .	<a href="#">264</a>
\seq_gset_eq:NN . . . . .	<a href="#">156</a> , <a href="#">218</a> , <a href="#">247</a>
\seq_if_empty:NNTF . . . . .	<a href="#">197</a>
\seq_item:Nn . . . . .	<a href="#">113</a> , <a href="#">115</a> , <a href="#">122</a> , <a href="#">126</a> , <a href="#">133</a> , <a href="#">137</a> , <a href="#">172</a> , <a href="#">271</a> , <a href="#">301</a> , <a href="#">303</a> , <a href="#">310</a> , <a href="#">427</a> , <a href="#">428</a> , <a href="#">688</a> , <a href="#">689</a>
\seq_log:N . . . . .	<a href="#">172</a> , <a href="#">187</a> , <a href="#">196</a> , <a href="#">207</a> , <a href="#">365</a> , <a href="#">380</a>
\seq_map_indexed_inline:Nn . . . .	<a href="#">368</a> , <a href="#">381</a>
\seq_map_inline:Nn . . . . .	<a href="#">241</a> , <a href="#">298</a> , <a href="#">1021</a> , <a href="#">1061</a>
\seq_new:N . . . . .	<a href="#">11</a> , <a href="#">13</a> , <a href="#">13</a> , <a href="#">15</a> , <a href="#">16</a> , <a href="#">16</a> , <a href="#">17</a> , <a href="#">18</a> , <a href="#">18</a> , <a href="#">19</a> , <a href="#">106</a> , <a href="#">107</a> , <a href="#">169</a> , <a href="#">995</a>
\seq_pop_left:NN . . . . .	<a href="#">377</a> , <a href="#">379</a> , <a href="#">380</a>
\seq_put_right:Nn . . . . .	<a href="#">242</a>
\seq_remove_all:Nn . . . . .	<a href="#">245</a>
\seq_set_eq:NN . . . . .	<a href="#">204</a> , <a href="#">205</a>
\seq_set_from_clist:NN . . . . .	<a href="#">1016</a> , <a href="#">1052</a>
\seq_set_from_clist:Nn . . . . .	<a href="#">84</a> , <a href="#">87</a> , <a href="#">193</a> , <a href="#">213</a> , <a href="#">365</a> , <a href="#">376</a>
\seq_set_map:NNn . . . . .	<a href="#">265</a>
\seq_set_map_x:NNn . . . . .	<a href="#">1017</a> , <a href="#">1053</a>
\seq_set_split:Nnn . . . . .	<a href="#">134</a> , <a href="#">426</a> , <a href="#">687</a>
\seq_show:N . . . . .	<a href="#">51</a> , <a href="#">154</a> , <a href="#">155</a> , <a href="#">174</a> , <a href="#">188</a> , <a href="#">243</a> , <a href="#">244</a> , <a href="#">246</a> , <a href="#">288</a> , <a href="#">742</a> , <a href="#">794</a> , <a href="#">797</a> , <a href="#">807</a>
\seq_use:Nn . . . . .	<a href="#">38</a> , <a href="#">107</a> , <a href="#">108</a> , <a href="#">171</a> , <a href="#">172</a> , <a href="#">202</a> , <a href="#">276</a> , <a href="#">283</a> , <a href="#">1032</a>
\l_tmpa_seq . . . . .	<a href="#">258</a> , <a href="#">278</a> , <a href="#">288</a> , <a href="#">687</a> , <a href="#">688</a> , <a href="#">689</a>
shipout commands:	
\g_shipout_readonly_int . . . . .	<a href="#">72</a> , <a href="#">147</a> , <a href="#">213</a> , <a href="#">346</a>
show-spaces <sub>␣</sub> (setup-key) . . . . .	<a href="#">157</a> , <a href="#">6</a>

  

\ShowTagging . . . . .	<a href="#">16</a> , <a href="#">33</a> , <a href="#">61</a>
skip commands:	
\skip_horizontal:n . . . . .	<a href="#">72</a>
\c_zero_skip . . . . .	<a href="#">72</a>
stash <sub>␣</sub> (mc-key) . . . . .	<a href="#">59</a> , <a href="#">113</a>
stash <sub>␣</sub> (struct-key) . . . . .	<a href="#">87</a> , <a href="#">402</a>
\stepcounter . . . . .	<a href="#">380</a>
str commands:	
\str_case:nnTF . . . . .	<a href="#">52</a> , <a href="#">711</a>
\str_const:Nn . . . . .	<a href="#">58</a>
\str_if_empty:nTF . . . . .	<a href="#">593</a>
\str_if_eq:nnTF . . . . .	<a href="#">124</a> , <a href="#">310</a> , <a href="#">396</a> , <a href="#">523</a>
\str_if_eq_p:nn . . . . .	<a href="#">283</a> , <a href="#">301</a> , <a href="#">303</a>
\str_new:N . . . . .	<a href="#">104</a>
\str_set_convert:Nnnn . . . . .	<a href="#">135</a> , <a href="#">252</a> , <a href="#">273</a> , <a href="#">433</a> , <a href="#">434</a> , <a href="#">445</a> , <a href="#">447</a> , <a href="#">459</a> , <a href="#">475</a> , <a href="#">505</a>
\str_use:N . . . . .	<a href="#">263</a> , <a href="#">286</a>
\string . . . . .	<a href="#">20</a> , <a href="#">21</a> , <a href="#">22</a> , <a href="#">352</a>
struct-faulty-nesting . . . . .	<a href="#">18</a> , <a href="#">25</a>
struct-label-unknown . . . . .	<a href="#">18</a> , <a href="#">31</a>
struct-missing-tag . . . . .	<a href="#">18</a> , <a href="#">28</a>
struct-no-objnum . . . . .	<a href="#">18</a> , <a href="#">24</a>
struct-show-closing . . . . .	<a href="#">18</a> , <a href="#">33</a>
struct-stack <sub>␣</sub> (show-key) . . . . .	<a href="#">33</a> , <a href="#">184</a>
struct-unknown . . . . .	<a href="#">22</a>
struct-used-twice . . . . .	<a href="#">18</a> , <a href="#">29</a>
sys commands:	
\c_sys_backend_str . . . . .	<a href="#">52</a>
\c_sys_engine_str . . . . .	<a href="#">10</a> , <a href="#">12</a>
\sys_if_engine luatex:TF . . . . .	<a href="#">41</a> , <a href="#">42</a> , <a href="#">66</a> , <a href="#">71</a> , <a href="#">84</a> , <a href="#">85</a> , <a href="#">107</a> , <a href="#">221</a> , <a href="#">265</a>
\sys_if_engine pdftex:TF . . . . .	<a href="#">16</a>
\sys_if_output_pdf:TF . . . . .	<a href="#">11</a> , <a href="#">18</a>
sys-no-interwordspace . . . . .	<a href="#">19</a> , <a href="#">57</a>

  

<b>T</b>	
tabsorder <sub>␣</sub> (setup-key) . . . . .	<a href="#">6</a> , <a href="#">253</a>
tag <sub>␣</sub> (mc-key) . . . . .	<a href="#">59</a> , <a href="#">229</a> , <a href="#">420</a>
tag <sub>␣</sub> (rolemap-key) . . . . .	<a href="#">136</a> , <a href="#">666</a>
tag <sub>␣</sub> (struct-key) . . . . .	<a href="#">87</a> , <a href="#">402</a>
tag commands:	
\tag_check_child:nn . . . . .	<a href="#">136</a> , <a href="#">610</a> , <a href="#">612</a>
\tag_check_child:nnTF . . . . .	<a href="#">136</a> , <a href="#">610</a>
\tag_get:n . . . . .	<a href="#">16</a> , <a href="#">86</a> , <a href="#">87</a> , <a href="#">100</a> , <a href="#">101</a> , <a href="#">64</a> , <a href="#">64</a> , <a href="#">80</a> , <a href="#">83</a> , <a href="#">349</a>
\tag_if_active: . . . . .	<a href="#">66</a> , <a href="#">70</a>
\tag_if_active:TF . . . . .	<a href="#">16</a> , <a href="#">18</a> , <a href="#">65</a> , <a href="#">203</a> , <a href="#">313</a>
\tag_if_active_p: . . . . .	<a href="#">16</a> , <a href="#">65</a>
\tag_mc_artifact_group_begin:n . .	<a href="#">58</a> , <a href="#">54</a> , <a href="#">54</a> , <a href="#">57</a>
\tag_mc_artifact_group_end: . . . .	<a href="#">58</a> , <a href="#">54</a> , <a href="#">55</a> , <a href="#">64</a>

\tag_mc_begin:n	10, 58, 25, 60, 105, <a href="#">154</a> , 154, 261, 272, 293, <a href="#">318</a> , 318, 322, 328, 403, 429, 477, 500	\__tag_add_missing_mcs_to_-stream:Nn	<a href="#">58</a> , 58, <a href="#">186</a> , 186, 344, 348, 355, 357
\tag_mc_begin_pop:n	58, 68, <a href="#">71</a> , 72, 93, 410, 438, 491, 514	\g__tag_attr_class_used_seq	264, 265, <a href="#">993</a> , 1027
\tag_mc_end:	58, 31, 67, 84, <a href="#">216</a> , 216, 263, 274, 301, <a href="#">318</a> , 319, 395, 401, 407, 434, 489, 512	\g__tag_attr_entries_prop	270, <a href="#">993</a> , 1000, 1023, 1063, 1068, 1072
\tag_mc_end_push:	58, 59, <a href="#">71</a> , 71, 74, 397, 422, 475, 498	\__tag_attr_new_entry:nn	416, <a href="#">998</a> , 998, 1008
\tag_mc_if_in:	73, 229	\g__tag_attr_objref_prop	<a href="#">993</a> , 1067, 1074, 1079
\tag_mc_if_in:TF	58, 42, 59, <a href="#">222</a>	\l__tag_attr_value_tl	<a href="#">993</a> , 1057, 1076, 1081, 1083, 1087, 1091
\tag_mc_if_in_p:	58, 59, <a href="#">222</a>	\__tag_check_add_tag_role:nn	131, <a href="#">145</a> , 145
\tag_mc_use:n	58, <a href="#">30</a> , 30, 32, 36	\__tag_check_add_tag_role:nnn	164, 173
\tag_start:	6, <a href="#">183</a> , 195, 225	\__tag_check_if_active_mc:	87
\tag_start:n	6, <a href="#">183</a> , 213, 227	\__tag_check_if_active_mc:TF	76, 87, 95, 156, 188, 218, 324, 330, 397, 403
\tag_stop:	6, <a href="#">183</a> , 190, 224	\__tag_check_if_active_struct:	97
\tag_stop:n	6, <a href="#">183</a> , 201, 226	\__tag_check_if_active_struct:TF	34, <a href="#">87</a> , 663, 664, 808, 809, 845, 895, 978
\tag_stop_group_begin:	6, 61, <a href="#">183</a> , 183	\__tag_check_if_mc_in_galley:	291
\tag_stop_group_end:	6, 66, <a href="#">183</a> , 189	\__tag_check_if_mc_in_galley:TF	147, 168
\tag_struct_begin:n	86, 48, 285, 291, 428, 476, 499, <a href="#">656</a> , 656, 660, 661	\__tag_check_if_mc_tmb_missing:	297
\tag_struct_end:	86, 26, 53, 303, 307, 435, 490, 513, <a href="#">656</a> , 657, 803, 804, 838	\__tag_check_if_mc_tmb_missing:TF	109, 156, 173, <a href="#">297</a>
\tag_struct_end:n	86, 658, 835	\__tag_check_if_mc_tmb_missing_p:	297
\tag_struct_gput:nnn	953, 953, 961	\__tag_check_if_mc_tme_missing:	308
\tag_struct_insert_annot:nn	86, 113, 488, 511, <a href="#">975</a> , 975, 984	\__tag_check_if_mc_tme_missing:TF	152, 160, 177, <a href="#">308</a>
\tag_struct_object_ref:n	86, <a href="#">947</a> , 948, 952	\__tag_check_if_mc_tme_missing_p:	308
\tag_struct_parent_int:	86, 113, 481, 488, 504, 511, <a href="#">975</a> , 985	\__tag_check_info_closing_struct:n	122, 122, 130, 814
\tag_struct_use:n	86, 87, 58, <a href="#">841</a> , 841, 843	\__tag_check_init_mc_used:	221, 221, 224, 230
\tag_struct_use_num:n	891, 891, 893	\__tag_check_mc_if_nested:	159, <a href="#">183</a> , 183, 335
\tag_tool:n	32, <a href="#">13</a> , 13, 14, 16, 20	\__tag_check_mc_if_open:	183, 191, 220, 407
tag internal commands:		\__tag_check_mc_in_galley:TF	291
__tag_activate_mark_space	427	\__tag_check_mc_in_galley_p:	291
\g__tag_active_mc_bool	33, 75, 89, <a href="#">115</a> , 233	\__tag_check_mc_pushed_popped:nn	81, 88, 101, 104, 109, <a href="#">198</a> , 198
\l__tag_active_mc_bool	78, 89, <a href="#">121</a> , 187, 193, 198, 206, 219	\__tag_check_mc_tag:N	172, <a href="#">210</a> , 210, 347
\g__tag_active_space_bool	9, 48, 54, <a href="#">115</a> , 232	\__tag_check_mc_used:n	133, <a href="#">226</a> , 226, 291
\g__tag_active_struct_bool	74, 99, <a href="#">115</a> , 213, 235, 348	\g__tag_check_mc_used_intarray	221, 231, 233, 236
\l__tag_active_struct_bool	77, 99, <a href="#">121</a> , 186, 192, 197, 205, 218		
\g__tag_active_struct_dest_bool	115, 212, 239		
\g__tag_active_tree_bool	9, 32, 76, <a href="#">115</a> , 234, 324, 339		
\__tag_add_missing_mcs:Nn	71, <a href="#">164</a> , 164, 216		

\__tag_check_no_open_struct: . . .	\__tag_get_data_struct_num: <a href="#">396</a> , <a href="#">397</a>
<a href="#">131</a> , <a href="#">131</a> , <a href="#">816</a> , <a href="#">823</a>	\__tag_get_data_struct_tag: <a href="#">383</a> , <a href="#">383</a>
\__tag_check_para_begin_show:nn .	__tag_get_mathsubtype . . . . . <a href="#">251</a>
256, <a href="#">292</a>	\__tag_get_mc_abs_cnt: . . <a href="#">9</a> , <a href="#">9</a> , <a href="#">19</a> ,
\__tag_check_para_end_show:nn . . .	20, <a href="#">73</a> , <a href="#">93</a> , <a href="#">103</a> , <a href="#">114</a> , <a href="#">168</a> , <a href="#">187</a> , <a href="#">195</a> ,
267, <a href="#">302</a>	210, <a href="#">214</a> , <a href="#">237</a> , <a href="#">245</a> , <a href="#">263</a> , <a href="#">284</a> , <a href="#">298</a> , <a href="#">308</a>
\__tag_check_parent_child:nnN . . .	__tag_get_mc_cnt_type_tag . . . . . <a href="#">245</a>
513, <a href="#">519</a> , <a href="#">607</a>	__tag_get_num_from . . . . . <a href="#">270</a>
__tag_check_parent_child:nnnnN . <a href="#">467</a>	\l__tag_get_parent_tmpa_tl . . . . .
\__tag_check_parent_child:nnnnN .	102, <a href="#">187</a> , <a href="#">190</a> , <a href="#">203</a> ,
189, <a href="#">363</a> , <a href="#">469</a> ,	361, <a href="#">364</a> , <a href="#">377</a> , <a href="#">617</a> , <a href="#">620</a> , <a href="#">748</a> , <a href="#">751</a> , <a href="#">765</a>
515, <a href="#">528</a> , <a href="#">543</a> , <a href="#">608</a> , <a href="#">619</a> , <a href="#">750</a> , <a href="#">866</a> , <a href="#">922</a>	\l__tag_get_parent_tmpa_tl_uuuu\l_-
\__tag_check_show_MCID_by_page: .	__tag_get_parent_tmpb_tl_uuuu\l_-
245, <a href="#">245</a>	__tag_tmpa_str . . . . . <a href="#">99</a>
\__tag_check_struct_used:n . . . . .	\l__tag_get_parent_tmpb_tl . . . . .
135, <a href="#">135</a> , <a href="#">850</a>	103, <a href="#">188</a> , <a href="#">191</a> , <a href="#">203</a> ,
\__tag_check_structure_has_tag:n	362, <a href="#">365</a> , <a href="#">377</a> , <a href="#">618</a> , <a href="#">621</a> , <a href="#">749</a> , <a href="#">752</a> , <a href="#">765</a>
107, <a href="#">107</a> , <a href="#">684</a>	__tag_get_tag_from . . . . . <a href="#">289</a>
\__tag_check_structure_tag:N . . .	\l__tag_get_tmpc_tl . . . . <a href="#">99</a> , <a href="#">145</a> ,
115, <a href="#">115</a> , <a href="#">429</a>	150, <a href="#">161</a> , <a href="#">163</a> , <a href="#">164</a> , <a href="#">721</a> , <a href="#">727</a> , <a href="#">968</a> , <a href="#">972</a>
\__tag_check_typeout_v:n . . . . .	\__tag_hook_kernel_after_foot: . .
59, <a href="#">59</a> , <a href="#">107</a> , <a href="#">108</a> , <a href="#">111</a> ,	378, <a href="#">387</a> , <a href="#">452</a> , <a href="#">459</a> , <a href="#">466</a>
146, <a href="#">154</a> , <a href="#">161</a> , <a href="#">199</a> , <a href="#">208</a> , <a href="#">246</a> , <a href="#">347</a> , <a href="#">352</a>	\__tag_hook_kernel_after_head: . .
\__tag_debug_mc_begin_ignore:n . .	376, <a href="#">385</a> , <a href="#">451</a> , <a href="#">458</a> , <a href="#">465</a>
326, <a href="#">390</a>	\__tag_hook_kernel_before_foot: .
\__tag_debug_mc_begin_insert:n . .	377, <a href="#">386</a> , <a href="#">450</a> , <a href="#">457</a> , <a href="#">464</a>
319, <a href="#">332</a>	\__tag_hook_kernel_before_head: .
\__tag_debug_mc_end_ignore: <a href="#">340</a> , <a href="#">415</a>	375, <a href="#">384</a> , <a href="#">449</a> , <a href="#">456</a> , <a href="#">463</a>
\__tag_debug_mc_end_insert: <a href="#">333</a> , <a href="#">405</a>	\g__tag_in_mc_bool . . . . .
\__tag_debug_struct_begin_-	11, <a href="#">18</a> , <a href="#">160</a> , <a href="#">221</a> , <a href="#">224</a> ,
ignore:n . . . . . <a href="#">368</a> , <a href="#">801</a>	336, <a href="#">400</a> , <a href="#">401</a> , <a href="#">408</a> , <a href="#">413</a> , <a href="#">425</a> , <a href="#">426</a> , <a href="#">441</a>
\__tag_debug_struct_begin_-	__tag_insert_bdc_node . . . . . <a href="#">341</a>
insert:n . . . . . <a href="#">360</a> , <a href="#">798</a>	__tag_insert_bmc_node . . . . . <a href="#">334</a>
\__tag_debug_struct_end_check:n .	__tag_insert_emc_node . . . . . <a href="#">327</a>
390, <a href="#">837</a>	\__tag_lastpagelabel: . . . . <a href="#">62</a> , <a href="#">63</a> , <a href="#">81</a>
\__tag_debug_struct_end_ignore: .	__tag_log . . . . . <a href="#">173</a>
383, <a href="#">832</a>	\l__tag_loglevel_int . . . . .
\__tag_debug_struct_end_insert: .	114, <a href="#">124</a> , <a href="#">134</a> , <a href="#">154</a> , <a href="#">170</a> ,
375, <a href="#">830</a>	173, <a href="#">174</a> , <a href="#">201</a> , <a href="#">204</a> , <a href="#">228</a> , <a href="#">242</a> , <a href="#">245</a> ,
\__tag_exclude_headfoot_begin: . .	248, <a href="#">249</a> , <a href="#">250</a> , <a href="#">321</a> , <a href="#">328</a> , <a href="#">335</a> , <a href="#">342</a> ,
392, <a href="#">449</a> , <a href="#">450</a>	362, <a href="#">370</a> , <a href="#">377</a> , <a href="#">385</a> , <a href="#">392</a> , <a href="#">436</a> , <a href="#">647</a> , <a href="#">660</a>
\__tag_exclude_headfoot_end: . . .	__tag_mark_spaces . . . . . <a href="#">368</a>
405, <a href="#">451</a> , <a href="#">452</a>	\__tag_mc_artifact_begin_marks:n
\__tag_exclude_struct_headfoot_-	20, <a href="#">42</a> , <a href="#">78</a> , <a href="#">344</a>
begin:n . . . . . <a href="#">417</a> , <a href="#">456</a> , <a href="#">457</a>	\l__tag_mc_artifact_bool . . . . .
\__tag_exclude_struct_headfoot_-	15, <a href="#">116</a> , <a href="#">161</a> , <a href="#">175</a> , <a href="#">222</a> , <a href="#">340</a>
end: . . . . . <a href="#">432</a> , <a href="#">458</a> , <a href="#">459</a>	\l__tag_mc_artifact_type_tl . . . .
__tag_fakespace . . . . . <a href="#">363</a>	14, <a href="#">120</a> , <a href="#">124</a> , <a href="#">128</a> ,
\__tag_fakespace: . . . . . <a href="#">66</a> , <a href="#">68</a> , <a href="#">225</a>	132, <a href="#">136</a> , <a href="#">140</a> , <a href="#">144</a> , <a href="#">148</a> , <a href="#">321</a> , <a href="#">342</a> , <a href="#">344</a>
\__tag_finish_structure: . . . . .	\__tag_mc_bdc:nn <a href="#">230</a> , <a href="#">233</a> , <a href="#">234</a> , <a href="#">274</a> , <a href="#">306</a>
13, <a href="#">16</a> , <a href="#">321</a> , <a href="#">322</a>	\__tag_mc_bdc_mcid:n . . <a href="#">120</a> , <a href="#">235</a> , <a href="#">278</a>
\__tag_get_data_mc_tag: . . . . .	\__tag_mc_bdc_mcid:nn . . . . .
228, <a href="#">228</a> , <a href="#">316</a> , <a href="#">316</a>	235, <a href="#">235</a> , <a href="#">280</a> , <a href="#">285</a>
\__tag_get_data_struct_id: . <a href="#">391</a> , <a href="#">391</a>	



\__tag_mc_begin_marks:nn .....	\g__tag_mc_parenttree_prop .....
..... 20, 20, 41, 77, 351	..... 12, 13, 100, 148, 167, 295
\__tag_mc_bmc:n .....	\l__tag_mc_ref_abbrev_t1 .....
..... 230, 231, 302	..... 12, 238, 250, 258, 266
\__tag_mc_bmc_artifact: 300, 300, 313	\__tag_mc_set_label_used:n 25, 25, 45
\__tag_mc_bmc_artifact:n 300, 304, 314	\g__tag_mc_stack_seq 13, 80, 87, 97, 207
\l__tag_mc_botmarks_seq .....	\__tag_mc_store:nnn . 90, 90, 104, 131
..... 71, 18, 87, 108,	\l__tag_mc_tmpa_t1 . 13, 252, 255, 259
155, 158, 172, 205, 213, 218, 293, 310	g__tag_MCID_abs_int .....
\__tag_mc_disable_marks: .... 75, 75	7
\__tag_mc_emc: .... 155, 230, 232, 410	\g__tag_MCID_byabbrev_prop .....
\__tag_mc_end_marks: . 20, 60, 79, 411	..... 10, 248, 257, 265
\l__tag_mc_firstmarks_seq .....	\g__tag_MCID_tmp_bypage_int .....
..... 71, 18, 84, 107, 154, 171,	..... 10, 151, 255, 263, 276
193, 196, 197, 204, 205, 293, 301, 303	\g__tag_mode_lua_bool .....
\g__tag_mc_footnote_marks_seq ... 15	..... 41, 42, 43, 82, 220, 238,
\__tag_mc_get_marks: 81, 81, 146, 167	264, 271, 280, 339, 395, 408, 420, 436
\__tag_mc_handle_artifact:N .....	\__tag_new_output_prop_handler:n
..... 116, 300, 308, 342	..... 67, 77, 87, 669
\__tag_mc_handle_mc_label:n .....	__tag_pairs_prop .....
..... 21, 21, 180, 355	190
\__tag_mc_handle_mcid:nn .....	\g__tag_para_begin_int .....
..... 235, 283, 288, 348	..... 229, 262, 290, 326, 331
\__tag_mc_handle_stash:n .... 44,	\l__tag_para_bool .....
131, 131, 153, 210, 289, 289, 299, 383	229,
\__tag_mc_if_in: .... 59, 73, 222, 229	246, 280, 298, 366, 367, 370, 394, 419
\__tag_mc_if_in:TF 59, 78, 185, 193, 222	\g__tag_para_end_int .....
\__tag_mc_if_in_p: .....	..... 229, 273, 300, 326, 332
59, 222	\l__tag_para_flattened_bool .....
\__tag_mc_insert_extra_tmb:n ...	..... 229, 254, 282, 304, 371
..... 105, 105, 168	\g__tag_para_main_begin_int .....
\__tag_mc_insert_extra_tme:n ...	..... 229, 284, 317, 322
..... 105, 150, 169	\g__tag_para_main_end_int .....
\__tag_mc_insert_mcid_kids:n ...	..... 229, 306, 317, 323
..... 122, 122, 138, 229	\l__tag_para_main_tag_t1 229, 253, 287
\__tag_mc_insert_mcid_single_-	\l__tag_para_show_bool .....
kids:n .....	..... 229, 247, 259, 270
122, 127, 230	\l__tag_para_tag_default_t1 ... 229
\l__tag_mc_key_label_t1 .....	\l__tag_para_tag_t1 229, 248, 252, 291
. 17, 177, 180, 293, 351, 352, 355, 456	\l__tag_parent_child_check_t1 ...
\l__tag_mc_key_properties_t1 ...	..... 193, 194, 367, 368, 413,
..... 17, 162, 242, 257, 258,	623, 624, 755, 756, 871, 872, 927, 928
278, 279, 350, 430, 439, 440, 452, 453	\__tag_parenttree_add_objr:nn ...
\l__tag_mc_key_stash_bool .....	..... 144, 144, 372
..... 15, 28, 37, 115, 183, 357	\l__tag_parenttree_content_t1 ...
\g__tag_mc_key_tag_t1 ... 17, 19,	..... 151, 170, 182, 199, 207, 228, 231
165, 225, 228, 234, 316, 338, 409, 426	\g__tag_parenttree_objr_t1 .....
\l__tag_mc_key_tag_t1 17, 164, 172,	..... 143, 146, 228
174, 224, 233, 337, 347, 349, 351, 425	\__tag_pdf_name_e:n .....
\__tag_mc_lua_set_mc_type_attr:n	85, 85
..... 74, 74, 98, 174	__tag_pdf_object_ref .....
\__tag_mc_lua_unset_mc_type_-	348
attr: .....	\__tag_prop_gput:Nnn .....
74, 100, 223	..... 9, 23, 84, 90, 93,
\g__tag_mc_main_marks_seq .....	95, 97, 100, 105, 112, 114, 132, 141,
15	147, 168, 170, 177, 256, 264, 269,
\g__tag_mc_marks .....	280, 288, 438, 450, 464, 480, 488,
14,	510, 533, 560, 600, 640, 674, 705,
22, 31, 44, 51, 62, 68, 85, 88, 194, 214	723, 732, 781, 856, 912, 969, 1037, 1088
\g__tag_mc_multicol_marks_seq ... 15	



\\_\_tag\_prop\_item:Nn . . . [9](#), [43](#), [168](#), [173](#)  
 \\_\_tag\_prop\_new:N . . . . . [9](#),  
     [9](#), [10](#), [11](#), [12](#), [86](#), [168](#), [168](#), [179](#), [668](#)  
 \\_\_tag\_prop\_show:N [9](#), [56](#), [168](#), [175](#), [182](#)  
 \\_\_tag\_ref\_label:nn . . . . .  
     . . . . . [23](#), [152](#), [152](#), [158](#), [269](#), [688](#)  
 \\_\_tag\_ref\_value:nnn . . . . . [36](#), [138](#),  
     [159](#), [159](#), [162](#), [163](#), [166](#), [178](#), [179](#),  
     [240](#), [270](#), [281](#), [368](#), [848](#), [854](#), [857](#), [863](#)  
 \\_\_tag\_ref\_value\_lastpage:nn . . . . .  
     . . . . . [46](#), [141](#), [155](#), [158](#), [164](#), [164](#), [249](#), [263](#)  
 \c\_tag\_refmc\_clist . . . . . [112](#)  
 \c\_tag\_refstruct\_clist . . . . . [112](#)  
 g\_\_tag\_role/RoleMap\_dict . . . . . [17](#)  
 \\_\_tag\_role\_add\_tag:nn . . . . .  
     . . . . . [129](#), [129](#), [157](#), [253](#), [329](#), [710](#)  
 \\_\_tag\_role\_add\_tag:nnnn . . . . .  
     . . . . . [171](#), [171](#), [208](#), [285](#), [715](#)  
 \\_\_tag\_role\_alloctag:nnn . . . . . [83](#),  
     [87](#), [97](#), [109](#), [119](#), [128](#), [144](#), [183](#), [250](#), [281](#)  
 \l\_\_tag\_role\_debug\_prop . . . . .  
     . . . . . [137](#), [11](#), [472](#), [473](#), [545](#), [546](#)  
 \\_\_tag\_role\_get:nnNN . . . . .  
     . . . . . [158](#), [160](#), [168](#), [209](#), [211](#), [226](#), [700](#)  
 \\_\_tag\_role\_get\_parent\_child\_-  
     rule:nnn [150](#), [413](#), [414](#), [466](#), [498](#), [591](#)  
 \g\_\_tag\_role\_index\_prop . . . . . [137](#), [10](#),  
     [370](#), [378](#), [390](#), [391](#), [392](#), [397](#), [403](#),  
     [405](#), [406](#), [409](#), [411](#), [418](#), [419](#), [474](#), [484](#)  
 \g\_\_tag\_role\_NS<ns>\_class\_prop [137](#)  
 \g\_\_tag\_role\_NS<ns>\_prop . . . . . [137](#)  
 \g\_\_tag\_role\_NS\_mathml\_prop . . . . . [407](#)  
 \\_\_tag\_role\_NS\_new:nnn . . . . . [139](#),  
     [19](#), [21](#), [29](#), [72](#), [73](#), [76](#), [78](#), [79](#), [80](#), [82](#)  
 \g\_\_tag\_role\_NS\_prop . . . . .  
     . . . . . [137](#), [9](#), [25](#), [55](#), [145](#), [299](#), [317](#), [698](#)  
 \g\_\_tag\_role\_parent\_child\_-  
     intarray . . . . . [346](#), [349](#), [427](#)  
 \\_\_tag\_role\_read\_namespace:n . . . . .  
     . . . . . [291](#), [291](#),  
     [310](#), [311](#), [313](#), [315](#), [316](#), [318](#), [319](#), [320](#)  
 \\_\_tag\_role\_read\_namespace\_-  
     line:nw . . . . . [228](#), [232](#), [265](#), [301](#)  
 \\_\_tag\_role\_remap: . . . . .  
     . . . . . [630](#), [630](#), [631](#), [773](#), [876](#), [932](#)  
 \\_\_tag\_role\_remap\_id: . . . . . [631](#), [631](#)  
 \\_\_tag\_role\_remap\_inline: . . . . .  
     . . . . . [632](#), [634](#), [654](#)  
 \l\_\_tag\_role\_remap\_NS\_tl . . . . . [628](#),  
     [642](#), [658](#), [772](#), [775](#), [875](#), [878](#), [931](#), [934](#)  
 \l\_\_tag\_role\_remap\_tag\_tl . . . . .  
     . . . . . [628](#), [636](#), [638](#), [649](#),  
     [656](#), [662](#), [771](#), [774](#), [874](#), [877](#), [930](#), [933](#)  
 \l\_\_tag\_role\_role\_namespace\_-  
     tmpa\_tl . . . . . [12](#),  
     [671](#), [691](#), [696](#), [698](#), [700](#), [704](#), [719](#)  
 \l\_\_tag\_role\_role\_tmpa\_tl . . . . .  
     . . . . . [12](#), [670](#), [689](#), [695](#), [712](#), [718](#)  
 \g\_\_tag\_role\_rolemap\_prop . . . . . [137](#),  
     [17](#), [147](#), [150](#), [153](#), [162](#), [242](#), [479](#), [489](#)  
 \c\_\_tag\_role\_rules\_num\_prop [347](#), [438](#)  
 \c\_\_tag\_role\_rules\_prop [347](#), [350](#), [431](#)  
 \l\_\_tag\_role\_tag\_namespace\_tmpa\_-  
     tl . . . . . [12](#), [521](#), [525](#), [529](#), [669](#), [717](#)  
 \l\_\_tag\_role\_tag\_namespace\_tmpb\_-  
     tl . . . . . [522](#), [523](#), [526](#), [530](#)  
 \l\_\_tag\_role\_tag\_tmpa\_tl . . . . .  
     . . . . . [12](#), [668](#), [688](#), [711](#), [716](#)  
 \g\_\_tag\_role\_tags\_class\_prop . . . . .  
     . . . . . [137](#), [8](#), [92](#), [101](#), [114](#), [123](#), [139](#), [241](#)  
 \g\_\_tag\_role\_tags\_NS\_prop . . . . .  
     . . . . . [137](#), [7](#), [90](#), [99](#), [112](#), [117](#), [121](#),  
     [132](#), [152](#), [216](#), [341](#), [426](#), [521](#), [522](#), [694](#)  
 \l\_\_tag\_role\_tmpa\_seq . . . . . [12](#)  
 \l\_\_tag\_role\_update\_bool . . . . .  
     . . . . . [228](#), [229](#), [237](#), [314](#), [317](#)  
 \c\_\_tag\_role\_userNS\_id\_str . . . . .  
     . . . . . [138](#), [58](#), [82](#)  
 \g\_\_tag\_root\_default\_tl . . . . . [191](#)  
 \g\_\_tag\_saved\_in\_mc\_bool . . . . .  
     . . . . . [391](#), [400](#), [413](#), [425](#), [441](#)  
 \\_\_tag\_seq\_gput\_right:Nn . . . . . [9](#),  
     [30](#), [168](#), [171](#), [178](#), [184](#), [189](#), [199](#), [216](#)  
 \\_\_tag\_seq\_item:Nn . . . . . [9](#), [38](#), [168](#), [172](#)  
 \\_\_tag\_seq\_new:N . . . . .  
     . . . . . [9](#), [9](#), [16](#), [88](#), [168](#), [169](#), [180](#), [670](#)  
 \\_\_tag\_seq\_show:N . . . . . [9](#), [49](#), [168](#), [174](#), [181](#)  
 \_\_tag\_show\_spacemark . . . . . [354](#)  
 \l\_\_tag\_showspace\_bool . . . . . [14](#), [26](#), [35](#)  
 \_\_tag\_space\_chars\_shipout . . . . . [448](#)  
 \g\_\_tag\_state\_prop . . . . . [200](#), [207](#), [210](#), [215](#)  
 \\_\_tag\_store\_parent\_child\_-  
     rule:nnn . . . . . [347](#), [347](#), [384](#)  
 g\_\_tag\_struct\_0\_prop . . . . . [86](#)  
 \\_\_tag\_struct\_add\_AF:nn . . . . .  
     . . . . . [530](#), [557](#), [573](#), [592](#), [599](#), [639](#)  
 \\_\_tag\_struct\_add\_inline\_AF:nn . . . . .  
     . . . . . [519](#), [548](#), [572](#), [616](#), [620](#), [629](#)  
 \g\_\_tag\_struct\_AFobj\_int . . . . .  
     [516](#), [523](#), [524](#), [528](#), [529](#), [532](#), [552](#), [555](#)  
 \g\_\_tag\_struct\_cont\_mc\_prop . . . . .  
     . . . . . [10](#), [92](#), [93](#), [95](#), [98](#), [192](#)  
 \g\_\_tag\_struct\_dest\_num\_prop . . . . . [63](#)  
 \l\_\_tag\_struct\_elem\_stash\_bool . . . . .  
     . . . . . [62](#), [406](#), [744](#)  
 \\_\_tag\_struct\_exchange\_kid\_-  
     command:N . . . . . [225](#), [225](#), [235](#), [266](#)

\__tag_struct_fill_kid_key:n ...	\g__tag_struct_tag_NS_tl 57, 428,
..... 101, 118, 236, 236, 330	683, 702, 754, 766, 772, 775, 779,
\__tag_struct_format_Ref:n .....	868, 875, 878, 882, 924, 931, 934, 938
..... 324, 324, 325	\g__tag_struct_tag_stack_seq ...
\__tag_struct_get_dict_content:nN	..... 13, 38,
..... 102, 119, 295, 295, 331	187, 188, 365, 380, 394, 739, 811, 825
\__tag_struct_get_id:n .....	\g__tag_struct_tag_tl 57, 164, 165,
.... 59, 64, 77, 78, 117, 117, 338, 393	168, 337, 338, 427, 429, 682, 701,
\__tag_struct_get_parentrole:nNN	740, 753, 766, 771, 774, 778, 827,
..... 155,	867, 874, 877, 881, 923, 930, 933, 937
155, 171, 185, 359, 615, 746, 862, 918	\__tag_struct_write_obj:n .....
\__tag_struct_gput_data_ref:nn ..	..... 132, 326, 326
..... 501, 962, 962, 974	\g__tag_tagunmarked_bool ... 125, 251
\__tag_struct_insert_annot:nn ...	\l__tag_tmpa_box .....
..... 345, 345, 980	..... 99, 168, 174, 175, 179, 190, 191
\l__tag_struct_key_label_tl .....	\l__tag_tmpa_clist .....
..... 61, 405, 686, 688	..... 99, 1015, 1016, 1049, 1050, 1052
\__tag_struct_kid_mc_gput_-	\l__tag_tmpa_int .....
right:nn .....	56, 61, 64, 68, 77, 99, 352, 364, 366, 436
172, 182, 195, 292	\l__tag_tmpa_prop 99, 157, 165, 178, 180
\__tag_struct_kid_OBJR_gput_-	\l__tag_tmpa_seq .... 99, 240, 242,
right:nnn .....	244, 245, 246, 247, 265, 277, 365,
207, 207, 223, 360	368, 376, 377, 379, 380, 381, 426,
\__tag_struct_kid_struct_gput_-	427, 428, 1017, 1021, 1031, 1032,
right:nn 197, 197, 206, 790, 852, 908	1033, 1035, 1053, 1059, 1061, 1085
g__tag_struct_kids_0_seq .....	\l__tag_tmpa_str .....
86	41,
\__tag_struct_mcid_dict:n .....	42, 47, 104, 253, 258, 263, 274, 279,
..... 95, 98, 172, 187	286, 434, 435, 440, 441, 446, 448,
\g__tag_struct_objR_seq .....	453, 453, 460, 467, 476, 483, 506, 513
8	\l__tag_tmpa_tl .....
\__tag_struct_output_prop_aux:nn	36, 37,
..... 67, 67, 81	44, 51, 57, 65, 69, 72, 77, 79, 84, 93,
\g__tag_struct_ref_by_dest_prop . 66	95, 97, 99, 99, 102, 104, 105, 107,
\g__tag_struct_roletag_NS_tl ... 57	115, 116, 119, 124, 139, 140, 140,
\l__tag_struct_roletag_NS_tl ...	142, 144, 147, 148, 153, 178, 179,
..... 60, 704, 709, 736	180, 181, 181, 183, 184, 186, 197,
\l__tag_struct_roletag_tl .....	198, 199, 204, 207, 215, 216, 216,
..... 57, 703, 709, 711, 736, 740	218, 219, 227, 231, 232, 241, 242,
\__tag_struct_set_tag_info:nnn ..	244, 247, 248, 250, 255, 263, 272,
127, 129, 139, 154, 680, 776, 879, 935	273, 274, 275, 279, 281, 281, 287,
\g__tag_struct_stack_current_tl .	331, 337, 373, 377, 378, 379, 380,
..... 15, 26,	380, 390, 391, 392, 394, 397, 398,
35, 66, 72, 84, 136, 144, 150, 186,	402, 403, 405, 409, 418, 421, 428,
197, 207, 217, 293, 297, 360, 371,	438, 440, 449, 474, 476, 479, 481,
380, 388, 393, 399, 741, 788, 792,	495, 495, 498, 499, 501, 549, 555,
793, 796, 814, 820, 853, 860, 909, 916	556, 557, 558, 559, 560, 564, 588,
\l__tag_struct_stack_parent_-	592, 614, 616, 636, 640, 644, 656,
tmpa_tl .....	761, 768, 811, 812, 818, 820, 825,
15, 353,	828, 864, 869, 903, 920, 925, 1029, 1040
362, 377, 416, 678, 690, 694, 719,	\l__tag_tmpb_box .....
747, 759, 768, 785, 789, 791, 794, 797	..... 99, 169, 176, 177, 181, 183
\g__tag_struct_stack_seq 11, 22, 25,	\l__tag_tmpb_seq .....
352, 614, 693, 699, 742, 807, 812, 818	..... 99, 1016, 1017, 1052, 1053
\c__tag_struct_StructElem_-	\l__tag_tmpb_tl .....
entries_seq .....	148, 52,
20	67, 81, 83, 99, 378, 384, 406, 411,
\c__tag_struct_StructTreeRoot_-	
entries_seq .....	
20	

419, 422, 428, 442, 484, 486, 489, 491, 496, 499, 569, 575, 577, 578, 580, 584, 589, 592, 865, 870, 921, 926	TeX and L <sup>A</sup> T <sub>E</sub> X 2 <sub>ε</sub> commands:
<code>__tag_tree_fill_parenttree:</code> . . .	<code>\OM</code> . . . . . 165
152, 153, 225	<code>\auxout</code> . . . . . 67
<code>__tag_tree_final_checks:</code> 20, 20, 327	<code>\bsphack</code> . . . . . 154
<code>g_tag_tree_id_pad_int</code> . . 41, 45, 122	<code>\cclv</code> . . . . . 348
<code>__tag_tree_lua_fill_parenttree:</code>	<code>\esphack</code> . . . . . 156
205, 205, 222	<code>\gobble</code> . . . . . 24, 48
<code>__tag_tree_parenttree_rerun_-</code>	<code>\ifpackageloaded</code> . . . . . 28
<code>msg:</code> . . . . . 152, 192, 227	<code>\ifundefined</code> . . . . . 338
<code>__tag_tree_write_classmap:</code> . . .	<code>\kernel@after@foot</code> . . . . . 387
261, 261, 331	<code>\kernel@after@head</code> . . . . . 385
<code>__tag_tree_write_idtree:</code> . . . 49, 329	<code>\kernel@before@cclv</code> . . . . . 345
<code>__tag_tree_write_namespaces:</code> . . .	<code>\kernel@before@foot</code> . . . . . 386
295, 295, 332	<code>\kernel@before@footins</code> . . . . 341, 343
<code>__tag_tree_write_parenttree:</code> . . .	<code>\kernel@before@head</code> . . . . . 382, 384
218, 218, 328	<code>\makecol</code> . . . . . 347
<code>__tag_tree_write_rolemap:</code> . . . .	<code>\maxdepth</code> . . . . . 178
238, 240, 258, 330	<code>\mult@ptagging@hook</code> . . . . . 350
<code>__tag_tree_write_structelements:</code>	<code>\secondoftwo</code> . . . . . 24, 48
128, 128, 333	<code>\cpage</code> . . . . . 347
<code>__tag_tree_write_structtreeroot:</code>	<code>\count@</code> . . . . . 355
89, 91, 112, 334	<code>\mult@firstbox</code> . . . . . 353
<code>__tag_whatsits:</code> 30, 54, 55, 58, 318, 319	<code>\mult@rightbox</code> . . . . . 357
<code>tag-namespace<sub>␣</sub>(rolemap-key)</code> . . . . . 666	<code>\page@sofar</code> . . . . . 352
<code>tag/struct/0</code> internal commands:	<code>\process@cols</code> . . . . . 353
<code>__tag/struct/0</code> . . . . . 29	tex commands:
<code>tag/tree/namespaces</code> internal commands:	<code>\tex_botmarks:D</code> . . . . . 88
<code>__tag/tree/namespaces</code> . . . . . 294	<code>\tex_firstmarks:D</code> . . . . . 85
<code>tag/tree/parenttree</code> internal commands:	<code>\tex_kern:D</code> . . . . . 181
<code>__tag/tree/parenttree</code> . . . . . 135	<code>\tex_marks:D</code> . . . . 22, 31, 44, 51, 62, 68
<code>tag/tree/rolemap</code> internal commands:	<code>\tex_special:D</code> . . . . . 58
<code>__tag/tree/rolemap</code> . . . . . 234	<code>\tex_splitbotmarks:D</code> . . . . . 214
<code>tagabspage</code> . . . . . 6, 137	<code>\tex_splitfirstmarks:D</code> . . . . . 194
<code>tagmcabs</code> . . . . . 6, 137	<code>\the</code> . . . . . 347
<code>\tagmcbegin</code> . . . . . 32, 137, 22	<code>\tiny</code> . . . . . 262, 273
<code>\tagmcend</code> . . . . . 32, 22	<code>title<sub>␣</sub>(struct-key)</code> . . . . . 87, 402
<code>tagmcid</code> . . . . . 6, 137	<code>title-o<sub>␣</sub>(struct-key)</code> . . . . . 87, 402
<code>\tagmcifin</code> . . . . . 32	tl commands:
<code>\tagmcifinTF</code> . . . . . 32, 39	<code>\c_empty_tl</code> . . . . . 329
<code>\tagmcuse</code> . . . . . 32, 22	<code>\c_space_tl</code> 67, 73, 148, 172, 173, 175, 177, 179, 188, 190, 231, 267, 288, 312, 337, 347, 582, 769, 972, 1032, 1078
<code>\tagpdfparaOff</code> . . . . . 34, 363	<code>\tl_clear:N</code> . . . . . 51, 52, 69, 162, 167, 168, 263, 297, 495, 523
<code>\tagpdfparaOn</code> . . . . . 34, 363	<code>\tl_count:n</code> . . . . . 42, 46, 122
<code>\tagpdfsetup</code> . . . . . 32, 88, 89, 136, 6	<code>\tl_gput_right:Nn</code> . . . . . 146, 580
<code>\tagpdfsuppressmarks</code> . . . . . 34, 373	<code>\tl_gset:Nn</code> 17, 84, 192, 203, 225, 234, 409, 426, 427, 428, 587, 741, 820, 827
<code>tagstruct</code> . . . . . 6, 137	<code>\tl_gset_eq:NN</code> . . . . . 165, 338
<code>\tagstructbegin</code> . . . . 33, 136, 137, 45, 194	<code>\tl_head:N</code> . . . . . 557, 577
<code>\tagstructend</code> . . . . . 33, 45, 195	<code>\tl_if_empty:NTF</code> 37, 42, 72, 177, 212, 280, 312, 352, 558, 578, 685, 685, 691
<code>tagstructobj</code> . . . . . 6, 137	
<code>\tagstructuse</code> . . . . . 33, 45	
<code>tagtool</code> . . . . . 32, 13	
<code>tagunmarked<sub>␣</sub>(setup-key)</code> . . . . . 6, 251	

\tl_if_empty:nTF	50, 145, 147, 166, 195, 235, 239, 250, 268, 270, 271, 362, 445, 457, 473, 547, 567
\tl_if_empty_p:n	283
\tl_if_eq:NNTF	293
\tl_if_eq:NnTF	99
\tl_if_eq:nnTF	244, 251
\tl_if_exist:NTF	92, 575
\tl_if_in:nnTF	184
\tl_new:N	12, 12, 13, 13, 14, 14, 15, 16, 17, 18, 19, 19, 20, 27, 57, 58, 59, 60, 61, 99, 100, 101, 102, 103, 143, 151, 191, 238, 240, 242, 413, 585, 628, 629, 996
\tl_put_left:Nn	385, 387
\tl_put_right:Nn	57, 67, 81, 170, 182, 198, 228, 242, 257, 258, 278, 279, 305, 343, 345, 350, 384, 386, 430, 439, 440, 452, 453, 498, 1076, 1083
\tl_set:Nn	36, 77, 115, 120, 124, 128, 132, 136, 140, 142, 144, 148, 163, 164, 164, 166, 181, 207, 217, 218, 219, 222, 223, 224, 233, 238, 239, 241, 243, 244, 247, 248, 274, 275, 279, 293, 416, 424, 425, 440, 442, 457, 476, 481, 486, 491, 504, 534, 549, 557, 560, 564, 569, 577, 580, 584, 597, 638, 642, 658, 678, 688, 689, 700, 704, 1029, 1057
\tl_set_eq:NN	164, 337
\tl_show:N	788, 789, 1081, 1087
\tl_tail:n	386
\tl_to_str:n	27, 42, 88, 150, 201, 316, 349
\tl_use:N	93, 538, 565, 605, 645
\l_tmpa_tl	152, 171, 684, 685, 687
token commands:	
\token_to_str:N	69, 347
tree-mcid-index-wrong	19, 55
tree-struct-still-open	35
U	
unittag_(tool-key)	244
\unskip	32
use commands:	
\use:N	64, 374
\use:n	34
\use_i:nn	163, 218, 329, 398, 402, 640, 828
\use_ii:nn	164, 219, 317, 644
\use_none:n	59, 78
\use_none:nn	77, 957
V	
\vbadness	165, 189
vbox commands:	
\vbox_set_split_to_ht:NNn	191
\vbox_set_to_ht:Nnn	167
\vbox_unpack_drop:N	180
\vfuzz	166